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Ferndale Watershed Planning
Receiving Water Assessment and Prioritization

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EXECUTIVE SUMMARY

As part of its NPDES Phase II Permit, the City of Ferndale (City) must perform stormwater planning to identify policies and strategies to improve water quality and protect the receiving waters to which the City's municipal separate storm sewer system (MS4) discharges. Specific requirements include performing a citywide watershed assessment to characterize receiving water conditions, prioritizing watersheds for retrofits and other stormwater management actions, and developing a Stormwater Management Action Plan (SMAP[1]) for a priority watershed. The planning and implementation of stormwater infrastructure typically occurs on a site-by-site basis, rather than a comprehensive approach which takes into consideration the landscape and actions needed to improve or maintain water quality and habitat (Commerce, 2016). The SMAP process uses a regional approach to prioritize watersheds more efficiently for stormwater retrofits and other actions. This report documents the Receiving Water Assessment (RWA) and Receiving Water Prioritization (RWP), the first two steps in the SMAP process.

The Ferndale RWA involved gathering available information to assess existing conditions of the City's receiving waters. As part of this process, the eight major drainage basins (the Nooksack River and seven smaller streams) within the City's Urban Growth Area (UGA) were split into 19 smaller planning level units (subbasins). Available geographic, monitoring, and modeling data was compiled to assess existing conditions in each subbasin. This included information related to land cover and land use, stormwater infrastructure, water quality and hydrology, overburdened communities, and fish use and aquatic habitat. Relative conditions of each subbasin were characterized in terms of its resource importance (to aquatic species and natural processes) and degradation (from development and human impacts) using the data collected. Ten individual importance and degradation metrics were developed and scored for each subbasin to identify the most appropriate management objective and goals for each subbasin. Fifteen of the 19 subbasins were recommended for basin prioritization. The four excluded subbasins either met the criteria for low stormwater management influence, or actions within City jurisdiction were deemed unlikely to impact overall basin conditions based on the percent of the subbasin area within the UGA. The Ferndale RWA was submitted to the Washington State Department of Ecology (Ecology) prior to the March 31, 2022, deadline.

For the Ferndale RWP, prioritization criteria developed from information collected for the RWA were used to score and rank the 15 candidate subbasins for SMAP. Five prioritization metrics describing existing degradation, resource importance, future development pressure, jurisdictional influence, and coordinated planning efforts were scored for each subbasin. The aggregate prioritization score, computed as a weighted average of the individual scores, was used to rank the subbasins for SMAP. Based on this prioritization scheme, the highest priority subbasins for SMAP were 1) Whiskey Creek, 2) Schell Creek, 3) Cedar Creek, 4) Creighton, and 5) Tennant. Basin characteristics related to stormwater planning and implementation potential were reviewed to assess the relative level of investment needed to achieve water quality goals within these five subbasins to assist with subbasin selection. The Schell Creek subbasin was selected for development of a SMAP because it has good restoration potential, is mostly in the city limits, includes other regional rehabilitation efforts, and has good stormwater retrofit potential. Several high priority catchment areas within this subbasin were identified for potential stormwater retrofits, land management strategies, and stormwater management actions to improve

[1] Consistent with the NPDES Phase II Permit language (Ecology, 2019d), SMAP is used interchangeably in this report for both Stormwater Management Action Plan and Stormwater Management Action Planning.

overall basin conditions. Initial results and recommendations were presented to interested parties on April 28, 2022, and the draft RWA/RWP document was posted to the City's stormwater webpage for a 30-day period for public review and feedback. The Ferndale RWP is due to Ecology by June 30, 2022.

The final step in the SMAP process is development of a SMAP for at least one high priority catchment area that includes stormwater facility retrofits, land management/development strategies, stormwater management actions, and an implementation schedule and budget. This plan is due to Ecology by March 31, 2023.

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1 INTRODUCTION

The deleterious influence of urbanization on small streams has been extensively documented over the past several decades and is of particular interest and concern in western Washington due to impacts on endangered salmonids (Booth, 1990; Booth and Jackson, 1997; May et al., 1997; Horner and May, 1998; Booth et al., 2002; Konrad and Booth, 2002; Rosburg et al., 2017). The transition of a watershed from its natural forested state to a predominantly urban condition encompasses removal of vegetation and canopy, compaction of soils, creation of impervious surfaces, introduction of pollutants, and alteration of natural drainage networks. Managing the impacts of runoff from urban areas (i.e., “stormwater”) on natural systems has become a major focus of the Washington State Department of Ecology (Ecology), with regulations continually evolving to protect and restore stream hydrology, water quality, and ecological function.

The City of Ferndale (City) is performing stormwater planning for a 9.4 square mile area encompassing its city limits (7.1 square miles) and associated urban growth area (UGA; 2.3 square miles) which includes approximately 35 miles of streams. The City’s municipal separate storm sewer system (MS4) includes 67 miles of pipes and ditches and 41 City-owned stormwater facilities (ponds, infiltration trenches, bioswales, bioretention, and permeable pavement). As a condition of its NPDES Phase II Municipal Stormwater Permit (Permit), the City is required to perform a citywide watershed assessment, prioritize watersheds for retrofits and other stormwater management actions, and develop a Stormwater Management Action Plan (SMAP) for a priority watershed.

2 RECEIVING WATER ASSESSMENT

The purpose of the Receiving Water Assessment (RWA) is to document and assess existing information related to the City’s receiving waters and contributing area conditions to identify which receiving waters are most likely to benefit from stormwater management planning. The outcome of the RWA is a watershed inventory that summarizes receiving water existing conditions and identifies the candidate basins that will be considered for prioritization (Ecology, 2019d). The RWA includes four steps as outlined in the Ecology SMAP guidance document (2019a):

- Step 1: Delineate basins and identify receiving waters
- Step 2: Assess receiving water conditions
- Step 3: Assess stormwater management influence
- Step 4: Assess relative conditions and contributions

2.1 Receiving Waters and Planning Units

The first step in the RWA is to delineate basins in the City’s jurisdiction and identify the receiving waters to which the City’s MS4 discharges (Ecology, 2019a).

Receiving waters are defined as the "naturally and/or reconstructed naturally occurring surface water bodies, such as creeks, streams, rivers, lakes, wetlands, estuaries, and marine waters, or groundwater, to which a MS4 discharges" (Ecology, 2019b). The UGA (inclusive of the City's incorporated limits) includes portions of the watersheds of several receiving waters that ultimately drain to the Nooksack River, Lummi River/Bay, Birch Bay, and/or Drayton Harbor. Besides local runoff and direct discharge areas to the Nooksack River, the UGA predominantly drains to Silver Creek on the east side of the Nooksack and California Creek, Whiskey Creek, or Schell Creek on the west side of the Nooksack.

The receiving water basins were broken up into 19 smaller planning level units (subbasins). Previous basin delineations by the City for stormwater planning were used as a starting point for subbasin delineation and modified based on the mapped stormwater network and updated topography. Table 2.1 summarizes the area of each subbasin and percent of the subbasin area within City jurisdiction (within the UGA). All maps, including one showing the subbasins, are included in Appendix B.

Table 2.1 Planning Unit Areas and Percent Within City Jurisdiction (UGA)

No.	Receiving Water	Subbasin/Planning Unit	Drainage Area (ac)	Percent in UGA
1	California Creek	California Creek	3,189	42%
2	Jordan Creek	Jordan Creek	588	60%
3	Nooksack River	Local Nooksack River Drainages	119	100%
4	Nooksack River	Neubauer	57	99%
5	Nooksack River	Portal Way	53	100%
6	Nooksack River	Riverside Drive	247	84%
7	Nooksack River	Vanderyacht Park	122	100%
8	Schell Creek	Schell Creek	809	96%
9	Schell Creek	Schell Ditch	281	100%
10	Schell Creek	Schell Marsh	335	100%
11	Silver Creek	Creighton	371	95%
12	Silver Creek	Pacific Highway	551	49%
13	Silver Creek	Silver Creek	6,475	7%
14	Silver Creek/Tennant Lake	Tennant	197	51%
15	Tenmile Creek	Tenmile & Deer Creek	938	21%
16	Terrell Creek/Lake Terrell	Terrell Creek	226	85%
17	Whiskey Creek	Cedar Creek	238	100%
18	Whiskey Creek	Portal Creek	294	65%

No.	Receiving Water	Subbasin/Planning Unit	Drainage Area (ac)	Percent in UGA
19	Whiskey Creek	Whiskey Creek	1,086	95%

2.2 Receiving Water Conditions

The second step in the RWA is to review available information to rapidly evaluate receiving water existing conditions (Ecology, 2019a). This includes identifying the designated uses and desired water quality conditions for each receiving water and reviewing available information (GIS, monitoring, and modeling data) to assess the extent to which the desired conditions are likely being met.

2.2.1 Designated Uses and Desired Water Quality Conditions

Designated uses define the beneficial functions determined for a water body to support aquatic life, recreation, water supply, and various miscellaneous uses (Ecology, 2022). Except for California Creek, all the City's receiving waters have the same designated uses: core summer salmonid habitat, primary contact recreation, water supply, and various miscellaneous uses (Ecology, 2021). California Creek has the same designated uses except its aquatic life use is to provide salmonid spawning, rearing, and migration (Ecology, 2019c). To support these uses, Ecology has established water quality standards for each designated use to assess whether a waterbody is healthy or impaired. Numeric criteria have been established for various water quality constituents including water temperature, dissolved oxygen (DO), total dissolved gas (TDG), pH, turbidity, and bacteria (Ecology, 2020).

2.2.2 Data Review and Development

To assess receiving water conditions, the planning team compiled available geographic, monitoring, and modeling data. Available information included water quality and biological monitoring data, Puget Sound Watershed Characterization assessments, the City's stormwater facility inventory, Ecology 303(d) and TMDL listings, and geospatial data including hydrography, geology, land use, land cover, and WDFW fish use/barrier datasets. In addition, as part of its contractual agreement to update the City's stormwater comprehensive plan and develop a SMAP, NHC also developed a hydrologic model of the subbasin areas and conducted stream temperature monitoring during the summer of 2021 to further characterize existing conditions. Appendix A summarizes the data sources used for the assessment.

Baseline GIS data used for subbasin characterization were provided by the City or obtained from public data sources. These datasets included:

- Hydrography, including streams and wetlands
- Stormwater system mapping, including stormwater facilities and attributes
- Land use data based on City and Whatcom County zoning
- Infiltration potential (feasibility analyses conducted by another consultant; AESI, 2018a and 2018b)
- LiDAR topography

- Aerial imagery
- WDFW fish datasets, including fish use and passage barriers

NHC used this baseline GIS data to develop several supplemental datasets including:

- **Stream Slope.** The slope of the stream hydrography layer was computed to predict channel morphology and the reaches potentially more suitable for fish use. Montgomery and Buffington (1997) studied several Pacific Northwest streams and developed the following slope/geomorphic classes: 0-1.5% (pool-riffle), 1.5-3% (plane-bed), 3-6.5% (step-pool), and >6.5% (cascade). While the authors acknowledge that the channel classes are not uniquely related to reach slope (particularly under 3% slope), the general segregation of reach type by slope allows easy prediction of likely channel morphology from which a higher likelihood for the presence of fish can be inferred. Reach slopes were estimated from LiDAR.
- **Existing Water Quality Treatment and Flow Control.** The City's stormwater facility inventory was used to summarize the type and age of water quality and flow control treatment provided by the largest public and private stormwater facilities (mostly stormwater ponds) mapped in the UGA. Due to changes in stormwater regulations, newer facilities are significantly more protective of downstream flow and water quality than older ones. Therefore, facility age (year of design or construction) was incorporated to denote facilities built before or after 1998 when flow duration control became required. Water quality treatment categories include "Limited" (basic treatment, pre-1998), "Basic" (basic treatment, post-1998), and "Enhanced: (solids and metals treatment, post-1998); flow control categories include "Detention, Level 1" (pre flow duration standard, pre-1998), "Detention, Level 2" (subject to flow duration control, post-1998), "Infiltration", and "Exempt" (for facilities that discharge directly to the Nooksack River, which is flow control exempt). Approximate drainage areas to each facility were delineated to provide coverage across the UGA.
- **Land Cover.** Existing land cover was delineated using the Image Classification toolbar in ArcGIS. Cover type categories included water, impervious surface, forest, and grass. The 2017 USDA NAIP orthoimage was the best quality image available and used for the analysis. Polygons were manually drawn around pixels of the same landcover type and assigned that landcover value. The image classification tool was then run to assign all pixels of the image to one of the designated landcover types.
- **Development Pressure Based on Land Cover/Use.** Development pressure in each subbasin was assessed by computing the change in total impervious area (TIA) between existing and anticipated future land use conditions. Existing TIA was estimated from the remotely sensed land cover data. Future TIA was prescribed for each land use based on previously established hydrologic modeling protocols (Snohomish County, 2002) assuming full build out conditions based on zoning and following several rounds of discussion/revisions with the City. The TIA change between existing and future land use conditions was calculated on a parcel basis and then normalized by parcel area to reflect the percent of a given parcel that is expected to have new impervious under future conditions.
- **Hydrologic Modeling.** A HSPF model encompassing the 19 subbasins was developed and used to evaluate hydrologic metrics linked to stream ecology at the outlet of each subbasin. Regionally

accepted HSPF runoff parameters were assigned to the pervious and impervious hydrologic response units (Dinicola, 1990). Hydrologic metrics were computed for both existing and forested (predeveloped) conditions to assess development impacts on hydrologic regime. The existing condition HSPF model makes use of the existing land use, land cover, and surface geology datasets. The numerous stormwater flow control facilities were represented implicitly by assigning a forested condition to their drainage areas rather than explicitly using stage-storage-discharge curves. A 73-year (water years 1949-2021) continuous runoff simulation was performed using 15-minute precipitation compiled from local sources (NOAA station at Semiahmoo from 1949-2001 and City of Bellingham data from 2002-2021). Hydrologic metrics describing stream flashiness, baseflow, and flood quantiles were compared between existing and predevelopment (forested) conditions.

- **Pollutant Load Estimates.** Pollutant loads were computed for each subbasin to better assess stormwater management influence and basin degradation. Following a similar approach to that used by the Puget Sound Watershed Characterization Project for the assessment units, pollutant loads were estimated for the 19 subbasins based on land use and associated relative event mean concentrations (EMCs) derived from literature and peer review (Ecology, 2016). The land use-based EMCs were combined with the average daily discharge of each pervious and impervious hydrologic response unit from the 73-year HSPF simulation to compute a relative load, and the load was then normalized by subbasin area to aid comparison among the subbasins. Relative pollutant loads, reduced in subbasins with existing stormwater treatment, were computed for nutrients (TP and TN), sediment (TSS), dissolved metals (Cu and Zn), and pathogens.

The team also reviewed available water quality and benthic index of biotic integrity (B-IBI) monitoring data to evaluate instream conditions. Where sufficient sampling data were available, water quality data were compared to state standards for temperature, pH, dissolved oxygen, and bacteria. Finally, two data sources related to overburdened communities were reviewed to determine where it may be possible to improve receiving water conditions for both water quality and human health.

2.2.3 Basin Characterization

The data described above were reviewed and analyzed to characterize existing conditions in each subbasin related to land use/cover, stormwater treatment and flow control, water quality, and ecology. Appendix B includes the full watershed inventory tabular summary, maps, and individual characterization tables for each subbasin. The watershed inventory information is summarized below.

- **General Material.** The first section of the watershed inventory is nearly identical to Table 2.1 and summarizes the City's receiving waters, subbasin areas, and percent of the subbasin area in the City's jurisdiction (UGA). Recommended subbasins to exclude from the next phase of SMAP (basin prioritization) are noted.
- **Land Cover – Land Use.** Development-related characteristics – existing forest and impervious cover types, future impervious area based on full build out conditions, and the dominant zoning land use – are summarized within each subbasin. This information provides an indication of existing development intensity and future development pressure.

- **Stormwater Treatment.** Percent of the subbasin area within the UGA having limited, basic, or enhanced water quality treatment. The remaining area is classified as undeveloped or untreated.
- **Stormwater Flow Control.** Percent of the subbasin area within the UGA having flow control via detention (Level 1: pre flow duration control standard; Level 2: post flow duration control standard) or infiltration. Subbasins that currently are or are likely to be flow control exempt because of their proximity to the Nooksack River are noted. The remaining area is classified as undeveloped or not having flow control.
- **Water Quality.** Water quality was assessed based on the number of constituents listed on the 303(d) impaired water list, presence of a TMDL, available monitoring data relative to water quality standards, and pollutant loads estimated from land use and hydrologic modeling. Constituents on the 303(d)-list included temperature, DO, bacteria, and pH and those listed for the Nooksack River (temperature and DO) were applied to the subbasins likely to be flow control exempt. Due to monitored bacteria levels that exceed the standard for primary contact recreation, a bacteria TMDL is in development for Drayton Harbor and has been approved for the Nooksack River. A qualitative assessment of overall water quality was made after reviewing available pH, DO, bacteria, and water temperature monitoring data collected by the City between 2010 and 2021 and stream temperature monitoring data collected by NHC during the summer of 2021. If a station met the state standard for a parameter, then it "passed" for that parameter. If it failed to meet the standard, then it got a "fail" for that parameter. Station pass/fail rankings were then aggregated by subbasin to come up with a coarse ranking amongst the basins. Subbasins that had all "pass" ratings were "good". Subbasins where every station or all but one failed the standards that we had data for were rated "poor". Other subbasins with a mix of "pass" and "fail" and were rated "fair". Finally, the relative pollutant loading assesses the overall pollutant load potential (from nutrients, solids, metals, and pathogens) of each subbasin. Loads were reduced by varying degrees in subbasins having existing water quality treatment.
- **Ecological Conditions.** Ecological conditions were assessed based on the number of fish species present as documented by WDFW, relative hydrologic conditions based on the ratio of the high pulse count (HPC) metric calculated from modeled flows for existing and forested (predevelopment) conditions, and available B-IBI scores. Fish species believed to be present included coho, chum, steelhead, bull trout, chinook, pink, and cutthroat. The HPC is an indicator of flow "flashiness," which generally increases in developed watersheds and is often linked to stream erosion and channel instability. Studies in the Puget Sound region (e.g. DeGasperi et al., 2009) have found correlations between HPC and other hydrologic metrics and stream B-IBI scores. The lone B-IBI score reported for California Creek came from the Puget Sound Stream Benthos monitoring project and was computed at a site downstream of the subbasin.

2.2.4 Human Health Considerations

Two data sources were reviewed to identify populations that may experience disproportionate environmental risk and/or geographic areas of the City that may pose environmental hazards. The two data sources, the EPA EJScreen-Environmental Justice Screening and Mapping Tool and Washington State Department of Health Environmental Health Disparities Map, function similarly. Each tool evaluates sources of pollutants or the potential for pollutants to be present. The pollutant risks are then compared with demographic and other population statistics that could indicate a susceptibility for harm to the people who live in the area. Report and map outputs from these tools to support the environmental justice (EJ) review are provided in Appendix C.

Results from running the EPA EJScreen tool (2022) indicate the Ferndale city limits has relatively low EJ concerns. The 12 EJ index values, computed from pollutant and socioeconomic data and displayed as percentiles, were relatively low compared to the state, EPA region, and nation. None of the EJ indexes exceeded the 40th percentile, meaning the overall population in the city limits is exposed to or has a lower susceptibility to pollutants than most (>60%) people in the state, EPA region, or nation. Furthermore, none of the socioeconomic indicators for the city limits exceeded the 80th state percentile, which Ecology recommends as a threshold to determine if there are potential EJ considerations. Several pollutant and socioeconomic indicators did exceed the 50th percentile, including the proximity to risk management plan facilities (facilities that use extremely hazardous substances) and unemployment rate. Both metrics ranked near the 70th percentile, indicating levels of both in the city limits when compared to the state, EPA region, and nation.

Results from viewing the Washington State Department of Health Environmental Health Disparities Map (2022) indicate parts of the Ferndale city limits, including the downtown area and areas west of the Nooksack River, generally have higher exposure or are more susceptible to environmental risks than surrounding areas and the rest of the state. This statewide mapping tool displays a variety of environmental and human health data that is scored on a scale from 1 (low concern) to 10 (high concern). The composite score for each primary category (Environmental Health Disparities, Diesel Pollution and Disproportionate Impact, Social Vulnerability to Hazards, Lead Exposure Risk, and Health Disparities), in this part of the city limits exceeds seven out of ten, including a nine for Social Vulnerability. The higher risk in this part of the city limits stems from both environmental effects (proximity to hazardous waste sites, among other factors) and socioeconomic factors (greater proportion of unemployed, uneducated, and/or low-income people).

While EJ considerations are important and may potentially warrant further investigation by the City, the relatively low spatial resolution of the two data sources reviewed makes incorporating this data at the subbasin scale difficult. Therefore, this element will not be included to assess relative conditions and contributions or used as a basin ranking criterion.

2.3 Stormwater Management Influence

The third step in the receiving water conditions assessment is to assess the relative influence the City's MS4 and potential SMAP actions can have on protecting and improving receiving water conditions (Ecology, 2019a). Professional judgement is required to determine the receiving waters that are most likely to benefit from a SMAP based on the City's MS4 contribution to each receiving water under existing and anticipated future conditions.

Ecology's SMAP guidance (2019a) allows for exclusion of watershed areas where stormwater management actions cannot be implemented or where actions would provide minimal improvement to water quality. The only specific provision Ecology provides for excluding subbasins from prioritization is based on low stormwater management influence, defined by both “low expected hydrologic impacts” and “low expected pollutant loadings.” The Neubauer and Vanderyacht Park subbasins meet both criteria since each respective wet pond facility (for which the subbasin is named) was designed to provide basic treatment for the entire subbasin area before discharge to the Nooksack River, which has been designated by Ecology as a flow control exempt and basic treatment receiving water (2019b). Portions of the Local Nooksack River, Portal Way, and Riverside Drive subbasins are also flow control exempt and would meet the low hydrologic impacts criterion, but none of these subbasins meet the low pollutant loading criterion.

Exclusion criteria based on subbasin area and fraction within the City’s jurisdiction (UGA) were also considered. Although not an absolute criterion, Ecology’s SMAP guidance (2019a) recommends assessing receiving waters with watershed areas between one and twenty square miles. This criterion would eliminate 14 of the 19 subbasins, leaving only the Schell Creek, Tenmile & Deer Creek, Whiskey Creek, California Creek, and Silver Creek subbasins. Additionally, four subbasins (California Creek, Pacific Highway, Silver Creek, and Tenmile & Deer Creek) have less than 50% of their area within the UGA, so actions within City jurisdiction of these subbasins would likely have limited ability to impact overall basin conditions. However, only the Silver Creek (7% in the UGA) and Tenmile & Deer Creek (21% in the UGA) subbasins are recommended to be excluded from prioritization based on this area-based criteria.

In summary, 15 of the 19 subbasins (all but the Silver Creek, Tenmile & Deer Creek, Neubauer, and Vanderyacht Park subbasins) are recommended for consideration during basin prioritization. Answers to the three stormwater management influence questions for each subbasin are included in Appendix B.

2.4 Relative Conditions and Contributions

The fourth and final step in the receiving water conditions assessment is to assess relative conditions and contributions in each subbasin to identify the most appropriate management approaches for improving water quality and restoring designated uses. (Ecology, 2019a).

2.4.1 Method and Process

Consistent with Ecology guidance, relative conditions in each subbasin were evaluated using a framework developed by Ecology as part of the Puget Sound Characterization study and documented in the *Building Cities in the Rain* watershed prioritization guidance (Commerce, 2016). The framework (Figure 2.1) uses level of importance and level of degradation to define the types of actions appropriate for protection and/or restoration of beneficial uses.

