City of Bellingham
Wildlife Habitat Assessment

March 2003 -DRAFT-

prepared for:

City of Bellingham
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Wildlife Habitat Assessment

March 2003 **-DRAFT-**

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INTRODUCTION

The Bellingham Wildlife Habitat Assessment is an update of habitat conditions within the city and urban growth areas. The 2003 assessment builds on and expands the city wide habitat inventory conducted in 1991 (Eissinger 1995). In essence, the 2003 habitat assessment provides a ten-year update of the habitat area, availability and type within the expanded city area including the City Limits, Urban Growth Area (UGA) and Five Year Growth Area. The assessment process also converted the habitat information into an electronic Geographic Information System (GIS) product, which was used to map and analyze habitat areas.

The 2003 wildlife habitat assessment is concentrated on habitat information and offers three primary informational sections. First is the city-wide habitat area delineation, typing and description. Second, is the analysis of the habitat areas for function and value for wildlife including: quality, risk and connectivity. Third, is the assessment of streams within the city, including water quality and habitat attributes pertaining to fish as well as overall stream health.

The presentation of the assessment information, findings, maps, graphs and descriptions are provided in this summary report. The information provided serves as a current baseline of habitat conditions within the city. In addition to the summary and presentation of information, the report also identifies and lists gaps in the information or data and recommendations for further investigation and action.

The information presented in this report consists of three formats. The mapped habitat information is presented in spatial (map), graphic (quantitative) and descriptive text formats. The mapped habitat is based on a course filter, aerial interpretation and text description. This provides an evaluation of dominate habitat and features within contiguous habitat blocks. Site specific detail, location and wildlife attributes are provided in the text descriptions for each block. The stream assessment information is also presented in a graphic (quantitative) and spatial (mapped) formats. Stream descriptions are also provided in a text format. In addition, a species occurrence map is provided to illustrate the current state of fish distribution data.

With the concentration of the 2003 assessment on city-wide habitat, there remains a need for wildlife habitat association and occurrence information updating. The perpetuation of old, sometimes historic, species occurrence and distribution information is misleading, given the rapid changes within the landscape. Although the 1995 Bellingham Wildlife and Habitat Assessment provides a comprehensive account of wildlife within the City of Bellingham, it also points to the lack of up-to-date empirical data. With the increased fragmentation of habitat, habitat impairment and loss of connectivity, as expressed in this report, it is likely that simple species association based on habitat type can no longer be assumed. It is likely that wildlife occurrence and viability of certain populations within the city has changed. As a result, it is recommended that while targeted habitat protection and restoration measures are planned and implemented, that species specific occurrence and distribution information within the city is updated.

BACKGROUND

The 2003 Bellingham Wildlife Habitat Assessment is a product of the City's combined fish and wildlife data, set of maps and summary report that will reflect the current conditions for wildlife within the city and urban growth area. The need to assess the city's wildlife and habitat areas is motivated by state and federal regulatory processes including Washington State Growth Management, Critical Areas and Shoreline Master Plan updates and National Marine Fisheries Service requirements for compliance with the U.S. Endangered Species Act 4 (d) rule, resulting from the addition of Chinook salmon *(Oncorhynchus tshawytscha)* and bull trout *(Salvelinus confluentus)* on the federal endangered species list and proposed listing of coho salmon (*Oncorhynchus kisutch)*. In addition to these species, at least one listed and ten other federal species of concern occur within the city, several of which are little known. The information provided through this project will assist the City in planning and regulatory efforts necessary to identify, protect, and restore critical habitats, as well as set goals for future habitat needs and ecosystem enhancement.

The Growth Management Act (GMA) of 1990, also continues to provide guidance. The GMA directs each jurisdiction to protect biodiversity and stipulates the need to consider habitat connectivity across the landscape. In addition, it emphasizes the protection of riparian ecosystems, the restoration of salmonid habitat and maintaining larger habitat blocks and open space. As the City's boundaries expand, applying these objectives at a landscape level would help in preserving species diversity and restoring a potentially functional habitat matrix or network. Such a network would combine natural corridors of native habitat and features such as streams, valleys and ridges with a variety of large functional habitat reserves. A properly designed and permanently protected City-area-wide habitat network holds the potential for meeting all the requirements set forth in the GMA and perpetuating our local indigenous wildlife diversity well into the next century.

In 1995 the *Wildlife and Habitat Assessment: an inventory of existing conditions and background information* (Eissinger, 1995) was prepared for the City of Bellingham. The report provided a detailed account and inventory of habitats and wildlife within the city limits and was accompanied by a complete set of aerial photos with supporting mapped data. The text also included a historical perspective of wildlife in Bellingham, guidelines for planning for wildlife, regulatory protection and non-regulatory programs for protecting wildlife and habitat and an extensive bibliography. The 1995 document is detailed and provides and excellent guidance resource for planning and decision making. It continues to be the best source of wildlife specific information available in the City of Bellingham. The 2003 habitat assessment builds on the previous work and as a result presents an updated, digitally mapped account of habitat citywide and an assessment of habitat conditions.

The 2003 Habitat Assessment is an update of the 1995 habitat assessment and originally, was planned as a means to digitize mapped data and compare the past and present conditions. Unfortunately, the maps and aerials on which the 1995 work was based were lost in city storage. In addition, historical and expert habitat and species notes recorded on the original maps were also lost. As a result, habitat had to be remapped on current 2001 aerial photos and then compared to 1991 aerials for comparison. Every effort was made to recreate the earlier habitat blocks and attributes accurately. The final mapped assessment and analysis provides a detailed evaluation of the City's wildlife habitat and should serve as a model planning tool.

The goal of the Bellingham wildlife habitat assessment is to provide a graphic tool to guide planning, critical area protection and restoration efforts city wide. In order to accomplish this goal, habitat throughout the city was identified, divided into discernable units, classified, rated and mapped. The resulting maps provide a quick visual reference to habitats, color coded by relative quality and risk. Additional habitat attributes including corridors, road passage points, stream/fish specific habitats, and potential habitat sinks are mapped separately.

The assessment process utilized a course filter approach, in which, only dominate habitats were identified. In addition, habitat was evaluated for quality by scoring each block based on quantity and quality combined with function and certain wildlife attributes. These characterizations were divided into 31 general categories and further refined by 10 subcategories (Habitat Quality Rating System attached). The filter and evaluation were created specific to Bellingham, utilizing a whole-system approach combining landscape, habitat and wildlife considerations. The habitat was then assessed for risk, based on 8 parameters (Risk Score System attached). The course filter approach is a standard method of Geographic Information System (GIS) based landscape level habitat analysis.

In addition to a general habitat assessment, an effort was made to evaluate streams and shorelines in detail. Due to the lack of certain empirical data, the result of this effort was a limited evaluation of streams and a set of recommendations for a targeted shoreline assessment.

The project results presented within this report are summarized within each section. Results vary. For certain analysis the results are definitive and quantitative, for others, the exercise may have just raised more questions. There was an effort to combine information from past and present sources to provide an up-to-date review of conditions. In addition to the assessment, is a list of identified gaps in relevant information or discrepancies in existing data. There is also a recommendations section outlining steps needed to address site specific issues, improve conditions for wildlife and topics for further investigation or action.

ASSESSMENT SCOPE

The scope of work for the Bellingham Wildlife Habitat Assessment included updating existing information, mapping all habitat areas, comparing habitat changes over time, assessment of habitat, rating habitat values and risk analysis. Areas evaluated included aquatic, riparian, wetland, terrestrial and marine habitats. Particular attention was given to streams and fish habitat, including all four major stream systems within the city: Chuckanut, Padden, Whatcom and Squalicum. Other stream systems within the UGA were also reviewed.

The project was intended, in part, to assess current habitat conditions and compare changes based an original set of 1988 orthophotographic maps from the 1995 assessment, on which the habitat within the city limits was delineated. Unfortunately, the earlier maps were lost in city storage. Therefore the scope of the project expanded to include the recreation of the earlier habitat delineation as a substitute for comparison purposes.

Information utilized for the 2003 Bellingham Habitat Assessment includes various sources ranging from city, state and federal documents, species lists and mapped data. Additional information was integrated from agency personnel and field examination.

Habitat mapping was performed for the study area (Bellingham City Limits and UGA) and included stream, riparian and upland areas. Lake and marine habitats were reviewed and discussed without comparative analysis. The habitats were mapped and evaluated using a numbered block system (Eissinger, 1995). Blocks were assessed for habitat quality and quantity, then compared to determine changes over time.

The habitat blocks, once identified, were digitized and habitat codes applied. Each block was also described in text. A habitat rating system was then utilized to rank each block according to habitat attributes and wildlife occurrence. Scores were lumped to provide a general quality category and color coded for mapping purposes.

The final step in evaluation, involved a risk assessment, which screened each habitat block for risk factors potentially threatening habitat quality and function. The results from the risk assessment are also color coded and mapped.

A list of project elements and products include:

Assessment report
Habitat block delineation
Habitat block map
Habitat block descriptions
Habitat typing
Habitat type map
Habitat quality assessment
Habitat quality score map
Habitat quality assessment spreadsheet
Habitat loss
Habitat loss map
Habitat risk assessment
Habitat risk assessment map
Habitat risk assessment spreadsheet
Wildlife corridor map

Streams
Stream Water Quality
- water quality graphs
- water quality maps

Stream Habitat Quality
- Stream habitat maps

Stream Fish Habitat and Distribution

Mapping Methods

The maps for the Bellingham Habitat Assessment were digitized by Jean Olson from 2001 aerial photographs supplied by the City of Bellingham. In preparation for the digitizing, habitat blocks corresponding to the 1991 Habitat Assessment (Eissinger 1995) were drawn on the new aerials. Also drawn on the maps were streams, watershed, block numbers and habitat lost since the 1991 assessment. Due to the misplacement of the 1991 aerials used in the 1995 assessment, the exact dimensions of the original blocks are unknown and areas of blocks between the two assessments are different. Since the city limits of Bellingham have grown since 1991, 87 new blocks were added to the 110 blocks from the 1991 assessment for a total of 197 blocks. Once all the blocks were delineated, their habitat types were truthed through field visits.

Once the blocks had been drawn on the aerials, they were digitized onto digital aerials using ArcView 3.x. Two extensions were downloaded from the ArcScripts portion of the ESRI website (www.esri.com) to help with this project.

Habitat Digitizer Extension version 3.1	written by Ken Buja
Xtools	written by Mike Delaune

Using the Habitat Digitizer, habitat classifications were divided into the following Categories:

Habitat	Type	Sub-Type
Marine	Estuary - mudflat (15)	
	Estuary - open water (14)	
	Estuary - salt marsh (16)	
	Saltwater - open water (12)	
	Saltwater Shoreline (13)	
Upland	Cleared Forest	
	Fallow Field (9)	
	Forest	Lowland/Temperate Coniferous Forest (24)
		Mixed Conifer-Hardwood Forest (28)
		Mixed Deciduous Forest (29)
		Red Alder Forest (27)
	Lake/Pond (19/20)	
	Shrub Habitat	
Urban/Rural	Backyard Habitat (2)	
	Cemetery (6)	
	Cultivated Agricultural Land (8)	
	Golf Course (7)	
	Lawn (2)	
	Park (developed/landscaped) (5)	
	Playfield/School Ground (4)	
	Urban Open Space/Vacant Lots (2)	
	Utility Corridor (11)	

Once the digitizing commenced, blocks were digitized according to habitat types. Blocks with multiple habitat types had multiple sub-blocks. Once all the habitat was digitized, sub-blocks were assigned block numbers and a total block outline was created.

During the field truthing, blocks were scored according to the habitat and risk assessment. These values were entered in Microsoft Excel and saved as a Dbase 4 file. These files were then joined in ArcView to the block .dbf file. A legend palette was created to reflect the rating system for the blocks.

Other shapefiles needed to produce completed maps were downloaded from the City of Bellingham Public Works' ftp website (www.cob.org/cobweb/pw/ENG/GIS/). They include the following: Streams, Bay-Lake, Wetlands, Cityuga, Street and Zoning. Metadata for the layers and aerials are as follows (from the City of Bellingham):

Projection:	State Plane, Washington North
Units:	Feet
FIPS Zone:	4601
Datum:	NAD27
Spheroid:	Clarke 1866
X-shift:	609601.21920
Y-shift:	0.0
Parameters:	None

All other map layers were produced by Jean Olson of Nahkeeta Northwest. They include the Habitat blocks, corridors, movement, questions, shoreline habitat, lost habitat and water quality map layers.

Information Sources

The project was built on a combination of existing habitat information and recently complied data. The primary source of existing information was the 1995 Bellingham Wildlife and Habitat Assessment, which contains background information, complete habitat and species lists, descriptions of habitat and species by watershed and generally by site and block. The 1995 assessment relied upon over 50 area-specific documents and numerous fish and wildlife expert interviews. As a result, the institutional memory contained in the 1995 document is the best to date.

Updated information for the 2003 assessment was colleted from several sources including the Washington State Department of the Fish and Wildlife Priority Habitats and Species data (mapped and tabular), Washington State Natural Heritage database review, (list other fish sources from Chris) and other sources to be added…….

STUDY AREA

Study Area Description

The study area includes the City of Bellingham and its growth boundaries, situated in Whatcom County at the northwest corner of Washington State. The study area consists of the City of Bellingham, current city limits, the Urban Growth Area (UGA), and the 5 Year Growth Area outside the UGA. The City currently consists of 18,324 acres including the urban core, adjacent to Bellingham Bay, immediately surrounded by a mix of residential, commercial and light industrial land uses and expansive natural areas. The city's outer fringe area includes the Urban Growth Area consisting of 8,300 acres and the 5 year Growth Area, 2,655 acres. This outer growth area consists of contrasting uses from airport, residential housing and retail development, to farmland, rural residential and open forest lands. The total study area contains over 29,200 acres. Of this total area about 12,000 acres or 41 percent is build, while the remaining majority of the area functions as potential habitat of various quality. The proximity of the city wedged between scenic marine and mountain environments endows Bellingham with aesthetically pleasing and recreationally rich reputation. These surroundings are also ecologically diverse and representative of a biologically rich temperate zone.

From a wildlife perspective, Bellingham and its associated area, harbor numerous unique characteristics when combined create a nexus for biological diversity and a richly dynamic landscape. The physical characteristics include a large marine embayment, major river estuary, four salmon bearing streams running through the city limits, large freshwater lakes, remnants of old growth forest, tens of thousands of acres of wild and plantation forest extending from the city limits, a direct land linkage between marine shoreline and Cascade mountains. In addition to the physical, are the dynamic conditions which create the habitats and stimulate wildlife movement, including: temperate climate influences, moderate to abundant rainfall, microclimates, Pacific flyway and other migration routes which include elevation movements, freshwater-upland migration and saltwater-freshwater interface for anadromous fish...etc

This combination environmental characteristics are found in no other city if its size within the Salish Sea. As a result the City of Bellingham has an opportunity to embrace its uniqueness and champion the preservation and restoration of habitats to maintain and improve the natural heritage and wildlife community it supports.

including the same uses to the north and a mix of residential, park and rural forest to the east and south.

As of the 2000 census, Bellingham's population is 66,815. Compared to the population of 52,179 in 1990, Bellingham has experienced an increase of 14,636 new persons or 28 percent growth in the past ten years. Along with the increase in population, was the construction of 7,263 added housing units, an increase of about 33 percent over ten years. The construction of housing units increased significantly, 82 percent over the previous ten year period 1980-1990. Along with the grow in the human population and increased number of housing units, is the associated commercial growth and support structure.

Bellingham as a rapidly growing community is urbanizing the landscape and converting surrounding natural areas to built environments. As of 1991, approximately 28% of the city remained as natural area. With the expansion of the city growth boundaries more natural area is soon to be annexed into the city and subsequently developed. Today, within the study area about 45% of the habitat is either of good or excellent quality. This accounts for about 13,000 acres of functional wildlife habitat. With added growth at the same rate as the past ten years, much of the natural habitat faces inevitable development pressure, unless building practices change.

Given the growth within the City of Bellingham since the 1991 habitat assessment (Eissinger 1995), the habitat loss, fragmentation and degradation has been measurable, totaling over 1,600 acres in ten years. The greatest habitat losses were identified as the following:

- Corridors
- Fragmentation of large blocks
- Riparian-upland connections
- Wetlands
- Whatcom Creek (due to burn)

Specific areas of loss are described later in the document.

The city however growing, has maintained its unique northwest character, certain natural features and open space. These natural features provide a variety of habitat opportunities for wildlife including, the Bay's inland marine habitat and its saltwater shoreline, mudflats, sandstone cliffs and small estuaries. Within the City four major fresh water stream courses flow to Bellingham Bay, connecting the marine waters to the headwater forests. The year-round streams are but one benefit of the annual average precipitation of 34 inches. The large natural lakes which act a reservoirs for two of the four stream drainage, also harbor wildlife and serve multiple recreational uses. Originating from temperate forests then flowing through agricultural lands and an urbanizing landscape to the bay, these streams create natural riparian corridors. These corridors link their aquatic and riparian habitats with, wetlands, urban upland forests, fresh water lakes and a patchwork of parks, trails and open spaces. By virtue of their habitat value, natural connectivity and available data, the City's streams received the greatest attention within the study area.

To illustrate the study area, are the following maps:

Study Area Map
Bellingham Watershed Map

Bellingham Habitat Assessment

Study Area

Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

HABITAT MAPPING AND ASSESSMENT

The Bellingham Habitat Assessment includes two primary divisions of focus, uplands and streams. The upland section, as follows, assesses the terrestrial areas of the city and associated habitats.

This section provides a city wide evaluation that is both broad and inclusive. Through the delineation of habitat types, combined with an accounting of habitat area, availability and connectivity, this section presents the current conditions of wildlife habitats within each watershed, citywide.

The upland section as follows contains six separate habitat analysis and associated maps:

1. Habitat typing, delineation, distribution and type per area within the city
2. Habitat block or contiguous habitat area identification and delineation
3. Habitat quality assessment and rating per block
4. Habitat loss
5. Habitat risk assessment and rating per block
6. Wildlife corridors and habitat sinks

Each of these subsections provide descriptions, methods and results.

HABITAT BLOCK DELINEATION

Habitat Blocks: definition & description

As a means to inventory habitat area and value within an urban landscape, a "block" system was applied. Blocks (blk) are a descriptive unit, representing an area of contiguous open space that contains one or more habitat types. Each block embodies a delineated area of habitat and associated wildlife communities. Because habitat value and function is dependant on area (size), condition and connectivity, blocks serve as a comparative measure of available open space, connectivity and habitat diversity within each watershed, city wide.

The habitat block system is utilized as the base for the citywide habitat analysis and mapping. Once identified and delineated, the habitat blocks were mapped by numeric identifier and then color coded according to habitat type, assessment rating, and risk score. All of these mapped results are illustrated in the corresponding sections of this report.

The area of each block and general habitat type is based on aerial photo interpretation. The 2003 assessment is based on a set of 2001 color aerial photos (1"=400'), plus one large aggregate aerial. The aerials utilized were both in printed and electronic format. Additional habitat information was collected from the 1995 Bellingham Wildlife and Habitat Assessment, 1990 Bellingham Wetland Inventory, WDFW data and field truthing. The previous, 1991 assessment utilized 1988 orthophotographic maps (1"=200'), 1990 city wetland inventory data, 1991 Department of Natural Resources orthophotos and other available reference information, as well as limited field truthing.

Methods

The habitats within the city were identified and delineated as contiguous units ranging in size and configuration. Each unit is defined as a block. Blocks are organized by a corresponding identification number. Most blocks within the City limits, were previously identified and carried over from the 1991 assessment (Eissinger, 1995). Areas of habitat that have been fragmented, or those blocks that have been bisected by roads or development since 1991, were adjusted with an alpha-numeric code to reflect the current parts of the original block, e.g., block 10 would be 10, 10a, 10b, 10c, etc. New blocks have been assigned new numbers.

Each block was also identified by its habitat. Blocks may contain one or more types of habitat, but each block is recorded by its dominate habitat type. Habitat typing of each block is described in the next section of this report: habitat typing.

In addition to block identification and habitat, each block has also been described. The text description of each block includes location, habitat features, noted wildlife and any special or unique aspects of the block. The description may also contain information about landuse, and habitat function or value. The complete block descriptions are contained in the Appendix of this document.

The habitat block identification and delineation methods were carried over from the 1991 assessment.

Results

The results of the habitat block delineation are, 197 habitat blocks city-wide were identified and mapped. Of the 197 total blocks, 87 were new blocks, added since 1991. The new blocks and added area, accounts for an expanded study area and habitat fragmentation. There were also 23 blocks lost to development or not found during this assessment. The blocks now span from the current city limits to the UGA.

The habitat blocks represent nine watersheds including: Chuckanut Creek, Padden Creek, Whatcom Creek, Squalicum Creek, Silver Creek, Little Squalicum Creek, Bellingham Bay, Chuckanut Bay and Lake Whatcom.

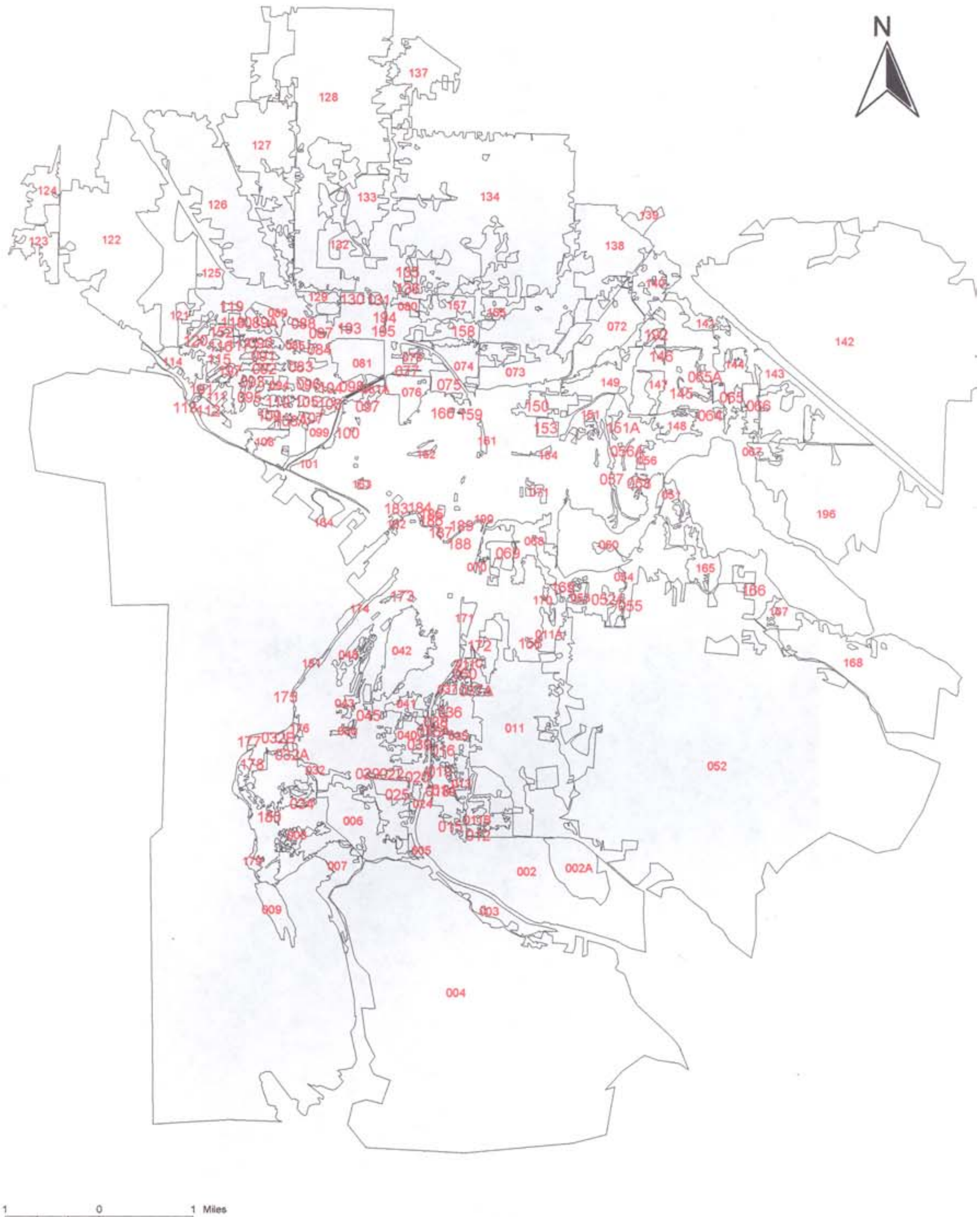
A total 17,865 acres were identified as potential habitat within the study area. These include 9,275 acres within the city limits, 6,006 acres in the UGA and 2,585 acres within the 5 year growth area. This total habitat area represents 58 percent of the total study area. In addition, the large waterbodies also provide 2,800 acres of aquatic and marine habitat within the city, which extends well beyond the city boundaries. Habitat blocks include terrestrial habitats, fresh water systems (with the exception of Lake Whatcom) and small estuaries.

The following pages provide the graphic results of the habitat block delineation including:

Habitat Block Map
Block Number Index

Bellingham Habitat Assessment

Block Numbers



Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

176	0.071
178	0.132
180	4.790
None	142.245
SILVER CREEK (16 Blocks)	
089	0.019
089A	1.620
118	2.697
119	7.461
121	0.981
122	724.792
123	96.941
124	108.828
125	66.782
126	673.114
127	456.938
128	1234.874
132	13.308
133	91.417
134	70.853
137	198.202
None	170.937
SQUALICUM CREEK (62 Blocks)	
065A	1.358
072	223.693
073	199.718
074	89.147
075	49.453
076	93.795
077	5.133
078	33.989
080	22.966
081	142.511
081A	13.035
083	4.684
084	4.876
085	7.308
087	1.840
088	5.308
089	33.667
089A	19.286
090	17.240
091	2.204
097	8.034
098	5.172
099	66.447
100	15.268
101	13.771
107	1.920
117	2.574
118	9.814
120	0.096
126	12.284
127	2.369
128	74.464
129	44.615
130	17.578
131	8.391
132	18.121
133	49.502
134	1681.300
135	10.542
136	5.533
137	3.789
138	334.411
139	39.656
140	119.335
141	44.989
142	1974.128
143	43.088
145	0.156
146	7.026
147	8.853
149	67.523
150	37.755
152	3.286
155	53.008
157	71.270
158	69.764
159	1.860
160	1.144
192	37.664
193	2.613
194	1.628
195	0.994
None	146.028
WHATCOM CREEK (45 Blocks)	
011	422.234
011A	67.669
011C	5.499
037	2.913
037A	1.915
042	30.574
050	6.301
052	1155.779
052A	16.321
053	17.740
054	4.704
055	4.200
056	4.469
056A	4.914
057	6.748
058	1.525
060	320.435
068	124.393
069	41.806
070	8.524
071	9.388
147	28.412
148	8.800
149	85.733
150	9.021
151	80.634
151A	7.922
153	27.737
154	7.157
156	3.189
161	9.612
165	0.157
169	4.266
170	4.058
171	33.668
172	3.519
182	8.593
183	1.629
184	1.074
185	2.770
186	2.004
187	0.435
188	2.564
189	2.306
190	2.318
None	88.955

Bellingham Habitat Assessment 2003
Habitat Block Index by Watershed

BELLINGHAM BAY (40 Blocks)

006	4.072
007	89.196
008	15.706
009	75.784
032A	0.606
032B	1.447
034	0.116
042	28.370
043	5.850
048	48.154
101	6.468
108	5.199
111	0.270
112	18.123
113	36.881
114	65.648
115	8.109
116	7.296
117	0.463
118	2.172
119	1.297
120	18.236
121	55.282
122	329.052
123	1.222
125	39.005
162	9.329
163	6.737
164	8.769
173	4.554
174	26.827
175	5.191
176	8.050
177	2.022
178	50.244
179	17.928
180	2.858
181	9.946
191	4.001
197	4.107
None	98.253

CHUCKANUT BAY (2 Blocks)

004	1063.836
007	34.784
None	29.154

CHUCKANUT CREEK (7 Blocks)

002	265.659
003	93.518
004	2005.596
005	9.140
006	160.321
007	43.495
052	1280.542
None	1.449

LAKE WHATCOM (21 Blocks)

051	49.439
052	2732.246
056	7.586
058	4.973
060	27.331
064	5.561
065	47.055
065A	12.180
066	54.617
067	22.054
142	1129.669
143	363.485
144	2.760
145	4.442
147	0.182
148	66.588
165	92.632
166	8.696
167	25.283
168	691.300
196	856.119
None	197.815

LITTLE SQUALICUM CREEK (21 Blocks)

083	1.137
090	4.266
091	13.291
092	19.401
093	2.615
094	24.780
095	8.297
096	9.020
099	1.722
104	7.493
105	6.753
106	12.834
107	8.348
108	36.258
108A	11.653
109	9.452
110	21.961
111	30.401
112	5.567
117	0.811
197	8.002
None	3.533

PADDEN CREEK (41 Blocks)

002	675.015
002A	192.040
005	0.717
006	148.971
008	25.820
011	355.708
011B	42.767
012	12.300
013	43.949
014	9.592
015	7.545
016	11.846
016A	1.157
018	2.031
019	3.550
020	1.706
022	15.700
024	17.458
025	1.441
029	1.773
030	12.248
032	34.351
032A	12.500
032B	0.021
034	39.392
035	8.829
036	6.852
037	11.726
037A	4.309
038	10.333
039	10.420
040	69.492
041	34.940
042	153.057
043	23.238
045	5.433
048	1.887
052	316.042

HABITAT TYPES: DISTRIBUTION & ABUNDANCE

Description

Habitat characterization is a method of distinguishing plant communities, landforms, water bodies and other natural features that serve a specific function and value for wildlife. Many wildlife species or guilds associate with distinct areas and features, and/or specific conditions that provide the elements necessary to support and perpetuate the needs of that particular group through a complete life cycle. Habitat types are usually utilized in combination by most species.

Habitat typing for the city was completed in a course filter, resulting the identification of general habitat areas which may contain a variety of specific habitat features and/or micro habitats. The habitat type map illustrates each habitat type and its location.

Habitats and their quality provide varying degrees of value for wildlife. Some habitats support higher diversity, while others may offer conditions for a critical life stage for a few species, and another habitat lack function or value for most species.

A habitat analysis, in conjunction with the habitat typing, identifies actual habitat area within the city. This analysis sorts the primary habitats within the city by location and area (in acres). An index of habitat-type abundance and availability was developed by measuring the size of like habitats within specific locations. This also serves as an indicator of those habitats most threatened by future growth.

Methods

The habitat characterization and description in this assessment, is based on the Wildlife Habitat Classification System (Eissinger 1992) described and applied the 1995 Bellingham Wildlife and Habitat Assessment. The 1992 habitat classification system was based on a combination of several wildlife and habitat association indexes including Management of Wildlife and Fish Habitats in forests of Western Oregon and Washington (E.R. Brown 1985).

The classification system contained 39 habitat codes with 10 qualifier codes. The system was subsequently modified to meet the requirements for computer query and analysis. The habitat type descriptions and codes are listed in the attached Habitat Codes sheet and the classification system (appendix..too be added)

Although the habitats are defined in detail within the classification system, delineating and matching the habitat to previous mapped information was difficult. The 1995 mapped habitat information was more detailed, but with the loss of the earlier maps, only gross habitat was delineated and digitized. Certain habitats, primarily forest types were not well distinguishable, given resolution and timing of the 2001 aerial photos. As a result forest types are also generalized. A special habitat layer including wetlands, forest age class, forest type and other unique features needs to be developed and overlayed for greater detail and accuracy. In addition a complete assessment of marine and shoreline and mapping of habitat is needed to update the condition of the City's waterfront.

In addition to the habitat typing and mapping, is the habitat area analysis. The habitat area analysis, sorted and lumped like habitats and measured total area in acres. This was done for the city as a whole and then analyzed habitat area within the three jurisdictional boundaries of the city: the City Limits, Five Year Growth Area and Urban Growth Boundary. The results of the habitat area analysis are represented on pie charts with the percent of habitat per area represented.

Results

The habitat types citywide are illustrated on the Habitat Type Map. As stated before, these areas represent macrohabitats or generalized habitat areas. As a result specific habitat features and/or microhabitats may be contained within each contiguous block but are not delineated. However, the habitat type map provides an excellent illustrative view of gross habitats and their distribution throughout the city.

The delineated and digitized habitat areas make up 59% of the total land area within the City of Bellingham. The total habitat area within the City Limits is 9,274 acres, in the UGA 6,005 acres, and in the 5 year growth area 2,584 acres. The habitat total for the study area is 17,864 acres.

The results of the habitat area analysis, is represented on the following pages, with an accounting of habitat by acre and percent of habitat type within each boundary. Within the study area as a whole the most abundant habitats are:

1.	Mixed Conifer-Hardwood forest	44%
2.	Fallow Field	11%
3.	Saltwater open water	7%
4.	Lowland temperate forest	6%
5.	Backyard habitat	5%
6.	Estuary	5%

The five most abundant habitats within the three zones are:

City Limits

1.	Mixed Conifer-Hardwood forest	41%
2.	Saltwater (marine) open water	12%
3.	Fallow Field (Cordata)	9%
4.	Fresh Water Lake-pond	6%
5.	Lowland/Temperate Forest	5%

Five Year Growth Area

1.	Mixed Conifer-Hardwood forest	35%
2.	Fallow Field	24%
3.	Lowland/Temperate Conifer Forest	22%
4.	Golf Course	12%
5.	Backyard Habitat	4%

Urban Growth Area

1.	Mixed Conifer-Hardwood forest	55%
2.	Fallow Field	11%
3.	Estuary-Mudflat	7%
4.	Freshwater Lake-Pond	6%
5.	Shrub	6%

There are clearly dominate habitat areas within the city including mixed and conifer forest, salt and fresh water bodies, and fallow field. These also represent large, contiguous blocks of habitat, in some cases spanning hundreds or thousands of acres in size. In fact, the largest habitat blocks within the study area include the major forest blocks in the following watersheds:

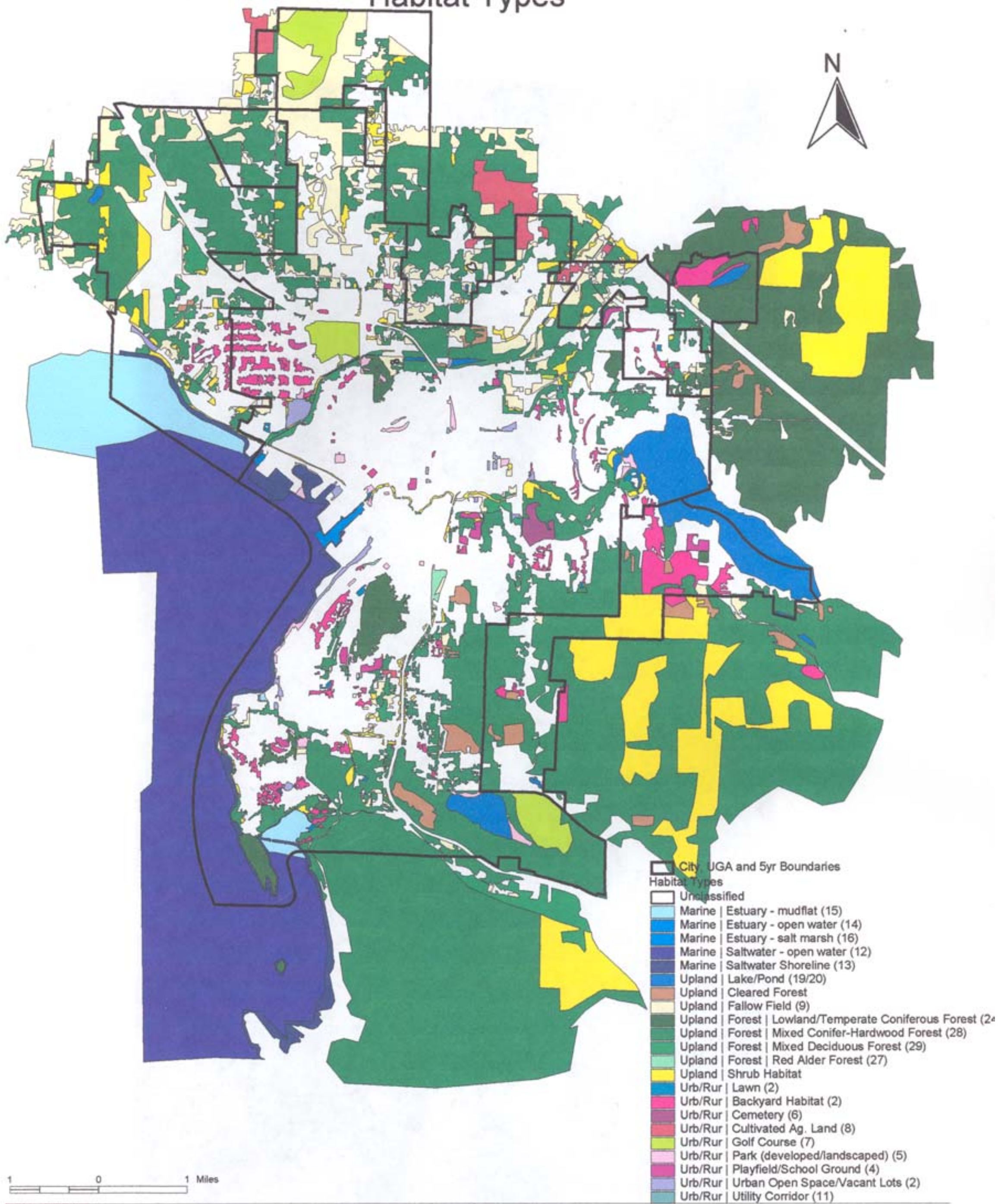
1. Chuckanut 004 2,005 ac
2. Chuckanut 52 1,208 ac
3. Whatcom 52 2,732 ac
4. Squalicum 134 1,681 ac
5. Silver 128 1,234 ac

The following map and pie chart graphically describe the habitat types within the study area and percent area coverage by each type and associated acreages.

Habitat Type Map
Habitat Area Analysis

Bellingham Habitat Assessment

Habitat Types



Nahkeeta Northwest Wildlife Services
Map by Jean Olson

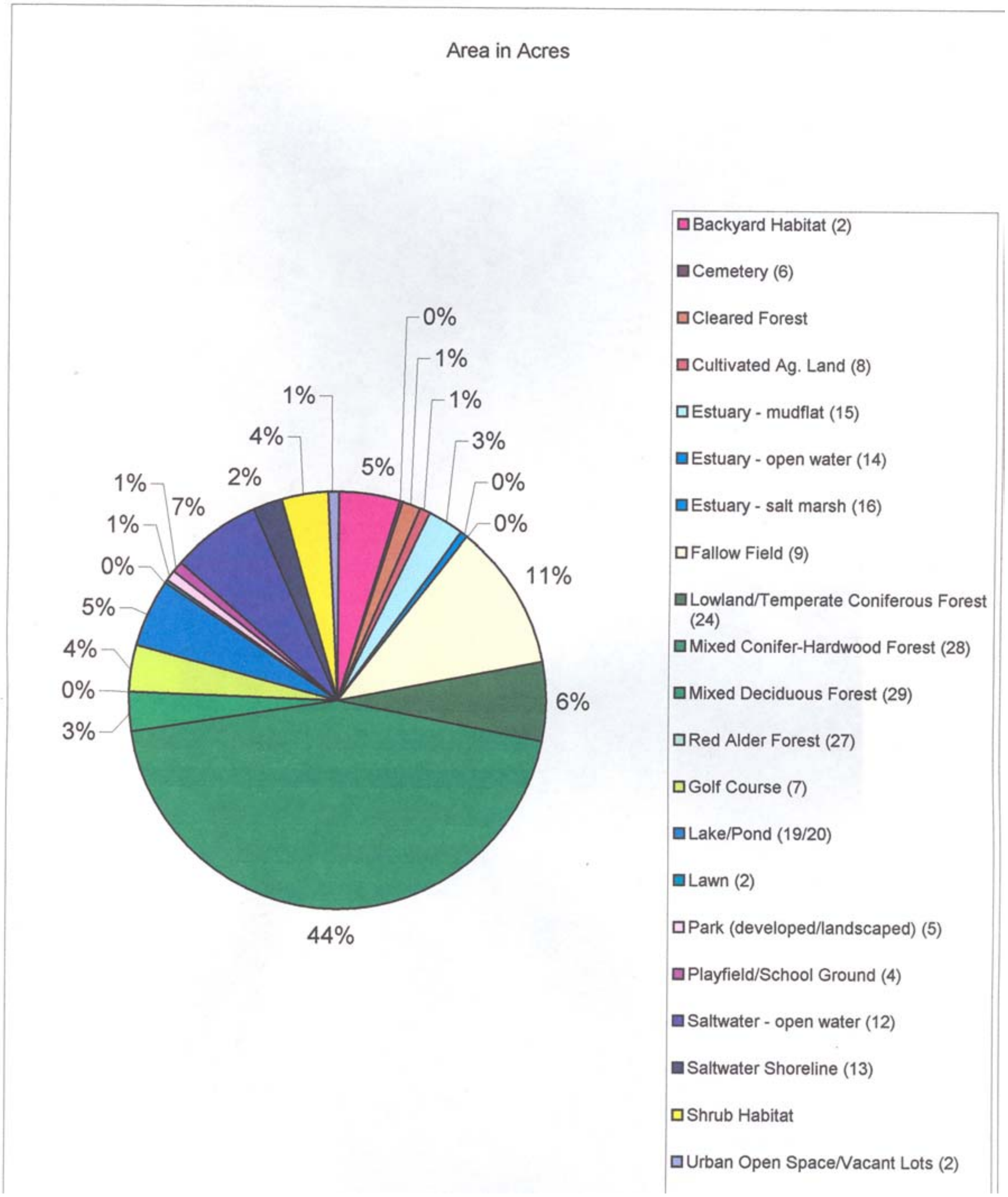
City of Bellingham
Public Works Department

Bellingham Habitat Assessment

2003

City Limits, UGA and 5Year

Habitat Area by Habitat Type



Habitat Type	Area in Acres
Backyard Habitat (2)	797.544
Cemetery (6)	66.114
Cleared Forest	244.473
Cultivated Ag. Land (8)	107.346
Estuary - mudflat (15)	520.233
Estuary - open water (14)	52.036
Estuary - salt marsh (16)	4.183
Fallow Field (9)	1953.236
Lowland/Temperate Coniferous Fores	1044.114
Mixed Conifer-Hardwood Forest (28)	7607.248
Mixed Deciduous Forest (29)	528.074
Red Alder Forest (27)	27.919
Golf Course (7)	618.925
Lake/Pond (19/20)	914.81
Lawn (2)	29.066
Park (developed/landscaped) (5)	148.476
Playfield/School Ground (4)	146.385
Saltwater - open water (12)	1193.483
Saltwater Shoreline (13)	348.993
Shrub Habitat	627.768
Urban Open Space/Vacant Lots (2)	146.592
Grand Total	17132.3

HABITAT QUALITY EVALUATION

Description

Each habitat block has been individually assessed, rated using the habitat rating system and described. Scores of each block were grouped in specific categories and mapped using color coding to reflect rankings.

