FINAL - BELLINGHAM HABITAT RESTORATION

Technical Assessment

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EXECUTIVE SUMMARY

The City of Bellingham (City) has prepared this Habitat Restoration Technical Assessment (Restoration Assessment) in order to provide a framework to guide future restoration, protection, and recovery of the city's terrestrial, freshwater, and riparian habitats. Although the City of Bellingham has successfully implemented numerous projects involving the creation, protection, and restoration of riverine, wetland, riparian, and forest habitats, as well as stormwater improvement projects, a comprehensive scientific effort to plan, prioritize, and integrate habitat restoration and protection efforts across the city had heretofore not been conducted. The Restoration Assessment project was developed with ongoing input from a Technical Advisory Group (TAG) composed of City of Bellingham staff, academics, resource agency staff, consultants, and members of the community.

The Restoration Assessment creates a science-based technical framework for assessing existing conditions and functions throughout various types of habitat, compares existing conditions among different areas in the city, and evaluates where and what type of restoration actions may have the greatest positive effect (ecological uplift). It is important to note that these comparisons are relative and limited to the Project Area, and they do not include comparisons to fully functioning (undisturbed) ecosystems outside of the city.

The Restoration Assessment is based on a conceptual model that links ecological functions to those attributes and corresponding quantitative measures that describe the functions. Functions were evaluated within each of four Habitat Groups: riverine, wetland, forest, and meadow/shrub.

The analysis consisted of three prioritization exercises: Preliminary, Secondary, and Comprehensive Prioritizations. All geographic areas (sub-watersheds) within the Project Area were placed into one of three buckets, or Tiers (Tiers 1 through 3). The primary endpoint of this particular assessment focuses on areas where the application of a wide variety of restoration actions would result in substantial ecological uplift over multiple Habitat Groups. These sub-watersheds were classified as Tier 1. However, the step-wise prioritization process should not be viewed only as linear refinement of data that results in a final list. Rather, the different prioritization steps offer different perspectives, or filters, to view restoration opportunities and select appropriate actions for all sub-watersheds, including those classified as Tier 2 or Tier 3.

The Preliminary Prioritization combined data on ecological function with an analysis of the effectiveness of various protection and restoration actions, in order to rank sub-watersheds for protection and restoration. This exercise also evaluated which restoration and protection actions would produce the greatest function uplift in a given area. The results were based solely on ecological relationships and did not consider feasibility, cost, or other similar factors.

In the Secondary Prioritization factors such as feasibility, scope, and scale of applying the restoration or protection actions were considered. The Secondary Prioritization resulted in some Habitat Analysis Units being dismissed for consideration as a Tier 1 sub-watershed and subsequently classified as a Tier 2 or Tier 3 sub-watershed. This was because the degree of functional impairment in these sub-watersheds

was considered too high to make restoration or protection very feasible. This is based on the assumption that the likelihood of achieving full and sustainable ecological recovery is very low where there is extreme impairment of the underlying processes necessary to sustain the habitats.

Habitat units that were initially "set aside" at the conclusion of the Secondary Prioritization and not considered further as Tier 1 units included 6 of the 24 riverine sub-watersheds, 7 of the 28 wetland sub-watersheds, 12 of the 85 forest habitat blocks, and 11 of the 46 meadow/shrub habitat blocks. However, these "set aside" Habitat Analysis Units were eventually classified as Tier 2 or Tier 3 in the final prioritization, and they identify areas that may benefit from targeted restoration and/or protection actions focusing on improving specific functions.

The Preliminary and Secondary Prioritization analyses allow the determination of (1) which specific areas that have the highest ecological potential for habitat restoration and protection based on existing function, (2) which restoration/ protection actions have the highest potential to improve functions in the Project Area, and (3) which areas have the highest overall ecological restoration/protection potential by individual Habitat Group. The prioritizations are based mostly on ecological considerations and to some degree based on cost/feasibility; however, the prioritizations does not directly incorporate social and community values.

The Comprehensive Prioritization was developed by further refining the results of the Secondary Prioritization. The purpose of the Comprehensive Prioritization was to identify areas that would allow for total ecological improvement over multiple habitat types. The process of generating the Comprehensive Prioritization involved the following steps:

1) Riverine and wetland Habitat Group scores from the Secondary Prioritization were assessed together for combined uplift.
2) The project team conducted a supplemental qualitative assessment of habitat connectivity. This assessment was completed because during the analysis of the Preliminary and Secondary Prioritization for forest blocks, the project team and TAG determined that the results did not fully capture the overall habitat value, and in particular, the corresponding high ecological value of connectivity. Connectivity was qualitatively assessed, but a full assessment (re-delineation and classification of corridors and more complete data on forest stand structure using up-to-date information) was not feasible as part of the Restoration Assessment.
3) The results were then reviewed and adjusted, using input from local technical experts with on-the-ground knowledge. During this process, the project team and local experts reviewed the prioritization results for the meadow/shrub Habitat Group and found that the data were too limited to accurately inform the application of meaningful restoration actions within the Project Area. This is primarily due to a lack of data on the existing functional conditions for the meadow/shrub Habitat Group.
4) Due to the lack of complete forest data (see 3, above), the forest prioritization was still included in the final prioritization, but it was incorporated at a larger scale (watershed) that could be combined with the wetland and riverine results.

5) Fish use and sub-watershed size were also included as part of the Comprehensive Prioritization, in order to incorporate the project goals and to ensure restoration or protection actions would occur on a geographic scale that would allow for significant ecological uplift.

After completing these steps, the results were used to create the following:

1) The sub-watersheds considered in the Comprehensive Prioritization were ranked into two Tiers (Tiers 1 and 2). Tier 1 represents those sub-watersheds where a combination of recommended actions would produce maximum practicable ecological uplift across Habitat Groups. Tier 2 sub-watersheds would also benefit somewhat from the broad application of multiple restoration actions.
2) The lowest scoring sub-watersheds that were "set aside" during the Secondary Prioritization were then classified as either Tier 2 or 3 sub-watersheds. Although these areas may benefit less from broad-based restoration or protection, they could benefit ecologically from targeted restoration or protection actions focused on specific habitats or functions.
3) A specific menu of recommended restorative and protective actions was developed for Tier 1 sub-watersheds. The Tier 1 priority areas for restoration presented in this report cover a large portion of the city, with specific restoration and protection actions selected to provide comprehensive ecological uplift within a variety of habitat types within the Tier 1 sub-watersheds and to provide connected corridors and habitats for native flora and fauna.

In addition to providing a detailed assessment of existing ecological conditions, the Restoration Assessment provides useful information that can be applied city-wide to a wide variety of restoration, mitigation, and planning uses. Among other applications, the results of this assessment can assist City departments, environmental groups, and the general public in screening and selecting restoration and mitigation opportunities and in determining where to focus general restoration and protection efforts within the city and its urban growth area (UGA), in order to improve stream, wetland, and forest habitat through the uplift of ecological functions.

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ACKNOWLEDGEMENTS

The core project team consisted of Renée LaCroix, Project Manager, City of Bellingham Public Works; Pete Lawson and Margaret Clancy, ESA; Vikki Jackson, NES; and Hilary Wilkinson, Veda Environmental. We would like to thank and acknowledge the important contributions to this project from members of the Technical Advisory Group and other project contributors. Their collective knowledge, suggestions, and guidance over the course of this project were extremely valuable.

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GLOSSARY

The following are definitions specific to the Habitat Restoration Technical Assessment

Action Effectiveness Rating – A numerical score of 0, 1, or 2 applied to each restoration or protection action as an estimate of that action's ability to increase a specific ecological function or attribute. The score was combined with the Relative Functional Condition Score as part of the Preliminary Prioritization process.

Attribute Measures – Metrics that fully or partially assesses the attributes of functions. Attributes are specific, measurable features that are a characteristic or inherent part of a function that can indicate the extent to which a particular function is active. Attribute measures should be based on peer reviewed or commonly established methods or on established linkages (e.g., impervious surface to peak flow relationships) and may be continuous (e.g., amount of impervious surface) or discreet (presence/absence of rare or priority species).

Comprehensive Prioritization – A prioritization to identify areas that would allow for total ecological improvement over multiple habitat types (Tier 1 sub-watersheds). Steps in the Comprehensive Prioritization included combining results for Riverine and Wetland Habitat Groups, conducting a supplemental qualitative assessment of habitat connectivity, adjusting the results based on technical expert input by incorporating Forest Group results at a larger (watershed) scale, and incorporating fish use data.

Ecological Uplift – Measureable improvement in one or more ecological functions within a Habitat Group

Forest Block – The Habitat Analysis Unit for Forest Habitat Group. Consists of significant forest habitat patches (greater than 5 acres) within the Project Area. The forest blocks were previously identified and delineated by Nahkeeta Northwest (2003).

Functions - Individual processes that create and support an ecosystem, maintain and create habitat, and support natural species assemblages. Specific ecological functions for various habitat types are described in the scientific literature; some functions cannot be measured directly or are very labor and/or time-intensive to measure.

Habitat Analysis Unit – Discrete geographical subdivision of each Habitat Group, used to provide functional assessment and targeted prioritization. Includes sub-watersheds for riverine and wetland groups, and habitat blocks for forest and meadow/shrub groups, e.g., Upper Whatcom Creek sub-watershed; Forest Block 004.

Habitat Block – The Habitat Analysis Unit for both the forest Habitat Group and meadow/shrub Habitat Group. See definitions for Forest Block and Meadow/Shrub Block. The Habitat Blocks were previously identified and delineated by Nahkeeta Northwest (2003).

Habitat Group – A habitat assemblage with similar physical, chemical, and biological components, which is influenced by a discrete set of functions. Habitat groups were selected to represent the broad range of ecological assemblages present within the Project Area. The four types of Habitat Groups analyzed in the Restoration Assessment were (1) riverine, (2) wetland, (3) forest, and (4) meadow/shrub.

Meadow/Shrub Block - The Habitat Analysis Unit for meadow/shrub Habitat Group. Consists of significant meadow/shrub habitat patches (greater than 5 acres) within the Project Area. The Meadow/Shrub Blocks were previously identified and delineated by Nahkeeta Northwest (2003).

Objectives - The constituent components of each project goal. Objectives are the basis of assessment to determine progress toward goals over time. Objectives will be measureable, as they will serve as the cornerstone of the important adaptive management component of the Restoration Assessment.

Preliminary Prioritization - The Preliminary Prioritization combined data on ecological function with an analysis of the effectiveness of various protection and restoration actions, in order to identify priorities for protection and restoration. This exercise also evaluated which restoration and protection actions would produce the greatest function uplift in a given area. The results were based solely on ecological relationships and did not consider feasibility, cost, or other similar factors.

Project Area – The geographic area within which analysis was performed to prioritize habitat restoration and protection. Extends outside the City of Bellingham and its urban growth area (UGA) to include those Habitat Analysis Units that are located both within and outside of the City/UGA boundary.

Protection Actions – Actions that involve conservation and preservation of existing habitat functions and structures through measures such as property acquisition (fee simple or conservation easements) and changes in City land use policies and/or regulations. Examples could include changes in building codes, zoning codes, and critical areas/shoreline regulations.

Relative Functional Condition Score – The scoring system used to classify the relative condition of function within a Habitat Analysis Unit, as compared to (relative to) the other Habitat Analysis Units within the Project Area. The scoring system is based on rank ordering the function analysis scores, then placing all of the Habitat Analysis Units into one of five groups that describe relative function: higher, high, median, lower, or low.

Restoration Actions - Project-level actions that focus on improvement of one or more habitat elements following project execution. These project types can include the enhancement or restoration of ecological functions/processes (such as stormwater retrofit projects that provide flow control), habitat structures (e.g., large woody debris [LWD] installation projects), or elements of both (e.g., riparian buffer planting increases habitat structure in the form of vegetation, and improves LWD recruitment processes).

Secondary Prioritization – The Secondary Prioritization incorporates the feasibility, scope, and scale of applying the restoration or protection actions. The Secondary Prioritization resulted in some Habitat Analysis Units being dismissed for consideration as Tier 1 and subsequently classified as Tier 2 or Tier 3,

based on a high degree of functional impairment in those Habitat Analysis Units that would make substantial restoration or protection in these areas unlikely.

Sub-watershed – The Habitat Analysis Unit for riverine and wetland Habitat Groups. A total of 28 sub-watersheds were delineated within nine larger watersheds.

Tier 1 Sub-watershed – Those sub-watersheds where a combination of recommended actions would produce maximum practicable ecological uplift across multiple Habitat Groups. Identification of Tier 1 sub-watersheds was a primary focus of the Restoration Assessment prioritization process.

Tier 2 Sub-watershed - Those sub-watersheds where a combination of recommended actions would produce moderate practicable ecological uplift across multiple Habitat Groups, or substantial uplift over a single habitat group.

Tier 3 Sub-watershed – Those sub-watersheds that would benefit less from broad-based restoration or protection, but could benefit ecologically from targeted restoration or protection actions focused on specific habitats or functions.

1.0 Introduction

Environmental Science Associates (ESA), with support from Northwest Ecological Services (NES) and Veda Environmental Consulting, assisted the City of Bellingham (City) with a city-wide Habitat Restoration Technical Assessment (Restoration Assessment). The purpose of the Restoration Assessment is to provide a science-based framework to guide future restoration, protection, and recovery of the city's terrestrial, freshwater, and riparian habitats, in order to increase overall ecological function. The Restoration Assessment is also intended to help achieve the City's Legacies and Strategic Commitments (adopted by Bellingham City Council on July 13, 2009), which include the following goals:

- Protection and improvement of the health of lakes, streams, and bays
- Protection and restoration of ecological functions and habitat
- Reduction of contributions to climate change
- Conservation of natural and consumable resources

Additional goals of the project were to support the City's ongoing restoration and environmental management efforts, including:

- The protection and recovery of species listed under the Endangered Species Act
- The protection and improvement of water quality

Ecological restoration is an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity, and sustainability. Current restoration science, as well as state and federal policies, stress the importance of focusing restoration actions on the individual processes that create and support an ecosystem, maintain and create habitat, and support natural species assemblages (EPA et al., 2000; Palmer et al., 2005; Sheldon et al., 2005; OMB, 2006; Cramer. 2012; Harman et al., 2012). In addition, for comprehensive ecological restoration and mitigation programs, a watershed approach is generally recommended (Hruby and Stanley, 2009; Cramer, 2012). Therefore, the approach to developing the Restoration Assessment is based on the characterization of ecosystem processes, through the "measurement" of ecological functions, across the city's ecological landscape.

The City of Bellingham has implemented numerous environmental restoration projects in recent years and several more are in the planning stages. These projects typically involve creation, protection, enhancement, and restoration of riverine, nearshore, wetland, riparian, and forest habitats as well as stormwater improvement projects. Although many of these projects have been successful, there has not been a comprehensive scientific effort to plan, prioritize, and integrate habitat restoration and protection efforts across the city.

The objective of the Restoration Assessment project is to inform future restoration and protection efforts by identifying those geographic areas most amenable to achieve measurable, meaningful, and coordinated improvement in ecological functions. Although the objective of the Restoration Assessment project is relatively focused, the analysis completed to reach this goal also provides useful information that can be used for many other purposes, including informing other restoration, mitigation, and

planning actions on multiple scales. Because the analysis is based on well-established ecological linkages, meeting the project objective is expected to address the project goals described above.

The City hired Coastal Geologic Services (CGS) to produce a prioritization tool for estuarine and marine nearshore restoration and protection efforts in Water Resources Inventory Area (WRIA) 1 (CGS, 2013). Likewise, the Lake Whatcom watershed has undergone numerous evaluations for restoration priorities. The Restoration Assessment provides a similar science-based assessment tool for terrestrial, freshwater, and riparian habitats. The Restoration Assessment model can be used to inform restoration actions and programs in many ways, such as:

1. Characterizing existing ecological conditions and functions throughout the various habitats in the city (excluding the nearshore environment and the Lake Whatcom watershed).
2. Comparing habitat types across the city in terms of their existing functions and their restoration needs and opportunities.
3. Identifying which restoration actions are most likely to be effective in a specific location.
4. Identifying where to locate restoration actions to have the highest likelihood of improving a specific function.

This document was developed with input from a Technical Advisory Group (TAG) composed of City of Bellingham staff, academics, resource agency staff, consultants, and members of the community. The TAG guided and advised the project team to ensure the technical assessment was scientifically sound, relevant to the City of Bellingham, and useful for future planning. The TAG provided feedback on each step of the project.

1.1 Technical Report Organization

This Restoration Assessment is composed of seven sections and two attachments. Attachments A and B contain additional data tables relevant to this report.

1.2 Project Area, Habitat Groups, and Habitat Analysis Units

The Project Area includes areas within the Bellingham City limits and its Urban Growth Area (UGA), exclusive of the nearshore environment and Lake Whatcom watershed (Figure 1). The Project Area is the area in which specific habitat restoration and protection actions were defined and prioritized. The Project Area is composed of smaller Habitat Analysis Units specific to each Habitat Group (Figures 2 through 5b). For some Habitat Groups, the Project Area extended outside the limits of the City and UGA due to natural ecological boundaries such as watersheds and terrestrial habitat blocks.

The project team identified the following Habitat Groups for this assessment:

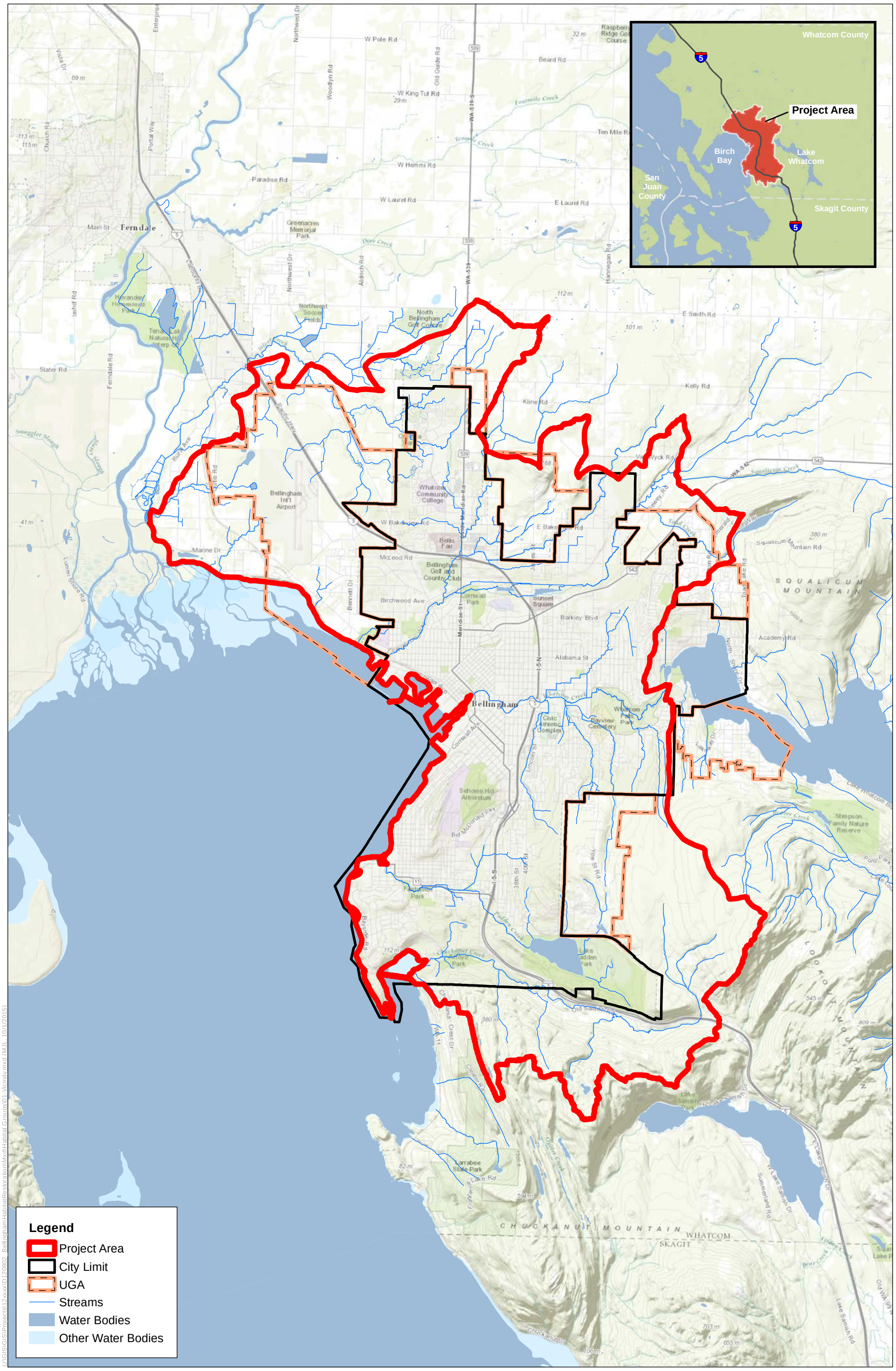
- Riverine (including riparian areas)
- Wetlands

- Forests
- Meadow / shrub

Many of the impairments affecting Bellingham's aquatic habitats (riverine and wetland) are a result of processes that occur at the watershed level. For example, land disturbance can lead to excess fine sediments being delivered to watercourses. Urbanization and impervious surfaces can cause increased runoff during rainfall events and cause high peak flows that erode stream channels. Pollution, both from point and non-point sources, enters streams and impairs water quality. To fully address these impairments, restoration and protection efforts should be planned and prioritized at a watershed or sub-watershed scale and targeted toward improving ecosystem processes in a holistic way. Therefore, the analysis of functions contributing to the riverine and wetland Habitat Groups (Figures 2 and 3) is summarized at the sub-watershed scale.

On the other hand, a watershed-based analysis scale for the terrestrial Habitat Groups (forest and meadow/shrub) is not appropriate because vegetation patches and vegetated wildlife corridors do not always correspond to or follow watershed boundaries. Therefore, an alternative Habitat Analysis Unit, the Forest Habitat Block, was used for assessing the terrestrial Habitat Groups (Figures 4a, b and 5a, b). The terrestrial Habitat Analysis Units consist of significant terrestrial habitat blocks with significant forest patches (defined here as greater than 5 acres) within the Project Area.

Forest Habitat Blocks in the Project Area were previously delineated and classified by Nahkeeta Northwest (2003). The Forest Habitat Blocks were included in the analysis is there is at least one contiguous habitat patch, consisting of more than 5 acres of forest habitat. Any forested habitat block that was at least partially within the Project Area was included in the analysis.



SOURCE City of Bellingham, 2012, ESA, 2012, ESRI, 2010.

Figure 1

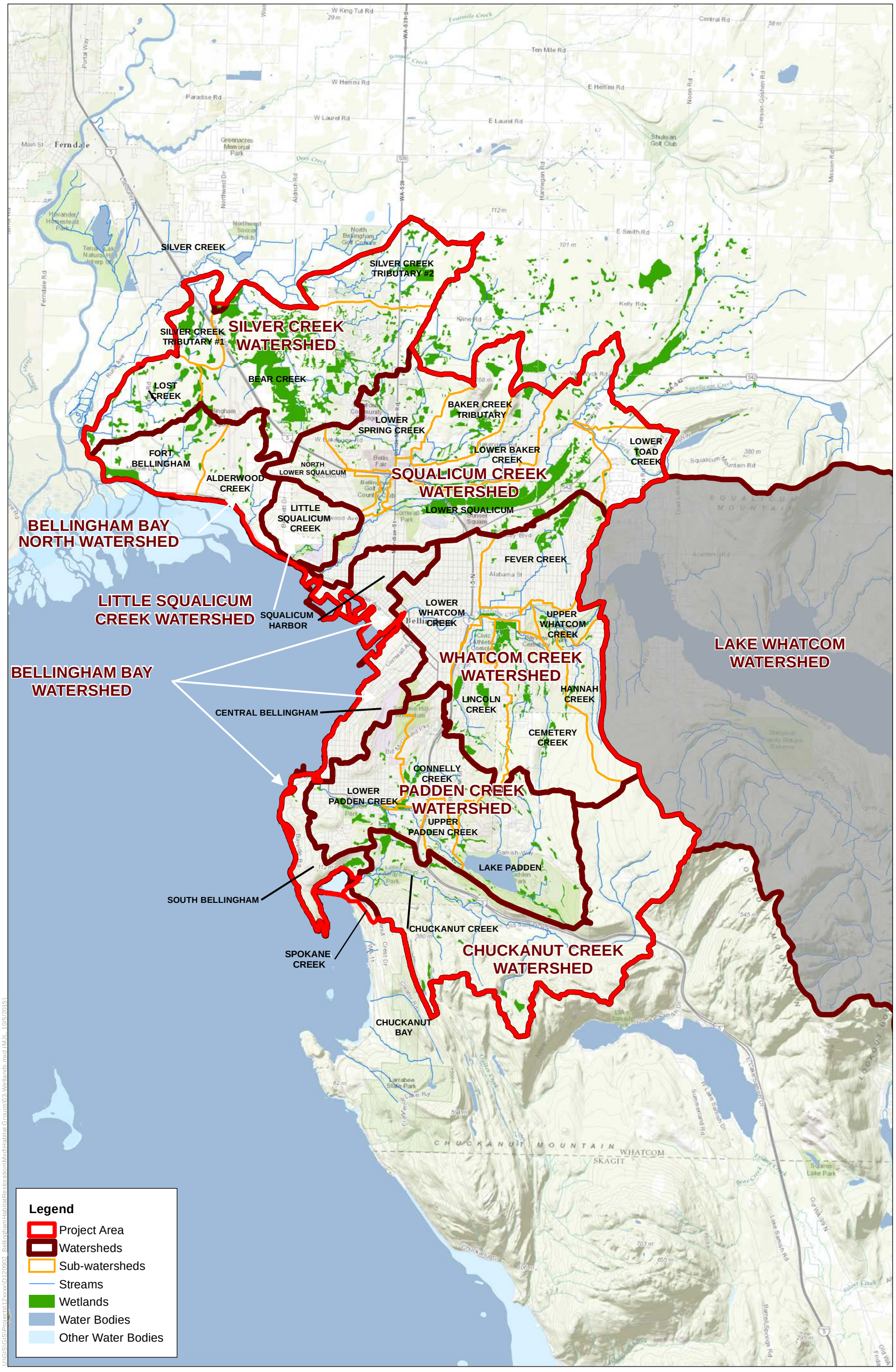
Bellingham Habitat Restoration Project Area and Vicinity Bellingham, Washington

SOURCE City of Bellingham, 2012, ESA, 2012, ESRI, 2010.

Bellingham Habitat Restoration Master Plan . 120902

Figure 2

Riverine and Wetland Habitat Groups: Habitat Analysis Units
Bellingham, Washington



SOURCE City of Bellingham, 2012, ESA, 2012, ESRI, 2010.

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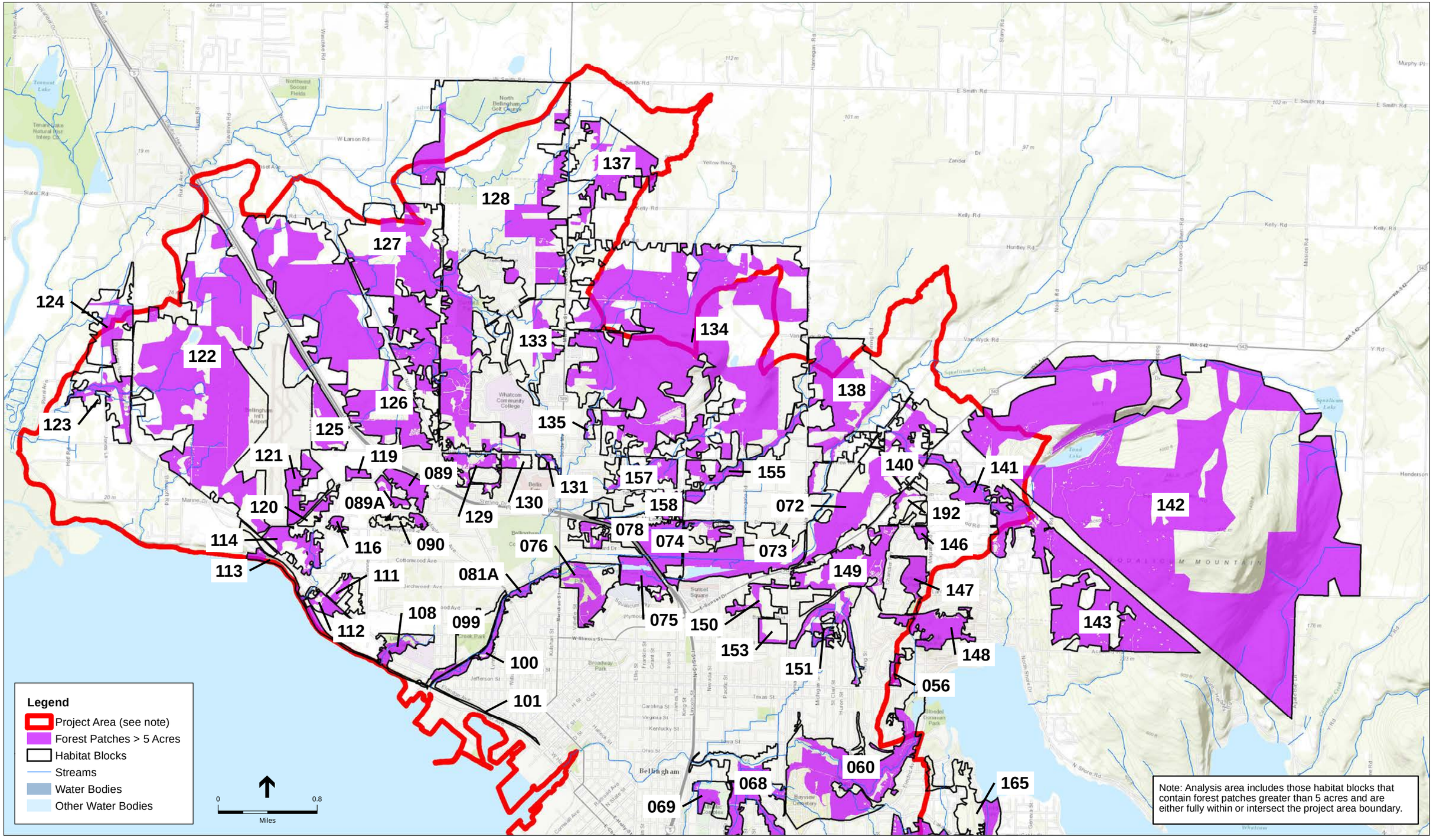
Figure 3

Project Area Wetlands (from NWI)

Bellingham, Washington



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SOURCE City of Bellingham, 2012; ESRI, 2010; Nahkeeta, 2009.

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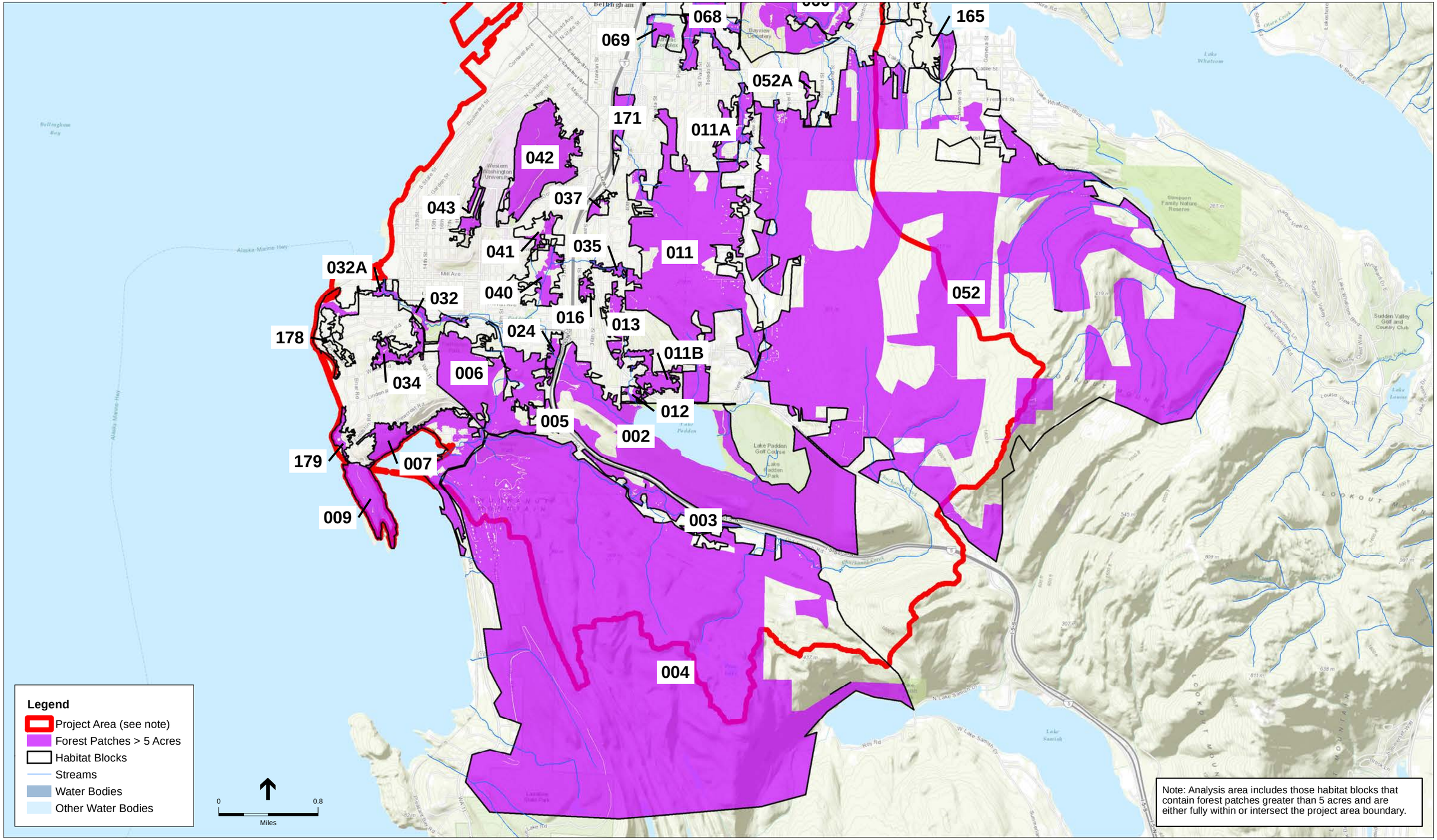
Figure 4a

Forest Habitat Group Analysis Units - North

Bellingham, Washington



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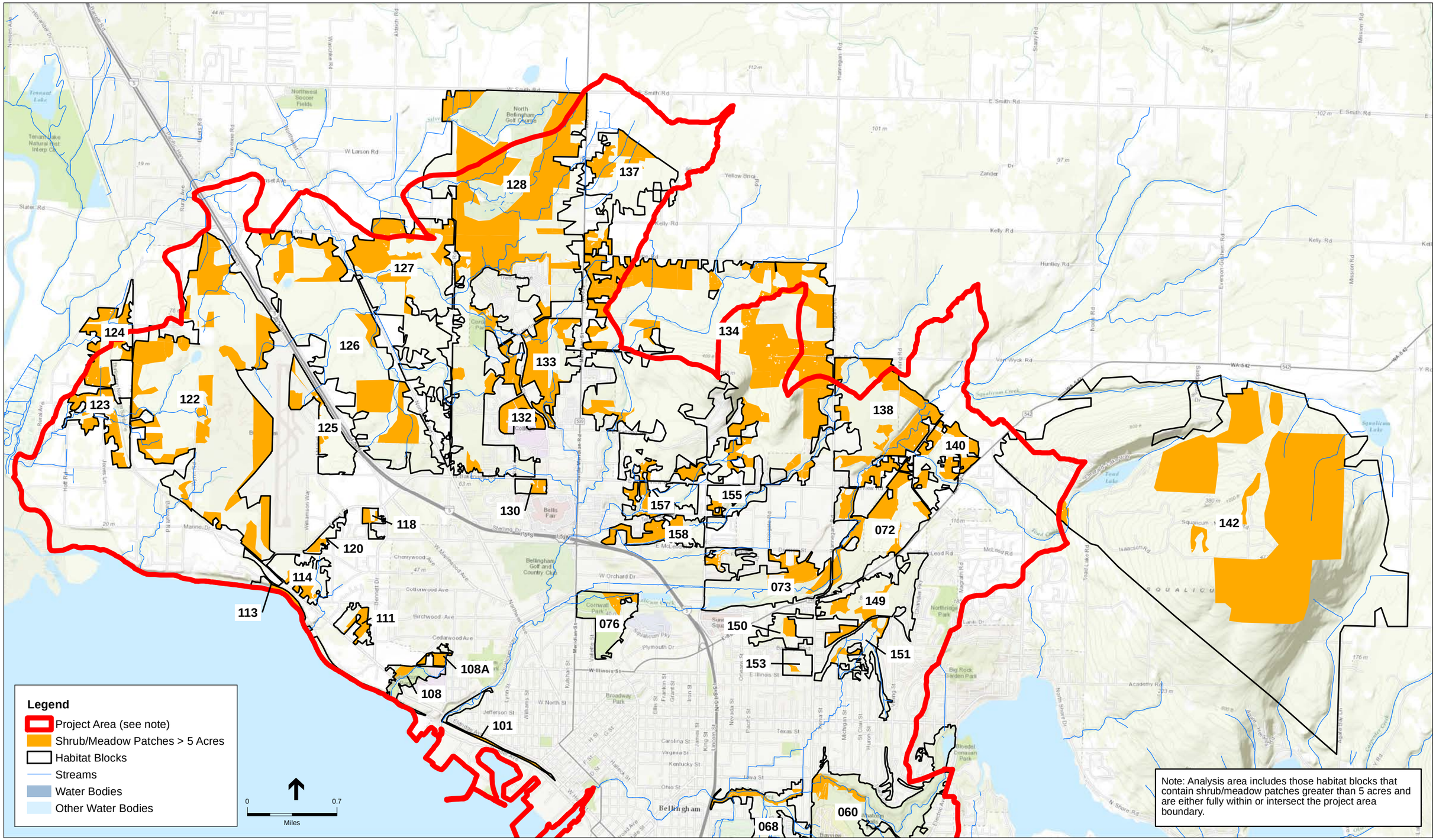
SOURCE City of Bellingham, 2012; ESRI, 2010; Nahkeeta, 2009.

Bellingham Habitat Restoration Master Plan . 120902

Figure 4b

Forest Habitat Group Analysis Units - South

Bellingham, Washington



SOURCE City of Bellingham, 2012; ESRI, 2010; Nahkeeta, 2009.

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Figure 5a

Shrub/Meadow Habitat Group Analysis Units - North
Bellingham, Washington

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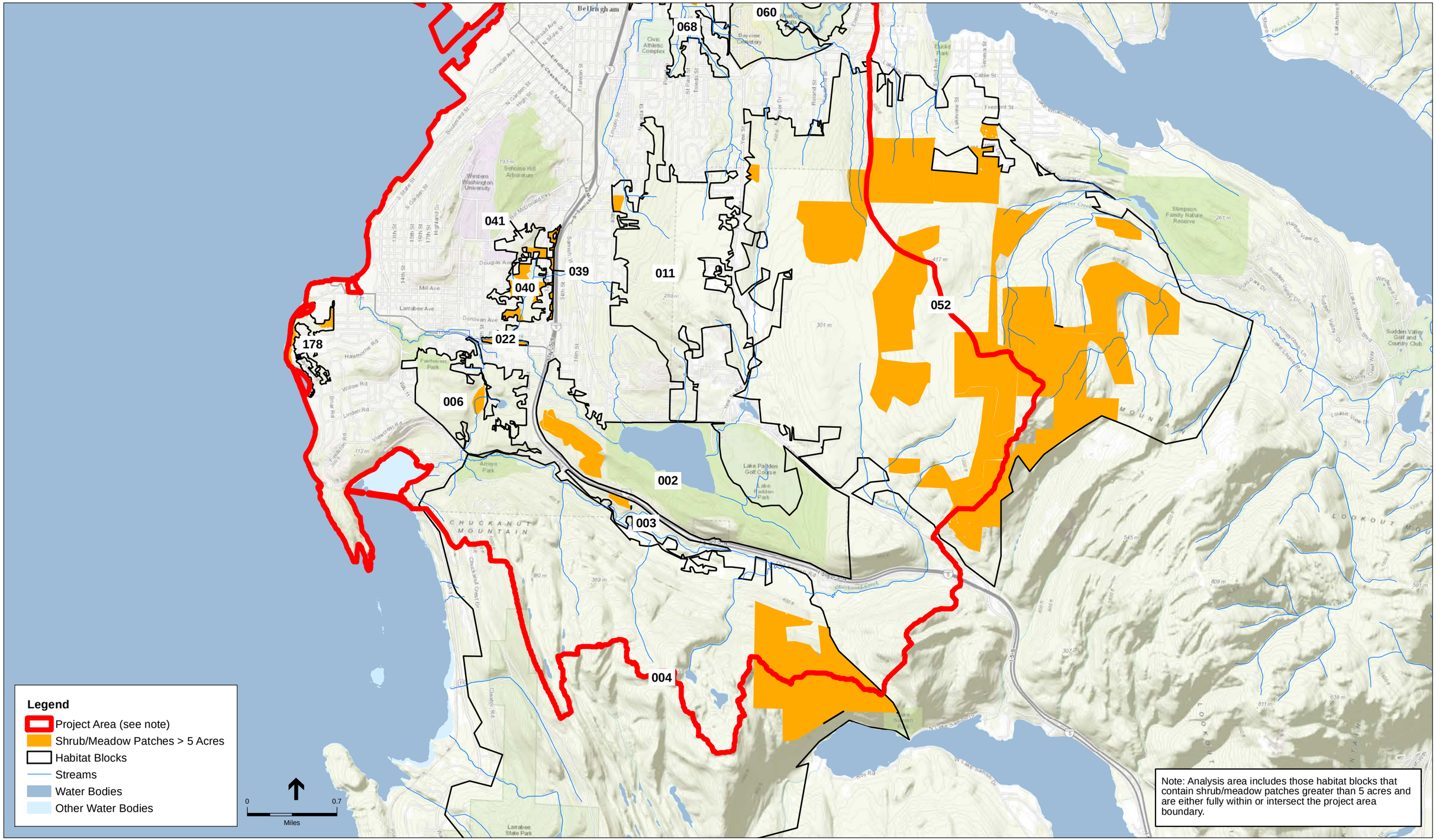

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SOURCE City of Bellingham, 2012; ESRI, 2010; Nahkeeta, 2009.

Bellingham Habitat Restoration Master Plan . 120902

Figure 5b

Shrub/Meadow Habitat Group Analysis Units - South

Bellingham, Washington

1.2.1 Historical Perspective on Ecological Conditions within Project Area

A key element of the technical assessment is the comparison of baseline (current) ecological conditions among various habitat types within the Project Area. It is important to note however, that baseline conditions have been substantially altered from historical (pre-European settlement) conditions. Many historical habitats and the processes that sustain them have been lost or altered. Multiple ecological stressors, generally related to man-made infrastructure and development, have altered ecological functions and processes. Because full ecosystem recovery to historical conditions is not practical or achievable, the assessment compares and rates ecological function within the Project Area under existing conditions, and does not evaluate functions based on historic conditions. However, knowledge of historical ecological conditions, functions, and stressors can serve to inform the development of specific restoration strategies.

2.0 Assessment Methods and Key Terms

This section summarizes the assessment method and introduces key project terms. The assessment includes multiple steps that are described below and summarized as follows:

1. Develop a conceptual model based on sound science.
2. Identify key Habitat Groups in Bellingham.
3. Assess existing habitat conditions and functions across the Project Area.
4. Identify restoration and protection actions that will have the greatest benefit to existing conditions.
5. Develop an initial list of areas that would benefit most from restoration or protection actions (Preliminary Prioritization).
6. Refine the initial list to take into account the feasibility and likelihood of accomplishing the City's goals (Secondary Prioritization).
7. Further refine list to identify areas that would allow for total ecological improvement over multiple habitat types. (Comprehensive Prioritization)

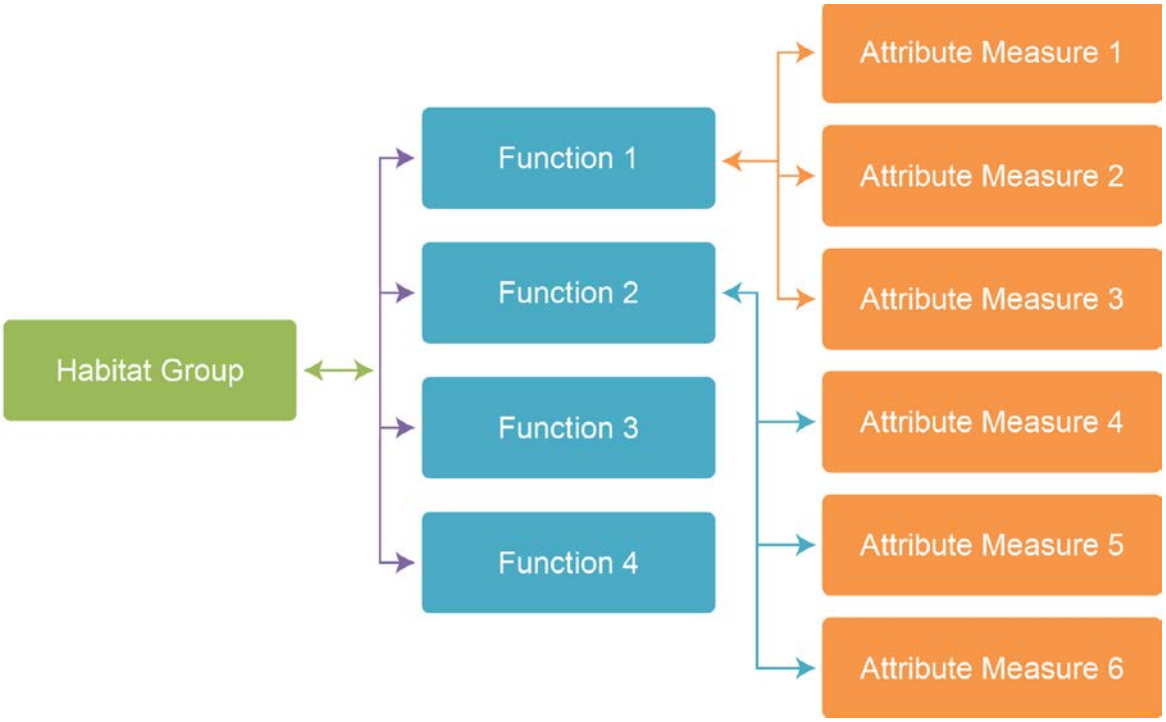
This document contains complete information on the steps listed above, as well as relevant supporting data and analysis results. However, some additional information is contained in the *Bellingham Habitat Restoration Technical Assessment - Technical Memoranda* (ESA, 2013a,b,c).

2.1 Conceptual Model

The project team developed a conceptual model to evaluate the extent to which restoration actions will improve ecosystem functions. The basis of the conceptual model is the relationship between the project goals, ecological functions, and quantifiable measures (attribute measures) of these functions. Using these measures, the condition of the existing ecological function (pre-restoration action) and future ecological function (post-restoration action) can be compared and related to the specific project

objectives, by Habitat Group (Figure 6). Brief definitions of each element are provided below to introduce the general concepts and relationships within the model.

Figure 6. Conceptual Model for Restoration Assessment



Habitat Group – A habitat assemblage with similar physical, chemical, and biological components, which is influenced by a discrete set of functions. A number of Habitat Groups were screened against criteria including data availability, scientific defensibility, and uniqueness. Based on these criteria, the project team identified four Habitat Groups that capture the primary ecosystem components within the city:

- Riverine (including riparian areas)
- Wetlands
- Forests
- Meadow/shrub

Function – An individual process that creates and supports an ecosystem, maintains and creates habitat, and supports natural species assemblages. Specific ecological functions for various habitat types are described in the scientific literature. Some functions cannot be measured directly or are very labor-intensive or time-consuming to measure.

Attribute Measure – A metric that fully or partially assesses the attributes of functions. Attributes are specific, measurable features that are a characteristic or inherent part of a function that can indicate the extent to which a particular function is active. Attribute measures are based on peer reviewed or

commonly established methods or on established linkages (e.g., impervious surface to peak flow relationships) and may be continuous (e.g., amount of impervious surface) or discrete (presence/absence of rare or priority species).

2.1.1 Selection of Functions and Attributes

Once the Habitat Groups were selected, the project team reviewed ecological functions for each Habitat Group and selected appropriate functions for advancement. Selection of functions was based on review of scientific literature and guidance from regulatory agencies. Within each Habitat Group, each proposed ecological function was assessed for relevance, utility, and multi-functionality to determine the ability of the function to adequately address the key ecosystem processes of the respective Habitat Group.

The screening process ensured that each Habitat Group had a set of functions that, taken together, would be adequate to describe the level of ecosystem functioning. However, because ecosystem functions often cannot be measured directly, the project team correlated functions to a number of variables (termed attributes) and indirect measures of function, called attribute measures. The number of attributes that potentially describe ecological functions is large, but the number of meaningful attribute measures that can be assessed based on existing data is relatively small.

In order to assess the relevance and utility of potential attribute measures, each measure was compared against pre-defined screening criteria, as follows:

- Availability – Assessment of whether GIS data for the entire Project Area are readily available for the measure, or whether other suitable data sources are easily incorporated into GIS.
- Analysis Protocol – Assessment of whether a data analysis protocol exists or could be readily adapted for the measure.
- Directness – Assessment of whether the measure is a direct measure of function (preferable, but rare), or a semi-direct measure of function. Where direct measures are impractical, attributes may include indicators for the function.
- Repeatability – Assessment of whether two assessment teams would arrive at similar analysis results using the measure.
- Sensitivity – Assessment of whether the measure is sensitive to change over a short- to medium-length period (0 to 10 years) resulting from the most common restoration actions at the scale of the measure[1].

The majority of the evaluated measures passed all of the screening criteria. In general, the suite of measures that passed the screening was considered adequate to properly describe the key functions that maintain the respective Habitat Groups. However, some attribute measures could not be used as

[1] In many cases it will take longer than 10 years to see a full response to a given restoration action, but 5 to 10 years is typically sufficient for some changes to become evident (measurable).

useful indicators of function because of the lack of available data (see Attachment A, Tables A-1 through A-4).

Table 1 contains the final list of functions (or in the case of the forest and shrub meadow groups, attributes) for each Habitat Group that could be assessed at a suitable level, using available data and information.

Table 1. List of Ecological Functions Assessed for Each Habitat Group

Riverine Habitat Group (6 Ecological Functions)	**Meadow/Shrub Habitat Group** (*4 Attributes* contributing to 2 Ecological Functions)*
Flow Variation	Biodiversity
Surface Storage (flood storage)	*Attribute: Lifeform Diversity*
Biodiversity Maintenance	*Attribute: Habitat Community*
Habitat Creation and Maintenance	Habitat Maintenance
Chemical Regulation	*Attribute: Habitat Connection and Fragmentation*
Thermo-regulation	*Attribute: Vegetation Structure*
Wetland Habitat Group (7 Ecological Functions)	**Forest Habitat Group** (*5 Attributes* contributing to 2 Ecological Functions)*
Surface Water Storage	Biodiversity
Nitrogen Removal	*Attribute: System Maturity*
Pathogen Removal	*Attribute: Lifeform Diversity*
Organic Matter Export/ Contribution	*Attribute: Habitat Community*
Sediment/ Phosphorus Removal	Habitat Maintenance
Wildlife Habitat	*Attribute: Habitat Connection and Fragmentation*
Carbon Sequestration	*Attribute: Vegetation Structure*

*Initial comparison of the forest and meadow/shrub Habitat Groups occurred at the function level. However, due to the limited number of functions where site-specific data were available to assess and compare functional status, subsequent comparisons of existing conditions of these Habitat Groups used the individual attributes that contribute to the functions.