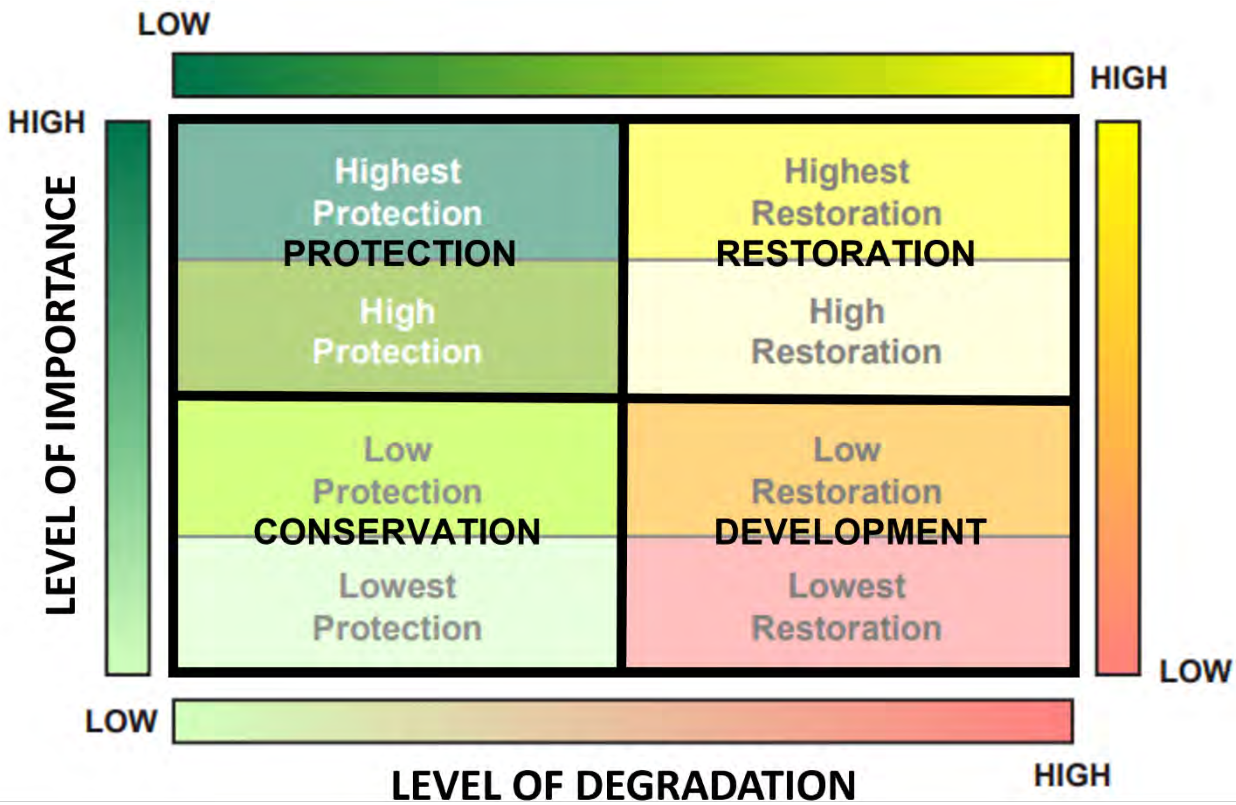

Figure 2.1 Puget Sound Characterization Stormwater Management Framework (Source: Ecology, 2013 (adapted from Figure 2))

A GIS-based screening process was used to characterize each subbasin in terms of its relative resource value (or importance for natural processes and aquatic species) and level of degradation from existing development and other human impacts. The GIS data and other information collected to characterize receiving water conditions and stormwater management influence were used to rank the subbasins *relative to one another* in terms of 10 individual metrics related to importance (i.e., resource value) or level of watershed degradation. Values for each metric were assigned a score from zero to three, and scores were summed to provide a relative comparison of each subbasin on the “Importance” and “Degradation” axes.

2.4.2 Importance Metrics

Four metrics were used to characterize the relative resource importance in each subbasin: forest cover, wetlands, riparian forest, and aquatic habitat and fish use. These metrics represent basin conditions that preserve natural processes and support healthy streams and aquatic species. Higher scores indicate greater resource value and importance for watershed function. Ranges were developed based on experience and scientific understanding of impact thresholds (e.g. Booth et al, 2002) and to distribute values for Ferndale subbasins over the range.

Forest Land Cover: Percent of subbasin area with forest land cover. Forest cover is indicative of an undisturbed (or less disturbed) landscape. Forested areas produce a hydrologic response with less surface runoff and higher baseflows – conditions that are correlated with stable stream channels and higher ecological function.

Percent Forest Cover	Scoring
<15%	0
15-30%	1
30-45%	2
>45%	3

Wetlands: Percent of subbasin area occupied by wetlands as defined by the Washington DNR wetland dataset (Ecology, 2019e). Wetlands provide aquatic habitat, water quality benefits, and natural flow buffering.

Percent Wetland Area	Scoring
No wetlands	0
0-5%	1
5-10%	2
>10%	3

Riparian Forest: Percent of riparian corridor (100-foot buffer on either side of stream) within each subbasin with forest land cover. Riparian canopy cover provides nutrient inputs, wood recruitment, and shading critical to maintaining fish-friendly stream temperatures.

Percent Riparian Forest	Scoring
<15%	0
15-30%	1
30-45%	2
>45%	3

Aquatic Habitat and Fish Use: Measure of aquatic habitat value considering potential habitat extent, quality, and fish use. Calculated as the product of a potential habitat score, habitat quality factor, and fish use score. Total stream length in the subbasin used as proxy for potential aquatic habitat extent. Stream slope used as a proxy for habitat quality (Montgomery and Buffington, 1997). Fish use derived from WDFW datasets (Statewide Washington Integrated Fish Distribution and SalmonScape layers). Listed chinook, steelhead, and bull trout are present in parts of the basin. Subbasins either had no documented fish use or a combination of listed and non-listed species (coho, chum, pink, and cutthroat). Computed scores were normalized on a scale from 0 to 3.

Stream Length (miles)	Scoring
<0.5	0
0.5-1	1
1-2	2
>2	3

Stream Slope	Rating Factor
>6.5%	0
3-6.5%	0.8
0-3%	1

Fish Use	Scoring
No Fish Use/Unknown	0
1 Listed Species	1
2 Listed Species	2
3 Listed Species	3

Table 2.2 lists the importance scores for each metric by subbasin. The aggregate importance score, determined from a weighted average of the individual scores, was used to assign a position on the Importance axis in the management matrix. All metrics were weighted evenly, so the value is the arithmetic average of the individual scores.

Table 2.2 Subbasin Importance Scoring

Subbasin	Forest Cover	Wetlands	Riparian Forest	Aquatic Habitat and Fish Use	Aggregate Score
Tenmile & Deer Creek[1]	2	3	3	3.0	**2.75**
Portal Creek	3	2	3	1.3	**2.33**
Silver Creek[1]	2	2	3	2.0	**2.25**
California Creek[1]	2	2	3	1.9	**2.22**
Whiskey Creek	2	1	3	1.9	**1.98**
Riverside Drive	1	3	2	1.0	**1.75**
Jordan Creek	1	2	2	1.8	**1.71**
Pacific Highway[1]	1	2	3	0.7	**1.67**
Schell Creek	1	1	3	1.6	**1.64**
Cedar Creek	1	1	3	0.6	**1.39**
Creighton	2	3	0	0.0	**1.25**
Schell Marsh	1	3	0	1.0	**1.25**
Terrell Creek	1	3	1	0.0	**1.25**

Subbasin	Forest Cover	Wetlands	Riparian Forest	Aquatic Habitat and Fish Use	Aggregate Score
Schell Ditch	0	2	1	1.3	**1.08**
Local Nooksack River	2	2	0	0.0	**1.00**
Tennant	1	3	0	0.0	**1.00**
Neubauer	0	3	0	0.0	**0.75**
Portal Way	1	2	0	0.0	**0.75**
Vanderyacht Park	0	2	0	0.0	**0.50**

[1]Less than 50% of subbasin area within the UGA.

2.4.3 Degradation Metrics

Six metrics were used to characterize the relative degradation in each subbasin: impervious cover, anticipated future development pressure, water quality impairment, hydrologic impairment, pollutant loading, and barriers to fish passage. These metrics represent basin conditions caused by existing development and other human factors that disturb natural processes and are linked with negative impacts on streams and aquatic species. Higher scores indicate greater level of degradation. Ranges were developed based on experience and scientific understanding of impact thresholds (e.g. Booth et al, 2002) and to distribute values for Ferndale subbasins over the range.

Impervious Land Cover: Percent of subbasin area with impervious land cover. Higher runoff from impervious surfaces increases peak flows and stormflow volumes in streams, which leads to erosion and channel instability that disrupt habitat and stream biology.

Percent Impervious Surface	Scoring
<15%	0
15-30%	1
30-45%	2
>45%	3

Development Pressure: Measure of potential development pressure and anticipated growth under future conditions that could degrade stream health without proper stormwater treatment and flow control. Calculated as the percent of subbasin area having new impervious under future build out conditions. Thus, for a subbasin with 15% impervious currently that is anticipated to increase to 40% under future conditions, the change in impervious area (“TIA Change”) would be 25%.

TIA Change	Scoring
<10%	0
10-25%	1
25-40%	2
>40%	3

Water Quality Impairment: Level of current water quality impairment based on sampling data, where available, and 303(d) or TMDL listings for streams in the subbasin. Water bodies listed on the 303(d) list are significantly impaired and require a TMDL or other approved water quality improvement project to address the listed constituent(s). Scoring is based on the number of constituents listed at Level 5 on the 303(d) list, number of TMDLs planned or in place, or constituents failing to meet state water quality standards. Nooksack River impairments within the City vicinity were assigned to subbasins where direct discharge is likely.

Impaired WQ Constituents	Scoring
None	0
1	1
2	2
>2	3

Hydrologic Impairment: Impact of existing development on hydrologic regime, as indicated by the High Pulse Count (HPC) flashiness metric calculated from hydrologic modeling. The HPC is among a suite of metrics that have been demonstrated to correlate to B-IBI in western Washington streams. The score is based on the ratio between simulated current and predevelopment (forested) conditions HPC. The hydrologic impact of existing flow control stormwater facilities was represented by assigning facility drainage areas a forested cover condition, consistent with Ecology design guidelines (2019b).

HPC Ratio	Scoring
<1.5	0
1.5-3	1
3-4.5	2
>4.5	3

Pollutant Loading: Relative pollutant loading from each subbasin based on land use, soil type, hydrologic modeling, and existing stormwater treatment. Subbasin loads computed for nutrients, sediment, dissolved metals, and pathogens were arithmetically averaged to compute an overall pollutant loading export potential for each subbasin. Within each subbasin, the loads computed upstream of existing stormwater treatment facilities were reduced by 30-90% based on the type of treatment provided.

Pollutant Loading	Scoring
Low	0
Medium-Low	1
Medium-High	2
High	3

Existing Treatment	Load Reduction Factor
Limited (pre-1998)	30%
Basic (solids, post-1998)	60%
Enhanced (solids + metals)	90%

Fish Passage Barriers: Number and type of WDFW fish passage barriers per mile of stream in each subbasin. Calculated as the product of the barrier density score and barrier type score based on the percent of each barrier type in the subbasin. Computed scores were normalized on a scale from 0 to 3. Most of the barriers occur at road crossings where culverts may likely be undersized and limit fish passage for certain species and life stages.

Barriers per Stream Mile	Scoring
0	0
0-1	1
1-2	2
>2	3

Fish Barrier Type	Scoring
Potential Barrier	1
Partial Blockage	2
Total Blockage	3

Table 2.3 lists the degradation scores for each metric by subbasin. The aggregate degradation score, determined from a weighted average of the individual scores, was used to assign a position on the Degradation axis in the prioritization matrix. All degradation metrics were weighted evenly, so the value is the arithmetic average of the individual scores.

Table 2.3 Subbasin Degradation Scoring

Subbasin	Impervious Cover	Development Pressure	WQ Impairment	Hydrologic Impairment	Pollutant Loading	Fish Barriers	Aggregate Score
Portal Way	2	3	3	3	3	0.0	**2.33**
Riverside Drive	1	2	3	3	3	0.0	**2.00**

Subbasin	Impervious Cover	Development Pressure	WQ Impairment	Hydrologic Impairment	Pollutant Loading	Fish Barriers	Aggregate Score
Local Nooksack River	0	2	3	3	3	0.0	**1.83**
Neubauer	3	2	3	3	0	0.0	**1.83**
Vanderyacht Park	2	3	3	3	0	0.0	**1.83**
Schell Ditch	2	1	1	3	2	1.1	**1.69**
Schell Creek	2	1	1	2	1	2.9	**1.65**
Silver Creek[1]	0	2	2	1	2	2.5	**1.58**
California Creek[1]	0	1	3	1	1	3.0	**1.50**
Creighton	1	3	0	2	3	0.0	**1.50**
Tenmile & Deer Creek[1]	0	1	3	2	1	1.7	**1.45**
Pacific Highway[1]	1	1	0	3	1	2.2	**1.37**
Schell Marsh	1	1	0	3	2	1.1	**1.35**
Cedar Creek	2	1	1	1	1	1.1	**1.19**
Whiskey Creek	0	2	1	1	2	0.9	**1.15**
Portal Creek	1	1	1	2	1	0.6	**1.09**
Tennant	0	2	0	1	2	0.0	**0.83**
Jordan Creek	0	1	0	1	1	1.7	**0.78**
Terrell Creek	0	1	0	0	1	0.0	**0.33**

[1]Less than 50% of subbasin area within the UGA.

2.4.4 Subbasin Management Objectives and Goals

Subbasin importance and degradation scores (from Table 2.2 and Table 2.3, respectively) were plotted on the management matrix as shown below in Figure 2.2. The basins falling into the “Restoration” quadrant will require a large effort to restore natural processes and achieve significant water quality benefits but also have a high ecosystem value. Basins in the “Protection” quadrant have a high ecological importance and low degradation. These basins have not been heavily impacted by development and may be target areas for programmatic actions or code revisions to protect existing resources. Basins in the “Conservation” quadrant have low ecological importance but also low degradation. These would require a much lower level of action, mainly to maintain existing conditions. The basins in the “Development” quadrant have relatively low ecological importance and significant existing human impact. Significant efforts to achieve water quality benefits may not be warranted by the lower resource value, and development should continue to be directed to these areas.

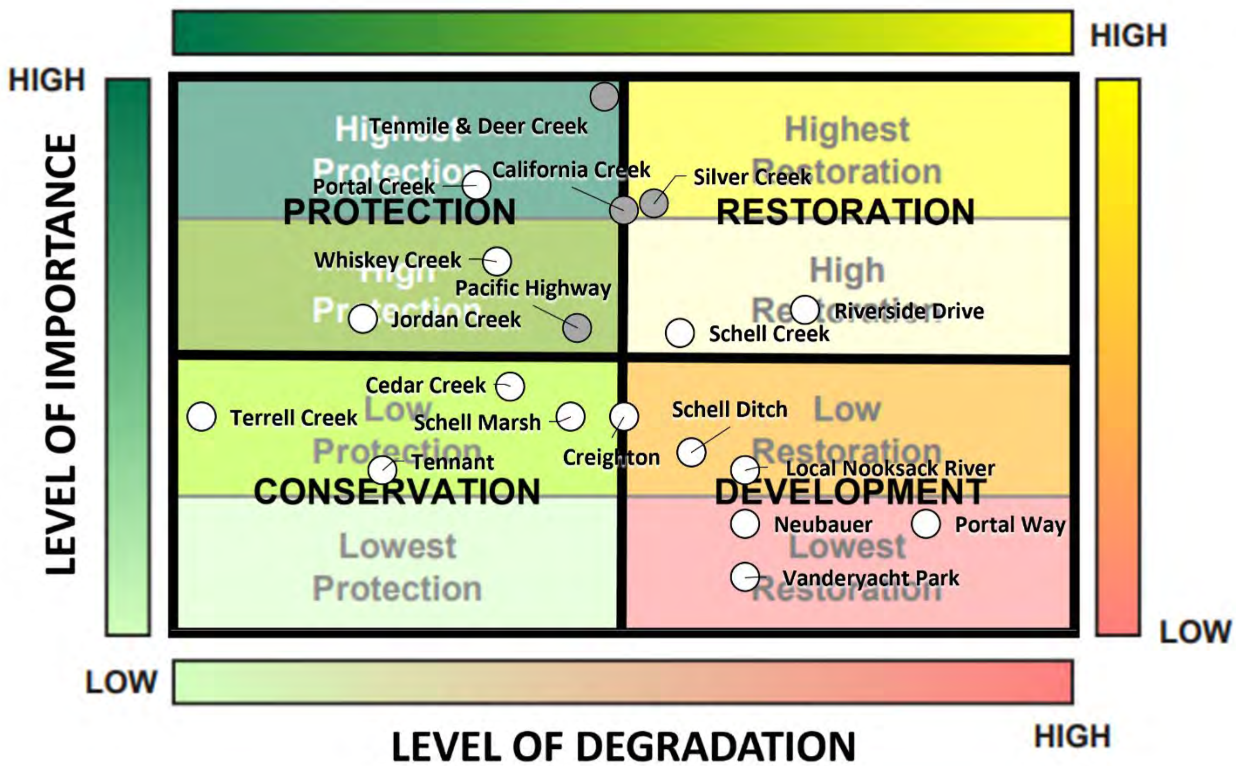

Figure 2.2 Subbasin Management Matrix

Gray dots indicate subbasins with <50% area within the UGA.

Based on Figure 2.2, the primary management objective was identified for each subbasin, and management goals were developed. The proposed management goals include both structural and non-structural measures to lessen degradation, improve water quality, and/or protect aquatic ecosystems and were assigned based on basin-specific conditions. The following eight broadly defined management goals were developed after reviewing other watershed improvement plans (Thurston County, 2015; NHC, 2017; King County, 2018) and assigned to the appropriate Ferndale subbasins:

- Stormwater retrofits: construct stormwater retrofits to mitigate runoff from existing development lacking stormwater treatment and/or flow control.
- Stormwater management: ensure new development complies with current stormwater standards. Assigned to subbasins where stormwater treatment and flow control is provided for most existing development or subbasins with relatively high development pressure.
- LID and infiltration: promote infiltration BMPs in areas with favorable infiltration to help maintain summer baseflows and reduce stream temperature in impaired waters.
- Riparian restoration: restore the riparian corridor to improve shading and nutrient processing. Assigned to subbasins with temperature and DO impairments.

- Septic inspections and O&M: implement a focused O&M program to monitor septic systems in high-risk areas and potentially convert to sewer systems. Assigned to subbasins with bacteria impairment.
- Land use management: reassign or reduce zoning densities or implement conservation easements in targeted and undeveloped areas to preserve rural character, existing forest, and wetlands.
- Floodplain protection: limit development in the Nooksack River floodplain and floodway. Assigned to subbasins adjacent to the Nooksack River.
- Fish passage: improve fish passage on streams with a high number of barriers (based on WDFW data).

Ecology recommends that subbasins with high importance (“Protection” or “Restoration” management objectives) be prioritized for stormwater investments (Commerce, 2016). Table 2.4 summarizes the management objective and goals for each subbasin and notes which subbasins are recommended to be excluded from basin prioritization.

Table 2.4 Subbasin Management Objectives and Goals

No.	Subbasin/Planning Unit	Management Objective	Management Goals
1	California Creek[2]	Restoration	• Stormwater retrofits (flow control and treatment) • Stormwater management • Septic inspections and O&M • Riparian restoration • Fish passage • Land use management
2	Jordan Creek	Protection	• Stormwater retrofits (treatment) • Land use management
3	Local Nooksack River Drainages	Development	• Land use management • Stormwater management • Floodplain protection
4	Neubauer[1A]	Development	• Septic inspections and O&M • LID and infiltration
5	Portal Way	Development	• Stormwater retrofits (treatment) • LID and infiltration • Septic inspections and O&M
6	Riverside Drive	Restoration	• Stormwater retrofits (treatment) • Septic inspections and O&M • Floodplain protection
7	Vanderyacht Park[1A]	Development	• Septic inspections and O&M • LID and infiltration • Floodplain protection
8	Schell Creek	Restoration	• Stormwater retrofits (flow control and treatment) • Riparian restoration

No.	Subbasin/Planning Unit	Management Objective	Management Goals
			• Septic inspections and O&M • Fish passage
9	Schell Ditch	Development	• Stormwater retrofits (flow control and treatment) • LID and infiltration • Septic inspections and O&M
10	Schell Marsh	Conservation	• Land use management
11	Creighton	Development	• Stormwater management • Land use management
12	Pacific Highway[2]	Protection	• Stormwater management • Land use management
13	Silver Creek[1B]	Restoration	• Septic inspections and O&M • Land use management • Fish passage
14	Tennant	Conservation	• Land use management • Floodplain protection
15	Tenmile & Deer Creek[1B]	Protection	• Septic inspections and O&M • Land use management • Riparian restoration
16	Terrell Creek	Conservation	• Stormwater management • Land use management
17	Cedar Creek	Conservation	• Stormwater retrofits (flow control and treatment) • Riparian restoration • Septic inspections and O&M
18	Portal Creek	Protection	• LID and infiltration • Riparian restoration • Septic inspections and O&M • Land use management
19	Whiskey Creek	Protection	• Stormwater retrofits (flow control and treatment) • Stormwater management • Land use management • Septic inspections and O&M • Riparian restoration

[1]Excluded from basin prioritization based on: A) low stormwater management influence or B) low jurisdictional influence (<25% of subbasin area within the UGA).

[2]Less than 50% of subbasin area within the UGA.

2.5 Summary

The Ferndale RWA used available information to assess current conditions of the City's receiving waters. As part of the assessment, 19 planning level units (subbasins) covering the eight major drainage basins within the City were delineated. Information related to land cover and land use, stormwater infrastructure, water quality and hydrology, fish use and aquatic habitat, and overburdened communities was compiled to help assess overall basin conditions.

Fifteen of the 19 subbasins are recommended for basin prioritization. Two subbasins (Neubauer and Vanderyacht Park) met the criteria for low stormwater management influence and were excluded from prioritization. Four subbasins have less than 50% of their area within the UGA, so actions within City jurisdiction would likely have limited ability to impact overall basin conditions. However, only the Silver Creek (7%) and Tenmile & Deer Creek (21% in the UGA) subbasins were excluded based on this criterion.

All subbasins were scored in terms of their relative degradation (from development and human impacts) and relative resource importance (to support aquatic species and natural processes). Individual degradation and importance metrics were developed and scored for each subbasin using available geographic, monitoring, and modeling data. The aggregated degradation and importance scores were used to identify a primary management objective – Protection, Restoration, Conservation, or Development – and related management goals for each subbasin to assist with basin prioritization as part of the next step of the SMAP process.

3 RECEIVING WATER PRIORITIZATION

Informed by the RWA, local and regional information, and stakeholder input, the Receiving Water Prioritization (RWP) involves defining and applying a set of prioritization criteria to determine which receiving waters will receive the most benefit from implementation of stormwater retrofits, stormwater management plan actions, and land management strategies. The retrofits and actions are intended to 1) conserve, protect, or restore receiving waters, 2) reduce pollutant loading, and 3) address hydrologic impacts from existing development and future buildout conditions (Ecology, 2019d). The outcome of the RWP is a ranked list of the highest priority receiving waters and identification of high priority catchment area(s) for focus of the SMAP.

3.1 Prioritization Criteria

In general, Ecology's SMAP guidance (2019a) recommends prioritizing basins under development pressure that drain to high quality receiving waters. Higher priority should be given to basins:

- With receiving waters that show low to moderate levels of impairment since they are expected to benefit more quickly from stormwater management actions.
- Where the municipality can exert greater influence.
- Where other local and regional rehabilitation efforts or other planning processes are also focused or there is ripeness to proceed.
- With overburdened communities where overlapping water quality and human health issues could be at least partially addressed through stormwater improvements.

Based on these recommendations, five prioritization criteria were selected to rank the 15 candidate Ferndale subbasins for SMAP as summarized below. Overburdened communities was not included as a prioritization metric for the reasons discussed in section 2.2.4. Values for each metric were assigned a score from zero (low priority) to three (high priority), and a weighted average of the individual scores was computed to rank the highest priority subbasins for SMAP.

Degradation: Subbasins with low to moderate levels of existing degradation are prioritized for SMAP. The most degraded subbasins (the quarter with the highest relative degradation scores) were assigned a prioritization score of zero and all others with lower degradation were assigned a score of three. The relative degradation scores were recomputed so as not to include Development Pressure, which was assigned its own metric. Hence, the degradation scoring used for prioritization is based on existing impairments as described by current impervious cover, water quality impairment, hydrologic impairment, pollutant loading, and barriers to fish passage.

Relative Degradation Score	Scoring
>75^{th} percentile	0
<75^{th} percentile	3

Importance: Subbasins with higher resource importance are prioritized for SMAP. The relative importance scores are based on existing forest cover, wetlands, riparian forest, and aquatic habitat and fish use. These scores were normalized on a scale from 0 to 3 for prioritization.

Relative Resource Importance	Scoring
Low	0
Moderate-Low	1
Moderate-High	2
High	3

Development Pressure: Subbasins with higher development pressure are prioritized for SMAP. Identical to the Development Pressure degradation metric described in the RWA, which is based on the change in total impervious area ("TIA Change") in the subbasin between existing and anticipated future build out conditions.

TIA Change	Scoring
<10%	0
10-25%	1
25-40%	2
>40%	3

Jurisdictional Influence: Subbasins with a greater percent of their area in the city limits are prioritized for SMAP since this is where the City can exert the greatest influence. Five of the 15 candidate subbasins have less than 50% of their area in the city limits (California Creek, Jordan Creek, Pacific Highway, Portal Creek, and Terrell Creek) and received a reduced score for this metric.