Methods

Habitat Quality Evaluation and Rating System

The habitat assessment rating system is a method of analyzing habitat blocks based on a set of criteria pertinent to the local conditions and wildlife. The rating system utilizes a matrix of habitat attributes, each associated with a standard score which are then totaled for an overall score per block. The matrix is made up of 31 parameters under 10 categories which are:

- Area:
  - size
- Connectivity:
  - continuity, multibasin, wildlife movement, # of connectors, quality of connection
- Streams:
  - association with block, type
- Riparian:
  - quality, upland association
- Wetlands:
  - isolated, hydrologically connected, upland association
- Shoreline:
  - quality, upland association
- Quality of Habitat:
  - ground, shrub, overstory, snags, cliffs/caves, woody debris, ephemeral water
- Plants:
  - diversity, native community
- Sensitive Species:
  - listed species, species of concern/PHS species
- Species Diversity:
  - mammals, birds, amphibians, reptiles, fish

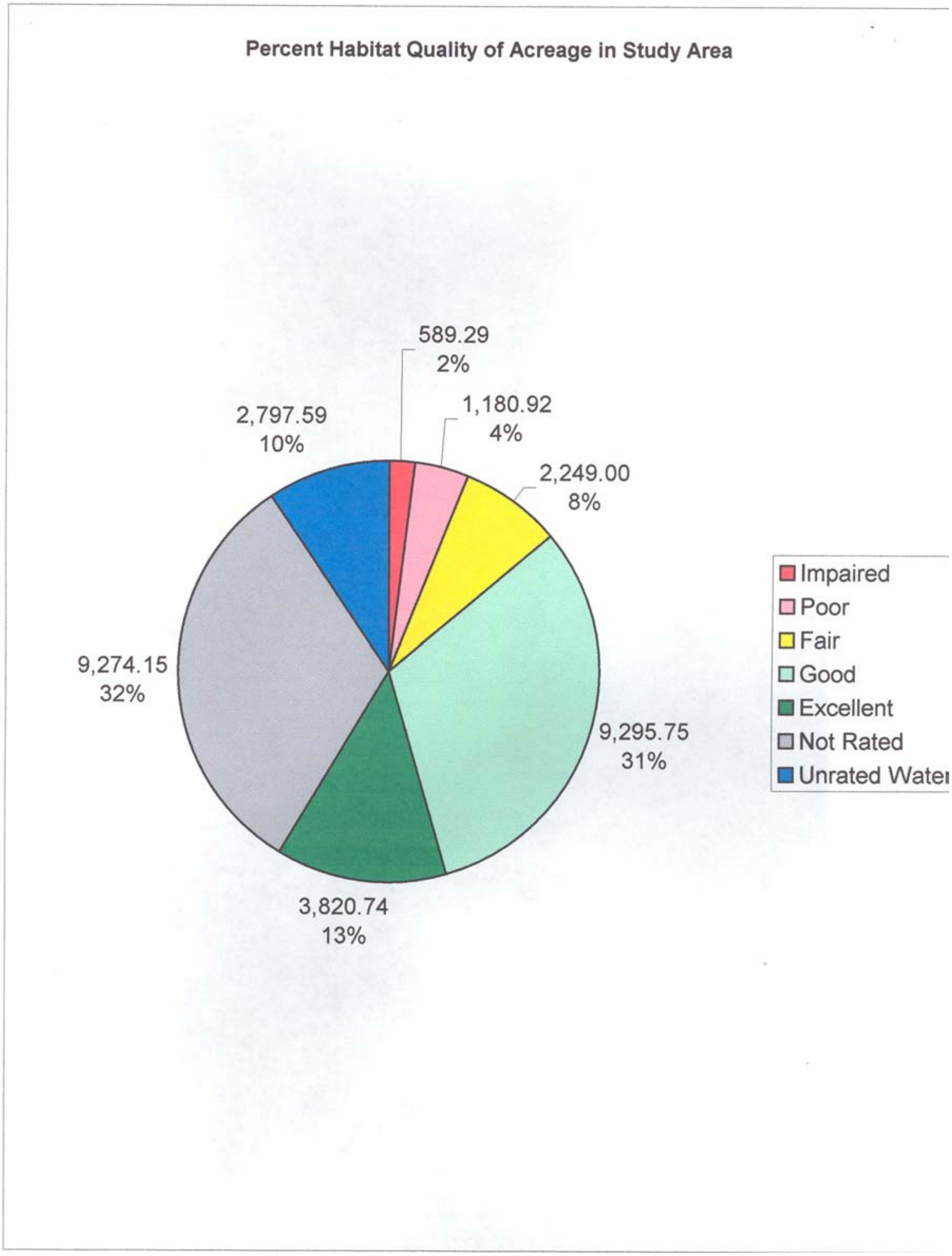
Each parameter is described and scored from 0-5 for a maximum block score of 155. The total for each block is applied to a ranking of 5 categories representing 5 different colors which are then mapped to illustrate the score.

Results

Based on the habitat quality evaluation and scoring, there is a significant area within the study area of good and excellent habitat. The excellent rating applied to 13% or the area or 3,820 acres, the good habitat represented 31% of the area with 9,295 acres, the fair habitat was 8% of the area with 2,249 acres, poor and impaired habitat made up 6% with a combined area of 1,770 acres. The remaining area represented water bodies (10%) or urbanized or unsuitable area (32%).

The results of the habitat quality evaluation are illustrated on the Habitat Quality Map and associated pie chart which breaks down the percent of area (acres) represented by each quality score. Supporting spreadsheets and habitat quality guidelines (appendix-to be added)

Habitat Quality Map


Percent Habitat Quality of Acreage in Study Area
589.29
2%
1,180.92
4%
2,249.00
8%
9,295.75
31%
3,820.74
13%
9,274.15
32%
2,797.59
10%
Impaired
Poor
Fair
Good
Excellent
Not Rated
Unrated Water

HABITAT LOSS

Description

Habitat loss is expected to occur within the city and associated urbanizing area. The rate, type and area of loss is however, an indicator of change and could assist in documenting declines in diversity and predicting species extirpation. The loss of habitat in Bellingham is a general measure and would require a finer filter for making definitive conclusions. This habitat loss assessment is based on changes between 1991 and 2001, a period of ten years.

Methods

To be added

Results

The results of the habitat loss analysis between 1991 and 2001 totaled 1,620 acres in the study area. Within each watershed a total acreage was calculated.

Bellingham Bay	32.58 ac
Chuckanut Creek	46.65 ac
Lake Whatcom	252.14 ac
Little Squalicum	.35 ac
Padden Creek	212.95 ac
Silver Creek	162.67 ac
Squalicum Creek	430.94 ac
Whatcom Creek	481.40 ac

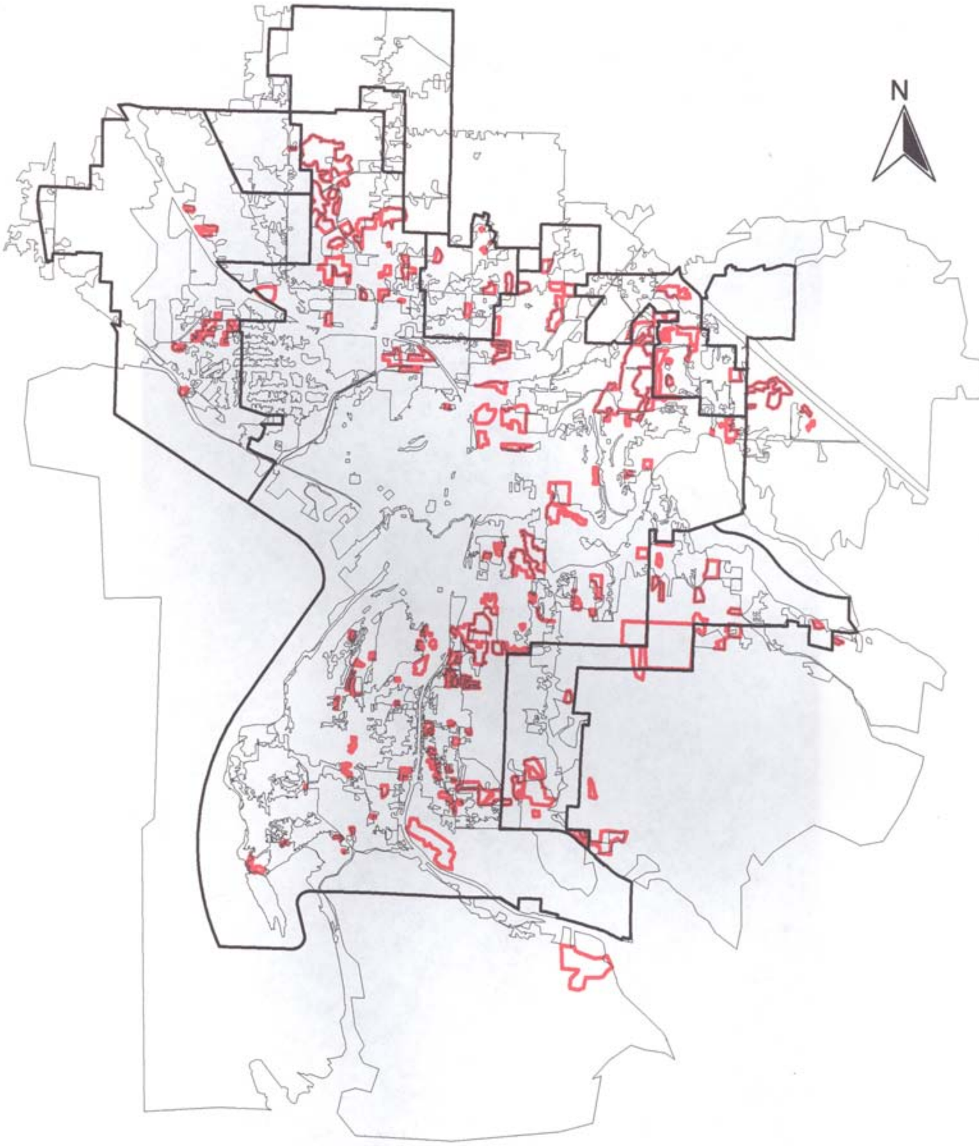
A more detailed results summary will be added.

The following map illustrates the habitat loss throughout the study area between 1991 and 2001.

Habitat Loss Map

Bellingham Habitat Assessment

Habitat Lost Since 1991

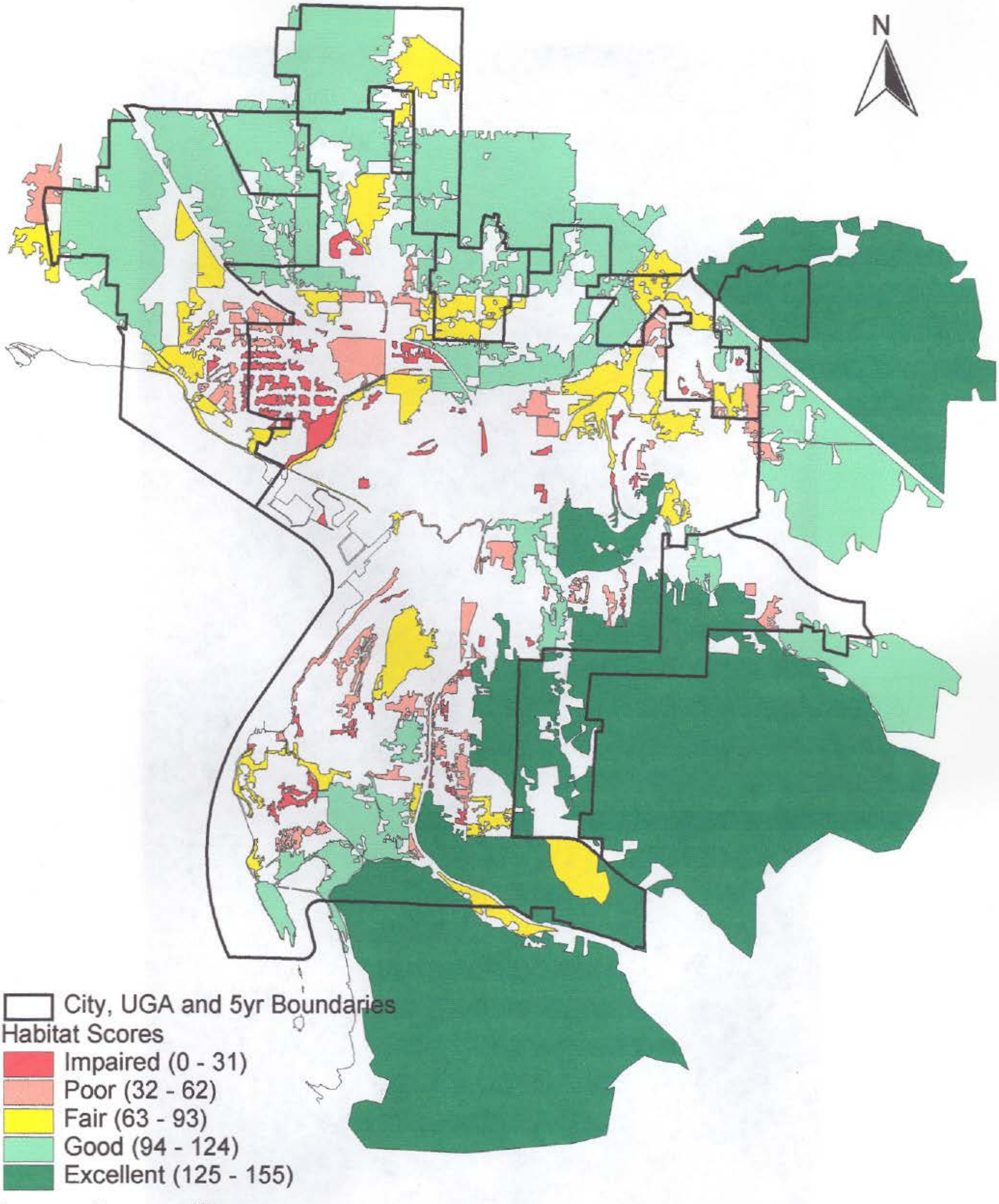


Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

Bellingham Habitat Assessment

Habitat Scores



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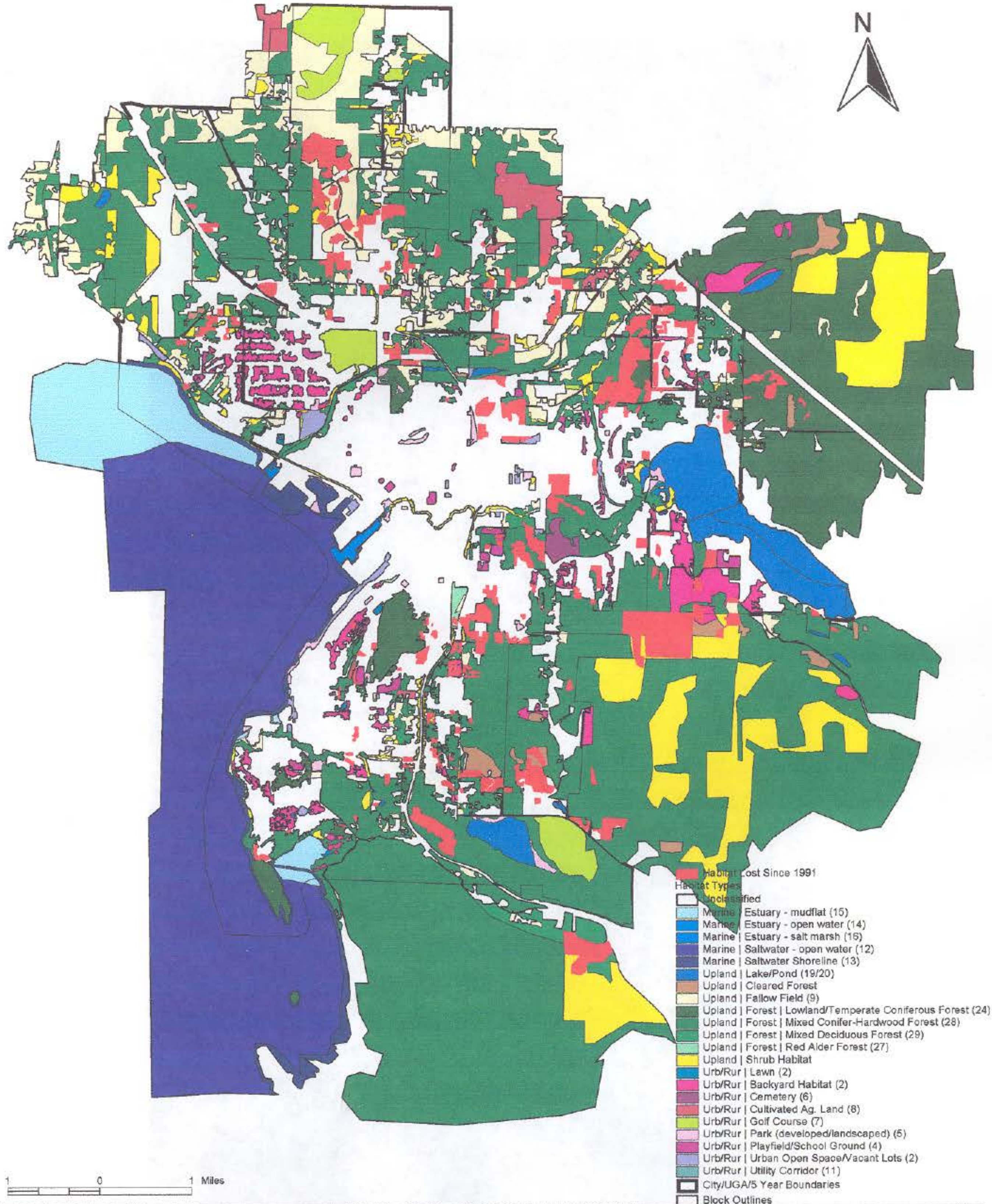
Map by Jean Olson

City of Bellingham
Public Works Department

Bellingham Habitat Assessment

Lost Habitat Since 1991



Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

HABITAT RISK ANALYSIS

Description

A risk assessment for each block was conducted using a risk matrix devised to identify potential impairment, loss or reduced wildlife use.

Methods

The risk analysis was requested specifically to serve as a tool for identifying vulnerable habitat and high priority restoration areas. Risk to most terrestrial habitat function and value is a direct result of fragmentation, isolation, degradation or loss. For stream systems the risks are more complex given the dependence of the flow from head waters, tributaries and recharge areas far removed from the main channel, and water quality dependant on every point source of inflow. The risk matrix included a broad spectrum of potential risk factors that could degrade the habitat associated with each block. The risk factors include 9 categories with values between 0-5 for each for a maximum risk of 45. The categories include:

- Size change
- Protection status
- Corridor loss
- Diversity/Isolation Potential
- Habitat Considerations
  - Wetlands
  - Stream/Riparian
  - Shoreline
  - Terrestrial
  - Headwater/Recharge

The scoring for all habitat blocks were then divided into 4 ratings.

1. Low risk
2. Medium risk
3. High risk
4. Extreme risk

The complete risk matrix and associated spreadsheets are attached in the appendix of this report.

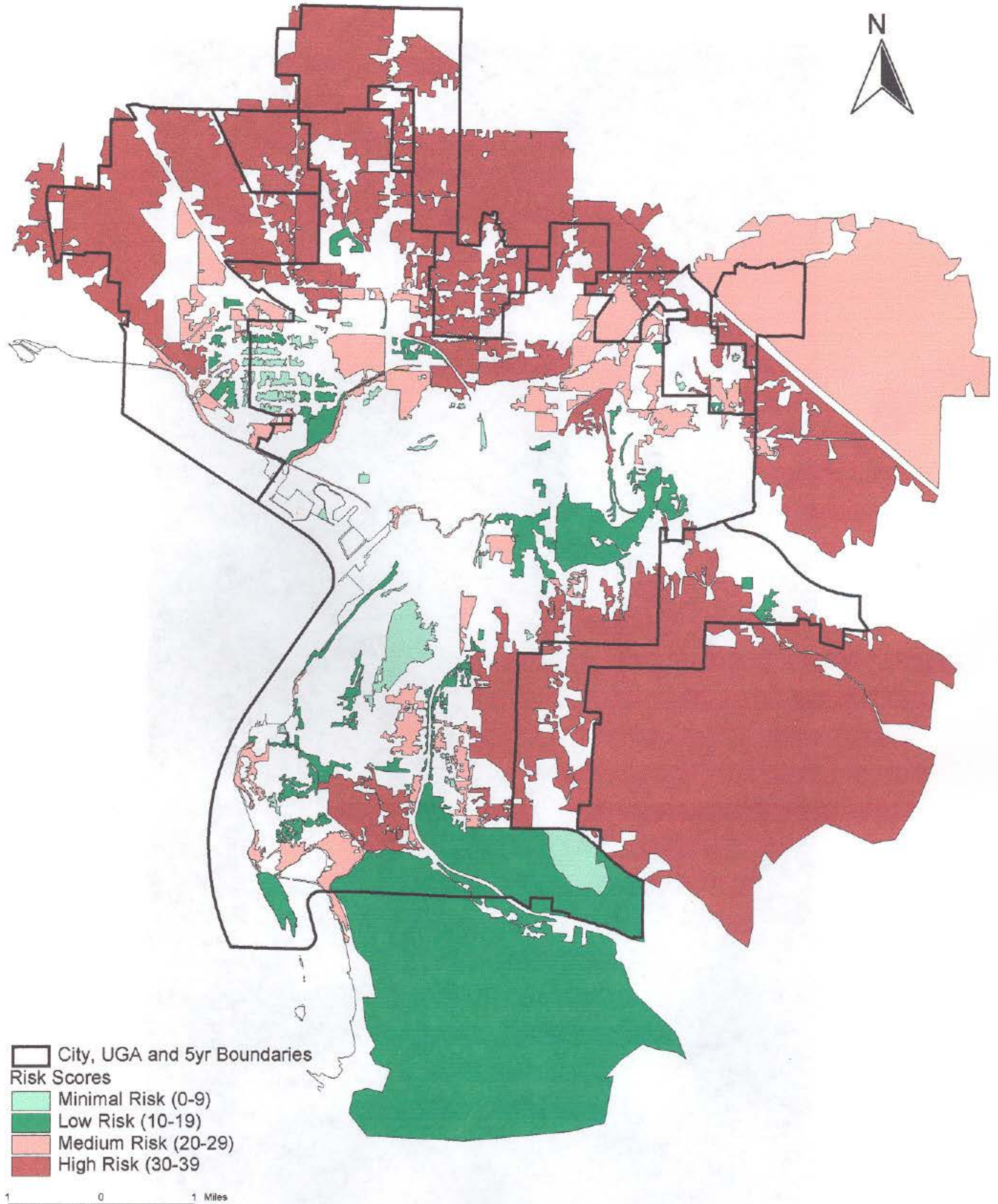
Results

A result summery will be added.
The risk assessment map illustrates the risk level of each habitat block within the study area.

Risk Assessment Map

Bellingham Habitat Assessment

Risk Scores



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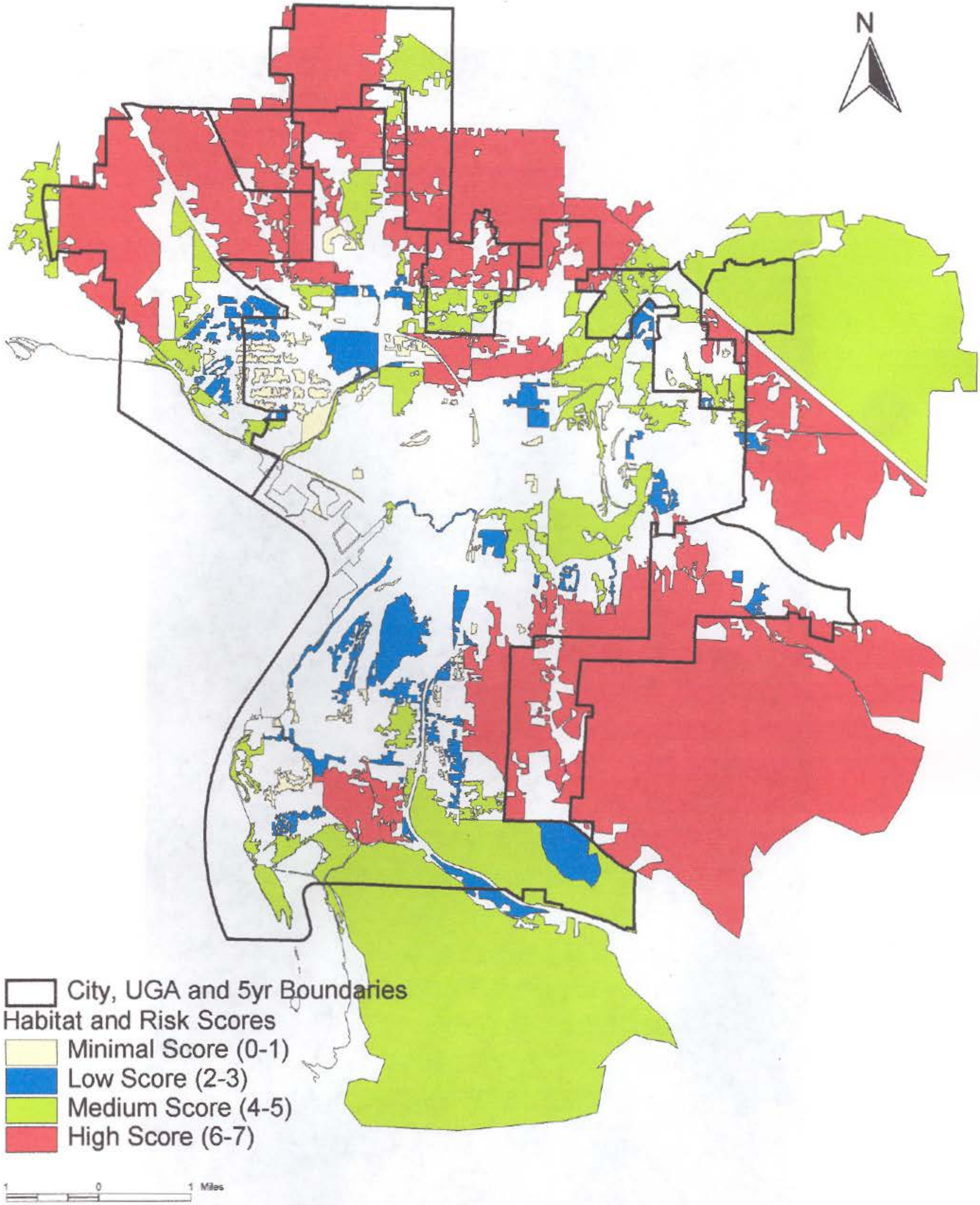
Bellingham Habitat Assessment

Habitat and Risk Scores Combined



Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

WILDLIFE CORRIDORS

Description-Methods

Wildlife corridors were determined by a general evaluation of aerial photo with limited in-field evaluation. Wildlife corridor identification are based on the life cycle and habitat needs of each taxonomic group, plus the occurrence and terrain of the occurrence area. The species specific needs are described in the 1995 Bellingham Wildlife and Habitat Assessment.

Corridors are vital for species movement across the landscape. This movement is essential for breeding, seasonal migration, foraging, life stage needs, population recruitment and dispersal. As habitats become more fragmented, corridors become more important for the safe passage of wildlife across the land and cityscape. Corridors require adequate cover, screening, width and access. Finally, corridors cannot function in isolation; they must lead to and from larger areas of habitat, that provide the essential elements for animal survival.

One frequently overlooked corridor is that of the aquatic-upland interface. Riparian habitat is essential for linking the upland terrestrial area with the aquatic(and marine). This linkage is one of the most important habitat connections on the landscape and one that has been overlooked by placing too much value on riparian habitat alone. Although we know most fish don't walk; frogs, toads, salamanders and semi aquatic mammals require movement between the freshwater (and in some cases marine saltwater) to upland environs. These linkages are, in many cases, non-linear. Not only does wildlife move between terrestrial and aquatic systems, most amphibian populations, for example, depend on aquatic-upland corridors for reproduction and survival. Other important corridor features include linear corridors such as streams, ditches, riparian stringers, trails/greenways, shorelines and street trees. Natural landscape corridor features also include forest or open space connectors, wetland complexes and topographic features including ridgelines and drainages.

In addition to corridors, there are negative habitats, such as major roadways, severed linkages, barriers and habitat sinks. These areas may bisect or terminate an existing or historical corridor and trap wildlife and/or result in death. I-5 is by far the greatest barrier and hazard to wildlife movement in the City of Bellingham. Only one wildlife underpass (passageway) existing within the city. Major habitats that have become isolated, or islands of habitat, are known as sinks and trap animals or result in inhibited faunal flow which reduces and eliminate species over time.

The corridor mapping was completed through a process of evaluating the available habitat information, build and landscape features, potential species occurrence and species requirements. This is the first corridor mapping within the City and provides a conceptual view of wildlife movement. Important features include the identification of sinks, road crossings, particularly along I-5, and narrowing linkages between major habitat reserves and the bisection of habitat blocks by new roadways.

Results

Wildlife corridors within the City of Bellingham are little known and poorly recognized as important wildlife features. The wildlife corridor mapping process revealed a corridor system within the city and certain areas of concern. As mentioned before, this is the first attempt to identify corridors in the city and was completed at a marco scale. These results should be used as the bases of further, more detailed work, particularly by watershed. Basically without the implementation of a wildlife/habitat network as defined in the 1995 assessment, Bellingham will witness the loss of native wildlife diversity.

Corridors are connections to and from large habitat areas or nodes. If a safe passage is not available in association with a node, species are extirpated, diversity declines, and only urban tolerant species remain, including non-native species. These areas are described as habitat sinks. A typical scenario is the development of a natural area into a housing development. The development is required to leave a wetland area and buffer. This area is left intact while the remaining habitat is removed and built. The result is a sink.

Examples of areas in Bellingham that were identified as sinks are Sehome Hill, Lincoln Creek..... Potential sinks are Whatcom Falls Park, Cornwall Park, Clark's Point,...

The examination of corridor connections within the city illustrated the loss of habitat connectivity citywide, particularly north and south across the developed urban area. Unfortunately, the lack of north-south connectors is exacerbated by Lake Whatcom, which is not only a natural barrier for terrestrial species, but with the high development around the lake, wildlife is further limited.

In addition to dense development, the single greatest obstruction to east-west wildlife movement in the city is I-5. I-5 has become a death trap for wildlife in the past ten years, due to the increased traffic 24 hours a day, 7 days per week. Wildlife, small and large, including some birds and entire mammalian family units are hit and run over on the freeway. There is a serious need, both from a human safety and wildlife protection perspective to provide safe passages for wildlife under/over I-5. Only one seminatural passage currently exists, just north of Squalicum Creek, which is an abandoned railway underpass. Wildlife utilizes this passage daily and with some enhancement to connect with Squalicum Creek, could serve the creek's wildlife community. Recently, however clearing around the underpass has discouraged certain species, such as beaver, who have attempted to cross the freeway from Bug Lake to Sunset Pond.

Shoreline development throughout the city has limited wildlife use and degraded habitat citywide. The natural flow of wildlife within the Salish Sea, was of unobstructed movement to and from shoreline areas, along streams and lakes. This movement has been bisected by I-5, obstructed by shoreline development (including the railroad) and limited by urban growth. The only natural marine shoreline available for wildlife to access is Clark's Point and Chuckanut Bay.

Although the Greenways program has created a pedestrian trail network throughout the city, many of the trails have limited value for wildlife. In fact, the consistent creation of trails along waterbodies, shorelines and streams, directly obstructs wildlife access to fresh and salt water. These shoreline and stream-side trails also bisect important aquatic upland connections. Wider stream and wetland riparian buffers with upland connection are essential. In addition, fully functional natural corridors are needed to connect habitat areas.

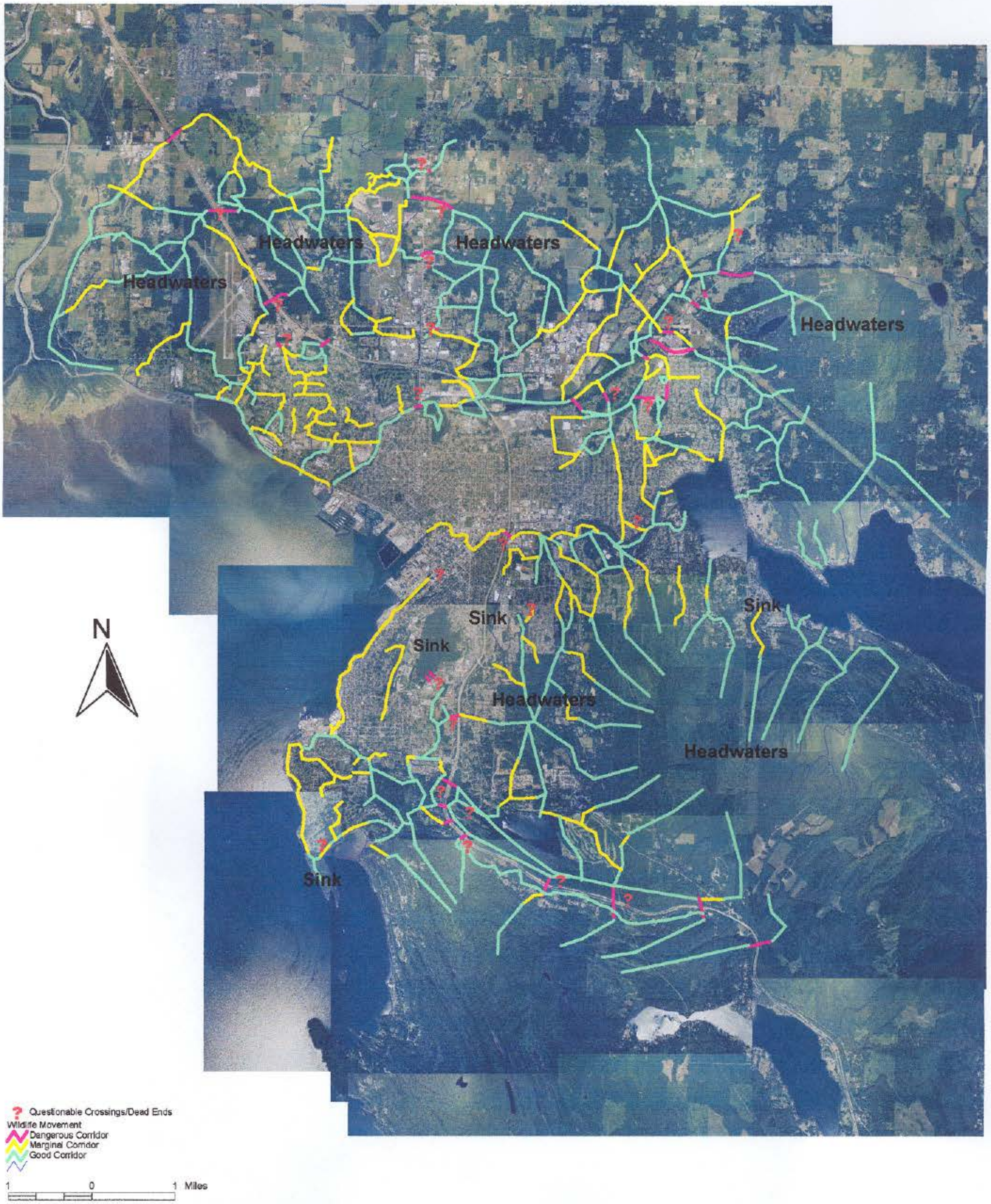
The planning process needs to incorporate wildlife movement and the retention of functional corridors as a fundamental part of development. It is also recommended that a more detailed analysis of corridors be conducted with the goal of creating a citywide habitat network.

The results of the corridor mapping in this assessment is an illustrated aerial photo depicting conceptual corridors, habitat sinks and important road crossings. Each corridor is rated as good, marginal and dangerous.

Wildlife Corridor Map

Bellingham Habitat Assessment

Wildlife Corridors



Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

STREAM ASSESSMENT (to be completed)

Description

The major streams and tributaries throughout the study area were mapped for habitat quality, fish utilization and water quality. Streams are a focal point of protection and restoration throughout the Pacific Northwest due to the recent listing of certain salmonid species under the Federal Endangered Species Act. Stream habitat is multifaceted and requires assessment of several parameters. These parameters have been published along with acceptable guidelines for fish.

The major stream courses within Bellingham have been studied at varying degrees of detail, however the minor streams, streams in the UGA and tributaries have not been received the same examination. One of the important findings of this assessment was the linear area of the stream tributaries as compared to the main stem ....

	Main Stem (Ft)	Total streams in watershed (ft)	Tributary (ft)	Tributary % of Watershed	Mainstem % of Watershed
Squalicum	57369.66284	241086.0127	183716.3498	76.20	23.796346
Silver	38063.83588	227165.4652	189101.6293	83.24	16.755996
Padden	31286.42205	94065.34382	62778.92177	66.74	33.260307
Little Squalicum	3409.02221	14779.00183	11369.97962	76.93	23.066661
Chuckanut	36955.52172	86575.94594	49620.42422	57.31	42.685669
Whatcom	29676.78653	161779.4566	132102.6701	81.66	18.343977

The city stream data was made available

Further assistance was provided by Bellingham Environmental Specialist, Renee LaCroix. The data sources included.... Water quality and in-stream habitat quality data were divided into three categories, good, fair and poor. These three categories were then mapped in color codes to depict general quality within specific reaches. In addition barriers to fish passage were identified and described. Riparian habitat features are available for only portions of the city and were too inconsistent to evaluate or map.

Fish distribution and habitat utilization data was reviewed and mapped. Chris Behee, GIS Specialist for the City of Bellingham, combined the available data sources to create a composite map which served as a baseline. The data sources included (to be added). The fish map includes anadromous and resident fish, and certain shoreline spawning species. Habitat utilization included rearing, spawning, unspecified occurrence and limits of occurrence. Six types of barriers to fish were also identified and mapped in locations of occurrence.

Stream Fish Habitat (to be completed)

Description

.

Methods-Results

Barriers, Spawning and Rearing

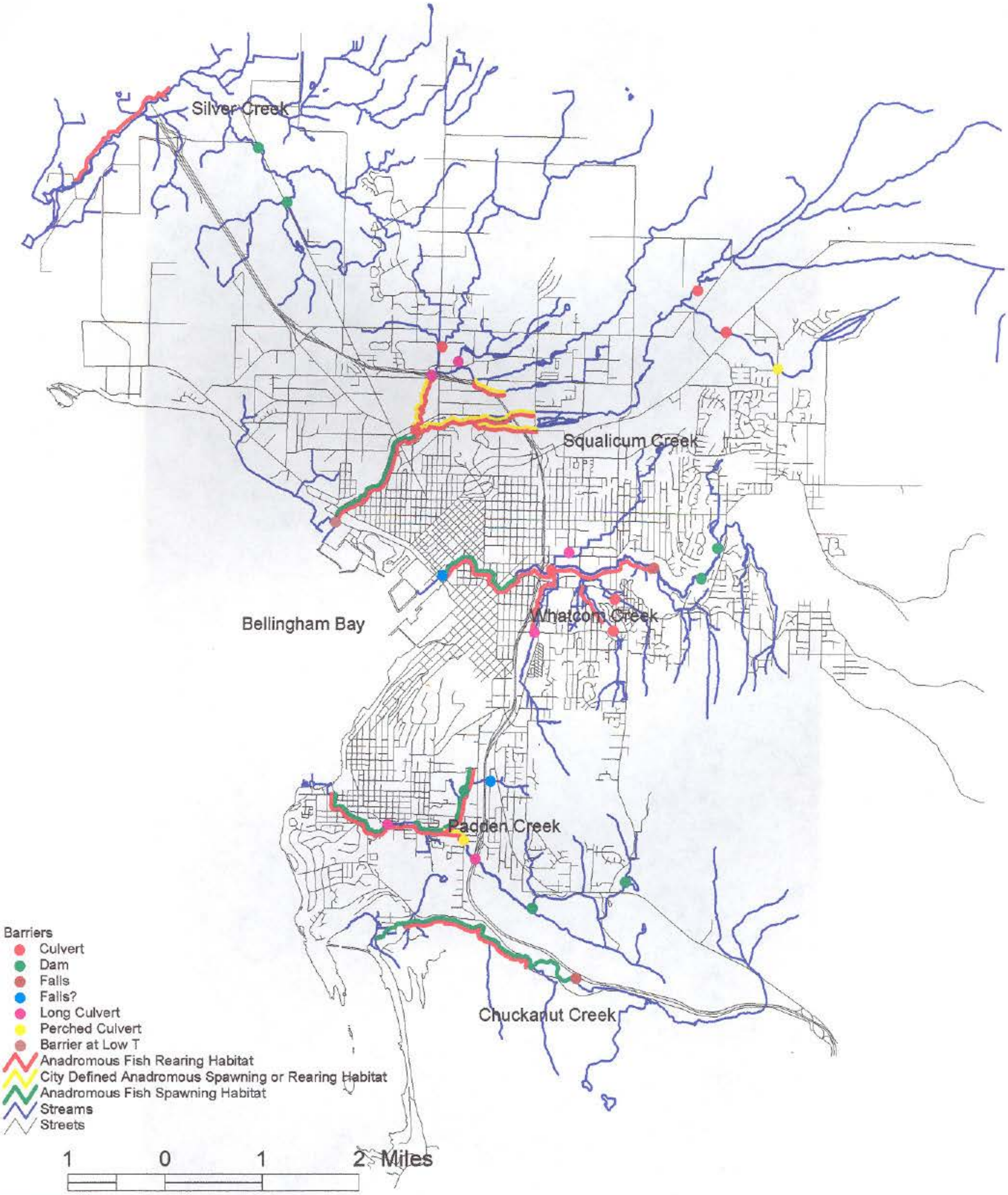
The maps showing barriers to anadromous fish movement and anadromous spawning and rearing habitat were compiled from information supplied by the City of Bellingham

Fish Habitat and Barrier Map

Bellingham Habitat Assessment

Anadromous Fish

Barriers, Spawning and Rearing Habitat



Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

Stream Water Quality

Description

Stream water quality is the most important parameter in assessing fish habitat and overall stream health. There is little debate that fish and other aquatic life can only be sustained overtime with good water quality. The water quality for the 5 major streams in the city and UGA has been monitored by Bellingham Public Works Department and this accumulated data was used for the assessment. As previously mentioned, the stream assessment is focused on fish, anadromous fish. The parameters used to measure water quality were based on fish (primarily anadromous fish) guidelines reviewed from several sources. List those sources....................

The water quality background (to be completed)

Methods

Water quality data from the City was acquired and examined. The city data included 6 parameters spanning over 10? years. Following the review of several literature sources and guidelines for interpreting water quality data for salmonids, an application and interpretive method was determined. The parameters important to fish health were identified. Specific values were then applied, per parameter, as ranges for fish survival. These ranges include the following:

Dissolved oxygen:	Juv/Adult: >5 = functional; 4 or less is lethal	
	Egg: >8 = functional; 7 or less is lethal	
pH:	6.00=functional low; 9.00=functional high	
Temperature:	Juv/Adult:	functional = 10 to 15.6 degrees Celsius
		Impaired = > 15.6 degrees Celsius
		Lethal = > 22.8 degrees Celsius
	Egg:	functional = 5 to 15 degrees Celsius
Conductivty:	functional = 30 to 1500 umhos	
Turbidity:	functional = <10 NTU's	
Fecal coliform:	Class A Stream = >14 colonies per 100 mL	
	Class AA Stream = >50 colonies per 100 mL	
	Class B Stream = >100 colonies per 100 mL	

(References for determining parameter levels include: ....