2.2 Function Assessments by Habitat Group

Following development of the conceptual model and review by the TAG, the project team analyzed existing conditions (level of existing function) of Habitat Groups within the Project Area. To complete the analysis, each Habitat Group was divided into smaller units (see Figures 2 through 5). The relationships between habitat types, Habitat Groups, and Habitat Analysis units is shown in Table 2. The general methodology for assessing the relative level of ecological function within each Habitat Group, as well as the results of the analysis for each Habitat Group, is presented below.

Table 2. Relationship between Habitat Type, Habitat Group, and Habitat Analysis Unit

Habitat Type	Habitat Groups	Habitat Analysis Unit
Aquatic	Riverine	Sub-Watershed
	Wetland	Sub-Watershed
Terrestrial	Forest	Forest Habitat Block[1]
	Meadow/Shrub	Meadow/Shrub Habitat Block

[1] Forest Habitat Blocks were re-classified into watersheds during the Comprehensive Prioritization.

2.2.1 Functional Assessment Methodology

For each Habitat Group, the data in Table 1 were analyzed at the level of the Habitat Analysis Unit, either sub-watershed (for riverine and wetland Habitat Groups) or habitat blocks (for forest and meadow/shrub Habitat Groups). Some Habitat Analysis Units were excluded from the function analysis due to lack of a feature within the unit (e.g., no streams present within a sub-watershed) or because none, or only a very small portion of, the Habitat Analysis Unit was contained within the Project Area. However, for the riverine and wetland Habitat Groups, data analysis included some of these areas for calculations involving upstream or adjacent basins (e.g., contributing basin information for water flow analysis).

The project team scored each sub-watershed or habitat block according to how well it performs each function listed in Table 1. For example, in scoring the flow variation function for the riverine Habitat Group, the team calculated the percent of impervious surface within the contributing basin as a measure of the runoff regime and the percent forest cover within the contributing basin as a measure of the infiltration regime. Similarly, for the surface storage function, the team calculated the area of historic floodplain (using soil data) per unit of stream length and the amount of wetlands and lakes as a percent of the contributing basin. The scoring process required identification of the appropriate data sets, metrics (units) and formulas for each attribute, and in some cases weighting factors to account for differences in the quality of the data. Weighting factors for measures and attributes were developed using the following criteria:

- The data were equally weighted where (1) all data were considered of equal quality and geographic coverage, and (2) ecological principles indicate that the multiple measures or attributes generally contribute equally to the respective attribute or function.
- Where the conditions above did not apply, a lower weighting factor was applied to those measures where data quality was sub-standard compared to other data sources and/or where a measure was determined to contribute (or "drive") a function to a lesser degree than other associated functions.

The data were analyzed in GIS and then exported to Microsoft Excel, which was then used to calculate all attributes and function scores. Because the purpose of this exercise is to compare functions among Habitat Analysis Units across the Project Area, the function scores were rank-ordered and assigned into one of five categories, corresponding to the relative level of function within the Habitat Analysis Unit.

The overall analysis approach only compares conditions of functions relative to habitats *within* the Project Area, and does not assess these functions in relation to the range of natural conditions over a larger area (e.g., WRIA 1 or the Puget Sound). To emphasize this important point, these five categories are collectively called the **Relative Functional Condition Score**. Based on a statistical analysis and assessment of the project purpose and ease of use, five categories were selected to describe the level of comparative function, in order from lowest ecological function to highest. The categories are as follows:

- **Lowest** – The Habitat Analysis Units have the very lowest function scores. This group included the lower outliers and would be a primary focus for investigating restoration actions to increase function.
- **Lower** – The Habitat Analysis Units have function scores higher than the lowest group, but lower than the median group. This group could be a focus for investigating restoration actions to increase function, especially if other associated functions in the Habitat Group are low functioning.
- **Median** – The Habitat Analysis Units classified have scores at and adjacent to the median scores for the Project Area. Units in this group generally represent the median condition for the function in question within the Project Area. Habitat Analysis Units in this group will likely not be the primary focus of restoration or protection efforts targeted at the function being analyzed.
- **Higher** – The Habitat Analysis Units have function scores lower than the highest group, but higher than the median group. This group could be a focus for investigating protection actions to maintain function, especially if other associated functions in the Habitat Group are high functioning.
- **Highest** – The Habitat Analysis Units have the very highest function scores. This group included the upper outliers and would be a primary focus for investigating protection actions to maintain function.

The following subsections present the results for riverine, wetland, forest, and meadow/shrub Habitat Groups. The findings of this assessment were reviewed by City of Bellingham staff and the TAG to ensure the modeled results generally adhered to on-the-ground conditions. In general, the model results appeared to reflect the existing functional condition of the Habitat Analysis Units within the Project Area. However, during the establishment of the conceptual model and development of specific attribute measures, a number of data gaps were identified. Although no data collection or field verification was included in the scope of this project, filling the identified data gaps could yield a more robust and sensitive analysis.

2.2.2 Riverine Habitat Group Functional Assessment Results

The results of the functional assessment for all 28 sub-watersheds in the Riverine Habitat Group are shown in Table 3. A subset of sub-watersheds have all functions scoring high or low, but many of the sub-watersheds have functions that are mixed in terms of existing condition ratings. Also, some of the watersheds analyzed did not have natural stream systems within the sub-watershed and therefore could not be analyzed in the functional assessment.

Table 3. Relative Functional Condition Ratings for All Analyzed Functions in the Riverine Habitat Group by Sub-Watershed

Sub-watershed	RIVERINE HABITAT GROUP FUNCTION					
	Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Alderwood Creek	Lower	Median	Lower	Lowest	Lower	Median
Baker Creek Tributary	Median	Median	Lowest	Lower	Lowest	Median
Bear Creek	Lower	Highest	Median	Lower	Median	Higher
Cemetery Creek	Higher	Lower	Higher	Highest	Median	Lower
Chuckanut Creek	Highest	Lower	Higher	Highest	Highest	Highest
Connelly Creek	Lower	Median	Lower	Higher	Lower	Lowest
Fever Creek	Lowest	Median	Lower	Lower	Lowest	Lower
Fort Bellingham	Median	Highest	Highest	Lower	Median	Lowest
Hannah Creek	Higher	Lowest	Median	Median	Median	Higher
Lake Padden	Highest	Highest	Lowest	Higher	Higher	Higher
Lincoln Creek	Lowest	Higher	Lower	Median	Lower	Lower
Little Squalicum Creek	Lowest	Median	Lowest	Lowest	Higher	Higher
Lost Creek	Higher	Highest	Higher	Lowest	Higher	Lower
Lower Baker Creek	Median	Lower	Median	Median	Lowest	Median
Lower Padden Creek	Median	Lower	Lower	Median	Lower	Median
Lower Spring Creek	Lower	Lower	Highest	Median	Lower	Higher
Lower Squalicum Creek	Median	Higher	Higher	Higher	Median	Lowest
Lower Toad Creek	Higher	Lowest	Median	Higher	Higher	Median
Lower Whatcom Creek	Lowest	Lowest	Highest	Median	Lowest	Lowest
Silver Creek Tributary #1	Median	Higher	Higher	Lower	Higher	Median
Silver Creek Tributary #2	Lower	Median	Lowest	Lowest	Median	Lower
Spokane Creek	Highest	Higher	Median	Higher	Highest	Highest
Upper Padden Creek	Higher	Lowest	Median	Highest	Highest	Highest
Upper Whatcom Creek	Highest	Higher	Highest	Highest	Highest	Highest
Central Bellingham[1]						
Squalicum Harbor[1]						
North Lower Squalicum[1]						
South Bellingham[1]						

[1]The functions of these sub-watersheds were not evaluated as no natural stream features are present within the sub-watershed boundaries.

2.2.3 Wetland Habitat Group Functional Assessment Results

The results of the functional assessment for all 28 sub-watersheds in the Wetland Habitat Group are shown in Table 4. As with the Riverine Habitat Group, there are a number of high functioning, low functioning, and mixed sub-watersheds in terms of existing condition ratings.

Table 4. Relative Functional Condition Ratings for All Analyzed Functions in the Wetland Habitat Group by Sub-Watershed

Sub-watershed	WETLAND HABITAT GROUP FUNCTION						
	Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Alderwood Creek	Lowest	Lower	Lower	Lowest	Lower	Lower	Lower
Baker Creek Tributary	Higher	Highest	Highest	Median	Higher	Higher	Higher
Bear Creek	Higher	Highest	Higher	Higher	Highest	Highest	Median
Cemetery Creek	Highest	Higher	Median	Highest	Median	Higher	Higher
Central Bellingham	Lowest	Lowest	Highest	Lowest	Lowest	Lowest	Lowest
Chuckanut Creek	Highest	Higher	Highest	Higher	Higher	Highest	Highest
Connelly Creek	Median	Lower	Lower	Median	Lowest	Median	Lower
Fever Creek	Median	Lower	Lowest	Median	Median	Median	Higher
Fort Bellingham	Median	Higher	Higher	Lowest	Higher	Lower	Lower
Hannah Creek	Highest	Median	Median	Higher	Median	Median	Highest
Lake Padden	Higher	Higher	Median	Higher	Median	Higher	Higher
Lincoln Creek	Lower	Median	Lower	Lower	Lower	Lower	Median
Little Squalicum Creek	Lower	Lowest	Lowest	Lower	Lower	Lowest	Lowest
Lost Creek	Median	Highest	Higher	Median	Higher	Median	Median
Lower Baker Creek	Higher	Median	Higher	Higher	Highest	Higher	Median
Lower Padden Creek	Lower	Lower	Lower	Lower	Lowest	Median	Median
Lower Spring Creek	Lower	Median	Median	Lower	Higher	Median	Lower
Lower Squalicum Creek	Higher	Highest	Higher	Higher	Highest	Highest	Median
Lower Toad Creek	Lower	Lower	Higher	Median	Median	Lowest	Lower
Lower Whatcom Creek	Lowest	Lowest	Lowest	Lowest	Lowest	Lower	Lowest
North Lower Squalicum	Lower	Lowest	Lowest	Lower	Lower	Lowest	Highest

Sub-watershed	WETLAND HABITAT GROUP FUNCTION						
	Surface Water Storage	**Nitrogen Removal**	**Pathogen Removal**	**Organic Matter Export/ Contribution**	**Sediment/ Phosphorus Removal**	**Wildlife Habitat**	**Carbon Seques-tration**
Silver Creek Tributary #1	Median	Highest	Highest	Highest	Higher	Higher	Lower
Silver Creek Tributary #2	Higher	Median	Highest	Highest	Highest	Lower	Higher
South Bellingham	Lowest	Lower	Lower	Lowest	Lower	Highest	Lowest
Spokane Creek	Highest	Higher	Median	Highest	Highest	Highest	Highest
Squalicum Harbor	Lowest	Lowest	Lowest	Lower	Lowest	Lowest	Lowest
Upper Padden Creek	Median	Median	Lower	Median	Lower	Lower	Higher
Upper Whatcom Creek	Highest	Higher	Median	Highest	Median	Higher	Highest

2.2.4 Forest Habitat Group Functional Assessment Results

The results of the functional assessment for all Forest Habitat Blocks in the Forest Habitat Group are shown in Table 5. This analysis calculated relative condition for two functions (biodiversity and habitat maintenance) but also for the attributes that contribute to these functions (three attributes for biodiversity and two attributes for habitat maintenance). The need for a more detailed attribute analysis was determined based on the relatively low number of functions for this Habitat Group (two) and the recommendation of the TAG. As with the other Habitat Groups, there are a number of high functioning, low functioning, and mixed sub-watersheds in terms of existing condition ratings.

Table 5. Relative Functional Condition Ratings for All Analyzed Functions and Attributes in the Forest Habitat Group by Sub-Watershed

Forest Block ID Number	Biodiversity Function[1]				Habitat Maintenance Function[1]		
	Overall Biodiversity Function Score	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*	Overall Habitat Maintenance Function Score	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
002	**Highest**	*Highest*	*Lower*	*Highest*	**Highest**	*Highest*	*Higher*
003	**Higher**	*Highest*	*Median*	*Median*	**Higher**	*Higher*	*Highest*
004	**Highest**	*Highest*	*Higher*	*Highest*	**Highest**	*Highest*	*Highest*
005	**Median**	*Median*	*Higher*	*Lowest*	**Median**	*Lower*	*Median*
006	**Highest**	*Highest*	*Higher*	*Highest*	**Highest**	*Highest*	*Higher*
007	**Highest**	*Higher*	*Highest*	*Highest*	**Highest**	*Highest*	*Highest*
009	**Highest**	*Higher*	*Median*	*Highest*	**Highest**	*Higher*	*Highest*
011	**Highest**	*Highest*	*Median*	*Higher*	**Highest**	*Highest*	*Highest*
011A	**Higher**	*Higher*	*Lowest*	*Median*	**Higher**	*Median*	*Higher*
011B	**Higher**	*Highest*	*Highest*	*Lower*	**Higher**	*Higher*	*Higher*
012	**Median**	*Median*	*Lower*	*Median*	**Lower**	*Median*	*Lowest*
013	**Median**	*Higher*	*Lower*	*Median*	**Median**	*Higher*	*Median*
016	**Lower**	*Lower*	*Lower*	*Lower*	**Median**	*Lower*	*Median*
024	**Median**	*Higher*	*Median*	*Lower*	**Median**	*Median*	*Higher*
032	**Median**	*Median*	*Median*	*Median*	**Lower**	*Lower*	*Lower*
032A	**Lowest**	*Lowest*	*Median*	*Lowest*	**Lowest**	*Lowest*	*Lowest*
034	**Lowest**	*Higher*	*Median*	*Lowest*	**Median**	*Higher*	*Median*

Forest Block ID Number	Biodiversity Function[1]				Habitat Maintenance Function[1]		
	Overall Biodiversity Function Score	***System Maturity Attribute Score***	***Lifeform Diversity Attribute Score***	***Habitat Community Attribute Score***	**Overall Habitat Maintenance Function Score**	***Habitat Connection and Fragmentation Attribute Score***	***Vegetation Structure Attribute Score***
035	**Lowest**	*Median*	*Lower*	*Lowest*	**Higher**	*Higher*	*Median*
037	**Lower**	*Median*	*Lowest*	*Lower*	**Lower**	*Lowest*	*Median*
040	**Higher**	*Lower*	*Lowest*	*Highest*	**Median**	*Median*	*Median*
041	**Lower**	*Lower*	*Highest*	*Lower*	**Lower**	*Lower*	*Lower*
042	**Highest**	*Highest*	*Lowest*	*Highest*	**Highest**	*Higher*	*Highest*
043	**Median**	*Higher*	*Higher*	*Median*	**Median**	*Median*	*Higher*
052	**Highest**	*Higher*	*Highest*	*Highest*	**Highest**	*Highest*	*Median*
052A	**Median**	*Higher*	*Higher*	*Lower*	**Median**	*Median*	*Median*
056	**Lowest**	*Lowest*	*Highest*	*Lowest*	**Lower**	*Lower*	*Lower*
060	**Highest**	*Highest*	*Lower*	*Highest*	**Higher**	*Highest*	*Median*
068	**Median**	*Higher*	*Lower*	*Median*	**Median**	*Median*	*Median*
069	**Lower**	*Median*	*Lowest*	*Median*	**Lower**	*Lowest*	*Lower*
072	**Highest**	*Highest*	*Lower*	*Higher*	**Median**	*Median*	*Median*
073	**Higher**	*Higher*	*Higher*	*Higher*	**Median**	*Lower*	*Median*
074	**Median**	*Median*	*Median*	*Lower*	**Median**	*Median*	*Higher*
075	**Higher**	*Median*	*Lower*	*Higher*	**Higher**	*Median*	*Higher*
076	**Median**	*Highest*	*Lowest*	*Lower*	**Median**	*Higher*	*Median*
078	**Lowest**	*Median*	*Highest*	*Lowest*	**Lowest**	*Lowest*	*Lower*

Forest Block ID Number	Biodiversity Function[1]				Habitat Maintenance Function[1]		
	Overall Biodiversity Function Score	***System Maturity Attribute Score***	***Lifeform Diversity Attribute Score***	***Habitat Community Attribute Score***	**Overall Habitat Maintenance Function Score**	***Habitat Connection and Fragmentation Attribute Score***	***Vegetation Structure Attribute Score***
081A	**Lower**	*Lower*	*Highest*	*Lower*	**Lowest**	*Lowest*	*Lowest*
089	**Median**	*Median*	*Lower*	*Lower*	**Higher**	*Higher*	*Higher*
089A	**Median**	*Median*	*Median*	*Lower*	**Lower**	*Higher*	*Lowest*
090	**Lowest**	*Median*	*Median*	*Lowest*	**Lowest**	*Lower*	*Lower*
099	**Lowest**	*Lowest*	*Higher*	*Lowest*	**Lowest**	*Lowest*	*Lowest*
100	**Lower**	*Median*	*Median*	*Lower*	**Lowest**	*Lower*	*Lowest*
101	**Lower**	*Median*	*Lower*	*Lower*	**Lowest**	*Lower*	*Lowest*
108	**Lowest**	*Lower*	*Lowest*	*Lowest*	**Median**	*Lower*	*Lower*
111	**Lowest**	*Lowest*	*Highest*	*Lower*	**Lowest**	*Lower*	*Lowest*
112	**Lower**	*Lowest*	*Highest*	*Median*	**Median**	*Median*	*Median*
113	**Lower**	*Lowest*	*Higher*	*Median*	**Lower**	*Median*	*Lowest*
114	**Median**	*Lower*	*Lower*	*Median*	**Median**	*Median*	*Median*
116	**Median**	*Lower*	*Median*	*Median*	**Median**	*Median*	*Higher*
119	**Median**	*Lowest*	*Median*	*Median*	**Median**	*Median*	*Higher*
120	**Lower**	*Lower*	*Highest*	*Median*	**Lower**	*Lower*	*Lowest*
121	**Median**	*Lowest*	*Lower*	*Higher*	**Higher**	*Highest*	*Lower*
122	**Higher**	*Lower*	*Higher*	*Highest*	**Highest**	*Highest*	*Highest*
123	**Lower**	*Lowest*	*Highest*	*Lower*	**Lower**	*Median*	*Lowest*

Forest Block ID Number	Biodiversity Function[1]				Habitat Maintenance Function[1]		
	Overall Biodiversity Function Score	***System Maturity Attribute Score***	***Lifeform Diversity Attribute Score***	***Habitat Community Attribute Score***	**Overall Habitat Maintenance Function Score**	***Habitat Connection and Fragmentation Attribute Score***	***Vegetation Structure Attribute Score***
124	**Lower**	*Lowest*	*Median*	*Lower*	**Lower**	*Higher*	*Lower*
125	**Lower**	*Lower*	*Lowest*	*Median*	**Lowest**	*Lowest*	*Lower*
126	**Higher**	*Lower*	*Higher*	*Higher*	**Higher**	*Higher*	*Higher*
127	**Higher**	*Lower*	*Lowest*	*Higher*	**Higher**	*Highest*	*Higher*
128	**Higher**	*Lower*	*Lower*	*Higher*	**Median**	*Median*	*Median*
129	**Median**	*Lowest*	*Median*	*Highest*	**Higher**	*Median*	*Highest*
130	**Median**	*Lowest*	*Highest*	*Higher*	**Lowest**	*Lowest*	*Lower*
131	**Lowest**	*Lowest*	*Higher*	*Lowest*	**Lower**	*Lowest*	*Lower*
133	**Lower**	*Median*	*Highest*	*Median*	**Lower**	*Lowest*	*Median*
134	**Highest**	*Higher*	*Higher*	*Highest*	**Highest**	*Highest*	*Higher*
135	**Lowest**	*Lower*	*Median*	*Lowest*	**Lower**	*Lower*	*Lower*
137	**Median**	*Lowest*	*Lowest*	*Highest*	**Highest**	*Higher*	*Highest*
138	**Higher**	*Median*	*Median*	*Higher*	**Higher**	*Higher*	*Median*
140	**Higher**	*Higher*	*Higher*	*Higher*	**Median**	*Median*	*Median*
141	**Median**	*Median*	*Median*	*Median*	**Highest**	*Highest*	*Higher*
142	**Highest**	*Highest*	*Higher*	*Highest*	**Highest**	*Highest*	*Highest*
143	**Higher**	*Higher*	*Median*	*Higher*	**Highest**	*Highest*	*Highest*
146	**Median**	*Higher*	*Higher*	*Median*	**Higher**	*Median*	*Highest*

Forest Block ID Number	Biodiversity Function[1]					Habitat Maintenance Function[1]		
	Overall Biodiversity Function Score	***System Maturity Attribute Score***	***Lifeform Diversity Attribute Score***	***Habitat Community Attribute Score***		**Overall Habitat Maintenance Function Score**	***Habitat Connection and Fragmentation Attribute Score***	***Vegetation Structure Attribute Score***
147	**Higher**	*Highest*	*Median*	*Higher*		**Higher**	*Median*	*Highest*
148	**Highest**	*Highest*	*Higher*	*Higher*		**Higher**	*Higher*	*Highest*
149	**Higher**	*Median*	*Median*	*Higher*		**Median**	*Median*	*Higher*
150	**Lower**	*Median*	*Lower*	*Median*		**Lower**	*Lower*	*Lower*
151	**Higher**	*Median*	*Highest*	*Higher*		**Median**	*Median*	*Median*
153	**Lowest**	*Median*	*Lowest*	*Lowest*		**Lowest**	*Lowest*	*Lowest*
155	**Median**	*Lower*	*Lowest*	*Median*		**Median**	*Median*	*Median*
157	**Lower**	*Median*	*Lowest*	*Median*		**Median**	*Lower*	*Median*
158	**Median**	*Higher*	*Median*	*Median*		**Median**	*Median*	*Lower*
165	**Highest**	*Highest*	*Lower*	*Median*		**Lower**	*Lowest*	*Median*
171	**Lowest**	*Lower*	*Median*	*Lowest*		**Lowest**	*Lowest*	*Lowest*
178	**Median**	*Median*	*Lowest*	*Median*		**Lowest**	*Lowest*	*Lower*
179	**Median**	*Median*	*Median*	*Median*		**Higher**	*Higher*	*Median*
192	**Lowest**	*Median*	*Median*	*Lowest*		**Lowest**	*Lower*	*Lowest*

[1]Note that in the columns below, the results are presented for both overall function (bold text) and for the individual attributes that comprise the function (italicized text).

2.2.5 Meadow/Shrub Habitat Group Functional Assessment Results

The results of the functional assessment for all Meadow/Shrub Habitat Blocks in the Meadow/Shrub Habitat Group are shown in Table 6. As with the Forest Block Analysis, relative condition was calculated for two functions (biodiversity and habitat maintenance) but also for the attributes that contribute to these functions (two attributes each for biodiversity and habitat maintenance). The need for a more detailed attribute analysis was determined based on the relatively low number of functions for this Habitat Group (two) and the recommendation of the TAG. As with the other Habitat Groups, there are a number of high functioning, low functioning, and mixed sub-watersheds in terms of existing condition ratings.

Table 6. Relative Functional Condition Ratings for All Analyzed Functions and Attributes in the Meadow/Shrub Habitat Group by Sub-Watershed

Meadow/ Shrub Block ID Number	Biodiversity Function			Habitat Maintenance Function		
	Overall Biodiversity Function Score	*Diversity of Lifeforms Attribute Score*	*Habitat Community and Diversity Attribute Score*	Habitat Maintenance Function Score	*Habitat Connection and Fragmentation Attribute Score*	*Animal Diversity Attribute Score*
002	Higher	Higher	Median	Higher	Median	Highest
003	Median	Median	Lowest	Lowest	Lowest	Lower
004	Highest	Highest	Highest	Highest	Highest	Highest
006	Highest	Highest	Highest	Median	Lowest	Highest
011	Median	Highest	Lowest	Lower	Lowest	Highest
022	Lowest	Lowest	Median	Median	Highest	Lowest
039	Lower	Lowest	Higher	Median	Highest	Lowest
040	Higher	Highest	Median	Higher	Higher	Median
041	Lowest	Lowest	Lowest	Lowest	Lowest	Lowest
052	Highest	Higher	Highest	Highest	Highest	Highest
060	Highest	Higher	Highest	Higher	Median	Highest
068	Higher	Median	Higher	Median	Median	Median
072	Higher	Higher	Median	Higher	Median	Highest
073	Median	Higher	Median	Highest	Higher	Highest
076	Lowest	Lower	Lowest	Lower	Lower	Median
101	Median	Lowest	Highest	Median	Median	Lower
108	Median	Lower	Higher	Lowest	Lowest	Lower
108A	Lowest	Lowest	Median	Lower	Highest	Lowest
111	Lower	Lower	Median	Median	Median	Lower
113	Higher	Lower	Highest	Median	Median	Lower
114	Median	Median	Lower	Median	Median	Median
118	Median	Lower	Higher	Median	Lower	Median

Meadow/ Shrub Block ID Number	Biodiversity Function				Habitat Maintenance Function		
	Overall Biodiversity Function Score	*Diversity of Lifeforms Attribute Score*	*Habitat Community and Diversity Attribute Score*		Habitat Maintenance Function Score	*Habitat Connection and Fragmentation Attribute Score*	*Animal Diversity Attribute Score*
120	**Median**	*Lower*	*Higher*		**Lowest**	*Lower*	*Lower*
122	**Highest**	*Highest*	*Higher*		**Higher**	*Median*	*Highest*
123	**Lower**	*Lower*	*Lower*		**Higher**	*Higher*	*Median*
124	**Lower**	*Median*	*Lower*		**Higher**	*Higher*	*Median*
125	**Lowest**	*Lower*	*Lower*		**Lowest**	*Lowest*	*Median*
126	**Median**	*Higher*	*Lower*		**Median**	*Lower*	*Highest*
127	**Median**	*Median*	*Lower*		**Highest**	*Higher*	*Highest*
128	**Higher**	*Median*	*Median*		**Highest**	*Highest*	*Highest*
130	**Median**	*Median*	*Lowest*		**Lower**	*Lowest*	*Median*
132	**Lowest**	*Lowest*	*Lower*		**Lowest**	*Median*	*Lowest*
133	**Median**	*Median*	*Median*		**Lower**	*Higher*	*Lowest*
134	**Highest**	*Highest*	*Median*		**Highest**	*Highest*	*Highest*
137	**Higher**	*Higher*	*Median*		**Median**	*Median*	*Highest*
138	**Median**	*Median*	*Median*		**Highest**	*Higher*	*Highest*
140	**Median**	*Median*	*Higher*		**Higher**	*Median*	*Highest*
142	**Highest**	*Highest*	*Highest*		**Higher**	*Higher*	*Highest*
149	**Higher**	*Higher*	*Median*		**Median**	*Lower*	*Highest*
150	**Lowest**	*Lower*	*Lowest*		**Lower**	*Lower*	*Lower*
151	**Higher**	*Higher*	*Higher*		**Lower**	*Lower*	*Median*
153	**Lower**	*Lowest*	*Higher*		**Lowest**	*Lower*	*Lowest*
155	**Lower**	*Median*	*Lowest*		**Lower**	*Lower*	*Median*
157	**Lower**	*Median*	*Lower*		**Lower**	*Median*	*Lower*
158	**Lower**	*Median*	*Lower*		**Median**	*Median*	*Lower*
178	**Lower**	*Median*	*Median*		**Median**	*Higher*	*Median*

2.2.6 Identified Data Gaps

During the establishment of the conceptual model and development of specific attribute measures, a number of data gaps were identified. Filling these gaps would allow a more robust and sensitive analysis. Table 7 lists the key data gaps for each Habitat Group, as well as the relevance of the information to both the current analysis for purposes of producing the Restoration Assessment, as well as other potential benefits that procurement of this data may provide.

Table 7. Key Data Gaps Identified for Each Habitat Group

Habitat Group	Priority (H = Highest, M=Moderate, L= Lowest)	Data Gap Description	Additional Information and Relevance to Restoration Assessment	Relevance to Other Uses and COB Departments
Riverine	H	Mapping of floodplain and channel migration zones (CMZs) within the City of Bellingham/UGA	Detailed information on presence of stream floodplain and CMZs would assist in refining measures for multiple functions in the analysis for riverine and wetland Habitat Groups, resulting in more accurate and precise measures for flood storage, off-channel habitat, and riparian wetlands.	This information would potentially provide the City, floodplain managers, and the public key data for planning, implementation, and regulation of 1) flood control and floodplain development, 2) shoreline and critical areas, 3) general mitigation and restoration efforts, and 4) hydraulic and hydrologic modeling and monitoring efforts, 5) comprehensive planning efforts.
Riverine	H	Mapping of stream bank condition, including mapping of armoring/confinement (mapping of levees, dikes, walls, rip-rapped channel segments) and reaches of bank instability (mapping of bank sloughing, slumping, fracturing, slides and similar features).	Detailed information on streambank conditions would assist in refining measures for multiple functions in the analysis for riverine Habitat Groups, resulting in more accurate and precise measures for flood storage, off-channel habitat, and other riparian functions. Could be done in conjunction with streambank mapping exercise to develop polygon (versus existing line) City GIS stream layer.	This information would potentially provide the City, stakeholders, and the public with key data for planning, implementation, and regulation of 1) flood control and floodplain development, 2) project implementation and success monitoring, 3) mitigation and restoration, and 4) stormwater, hydraulic, and hydrologic modeling and monitoring efforts.

Habitat Group	Priority (H = Highest, M=Moderate, L= Lowest)	Data Gap Description	Additional Information and Relevance to Restoration Assessment	Relevance to Other Uses and COB Departments
Riverine	M	Results from benthic index of biotic integrity (B-IBI), or other similar macroinvertebrate index, for streams within the city/UGA.	Results from an annual or biennial B-IBI sampling would provide a key metric for riverine biodiversity and could assist in developing additional measures for other functions such as water quality (using pollution tolerant taxa data), trophic structure (data on shredders and grazers). A B-IBI sampling program would ideally include all watersheds within Bellingham, and sampling locations in upper and lower basin positions and key tributaries.	This information would potentially provide City, stakeholders, and the public key data for planning, implementation, and regulation of 1) project implementation and success monitoring 2) water quality programs including TMDL and 303(d) listed reaches, 3) non-Restoration Assessment mitigation and restoration efforts
Riverine	M	Comprehensive stream surveys to determine channel morphology, substrate, confinement, and other key habitat features.	Detailed information on instream habitat would assist in refining riverine function measures, resulting in more accurate and precise measures for instream habitat, as well as sediment functions. Could be done in conjunction with streambank mapping exercise as described above to add detailed habitat information to City GIS stream layer.	This information would potentially provide City, stakeholders, and the public key data for planning, implementation, and regulation of 1) project implementation and success monitoring, and 2) non-Restoration Assessment mitigation and restoration efforts
Wetland	H	Wetland inventory verifications and updates, including site specific wetland boundary information, wetland classifications and ratings from delineations submitted to the City.	In some cases, data in this analysis is ten to twenty years old or more (e.g., wetland inventories from 1992 and 2003) and may have relied on aerial photography with limited ground-truthing. Accurate wetland mapping would assist the City in refining several measures in this analysis.	This information would be useful to the City and stakeholders in planning, implementation, and regulation with respect to Critical Areas, Shoreline Management, and Comprehensive Planning assessment

Habitat Group	Priority (H = Highest, M=Moderate, L= Lowest)	Data Gap Description	Additional Information and Relevance to Restoration Assessment	Relevance to Other Uses and COB Departments
Wetland	M	Aquatic/wetland dependent fish, wildlife, and rare/significant native plant species inventory for wetlands within the city/UGA.	Additional species inventory would strengthen wetland biodiversity measures in this analysis.	This information would provide the City with specific locations of high wetland biodiversity to be used in planning, implementation and regulation of City Critical Areas Ordinance, Shoreline Master Program and comprehensive planning efforts
Wetland	M	Wetland hydrology characteristics (e.g., Cowardin water regimes, source of hydrology inputs/outputs, area of contributing basin, connectivity, depth and duration of ponding, and live storage)	Detailed information on wetland hydrology characteristics would refine hydrology and water quality functions of wetlands. The City's site-specific GIS information included some hydrology information, but did not include enough coverage of the analysis area. Additional information from critical areas studies could be incorporated into City databases or the City could partner with local naturalist groups to set up citizen science programs to collect data.	This information would be useful to the City, stakeholders, and the public in planning, implementation, and regulation with respect to the Critical Areas Ordinance, Shoreline Master Program, Comprehensive Plan, wetland mitigation and restoration monitoring.
Wetland	M	Inventory and mapping of invasive plant cover	Accurate mapping of invasive plant populations is important in wetland habitat management. Whatcom County noxious weed board provides assistance, but they are behind in mapping and do not keep records on all invasive plants. Could partner with local naturalist groups to set up citizen science programs to collect data.	This information would provide the City, stakeholders, and the public with specific locations of invasive species populations to be used in planning, implementation and regulation of City Critical Areas Ordinance, Shoreline Master Program, comprehensive planning efforts, and wetland restoration/mitigation monitoring.

Habitat Group	Priority (H = Highest, M=Moderate, L= Lowest)	Data Gap Description	Additional Information and Relevance to Restoration Assessment	Relevance to Other Uses and COB Departments
Wetland	M	Inventory and mapping of organic soils and soil carbon content.	Information on the extent of organic soils and soil carbon storage is important for calculating carbon sequestration in wetlands and responding to climate change. Could partner with local naturalist groups to set up citizen science programs to collect data.	This information would be useful to the City, stakeholders, and the public in planning, implementation, and regulation with respect to the Critical Areas Ordinance, Shoreline Master Program, comprehensive planning efforts, wetland mitigation and restoration monitoring.
Forest and Meadow/ Shrub	M	Terrestrial species inventory of wildlife within city/UGA	Results from an inventory of terrestrial wildlife species would provide a strong metric for terrestrial (forest and meadow/shrub) biodiversity. Inventory could be limited to indicator species within a taxa or guild to reduce cost but still retain analysis value. Could partner with local naturalist groups to set up citizen science programs to collect data.	This information would provide the City and stakeholders with specific locations of high biodiversity to be used in planning, implementation and regulation of City Critical Areas Ordinance, Shoreline Master Program and comprehensive planning efforts
Forest and Meadow/ Shrub	H	Update data in Nahkeeta NW 2003 City of Bellingham Wildlife Habitat Assessment	The data in this analysis is over ten years old. Development during that time has altered habitat block conditions and project conclusions.	This information would provide the City, stakeholders, and the public with specific locations of high biodiversity to be used in planning, implementation and regulation of Critical Areas Ordinance, Shoreline Master Program and comprehensive planning efforts

Habitat Group	Priority (H = Highest, M=Moderate, L= Lowest)	Data Gap Description	Additional Information and Relevance to Restoration Assessment	Relevance to Other Uses and COB Departments
Forest and Meadow/ Shrub	M	Inventory and mapping of invasive plant cover	Accurate mapping of invasive plant populations is important in terrestrial habitat management. Whatcom County Noxious Weed Board provides assistance, but they are behind in mapping and do not keep records on all invasive plants. Could partner with local naturalist groups to set up citizen science programs to collect data.	This information would provide the City, stakeholders, and the public with specific locations of high biodiversity to be used in planning, implementation and regulation of City Critical Areas Ordinance, Shoreline Master Program and comprehensive planning efforts
Forest and Meadow/ Shrub	M	Inventory and mapping of invasive wildlife	No data was located on invasive wildlife distribution and/or status. This data can be important in managing sensitive plant and animal species populations. Could partner with local naturalist groups to set up citizen science programs to collect data.	This information would provide the City, stakeholders, and the public with specific locations of high biodiversity to be used in planning, implementation and regulation of City Critical Areas Ordinance, Shoreline Master Program and comprehensive planning efforts
Forest and Meadow/ Shrub	M	Inventory and mapping of sensitive and locally important native plant populations	Results from an inventory of terrestrial wildlife species would provide a strong metric for terrestrial (forest and meadow/shrub) biodiversity. Inventory could be limited to indicator species within a taxa or guild to reduce cost but still retain analysis value.	This information would provide the City, stakeholders, and the public with specific locations of high biodiversity to be used in planning, implementation and regulation of City Critical Areas Ordinance, Shoreline Master Program and comprehensive planning efforts

Habitat Group	Priority (H = Highest, M=Moderate, L= Lowest)	Data Gap Description	Additional Information and Relevance to Restoration Assessment	Relevance to Other Uses and COB Departments
Forest	L	Assessment and mapping of forest habitat structure	This data is partially presented in the 1995 and 2003 Nahkeeta NW datasets, but is out of date and limited in the original scope. Could partner with local naturalist groups to set up citizen science programs to collect data.	This information would provide the City, stakeholders, and the public with specific locations of high biodiversity to be used in planning, implementation and regulation of City Critical Areas Ordinance, Shoreline Master Program and comprehensive planning efforts
Forest and Meadow/ Shrub	H	Identification of significant habitat corridors	This data is partially presented in the 1995 and 2003 Nahkeeta NW datasets, but is out of date since significant development has occurred since the analysis was performed. The Restoration Assessment project qualitatively identified such corridors, but a fine-scale quantitative evaluation would benefit future analysis.	This information would provide the City, stakeholders, and the public with specific locations of high biodiversity to be used in planning, implementation and regulation of City Critical Areas Ordinance, Shoreline Master Program and comprehensive planning efforts

3.0 Restoration Actions Prioritization Overview

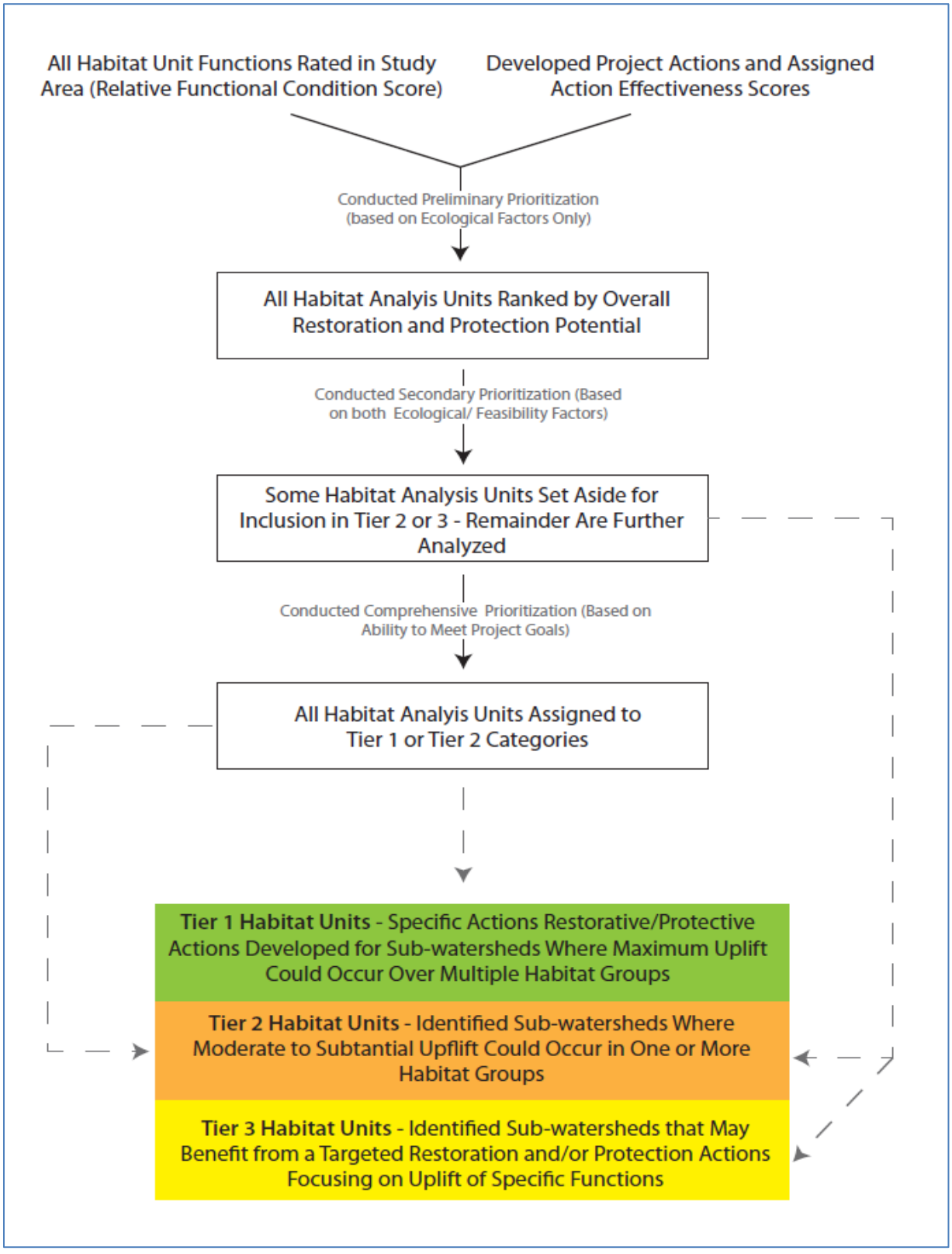
The restoration actions were refined using three levels of prioritization: Preliminary, Secondary, and Comprehensive Prioritizations. The prioritization exercises resulted in classification of geographic areas within the Project Area (sub-watersheds) being placed into one of three buckets, or Tiers (Tiers 1 through 3). The primary endpoint of this particular assessment focuses on areas where the application of a wide variety of restoration actions would result in substantial ecological uplift over multiple Habitat Groups. These sub-watersheds were classified as Tier 1. However, the step-wise prioritization process should not be viewed only as a linear refinement of data that results in a final list. Rather, the different prioritization steps offer different perspectives, or filters, to view restoration opportunities and select appropriate actions for all sub-watersheds, including those classified as Tier 2 or Tier 3.

In the Preliminary Prioritization, areas where existing functions are highly intact (see Tables 2 and 3) were identified as good candidates (high priorities) for actions that maintain and preserve those functions. A list of restoration actions was then developed and scored for effectiveness (Action Effectiveness Score), which was then combined with the existing level of function to determine which combinations of action and Habitat Analysis Units would produce the greatest function performance (uplift of degraded functions and maintenance of functions currently operating at a high level). This produced an ordered list of all sub-watersheds based solely on ecological elements.

In the Secondary Prioritization, factors such as feasibility, scope, and scale of applying the restoration or protection actions were considered, which shifted the prioritization. Within this framework, areas where almost all functions are low were not considered high priorities for restoration, as the likelihood of achieving full and sustainable ecological recovery would be very low due to extreme impairment of those underlying processes necessary to sustain the habitats. The Secondary Prioritization resulted in some Habitat Analysis Units being set aside (not considered further as Tier 1 units) due to multiple impaired existing functions; this included 6 of the 24 riverine sub-watersheds, 7 of the 28 wetland sub-watersheds, 12 of the 85 forest habitat blocks, and 11 of the 46 meadow/shrub habitat blocks. However, these sub-watersheds were re-integrated into the comprehensive analysis, where they were assigned into Tier 2 or Tier 3 restoration/protection categories.

In the Comprehensive Prioritization, habitats and actions were analyzed to identify opportunities for broad ecological improvement over multiple habitat types and multiple functions. The Comprehensive Prioritization also considered which areas had the highest potential to meet the project goals (see page 1). In order to develop a Comprehensive Prioritization that would allow for total ecological improvement over multiple habitat types, the Habitat Analysis Unit Secondary Prioritization results were combined for different Habitat Groups. The results were then reviewed and adjusted, using input from local technical experts with on-the-ground knowledge. The Comprehensive Prioritization resulted in 9 sub-watersheds assigned into the Tier 1 category, 14 sub-watersheds into the Tier 2 Category, and 5 sub-watersheds into the Tier 3 category. Although the focus of this report is primarily on the Tier 1 sub-watersheds, the sub-watersheds in the other Tiers would also benefit from either a sub-watershed approach to restoration/protection or through targeted restoration and/or protection actions focusing on uplift of specific functions. The general steps and potential outcomes of these analyses are presented in Figure 7.

Figure 7. Summary of Technical Analysis Prioritization Steps and Outcomes



4.0 Preliminary (Ecological) Prioritization

4.1 Methods

The specific steps associated with the Preliminary Prioritization are described below and can be summarized as follows:

1. Generate individual numeric scores for potential uplift of functions/attributes for all proposed restoration actions in a given Habitat Group.
2. For each Habitat Group, convert the existing condition ratings (highest, higher, median, lower, or lowest) for each combination of function/attribute and Habitat Analysis Unit into a numerical score on a 1 to 5 scale.
3. For each Habitat Group, take the product of steps 1 and 2 above for each combination of function/attribute and Habitat Analysis Unit. The resulting number represents the total potential uplift of a single function from each restoration action/Habitat Analysis Unit combination.
4. For each Habitat Analysis Unit, sum the individual function/attribute scores to produce a single combined score for the Habitat Analysis Unit. This score represents the total potential uplift to all Habitat Group functions and is the basis for prioritization.
5. For each proposed restoration action, rank the total uplift scores and associated Habitat Analysis Units generated in step 4 in a descending numerical order (highest to lowest scores) to generate a prioritized list of restoration opportunities across all Habitat Analysis Units of a particular Habitat Group.

In conjunction with City staff and the TAG, the project team identified a list of potential restoration actions that could be applied over the Project Area to improve ecological functions. These actions also include protection actions that would be effective in preserving existing functions in areas where there has been minimal degradation or impairment. In the context of this assessment, restoration actions are categorized broadly as follows:

- **Primary Restorative Measures** – Project-level actions that focus on improvement of one or more habitat elements following project execution. These project types can include the enhancement or restoration of ecological functions/processes (such as stormwater retrofit projects that provide flow control), habitat structures (e.g., large woody debris [LWD] installation projects), or elements of both (e.g., riparian buffer planting increases habitat structure in the form of vegetation and improves LWD recruitment processes).
- **Protective Measures** – Conservation and protection of existing habitat functions and structures through measures such as property acquisition (fee simple or conservation easements) and application of existing or new land use policies and regulations such as building codes, zoning codes, and critical areas/shoreline regulations.

In order to develop a specific list of actions from the broad categories above, the project team sought to identify actions that generally met certain criteria, including:

1. Actions that will meet the project goals,
2. Well established and documented in scientific literature as having a direct or indirect link between the action and a significant positive response in habitat functions,
3. Effects of the action on various functions that can be clearly delineated and ideally measured,
4. Actions commonly applied in the Puget Sound area with established protocols for implementation and success monitoring, and
5. Actions applicable at wide-ranging scales and locations (so an action is not precluded based on parcel size or land ownership or a specific portion of the Project Area).

Based on the considerations above, 4 to 10 restoration actions were developed for each of the four Habitat Groups considered (Table 8). The table presents information on each action considered, including those restoration sub-actions that were classified together. Additional consideration was given to whether the action is expected to affect ecological functions, habitat structure, or both, as well as the physical scale of the action and the temporal scale before measureable positive changes in function are expected.

Table 8. Description of Proposed Habitat Restoration Actions by Habitat Group

Habitat Group	Project Action Name/Brief Description	Project Action Elements/Sub-Actions
Riverine	Increase in-channel habitat quantity	Meander stream, create side channels/oxbows/blind channels
	Reconnect stream to floodplain	Remove or modify streamside berms/dikes, create floodplain through grading
	Restore depressional wetlands	Create or expand depressional wetlands through grading/planting
	Install instream complexity and increase habitat quality	Install large woody debris/engineered log jams (ELJs), install substrate, install boulders
	Remove or modify streamside armor	Remove riprap, concrete, or structural revetments
	Restore/enhance vegetated riparian buffer	Significant native tree and shrub planting/underplanting, invasive removal
	Retrofit stormwater facilities and existing development	Conventional stormwater treatment (wet-ponds, filter systems, bioswales, infiltration); and stormwater flow control/ detention
	Implement low impact development (LID) program	Install rain gardens, soil amended lawns, tree planting, green roofs, infiltration trenches, and/or create City incentives/funding
	Permanent protection of stream buffer	Acquisition or establishment of conservation easements/Native Growth Protection Areas (NGPAs)

Habitat Group	Project Action Name/Brief Description	Project Action Elements/Sub-Actions
	Improve protection of stream buffer through regulatory/City code changes	Application of or changes in land use regulations, zoning density, critical areas/shoreline ordinances
Wetland	Create wetland and wetland buffer	Grading, planting, invasive species removal, and hydrologic alterations
	Enhance wetland and wetland buffer	Grading, planting, underplanting, invasive species removal, and hydrologic alterations
	Permanent protection of wetland and wetland buffer	Property acquisition or establishment of conservation easements/NGPAs
	Improve protection of wetland/wetland buffer through regulatory/City code changes	Application of or changes in land use regulations, zoning density, critical areas/shoreline ordinances
Forest	Restore upland forest	Create or expand forest habitat through reforestation and invasive species removal
	Enhance upland forest	Selective harvest, thinning, understory planting, and invasive species removal
	Permanent protection of forest habitat	Property acquisition and establishment of conservation easements/NGPAs
	Protect forest habitat through regulatory changes	Application of or changes in land use regulations, zoning density, critical areas/shoreline ordinances
Meadow / Shrub	Restore meadow/shrub habitat	Create or expand meadow-shrub habitat by grading, replanting, invasive species removal
	Enhance meadow/shrub habitat	Inplanting and invasive species removal
	Permanent protection of meadow/shrub habitat	City/non-profit property acquisition or establishment of conservation easements/NGPAs
	Protect meadow/shrub habitat through regulatory measures	Application of or changes in land use regulations, zoning density, critical areas/shoreline ordinances

The next step was development of a method to analyze the potential for each action to provide uplift for every Habitat Analysis Unit in each of four different Habitat Groups. The primary question was: Which actions should be applied in which areas (Habitat Analysis Units) to achieve maximum uplift of ecological functions, in the absence of other constraints?

The team assigned each action an **Action Effectiveness Score** of high, medium, or low. A more detailed classification system using a greater number of categories was not supported by the current state of ecological research and could introduce evaluator bias into the ranking process. Action Effectiveness Scores were converted into numerical scores of 0 to 2 to facilitate numerical ranking (Table 9).

Table 9. Descriptions of Restoration Action Effectiveness Ratings and Scores for Ecological Functions

Restoration Action Effectiveness Rating	Description	Equivalent Numerical Score
High	The relevant action is highly effective at improvement of the specific function. It is expected that if this action is conducted throughout a significant portion of the landscape, the function will show positive response, in the form of measurable improvement of the function (increase in function score), in an intermediate time period (5 to 20 years).	2
Medium	The relevant action is moderately effective at improvement of the specific function It is expected that if this action is conducted throughout a significant portion of the landscape, the action is would likely produce a positive response in the function, although this response may or may not be measurable response in an intermediate time period (5 to 20 years).	1
Low	The relevant action is rated as being ineffective in improving the specific function. It is expected that that if this action is conducted throughout a significant portion of the landscape, the response is minimal or unmeasureable in an intermediate time period (5 to 20 years).	0

The results of assigning Action Effectiveness Scores for the Riverine and Wetland Habitat Groups are presented in Tables 10 and 11. For these Habitat Groups we assessed the potential for uplift from restoration actions on all functions (six and seven functions, respectively). Due to a limited amount of data on existing conditions and structure, the Forest and Meadow/Shrub Habitat Groups are described by only two functions. Therefore, it was determined that in the case of those two groups, the functional attributes should be used instead of functions. This provides a more comprehensive analysis of the functional components and allows more refined comparisons within the groups. Tables 12 and 13 present the results of the ranking process for the Forest and Meadow/Shrub Habitat Groups, with restoration uplift potential analyzed at the functional attribute level.

The assigned rankings will be combined with the results from the previously conducted existing conditions function assessment (or attribute assessment in the case of the Forest and Meadow/Shrub Habitat Groups). The results of combining this information will be used to prioritize restoration actions by habitat, using the methods described below.