Percent Subbasin Area in City Limits	Scoring
<10%	0
10-30%	1
30-50%	2
>50%	3

Coordinated Efforts: Subbasins where other regional rehabilitation efforts or planning processes are focused or there is ripeness to proceed on other environmental projects have higher priority for SMAP. A score of zero to three was assigned to each subbasin based on the count of such projects that are planned or underway based on current City knowledge.

Other Rehabilitation/Planning Efforts	Scoring
None	0
1	1
2	2
>2	3

3.2 Subbasin Priority Ranking for SMAP

Table 3.1 lists the prioritization scores for each metric by subbasin. The aggregate prioritization score, determined from a weighted average of the individual scores, was used to rank the highest priority subbasins for SMAP. Based on this prioritization scheme, the highest priority subbasins for SMAP were 1) Whiskey Creek, 2) Schell Creek, 3) Cedar Creek, 4) Creighton, and 5) Tennant. The ranked subbasins are also shown in Figure 1 of Appendix D. The two highest ranked subbasins for SMAP (Whiskey Creek and Schell Creek) did not change following a sensitivity analysis of the weights applied to the prioritization criteria.

Table 3.1 Subbasin Prioritization Scoring for SMAP

SMAP Rank	Subbasin	Degradation (20%)	Importance (20%)	Development Pressure (20%)	Jurisdictional Influence (20%)	Coordinated Efforts (20%)	Aggregate Score
1	Whiskey Creek	3	2.5	2	3	3	**2.71**
2	Schell Creek	3	1.9	1	3	3	**2.38**
3	Cedar Creek	3	1.2	1	3	2	**2.04**
4	Creighton	3	0.8	3	3	0	**1.97**
5	Tennant	3	0.4	2	3	1	**1.88**
6	Schell Marsh	3	1.1	1	3	1	**1.82**
7	Portal Creek	3	3.0	1	2	0	**1.80**
8	Riverside Drive	0	1.9	2	3	1	**1.59**
9	California Creek	3	2.9	1	0	1	**1.59**
10	Pacific Highway	3	1.7	1	2	0	**1.54**
11	Jordan Creek	3	2.1	1	1	0	**1.41**
12	Terrell Creek	3	0.8	1	2	0	**1.37**
13	Portal Way	0	0.0	3	3	0	**1.20**
14	Schell Ditch	0	0.9	1	3	1	**1.18**
15	Local Nooksack River	0	0.4	2	3	0	**1.08**

The relative level of investment needed to meet water quality goals was qualitatively assessed for the five highest ranked subbasins for SMAP by reviewing basin characteristics related to stormwater planning and implementation potential, as summarized below.

Whiskey Creek:

- Management objective and goals: Protection – stormwater retrofits (flow control and treatment), stormwater management, land use management, septic inspections and O&M, riparian restoration
- TMDLs: bacteria (Nooksack River Watershed)
- Stormwater retrofit potential:
    - Existing facilities: low (most existing development is mitigated to current stormwater standards except for several City-owned facilities that lack treatment and could use flow control enhancements), more opportunities in Cedar Creek tributary subbasin
    - New facilities: high (large amount of new development anticipated in UGA outside city limits – will have to construct current code-compliant stormwater facilities)
    - City-owned property: low
    - Infiltration potential: moderate (good infiltration east of Malloy Road)
- Pollutant loading: medium-high
- Relative level of investment needed to achieve water quality goals: medium (retrofits and land use management)

Schell Creek:

- Management objective and goals: Restoration – stormwater retrofits (flow control and treatment), septic inspections and O&M, riparian restoration, fish passage
- TMDLs: none
- Stormwater retrofit potential:
    - Existing facilities: high (existing development runoff in the northern part of the subbasin is directed to City-owned and private facilities that lack treatment or could use flow control and treatment enhancements)
    - New facilities: high (approximately half of existing development lacks flow control and treatment)
    - City-owned property: moderate
    - Infiltration potential: low
- Pollutant loading: medium-low
- Relative level of investment needed to achieve water quality goals: high (mostly retrofits)

Cedar Creek:

- Management objective and goals: Conservation – stormwater retrofits (flow control and treatment), riparian restoration, septic inspections and O&M
- TMDLs: bacteria (Nooksack River Watershed)
- Stormwater retrofit potential:
    - Existing facilities: high (approximately half of existing development runoff is directed to City-owned and private facilities that lack treatment or could use flow control and treatment enhancements)
    - New facilities: moderate (approximately one-third of existing development lacks flow control and treatment but the subbasin is mostly built out)
    - City-owned property: high
    - Infiltration potential: low
- Pollutant loading: medium-low
- Relative level of investment needed to achieve water quality goals: medium (mostly retrofits)

Creighton:

- Management objective and goals: Development – stormwater management, land use management
- TMDLs: none
- Stormwater retrofit potential:
    - Existing facilities: low (approximately two-thirds of existing development is mitigated to current stormwater standards except one City-owned facility that lacks treatment and could use flow control enhancement)
    - New facilities: moderate (approximately one-third of existing development lacks flow control and treatment and new development is anticipated)
    - City-owned property: low
    - Infiltration potential: moderate (decent infiltration potential east of I-5)
- Pollutant loading: high
- Relative level of investment needed to achieve water quality goals: low (mostly land use management)

Tennant:

- Management objective and goals: Conservation – land use management, floodplain protection
- TMDLs: none
- Stormwater retrofit potential:

   - Existing facilities: low (approximately two-thirds of existing development is mitigated to current stormwater standards except for two private facilities that could use flow control and treatment enhancements)
   - New facilities: moderate (approximately one-third of existing development lacks flow control and treatment and new development is anticipated, particularly east of Hovander Drive)
   - City-owned property: low
   - Infiltration potential: moderate
- Pollutant loading: medium-high
- Relative level of investment needed to achieve water quality goals: low (mostly land use management)

3.3 Outreach

Results of the RWA and RWP were presented to interested parties on April 28, 2022, as part of a public process. Representatives from the City, Ecology, Lummi Nation, Nooksack Indian Tribe, US EPA, Whatcom Conservation District, and Whatcom County were invited to the meeting. The Interested Parties Feedback Form is included in Appendix D. This document was also posted to the City's stormwater webpage[2] for public review and comment for a 30-day period (April 28 – May 28). Input received was reviewed by the project team prior to final subbasin selection for stormwater planning.

3.4 SMAP Subbasin Selection and Identification of High Priority Catchment Areas

Based on project team discussion and input received from interested parties and the public, the Schell Creek subbasin was selected for development of a SMAP (final step in the SMAP process). Stormwater retrofit opportunities, land management strategies, and targeted stormwater management actions will be focused in one or several of the high priority catchment areas identified in this 809-acre subbasin (Figure 2 in Appendix D). Schell Creek was selected in part because it has good restoration potential, is mostly in the city limits, includes other regional rehabilitation efforts, and offers opportunities for both existing and new stormwater retrofits. Future development in Schell Creek and all other areas in the city limits will continue to require implementing modern stormwater systems that meet current stormwater standards to improve overall treatment and flow control (where applicable). In other less developed subbasins, additional protection measures can be accomplished through long range planning and land use management to protect water quality and beneficial uses.

[2] https://www.cityofferndale.org/public-works-department/stormwater/stormwater-planning/

3.5 Summary

The Ferndale RWP documents the prioritization criteria used to score and rank the 15 candidate subbasins for SMAP. Five prioritization metrics related to existing degradation, resource importance, development pressure, jurisdictional influence, and other planning efforts were used to score and rank the subbasins for stormwater action planning. Based on this prioritization scheme, the highest priority subbasins for SMAP were 1) Whiskey Creek, 2) Schell Creek, 3) Cedar Creek, 4) Creighton, and 5) Tennant. Basin characteristics related to stormwater planning and implementation potential were reviewed for these five subbasins to assist with subbasin selection. The Schell Creek subbasin was selected by the project team for development of a SMAP because of its restoration potential, location mostly in the city limits, other regional rehabilitation efforts, and good stormwater retrofit potential. Input received from interested parties and the public as part of a public process were reviewed prior to final subbasin selection. Several high priority catchment areas were identified in this subbasin for targeted stormwater retrofits, land management strategies, and stormwater actions to restore and protect healthy basin conditions. These items, along with a proposed implementation schedule and budget, will be documented in the third and final step of the SMAP process.

4 SUMMARY AND CONCLUSIONS

As required by its NPDES Phase II Permit, the City of Ferndale must perform a citywide watershed assessment, prioritize watersheds for retrofits and other stormwater management actions, and develop a Stormwater Management Action Plan (SMAP) for a priority watershed. To assess the current condition of the City's receiving waters, NHC and City staff performed an existing condition assessment. As part of the assessment, 19 planning units covering the eight major drainage basins within the City were delineated. Information related to land cover and land use, stormwater infrastructure, water quality and hydrology, fish use and aquatic habitat, and over-burdened communities was compiled to help assess overall basin conditions.

The Ferndale RWA summarized current conditions, including relative degradation and resource importance, in the City's eight receiving water basins, which were further split into 19 planning level units (subbasins). Fifteen of the 19 subbasins were recommended for basin prioritization. The four subbasins that were excluded either met the Ecology criteria for low stormwater management influence or jurisdictional influence was expected to be low.

The Ferndale RWP documented the prioritization criteria used to score and rank the 15 candidate subbasins for stormwater action planning. Based on this prioritization scheme which involved the use of five metrics, the highest priority subbasins for SMAP were) Whiskey Creek, 2) Schell Creek, 3) Cedar Creek, 4) Creighton, and 5) Tennant. The Schell Creek subbasin was selected by the project team for development of a SMAP because of its restoration/retrofit potential, location, and other rehabilitation efforts in the basin. Input received from interested parties and the public was reviewed prior to final subbasin selection. High priority catchment areas were identified in this subbasin for targeted stormwater retrofits, land management strategies, and stormwater actions which, along with a proposed implementation schedule and budget, will be documented in a formal plan in the third and final step of the SMAP process.

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APPENDIX A
SOURCE DATA INVENTORY

Category	Type	Source	URL/Feature Class/Filename	Updated	Spatial Extent	Description
GIS	Administrative Boundaries	City of Ferndale	COF_City_Limits.shp, COF_UrbanGrowthArea.shp		Ferndale City Limits + UGA	Ferndale city limit and UGA boundaries
GIS	Land Cover	NHC	LandCover2017_r0c_clip_dissolve.shp	2021	SMAP planning units	Land cover types within the SMAP planning units (2017 imagery analyzed)
GIS	Zoning	City of Ferndale	OfficialZoning.shp	2021	Ferndale City Limits	Zoning as of 08/2021
GIS	Zoning	Whatcom County	WC_AR_TaxParcel2021_clip_join.shp	2021	Whatcom County	Zoning as of 07/2021
GIS	Stormwater System	City of Ferndale	Stormwater_System.gdb	2021	Ferndale City Limits + UGA	Stormwater network and facilities in point, line, and polygon formats
GIS	Streams	City of Ferndale	CAO_Streams.shp		Ferndale City Limits + UGA	Stream centerlines , including name and DNR type
GIS	Streams	WA DNR	DNR_Stream_Centerlines.shp		SMAP planning units	Stream centerlines , various attribute data
GIS	Wetlands	City of Ferndale	COF_Wetlands_known.shp		Ferndale City Limits + UGA	Associated subdivision listed
GIS	Wetlands	WA DNR	DNR_fpwet_clip.shp		SMAP planning units	Various attribute data, including class, type, and description
GIS	Subbasins	City of Ferndale and NHC	SMAP_PlanningUnits_r0b.shp	2021	SMAP planning units	SMAP planning unit subbasins (updated City layer (Basins_2020.shp) based on mapped stormwater network and updated topography)
GIS	Geology	WA DNR	surface_geology_100k.gdb		Statewide	Surface geology 1:100,000 scale GIS dataset
GIS	Topography	WA DNR	https://lidarportal.dnr.wa.gov/	2006	SMAP planning units (partial)	LiDAR Bare Earth: North Puget USGS (Silver Creek Basin)
GIS	Topography	WA DNR	https://lidarportal.dnr.wa.gov/	2013	SMAP planning units (partial)	LiDAR Bare Earth: Nooksack (Nooksack River corridor)
GIS	Topography	WA DNR	https://lidarportal.dnr.wa.gov/	2017	SMAP planning units (partial)	LiDAR Bare Earth: North Puget 2017 (west side of Nooksack River)
GIS	Infiltration Potential	City of Ferndale	AESI_Infiltration_AppB.gdb	2018	Ferndale City Limits + UGA	Shallow and deep infiltration potential, infeasible areas for infiltration, steep slopes (>20%)
GIS	Fish Use	WDFW	https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html	2018	Statewide	Fish species distribution (SWIFD) (line format)
GIS	Fish Passage Barriers	WDFW	https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html	2018	Statewide	Fish passage sites (point format)
Ecology	Monitoring	Puget Sound Stream Benthos	https://pugetsoundstreambenthos.org/Biotic-Integrity-Map.aspx	2021	Statewide	Benthic Index of Biotic Integrity (B-IBI) data
WQ	Monitoring	City of Ferndale	Fecal Summary Table.xls	2021	Ferndale City Limits	Fecal coliform and turbidity data, Schell Creek/Ditch/Marsh-Vanderyacht Park Pond-Neubauer Pond, 2009-2021
WQ	Monitoring	City of Ferndale	Schell Cr NSEA WQ Data 1995-2018.xlsx	2018	Ferndale City Limits	WQ data, Schell Creek/Ditch/Marsh, 2010-2018
WQ	Monitoring	NHC	http://water.nhcweb.com/Account/SignIn	2021	Ferndale City Limits	Water temperature data, multiple sites, summer 2021
WQ	Regulatory	WA DOE	https://apps.ecology.wa.gov/waterqualityatlas/wqa/map	2016	Statewide	Washington State Water Quality Assessment 303(d) Impaired Water List
WQ	Regulatory	WA DOE	https://apps.ecology.wa.gov/waterqualityatlas/wqa/map		Statewide	Washington State WQ Improvement Projects (TMDLs)
WQ	Regulatory	Washington State Legislature	https://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-600		Statewide	Fresh water use designations, unspecified waterbodies (WAC173-201A-600)
WQ	Regulatory	Washington State Legislature	https://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-602		Statewide	Fresh water use designations, specified waterbodies (WAC173-201A-602)
WQ	Regulatory	Washington State Legislature	https://app.leg.wa.gov/WAC/default.aspx?cite=173-201A-200		Statewide	Fresh water use designations and criteria (WAC173-201A-200)
Models	HSPF	NHC	Fern.uci	2022	SMAP planning units	HSPF model for Ferndale SMAP planning units

APPENDIX B

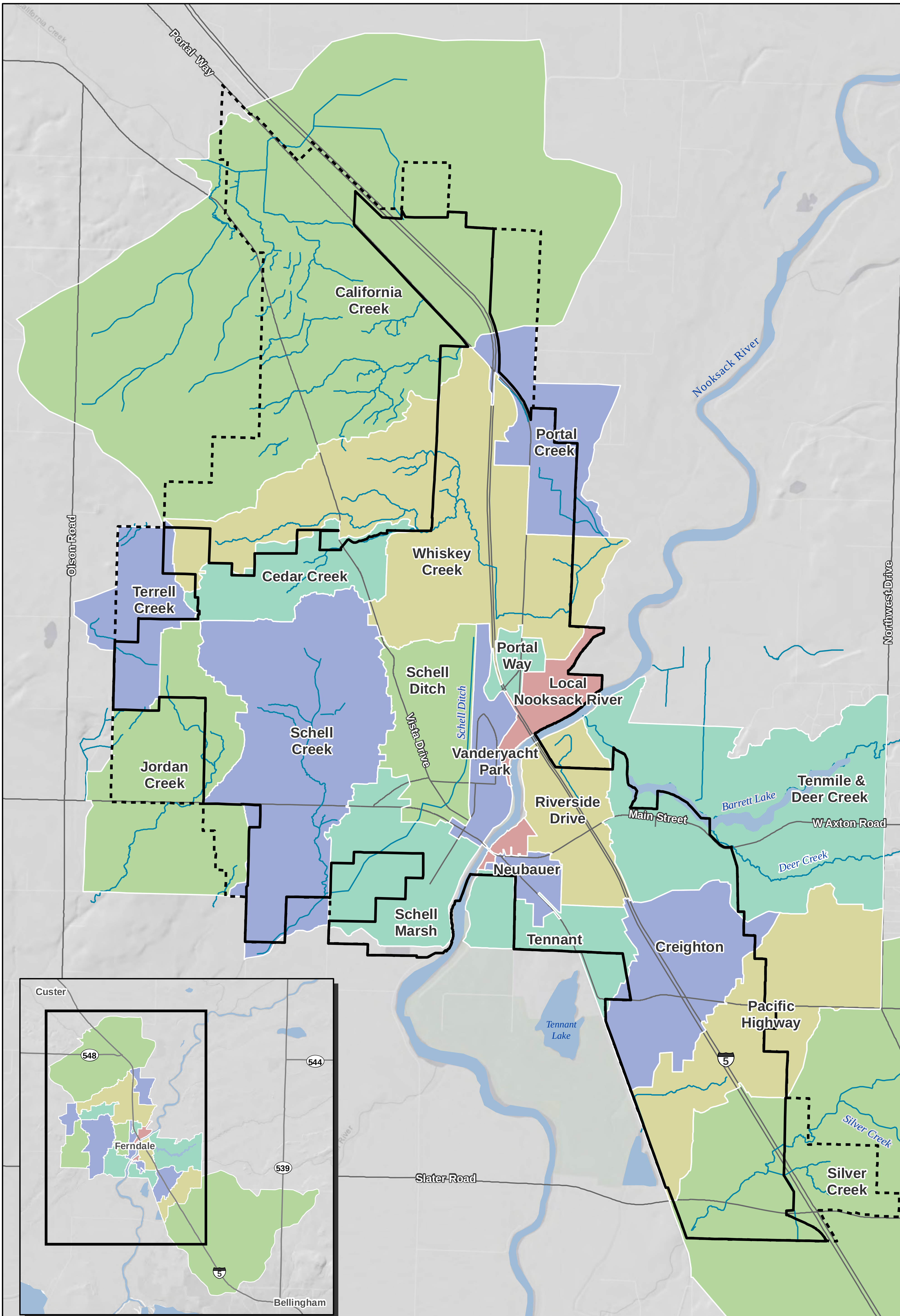
RECEIVING WATER ASSESSMENT

City of Ferndale Receiving Water Assessment - Summary

General						Land Cover - Land Use (basin-wide)				Stormwater Treatment (in UGA)				Stormwater Flow Control (in UGA)					Water Quality				Ecological Conditions		
No.	Receiving Water	Subbasin/Planning Unit	Area (ac)	Percent in UGA	Excluded from Prioritization	Existing Forest	Existing Impervious	Future Impervious	Dominant Zoning Land Use	Limited	Basic	Enhanced	Undeveloped or Untreated	Detention, Level 1	Detention, Level 2	Infiltration	Exempt	Undeveloped or No Flow Control	303(d) Listings	TMDLs	Relative WQ vs Standards	Pollutant Loading	Fish Species	Relative Hydrology (HPC)	B-IBI
1	California Creek	California Creek	3,189	42%	No, but <50% in UGA	38%	8%	22%	SFR-Rural (72%)	0%	0%	0%	100%	0%	0%	0%	0%	100%	3	Bacteria	Fair	Medium-Low	5	Fair-Good	Poor (1)
2	Jordan Creek	Jordan Creek	588	60%		29%	8%	23%	SFR-Rural (45%)	9%	0%	0%	91%	18%	1%	0%	0%	81%				Medium-Low	5	Fair-Good	
3	Nooksack River	Local Nooksack River Drainages	119	100%		33%	15%	47%	MFR (75%)	0%	7%	0%	93%	0%	7%	0%	Likely	93%	2	Bacteria		High	7	Poor	
4	Nooksack River	Neubauer	57	99%	Yes: low stormwater management influence	6%	56%	90%	Commercial (86%)	0%	100%	0%	0%	0%	0%	0%	100%	0%	2	Bacteria	Fair	Low	7	Poor	
5	Nooksack River	Portal Way	53	100%		25%	39%	90%	Commercial (56%)	0%	9%	15%	76%	10%	9%	15%	Likely	66%	2	Bacteria		High	0	Poor	
6	Nooksack River	Riverside Drive	247	84%		15%	25%	55%	Commercial (62%)	2%	0%	11%	87%	2%	13%	0%	Likely	85%	2	Bacteria		High	7	Poor	
7	Nooksack River	Vanderyacht Park	122	100%	Yes: low stormwater management influence	14%	32%	75%	Commercial (54%)	0%	100%	0%	0%	0%	0%	0%	100%	0%	2	Bacteria	Good	Low	7	Poor	
8	Schell Creek	Schell Creek	809	96%		22%	31%	50%	SFR-Med (40%)	8%	22%	11%	59%	20%	31%	0%	0%	49%			Poor	Medium-Low	5	Fair-Poor	
9	Schell Creek	Schell Ditch	281	100%		13%	38%	62%	SFR-Med (31%)	0%	6%	0%	94%	9%	6%	0%	0%	84%			Poor	Medium-High	5	Poor	
10	Schell Creek	Schell Marsh	335	100%		16%	20%	38%	Commercial (33%)	0%	10%	1%	89%	0%	10%	0%	0%	90%				Medium-High	7	Poor	
11	Silver Creek	Creighton	371	95%		39%	20%	61%	Commercial (50%)	0%	18%	1%	81%	3%	15%	5%	0%	77%				High	5	Fair-Poor	
12	Silver Creek	Pacific Highway	551	49%	No, but <50% in UGA	21%	28%	53%	SFR-Low (41%)	0%	41%	4%	56%	0%	44%	0%	0%	56%				Medium-Low	5	Poor	
13	Silver Creek	Silver Creek	6,475	7%	Yes: <<50% in UGA	42%	10%	48%	SFR-Rural (42%)	1%	20%	5%	73%	1%	22%	4%	0%	73%	2			Medium-High	5	Fair-Good	
14	Silver Creek/Tennant Lake	Tennant	197	51%		26%	13%	43%	SFR-Rural (44%)	12%	5%	14%	70%	12%	19%	0%	0%	70%				Medium-High	7	Fair-Good	
15	Tenmile Creek	Tenmile & Deer Creek	939	21%	Yes: <<50% in UGA	38%	12%	23%	SFR-Low (38%)	0%	6%	0%	94%	5%	6%	0%	0%	89%	3	Bacteria		Medium-Low	7	Fair-Poor	
16	Terrell Creek/Lake Terrell	Terrell Creek	226	85%		15%	13%	28%	SFR-Med (52%)	0%	42%	0%	58%	0%	42%	0%	0%	58%				Medium-Low	0	Good	
17	Whiskey Creek	Cedar Creek	238	100%		24%	33%	49%	SFR-Med (76%)	9%	18%	0%	74%	38%	19%	0%	0%	43%		Bacteria		Medium-Low	2	Fair-Good	
18	Whiskey Creek	Portal Creek	294	65%		46%	19%	40%	SFR-Rural (43%)	11%	30%	0%	59%	11%	22%	8%	0%	59%		Bacteria		Medium-Low	5	Fair-Poor	
19	Whiskey Creek	Whiskey Creek	1,086	95%		39%	14%	50%	SFR-Med (49%)	0%	12%	1%	87%	6%	12%	1%	0%	82%		Bacteria	Fair	Medium-High	5	Fair-Good	

Notes:

1. Land Cover - Land Use. Future impervious estimated assuming full build out condition based on zoning following several rounds of revision with the City.
2. Stormwater Treatment. Limited: basic (solids) treatment, pre-1998; Basic: basic treatment, post-1998. Enhanced: treatment for solids and metals (required post-1998). Undeveloped or Untreated: no mapped stormwater treatment facilities or undeveloped land that does not require treatment.
3. Stormwater Flow Control. Detention, Level 1: prior to flow duration control standard (pre-1998); Detention, Level 2: subject to flow duration control standard (post-1998); Infiltration: Flow control provided by an infiltration facility; Exempt: direct discharge to the Nooksack River exists or is very likely; Undeveloped or No Flow Control: no mapped stormwater facilities or undeveloped land that does not require flow control.
4. Water Quality. 303(d) Listings: includes Temperature, DO, Bacteria, and pH. 303(d) constituents for the Nooksack River (Temperature and DO) have been listed for subbasins likely to be Flow Control (in UGA) exempt . Bacteria TMDLs are in development or have been approved for Drayton Harbor Tributaries and the Nooksack River Watershed and were listed for subbasins included in their drainage areas. Relative WQ vs Standards: comparison of available WQ
5. Ecological Conditions. Fish Species: number of fish species believed to be present (includes Coho, Chum, Steelhead, Bull trout, Chinook, Pink, and Cutthroat); Relative Hydrology (HPC): ratio of the High Pulse Count, a flow "flashiness" metric, computed from modeled flows for existing and predevelopment (forested) conditions; B-IBI (Benthic Index of Biotic Integrity): metric describing in-stream biological conditions. The one B-IBI sampling score reported for California Creek was located downstream of the planning unit boundary and was found through the Puget Sound Stream Benthos monitoring project (https://pugetsoundstreambenthos.org/Default.aspx).