The water quality data per stream reach (sampling station) were then applied to each parameter then graphed and mapped. Each watershed is represented separately.

The line graphs are color coded with all streams depicted by color and each year by symbol. The graph represents a one year (12 month) period to display an annual cycle of change (x-axis).

The units of measure on the y-axis provide ranges for functional (green), stressed (yellow) and lethal (red) level lines. These ranges may vary by life stage, so a color coded line denotes life stage limits.

The maps illustrate each parameter by stream and reach. The data applied to the maps was treated differently than the graphed data, in order to show multiple years with one value. The maps reflect the percentage of samples that fall outside functional parameters for fish. The degree of impairment is divided into three categories: low = 0-10, moderate = 11-49, high = 50-100.

The map is meant to serve as a useful tool to identify and isolate areas of water quality impairment per stream.

Results

The result of the water quality assessment is very interesting. A total of # graphs and # maps were prepared. Each graphically represents the data with respect to fish function. Of the six water quality parameters, pH and conductivity were maintained within a functional range throughout the city, year round. The other parameters fluctuated per stream and/or season. Fecal coliform exceeded acceptable ranges most frequently of all the parameters and usually corresponded with high turbidity. Temperature was the one parameter which consistently stressed all stream systems in between June and August. The most stable stream system, based on the water quality parameters, was Chuckanut Creek. The least stable is Silver Creek, which seems odd, given it's forested headwaters, and relatively natural setting. Fish survival in Silver Creek is likely depressed.

Specific problem areas identified for fish are:

Due to the City's data sampling area and design, the available data focuses on the stream main stems and some secondary streams. This is likely due to flow limitations in smaller tributaries.

Not all streams are equally sampled …number of sites vary by stream..

list #sites per stream list

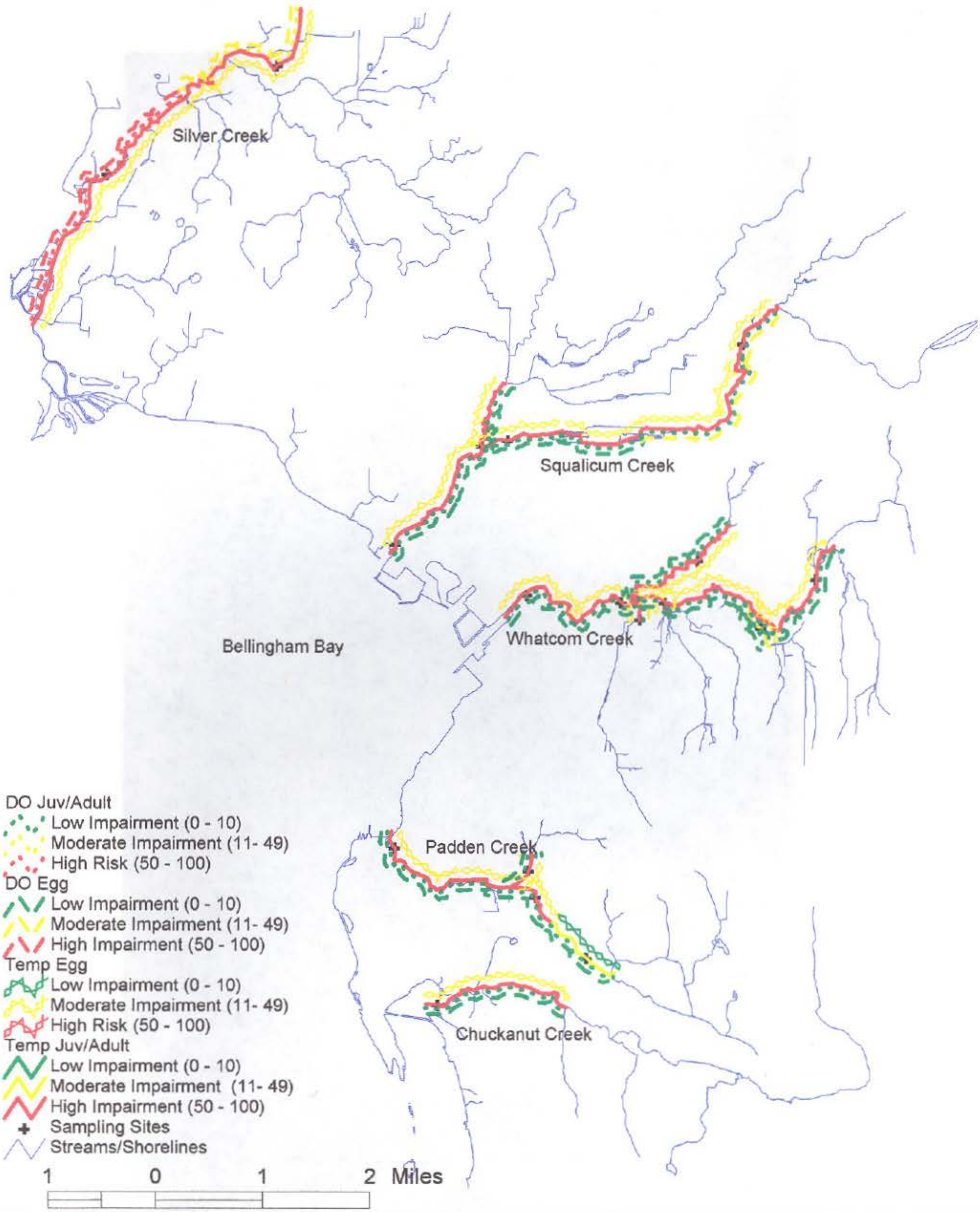
The frequency of sampling is monthly and consistent, yet leaves much to the imagination when abnormal spikes are encountered

Stream Water Quality Graphs
Stream Water Quality Maps

Bellingham Habitat Assessment

Dissolved Oxygen and Temperature

Percent Samples Outside Functional Parameters



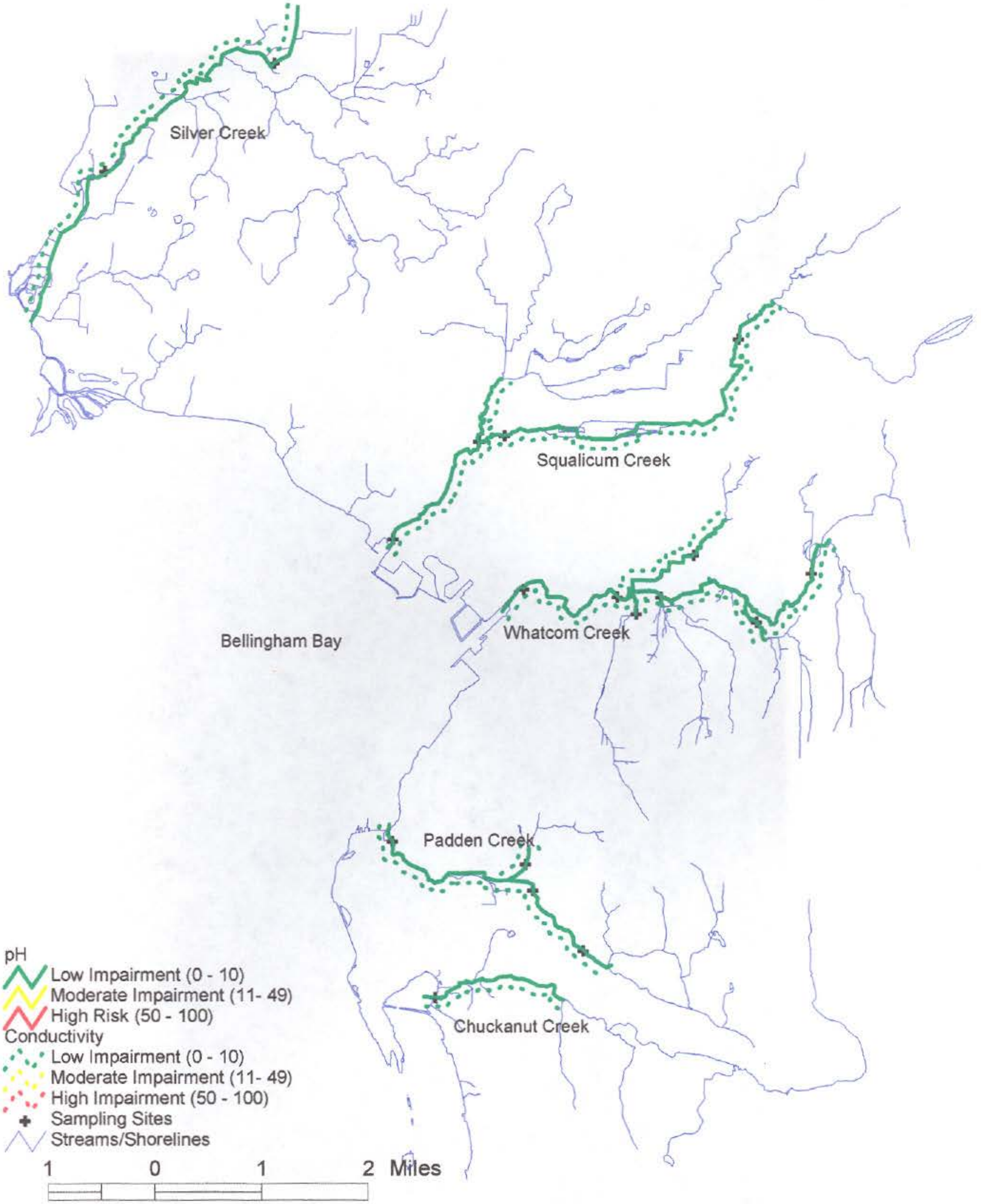
Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

Bellingham Habitat Assessment

pH and Conductivity

Percent Samples Outside Functional Parameters



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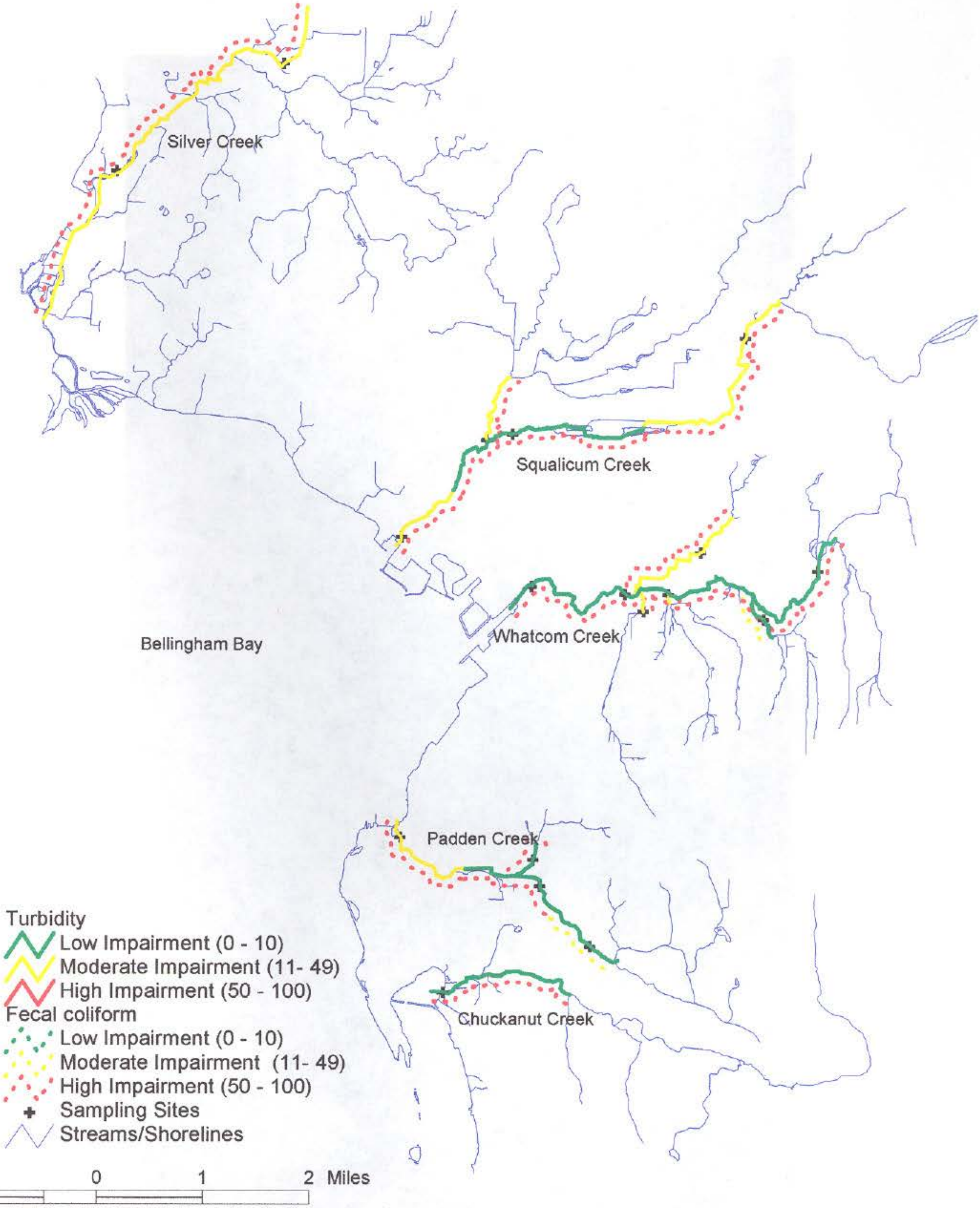
Public Works Department

Bellingham Habitat Assessment

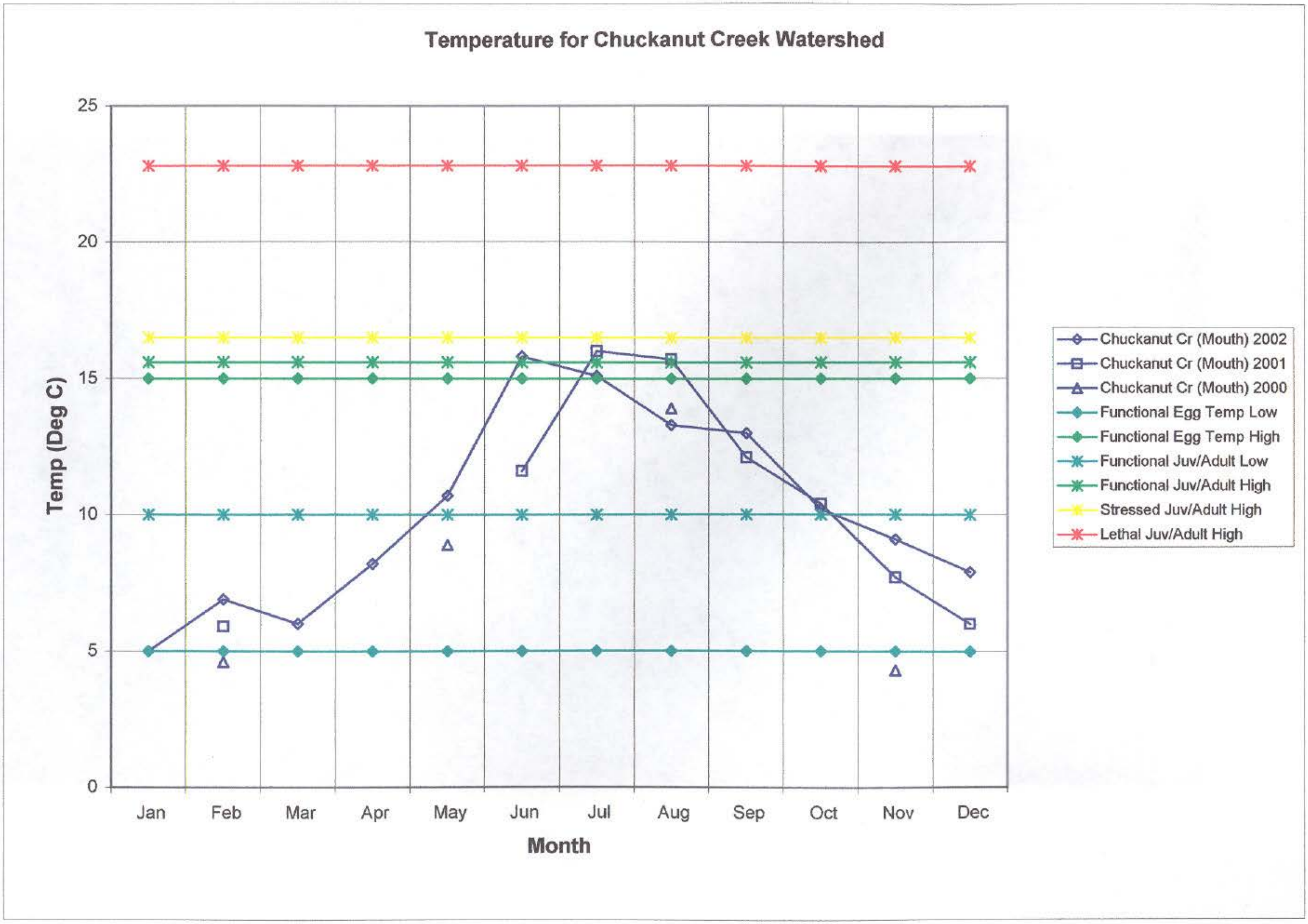
Fecal coliform and Turbidity

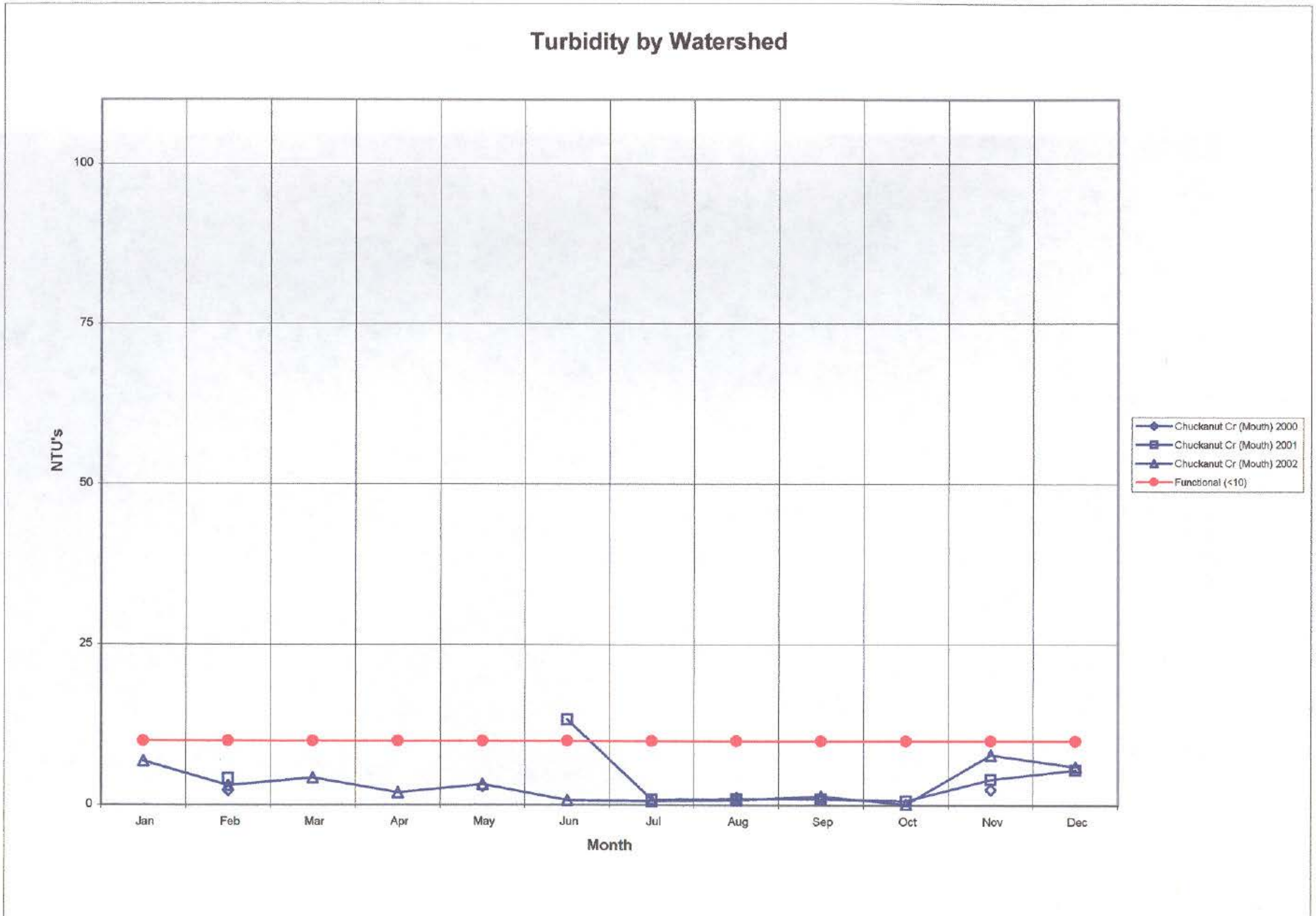
Percent Samples Outside Functional Parameters



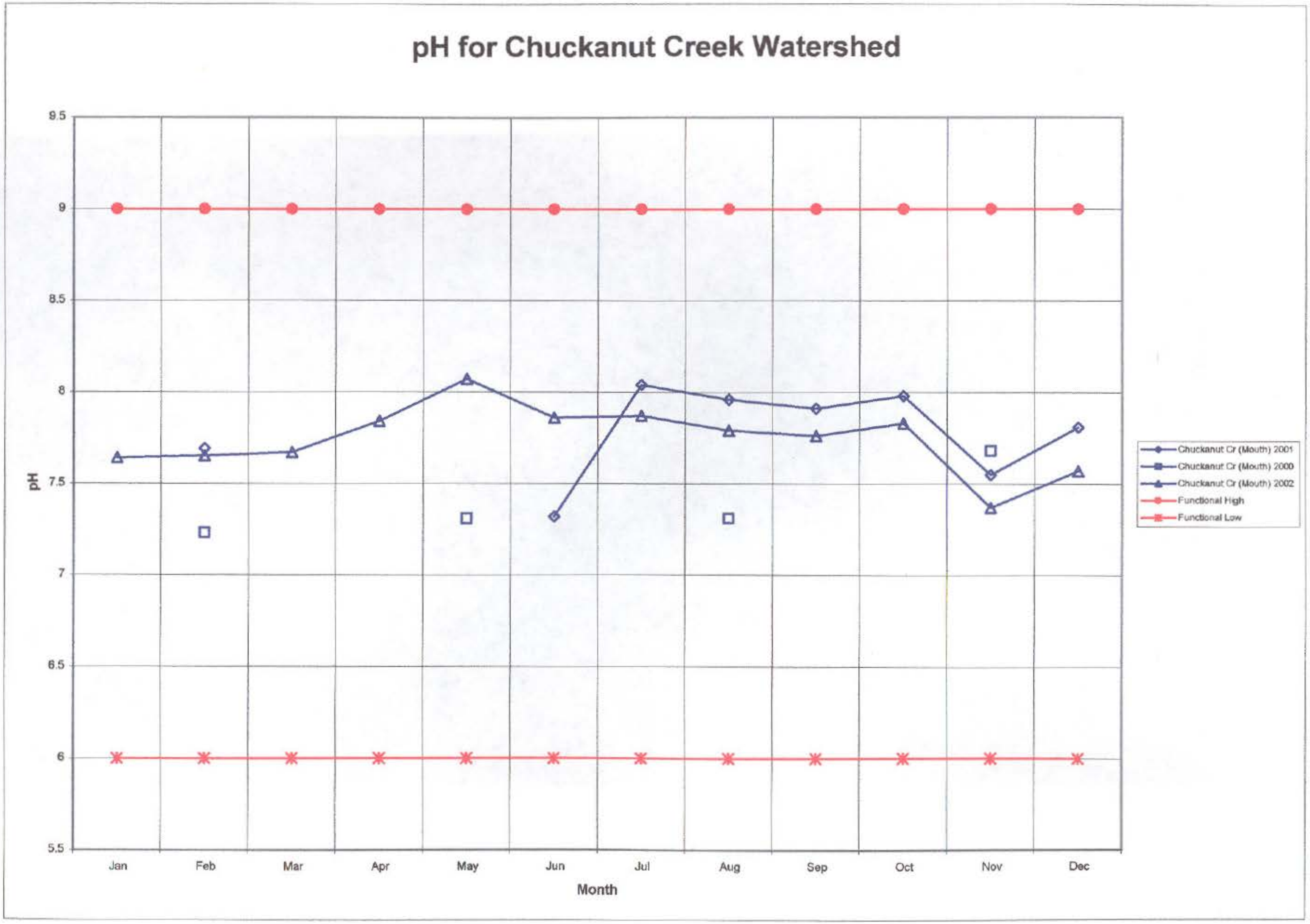
Nahkeeta Northwest Wildlife Services
Map by Jean Olson

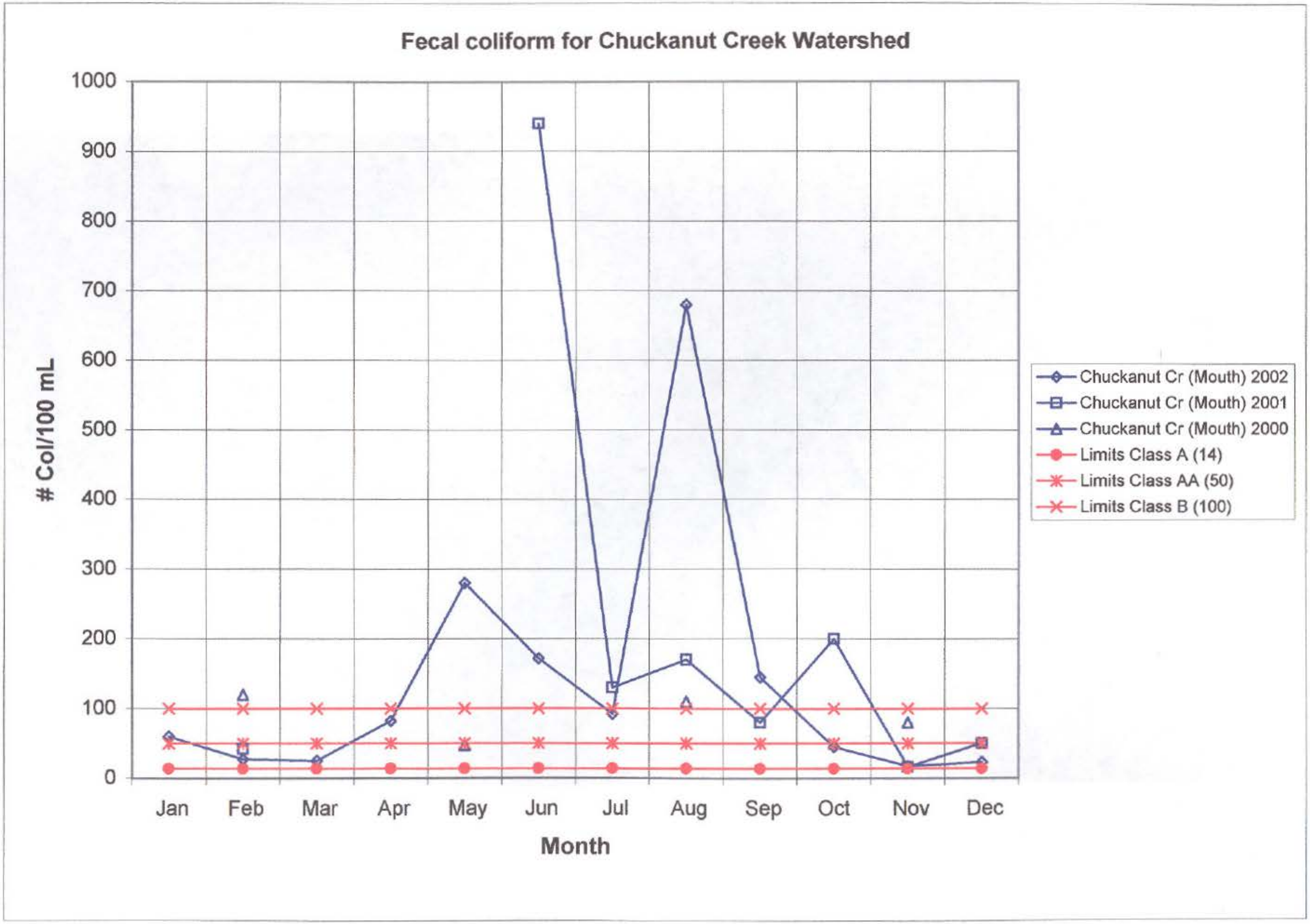
City of Bellingham
Public Works Department

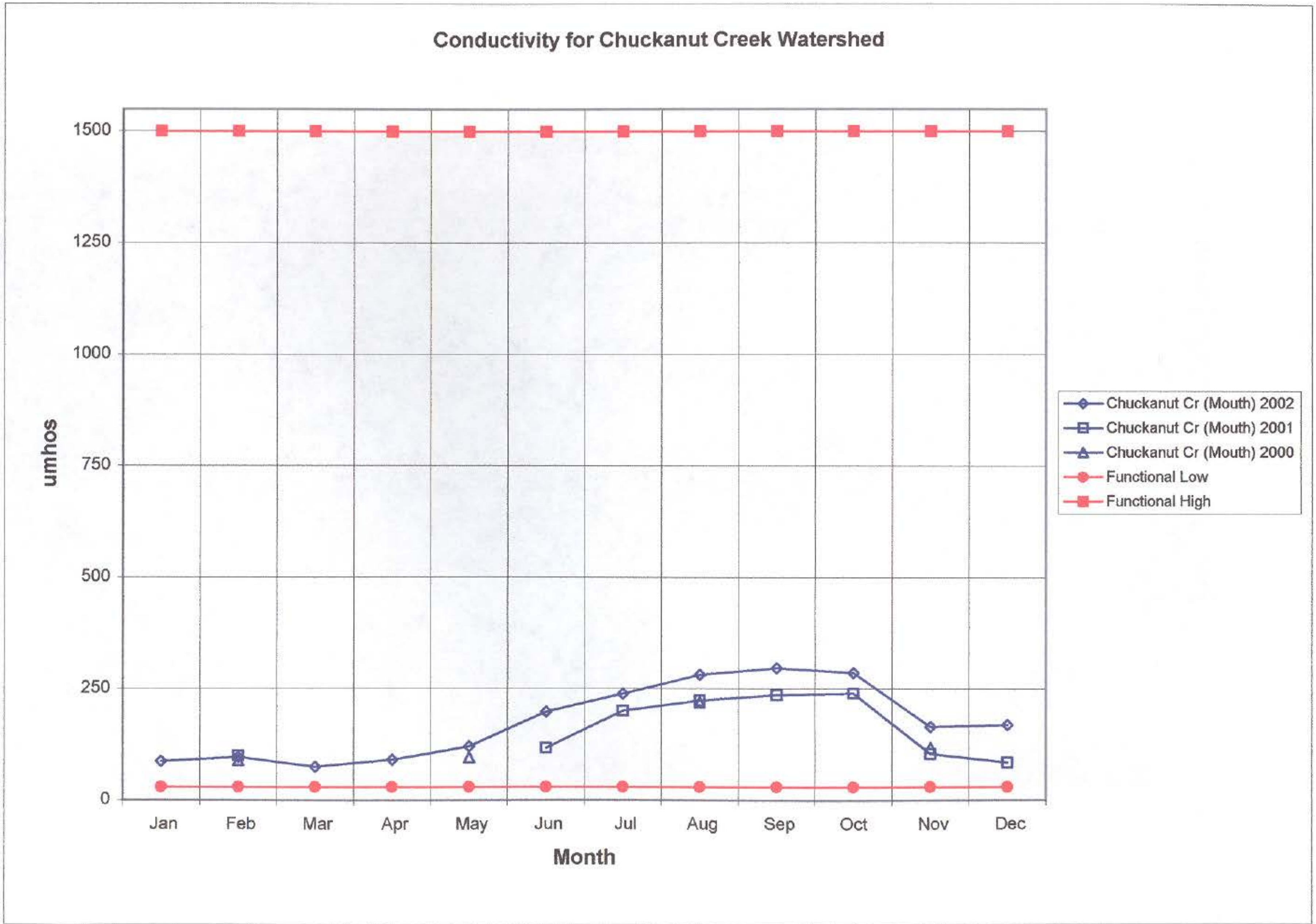

Temperature for Chuckanut Creek Watershed
Temp (Deg C)
25
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Chuckanut Cr (Mouth) 2002
Chuckanut Cr (Mouth) 2001
Chuckanut Cr (Mouth) 2000
Functional Egg Temp Low
Functional Egg Temp High
Functional Juv/Adult Low
Functional Juv/Adult High
Stressed Juv/Adult High
Lethal Juv/Adult High

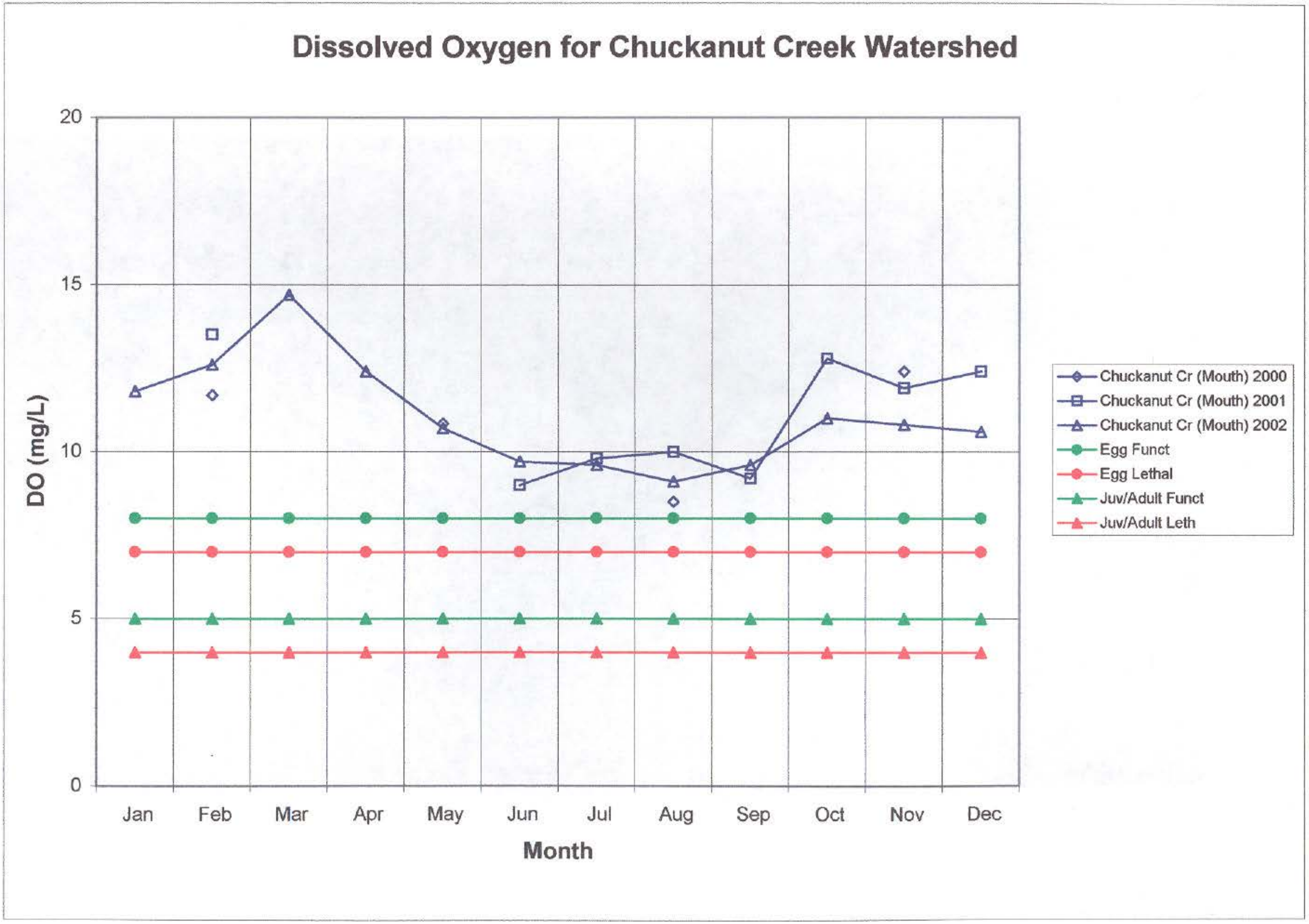


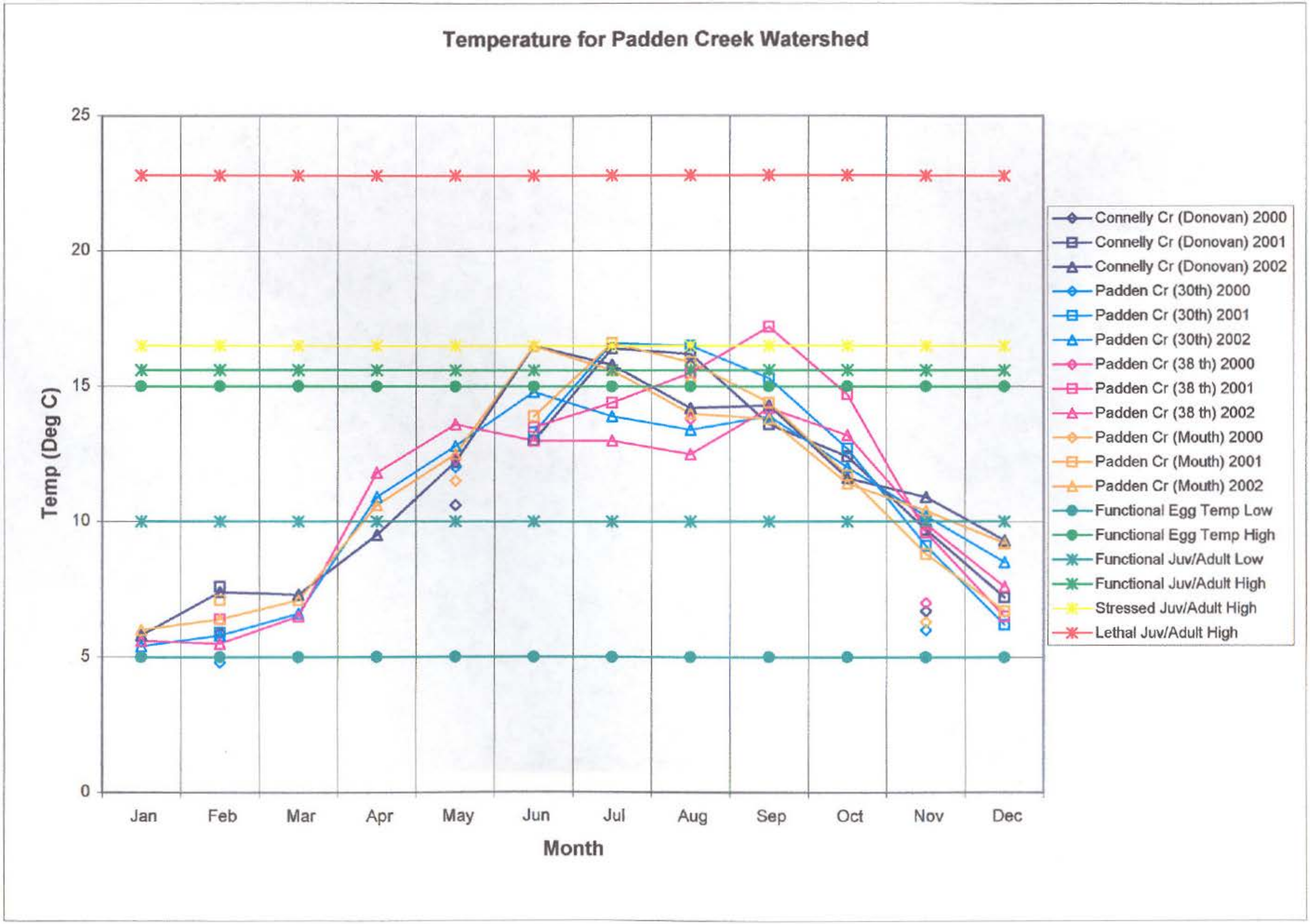
Turbidity by Watershed
NTU's
100
75
50
25
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Chuckanut Cr (Mouth) 2000
Chuckanut Cr (Mouth) 2001
Chuckanut Cr (Mouth) 2002
Functional (<10)


pH for Chuckanut Creek Watershed
9.5
9
8.5
8
7.5
7
6.5
6
5.5
pH
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Chuckanut Cr (Mouth) 2001
Chuckanut Cr (Mouth) 2000
Chuckanut Cr (Mouth) 2002
Functional High
Functional Low

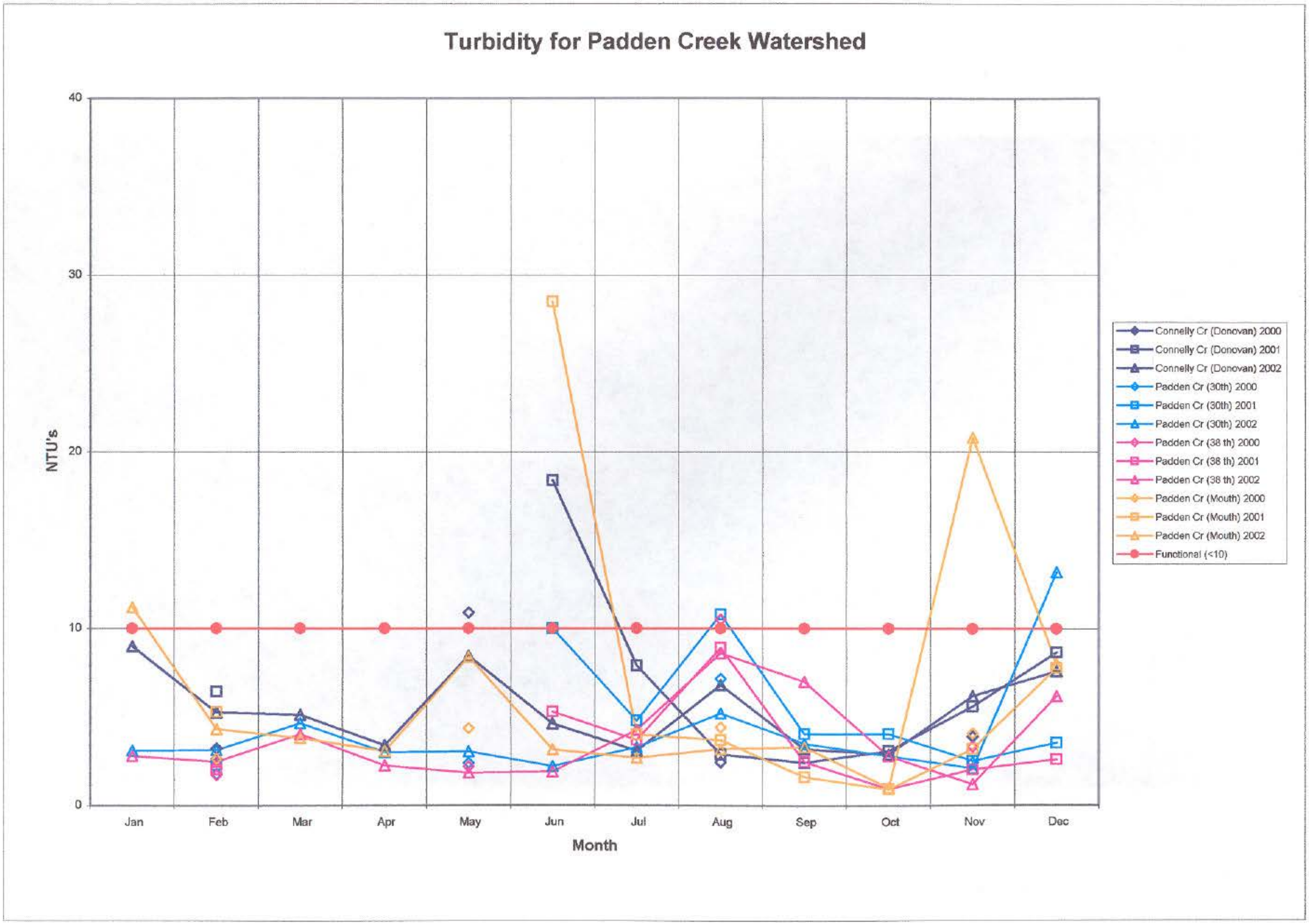

Fecal coliform for Chuckanut Creek Watershed
Col/100 mL
1000
900
800
700
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Chuckanut Cr (Mouth) 2002
Chuckanut Cr (Mouth) 2001
Chuckanut Cr (Mouth) 2000
Limits Class A (14)
Limits Class AA (50)
Limits Class B (100)