Table 10. Restoration Action Effectiveness Scores for the Riverine Habitat Group (High Uplift =2, Medium Uplift =1, Low Uplift =0)

Project Action Name	Riverine Function					
	Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Increase In-channel Habitat Quantity	0	1	1	2	0	1
Reconnect Stream to Floodplain	0	2	2	2	0	1
Restore Depressional Wetlands	1	2	0	0	0	0
Install Instream Complexity and Increase Habitat Quality	0	0	2	2	0	0
Remove or Modify Streamside Armor	0	0	1	2	0	0
Restore/enhance Vegetated Riparian Buffer	0	0	2	2	1	2
Retrofit Stormwater Facilities and Existing Development	2	1	0	0	2	1
Implement LID Program	1	1	0	0	1	1
Permanent Protection of Stream Buffer	0	0	0	0	1	0
Improve Protection of Stream Buffer Through Regulatory/City Code Changes	0	0	0	1	0	1
Implement Targeted Public Outreach on Water Quality	0	0	2	2	1	2
Implement Targeted Public Outreach on Vegetation Management	0	0	1	1	1	1

Table 11. Restoration Action Effectiveness Scores for the Wetland Habitat Group (High Uplift =2, Medium Uplift =1, Low Uplift =0)

Project Action Name	Wetland Function						
	Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Create Wetland and Wetland Buffer	2	1	1	2	1	2	2
Enhance Wetland and Wetland Buffer	1	1	0.5	1	0.5	1	1
Permanent Protection of Wetland and Wetland Buffer	2	1	1	2	1	2	2
Improve Protection of Wetland/Wetland Buffer Through Regulatory/City Code Changes	1	1	0	1	0	1	1

Table 12. Restoration Action Effectiveness Scores for the Forest Habitat Group (High Uplift =2, Medium Uplift =1, Low Uplift =0)

Project Action Name	Forest Biodiversity Function			Forest Habitat Maintenance Function	
	System Maturity Attribute	Lifeform Diversity Attribute	Habitat Community Attribute	Habitat Connection and Fragmentation Attribute	Vegetation Structure Attribute
Restore Upland Forest	1	1	1	2	1
Enhance Upland Forest	0	1	1	0	2
Permanent Protection of Forest Habitat	2	2	1	2	1
Protect Forest Habitat Through Regulatory Changes	1	1	0	1	0

Table 13. Restoration Action Effectiveness Scores for the Meadow/Shrub Habitat Group (High Uplift =2, Medium Uplift =1, Low Uplift =0)

Project Action Name	Meadow/Shrub Biodiversity Function		Meadow/Shrub Habitat Maintenance Function	
	Diversity of Lifeforms Attribute Score	Habitat Community and Diversity Attribute Score	Habitat Connection and Fragmentation Attribute Score	Animal Diversity Attribute Score
Restore Meadow/Shrub Habitat	1	1	1	2
Enhance Meadow/Shrub Habitat	0	1	1	0
Permanent Protection of Meadow/Shrub Habitat	2	2	1	2
Protect Meadow/Shrub Habitat Through Regulatory Changes	1	1	0	1

Once each restoration action was assigned an Action Effectiveness Score (assessing potential functional uplift to the individual functions/attributes of Habitat Groups) as described above, this information was combined with the results of the existing condition analysis, in order to estimate restoration potential.

The assessment of potential functional uplift in Preliminary Prioritization reflects two common tenets of ecological restoration and protection (NRC, 1992; Bell et al., 1997; Clewell et al. 2005):

- The greater the level of degradation in a particular function, the greater the potential for improvement through **restorative** actions. The potential for a high level of degradation (above a recoverable threshold) that would limit the practical ability to restore ecological processes and functions was not accounted for in the Preliminary Prioritization, but was considered in the Secondary Prioritization.
- The higher the level of function, the higher the potential for maintaining a high level of function through **protective** actions.

Therefore, the five categories from the existing conditions analysis (higher, high, moderate, etc.) were converted into a 1 through 5 numerical scale, with a lower score indicating higher potential for uplift (assuming the more degraded a function is, the more potential for uplift). The numeric equivalents assigned to functions for analysis of restoration and protective measures are given in Table 14 (note there is an inverse relationship between the two types of measures).

Table 14. Numerical Score Assignment for Habitat Restoration Action Types (higher numbers indicate higher potential or priority for improvement/maintenance of function/attribute condition)

Function/Attribute Condition Rating	Habitat Restoration Action Type	
	Primary Restorative Measures	Protective Measures
Highest	1	5
Higher	2	4
Median	3	3
Lower	4	2
Lowest	5	1

After all existing function/attribute scores were calculated for all Habitat Analysis Units, this metric (measuring potential uplift - the amount of improvement that can occur to a particular function) is multiplied by the Action Effectiveness Score, which measures the effectiveness of a given action. The product of the two numbers indicates the overall restoration potential for each function in a Habitat Analysis Unit for a given restoration or protection action. In addition, a weighting score was applied to the Forest and Meadow/Shrub Habitat Groups in order to account for differences in the contribution of each attribute to the overall function score.

By summing all of the functional restoration potential scores, a total restoration or protection score for each Habitat Analysis Unit is generated. This list can be sorted by score to produce a prioritized list of Habitat Analysis Units for each restoration action. As previously mentioned this Preliminary Prioritization includes only ecological considerations and does not incorporate practical constraints (which will be analyzed during the next phase of the project).

4.2 Preliminary Prioritization Results

4.2.1 Riverine Habitat Group Results

The overall ordered results of the Preliminary Prioritization for the riverine Habitat Group for restorative and protective actions is presented in Tables 15 and 16, respectively. These results are based on summing all individual scores for all restoration actions by sub-watershed, then rank ordering the sub-watersheds based on overall score. Table 17 shows all Riverine Habitat Analysis Units in relative rank order from highest to lowest, for each separate restorative or protective action. For example, the analysis indicates that the best place to apply floodplain reconnection actions is in the Silver Creek Tributary #2 sub-watershed (Table 17). This is where one could expect to see the greatest improvement in riverine habitat functions for that action. Similarly, increasing instream habitat complexity in the Little Squalicum Creek sub-watershed, for example, would improve riverine functions to a greater degree than applying that same action in the Chuckanut Creek sub-watershed. Likewise, Table 17 indicates that Upper Whatcom Creek would benefit most from both of the protective actions analyzed (permanent buffer protection and protect through regulatory change). Numeric results of the prioritization by restoration and protection actions are provided in Attachment A (Table A-5).

Table 15. Preliminary Overall Prioritization Results for Restoration Actions within the Riverine Habitat Group

Rank Order	Sub-watershed	Increase In-Channel Habitat Quantity	Floodplain Reconnect	Restore Depressional Wetlands	Increase Instream Habitat Complexity	Remove Armor	Enhance Riparian Buffer	Retrofit Stormwater Facilities	Implement LID Program	Sum of Restoration ActionScores
1	Silver Creek Tributary #2	22	30	10	20	15	31	21	14	**163**
2	Alderwood Creek	19	26	11	16	12	29	27	17	**157**
3	Little Squalicum Creek	20	27	10	18	14	28	22	14	**153**
4	Fever Creek	19	27	9	18	13	29	22	14	**151**
5	Baker Creek Tributary	20	28	11	20	15	26	19	12	**151**
6	Lower Whatcom Creek	17	23	15	8	7	23	30	20	**143**
7	Lower Padden Creek	16	22	9	14	10	26	24	15	**136**
8	Lost Creek	17	25	11	14	10	24	21	14	**136**
9	Lincoln Creek	16	23	10	12	8	26	24	16	**135**
10	Connelly Creek	16	23	11	12	9	23	23	15	**132**
11	Lower Baker Creek	16	24	12	12	9	19	17	12	**121**
12	Hannah Creek	17	20	4	14	12	24	13	9	**113**
13	Lower Toad Creek	15	23	12	10	7	18	16	12	**113**
14	Fort Bellingham	14	18	6	14	11	21	17	10	**111**
15	Silver Creek Tributary #1	13	18	12	8	7	16	22	14	**110**
16	Bear Creek	15	17	5	10	9	23	18	12	**109**
17	Lower Spring Creek	15	19	7	12	10	20	15	10	**108**
18	Lower Squalicum Creek	13	17	7	8	6	21	19	13	**104**
19	Cemetery Creek	12	18	10	6	4	17	18	13	**98**
20	Lake Padden	12	18	3	14	9	20	9	6	**91**
21	Upper Padden Creek	11	19	12	8	5	11	12	9	**87**
22	Spokane Creek	10	15	5	10	7	13	7	5	**72**
23	Chuckanut Creek	9	15	9	6	4	9	9	7	**68**
24	Upper Whatcom Creek	6	9	5	4	3	7	7	5	**46**

Table 16. Preliminary Overall Prioritization Results for Protection Actions within the Riverine Habitat Group

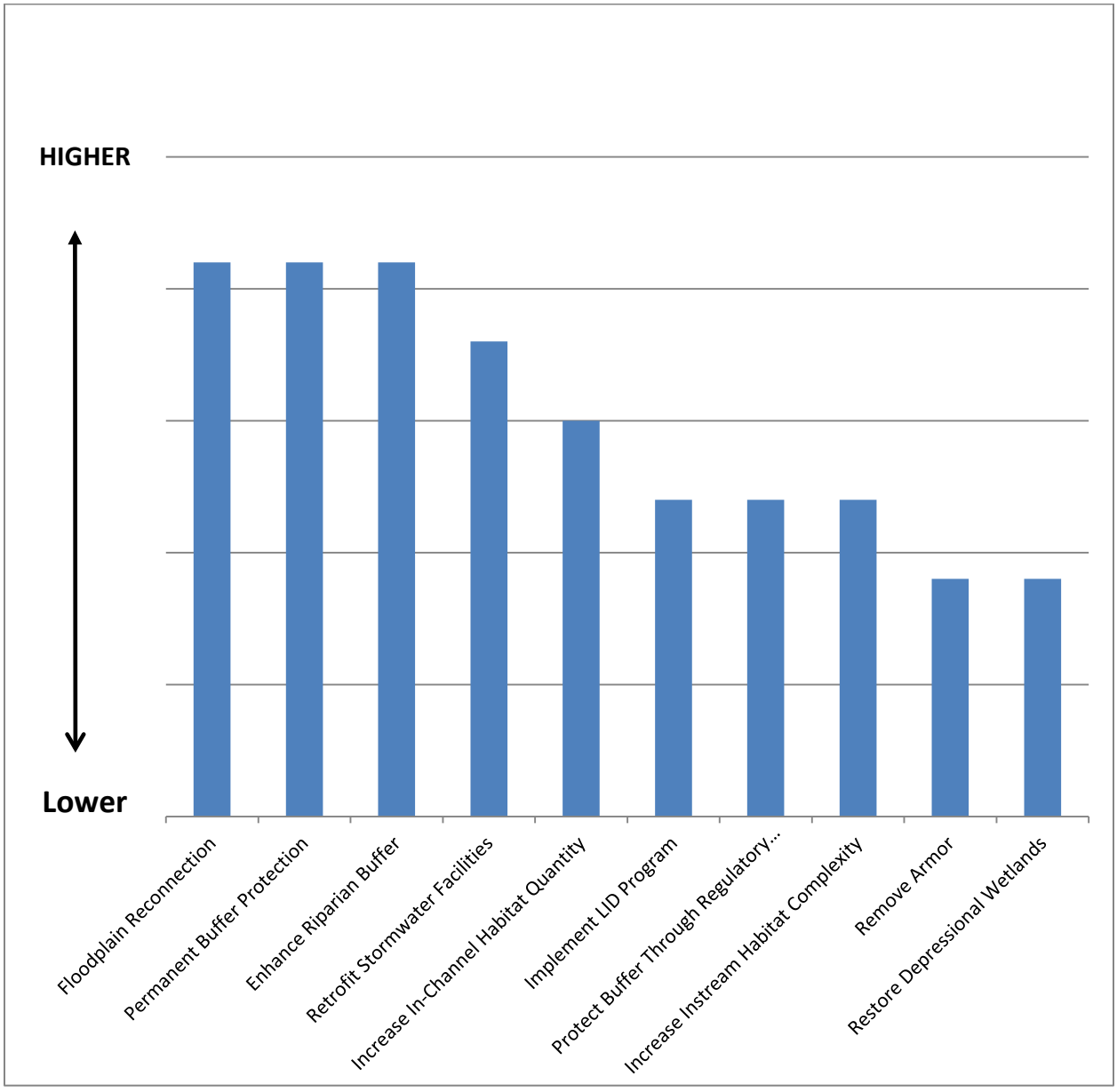
Rank Order	Sub-watershed	Permanent Buffer Protection	Protect Through Regulatory Change	Sum of Protection Action Scores
4	Upper Whatcom Creek	35	20	**55**
2	Chuckanut Creek	33	19	**52**
3	Upper Padden Creek	31	18	**49**
4	Spokane Creek	29	17	**46**
5	Lower Spring Creek	26	14	**40**
6	Cemetery Creek	25	14	**39**
7	Lower Toad Creek	24	14	**38**
8	Hannah Creek	23	13	**36**
9	Lake Padden	22	13	**35**
10	Silver Creek Tributary #1	22	13	**35**
11	Bear Creek	21	12	**33**
12	Lower Squalicum Creek	21	12	**33**
13	Fort Bellingham	19	11	**30**
14	Lost Creek	18	11	**29**
15	Lower Baker Creek	19	10	**29**
16	Lower Whatcom Creek	19	10	**29**
17	Lower Padden Creek	18	10	**28**
18	Little Squalicum Creek	16	10	**26**
19	Connelly Creek	16	9	**25**
20	Lincoln Creek	16	9	**25**
21	Alderwood Creek	14	8	**22**
22	Baker Creek Tributary	13	7	**20**
23	Fever Creek	13	7	**20**
24	Silver Creek Tributary #2	11	7	**18**

Table 17. Preliminary Prioritization Results for the Riverine Habitat Group by Individual Restorative/Protective Actions Rank Ordered from Highest to Lowest

Restorative Actions								Protective Actions	
Increase In-Channel Habitat Quantity	**Floodplain Reconnection**	**Restore Depressional Wetlands**	**Increase Instream Habitat Complexity**	**Remove Armor**	**Enhance Riparian Buffer**	**Retrofit Stormwater Facilities**	**Implement LID Program**	**Permanent Buffer Protection**	**Protect Through Regulatory Change**
Silver Creek Tributary #2	Silver Creek Tributary #2	Lower Whatcom Creek	Little Squalicum Creek	Little Squalicum Creek	Silver Creek Tributary #2	Lower Whatcom Creek	Lower Whatcom Creek	Upper Whatcom Creek	Upper Whatcom Creek
Alderwood Creek	Little Squalicum Creek	Hannah Creek	Silver Creek Tributary #2	Silver Creek Tributary #2	Baker Creek Tributary	Fever Creek	Fever Creek	Chuckanut Creek	Chuckanut Creek
Little Squalicum Creek	Alderwood Creek	Lower Spring Creek	Alderwood Creek	Alderwood Creek	Fever Creek	Connelly Creek	Connelly Creek	Upper Padden Creek	Upper Padden Creek
Baker Creek Tributary	Baker Creek Tributary	Lower Toad Creek	Baker Creek Tributary	Baker Creek Tributary	Alderwood Creek	Lincoln Creek	Lincoln Creek	Spokane Creek	Spokane Creek
Fever Creek	Fever Creek	Upper Padden Creek	Fever Creek	Fever Creek	Connelly Creek	Lower Baker Creek	Lower Baker Creek	Lower Spring Creek	Cemetery Creek
Lost Creek	Lower Padden Creek	Fever Creek	Bear Creek	Lost Creek	Lincoln Creek	Alderwood Creek	Alderwood Creek	Cemetery Creek	Lower Spring Creek
Lower Padden Creek	Hannah Creek	Little Squalicum Creek	Lake Padden	Bear Creek	Little Squalicum Creek	Baker Creek Tributary	Baker Creek Tributary	Lower Toad Creek	Lower Toad Creek
Lower Whatcom Creek	Connelly Creek	Lower Baker Creek	Lincoln Creek	Lincoln Creek	Lost Creek	Lower Spring Creek	Lower Padden Creek	Hannah Creek	Hannah Creek
Connelly Creek	Lower Baker Creek	Lower Padden Creek	Lost Creek	Lower Padden Creek	Lower Padden Creek	Lower Padden Creek	Lower Spring Creek	Lake Padden	Lake Padden
Hannah Creek	Lower Toad Creek	Alderwood Creek	Lower Padden Creek	Silver Creek Tributary #1	Fort Bellingham	Silver Creek Tributary #2	Silver Creek Tributary #2	Silver Creek Tributary #1	Silver Creek Tributary #1
Lincoln Creek	Lower Whatcom Creek	Cemetery Creek	Connelly Creek	Fort Bellingham	Lower Baker Creek	Little Squalicum Creek	Cemetery Creek	Bear Creek	Bear Creek
Lower Baker Creek	Lincoln Creek	Connelly Creek	Hannah Creek	Hannah Creek	Lower Whatcom Creek	Lower Squalicum Creek	Lower Squalicum Creek	Lower Squalicum Creek	Lower Squalicum Creek
Fort Bellingham	Lost Creek	Silver Creek Tributary #2	Lower Baker Creek	Lake Padden	Bear Creek	Cemetery Creek	Fort Bellingham	Fort Bellingham	Fort Bellingham
Lower Toad Creek	Silver Creek Tributary #1	Baker Creek Tributary	Silver Creek Tributary #1	Lower Baker Creek	Lower Squalicum Creek	Fort Bellingham	Hannah Creek	Lower Baker Creek	Lost Creek
Silver Creek Tributary #1	Upper Padden Creek	Chuckanut Creek	Fort Bellingham	Connelly Creek	Lake Padden	Bear Creek	Little Squalicum Creek	Lower Whatcom Creek	Little Squalicum Creek
Bear Creek	Bear Creek	Lincoln Creek	Lower Toad Creek	Lower Spring Creek	Silver Creek Tributary #1	Hannah Creek	Lower Toad Creek	Lost Creek	Lower Baker Creek
Lower Spring Creek	Cemetery Creek	Lower Squalicum Creek	Spokane Creek	Lower Toad Creek	Hannah Creek	Lower Toad Creek	Bear Creek	Lower Padden Creek	Lower Padden Creek
Lower Squalicum Creek	Lake Padden	Silver Creek Tributary #1	Lower Spring Creek	Lower Whatcom Creek	Lower Toad Creek	Silver Creek Tributary #1	Silver Creek Tributary #1	Connelly Creek	Lower Whatcom Creek
Cemetery Creek	Lower Spring Creek	Bear Creek	Lower Squalicum Creek	Spokane Creek	Cemetery Creek	Lost Creek	Lost Creek	Lincoln Creek	Connelly Creek
Lake Padden	Fort Bellingham	Fort Bellingham	Lower Whatcom Creek	Lower Squalicum Creek	Lower Spring Creek	Upper Padden Creek	Upper Padden Creek	Little Squalicum Creek	Lincoln Creek
Upper Padden Creek	Lower Squalicum Creek	Spokane Creek	Upper Padden Creek	Upper Padden Creek	Spokane Creek	Chuckanut Creek	Chuckanut Creek	Alderwood Creek	Alderwood Creek
Spokane Creek	Chuckanut Creek	Upper Whatcom Creek	Cemetery Creek	Cemetery Creek	Upper Padden Creek	Lake Padden	Lake Padden	Baker Creek Tributary	Baker Creek Tributary
Chuckanut Creek	Spokane Creek	Lost Creek	Chuckanut Creek	Chuckanut Creek	Chuckanut Creek	Spokane Creek	Spokane Creek	Fever Creek	Fever Creek
Upper Whatcom Creek	Upper Whatcom Creek	Lake Padden	Upper Whatcom Creek	Upper Whatcom Creek	Upper Whatcom Creek	Upper Whatcom Creek	Upper Whatcom Creek	Silver Creek Tributary #2	Silver Creek Tributary #2

The prioritization results by protective or restorative action are directly related to the inherent variability in the effectiveness of restoration actions. As an example, the comparative amount of expected ecological uplift for each riverine restorative and protective action was calculated and is presented in Figure 8.

Figure 8. Comparison of Relative Ecological Uplift of Each Riverine Restoration Action, Across the Project Area



4.2.2 Wetland Habitat Group Results

The overall ordered results of the Preliminary Prioritization for the wetland Habitat Group for restorative and protective actions are presented in Tables 18 and 19, respectively. These results are

based on summing all individual scores for all restoration actions by sub-watershed, then rank ordering the sub-watersheds based on overall score. Table 20 shows all Wetland Habitat Analysis Units in relative rank order from highest to lowest, for each separate restorative or protective action. Numeric results of the prioritization by restoration and protection actions are provided in Attachment A (Table A-6).

Table 18. Preliminary Overall Prioritization Results for Restoration Actions within the Wetland Habitat Group

Rank Order	Sub-watershed	Restore Wetland and Buffer	Enhance Wetland and Buffer	Sum of Restoration Action Scores
1	Lower Whatcom Creek	53	29	**82**
2	Squalicum Harbor	53	29	**82**
3	Central Bellingham	51	28	**79**
4	Little Squalicum Creek	50	27.5	**77.5**
5	Alderwood Creek	48	26	**74**
6	South Bellingham	44	24	**68**
7	North Lower Squalicum	42	23.5	**65.5**
8	Lower Padden Creek	41	22.5	**63.5**
9	Lower Toad Creek	41	22.5	**63.5**
10	Lincoln Creek	41	22	**63**
11	Connelly Creek	39	21.5	**60.5**
12	Lower Spring Creek	38	20.5	**58.5**
13	Fort Bellingham	38	20	**58**
14	Upper Padden Creek	35	19	**54**
15	Fever Creek	34	19	**53**
16	Lost Creek	29	15	**44**
17	Lower Baker Creek	24	13.5	**37.5**
18	Lake Padden	24	13	**37**
19	Silver Creek Tributary #1	24	12.5	**36.5**
20	Hannah Creek	23	13	**36**
21	Silver Creek Tributary #2	23	13	**36**
22	Baker Creek Tributary	22	11.5	**33.5**
23	Cemetery Creek	20	11	**31**
24	Bear Creek	20	10.5	**30.5**
25	Lower Squalicum Creek	20	10.5	**30.5**
26	Upper Whatcom Creek	18	10	**28**
27	Chuckanut Creek	15	8.5	**23.5**
28	Spokane Creek	14	8	**22**

Table 19. Preliminary Overall Prioritization Results for Protection Actions within the Wetland Habitat Group

Rank Order	Sub-watershed	Permanent Protection	Regulatory Protection	Sum of Protection Action Scores
1	Spokane Creek	52	24	**76**
2	Chuckanut Creek	51	23	**74**
3	Upper Whatcom Creek	48	23	**71**
4	Cemetery Creek	46	22	**68**
5	Bear Creek	46	21	**67**
6	Lower Squalicum Creek	46	21	**67**
7	Baker Creek Tributary	44	20	**64**
8	Hannah Creek	43	20	**63**
9	Lake Padden	42	20	**62**
10	Silver Creek Tributary #1	42	19	**61**
11	Silver Creek Tributary #2	43	18	**61**
12	Lower Baker Creek	42	18	**60**
13	Lost Creek	37	17	**54**
14	Fever Creek	32	15	**47**
15	Upper Padden Creek	31	15	**46**
16	Connelly Creek	27	13	**40**
17	Fort Bellingham	28	12	**40**
18	Lower Spring Creek	28	12	**40**
19	Lincoln Creek	25	12	**37**
20	Lower Padden Creek	25	12	**37**
21	Lower Toad Creek	25	10	**35**
22	North Lower Squalicum	24	11	**35**
23	South Bellingham	22	10	**32**
24	Alderwood Creek	18	8	**26**
25	Little Squalicum Creek	16	7	**23**
26	Central Bellingham	15	5	**20**
27	Lower Whatcom Creek	13	6	**19**
28	Squalicum Harbor	13	6	**19**

Table 20. Preliminary Prioritization Results for the Wetland Habitat Group by Individual Restorative/Protective Actions Rank Ordered from Highest to Lowest

Restorative Actions		Protective Actions	
Restore Wetland And Buffer	**Enhance Wetland And Buffer**	**Permanent Protection**	**Regulatory Protection**
Lower Whatcom Creek	Lower Whatcom Creek	Spokane Creek	Spokane Creek
Squalicum Harbor	Squalicum Harbor	Chuckanut Creek	Chuckanut Creek
Central Bellingham	Central Bellingham	Upper Whatcom Creek	Upper Whatcom Creek
Little Squalicum Creek	Little Squalicum Creek	Bear Creek	Cemetery Creek
Alderwood Creek	Alderwood Creek	Cemetery Creek	Bear Creek
South Bellingham	South Bellingham	Lower Squalicum Creek	Lower Squalicum Creek
North Lower Squalicum	North Lower Squalicum	Baker Creek Tributary	Baker Creek Tributary
Lincoln Creek	Lower Padden Creek	Hannah Creek	Hannah Creek
Lower Padden Creek	Lower Toad Creek	Silver Creek Tributary #2	Lake Padden
Lower Toad Creek	Lincoln Creek	Lake Padden	Silver Creek Tributary #1
Connelly Creek	Connelly Creek	Lower Baker Creek	Lower Baker Creek
Fort Bellingham	Lower Spring Creek	Silver Creek Tributary #1	Silver Creek Tributary #2
Lower Spring Creek	Fort Bellingham	Lost Creek	Lost Creek
Upper Padden Creek	Fever Creek	Fever Creek	Fever Creek
Fever Creek	Upper Padden Creek	Upper Padden Creek	Upper Padden Creek
Lost Creek	Lost Creek	Fort Bellingham	Connelly Creek
Lake Padden	Lower Baker Creek	Lower Spring Creek	Fort Bellingham
Lower Baker Creek	Hannah Creek	Connelly Creek	Lincoln Creek
Silver Creek Tributary #1	Lake Padden	Lincoln Creek	Lower Padden Creek
Hannah Creek	Silver Creek Tributary #2	Lower Padden Creek	Lower Spring Creek
Silver Creek Tributary #2	Silver Creek Tributary #1	Lower Toad Creek	North Lower Squalicum
Baker Creek Tributary	Baker Creek Tributary	North Lower Squalicum	Lower Toad Creek
Bear Creek	Cemetery Creek	South Bellingham	South Bellingham
Cemetery Creek	Bear Creek	Alderwood Creek	Alderwood Creek
Lower Squalicum Creek	Lower Squalicum Creek	Little Squalicum Creek	Little Squalicum Creek
Upper Whatcom Creek	Upper Whatcom Creek	Central Bellingham	Lower Whatcom Creek
Chuckanut Creek	Chuckanut Creek	Lower Whatcom Creek	Squalicum Harbor
Spokane Creek	Spokane Creek	Squalicum Harbor	Central Bellingham

4.2.3 Forest Habitat Group Results

The overall ordered results of the Preliminary Prioritization for the forest Habitat Group for restorative and protective actions are presented in Tables 21 and 22, respectively. These results are based on summing all individual scores for all restoration actions by sub-watershed, then rank ordering the sub-watersheds based on overall score. Table 23 shows all Wetland Habitat Analysis Units in relative rank order from highest to lowest, for each separate restorative or protective action. Numeric results of the prioritization by restoration and protection actions are provided in Attachment A (Table A-7).

Table 21. Preliminary Overall Prioritization Results for Restoration Actions within the Forest Habitat Group

Forest Block ID Number	Restore Forest	Enhance Forest	Sum of Restoration Action Scores
153	126	80	**206**
032A	122	72	**194**
171	120	72	**192**
099	118	68	**186**
108	112	72	**184**
125	116	64	**180**
069	114	64	**178**
101	106	72	**178**
178	114	64	**178**
192	106	72	**178**
037	114	60	**174**
131	114	60	**174**
100	102	68	**170**
081A	108	60	**168**
135	104	64	**168**
090	102	64	**166**
078	106	56	**162**
012	90	68	**158**
111	98	60	**158**
150	98	60	**158**
016	100	56	**156**
056	98	56	**154**
157	98	56	**154**
165	102	52	**154**
032	94	56	**150**
120	92	56	**148**
005	94	52	**146**

Forest Block ID Number	Restore Forest	Enhance Forest	Sum of Restoration Action Scores
089A	78	68	**146**
113	86	60	**146**
123	86	60	**146**
041	92	52	**144**
155	88	56	**144**
130	98	44	**142**
035	78	60	**138**
124	78	60	**138**
114	84	52	**136**
158	80	56	**136**
076	74	60	**134**
133	94	40	**134**
068	80	52	**132**
011A	80	48	**128**
034	72	56	**128**
040	80	48	**128**
128	80	48	**128**
052A	76	48	**124**
072	74	48	**122**
074	78	44	**122**
013	68	52	**120**
024	76	44	**120**
073	80	40	**120**
089	70	48	**118**
119	78	40	**118**
121	62	56	**118**
116	76	40	**116**
075	74	40	**114**
112	74	40	**114**
179	66	48	**114**
140	68	40	**108**
138	62	44	**106**
149	70	36	**106**
043	68	36	**104**
151	66	36	**102**
127	56	44	**100**

Forest Block ID Number	Restore Forest	Enhance Forest	Sum of Restoration Action Scores
137	62	32	**94**
146	64	28	**92**
011B	54	36	**90**
060	46	44	**90**
129	66	24	**90**
141	50	40	**90**
147	62	28	**90**
126	56	32	**88**
003	54	32	**86**
042	54	32	**86**
002	42	36	**78**
009	48	24	**72**
148	46	24	**70**
052	36	32	**68**
143	40	28	**68**
011	38	28	**66**
134	36	28	**64**
006	34	28	**62**
122	36	20	**56**
004	30	20	**50**
142	30	20	**50**
007	28	16	**44**

Table 22. Preliminary Overall Prioritization Results for Protection Actions within the Forest Habitat Group

Forest Block ID Number	Permanent Protection	Regulatory Protection	Sum of Protection Action Scores
007	156	58	**214**
004	152	56	**208**
142	152	56	**208**
052	148	58	**206**
006	148	56	**204**
134	144	54	**198**
011	140	52	**192**
122	140	50	**190**
011B	132	54	**186**

Forest Block ID Number	Permanent Protection	Regulatory Protection	Sum of Protection Action Scores
143	136	50	**186**
148	136	50	**186**
002	132	48	**180**
060	128	48	**176**
009	128	44	**172**
141	124	48	**172**
003	124	46	**170**
126	120	44	**164**
151	116	44	**160**
146	116	42	**158**
147	116	40	**156**
042	116	38	**154**
043	112	42	**154**
138	112	42	**154**
140	112	42	**154**
179	108	42	**150**
034	104	44	**148**
052A	104	42	**146**
127	108	38	**146**
013	104	40	**144**
112	104	40	**144**
121	104	40	**144**
149	104	36	**140**
024	100	38	**138**
089	100	38	**138**
089A	96	42	**138**
072	100	36	**136**
073	100	36	**136**
129	104	32	**136**
076	96	38	**134**
158	96	38	**134**
074	96	36	**132**
123	92	40	**132**
035	92	38	**130**
116	96	34	**130**
124	92	38	**130**
137	100	30	**130**

Forest Block ID Number	Permanent Protection	Regulatory Protection	Sum of Protection Action Scores
075	96	32	**128**
068	92	34	**126**
041	88	36	**124**
113	88	36	**124**
119	92	32	**124**
120	88	36	**124**
133	88	32	**120**
005	84	34	**118**
011A	88	30	**118**
128	88	30	**118**
056	80	34	**114**
111	80	34	**114**
114	84	30	**114**
012	80	32	**112**
032	80	30	**110**
040	84	26	**110**
078	76	32	**108**
130	80	28	**108**
081A	72	30	**102**
090	72	30	**102**
100	72	30	**102**
155	76	26	**102**
150	72	26	**98**
192	68	30	**98**
135	68	28	**96**
165	72	24	**96**
016	68	24	**92**
101	64	26	**90**
157	68	22	**90**
131	60	24	**84**
099	56	24	**80**
171	52	22	**74**
108	52	20	**72**
032A	48	20	**68**
037	52	16	**68**
069	52	16	**68**
178	52	16	**68**

Forest Block ID Number	Permanent Protection	Regulatory Protection	Sum of Protection Action Scores
125	48	14	**62**
153	40	16	**56**

Table 23. Preliminary Prioritization Results for the Forest Habitat Group by Individual Restorative/Protective Actions Rank Ordered from Highest to Lowest

Restore Forest	Enhance Forest	Permanent Protection	Regulatory Protection
153	153	007	007
032A	032A	004	052
171	171	142	004
099	108	052	142
125	101	006	006
069	192	134	134
178	099	011	011B
037	100	122	011
131	012	143	122
108	089A	148	143
081A	125	011B	148
101	069	002	002
192	178	060	060
078	135	009	141
135	090	141	003
100	037	003	009
090	131	126	126
165	081A	151	151
016	111	146	034
111	150	147	146
150	113	042	043
056	123	043	138
157	035	138	140
130	124	140	179
032	076	179	052A
005	078	127	089A
133	016	034	147
120	056	052A	013
041	157	013	112
012	032	112	121
155	120	121	123

Restore Forest	Enhance Forest	Permanent Protection	Regulatory Protection
113	155	149	042
123	158	129	127
114	034	024	024
158	121	089	089
068	165	072	076
011A	005	073	158
040	041	137	035
128	114	089A	124
073	068	076	149
089A	013	158	072
035	011A	074	073
124	040	116	074
074	128	075	041
119	052A	123	113
052A	072	035	120
024	089	124	116
116	179	068	068
076	130	119	005
072	074	041	056
075	024	113	111
112	138	120	129
034	127	133	075
089	060	011A	119
149	133	128	133
013	073	005	012
140	119	114	078
043	116	040	137
179	075	056	011A
151	112	111	128
129	140	012	114
146	141	032	032
121	149	130	081A
138	043	078	090
137	151	155	100
147	011B	081A	192
127	002	090	130
126	137	100	135
011B	126	150	040

Restore Forest	Enhance Forest	Permanent Protection	Regulatory Protection
003	003	165	155
042	042	192	150
141	052	135	101
009	146	016	165
060	147	157	016
148	143	101	131
002	011	131	099
143	134	099	157
011	006	171	171
052	129	108	108
134	009	037	032A
122	148	069	037
006	122	178	069
004	004	032A	178
142	142	125	153
007	007	153	125

4.2.4 Meadow/Shrub Habitat Group Results

The overall ordered results of the Preliminary Prioritization for the meadow/shrub Habitat Group for restorative and protective actions are presented in Tables 24 and 25, respectively. These results are based on summing all individual scores for all restoration actions by sub-watershed, then rank ordering the sub-watersheds based on overall score. Table 26 shows all Meadow/Shrub Habitat Analysis Units in relative rank order from highest to lowest, for each separate restorative or protective action. Numeric results of the prioritization by restoration and protection actions are provided in Attachment A (Table A-8).

Table 24. Preliminary Overall Prioritization Results for Restoration Actions within the Meadow/Shrub Habitat Group

Meadow/Shrub Block ID Number	Restore Meadow/Shrub	Enhance Meadow/Shrub	Sum of Restoration Action Scores
41	117	58	**175**
3	100	58	**158**
130	93	58	**151**
150	98	52	**150**
125	93	53	**146**
76	92	52	**144**
155	87	52	**139**

Meadow/Shrub Block ID Number	Restore Meadow/Shrub	Enhance Meadow/Shrub	Sum of Restoration Action Scores
132	98	40	**138**
108	90	43	**133**
153	95	37	**132**
11	70	58	**128**
157	82	40	**122**
158	82	40	**122**
120	83	37	**120**
111	82	35	**117**
114	75	40	**115**
118	77	37	**114**
126	63	47	**110**
123	73	33	**106**
133	77	28	**105**
151	67	37	**104**
22	80	22	**102**
101	77	25	**102**
108A	80	22	**102**
124	68	33	**101**
149	58	42	**100**
113	72	25	**97**
68	65	30	**95**
39	75	17	**92**
178	63	28	**91**
6	50	38	**88**
127	55	33	**88**
2	52	35	**87**
72	52	35	**87**
137	52	35	**87**
140	52	30	**82**
40	53	28	**81**
138	50	28	**78**
73	45	28	**73**
122	42	30	**72**
60	42	25	**67**
128	43	22	**65**
134	33	22	**55**

Meadow/Shrub Block ID Number	Restore Meadow/Shrub	Enhance Meadow/Shrub	Sum of Restoration Action Scores
142	30	18	**48**
52	28	12	**40**
4	23	12	**35**

Table 25. Preliminary Overall Prioritization Results for Protection Actions within the Meadow/Shrub Habitat Group

Meadow/Shrub Block ID Number	Permanent Protection of Meadow/Shrub	Meadow/Shrub Protection through Regulatory Means	Sum of Protection Action Scores
4	167	67	**234**
142	160	67	**227**
52	157	62	**219**
6	140	67	**207**
60	143	62	**205**
122	143	62	**205**
134	147	57	**204**
73	130	52	**182**
40	127	50	**177**
2	123	52	**175**
72	123	52	**175**
137	123	52	**175**
140	123	52	**175**
128	127	47	**174**
149	117	52	**169**
138	120	47	**167**
151	113	50	**163**
68	110	45	**155**
126	107	47	**154**
127	110	42	**152**
11	100	47	**147**
178	107	40	**147**
113	103	42	**145**
118	93	40	**133**
124	97	35	**132**
101	93	37	**130**
133	93	33	**126**
114	90	35	**125**
120	87	37	**124**

Meadow/Shrub Block ID Number	Permanent Protection of Meadow/Shrub	Meadow/Shrub Protection through Regulatory Means	Sum of Protection Action Scores
39	90	28	**118**
108	80	37	**117**
123	87	30	**117**
111	83	32	**115**
157	83	32	**115**
158	83	32	**115**
22	80	23	**103**
108A	80	23	**103**
155	73	30	**103**
153	70	28	**98**
125	67	30	**97**
130	67	30	**97**
76	63	25	**88**
3	60	27	**87**
150	57	22	**79**
132	57	18	**75**
41	33	13	**46**

Table 26. Preliminary Prioritization Results for the Meadow/Shrub Habitat Group by Individual Restorative/Protective Actions Rank Ordered from Highest to Lowest

Restore Meadow	Enhance Meadow	Permanent Protection of Meadow	Meadow Protection through Regulatory Means
41	3	2	2
3	11	3	3
132	41	4	4
150	130	6	6
153	125	11	11
125	76	22	22
130	150	39	39
76	155	40	40
108	126	41	41
155	108	52	52
120	149	60	60
111	114	68	68
157	132	72	72

Restore Meadow	Enhance Meadow	Permanent Protection of Meadow	Meadow Protection through Regulatory Means
158	157	73	73
22	158	76	76
108A	6	101	101
101	118	108	108
118	120	108A	108A
133	151	111	111
39	153	113	113
114	2	114	114
123	72	118	118
113	111	120	120
11	137	122	122
124	123	123	123
151	124	124	124
68	127	125	125
178	68	126	126
126	122	127	127
149	140	128	128
127	40	130	130
40	73	132	132
2	133	133	133
72	138	134	134
137	178	137	137
140	60	138	138
138	101	140	140
6	113	142	142
73	22	149	149
128	108A	150	150
60	128	151	151
122	134	153	153
134	142	155	155
142	39	157	157
52	4	158	158
4	52	178	178

4.3 Secondary Prioritization

The Secondary Prioritization was focused on identifying those Habitat Analysis Units where the probability of achieving full and sustainable ecological recovery would be very low and to set aside these units from consideration as Tier 1 units. The Secondary Prioritization was based both on ecological principles and the ability of functional uplift to be achieved within reasonable cost and implementation limits. The ecological relationship is based on the tenet that when many or all of the underlying ecological processes are severely degraded within a geographic area, in this case a Habitat Analysis Unit, the probability of providing broad uplift of overall ecological function is low (Clewell et al., 2005). This is due to the intricate and complex relationships between ecological functions and supporting processes, and the high amount of improvement in conditions required to uplift and maintain functions in an area with substantially degraded baseline conditions. Even if such improvement could be achieved, the feasibility of implementing such a broad-based approach is often limited by the constraints of cost, existing land use regulations, and property ownership. It is unlikely that given these constraints, the scope and scale of required actions would be feasible or implementable.

Therefore, the Secondary Prioritization sought to identify those Habitat Analysis Units where the likelihood of achieving full and sustainable ecological recovery would be very low, in order to set aside such Habitat Analysis Units from further consideration as Tier 1 Habitat Analysis Units (where the goal is broad ecological improvement). However, just because these Habitat Analysis Units were set aside during the Secondary Prioritization, they were not eliminated from further consideration for restoration or protection. This is because even a Habitat Analysis Unit that is not a good candidate for broad ecological improvement could likely benefit from restoration that targeted a specific function or individual Habitat Group. Therefore, the set aside units were categorized into either Tier 2 or Tier 3 (see Section 5.5 for details).

The methods used for the Secondary Prioritization were based on the existing functional rating for each Habitat Analysis Unit (see Tables 3 through 6). For each Habitat Group, the results of the functional analysis (see Section 2) were examined by calculating how many functions were rated as good (equivalent to a functional rating of high or higher) versus those rated as median or poor (equivalent to a functional rating of low or lower) within each Habitat Analysis Unit. A threshold was then established to classify which specific Habitat Analysis Units had degradation of the vast majority of their functions (or attributes in the case of the terrestrial Habitat Groups). The threshold varied by Habitat Group based on the total number of functions or attributes. As already mentioned, these Habitat Analysis Units were set aside and not considered further as Tier 1 units.

4.3.1 Riverine Habitat Group Results

The results of the Secondary Prioritization for the Riverine Habitat Group indicate which Habitat Analysis Units were considered too heavily degraded to be advanced to the Comprehensive Prioritization step, and were thus set aside. Six of the 24 riverine sub-watersheds (highlighted in grey shade in Table 27) were set aside based on severe functional degradation, in this case defined as four or more of the six overall functions scoring as low or lowest.

Table 27. Secondary Prioritization Screening Results for Riverine Habitat Group

Sub-watersheds with Multiple Degraded Ecological Functions and Classified as Too Severely Degraded for Successful Application of Comprehensive Restoration or Protection Actions Are Shaded in Grey[1]

Sum of Riverine Function Scores	Sub-watershed	Functions Rated Lower or Lowest (out of 6)	Functions Rated Higher or Highest (out of 6)	Functions Rated Median (out of 6)
29	Upper Whatcom Creek	0	6	0
26	Chuckanut Creek	1	5	0
26	Spokane Creek	0	5	1
23	Lake Padden	1	5	0
23	Upper Padden Creek	1	4	1
20	Cemetery Creek	2	3	1
20	Lost Creek	2	4	0
20	Silver Creek Tributary #1	2	3	1
19	Bear Creek	2	2	2
19	Fort Bellingham	2	2	2
19	Lower Squalicum Creek	1	3	2
19	Lower Toad Creek	1	3	2
18	Hannah Creek	1	2	3
18	Lower Spring Creek	3	2	1
15	Lower Baker Creek	2	0	4
15	Lower Padden Creek	3	0	3
14	Connelly Creek	4	1	1
14	Lincoln Creek	4	1	1
14	Little Squalicum Creek	3	2	1
13	Alderwood Creek	4	0	2
13	Baker Creek Tributary	3	0	3
12	Lower Whatcom Creek	4	1	1
12	Silver Creek Tributary #2	4	0	2
11	Fever Creek	5	0	1

[1] Defined as those sub-watersheds with four or more functions that are rated lower or lowest

4.3.2 Wetland Habitat Group Results

The results of the Secondary Prioritization for the Wetland Habitat Group indicate which Habitat Analysis Units were considered too heavily degraded to be advanced to the Comprehensive Prioritization step, and were thus set aside. Seven of the 28 wetland sub-watersheds (highlighted in grey shade in Table 28) were set aside based on severe functional degradation, in this case defined as six or more of the seven overall functions scoring as low or lowest.

Table 28. Secondary Prioritization Screening Results for Wetland Habitat Group

(Sub-watersheds with Multiple Degraded Ecological Functions and Classified as Too Severely Degraded for Successful Application of Comprehensive Restoration or Protection Actions Are Shaded in Grey[1])

Sum of Wetland Function Scores	Sub-watershed	Functions Rated Lower or Lowest (out of 7)	Functions Rated Higher or Highest (out of 7)	Functions Rated Median (out of 7)
32	Chuckanut Creek	0	7	0
32	Spokane Creek	0	6	1
30	Bear Creek	0	6	1
30	Lower Squalicum Creek	0	6	1
29	Baker Creek Tributary	0	6	1
29	Upper Whatcom Creek	0	5	2
28	Cemetery Creek	0	5	2
28	Silver Creek Tributary #1	1	5	1
28	Silver Creek Tributary #2	1	5	1
27	Lower Baker Creek	5	0	2
26	Hannah Creek	0	3	4
26	Lake Padden	0	5	2
25	Lost Creek	0	3	4
20	Fort Bellingham	3	3	1
19	Fever Creek	2	1	4
19	Lower Spring Creek	3	1	3
19	Upper Padden Creek	3	1	3
17	Lower Toad Creek	4	1	2
16	Connelly Creek	4	0	3
16	Lincoln Creek	5	0	2
15	Lower Padden Creek	5	0	2
14	North Lower Squalicum	6	1	0
14	South Bellingham	6	1	0
12	Alderwood Creek	7	0	0
11	Central Bellingham	6	1	0
10	Little Squalicum Creek	7	0	0
8	Lower Whatcom Creek	7	0	0
8	Squalicum Harbor	7	0	0

[1] Defined as those sub watersheds with six or more functions that are rated lower or lowest

4.3.3 Forest Habitat Group Results

The results of the Secondary Prioritization for the Forest Habitat Group indicate which Habitat Analysis Units were considered too heavily degraded to be advanced to the Comprehensive Prioritization step, and were thus set aside. A total of 12 of the 85 forest habitat blocks (highlighted in grey shade in Table 29) were set aside based on severe degradation, in this case based on an analysis of functional

attributes. In the Forest Habitat Group, this was defined as four or more of the five overall attributes scoring as low or lowest (Table 29).

Table 29. Secondary Prioritization Screening Results for Forest Habitat Group

(Sub-watersheds with Multiple Degraded Ecological Functions and Classified as Too Severely Degraded for Successful Application of Comprehensive Restoration or Protection Actions Are Shaded in Grey[1])

Forest Block ID Number	Total Function Score	Attributes Rated Lower or Lowest (out of 5)	Attributes Rated Higher or Highest (out of 5)	Attributes Rated Median (out of 5)
004	24	0	5	0
007	24	0	5	0
142	24	0	5	0
006	23	0	5	0
011	22	0	4	1
052	22	0	4	1
134	22	0	5	0
148	22	0	5	0
002	21	1	4	0
009	21	0	4	1
122	21	1	4	0
143	21	0	4	1
003	20	0	3	2
011B	20	1	4	0
042	20	1	4	0
060	20	1	3	1
147	20	0	3	2
146	19	0	3	2
043	18	0	3	2
126	18	1	4	0
140	18	0	3	2
141	18	0	2	3
151	18	0	2	3
072	17	1	2	2
073	17	1	3	1
129	17	1	2	2
138	17	0	2	3
149	17	0	2	3
013	16	1	2	2
024	16	1	2	2
052A	16	1	2	2
075	16	1	2	2

Forest Block ID Number	Total Function Score	Attributes Rated Lower or Lowest (out of 5)	Attributes Rated Higher or Highest (out of 5)	Attributes Rated Median (out of 5)
127	16	2	3	0
137	16	2	3	0
179	16	0	1	4
011A	15	1	2	2
034	15	1	2	2
068	15	1	1	3
074	15	1	1	3
076	15	2	2	1
089	15	2	2	1
112	15	1	1	3
116	15	1	1	3
133	15	1	1	3
158	15	1	1	3
040	14	2	1	2
119	14	1	1	3
121	14	3	2	0
128	14	2	1	2
165	14	2	1	2
005	13	2	1	2
032	13	2	0	3
035	13	2	1	2
041	13	4	1	0
089A	13	2	1	2
114	13	2	0	3
120	13	3	1	1
130	13	3	2	0
012	12	2	0	3
078	12	3	1	1
113	12	2	1	2
123	12	3	1	1
124	12	3	1	1
150	12	3	0	2
155	12	2	0	3
157	12	2	0	3
016	11	4	0	1
056	11	4	1	0
081A	11	4	1	0

Forest Block ID Number	Total Function Score	Attributes Rated Lower or Lowest (out of 5)	Attributes Rated Higher or Highest (out of 5)	Attributes Rated Median (out of 5)
090	11	3	0	2
100	11	3	0	2
111	11	4	1	0
037	10	3	0	2
069	10	3	0	2
101	10	4	0	1
135	10	4	0	1
178	10	3	0	2
192	10	3	0	2
125	9	4	0	1
131	9	4	1	0
099	8	4	1	0
108	8	5	0	0
171	8	4	0	1
032A	7	4	0	1

[1] Defined as those forest habitat blocks with four or more functions that are rated low or lowest.

4.3.4 Meadow/Shrub Habitat Group Results

The results of the Secondary Prioritization for the Meadow/Shrub Habitat Group indicate which Habitat Analysis Units were considered too heavily degraded to be advanced to the Comprehensive Prioritization step, and were thus set aside. A total of 11 of the 46 meadow/shrub habitat blocks (highlighted in grey shade in Table 30) were set aside based on severe degradation, in this case based on an analysis of functional attributes. In the Meadow/Shrub Habitat Group, this was defined as three or more of the four overall attributes scoring as low or lowest (Table 30).

Table 30. Secondary Prioritization Screening Results for Meadow/Shrub Habitat Group

(Sub-watersheds with Multiple Degraded Ecological Functions and Classified as Too Severely Degraded for Successful Application of Comprehensive Restoration or Protection Actions Are Shaded in Grey[1])

Meadow/Shrub Block ID Number	Total Function Score	Attributes Rated Lower or Lowest (out of 4)	Attributes Rated Higher or Highest (out of 4)	Attributes Rated Median (out of 4)
004	20	0	4	0
052	19	0	4	0
142	19	0	4	0
134	18	0	3	1
060	17	0	3	1
122	17	0	3	1

Meadow/Shrub Block ID Number	Total Function Score	Attributes Rated Lower or Lowest (out of 4)	Attributes Rated Higher or Highest (out of 4)	Attributes Rated Median (out of 4)
006	16	1	3	0
073	16	0	3	1
128	16	0	2	2
002	15	0	2	2
040	15	0	2	2
072	15	0	2	2
137	15	0	2	2
138	15	0	2	2
140	15	0	2	2
127	14	1	2	1
149	14	1	2	1
068	13	0	1	3
126	13	2	2	0
151	13	1	2	1
178	13	0	1	3
011	12	2	2	0
113	12	2	1	1
124	12	1	1	2
039	11	2	2	0
101	11	2	1	1
114	11	1	0	3
118	11	2	1	1
123	11	2	1	1
133	11	1	1	2
022	10	2	1	1
108A	10	2	1	1
111	10	2	0	2
120	10	3	1	0
157	10	2	0	2
158	10	2	0	2
108	9	3	1	0
155	9	2	0	2
076	8	3	0	1
125	8	3	0	1
130	8	2	0	2
153	8	3	1	0
003	7	3	0	1

Meadow/Shrub Block ID Number	Total Function Score	Attributes Rated Lower or Lowest (out of 4)	Attributes Rated Higher or Highest (out of 4)	Attributes Rated Median (out of 4)
132	7	3	0	1
150	7	4	0	0
041	4	4	0	0

[1] Defined as those meadow-shrub habitat blocks with three or more attributes that are rated low or lowest.