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream

SCALE - 1 inch = 1/2 mile

0 0.25 0.5 1
Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

N

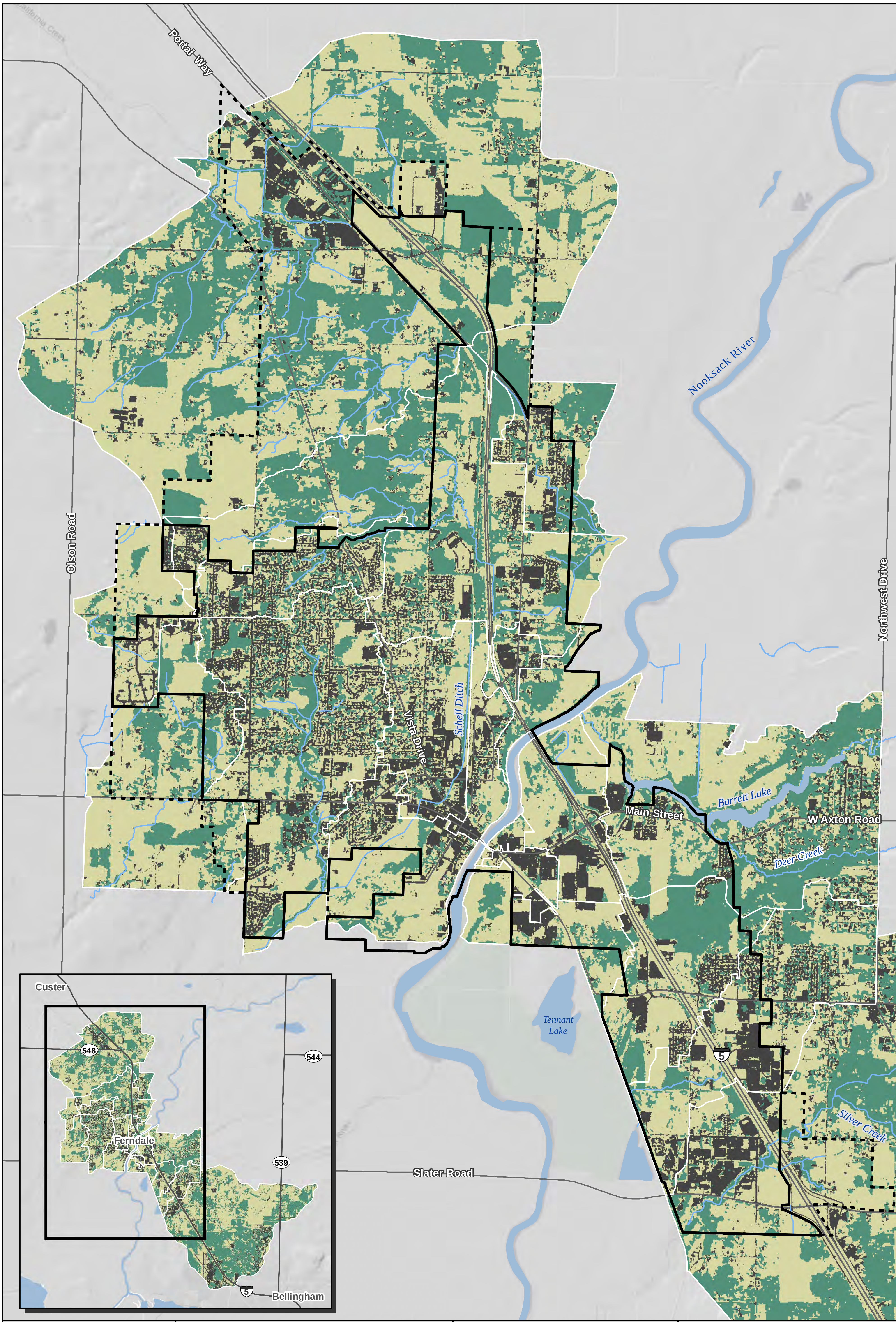
Job: 2006286 DATE: 24-Mar-2022

FERNDALE SMAP

Planning Units

FIGURE 1

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_PlanningUnits_r0b.mxd



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream

Landcover
Forest
Grass
Impervious
Water

SCALE - 1 inch = 1/2 mile
0 0.25 0.5 1
Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

N

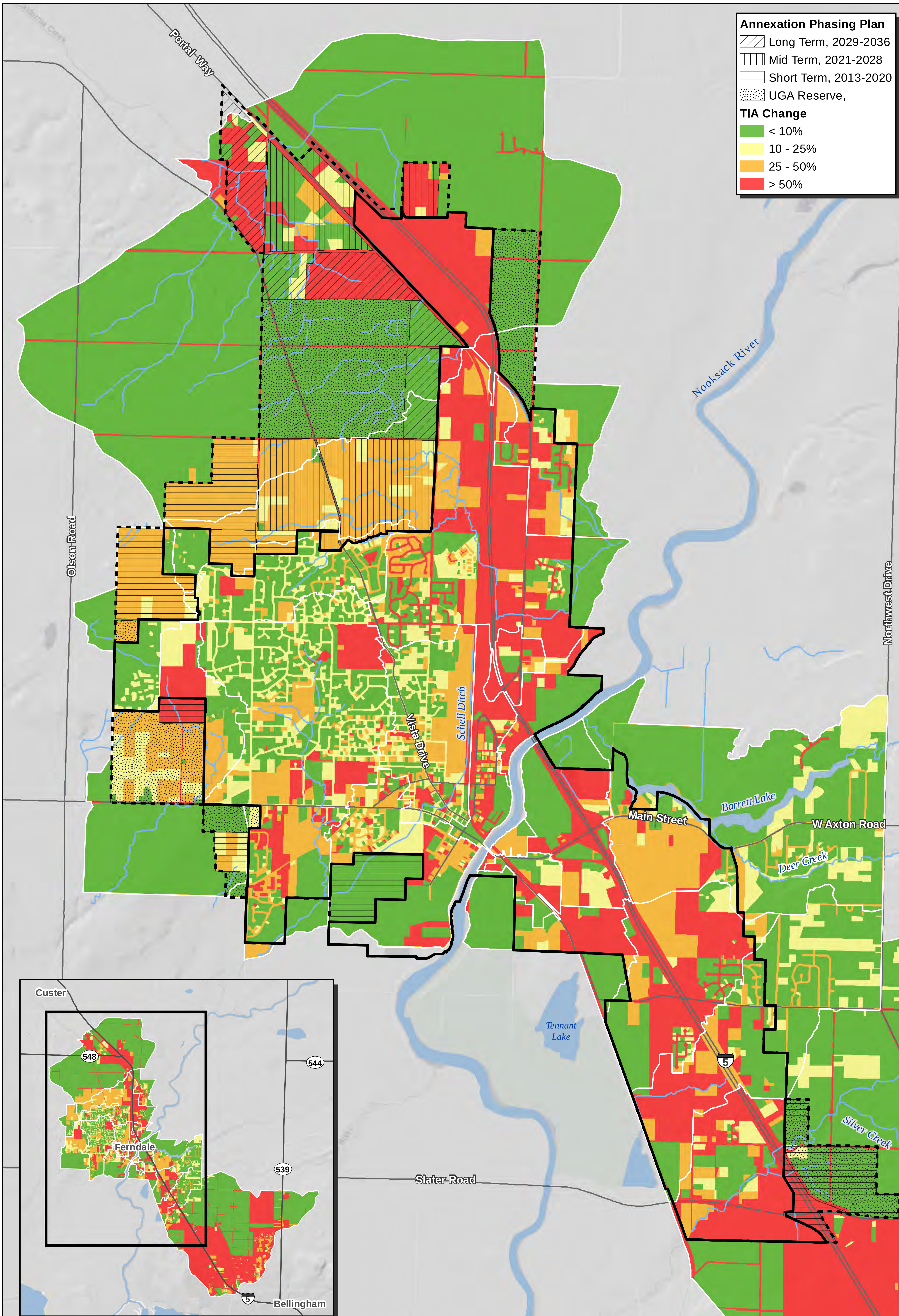
Job: 2006286 DATE: 24-Mar-2022

FERNDALE SMAP

Landcover

FIGURE 2

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_Landcover_r0b.mxd



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream

SCALE - 1 inch = 1/2 mile
0 0.25 0.5 1
Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

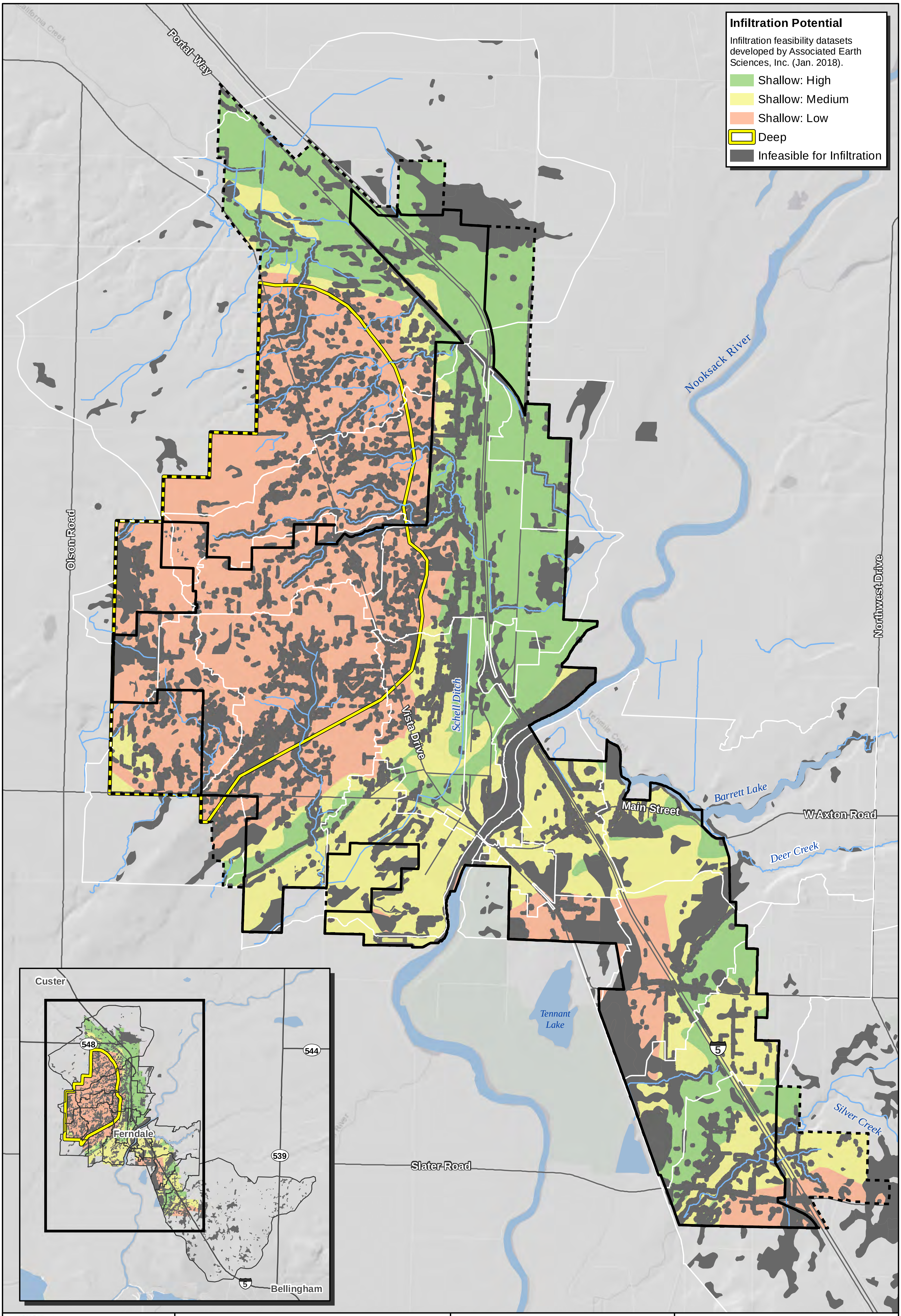
Job: 2006286
DATE: 24-Mar-2022

FERNDALE SMAP

Land Use

FIGURE 3

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_Landuse_r0b.mxd



City of Ferndale

nhc northwest hydraulic consultants

Legend
- City Limits
- UGA
- Planning Unit
- Stream

SCALE - 1 inch = 1/2 mile

0 0.25 0.5 1 Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

Job: 2006286

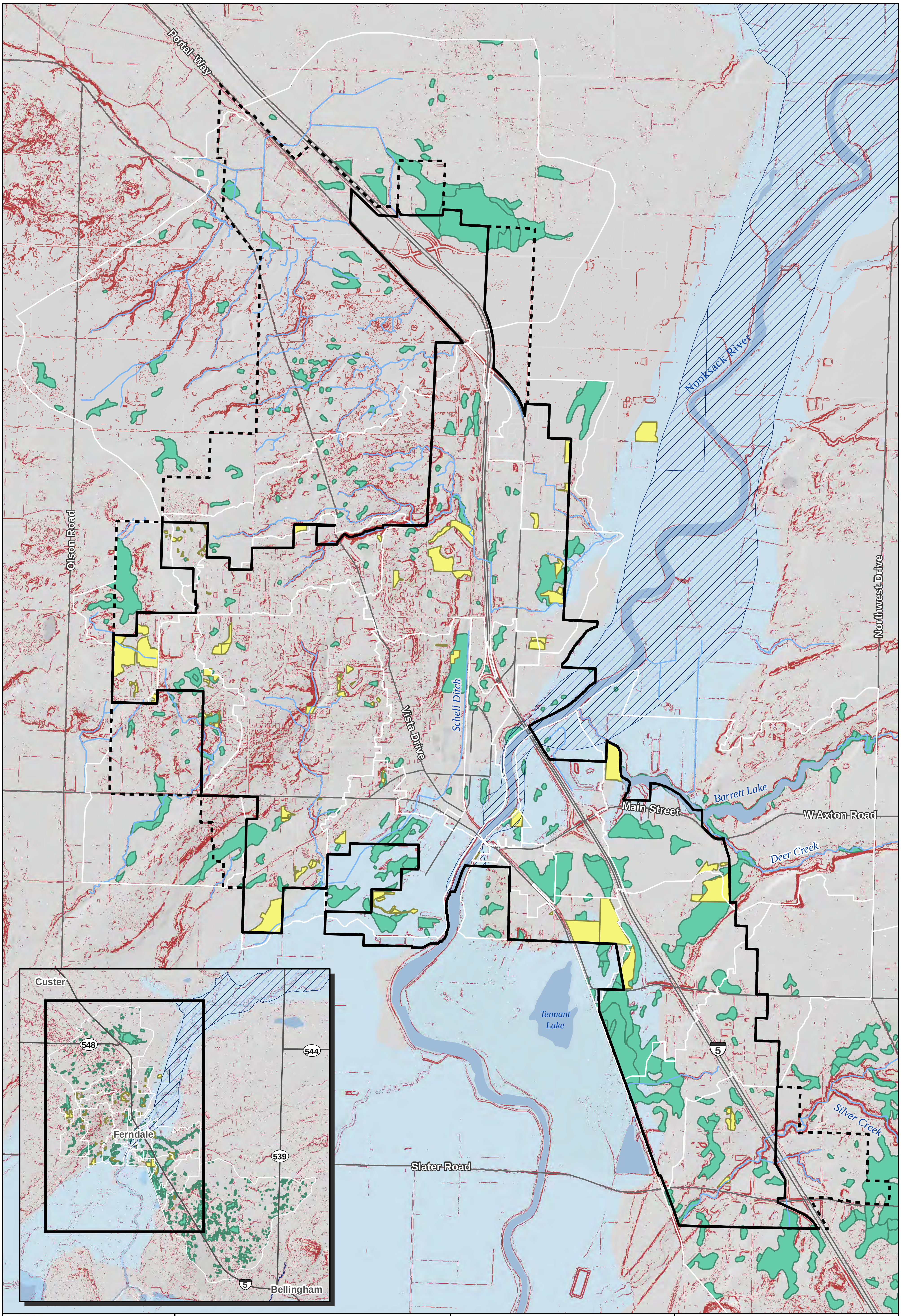
DATE: 24-Mar-2022

FERNDALE SMAP

Infiltration Feasibility

FIGURE 4

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_InfiltrationFeasibility_r0c.mxd



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream
Floodway
CoF Wetland
DNR Wetland
Steep Slope (>20%)
100-year Floodplain

SCALE - 1 inch = 1/2 mile

0 0.25 0.5 1

Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

N

Job: 2006286

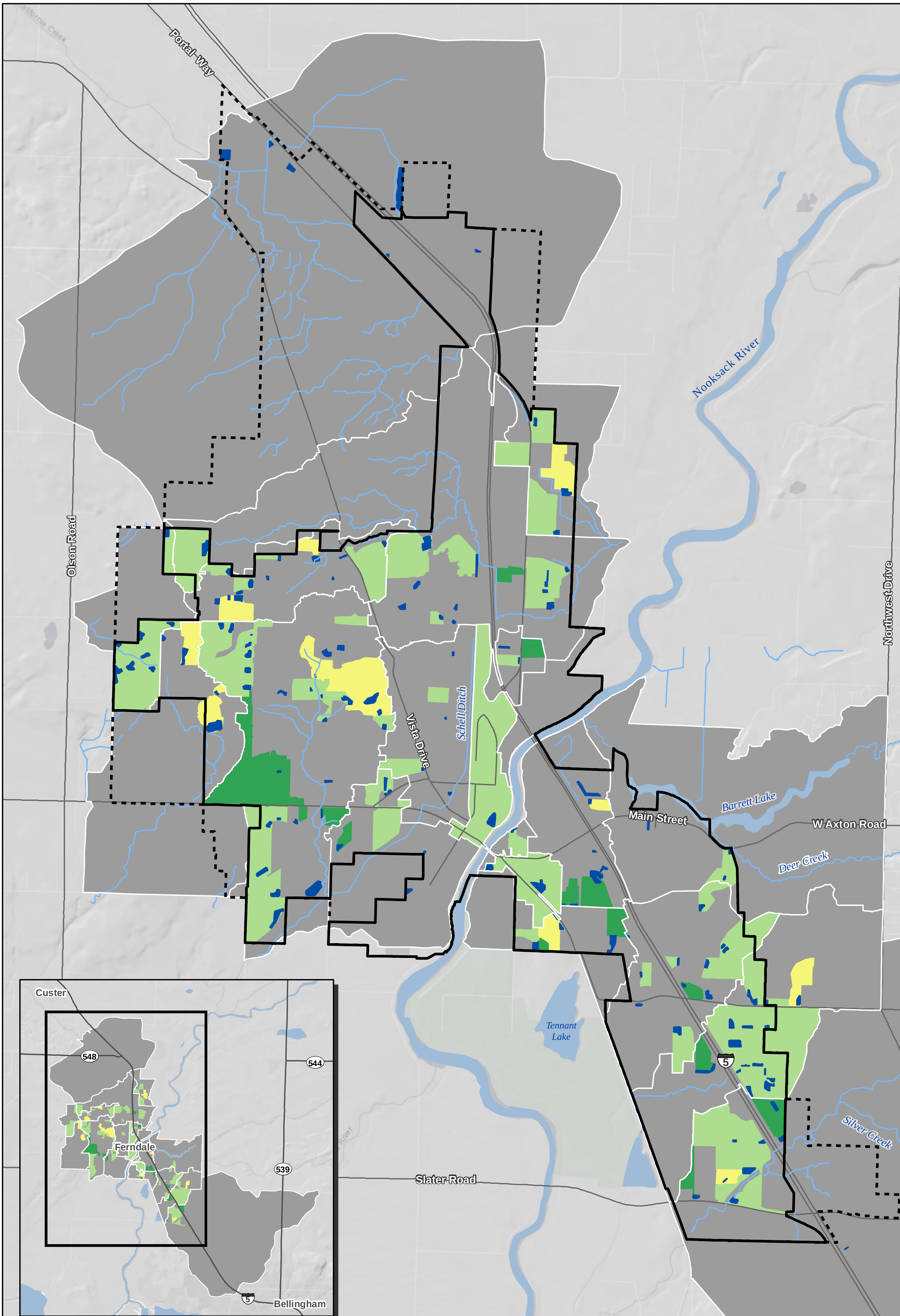
DATE: 24-Mar-2022

FERNDALE SMAP

Hydrography & Critical Areas

FIGURE 5

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_Hydrography_r0c.mxd



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream
Stormwater Pond

Treatment
No Treatment
Limited
Basic
Enhanced

SCALE - 1 inch = 1/2 mile
0 0.25 0.5 1
Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