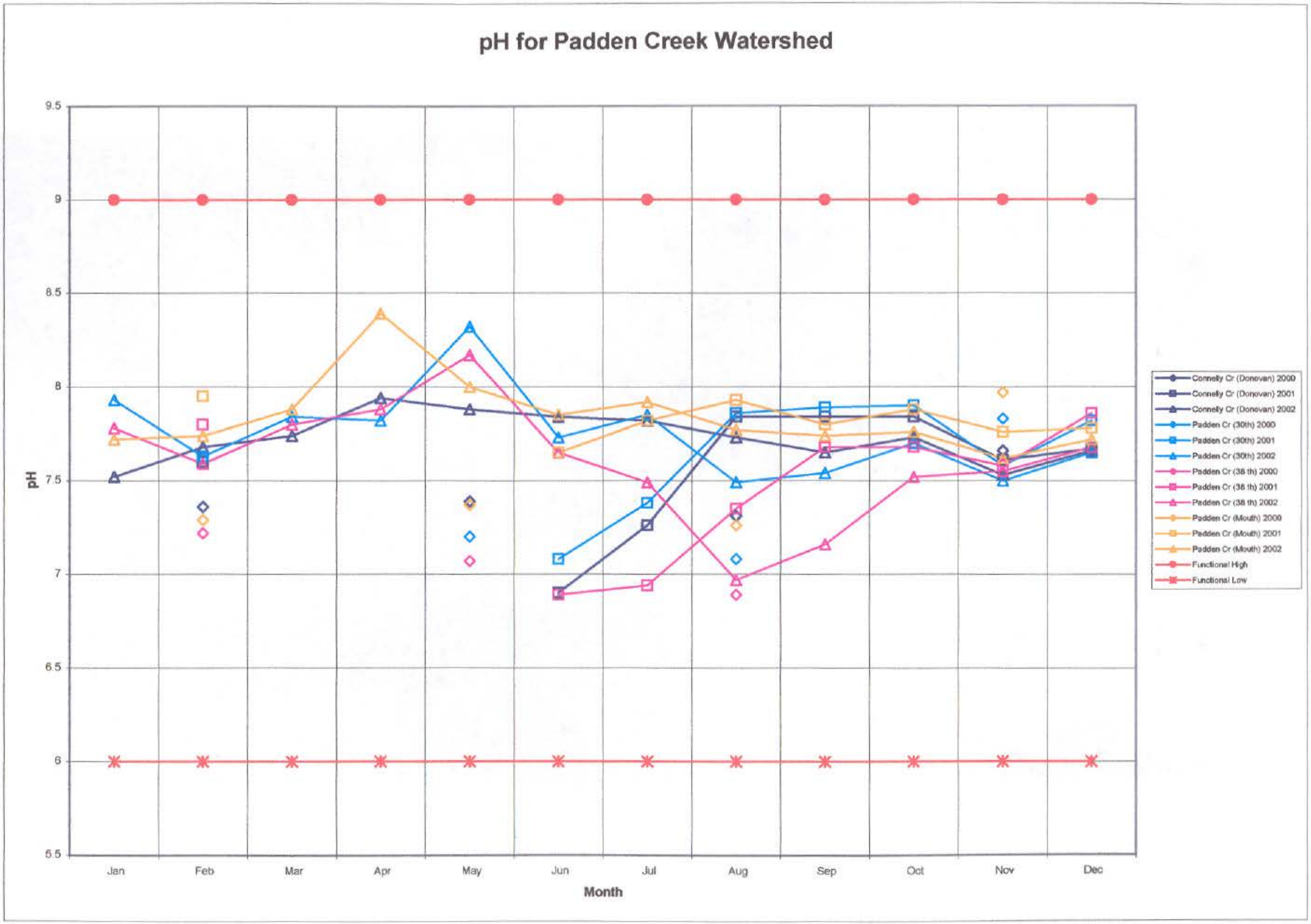

Conductivity for Chuckanut Creek Watershed
1500
1250
1000
750
500
250
0
umhos
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Chuckanut Cr (Mouth) 2002
Chuckanut Cr (Mouth) 2001
Chuckanut Cr (Mouth) 2000
Functional Low
Functional High

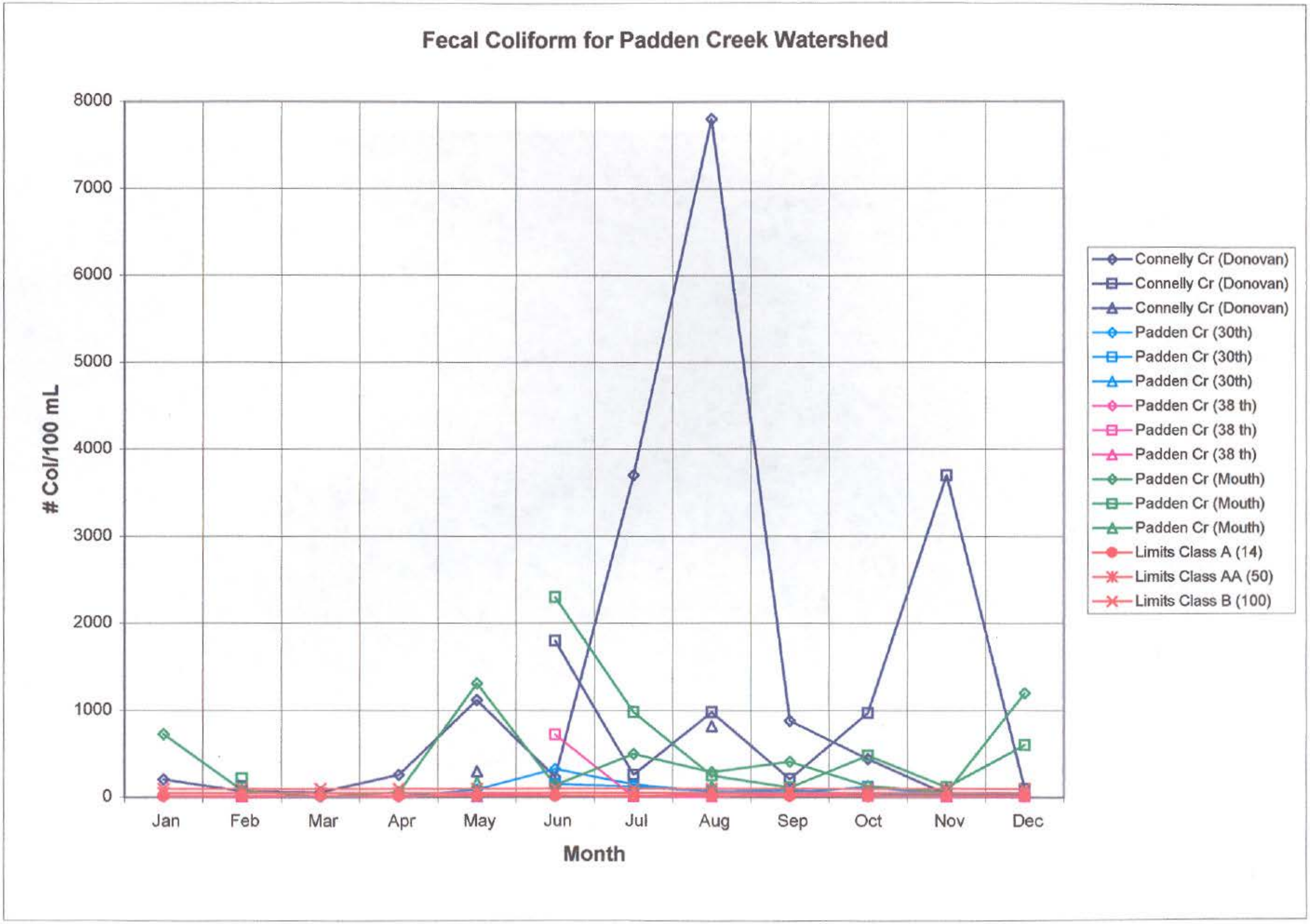

Dissolved Oxygen for Chuckanut Creek Watershed
20
15
10
5
0
DO (mg/L)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Chuckanut Cr (Mouth) 2000
Chuckanut Cr (Mouth) 2001
Chuckanut Cr (Mouth) 2002
Egg Funct
Egg Lethal
Juv/Adult Funct
Juv/Adult Leth

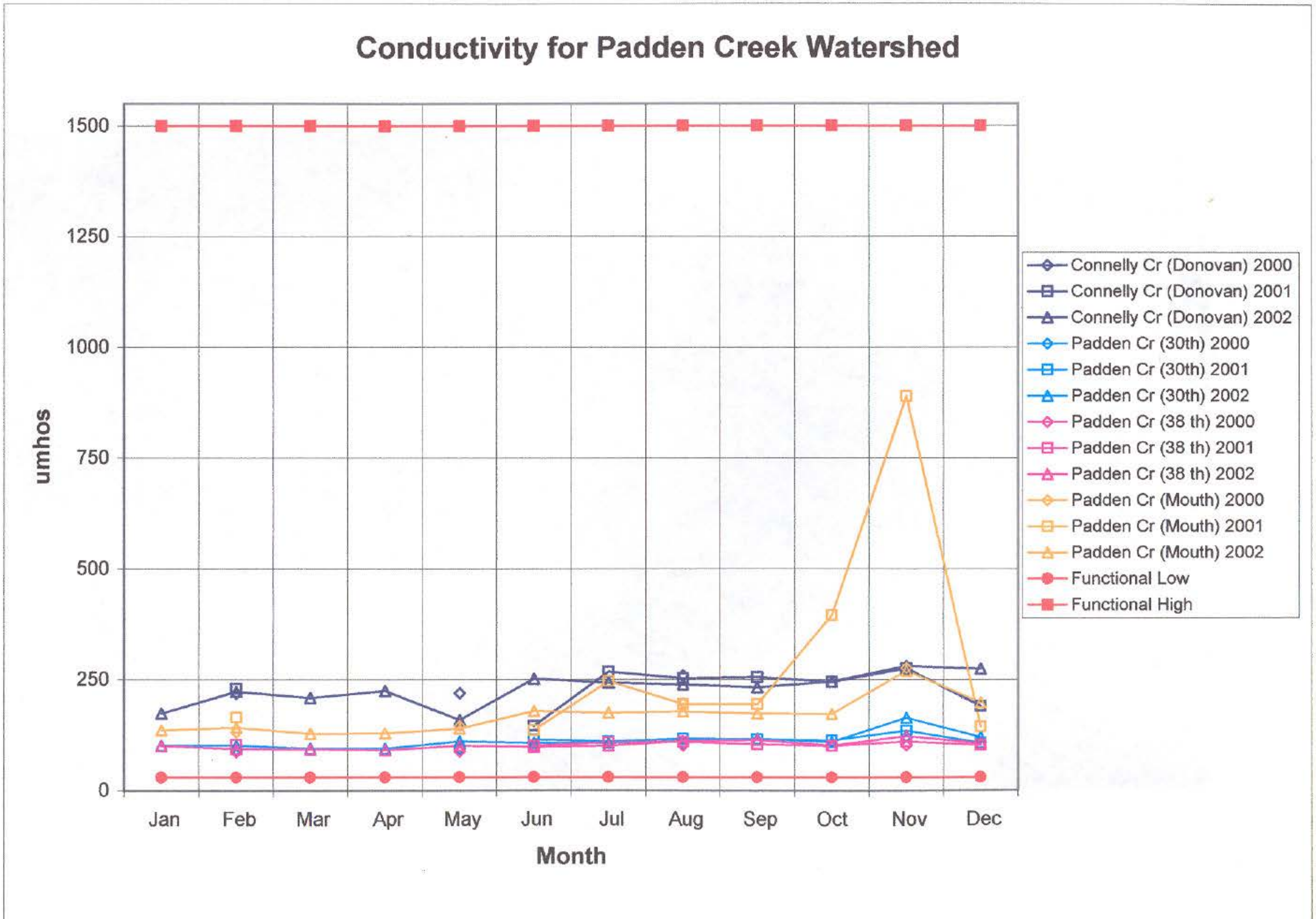


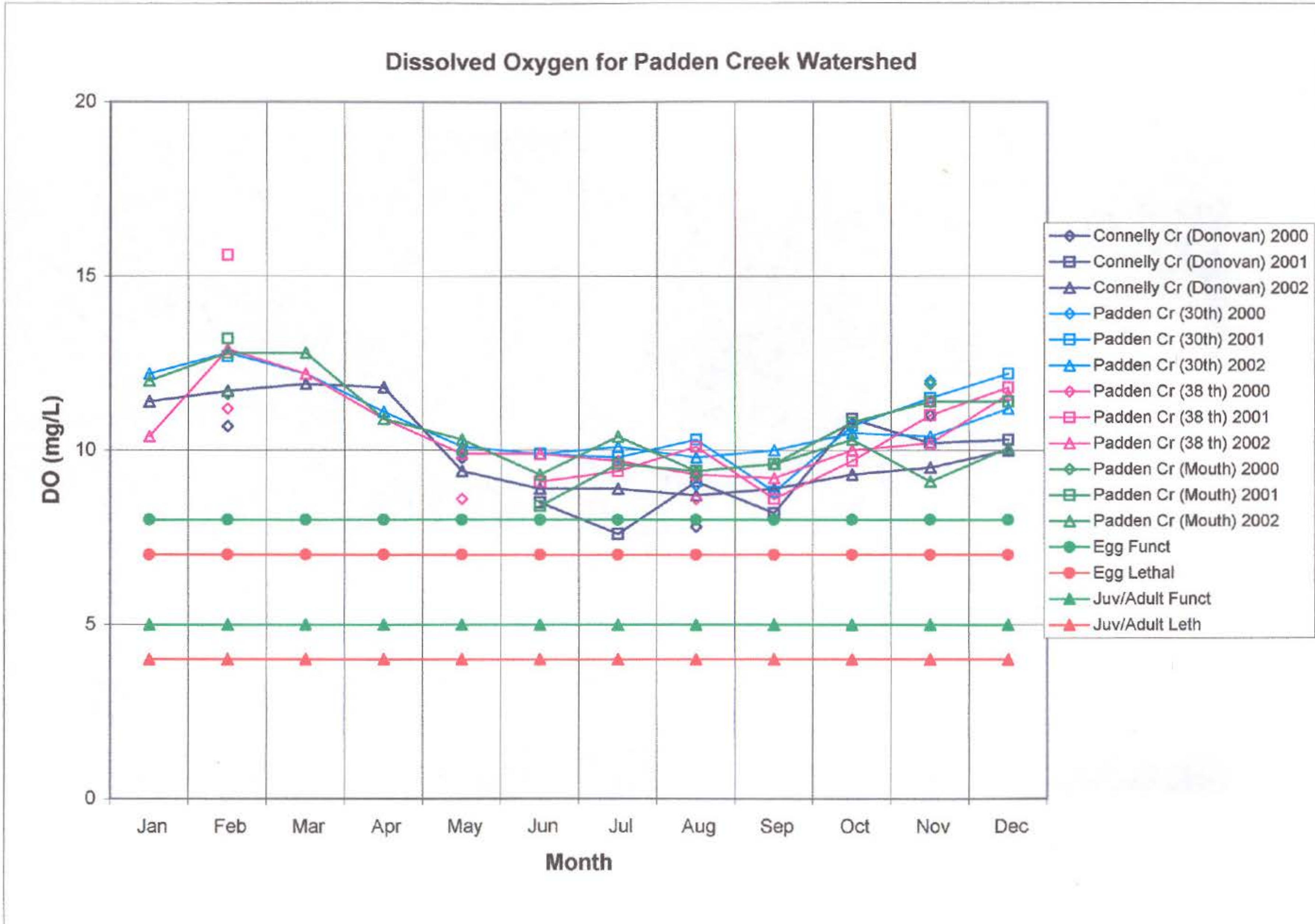
Temperature for Padden Creek Watershed
25
20
15
10
5
0
Temp (Deg C)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Connelly Cr (Donovan) 2000
Connelly Cr (Donovan) 2001
Connelly Cr (Donovan) 2002
Padden Cr (30th) 2000
Padden Cr (30th) 2001
Padden Cr (30th) 2002
Padden Cr (38 th) 2000
Padden Cr (38 th) 2001
Padden Cr (38 th) 2002
Padden Cr (Mouth) 2000
Padden Cr (Mouth) 2001
Padden Cr (Mouth) 2002
Functional Egg Temp Low
Functional Egg Temp High
Functional Juv/Adult Low
Functional Juv/Adult High
Stressed Juv/Adult High
Lethal Juv/Adult High

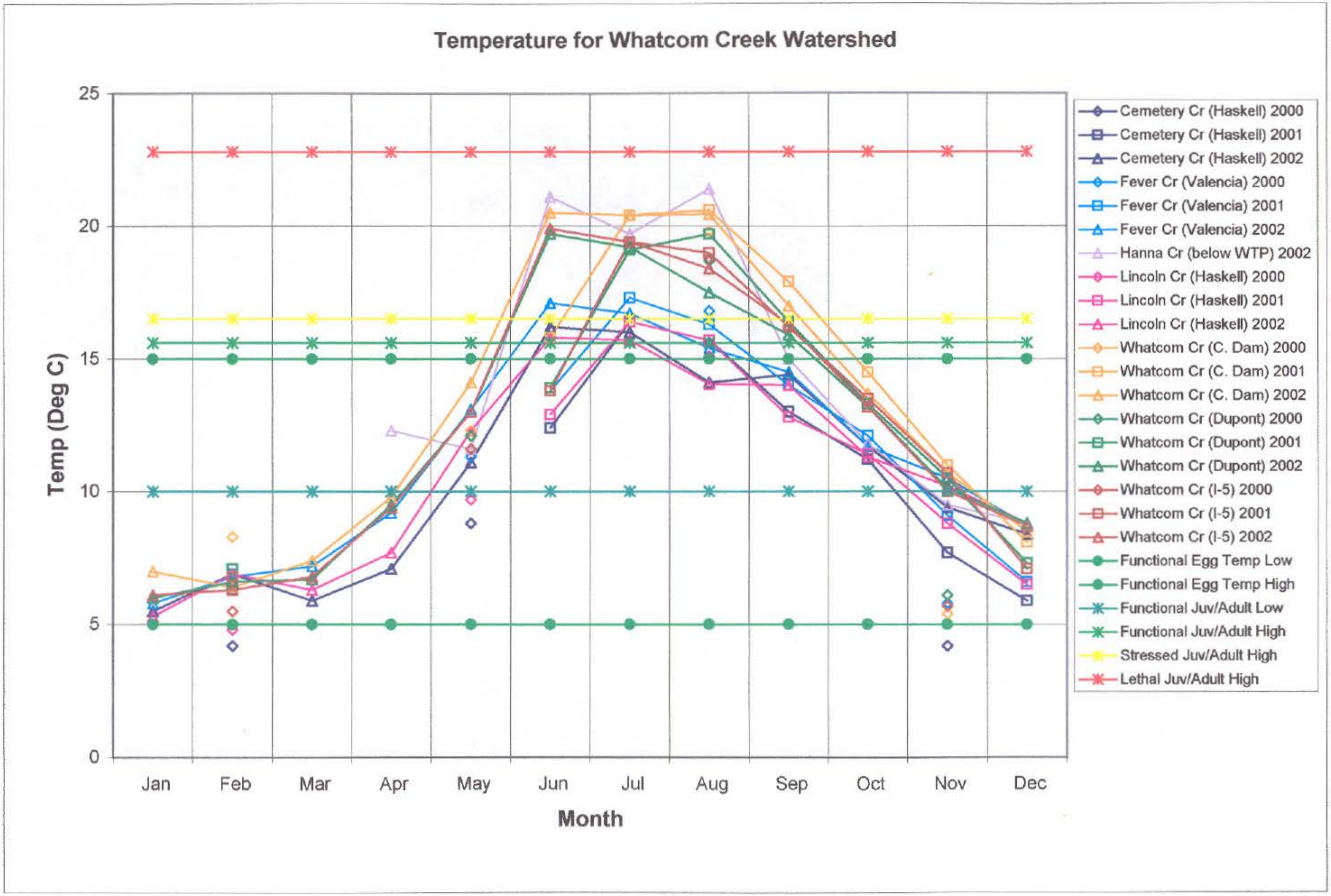

Turbidity for Padden Creek Watershed
NTU's
40
30
20
10
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Connelly Cr (Donovan) 2000
Connelly Cr (Donovan) 2001
Connelly Cr (Donovan) 2002
Padden Cr (30th) 2000
Padden Cr (30th) 2001
Padden Cr (30th) 2002
Padden Cr (38 th) 2000
Padden Cr (38 th) 2001
Padden Cr (38 th) 2002
Padden Cr (Mouth) 2000
Padden Cr (Mouth) 2001
Padden Cr (Mouth) 2002
Functional (<10)

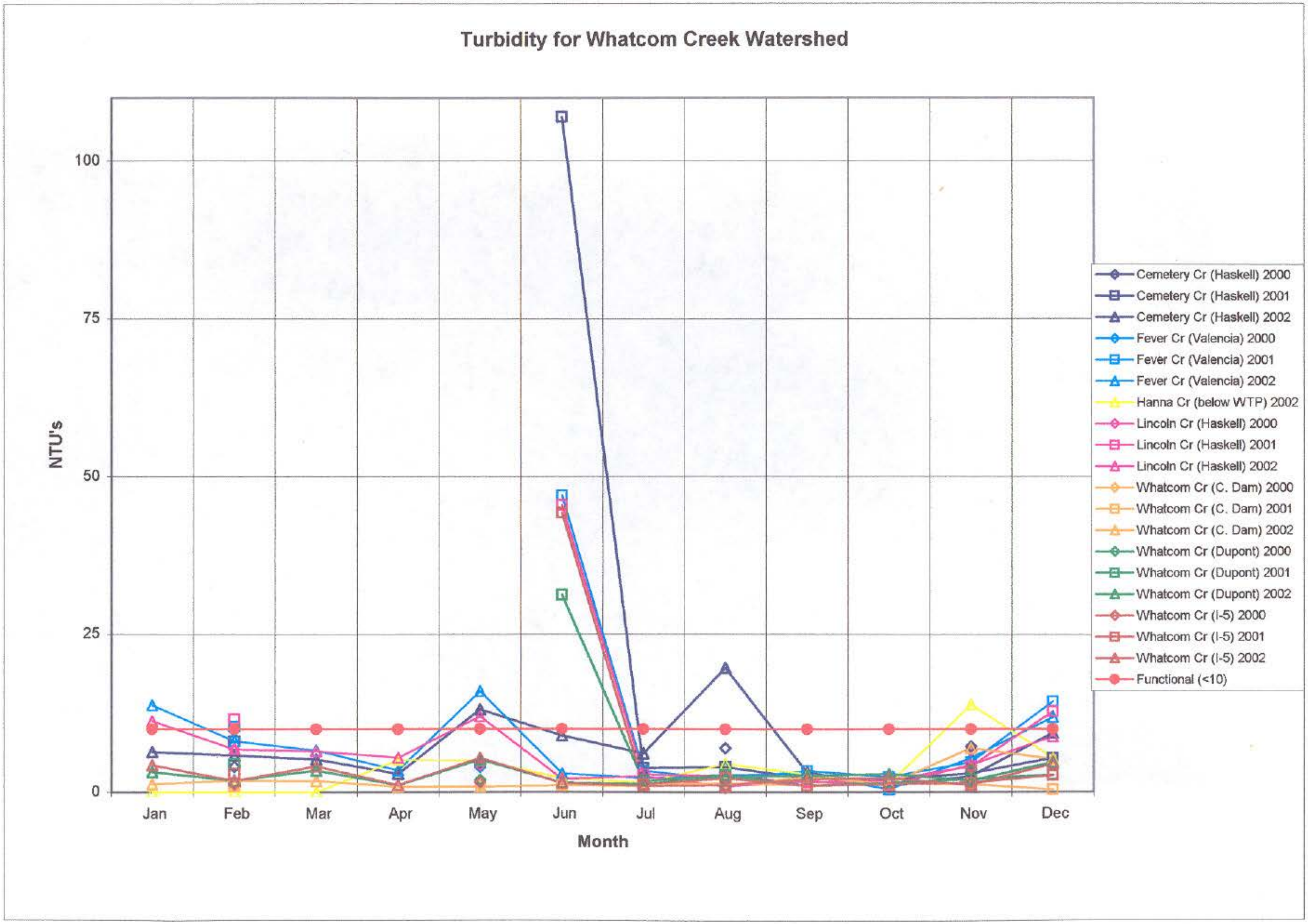

pH for Padden Creek Watershed
9.5
9
8.5
8
7.5
7
6.5
6
5.5
pH
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Connelly Cr (Donovan) 2000
Connelly Cr (Donovan) 2001
Connelly Cr (Donovan) 2002
Padden Cr (30th) 2000
Padden Cr (30th) 2001
Padden Cr (30th) 2002
Padden Cr (38 th) 2000
Padden Cr (38 th) 2001
Padden Cr (38 th) 2002
Padden Cr (Mouth) 2000
Padden Cr (Mouth) 2001
Padden Cr (Mouth) 2002
Functional High
Functional Low

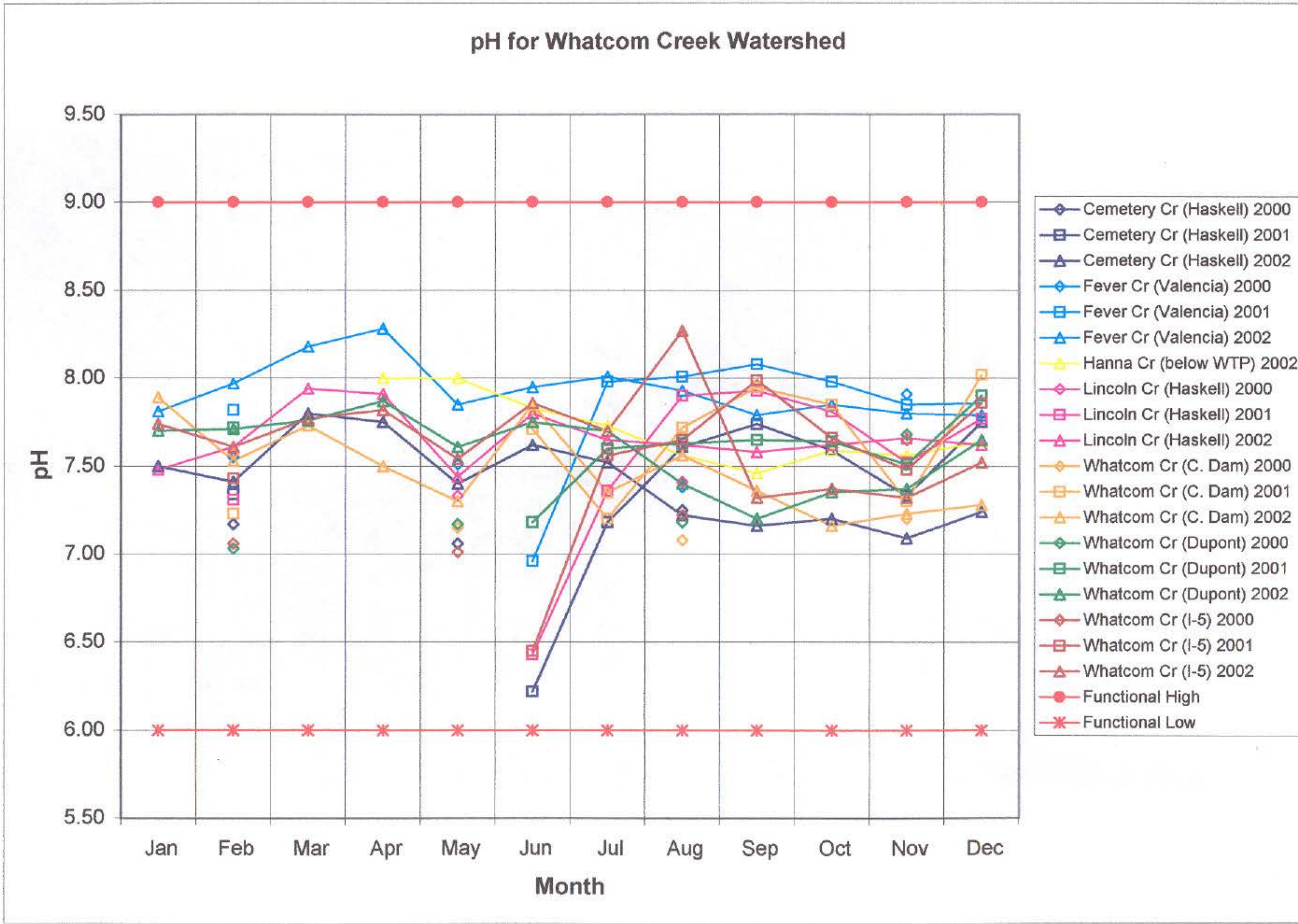

Fecal Coliform for Padden Creek Watershed
8000
7000
6000
5000
4000
3000
2000
1000
0
Col/100 mL
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Connelly Cr (Donovan)
Connelly Cr (Donovan)
Connelly Cr (Donovan)
Padden Cr (30th)
Padden Cr (30th)
Padden Cr (30th)
Padden Cr (38 th)
Padden Cr (38 th)
Padden Cr (38 th)
Padden Cr (Mouth)
Padden Cr (Mouth)
Padden Cr (Mouth)
Limits Class A (14)
Limits Class AA (50)
Limits Class B (100)

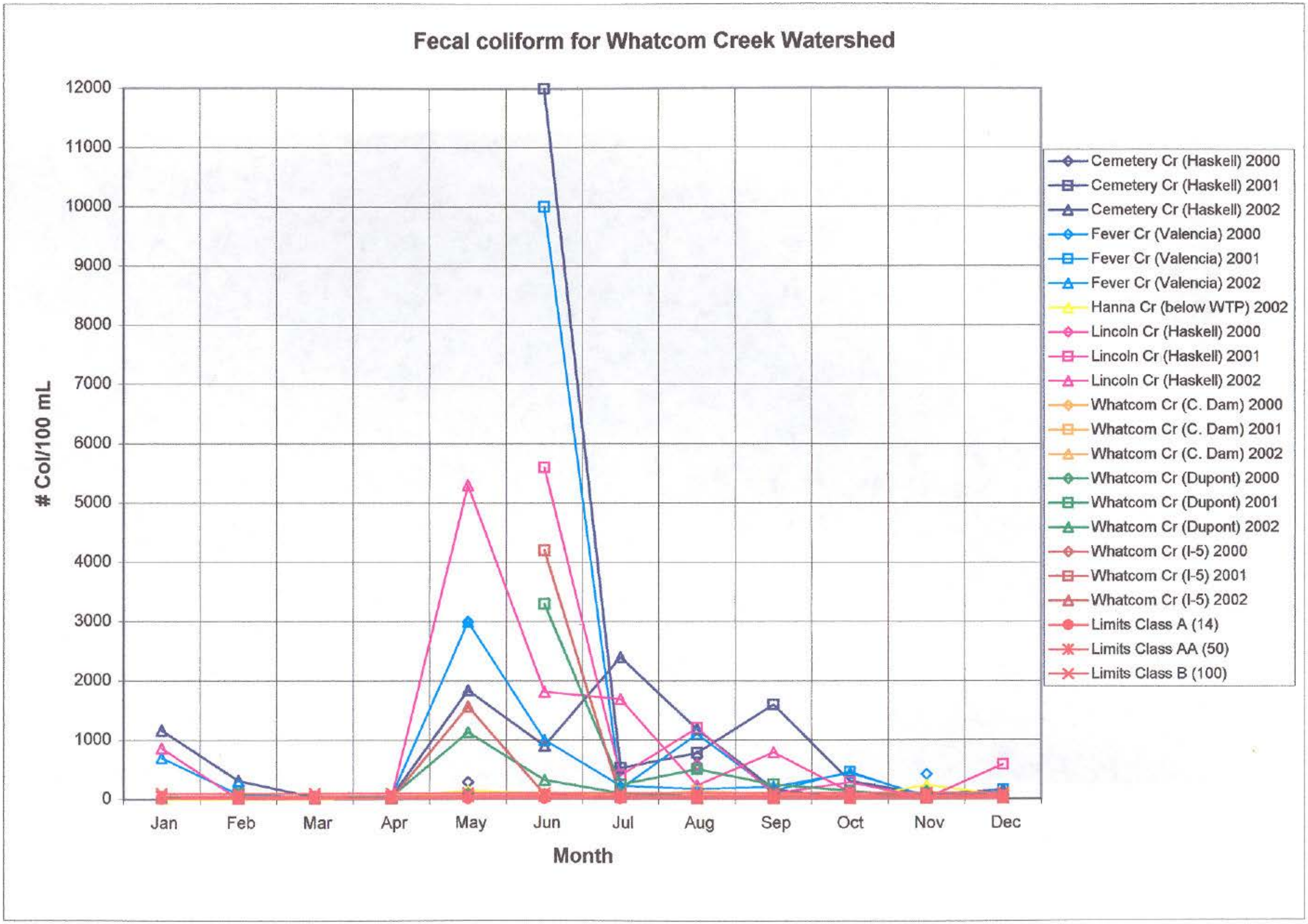

Conductivity for Padden Creek Watershed
umhos
1500
1250
1000
750
500
250
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Connelly Cr (Donovan) 2000
Connelly Cr (Donovan) 2001
Connelly Cr (Donovan) 2002
Padden Cr (30th) 2000
Padden Cr (30th) 2001
Padden Cr (30th) 2002
Padden Cr (38 th) 2000
Padden Cr (38 th) 2001
Padden Cr (38 th) 2002
Padden Cr (Mouth) 2000
Padden Cr (Mouth) 2001
Padden Cr (Mouth) 2002
Functional Low
Functional High

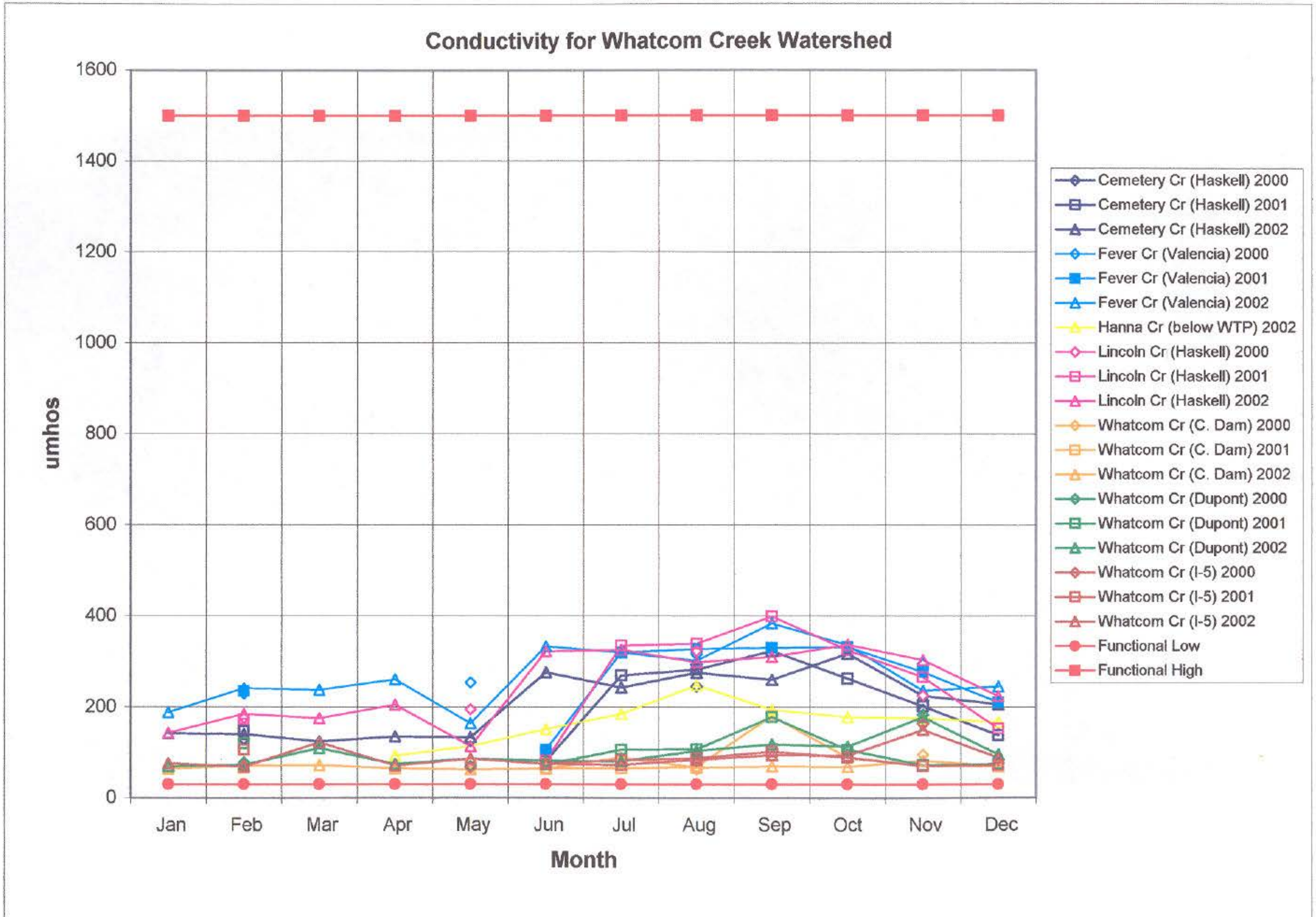

Dissolved Oxygen for Padden Creek Watershed
DO (mg/L)
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Connelly Cr (Donovan) 2000
Connelly Cr (Donovan) 2001
Connelly Cr (Donovan) 2002
Padden Cr (30th) 2000
Padden Cr (30th) 2001
Padden Cr (30th) 2002
Padden Cr (38 th) 2000
Padden Cr (38 th) 2001
Padden Cr (38 th) 2002
Padden Cr (Mouth) 2000
Padden Cr (Mouth) 2001
Padden Cr (Mouth) 2002
Egg Funct
Egg Lethal
Juv/Adult Funct
Juv/Adult Leth

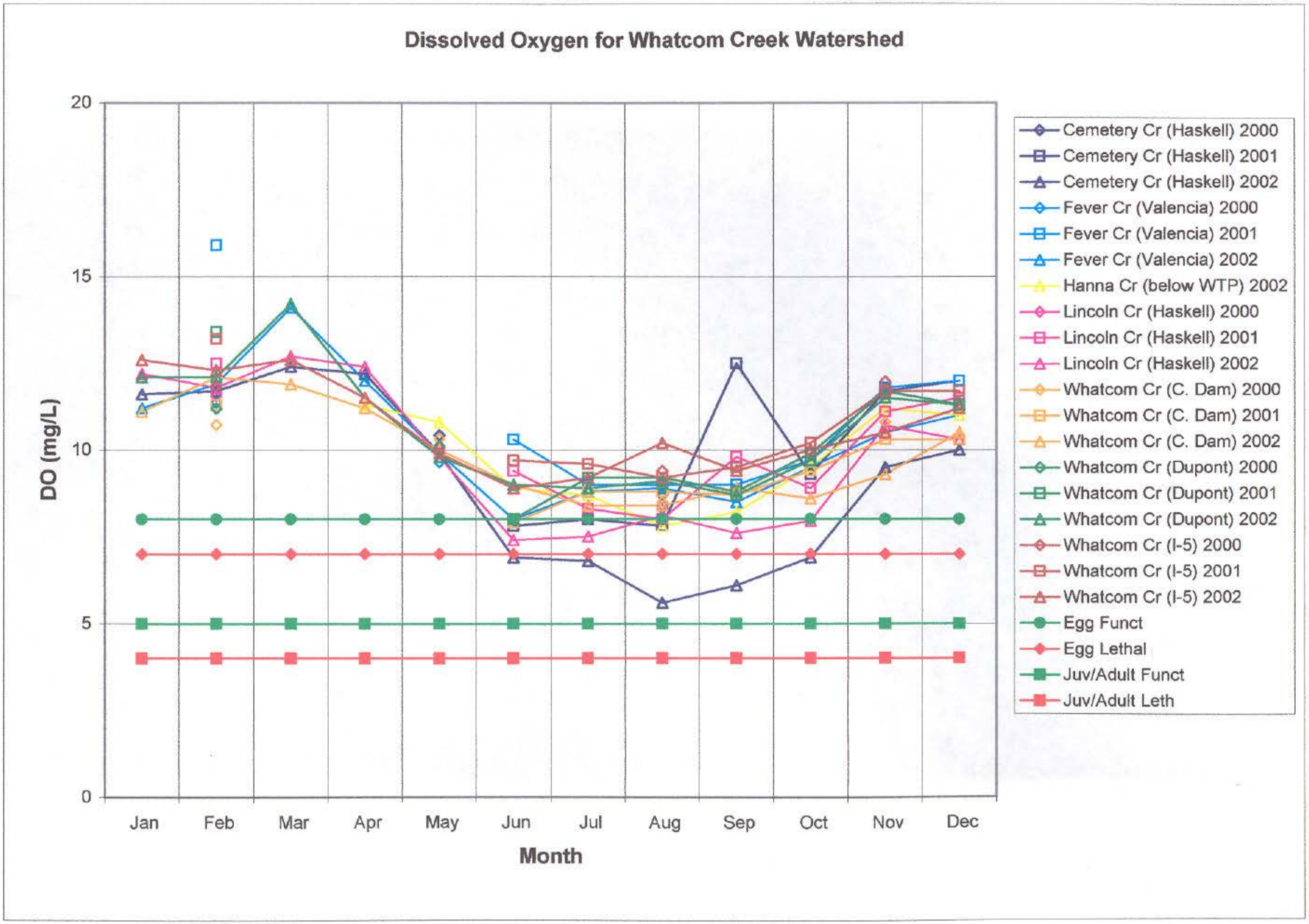

Temperature for Whatcom Creek Watershed
25
20
15
10
5
0
Temp (Deg C)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Cemetery Cr (Haskell) 2000
Cemetery Cr (Haskell) 2001
Cemetery Cr (Haskell) 2002
Fever Cr (Valencia) 2000
Fever Cr (Valencia) 2001
Fever Cr (Valencia) 2002
Hanna Cr (below WTP) 2002
Lincoln Cr (Haskell) 2000
Lincoln Cr (Haskell) 2001
Lincoln Cr (Haskell) 2002
Whatcom Cr (C. Dam) 2000
Whatcom Cr (C. Dam) 2001
Whatcom Cr (C. Dam) 2002
Whatcom Cr (Dupont) 2000
Whatcom Cr (Dupont) 2001
Whatcom Cr (Dupont) 2002
Whatcom Cr (I-5) 2000
Whatcom Cr (I-5) 2001
Whatcom Cr (I-5) 2002
Functional Egg Temp Low
Functional Egg Temp High
Functional Juv/Adult Low
Functional Juv/Adult High
Stressed Juv/Adult High
Lethal Juv/Adult High