4.3.5 Secondary Prioritization Applications

Once the lowest ranking Habitat Analysis Units were set aside, the remaining Habitat Analysis Units were analyzed to prioritize restoration and protection in different ways by Habitat Group. The Secondary Prioritization produces three distinct outputs that can be used to guide restoration and protection efforts within a defined Habitat Group:

1. Recommended Locations for Multiple Benefits

In order to determine where habitat restoration efforts should be focused, the total uplift for both restoration and protective actions was calculated for each Habitat Analysis Unit (minus the lowest functioning areas that were set aside). This involved summing the individual scores in each Habitat Analysis Unit for each restoration action and then repeating the process for protection actions. Table 31 shows the resulting ranking for the riverine Habitat Group. Table 32 shows the resulting ranking for the wetland Habitat Group, while Table 33 shows the resulting ranking for the forest Habitat Group and Table 34 shows the same information for the Meadow /Shrub Habitat Group. The complete numerical scoring results for all Habitat Groups are found in Tables B-1 and B-4 in Attachment B. The subsequent selection process (Comprehensive Prioritization) involves combing results from the various Habitat Groups to determine in which geographic areas maximum uplift could occur across multiple Habitat Groups. This process is discussed in Section 5 of this document.

2. Recommended Locations for Specific Actions

The Preliminary Prioritization results also show the locations (Habitat Analysis Units) where each particular restorative or protective action would produce the greatest ecological lift. Based on the rank order and the distribution of overall scores, the highest ranked units (highlighted in dark green) and the high units (highlighted in light green) were determined for each restoration action. The results are presented for all four Habitat Groups (Tables B-5 through B-9 in Attachment B). These lists could be useful in prioritizing a single type of restoration where funds or materials have become available through a specific program or organization (e.g., adding instream habitat complexity to a riverine system or acquiring forest land for protection).

3. Recommended Actions for Specific Locations

In some cases, certain restoration or mitigation efforts may want to target a specific location (a pre-defined sub-watershed or habitat block). Additionally, the riverine Habitat Group has a relatively large and varied suite of restorative actions from which to choose. Therefore, for the riverine

Habitat Group only, the project team evaluated the most beneficial restoration actions within each sub-watershed, defined as those actions that would produce the highest amount of ecological uplift in a specific sub-watershed. The results of this evaluation, presented in Table B-5 of Attachment B, are based on the overall distribution of restoration scores within the Project Area. These results may be useful in selecting appropriate actions within a pre-defined specific geographic area.

Table 31. Secondary Prioritization Rank Order of Riverine Habitat Units for Restorative and Protective Actions (sub-watersheds that have a low chance of restoration or protection are highlighted but not rank ordered)

Rank Order	Ranked Sub-watersheds for Restorative Actions	Ranked Sub-watersheds for Protective Actions
1	Baker Creek Tributary	Upper Whatcom Creek
2	Little Squalicum Creek	Chuckanut Creek
3	Lower Padden Creek	Upper Padden Creek
4	Lower Baker Creek	Spokane Creek
5	Hannah Creek	Lower Spring Creek
6	Lost Creek	Cemetery Creek
7	Lower Toad Creek	Lower Toad Creek
8	Bear Creek	Hannah Creek
9	Lower Spring Creek	Lake Padden
10	Fort Bellingham	Silver Creek Tributary #1
11	Silver Creek Tributary #1	Bear Creek
12	Lower Squalicum Creek	Lower Squalicum Creek
13	Cemetery Creek	Fort Bellingham
14	Lake Padden	Lost Creek
15	Upper Padden Creek	Lower Baker Creek
16	Spokane Creek	Lower Padden Creek
17	Chuckanut Creek	Little Squalicum Creek
18	Upper Whatcom Creek	Baker Creek Tributary
N/A	Connelly Creek	Connelly Creek
N/A	Lincoln Creek	Lincoln Creek
N/A	Alderwood Creek	Alderwood Creek
N/A	Lower Whatcom Creek	Lower Whatcom Creek
N/A	Silver Creek Tributary #2	Silver Creek Tributary #2
N/A	Fever Creek	Fever Creek

Table 32. Secondary Prioritization Rank Order of Wetland Habitat Units for Restorative and Protective Actions (sub-watersheds that have a low chance of restoration or protection are highlighted but not rank ordered)

Rank Order	Ranked Sub-watersheds for Restorative Actions	Ranked Sub-watersheds for Protective Actions
1	Lower Padden Creek	Spokane Creek
2	Lower Toad Creek	Chuckanut Creek
3	Lincoln Creek	Upper Whatcom Creek
4	Connelly Creek	Cemetery Creek
5	Lower Spring Creek	Bear Creek
6	Fort Bellingham	Lower Squalicum Creek
7	Upper Padden Creek	Baker Creek Tributary
8	Fever Creek	Hannah Creek
9	Lost Creek	Lake Padden
10	Lower Baker Creek	Silver Creek Trib. #1
11	Lake Padden	Silver Creek Trib. #2
12	Silver Creek Trib. #1	Lower Baker Creek
13	Hannah Creek	Lost Creek
14	Silver Creek Trib. #2	Fever Creek
15	Baker Creek Tributary	Upper Padden Creek
16	Cemetery Creek	Connelly Creek
17	Bear Creek	Fort Bellingham
18	Lower Squalicum Creek	Lower Spring Creek
19	Upper Whatcom Creek	Lincoln Creek
20	Chuckanut Creek	Lower Padden Creek
21	Spokane Creek	Lower Toad Creek
N/A	N. Lower Squalicum	N. Lower Squalicum
N/A	South Bellingham	South Bellingham
N/A	Alderwood Creek	Alderwood Creek
N/A	Central Bellingham	Central Bellingham
N/A	Little Squalicum Creek	Little Squalicum Creek
N/A	Lower Whatcom Creek	Lower Whatcom Creek
N/A	Squalicum Harbor	Squalicum Harbor

Table 33. Secondary Prioritization Rank Order of Forest Habitat Units for Restorative and Protective Actions (sub-watersheds that have a low chance of recovery are highlighted but not rank ordered)

Rank Order	Ranked Sub-watersheds for Restorative Actions	Ranked Sub-watersheds for Protective Actions
1	153	007
2	069	004
3	178	142
4	192	052
5	037	006
6	100	134
7	090	011
8	078	122
9	012	011B
10	150	143
11	157	148
12	165	002
13	032	060
14	120	009
15	005	141
16	089A	003
17	113	126
18	123	151
19	041	146
20	155	147
21	130	042
22	035	043
23	124	138
24	114	140
25	158	179
26	076	034
27	133	052A
28	068	127
29	011A	013
30	034	112
31	040	121
32	128	149
33	052A	024
34	072	089

Rank Order	Ranked Sub-watersheds for Restorative Actions	Ranked Sub-watersheds for Protective Actions
35	074	089A
36	013	072
37	024	073
38	073	129
39	089	076
40	119	158
41	121	074
42	116	123
43	075	035
44	112	116
45	179	124
46	140	137
47	138	075
48	149	068
49	043	041
50	151	113
51	127	119
52	137	120
53	146	133
54	011B	005
55	060	011A
56	129	128
57	141	114
58	147	012
59	126	032
60	003	040
61	042	078
62	002	130
63	009	090
64	148	100
65	052	155
66	143	150
67	011	192
68	134	165
69	006	157
70	122	037

Rank Order	Ranked Sub-watersheds for Restorative Actions	Ranked Sub-watersheds for Protective Actions
71	004	069
72	142	178
73	007	153
N/A	032A	056
N/A	171	111
N/A	099	081A
N/A	108	135
N/A	125	016
N/A	101	101
N/A	131	131
N/A	081A	099
N/A	135	171
N/A	111	108
N/A	016	032A
N/A	056	125

Table 34. Secondary Prioritization Rank Order of Meadow/Shrub Habitat Units for Restorative and Protective Actions (sub-watersheds that have a low chance of recovery are highlighted but not rank ordered)

Rank Order	Ranked Order of Sub-watersheds for Restorative Actions	Ranked Order of Sub-watersheds for Protective Actions
1	130	4
2	155	142
3	11	52
4	157	6
5	158	60
6	111	122
7	114	134
8	118	73
9	126	40
10	123	2
11	133	72
12	151	137
13	22	140
14	101	128
15	124	149
16	108A	138
17	149	151

Rank Order	Ranked Order of Sub-watersheds for Restorative Actions	Ranked Order of Sub-watersheds for Protective Actions
18	113	68
19	68	126
20	39	127
21	178	11
22	6	178
23	127	113
24	2	118
25	72	124
26	137	101
27	40	133
28	140	114
29	138	39
30	73	123
31	122	111
32	60	157
33	128	158
34	134	22
35	142	155
36	52	108A
37	4	130
38	120	120
39	108	108
N/A	76	76
N/A	125	125
N/A	153	153
N/A	3	3
N/A	132	132
N/A	150	150
N/A	41	41

5.0 Comprehensive Prioritization of Restoration and Protection Actions

5.1 Methods

The final step undertaken in this Restoration Assessment was developing a comprehensive analysis that included the following steps:

1. Riverine and wetland Habitat Group scores advanced from the Secondary Prioritization were assessed together for combined uplift.
2. The project team conducted a supplemental qualitative assessment of habitat connectivity. This assessment was completed because, during the analysis of the Preliminary and Secondary Prioritization of Forest Blocks, the project team and TAG determined that the results did not fully capture the overall habitat value, and in particular, the corresponding high ecological value of connectivity. Connectivity was qualitatively assessed, but a full assessment (re-delineation and classification of corridors and more complete data on forest stand structure using up-to-date information) was not feasible as part of the Restoration Assessment.
3. The results were then reviewed and adjusted, using input from local technical experts (Geoff Middaugh, Bill Reilly, James Luce, Wendy Scherrer, and Rachel Vasak), with on-the-ground knowledge. During this process, the project team and local experts reviewed the prioritization results for the meadow/shrub Habitat Group and found that the data were too limited to accurately inform the application of meaningful restoration actions within the Project Area. This is primarily due to a lack of data on the existing functional conditions for the meadow/shrub Habitat Group.
4. Due to the lack of complete forest data (see 3, above), the results of the Forest Habitat Group analysis was still included in the final prioritization, but it was incorporated at a larger scale (watershed) that could be combined with the wetland and riverine results.
5. Fish use and sub-watershed size were also included as part of the Comprehensive Prioritization, in order to incorporate the project goals and to ensure restoration or protection actions would occur on a geographic scale that would allow for significant ecological uplift.

5.2 Riverine and Wetland Habitat Group Comprehensive Habitat Prioritization Methods and Results

The individual and combined riverine and wetland ratings for restorative actions are presented by sub-watershed as the first two columns in Table 35 (the ratings were based on summed individual scores as presented in Attachment B, Table B-10). For each sub-watershed, the riverine and wetland scores were added together and the list re-sorted to produce a combined restoration prioritization list, which is given as the third column in Table 35.

Table 35. Potential Tier 1 Sub-watersheds for Riverine, Wetland, and Combined Riverine and Wetland Restoration (sub-watersheds highlighted in green advanced for further evaluation)

Top Priorities for **Riverine Restorative Actions**	
Sub-watershed	**Riverine Restoration – Ordered From Highest to Lowest Scores***
Baker Creek Tributary	Highest
Little Squalicum Creek	Highest
Lower Padden Creek	Highest
Lower Baker Creek	High
Hannah Creek	High
Lost Creek	High
Lower Toad Creek	High
Bear Creek	High
Lower Spring Creek	Moderate
Fort Bellingham	Moderate
Silver Creek Tributary #1	Moderate
Lower Squalicum Creek	Moderate
Cemetery Creek	Moderate
Lake Padden	Lower
Upper Padden Creek	Lower
Spokane Creek	Lower
Chuckanut Creek	Lower
Upper Whatcom Creek	Lower
Connelly Creek*	Lowest
Lincoln Creek*	Lowest
Alderwood Creek*	Lowest
Lower Whatcom Creek*	Lowest
Silver Creek Tributary #2*	Lowest
Fever Creek*	Lowest

Top Priorities for **Wetland Restorative Actions**	
Sub-watershed	**Wetland Restoration – Ordered From Highest to Lowest Scores***
Lower Padden Creek	Highest
Lower Toad Creek	Highest
Lincoln Creek	Highest
Connelly Creek	Highest
Lower Spring Creek	High
Fort Bellingham	High
Upper Padden Creek	High
Fever Creek	High
Lost Creek	High
Lower Baker Creek	Moderate
Lake Padden	Moderate
Silver Creek Tributary #1	Moderate
Hannah Creek	Moderate
Silver Creek Tributary #2	Moderate
Baker Creek Tributary	Moderate
Cemetery Creek	Lower
Bear Creek	Lower
Lower Squalicum Creek	Lower
Upper Whatcom Creek	Lower
Chuckanut Creek	Lower
Spokane Creek	Lower
North Lower Squalicum Creek*	Lowest
South Bellingham*	Lowest
Alderwood Creek*	Lowest
Central Bellingham*	Lowest
Little Squalicum Creek*	Lowest
Lower Whatcom Creek*	Lowest
Squalicum Harbor*	Lowest

Top Priorities for **Combined Riverine and Restorative Actions**	
Sub-watershed	**Combined Riverine and Wetland Restoration – Ordered From Highest to Lowest Scores***
Lower Padden Creek	Highest
Baker Creek Tributary	Highest
Lower Toad Creek	Highest
Lower Baker Creek	Highest
Lower Spring Creek	High
Fort Bellingham	High
Hannah Creek	High
Lost Creek	High
Little Squalicum Creek	High
Silver Creek Tributary #1	Moderate
Bear Creek	Moderate
Upper Padden Creek	Moderate
Lower Squalicum Creek	Moderate
Cemetery Creek	Moderate
Lake Padden	Moderate
Spokane Creek	Lower
Chuckanut Creek	Lower
Upper Whatcom Creek	Lower
Lincoln Creek	Lower
Connelly Creek	Lower
Fever Creek	Lower
Silver Creek Tributary #2	Lowest
North Lower Squalicum Creek*	Lowest
South Bellingham*	Lowest
Alderwood Creek*	Lowest
Central Bellingham*	Lowest
Lower Whatcom Creek*	Lowest
Squalicum Harbor*	Lowest

*The gray shaded cells were not considered for selection as a Tier 1 sub-watershed due to substantial degraded ecological function, as identified during the Secondary Prioritization. These sub-watersheds will be classified as Tier 2 or Tier 3 and shown here for purposes of completeness.

The same procedure was used for assessing the protection actions, with both scores added together to assess combined ecological uplift in both the riverine and wetland Habitat Groups (Table 36). The ratings were based on summed individual scores (see Tables B-10 and B-11 in Attachment B). Based on this approach, the highest scoring wetland and riverine sub-watersheds were advanced for further consideration as Tier 1 priorities for restoration and protection. This includes the highest rated combined sub-watersheds, as well as the top scoring individual sub-watersheds in the riverine and sub-wetlands. The remaining sub-watersheds were then classified as Tier 2 or Tier 3 sub-watersheds, as discussed in Section 5.5.

In most cases, the combined sub-watershed ranking included the top ranked sub-watersheds from both the riverine and wetland groups (see green highlighted cells in Tables 35 and 36). However, in some cases, a top ranked riverine or wetland sub-watershed did not score as high in the combined list. For example, when considering restorative actions, the Lincoln Creek and Connelly Creek sub-watersheds are ranked near the top for wetland restorative actions, but are ranked low for riverine restorative action. A similar case exists for the Little Squalicum sub-watershed, where riverine restorative actions would produce significant uplift in overall ecological function, but wetland restorative actions would produce extremely limited uplift. The magnitude of increase in ecosystem function achieved solely from wetland restoration may be significant enough to produce significant ecological uplift within the sub-watershed. Therefore, these sub-watersheds were advanced for analysis as Tier 1 sub-watersheds.

In order to further analyze the selected watersheds in Tables 35 and 36, the project team considered several other factors that could influence the restoration/protection priorities. During project scoping, restoration activities that benefit salmonids including species listed under the federal Endangered Species Act were determined to be one of the goals for the technical assessment. Therefore, all other factors being even, sub-watersheds that support federally listed fish are considered to be higher priorities for restoration and protection than sub-watersheds that have minimal or no fish use. Likewise, sub-watersheds that have multiple salmonid species under existing conditions are likely potential candidates for future use by federally listed species. The fish use and distribution data were from a wide variety of available sources, including the Washington State Department of Fish and Wildlife and City of Bellingham. The fish use data were used to assign a fish use rating (Table 37) to assist in further prioritization. Table 38 shows the fish use data and the fish use rating applied to each sub-watershed, as well as a complete list of references for data sources.

Table 36. Potential Tier 1 Sub-watersheds for Riverine, Wetland, and Combined Riverine and Wetland Protection (sub-watersheds in green highlighted cells advanced for further evaluation)

Top Priorities for **Riverine Protective Actions**	
Sub-watershed	**Riverine Protection– Ordered From Highest to Lowest Scores***
Upper Whatcom Creek	Highest
Chuckanut Creek	Highest
Upper Padden Creek	Highest
Spokane Creek	High
Lower Spring Creek	High
Cemetery Creek	High
Lower Toad Creek	High
Hannah Creek	High
Lake Padden	Moderate
Silver Creek Tributary #1	Moderate
Bear Creek	Moderate
Lower Squalicum Creek	Moderate
Fort Bellingham	Moderate
Lost Creek	Lower
Lower Baker Creek	Lower
Lower Padden Creek	Lower
Little Squalicum Creek	Lower
Baker Creek Tributary	Lower
Connelly Creek*	Lowest
Lincoln Creek*	Lowest
Alderwood Creek*	Lowest
Lower Whatcom Creek*	Lowest
Silver Creek Tributary #2*	Lowest
Fever Creek*	Lowest

Top Priorities for **Wetland Protective Actions**	
Sub-watershed	**Wetland Protection – Ordered From Highest to Lowest Scores***
Spokane Creek	Highest
Chuckanut Creek	Highest
Upper Whatcom Creek	Highest
Cemetery Creek	Highest
Bear Creek	High
Lower Squalicum Creek	High
Baker Creek Tributary	High
Hannah Creek	High
Lake Padden	High
Silver Creek Tributary #1	Moderate
Silver Creek Tributary #2	Moderate
Lower Baker Creek	Moderate
Lost Creek	Moderate
Fever Creek	Moderate
Upper Padden Creek	Moderate
Connelly Creek	Lower
Fort Bellingham	Lower
Lower Spring Creek	Lower
Lincoln Creek	Lower
Lower Padden Creek	Lower
Lower Toad Creek	Lower
North Lower Squalicum Creek*	Lowest
South Bellingham*	Lowest
Alderwood Creek*	Lowest
Central Bellingham*	Lowest
Little Squalicum Creek*	Lowest
Lower Whatcom Creek*	Lowest

Top Priorities for **Combined Riverine and Protective Actions**	
Sub-watershed	**Combined Riverine and Wetland Protection – Ordered From Highest to Lowest Scores***
Chuckanut Creek	Highest
Upper Whatcom Creek	Highest
Spokane Creek	Highest
Cemetery Creek	Highest
Bear Creek	High
Lower Squalicum Creek	High
Hannah Creek	High
Lake Padden	High
Silver Creek Tributary #1	High
Upper Padden Creek	Moderate
Lower Baker Creek	Moderate
Baker Creek Tributary	Moderate
Lost Creek	Moderate
Lower Spring Creek	Moderate
Lower Toad Creek	Moderate
Fort Bellingham	Lower
Lower Padden Creek	Lower
Lincoln Creek	Lower
Silver Creek Tributary #2	Lower
Fever Creek	Lower
Connelly Creek	Lower
Alderwood Creek*	Lowest
Lower Whatcom Creek*	Lowest
North Lower Squalicum Creek*	Lowest
South Bellingham*	Lowest
Central Bellingham*	Lowest
Little Squalicum Creek*	Lowest

*The gray shaded cells were not considered for selection as a Tier 1 sub-watershed due to substantial degraded ecological function, as identified during the Secondary Prioritization. These sub-watersheds will be classified as Tier 2 or Tier 3 and shown here for purposes of completeness.

Table 37. Rating criteria for Fish Use within Project Area Watersheds and Sub-watersheds (fish use rating based on data in Table 38)

Fish Use Rating	Criteria
Highest	Known distribution of at least two ESA-listed fish species AND six or more total salmonid species
High	Known distribution of at least two ESA-listed fish species AND five or more total salmonid species
Moderate	Known distribution of at least one ESA-listed fish species OR four or more total salmonid species
Moderate-Low	Known distribution of at least three or more total salmonid species
Lower	Known distribution of at least two or more total salmonid species
Lowest	Known distribution of only one or no salmonid species

Table 38. Fish Use within Project Area Watersheds and Sub-watersheds (Source: WDFW 2015a, b; COB 2015)

Watershed	Sub-watershed	Documented Use by Salmonid Species[a]								Comments	Fish Use Rating
		Chinook Salmon	Steelhead/Rainbow Trout	Coho Salmon	Chum Salmon	Pink Salmon	Sockeye Salmon/ Kokanee	Cutthroat Trout	Bull Trout		
Silver Creek	Bear Creek			1,6,13,15,16				15			Lower
	Lost Creek			15,16				15			Lower
	Silver Creek Tributary #1										Lowest
	Silver Creek Tributary #2			15,16				15			Lower
Squalicum Creek	Baker Creek Tributary			1,6,15,16,13							Lower
	Lower Baker Creek		1,15,16	1,6,15,16,13	1,6,15,16			15			Lowest
	Lower Spring Creek		4,15,16	4,15,16	15,16			15			Moderate
	Lower Squalicum	5,6,15,16	3,5,6,15,16,	3,5,6,13,15,16	6,10,13,15,16	6,15,16		15	14,16	Bull trout absent or very rare (last documented occurrence of one sub-adult in 1970)	Highest
	Lower Toad Creek		15,16	15,16				15			Moderate-Low
Whatcom Creek	Cemetery Creek	6,7,15,16	2,6,15,16	2,6,7,15,16	15,16			15			High
	Fever Creek										Lowest
	Hannah Creek							15			Lowest
	Lincoln Creek	15,16		15,16	15,16			15		Chinook in lower reach only	Moderate
	Lower Whatcom Creek	6,7,15,16	6,7,8,15,16,	6,7,9,13,15,16	6,7,10,13,15,16	6,9,15,16	15,16	15	14,16	Bull trout rare, but documented in lower reaches. Three sub-adult Bull Trout documented in lower reach in 2002, which was the first bull trout observation in over a decade.	Highest
	Upper Whatcom Creek						15	15		No anadromous fish due to natural fish passage barrier just downstream of sub-watershed at Middle Falls.	Lower
Padden Creek	Connelly Creek			15,16	15,16						Lowest
	Lake Padden		17				17	15,17		Cutthroat trout, rainbow trout, and kokanee salmon stocked in lake	Moderate-Low
	Lower Padden Creek	6,15,16	6,15,16	6,13,15,16	6,10,13,15,16			15			High
	Upper Padden Creek			6,13,15,16				15			Lower
Chuckanut Creek	Chuckanut Creek	6	9,15,16	6,13,15,16	6,10,13,15,16			15			Moderate
Independent Basins	Alderwood Creek			15,16							Lowest
	Fort Bellingham			15,16				15			Lower
	Little Squalicum Creek										Lowest
	Spokane Creek										Lowest

[a]**Table References:** 1) LaCroix et al. 2004, 2) COB 2013, 3) COB 2015, 4) COB 2005, 5) Downen 1999, 6) NSEA & COB 2014, 7) R2 2000, 8) Brown 2001, 9) COB, 2003, 10) Smith 2002, 11) Blakley et al. 2000, 12) Phelps, et al. 1995, 13) Phinney and Williams 1975, 14) USFWS 2004, 15) WDFW 2015a, 16) WDFW 2015b. 17) WDFW 2007

In addition, the project team considered the overall potential for ecological uplift, based on both (1) the overall size of the sub-watershed, and (2) the percentage of the sub-watershed within the Project Area. This element relates to the project goal of providing substantial measurable uplift within a Habitat Analysis Unit. If a sub-watershed is very small, the options for restoration or protection may be limited because few parcels are available to conduct such actions or because any resulting ecological lift in the sub-watershed is expected to have only a minor influence on overall ecological health due to its small size relative to the larger watershed. Likewise if a sub-watershed is large, but only a small portion of it is within the Project Area, this limits the ability of the City to implement projects within their jurisdiction on a scope and scale that result in significant ecological uplift.

The project team also considered watershed models compiled by the Washington State Department of Ecology as part of the Puget Sound Watershed Characterization Project (Stanley et al., 2011)[1]. The Watershed Characterization calculated the relative importance of each watershed in the Puget Sound basin in terms of hydrologic processes such as water delivery, water storage, and recharge/discharge. Similar to fish use, the project team considered elevating the rank of restoration and protection in sub-watersheds that rank higher in terms of hydrologic importance. As with fish use, sub-watersheds that rank high in terms of hydrologic importance could generally be assumed to be higher priorities for restoration and protection than sub-watersheds with low hydrologic importance. Ultimately, the project team determined that hydrological conditions were already included in the existing conditions analysis and that further incorporation of this variable was not appropriate to include in the final prioritization.

The sub-watersheds selected from the list of combined top ranked wetland/riverine sub-watersheds (shaded green in Tables 35 and 36) were then further analyzed to determine which should be classified as Tier 1 sub-watersheds, utilizing both the fish use rating and information on sub-watershed size within the Project Area.

Tables 39 and 40 show how the top ranked watersheds were ultimately prioritized, using the data on fish use and sub-watershed size/location, as discussed above. Some of the sub-watersheds assessed do not contain enough area within the Project Area to conduct the scope and scale of restoration/ protective actions necessary for substantial ecological uplift (e.g., Spokane Creek), while other sub-watersheds have a large portion of the sub-watershed outside of the Project Area, potentially limiting ecological uplift, particularly if the portion of the unit that is outside the Project Area represents the headwaters of the sub-watershed (e.g., Fort Bellingham).

[1] For more information go to: http://www.ecy.wa.gov/puget_sound/characterization/

Table 39. Comprehensive Prioritization of Top Ranked Wetland/Riverine Sub-watersheds Evaluated for Inclusion as Tier 1 Sub-watershed for Restorative Actions

Sub-watershed Analyzed	Riverine Habitat Group Ranking	Wetland Habitat Group Ranking	Fish Use Rating	Acres Within Project Area	Percent of Watershed Within Project Area	Final Prioritization Status	Comments
Lower Padden Creek	Highest	Highest	High	1,252	100	Tier 1	Classified as Tier 1 due to highest riverine and wetland rankings and high fish use
Baker Creek Tributary	Highest	Moderate	Lower	545	65	Tier 1	Classified as Tier 1 due to highest to moderate riverine and wetland rankings
Lower Toad Creek	High	Highest	Moderate-Low	395	68	Tier 2	Classified as Tier 2 due to limited wetland opportunity and much of sub-watershed outside of Project Area and moderate-low fish use rating
Lower Baker Creek	High	Moderate	Moderate	852	96	Tier 1	Classified as Tier 1 due to highest to moderate riverine and wetland rankings and moderate
Lower Spring Creek	Moderate	High	Moderate	1,047	99	Tier 1	Classified as Tier 1 due to highest to moderate riverine and wetland rankings
Fort Bellingham	Moderate	High	Low	198	23	Tier 2	Classified as Tier 2 due to majority of sub-watershed outside of city limits , low fish use rating, and majority of sub-watershed outside of Project Area
Hannah Creek	High	Moderate	Lowest	391	66	Tier 2	Classified as Tier 2 due to lowest fish use rating and substantial portion of sub-watershed outside of Project Area
Little Squalicum Creek	Highest	Lowest *	Lowest	691	100	Tier 2	Classified as Tier 2 due to severe degradation in wetland Habitat Group existing conditions and lowest fish use rating
Lincoln Creek	Lowest*	Highest	Moderate	874	100	Tier 2	Classified as Tier 2 due to severe degradation in riverine Habitat Group existing conditions
Connelly Creek	Lowest*	High	Lowest	894	100	Tier 2	Classified as Tier 2 due to severe degradation in riverine Habitat Group existing conditions

*Indicates sub-watershed had multiple degraded functions in either the wetland or riverine Habitat Group and was thus classified as a Tier 2 sub-watershed.

Table 40. Comprehensive Prioritization of Top Ranked Wetland/Riverine Sub-watersheds Evaluated for Inclusion as Tier 1 Sub-watershed for Protective Actions

Sub-watershed Analyzed	Riverine Habitat Group Ranking	Wetland Habitat Group Ranking	Fish Use Rating	Final Prioritization Status	Comments
Chuckanut Creek	Highest	Highest	High	Tier 1	Classified as Tier 1 due to highest riverine and wetland rankings and high fish use
Upper Whatcom Creek	Highest	Highest	Lower	Tier 1	Classified as Tier 1 due to highest riverine and wetland rankings
Spokane Creek	High	Highest	Low	Tier 2	Classified as Tier 2 due to extremely small size (<30 acres) of sub-watershed limiting scope and scale of protective actions.
Cemetery Creek	High	Highest	High	Tier 1	Classified as Tier 1 due to high/highest riverine and wetland rankings and high fish use
Bear Creek	Moderate	High	Lower	Tier 1	Classified as Tier 1 due to high wetland ranking and highest fish use rating.
Lower Squalicum Creek	Moderate	High	Highest	Tier 1	Classified as Tier 1 due to high wetland ranking and highest fish use rating.
Upper Padden Creek	Highest	Moderate	Moderate-Low	Tier 2	Classified as Tier 2 due to moderate ranking for wetlands, moderate-low fish use rating, and fact that Lake Padden Park already contains majority of high quality wetland and riverine habitat requiring protection.

Many of the sub-watersheds that were classified as Tier 2 have extremely low restoration potential in either the riverine or wetland Habitat Group, indicating that maximal aquatic habitat uplift would be difficult to achieve in the specific geography. For similar reasons, these sub-watersheds would score the lowest for protection. In addition, some of the sub-watersheds do not contain enough area within the Project Area to conduct the scope and scale of restoration/protective actions necessary for substantial ecological uplift (e.g., Spokane Creek was not placed as a Tier 1 priority due to the extremely small size of the sub-watershed located within the Project Area of 23 acres and 0.3 stream miles). Similarly, some of the sub-watersheds have a large portion of the sub-watershed outside of the Project Area, potentially limiting ecological uplift, particularly if the portion of the unit that is outside the Project Area represents the headwaters of the sub-watershed. Sub-watersheds that were determined not to be Tier 1 watersheds in the final assessment were classified as Tier 2 watersheds. However, some of these sub-watersheds may be appropriate for restoration efforts focused on the forest Habitat Group because of high forest Habitat Group scores.

Local technical experts (Geoff Middaugh, Bill Reilly, James Luce, Wendy Scherrer, and Rachel Vasak) with on-the-ground knowledge reviewed the Tier 1 sub-watersheds and the associated restorative and protective actions. General consensus was that the prioritization captured those sub-watersheds that would benefit most from restoration, and that the prioritized list of specific actions appeared appropriate for achieving uplift in functions (V. Jackson, 2014).

After evaluating all of the data and using a weight of evidence approach, the project team selected four sub-watersheds as the Tier 1 priorities (highlighted green in Table 39) for combined riverine and stream restorative actions (Lower Padden Creek, Baker Creek Tributary, Lower Spring Creek, and Lower Baker Creek), and an additional five sub-watersheds as Tier 1 priorities (highlighted green in Table 40) for protective actions (Chuckanut Creek, Upper Whatcom Creek, Cemetery Creek, Bear Creek, and Lower Squalicum Creek).

A summary of the final prioritization actions recommended for restoration, based on the results discussed above, is presented in Table 41. The table lists the restorative actions that could result in the greatest amount of uplift for the Tier 1 priority riverine and wetland Habitat Analysis Units, based on the modeled degree of comprehensive ecological uplift from the technical assessment.

Table 41. Comprehensive Prioritization Results: Tier 1 Sub-watersheds and Recommended Restoration Actions for the Riverine and Wetland Habitat Groups

Tier 1Sub-Watershed for Restoration	Top Recommended Riverine Restorative Actions – In order of functional uplift potential	Top Recommended Wetland Restorative Actions (Creation has greatest potential for uplift)
Lower Padden Creek	Retrofit Stormwater Facilities	Ranked Very High for Creation and Enhancement
	Implement LID Program	
	Restore Depressional Wetlands	
	Floodplain Reconnect	
	Riparian Buffer	
	Increase Instream Habitat Complexity	
Baker Creek Tributary	Increase Instream Habitat Complexity	Ranked Medium-Low for Creation and Enhancement
	Remove Armor	
	Riparian Buffer	
	Retrofit Stormwater Facilities	
	Floodplain Reconnect	
	Increase In-Channel Habitat Quantity	
Lower Spring Creek	Retrofit Stormwater Facilities	Ranked High for Creation or Enhancement
	Implement LID Program	
	Restore Depressional Wetlands	
Lower Baker Creek	Retrofit Stormwater Facilities	Ranked Moderate for Restoration or Enhancement
	Implement LID Program	
	Restore Depressional Wetlands	
	Riparian Buffer	
	Floodplain Reconnect	
	Increase In-Channel Habitat Quantity	

5.3 Riverine and Wetland Habitat Group Comprehensive Habitat Prioritization Methods and Results

The Comprehensive Prioritization for forest Habitat Analysis Units was conducted somewhat differently than the riverine and wetland Habitat Groups. Forest habitats were assessed as individual habitat blocks, but this resulted in multiple smaller blocks scattered across the landscape, a situation that does not lend itself to cohesive restoration management. Therefore, the team determined the highest ranking habitat blocks for restorative and protective actions should be combined into watershed-level geographic units, which include multiple sub-watersheds (e.g., Padden Creek watershed includes the

Lower Padden and Upper Padden sub-watersheds). This action is based on the project goal of achieving meaningful and measurable ecological uplift. Then, based on the number of high ranking habitat blocks in a watershed, the size of those habitat blocks, and the restoration or protection scores of the blocks, several watersheds were selected as either Tier 1 or Tier 2 for restoration and protection (Table 42).

Local technical experts with on-the-ground knowledge reviewed the top ranked watersheds and the associated general restorative and protective actions for the forest habitat blocks (V. Jackson, 2014). General consensus was that the prioritization, in many cases, did not generally reflect the experts' local knowledge of forested areas that would benefit from restorative actions within the Project Area. Specifically, the local experts felt the results did not fully capture the overall habitat value, and corresponding high ecological connectivity, that forest corridors provide (specifically riparian corridors) (V. Jackson, 2014).

As a result, forest habitat connectivity was added as one of the determining factors in selecting specific geographic locations for forest restoration and protective actions, within Tier 1 priority sub-watersheds. The team assessed connectivity using qualitative GIS data, and the effort was focused on the proximity of forest habitat blocks/patches previously delineated and evaluated by Nahkeeta (2003) to other forest blocks/patches and to development, in order to capture where restoration actions would preserve or enhance this important forest and wildlife function.

A more formal redelineation and classification of corridors, and more complete data on forest stand structure using up-to-date information, would allow for a more robust characterization of connectivity, but this was not feasible due to budget constraints. Supplementing such information with field reconnaissance ("ground truthing") would also provide useful information for prioritizing forest protection and restoration actions. Both of these actions are listed in the Data Gap section of this report (Section 2.1.7).

That said, individual forest blocks, even if somewhat geographically isolated, can benefit from restorative or protective measures. These blocks often provide valuable nesting, feeding, and refuge habitat for urban wildlife, as well as providing hydrologic interception/infiltration, stormwater and runoff treatment, microclimate functions, and recreational and visual benefits to local residents. Therefore, some focus on semi-isolated parcels is likely appropriate even if the block is not classified into Tier 1 in this report.

Table 42. Comprehensive Prioritization: Forest Habitat Group Tier 1 and 2 Watersheds for Restorative and Protective Actions

Watershed	Highest Ranked Blocks for Restorative Actions (forested patch area)	Prioritization for Forest Restorative Actions	Highest Ranked Blocks for Protective Actions (forested patch area)	Prioritization for Forest Protective Actions
Bellingham Bay	Block 007 (130 acres)	Tier 2	Block 178 (9 acres)	Tier 2
Bellingham Bay North	Block 120 (8 acres)	Tier 2	None	Tier 2
Chuckanut Creek	None	Tier 2	Block 004 (4,201 acres)	Tier 1
			Block 006 (264 acres)	
Little Squalicum Creek	None	Tier 2	None	Tier 2
Padden Creek	Blocks 012 (7acres)	Tier 1	Block 002 (682 acres)	Tier 2
	Block 032 (13 acres)		Block 011B (41 acres)	
	Block 037 (7 acres)			
Silver Creek	None	Tier 2	Block 122 (681 acres)	Tier 2
Squalicum Creek	Block 078 (12 acres)	Tier 1	Block 134 (1,092 acres)	Tier 1
	Block 090 (6 acres)		Block 142 (2,147 acres)	
	Block 100 (14 acres)		Block 143 (347 acres)	
	Block 150 (17 acres)			
	Block 157 (45 acres)			
	Block 192 (6 acres)			
Whatcom Creek	Block 069 (17 acres)	Tier 1	Block 011 (704 acres)	Tier 1
			Block 052 (3,644 acres)	
			Block 060 (207 acres)	
			Block 148 (72 acres)	

5.4 Meadow/Shrub Habitat Group Final Prioritization Results

The project team and local experts reviewed the prioritization results for the meadow/shrub Habitat Group and found that the data were too limited to accurately inform the application of meaningful restoration actions within the Project Area. This is primarily due to a lack of data on the existing

functional conditions for this Habitat Group. With the exception of coarse-scale land cover data (e.g., impervious surface), the team found minimal information with which to assess plant community composition and structure. Most of the available information was outdated, having been acquired from meadow/shrub studies conducted in the early 2000s by Nahkeeta (2003). In addition, the team had difficulty classifying meadow/shrub habitat and differentiating such habitat from other open spaces, including clearcuts, cleared lots, active agricultural areas, and other types of land cover.

Based on the data limitations (see Section 2.1.7), the project team identified a need for more detailed, site-specific data on the existing vegetative structure of meadow/shrub habitat within the Project Area. If and when such data are collected, the conceptual model and analysis framework presented within this report can be used to reassess existing conditions and restoration priorities for meadow and shrub habitats. Until that time, the meadow and shrub prioritization results, both Preliminary and Secondary Prioritization, should not be used to identify meadow/shrub areas where restoration and protection actions would be most ecologically beneficial. Therefore, the prioritization of meadow/shrub restoration and protective actions is not examined further in this report and was not included in the assignment of sub-watersheds into restoration tiers.

5.5 Summarized Comprehensive Prioritization Results

The results for the riverine/wetland and forest Habitat Groups discussed above were considered together and used to classify nine sub-watersheds into Tier 1 (Table 43). Table 43 also shows a complete list of sub-watersheds, classified into one of three Tiers (Tier 1, 2, or 3). The sub-watersheds remaining (including those set aside at the end of the Secondary Prioritization) were classified as either Tier 2 or Tier 3, based on the potential for functional uplift or maintenance a given sub-watershed may achieve, over multiple Habitat Groups. Therefore, a sub-watershed was considered as Tier 3 if either of the following cases applied to actions:

1. The sub-watershed scored lowest for both restoration and protection uplift/maintenance in both the riverine and wetland Habitat Groups, or
2. The sub-watershed did not have riverine habitat (no streams were present) and the wetland Habitat Group scored lowest for both restoration and protection.

The remainder of the sub-watersheds were grouped into Tier 2. The overall categorization offers different perspectives, or filters, to view restoration opportunities and select appropriate actions for all sub-watersheds: Tier 1 sub-watersheds where restoration and protection actions can result in substantial and widespread ecological improvement or maintenance over multiple Habitat Groups; Tier 2 sub-watersheds where such improvement may result, but may be at a somewhat reduced level or would be focused on a single Habitat Group; and Tier 3 sub-watersheds where the application of restoration and protection actions could focus on improvement of specific functions. Figure 9 shows all Project Area sub-watersheds, divided into the three tier categories. A discussion of specific recommended actions for Tier 1 sub-watersheds follows in Section 6.

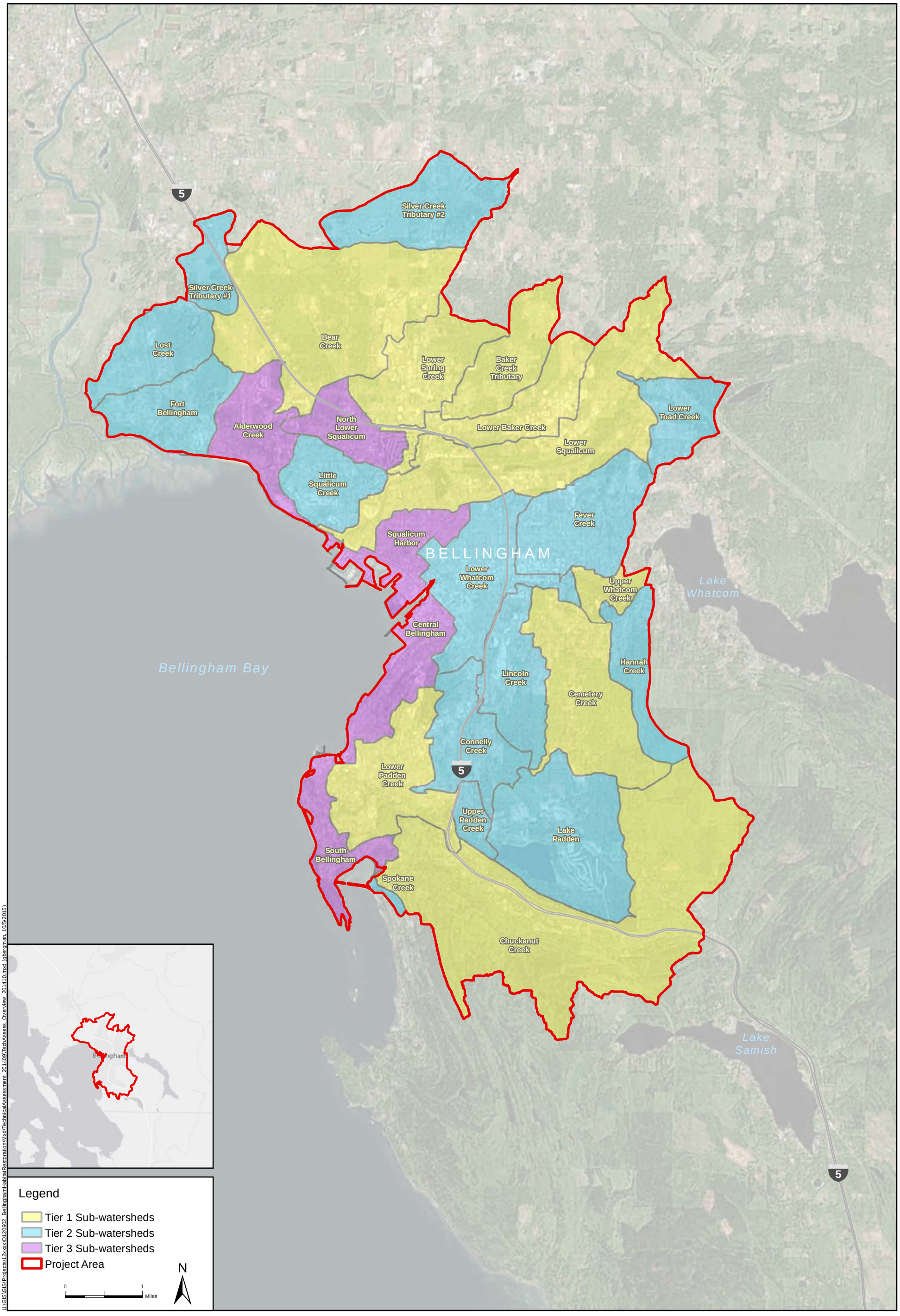
Table 43. Summary and Results of Comprehensive Prioritization of Restoration and Protection Actions[1]

Restoration Tier	Sub-watershed	Restoration Ratings			Protection Ratings		
		Stream Restoration Rating	Wetland Restoration Rating	Forest Restoration Rating[2]	Stream Protection Rating	Wetland Protection Rating	Forest Protection Rating[2]
Tier 1 Sub-watersheds for Restoration and Protection	Lower Padden Creek	Highest	Highest	Highest	Lower	Lower	
	Baker Creek Tributary	Highest	:Lower		Lower	High	
	Lower Baker Creek	High	Moderate-High		Lower	Moderate	
	Lower Spring Creek	Moderate	High		High	Lower	
	Chuckanut Creek	Lower	Lower		Highest	Highest	Highest
	Upper Whatcom Creek	Lower	Lower		Highest	Highest	Highest
	Cemetery Creek	Moderate	Lower		High	Highest	
	Bear Creek	Moderate	Lower		Moderate	High	
	Lower Squalicum Creek	Moderate	Lower	Highest	Moderate	High	Highest
Tier 2 Sub-watersheds for Restoration and Protection	Lower Toad Creek	High	Highest		High	Lower	
	Upper Padden Creek	Lower	High		Highest	Moderate-Low	
	Little Squalicum Creek	Highest	Lowest		Lower	Lowest	
	Hannah Creek	High	Lowest		High	Lowest	
	Lost Creek	High	High-Moderate		Lower	High	
	Fort Bellingham	Moderate	High		Moderate	High	
	Silver Creek Tributary #1	Moderate	Moderate		Moderate	Moderate	
	Lake Padden	Lower	Moderate		Moderate	Moderate	
	Spokane Creek	Lower	Lower		High	Lower	
	Connelly Creek	Lowest	Highest		Lowest	Highest	
	Lincoln Creek	Lowest	Highest		Lowest	Highest	
	Lower Whatcom Creek	Lowest	Lowest		Lowest	Lowest	
	Silver Creek Tributary #2	Lowest	Moderate		Lowest	Moderate	
	Fever Creek	Lowest	High		Lowest	High	
Tier 3 Sub-watersheds for Restoration and Protection[1]	North Lower Squalicum	No Streams	Lowest[3]		No Streams	Lowest[3]	
	South Bellingham	No Streams	Lowest[3]		No Streams	Lowest[3]	
	Alderwood Creek	Lowest[3]	Lowest[3]		Lowest[3]	Lowest[3]	
	Central Bellingham	No Streams	Lowest[3]		No Streams	Lowest[3]	
	Squalicum Harbor	No Streams	Lowest[3]		No Streams	Lowest[3]	

[1] Some of the Restoration Assessment results appear to conflict with the prioritized restoration rankings presented in CGS (2013). This can be explained based on the exclusion of marine nearshore habitat in the assessment. Although a sub-watershed may rank low for wetland, forest, or riverine restoration many of these sub-watersheds could benefit from nearshore restoration.

[2] Only the Tier 1 forest protection priorities are shown in the table. See Table B-8 in Attachment B for complete list of forest block prioritization.

[3] Classified as Tier 3 during the Secondary Prioritization. These sub-watersheds were evaluated as having an extremely low chance of successful restoration, due to very low existing habitat functions for both riverine and wetland Habitat Groups or the lack of multiple Habitat Groups.



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SOURCE: City of Bellingham, 2013; WA DRN, 2013; ESRI, 2014

Bellingham Habitat Restoration · 120902

Figure 9

Results of Comprehensive Restoration Prioritization - Sub-Watershed Tiers

6.0 Comprehensive Habitat Restoration and Protection Recommendations by Sub-Watershed

Specific habitat restoration recommendations are presented below for those sub-watersheds selected as Tier 1 sub-watersheds. These recommendations for the Project Area (city and UGA) were developed based on the results of the Preliminary, Secondary, and Comprehensive Prioritizations; and input from City staff, TAG members, and local technical experts. The goal of the recommendations is to present a number of geographically related restorative and protective actions for each habitat type (riverine, wetland, and forest). These Tier 1 actions were selected based on their potential to produce a substantial and measureable increase in multiple ecological functions, as well as their practicality.

These recommendations are not exhaustive, but rather seek to serve as a general blueprint for informing and providing context for management decisions (e.g., integrated management decisions can address multiple restoration/protection needs). Additional restorative or protective measures not listed below may produce an equivalent or better ecological uplift.

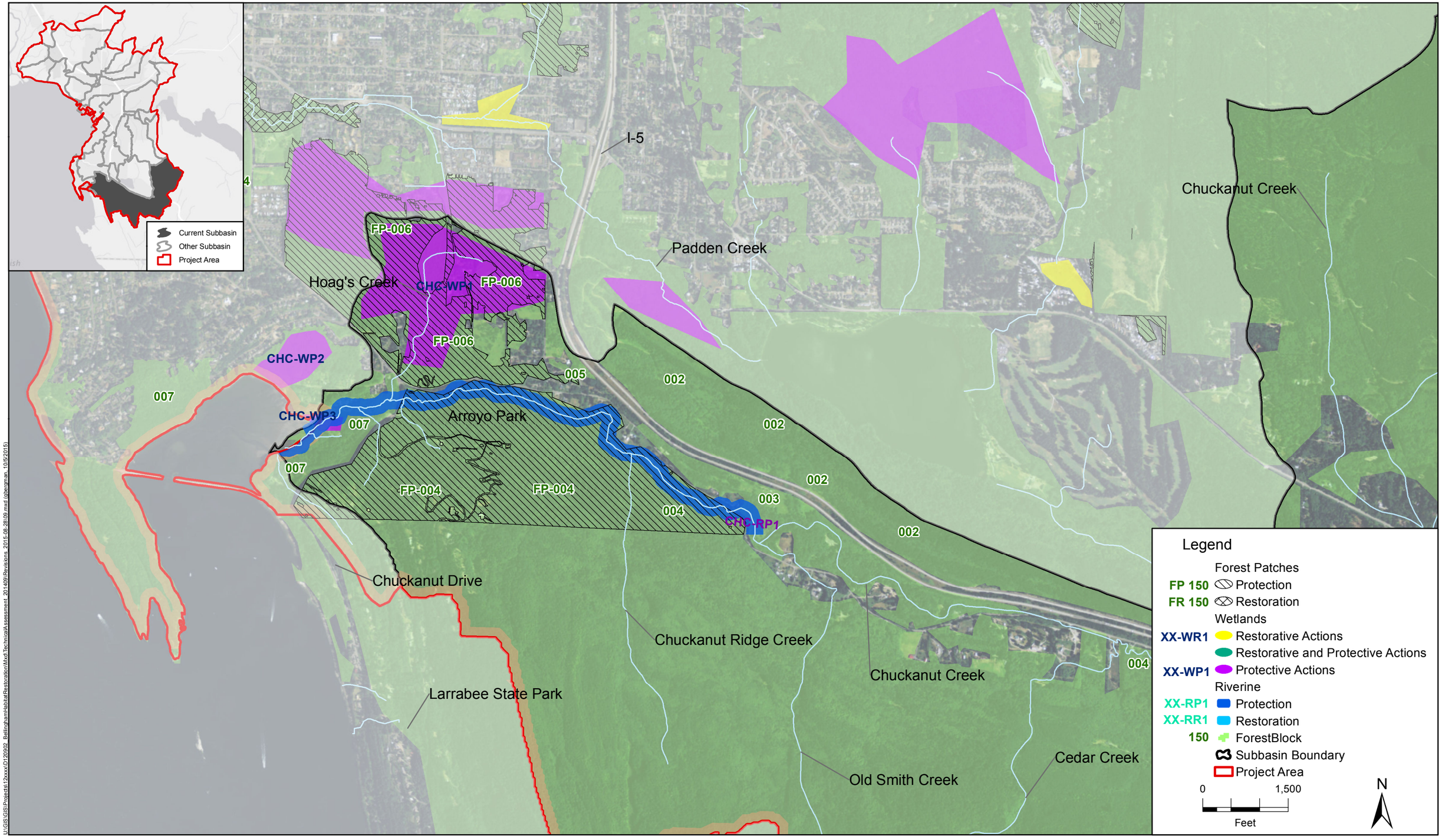
In order to geographically relate the actions in Tier 1 sub-watersheds, the following discussion is organized by major watershed and sub-watershed, from south to north, as presented in Table 44.