N

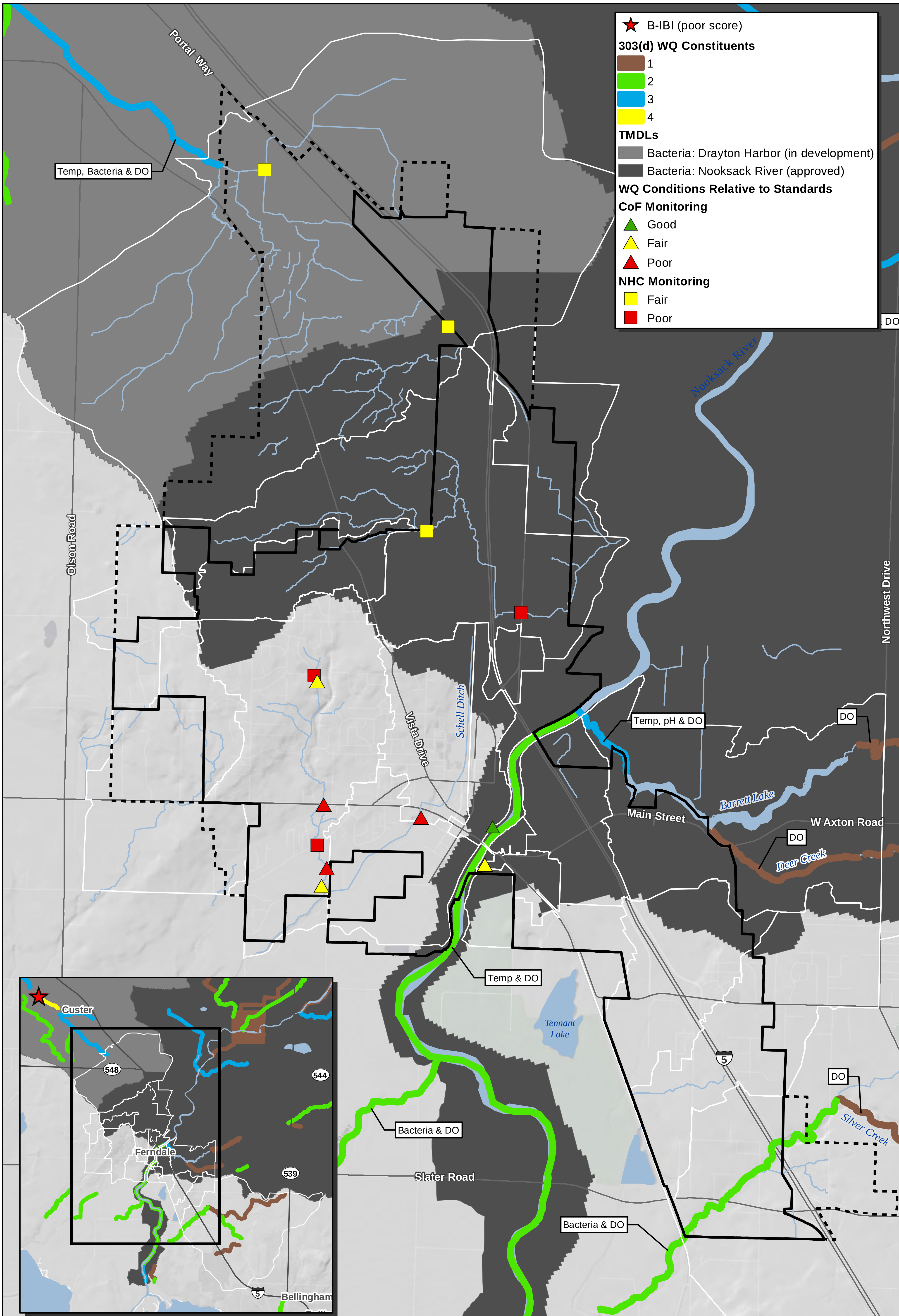
Job: 2006286 DATE: 24-Mar-2022

FERNDALE SMAP

Water Quality Treatment & Pollutant Loading

FIGURE 6

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_Treatment_r0b.mxd



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream

SCALE - 1 inch = 1/2 mile

0 0.25 0.5 1

Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

N

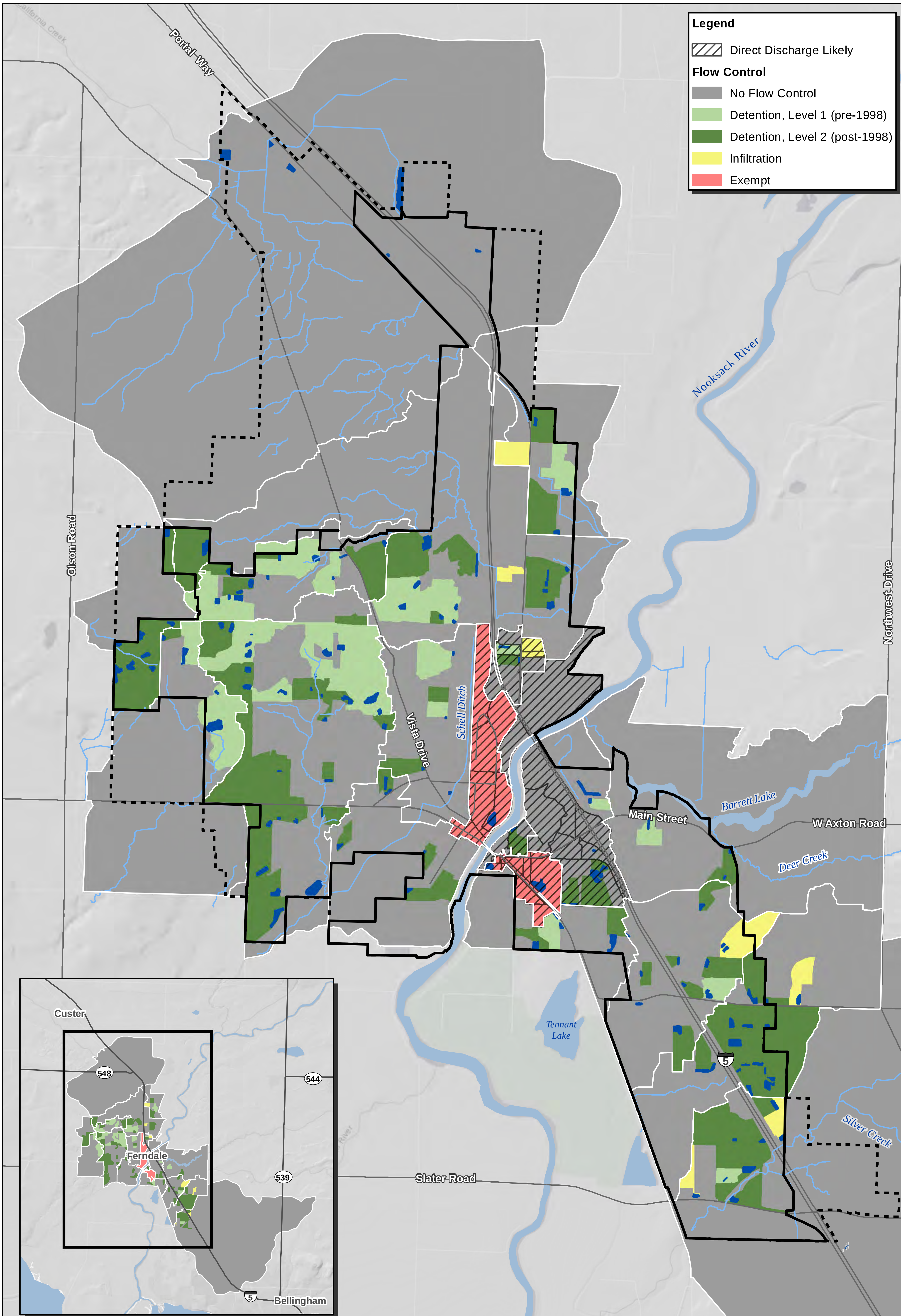
Job: 2006286 DATE: 24-Mar-2022

FERNDALE SMAP

Water Quality Monitoring

FIGURE 7

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_WaterQuality_r0b.mxd



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream
Stormwater Pond

SCALE - 1 inch = 1/2 mile

0 0.25 0.5 1
Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

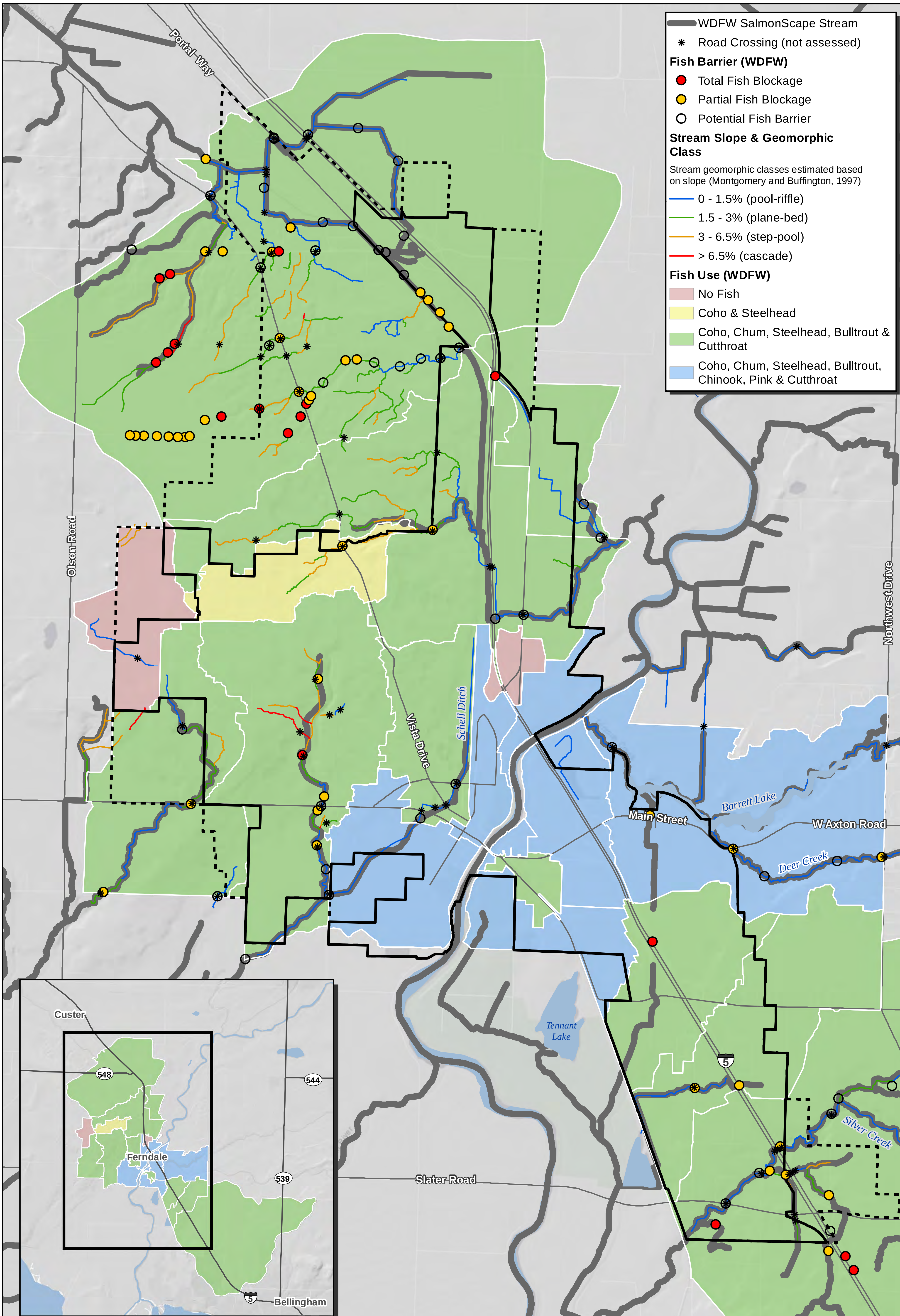
Job: 2006286 DATE: 24-Mar-2022

FERNDALE SMAP

Flow Control

FIGURE 8

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_FlowControl_f0b.mxd



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream

SCALE - 1 inch = 1/2 mile
0 0.25 0.5 1
Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

N

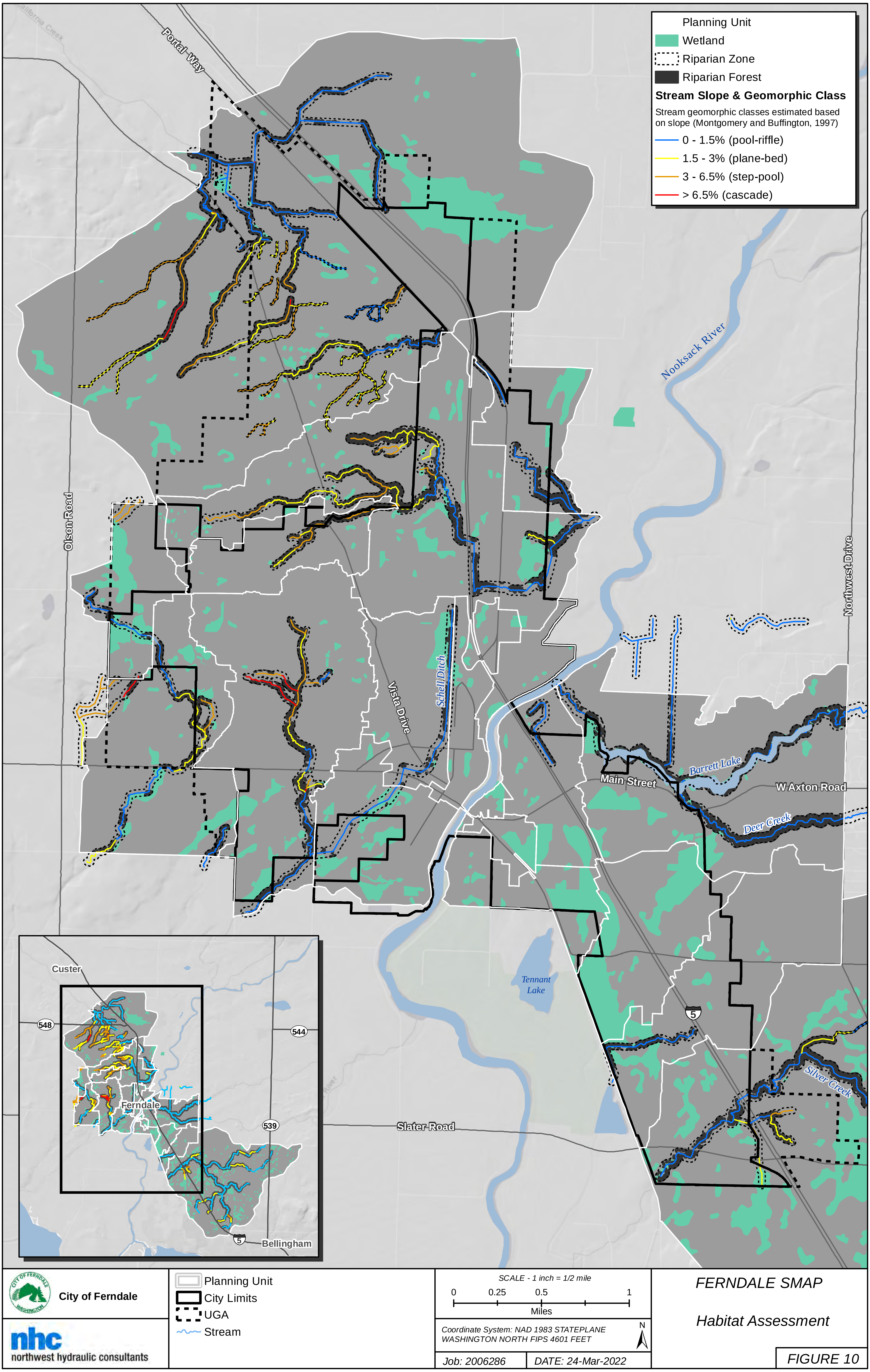
Job: 2006286 DATE: 24-Mar-2022

FERNDALE SMAP

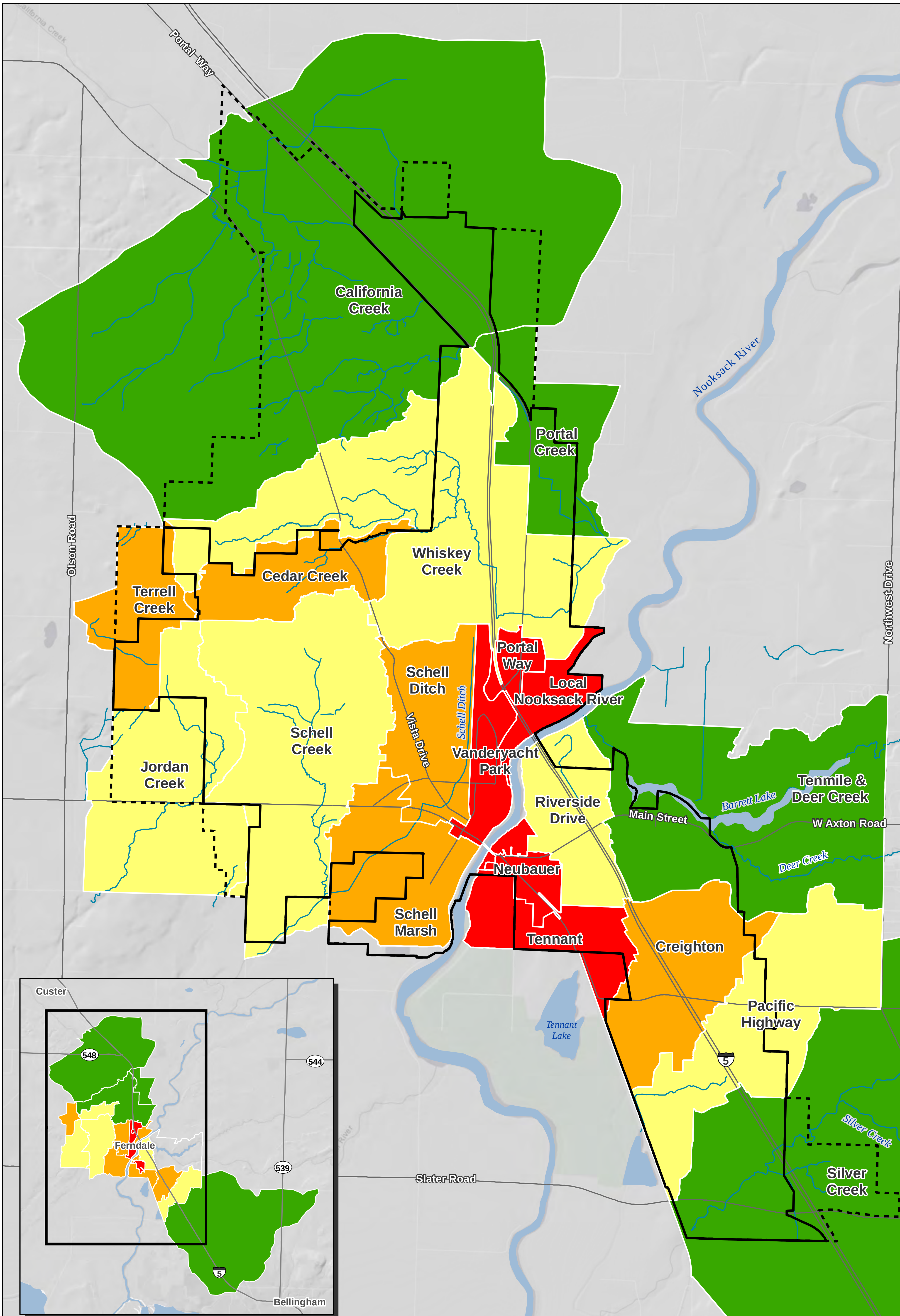
Fish Assessment

FIGURE 9

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_FishAssessment_r0a.mxd



Planning Unit
Wetland
Riparian Zone
Riparian Forest
Stream Slope & Geomorphic Class
Stream geomorphic classes estimated based on slope (Montgomery and Buffington, 1997)
0 - 1.5% (pool-riffle)
1.5 - 3% (plane-bed)
3 - 6.5% (step-pool)
> 6.5% (cascade)
Portal Way
California Creek
Olson Road
Nooksack River
Northwest Drive
Schell Ditch
Vista Drive
Barrett Lake
Main Street
W Axton Road
Deer Creek
Tennant Lake
Silver Creek
Slater Road
Custer
548
544
539
Ferndale
5
Bellingham
City of Ferndale
nhc
northwest hydraulic consultants
Planning Unit
City Limits
UGA
Stream
SCALE - 1 inch = 1/2 mile
0
0.25
0.5
1
Miles
N
Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET
Job: 2006286
DATE: 24-Mar-2022
FERNDALE SMAP
Habitat Assessment
FIGURE 10



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream

Resource Importance
Low
Moderate
High
Very High

SCALE - 1 inch = 1/2 mile
0 0.25 0.5 1
Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

N

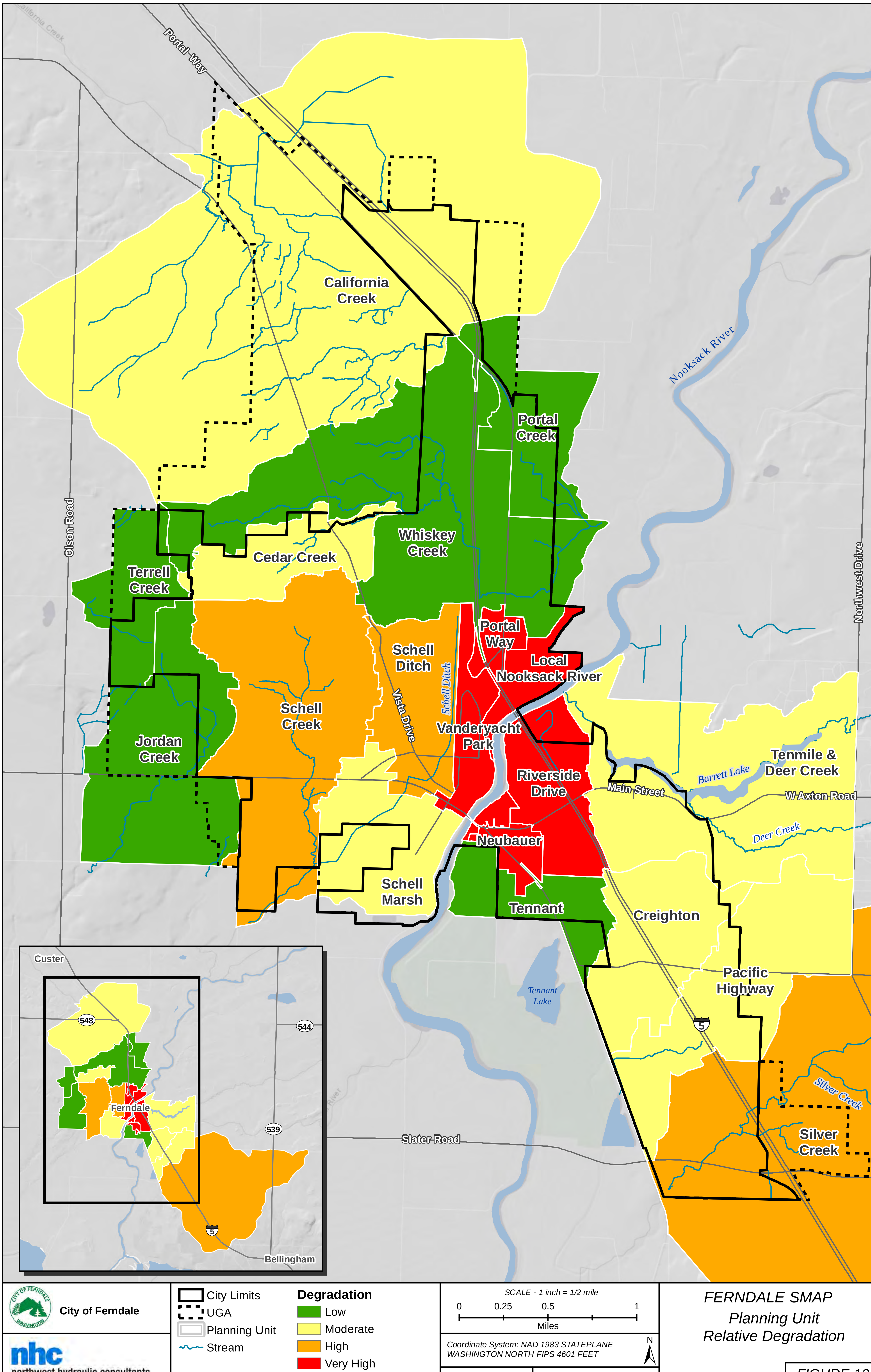
Job: 2006286 | DATE: 24-Mar-2022

FERNDALE SMAP

Planning Unit Relative Importance

FIGURE 11

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_importance.mxd



FERNDALE SMAP
Planning Unit Relative Degradation

FIGURE 12

California Creek Subbasin

General	
Receiving Water	California Creek
Watershed (HUC12)	Dakota Creek-Frontal Drayton Harbor
Total subbasin area	3,189 acres
Subbasin area within UGA	1,333 acres
Percent of Subbasin within UGA	42%
Waterbodies	
Streams	California Creek
Wetlands (DNR)	76 wetlands (207 acres)
Landcover (basin-wide)	
Impervious land cover	254 acres (8%)
Forest land cover	1,208 acres (38%)
Impervious (future - full build out)	694 acres (22%)
Zoning (basin-wide)	
Commercial	5%
Light Industrial	12%
MFR	-
Pasture	-
SFR-High	-
SFR-Low	-
SFR-Med	5%
SFR-Rural	72%
Transportation	6%
Water Quality Conditions	
WQ sampling	1 site met Temp standards and 1 site did not
Pollutant loading	Medium-Low
303d listings	Temperature, DO, bacteria
TMDL	Bacteria (Drayton Harbor Tributaries)
Ecological Conditions	
Modeled High Pulse Count	8.5 (existing) / 4.4 (forested)
B-IBI sampling	26.9/100 (1 sample outside subbasin)
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Development/Restoration
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	0%
Enhanced	0%
Undeveloped or Untreated	100%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	0%
Detention, Level 2 (post-1998)	0%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	100%

Stormwater Management Influence by Subbasin

California Creek

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This subbasin is 42% with the UGA. The major pollutants associated with point sources come from 7 mapped stormwater outfalls within the UGA and are expected to be typical of commercial/industrial areas. The major non-point sources of pollution are expected to be typical of agricultural areas. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 8.5. In a forested condition the high pulse count would be 4.4.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is primarily agricultural or commercial/industrial. The area is zoned for commercial and light industrial. Future build out of higher intensity uses can potentially occur, especially as the UGA expands.
- Existing impervious in the subbasin (basin-wide) is 8% and is estimated to increase to 22% under future conditions.
- Few developed areas in the UGA appear to have stormwater treatment or flow control.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Cedar Creek Subbasin

General	
Receiving Water	Whiskey Creek
Watershed (HUC12)	Wiser Lake Creek-Nooksack River
Total subbasin area	238 acres
Subbasin area within UGA	238 acres
Percent of Subbasin within UGA	100%
Waterbodies	
Streams	Cedar Creek
Wetlands (DNR)	5 wetlands (2.4 acres)
Landcover (basin-wide)	
Impervious land cover	79 acres (33%)
Forest land cover	58 acres (24%)
Impervious (future - full build out)	116 acres (49%)
Zoning (basin-wide)	
Commercial	8%
Light Industrial	-
MFR	-
Pasture	-
SFR-High	0%
SFR-Low	-
SFR-Med	76%
SFR-Rural	-
Transportation	16%
Water Quality Conditions	
WQ sampling	
Pollutant loading	Medium-Low
303d listings	
TMDL	Bacteria (Nooksack River)
Ecological Conditions	
Modeled High Pulse Count	11.5 (existing) / 6.2 (forested)
B-IBI sampling	
Fish Species	Coho, Steelhead
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Development/Restoration
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	9%
Basic	18%
Enhanced	0%
Undeveloped or Untreated	74%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	38%
Detention, Level 2 (post-1998)	19%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	43%

Cedar Creek

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 7 mapped stormwater outfalls within the UGA and are expected to be typical of residential areas. The major non-point sources of pollution are expected to also be typical of residential areas but are expected to be small. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 11.5. In a forested condition the high pulse count would be 6.2.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly medium density residential. The area is zoned for medium density residential. The basin is mostly developed to the zoned use already, so future build out seems limited.
- Existing impervious in the subbasin (basin-wide) is 33% and is estimated to increase to 49% under future conditions.
- Approximately half of existing development in the UGA has stormwater treatment and flow control. Stormwater treatment (mostly basic) and flow control (mostly Level 1 detention) is provided for 26% and 57% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Creighton Subbasin