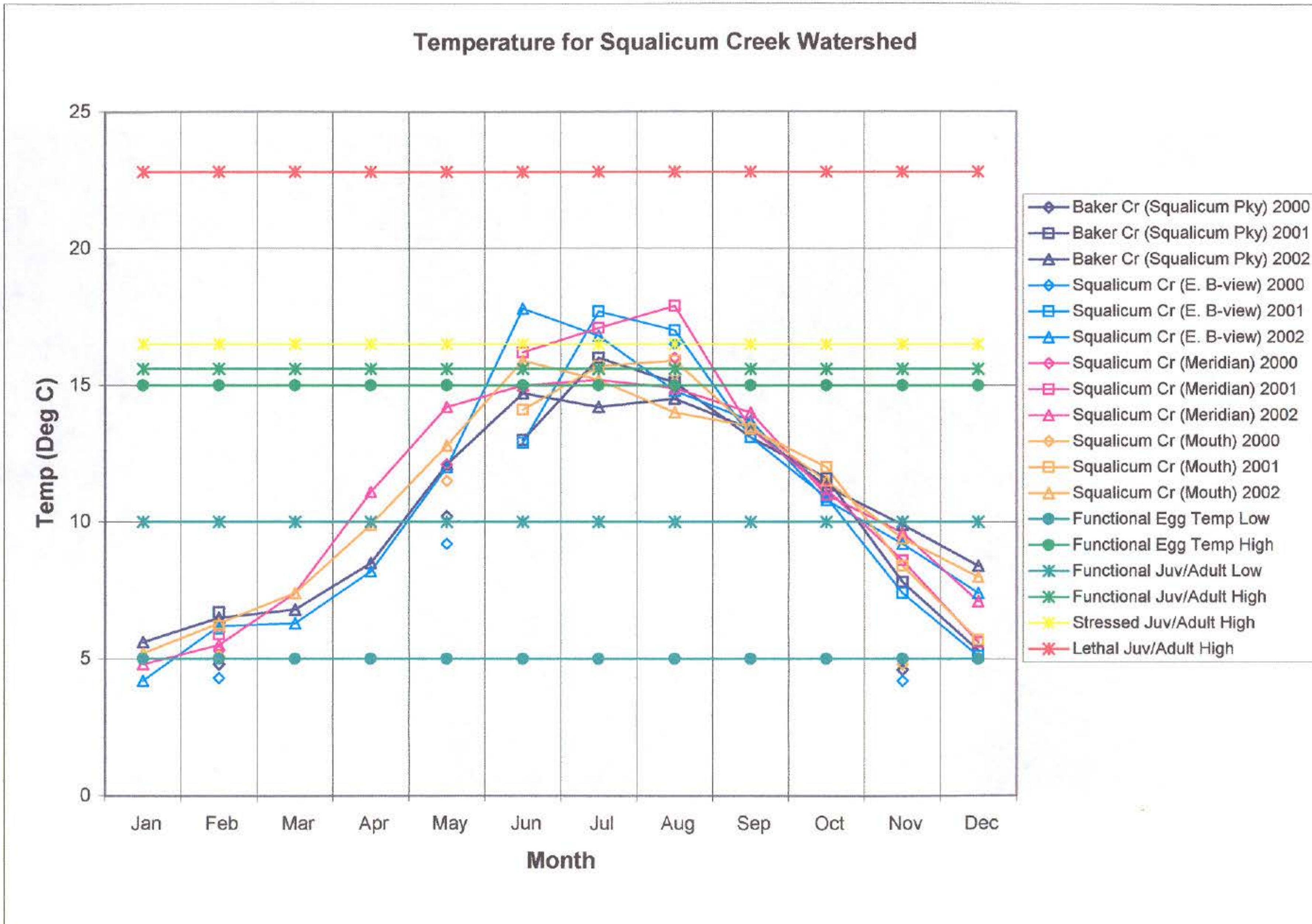

Turbidity for Whatcom Creek Watershed
NTU's
100
75
50
25
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Cemetery Cr (Haskell) 2000
Cemetery Cr (Haskell) 2001
Cemetery Cr (Haskell) 2002
Fever Cr (Valencia) 2000
Fever Cr (Valencia) 2001
Fever Cr (Valencia) 2002
Hanna Cr (below WTP) 2002
Lincoln Cr (Haskell) 2000
Lincoln Cr (Haskell) 2001
Lincoln Cr (Haskell) 2002
Whatcom Cr (C. Dam) 2000
Whatcom Cr (C. Dam) 2001
Whatcom Cr (C. Dam) 2002
Whatcom Cr (Dupont) 2000
Whatcom Cr (Dupont) 2001
Whatcom Cr (Dupont) 2002
Whatcom Cr (I-5) 2000
Whatcom Cr (I-5) 2001
Whatcom Cr (I-5) 2002
Functional (<10)

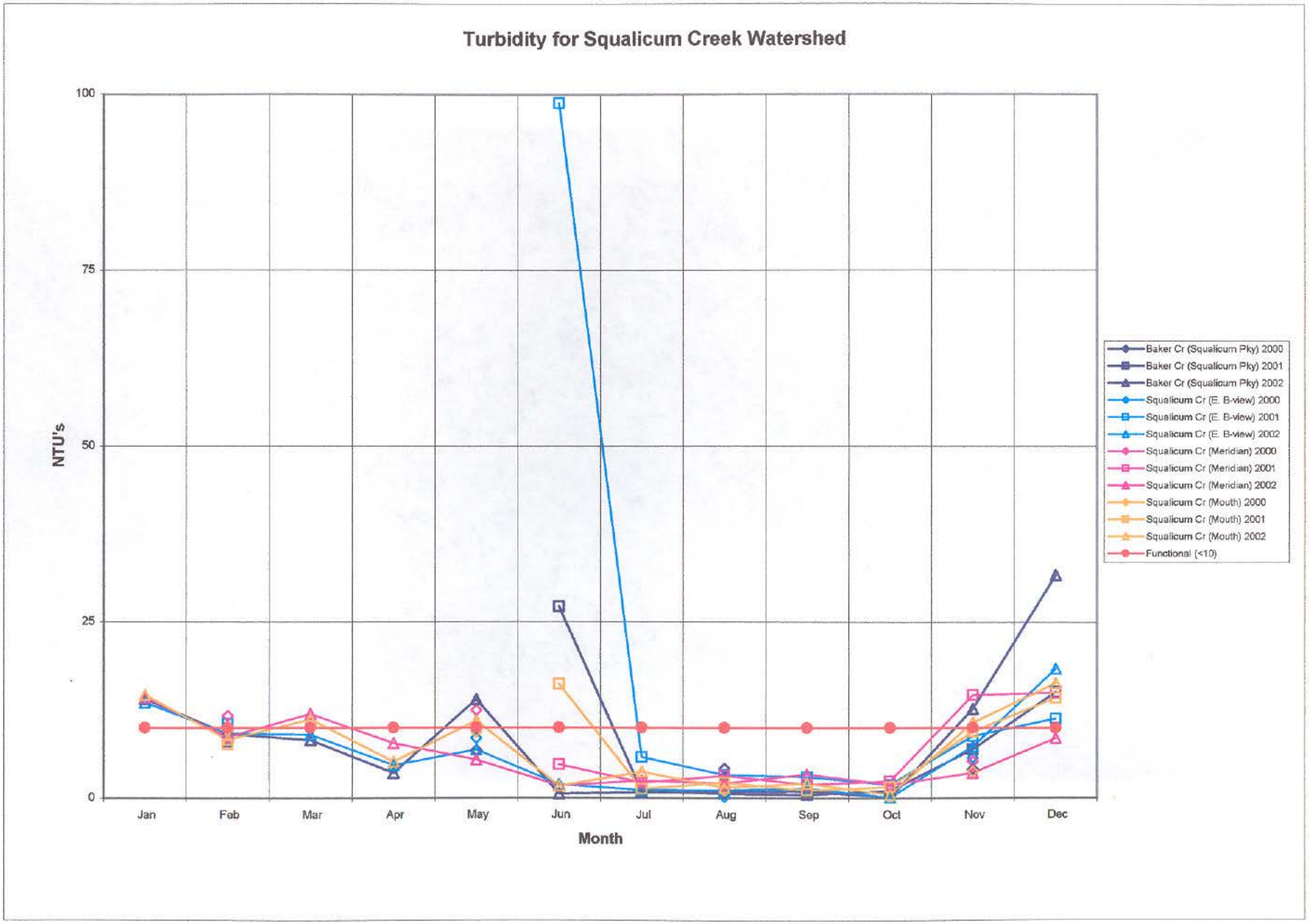

pH for Whatcom Creek Watershed
9.50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5.50
pH
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Cemetery Cr (Haskell) 2000
Cemetery Cr (Haskell) 2001
Cemetery Cr (Haskell) 2002
Fever Cr (Valencia) 2000
Fever Cr (Valencia) 2001
Fever Cr (Valencia) 2002
Hanna Cr (below WTP) 2002
Lincoln Cr (Haskell) 2000
Lincoln Cr (Haskell) 2001
Lincoln Cr (Haskell) 2002
Whatcom Cr (C. Dam) 2000
Whatcom Cr (C. Dam) 2001
Whatcom Cr (C. Dam) 2002
Whatcom Cr (Dupont) 2000
Whatcom Cr (Dupont) 2001
Whatcom Cr (Dupont) 2002
Whatcom Cr (I-5) 2000
Whatcom Cr (I-5) 2001
Whatcom Cr (I-5) 2002
Functional High
Functional Low

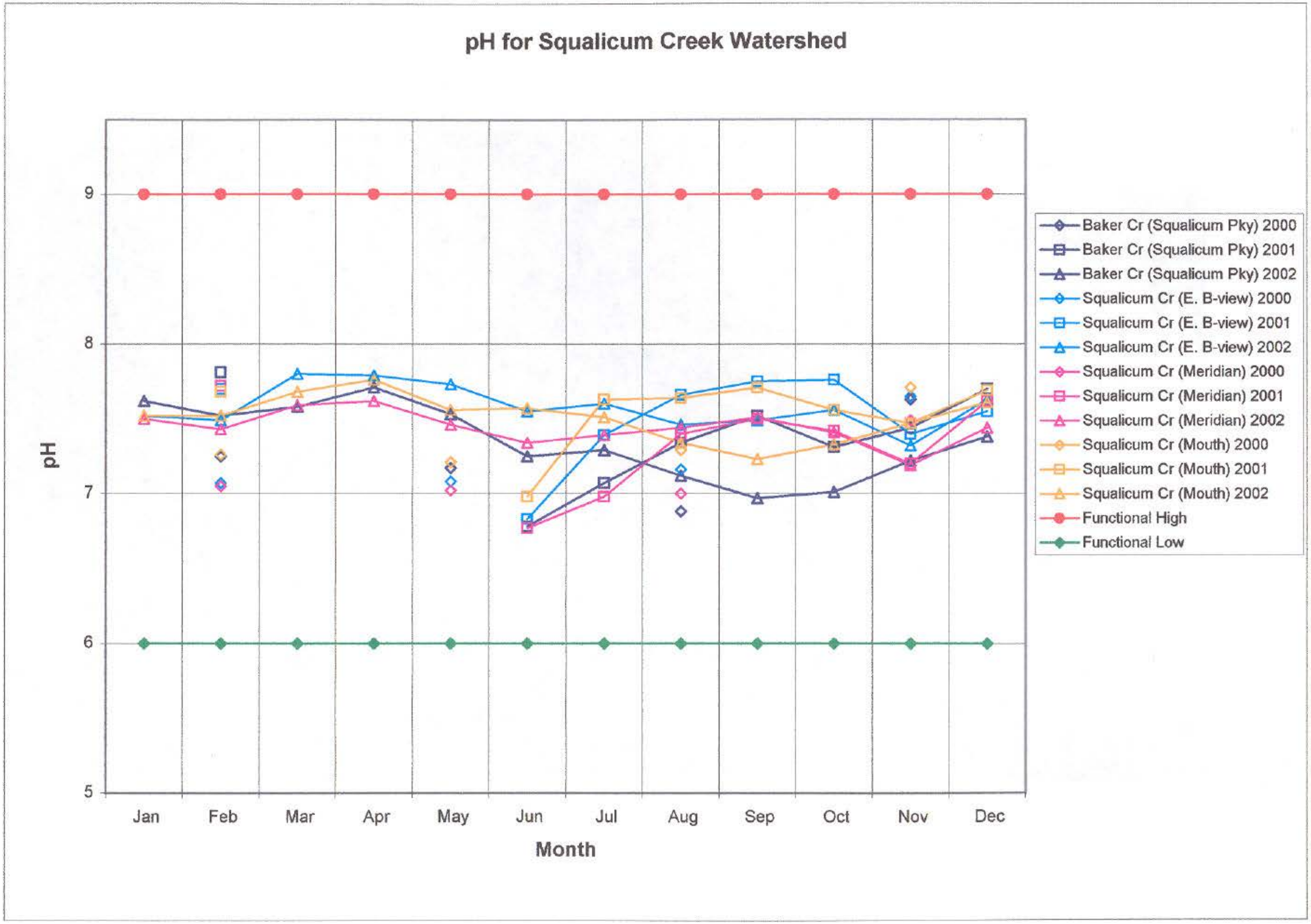

Fecal coliform for Whatcom Creek Watershed
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Col/100 mL
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Cemetery Cr (Haskell) 2000
Cemetery Cr (Haskell) 2001
Cemetery Cr (Haskell) 2002
Fever Cr (Valencia) 2000
Fever Cr (Valencia) 2001
Fever Cr (Valencia) 2002
Hanna Cr (below WTP) 2002
Lincoln Cr (Haskell) 2000
Lincoln Cr (Haskell) 2001
Lincoln Cr (Haskell) 2002
Whatcom Cr (C. Dam) 2000
Whatcom Cr (C. Dam) 2001
Whatcom Cr (C. Dam) 2002
Whatcom Cr (Dupont) 2000
Whatcom Cr (Dupont) 2001
Whatcom Cr (Dupont) 2002
Whatcom Cr (I-5) 2000
Whatcom Cr (I-5) 2001
Whatcom Cr (I-5) 2002
Limits Class A (14)
Limits Class AA (50)
Limits Class B (100)

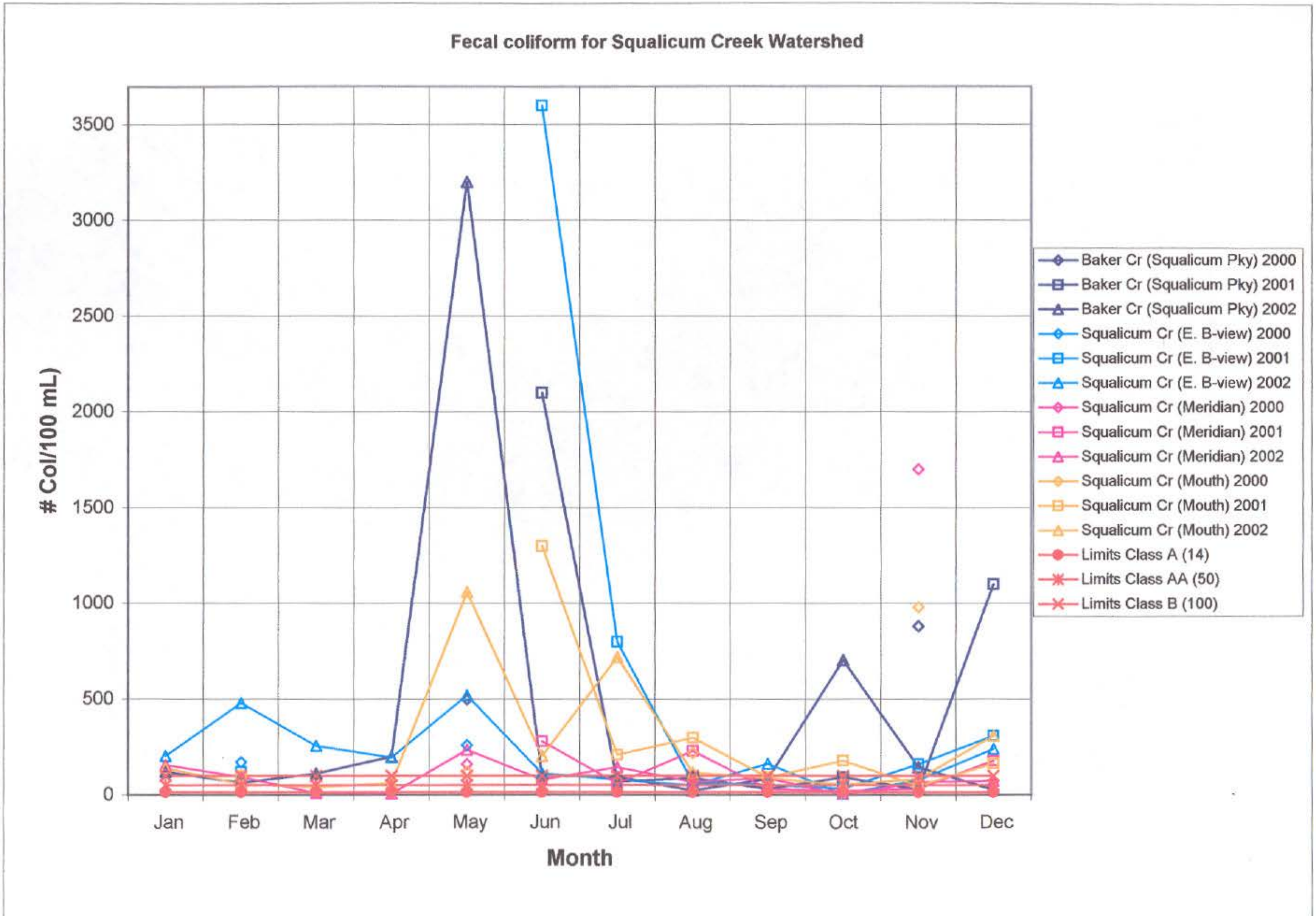

Conductivity for Whatcom Creek Watershed
umhos
1600
1400
1200
1000
800
600
400
200
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Cemetery Cr (Haskell) 2000
Cemetery Cr (Haskell) 2001
Cemetery Cr (Haskell) 2002
Fever Cr (Valencia) 2000
Fever Cr (Valencia) 2001
Fever Cr (Valencia) 2002
Hanna Cr (below WTP) 2002
Lincoln Cr (Haskell) 2000
Lincoln Cr (Haskell) 2001
Lincoln Cr (Haskell) 2002
Whatcom Cr (C. Dam) 2000
Whatcom Cr (C. Dam) 2001
Whatcom Cr (C. Dam) 2002
Whatcom Cr (Dupont) 2000
Whatcom Cr (Dupont) 2001
Whatcom Cr (Dupont) 2002
Whatcom Cr (I-5) 2000
Whatcom Cr (I-5) 2001
Whatcom Cr (I-5) 2002
Functional Low
Functional High

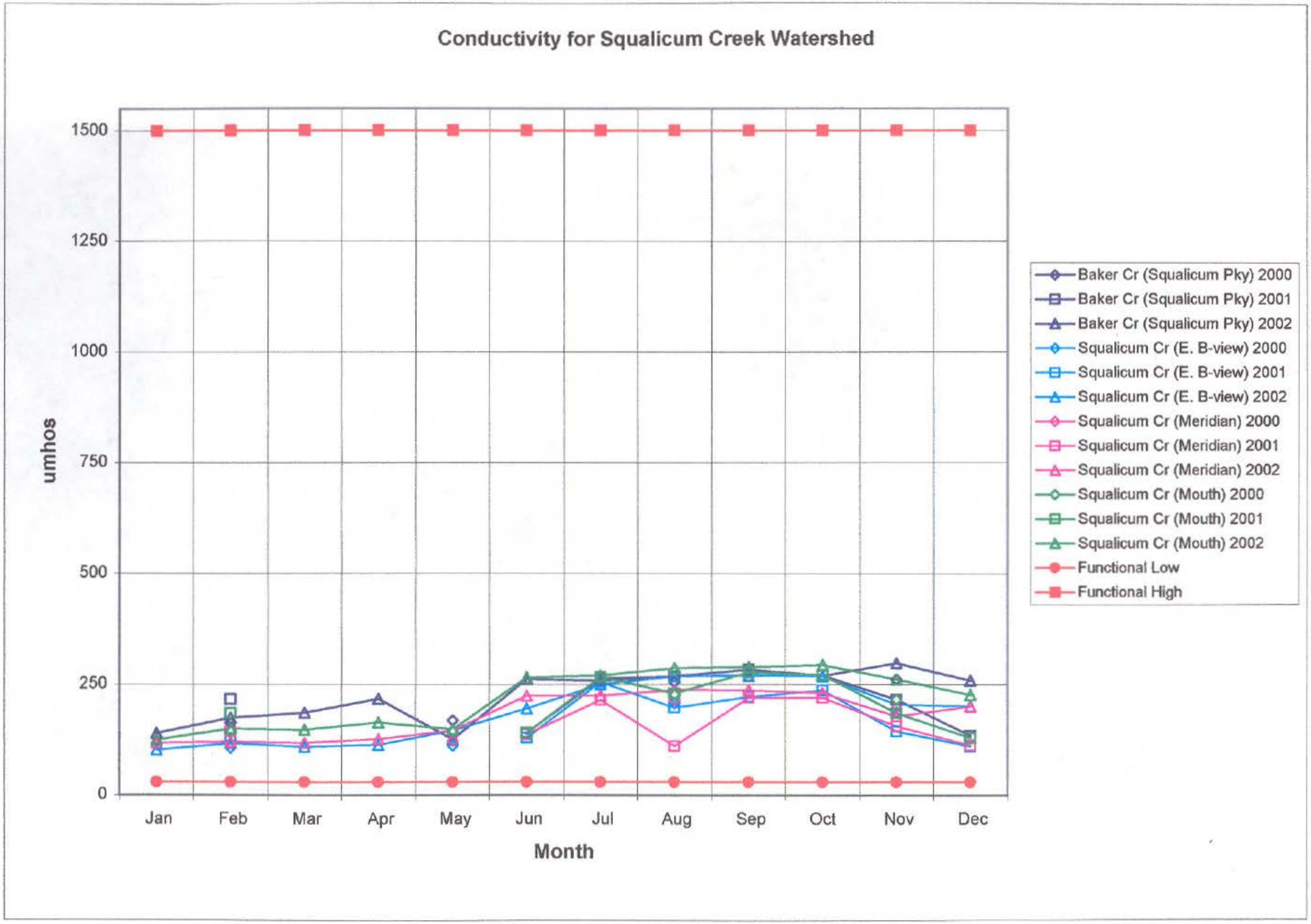

Dissolved Oxygen for Whatcom Creek Watershed
20
15
10
5
0
DO (mg/L)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Cemetery Cr (Haskell) 2000
Cemetery Cr (Haskell) 2001
Cemetery Cr (Haskell) 2002
Fever Cr (Valencia) 2000
Fever Cr (Valencia) 2001
Fever Cr (Valencia) 2002
Hanna Cr (below WTP) 2002
Lincoln Cr (Haskell) 2000
Lincoln Cr (Haskell) 2001
Lincoln Cr (Haskell) 2002
Whatcom Cr (C. Dam) 2000
Whatcom Cr (C. Dam) 2001
Whatcom Cr (C. Dam) 2002
Whatcom Cr (Dupont) 2000
Whatcom Cr (Dupont) 2001
Whatcom Cr (Dupont) 2002
Whatcom Cr (I-5) 2000
Whatcom Cr (I-5) 2001
Whatcom Cr (I-5) 2002
Egg Funct
Egg Lethal
Juv/Adult Funct
Juv/Adult Leth

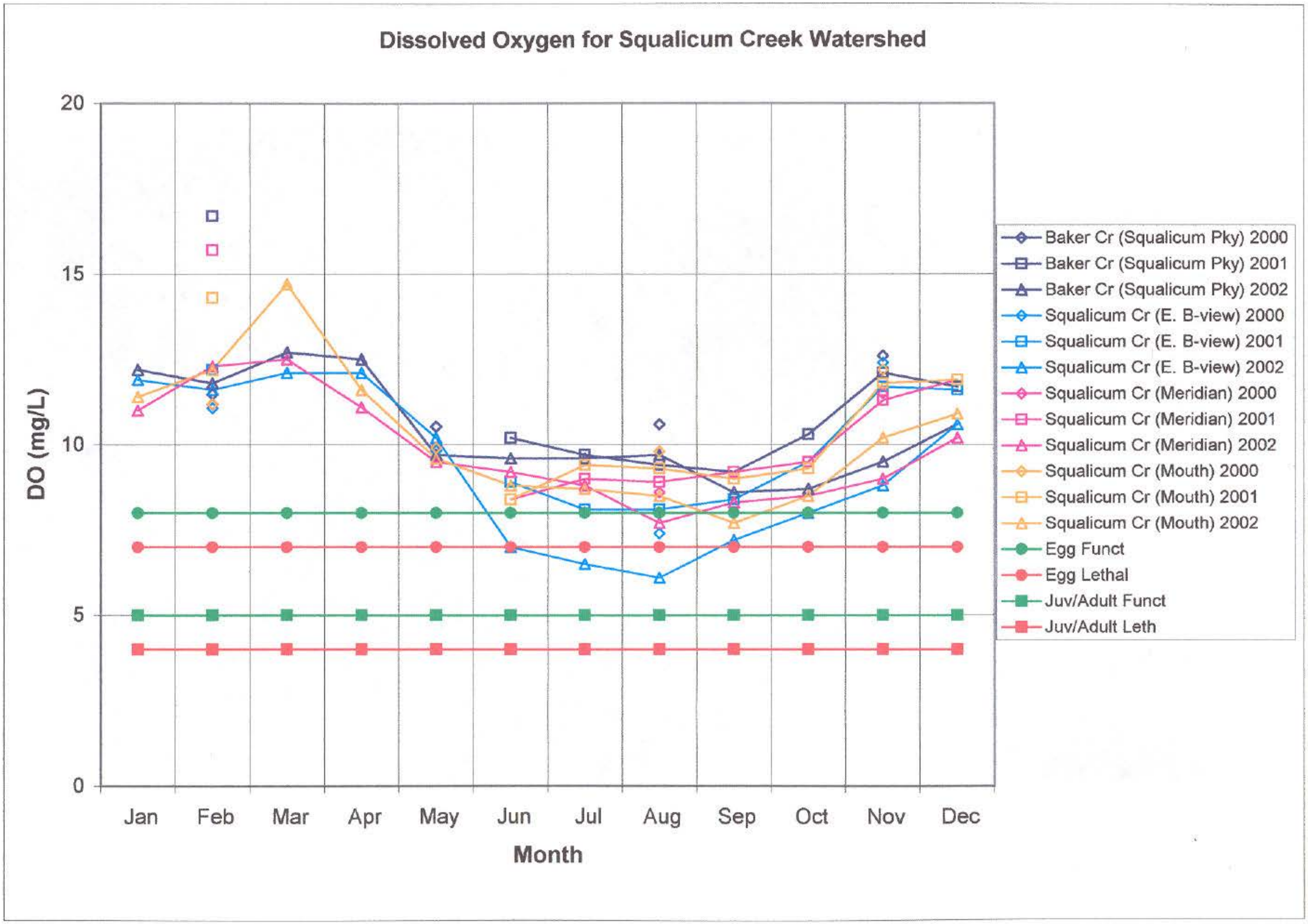

Temperature for Squalicum Creek Watershed
25
20
15
10
5
0
Temp (Deg C)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Baker Cr (Squalicum Pky) 2000
Baker Cr (Squalicum Pky) 2001
Baker Cr (Squalicum Pky) 2002
Squalicum Cr (E. B-view) 2000
Squalicum Cr (E. B-view) 2001
Squalicum Cr (E. B-view) 2002
Squalicum Cr (Meridian) 2000
Squalicum Cr (Meridian) 2001
Squalicum Cr (Meridian) 2002
Squalicum Cr (Mouth) 2000
Squalicum Cr (Mouth) 2001
Squalicum Cr (Mouth) 2002
Functional Egg Temp Low
Functional Egg Temp High
Functional Juv/Adult Low
Functional Juv/Adult High
Stressed Juv/Adult High
Lethal Juv/Adult High

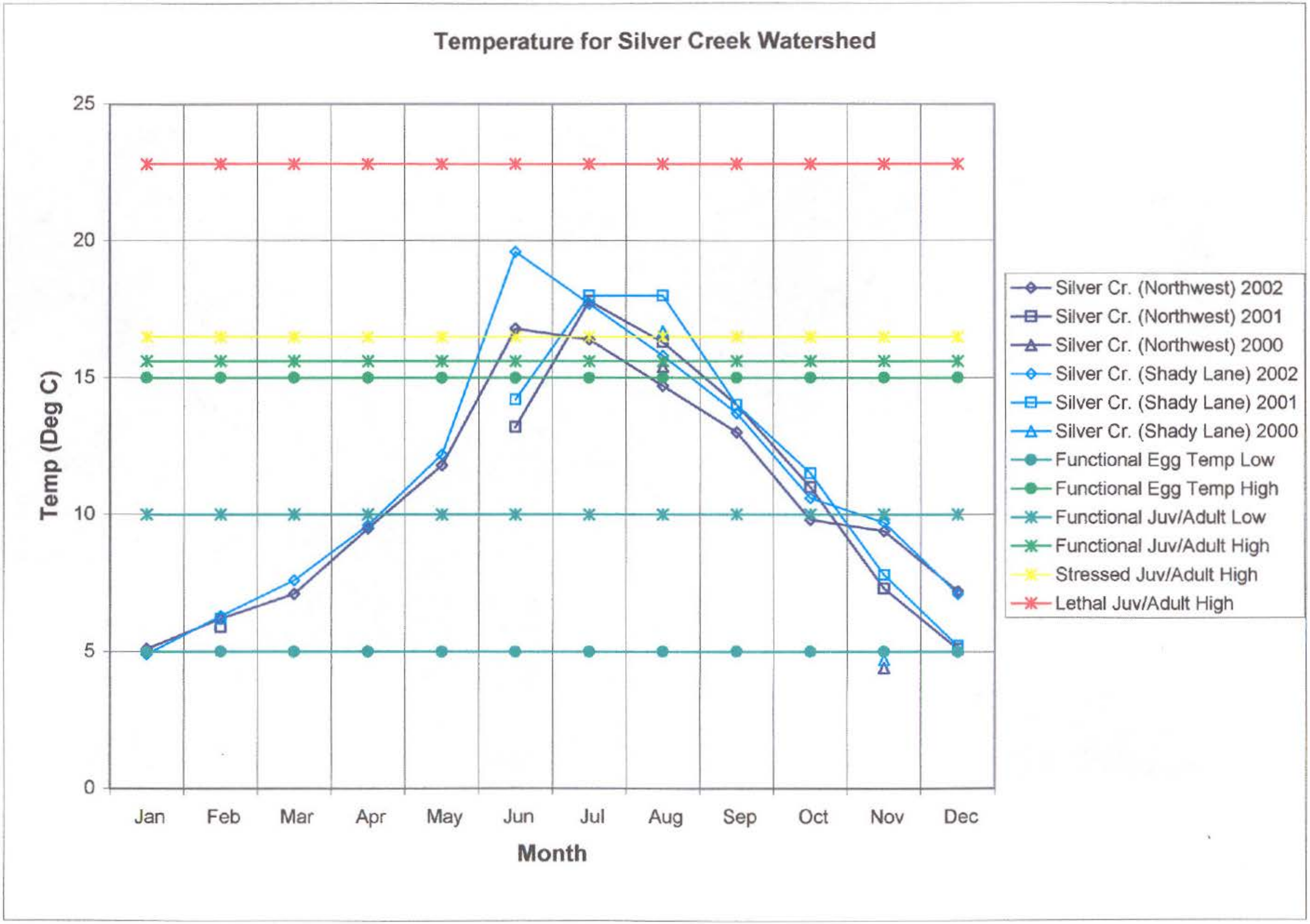

Turbidity for Squalicum Creek Watershed
100
75
50
25
0
NTU's
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Baker Cr (Squalicum Pky) 2000
Baker Cr (Squalicum Pky) 2001
Baker Cr (Squalicum Pky) 2002
Squalicum Cr (E. B-view) 2000
Squalicum Cr (E. B-view) 2001
Squalicum Cr (E. B-view) 2002
Squalicum Cr (Meridian) 2000
Squalicum Cr (Meridian) 2001
Squalicum Cr (Meridian) 2002
Squalicum Cr (Mouth) 2000
Squalicum Cr (Mouth) 2001
Squalicum Cr (Mouth) 2002
Functional (<10)

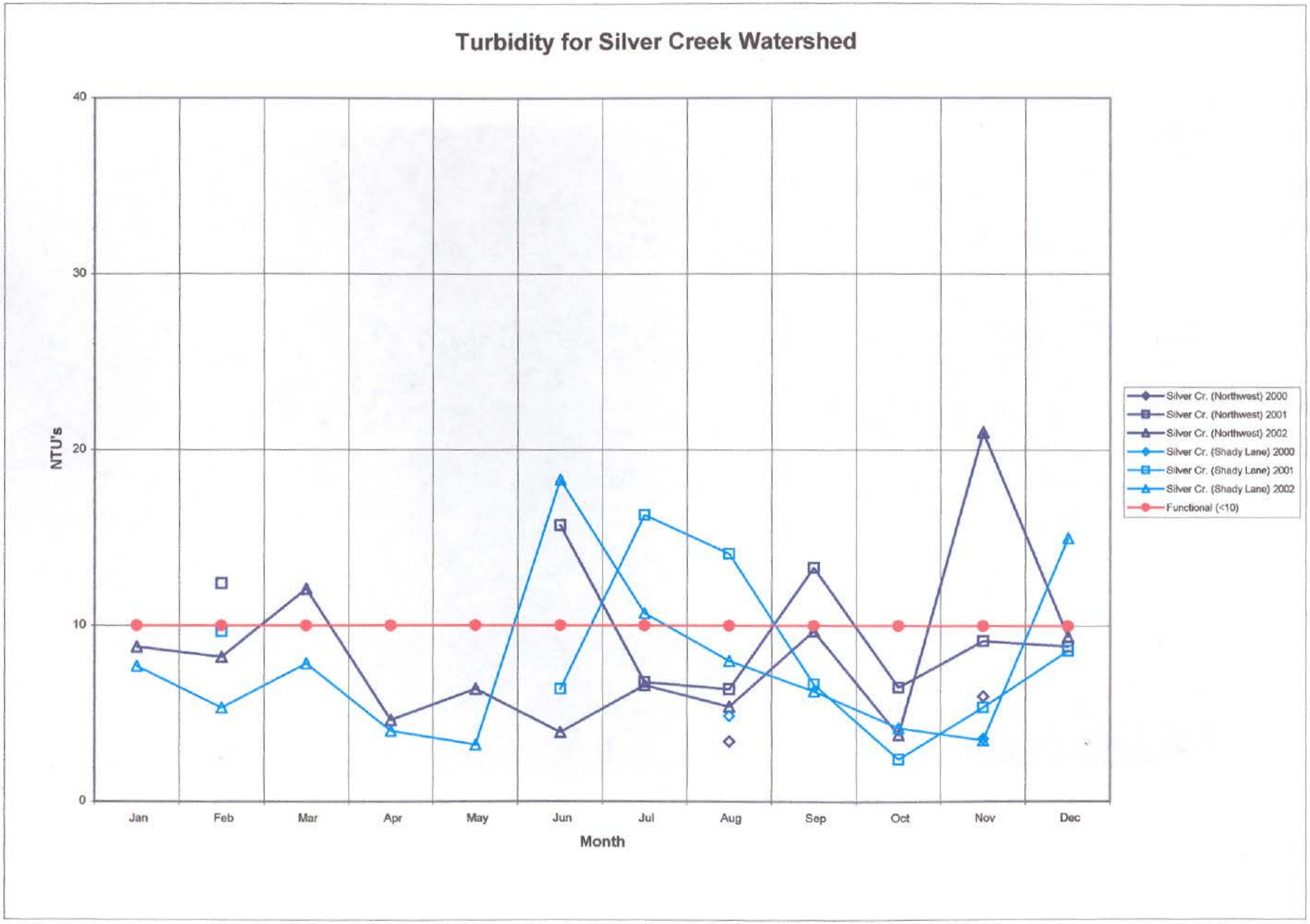

pH for Squalicum Creek Watershed
9
8
7
6
5
pH
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Baker Cr (Squalicum Pky) 2000
Baker Cr (Squalicum Pky) 2001
Baker Cr (Squalicum Pky) 2002
Squalicum Cr (E. B-view) 2000
Squalicum Cr (E. B-view) 2001
Squalicum Cr (E. B-view) 2002
Squalicum Cr (Meridian) 2000
Squalicum Cr (Meridian) 2001
Squalicum Cr (Meridian) 2002
Squalicum Cr (Mouth) 2000
Squalicum Cr (Mouth) 2001
Squalicum Cr (Mouth) 2002
Functional High
Functional Low

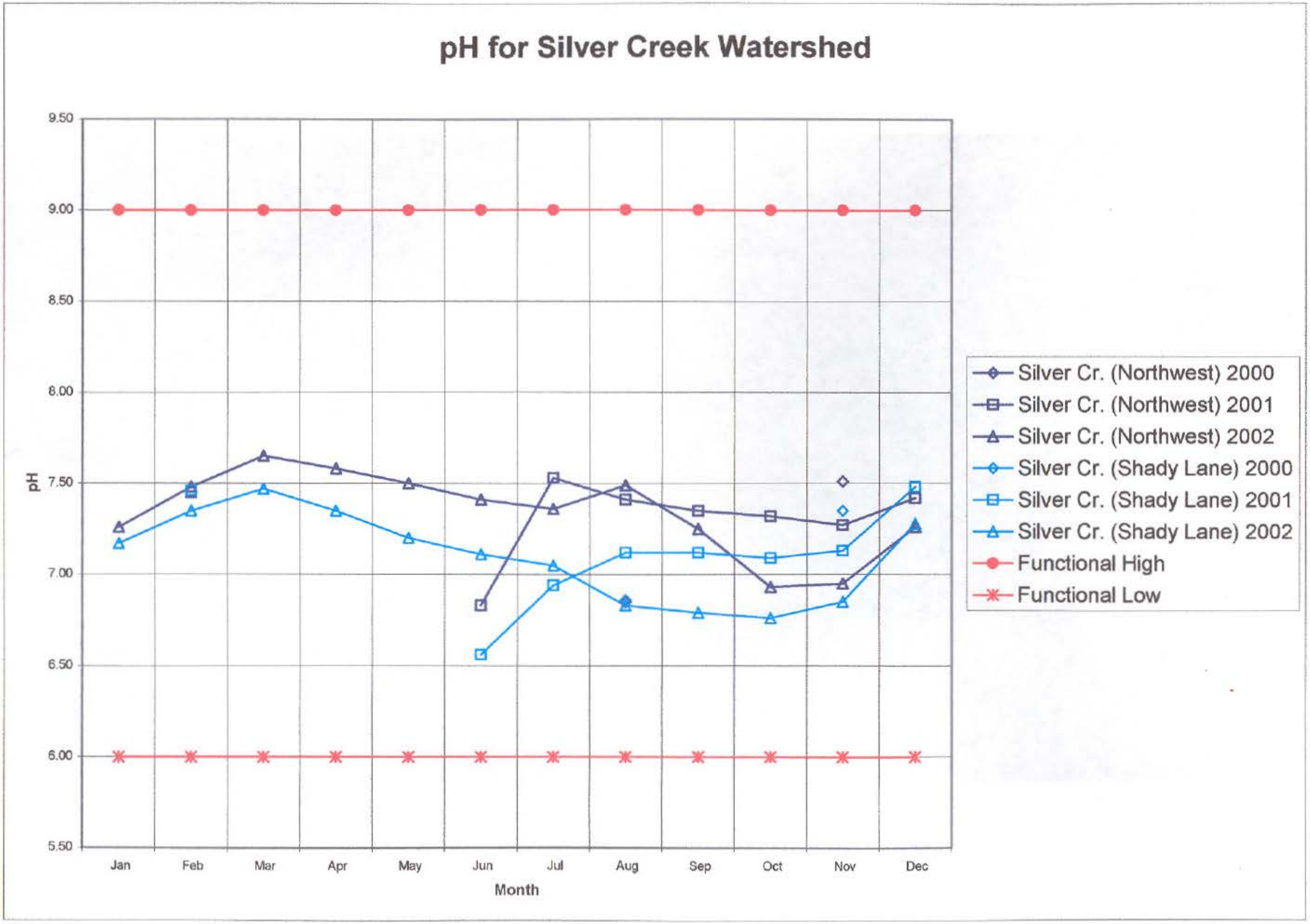

Fecal coliform for Squalicum Creek Watershed
3500
3000
2500
2000
1500
1000
500
0
Col/100 mL)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Baker Cr (Squalicum Pky) 2000
Baker Cr (Squalicum Pky) 2001
Baker Cr (Squalicum Pky) 2002
Squalicum Cr (E. B-view) 2000
Squalicum Cr (E. B-view) 2001
Squalicum Cr (E. B-view) 2002
Squalicum Cr (Meridian) 2000
Squalicum Cr (Meridian) 2001
Squalicum Cr (Meridian) 2002
Squalicum Cr (Mouth) 2000
Squalicum Cr (Mouth) 2001
Squalicum Cr (Mouth) 2002
Limits Class A (14)
Limits Class AA (50)
Limits Class B (100)