Table 44. Recommended Tier 1 Sub-watersheds by Geographic Location

Watershed	Recommended Tier 1 Sub-watershed
Chuckanut Creek	Chuckanut Creek
Padden Creek	Lower Padden Creek
Whatcom Creek	Cemetery Creek
	Upper Whatcom Creek
Squalicum Creek	Lower Squalicum Creek
	Lower Baker Creek
	Lower Spring Creek
	Baker Creek Tributary
Silver Creek	Bear Creek

6.1 Chuckanut Creek Sub-watershed

The Chuckanut Creek sub-watershed is approximately 4,762 acres, of which approximately 869 acres (18%) is located within the Project Area. The sub-watershed includes approximately 14 stream miles, consisting of the lower portion of the mainstem, including the mouth, and several tributaries including Hoag's Creek and the mouth of Chuckanut Ridge Creek, Toad Creek from near the headwaters to the mouth, as well as approximately 80 acres of wetland area (Figure 10). The sub-watershed is dominated by forest, with scattered residential land uses, primarily along the western portion of the basin. An overview map of the sub-watershed is presented (Figure 10), as is a summary of the Restoration Assessment outcomes for this sub-watershed (Figure 11).



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SOURCE: City of Bellingham, 2013; ESRI, 2014

Figure 10

Recommended Restoration and Protection Actions in the Chuckanut Creek Sub-Watershed

Figure 11. Chuckanut Creek Sub-watershed: HRTA Tier 1 Summary

Riverine Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 3)

Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Highest	Lower	Higher	Highest	Highest	Highest

Wetland Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 4)

Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Highest	Higher	Highest	Higher	Higher	Highest	Highest

Forest Existing Condition -Relative Functional Condition Ratings

(excerpt from Table 5)

Block ID Number	**Biodiversity Function Score**	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*	**Habitat Maintenance Function Score**	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
002	**Highest**	*Highest*	*Lower*	*Highest*	**Highest**	*Highest*	*Higher*
003	**Higher**	*Highest*	*Median*	*Median*	**Higher**	*Higher*	*Highest*
004	**Highest**	*Highest*	*Higher*	*Highest*	**Highest**	*Highest*	*Highest*
005	**Median**	*Median*	*Higher*	*Lowest*	**Median**	*Lower*	*Median*
006	**Highest**	*Highest*	*Higher*	*Highest*	**Highest**	*Highest*	*Higher*
007	**Highest**	*Higher*	*Highest*	*Highest*	**Highest**	*Highest*	*Highest*

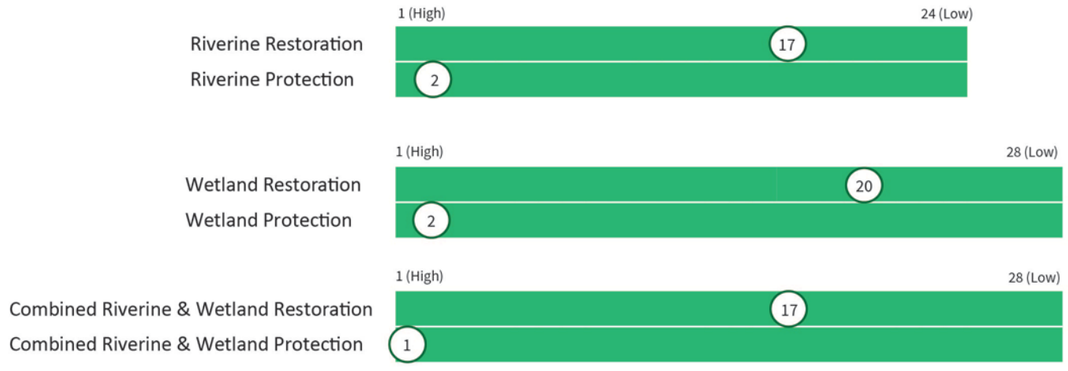
Preliminary Prioritization Rankings

(excerpt from Tables 15, 16, 18, and 19)

Riverine Restoration: #23 of 24
Riverine Protection: #2 of 24
Wetland Restoration: #27 of 28
Wetland Protection: #2 of 28

Secondary Prioritization Rankings (Relative Rank Score for Restoration and Protective Actions)

(excerpt from Tables 35, 36, and 41)



Tier 1 Forest Blocks for Restoration: None
Tier 1 Forest Blocks for Protection: Blocks 004 and 006

6.1.1 Relevant Physical, Chemical, and Biological Conditions

Existing physical, chemical, and biological conditions within the sub-watershed relevant to the formulation of a restoration plan include the following:

- The majority of the Chuckanut Creek sub-watershed is heavily forested with approximately 3,924 forested acres that represent approximately 83% of the total land cover in the overall watershed (NOAA, 2010).
- Chuckanut Creek has been identified as at risk for invasive species presence near the estuary (NES, 2004). Invasive species are less prevalent in the area above Chuckanut Drive, but Himalayan blackberry, reed canarygrass, Japanese knotweed, and herb-Robert are among the invasive plant species present in the sub-watershed.
- Riparian vegetation appears to be functioning in the overall watershed. Data indicate that more than two-thirds of the riparian corridor is forested in the overall watershed (Nahkeeta, 2008).
- The Chuckanut Creek watershed has approximately 245 acres of impervious surface that represent approximately 5% of the total land cover in the watershed (NOAA, 2008), a relatively low amount that does not generally impair water quality or hydrological functions by impervious surface cover (Nahkeeta, 2003). The majority of Chuckanut Creek runs through secluded backyards and a pristine City of Bellingham park; thus, the riparian area is relatively undisturbed compared to other city streams (Anchor QEA and Northwest Geological Services, 2012).
- Chuckanut Creek has documented presence of coho salmon, chum salmon, coastal cutthroat trout, and steelhead (WDFW, 2015a, b). Bull trout are presumed to occur within the lower reaches of Chuckanut Creek (WDFW, 2015b).
- Chuckanut Creek is listed on Ecology's 303(d)[3] list for fecal coliform and dissolved oxygen (Ecology, 2008). A single total maximum daily load (TMDL) has been developed for Whatcom, Squalicum, and Padden Creeks for temperature.
- Overall instream flow conditions in Chuckanut Creek are functioning but are at risk with further development in the basin (HDR, 1995).

6.1.2 Review of Functional Assessment Results and Recommendations by Habitat Group

Riverine Habitat Group – Of the six riverine functions evaluated for Relative Functional Condition Score, one scored lower (surface storage function), one higher (biodiversity maintenance), and the remainder scored highest (Figure 11) as compared to the other sub-watersheds in the city (Table 3). Based on high

[3] 303(d) listing indicates the list of impaired and threatened waters (stream/river segments, lakes) that the Clean Water Act requires all states to submit for EPA approval every two years on even-numbered years. The states identify all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards, and establish priorities for development of TMDLs based on the severity of the pollution and the sensitivity of the uses to be made of the waters, among other factors (40C.F.R. §130.7(b)(4)). States then provide a long-term plan for completing TMDLs within 8 to 13 years from first listing. Only Category 5 listings are included in this report.

scores across the group of riverine functions evaluated, the sub-watershed ranked highest for the implementation of protection actions.

Wetland Habitat Group – All seven of the wetland functions scored high or highest on the Relative Functional Condition Score, as compared to the other sub-watersheds in the city (Figure 11 and Table 4). Therefore, protection of existing wetland resources is highly recommended for the Chuckanut Creek sub-watershed.

Forest Habitat Group – Portions of large forest habitat blocks are located within the Chuckanut Creek sub-watershed (Blocks 004 and 006), as well as several additional smaller blocks. The Relative Functional Condition Score for the large blocks ranked higher or highest for all attributes, while the smaller blocks had attribute ratings ranging from high to low (Figure 11 and Table 5). The two large blocks were both ranked as Tier 1 for protection (both were in the top 5 out of 85 blocks evaluated).

6.1.3 Recommended Actions

Based on the results of the prioritization and interviews with local experts, the clear focus of riverine, wetland, and forest actions is on protection. As evidenced by existing data and literature, ecological functions are performing adequately and much better than in many other parts of the Project Area.

Below is a list of general recommendations for protective actions. These recommendations are based on the final Comprehensive Prioritization; therefore, they are broad in nature. If the reader has a specific target function, these actions may not meet their needs and they should refer to the Preliminary Prioritization Rankings for guidance in identifying specific actions.

Forest, Riverine, and Wetland Habitat Recommendations (Figure 10)

Chuckanut Creek Riverine Protection (CHC-RP1) – Stream functions are generally properly functioning, so protection of existing instream and riparian habitat is a priority. Much of the Chuckanut Creek corridor within the Project Area is contained in the City-owned parks and open space (the Arroyo Nature Area, Chuckanut Bay Open Space, and Interurban Trail).

Protection of Forest and Associated Wetlands (CHC-WP1) in Forest Block 006 – This very large forest block extends north to include a portion of the Padden Creek drainage, but the majority of the block is located within the drainage basin of Hoag's Creek and Chuckanut Creek. The majority of the block is well forested with a large stand of native moderate-aged mixed forest, located east of Chuckanut Drive. In addition to high functioning forest, which provides excellent wildlife dispersal, nesting, and roosting habitat, this large block also contains palustrine scrub-shrub and forested wetlands. These wetlands, which help support baseflow in Hoag's and Chuckanut Creeks and provide wildlife habitat, are identified as appropriate for protective actions (Action CHC-WP1). This block also contains a corridor of City-owned undeveloped property, which provides a key forested wildlife corridor between the large forested lands of Chuckanut Mountain to the south and the Padden Creek corridor to the north.

Block 006 consists primarily of City-owned land, much of it associated with Fairhaven Park, the Chuckanut Community Forest, and the Interurban Trail. However, there are numerous private parcels,

many of which are undeveloped and zoned residential. It is recommended that the City holdings should continue to be managed as undeveloped open space, while acquisition or establishment of conservation easements is explored for key private forested parcels along the edges of the block, to help maintain existing functions (Biodiversity and Habitat Maintenance) into the future.

Protection in Forest Block 004 – This very large forest block (4,201 acres) extends from Chuckanut Creek south to Larrabee State Park and includes a portion of the Project Area. The majority of the block is well forested with native mature and second-growth mixed and coniferous forest. In addition to high functioning forest, which provides excellent wildlife dispersal, nesting, and roosting habitat, this large block also contains palustrine scrub-shrub and forested wetlands. This block provides a key forested wildlife corridor between the large forested lands of Chuckanut Mountain to the south and the Padden Creek corridor to the north.

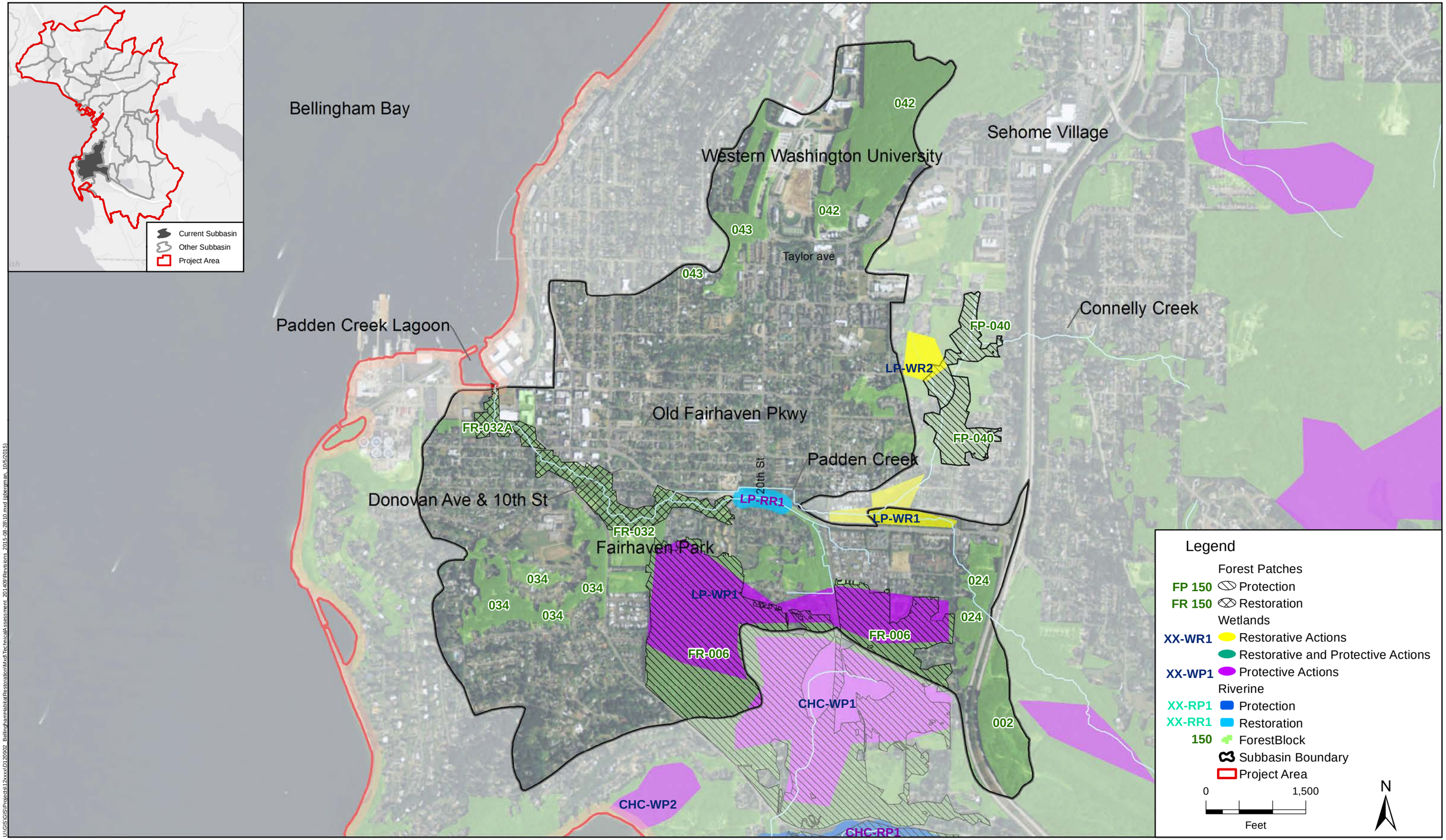
Much of this block within the Project Area is contained in City- and County-owned parks and open space (the Arroyo Nature Area and Whatcom County Parks, Larrabee State Park). However, there are numerous private parcels, many of which are undeveloped and zoned residential. It is recommended that the City and County holdings should continue to be managed as undeveloped open space, while acquisition or establishment of conservation easements is explored for key private forested parcels along the southeast portion of the Project Area to help maintain existing functions (Biodiversity and Habitat Maintenance) into the future.

Wetland Protection (CHC-WP2 and CHC-WP3) – Two additional areas (Actions CHC-WP2 and WP3) are recommended for the protection of wetland resources. The first area is located at the mouth of the Chuckanut Creek estuary. This area, although partly developed with single-family residences, provides high-quality wildlife habitat for marine and estuarine species including fish and also provides water quality functions. The second area (CHC-WP3) is also located at the head of Chuckanut Bay and consists of a large wetland just north of CHC-WP2 that would benefit from protection.

Recommendations to maintain existing wetland functions into the future include potential property acquisitions, establishment of conservation easements, or regulatory protections (including the Shoreline Master Program and Critical Areas regulations).

6.2 Lower Padden Creek Sub-watershed

The Lower Padden Creek sub-watershed is approximately 1,252 acres and includes approximately 2.0 stream miles, including the lower mainstem and mouth of Padden Creek from I-5 to Padden lagoon/estuary, as well as the confluence of Connelly Creek, which drains the area to the northeast (Figure 12). For much of its length, Lower Padden Creek flows adjacent to Fairhaven Parkway, which crosses the stream twice. The sub-watershed has approximately 64 acres of National Wetland Inventory (NWI) wetland area (USFWS, 2012). The sub-watershed is located entirely within the city limits and the primary land uses include residential, commercial, and industrial. A summary of the Restoration Assessment outcomes for this sub-watershed is provided in Figure 13.



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SOURCE: City of Bellingham, 2013; ESRI, 2014

Figure 12

Recommended Restoration and Protection Actions in the Lower Padden Creek Sub-Watershed

Figure 13. Lower Padden Creek Sub-watershed: HRTA Tier 1 Summary

Riverine Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 3)

Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Median	Lower	Lower	Median	Lower	Median

Wetland Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 4)

Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Lower	Lower	Lower	Lower	Lowest	Median	Median

Forest Existing Condition -Relative Functional Condition Ratings

(excerpt from Table 5)

Block ID Number	**Biodiversity Function Score**	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*		**Habitat Maintenance Function Score**	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
002	**Highest**	*Highest*	*Lower*	*Highest*		**Highest**	*Highest*	*Higher*
006	**Highest**	*Highest*	*Higher*	*Highest*		**Highest**	*Highest*	*Higher*
024	**Median**	*Higher*	*Median*	*Lower*		**Median**	*Median*	*Higher*
032	**Median**	*Median*	*Median*	*Median*		**Lower**	*Lower*	*Lower*
032A	**Lowest**	*Lowest*	*Median*	*Lowest*		**Lowest**	*Lowest*	*Lowest*
034	**Lowest**	*Higher*	*Median*	*Lowest*		**Median**	*Higher*	*Median*
042	**Highest**	*Highest*	*Lowest*	*Highest*		**Highest**	*Higher*	*Highest*
043	**Median**	*Higher*	*Higher*	*Median*		**Median**	*Median*	*Higher*

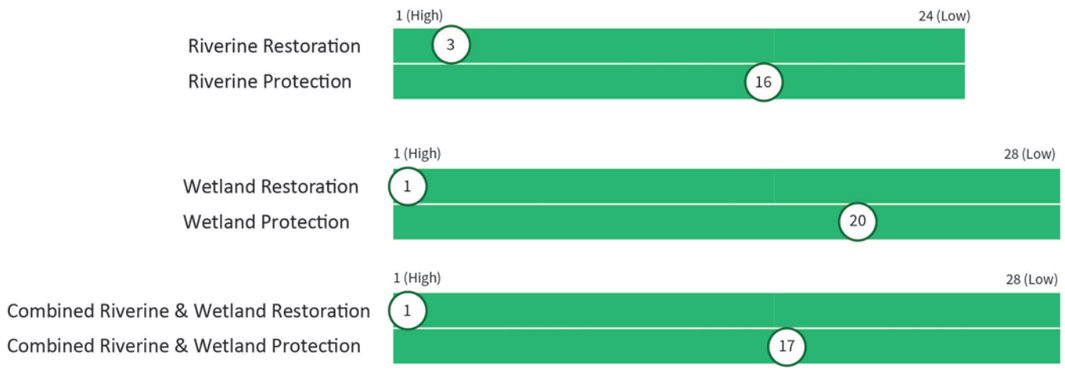
Preliminary Prioritization Rankings

(excerpt from Tables 15, 16, 18, and 19)

Riverine Restoration: #7 of 24
Riverine Protection: #17 of 24
Wetland Restoration: #8 of 28
Wetland Protection: #20 of 28

Secondary Prioritization Rankings (Relative Rank Score for Restoration and Protective Actions)

(excerpt from Tables 35,36, and 41)



Tier 1 Forest Blocks for Restoration: Block 032
Tier 1 Forest Blocks for Protection: Block 002

6.2.1 Relevant Physical, Chemical, and Biological Conditions

Existing physical, chemical, and biological conditions within the sub-watershed relevant to the formulation of a restoration plan include the following:

- A Padden Creek macroinvertebrate study found that the reaches of Padden Creek downstream of Connelly Creek had fewer taxa and larger numbers of pollution-tolerant macroinvertebrates, as compared with most other sites in the watershed (Vandersypen et al., 2006).
- Upstream of the sub-watershed, the outlet of Lake Padden is controlled by a dam with a weir. During the summer the lake level is below the dam, so no water flows from the lake to the stream from midsummer until late fall when winter rains again raise the lake level.
- Much of the drainage to Padden Creek downstream from Lake Padden occurs via storm drains. Stormwater from the south end of Western Washington University flows into Padden Creek via storm drains on Taylor Avenue, and stormwater runoff from the Sehome Village mall drains into Connelly Creek.
- Historically, approximately 2,300 feet of Padden Creek flowed through a brick tunnel that was built circa 1892. The tunnel, located parallel with Old Fairhaven Parkway between approximately 17th and 22nd Streets, was a barrier to migrating salmonids. In 2015, the City completed a daylighting project to remove the stream from the tunnel. In addition, WSDOT previously replaced the tunnel crossing just east of 20th Street with a fish passable bridge in anticipation of the daylighting project.
- Lower Padden Creek supports salmonids, many of which spawn within the larger watershed. Species include Endangered Species Act-listed Chinook salmon and steelhead, of which relatively small numbers are observed annually. Other salmonids using Lower Padden Creek include chum salmon, coho salmon, and cutthroat trout (WDFW, 2015a, b).
- The Padden Creek watershed and associated marine shoreline contain the following WDFW Priority Habitats and Species (PHS) within the Lower Padden Creek sub-watershed: a biodiversity corridor that connects the Chuckanut Mountains, Galbraith Mountain, and areas eastward; multiple wetlands; the Padden Creek estuary; and various wildlife species, including bald eagle, great blue heron, Townsend's big-eared bat, and western toad.
- Information on Padden Creek instream conditions, including the presence of pool/riffle complexes, LWD, and a variety of substrate conditions, is generally lacking. However, the channelized linear nature of the stream in the middle reaches where it flows parallel with Old Fairhaven Parkway, combined with riparian vegetation conditions that are not highly functioning (HDR, 1995; ESA, 2012; Nahkeeta, 2003), has resulted in relatively homogeneous instream habitat conditions that do not generally support stream functions. The City plans to complete a Padden Creek daylighting project in the summer and early fall of 2015. The project will improve stream substrate, LWD, and riparian conditions between 22nd Street and 17th Street.

- Padden Creek is listed on Ecology's 303(d) list for fecal coliform and dissolved oxygen (Ecology, 2008). A single TMDL has been developed for Whatcom, Squalicum, and Padden Creeks for temperature.
- There are patches of forest throughout the lower watershed, but the dominant land use is residential. The riparian corridor of Padden Creek is indicated to provide a good wildlife corridor along most of its length. Corridors along tributaries are more at risk. I-5 presents a dangerous wildlife crossing (Nahkeeta, 2003). The Padden Creek riparian corridor currently has good connections with forested habitat extending to the Chuckanut Creek watershed, but it is at risk due to future development (V. Jackson, 2014).
- Stormwater treatment levels for inputs into the Padden Creek watershed are not adequate to protect water quality (HDR, 1995; Hood, 2006; COB, 2003). The Padden Creek watershed has been identified as not functioning for instream flow conditions (COB, 2006-2010; HDR, 1995). The City plans to complete a Padden Creek daylighting project and a Padden Estuary water quality project in the summer and early fall of 2015. The daylighting project may improve water quality conditions downstream of 22nd Street due to riparian vegetation and streambed improvements. The daylighting project is expected to improve water quality between 22nd Street and 17th Street due to the separation of stormwater and stream flows. The estuary project is expected to improve water quality in the Padden Estuary by treating stormwater runoff from 90 acres of existing development within the Fairhaven area.
- The Lower Padden Creek floodplain has been severely restricted over the years, with significant losses at the convergence with Connelly Creek and through Happy Valley. Urban flooding on the mainstem currently occurs upstream of the 22nd Street tunnel inlet. The City plans to complete the Padden Creek daylighting project in the summer and early fall of 2015. This project will reduce flooding in the Happy Valley Neighborhood.

6.2.2 Review of Functional Assessment Results and Recommendations by Habitat Group

Riverine Habitat Group – Of the six riverine functions evaluated for Relative Functional Condition Score, three functions scored median and three scored lower, as compared to the other sub-watersheds in the city (Figure 13 and Table 3). Based on moderate and slightly impaired functions, the sub-watershed ranked highest for the implementation of restorative actions (Figure 13 and Table 35). The actions with the greatest potential to produce functional uplift are as follows: (1) retrofit stormwater facilities/ implement LID program, (2) restore depressional wetlands, and (3) reconnect floodplain, enhance riparian buffer, and increase instream habitat complexity.

Wetland Habitat Group – With the exception of sediment/phosphorus removal function, which rated as lowest, the remaining six wetland functions were assessed as lower (four functions) or median (two functions) for Relative Functional Condition Score as compared to the other sub-watersheds in the city (Figure 13 and Table 4). Therefore, restoration (enhancement/creation) of existing wetlands is recommended for the Lower Padden Creek sub-watershed. However, this sub-watershed is highly

urbanized, with relatively few wetlands that are generally located within forest blocks or riparian habitat, so wetland enhancement opportunities are somewhat limited.

Forest Habitat Group – Large forest habitat blocks within the Lower Padden Creek sub-watershed had Relative Functional Condition Scores ranging from high to low across the area (Figure 13 and Table 5). These habitat blocks generally ranked as moderate priorities for both restorative and protective actions, although a few larger individual habitat blocks ranked high for these actions (Figure 13 and Table 33). However, several of these blocks were located a substantial distance from other habitat corridors or are separated from other habitat corridors by I-5 or other major roadways. Therefore, the forest habitat blocks from the final prioritization were qualitatively reexamined in light of habitat connectivity and contribution to functions within the other Habitat Groups. In some cases, high value riparian or forest corridors near, but outside of, the target sub-watershed were included as recommended actions. In addition, some habitat blocks outside the sub-watershed, but within the larger Padden Creek watershed, were included in the final recommendations because they provide opportunities to improve connectivity.

6.2.3 Recommended Actions

Based on the results of the prioritization and interviews with local technical experts, a primary focus of implementing riverine, wetland, and forest actions is restoration or protection of existing resources, specifically in light of forest and riparian habitat connectivity. Although the primary focus within Lower Padden Creek is riverine and wetland restoration, benefiting a salmon-bearing stream in an urban environment that still supports multiple salmonid species, some protective measures would likely benefit Lower Padden Creek.

Below is a list of general recommended actions. These recommendations are based on the final Comprehensive Prioritization; therefore, they are broad in nature. If the reader has a specific target function, these actions may not meet their needs and they should refer to the Preliminary Prioritization Rankings for guidance in identifying specific actions.

Forest, Riverine, and Wetland Habitat Recommendations (Figure 12)

Padden Creek Restoration (LP-RR1) – A primary opportunity for the creation of a functioning riparian zone and floodplain will be along the future daylighted portion of Padden Creek and will be addressed by that project (Figure 10). In addition, the remaining Padden Creek corridor still has large infestations of invasive species and would benefit from weed control (particularly removal of English ivy) and interplanting with conifers. Other riparian enhancements are discussed below under forest block restoration.

Wetland Restoration at the Padden Creek/Connelly Creek Confluence (LP-WR1) – This area includes a number of wetlands that provide water quality and hydrologic functions that benefit Lower Padden Creek. In addition, these wetlands are located at an important junction between an east-west wildlife corridor (along Padden Creek) and a north-south corridor (along Connelly Creek). Although some enhancement work has occurred here, continued work is warranted. Specific actions could include

wetland expansion (Action LP-WR1), wetland and buffer plantings, invasive species removal, and placement of habitat features (e.g., LWD, micro-topographical upland islands, perch structures, etc.).

Forest Block 006 Protection and Associated Wetland Protection (LP-WP1) -This large forest block extends south to include a portion of the Hoag's Creek drainage, flowing to Chuckanut Creek. The northwest portion of the block contains a large stand of moderate aged mixed forest, located between the south side of Padden Creek and Chuckanut Drive. This block, also containing the Interurban Trail and Chuckanut Community Forest, provides a key forested wildlife corridor between the large forested lands of Chuckanut Mountain to the south and the Padden Creek corridor to the north.

The block consists primarily of City-owned land, much of it associated with Fairhaven Park and the Chuckanut Community Forest. In addition to high functioning forest, which provides excellent wildlife dispersal, nesting, and roosting habitat, this large block also contains palustrine scrub-shrub and forested wetlands. Although a conservation easement protects part of the wetlands in the Chuckanut Community Forest, this assessment recommends the larger LP-WP1 polygon be protected. In addition to wildlife support functions, both the forest and wetland habitat help provide baseflows and moderate peak flows in Padden Creek. This assessment recommends City holdings continue to be managed as open space, while application of regulations or incentive programs for private forested parcels along the edges of the block could help maintain existing functions into the future.

Forest Block 032 and 032A Restoration – These forest habitat blocks also contain the forested Lower Padden Creek riparian zone, from about 20th Street downstream to the stream transition into the Padden Estuary. These blocks, consisting of mixed (but mostly deciduous) forest, are located primarily on City-owned property, including the Interurban Trail and Fairhaven Park. Recommended restoration actions consist of removal of invasive species, including non-native hawthorn, which is abundant in this area, and interplanting of shade-tolerant conifer species.

In addition, daylighting Padden Creek at the intersection of Donovan Avenue and 10th Street (on City property) would also allow for restoration of approximately 270 feet of instream and riparian habitat. This would necessitate building several bridges to maintain trail connections.

Forest Block 040 Forest Protection and Enhancement of Associated Riparian and Wetland Habitat (LP-WR2) – This block is located on Connelly Creek (about 1,000 feet north of the Padden Creek mainstem), and not within the borders of the Lower Padden sub-watershed. However, the forest, riparian, and wetland habitat in this block provides important north-south wildlife connectivity in the larger Padden Creek Watershed and maintains flow and water quality conditions in the Lower Padden Creek sub-watershed.

Forest Block 40 is located in the middle reaches of Connelly Creek and is ranked relatively high (Table 33) for forest protection. The block consists primarily of City-owned parcels, and the existing deciduous forest riparian zone supports riverine functions that benefit fish, which will be even a higher priority once full fish access is restored from the planned Padden Creek daylighting project. Additionally, the block provides wildlife connectivity to and from Padden Creek. Although protection is the primary focus,

the block can also benefit from continued implementation of specific restoration actions, including removal of invasive species and conifer interplanting.

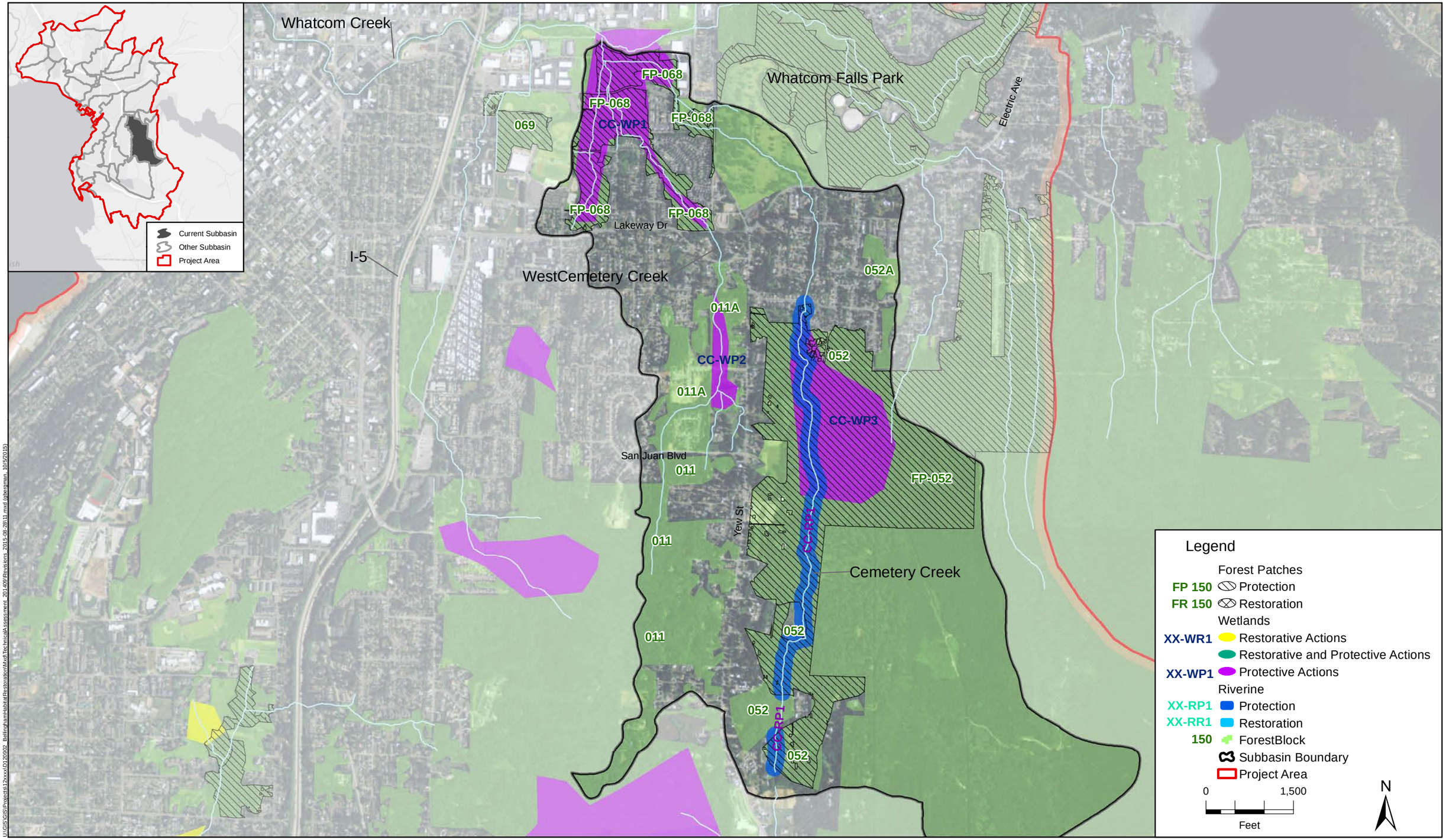
Additionally, a large emergent wetland (Action LP-WR2) is located in this block on a private parcel located between Mill Avenue and I-5, which previously served as a farm. The wetland provides important hydrologic and water quality functions for Connelly Creek and has a high potential for lift in overall ecological functions through expanding the wetland and its buffer and through enhancement with planting of native shrubs and trees and removal of invasive species.

Water Quality and Flow Improvement Recommendations (Figure 12)

As of early 2015, most of the Lower Padden Creek sub-watershed had no stormwater treatment or storage. The City completed the Padden Estuary water quality project in the summer and early fall of 2015 to improve water quality in the Padden Estuary. The project treats stormwater runoff from 90 acres of existing development within the northwest corner of the Padden Creek sub-watershed. Retrofitting the area for stormwater detention is also recommended. These measures, in conjunction with the daylighting of Padden Creek and the creation and enhancement of floodplain wetlands, would help to attenuate peak flows and reduce urban flooding. One of the primary issues within Padden Creek is low summer flows. Therefore, in addition to implementing LID to increase groundwater recharge, supplementing summer low flows in Padden Creek by increasing flows from Lake Padden should be examined.

6.3 Cemetery Creek Sub-watershed

Approximately 73% of the Cemetery Creek sub-watershed is located within the Project Area. The sub-watershed is part of the larger Whatcom Creek watershed and is composed of approximately 1,587 acres, of which approximately 99 acres are NWI wetland area. The Cemetery Creek sub-watershed includes approximately 6.9 stream miles, consisting of the entire mainstem of Cemetery Creek, West Cemetery Creek, and Racine Creek, all of which converge a short distance from Whatcom Creek, in the northwest portion of the basin (Figure 14). The sub-watershed has primarily residential land use along the north and east sides of the basin, while forestry land use predominates in the remainder of the basin. Industrial land use dominates the extreme northern (downstream) extent of the sub-watershed at the confluence of Cemetery and Whatcom Creeks. A summary of the Restoration Assessment outcomes for this sub-watershed is provided in Figure 15.



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SOURCE: City of Bellingham, 2013; ESRI, 2014

Figure 14

Recommended Restoration and Protection Actions in the Cemetery Creek Sub-Watershed

Figure 15. Cemetery Creek Sub-watershed: HRTA Tier 1 Summary

Riverine Existing Condition - Relative Functional Condition Ratings
(excerpt from Table 3)

Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Higher	Lower	Higher	Highest	Median	Lower

Wetland Existing Condition - Relative Functional Condition Ratings
(excerpt from Table 4)

Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Highest	Higher	Median	Highest	Median	Higher	Higher

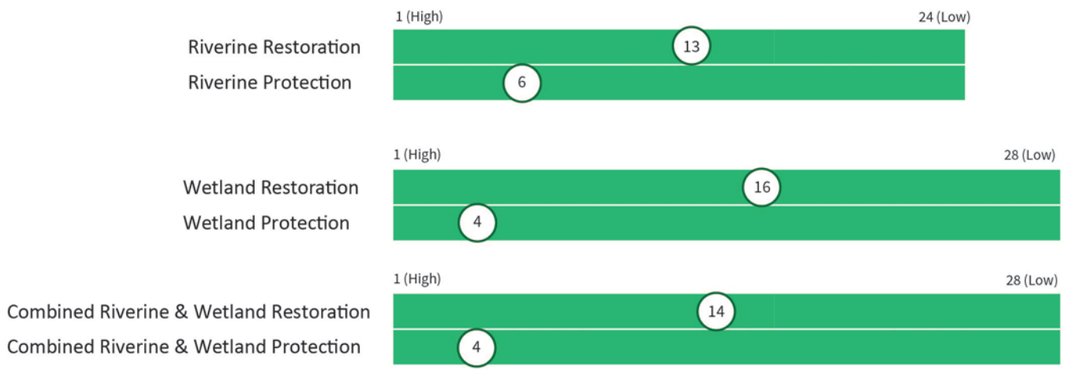
Forest Existing Condition -Relative Functional Condition Ratings
(excerpt from Table 5)

Block ID Number	**Biodiversity Function Score**	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*		**Habitat Maintenance Function Score**	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
011	**Highest**	*Highest*	*Median*	*Higher*		**Highest**	*Highest*	*Highest*
011A	**Higher**	*Higher*	*Lowest*	*Median*		**Higher**	*Median*	*Higher*
052	**Highest**	*Higher*	*Highest*	*Highest*		**Highest**	*Highest*	*Median*
052A	**Median**	*Higher*	*Higher*	*Lower*		**Median**	*Median*	*Median*
060	**Highest**	*Highest*	*Lower*	*Highest*		**Higher**	*Highest*	*Median*
068	**Median**	*Higher*	*Lower*	*Median*		**Median**	*Median*	*Median*

Preliminary Prioritization Rankings
(excerpt from Tables 15, 16, 18, and 19)

Riverine Restoration: #19 of 24
Riverine Protection: #6 of 24
Wetland Restoration: #23 of 28
Wetland Protection: #4 of 28

Secondary Prioritization Rankings (Relative Rank Score for Restoration and Protective Actions)
(excerpt from Tables 35,36, and 41)



Tier 1 Forest Blocks for Restoration: None
Tier 1 Forest Blocks for Protection: Blocks 011, 052, and 060

6.3.1 Relevant Physical, Chemical, and Biological Conditions

Existing physical, chemical, and biological conditions within the sub-watershed relevant to the formulation of a restoration plan include the following:

- The stream's headwaters flow through forested areas in the south part of the sub-watershed, but the lower (northern) sub-watershed consists of a mixture between forested open space, residential development, and industrial development.
- The lower reaches of Cemetery Creek include multiple 303(d) listings, including temperature (TMDL is in place), dissolved oxygen, and fecal coliform bacteria (Ecology, 2008).
- The lower reaches of Cemetery Creek, including the mouth, have documented presence of Chinook salmon, coho salmon, chum salmon, coastal cutthroat trout, and steelhead (WDFW, 2015a, b).

6.3.2 Review of Functional Assessment Results and Recommendations by Habitat Group

Riverine Habitat Group – During the evaluation of Relative Functional Condition Scores, three of the functions scored as high or highest (flow variation, habitat creation and maintenance, and biodiversity maintenance), one as median (chemical regulation), with the other two functions scoring as lower (Table Figure 15 and Table 3). Based on these scores, the sub-watershed ranked high for protective actions (Figure 15 and Table 36). Protection of riverine resources overlaps almost entirely with forest and wetland protection areas, so these actions will be incorporated into the recommendations for those Habitat Groups.

Wetland Habitat Group – With the exception of the sediment and phosphorus removal and pathogen removal functions, which rated as a median Relative Functional Condition Score, the remaining five wetland functions rated as higher (four) or highest (one), as compared to the other sub-watersheds in the Project Area (Figure 15 and Table 4). Overall, the wetlands appear to be functioning at a relatively high level, and therefore this Habitat Group was recommended for protection in the Cemetery Creek sub-watershed.

Forest Habitat Group – A very large, contiguous forest block (Forest Block 52), located primarily to the east of Cemetery Creek, covers the entire southeast portion of the sub-watershed. This block rates as high or highest for all Relative Functional Condition Scores (Figure 15 and Table 5). Three other smaller forest blocks are located west of Cemetery Creek (Forest Blocks 68, 11, and 11A) in the moderately developed west portion of the sub-watershed. In this area, moderately dense residential development is present along both sides of Yew Street.

The scattered smaller blocks had Relative Functional Condition Scores that ranged from highest (Forest Block 011) to median (Forest Block 068) (Figure 15 and Table 5). Blocks 11A and 68 did not score as high for either restoration or protection, while the larger block (Forest Block 11) had moderate to high Relative Functional Condition Scores, resulting in a high rating for protection (Figure 15 and Table 33).

6.3.3 Recommended Actions

Based on the results of the prioritization and interviews with local experts, the application of both restorative and protective actions is recommended for the Cemetery Creek sub-watershed. The main focus area for protection is the relatively intact forested area along the upper mainstem of Cemetery Creek. Here forest and wetland protection and enhancement could maintain overall ecological integrity in the upper basin and benefit downstream functions in the more developed areas. This approach is supplemented with riparian enhancement within Cemetery Creek and its tributaries, which will also improve water quality and flow functions, while providing valuable aquatic habitat refuge in a rapidly developing area.

Below is a list of general recommended actions. These recommendations are based on the final Comprehensive Prioritization; therefore, they are broad in nature. If the reader has a specific target function, these actions may not meet their needs and they should refer to the Preliminary Prioritization Rankings for guidance in identifying specific actions.

Forest, Riverine, and Wetland Habitat Recommendations (Figure 14)

Protection of Forest Block 52 and Cemetery Creek Riparian Areas (CC-RP1) – Forest Block 52 is a very large (over 3,600 acres) block, a significant portion of which is located within the Cemetery Creek sub-watershed, including a substantial amount within the Project Area, along the mainstem of Cemetery Creek (Figure 11). Much of the forest block within the Project Area includes multiple undeveloped parcels ranging substantially in size and dominated by moderately aged mixed forest. Zoning in the block varies but includes a substantial amount of residential zoning, with some forestry land use. In addition to the standard protection actions such as parcel acquisition and regulatory protection, a potential protective measure would be the establishment of a forest easement, where existing forest land uses would be required to be maintained. Although this approach may not maintain overall levels of function over time, the forest growth-harvest cycle would allow for some level of function, which is not the case if the parcels are fully developed.

Protection of this block and the associated wetlands (see below) would assist in regulating baseflow and peak flows in Cemetery Creek. In addition, this action could be combined with enhancement of forest riparian areas within Cemetery Creek and its tributaries (CC-RP1). This would be accomplished by removal of invasive species and underplanting of conifers within the riparian zones.

Protection of Forest Block 068 – Located just downstream of the Upper Whatcom Creek sub-watershed, Block 068 in Cemetery Creek is a candidate for forest restoration and protection, as well as wetland protection (see below). This large contiguous forest block serves as an important wildlife node and corridor connecting the east-west corridor of Whatcom Creek to the north-south corridor of Cemetery Creek and several of its tributaries. This forest block ranked moderately overall for both forest enhancement and protection (Table 41). However, as the forest block is surrounded by urban development the primary recommendation is for protection, although restoration activities may also benefit the block.

Although the majority of the forest block is City-owned (consisting partly of the Whatcom Creek Trail and Salmon Woods Open Space), several densely forested large parcels in the northeast portion of the block are privately owned. Recommendations for this block include continued management of City property as undeveloped park/natural area land or, if some development occurs, limiting this to passive recreational uses. In addition, property acquisitions or alterations in the regulatory approach (e.g, Shoreline Master Program or Critical Areas Ordinance) to private forested parcels along the edges of the block could help maintain existing functions into the future.

Wetland Protection (CC-WP 1,2, and 3) – Several dispersed riverine areas currently support numerous high-quality forested wetlands associated with Cemetery Creek. These wetlands are a combination of forested and emergent vegetation. Protection of these features would serve to maintain downstream water quality and provide flood storage, in addition to continuing to provide habitat for salmon and other aquatic and terrestrial species.

The northernmost location where continued wetland protection is recommended is within the wetland complex at the mouth of Cemetery Creek (CC-WP1), where it both flows into Whatcom Creek and receives flow from several of its tributaries. This includes wetlands along the lower reaches of Racine Creek and the West Cemetery Creek. This large, connected wetland complex provides important off-channel and floodplain habitat for salmonids as well as other aquatic organisms, birds, and terrestrial wildlife. The vast majority of the wetland area is City-owned and should continue to be managed as open space to maintain existing functions.

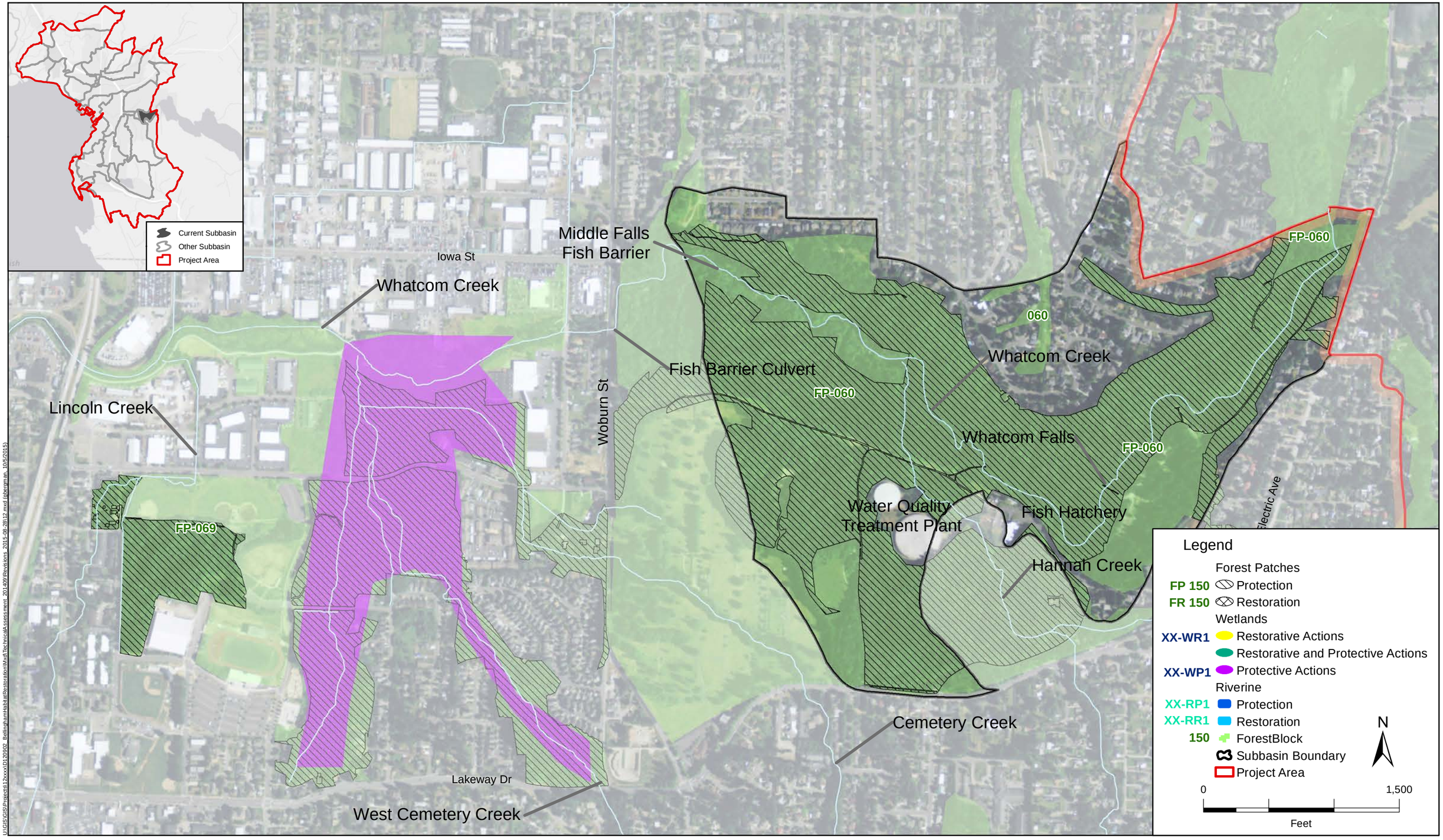
The second location for wetland protection (CC-WP2) is a riverine wetland complex located on the West Cemetery Creek, approximately between Lopez Street and Old Whatcom Drive. These wetlands provide flood storage and water quality functions, as well as serving as a habitat corridor. With the exception of two City-owned parcels (Parcels 380332515344 and 380332510318) near the south portion of the area, the remaining wetland area is on multiple private parcels, predominantly with residential zoning. Protection of all or a contiguous portion of these wetlands could occur through acquisition, placement of conservation easements, or various regulatory mechanisms.

The third location for wetland enhancement is located on the mainstem of Cemetery Creek, within a large contiguous forested portion of Block 052 (CC-WP3). Large numbers of high quality wetlands are located in this area, which provide hydrologic and water quality functions that benefit Cemetery Creek. The portion of the wetland north of Lopez Street is City-owned (Parcel 380333093340) and is part of the Cemetery Creek Greenway. The majority of the area south of Lopez Street includes two large privately owned undeveloped parcels, with forestry and residential zoning. Protection options include acquisition, placement of a forestry or conservation easement, or regulatory approaches.

6.4 Upper Whatcom Creek Sub-watershed

The Upper Whatcom Creek sub-watershed is approximately 269 acres and includes approximately 1.8 stream miles. The sub-watershed contains the upper mainstem of Whatcom Creek, and the lower forested reaches of a single tributary, Hannah Creek (Figure 16). In addition, the sub watershed contains

approximately 12.4 acres of NWI wetland area. The sub-watershed is located entirely within the city limits, with the primary land use consisting of parkland (Whatcom Falls Park), with some residential development in the northern portion of the sub-watershed. The sub-watershed is generally undeveloped and extends from the upstream headwaters, the only natural outlet of Lake Whatcom, downstream to just east of Woburn Street. A summary of the Restoration Assessment outcomes for this sub-watershed is provided in Figure 17.