General	
Receiving Water	Silver Creek
Watershed (HUC12)	Silver Creek
Total subbasin area	371 acres
Subbasin area within UGA	352 acres
Percent of Subbasin within UGA	95%
Waterbodies	
Streams	unnamed tributary
Wetlands (DNR)	12 wetlands (118 acres)
Landcover (basin-wide)	
Impervious land cover	76 acres (20%)
Forest land cover	145 acres (39%)
Impervious (future - full build out)	227 acres (61%)
Zoning (basin-wide)	
Commercial	50%
Light Industrial	-
MFR	9%
Pasture	-
SFR-High	9%
SFR-Low	5%
SFR-Med	7%
SFR-Rural	1%
Transportation	20%
Water Quality Conditions	
WQ sampling	
Pollutant loading	High
303d listings	
TMDL	
Ecological Conditions	
Modeled High Pulse Count	15.1 (existing) / 4.0 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Highest Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	18%
Enhanced	1%
Undeveloped or Untreated	81%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	3%
Detention, Level 2 (post-1998)	15%
Infiltration	5%
Exempt	0%
Undeveloped or No Flow Control	77%

Creighton

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 3 mapped stormwater outfalls and are expected to be typical of commercial areas and roadways. The major non-point sources of pollution are expected to be typical of agricultural areas. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 15.1. In a forested condition the high pulse count would be 4.0.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mixed among residential, agricultural, and undeveloped. The area is zoned for commercial and high density residential. Future build out can occur, though extensive wetlands (covering 32% of the subbasin area) are likely to impede development.
- Existing impervious in the subbasin (basin-wide) is 20% and is estimated to increase to 61% under future conditions.
- Most existing development in the UGA has stormwater treatment and flow control. Stormwater treatment (mostly basic) and flow control (mostly Level 2 detention) is provided for 19% and 23% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Jordan Creek Subbasin

General	
Receiving Water	Jordan Creek
Watershed (HUC12)	Nooksack River-Frontal Bellingham Bay
Total subbasin area	588 acres
Subbasin area within UGA	351 acres
Percent of Subbasin within UGA	60%
Waterbodies	
Streams	Jordan Creek
Wetlands (DNR)	26 wetlands (45 acres)
Landcover (basin-wide)	
Impervious land cover	46 acres (8%)
Forest land cover	168 acres (29%)
Impervious (future - full build out)	137 acres (23%)
Zoning (basin-wide)	
Commercial	5%
Light Industrial	-
MFR	-
Pasture	-
SFR-High	-
SFR-Low	6%
SFR-Med	42%
SFR-Rural	45%
Transportation	2%
Water Quality Conditions	
WQ sampling	
Pollutant loading	Medium-Low
303d listings	
TMDL	
Ecological Conditions	
Modeled High Pulse Count	9.6 (existing) / 6.3 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Highest Restoration
Sediment	Development/Restoration
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	9%
Basic	0%
Enhanced	0%
Undeveloped or Untreated	91%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	18%
Detention, Level 2 (post-1998)	1%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	81%

Jordan Creek

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 3 mapped stormwater outfalls within the UGA and are expected to be typical of residential areas. The major non-point sources of pollution are expected to be typical of agricultural areas. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 9.6. In a forested condition the high pulse count would be 6.3.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly residential and agricultural. The area is zoned for residential. Future build out can occur.
- Existing impervious in the subbasin (basin-wide) is 8% and is estimated to increase to 23% under future conditions.
- Most existing development in the UGA has stormwater flow control, and fewer areas have treatment. Stormwater treatment (limited) and flow control (mostly Level 1 detention) is provided for 9% and 19% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Local Nooksack Drainages Subbasin

General	
Receiving Water	Nooksack River
Watershed (HUC12)	Nooksack River-Frontal Bellingham Bay
Total subbasin area	119 acres
Subbasin area within UGA	119 acres
Percent of Subbasin within UGA	100%
Waterbodies	
Streams	Nooksack River
Wetlands (DNR)	8 wetlands (6.6 acres)
Landcover (basin-wide)	
Impervious land cover	18 acres (15%)
Forest land cover	39 acres (33%)
Impervious (future - full build out)	56 acres (47%)
Zoning (basin-wide)	
Commercial	17%
Light Industrial	-
MFR	75%
Pasture	-
SFR-High	-
SFR-Low	-
SFR-Med	-
SFR-Rural	-
Transportation	8%
Water Quality Conditions	
WQ sampling	
Pollutant loading	High
303d listings	Temperature, DO (Nooksack River)
TMDL	Bacteria (Nooksack River)
Ecological Conditions	
Modeled High Pulse Count	12.3 (existing) / 2.1 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat, Chinook, Pink
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	7%
Enhanced	0%
Undeveloped or Untreated	93%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	0%
Detention, Level 2 (post-1998)	7%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	93%

Local Nooksack River Drainages

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The Local Nooksack River Drainages are located on the floodplain of the Nooksack River, a flow control exempt and basic treatment receiving water. The major pollutants associated with point sources come from 3 mapped stormwater outfalls within the UGA and are expected to be typical of commercial and residential areas. The major non-point sources of pollution are expected to be typical of agricultural areas. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 12.3. In a forested condition the high pulse count would be 2.1.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly undeveloped on the west side of the river and commercial on the east side of the river. The area is zoned for medium commercial and multifamily residential. Future build out can occur on the west side of the river, though the Nooksack River floodway and floodplain is likely to impede development.
- Existing impervious in the subbasin (basin-wide) is 15% and is estimated to increase to 47% under future conditions.
- Most existing development on the east side of the river has stormwater treatment and flow control. Stormwater treatment (basic) and flow control (Level 2 detention) is provided for 7% of the subbasin area (in UGA).
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Neubauer Subbasin

General	
Receiving Water	Nooksack River
Watershed (HUC12)	Nooksack River-Frontal Bellingham Bay
Total subbasin area	57 acres
Subbasin area within UGA	56 acres
Percent of Subbasin within UGA	99%
Waterbodies	
Streams	
Wetlands (DNR)	2 wetlands (14 acres)
Landcover (basin-wide)	
Impervious land cover	32 acres (56%)
Forest land cover	4 acres (6%)
Impervious (future - full build out)	51 acres (90%)
Zoning (basin-wide)	
Commercial	86%
Light Industrial	-
MFR	-
Pasture	-
SFR-High	-
SFR-Low	-
SFR-Med	-
SFR-Rural	1%
Transportation	13%
Water Quality Conditions	
WQ sampling	Meets overall bacteria standard but several seasonal exceedances
Pollutant loading	Low
303d listings	Temperature, DO (Nooksack River)
TMDL	Bacteria (Nooksack River)
Ecological Conditions	
Modeled High Pulse Count	31.6 (existing) / 3.5 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	100%
Enhanced	0%
Undeveloped or Untreated	0%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	0%
Detention, Level 2 (post-1998)	0%
Infiltration	0%
Exempt	100%
Undeveloped or No Flow Control	0%

Neubauer

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This subbasin consists of the drainage area to the City-owned Neubauer Regional Pond stormwater facility which provides basic treatment prior to discharge to the Nooksack River, a flow control exempt and basic treatment receiving water. The major pollutants associated with point sources come from 1 mapped stormwater outfall within the UGA and are expected to be typical of commercial areas. Nonpoint source pollutant loading is expected to be small. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 31.6. In a forested condition the high pulse count would be 3.5.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly commercial. The area is zoned for commercial. The basin is mostly developed to the zoned use already, so future build out seems limited.
- Existing impervious in the subbasin (basin-wide) is 56% and is estimated to increase to 90% under future conditions.
- The City-owned Neubauer Regional Pond facility provides basic treatment for the entire subbasin area prior to discharge to the Nooksack River. Flow control is not provided nor required.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Pacific Highway Subbasin

General	
Receiving Water	Silver Creek
Watershed (HUC12)	Silver Creek
Total subbasin area	551 acres
Subbasin area within UGA	273 acres
Percent of Subbasin within UGA	49%
Waterbodies	
Streams	unnamed tributary
Wetlands (DNR)	14 wetlands (47 acres)
Landcover (basin-wide)	
Impervious land cover	156 acres (28%)
Forest land cover	113 acres (21%)
Impervious (future - full build out)	290 acres (53%)
Zoning (basin-wide)	
Commercial	23%
Light Industrial	12%
MFR	5%
Pasture	-
SFR-High	1%
SFR-Low	41%
SFR-Med	6%
SFR-Rural	3%
Transportation	10%
Water Quality Conditions	
WQ sampling	
Pollutant loading	Medium-Low
303d listings	
TMDL	
Ecological Conditions	
Modeled High Pulse Count	10.9 (existing) / 2.4 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Highest Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	41%
Enhanced	4%
Undeveloped or Untreated	56%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	0%
Detention, Level 2 (post-1998)	44%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	56%

Pacific Highway

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This subbasin is 42% with the UGA. The major pollutants associated with point sources come from 3 mapped stormwater outfalls within the UGA and are expected to be typical of commercial/industrial and residential areas. The major non-point sources of pollution are expected to be typical of agricultural areas and are expected to be small. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 10.9. In a forested condition the high pulse count would be 2.4.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is commercial, agriculture, or undeveloped. The area is zoned for commercial, light industrial, and multifamily residential. Future build out can occur in select areas. Existing wetlands in the southwest part of the subbasin near Brennan Pond may impede development.
- Existing impervious in the subbasin (basin-wide) is 28% and is estimated to increase to 53% under future conditions.
- Most existing development in the UGA, particularly east of I-5, has stormwater treatment and flow control. Stormwater treatment (mostly basic) and flow control (Level 2 detention) is provided for 44% the subbasin area (in UGA).
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Portal Creek Subbasin

General	
Receiving Water	Whiskey Creek
Watershed (HUC12)	Wiser Lake Creek-Nooksack River
Total subbasin area	294 acres
Subbasin area within UGA	191 acres
Percent of Subbasin within UGA	65%
Waterbodies	
Streams	Portal Creek
Wetlands (DNR)	2 wetlands (17 acres)
Landcover (basin-wide)	
Impervious land cover	55 acres (19%)
Forest land cover	134 acres (46%)
Impervious (future - full build out)	119 acres (40%)
Zoning (basin-wide)	
Commercial	19%
Light Industrial	-
MFR	-
Pasture	-
SFR-High	4%
SFR-Low	-
SFR-Med	21%
SFR-Rural	43%
Transportation	13%
Water Quality Conditions	
WQ sampling	
Pollutant loading	Medium-Low
303d listings	
TMDL	Bacteria (Nooksack River)
Ecological Conditions	
Modeled High Pulse Count	7.4 (existing) / 2.3 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Development/Restoration
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	11%
Basic	30%
Enhanced	0%
Undeveloped or Untreated	59%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	11%
Detention, Level 2 (post-1998)	22%
Infiltration	8%
Exempt	0%
Undeveloped or No Flow Control	59%

Portal Creek

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 2 mapped stormwater outfalls within the UGA and are expected to be typical of residential areas. The major non-point sources of pollution are expected to be typical of agricultural areas. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 7.4. In a forested condition the high pulse count would be 2.3.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly residential. The area is zoned for medium density residential and commercial. Future build out is mostly limited to a 12-acre vacant parcel east of Portal Way and areas outside the UGA.
- Existing impervious in the subbasin (basin-wide) is 19% and is estimated to increase to 40% under future conditions.
- Most existing development has stormwater treatment and flow control. Stormwater treatment (mostly basic) and flow control (mostly Level 2 detention) is provided for 41% of the subbasin area (in UGA).
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Portal Way Subbasin

General	
Receiving Water	Nooksack River
Watershed (HUC12)	Nooksack River-Frontal Bellingham Bay
Total subbasin area	53 acres
Subbasin area within UGA	53 acres
Percent of Subbasin within UGA	100%
Waterbodies	
Streams	Portal Creek
Wetlands (DNR)	4 wetlands (4.6 acres)
Landcover (basin-wide)	
Impervious land cover	21 acres (39%)
Forest land cover	14 acres (25%)
Impervious (future - full build out)	47 acres (90%)
Zoning (basin-wide)	
Commercial	56%
Light Industrial	-
MFR	5%
Pasture	-
SFR-High	-
SFR-Low	-
SFR-Med	-
SFR-Rural	-
Transportation	39%
Water Quality Conditions	
WQ sampling	
Pollutant loading	High
303d listings	Temperature, DO (Nooksack River)
TMDL	Bacteria (Nooksack River)
Ecological Conditions	
Modeled High Pulse Count	24.5 (existing) / 2.3 (forested)
B-IBI sampling	
Fish Species	no fish
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	9%
Enhanced	15%
Undeveloped or Untreated	76%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	10%
Detention, Level 2 (post-1998)	9%
Infiltration	15%
Exempt	0%
Undeveloped or No Flow Control	66%

Portal Way

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

Most runoff in the Portal Way subbasin is collected and conveyed through the City's MS4 to the Nooksack River, a flow control exempt and basic treatment receiving water. While there are no mapped stormwater outfalls in the subbasin, the major pollutants associated with point sources are expected to be typical of commercial areas. The major non-point sources of pollution are expected to be typical of roadways. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 24.5. In a forested condition the high pulse count would be 2.3.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly commercial. The area is zoned for commercial. The basin is mostly developed to the zoned use already, so future build out seems limited.
- Existing impervious in the subbasin (basin-wide) is 39% and is estimated to increase to 90% under future conditions.
- Approximately half of the existing development in the UGA has stormwater treatment and flow control. Stormwater treatment (basic or enhanced) and flow control (mix of detention and infiltration) is provided for 24% and 34% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Riverside Drive Subbasin

General	
Receiving Water	Nooksack River
Watershed (HUC12)	Nooksack River-Frontal Bellingham Bay
Total subbasin area	247 acres
Subbasin area within UGA	208 acres
Percent of Subbasin within UGA	84%
Waterbodies	
Streams	unnamed tributary
Wetlands (DNR)	15 wetlands (28 acres)
Landcover (basin-wide)	
Impervious land cover	61 acres (25%)
Forest land cover	38 acres (15%)
Impervious (future - full build out)	137 acres (55%)
Zoning (basin-wide)	
Commercial	62%
Light Industrial	-
MFR	-
Pasture	15%
SFR-High	-
SFR-Low	-
SFR-Med	-
SFR-Rural	-
Transportation	23%
Water Quality Conditions	
WQ sampling	
Pollutant loading	High
303d listings	Temperature, DO (Nooksack River)
TMDL	Bacteria (Nooksack River)
Ecological Conditions	
Modeled High Pulse Count	19.2 (existing) / 2.4 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat, Chinook, Pink
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	2%
Basic	0%
Enhanced	11%
Undeveloped or Untreated	87%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	2%
Detention, Level 2 (post-1998)	13%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	85%

Riverside Drive

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

Most runoff in the Riverside Drive subbasin is collected and conveyed through the City's MS4 to the Nooksack River, a flow control exempt and basic treatment receiving water. The major pollutants associated with point sources come from 2 mapped stormwater outfalls within the UGA and are expected to be typical of commercial and roadway areas. The major non-point sources of pollution are expected to be typical of agricultural areas. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 19.2. In a forested condition the high pulse count would be 2.4.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly commercial south of Main Street and agricultural north of Main Street moving towards the Nooksack River. The area is zoned for commercial. Build out of higher intensity is mostly limited to north of Main Street, but the Nooksack River floodway and floodplain is likely to impede development.
- Existing impervious in the subbasin (basin-wide) is 25% and is estimated to increase to 55% under future conditions.
- Most existing development in the UGA (south of Main Street) has stormwater treatment and flow control. Stormwater treatment (mostly enhanced) and flow control (mostly Level 2 detention) is provided for 13% and 15% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Schell Creek Subbasin

General	
Receiving Water	Schell Creek
Watershed (HUC12)	Nooksack River-Frontal Bellingham Bay
Total subbasin area	809 acres
Subbasin area within UGA	775 acres
Percent of Subbasin within UGA	96%
Waterbodies	
Streams	Schell Creek
Wetlands (DNR)	15 wetlands (19 acres)
Landcover (basin-wide)	
Impervious land cover	248 acres (31%)
Forest land cover	176 acres (22%)
Impervious (future - full build out)	407 acres (50%)
Zoning (basin-wide)	
Commercial	13%
Light Industrial	-
MFR	8%
Pasture	3%
SFR-High	17%
SFR-Low	5%
SFR-Med	40%
SFR-Rural	1%
Transportation	14%
Water Quality Conditions	
WQ sampling	Fails pH, Temp, DO, and bacteria standards
Pollutant loading	Medium-Low
303d listings	
TMDL	
Ecological Conditions	
Modeled High Pulse Count	18.1 (existing) / 5.0 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Highest Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	8%
Basic	22%
Enhanced	11%
Undeveloped or Untreated	59%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	20%
Detention, Level 2 (post-1998)	31%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	49%

Schell Creek

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 32 mapped stormwater outfalls within the UGA and are expected to be typical of residential areas. The major non-point sources of pollution are expected to be typical of residential and agricultural areas but are expected to be relatively small. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 18.1. In a forested condition the high pulse count would be 5.0.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly residential. The area is zoned for medium and high density residential. Future build out can occur in select areas.
- Existing impervious in the subbasin (basin-wide) is 31% and is estimated to increase to 50% under future conditions.
- Approximately half of the existing development in the UGA has stormwater flow control and a slightly lesser amount has treatment. Stormwater treatment (mostly basic) and flow control (mostly Level 2 detention) is provided for 41% and 51% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Schell Ditch Subbasin

General	
Receiving Water	Schell Creek
Watershed (HUC12)	Nooksack River-Frontal Bellingham Bay
Total subbasin area	281 acres
Subbasin area within UGA	281 acres
Percent of Subbasin within UGA	100%
Waterbodies	
Streams	Schell Ditch
Wetlands (DNR)	5 wetlands (20 acres)
Landcover (basin-wide)	
Impervious land cover	107 acres (38%)
Forest land cover	36 acres (13%)
Impervious (future - full build out)	175 acres (62%)
Zoning (basin-wide)	
Commercial	29%
Light Industrial	-
MFR	15%
Pasture	-
SFR-High	11%
SFR-Low	-
SFR-Med	31%
SFR-Rural	-
Transportation	14%
Water Quality Conditions	
WQ sampling	Fails pH, Temp, DO, and bacteria standards
Pollutant loading	Medium-High
303d listings	
TMDL	
Ecological Conditions	
Modeled High Pulse Count	25.2 (existing) / 5.2 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Highest Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	6%
Enhanced	0%
Undeveloped or Untreated	94%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	9%
Detention, Level 2 (post-1998)	6%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	84%

Schell Ditch

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 5 mapped stormwater outfalls within the UGA and are expected to be typical of residential and commercial areas. The major non-point sources of pollution are expected to be typical of residential areas but are expected to be small. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 25.2. In a forested condition the high pulse count would be 5.2.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly commercial and residential. The area is zoned for commercial and medium to high density residential. The basin is mostly developed to the zoned use already, so future build out seems limited except for some undeveloped area north of Ferndale High School.
- Existing impervious in the subbasin (basin-wide) is 38% and is estimated to increase to 62% under future conditions.
- Few developed areas in the UGA have stormwater treatment and flow control. Stormwater treatment (basic) and flow control (mostly Level 1 detention) is provided for 6% and 16% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Schell Marsh Subbasin

General	
Receiving Water	Schell Creek
Watershed (HUC12)	Nooksack River-Frontal Bellingham Bay
Total subbasin area	335 acres
Subbasin area within UGA	335 acres
Percent of Subbasin within UGA	100%
Waterbodies	
Streams	Schell Ditch
Wetlands (DNR)	19 wetlands (45 acres)
Landcover (basin-wide)	
Impervious land cover	68 acres (20%)
Forest land cover	53 acres (16%)
Impervious (future - full build out)	126 acres (38%)
Zoning (basin-wide)	
Commercial	33%
Light Industrial	-
MFR	23%
Pasture	27%
SFR-High	9%
SFR-Low	-
SFR-Med	-
SFR-Rural	-
Transportation	9%
Water Quality Conditions	
WQ sampling	
Pollutant loading	Medium-High
303d listings	
TMDL	
Ecological Conditions	
Modeled High Pulse Count	23.0 (existing) / 4.2 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat, Chinook, Pink
PCWS Restoration Potential/Best Use	
Flow	Highest Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	10%
Enhanced	1%
Undeveloped or Untreated	89%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	0%
Detention, Level 2 (post-1998)	10%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	90%

Schell Marsh

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 7 mapped stormwater outfalls within the UGA and are expected to be typical of commercial and residential areas. The major non-point sources of pollution are expected to be typical of agricultural areas and low intensity urban green space (grass areas from the Conoco Phillips Sports Complex). The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 23.0. In a forested condition the high pulse count would be 4.2.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA consists of both low and high intensity uses. Schell Marsh and the Conoco Phillips Sports Complex (open green space) are largely undeveloped while high density residential and commercial areas are located in the northern part of the subbasin near Main Street. Excluding most of Schell Marsh, the area is zoned for commercial and high density residential. Future build out on the fringes of Schell Marsh is possible.
- Existing impervious in the subbasin (basin-wide) is 20% and is estimated to increase to 38% under future conditions.
- Less than half of existing development in the UGA has stormwater treatment and flow control. Stormwater treatment (mostly basic) and flow control (Level 2 detention) is provided for 11% and 10% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Silver Creek Subbasin

General	
Receiving Water	Silver Creek
Watershed (HUC12)	Silver Creek
Total subbasin area	6,475 acres
Subbasin area within UGA	433 acres
Percent of Subbasin within UGA	7%
Waterbodies	
Streams	Silver Creek, 3 unnamed tributaries
Wetlands (DNR)	253 wetlands (627 acres)
Landcover (basin-wide)	
Impervious land cover	672 acres (10%)
Forest land cover	2,723 acres (42%)
Impervious (future - full build out)	3,082 (48%)
Zoning (basin-wide)	
Commercial	30%
Light Industrial	11%
MFR	6%
Pasture	0%
SFR-High	0%
SFR-Low	2%
SFR-Med	1%
SFR-Rural	42%
Transportation	8%
Water Quality Conditions	
WQ sampling	
Pollutant loading	Medium-High
303d listings	DO, bacteria
TMDL	
Ecological Conditions	
Modeled High Pulse Count	10.9 (existing) / 5.0 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Restoration/Development
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	1%
Basic	20%
Enhanced	5%
Undeveloped or Untreated	73%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	1%
Detention, Level 2 (post-1998)	22%
Infiltration	4%
Exempt	0%
Undeveloped or No Flow Control	73%

Silver Creek

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This subbasin is 7% with the UGA. The major pollutants associated with point sources come from 8 mapped stormwater outfalls within the UGA and are expected to be typical of commercial areas. The major non-point sources of pollution are expected to be typical of agricultural areas located mostly outside the UGA. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 10.9. In a forested condition the high pulse count would be 5.0.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is commercial, agricultural, or undeveloped. The area is zoned for commercial west of I-5 and low-density residential east of I-5. Future build out can occur.
- Existing impervious in the subbasin (basin-wide) is 10% and is estimated to increase to 48% under future conditions.
- Most existing development in the UGA has stormwater treatment and flow control. Stormwater treatment (mostly basic) and flow control (mostly Level 2 detention) is provided for 27% of the subbasin area (in UGA).
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Tenmile & Deer Creek Subbasin

General	
Receiving Water	Tenmile Creek
Watershed (HUC12)	Tenmile Creek
Total subbasin area	939 acres
Subbasin area within UGA	201 acres
Percent of Subbasin within UGA	21%
Waterbodies	
Streams	Tenmile Creek, Deer Creek
Wetlands (DNR)	21 wetlands (100 acres)
Landcover (basin-wide)	
Impervious land cover	113 acres (12%)
Forest land cover	361 acres (38%)
Impervious (future - full build out)	220 acres (23%)
Zoning (basin-wide)	
Commercial	16%
Light Industrial	-
MFR	-
Pasture	30%
SFR-High	-
SFR-Low	38%
SFR-Med	6%
SFR-Rural	5%
Transportation	4%
Water Quality Conditions	
WQ sampling	
Pollutant loading	Medium-Low
303d listings	Temperature, DO, pH
TMDL	Bacteria (Nooksack River)
Ecological Conditions	
Modeled High Pulse Count	7.3 (existing) / 2.4 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat, Chinook, Pink
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Restoration/Development
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	6%
Enhanced	0%
Undeveloped or Untreated	94%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	5%
Detention, Level 2 (post-1998)	6%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	89%