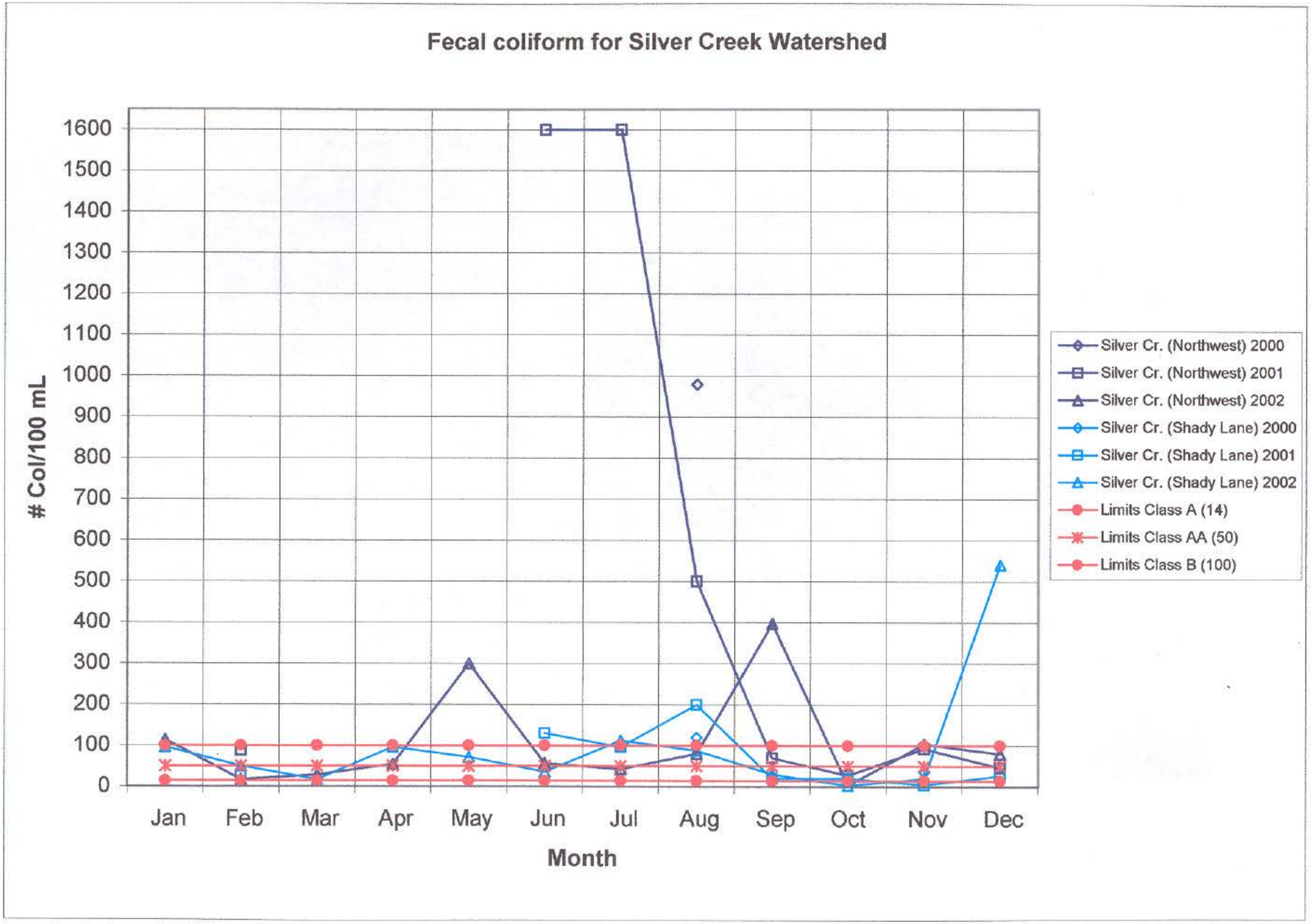

Conductivity for Squalicum Creek Watershed
1500
1250
1000
750
500
250
0
umhos
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Baker Cr (Squalicum Pky) 2000
Baker Cr (Squalicum Pky) 2001
Baker Cr (Squalicum Pky) 2002
Squalicum Cr (E. B-view) 2000
Squalicum Cr (E. B-view) 2001
Squalicum Cr (E. B-view) 2002
Squalicum Cr (Meridian) 2000
Squalicum Cr (Meridian) 2001
Squalicum Cr (Meridian) 2002
Squalicum Cr (Mouth) 2000
Squalicum Cr (Mouth) 2001
Squalicum Cr (Mouth) 2002
Functional Low
Functional High


Dissolved Oxygen for Squalicum Creek Watershed
20
15
10
5
0
DO (mg/L)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Baker Cr (Squalicum Pky) 2000
Baker Cr (Squalicum Pky) 2001
Baker Cr (Squalicum Pky) 2002
Squalicum Cr (E. B-view) 2000
Squalicum Cr (E. B-view) 2001
Squalicum Cr (E. B-view) 2002
Squalicum Cr (Meridian) 2000
Squalicum Cr (Meridian) 2001
Squalicum Cr (Meridian) 2002
Squalicum Cr (Mouth) 2000
Squalicum Cr (Mouth) 2001
Squalicum Cr (Mouth) 2002
Egg Funct
Egg Lethal
Juv/Adult Funct
Juv/Adult Leth

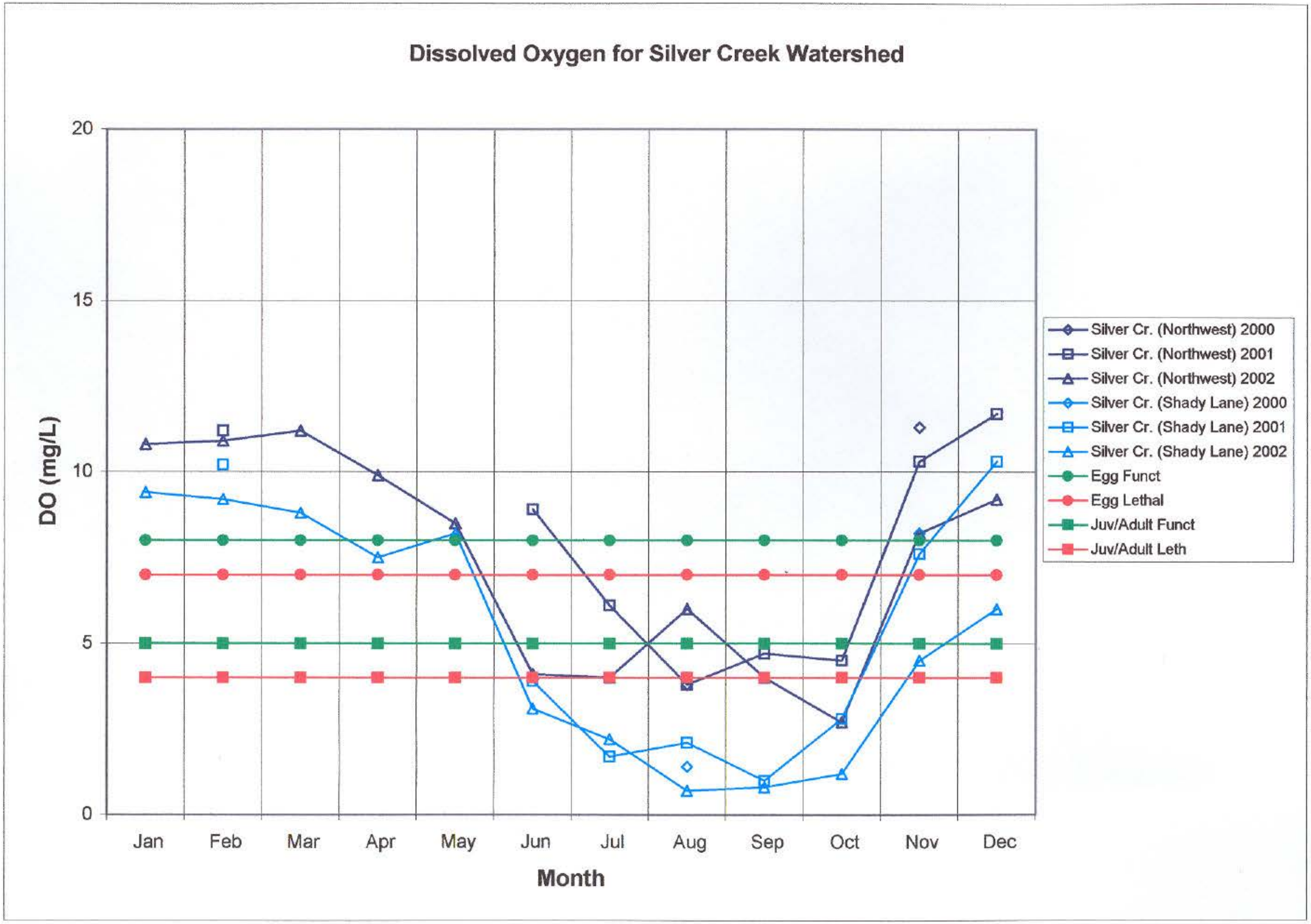

Temperature for Silver Creek Watershed
25
20
15
10
5
0
Temp (Deg C)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Silver Cr. (Northwest) 2002
Silver Cr. (Northwest) 2001
Silver Cr. (Northwest) 2000
Silver Cr. (Shady Lane) 2002
Silver Cr. (Shady Lane) 2001
Silver Cr. (Shady Lane) 2000
Functional Egg Temp Low
Functional Egg Temp High
Functional Juv/Adult Low
Functional Juv/Adult High
Stressed Juv/Adult High
Lethal Juv/Adult High


Turbidity for Silver Creek Watershed
40
30
20
10
0
NTU's
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Silver Cr. (Northwest) 2000
Silver Cr. (Northwest) 2001
Silver Cr. (Northwest) 2002
Silver Cr. (Shady Lane) 2000
Silver Cr. (Shady Lane) 2001
Silver Cr. (Shady Lane) 2002
Functional (<10)


pH for Silver Creek Watershed
9.50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5.50
pH
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Silver Cr. (Northwest) 2000
Silver Cr. (Northwest) 2001
Silver Cr. (Northwest) 2002
Silver Cr. (Shady Lane) 2000
Silver Cr. (Shady Lane) 2001
Silver Cr. (Shady Lane) 2002
Functional High
Functional Low


Fecal coliform for Silver Creek Watershed
Col/100 mL
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Silver Cr. (Northwest) 2000
Silver Cr. (Northwest) 2001
Silver Cr. (Northwest) 2002
Silver Cr. (Shady Lane) 2000
Silver Cr. (Shady Lane) 2001
Silver Cr. (Shady Lane) 2002
Limits Class A (14)
Limits Class AA (50)
Limits Class B (100)


Conductivity for Silver Creek Watershed
1500
1250
1000
750
500
250
0
umhos
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Silver Cr. (Northwest) 2000
Silver Cr. (Northwest) 2001
Silver Cr. (Northwest) 2002
Silver Cr. (Shady Lane) 2000
Silver Cr. (Shady Lane) 2001
Silver Cr. (Shady Lane) 2002
Functional Low
Functional High


Dissolved Oxygen for Silver Creek Watershed
DO (mg/L)
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Silver Cr. (Northwest) 2000
Silver Cr. (Northwest) 2001
Silver Cr. (Northwest) 2002
Silver Cr. (Shady Lane) 2000
Silver Cr. (Shady Lane) 2001
Silver Cr. (Shady Lane) 2002
Egg Funct
Egg Lethal
Juv/Adult Funct
Juv/Adult Leth

Stream Habitat Quality

Description-Methods-Results (to be added)

Riparian Qualities

The riparian areas were assessed using >> parameters which were available. The City of Bellingham performed an assessment within a 200 foot corridor on either side of the stream for vegetation and impervious surface area for reaches defined by the city. Percent forest canopy and percent non-forest vegetation were calculated by the City. Impervious surface areas were calculated using all structures and roads within the corridor.

Road density is measured in miles of road per square mile of watershed quality was determined after reviewing stream monitoring protocol documents (Hillman 2002 and MacDonald 1991). Because these documents dealt strictly with non-urban forested habitat, it was decided that the road limitations were too strict for an already developed urban environment (Hillman 2002: Functional: < 2 mi/mi^2; At Risk: 2-3 mi/mi^2; Not Functioning: >3 mi/mi^2). The new parameters are: Functional: < 5 mi/mi^2; At Risk: >5 mi/mi^2; Not Functioning: >10 mi/mi^2.

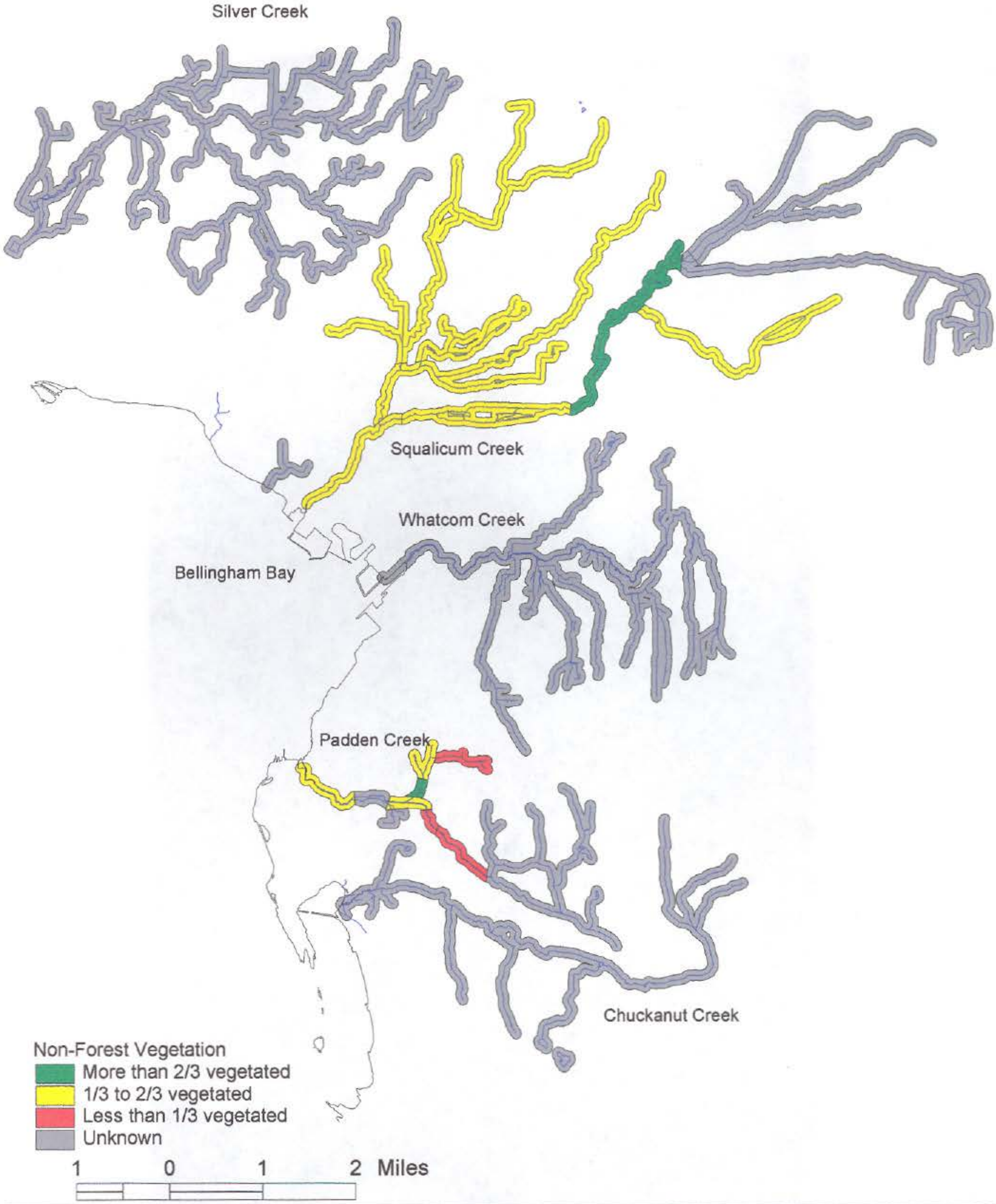
Percentages and road density were mapped using the values listed in the table below.

Stream	Reach	% Canopy Cover	% Other Vegetation	% Total Impervious Surface Area	Road mi./sq. mi. of watershed.
Chuckanut		70.40	0.00	0.00	3.88
Little Squalicum		0.00	0.00	0.00	11.62
Padden Creek	Connelly A	9.70	74.20	15.90	14.12
Padden Creek	Connelly B	58.30	36.50	11.50	14.12
Padden Creek	Connelly Knox	29.90	11.60	18.30	14.12
Padden Creek	Fairhaven Culver	0.00	0.00	0.00	14.12
Padden Creek	Padden Main A	25.60	42.60	21.80	14.12
Padden Creek	Padden Main B	17.80	55.10	29.20	14.12
Padden Creek	Padden Main C	42.40	25.00	18.70	14.12
Padden Creek	Padden Main D	88.10	6.90	1.90	14.12
Padden Creek	Lake Padden	0.00	0.00	0.00	14.12
Padden Creek	100 Acre Trib	0.00	0.00	0.00	14.12
Silver Creek		0.00	0.00	0.00	3.65
Squalicum Creek	Baker Creek N	27.00	56.10	16.90	6.11
Squalicum Creek	Baker Creek S	32.30	42.50	25.20	6.11
Squalicum Creek	Spring Creek	32.40	36.40	11.20	6.11
Squalicum Creek	Squal. Main A	44.80	34.60	20.40	6.11
Squalicum Creek	Squal. Main B	47.70	41.60	10.70	6.11
Squalicum Creek	Squal. Main C	12.00	77.20	10.83	6.11
Squalicum Creek	Toad Creek	45.40	40.30	14.40	6.11
Squalicum Creek	Squal. Main D	0.00	0.00	0.00	6.11
Squalicum Creek	Squal. N Trib	0.00	0.00	0.00	6.11
Whatcom Creek		0.00	0.00	0.00	16.52

Stream Habitat Quality Maps

Bellingham Habitat Assessment

Percent Non-Forest Vegetation
within 200 Feet of Stream

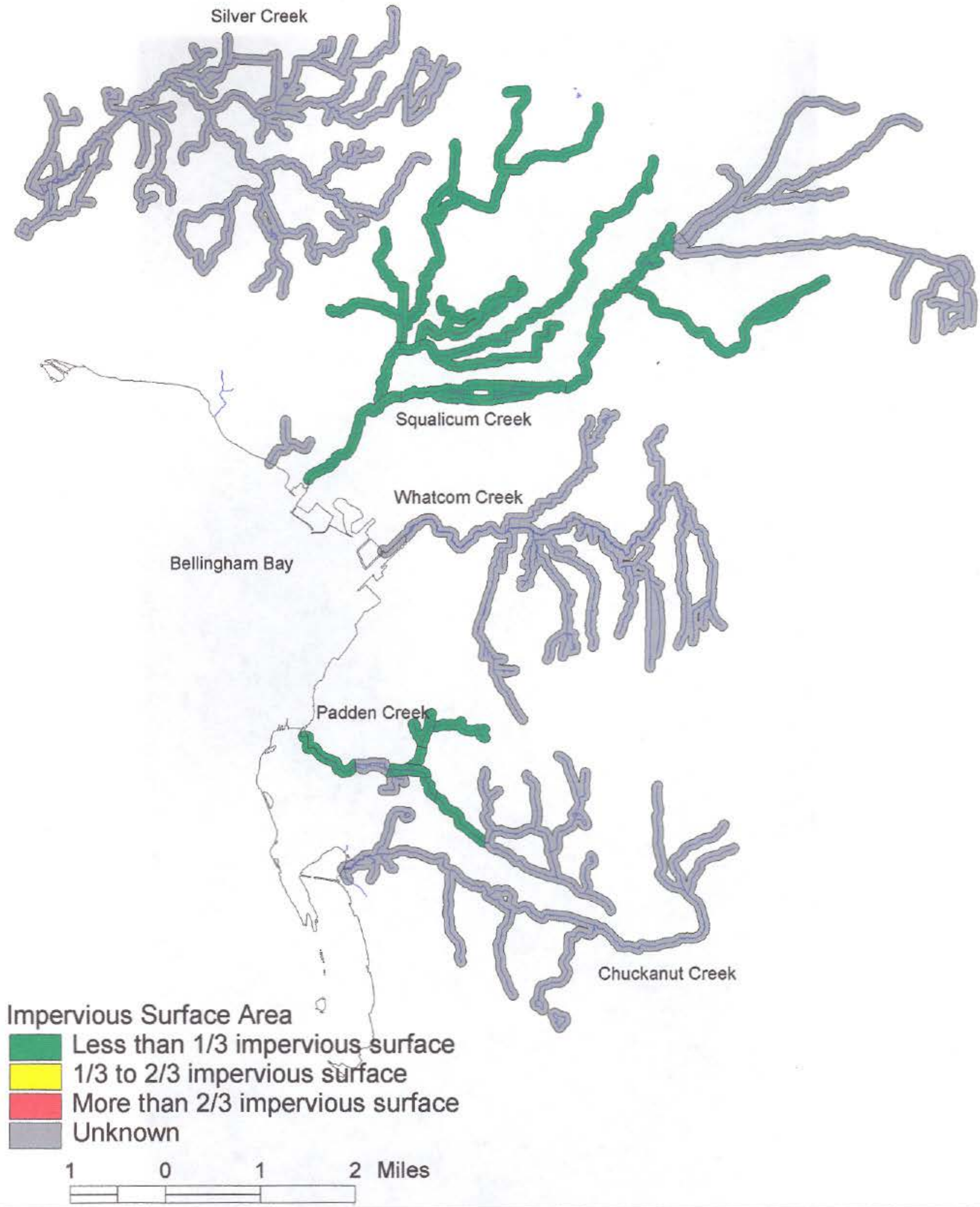


Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

Bellingham Habitat Assessment

Percent Impervious Surface Area within 200 Feet of Stream

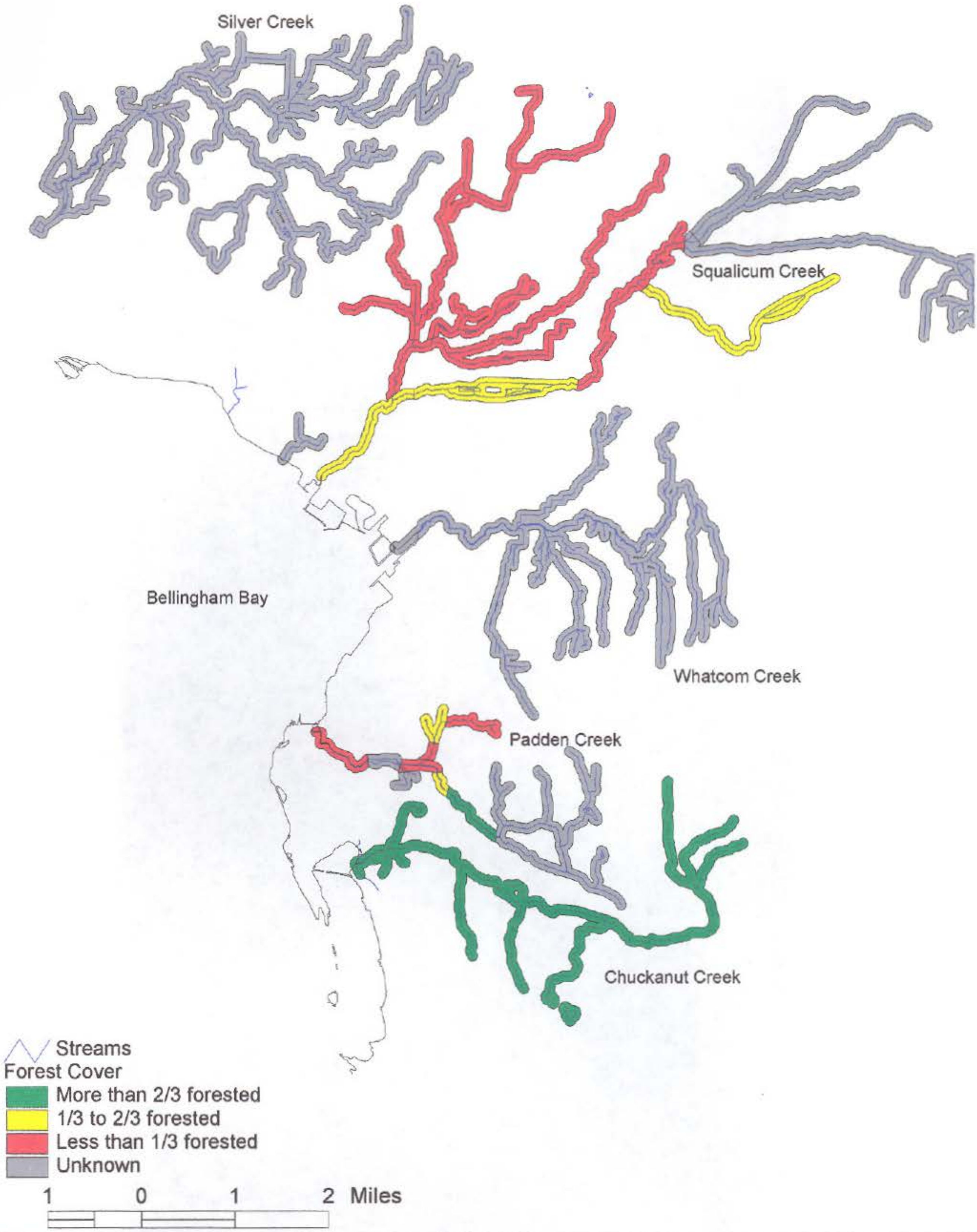


Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

Bellingham Habitat Assessment

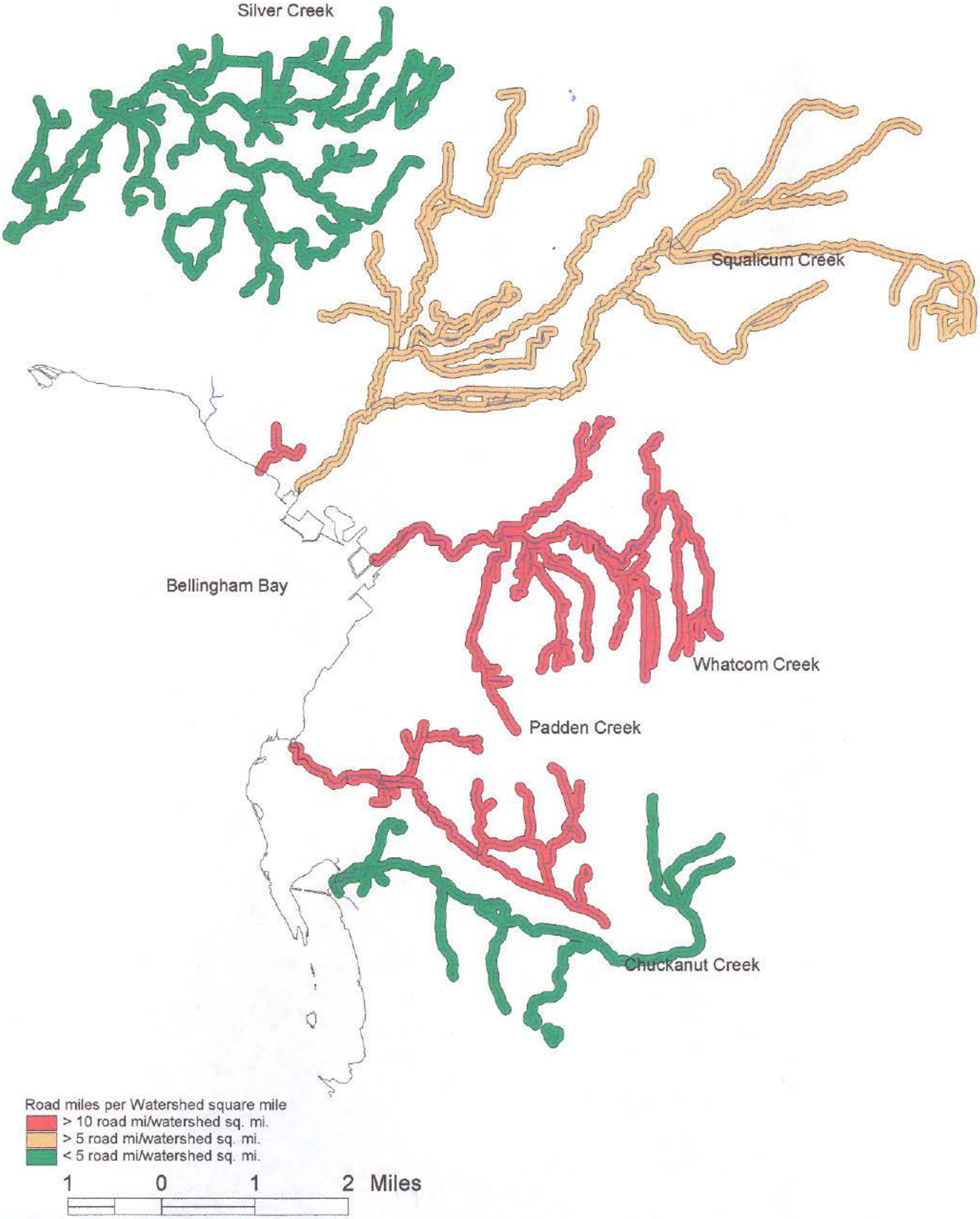
Percent Forest Cover within 200 Feet of Stream



Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

Bellingham Habitat Assessment
Road Miles per Square Mile of Watershed



Nahkeeta Northwest Wildlife Services
Map by Jean Olson

City of Bellingham
Public Works Department

Information Gaps
Recommendations
References

(to be added)

Bellingham Habitat Assessment
Rating System for Habitat Quality Assessment

Simple Rating Factors: All areas of consideration are valued between 0 and 5.

Overall Habitat Rankings

Class	Total Score
Excellent Quality:	125-155
Good Quality:	94-124
Fair Quality:	63-93
Poor Quality:	32-62
Impaired:	0-31

Size Rating:

0	small or fragmented < 5 acres
1	small good quality < 10 acres
2	medium 10-20 acres
3	medium-large 20-50 acres
4	large 50 - 100 acres
5	large high quality > 100 acres

Block Intactness and Connectedness

Continuity

0	block isolated and fragmented habitat > 80%
1	fragmented habitat, not isolated > 80%
2	habitat partly fragmented > 50%
3	habitat fragmented < 50%
4	contiguous habitat with major disturbances
5	contiguous habitat with minor disturbances

Multi-Basin

0	block does not connect watershed basins
1	block connects 2 watershed basins with disturbed, narrow habitat
2	block connects 2 watershed basins with low to moderate quality habitat
3	block connects 2 watershed basins with moderate to high quality habitat
4	block connects multiple watershed basins with moderate quality habitat
5	block connects multiple watershed basins with high quality habitat

Wildlife Movement

0	no animal movement possible w/o high risk
1	only avian/fish movement easy
2	large and medium animal movement possible
3	large and medium animal movement easy
4	all sizes of animal including amphibians movement possible
5	all animal movement easy

# of Connectors

0	isolated
1	1 low quality connector
2	1 to 2 low to moderate quality connectors
3	1 to 3 moderate quality connectors
4	moderate quality connector(s) and 1 high quality connector
5	at least 2 high quality connectors

Quality of Connection

0 no connectors
1 connector(s) with freeway crossing(s)
2 thin to medium connector(s) with major road crossing(s) or development
3 thin to medium connector(s) with minor road crossing(s)
4 medium to wide connector(s) with minor road crossing or thin with no road crossings
5 wide high quality connectors with no road crossings

Stream

Association

0 no streams associated with block
1 stream connected to block by narrow, long corridor
2 stream connected to block by wide, short corridor
3 stream adjacent to block
4 minor stream running through block or minor headwater
5 major stream running through block or major headwater

Type

0 no streams present
1 channel < 2 feet wide, seasonal or ephemeral, no fish presence possible
2 channel < 5 feet wide, seasonal, fish presence possible
3 channel < 5 feet wide, permanent flow, fish presence possible, moderate human, wildlife use
4 channel > 5 feet wide, permanent flow, fish presence confirmed, high wildlife, human use
5 channel > 10 feet wide and/or shoreline outflow

Riparian

Quality

0 riparian area non-existent (stream routed under ground or ditched
1 riparian area very narrow and/or bisected by road
2 riparian area fragmented dominated by shrubs and/or disturbed areas
3 riparian area is regenerating mix of shrubs and trees
4 riparian area natural, tree dominated with shrubs, some woody material
5 completely natural, contiguous, mature multi-layered riparian area with large woody material

Riparian/Upland Association

0 no natural upland association
1 contiguous to developed upland with restricted area or limited habitat value
2 contiguous to developed upland with natural habitat corridors
3 contiguous to upland with natural habitat and wide corridors to upland forest
4 contiguous with upland forest block
5 contiguous with large uninterrupted upland mature forest

Wetlands

Isolated

0 no isolated wetlands
1 single isolated wetland with low quality habitat
2 small isolated wetlands with moderate quality habitat
3 medium isolated wetlands with moderate quality habitat
4 large isolated wetlands with moderate quality habitat
5 multiple wetlands with associated high quality habitats

Hydrologically connected with stream

- 0 no hydrologically connected wetlands
- 1 small hydrologically connected wetlands with low quality habitat
- 2 small to medium hydrologically connected wetlands with low to moderate quality habitat
- 3 small and medium hydrologically connected wetlands with moderate to high quality habitat
- 4 large hydrologically connected wetland(s) with moderate to high quality habitat
- 5 hydrologically connected wetland(s) with direct stream/shoreline association and potential rearing habitat for fish

Wetland/Upland Association

- 0 no natural upland association
- 1 contiguous to developed upland with restricted area or limited habitat value
- 2 contiguous to developed upland with natural habitat corridors
- 3 contiguous to upland with natural habitat and wide corridors to upland forest
- 4 contiguous with upland forest block
- 5 contiguous with large uninterrupted upland mature forest

Shoreline

Quality

- 0 no shoreline
- 1 heavily developed shoreline (industry, urban, marina)
- 2 moderately developed shoreline (habitat limited, residential)
- 3 lightly developed shoreline (residential w/ corridors)
- 4 shoreline associated with open space or parks
- 5 totally natural shoreline contiguous with natural upland

Shoreline/Upland Association

- 0 no upland or riparian association
- 1 contiguous to upland with open space
- 2 contiguous with forest block
- 3 contiguous with stream outflow or inflow
- 4 contiguous with forest and stream outflow or inflow
- 5 contiguous with forest, stream outflow or inflow and high quality wetland

Quality of Habitat

Ground

- 0 bare earth-disturbed-weeds
- 1 human controlled monoculture/non-native yards
- 2 first stage fallow field/pasture or predominantly non-native - low quality
- 3 fallow field or regenerating natives with non-natives
- 4 medium quality mixed native and non-natives
- 5 high quality diverse native species including some shrub or understory layers

Shrub

- 0 no shrubs
- 1 small nonnative shrubs
- 2 predominantly non-natives with some native shrubs
- 3 regenerating native and nonnative shrub habitat
- 4 diverse native shrub habitat no overstory or fragmented overstory
- 5 diverse native shrub habitat with emergent overstory

Overstory

0 no overstory
1 sparse overstory
2 regenerating thicket or mature patch < 10 acres
3 young forest with shrub and ground cover or mature patch < 20 acres
4 forest with mature component and emerging young trees
5 mature native forest with emergent trees

Snags

0 no snags present
1 a few small snags
2 predominantly small snags, occasional medium snag
3 predominantly medium snags
4 predominantly medium snags, occasional large snag
5 many large snags

Cliffs or caves

0 no cliffs or caves
1 cliffs < 10 feet without cavities or fissures
2 cliffs < 10 feet with cavities or fissures
3 cliffs 10 to 25 feet without cavities or fissures
4 cliffs 10 to 25 feet with cavities or fissures
5 cliffs > 25 feet with cavities or fissures

Large down woody debris (logs/stumps)

0 no down wood or stumps
1 woody debris limited to branches
2 branches and stumps on ground
3 small down trees and few stumps
4 medium sized down trees and some stumps
5 large woody debris with large rotting stumps

Ephemeral water

0 no ephemeral streams or pools
1 isolated ephemeral stream and/or pools with low quality habitat
2 multiple ephemeral streams and/or pools with low quality habitat
3 ephemeral streams and/or pools associated with medium quality habitat
4 multiple and/or connected ephemeral streams and/or pools associated with medium quality habitat
5 multiple and/or connected ephemeral streams and/or pools associated with high quality habitat

Plants

Diversity

0 no habitat
1 habitat is man-controlled monoculture
2 predominantly non-natives with natives mixed in
3 equal mix of native and naturalized non-native plants
4 predominantly native
5 diverse multi-structured native habitat

Community

0 no native plant communities
1 low quality native plant community
2 medium quality native plant community
3 high quality native plant community
4 high quality native plant community with unusual plants present
5 diverse native plant community with rare plants present

Listed species present

- 0 no listed species present
- 1 listed species present sporadically
- 2 listed species present for foraging or other non-breeding activity semi-regularly
- 3 listed species uses habitat regularly for foraging or other non-breeding activity
- 4 listed species uses habitat for breeding and/ or rearing
- 5 multiple listed species use habitat for breeding/rearing/ wintering

PHS species or species of concern (SC) present

- 0 no PHS species or SC present
- 1 PHS or SC species present sporadically
- 2 PHS or SC present for foraging or other non-breeding activity semi-regularly
- 3 PHS or SC uses habitat regularly for foraging or other non-breeding activity
- 4 PHS or SC uses habitat for breeding and/ or rearing
- 5 multiple PHS or SC use habitat for breeding/rearing/wintering

Species Diversity

Mammals

- 0 no mammals present/unknown
- 1 only urban associated mammals present
- 2 urban and some non-urban species present
- 3 large and medium non-urban species present
- 4 a variety of non-urban mammals present, no habitat specific species present
- 5 a variety of non-urban mammals present, including habitat specific species

Birds

- 0 no birds present/unknown
- 1 only urban associated birds present
- 2 predominantly urban birds with a few non-urban birds present
- 3 equal numbers of urban and non-urban birds present
- 4 a variety of predominantly non-urban birds
- 5 a variety of non-urban birds dominate, including habitat specific species

Amphibians

- 0 no amphibians present/unknown
- 1 nonnative frogs present
- 2 native frogs or salamanders
- 3 salamanders or newts and frogs
- 4 a variety of native only amphibians present
- 5 a variety of amphibians present, including western toad

Reptiles

- 0 no reptiles present/unknown
- 1 only garter snakes
- 2 garter snakes and lizards
- 3 garter snakes and lizards with denning habitat
- 4 an abundance garter snakes and lizards present with denning habitat
- 5 an abundance of reptiles present with denning habitat, including rubber boa

Fish

- 0 no fish present/barriers exist/unknown
- 1 introduced non-native fish
- 2 native resident fish only
- 3 native anadromous and resident fish
- 4 listed species or species of concern present
- 5 multiple listed species or species of concern present

Bellingham Habitat Assessment
Rating System for Habitat Risk Assessment

Risks are activities that endanger current habitat function and value, and/or
Potentially displace dependent species

Simple Rating Factors: All areas of consideration are valued between 0 and 5.

Overall Risk Rankings

Class	Total Score
Minimal Risk:	0-9
Low Risk:	10-19
Moderate Risk:	20-29
High Risk:	30-39

Habitat Score

0 Impaired habitat (0-31)
1 Poor habitat (32-62)
2 Fair habitat (63-93)
3 Good habitat (94-124)
4 Excellent habitat (125-155)

Protection Status

0 Block fully protected
1 Block more than 2/3 protected
2 Block less than 2/3 protected
3 Block less than 1/3 protected
4 Block not protected, development status unknown or for sale
5 Block not protected and at immediate risk from development

Corridor Loss

0 corridor(s) not at risk, protected or already isolated
1 corridor(s) has potential risk
2 corridor(s) at risk for temporary narrowing or infringement
3 corridor(s) at risk for permanent narrowing or infringement
4 corridor(s) at risk for bisection
5 corridor(s) at risk for complete loss

Diversity/Isolation Potential

0 no isolation potential, connectors protected, diversity protected
1 low potential for isolation, diversity stable
2 block isolated, diversity threatened (Sink)
3 block mostly isolated, connectors can't be repaired, diversity is permanently threatened (Sink)
4 block partially isolated, connectors could be repaired, diversity threatened, but could be maintained
5 block not isolated, connectors and diversity at risk

Habitat Considerations

Wetland

0 Overall conditions will not change or habitat not present
1 Low - minimal displacement of species and/or impairment of habitat value or function, habitat fully or partially protected
2 Low - minimal displacement of species and/or impairment of habitat value or function
3 Medium - may displace species and/or negatively affect habitat function and value
4 High - will displace species and/or severely affect habitat function and value
5 Extreme - species will be extirpated and/or habitat function and value will be permanently lost

Stream/Riparian/Shoreline

0 Overall conditions will not change or habitat not present
1 Low - minimal displacement of species and/or impairment of habitat value or function, habitat fully protected or partially protected
2 Low - minimal displacement of species and/or impairment of habitat value or function
3 Medium - may displace species and/or negatively affect habitat function and value
4 High - will displace species and/or severely affect habitat function and value
5 Extreme - species will be extirpated and/or habitat function and value will be permanently lost

Terrestrial

0 Overall conditions will not change or habitat not present
1 Low - minimal displacement of species and/or impairment of habitat value or function, habitat fully protected or partially protected
2 Low - minimal displacement of species and/or impairment of habitat value or function
3 Medium - may displace species and/or negatively affect habitat function and value
4 High - will displace species and/or severely affect habitat function and value
5 Extreme - species will be extirpated and/or habitat function and value will be permanently lost

Headwater/Recharge

0 no headwater or recharge threat or habitat not present
1 low risk to headwaters or recharge – block is fully protected
2 low risk to headwaters or recharge – block is partially protected
3 moderate risk to headwaters or recharge
4 high risk for impairment to headwaters or recharge – block not protected
5 extreme risk for loss of headwaters or recharge – block not protected

Bellingham Habitat Assessment 2003
Habitat Block Index by Watershed

BELLINGHAM BAY (40 Blocks)

006	4.072
007	89.196
008	15.706
009	75.784
032A	0.606
032B	1.447
034	0.116
042	28.370
043	5.850
048	48.154
101	6.468
108	5.199
111	0.270
112	18.123
113	36.881
114	65.648
115	8.109
116	7.296
117	0.463
118	2.172
119	1.297
120	18.236
121	55.282
122	329.052
123	1.222
125	39.005
162	9.329
163	6.737
164	8.769
173	4.554
174	26.827
175	5.191
176	8.050
177	2.022
178	50.244
179	17.928
180	2.858
181	9.946
191	4.001
197	4.107
None	98.253

CHUCKANUT BAY (2 Blocks)

004	1063.836
007	34.784
None	29.154

CHUCKANUT CREEK (7 Blocks)

002	265.659
003	93.518
004	2005.596
005	9.140
006	160.321
007	43.495
052	1280.542
None	1.449

LAKE WHATCOM (21 Blocks)

051	49.439
052	2732.246
056	7.586
058	4.973
060	27.331
064	5.561
065	47.055
065A	12.180
066	54.617
067	22.054
142	1129.669
143	363.485
144	2.760
145	4.442
147	0.182
148	66.588
165	92.632
166	8.696
167	25.283
168	691.300
196	856.119
None	197.815

LITTLE SQUALICUM CREEK (21 Blocks)

083	1.137
090	4.266
091	13.291
092	19.401
093	2.615
094	24.780
095	8.297
096	9.020
099	1.722
104	7.493
105	6.753
106	12.834
107	8.348
108	36.258
108A	11.653
109	9.452
110	21.961
111	30.401
112	5.567
117	0.811
197	8.002
None	3.533

PADDEN CREEK (41 Blocks)

002	675.015
002A	192.040
005	0.717
006	148.971
008	25.820
011	355.708
011B	42.767
012	12.300
013	43.949
014	9.592
015	7.545
016	11.846
016A	1.157
018	2.031
019	3.550
020	1.706
022	15.700
024	17.458
025	1.441
029	1.773
030	12.248
032	34.351
032A	12.500
032B	0.021
034	39.392
035	8.829
036	6.852
037	11.726
037A	4.309
038	10.333
039	10.420
040	69.492
041	34.940
042	153.057
043	23.238
045	5.433
048	1.887
052	316.042

176	0.071
178	0.132
180	4.790
None	142.245

SILVER CREEK (16 Blocks)

089	0.019
089A	1.620
118	2.697
119	7.461
121	0.981
122	724.792
123	96.941
124	108.828
125	66.782
126	673.114
127	456.938
128	1234.874
132	13.308
133	91.417
134	70.853
137	198.202
None	170.937

SQUALICUM CREEK (62 Blocks)

065A	1.358
072	223.693
073	199.718
074	89.147
075	49.453
076	93.795
077	5.133
078	33.989
080	22.966
081	142.511
081A	13.035
083	4.684
084	4.876
085	7.308
087	1.840
088	5.308
089	33.667
089A	19.286
090	17.240
091	2.204
097	8.034
098	5.172
099	66.447
100	15.268
101	13.771
107	1.920
117	2.574
118	9.814
120	0.096
126	12.284
127	2.369
128	74.464
129	44.615
130	17.578
131	8.391
132	18.121
133	49.502
134	1681.300
135	10.542
136	5.533
137	3.789
138	334.411
139	39.656
140	119.335
141	44.989
142	1974.128
143	43.088
145	0.156
146	7.026
147	8.853
149	67.523
150	37.755
152	3.286
155	53.008
157	71.270
158	69.764
159	1.860
160	1.144
192	37.664
193	2.613
194	1.628
195	0.994
None	146.028

WHATCOM CREEK (45 Blocks)

011	422.234
011A	67.669
011C	5.499
037	2.913
037A	1.915
042	30.574
050	6.301
052	1155.779
052A	16.321
053	17.740
054	4.704
055	4.200
056	4.469
056A	4.914
057	6.748
058	1.525
060	320.435
068	124.393
069	41.806
070	8.524
071	9.388
147	28.412
148	8.800
149	85.733
150	9.021
151	80.634
151A	7.922
153	27.737
154	7.157
156	3.189
161	9.612
165	0.157
169	4.266
170	4.058
171	33.668
172	3.519
182	8.593
183	1.629
184	1.074
185	2.770
186	2.004
187	0.435
188	2.564
189	2.306
190	2.318
None	88.955

Bellingham Habitat Assessment
Block Descriptions 2003

Habitat Blocks

As a means to inventory habitat area and value within an urban landscape, a "block" system was applied. Blocks (blk) are a descriptive unit, representing an area of contiguous open space that contains one or more habitat types. Each block embodies an area of definable habitat and its associated wildlife community. Because habitat value and function is dependant on area (size), condition and connectivity, blocks serve as a comparative measure of available open space, connectivity and habitat diversity within each watershed.