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SOURCE: City of Bellingham, 2013; ESRI, 2014

Figure 16

Recommended Restoration and Protection Actions in the Upper Whatcom Creek Sub-Watershed

Figure 17. Upper Whatcom Creek Sub-watershed: HRTA Tier 1 Summary

Riverine Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 3)

Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Highest	Higher	Highest	Highest	Highest	Highest

Wetland Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 4)

Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Highest	Higher	Median	Highest	Median	Higher	Highest

Forest Existing Condition -Relative Functional Condition Ratings

(excerpt from Table 5)

Block ID Number	**Biodiversity Function Score**	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*	**Habitat Maintenance Function Score**	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
060	**Highest**	*Highest*	*Lower*	*Highest*	**Higher**	*Highest*	*Median*

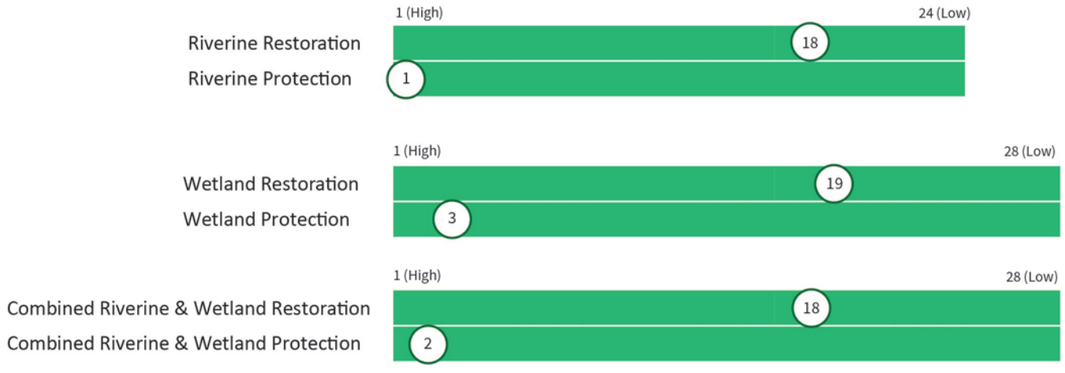
Preliminary Prioritization Rankings

(excerpt from Tables 15, 16, 18, and 19)

Riverine Restoration: #24 of 24
Riverine Protection: #1 of 24
Wetland Restoration: #26 of 28
Wetland Protection: #3 of 28

Secondary Prioritization Rankings (Relative Rank Score for Restoration and Protective Actions)

(excerpt from Tables 35,36, and 41)



Tier 1 Forest Blocks for Restoration: None
Tier 1 Forest Blocks for Protection: Block 060

6.4.1 Relevant Physical, Chemical, and Biological Conditions

Existing physical, chemical, and biological conditions within the sub-watershed relevant to the formulation of a restoration plan include the following:

- Within the sub-watershed, many waterfalls are present, two of which preclude upstream fish passage of anadromous species (although resident salmonids including cutthroat trout are present). Middle Whatcom Falls is located just upstream of Woburn Street (RM 2.5) and Upper Whatcom Falls is upstream near RM 3.0. However, multiple salmonid species are documented immediately downstream, in the Lower Whatcom Creek sub-basin, including Chinook salmon, chum salmon, coho salmon, pink salmon, steelhead, and cutthroat trout (WDFW, 2015a, b).
- The Whatcom Creek sub-watershed includes a biodiversity corridor that connects Whatcom Falls Park to Lake Whatcom, multiple wetlands, the Whatcom Creek estuary, and various state priority wildlife species, including bald eagle (WDFW 2015).
- Whatcom Creek is listed on Ecology's 303(d) list as impaired for temperature, fecal coliform, and dissolved oxygen (Ecology, 2008). A fecal coliform TMDL for Whatcom Creek is currently in development by Ecology and a single TMDL has been developed for Whatcom, Squalicum, and Padden Creeks for temperature.
- Whatcom Creek flows 2.5 miles through Whatcom Falls Park, the site of a 1999 Olympic Pipeline explosion, which significantly changed conditions along the creek. The City has extensively restored the riparian vegetation along Whatcom Creek since the Olympic Pipeline incident with several large stream and riparian habitat restoration projects.
- Wildlife corridors are relatively wide and well-functioning in the upper portions of the sub-watershed near Whatcom Falls Park (Nahkeeta, 2003).
- Water levels in Lake Whatcom are controlled by a dam at the outlet of the lake that affects the natural hydrology in Whatcom Creek. Runoff rates in the Whatcom Creek, Fever Creek, Lincoln Creek, and Cemetery Creek sub-watersheds have been identified as not properly functioning (HDR, 1995; COB, 2006 – 2010).

6.4.2 Review of Functional Assessment Results and Recommendations by Habitat Group

Riverine Habitat Group – Of the six riverine functions evaluated, five of the functions scored as highest for the Relative Functional Condition Score, and one (surface storage) scored as higher, as compared to the other sub-watersheds in the city (Figure 17 and Table 3). This sub-watershed ranked highest of all the sub-watersheds in the Project Area for existing functions. Based on the high levels of ecological function, this sub-watershed ranks highest for protection of existing riverine and riparian habitat (Figure 17 and Table 36).

Wetland Habitat Group – Five of the wetland functions had high or highest Relative Functional Condition Scores, with the remaining two (pathogen removal and sediment/phosphorus removal) ranking as median (Figure 17 and Table 4). Therefore, protection (through acquisition/regulatory

mechanisms) of existing wetland resources is recommended for Upper Whatcom Creek, with restoration being a lower priority overall (Figure 17 and Tables 35, 36).

Forest Habitat Group – A single large forest habitat block (Block 060) is located within the sub-watershed. This habitat block had high Relative Functional Condition Scores for all functions (Figure 17 and Table 5) and therefore ranked high for protection (Figure 17 and Table 41). In addition, one habitat block downstream of the sub-watershed but within the larger Whatcom Creek watershed, specifically Forest Block 069, was included in the final recommendations because it provides opportunities to improve habitat connectivity.

6.4.3 Recommended Actions

Based on the results of the prioritization and interviews with local technical experts, a primary focus of riverine, wetland, and forest actions is protection of existing resources, particularly in light of forest and riparian habitat connectivity. Although the primary focus within the Upper Whatcom Creek sub-watershed is resource protection, limited riparian restorative measures (invasive species control) are recommended.

Below is a list of general recommended actions. These recommendations are based on the final Comprehensive Prioritization; therefore, they are broad in nature. If the reader has a specific target function, these actions may not meet their needs and they should refer to the Preliminary Prioritization Rankings for guidance in identifying specific actions.

Forest, Riverine, and Wetland Habitat Recommendations (Figure 16)

Forest Block 060 Protection and Associated Whatcom Creek Restoration – The block consists primarily of City-owned land associated with Whatcom Falls Park. In addition to high functioning mature second-growth forest, which provides excellent wildlife dispersal, nesting, and roosting habitat, this large block also contains several forested wetlands identified by NWI (see Figure 3). In addition to wildlife support functions, both the forest and wetland habitat help provide baseflows and moderate peak flows in Whatcom Creek. This assessment recommends City holdings continue to be managed as open space, with continued protection of forested upland and riparian buffer areas, in order to maintain existing functions into the future.

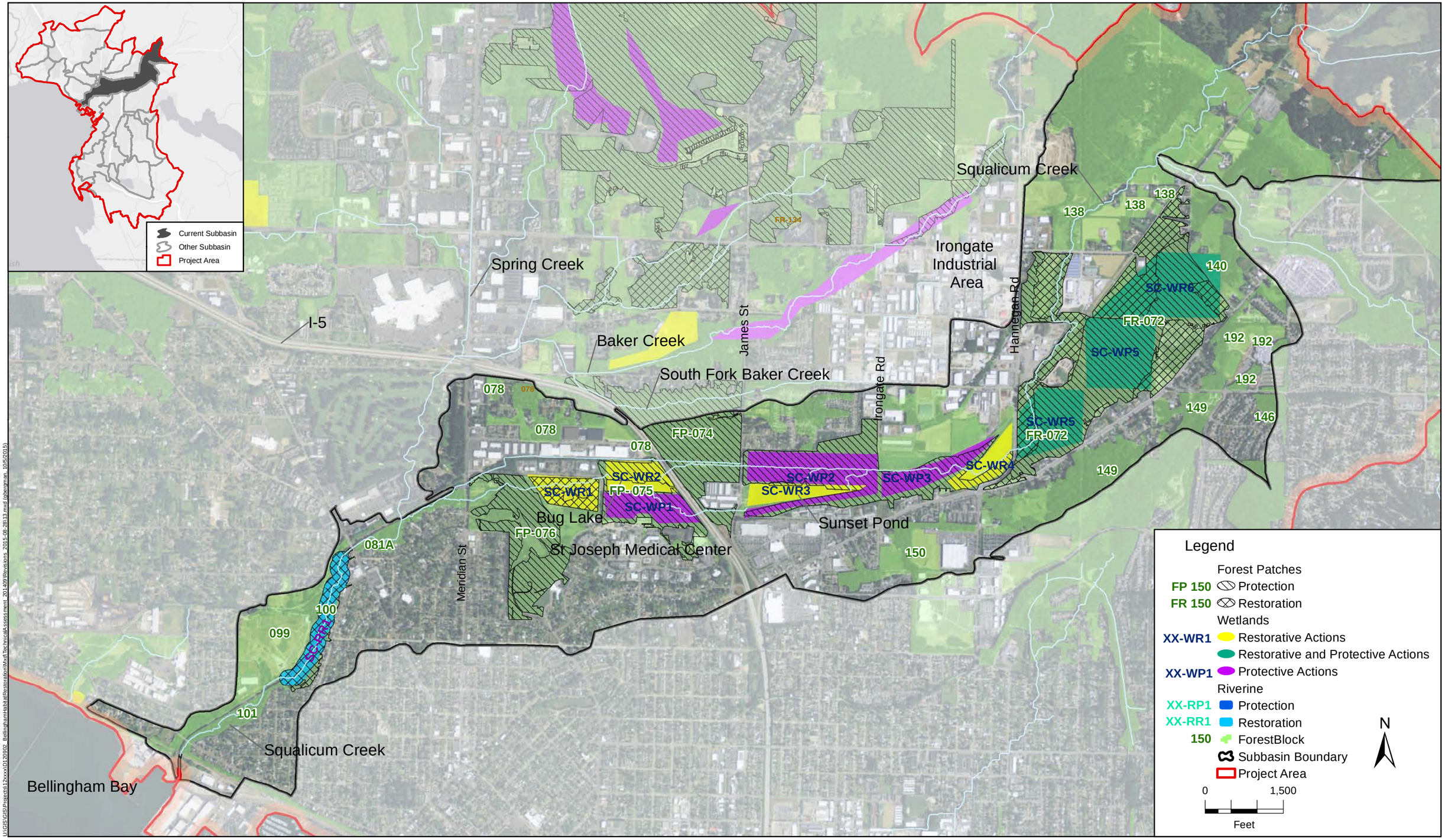
The single enhancement activity recommended is the removal of invasive species from the forest and riparian areas. Whatcom Falls Park has widespread ivy infestations (the major invasive species in the block). Local experts identified the areas on the north side of the park, abutting neighborhoods such as those around St. Clair Street, as containing particularly high ivy densities (V. Jackson, 2014).

Forest Block 069 Protection – Although located downstream of the Upper Whatcom Creek sub-watershed, Block 069 in Lower Whatcom Creek could benefit from enhancement and support functions in Upper Whatcom Creek. This block is the farthest downstream and largest contiguous block in the Whatcom Creek watershed in relative proximity to Whatcom Creek, Lincoln Creek, and Racine Creeks. This block ranked as one of the high priorities for restorative actions, based on the final prioritization. It also may serve as an important node for wildlife habitat for the east-west habitat corridor along

Whatcom Creek. The majority of Block 069 is City-owned (Civic Athletic Complex) and would benefit from interplanting of coniferous trees and removal of invasive species. During the review process, protection for this block was also listed as a priority by several local experts, due to the relatively high habitat value and important connectivity functions.

6.5 Lower Squalicum Creek Sub-watershed

The Lower Squalicum Creek sub-watershed is approximately 2,571 acres and includes approximately 8.5 stream miles, including the lower mainstem and mouth of Squalicum Creek (Figure 18). The stream has approximately 388 acres of wetland area, based on NWI data. The sub-watershed is located entirely within the city limits and the primary land uses are residential, commercial, and industrial. A summary of the Restoration Assessment outcomes for this sub-watershed is provided in Figure 19.



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SOURCE: City of Bellingham, 2013; ESRI, 2014

Bellingham Habitat Restoration · 120902

Figure 18

Recommended Restoration and Protection Actions in the Lower Squalicum Creek Sub-Watershed

Figure 19. Lower Squalicum Creek Sub-watershed: HRTA Tier 1 Summary

Riverine Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 3)

Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Median	Higher	Higher	Higher	Median	Lowest

Wetland Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 4)

Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Higher	Highest	Higher	Higher	Highest	Highest	Median

Forest Existing Condition -Relative Functional Condition Ratings

(excerpt from Table 5)

Block ID Number	**Biodiversity Function Score**	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*		**Habitat Maintenance Function Score**	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
072	**Highest**	*Highest*	*Lower*	*Higher*		**Median**	*Median*	*Median*
073	**Higher**	*Higher*	*Higher*	*Higher*		**Median**	*Lower*	*Median*
074	**Median**	*Median*	*Median*	*Lower*		**Median**	*Median*	*Higher*
075	**Higher**	*Median*	*Lower*	*Higher*		**Higher**	*Median*	*Higher*
076	**Median**	*Highest*	*Lowest*	*Lower*		**Median**	*Higher*	*Median*
078	**Lowest**	*Median*	*Highest*	*Lowest*		**Lowest**	*Lowest*	*Lower*
081A	**Lower**	*Lower*	*Highest*	*Lower*		**Lowest**	*Lowest*	*Lowest*
099	**Lowest**	*Lowest*	*Higher*	*Lowest*		**Lowest**	*Lowest*	*Lowest*
100	**Lower**	*Median*	*Median*	*Lower*		**Lowest**	*Lower*	*Lowest*
101	**Lower**	*Median*	*Lower*	*Lower*		**Lowest**	*Lower*	*Lowest*
138	**Higher**	*Median*	*Median*	*Higher*		**Higher**	*Higher*	*Median*
140	**Higher**	*Higher*	*Higher*	*Higher*		**Median**	*Median*	*Median*

Preliminary Prioritization Rankings

(excerpt from Tables 15, 16, 18, and 19)

Riverine Restoration: #18 of 24
Riverine Protection: #12 of 24
Wetland Restoration: #25 of 28
Wetland Protection: #6 of 28

Secondary Prioritization Rankings (Relative Rank Score for Restoration and Protective Actions)

(excerpt from Tables 35,36, and 41)

Tier 1 Forest Blocks for Restoration: Blocks 078 and 100
Tier 1 Forest Blocks for Protection: None

6.5.1 Relevant Physical, Chemical, and Biological Conditions

Relevant basin conditions in Lower Squalicum Creek include the following:

- Lower Squalicum Creek supports significant numbers of salmonids, including Endangered Species Act-listed Chinook salmon, steelhead, and bull trout, as well as coho salmon, chum salmon, and cutthroat trout (WDFW, 2015a, b).
- Squalicum Creek is 303(d) listed for dissolved oxygen and fecal coliform. A single TMDL has been developed for Whatcom, Squalicum, and Padden Creeks for temperature. A flow TMDL is under development by Department of Ecology/EPA as a pilot project.
- Macroinvertebrate studies on the stream indicate low numbers of sensitive organisms and dominance by pollution-tolerant taxa (Ecology, 2013; Vandersypen et al., 2006).
- A large industrial site (Irongate Industrial Area) is located on the north side of the stream in the central portion of the sub-watershed. This area has a large area of impervious surface that drains to Squalicum Creek, with much of the stormwater runoff undetained and untreated. Stormwater treatment levels for inputs into Squalicum Creek have been identified as not adequate to protect water quality (HDR, 1995; Hood, 2006).
- The Lower Squalicum Creek sub-watershed has been identified as being not functioning for instream flow conditions and runoff rates (Nahkeeta, 2003; COB, 2009).
- Forested wildlife corridors are indicated to be relatively intact and functioning well along the mainstem of Squalicum Creek but reduced in function in the tributaries. Hazardous wildlife crossings exist across major arterials such as Meridian Street, James Street, and Hannegan Road (Nahkeeta, 2003).
- A relatively contiguous but in some places narrow riparian corridor is present along the mainstem of Lower Squalicum Creek.
- Some significant stands of older (> 30 years old) forest remain within the sub-watershed, mostly located along Lower Squalicum Creek.
- In the 1960s, Squalicum Creek was channeled through two shallow man-made lakes (Bug Lake and Sunset Pond). The lakes are located near the freeway and were excavated for fill material when Interstate 5 was being built. The City plans to construct a new stream channel to reroute Squalicum Creek around the two man-made ponds. The reroute will be conducted in phases, with Phases 1 and 2 (removing the creek from Sunset Pond), planned for construction in summer 2015. These projects will reactivate remnant channels and reconnect the stream with its floodplain, while also eliminating an existing fish passage blockage under I-5.
- As a result of historic shoreline development, the mouth of Squalicum Creek has been relocated and confined between two concrete box culvert bridges in a heavily armored channel with a concrete bottom that creates jump, depth, and velocity barriers to fish passage. Restoring the mouth of Squalicum Creek and its associated estuary habitats was identified as a priority restoration project through the landscape-level planning efforts of The Bellingham Bay

Demonstration Pilot Project. The proposed project included removal of a 15,500-square-foot derelict pier and 680 creosote piles from areas adjacent to the existing delta. Future phases are expected to replace the Roeder Avenue Bridge, modify the Burlington Northern/Santa Fe concrete box culvert rail bridge, replace existing sewer lines, remove a 350-foot-long concrete channel bottom between the two bridges, and reestablish a natural streambed.

6.5.2 Review of Functional Assessment and Recommendations by Habitat Group

Riverine Habitat Group – The thermoregulation function scored lowest, while flow variation and chemical regulation functions were ranked median for a Relative Functional Condition Score compared to the other sub-watersheds in the city (Figure 19 and Table 3). The other functions were ranked above median. Based on the relatively high levels of functions within the sub-watershed, the sub-watershed ranked high for the implementation of protective actions but medium-low for restorative actions (Figure 19 and Tables 35, 36).

Wetland Habitat Group – With the exception of carbon sequestration function for wetlands, which rated as median, the remaining six wetland functions had high or highest Relative Functional Condition Scores as compared to the other sub-watersheds in the city (Figure 19 and Table 4). Therefore, protection of existing wetland resources is recommended for Lower Squalicum Creek (Figure 19 and Table 36).

Forest Habitat Group – The forest habitat blocks within the sub-watershed had a variety of Relative Functional Condition Scores, ranging from high to low across the area (Figure 19 and Table 5). These habitat blocks generally ranked as moderate for both restorative and protective actions, although a number of individual habitat blocks, specifically blocks 078 and 100, were classified as Tier 1 blocks for restoration (Figure 19 and Table 41). However, some of these blocks were located a fair distance from any habitat corridors, such as block 078. Therefore, the forest habitat blocks were qualitatively reexamined in light of habitat connectivity and ability to support ecological functions within the other Habitat Groups examined. In cases where forest blocks outside the sub-watershed provided key corridors for connectivity, the outlying blocks were included within the associated Habitat Analysis Unit. This resulted in numerous blocks (Forest Blocks 72 through 76) being included in the recommendations.

6.5.3 Recommended Actions

Based on the results of the prioritization and interviews with local technical experts, a primary focus of riverine, wetland, and forest actions is protection of existing resources, particularly in light of forest and riparian habitat connectivity. Although the primary focus within the Lower Squalicum Creek sub-watershed is resource protection, some restorative measures would likely benefit Lower Squalicum Creek, which supports multiple species of anadromous salmonids, including federally listed species. These actions include stormwater quality and quantity retrofit, and potential application of LID techniques to improve water quality where feasible. In addition, the functions of the Lower Squalicum Creek riparian zone could be improved through removal of invasive species and conifer planting. Sitka spruce would be a good candidate in the wet soils in the riparian zone.

Below is a list of general recommended actions. These recommendations are based on the final Comprehensive Prioritization; therefore, they are broad in nature. If the reader has a specific target function, these actions may not meet their needs and they should refer to the Preliminary Prioritization Rankings for guidance in identifying specific actions.

Forest, Riverine, and Wetland Habitat Recommendations (Figure 18)

Forest Block 100 Restoration and Associated Riparian Restoration (SC-RR1) –Forest Block 100, located along both sides of Squalicum Creek between Northwest Avenue and West Street (Figure 13), is a Tier 1 area for enhancement. This block, consisting primarily of deciduous forest, has received a substantial amount of enhancement by the City, who has been working on controlling invasive plant species and interplanting with native understory and conifer species. However, there is still a large infestation of ivy and clematis within the block on private property that would benefit from control and removal (Action SC-RR1). Additional interplanting of coniferous species and invasive species removal within the forested corridor is recommended, in order to approximate natural stand conditions and the process of succession toward a more mature condition, where habitat functions are improved.

Forest Block 076 Protection/Restoration and Associated Wetland /Floodplain Restoration (SC-WR1) - Squalicum Creek flows through two private parcels with a narrow riparian zone partially composed of wetland habitats. Actions that would result in functional uplift on these parcels include floodplain/wetland creation and enhancement, and creation of a wider forested riparian zone along Squalicum Creek (Action SC-WR1). These actions would increase forest biodiversity and habitat maintenance functions, and widen a primary wildlife corridor along the stream, as well as increase stream shading and water quality functions of the riparian zone.

This assessment recommends the structure of the relatively well functioning area of mixed forest in the City-owned Cornwall Park, in the east end of the block, be maintained and protected to the extent feasible, as it provides an important forested node within a larger habitat corridor (FP-076).

Forest Protection in Forest Block 075 and Associated Wetland Restoration/Protection (SC-WR2, SC-WR3, and WP1) -A number of undeveloped public and private parcels, several of them zoned industrial, comprise Forest Block 75, which encompasses Bug Lake and a large contiguous mixed forest with extensive lake buffer to the north and mixed wetlands and buffer to the south of the lake (Figure 13). Although not fully mature, this block provides key functions for riverine, wetland, and forest habitat and serves as a central element in providing east-west connectivity for the Squalicum Creek forest and riparian habitat. Protection (Action SC-WP1) of riparian, wetland, and forest areas south of Bug Lake through regulations (Shoreline Master Program, Critical Areas Code, etc.) or acquisition, or a permanent conservation easement, is recommended.

Sunset Pond was created from a borrow pit during construction of Interstate 5. Squalicum Creek currently flows through the pond, which has large numbers of invasive species including bass, bullfrog, yellow-flag iris, reed canarygrass, and others. Water quality problems include high temperature and low dissolved oxygen which have negatively affected salmonids. Sunset Pond and the associated forested area to the north are good candidates for buffer restoration (SC-WR3). The pond could be enhanced to

have more hydrologic and vegetative diversity, including restoration of the wetland fringe, invasive species removal, and restoration and reestablishment of coniferous forested wetlands north of Sunset Pond (see Action SC-WP2).

Forest Protection in Block 074. - Several undeveloped parcels, both publicly owned and private (zoned industrial and residential) and varying from 3 to 12 acres in size, compose Forest Block 74. This block is located between James Street and Interstate 5 and will contain a portion of the future Phase 3 reroute alignment of Squalicum Creek (which will, once funded and completed, reroute Squalicum Creek north of Bug Lake, bypassing the feature). As with Block 075, this block provides key functions for riverine, wetland, and forest habitat and serves as a central element in providing east-west connectivity for the Squalicum Creek forest and riparian habitat. Protection of riverine, wetland, and forest through regulations (Shoreline Master Program, Critical Areas Code, etc.), acquisition, or a permanent conservation easement is recommended.

Forest Block 073 Protection and Associated Wetland Protection (SC-WP2 and WP3) and Restoration (SC-WR 3 and WR4) - Several undeveloped parcels, both publicly owned and private and varying from 3 to 12 acres in size, compose Block 73. This block is located east of James Street in the vicinity of Sunset Pond. The block will contain a portion of the Phase II reroute alignment of Squalicum Creek, once the project is complete. As with Blocks 074 and 075, this block provides key functions for riverine, wetland, and forest habitat and serves as a central element in providing east-west connectivity for the Squalicum Creek forest and riparian habitat. Furthermore, the forested floodplain wetlands within this block are high functioning and excellent candidates for protection (Actions SC-WP2 and SC-WP3), as they currently support floodplain, hydrologic, water quality, and wildlife functions. Protection of forest and riparian areas through either regulations (Shoreline Master Program, Critical Areas Code, etc.) or permanent protection of these areas through acquisition and placement of a permanent conservation easement is recommended.

Sunset Pond was created from a borrow pit during construction of Interstate 5. As with Bug Lake, the pond has large numbers of invasive plant and wildlife species, and it contributes to water quality problems include high temperature and low dissolved oxygen that affect salmonids. The City plans to implement Phases 1 and 2 of the Squalicum Creek Reroute project in the summer of 2015, rerouting the stream around the pond, which could then be enhanced to have more hydrologic and vegetative diversity, including restoration of the wetland fringe, palustrine wetlands extending into existing open-water areas, and invasive species removal (SC-WR3).

Along the east side of Block 073, the existing riverine wetland is a recommended for restoration (Action SC-WR4). The wetland, located in the Squalicum Creek floodplain, has been pastured and is dominated by non-native grasses. The wetland has high potential for wetland enhancement or creation and riparian enhancement.

Block 072 Forest Protection and Associated Wetland Protection (SC-WP5) and Restoration (SC-WR5 and WR6) – Forest Block 072 includes several Washington State Department of Natural Resource (DNR) parcels. On the west side of the block (Action SC-WR5), a DNR parcel and another private parcel (zoned

commercial) have substantial restoration potential, including removal of invasive species (primarily reed canarygrass), establishment of a mixed forest riparian zone, establishment/improvement of functional floodplains and riverine wetland areas, and installation of LWD and other instream habitat structures. A similar wetland area (Action SC-WR6) exists along the northeast end of the block.

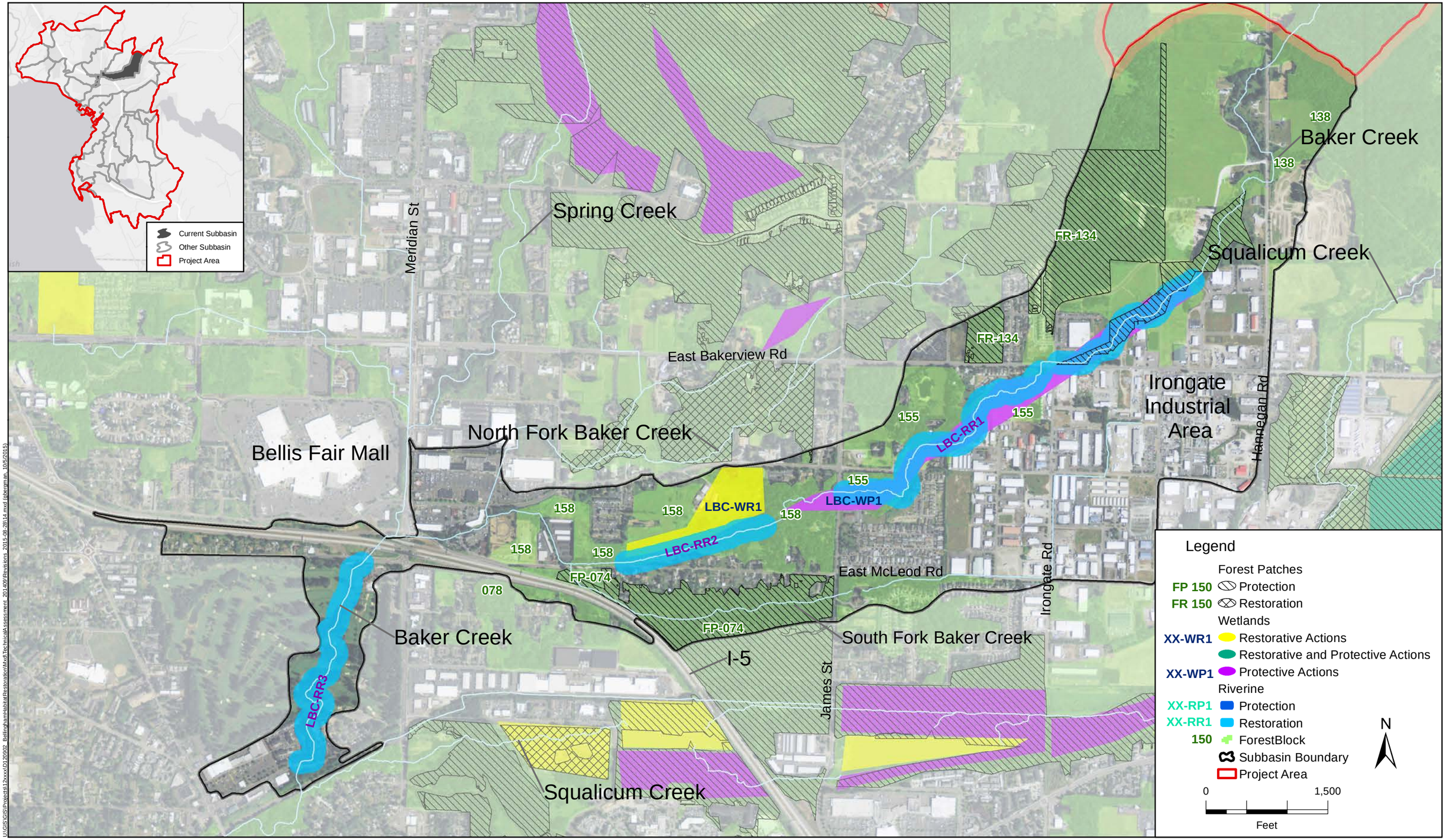
The three DNR parcels are mostly forested with mature coniferous forest and are excellent candidates for forest protection and wetland protection in those areas not recommended for restoration (SC-WP-5).

Water Quality and Flow Improvement Recommendations (Figure 18)

Specific stormwater recommendations for the Lower Squalicum Creek sub-watershed include improvement of stormwater infrastructure, especially along the Irongate Industrial Area to address both water quality and peak flow issues. Potential water quality issues in Squalicum Creek include runoff from businesses involved in sand and gravel operations and stonework, which contribute to elevated instream pH and sediment levels (V. Jackson, 2014). This area currently lacks sufficient stormwater detention and treatment (B. Reilly, personal communication). Open ditches currently provide some detention and treatment and should be maintained until a full retrofit occurs. Water quality in the sub-watershed could benefit from the implementation of source control, through City encouragement and assistance to property owners. Pending further study, a regional treatment or detention facility may also be appropriate.

6.6 Lower Baker Creek Sub-watershed

The Lower Baker Creek sub-watershed, part of the larger Squalicum Creek watershed, is approximately 887 acres, of which approximately 96% is located within the Project Area (Figure 20). The sub-watershed includes approximately 5.8 stream miles, including the mainstem Baker Creek and Irongate Creek, as well as approximately 58 acres of NWI wetland area. The sub-watershed is located essentially entirely within the city limits, with primary land uses including residential, commercial, and industrial. A summary of the Restoration Assessment outcomes for this sub-watershed is provided in Figure 21.



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SOURCE: City of Bellingham, 2013; ESRI, 2014

Bellingham Habitat Restoration · 120902

Figure 20

Recommended Restoration and Protection Actions in the Lower Baker Creek Sub-Watershed

Figure 21. Lower Baker Creek Sub-watershed: HRTA Tier 1 Summary

Riverine Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 3)

Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Median	Lower	Median	Median	Lowest	Median

Wetland Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 4)

Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Higher	Median	Higher	Higher	Highest	Higher	Median

Forest Existing Condition -Relative Functional Condition Ratings

(excerpt from Table 5)

Block ID Number	**Biodiversity Function Score**	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*		**Habitat Maintenance Function Score**	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
074	**Median**	*Median*	*Median*	*Lower*		**Median**	*Median*	*Higher*
134	**Highest**	*Higher*	*Higher*	*Highest*		**Highest**	*Highest*	*Higher*
138	**Higher**	*Median*	*Median*	*Higher*		**Higher**	*Higher*	*Median*
155	**Median**	*Lower*	*Lowest*	*Median*		**Median**	*Median*	*Median*
158	**Median**	*Higher*	*Median*	*Median*		**Median**	*Median*	*Lower*

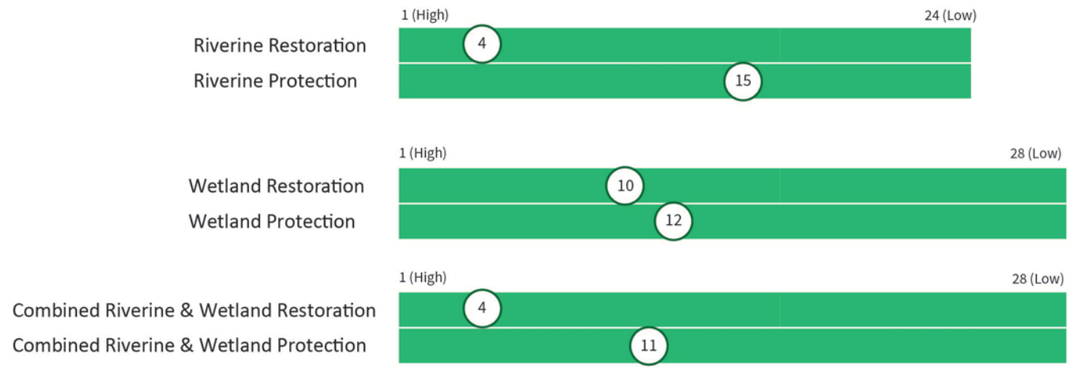
Preliminary Prioritization Rankings

(excerpt from Tables 15 through 18)

Riverine Restoration: #11 of 24
Riverine Protection: #15 of 24
Wetland Restoration: #17 of 28
Wetland Protection: #12 of 28

Secondary Prioritization Rankings (Relative Rank Score for Restoration and Protective Actions)

(excerpt from Tables 35,36, and 41)



Tier 1 Forest Blocks for Restoration: None
Tier 1 Forest Blocks for Protection: Block 134

6.6.1 Relevant Physical, Chemical, and Biological Conditions

Existing physical, chemical, and biological conditions within the sub-watershed relevant to the formulation of a restoration plan include the following:

- Baker Creek flows through the Bellingham Golf and Country Club golf course downstream of I-5 with little riparian cover.
- Culverts at the I-5 crossing are substantial fish passage barriers (WDFW, 2015b).
- The reach of Baker Creek downstream of I-5 is 303(d) listed for fecal coliform bacteria (Ecology, 2008).
- The reach of Baker Creek downstream of I-5 has documented presence of coho salmon, chum salmon, cutthroat trout, and steelhead. Steelhead and chum distribution end at I-5, but cutthroat trout and coho distribution extends up to James Street (WDFW, 2015a, b).

6.6.2 Review of Functional Assessment Results and Recommendations by Habitat Group

Riverine Habitat Group – Of the six riverine functions evaluated, the majority (four) had median Relative Functional Condition Scores, while two had low or lowest scores (chemical regulation is rated lowest and surface storage as lower) (Figure 21 and Table 3). Based on moderate and slightly impaired existing conditions across the group of functions evaluated, the sub-watershed ranked as moderate for the implementation of riverine restorative actions, the majority of which address water quality and flood storage (Figure 21 and Table 35). The actions with the greatest potential for resulting in functional uplift, in order, are as follows: stormwater facilities / LID, depressional wetland restoration, riparian buffer enhancement, reconnection of floodplains, and increased in-channel habitat quantity.

Wetland Habitat Group – With the exception of the carbon sequestration and nitrogen removal functions (which both rated as moderate), the remaining five wetland functions received higher or highest Relative Functional Condition Scores as compared to the other sub-watersheds in the city (Figure 21 and Table 4). Because the wetlands appear to be generally functioning appropriately, protection of existing wetland resources is recommended for the Lower Baker Creek sub-watershed (Figure 21 and Table 36).

Forest Habitat Group – The entirety or portions of three forest habitat blocks are located in the sub-watershed, Blocks 074, 155, and 158. These habitat blocks generally had habitat functions and values that scored median (Figure 21 and Table 5). These blocks were all rated as above median to median-high for restoration but lower for protection (Table 33).

6.6.3 Recommended Actions

Based on the results of the prioritization and interviews with local experts, the primary focus of riverine, wetland, and forest actions within the Lower Baker Creek sub-watershed would involve a combination of restorative and protective actions. The main focus areas are along the mainstem of Baker Creek upstream of Interstate 5 where forest, riverine, and wetland enhancement could occur adjacent to the stream, thus increasing overall ecological functions in the middle to upper portions of the sub-

watershed (Figure 14). Restorative riverine actions that address known downstream issues (water quality and quantity) are recommended, including the following: stormwater quality and quantity retrofit, application of LID, floodplain creation (preferably incorporating wetlands for flood storage and retention), and riparian enhancements. These actions are also complementary to wetland protection and forest enhancement/protection, which are also recommended.

Below is a list of general recommended actions. These recommendations are based on the final Comprehensive Prioritization; therefore, they are broad in nature. If the reader has a specific target function, these actions may not meet their needs and they should refer to the Preliminary Prioritization Rankings for guidance in identifying specific actions.

Forest, Riverine, and Wetland Habitat Recommendations (Figure 20)

Wetland Protection (LBC-WP1), Riparian Buffer Restoration (LBC-RR1), and Forest Restoration (Forest Blocks 155 and 158) - Actions LBC-WP1 and LBC-RR1 includes portions of Forest Blocks 155 and 158 and are located along about 1.5 miles of Baker Creek from approximately Hannegan Road, downstream (southwest) to a point approximately 1,500 feet southwest of James Street (Figure 14). Existing conditions include a 100- to 500-foot-wide corridor of forested upland and riparian buffer, with interspersed forested and scrub-shrub wetlands. The wetland protection and riverine restoration areas currently consist of primarily deciduous forest, and the reach along Baker Creek has documented beaver presence and a large number of high quality wetlands.

The area recommended for wetland protection and riverine restoration currently consists of multiple private parcels, most with industrial or commercial zoning, with several large undeveloped sites. In addition, several conservation easement parcels and a single undeveloped City-owned parcel are located in this area. Although it is likely not practical for the City to acquire the entire corridor because of cost factors, recommendations include considering property acquisitions or regulatory protection, with a goal of creating and maintaining a contiguous forested wildlife corridor that provides connectivity around the Irongate Industrial Area through a functioning forested stream and wetland corridor.

This assessment recommends forest and wetland protection actions be combined with enhancement of riparian and upland forest areas, consisting of removal of invasive species and interplanting of additional shade-tolerant conifer species.

Baker Creek Wetland Restoration (LBC-WR1) and Riparian Buffer Restoration (LBC-RR2) – A primary opportunity for wetland creation and enhancement (LBC-WR1) coupled with floodplain expansion and creation is located along Baker Creek, within an existing wetland area that has been farmed. This area, located north of Baker Creek between James Street and East McLeod Road, has potential for wetland and floodplain expansion through grading or enhancement with forest species to improve riparian and wetland functions. In combination with restoration of floodplain and riparian habitat along the adjacent reach of Baker Creek (LBC-RR2), this would create a functioning riparian zone consisting of trees and large bank-side shrubs (willow species). The net result of these actions would have the potential to improve downstream water quality and stream temperature and improve flood storage functions.

Complete restoration and enhancement would involve from 6 to 10 parcels including 4 larger parcels with a combination of commercial, agricultural, and residential zoning.

Protection of Forest Block 134 – A significant portion of this large (over 1,000-acre) forest habitat block is located to the northeast of the Lower Baker Creek sub-watershed. Protection recommendations are discussed below, under recommendations for the Baker Creek Tributary sub-watershed.

Protection of Forest Block 074 – This large forest block is mostly undeveloped and provides a forested wildlife corridor connecting Baker Creek with the mainstem of Squalicum Creek. Protection recommendations are discussed above, under recommendations for the Lower Squalicum Creek sub-watershed.

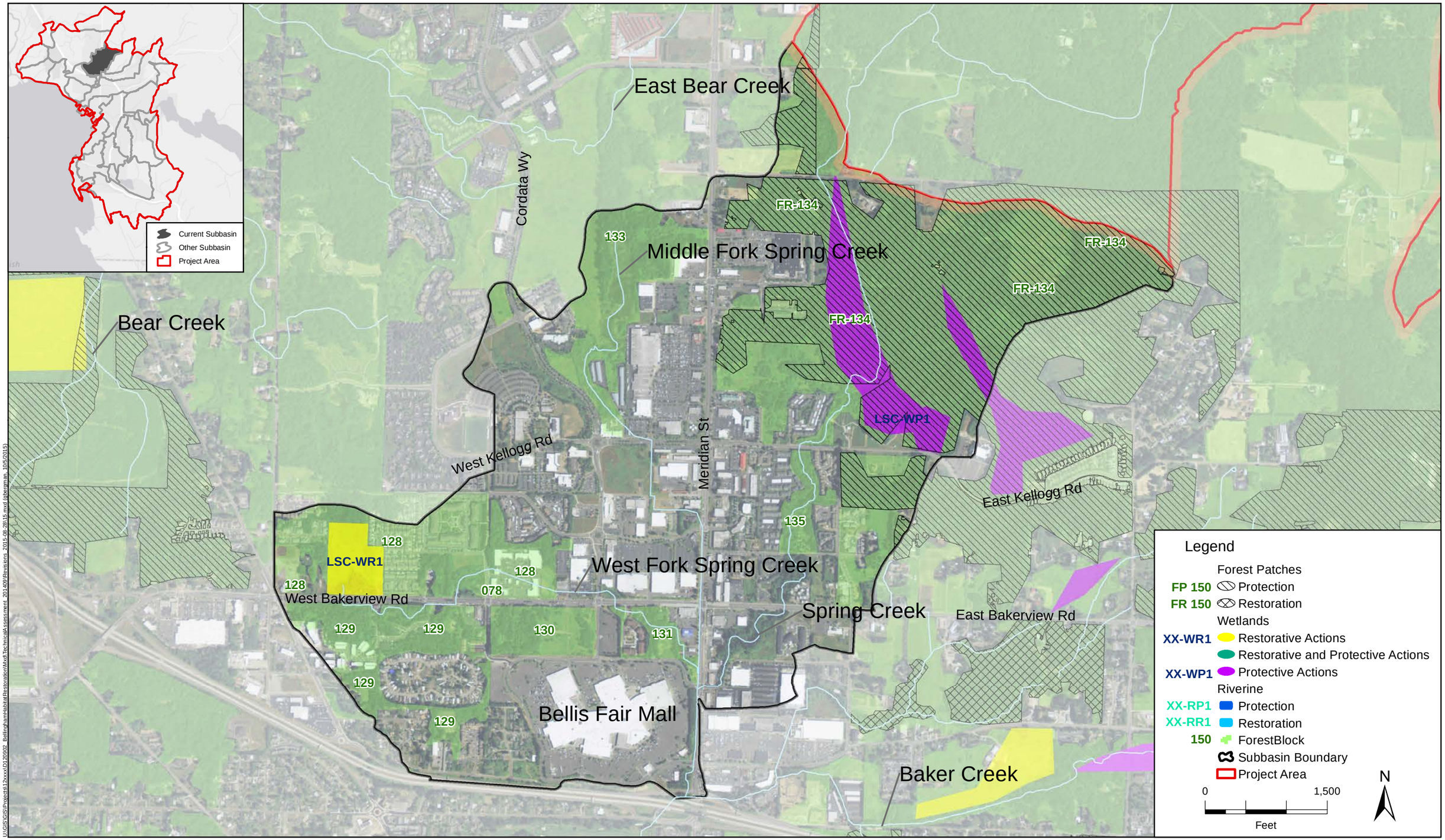
Restoration (Riparian Enhancement) on Lower Baker Creek (LBC-RR3) – The majority of the lower reaches of Baker Creek, from I-5 south to the stream mouth at Squalicum Creek, flow through the Bellingham Golf and Country Club (Figure 14). Within this reach, the riparian zone is extremely degraded, consisting of patchy deciduous trees and numerous segments of stream with no substantial tree or native shrub cover. Based on aerial photographs, only scattered deciduous trees are present in this reach. Invasive species are also likely to occur in such a setting. Baker Creek water quality and stream temperature functions have the potential for substantial improvement through a riparian enhancement plan, consisting of riparian planting of native trees and shrubs and removal of invasive species. The City could work with the Bellingham Golf and Country Club staff and provide technical expertise or funding to develop and implement a restoration plan to improve stream functions, while enhancing the recreational experience through visual enhancements from native plant landscaping.

Water Quality and Flow Improvement Recommendations (Figure 20)

Specific stormwater recommendations for the Lower Baker Creek sub-watershed include improvement of stormwater infrastructure within the sub-watershed, especially along the Irongate Industrial Area, to address both water quality and peak flow issues. Baker Creek drains to Squalicum Creek, where identified water quality issues may include runoff from businesses involved in sand and gravel operations and stonework, which contribute to elevated instream pH and sediment levels (V. Jackson, 2014). This area currently lacks sufficient stormwater detention and treatment (B. Reilly, personal communication). Open ditches provide some detention and treatment and should be maintained until a full retrofit occurs. One approach is for the City to encourage or assist property owners in implementing source control, but a regional treatment or detention facility may be appropriate.

6.7 Lower Spring Creek Sub-watershed

The Lower Spring Creek sub-watershed, part of the larger Squalicum Creek watershed, is approximately 1,056 acres, of which approximately 99% is located within the Project Area. The sub-watershed includes approximately 4.6 stream miles, including the mainstem, West Fork, and Middle Forks of Spring Creek, as well as approximately 68 acres of wetland area. The sub-watershed is located essentially entirely within the city limits. Primary land uses include extensive commercial development, with some residential development concentrated along the western portion of the sub-watershed (Figure 22). A summary of the Restoration Assessment outcomes for this sub-watershed is provided in Figure 23.



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SOURCE: City of Bellingham, 2013; ESRI, 2014

Figure 22

Recommended Restoration and Protection Actions in the Lower Spring Creek Sub-Watershed

Figure 23. Lower Spring Sub-watershed: HRTA Tier 1 Summary

Riverine Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 3)

Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Lower	Lower	Highest	Median	Lower	Higher

Wetland Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 4)

Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Lower	Median	Median	Lower	Higher	Median	Lower

Forest Existing Condition -Relative Functional Condition Ratings

(excerpt from Table 5)

Block ID Number	**Biodiversity Function Score**	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*		**Habitat Maintenance Function Score**	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
128	**Higher**	*Lower*	*Lower*	*Higher*		**Median**	*Median*	*Median*
129	**Median**	*Lowest*	*Median*	*Highest*		**Higher**	*Median*	*Highest*
130	**Median**	*Lowest*	*Highest*	*Higher*		**Lowest**	*Lowest*	*Lower*
131	**Lowest**	*Lowest*	*Higher*	*Lowest*		**Lower**	*Lowest*	*Lower*
133	**Lower**	*Median*	*Highest*	*Median*		**Lower**	*Lowest*	*Median*
134	**Highest**	*Higher*	*Higher*	*Highest*		**Highest**	*Highest*	*Higher*
135	**Lowest**	*Lower*	*Median*	*Lowest*		**Lower**	*Lower*	*Lower*

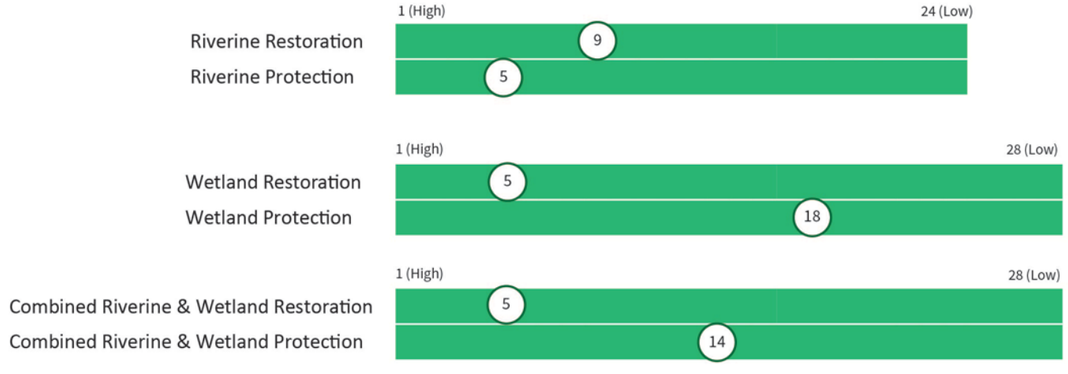
Preliminary Prioritization Rankings

(excerpt from Tables 15, 16, 18, and 19)

Riverine Restoration: #17 of 24
Riverine Protection: #5 of 24
Wetland Restoration: #12 of 28
Wetland Protection: #18 of 28

Secondary Prioritization Rankings (Relative Rank Score for Restoration and Protective Actions)

(excerpt from Tables 35,36, and 41)



Tier 1 Forest Blocks for Restoration: None
Tier 1 Forest Blocks for Protection: Block 134

6.7.1 Relevant Physical, Chemical, and Biological Conditions

Existing physical, chemical, and biological conditions within the sub-watershed relevant to the formulation of a restoration plan include the following:

- The stream flows through forested areas in the north part of the sub-watershed, but the lower sub-watershed consists of heavily developed commercial areas, including Bellis Fair Mall.
- Neither the mainstem of Spring Creek nor its tributaries are listed for 303(d) exceedences.
- Within the Lower Spring Creek Sub-watershed the documented presence of chum salmon, cutthroat trout, and steelhead extends to West Kellogg Road, while coho salmon presence extends upstream past the sub-watershed lower reaches of Spring Creek (WDFW, 2015a, b).

6.7.2 Review of Functional Assessment Results and Recommendations by Habitat Group

Riverine Habitat Group – Two of the functions had Relative Functional Condition Scores of high or highest (biodiversity maintenance and thermoregulation), one as median (habitat creation and maintenance), and the remainder as functioning lower (Figure 23 and Table 3). Based on a range of good to somewhat impaired existing conditions across the group of functions evaluated, the sub-watershed ranked as moderate for the implementation of restorative actions (Figure 23 and Table 35). The actions with the greatest potential for resulting in functional uplift are retrofit of stormwater facilities/implement LID program, and restoration of depressional wetlands (Table 41).

Wetland Habitat Group – With the exception of sediment and phosphorus removal, which had higher Relative Functional Condition Scores, the remaining six wetland functions scored as median (three) or lower (three), when compared to the other sub-watersheds in the Project Area. Overall, the wetlands appear to be functioning at a slightly impaired level (Figure and Table 4) and this Habitat Group was recommended for enhancement in the basin (Figure 23 and Table 35). However, the character of the sub-watershed has resulted in small, more isolated wetlands in the developed portion, and generally high functioning wetlands in the forested northeast portion of the sub-watershed. Therefore, the recommendations include a mix of protection of some existing wetland resources and enhancement of others.

Forest Habitat Group – Several scattered small forest blocks are located in the developed south portion of the basin, generally surrounded by moderate to heavy commercial and residential development. In addition, a large contiguous forest block (Forest Block 134) is located in the less-developed northern portion of the sub-watershed. The scattered smaller blocks had Relative Functional Condition Scores that ranged from low to high (Figure 23 and Table 5), and as such did not rank as high priorities for either restoration or protection, while the larger block had moderate to high Relative Functional Condition Scores, indicating a high priority for protection (Table 33).

6.7.3 Recommended Actions

Based on the results of the prioritization and interviews with local experts, the primary focus of riverine, wetland, and forest actions is primarily protective actions, with some wetland and stormwater

restorative actions that address water quality and flow. The main focus area for protection is the relatively intact forested area along the upper mainstem of Spring Creek, where forest and wetland protection and enhancement could maintain overall ecological integrity in the upper basin and benefit downstream functions in the more developed areas (Figure 15). This approach, supplemented with a wetland enhancement recommendation in the upper reaches of the West Fork Spring Creek, has the potential to also improve water quality and flow functions, while also providing valuable aquatic habitat refuge in a rapidly developing area.

Below is a list of general recommended actions. These recommendations are based on the final Comprehensive Prioritization; therefore, they are broad in nature. If the reader has a specific target function, these actions may not meet their needs and they should refer to the Preliminary Prioritization Rankings for guidance in identifying specific actions.

Forest, Riverine, and Wetland Habitat Recommendations (Figure 22)

Protection of Forest Block 134 – A significant portion of this large (over 1,000-acre) forest habitat block is located to the northeast of the Lower Spring Creek sub-watershed. Much of the Forest Block 134 within the Project Area includes undeveloped parcels dominated by moderately aged mixed forest, ranging from 5 to 35 acres in size with a variety of zoning, primarily residential and forest/timberland. In addition to the standard protection actions such as parcel acquisition and changes in regulatory policies, a potential protective measure would be the establishment of a forest conservation easement to protect existing forest land, with financial compensation to landowners for granting the easement that precludes development but allows for forestry activities. Although this approach may not maintain overall constant levels of function over time due to logging, the forest growth-harvest cycle would allow for the establishment of some functions on a periodic basis, which is not the case if the parcels are developed for urban uses. Protection recommendations are discussed under recommendations for the Baker Creek Tributary sub-watershed.

Wetland Protection (LSC-WP1) – A large wetland complex associated with Block 134 (Figure 22) currently supports numerous high quality forested wetlands that are associated with Spring Creek. This area consists of private parcels, with high-functioning wetlands at risk due to residential zoning, commercial zoning, and substantial growth in this area (V. Jackson, 2014). This wetland complex provides flow and water quality regulation functions for Spring Creek and also provides habitat heterogeneity within a key forested corridor. Recommendations include property acquisitions or regulatory protection to maintain existing wetland functions into the future. See the recommendations for BCT WP1, discussed under the Baker Creek Tributary sub-watershed.