Tenmile & Deer Creek

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This subbasin is 21% with the UGA. The major pollutants associated with point sources come from 5 mapped stormwater outfalls within the UGA and are expected to be typical of residential areas. The major non-point sources of pollution are expected to be typical of agricultural areas. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 7.3. In a forested condition the high pulse count would be 2.4.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly agricultural or residential. The area is zoned for commercial. Additional build out can occur.
- Existing impervious in the subbasin (basin-wide) is 12% and is estimated to increase to 23% under future conditions.
- Approximately half of existing development in the UGA has stormwater flow control and a quarter has treatment. Stormwater treatment (basic) and flow control (Level 1 and 2 detention) is provided for 6% and 11% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Tennant Subbasin

General	
Receiving Water	Silver Creek/Tennant Lake
Watershed (HUC12)	Silver Creek
Total subbasin area	197 acres
Subbasin area within UGA	101 acres
Percent of Subbasin within UGA	51%
Waterbodies	
Streams	
Wetlands (DNR)	20 wetlands (21 acres)
Landcover (basin-wide)	
Impervious land cover	26 acres (13%)
Forest land cover	51 acres (26%)
Impervious (future - full build out)	84 acres (43%)
Zoning (basin-wide)	
Commercial	33%
Light Industrial	16%
MFR	-
Pasture	-
SFR-High	-
SFR-Low	-
SFR-Med	3%
SFR-Rural	44%
Transportation	4%
Water Quality Conditions	
WQ sampling	
Pollutant loading	Medium-High
303d listings	
TMDL	
Ecological Conditions	
Modeled High Pulse Count	9.4 (existing) / 4.7 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat, Chinook, Pink
PCWS Restoration Potential/Best Use	
Flow	Highest Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	12%
Basic	5%
Enhanced	14%
Undeveloped or Untreated	70%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	12%
Detention, Level 2 (post-1998)	19%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	70%

Tennant

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 2 mapped stormwater outfalls within the UGA and are expected to be typical of commercial/industrial areas. The major non-point sources of pollution are expected to be typical of agricultural and undeveloped areas and are expected to be small. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 9.4. In a forested condition the high pulse count would be 4.7.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is commercial or undeveloped. The area is zoned for commercial and light industrial. Future build out can occur.
- Existing impervious in the subbasin (basin-wide) is 13% and is estimated to increase to 43% under future conditions.
- Most existing development in the UGA has stormwater treatment and flow control. Stormwater treatment (mostly limited or enhanced) and flow control (Level 1 and Level 2 detention) is provided for 30% the subbasin area (in UGA).
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Terrell Creek Subbasin

General	
Receiving Water	Terrell Creek/Lake Terrell
Watershed (HUC12)	Terrell Creek-Frontal Birch Bay
Total subbasin area	226 acres
Subbasin area within UGA	192 acres
Percent of Subbasin within UGA	85%
Waterbodies	
Streams	Terrell Creek
Wetlands (DNR)	3 wetlands (32 acres)
Landcover (basin-wide)	
Impervious land cover	30 acres (13%)
Forest land cover	34 acres (15%)
Impervious (future - full build out)	64 acres (28%)
Zoning (basin-wide)	
Commercial	1%
Light Industrial	-
MFR	-
Pasture	-
SFR-High	-
SFR-Low	25%
SFR-Med	52%
SFR-Rural	14%
Transportation	7%
Water Quality Conditions	
WQ sampling	
Pollutant loading	Medium-Low
303d listings	
TMDL	
Ecological Conditions	
Modeled High Pulse Count	9.1 (existing) / 6.2 (forested)
B-IBI sampling	
Fish Species	no fish
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Development/Restoration
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Conservation
Metals	Restoration/Development
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	42%
Enhanced	0%
Undeveloped or Untreated	58%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	0%
Detention, Level 2 (post-1998)	42%
Infiltration	0%
Exempt	0%
Undeveloped or No Flow Control	58%

Terrell Creek

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 4 mapped stormwater outfalls within the UGA and are expected to be typical of residential areas. The major non-point sources of pollution are expected to be typical of agricultural areas which are mostly outside the UGA. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 9.1. In a forested condition the high pulse count would be 6.2.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is residential or agricultural. The area is zoned for residential. Future build out can occur, particularly north of Thornton Road.
- Existing impervious in the subbasin (basin-wide) is 13% and is estimated to increase to 28% under future conditions.
- Existing development in the UGA has stormwater treatment and flow control. Stormwater treatment (basic) and flow control (Level 2 detention) is provided for 42% of the subbasin area (in UGA).
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Vanderyacht Park Subbasin

General	
Receiving Water	Nooksack River
Watershed (HUC12)	Nooksack River-Frontal Bellingham Bay
Total subbasin area	122 acres
Subbasin area within UGA	122 acres
Percent of Subbasin within UGA	100%
Waterbodies	
Streams	
Wetlands (DNR)	6 wetlands (8.2 acres)
Landcover (basin-wide)	
Impervious land cover	39 acres (32%)
Forest land cover	18 acres (14%)
Impervious (future - full build out)	92 acres (75%)
Zoning (basin-wide)	
Commercial	54%
Light Industrial	-
MFR	20%
Pasture	-
SFR-High	-
SFR-Low	-
SFR-Med	-
SFR-Rural	-
Transportation	25%
Water Quality Conditions	
WQ sampling	Meets bacteria standard
Pollutant loading	Low
303d listings	Temperature, DO (Nooksack River)
TMDL	Bacteria (Nooksack River)
Ecological Conditions	
Modeled High Pulse Count	26.8 (existing) / 2.3 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat, Chinook, Pink
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Conservation
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Development/Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	100%
Enhanced	0%
Undeveloped or Untreated	0%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	0%
Detention, Level 2 (post-1998)	0%
Infiltration	0%
Exempt	100%
Undeveloped or No Flow Control	0%

Vanderyacht Park

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This subbasin consists of the drainage area to the City-owned Vanderyacht Regional Pond stormwater facility which provides basic treatment prior to discharge to the Nooksack River, a flow control exempt and basic treatment receiving water. The major pollutants associated with point sources come from 1 mapped stormwater outfall and are expected to be typical of residential and commercial areas. The major non-point sources of pollution are expected to be typical of agricultural areas but are expected to be small. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 26.8. In a forested condition the high pulse count would be 2.3.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mostly residential, commercial, or undeveloped. The area is zoned for multifamily residential and commercial. Future build can occur.
- Existing impervious in the subbasin (basin-wide) is 32% and is estimated to increase to 75% under future conditions.
- The City-owned Vanderyacht Regional Pond facility provides basic treatment for the entire subbasin area prior to discharge to the Nooksack River. Flow control is not provided nor required.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

Whiskey Creek Subbasin

General	
Receiving Water	Whiskey Creek
Watershed (HUC12)	Wiser Lake Creek-Nooksack River
Total subbasin area	1,086 acres
Subbasin area within UGA	1,030 acres
Percent of Subbasin within UGA	95%
Waterbodies	
Streams	Whiskey Creek
Wetlands (DNR)	43 wetlands (50 acres)
Landcover (basin-wide)	
Impervious land cover	147 acres (14%)
Forest land cover	429 acres (39%)
Impervious (future - full build out)	541 acres (50%)
Zoning (basin-wide)	
Commercial	24%
Light Industrial	4%
MFR	4%
Pasture	-
SFR-High	-
SFR-Low	-
SFR-Med	49%
SFR-Rural	7%
Transportation	10%
Water Quality Conditions	
WQ sampling	Fails Temp and bacteria standards
Pollutant loading	Medium-High
303d listings	
TMDL	Bacteria (Nooksack River)
Ecological Conditions	
Modeled High Pulse Count	10.1 (existing) / 4.9 (forested)
B-IBI sampling	
Fish Species	Coho, Chum, Steelhead, Bull trout, Cutthroat
PCWS Restoration Potential/Best Use	
Flow	Restoration
Sediment	Development/Restoration
Nutrients (N)	Development/Restoration
Nutrients (P)	Development/Restoration
Pathogens	Development/Restoration
Metals	Restoration
Stormwater Treatment (in UGA)	
Limited (pre-1998)	0%
Basic	12%
Enhanced	1%
Undeveloped or Untreated	87%
Flow Control (in UGA)	
Detention, Level 1 (pre-1998)	6%
Detention, Level 2 (post-1998)	12%
Infiltration	1%
Exempt	0%
Undeveloped or No Flow Control	82%

Whiskey Creek

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The major pollutants associated with point sources come from 9 mapped stormwater outfalls within the UGA and are expected to be typical of residential and commercial areas. The major non-point sources of pollution are expected to be typical of agricultural areas. The major flow impacts associated with point sources and non-point sources have been modeled and result in a high pulse count of 10.1. In a forested condition the high pulse count would be 4.9.

Modeling will be performed in the coming months to determine the extent to which runoff volumes and pollutant loadings may increase under future land use conditions. The following is currently known or estimated:

- Existing land use in the UGA is mixed among residential, commercial, or undeveloped. The area is zoned for medium density residential and commercial. Future build out can occur, particularly west of I-5.
- Existing impervious in the subbasin (basin-wide) is 14% and is estimated to increase to 50% under future conditions.
- Most existing development in the UGA has stormwater flow control but some areas lack treatment. Stormwater treatment (mostly basic) and flow control (mostly Level 2 detention) is provided for 13% and 18% of the subbasin area (in UGA), respectively.
- New and infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in its Municipal Code, implements Engineering Design and Development standards along with the requirements of the most current Department of Ecology Stormwater Management Manual for Western Washington.

APPENDIX C

ENVIRONMENTAL JUSTICE REVIEW

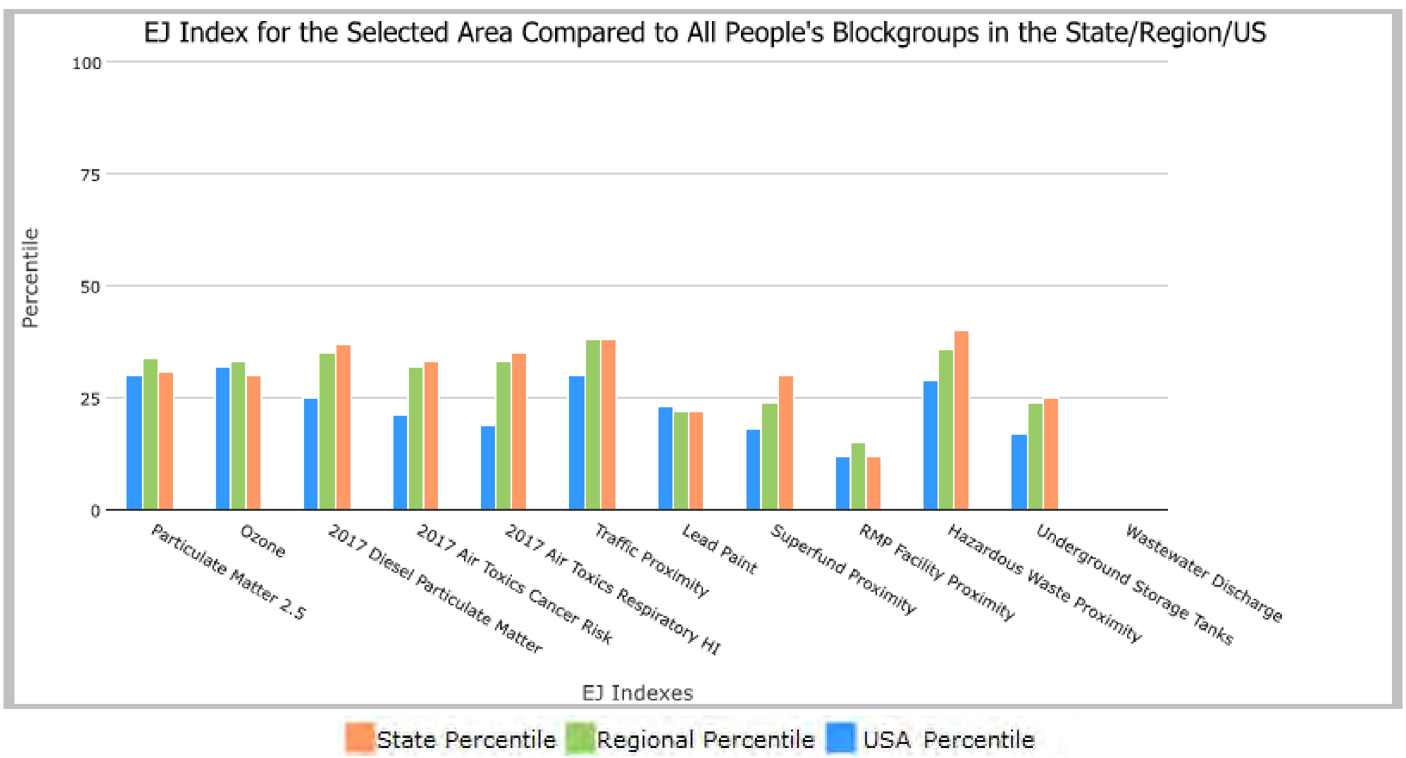
EJScreen Report (Version 2.0)

City: Ferndale, WASHINGTON, EPA Region 10

Approximate Population: 13,695

Input Area (sq. miles): 7.11

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	31	34	30
EJ Index for Ozone	30	33	32
EJ Index for 2017 Diesel Particulate Matter*	37	35	25
EJ Index for 2017 Air Toxics Cancer Risk*	33	32	21
EJ Index for 2017 Air Toxics Respiratory HI*	35	33	19
EJ Index for Traffic Proximity	38	38	30
EJ Index for Lead Paint	22	22	23
EJ Index for Superfund Proximity	30	24	18
EJ Index for RMP Facility Proximity	12	15	12
EJ Index for Hazardous Waste Proximity	40	36	29
EJ Index for Underground Storage Tanks	25	24	17
EJ Index for Wastewater Discharge	N/A	N/A	N/A



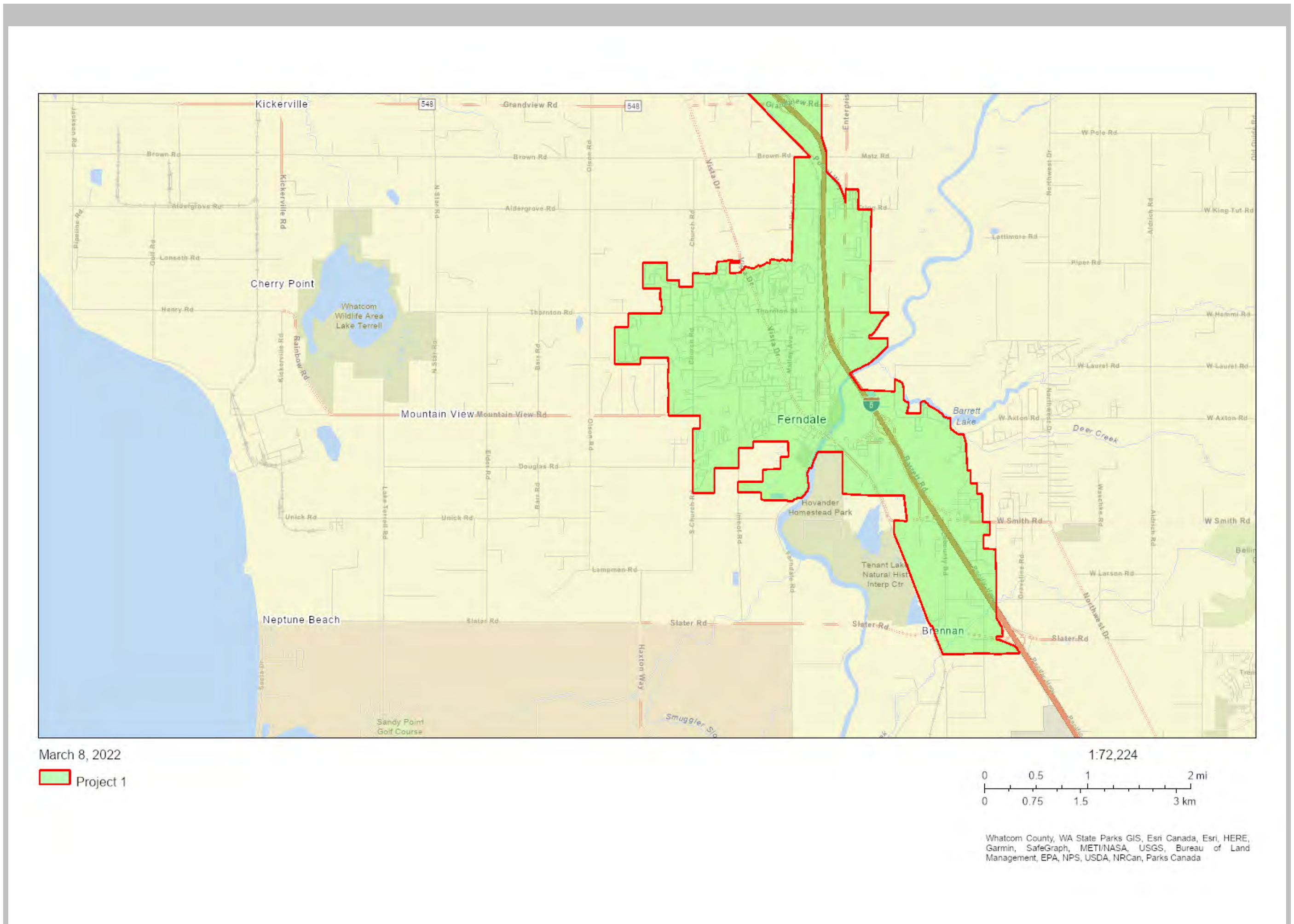
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJScreen Report (Version 2.0)

City: Ferndale, WASHINGTON, EPA Region 10

Approximate Population: 13,695

Input Area (sq. miles): 7.11



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	1

EJScreen Report (Version 2.0)

City: Ferndale, WASHINGTON, EPA Region 10

Approximate Population: 13,695

Input Area (sq. miles): 7.11

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Pollution and Sources							
Particulate Matter 2.5 ($\mu g/m^3$)	6.84	7.86	16	8.17	16	8.74	10
Ozone (ppb)	31.9	35.3	27	37.2	17	42.6	5
2017 Diesel Particulate Matter* ($\mu g/m^3$)	0.211	0.336	33	0.312	<50th	0.295	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	35	47	33	50-60th	29	80-90th
2017 Air Toxics Respiratory HI*	0.4	0.52	31	0.47	<50th	0.36	80-90th
Traffic Proximity (daily traffic count/distance to road)	160	710	40	600	44	710	43
Lead Paint (% Pre-1960 Housing)	0.21	0.22	63	0.22	63	0.28	54
Superfund Proximity (site count/km distance)	0.089	0.19	46	0.13	59	0.13	62
RMP Facility Proximity (facility count/km distance)	0.69	0.65	71	0.66	70	0.75	67
Hazardous Waste Proximity (facility count/km distance)	0.31	2.2	32	1.7	42	2.2	37
Underground Storage Tanks (count/km^2)	2.8	6.1	59	4.5	64	3.9	66
Wastewater Discharge (toxicity-weighted concentration/m distance)	N/A	0.021	N/A	0.53	N/A	12	N/A
Socioeconomic Indicators							
Demographic Index	24%	29%	48	28%	48	36%	40
People of Color	22%	31%	41	28%	48	40%	39
Low Income	26%	26%	59	28%	52	31%	47
Unemployment Rate	6%	5%	70	5%	69	5%	67
Linguistically Isolated	2%	4%	51	3%	57	5%	54
Less Than High School Education	9%	9%	64	9%	61	12%	50
Under Age 5	6%	6%	53	6%	53	6%	54
Over Age 64	14%	15%	54	16%	52	16%	51

*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's 2017 Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

For additional information, see: www.epa.gov/environmentaljustice

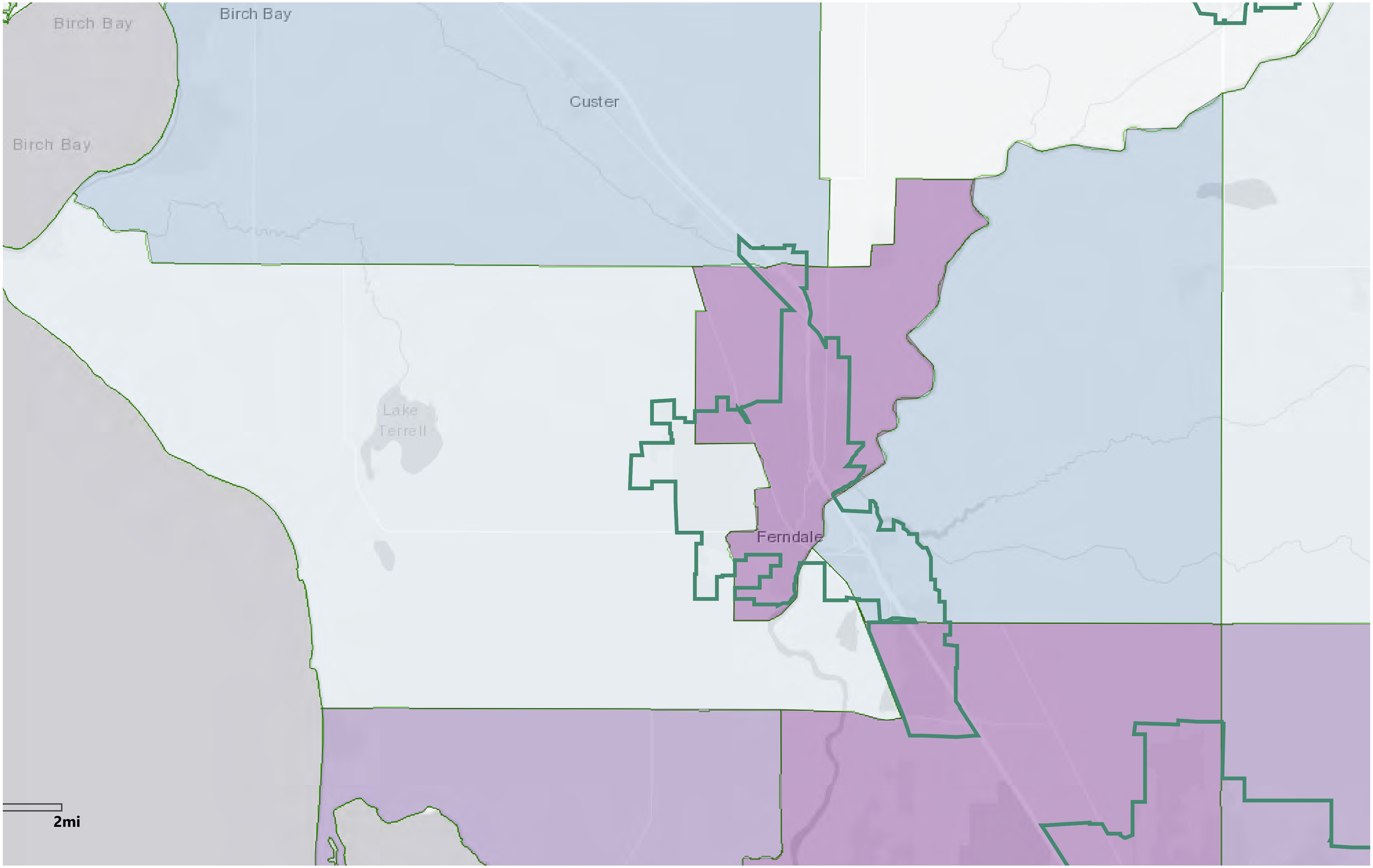
EJScreen is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJScreen documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJScreen outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

Washington State Department of Health

Selection: Environmental Health Disparities V 1.1 **Date: 03/08/2022 at 4:58 PM**

Environmental Exposures, Environmental Effects, Socioeconomic Factors, Sensitive Populations