Each block is defined by its dominate habitat and given a number as its identification. The habitat blocks of Bellingham were originally delineated as part of the Bellingham Wildlife and Habitat Assessment in 1991. Each block was identified using aerial photo interpretation, using 2001 orthophotographic maps. The blocks were then digitized. The original base maps from 1991 were lost. Although every effort was made to duplicate the earlier block delineation, complete duplication of the blocks and the level of detail were not achieved. Also lost were descriptive block documentation and notes on wildlife and habitat within certain areas. The text descriptions were, however, saved and updated as follows.

Block Descriptions

The block descriptions and numbering are based on the Bellingham Wildlife Habitat Assessment (Eissinger 1995). The earlier assessment included blocks 1 through 110. With the expansion of the City limits, UGA and 5 year growth boundary, additional blocks were necessary. An additional 87 blocks were added for a total of 197 blocks within the study area. The blocks in the southern Whatcom watershed retained the numbers and the other blocks in the northern Whatcom and Squalicum watersheds received new numbers. Also, many of the blocks in the Bellingham Bay watershed were unable to be reconciled with numbers so they also received new numbers. In addition, many contiguous blocks have been severed since 1995 as a result the separate fragments are numbered with the original number plus a letter. Wetland information is taken from the Bellingham Wildlife and Habitat Assessment (Eissinger 1995) and the Bellingham Wetlands Inventory (Shapiro 1991).

Block Key

A Block Index is provided prior to the descriptions as a list of block numbers within each watershed.

Each block is described by number, location and size. The block size includes the area digitized and defined for the assessment within the city limits, UGA and 5 year boundary. The acreages in parenthesis is the total block size that extends beyond the city boundaries. The block habitat quality and risk scores area also listed. The score totals are listed below and fully described earlier in the document.

Scoring System

Habitat Quality Rating	
0 - 31	Impaired Habitat
31 - 62	Poor Habitat
63 - 93	Fair Habitat
94 - 124	Good Habitat
125 - 155	Excellent Habitat

Risk Rating	
0 - 9	Minimal Risk
10 - 19	Low Risk
20 - 29	Moderate Risk
30 - 39	High Risk

Block Descriptions

Block 1
T37N R3E S16
In the 1991 assessment, block 1 was stated as being adjacent to blocks 2 and 2b, however, because the block's exact location could not be found; it has been combined with these two blocks.

Block 2
T37N R3E S07, S08, S16, S17, S18
Block Size: 901.81 (940.70) acres
Habitat Score: 139 – Excellent Habitat
Risk Score: 014 – Low Risk
Block 2 is a combination of blocks 1, 2 and 2b from the 1991 assessment and contains 901.81 acres within the boundaries specified above. Block 2 is bordered on the south and west by I-5 and continues east to the park boundary. It is bisected by an 80 foot wide power/pipeline corridor on the eastern edge of the golf course in 2a. To north it is bordered by Samish Way and Wilkin Street. This block is comprised primarily of Lake Padden Park and spans 2 watersheds: Padden Creek and Chuckanut Creek. The 1991 assessment list the Chuckanut watershed portion of the block containing 163.63 acres. The Padden watershed portion of the block contains 589.57 acres of upland and 142.76 acres of lake. The total combined acreage was 895.96 acres. It is primarily mature contiguous forest with recreational fields, picnic areas, playgrounds and multi-use trails. West of the western park border, approximately 40 acres was cleared and is currently for sale. Forest habitat is primarily mixed conifer/hardwood forest with patches of large second growth Douglas fir (*Pseudotsuga menziesii*). Mixed deciduous forest including Bigleaf maple (*Acer macrophyllum*) and red alder (*Alnus rubra*) patches border some lake and park areas. At the western edge of the lake, Padden Creek begins. The lake is separated from the stream by a slotted board dam. Water is diverted around the dam to keep the stream flowing during low flow periods. Wetlands occur in the block in both the Padden and Chuckanut watersheds as follows: wetlands CH-35, 36, 37, 38, 49, 50, 51, 56 amount to 3.6 acres within the block; and wetlands PA-56, 58, 63, 64, 65, 66, 67, 68, 69, 70, 71, 77, 78, 79, 80, 81, 82, 84, 85, 86, 93, 94, 95, 96, 97, 98, 99 amount to 26.3 acres for a total of 29.9 wetland acres. The eastern portion of this block has numerous ephemeral streams and pools. The diversity of wildlife lends itself to an extensive variety of species. Many passerine bird species are found in this block including olive-sided flycatcher (*Contopus borealis*). An active bald eagle (*Haliaeetus leucocephalus*) nesting territory (PHS #0783) occurs on the south edge of the lake. Pileated (*Dryocopus pileatus*) and other woodpecker species are also common. This is one of the few blocks large enough to support breeding pileated woodpeckers. Many species of waterfowl also use the lake for wintering and breeding. Other wildlife found in the block includes coyote (*Canis latrans*), river otter (*Lutra canadensis*), bats, deer (*Odocoileus* sp.) and amphibians. A PHS monitor species the Compton tortoiseshell butterfly (*Nymphalis vaualbum watsonii*) was seen here and is the city's only record of this species (WDFW record). Cutthroat trout (*Oncorhynchus clarki*) occur in the lake along with other native and planted species. Anadromous fish are listed as using the entirety of Padden Creek including chinook (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus kisutch*) and steelhead (Oncorhynchus *mykiss*) salmon; however it is unlikely they can swim past the culvert under I-5. Block 2 provides a corridor between Lookout Mountain and the Chuckanut mountains; however, I-5 prevents most terrestrial wildlife movement between these two areas. Passage could be improved by providing wildlife over or underpasses on the west side of Block 2 into block 6 or the Chuckanuts. The connection between block 2 and Lookout Mountain is wide and crossed only by Samish Way. At this point, barring further development on either side of the road, large and medium animal movement is easy. Small animals including amphibians will have a difficult time moving into or out of block 2 given the busy road barrier. An wildlife underpass would potentially improve wildlife passage between the two blocks. It needs to be stressed that without secure wildlife corridors under/over I-5 and Samish Way, the Lake Padden habitat could become isolated in the future.

Block 2A
T37N R3E S09, S16
Block Size: 192.04 (192.04) acres
Habitat Score: 079 – Fair Habitat
Risk Score: 009 – Minimal Risk
Lake Padden Golf Course, containing 192.04 acres, has mixed conifer/hardwood forest strips between fairways and greens. It contains several wetlands, PA-83, 87, 88, 89, 90, 91, 92a, 92b totaling 4.8 acres. The stream flowing from Our Lake under Samish Way through the golf course to Lake Padden provides spawning habitat for kokanee salmon (*Oncorhynchus nerka*) and cutthroat trout. Because the golf course is well wooded and directly adjacent to larger forest blocks, its habitat value is higher than that of an isolated golf course. However, the chain link fence surrounding the golf course provides a barrier to terrestrial wildlife. Its removal would increase wildlife use of this block. Wildlife found in block 2 will also use this block.

Block 2b
See Block 2. This block was added to block 2 because only a narrow power line corridor separates the two of them.

Block 3
T37N R3E S17, S18
Block Size: 39.07(93.54) acres
Habitat Score: 092 – Fair Habitat
Risk Score: 015 – Low Risk
Block 3 is contiguous east and west to Chuckanut Mountain, bordered by I-5 to the north, Old Samish Road to the south and 32nd Street to the west. This block contains 2,000 linear feet of Chuckanut Creek with spawning and rearing habitat for chum (*Oncorhynchus keta*), steelhead, coho and searun cutthroat trout. The forest is a mixed hardwood/conifer forest and is interspersed with rural residential areas. Wetlands contained in block 3 include CH-43, 46, 47, 48, 52, 53, 55 have a total area of 3.2 acres. Currently, the block is separated from Chuckanut Mountain by Old Samish Road, but passage is possible for most terrestrial species. With the addition of a wildlife over or underpass constructed over I-5, this block would provide an excellent wildlife corridor between Lookout Mountain and the Chuckanuts.

Block 4
T37N R2E S13; R3E S13, S17, S18, S19, S20
Block Size: 301.87 (4,624.50) acres
Habitat Score: 138 – Excellent Habitat
Risk Score: 015 – Low Risk
Block 4 is primarily forest with interspersed rural residential dwellings having an area within the city limits of 301.87 acres. Block 4 contains the northern edge of the Chuckanut mountain range and is bordered on the north by Old Samish Rd and the west by Chuckanut Drive. It is contiguous with the large forest block draping the Chuckanut Mountains and surrounding Lake Samish to the south and east. This block contains large second growth and some old growth trees in Arroyo Park. Forest types occurring here are lowland/temperate conifer, mixed conifer/hardwood and red alder. Seven thousand two hundred linear feet of Chuckanut Creek run through the north edge of block 4. This is the most natural stream and riparian corridor within the city offering an unobstructed stream-upland forest habitat interface. The stream contains spawning and rearing habitat for chum, steelhead and coho salmon and searun cutthroat trout. It has numerous wetlands including CH-5, 6, 8, 9, 10, 11, 20, 21a, 21b, 25, 26, 27, 28, 29a, 29b, 30, 31, 39, 40, 42, 43, 44, and 45 for a total area of 9.9 acres within the city limits and others throughout the Chuckanut Mountains. The majority of this forest block occurs outside the city limits and thus a detailed description of all its habitat features is not available. This block is an important link to Larrabee State Park south to Blanchard Mountain and thousands of acres of natural forest habitat. It allows for wildlife movement and supports a diversity of species. Amphibians seen here include rough skinned newt (*Taricha granulosa*), tailed frog (*Ascaphus truei*), red-backed salamander (*Plethodon vehiculum*) and alligator lizard (*Elgaria coerulea*). Deer, bats, cougar (*Felis concolor*), coyote and a variety of smaller mammals are found in Block 4 as well. Wildlife over or underpasses on I-5 would enable a variety of animals to move between the Chuckanuts and Lookout Mountain improving faunal flow and future species diversity.

Block 5
T37N R3E S07
Block Size: 9.86 (9.86) acres
Habitat Score: 045 – Poor Habitat
Risk Score: 020 – Moderate Risk
Block 5 is a strip habitat bordered by I-5 on the east, 30th and 32nd Streets on the west and south and developed land on the north and south containing a total area of 9.86 acres. It provides a travel corridor for wildlife between block 2 and 6. It is interspersed with rural residential dwellings and open fallow field/shrub habitat. There are also conifer forest patches within the block. Block 5 contains the wetland CH-34 for a total area of less than 0.1 acres. This block will not be able to support a population of wildlife, but will provide usable habitat as a corridor link.

Block 6
T37N R3E S07, R2E S12
Block Size: 313.36 (313.36) acres
Habitat Score: 123 – Good Habitat
Risk Score: 030 – High Risk
Block 6 is commonly known as 100-acre wood and contains 313.36 acres of mixed conifer/hardwood forest, fallow field, wetlands and rural residential dwellings. It is bordered on the south by Old Samish Rd, on the west by Chuckanut Drive, on the north by developed residential areas and Fairhaven Parkway and on the east by 30th Street. Hoag Lake provides excellent habitat for breeding amphibians including Pacific tree frogs, red legged frogs and has in the past supported a breeding population of western toad (*Bufo boreas*). Current status of toad breeding is unknown. Due the sensitivity and rarity of toad breeding areas it would be important to survey this site and surrounding area. Its outflow drains through the center of the block into Chuckanut Creek and contains searun cutthroat trout redds (Johnston, WDFW). The block spans both the Chuckanut and Padden Creek watersheds. It is an essential connector between blocks 2 and 4 and a centralized habitat node where corridors converge from Chuckanut Creek, Chuckanut Bay, Padden Creek and the Padden Gorge. This

block consists of diverse vegetative communities and vegetative structures which are accentuated by the high topographic relief forming low protected areas, year-round wetlands, steep slopes, swales and ridgelines. The forest is primarily mature mixed conifers including Douglas fir, western red cedar (*Thuja plicata*), grand fir (*Abies grandis*) and a successfully regenerating Sitka spruce (*Picea sitchensis*) grove. Wetlands located in the block are: CH-17, 18, 19, 22, 23, 24 totaling 9.0 acres and PA-5, 6, 8, 9, 17, 18, 19, 20, 23, 25 having an area 18.2 acres. The total wetland area in block 6 is 27.2 acres. Due to the variety of habitat available and its location, Block 6 supports a great diversity of species. Animals known to breed in the area include red fox (*Vulpes vulpes*), coyote, deer, river otter, muskrat (*Ondatra zibethicus*), and mink (*Mustela vison*). Pileated woodpecker, great blue heron (*Ardea herodias*), barred owl (*Strix varia*), belted kingfisher (*Ceryle alcyon*) and other forest associated species hunt and/or breed here. Amphibians have breeding populations in this block as well including: western toad, pacific tree frog (*Hyla regilla*), red-legged frog, ensatina (*Ensatina eschscholzii*), long toad salamander (*Ambystoma macrodactylum*), red backed salamander, northwest salamander (*Ambystoma gracile*) and northern alligator lizards. Parts of block 6 are protected, but the vast majority is not and some is proposed for development. Due to its centralization and intactness, this block should be targeted for conservation and a reconnection built with block 2.

Block 7
T37N R2E S12, S13
Block Size: 145.20 (167.70) acres
Habitat Score: 122 – Good Habitat
Risk Score: 022 – Moderate Risk
Block 7 contains the mouth of Chuckanut Creek. It encircles the east and north sides of inner Chuckanut Bay. This block contains contiguous forest, a large salt marsh and estuary. It provides a steep, narrow connection between Clark's Point (block 9) and block 4. It is bordered by Chuckanut Drive on the east, Viewcrest Drive and the Edgemoor neighborhood on the north and west and Chuckanut Bay to the south and west. The northern upland is dry Douglas fir forest with large cliffs and steep hillsides. A saltmarsh with tidal channels and many small snags merges into the upland to the northeast. Wetlands occurring in block 7 are CH-1, 2, 3, 4 and 7 for a total area of 13.1 acres. Throughout this area rural residential dwellings are found and a portion of the corridor connecting the dry upland with the saltmarsh has been converted to backyard habitat. The overstory is excellent, but the understory is lawn with a narrow shrubby border. A portion of the beach and saltmarsh are protected. Wildlife found commonly here include, bald eagle, osprey (*Pandion haliaetus*), great blue heron, red fox, deer, western tanager (*Piranga ludoviciana*), kingfisher, red-legged frog and a variety of salamanders. Chuckanut Creek flows for approximately 2,400 feet through block seven and contains spawning and rearing habitat for coho, chum, chinook and steelhead salmon and searun cutthroat trout. Between block 7 and block 4 there is a 10 foot by 12 foot box culvert with baffles and a fish ladder. During low flow, terrestrial wildlife can use the large culvert as passage under Chuckanut Drive; otherwise, they must cross the roadway. Portions of the stream running through the residential area are channeled and without overstory while other reaches contain excellent riparian cover. This block provides a good connector between upland and shoreline habitats. The tributary feeding from Hoag Lake passes through a culvert under Chuckanut Drive into block 7 and has had a spawning cutthroat trout run in the past. Wildlife movement between blocks 6 and 7 is more difficult than that between blocks 7 and 4; however, movement is possible. Block 7 has the best natural forested shoreline in the city.

Block 8
T37N R2E S12
Block Size: 41.53 (41.53) acres
Habitat Score: 036 – Poor Habitat
Risk Score: 015 – Low Risk
Block 8 contains small areas of habitat mixed into residential areas. Because the habitat consists primarily of tree canopy, arboreal wildlife is found most commonly in this block. Wetland CH-16 having an area of 5.7 acres is located in block 8. Deer, raccoons and other adaptable animals will be the primary terrestrial wildlife found here. Due to the fragmentation of block 8 by residences, its connection to block 7 is poor. This habitat although of low value is important to avian and other arboreal species.

Block 9
T37N R2E S13, S14
Block Size: 78.74 (78.74) acres
Habitat Score: 105 – Good Habitat
Risk Score: 013 – Low Risk
Block 9 is Clark's Point, a privately owned and preserved peninsula. This area is bordered by the Edgemoor neighborhood to the north, Chuckanut Bay to the east and south and Bellingham Bay to the west and south. The edges of the peninsula are cliffs more than 50 feet high with many cracks and fissures. Madrone (*Arbutus menziesii*) trees and less common Garry oak *(Quercus garryana)* occur here. This one of the only locations that Garry oak occur in the city. The forest is primarily large native second growth mixed conifer/hardwood forest. One small wetland CB-2 having an area of 0.2 acres occurs on the east side of the peninsula, however, the area is primarily dry forest. Wildlife found here include, nesting bald eagles (PHS #0781), roosting peregrine falcons (*Falco peregrinus*), osprey, red-tailed hawk (*Buteo jamaicensis*), nesting belted kingfisher, pileated woodpeckers, red fox, deer and Cooper's hawk (*Accipiter cooperii*). The connection between blocks 9

and 7 is a very narrow steep bluff. Animal movement between Clark Point and the Chuckanuts is possible, but not easy. Prior to recent housing construction, the connection was stronger and more easily accessible to wildlife. A reconnection of this corridor would prevent Clark's Point from becoming an isolated island of habitat and thus a diversity sink.

Block 10
T37N R2E S13
Block Size: 240 acres
Block 10 is Chuckanut Bay. This habitat is excellent and rich estuarine habitat, however it was not assessed the same as other blocks due to its lack of terrestrial features. The bay has two sections, one inside the Burlington Northern railroad bed and trestle (83 acres) and the other outside (157 acres). The total area of the bay is 240 acres. The substrate of the bay is soft mud with eelgrass (*Zostera* sp.) meadows, algae and shellfish beds. Contamination levels found in the shellfish have resulted in this area being closed for recreational shellfish harvest. River otter, harbor seals (*Phoca vitulina*) and gray whales (*Eschrichtius robustus*) can be found here. It is a major migration route for Dungeness crab (*Cancer magister*), coho, chum, steelhead and chinook salmon as well as searun cutthroat trout. Shorebirds and waterfowl also use this area extensively. Chuckanut Bay is an essential habitat for wildlife. Its usability and quality should be ensured by continued and expanded protection.

Block 11
T37N R3E S05, S08, S09; T38N R3E S32
Block Size: 1,175.41 (1,175.41) acres
Habitat Score: 127 – Excellent Habitat
Risk Score: 039 – High Risk
Block 11 consists of the Samish Hill crest. It spans two watersheds, Padden and Whatcom. Habitat available for wildlife use here includes expansive contiguous mixed conifer/hardwood forest. Some of the land has been acquired by the city for open space, but most is privately owned. Previously logged areas are regenerating or being developed. Block 11 is bordered on east by Yew Street Rd, on the south by Samish Way, on the west by 40th Street and on the north by San Juan Boulevard. This block contains diverse micro- habitats including swales, cliffs, caves, balds and snags. Wetlands listed for this block include: PA-43, 44, 45, 46, 47, 48, 49, 50, 51, 73, 74, 75, and 76 having an area of 8.5 acres and WH-5, 6, 7, 10 and 13 having an area of 29.0 acres. In all, block 11 has 37.5 acres of wetland. Deer, coyote, porcupine (*Erethizon dorsatum*) and amphibians were found in abundance throughout this block. Bobcat are also known to have resided and travel through the area. Many bird species use this area for breeding, rearing and foraging. Block 11 contains the headwaters of Connelly, Lincoln and Cemetery Creeks and a stream flowing into Lake Padden. Lincoln Creek has listed resident rainbow trout throughout its reach. Some of the habitat has been logged and replanted and some has been developed into large estate style homes or other residential developments. The headwaters of a stream flowing into Our Lake have been developed and since development, juvenile western toads have not been seen dispersing up the stream toward block 11. The status or viability of the western toad population in the area is now unknown. Other species have been impacted including porcupine which have been displaced by development from their cave dwellings and killed. Birds requiring specialized habitat have also lost area and habitat quality. Since 1991, nearly 200 acres of habitat have been lost to residential development within this block. This loss has isolated at least 4 blocks of habitat which were preserved because they contained wetlands. These wetlands lose value because they are not connected to the upland and wildlife use is more difficult.

Block 11A
T38N R3E S32
Block Size: 67.67 (67.67) acres
Habitat Score: 103 – Good Habitat
Risk Score: 035 – High Risk
Block 11A is separated from block 11 by San Juan Boulevard. It is bordered on the north by Lakeway, the west by Undine and associated residential neighborhoods and on the east by Yew Street. West Cemetery Creek flow through this block and is listed as having resident rainbow trout throughout its reach. Block 11A provides an essential corridor north/ south from Whatcom Falls Park into block 11 and eventually Lake Padden. Habitat is more fragmented in 11A than in 11. Wetlands WH-44, 45, 46, 47, 48, 49, 50, 54, 56, 57 have a total area of 18.7 acres. More than 4 acres of wetlands have been lost in this block since the late 1980's. Wildlife occurring in this block will be similar to block 11, but likely reduced diversity and numbers.

Block 11B
T37N R3E S08
Block Size: 42.77 (42.77) acres
Habitat Score: 079 – Fair Habitat
Risk Score: 030 – High Risk
Block 11B was formerly attached to block 11. Since the previous assessment, areas between 11B and 11 have been developed for residences. Block 11B contains wetlands PA-60 and 62 having a total area of 5.1 acres. It is mixed forest.

Wildlife listed in block 11 may also be found in block 11B. A corridor linking blocks 11 and 11B needs to be reconstructed to avoid this block becoming a wildlife sink.

Block 11C
T38N R3E S32
Block Size: 5.50 (5.50) acres
Habitat Score: 042 – Poor Habitat
Risk Score: 017 – Low Risk
Block 11C was also formerly attached to block 11 and much of it is currently for sale for residential development. Block 11C is primarily alder and provides daytime refuge habitat for wildlife moving through the area.

Block 12
T37N R3E S08
Block Size: 12.30 (12.30) acres
Habitat Score: 064 – Fair Habitat
Risk Score: 025 – Moderate Risk
Block 12 is a primarily mixed hardwood forest. This block contains some very large bigleaf maples with large snags and thick understory. Wetland PA-61 having an area of 5.2 acres is located here. An ephemeral stream flows from 11B through block 12 then into Lake Padden. A portion of the block is also fallow field and pasture. Block 12 is an essential connector between Lake Padden and the western portion of Samish Hill.

Block 13
T37N R3E S06, S07
Block Size: 43.95 (43.95) acres
Habitat Score: 057 – Poor Habitat
Risk Score: 029 – Moderate Risk
Block 13 was contiguous east to block 11, but since, has been fragmented by clearing and severed by the extension of 40th Street. It is mixed conifer/hardwood forest with a few small snags. Large and medium animal movement between blocks 11, 11B and 13 is still possible, but as traffic increases will become more difficult. Small mammal and amphibian populations in block 13 are essentially isolated.

Block 14
T37N R3E S07
Block Size: 9.59 (9.59) acres
Habitat Score: 022 – Impaired Habitat
Risk Score: 009 – Minimal Risk
Block 14 is severely fragmented habitat on Samish Hill. Formerly more than 8 acres were fully connected, now at least 1/3 of that habitat has been lost and the block has been split in two. Its value is retained for avian species, but limited for terrestrial species, since the block is no longer connected to the west, primary wildlife movement will be across Samish Way into block 13.

Block 15
T37N R3E S07
Block Size: 7.55 (7.55) acres
Habitat Score: 023 – Impaired Habitat
Risk Score: 022 – Moderate Risk
Block 15 occurs at the corner between Samish Way and Broad Street south of 40th Street. The majority of the forested portion of the block has been developed, however, a 2.9 acre wetland (PA-59) was retained as were some large Douglas fir. The southern half of the block is fallow field, lawn and deciduous forest. Block 15 links blocks 13 and 2, although the connection does not have the quality of the one running through block 12. Its habitat value is primarily for arboreal wildlife

Block 16
T37N R3E S06, S07
Block Size: 11.85 (11.85) acres
Habitat Score: 039 – Poor Habitat
Risk Score: 021 – Moderate Risk
Block 16 is heavily fragmented habitat on Samish Hill. The previous extent of the block was 27 acres. At least half of that has now been developed with single family residences and severed the north and south portions of the block completely requiring the redesignation of block 16 to 16 and 16A.

Block 16A
T37N R3E S06
Block Size: 1.16 (1.16) acres
Habitat Score: 034 – Poor Habitat

Risk Score: 024 – Moderate Risk
Block 16A is a narrow strip of habitat on Samish Hill surrounding upper Connelly Creek between Samish Way and 34th Street. It was previously attached to block 16. The riparian corridor is approximately 200 feet wide and is shaded with trees or shrubs. This reach is not known to have fish, however it has good flow during low flow periods and is a potentially viable fish stream, which needs further assessment. 16A is one of the last habitat corridors which linked Samish Hill with Happy Valley. As a result it provides an important link between block 40 (Connelly Creek Nature Area) and block 11 across I-5 through block 35 and provides good habitat for avian species. If a wildlife passage could be created to span I-5 this would be an important location.

Block 17
T37N R3E S07
Block 17 has been developed. It formerly contained wetland PA-55 with an area of 0.7 acres.

Block 18
T37N R3E S07
Block Size: 2.03 (2.03) acres
Habitat Score: 008 – Impaired Habitat
Risk Score: 013 – Low Risk
Block 18 is primarily canopy habitat at the northeast corner of I-5 and Fairhaven Parkway. It provides habitat for passerines, but is limited for terrestrial wildlife due to its lack of understory and flanking of the freeway.

Block 19
T37N R3E S07
Block Size: 3.55 (3.55) acres
Habitat Score: 022 – Impaired Habitat
Risk Score: 011 – Low Risk
Block 19 is strip habitat along the east side of I-5. It extends north and eventually connects with block 38. This block has limited habitat value due to its proximity to I-5 and the fence dividing the freeway from residential development. The vegetation is primarily regenerating shrubs with an occasional tree. It does contain a few small snags, but nothing large enough to support cavity dwelling species. Wildlife using this block is at high risk from freeway traffic.

Block 20
T37N R3E S07
Block Size: 1.71 (1.71) acres
Habitat Score: 017 – Impaired Habitat
Risk Score: 010 – Low Risk
Block 20 is a mitigated wetland at the northwest corner of I-5 and Fairhaven Parkway. It consists of small alders with many small snags, some shrubs and cattails (*Typha latifolia*). Due to its isolation and proximity to I-5 the value of this block is limited to all but avian species. Red-winged blackbirds (*Agelaius phoeniceus*) were observed in the cattails (*Typha latifolia*).

Block 21
T37N R3E S07
Block 21 has been developed.

Block 22
T37N R3E S07
Block Size: 15.70 (15.70) acres
Habitat Score: 050 – Poor Habitat
Risk Score: 014 - Low Risk
Block 22 was merged with block 26 due to proximity and habitat restoration. Block 22 and 26 comprise the confluence of Connelly and Padden Creeks. The habitat is primarily regenerating fallow field and shrubby riparian strips. It is bordered on the west by 24th Street on the north by Donovan Avenue on the south by Fairhaven Parkway and on the east by residential development and 32nd Street. The block provides good habitat for stream associated species and a connector between block 6 and 40.

Block 23
T37N R3E S07
Block 23 was a wetland, PA-53, with an area of 0.9 acres, but has since been developed with only a fringe of regenerating shrub habitat. The habitat has limited use to wildlife except for urban tolerant species. It was merged with block 24.

Block 24
T37N R3E S07

Block Size: 17.46 (17.46) acres
Habitat Score: 072 – Fair Habitat
Risk Score: 026 – Moderate Risk
Block 24 contains the Padden Creek corridor west of I-5 to 30th Street and has been merged with block 23. Portions of the block are mature Douglas fir. The riparian area of the stream, has some functional overstory, but along 30th Street is overgrown with blackberries (*Rubus* sp.). The forest is thick and there is a wide, direct connection to the west with block 6. Preservation of this block is essential for wildlife movement. This block would be the perfect place to put a wildlife over or underpass to connect it to block 2. An analysis of wildlife movement and road kill reports would guide the placement of a wildlife passage-way. None-the-less this is an important habitat area.

Block 25
T37N R3E S07
Block Size: 1.44 (1.44) acres
Habitat Score: 040 – Poor Habitat
Risk Score: 017 – Low Risk
Block 25 is a shrub wetland (PA-22 of 0.8 acres) including a swale adjacent to blocks 6 and 24. The understory is thick and provides daytime refuge for terrestrial wildlife and nice habitat for arboreal species.

Block 26
T37N R3E S07
Block 26 has been combined with block 22 due to the removal of structures and restoration work since the last evaluation.

Block 27
T37N R2E S12
Block 27 contains a nursery and part of the Padden Creek trail system. The wildlife value of this block is very limited as more than 1/2 of it has been developed. It formerly contained wetland PA-11 having an area of 2.9 acres.

Block 28
T37N R2E S12
Block 28 was not found.

Block 29
T37N R2E S12
Block Size: 1.77 (1.77) acres
Habitat Score: 054 – Poor Habitat
Risk Score: 003 – Minimal Risk
Block 29 is directly across 24th Street from Block 22. It contains the Padden Creek riparian corridor before the stream flows west under Fairhaven Parkway. Habitat is regenerating deciduous forest with thick understory. The stream flow is good through here and is part of the spawning and rearing habitat for anadromous and resident fish.

Block 30
T37N R2E S12
Block Size: 12.25 (12.25) acres
Habitat Score: 027 – Impaired Habitat
Risk Score: 010 – Low Risk
Block 30 is backyard and bluff habitat located between Mill and Knox Avenues. Small trees and thick shrubs including blackberries dominate the steep slopes of this block. Habitat value is good for passerine birds and small urban mammals. Deer have been seen moving between block 30 and 43 although they must cross the large lawn at SPIE to do so.

Block 31
T37N R2E S12
Block 31 was not found.

Block 32
T37N R2E S12
Block Size: 34.35 (34.35) acres
Habitat Score: 090 – Fair Habitat
Risk Score: 013 – Low Risk
Block 32 contains the eastern portion of the lower Padden Creek riparian area. It begins where the stream exits the culverts under Fairhaven Parkway and ends where the stream is routed through culverts at the corner of 10th and Fairhaven Parkway. The stream flows through a gorge under the 12th Street bridge which is an important bat roost and possible

nursery. A mixture of mature conifer and maturing deciduous trees are the primary overstory in this block. The understory is somewhat open with native and non-native herbaceous and woody plants. A few medium sized snags provide habitat for woodpeckers. Coho, chinook, chum and steelhead salmon and searun cutthroat trout spawn and rear throughout this block. A portion of the greenways trails system parallels the stream and has resulted in increased use by humans and dogs. Block 32 also contains Fairhaven Park and the lawn, trails and playing fields. Wetlands PA-4 and 10 with an area of 13.1 acres occur here. Block 32 is the only western connector between block 6 and Padden Creek and serves as an important wildlife corridor.

Block 32A
T37N R2E S02
Block Size: 13.11 (13.11) acres
Habitat Score: 076 – Fair Habitat
Risk Score: 013 – Low Risk
Block 32A continues where 32 leaves off. It contains alders and a variety of shrubs. The block is bordered on the north by Harris Avenue on the east by a racquet club and on the south by Donovan Avenue. It continues west across several arterial streets until it meets the Marine Park dog off-leash area in block 178 across 4th Street. The western portion of this block is a narrow trail surrounded by small trees and shrubs. Wetlands PA-2 and 3 with an area of 1.2 acres are found here. More spawning and rearing habitat for the fish species mentioned in block 32 is found here. This area is also nesting habitat for green heron. The riparian area in the forested section of block 32A has excellent under and overstory. It is an excellent block for passerine breeding. The gravel parking lot to the north is a killdeer (*Charadrius vociferus*) nesting area, but has been sprayed regularly with herbicides. It is possible these herbicides are leaching into Padden Creek and could effect the health and habitat of nearby wildlife.

Block 32B
T37N R2E S01, S02
Block Size: 4.99 (4.99) acres
Habitat Score: 056 – Poor Habitat
Risk Score: 005 – Minimal Risk
Block 32B is the mouth of Padden Creek and consists of Padden Lagoon and a restored vegetative border. A variety of waterbirds, shorebirds and gulls (*Larus* sp.) use the area continuously for feeding, loafing and bathing. Green heron adults and young have been observed feeding here. Otter and muskrat have also been observed in the block. A border of shrubs and other vegetation has been planted and is improving habitat quality and screening around the lagoon. However, the highly industrialized nature of the surrounding upland and width of Harris Avenue limits its value to terrestrial wildlife. Anadromous fish spawning in Padden Creek will travel through this lagoon and under Harris Avenue on both legs of their journey. Further habitat restoration and corridor improvement would greatly enhance wildlife use of the lagoon.

Block 33
T37N R2E S12
Block 33 was not found.

Block 34
T37N R2E S12
Block Size: 39.51 (39.51) acres
Habitat Score: 026 – Impaired Habitat
Risk Score: 017 – Low Risk
Block 34 is a strip of mature Douglas fir in the center of the Edgemoor neighborhood near Fairhaven Middle School. Much of the understory has been cleared by residents limiting its value to terrestrial wildlife. The primary wildlife associated with this habitat are urban and human tolerant bird species. It does serve as a corridor for motile species between block 6 and the rest of Edgemoor.

Block 35
T37N R3E S06
Block Size: 8.83 (8.83) acres
Habitat Score: 037 – Poor Habitat
Risk Score: 026 – Moderate Risk
Block 35 contains the Connelly Creek drainage from Samish Hill. It is a very narrow (approximately 100 feet wide in places) and fragmented stream corridor containing one 0.2 acre wetland (PA-41). It is an essential corridor for wildlife movement between block 40 (Connelly Creek Nature Area) and block 11 (Samish Crest). There is no known fish spawning or rearing in this reach of the stream. However, fish habitat and stream flow is good. Further assessment of this corridor is needed along with an examination of possible corridor enhancement and passage provision.

Block 36
T37N R3E S06
Block Size: 6.85 (6.85) acres

Habitat Score: 021 – Impaired Habitat
Risk Score: 014 – Low Risk
Block 36 is fragmented forest east of Samish Way and west of the Ridgemont neighborhood. It is primarily mixed conifer/hardwood forest with enclaves of fallow field. No wetlands are associated with block 36. It is excellent habitat for passerines and other avian species. It also provides refuge habitat for urban and large non-urban associated terrestrial wildlife.

Block 37
T37N R3E S06
Block Size: 14.64 (14.64) acres
Habitat Score: 032 – Poor Habitat
Risk Score: 016 – Low Risk
Block 37 was previously connected to Block 11 across Samish Way. The connection is now limited, but not wholly severed. The eastern half has been heavily fragmented by single family residences. The western half is an intact forest block consisting primarily of mixed conifer/hardwood forest. Block 37 straddles the Padden and Whatcom Creek watersheds. Several wetlands WH-17, 18, 19, 20, 21 having an area of 2.5 acres are located throughout block 37. The large forest block to the west will provide excellent habitat for a variety of wildlife.

Block 37A
T37N R3E S06
Block Size: 6.22 (6.22) acres
Habitat Score: 026 – Impaired Habitat
Risk Score: 014 – Low Risk
Block 37A is backyard habitat formerly connected to block 37. Currently it is most useful for avian and arboreal species. It provides a link between blocks 37 and 50 and block 11. Terrestrial wildlife may use this block for passage.

Block 38
T37N R3E S06
Block Size: 10.33 (10.33) acres
Habitat Score: 041 – Poor Habitat
Risk Score: 015 – Low Risk
Block 38 is strip habitat along the east side of I-5. Habitat consists of regenerating shrubs, grasses and a few scattered trees. This area is regularly used by red-tailed hawk for foraging. Some of the block extends into backyards. Its value to wildlife will be limited primarily to avian species. Wildlife using this block is at high risk from freeway traffic.

Block 39
T37N R3E S06
Block Size: 10.42 (10.42) acres
Habitat Score: 037 – Poor Habitat
Risk Score: 012 – Low Risk
Block 39 is strip habitat along the west side of I-5. Habitat consists of regenerating shrubs, grasses and a few scattered trees. This area is regularly used by red-tailed hawk for foraging. Some of the block extends into backyards. Its value to wildlife will be limited primarily to avian species. Wildlife using this block is at high risk from freeway traffic.

Block 40
T37N R3E S06
Block Size: 69.49 (69.49) acres
Habitat Score: 103 – Good Habitat
Risk Score: 027 – Moderate Risk
Block 40 is the Connelly Creek Nature Area. A portion of the area is protected. The habitat consists of fallow field interspersed with shrub, regenerating forest dominated by pioneer species such as alder and an area of mature conifer. A grove of mature Sitka spruce is located in the northern portion of the block which is one of the only native spruce groves remaining in the city. This is also the largest fallow field habitat within south Bellingham and supports a large species guild dependant on voles, field birds and other small prey. The Connelly Creek corridor was previously the only functional habitat connector between Sehome Arboretum, Happy Valley and south to the Chuckanuts. However, the corridor links north and south have been recently severed by development. As a result, the Connelly Nature Area is becoming isolated and could in the near future, become a habitat sink. A multi-use path weaves its way through the block, creating a consistent human presence. Wetlands found in block 40 include PA-28, 29, 30, 31, 32, 33, 34 for a total area of 26.9 acres. Because of the variety of habitat, a diversity of passerines and raptors can be found here. Woodpeckers, including pileated, ruffed grouse (*Bonasa umbellus*), great blue heron, hawks and owls plus, a variety of urban associated birds are found here. Other wildlife seen here includes bats, coyote (denning), mustelids, raccoon (*Procyon lotor*), skunk (*Mephitis mephitis*) and deer. Cougar have been seen moving through this area, but rarely. Because of its forest field interface, this habitat has excellent value to wildlife and promotes diversity. A formal inventory of wildlife present is needed. Portions of Connelly Creek are used as

spawning and rearing habitat for coho salmon and resident rainbow and cutthroat trout and kokanee salmon. It is likely that other anadromous fish spawning in Padden Creek use this reach as well. A flood control dam crosses eastern side of the nature area.

Block 41
T37N R3E S06
Block Size: 34.94 (34.94) acres
Habitat Score: 058 – Poor Habitat
Risk Score: 024 – Moderate Risk
Block 41 contains Joe's Garden and a patch of mature Douglas fir. A multi-use path connects Sehome Arboretum to the Connelly Creek Nature Area through this block. Wetlands PA-36 comprising 0.3 acres is located in this block. PA-35 comprising 1.3 acres was annexed by Joe's Garden and is now being cultivated. Much of the block is along a bluff line and served as a link between Connelly Creek and Sehome Hill. However the corridor function and value are being degraded and the block no longer extends to Sehome Hill, but is blocked by apartments and Sehome High School fences. The understory is diverse although invaded by blackberries. Moderate and large animals can move easily through this block. A new, camouflaged cellular phone tower was placed within this block. It appears as a large emergent conifer tree. Creating or modifying other such towers in the city to appear like this one would improve aesthetics. However, there is no added habitat value.

Block 42
T37N R2E S01; R3E S06, S31
Block Size: 212.00 (212.00) acres
Habitat Score: 086 – Fair Habitat
Risk Score: 005 – Minimal Risk
Block 42 is the Sehome Hill Arboretum. This block is approximately 165 acres of primarily dry mature native Douglas fir forest. The arboretum is bordered on the north and east by residential development, on the west by Western Washington University and on the south by Bill McDonald Parkway. The block spans the Padden and Whatcom watersheds, but contains no permanent streams. PA-16, 39 (0.7 acres) and WH-22 (1.0 acres) are the wetlands associated with this block. One paved road and several unpaved roads and trails weave through the block. A look out tower is perched on the north side of the block. Wildlife species associated with block 42 include deer, coyote, raccoon and other medium sized mammals. Mountain beaver (*Aplodontia rufa*) and porcupine were formerly found on Sehome Arboretum, but their status is currently unknown and they have likely been extirpated from this block. Block 42 has a diverse avian population. Pileated woodpecker, a variety of resident and neotropical passerines and raptors are found throughout the block. A connection with Connelly Creek should be reestablished to improve habitat quality for wildlife and prevent the Arboretum from becoming a wildlife diversity sink. Currently, Sehome Hill is isolated habitat for the remaining forest dwelling species and small, slow moving wildlife. As a result, the species diversity of this natural area will diminish over time.