Wetland Enhancement (LSC-WR1) – A large existing wetland complex is located at the headwaters for the West Fork Spring Creek, north of West Bakerview Road, between Aldrich Road and Palisade Way. This complex, consisting of emergent and scrub-shrub wetland, is located on nine privately owned parcels, all zoned commercial.

This area has potential for enhancement and potential expansion of existing headwater wetland area, through grading and planting with forest species to restore riparian and wetland functions in this reach.

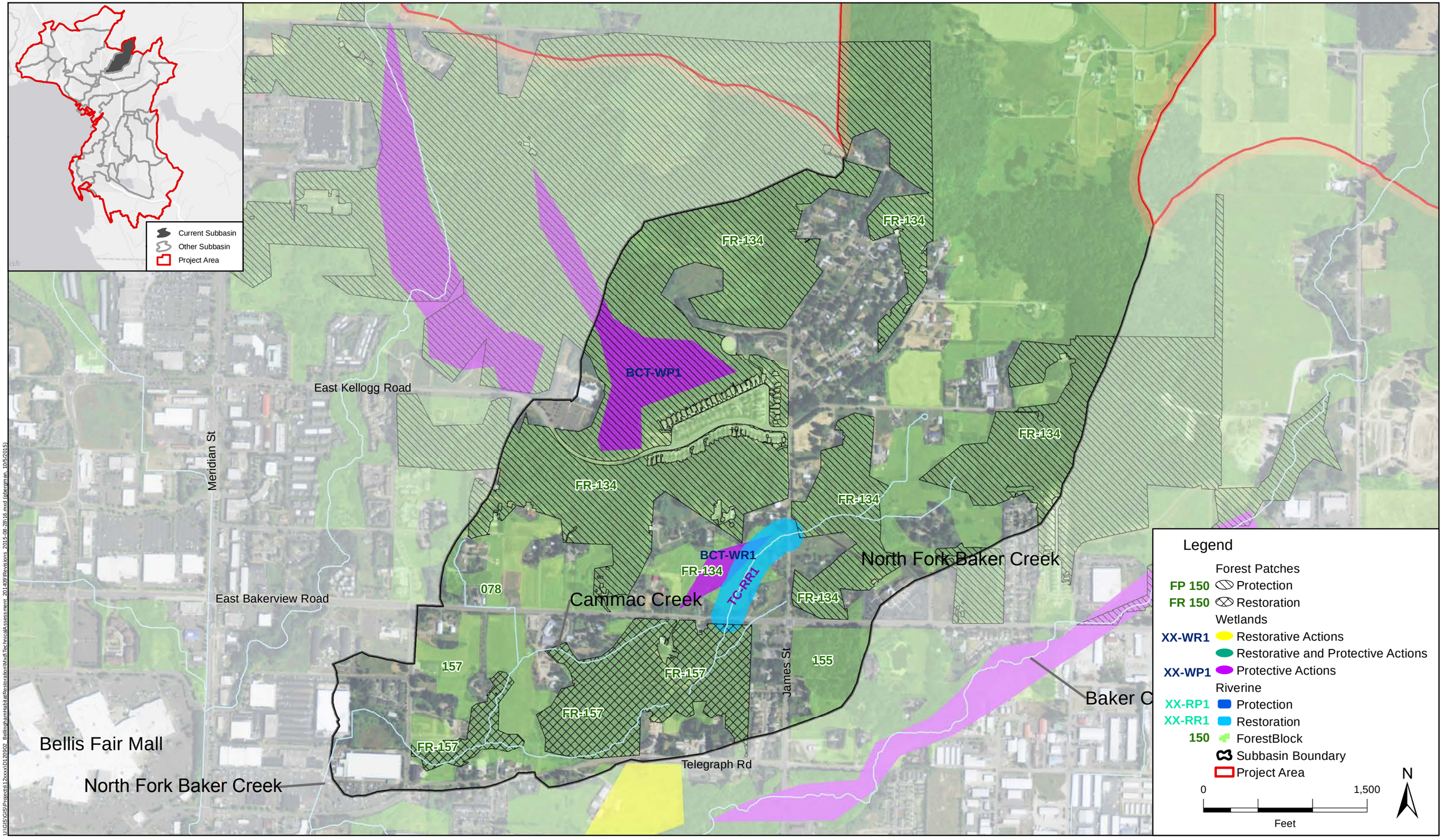
The net result of these actions has the potential to improve downstream water quality, provide flood storage, and help regulate downstream stream temperatures, in addition to providing wildlife habitat. The area has relatively high levels of development to the east and west, but protection of this area would help maintain natural open space connectivity to the north.

Water Quality and Flow Improvement Recommendations (Figure 22)

Improvement of stormwater infrastructure along Meridian Street and West Bakerview Road corridors would help to address both water quality and peak flow issues in Spring Creek and Squalicum Creek. Identified water quality and flow issues include runoff from impervious surfaces associated with businesses, parking lots, and roadways in this commercial center. Stormwater runoff from a substantial portion of the area currently lacks sufficient detention and treatment (Reilly, personal communication). Source control is recommended, supplemented with treatment and detention retrofit of suitable areas.

6.8 Baker Creek Tributary Sub-watershed

The Baker Creek Tributary sub-watershed, part of the larger Squalicum Creek watershed, is approximately 887 acres, of which approximately 545 acres (65%) is located within the Project Area (Figure 24). The sub-watershed includes approximately 2.7 stream miles, including Cammack and North Fork Baker Creeks, as well as approximately 88 acres of wetland. The sub-watershed is located entirely within the city limits. Primary land uses include residential and small-scale agriculture, with some commercial development concentrated near the mouth of the stream on the west side of the basin. A summary of the Restoration Assessment outcomes for this sub-watershed is provided in Figure 25.



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SOURCE: City of Bellingham, 2013; ESRI, 2014

Figure 24

Recommended Restoration and Protection Actions in the Baker Creek Tributary Sub-Watershed

Figure 25. Baker Creek Tributary Sub-watershed: HRTA Tier 1 Summary

Riverine Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 3)

Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Median	Median	Lowest	Lower	Lowest	Median

Wetland Existing Condition - Relative Functional Condition Ratings

(excerpt from Table 4)

Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Higher	Highest	Highest	Median	Higher	Higher	Higher

Forest Existing Condition -Relative Functional Condition Ratings

(excerpt from Table 5)

Block ID Number	**Biodiversity Function Score**	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*	**Habitat Maintenance Function Score**	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
134	**Highest**	*Higher*	*Higher*	*Highest*	**Highest**	*Highest*	*Higher*
157	**Lower**	*Median*	*Lowest*	*Median*	**Median**	*Lower*	*Median*

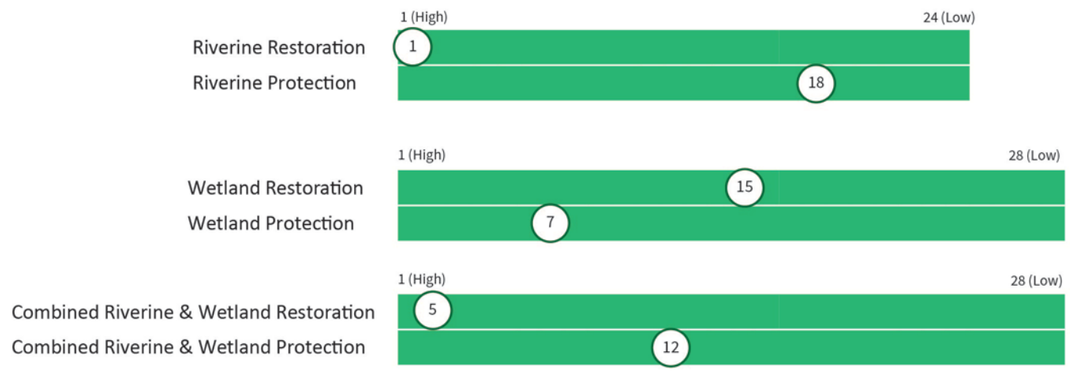
Preliminary Prioritization Rankings

(excerpt from Tables 15, 16, 18, and 19)

Riverine Restoration: #5 of 24
Riverine Protection: #22 of 24
Wetland Restoration: #22 of 28
Wetland Protection: #7 of 28

Secondary Prioritization Rankings (Relative Rank Score for Restoration and Protective Actions)

(excerpt from Tables 35,36, and 41)



Tier 1 Forest Blocks for Restoration: Block 157
Tier 1 Forest Blocks for Protection: Block 134

6.8.1 Relevant Physical, Chemical, and Biological Conditions

Existing physical, chemical, and biological conditions within the sub-watershed relevant to the formulation of a restoration plan include the following:

- The WDFW (2015b) fish database indicates coho salmon use of North Fork Baker Creek up to East Bakerview Road. However, a long series of downstream culverts (up to 1,500 feet in length) conveys the stream under a large commercial development on the east side of Meridian Street before discharging to the south in Baker Creek, potentially limiting fish passage.
- Although this sub-watershed does not contain any 303(d) listed waterbodies for exceedances, reported water quality issues include elevated stream temperatures and low dissolved oxygen (Vandersypen et al., 2006). These problems may be associated with agricultural land uses in the upper portions of the basin, upstream of the Project Area and outside City jurisdiction (V. Jackson, 2014).

6.8.2 Review of Functional Assessment Results and Recommendations by Habitat Group

Riverine Habitat Group – Of the six riverine functions evaluated, three functions had a Relative Functional Condition Score of low or lowest (biodiversity maintenance, chemical regulation, and habitat creation and maintenance), while the remaining three functions scored as median, as compared to the other sub-watersheds in the city (Figure 25 and Table 3). Based on moderate and slightly impaired existing conditions across the group of functions evaluated, the sub-watershed ranked high for restorative actions (Figure 23 and Table 35). The actions with the greatest potential for producing functional uplift, in order, are as follows: increased instream habitat complexity, armor removal, riparian buffer enhancement, retrofit of stormwater facilities, reconnection of floodplains, and increased in-channel habitat quantity.

Wetland Habitat Group – With the exception of the organic matter export/contribution function, which scored as moderate, the remaining six wetland functions were assessed as higher (four) or highest (two) Relative Functional Condition Scores as compared to the other sub-watersheds in the city (Figure 25 and Table 4). Because the wetlands appear to be generally functioning appropriately, protection of existing wetland resources is recommended for the Baker Creek Tributary sub-watershed (Figure 25 and Table 36).

Forest Habitat Group – Two larger forest habitat blocks are located in the sub-watershed, Block 134 and Block 157. Both of these habitat blocks were rated as Tier 1 Forest Blocks, one for restorative actions (Block 157) and one for protective actions (Block 134) (Figure 25 and Table 41).

6.8.3 Recommended Actions

Based on the results of the prioritization and interviews with local experts, the primary focus of riverine, wetland, and forest actions within the Baker Creek Tributary sub-watershed involve a combination of restorative and protective actions. Although instream restoration actions would create the largest amount of uplift, the two streams in the sub-watershed do not support large populations of protected

salmonids (Table 38). Therefore, restorative riverine actions that benefit known downstream issues (water quality and quantity) are recommended, including stormwater quality and quantity retrofit, and application of LID, floodplain creation (preferably also incorporating wetlands for flood storage and retention), and riparian enhancements. These actions are also complementary to wetland protection and forest enhancement /protection, which are also recommended.

Below is a list of general recommended actions. These recommendations are based on the final Comprehensive Prioritization; therefore, they are broad in nature. If the reader has a specific target function, these actions may not meet their needs and they should refer to the Preliminary Prioritization Rankings for guidance in identifying specific actions.

Forest, Riverine, and Wetland Habitat Recommendations (Figure 24)

North Fork Baker Creek Restoration (BCT-RR-1) – A primary opportunity for the creation of a functioning riparian zone and floodplain along North Fork Baker Creek is immediately northwest of the East Bakerview Road and James Street Road intersection (Figure 24). This area consists of three private parcels with degraded pasture habitat and a lack of vertical structure. This area would benefit from the installation of trees and large shrubs (willows, etc.) which could also be potentially combined with wetland creation in this area. These actions have the potential to improve downstream water quality and stream temperature, and if the installation of floodplain benches is included, the flood storage functions would likely also be improved.

Wetland Protection (BCT-WP-1) – A large wetland area associated with Block 134 (Figure 24) currently supports high quality wetlands that are associated with North Fork Baker Creek, as well as Spring Creek. This area consists of a variety of private parcels and wetlands. The residential zoning and commercial zoning create substantial potential for growth in this area. Important to flow and water quality regulation of North Fork Baker and Spring Creeks, this complex provides habitat heterogeneity within a key forested corridor. Recommendations include property acquisitions or regulatory protection to maintain existing wetland functions into the future.

Wetland Restoration (BCT-WR-1) – The degraded pasture area includes wetlands that would benefit from enhancement, including invasive species removal and planting with appropriate wetland shrubs and trees. Grading could increase wetland storage volume, hydrology, provide additional flood storage, and potentially serve as a floodplain bench in concert with stream enhancements.

Restoration of Forest Block 157 – This 45-acre block of mixed second-growth forest is located west of James Street, between East Bakerview Road and Telegraph Road. The Relative Functional Condition Score of this block was lower, indicating high potential for restoration. The block consists of about 12 acres of forest on a single private parcel with open space/agricultural zoning, with approximately nine additional residential parcels comprising the rest of the block.

Restoration actions would consist of removal of invasive species and interplanting of additional shade-tolerant conifer species. With restoration the block could provide a highly functioning riparian zone for

North Fork Baker Creek, and serve as a large, high-quality node in a north-south forested wildlife corridor.

Protection of Forest Block 134 – A significant portion of this large (over 1,000-acre) forest habitat block is located in the north and east parts of the Baker Creek Tributary sub-watershed. The forest is mixed in a mosaic with meadow or grass areas, and it appears as if large portions are dominated by conifers.

The block consists of multiple private parcels, most with residential zoning. Although it is likely not practical for the City to acquire the entire block because of cost considerations, recommendations include considering property acquisitions or regulatory protection, with a goal of creating and maintaining a contiguous wildlife corridor to both the north and south, with high quality existing second-growth forest. A thoughtful approach could balance future development with the maintenance of forest habitat through identification of specific key wildlife corridors that would be protected. In addition to providing wildlife habitat, this serves to intercept and infiltrate precipitation and help maintain streamflows in North Fork Baker and Spring Creeks.

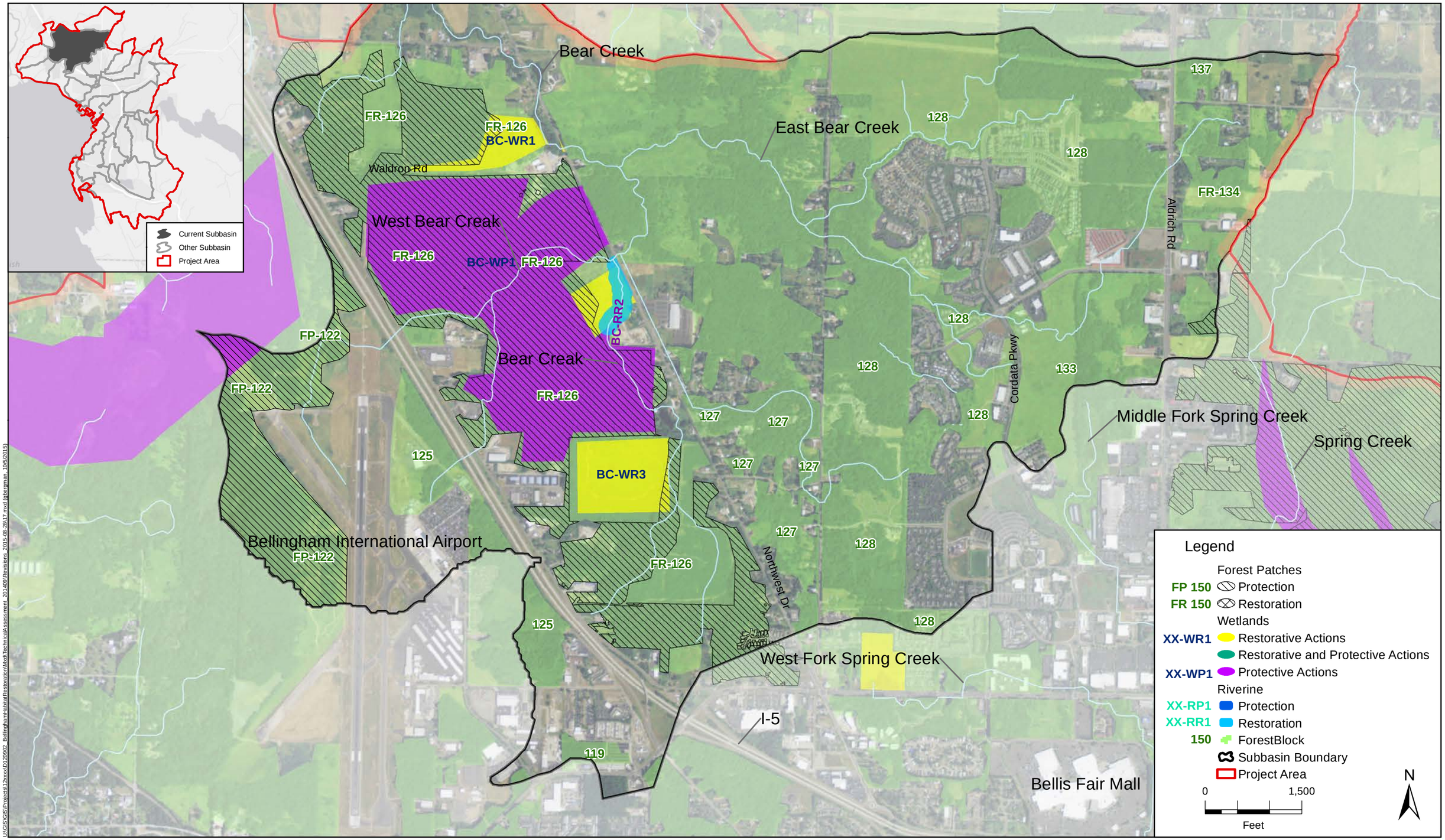
Water Quality and Flow Improvement Recommendations (Figure 24)

Residential development west of James Street and north of Kellogg Street has stormwater detention and treatment at the 1992 standards (B. Reilly, personal communication). This area could be retrofitted to current stormwater standards, potentially including shaded stormwater ponds or other detention and treatment facilities that do not increase downstream temperatures. An abandoned City water tank is located north of the James Street and Bakerview Avenue intersection, which could be repurposed to provide additional stormwater storage. Potentially, the tank system could also be designed to provide summertime flow augmentation, benefitting fish and aquatic life downstream in Baker, Spring, and Squalicum Creeks.

Also, a regional detention pond is located north of Telegraph Road. The pond was designed as a dry pond, but conversion to a wetpond would increase its water quality treatment function.

6.9 Bear Creek Sub-watershed

The Bear Creek sub-watershed, part of the larger Silver Creek watershed, is approximately 2,981 acres, of which approximately 80% is located within the Project Area. The sub-watershed includes approximately 13.3 stream miles, consisting of the entire Bear Creek drainage network including the mainstem, West Bear Creek, and East Bear Creek, as well as approximately 654 acres of NWI wetland area. The sub-watershed has high-density residential land use along the east portion of the basin, with the remainder of the basin consisting of low-density residential, low-intensity agriculture, forestry, and industrial (Bellingham International Airport) uses (Figure 16). A summary of the Restoration Assessment outcomes for this sub-watershed is provided in Figure 27.



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SOURCE: City of Bellingham, 2013; ESRI, 2014

Figure 26

Recommended Restoration and Protection Actions in the Bear Creek Sub-Watershed

Figure 27. Bear Creek Sub-watershed: HRTA Tier 1 Summary

Riverine Existing Condition - Relative Functional Condition Ratings
(excerpt from Table 3)

Flow Variation Function	Surface Storage Function	Biodiversity Maintenance	Habitat Creation and Maintenance	Chemical Regulation	Thermo-regulation
Lower	Highest	Median	Lower	Median	Higher

Wetland Existing Condition - Relative Functional Condition Ratings
(excerpt from Table 4)

Surface Water Storage	Nitrogen Removal	Pathogen Removal	Organic Matter Export/ Contribution	Sediment/ Phosphorus Removal	Wildlife Habitat	Carbon Sequestration
Higher	Highest	Higher	Higher	Highest	Highest	Median

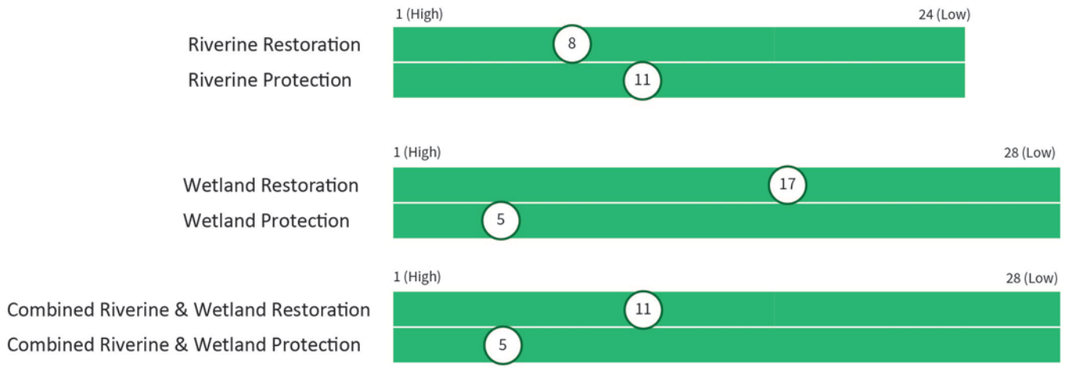
Forest Existing Condition -Relative Functional Condition Ratings
(excerpt from Table 5)

Block ID Number	**Biodiversity Function Score**	*System Maturity Attribute Score*	*Lifeform Diversity Attribute Score*	*Habitat Community Attribute Score*		**Habitat Maintenance Function Score**	*Habitat Connection and Fragmentation Attribute Score*	*Vegetation Structure Attribute Score*
119	**Median**	*Lowest*	*Median*	*Median*		**Median**	*Median*	*Higher*
125	**Lower**	*Lower*	*Lowest*	*Median*		**Lowest**	*Lowest*	*Lower*
126	**Higher**	*Lower*	*Higher*	*Higher*		**Higher**	*Higher*	*Higher*
127	**Higher**	*Lower*	*Lowest*	*Higher*		**Higher**	*Highest*	*Higher*
128	**Higher**	*Lower*	*Lower*	*Higher*		**Median**	*Median*	*Median*
133	**Lower**	*Median*	*Highest*	*Median*		**Lower**	*Lowest*	*Median*

Preliminary Prioritization Rankings
(excerpt from Tables 15, 16, 18, and 19)

Riverine Restoration: #16 of 24
Riverine Protection: #11 of 24
Wetland Restoration: #24 of 28
Wetland Protection: #5 of 28

Secondary Prioritization Rankings (Relative Rank Score for Restoration and Protective Actions)
(excerpt from Tables 35,36, and 41)



Tier 1 Forest Blocks for Restoration: None
Tier 1 Forest Blocks for Protection: None

6.9.1 Relevant Physical, Chemical, and Biological Conditions

Existing physical, chemical, and biological conditions within the sub-watershed relevant to the formulation of a restoration plan include the following:

- Fish species documented within Bear Creek and its tributaries include coho salmon and resident coastal cutthroat trout (WDFW, 2015a, b).
- A reach of Bear Creek, in the vicinity of Northwest Drive, is on the Ecology 303(d) list for fecal coliform, temperature, and dissolved oxygen (Ecology, 2008).

6.9.2 Review of Functional Assessment Results and Recommendations by Habitat Group

Riverine Habitat Group – Within the Bear Creek Watershed, high intensity development east of I-5 is reflected in the varying Relative Functional Condition Scores of the riverine functions. Two of the six functions scored as lower (habitat creation and maintenance and flow variation), two median, and two as higher and highest (thermoregulation and surface storage) (Figure 27 and Table 3). Based on this range of existing conditions across the group of functions evaluated, the sub-watershed ranked high for the implementation of restorative actions (Figure 27 and Table 35). However, upon further examination, only a few actions (instream habitat complexity and armor removal) showed potential for creating significant functional uplift. The high score for restoration potential was primarily based on a moderate increase in function as a result of implementing a full suite of all restoration actions. As such an approach is not expected to be feasible, some limited riverine habitat enhancements are recommended to be conducted in concert with wetland and forest actions, discussed below.

Wetland Habitat Group – With the exception of organic matter export/contribution, which had a median Relative Functional Condition Score, all remaining six wetland functions rated as higher (three) or highest (three), when compared to the other sub-watersheds in the Project Area (Figure 27 and Table 4). Overall, the wetlands appear to be highly functioning and therefore wetland protection ranks as high for the Bear Creek sub-watershed. In addition, several wetland enhancement actions are also recommended.

Forest Habitat Group – Located in the central and western portion of the sub-watershed are two large contiguous forest blocks (Blocks 122 and 126), as well as several other moderately sized forest blocks that are located either mostly outside the Project Area (Block 127) or along the western, more developed portions of the sub-watershed (Blocks 125 and 128). The larger forest blocks had Relative Functional Condition Scores that were generally high or highest, while the smaller blocks' attribute scores generally were at, or near, median (Figure 27 and Table 5). Therefore, the smaller blocks did not score as high for either restoration or protection, while the larger block scores resulted in a rating of high (Block 122) or moderate-high (Block 122) for protection.

6.9.3 Recommended Actions

Based on the results of the prioritization and interviews with local experts, the recommended focus is on forest and wetland protective actions, combined with wetland restorative actions. Riverine actions are

limited to those riparian enhancements that can be combined with the forest and wetland actions. The proposed approach has the potential to help maintain water quality and flow functions in Bear Creek and its tributaries, as well as provide valuable and varied wildlife habitat. This approach also has the potential to maintain a relatively intact forested corridor located between the city center and agricultural lands to the north, in an area that is currently showing development pressure.

Below is a list of general recommended actions. These recommendations are based on the final Comprehensive Prioritization; therefore, they are broad in nature. If the reader has a specific target function, these actions may not meet their needs and they should refer to the Preliminary Prioritization Rankings for guidance in identifying specific actions

Forest, Riverine, and Wetland Habitat Recommendations (Figure 26)

Protection of Forest Block 126 – This large forest habitat block is located entirely within the Bear Creek sub-watershed (Figure 17) and represents a significant portion of the undeveloped open space in the central portion of the drainage. Much of the block includes multiple undeveloped parcels dominated by young to moderately aged deciduous forest with intermixed wetland complexes in primarily private ownership, although the Port of Bellingham owns several large parcels. A variety of zoning exists within the block, including residential, industrial, and agriculture.

Although it is likely not practical for the City to acquire the entire corridor because of cost considerations, recommendations include considering property acquisitions or regulatory protection, with a goal of maintaining a contiguous forested wildlife corridor that provides north-south connectivity and contains functioning forested stream and wetlands within the corridor. Maximum effectiveness can be achieved through coordinating the specific locations of applied forest protection actions with wetland protection and enhancement locations (see below) and possible riparian buffer protection and enhancements on Bear Creek and West Bear Creek.

Protection of Forest Block 122 – A small portion of this large forest habitat block (680 acres) is located partially within the Bear Creek sub-watershed, with the majority of the block located in the Lost Creek and Fort Bellingham sub-watersheds. This mixed forest block, made up of what appears to be moderate-aged stands, also contains substantial wetland area. The area is mostly composed of a single parcel, owned by the Port of Bellingham. Protection of this forested area would also protect the associated wetlands, while maintaining an important north-south wildlife corridor that represents the larger contiguous open space between I-5 and the Nooksack River. Close coordination with the Port of Bellingham would be necessary to establish a conservation easement or some other pathway to protection. This approach may be feasible because this area is likely not suitable for some kinds of development due to Federal Aviation Administration height and clear distance regulations.

Wetland Protection (BC-WP1) – A large wetland complex is located within Block 126 (Figure 17) between I-5 and Northwest Drive. This forest area contains large beaver pond complexes and provides important water quality and water storage functions that benefit the headwaters to Bear Creek. The area has industrial and residential zoning and is experiencing increased growth. This assessment

recommends protection of these wetlands be considered in concert with forest protection described for Block 126.

Wetland and Stream Restoration (BC-WR1, 2, and 3; BC-RR1) – Three existing wetlands, contiguous with the large wetland complex recommended for restoration above, are located within Block 122. These wetlands are a combination of forested and emergent. Enhancement or expansion of these features has the potential to improve downstream water quality and provide flood storage, in addition to providing wildlife habitat for aquatic and terrestrial species.

The northernmost location where wetland enhancement is recommended (BC-WR1) is currently pasture land, consisting of two residential parcels. These wetlands, near the mainstem of Bear Creek, are pasture and could be enhanced to palustrine or scrub-shrub wetlands with appropriate native plantings, which would increase wildlife and water quality functions.

The second location for wetland enhancement is immediately west of Northwest Drive (BC-WR2), within two parcels: one that is City-owned (Parcel 380202179057), and one private parcel zoned residential (Parcel 380202222063). These parcels contain meadow wetlands with extensive ditches that drain the wetlands under existing conditions. These wetlands could be enhanced through filling of the ditches to restore hydrology and planting with native wetland forest vegetation. This area could be connected to an existing City mitigation area located immediately to the north.

In addition to enhancement of wetland, a portion of Bear Creek flows through the eastern part of the Project Area. The riverine habitat in this area would likely benefit from enhancement of riparian buffers, as well as creation and enhancement of floodplain areas. Because this area appears to be low gradient and relatively flat, the creation of off-channel or side-channel areas may also be appropriate.

The third location for wetland enhancement (BC-WR3) also contains two parcels, one that is City-owned and one private parcel zoned industrial. These parcels contain scrub-shrub wetlands degraded by extensive coverage with invasive species. These wetlands could be enhanced through clearing and planting with native wetland forest vegetation.

7.0 Future Applications

The Restoration Assessment can be used for a variety of applications. The following is a list of potential applications:

- The assessment can assist City departments, technical specialists, environmental groups, and the general public in selecting the most effective type of **action (restoration, protection, etc.)** within a specific area. For example, the assessment can be used to determine whether restorative or protective actions are more appropriate to achieve ecological uplift within a sub-watershed. Furthermore, the assessment identifies which specific restorative actions may be most effective in achieving maximum uplift. Such information may be useful in situations where the assessment users have interest in a specific geographic area.
- The assessment can assist City departments, technical specialists, environmental groups, and the general public in selecting the most suitable and effective **area for a particular type of action**.
- The assessment can assist City departments, technical specialists, environmental groups, and the general public in identifying sub-watersheds capable **of broad improvement over multiple Habitat Groups**.
- The assessment can help guide planning and site-selection efforts for effective **landscape-level restoration**.
- The assessment could be used as the foundation for a **mitigation program** (e.g., in-lieu fee program) by informing site selection and mitigation actions.
- The assessment also provides useful information on **existing ecological conditions**, which could be beneficial when administering or updating City environmental regulations, such as the Critical Areas Ordinance, Shoreline Master Program, or local zoning code.
- The assessment identifies **data gaps**, helping inform future data collection efforts. Specifically, this assessment identifies data gaps in forest connectivity, stand composition and structure, and forest species composition, as well as data to better characterize meadow and shrub habitat. This additional data could be used to further refine the assessment.
- The assessment can be used as the science-based foundation for a full **Habitat Restoration Master Plan**. This would involve incorporating social factors such as specific potential threats (risk), feasibility (land ownership, access, specific costs), and community values.

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ATTACHMENT A: FUNCTIONAL ASSESSMENT AND PRELIMINARY PRIORITIZATION: DATA AND ANALYSIS TABLES

Table A-1. Characterization of Riverine Habitat Group Attribute Measures and Results of Measure Screening

= Measure/Function will be Utilized in Analyis

= Measure/Function will be Utilized in Analyis if Data is Available

				Attribute Measure Criteria							
				Data Availablity			Data Analysis Protocol	Direct Measure	Repeatability	Sensitivity	
Riverine Function Name	Attribute Measure Name	Attribute Measure Description	Attribute Scale	*Existing GIS Layer for Attribute Curently in Project Database*	*Additional GIS Layers to Consider For Analysis*	*Data Type (Qualitative, Categorical, or Quantitative)*	*A data analysis protocol exists or can be readily adapted for the measure*	*Is measure direct measure of function, or if direct measure is impractical, is measure semi-direct (proxy for the function)?*	*Any two assessment teams would arrive at similar analysis results*	*Attribute should be sensitive to changes resulting from most common restoration actions at the scale of the restoration actions and within project timeframes*	**Measure Selected as Appropriate for Assessing Existing For Describing the associated function, or specific attributes of the function**
Flow Variation	Contributing Basin Impervious Area	Percent impervious surface within contributing basin	Sub/watershed and watershed	Yes		Categorical	Yes	Semi-direct	Yes	Yes	Yes
	Contributing Basin Forested Area	Percent forest cover within contributing basin	Sub/watershed and watershed	Yes		Categorical	Yes	Semi-direct	Yes	Yes	Yes
Surface Storage	Area of floodplain/stream length	FEMA mapped floodplain area	sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Extent of confinement/development within the floodplain	Percent of stream with levees, dikes, or other channel confinements	Sub/watershed	No - but if not available, can estimate by floodplain relation to development edges and stream slopes and/or SHIAP confinement	Identified levees, dikes, or channel confinement in project area, SHIAP data	Categorical	Yes	Semi-direct	Yes	Yes	Yes
	Area of wetlands plus lakes/sub-basin	Percent of the contributing basin in wetland/lake area	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
Sub/surface Transfer	Groundwater recharge	Course grained/land use/sub-basin	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	No	No
		Course grained/stream/sub-basin	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	No	No
Biodiversity Maintenance	Fish species structure and composition	Fish biodiversity index	Sub/watershed	Some - PHS data	City fish use/distribution data	Categorical	Yes	Direct	Yes	Yes	Yes
	Aquatic species connectivity	Number of and type (total blockage, partial blockage) of fish passage barriers (culverts, dams, etc.) within and downstream of the sub-basin	Sub/watershed	Some - WDFW barrier inventory data	Confluence data on culvert inventory	Categorical				Yes	Yes
	Benthic Invertebrate Community Structure and Function	B-IBI scores	Sub/watershed	No	Get B-IBI data from Renee	Categorical	Yes	Direct	Yes	Yes	Yes if data available
	Riparian species composition	Percent cover in riparian and floodplain zones of trees, shrubs, and herbaceous.	Sub/watershed	CCMP data	1) Vegetation catagories/classes	Categorical	Yes	Semi-direct	Yes	Yes	Yes if data available
	Riparian wildlife biodiversity	Riparian biodiversity index	Sub/watershed	Some - WDFW wildlife PHS data, Nakheeta data	City wildlife data or other reports	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
Habitat Creation and Maintenance	LWD Recruitment Potential	Presence of non-native species	Sub/watershed	No	1)City wildlife data or other reports, 2)State or local invasive species databases	Qualitative	Yes	Semi-direct	Yes	Yes	Yes if data available
		Type and cover of vegetation class, i.e.(tree, shrub, and herbaceous in riparian zone; relative distribution, sub-basin average. Also potentially differentiate among early and late successional species within tree/shrub, herbaceous class	Sub/watershed	Yes	1) Vegetation categories, 2) LIDAR for veg height, 3) Veg height, 4) Veg species data, other???	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Instream structure	LWD Frequency and Size	Sub/watershed	No	Reports listing LWD frequencies - likely not all subbasins	Categorical	Yes	Direct	Yes	Partial	Yes if data available
	Bank erosion/unstable banks	Percent of unstable banks	Sub/watershed	No	Bank instability locations and/or reports listing specific problems - likely not all subbasins			Direct		Yes	Yes if data available
	Off-channel or inline habitat features	Presence and quantity of floodplains, side-channels, oxbows, lakes, ponds, or riparian wetlands	Sub/watershed	Yes	May need to combine surface water and riparian wetland areas	Categorical	Yes	Semi-direct	Yes	No	Yes
	Bank armoring/hardening	Percent of bank length stabilized and/or contained in levees	Sub/watershed	No - but if not available, can estimate by floodplain relation to development edges and stream slopes and/or SHIAP confinement	Identified levees, dikes, or channel confinement in project area, SHIAP data	Categorical	Yes	Semi-direct	Yes	Yes	Yes
Chemical Regulation	Runoff Interception and Infiltration	Density of Stormwater Outfalls	Sub/watershed	No	City Storm Utility Datalayers	Categorical	Yes	Semi-direct	Yes	Yes	Yes
		Acres of riparian wetland associated with stream feature	Sub/watershed	Yes - NWI and City wetland layers		Categorical	Yes	Semi-direct	Yes	Yes	Yes
	Pollutant sources	Percent impervious area within sub-basin	Sub/watershed	Yes		Categorical	Yes	Semi-direct	Yes	No	Yes
		Listing on 303(d) list as pollutant impaired or waters of concern	Sub/watershed	Yes	City WQ datalayer and/or monitoring report data	Qualitative		Direct	Yes	Yes	Yes
		Intersection of stream/riparian zone with residential and agricultural land uses	Sub/watershed	Yes		Categorical		Semi-direct	Yes	No	Yes
Thermo-regulation	Riparian shade and cover	Type and cover of vegetation class, i.e.(tree, shrub, and herbaceous in riparian zone; relative distribution, sub-basin average. Also potentially differentiate among early and late successional species within tree/shrub, herbaceous class	Sub/watershed	Yes	1) Vegetation catagories, 2) LIDAR for veg height, 3) Veg height, 4) Veg species data, other???	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Water temperature	Ecology 303(d) temperature and DO listings	Sub/watershed	Yes	City WQ datalayer and/or monitoring report data	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
		Stream temperature	Sub/watershed	No	City stream temperature datalayer and/or monitoring report data	Categorical	YEs	Direct	Yes	Yes	Yes if data available

A *1) Qualitative (e.g., High, Medium and Low degree of function), 2) Categorical (Discreet) Quantitative and requires measurement of each attribute according to established protocol. The range of values is segmented into some number of classes developed from literature, research, and from expert input, and 3) Quantitative - This assessment requires measurement of absolute values for each attribute and does not segment the range of values. Unique and project-specific assessment protocol may be warranted and may require research or assessment protocol development.*

Table A-2. Characterization of Wetland Habitat Group Attribute Measures and Results of Measure Screening

= Measure/Function will be Utilized in Analyis

= Measure/Function will be Utilized in Analyis if Data is Available

Wetland Function Name	Attribute Measure Name	Attribute Measure Description	Attribute Scale	Attribute Measure Criteria							Measure selected as appropriate for assessing existing for describing the associated function, or specific attributes of the function
				Data Availablity			Data Analysis Protocol	Direct Measure	Repeatability	Sensitivity	
				Existing GIS Layer for Attribute Curently in Project Database	*Additional GIS Layers to Consider For Analysis*	*Data Type (Qualitative, Categorical, or Quantitative)*	*A data analysis protocol exists or can be readily adapted for the measure*	*Is measure direct measure of function, or if direct measure is impractical, is measure semi-direct (proxy for the function)?*	*Any two assessment teams would arrive at similar analysis results*	*Attribute should be sensitive to changes resulting from most common restoration actions at the scale of the restoration actions and within project timeframes*	
Surface Water Storage (incl. groundwater recharge)	Storage volume	Percent acreage of wetland compared to subbasin based on NWI mapped wetlands	Sub/watershed	Yes, for size	Potenital of using Lidar/other togpography for wetland depth	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Wetland location	Proximity to a river or stream	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Moderate	Yes
	Upstream storage potential	Presence/absence of storage areas (lakes, wetlands) upstream of wetland	subwatershed or catchment	Yes, may need to use catchments	Catchment data layer	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Water regime	Cowardin water regimes: temporarily flooded, saturated, seasonally flooded, semi-permanently flooded, permanently flooded, artificially flooded. NWI mapped polygons	Sub/watershed	Yes		Categorical	Yes	Semi-direct	Yes	Moderate	Yes
Nitrogen Removal	Soil Type	NRCS soil classifications for organic soils	Sub/watershed	Yes	City WQ data layer and/or monitoring report data	Categorical	Yes	Semi-direct	Yes	Low to Moderate	Yes
	Wetland buffer width	Width of vegetated corridor adjacent to wetland	Sub/watershed	Yes for extent of vegetation cover types		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Groundcover density	Density of herbaceous vegetation based on cover classes	Sub/watershed	No	Herbaceous cover data	Qualitative	Yes	Semi-direct	Yes	No	Yes, if data available
Pathogen Removal	Vegetative condition	Type and percent of vegetation classes in wetland	Sub/watershed	Yes, general classes exist	Higer resolution vegetation data	Qualitative	Yes	Semi-direct	Yes	Yes	Yes, if data available
	Water regimes	Cowardin water regimes: temporarily flooded, saturated, seasonally flooded, semi-permanently flooded, permanently flooded, artificially flooded. NWI mapped polygons	Sub/watershed	Yes		Categorical	Yes	Semi-direct	Yes	Moderate	Yes
	Wetland buffer width	Width of vegetated corridor adjacent to wetland	Sub/watershed	Yes for extent of vegetation cover types		Categorical	Yes	Semi-direct	Yes	Yes	Yes
Organic Matter Export/Contribution	Vegetative condition	Type and percent of vegetation classes in wetland	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes, if data available
	Hydrologic input/output	Connectivity/proximity to other surface water systems	Sub/watershed	Yes - in case of streams	City drainage maps	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
Sediment/Phosphorus Removal	Hydrologic input/output	Connectivity/proximity to other surface water systems	Sub/watershed	Yes - in case of streams	City drainage maps	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Soil type	NRCS soil classifications for organic and/or clay soils	Sub/watershed	Yes		Categorical	Yes	Semi-direct	Yes	Low to Moderate	Yes
	Vegetative condition	Type and percent of vegetation classes	Sub/watershed	Yes		Categorical	Yes	Semi-direct	Yes	Yes	Yes
Biodiversity Maintenance	Species diversity	Biodiversity index	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Connectivity	connectivity index (combination of interspersion of roads, development, etc)	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Vegetation structure and composition	Type and percent of vegetation classes	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
Wildlife Habitat	Vegetation structure and composition	Type and percent of vegetation classes	Sub/watershed	Yes for extent of vegetation cover types		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Connectivity	Connection of a wetland area to another via vegetated corridor.	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
		Width of corridor and size of connecting wetland.	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Size	Size of wetland and proximity to developed vs. undeveloped lands	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
Thermoregulation	Vegetation structure and composition	Type and percent of cover classes	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
		Outlet to stream or riparian wetland	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Evaporation capacity	Vegetation cover type and height or percent cover of vegetation cover classes.	Sub/watershed	No	Lidar data for vegetation height	Qualititative	Yes	Semi-direct	Yes	Yes	Yes, if data available
Carbon Sequestration	Bog/Fen vs. other	Known bogs/fens within project boundary area.	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	No	No
	Vegetation cover	Percent cover of vegetation in wetland	Sub/watershed	Yes		Qualitative	Yes	Semi-direct	Yes	Yes	Yes

1) Qualitative (e.g., High, Medium and Low degree of function), 2) Categorical (Discreet) Quantitative and requires measurement of each attribute according to established protocol. The range of values is segmented into some number of classes developed from literature, research, and from expert input, and 3) Continuous quantitative - This assessment requires measurement of absolute values for each attribute and does not segment the range of values. Unique and project-specific assessment protocol may be warranted and may require research or assessment protocol development.

Table A-3. Characterization of Upland Forest Habitat Group Attribute Measures and Results of Measure Screening

= Measure/Function will be Utilized in Analyis

= Measure/Function will be Utilized in Analyis if Data is Available

				Attribute Measure Criteria							
				Data Availablity			Data Analysis Protocol	Direct Measure	Repeatability	Sensitivity	Measure Selected as Appropriate for Assessing Existing For Describing the associated function, or specific attributes of the function
Upland Forest Function Name	**Attribute Measure Name**	**Attribute Measure Description**	**Attribute Scale**	*Existing GIS Layer for Attribute Curently in Project Database*	*Data Type (Qualitative, Categorical, or Quantitative)*	*Additional GIS Layers to Consider For Analysis*	*A data analysis protocol exists or can be readily adapted for the measure*	*Is measure direct measure of function, or if direct measure is impractical, is measure semi-direct (proxy for the function)?*	*Any two assessment teams would arrive at similar analysis results*	*Attribute should be sensitive to changes resulting from most common restoration actions at the scale of the restoration actions and within project timeframes*	
Biodiversity Maintenance	Wildlife species structure and composition	Species biodiversity index	Major habitat patch	City GIS Data, Nakeeta NW data, WA state GAP analysis data	Categorical	Xmas bird count lists or other reports	Yes	Direct	Yes	Yes	Yes
	Habitat connectivity	Road density (miles of road per habitat block), Developed area (area per habitat block); connectivity index (combines continuity, quality of connection, number of connections)	Major habitat patch	City GIS Data, Nakeeta NW data, WA state GAP analysis data, aerial photographs	Categorical		Partially	Some direct, connectivity index would be based on direct indicators	Yes	Yes	Yes
	Forest structure and composition	Vegetation diversity index:(Percent forest cover, size of patch (acres), habitat features, canopy age (coniferous vs deciduous), edge affect (edge to area ratio))	Major habitat patch	Percent cover: City forest cover data, Nakheeta NW data; aerial photographs	Categorical and quantative	Digitized patches and corridors and habitat edge ratios.	Yes	Vegetation diveristy index would be based on direct indicators	Yes	Yes	Yes
		Presence of Non-native species	Major habitat patch	Some vegetation data; random wildlife data	qualatative	Some data available through noxious weed board, and possibly DNR Natural Heritage Program and/orWDFW	Yes	Direct	Yes	Yes	Yes if data available
	Habitat biodiversity	Habitat biodiversity index (number of habitat types per polygon, PHS species/habitats)	Major habitat patch	Some - WDFW wildlife PHS data, Nakheeta data	Qualitative	City wildlife data or other reports	Limited	Semi-direct	Yes	Yes	Yes
Habitat Creation and Maintenance	Forest structure and composition	Vegetation diversity index:(Percent forest cover, size of patch (acres), habitat features, canopy age (coniferous vs deciduous), edge affect (edge to area ratio))	Major habitat patch	Percent cover: City forest cover data, Nakheeta NW data; aerial photographs	Categorical	Digitized patches and corridors and habitat edge ratios.	Yes	Vegetation diveristy index would be based on direct indicators	Yes	Yes	Yes
		Presence of Non-native species	Major habitat patch	Some vegetation data; random wildlife data	Categorical	Some data available through noxious weed board, and possibly DNR Natural Heritage Program and/orWDFW	Yes	Direct	Yes	Yes	Yes if data available
	Habitat features	Snag and downed wood frequency and size	Major habitat patch	No	Qualitative		Yes	No	Yes	Yes	No
	Habitat connectivity	Road density (miles of road per acre), distance between patch areas	Major habitat patch	Some - City GIS Data, Nakeeta NW data, but would require manipulation	Qualitative		Yes	Yes	Yes	Yes	Yes
	Forest structure and composition	Vegetation diversity index:(Percent forest cover, size of patch (acres), habitat features, canopy age (coniferous vs deciduous), edge affect (edge to area ratio))	Major habitat patch	Percent cover: City forest cover data, Nakheeta NW data; aerial photographs	Categorical	Digitized patches and corridors and habitat edge ratios	Yes	Semi-direct	Yes	Yes	Yes
		Presence of Non-native species	Major habitat patch	Some vegetation data; random wildlife data	Categorical	Some data available through noxious weed board, and possibly DNR Natural Heritage Program and/orWDFW	Yes	Semi-direct	Yes	Yes	Yes if data available

Upland Forest Function Name	Attribute Measure Name	Attribute Measure Description	Attribute Scale	Attribute Measure Criteria							Measure Selected as Appropriate for Assessing Existing For Describing the associated function, or specific attributes of the function
				Data Availablity			Data Analysis Protocol	Direct Measure	Repeatability	Sensitivity	
				Existing GIS Layer for Attribute Curently in Project Database	*Data Type (Qualitative, Categorical, or Quantitative)*	*Additional GIS Layers to Consider For Analysis*	*A data analysis protocol exists or can be readily adapted for the measure*	*Is measure direct measure of function, or if direct measure is impractical, is measure semi-direct (proxy for the function)?*	*Any two assessment teams would arrive at similar analysis results*	*Attribute should be sensitive to changes resulting from most common restoration actions at the scale of the restoration actions and within project timeframes*	
Sustain Trophic Structure	Habitat features	Snag and downed wood frequency and size	Major habitat patch	No	Qualitative		Yes	Semi-direct	Yes	Yes	No
	Wildlife species structure and composition	Species biodiversity index	Major habitat patch	City GIS Data, Nakeeta NW data, WA state GAP analysis data	Categorical	Xmas bird count lists or other reports	Yes	Direct	Yes	Yes	Yes
Nutrient Cycling and Soil Development	Forest structure and composition	Vegetation diversity index:(Percent forest cover, size of patch (acres), habitat features, canopy age (coniferous vs deciduous), edge affect (edge to area ratio))	Major habitat patch	Percent cover: City forest cover data, Nakheeta NW data; aerial photographs	Categorical	Digitized patches and corridors and habitat edge ratios	Yes	Semi-direct	Yes	Yes	Yes
Thermo-regulation	Forest structure and composition	Vegetation diversity index:(Percent forest cover, size of patch (acres), habitat features, canopy age (coniferous vs deciduous), edge affect (edge to area ratio))	Major habitat patch	Percent cover: City forest cover data, Nakheeta NW data; aerial photographs	Categorical	Digitized patches and corridors and habitat edge ratios	Yes	Semi-direct	Yes	Yes	Yes
Water Quality and Quanity	Forest structure and composition	Vegetation diversity index:(Percent forest cover, size of patch (acres), habitat features, canopy age (coniferous vs deciduous), edge affect (edge to area ratio))	Major habitat patch	Percent cover: City forest cover data, Nakheeta NW data; aerial photographs	Categorical	Digitized patches and corridors and habitat edge ratios	Yes	Semi-direct	Yes	Yes	Yes
	Soil type	NRCS soil survey, class A and B soils	Major habitat patch	Yes - NRCS soils maps	Categorical		Yes	Semi-direct	Yes	Yes	Yes
	Soil drainage	NRCS soil survey, class A and B soils	Major habitat patch	Yes - NRCS soils maps	Qualitative		Yes	Yes	Yes	No	Yes
	Contributing basin impervious area	Percent impervious surface within contributing basin	Sub/watershed where habitat patch located	Yes	Categorical		Yes	Semi-direct	Yes	Yes	Yes

1) Qualitative (e.g., High, Medium and Low degree of function), 2) Categorical (Discreet) Quantitative and requires measurement of each attribute according to established protocol. The range of values is segmented into some number of classes developed from literature, research, and from expert input, and 3) Quantitative - This assessment requires measurement of absolute values for each attribute and does not segment the range of values. Unique and project-specific assessment protocol may be warranted and may require research or assessment protocol development.