Legend: (High) 10 9 8 7 6 5 4 3 2 1 **(Low)**



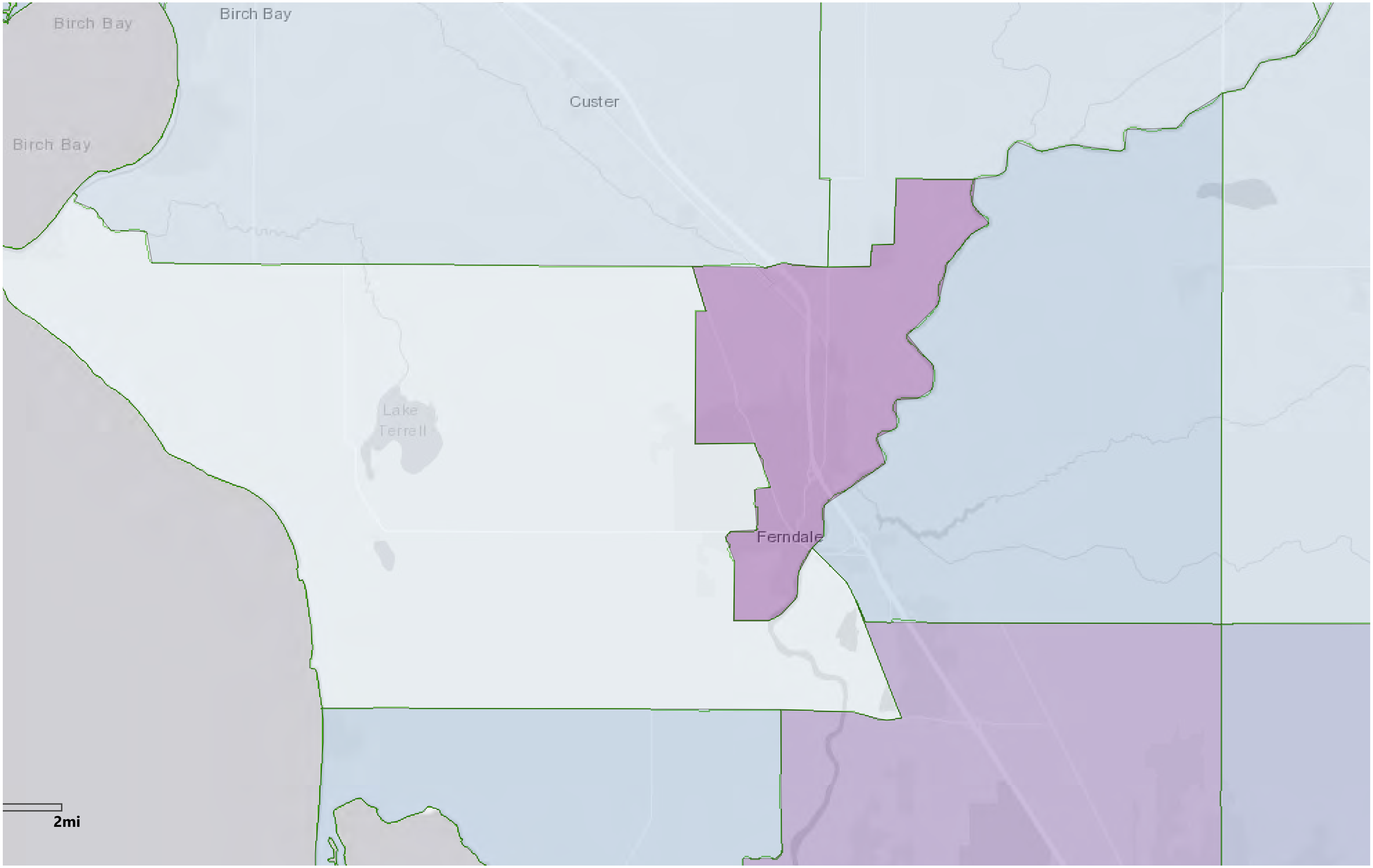
Washington State Department of Health

Selection: Diesel Pollution and Disproportionate Impact

Diesel Pollution Burden, Priority Populations

Date: 03/08/2022 at 4:59 PM

Legend: (High) 10 9 8 7 6 5 4 3 2 1 **(Low)**



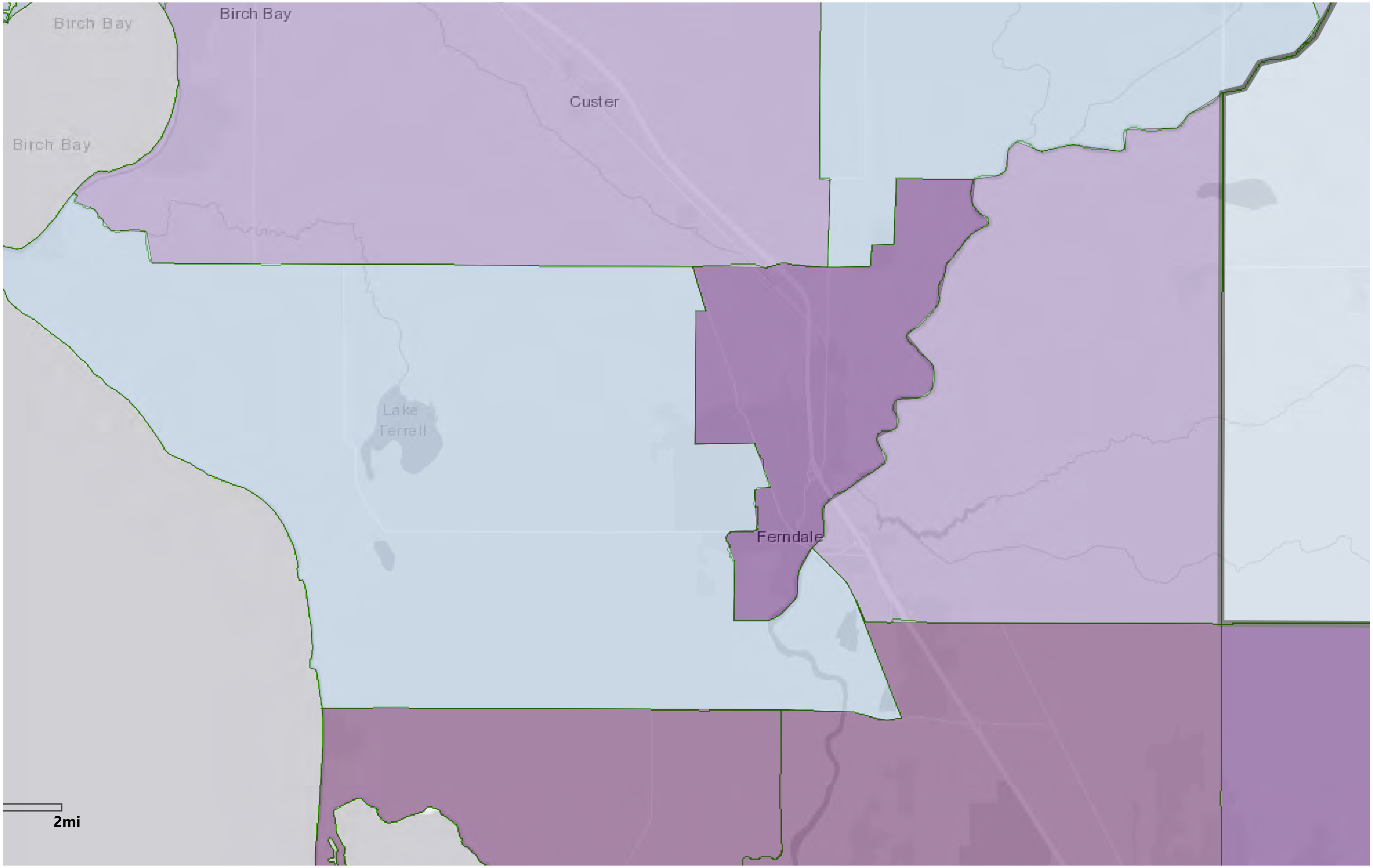
Washington State Department of Health

Selection: Social Vulnerability to Hazards

Household , Housing, SocioEconomic

Date: 03/08/2022 at 5:00 PM

Legend: (High) 10 9 8 7 6 5 4 3 2 1 **(Low)**



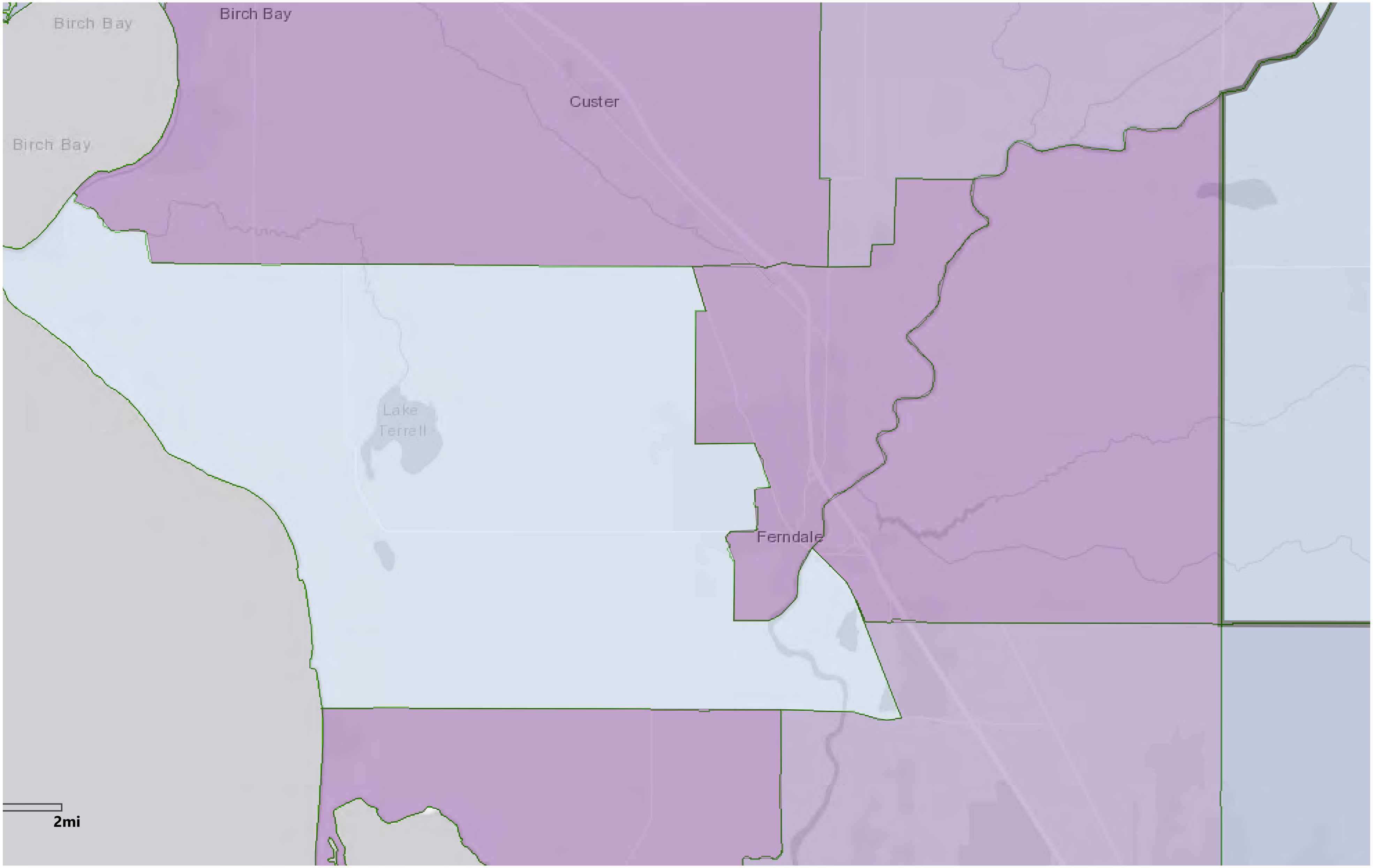
Washington State Department of Health

Selection: Lead Exposure Risk

Date: 03/08/2022 at 5:02 PM

Lead Exposure Risk

Legend: **(High)** 10 9 8 7 6 5 4 3 2 1 **(Low)**



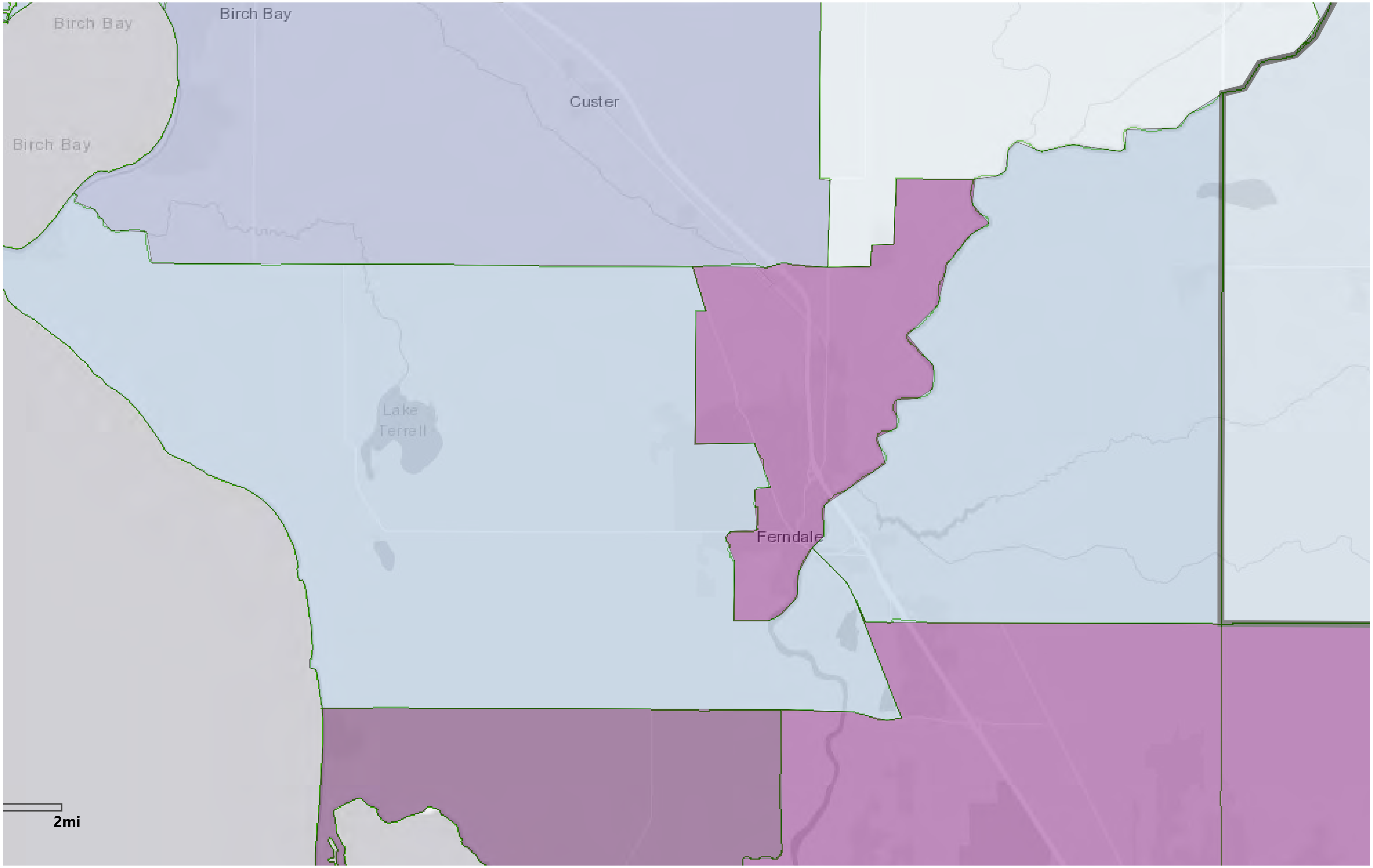
Washington State Department of Health

Selection: Health Disparities

Date: 03/08/2022 at 5:03 PM

Social Determinants, Economic Determinants, Poor Health Outcomes

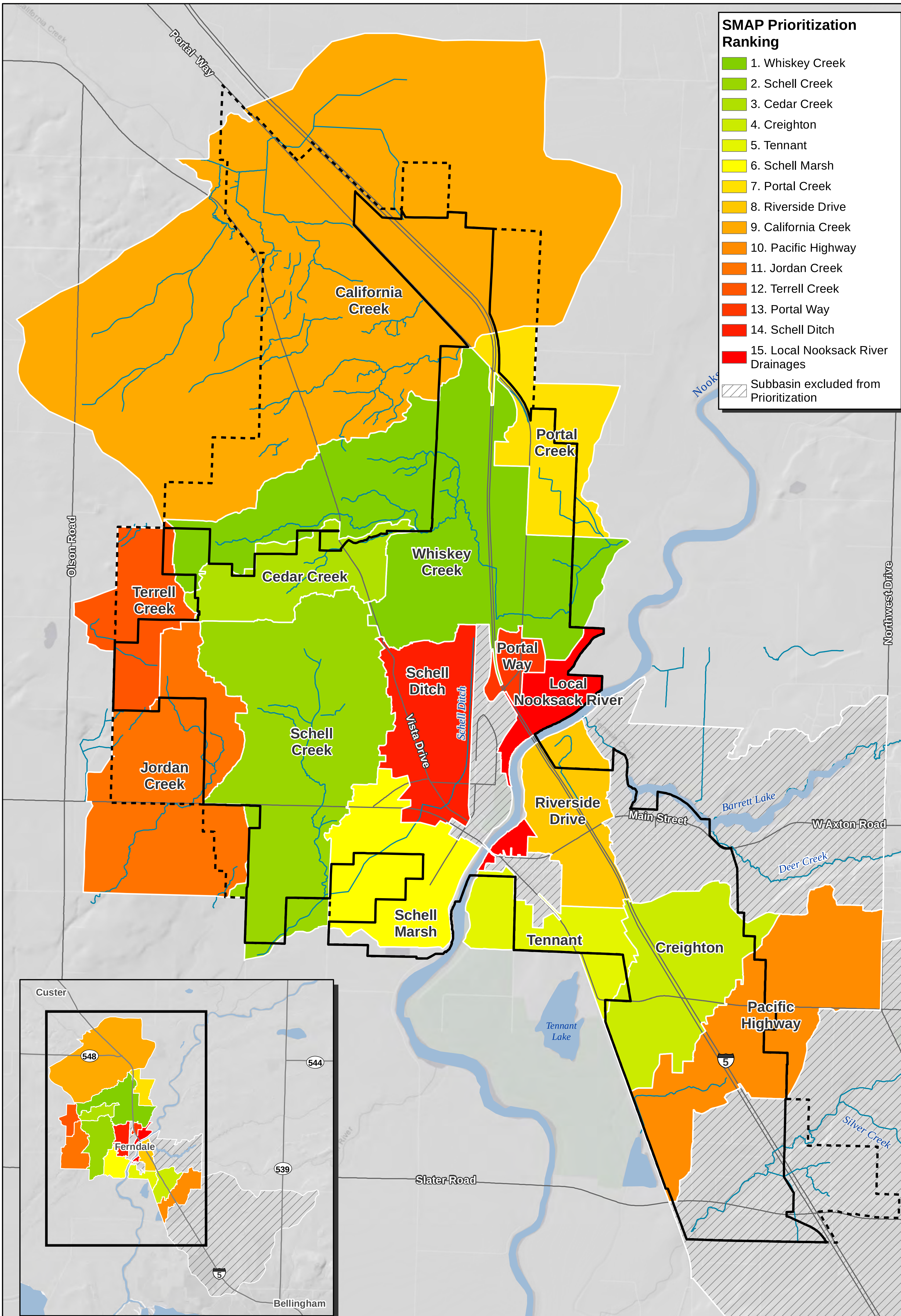
Legend: (High) 10 9 8 7 6 5 4 3 2 1 **(Low)**



APPENDIX D

RECEIVING WATER PRIORITIZATION

D.1	Basin Maps
D.2	Interested Parties Feedback Form



City of Ferndale

nhc northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream

SCALE - 1 inch = 1/2 mile
0 0.25 0.5 1
Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

N

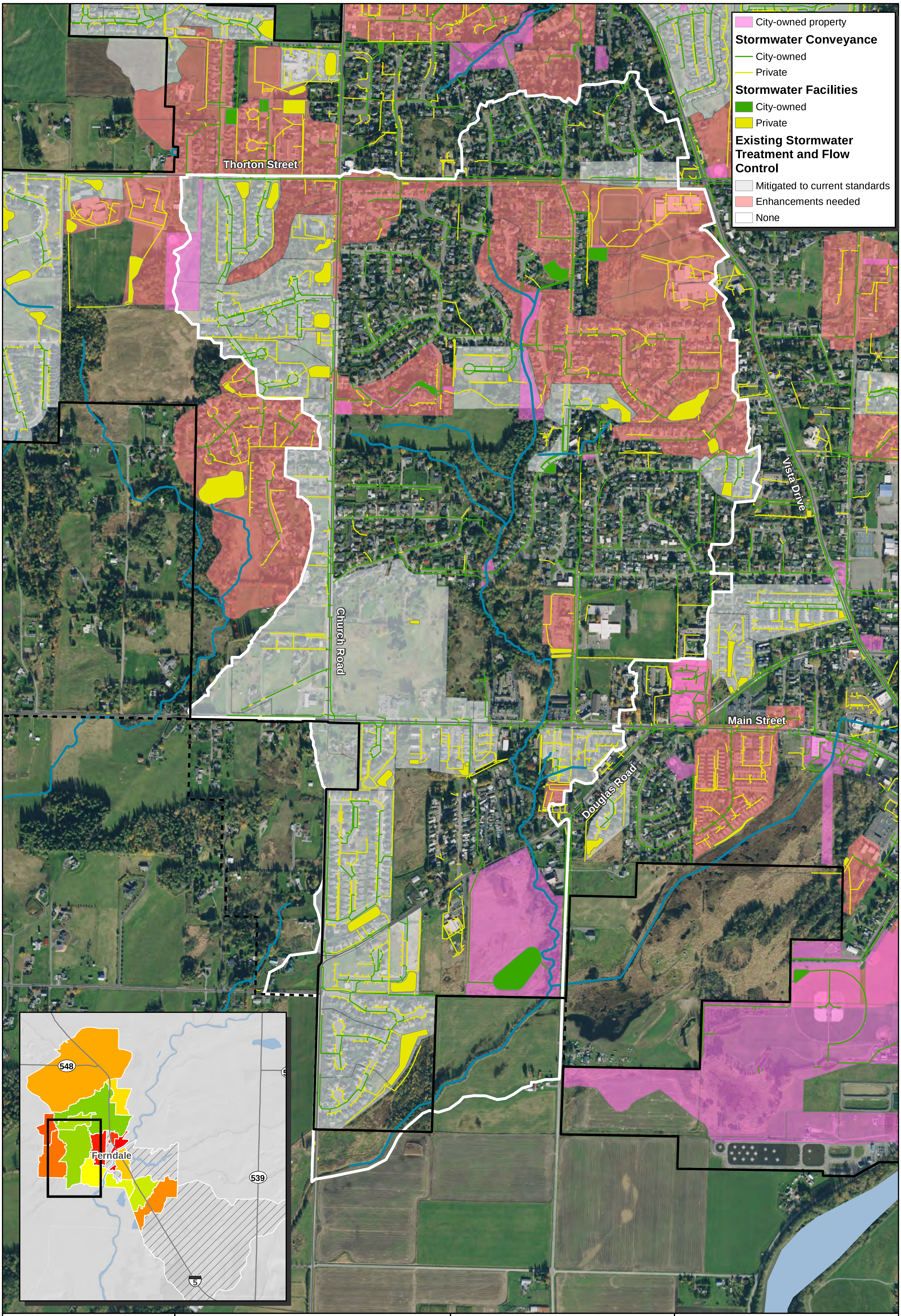
Job: 2006286 DATE: 08-Apr-2022

DRAFT

FERNDALE SMAP
Planning Units
Receiving Water Prioritization

FIGURE 1

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_PlanningUnits_r0b_RWP.mxd



City of Ferndale

nhc
northwest hydraulic consultants

City Limits
UGA
Planning Unit
Stream

SCALE - 1:10,000 (1 inch = 0.16 mile)
0 0.1 0.2
Miles

Coordinate System: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

N

Job: 2006286 DATE: 13-Apr-2022

DRAFT

FERNDALE SMAP
SMAP Subbasin Selection
Schell Creek Subbasin
Receiving Water Prioritization

FIGURE 2

Q:\2006286_Ferndale_SCP_and_SMAP\95_GIS\MXDs\Figures\2006286_Ferndale_PlanningUnits_r0b_RWP_CatchmentAreas.mxd

City of Ferndale

Stormwater Planning

Interested Parties Meeting – Thursday, April 28, 2022

Interested Parties Feedback Form

Receiving Water Assessment

The Receiving Water Assessment uses ten metrics to characterize each subbasin in terms of its relative importance (resource value for natural processes and aquatic species) and level of degradation (from existing development and other human impacts). The four importance metrics are forest cover, wetland area, riparian canopy, and aquatic habitat and fish use. The six degradation metrics are impervious cover, development pressure, water quality impairment, hydrologic impairment, pollutant loading, and fish passage barriers.

1. Is there any critical information missing from the Receiving Water Assessment?

Receiving Water Prioritization

The Receiving Water Prioritization uses five criteria to prioritize subbasins for stormwater management action planning (SMAP):

- Relative degradation (weight: 20%)
- Relative resource importance (weight: 20%)
- Future development pressure (weight: 20%)
- Jurisdictional influence (weight: 20%)
- Other coordinated/rehabilitation efforts (weight: 20%)

2. Should any other criteria be considered for basin prioritization?

3. Should any of the criteria be weighted more (or less) heavily for basin prioritization?

Other Feedback

4. Any other feedback or comments that would help inform the Receiving Water Assessment and/or Prioritization?