Table A-4. Characterization of Upland Meadow/Shrub Habitat Group Attribute Measures and Results of Measure Screening

= Measure/Function will be Utilized in Analyis

= Measure/Function will be Utilized in Analyis if Data is Available

				Attribute Measure Criteria							
				Data Availablity			Data Analysis Protocol	Direct Measure	Repeatability	Sensitivity	
Meadow/Shrub Function Name	Attribute Measure Name	Attribute Measure Description	Attribute Scale	*Existing GIS Layer for Attribute Curently in Project Database*	*Additional GIS Layers For Analysis*	*Data Type (Qualitative, Categorical, or Quantitative)*	*A data analysis protocol exists or can be readily adapted for the measure*	*Is measure direct measure of function, or if direct measure is impractical, is measure semi-direct (proxy for the function)?*	*Any two assessment teams would arrive at similar analysis results*	*Attribute should be sensitive to changes resulting from most common restoration actions at the scale of the restoration actions and within project timeframes*	**Measure Selected as Appropriate for Assessing Existing For Describing the associated function, or specific attributes of the function**
Biodiversity Maintenance	Wildlife species structure and composition	Species biodiversity index	Major habitat unit	City GIS Data, Nakeeta NW data, WA state GAP analysis data	Xmas bird count lists or other reports	Categorical	Yes	Direct	Yes	Yes	Yes
	Habitat connectivity	Road density (miles of road per habitat block), Developed area (area per habitat block); connectivity index (combines continuity, quality of connection, number of connections)	Major habitat unit	City GIS Data, Nakeeta NW data, WA state GAP analysis data, aerial photographs		Categorical	Partially	Some direct, connectivity index would be based on direct indicators	Yes	Yes	Yes
	Habitat biodiversity	Habitat biodiversity index (number of habitat types per polygon, PHS species/habitats)	Major habitat unit	Some - WDFW wildlife PHS data, Nakheeta data	City wildlife data or other reports	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
Habitat Creation and Maintenance	Vegetation community structure and composition	Presence of non-native species, disturbance (mowed, tilled, fallow), herbaceous vs shrub	Major habitat unit	Vegetation data; some assortedwildlife data	1) Vegetation catagories/classes	Qualitative	Yes	Semi-direct	Yes	Yes	Yes
	Habitat features	Snag and downed wood frequency and size	Major habitat unit	No		Categorical	Yes	No	Yes	Yes	Yes if data available
	Habitat connectivity	Road density (miles of road per habitat block), Developed area (area per habitat block); connectivity index (combines continuity, quality of connection, number of connections)	Major habitat unit	City GIS Data, Nakeeta NW data, WA state GAP analysis data, aerial photographs		Categorical	Partially	Some direct, connectivity index would be based on direct indicators	Yes	Yes	No
Sustain Trophic Structure	Vegetation community structure and composition	Presence of non-native species	Major habitat unit	No	City WQ datalayer and/or monitoring report data	Qualitative	Yes	Semi-direct		Yes	Yes
	Habitat features	Snag and downed wood frequency and size	Major habitat unit	No		Qualitative	Yes	No		Yes	No
	Wildlife species structure and composition	Species biodiversity index	Major habitat unit	City GIS Data, Nakeeta NW data, WA state GAP analysis data	Xmas bird count lists or other reports	Categorical	Yes	Direct	Yes	Yes	Yes
Nutrient Cycling and Soil Development	Community structure and composition	Percent vegetation cover, size of patch (acres), edge affect (edge to area ratio), habitat features	Major habitat unit	Percent cover: City data, Nakheeta NW data; distance between patches		Qualitative	Yes	Semi-direct		Yes	Yes
Water Quality and Quantity	Soil drainage	NRCS soil survey, class A and B soils	Major habitat unit	yes		Categorical	yes		Yes	No	Yes
	Contributing basin impervious surface area	Percent impervious surface within contributing basin	Sub/watershed where habitat patch located	Yes		Categorical	Yes	Semi-direct	Yes	Yes	Yes

1) Qualitative (e.g., High, Medium and Low degree of function), 2) Categorical (Discreet) Quantitative and requires measurement of each attribute according to established protocol. The range of values is segmented into some number of classes developed from literature, research, and from expert input, and 3) Quantitative - This assessment requires measurement of absolute values for each attribute and does not segment the range of values. Unique and project-specific assessment protocol may be warranted and may require research or assessment protocol development.

Table A-5. Preliminary Prioritization Results and Scores for the Riverine Habitat Group Ranked from Highest to Lowest Priority

Increase In-Channel Habitat Quantity		Floodplain Reconnection		Restore Depressional Wetlands		Increase Instream Habitat Complexity		Remove Armor	
Sub-watershed By Priority	**Score**	**Sub-watershed By Priority**	**Score**	**Sub-watershed By Priority**	**Score**	**Sub-watershed By Priority**	**Score**	**Sub-watershed By Priority**	**Score**
Silver Creek Tributary #2	22	Silver Creek Tributary #2	30	Lower Whatcom Creek	15	Little Squalicum Creek	20	Little Squalicum Creek	15
Alderwood Creek	20	Little Squalicum Creek	28	Hannah Creek	12	Silver Creek Tributary #2	20	Silver Creek Tributary #2	15
Little Squalicum Creek	20	Alderwood Creek	27	Lower Spring Creek	12	Alderwood Creek	18	Alderwood Creek	14
Baker Creek Tributary	19	Baker Creek Tributary	27	Lower Toad Creek	12	Baker Creek Tributary	18	Baker Creek Tributary	13
Fever Creek	19	Fever Creek	26	Upper Padden Creek	12	Fever Creek	16	Fever Creek	12
Lost Creek	17	Lower Padden Creek	25	Fever Creek	11	Bear Creek	14	Lost Creek	12
Lower Padden Creek	17	Hannah Creek	24	Little Squalicum Creek	11	Lake Padden	14	Bear Creek	11
Lower Whatcom Creek	17	Connelly Creek	23	Lower Baker Creek	11	Lincoln Creek	14	Lincoln Creek	10
Connelly Creek	16	Lower Baker Creek	23	Lower Padden Creek	11	Lost Creek	14	Lower Padden Creek	10
Hannah Creek	16	Lower Toad Creek	23	Alderwood Creek	10	Lower Padden Creek	14	Silver Creek Tributary #1	10
Lincoln Creek	16	Lower Whatcom Creek	23	Cemetery Creek	10	Connelly Creek	12	Fort Bellingham	9
Lower Baker Creek	16	Lincoln Creek	22	Connelly Creek	10	Hannah Creek	12	Hannah Creek	9
Fort Bellingham	15	Lost Creek	20	Silver Creek Tributary #2	10	Lower Baker Creek	12	Lake Padden	9
Lower Toad Creek	15	Silver Creek Tributary #1	19	Baker Creek Tributary	9	Silver Creek Tributary #1	12	Lower Baker Creek	9
Silver Creek Tributary #1	15	Upper Padden Creek	19	Chuckanut Creek	9	Fort Bellingham	10	Connelly Creek	8
Bear Creek	14	Bear Creek	18	Lincoln Creek	9	Lower Toad Creek	10	Lower Spring Creek	7
Lower Spring Creek	13	Cemetery Creek	18	Lower Squalicum Creek	7	Spokane Creek	10	Lower Toad Creek	7
Lower Squalicum Creek	13	Lake Padden	18	Silver Creek Tributary #1	7	Lower Spring Creek	8	Lower Whatcom Creek	7
Cemetery Creek	12	Lower Spring Creek	18	Bear Creek	6	Lower Squalicum Creek	8	Spokane Creek	7
Lake Padden	12	Fort Bellingham	17	Fort Bellingham	5	Lower Whatcom Creek	8	Lower Squalicum Creek	6
Upper Padden Creek	11	Lower Squalicum Creek	17	Spokane Creek	5	Upper Padden Creek	8	Upper Padden Creek	5
Spokane Creek	10	Chuckanut Creek	15	Upper Whatcom Creek	5	Cemetery Creek	6	Cemetery Creek	4
Chuckanut Creek	9	Spokane Creek	15	Lost Creek	4	Chuckanut Creek	6	Chuckanut Creek	4
Upper Whatcom Creek	6	Upper Whatcom Creek	9	Lake Padden	3	Upper Whatcom Creek	4	Upper Whatcom Creek	3

Table A-5 (continued). Preliminary Prioritization Results and Scores for the Riverine Habitat Group Ranked from Highest to Lowest Priority

Enhance Riparian Buffer		Retrofit Stormwater Facilities		Implement LID Program		Permanent Buffer Protection		Protect Through Regulatory Change	
Sub-watershed By Priority	Score	Sub-watershed By Priority	Score	Sub-watershed By Priority	Score	Sub-watershed By Priority	Score	Sub-watershed By Priority	Score
Silver Creek Tributary #2	31	Lower Whatcom Creek	30	Lower Whatcom Creek	20	Upper Whatcom Creek	35	Upper Whatcom Creek	20
Baker Creek Tributary	29	Fever Creek	27	Fever Creek	17	Chuckanut Creek	33	Chuckanut Creek	19
Fever Creek	29	Connelly Creek	24	Connelly Creek	16	Upper Padden Creek	31	Upper Padden Creek	18
Alderwood Creek	28	Lincoln Creek	24	Lincoln Creek	15	Spokane Creek	29	Spokane Creek	17
Connelly Creek	26	Lower Baker Creek	23	Lower Baker Creek	15	Lower Spring Creek	26	Cemetery Creek	14
Lincoln Creek	26	Alderwood Creek	22	Alderwood Creek	14	Cemetery Creek	25	Lower Spring Creek	14
Little Squalicum Creek	26	Baker Creek Tributary	22	Baker Creek Tributary	14	Lower Toad Creek	24	Lower Toad Creek	14
Lost Creek	24	Lower Spring Creek	22	Lower Padden Creek	14	Hannah Creek	23	Hannah Creek	13
Lower Padden Creek	24	Lower Padden Creek	21	Lower Spring Creek	14	Lake Padden	22	Lake Padden	13
Fort Bellingham	23	Silver Creek Tributary #2	21	Silver Creek Tributary #2	14	Silver Creek Tributary #1	22	Silver Creek Tributary #1	13
Lower Baker Creek	23	Little Squalicum Creek	19	Cemetery Creek	13	Bear Creek	21	Bear Creek	12
Lower Whatcom Creek	23	Lower Squalicum Creek	19	Lower Squalicum Creek	13	Lower Squalicum Creek	21	Lower Squalicum Creek	12
Bear Creek	21	Cemetery Creek	18	Fort Bellingham	12	Fort Bellingham	19	Fort Bellingham	11
Lower Squalicum Creek	21	Fort Bellingham	18	Hannah Creek	12	Lower Baker Creek	19	Lost Creek	11
Lake Padden	20	Bear Creek	17	Little Squalicum Creek	12	Lower Whatcom Creek	19	Little Squalicum Creek	10
Silver Creek Tributary #1	20	Hannah Creek	17	Lower Toad Creek	12	Lost Creek	18	Lower Baker Creek	10
Hannah Creek	19	Lower Toad Creek	16	Bear Creek	10	Lower Padden Creek	18	Lower Padden Creek	10
Lower Toad Creek	18	Silver Creek Tributary #1	15	Silver Creek Tributary #1	10	Connelly Creek	16	Lower Whatcom Creek	10
Cemetery Creek	17	Lost Creek	13	Lost Creek	9	Lincoln Creek	16	Connelly Creek	9
Lower Spring Creek	16	Upper Padden Creek	12	Upper Padden Creek	9	Little Squalicum Creek	16	Lincoln Creek	9
Spokane Creek	13	Chuckanut Creek	9	Chuckanut Creek	7	Alderwood Creek	14	Alderwood Creek	8
Upper Padden Creek	11	Lake Padden	9	Lake Padden	6	Baker Creek Tributary	13	Baker Creek Tributary	7
Chuckanut Creek	9	Spokane Creek	7	Spokane Creek	5	Fever Creek	13	Fever Creek	7
Upper Whatcom Creek	7	Upper Whatcom Creek	7	Upper Whatcom Creek	5	Silver Creek Tributary #2	11	Silver Creek Tributary #2	7

Table A-6. Preliminary Prioritization Results and Scores for the Wetland Habitat Group Ranked from Highest to Lowest Priority

Restore Wetland And Buffer		Enhance Wetland And Buffer		Permanent Protection		Regulatory Protection	
Sub-Watershed By Priority	**Score**	**Sub-Watershed By Priority**	**Score**	**Sub-Watershed By Priority**	**Score**	**Sub-Watershed By Priority**	**Score**
Lower Whatcom Creek	53	Lower Whatcom Creek	29	Spokane Creek	52	Spokane Creek	24
Squalicum Harbor	53	Squalicum Harbor	29	Chuckanut Creek	51	Chuckanut Creek	23
Central Bellingham	51	Central Bellingham	28	Upper Whatcom Creek	48	Upper Whatcom Creek	23
Little Squalicum Creek	50	Little Squalicum Creek	28	Bear Creek	46	Cemetery Creek	22
Alderwood Creek	48	Alderwood Creek	26	Cemetery Creek	46	Bear Creek	21
South Bellingham	44	South Bellingham	24	Lower Squalicum Creek	46	Lower Squalicum Creek	21
North Lower Squalicum	42	North Lower Squalicum	24	Baker Creek Tributary	44	Baker Creek Tributary	20
Lincoln Creek	41	Lower Padden Creek	23	Hannah Creek	43	Hannah Creek	20
Lower Padden Creek	41	Lower Toad Creek	23	Silver Creek Tributary #2	43	Lake Padden	20
Lower Toad Creek	41	Lincoln Creek	22	Lake Padden	42	Silver Creek Tributary #1	19
Connelly Creek	39	Connelly Creek	22	Lower Baker Creek	42	Lower Baker Creek	18
Fort Bellingham	38	Lower Spring Creek	21	Silver Creek Tributary #1	42	Silver Creek Tributary #2	18
Lower Spring Creek	38	Fort Bellingham	20	Lost Creek	37	Lost Creek	17
Upper Padden Creek	35	Fever Creek	19	Fever Creek	32	Fever Creek	15
Fever Creek	34	Upper Padden Creek	19	Upper Padden Creek	31	Upper Padden Creek	15
Lost Creek	29	Lost Creek	15	Fort Bellingham	28	Connelly Creek	13
Lake Padden	24	Lower Baker Creek	14	Lower Spring Creek	28	Fort Bellingham	12
Lower Baker Creek	24	Hannah Creek	13	Connelly Creek	27	Lincoln Creek	12
Silver Creek Tributary #1	24	Lake Padden	13	Lincoln Creek	25	Lower Padden Creek	12
Hannah Creek	23	Silver Creek Tributary #2	13	Lower Padden Creek	25	Lower Spring Creek	12
Silver Creek Tributary #2	23	Silver Creek Tributary #1	13	Lower Toad Creek	25	North Lower Squalicum	11
Baker Creek Tributary	22	Baker Creek Tributary	12	North Lower Squalicum	24	Lower Toad Creek	10
Bear Creek	20	Cemetery Creek	11	South Bellingham	22	South Bellingham	10
Cemetery Creek	20	Bear Creek	11	Alderwood Creek	18	Alderwood Creek	8
Lower Squalicum Creek	20	Lower Squalicum Creek	11	Little Squalicum Creek	16	Little Squalicum Creek	7
Upper Whatcom Creek	18	Upper Whatcom Creek	10	Central Bellingham	15	Lower Whatcom Creek	6
Chuckanut Creek	15	Chuckanut Creek	9	Lower Whatcom Creek	13	Squalicum Harbor	6
Spokane Creek	14	Spokane Creek	8	Squalicum Harbor	13	Central Bellingham	5

Table A-7. Preliminary Prioritization Results and Scores for the Forest Habitat Group Ranked from Highest to Lowest Priority

Habitat Restoration Actions for the Forest Habitat Group							
Restore Forest		**Enhance Forest**		**Permanent Protection of Forest**		**Forest Protection through Regulatory Means**	
Block Number by Priority	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**
153	126	153	80	007	156	007	58
032A	122	032A	72	004	152	052	58
171	120	101	72	142	152	004	56
099	118	108	72	052	148	142	56
125	116	171	72	006	148	006	56
037	114	192	72	134	144	134	54
069	114	012	68	011	140	011B	54
131	114	089A	68	122	140	011	52
178	114	099	68	143	136	122	50
108	112	100	68	148	136	143	50
081A	108	069	64	011B	132	148	50
078	106	090	64	002	132	002	48
101	106	125	64	060	128	060	48
192	106	135	64	009	128	141	48
135	104	178	64	141	124	003	46
090	102	035	60	003	124	009	44
100	102	037	60	126	120	126	44
165	102	076	60	151	116	151	44
016	100	081A	60	146	116	034	44
056	98	111	60	147	116	146	42
111	98	113	60	042	116	043	42
130	98	123	60	043	112	138	42
150	98	124	60	138	112	140	42
157	98	131	60	140	112	179	42
005	94	150	60	179	108	052A	42
032	94	016	56	127	108	089A	42
133	94	032	56	034	104	147	40
041	92	034	56	052A	104	013	40
120	92	056	56	013	104	112	40
012	90	078	56	112	104	121	40

Habitat Restoration Actions for the Forest Habitat Group							
Restore Forest		**Enhance Forest**		**Permanent Protection of Forest**		**Forest Protection through Regulatory Means**	
Block Number by Priority	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**
155	88	120	56	121	104	123	40
113	86	121	56	149	104	042	38
123	86	155	56	129	104	127	38
114	84	157	56	024	100	024	38
011A	80	158	56	089	100	089	38
040	80	005	52	072	100	076	38
068	80	013	52	073	100	158	38
073	80	041	52	137	100	035	38
128	80	068	52	089A	96	124	38
158	80	114	52	076	96	149	36
035	78	165	52	158	96	072	36
074	78	011A	48	074	96	073	36
089A	78	040	48	116	96	074	36
119	78	052A	48	075	96	041	36
124	78	072	48	123	92	113	36
024	76	089	48	035	92	120	36
052A	76	128	48	124	92	116	34
116	76	179	48	068	92	068	34
072	74	024	44	119	92	005	34
075	74	060	44	041	88	056	34
076	74	074	44	113	88	111	34
112	74	127	44	120	88	129	32
034	72	130	44	133	88	075	32
089	70	138	44	011A	88	119	32
149	70	073	40	128	88	133	32
013	68	075	40	005	84	012	32
043	68	112	40	114	84	078	32
140	68	116	40	040	84	137	30
129	66	119	40	056	80	011A	30
151	66	133	40	111	80	128	30
179	66	140	40	012	80	114	30
146	64	141	40	032	80	032	30

Habitat Restoration Actions for the Forest Habitat Group							
Restore Forest		**Enhance Forest**		**Permanent Protection of Forest**		**Forest Protection through Regulatory Means**	
Block Number by Priority	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**
121	62	002	36	130	80	081A	30
137	62	011B	36	078	76	090	30
138	62	043	36	155	76	100	30
147	62	149	36	081A	72	192	30
126	56	151	36	090	72	130	28
127	56	003	32	100	72	135	28
003	54	042	32	150	72	040	26
011B	54	052	32	165	72	155	26
042	54	126	32	192	68	150	26
141	50	137	32	135	68	101	26
009	48	006	28	016	68	165	24
060	46	011	28	157	68	016	24
148	46	134	28	101	64	131	24
002	42	143	28	131	60	099	24
143	40	146	28	099	56	157	22
011	38	147	28	171	52	171	22
052	36	009	24	108	52	108	20
122	36	129	24	037	52	032A	20
134	36	148	24	069	52	037	16
006	34	004	20	178	52	069	16
004	30	122	20	032A	48	178	16
142	30	142	20	125	48	153	16
007	28	007	16	153	40	125	14

Table A-8. Preliminary Prioritization Results and Scores for the Meadow/Shrub Habitat Group Ranked from Highest to Lowest Priority

Restore Meadow		Enhance Meadow		Permanent Protection of Meadow		Meadow Protection through Regulatory Means	
Block Number by Priority	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**
041	117	003	58	002	123	002	52
003	100	011	58	003	60	003	27
132	98	041	58	004	167	004	67
150	98	130	58	006	140	006	67
153	95	125	53	011	100	011	47
125	93	076	52	022	80	022	23
130	93	150	52	039	90	039	28
076	92	155	52	040	127	040	50
108	90	126	47	041	33	041	13
155	87	108	43	052	157	052	62
120	83	149	42	060	143	060	62
111	82	114	40	068	110	068	45
157	82	132	40	072	123	072	52
158	82	157	40	073	130	073	52
022	80	158	40	076	63	076	25
108A	80	006	38	101	93	101	37
101	77	118	37	108	80	108	37
118	77	120	37	108A	80	108A	23
133	77	151	37	111	83	111	32
039	75	153	37	113	103	113	42
114	75	002	35	114	90	114	35
123	73	072	35	118	93	118	40
113	72	111	35	120	87	120	37
011	70	137	35	122	143	122	62
124	68	123	33	123	87	123	30
151	67	124	33	124	97	124	35
068	65	127	33	125	67	125	30
178	63	068	30	126	107	126	47
126	63	122	30	127	110	127	42
149	58	140	30	128	127	128	47
127	55	040	28	130	67	130	30
040	53	073	28	132	57	132	18

Restore Meadow		Enhance Meadow		Permanent Protection of Meadow		Meadow Protection through Regulatory Means	
Block Number by Priority	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**	**Block Number by Priority**	**Score**
002	52	133	28	133	93	133	33
072	52	138	28	134	147	134	57
137	52	178	28	137	123	137	52
140	52	060	25	138	120	138	47
138	50	101	25	140	123	140	52
006	50	113	25	142	160	142	67
073	45	022	22	149	117	149	52
128	43	108A	22	150	57	150	22
060	42	128	22	151	113	151	50
122	42	134	22	153	70	153	28
134	33	142	18	155	73	155	30
142	30	039	17	157	83	157	32
052	28	004	12	158	83	158	32
004	23	052	12	178	107	178	40

ATTACHMENT B: SECONDARY PRIORITIZATION DATA AND ANALYSIS TABLES

Table B-1. Prioritized Overall Restoration Priority Scores of Riverine Habitat Units (with sub-watersheds that have less of a chance of recovery, removed from list) for Restorative and Protective Actions

Sub-watershed	Ranked Score of Summed Riverine Restorative Actions
BAKER CREEK TRIBUTARY	151
LITTLE SQUALICUM CREEK	151
LOWER PADDEN CREEK	136
LOWER BAKER CREEK	132
HANNAH CREEK	121
LOST CREEK	113
LOWER TOAD CREEK	113
BEAR CREEK	111
LOWER SPRING CREEK	110
FORT BELLINGHAM	109
SILVER CREEK TRIBUTARY #1	108
LOWER SQUALICUM CREEK	104
CEMETERY CREEK	98
LAKE PADDEN	91
UPPER PADDEN CREEK	87
SPOKANE CREEK	72
CHUCKANUT CREEK	68
UPPER WHATCOM CREEK	46

Sub-watershed	Ranked Score of Summed Riverine Protective Actions
UPPER WHATCOM CREEK	55
CHUCKANUT CREEK	52
UPPER PADDEN CREEK	49
SPOKANE CREEK	46
LOWER SPRING CREEK	40
CEMETERY CREEK	39
LOWER TOAD CREEK	38
HANNAH CREEK	36
LAKE PADDEN	35
SILVER CREEK TRIBUTARY #1	35
BEAR CREEK	33
LOWER SQUALICUM CREEK	33
FORT BELLINGHAM	30
LOST CREEK	29
LOWER BAKER CREEK	29
LOWER PADDEN CREEK	28
LITTLE SQUALICUM CREEK	26
BAKER CREEK TRIBUTARY	20

Table B-2. Prioritized Overall Restoration Priority Scores of Wetland Habitat Units (with sub-watersheds that have less of a chance of recovery, removed from list) for Restorative and Protective Actions

Sub-watershed	Ranked Score of Summed Wetland Restorative Actions
LOWER PADDEN CREEK	64
LOWER TOAD CREEK	64
LINCOLN CREEK	63
CONNELLY CREEK	61
LOWER SPRING CREEK	59
FORT BELLINGHAM	58
UPPER PADDEN CREEK	54
FEVER CREEK	53
LOST CREEK	44
LOWER BAKER CREEK	38
LAKE PADDEN	37
SILVER CREEK TRIBUTARY #1	37
HANNAH CREEK	36
SILVER CREEK TRIBUTARY #2	36
BAKER CREEK TRIBUTARY	34
CEMETERY CREEK	31
BEAR CREEK	31
LOWER SQUALICUM CREEK	31
UPPER WHATCOM CREEK	28
CHUCKANUT CREEK	24
SPOKANE CREEK	22

Sub-watershed	Ranked Score of Summed Wetland Protective Actions
SPOKANE CREEK	76
CHUCKANUT CREEK	74
UPPER WHATCOM CREEK	71
CEMETERY CREEK	68
BEAR CREEK	67
LOWER SQUALICUM CREEK	67
BAKER CREEK TRIBUTARY	64
HANNAH CREEK	63
LAKE PADDEN	62
SILVER CREEK TRIBUTARY #1	61
SILVER CREEK TRIBUTARY #2	61
LOWER BAKER CREEK	60
LOST CREEK	54
FEVER CREEK	47
UPPER PADDEN CREEK	46
CONNELLY CREEK	40
FORT BELLINGHAM	40
LOWER SPRING CREEK	40
LINCOLN CREEK	37
LOWER PADDEN CREEK	37
LOWER TOAD CREEK	35

Table B-3. Prioritized Overall Restoration Priority Scores of Forest Habitat Units (with Forest Blocks that have less of a chance of recovery, removed from list) for Restorative and Protective Actions

Forest Block ID Number	Ranked Score of Summed Forest Restorative Actions
069	178
178	178
192	178
037	174
100	170
090	166
078	162
012	158
150	158
157	154
165	154
032	150
120	148
005	146
089A	146
113	146
123	146
041	144
155	144
130	142
035	138
124	138
114	136
158	136
076	134
133	134
068	132
011A	128
034	128
040	128
128	128
052A	124
072	122
074	122
013	120

Forest Block ID Number	Ranked Score of Summed Forest Protective Actions
007	214
004	208
142	208
052	206
006	204
134	198
011	192
122	190
011B	186
143	186
148	186
002	180
060	176
009	172
141	172
003	170
126	164
151	160
146	158
147	156
042	154
043	154
138	154
140	154
179	150
034	148
052A	146
127	146
013	144
112	144
121	144
149	140
024	138
089	138
089A	138

Forest Block ID Number	Ranked Score of Summed Forest Restorative Actions
024	120
073	120
089	118
119	118
121	118
116	116
075	114
112	114
179	114
140	108
138	106
149	106
043	104
151	102
127	100
137	94
146	92
011B	90
060	90
129	90
141	90
147	90
126	88
003	86
042	86
002	78
009	72
148	70
052	68
143	68
011	66
134	64
006	62
122	56
004	50
142	50
007	44

Forest Block ID Number	Ranked Score of Summed Forest Protective Actions
072	136
073	136
129	136
076	134
158	134
074	132
123	132
035	130
116	130
124	130
137	130
075	128
068	126
041	124
113	124
119	124
120	124
133	120
005	118
011A	118
128	118
114	114
012	112
032	110
040	110
078	108
130	108
090	102
100	102
155	102
150	98
192	98
165	96
157	90
037	68
069	68
178	68

Table B-4. Prioritized Overall Restoration Priority Scores of Meadow/Shrub Habitat Units (with Meadow/Shrub Blocks that have less of a chance of recovery, removed from list) for Restorative and Protective Actions

Block ID Number	Sum of All Scores for all Restorative Actions
130	152
155	138
011	128
157	122
158	122
111	117
114	115
118	113
126	110
123	107
133	105
151	103
022	102
108A	102
124	102
101	102
149	100
113	97
068	95
039	92
178	92
127	88
006	88
002	87
072	87
137	87
040	82
140	82
138	78
073	73
122	72
060	67
128	65
134	55
142	48
052	40
004	35

Block ID Number	Sum of All Scores for all Protective Actions
004	233
142	227
052	218
006	207
122	205
060	205
134	203
073	182
040	177
002	175
072	175
137	175
140	175
128	173
149	168
138	167
151	163
068	155
126	153
127	152
011	147
178	147
113	145
118	133
124	132
101	130
133	127
114	125
039	118
123	117
157	115
158	115
111	115
155	103
022	103
108A	103
130	97

Table B-5. Highest Priority Riverine Restoration Actions by Sub-watershed (not including all sub-watersheds excluded during Secondary Prioritization).

Sub-watershed	In-Channel Habitat Quantity	Floodplain Reconnect	Restore Depressional Wetlands	Instream Habitat Complexity	Remove Armor	Riparian Buffer	Retrofit Stormwater Facilities	Implement LID Program	Permanent Buffer Protection	Protect Buffer Through Regulatory Change
BAKER CREEK TRIBUTARY	X	X		X	X	X	X	X		
BEAR CREEK				X	X					
CEMETERY CREEK								X	X	X
CHUCKANUT CREEK									X	X
FORT BELLINGHAM						X				
HANNAH CREEK	X	X	X							
LAKE PADDEN				X						
LITTLE SQUALICUM CREEK	X	X	X	X	X	X	X			
LOST CREEK	X			X	X	X				
LOWER BAKER CREEK	X	X	X			X	X	X		
LOWER PADDEN CREEK	X	X	X	X	X	X	X	X		
LOWER SPRING CREEK			X				X	X	X	X
LOWER SQUALICUM CREEK						X	X	X		
LOWER TOAD CREEK		X	X							X
SILVER CREEK TRIBUTARY #1					X					
SPOKANE CREEK									X	X
UPPER PADDEN CREEK			X						X	X
UPPER WHATCOM CREEK									X	X

Table B-6. Riverine Habitat Ranked Prioritization by Restoration Action (not including all sub-watersheds excluded during Secondary Prioritization)

Highest Priority Riverine Sub-watersheds High Priority Riverine Sub-watersheds

Sub-watershed	In-Channel Habitat Quantity	Sub-watershed	Floodplain Reconnect	Sub-watershed	Restore Depressional Wetlands	Sub-watershed	Instream Habitat Complexity	Sub-watershed	Remove Armor
LITTLE SQUALICUM CREEK	20	LITTLE SQUALICUM CREEK	28	HANNAH CREEK	12	LITTLE SQUALICUM CREEK	20	LITTLE SQUALICUM CREEK	15
BAKER CREEK TRIBUTARY	19	BAKER CREEK TRIBUTARY	27	LOWER SPRING CREEK	12	BAKER CREEK TRIBUTARY	18	BAKER CREEK TRIBUTARY	13
LOST CREEK	17	LOWER PADDEN CREEK	25	LOWER TOAD CREEK	12	BEAR CREEK	14	LOST CREEK	12
LOWER PADDEN CREEK	17	HANNAH CREEK	24	UPPER PADDEN CREEK	12	LAKE PADDEN	14	BEAR CREEK	11
HANNAH CREEK	16	LOWER BAKER CREEK	23	LITTLE SQUALICUM CREEK	11	LOST CREEK	14	LOWER PADDEN CREEK	10
LOWER BAKER CREEK	16	LOWER TOAD CREEK	23	LOWER BAKER CREEK	11	LOWER PADDEN CREEK	14	SILVER CREEK TRIBUTARY #1	10
FORT BELLINGHAM	15	LOST CREEK	20	LOWER PADDEN CREEK	11	HANNAH CREEK	12	FORT BELLINGHAM	9
LOWER TOAD CREEK	15	SILVER CREEK TRIBUTARY #1	19	CEMETERY CREEK	10	LOWER BAKER CREEK	12	HANNAH CREEK	9
SILVER CREEK TRIBUTARY #1	15	UPPER PADDEN CREEK	19	BAKER CREEK TRIBUTARY	9	SILVER CREEK TRIBUTARY #1	12	LAKE PADDEN	9
BEAR CREEK	14	BEAR CREEK	18	CHUCKANUT CREEK	9	FORT BELLINGHAM	10	LOWER BAKER CREEK	9
LOWER SPRING CREEK	13	CEMETERY CREEK	18	LOWER SQUALICUM CREEK	7	LOWER TOAD CREEK	10	LOWER SPRING CREEK	7
LOWER SQUALICUM CREEK	13	LAKE PADDEN	18	SILVER CREEK TRIBUTARY #1	7	SPOKANE CREEK	10	LOWER TOAD CREEK	7
CEMETERY CREEK	12	LOWER SPRING CREEK	18	BEAR CREEK	6	LOWER SPRING CREEK	8	SPOKANE CREEK	7
LAKE PADDEN	12	FORT BELLINGHAM	17	FORT BELLINGHAM	5	LOWER SQUALICUM	8	LOWER SQUALICUM CREEK	6
UPPER PADDEN CREEK	11	LOWER SQUALICUM CREEK	17	SPOKANE CREEK	5	UPPER PADDEN CREEK	8	UPPER PADDEN CREEK	5
SPOKANE CREEK	10	CHUCKANUT CREEK	15	UPPER WHATCOM CREEK	5	CEMETERY CREEK	6	CEMETERY CREEK	4
CHUCKANUT CREEK	9	SPOKANE CREEK	15	LOST CREEK	4	CHUCKANUT CREEK	6	CHUCKANUT CREEK	4
UPPER WHATCOM CREEK	6	UPPER WHATCOM CREEK	9	LAKE PADDEN	3	UPPER WHATCOM CREEK	4	UPPER WHATCOM CREEK	3

Table B-6 (continued). Riverine Habitat Ranked Prioritization by Restoration Action (not including all sub-watersheds excluded during Secondary Prioritization).

Sub-watershed	Riparian Buffer	Sub-watershed	Retrofit Stormwater Facilities	Sub-watershed	Implement LID Program	Sub-watershed	Permanent Buffer Protection	Sub-watershed	Protect Through Regulatory Change
BAKER CREEK TRIBUTARY	29	LOWER BAKER CREEK	23	LOWER BAKER CREEK	15	UPPER WHATCOM CREEK	35	UPPER WHATCOM CREEK	20
LITTLE SQUALICUM CREEK	26	BAKER CREEK TRIBUTARY	22	BAKER CREEK TRIBUTARY	14	CHUCKANUT CREEK	33	CHUCKANUT CREEK	19
LOST CREEK	24	LOWER SPRING CREEK	22	LOWER PADDEN CREEK	14	UPPER PADDEN CREEK	31	UPPER PADDEN CREEK	18
LOWER PADDEN CREEK	24	LOWER PADDEN CREEK	21	LOWER SPRING CREEK	14	SPOKANE CREEK	29	SPOKANE CREEK	17
FORT BELLINGHAM	23	LITTLE SQUALICUM CREEK	19	CEMETERY CREEK	13	LOWER SPRING CREEK	26	CEMETERY CREEK	14
LOWER BAKER CREEK	23	LOWER SQUALICUM CREEK	19	LOWER SQUALICUM CREEK	13	CEMETERY CREEK	25	LOWER SPRING CREEK	14
BEAR CREEK	21	CEMETERY CREEK	18	FORT BELLINGHAM	12	LOWER TOAD CREEK	24	LOWER TOAD CREEK	14
LOWER SQUALICUM CREEK	21	FORT BELLINGHAM	18	HANNAH CREEK	12	HANNAH CREEK	23	HANNAH CREEK	13
LAKE PADDEN	20	BEAR CREEK	17	LITTLE SQUALICUM CREEK	12	LAKE PADDEN	22	LAKE PADDEN	13
SILVER CREEK TRIBUTARY #1	20	HANNAH CREEK	17	LOWER TOAD CREEK	12	SILVER CREEK TRIBUTARY #1	22	SILVER CREEK TRIBUTARY #1	13
HANNAH CREEK	19	LOWER TOAD CREEK	16	BEAR CREEK	10	BEAR CREEK	21	BEAR CREEK	12
LOWER TOAD CREEK	18	SILVER CREEK TRIBUTARY #1	15	SILVER CREEK TRIBUTARY #1	10	LOWER SQUALICUM CREEK	21	LOWER SQUALICUM CREEK	12
CEMETERY CREEK	17	LOST CREEK	13	LOST CREEK	9	FORT BELLINGHAM	19	FORT BELLINGHAM	11
LOWER SPRING CREEK	16	UPPER PADDEN CREEK	12	UPPER PADDEN CREEK	9	LOWER BAKER CREEK	19	LOST CREEK	11
SPOKANE CREEK	13	CHUCKANUT CREEK	9	CHUCKANUT CREEK	7	LOST CREEK	18	LITTLE SQUALICUM CREEK	10
UPPER PADDEN CREEK	11	LAKE PADDEN	9	LAKE PADDEN	6	LOWER PADDEN CREEK	18	LOWER BAKER CREEK	10
CHUCKANUT CREEK	9	SPOKANE CREEK	7	SPOKANE CREEK	5	LITTLE SQUALICUM CREEK	16	LOWER PADDEN CREEK	10
UPPER WHATCOM CREEK	7	UPPER WHATCOM CREEK	7	UPPER WHATCOM CREEK	5	BAKER CREEK TRIBUTARY	13	BAKER CREEK TRIBUTARY	7

Table B-7. Wetland Habitat Ranked Prioritization by Restoration Action (not including all sub-watersheds excluded during Secondary Prioritization).

Highest Priority Wetland Sub-watersheds

High Priority Wetland Sub-watersheds

Sub-watershed	Restore Wetland and Buffer	Sub-watershed	Enhance Wetland and Buffer	Sub-watershed	Permanent Protection – Acquisition	Sub-watershed	Perm Protection – Regulatory Methods
LINCOLN CREEK	41	LOWER PADDEN CREEK	22.5	SPOKANE CREEK	52	SPOKANE CREEK	24
LOWER PADDEN CREEK	41	LOWER TOAD CREEK	22.5	CHUCKANUT CREEK	51	CHUCKANUT CREEK	23
LOWER TOAD CREEK	41	LINCOLN CREEK	22	UPPER WHATCOM CREEK	48	UPPER WHATCOM CREEK	23
CONNELLY CREEK	39	CONNELLY CREEK	21.5	BEAR CREEK	46	CEMETERY CREEK	22
FORT BELLINGHAM	38	LOWER SPRING CREEK	20.5	CEMETERY CREEK	46	BEAR CREEK	21
LOWER SPRING CREEK	38	FORT BELLINGHAM	20	LOWER SQUALICUM CREEK	46	LOWER SQUALICUM CREEK	21
UPPER PADDEN CREEK	35	FEVER CREEK	19	BAKER CREEK TRIBUTARY	44	BAKER CREEK TRIBUTARY	20
FEVER CREEK	34	UPPER PADDEN CREEK	19	HANNAH CREEK	43	HANNAH CREEK	20
LOST CREEK	29	LOST CREEK	15	SILVER CREEK TRIBUTARY #2	43	LAKE PADDEN	20
LAKE PADDEN	24	LOWER BAKER CREEK	13.5	LAKE PADDEN	42	SILVER CREEK TRIBUTARY #1	19
LOWER BAKER CREEK	24	HANNAH CREEK	13	LOWER BAKER CREEK	42	LOWER BAKER CREEK	18
SILVER CREEK TRIBUTARY #1	24	LAKE PADDEN	13	SILVER CREEK TRIBUTARY #1	42	SILVER CREEK TRIBUTARY #2	18
HANNAH CREEK	23	SILVER CREEK TRIBUTARY #2	13	LOST CREEK	37	LOST CREEK	17
SILVER CREEK TRIBUTARY #2	23	SILVER CREEK TRIBUTARY #1	12.5	FEVER CREEK	32	FEVER CREEK	15
BAKER CREEK TRIBUTARY	22	BAKER CREEK TRIBUTARY	11.5	UPPER PADDEN CREEK	31	UPPER PADDEN CREEK	15
BEAR CREEK	20	CEMETERY CREEK	11	FORT BELLINGHAM	28	CONNELLY CREEK	13
CEMETERY CREEK	20	BEAR CREEK	10.5	LOWER SPRING CREEK	28	FORT BELLINGHAM	12
LOWER SQUALICUM CREEK	20	LOWER SQUALICUM CREEK	10.5	CONNELLY CREEK	27	LINCOLN CREEK	12
UPPER WHATCOM CREEK	18	UPPER WHATCOM CREEK	10	LINCOLN CREEK	25	LOWER PADDEN CREEK	12
CHUCKANUT CREEK	15	CHUCKANUT CREEK	8.5	LOWER PADDEN CREEK	25	LOWER SPRING CREEK	12
SPOKANE CREEK	14	SPOKANE CREEK	8	LOWER TOAD CREEK	25	LOWER TOAD CREEK	10

Table B-8. Forest Habitat Ranked Prioritization by Restoration Action (not including sub-watersheds excluded during Secondary Prioritization).

Highest Priority Forest Blocks High Priority Forest Blocks

Forest Block ID Number	Restore Forest Score	Forest Block ID Number	Enhance Forest Score	Forest Block ID Number	Permanent Protection Score	Forest Block ID Number	Regulatory Protection Score
037	114	192	72	007	156	007	58
069	114	012	68	004	152	052	58
178	114	089A	68	142	152	004	56
078	106	100	68	006	148	006	56
192	106	069	64	052	148	142	56
090	102	090	64	134	144	011B	54
100	102	178	64	011	140	134	54
165	102	035	60	122	140	011	52
130	98	037	60	143	136	122	50
150	98	076	60	148	136	143	50
157	98	113	60	002	132	148	50
005	94	123	60	011B	132	002	48
032	94	124	60	009	128	060	48
133	94	150	60	060	128	141	48
041	92	032	56	003	124	003	46
120	92	034	56	141	124	009	44
012	90	078	56	126	120	034	44
155	88	120	56	042	116	126	44
113	86	121	56	146	116	151	44
123	86	155	56	147	116	043	42
114	84	157	56	151	116	052A	42
011A	80	158	56	043	112	089A	42
040	80	005	52	138	112	138	42
068	80	013	52	140	112	140	42
073	80	041	52	127	108	146	42
128	80	068	52	179	108	179	42
158	80	114	52	013	104	013	40
035	78	165	52	034	104	112	40
074	78	011A	48	052A	104	121	40
089A	78	040	48	112	104	123	40
119	78	052A	48	121	104	147	40
124	78	072	48	129	104	024	38
024	76	089	48	149	104	035	38
052A	76	128	48	024	100	042	38
116	76	179	48	072	100	076	38

Forest Block ID Number	Restore Forest Score	Forest Block ID Number	Enhance Forest Score	Forest Block ID Number	Permanent Protection Score	Forest Block ID Number	Regulatory Protection Score
072	74	024	44	073	100	089	38
075	74	060	44	089	100	124	38
076	74	074	44	137	100	127	38
112	74	127	44	074	96	158	38
034	72	130	44	075	96	041	36
089	70	138	44	076	96	072	36
149	70	073	40	089A	96	073	36
013	68	075	40	116	96	074	36
043	68	112	40	158	96	113	36
140	68	116	40	035	92	120	36
129	66	119	40	068	92	149	36
151	66	133	40	119	92	005	34
179	66	140	40	123	92	068	34
146	64	141	40	124	92	116	34
121	62	002	36	011A	88	012	32
137	62	011B	36	041	88	075	32
138	62	043	36	113	88	078	32
147	62	149	36	120	88	119	32
126	56	151	36	128	88	129	32
127	56	003	32	133	88	133	32
003	54	042	32	005	84	011A	30
011B	54	052	32	040	84	032	30
042	54	126	32	114	84	090	30
141	50	137	32	012	80	100	30
009	48	006	28	032	80	114	30
060	46	011	28	130	80	128	30
148	46	134	28	078	76	137	30
002	42	143	28	155	76	192	30
143	40	146	28	090	72	130	28
011	38	147	28	100	72	040	26
052	36	009	24	150	72	150	26
122	36	129	24	165	72	155	26
134	36	148	24	157	68	165	24
006	34	004	20	192	68	157	22
004	30	122	20	037	52	037	16
142	30	142	20	069	52	069	16
007	28	007	16	178	52	178	16

Table B-9. Meadow/Shrub Habitat Ranked Prioritization by Restoration Action (not including all sub-watersheds excluded during Secondary Prioritization).

Highest Priority Meadow/Shrub Blocks High Priority Meadow/Shrub Blocks

Meadow/ Shrub Block ID Number	Restore Meadow Score	Meadow/ Shrub Block ID Number	Enhance Meadow Score	Meadow/ Shrub Block ID Number	Permanent Protection of Meadow Score	Meadow/ Shrub Block ID Number	Meadow Protection through Regulatory Means Score
041	117	003	58	004	167	004	67
003	100	011	58	142	160	006	67
132	98	041	58	052	157	142	67
150	98	130	58	134	147	052	62
153	95	125	53	060	143	060	62
125	93	076	52	122	143	122	62
130	93	150	52	006	140	134	57
076	92	155	52	073	130	002	52
108	90	126	47	040	127	072	52
155	87	108	43	128	127	073	52
120	83	149	42	002	123	137	52
111	82	114	40	072	123	140	52
157	82	132	40	137	123	149	52
158	82	157	40	140	123	040	50
022	80	158	40	138	120	151	50
108A	80	006	38	149	117	011	47
101	77	118	37	151	113	126	47
118	77	120	37	068	110	128	47
133	77	151	37	127	110	138	47
039	75	153	37	126	107	068	45
114	75	002	35	178	107	113	42
123	73	072	35	113	103	127	42
113	72	111	35	011	100	118	40
011	70	137	35	124	97	178	40
124	68	123	33	101	93	101	37
151	67	124	33	118	93	108	37
068	65	127	33	133	93	120	37
178	63	068	30	039	90	114	35
126	63	122	30	114	90	124	35
149	58	140	30	120	87	133	33
127	55	040	28	123	87	111	32
040	53	073	28	111	83	157	32
002	52	133	28	157	83	158	32
072	52	138	28	158	83	123	30

Meadow/ Shrub Block ID Number	Restore Meadow Score
137	52
140	52
138	50
006	50
073	45
128	43
060	42
122	42
134	33
142	30
052	28
004	23

Meadow/ Shrub Block ID Number	Enhance Meadow Score
178	28
060	25
101	25
113	25
022	22
108A	22
128	22
134	22
142	18
039	17
004	12
052	12

Meadow/ Shrub Block ID Number	Permanent Protection of Meadow Score
108	80
022	80
108A	80
155	73
153	70
125	67
130	67
076	63
003	60
132	57
150	57
041	33

Meadow/ Shrub Block ID Number	Meadow Protection through Regulatory Means Score
125	30
130	30
155	30
039	28
153	28
003	27
076	25
022	23
108A	23
150	22
132	18
041	13

Table B-10. Potential Tier 1 Sub-watersheds for Riverine, Wetland, and Combined Riverine and Wetland Restoration (sub-watersheds highlighted in green advanced for further evaluation)

Top Priorities for Riverine Restorative Actions	
Sub-watershed	**Riverine Restoration – Ordered From Highest to Lowest Scores***
Baker Creek Tributary	151
Little Squalicum Creek	151
Lower Padden Creek	136
Lower Baker Creek	132
Hannah Creek	121
Lost Creek	113
Lower Toad Creek	113
Bear Creek	111
Lower Spring Creek	110
Fort Bellingham	109
Silver Creek Tributary #1	108
Lower Squalicum Creek	104
Cemetery Creek	98
Lake Padden	91
Upper Padden Creek	87
Spokane Creek	72
Chuckanut Creek	68
Upper Whatcom Creek	46
Connelly Creek*	Lowest
Lincoln Creek*	Lowest
Alderwood Creek*	Lowest
Lower Whatcom Creek*	Lowest
Silver Creek Tributary #2*	Lowest
Fever Creek*	Lowest

Top Priorities for Wetland Restorative Actions	
Sub-watershed	**Wetland Restoration– Ordered From Highest to Lowest Scores***
Lower Padden Creek	64
Lower Toad Creek	64
Lincoln Creek	63
Connelly Creek	61
Lower Spring Creek	59
Fort Bellingham	58
Upper Padden Creek	54
Fever Creek	53
Lost Creek	44
Lower Baker Creek	38
Lake Padden	37
Silver Creek Tributary #1	37
Hannah Creek	36
Silver Creek Tributary #2	36
Baker Creek Tributary	34
Cemetery Creek	31
Bear Creek	31
Lower Squalicum Creek	31
Upper Whatcom Creek	28
Chuckanut Creek	24
Spokane Creek	22
North Lower Squalicum Creek*	Lowest
South Bellingham*	Lowest
Alderwood Creek*	Lowest
Central Bellingam*	Lowest
Little Squalicum Creek*	Lowest
Lower Whatcom Creek*	Lowest
Squalicum Harbor*	Lowest

Top Priorities for Combine Riverine and Restorative Actions	
Sub-watershed	**Combined Riverine and Wetland Restoration– Ordered From Highest to Lowest Scores***
Lower Padden Creek	200
Baker Creek Tributary	185
Lower Toad Creek	177
Lower Baker Creek	170
Lower Spring Creek	169
Fort Bellingham	167
Hannah Creek	157
Lost Creek	157
Little Squalicum Creek	151
Silver Creek Tributary #1	145
Bear Creek	142
Upper Padden Creek	141
Lower Squalicum Creek	135
Cemetery Creek	129
Lake Padden	128
Spokane Creek	94
Chuckanut Creek	92
Upper Whatcom Creek	74
Lincoln Creek	63
Connelly Creek	61
Fever Creek	53
Silver Creek Tributary #2	36
North Lower Squalicum Creek*	Lowest
South Bellingham*	Lowest
Alderwood Creek*	Lowest
Central Bellingham*	Lowest
Lower Whatcom Creek*	Lowest
Squalicum Harbor*	Lowest

*The gray shaded cells are the lowest priority for action, as identified during the Secondary Prioritization and shown for purposes of completeness.

Table B-11. Potential Tier 1 Sub-watersheds for Riverine, Wetland, and Combined Riverine and Wetland Protection (sub-watersheds in green highlighted cells advanced for further evaluation)

Top Priorities for Riverine Protective Actions	
Sub-watershed	**Riverine Protection – Ordered From Highest to Lowest Scores***
Upper Whatcom Creek	55
Chuckanut Creek	52
Upper Padden Creek	49
Spokane Creek	46
Lower Spring Creek	40
Cemetery Creek	39
Lower Toad Creek	38
Hannah Creek	36
Lake Padden	35
Silver Creek Tributary #1	35
Bear Creek	33
Lower Squalicum Creek	33
Fort Bellingham	30
Lost Creek	29
Lower Baker Creek	29
Lower Padden Creek	28
Little Squalicum Creek	26
Baker Creek Tributary	20
Connelly Creek*	Lowest
Lincoln Creek*	Lowest
Alderwood Creek*	Lowest
Lower Whatcom Creek*	Lowest
Silver Creek Tributary #2*	Lowest
Fever Creek*	Lowest

Top Priorities for Wetland Protective Actions	
Sub-watershed	**Wetland Protection – Ordered From Highest to Lowest Scores***
Spokane Creek	76
Chuckanut Creek	74
Upper Whatcom Creek	71
Cemetery Creek	68
Bear Creek	67
Lower Squalicum Creek	67
Baker Creek Tributary	64
Hannah Creek	63
Lake Padden	62
Silver Creek Tributary #1	61
Silver Creek Tributary #2	61
Lower Baker Creek	60
Lost Creek	54
Fever Creek	47
Upper Padden Creek	46
Connelly Creek	40
Fort Bellingham	40
Lower Spring Creek	40
Lincoln Creek	37
Lower Padden Creek	37
Lower Toad Creek	35
North Lower Squalicum Creek*	Lowest
South Bellingham*	Lowest
Alderwood Creek*	Lowest
Central Bellingham*	Lowest
Little Squalicum Creek*	Lowest
Lower Whatcom Creek*	Lowest

Top Priorities for Combine Riverine and Protective Actions	
Sub-watershed	**Combined Riverine and Wetland Protection – Ordered From Highest to Lowest Scores***
Chuckanut Creek	126
Upper Whatcom Creek	126
Spokane Creek	122
Cemetery Creek	107
Bear Creek	100
Lower Squalicum Creek	100
Hannah Creek	99
Lake Padden	97
Silver Creek Tributary #1	96
Upper Padden Creek	95
Lower Baker Creek	89
Baker Creek Tributary	84
Lost Creek	83
Lower Spring Creek	80
Lower Toad Creek	73
Fort Bellingham	70
Lower Padden Creek	65
Lincoln Creek	63
Silver Creek Tributary #2	61
Fever Creek	47
Connelly Creek	40
Alderwood Creek*	Lowest
Lower Whatcom Creek*	Lowest
North Lower Squalicum Creek*	Lowest
South Bellingham*	Lowest
Central Bellingham*	Lowest
Little Squalicum Creek*	Lowest

*The gray shaded cells are the lowest priority for action, as identified during the Secondary Prioritization and shown for purposes of completeness.