Block 43
T37N R2E S01
Block Size: 29.09 (29.09) acres
Habitat Score: 053 – Poor Habitat
Risk Score: 018 – Low Risk
Block 43 consists of the southern half of the South Hill crest. It is residential with some forest habitat. Deer, coyote, woodpeckers and passerines are found here. Wetlands 7a and 7b having a total area of 0.7 acres are located here. This area may serve as dispersal habitat for the Sehome Arboretum, but offers no functional connections to other habitat areas.

Block 44
T37N R2E S01
Block 44 has been developed. Former wetland PA-12 with a total area 2.5 acres was located here.

Block 45
T37N R2E S01
Block Size: 5.43 (5.43) acres
Habitat Score: 023 – Impaired Habitat
Risk Score: 009 – Minimal Risk
Block 45 is a greenway strip south of the intersection of Bill McDonald Parkway and College Way. The center of the tree patch has been cleared and a linear swale was built to provide stormwater detention and treatment facilities. Some grass, shrub and medium sized deciduous trees. Wildlife is limited to avian species and urban associated wildlife using the block as a limited corridor ending in a built neighborhood. Surrounding upland is intensely developed. Water from an unknown source (potentially Fairhaven College) flows continually through block and then underground through the Happy Valley neighborhood.

Block 46

Block 46 was not found.

Block 47
T37N R2E S36
Block 47 was merged with 48, due to exact location of block 47 from the 1995 assessment being unknown.

Block 48
T37N R2E S01, S36
Block Size: 50.04 (50.04) acres
Habitat Score: 042 – Poor Habitat
Risk Score: 016 – Low Risk
Blocks 47 and 48 have been merged. Block 48 includes patches of wooded area interspersed with single family residences and Western Washington University on South Hill. It is good passerine and neotropical migrant bird habitat. There is a variety of native and ornamental deciduous and hardwood trees mixed throughout the residences. Deer and small urban mammals move through the neighborhood. Band-tailed pigeons (*Columba fasciata*) have previously been commonly seen in this block. Pileated woodpeckers also use the large trees here. Toward the north end of the block a forested lot extends east/west across several streets. This serves as a corridor for wildlife movement and is likely a daytime refuge for medium and large mammals and should be maintained as open space rather than developed.

Block 49
Block 49 was not found.

Block 50
T37N R3E S05, S06, S31, S32
Block Size: 6.30 (6.30) acres
Habitat Score: 030 – Impaired Habitat
Risk Score: 017 – Low Risk
Block 50 has been heavily fragmented by residential and commercial development. Elwood Avenue divides the block and portions of it are currently for sale. More than half of wetland WH-16 formerly 10.3 acres has been developed. Block 50 links to block 11 across newly improved 40th Street. Wildlife movement is still possible although becoming increasingly difficult. The forest is mixed with some portions primarily red alder and others a mixture of conifers and hardwoods.

Block 51
T38N R3E S22, S27
Block Size: 49.47 (49.47) acres
Habitat Score: 067 – Fair Habitat
Risk Score: 016 – Low Risk
Block 51 is Bloedel-Donovan Park. Much of the northern half has limited habitat value for wildlife due to the extensive lawns. A slough feeding into Lake Whatcom occurs on the southeast side. The slough does not have any shading overstory, however many waterfowl use it. Wetlands WH-96, 97 having an area of 8.9 acres are located at the south end of the slough near the Mill Wheel Apartments. This wetland is one of the finest complex wetlands remaining on Lake Whatcom and although the overall habitat score is low. Canada goose (a non-native subspecies) are over abundant and somewhat of a nuisance. Other waterfowl also frequent this habitat year round, including native coots, dabbling ducks and diving birds. Less common, cavity nesters such as hooded mergansers and wood ducks also likely occur here. Beaver (*Castor canadensis*), muskrat and otter are likely residents of the wetlands in this block. Many deer are found grazing on the grass surrounding the park and adjacent apartment complexes. Numerous deer tracks were seen in the mud along the slough's edge as were freshwater clam shells. The mixed deciduous forest consisting primarily of alder with some cottonwood provides daytime refuge for wildlife and breeding areas for passerines and other riparian associated birds. Bald eagles are seen flying over the block regularly from their nest in block 60 or a second nest in block 51. The wide, wetland corridor connecting with Whatcom Falls Park is bisected by busy Electric Ave. Block 51 connects through the Geneva neighborhood to Lookout Mountain (block 52). The connection between blocks 51 and 165 is interspersed forest and single family residences.

Block 52
T37N R3E S03, S04, S09, S10; T38N R3E S27, S28, S33, S34
Block Size: 1,085.72 (5,776.75) acres
Habitat Score: 130 – Excellent Habitat
Risk Score: 031-High Risk
Block 52 is a contiguous block of habitat and working forest land east of Yew Street Road, south of Lakeway Drive and north of Samish Way. Galbraith and Lookout Mountains occur outside the city limits in this block. Block 52 contains the headwaters of Hannah, East Cemetery and a variety of smaller streams emptying in to Lakes Whatcom and Padden. As a headwater area, this land and forest serve to protect the water quality and ensure the flow for Whatcom Creek. Habitat in this block is diverse with forests varying from lowland coniferous to mixed conifer/hardwood and mixed deciduous. Portions

of the block that have not been recently logged, some areas have very large down woody debris (old growth stumps and logs), but most of the trees are mid-sized second or third growth. Large woody material are essential for a healthy forest providing nutrients and material for soil building, water retention and essential habitat for many species and prey. Unfortunately, areas currently logged are being striped of woody material which is subsequently burned and lost forever. In addition, the recently planted forests are primarily hybridized, non-native Douglas fir. Currently, there is intensive logging throughout the mountain and the remaining native, naturally regenerated second growth forest is being liquidated. This marks the loss of vital mature forest habitat, species diversity and genetically native forest. Pileated woodpecker, barred owls, grouse, band-tailed pigeon a variety of passerines and raptors commonly use the mature forested areas. The use of younger forests are restricted to seasonally nesting passerines, aerial foragers and hawks. Terrestrial wildlife known to have inhabit this block include common mammals and less common black bear (*Ursus americanus*), cougar, mountain beaver and porcupine. Amphibians and reptiles of this area are poorly known. This block is essential to wildlife movement between the Cascades and the Chuckanuts. However, logging activities and construction of logging roads has altered the hydrology and established game trails throughout the Mountain. As headwater lands, any chemical management of these forest lands should be prohibited. In addition the introduction of logging roads have provide greater access for hunting and could result in the extirpation of certain large mammals such as black bear and elk in this area. An extensive system of recreational mountain bike trails has been built and is frequently used by local riders. This encourages additional human presence. Developments along the north and south edges of the block are increasingly isolating other more urban habitat blocks from this essential upland link to the Cascades.

Block 52A
T38N R3E S33
Block Size: 16.32 (16.32) acres
Habitat Score: 036 – Poor Habitat
Risk Score: 033 – High Risk
Due to unclear divisional boundaries, most of block 52A from the 1991 assessment is now included in block 52. Block 52a was previously a fully forested with mature native conifers and interspersed with wetlands. The block has been developed by Bellingham School District and now consists of the habitat strip west of Kulshan Middle School. In 1991, this was an essential north-south corridor connecting Whatcom Falls Park (block 60) to block 52 (Lookout Mt.), it is however been reduced to a strip of habitat the value and function of which is questionable. Wetlands WH-70, 71, 72, 73 having a total area of 2.0 acres are contained in block 52A. The remaining forest is primarily mixed conifer/hardwood buts has no interior function and provides daytime refuge for terrestrial animals and breeding habitat for passerines. There are likely a variety of amphibians found throughout the wetlands as well.

Block 53
T38N R3E S33
Block Size: 17.66 (17.66) acres
Habitat Score: 038 – Poor Habitat
Risk Score: 020 – Moderate Risk
Block 53 is strip of habitat surrounding housing development south of Lakeway Drive. The block is a donut shaped band of trees around single family residences. It consists of mixed conifer/hardwood trees and is excellent habitat for passerines and other avian species. It also provides daytime refuge habitat for medium and possibly deer. It connects with block 52. The east fork of Cemetery Creek runs through the block with thin riparian habitat and little or no upland habitat connections. The in-stream habitat needs further examination. Resident fish use this reach of the stream, although the ability of anadromous fish to make it past Woburn is unknown. No wetlands occur in this block.

Block 54
T38N R3E S28, S33
Block Size: 4.70 (4.70) acres
Habitat Score: 035 – Poor Habitat
Risk Score: 017 – Low Risk
Block 54 is island habitat within housing development south of Lakeway Drive. This block is small and has limited habitat value. Primary value would be to avian species. It does provide a link between Whatcom Falls Park (block 60) and block 52. An ephemeral portion of Hannah Creek flows through block 54. Much of the riparian area is yards without adequate shading and the stream is subjected to chemicals used on the yards. Habitat restoration would improve wildlife use and stream quality in this block.

Block 55
T38N R3E S33
Block Size: 4.20 (4.20) acres
Habitat Score: 031 – Impaired Habitat

Risk Score: 027 – Moderate Risk
Block 55 is island habitat within housing development south of Lakeway Drive. This block is small and has limited habitat value. Primary value would be to avian species. It does provide a link between Whatcom Falls Park (block 60) and Lookout/Galbraith Mountains (block 52). An ephemeral portion of Hannah Creek flows through block 55. Much of the riparian area is yards without adequate shading and the stream is subjected to chemicals used on the yards. Habitat restoration would improve wildlife use and stream quality in this block.

Block 55A
Block 55A was developed in 2002.

Block 56
T38N R3E S21
Block Size: 12.06 (12.06) acres
Habitat Score: 050 – Poor Habitat
Risk Score: 028 – Moderate Risk
Block 56 is backyard and strip habitat in the Alabama Hill neighborhood near Big Rock Park. Two wetlands, WH-84 and 85 having an area of 3.6 acres occur here. This habitat was previously intact forest, but has been fragmented by residential development. This habitat is narrow and value is limited to urban tolerant species. Some passerines will find usable habitat in the conifer forest, but usability by terrestrial wildlife is limited to daytime refuge and corridor connectivity.

Block 56A
T38N R3E S21
Block Size: 4.91 (4.91) acres
Habitat Score: 013 – Impaired Habitat
Risk Score: 014 – Low Risk
Block 56A was previously connected to block 56; however residential development has severed the connection. The block follows a bluff line and has a more open canopy than does block 56. Habitat values to wildlife are similar to block 56.

Block 57
T38N R3E S21, S28
Block Size: 6.75 (6.75) acres
Habitat Score: 027 – Impaired Habitat
Risk Score: 011 – Low Risk
Block 57 has been partially developed. It was previously a mixed conifer/hardwood vacant U-shaped lot. The western portion of the U was developed with single family residences. This block connects to block 60 via the railroad trail system and backyards. Its habitat value rests primarily with passerine usage and as a corridor between block 60 and block 151. Movement through this area and across Alabama Street for terrestrial wildlife is difficult. Wildlife and human passage through this area could be improved with an overpass over Alabama Street.

Block 58
T38N R3E S21, S28
Block Size: 6.50 (6.50) acres
Habitat Score: 024 – Impaired Habitat
Risk Score: 012 – Low Risk
Block 58 is backyards and vacant lots north of block 60. It is connected to that block by backyards. Portions of the block are wooded and others are fallow field. This block has limited habitat value for wildlife. Some avian species will be able to use it, but terrestrial wildlife is less likely to occur here. Its close connection to block 60 near Scudder pond will allow some wildlife movement through the block.

Block 59
T38N R3E S21
Block 59 was not found

Block 60
T38N R3E S21, S28, S29
Block Size: 355.94 (355.94) acres
Habitat Score: 134 – Excellent Habitat
Risk Score: 018 – Low Risk

Block 60 is Whatcom Falls Park, Bayview Cemetery and Railroad Trail. They are contiguous open space and a significant and valuable urban habitat area spanning over 300 acres from Lake Whatcom west to Woburn Street. Encroaching residential development along the park's edges continues to whittle down the total habitat area and in turn devalue the area for wildlife. Cumulative habitat and corridor loss over time has greatly impacted the areas function and value for wildlife. Development across Lakeway Drive is cutting off corridors which would link the park to Lookout Mountain. The park is already essentially cut off from Squalicum Mountain via development surrounding Barkley Boulevard, Alabama Hill and Britton Road. Block 60 has 19.7 acres of wetland. Whatcom Creek cuts through the block with waterfall, pools and riffles. Hannah Creek flows into Whatcom Creek within this block. Wildlife using this block includes deer, coyote, fox, beaver, muskrat, raccoons and opossum (*Didelphis virginiana*). Avian species found here include merlin (Falco columbarius), American dipper (Cinclus mexicanus) green-backed heron (Butorides striatus), gulls, common mergansers (*Mergus merganser*) and buffleheads (*Bucephala albeola*). A fish hatchery in the park stocks the lake and stream with cutthroat and rainbow trout. Thousands of fish and wildlife including juvenile salmon and Pacific lamprey (*Lampetra tridentate*), amphibians, birds and including mammals such as deer and otter, were killed when a gas pipeline breached and leaked fuel exploded in 1998. Fire burned the Whatcom Creek corridor and associated upland from the pipeline downstream to I-5. Through intensive restoration work, much of the lower gorge is regenerating after the fire and appears to be initially successful. The block contains a bald eagle nest and spawning and rearing habitat for fish. Much of the upland in the park has had access by people and therefore is not pristine due to the many trails which wind through the block. Scudder pond on the eastern side of the park is infected with bullfrogs (*Rana catesbeiana*) which offset the survival and abundance of native amphibians. However, with the restoration of riparian habitat following the fire, recovery of the stream and reestablishment of wildlife corridors to the large upland forest blocks, block 60 will continue to provide excellent habitat for fish and wildlife.

Block 61
T38N R3E S21
Block 61 was developed.

Block 62
T38N R3E S21
Block 62 was developed.

Block 63
Block 63 was not found.

Block 64
T38N R3E S22
Block Size: 5.56 (5.56) acres
Habitat Score: 047 – Poor Habitat
Risk Score: 017 – Low Risk
Block 64 is a U-shaped block to the west of block 65. The block was formerly a square, but recent clearing and development have removed a portion of it. It is surrounded by heavily developed residential areas, but is connected to Silver Beach Creek through a narrow forested corridor. The forest is mixed conifer/hardwood and will have similar species to block 65. Due to its fragmentation, breeding populations of most terrestrial species will not be sustained. It functions more importantly as a daytime refuge. A variety of avian species will be able to use this block for breeding.

Block 65
T38N R3E S22
Block Size: 47.08 (47.08) acres
Habitat Score: 070 – Fair Habitat
Risk Score: 020 – Moderate Risk
Block 65 is the riparian strip along Silver Beach Creek. This area is heavily developed and the riparian band is compromised. Habitat consists of a mixed conifer/hardwood forest with occasional residential ponds. Snags, gardens and forest provide good habitat for avian species and urban tolerant terrestrial animals. It is likely amphibians are found along the stream and there is potential for fish although at this time usage is unknown and requires further examiniation. Block 65 was previously connected to the shoreline of Lake Whatcom. This connection has since been severed. It is important for wildlife movement that the connections between upland and shorelines be maintained and restored where possible.

Block 65A
T38N R3E S15
Block Size: 13.54 (13.54) acres
Habitat Score: 051 – Poor Habitat
Risk Score: 030 – High Risk
Block 65A is strip habitat along Silver Beach Creek on the west side of Britton Road. The area directly adjacent to the road is a steep bank surrounding a small pond. Several medium sized snags occurred around the pond. This area is good

habitat for avian species, but due to its small size it is limited to a movement corridor between the Alabama Hill and Silver Beach Neighborhoods and Squalicum Mountain only for larger very mobile terrestrial species.

Block 66
T38N R3E S22
Block Size: 54.66 (54.66) acres
Habitat Score: 056 – Poor Habitat
Risk Score: 030 – High Risk
Block 66 is a small forested block formerly attached to block 143. A large portion of the block has been developed since the last assessment. It is still good habitat for a variety of wildlife and is still connected to contiguous upland forest blocks. Wetlands and streams are unknown in this area due to lack of survey. Although habitat is scored as poor, as a terrestrial forest with connections it is valuable and its size provides some forest interior condition. A full survey should be performed to discern exact wildlife usage. Although wildlife usage of this block is unknown, it is likely that the block is used extensively by deer, coyote, fox, and other small and medium terrestrial wildlife. A variety of avian species including neo-tropical migrants will use the block.

Block 67
T38N R3E S22
Block Size: 6.08 (22.05) acres
Habitat Score: 062 – Poor Habitat
Risk Score: 023 – Moderate Risk
Block 67 is also a continuation of block 143 and will contain similar wildlife. It is interspersed with rural residences. Block 67 is not contiguous forest and contains fingers of habitat. Wildlife movement through this area may be difficult due to the narrowness of the connectors, however the block is directly associated with block 143, so it is not isolated. Although wildlife usage of this block is unknown, it is likely that the block is used extensively by deer, coyote, fox, and other small and medium terrestrial wildlife. A variety of avian species including neo-tropical migrants will use the block.

Block 68
T38N R3E S29, S32
Block Size: 124.39 (124.39) acres
Habitat Score: 098 – Good Habitat
Risk Score: 018 – Low Risk
Block 68 contains the stream corridors for both branches of Cemetery Creek, Fever Creek and their confluences with Whatcom Creek. This is an important riparian-forested wetland and was identified as vital to salmonid rearing in the Whatcom system. The forest upland served as shade, wood recruitment and connection for semiaquatic species requiring terrestrial habitat. The forest component is mixed conifer/hardwood forest with extensive wetlands, WH-1 and 42 have a total of 91.7 acres. At one time this block contained the largest contiguous wetland in the watershed. However, portions of that wetland and a large area of forest have been developed. Large residential developments have destroyed a significant portion of this block and encroached on the riparian buffer for the two streams. Whereas block 68 was previously a large contiguous square, now it has 3 narrow fingers. Edge habitat has been increased dramatically lowering the ability of the block to support interior dependent species. The habitat function and value have been greatly reduced for both aquatic and terrestrial species. Wildlife and fish using this block will be similar to that of block 60.

Block 69
T38N R3E S29
Block Size: 41.81 (41.81) acres
Habitat Score: 049 – Poor Habitat
Risk Score: 028 – Moderate Risk
Block 69 is the forest block adjacent to the aquatic center and recreational ball fields. This block is a lowland temperate conifer forest and includes wetlands WH-2 and 3 with 1.9 acres. Lincoln Creek passes along the northern end of the block, but the riparian area is highly degraded and includes much open space and garbage. Coho and steelhead salmon and searun cutthroat trout use portions of this reach to rear and with restoration work, rearing habitat could be greatly improved. The forest block provides daytime refuge for terrestrial wildlife and nesting and foraging for a variety of avian species. The adjacent lawn areas of the recreational fields have limited foraging habitat for birds. The block is also quite isolated from adjacent blocks. Large terrestrial wildlife can move over the field areas into block 68, but smaller wildlife will have difficulties.

Block 70
T38N R3E S29
Block Size: 8.52 (8.52) acres
Habitat Score: 038 – Poor Habitat

Risk Score: 009 – Minimal Risk

Block 70 is a narrow riparian strip along Lincoln Creek. It consists of a few trees and lots of blackberries. Steelhead and coho salmon and cutthroat trout use portions of this reach for rearing. Wetland WH-4 with 1.1 acres provides some habitat for amphibians and fish. The stream passes east under Lincoln Street through a culvert to yards and a very narrow riparian area. This reach could use some restoration work including removal of invasive species and garbage. Habitat use by wildlife is limited to a few avian species and fish and daytime refuge for urban tolerant species.

Block 71
T38N R3E S29
Block Size: 9.39 (9.39) acres
Habitat Score: 019 – Impaired Habitat
Risk Score: 013 – Low Risk

Block 71 is Roosevelt Park and adjacent open space to the south including the Boys and Girls Club. Fever Creek runs through the block, however the riparian area is compromised along much of the stream and the block is isolated. The majority of the block is lawn or fallow field. A few shrubs grow along the stream corridor, but will only provide a habitat for a few urban avian species. Due to its lack of connectivity, this block is essentially a sink for wildlife. Wetlands WH- 29 and 30 having an area of 1.9 acres were found here. WH-29 has been developed leaving 0.2 acres of wetland in this block. No terrestrial mammals or amphibians will be supported by this block.

Block 72
T38N R3E S16
Block Size: 223.70 (223.70) acres
Habitat Score: 115 – Good Habitat
Risk Score: 026 – Moderate Risk

Block 72 is the southern end of Dewey Valley. The forest is a mixture of conifers and hardwoods. This block is the essential link between block 73 and the east/west corridor to the cascades as well as south into Fever Creek and eventually Whatcom Falls Park. So far is has been maintained as forest, fallow field or pasture. Some development along the stream corridor has occurred, but not as extensively as more western blocks. The forest provides habitat for a variety of avian and terrestrial species. Deer, coyote and a variety of smaller terrestrial wildlife utilized this block. Because of the variety of habitats, avian species using forest, field or both are common here. Snags occur throughout the forest adding to the habitat availability. The extensive wetlands including SQ-52, 53, 54 provide 29.6 acres of wetland habitat for amphibian and other species. With the wetland/upland forest component of this block it is likely that western toad occurs here. Squalicum Creek provides habitat for coho, steelhead and chum salmon, searun cutthroat trout and a variety of resident fish species. However, increasingly high amounts of turbidity from construction run-off is degrading water quality and filling in salmon spawning gravel. The wetlands provide stream recharge for Squalicum Creek and it is essential that they be maintained. The connector across the Mt. Baker highway to block 149 is narrow, but should be preserved as it provides wildlife access to adjacent blocks in a 35 mph zone as opposed to a 55 mph zone. This block connects east to block 140 across Dewey Road. This connection is excellent due to its width and the low traffic volume on Dewey Road. Eventual connections to Squalicum and King Mountains occur through this block. Portions of this block are owned by the DNR and the rest is privately owned. This block should remain intact so it can continue to provide habitat and corridors through the city for Bellingham's wildlife.

Block 73
T38N R3E S17
Block Size: 199.72 (199.72) acres
Habitat Score: 118 – Good Habitat
Risk Score: 036 – High Risk

Block 73 is a very large block of regenerating mixed deciduous forest. Alder, birch and cottonwood dominate in a similar manner to blocks 74 and 75 as this is a continuation of that forest. A few large snags are found throughout the forest and around the pond. Sunset pond has a variety of resident and anadromous fish including coho, chum and steelhead salmon and searun cutthroat trout. Crappie (*Pomoxis annularis*), large mouth bass (*Micropterus salmoides*), sunfish (*Lepomis macrochirus*), perch (*Perca* sp.), bullhead and cutthroat trout are a few of the resident species using the pond. The pond has a narrow shoreline ledge and is very deep. Beaver, muskrat, otter and mink are found along the shoreline. Deer, coyote and other terrestrial wildlife use the block as an east/west corridor. Many avian species including waterfowl, passerines and raptors are found throughout the forest and along the shoreline. A variety of amphibians are expected in the wetlands. Wetlands occurring here are SQ-39a, 39b, 39c, 40, 41, 42a, 42b, 43, 48, 49a, 49b and 49c having a total area of 131.8 acres. These wetlands are essential to the regeneration of Squalicum Creek. They provide flood control and detoxification of waters as well as support a variety of wildlife. The wetlands provide stream recharge for Squalicum Creek and it is essential that they be maintained. Block 73 is the essential east/west connector between the more developed blocks to the west and the less developed ones to the east. At the eastern edge of the block, fallow field and pasture provide grazing for ungulates and hunting opportunities for raptors. Wildlife crossing signs need to be posted on James and on Hannegan. A wildlife underpass under Hannegan would be the best solution to wildlife movement. Only a small portion of the block is protected. It is an area essential to wildlife in Bellingham and should be fully protected.

Block 74
T38N R3E S18, S19
Block Size: 89.16 (89.16) acres
Habitat Score: 097 – Good Habitat
Risk Score: 036 – High Risk
Block 74 is east of I-5 and consists of regenerating mixed deciduous lowland forest with alder, birch (*Betula* sp.) and emergent cottonwoods (*Populus* sp.) dominating the species list. This is a classic riparian forest. Squalicum Creek runs through the block as is passes between Sunset Pond and Bug Lake. Coho, steelhead and chum salmon and searun cutthroat trout use this reach. The only easy passage under I-5, in the City of Bellingham, is located between blocks 74 and 75 to the west. Wildlife were able to move freely between these blocks, but with the development of the Squalicum Creek flood plain with cold storage and medical facilities and clearing of associated forest, the habitat on the west side of the freeway has been degraded. There are however deer that use this passage as well as other species, however without good habitat connectors for the underpass to bug lake and Squalicum Creek, many animals become confused and attempt to climb the embankment and cross I-5, where they are killed. The corridor to the east follow through more open lands toward Dewey Valley. The forest habitat is multi-layered with a thick understory providing good cover and food for wildlife. The variety of trees allows a diversity of avian species to inhabit this block as well. Several large wetlands are found in block 74 including SQ-33, 34, 35, 36, 37 and 38 having a total area of 34.64 acres. The extensive wetlands provides habitat for a variety of amphibians. The wetlands provide stream recharge for Squalicum Creek and it is essential that they be maintained. Wildlife must cross James Street to access block 73. Wildlife crossing signs here are essential to minimize road mortality. The railroad grade passing through this block would be an excellent greenway addition.

Block 75
T38N R3E S18, S19
Block Size: 49.46 (49.46) acres
Habitat Score: 115 – Good Habitat
Risk Score: 036 – High Risk
Block 75 is a regenerating mixed deciduous forest consisting primarily of alder, birch and emergent cottonwood. Bug Lake is part of the Squalicum Creek system and contains beaver, coho, steelhead and chum salmon as well as searun cutthroat trout. Resident fish species include: crappie, large-mouth bass, sunfish, perch and bullhead. It has extensive wetlands including SQ-28, 29, 30, 31 and 32 which have at total area of 28.2 acres. The wetlands provide stream recharge for Squalicum Creek and it is essential that they be maintained. This block has excellent habitat for a variety of species including amphibians. With its thick understory, canopy including emergent trees and snags; deer, coyotes and other small mammals will thrive here. It also has an excellent connection to block 74 and upland through the Dewey Valley to the Cascades. This is the only area in the city where I-5 has a bridge over a stream corridor. Wildlife can move through this block without the risk of crossing the freeway. It is an example of what should exist over Padden Creek. Portions of the block are public reserve and have a trail that connects Cornwall Park under I-5 to Sunset Pond. The old railroad trail with some improvements would be an excellent addition to the greenway system.

Block 76
T38N R3E S18, S19
Block Size: 93.80 (93.80) acres
Habitat Score: 084 – Fair Habitat
Risk Score: 029 – Moderate Risk
Block 76 is Cornwall Park and adjacent open space. Squalicum Creek passes through Cornwall Park. Portions of the stream have excellent riparian coverage and others are surrounded by lawn. A few trees are spread throughout the pasture. The primary overstory is Douglas fir with the understory varying from open to thick shrubs. Anadromous fish including coho, chum and steelhead salmon and cutthroat trout use this reach of the stream. A variety of avian species inhabits this block including barred owl, wood duck, green heron (*Butorides virescens*), great blue heron, olive-sided flycatcher and breeding Cooper's hawk. The portions of the park with a very thick understory are excellent habitat for wildlife because they limit entry by people and their pets. The block has a direct connection with block 75 over Squalicum Parkway, however, with the amount of traffic using this section of the road some terrestrial wildlife cannot move between the blocks easily. Culverts under road have been blocked by beavers and road provides a great barrier for wildlife movement. Block 76 also connects across Meridian Street to block 81A, the Squalicum Creek riparian strip. Movement in this direction is more difficult for terrestrial wildlife, although still possible. A bridge over Squalicum Creek instead of the current box culver would aid in wildlife movement. Wetlands associated with this block include SQ-25, 26, 27 having a total area of 6.7 acres. These wetlands are associated with the stream because the upland is primarily dry Douglas fir forest. The eastern third of block 76 is a horse farm with devegetated riparian areas. Portions of the pasture area are for sale for development. It is essential that a corridor between block 76 and 75 be maintained.

Block 77
T38N R3E S18
Block Size: 5.13 (5.13) acres
Habitat Score: 046 – Poor Habitat

Risk Score: 026 – Moderate Risk
Block 77 is a triangular block with a tributary of Squalicum Creek flowing through it. Formerly a beaver dam occurred in a portion of block 77 that was developed. The overstory is primarily small deciduous trees. In mid summer, water was present in the stream, but flow was not good. Wetlands SQ-18, 20 are located here in association with the stream. They have a total area of 0.8 acres. SQ-19 was formerly in the block and had a beaver dam, but it has since been developed. Wildlife use of this block is limited to primarily avian species.

Block 78
T38N R3E S18
Block Size: 33.99 (33.99) acres
Habitat Score: 027 – Impaired Habitat
Risk Score: 019 – Low Risk
Block 78 consists of mixed residential and commercial development. The residences in this block are spaced widely apart and portions of the block are thickly forested with a mixture of conifers and deciduous trees. Block 78 was previously connected with block 75, but clearing along I-5 and the Bellingham Cold Storage facility has degraded this connection for use by all but the most mobile of terrestrial species. Wetlands SQ-23 and 24 comprising 0.9 acres are located in this block. Restoration is recommended to reconnect blocks 78 and 75. Avian species and urban tolerant wildlife will are the primary wildlife using this block.

Block 79
T38N R3E S18
Block 79 was not found.

Block 80
T38N R3E S18
Block Size: 22.97 (22.97) acres
Habitat Score: 050 – Poor Habitat
Risk Score: 027 – Moderate Risk
Block 80 is the Spring Creek ravine between East Bakerview Road and Meridian. Forestation is limited to the area surrounding the stream, the rest of the block is fallow field or pasture. This block eventually connects to block 157. Habitat is limited to avian and terrestrial species that can use both shrub and fallow field habitat. Portions of Baker Creek wind through the southeastern corner of the block. Fish use of the streams within this block is limited by the large culverts under I-5 and the Meridian Street retail centers. Daylighting these streams will increase usability by fish species.

Block 81
T38N R2E S13
Block Size: 142.51 (142.51) acres
Habitat Score: 047 – Poor Habitat
Risk Score: 024 – Moderate Risk
Block 81 is the Bellingham Golf and Country Club. Baker Creek meanders through the golf course with little setback or vegetative buffering, the corridor provides potential riparian and in-stream habitat if enhanced. Searun cutthroat trout, steelhead, chum and coho salmon are found in the stream. There is poor fish passage at Birchwood Avenue; however it spans the stream corridor with a bridge rather than a culvert which is good. Between the fairways and surrounding the golf course are strips of mature Douglas fir. The riparian area through the golf course needs some enhancement to improve use for fish species. The forest provides nesting and foraging habitat for a variety of avian species and some tolerant terrestrial species.

Block 81A
T38N R2E S13, S24
Block Size: 13.04 (13.04) acres
Habitat Score: 067 – Fair Habitat
Risk Score: 027 – Moderate Risk
Block 81A is the Squalicum Creek corridor west of Cornwall Park. This portion of the stream has seen much enhancement and with time the vegetative cover will improve. Currently portions of the stream are exposed to sunlight limiting the habitat for spawning salmonids. Most of the riparian vegetation is deciduous with alder and willow (*Salix* sp.) dominating. The block is bordered on the east by Meridian, on the south by the Columbia neighborhood, on the west by the Northwest Road bridge and on the north by Squalicum Parkway. It provides an essential corridor between the uplands and shoreline. Squalicum Creek is the only stream on the north side of Bellingham that allows wildlife movement from the mountains to the shoreline. It is essential that this corridor be maintained and improved. Currently the stream has spawning runs of coho and chum salmon. Chinook are also seen in the stream, but spawning status is unknown.

Block 82

T38N R2E S13
Block 82 was developed.

Block 83
T38N R2E S13
Block Size: 5.82 (5.82) acres
Habitat Score: 014 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 83 consists of vacant lots and backyard habitats. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 84
T38N R2E S13
Block Size: 4.88 (4.88) acres
Habitat Score: 011 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 84 consists of vacant lots and backyard habitats. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 85
T38N R2E S13
Block Size: 7.31 (7.31) acres
Habitat Score: 014 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 85 consists of fallow field and yards with a few trees. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 86
T38N R2E S13
Block 86 was developed

Block 87
T38N R2E S13
Block Size: 1.84 (1.84) acres
Habitat Score: 010 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 87 is a patch of trees adjacent to I-5. The value of the habitat is questionable due to its isolation and proximity to I-5. Wildlife using this block are at risk from vehicular traffic.

Block 88
T38N R2E S13
Block Size: 5.31 (5.31) acres
Habitat Score: 014 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 88 is a mixture of regenerating forest and cleared areas. It is adjacent to I-5, but not completely isolated; however, wildlife using this block are at risk from vehicular traffic. It connects to block 89 across a large open fallow field area. Block 88 has limited habitat for wildlife. A few bird species will use the forest block for nesting and foraging.

Block 89
T38N R2E S14
Block Size: 33.69 (33.69) acres
Habitat Score: 053 – Poor Habitat
Risk Score: 020 – Moderate Risk
Block 89 was once connected to the shoreline via blocks 114, 118 and 120. It was also previously connected to block 126 and 127 across I-5; however, this corner connector has been developed into a Fred Meyer. All connections across I-5 have been completely severed south of Bakerview Road. It is a large regenerating forest block consisting primarily of deciduous trees with an occasional conifer. Small wetlands occur through out the block including SQ-5 and 6 having a total area of 1.7 acres. As the block is bordered on the northeast side by I-5, movement in that direction is limited to avians and even then low flying species are at high risk. At one time it was part of the wetland system that recharged Silver Creek, but now its wetlands are completely isolated. Although their stream regeneration capacity has been eliminated, they are essential for residing amphibians. The block provides a daytime refuge for terrestrial wildlife and nesting and foraging habitat for birds including snags for snag dependent species.

Block 89A
T38N R2E S14
Block Size: 20.91 (20.91) acres
Habitat Score: 053 – Poor Habitat
Risk Score: 020 – Moderate Risk
Block 89A was formerly connected with block 89, but is now separated by West Maplewood Drive. It like block 89 is a mixed conifer/hardwood forest with the deciduous trees dominating similar to those in surrounding blocks. This block has more open fallow field areas than block 89, but only one small wetland, SQ-7 which has an area of 0.6 acres. Block 89A is essential for wildlife movement between 89 and 118 and in turn the blocks surrounding the airport.

Block 90
T38N R2E S14
Block Size: 21.51 (21.51) acres
Habitat Score: 035 – Poor Habitat
Risk Score: 016 – Low Risk
Block 90 is a mixture of intact forest block and potential backyard sanctuary habitat. The forest block including wetland SQ-4 which has an area of 2.0 acres. The forest is comprised of a mixture conifers and hardwoods similar to surrounding blocks. This block provides good habitat for avian species and daytime refuge habitat for terrestrial wildlife. The wetlands surrounded by forest also provide habitat for amphibians.

Block 91
T38N R2E S14
Block Size: 15.50 (15.50) acres
Habitat Score: 018 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 91 has potential for backyard sanctuaries. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards. Block 91 has more contiguous tree cover than blocks 92 through 95.

Block 92
T38N R2E S14
Block Size: 19.40 (19.40) acres
Habitat Score: 014 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 92 has potential for backyard sanctuaries. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 93
T38N R2E S14
Block Size: 2.62 (2.62) acres
Habitat Score: 012 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 93 has potential for backyard sanctuaries. Disturbed area. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 94
T38N R2E S14
Block Size: 24.78 (24.78) acres
Habitat Score: 015 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 94 has potential for backyard sanctuaries. Disturbed area. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 95
T38N R2E S14
Block Size: 8.30 (8.30) acres
Habitat Score: 013 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 95 has potential for backyard sanctuaries. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 96
T38N R2E S24
Block Size: 9.02 (9.02) acres
Habitat Score: 013 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 96 is a potential backyard sanctuary. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 97
T38N R2E S24
Block Size: 8.03 (8.03) acres
Habitat Score: 011 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 97 is a potential backyard sanctuary. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 98
T38N R2E S24
Block Size: 5.17 (5.17) acres
Habitat Score: 044 – Poor Habitat
Risk Score: 024 – Moderate Risk
Block 98 contains the outlet to Baker Creek and strip habitat north of Squalicum Parkway. It is primarily blackberries and small shrubs. The stream outlet had lots of garbage and needs some restoration work. The connector with block 81 is a bridged ravine rather than a culvert which is excellent and allows wildlife much easier passage. The railroad tracks also cross the stream via a bridge.

Block 99
T38N R2E S24
Block Size: 68.18 (68.18) acres
Habitat Score: 020 – Impaired Habitat
Risk Score: 018 – Low Risk
Block 99 is the gravel pit north of Squalicum Parkway. Portions of the pit are still working, but the edges are regenerating shrub habitat. Value is limited to a few urban associated bird species and small mammals. Once the gravel pit is closed, this would be an excellent spot for a park or recreational fields. A greenway trail connecting Cornwall Park to Squalicum Beach and Little Squalicum Creek outflow passes through this block on the northern edge. Many people were observed using this trail for exercise. Block 99 connects to the shoreline through blocks 107 and 108.

Block 100
T38N R2E S24
Block Size: 15.27 (15.27) acres
Habitat Score: 063 – Fair Habitat
Risk Score: 028 – Moderate Risk
Block 100 is a portion of the Squalicum Creek riparian corridor between Northwest Avenue and West Street. It consists of mixed deciduous trees with shrub understory. The riparian area is well vegetated in places more than 200 feet wide. Squalicum Creek has had some restoration. Vegetation extends up bluff face into the Columbia neighborhood.

Block 101
T38N R2E S24
Block Size: 20.24 (20.24) acres
Habitat Score: 065 – Poor Habitat
Risk Score: 028 – Moderate Risk
Block 101 is a continuation of block 100. It has variable width, and has a well vegetated bluff line. This block wraps around the corner of Squalicum Parkway and Roeder Avenue and continues along the marine bluff. The bluff is mostly blackberries and shrubs with a few trees including big-leaf maple, willow and apple. The extensive berry patches provide an ample supply of food for birds. Care should be taken to avoid disturbing the soils upland from the bluff, so the bluff does not wash out as happened at on residence. Construction inland from that house inserted water into the ground and caused the bluff line to erode where the water flowed out. The trees along the bluff provide essential perches for raptors. Squalicum Creek empties into Bellingham Bay in block 101. At low tide, passage into the stream is blocked by a wide concrete apron at the mouth. At high tide, fish passage is relatively easy.

Block 102
Block 102 was not found.

Block 103
Block 103 was not found.

Block 104
T38N R2E S24
Block Size: 7.49 (7.49) acres
Habitat Score: 012 – Impaired Habitat
Risk Score: 010 – Low Risk
Block 104 is a potential backyard sanctuary. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 105
T38N R2E S24
Block Size: 6.75 (6.75) acres
Habitat Score: 013 – Impaired Habitat
Risk Score: 010 – Low Risk
Block 105 is a potential backyard sanctuary. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 106
T38N R2E S24
Block Size: 12.83 (12.83) acres
Habitat Score: 013 – Impaired Habitat
Risk Score:
Block 106 is a potential backyard sanctuary. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 107
T38N R2E S24
Block Size: 10.27 (10.27) acres
Habitat Score: 021 – Impaired Habitat
Risk Score: 013 – Low Risk
Block 107 is a potential backyard sanctuary. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 108
T38N R2E S23
Block Size: 41.46 (41.46) acres
Habitat Score: 064 – Fair Habitat
Risk Score: 023 – Moderate Risk
Block 108 includes the lower portion of Little Squalicum Creek. This riparian area contains an excellent variety of deciduous trees with an occasional conifer. At least two small Sitka spruce were noted. The block has lots of shrubs including hawthorne, very large service berry, pacific ninebark and of course blackberry. Alder, big-leaf maple, cottonwood, willow and occasional cherry were the dominant trees. A very large invasive vine was seen on the northern trail. A greenway path borders the stream on both sides. The path is nice, but portions, especially along the railroad have been sprayed with herbicides. Once the path reaches the shoreline, the stream is directed through a culvert onto the beach. The culvert is perched at least 8 inches and appears to be perching itself. It is recommended that a bridge be placed at this stream crossing to prevent continual culvert perching and thus decreased fish access. In places, the streambed has nice gravel and with plantings and it maybe could support a small population of salmon. The stream had excellent flow and was surrounded by either forest or wet meadows. A kingfisher was seen in this block. Two boats were gillnetting near the mouth of Little Squalicum. The beach is excellent, very little garbage, nice sand and has known surf smelt and sand lance spawning areas.

Block 108A
T38N R2E S23, S24
Block Size: 11.65 (11.65) acres
Habitat Score: 018 – Impaired Habitat
Risk Score: 025 – Moderate Risk
Block 108A is a continuation of block 108 but is almost exclusively fallow field. It provides good habitat for hunting raptors, small mammals and snakes. The upper portion of Little Squalicum Creek flows through here, but at the time of field visit, the stream was dry. The riparian area needs some restoration including garbage removal. The railroad tracks through the block

have had the edges sprayed with herbicides. Mechanical weed control is recommended due the close proximity to Little Squalicum Creek. Some restorative plantings have occurred along the greenway trail and with time will improve habitat quality.

Block 109
T38N R2E S23
Block Size: 0.54 (9.45) acres
Habitat Score: 012 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 109 is a potential backyard sanctuary. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 110
T38N R2E S23
Block Size: 21.96 (21.96) acres
Habitat Score: 014 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 110 is a potential backyard sanctuary. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Block 111
T38N R2E S14, S23
Block Size: 30.68 (30.68) acres
Habitat Score: 046 – Poor Habitat
Risk Score: 017 – Low Risk
Block 111 stretches from Marine Drive north into the Birchwood Neighborhood. It is a mixture of fallow field and regenerating deciduous forest. Alder, willow, big-leaf maple, cottonwood and birch make of the forest with a thick understory. This area is excellent daytime refuge habitat for terrestrial animals foraging on the grass portions. A variety of birds use the block for nesting and foraging including neo-tropical migrants and raptors.

Block 112
T38N R2E S22, S23
Block Size: 23.69 (23.69) acres
Habitat Score: 065 – Fair Habitat
Risk Score: 026 – Moderate Risk
Block 112 is a regenerating forest of primarily alder with an occasional cottonwood. A swath down the center contains a very nice wet meadow with surrounding snags. This block provides good habitat for terrestrial and avian wildlife. It also provides a corridor link between blocks 113 and 111. A small stream with flowing water borders the northwestern edge of the block. The riparian corridor in block 112 is much better than that of the stream in block 191 on the opposite side of Marine Drive.

Block 113
T38N R2E S15, S22, S23
Block Size: 38.94 (38.94) acres
Habitat Score: 089 – Fair Habitat
Risk Score: 027 – Moderate Risk
Block 113 is the marine bluff and shoreline from Squalicum Park to the Nooksack River. It is a mixture of shrubs and trees. Willow, big-leaf maple and some naturalized apples. Blackberries dominate the shrubs and provide food for foraging avian and terrestrial wildlife. Bald eagles commonly fly along the bluff and perch (where available) during foraging. Both adults and sub-adults bald eagles and a variety of gulls were seen soaring along the bluff line over the bay. On the property at the southern edge of the airport some greenway trails follow the bluff. This area has a nice view over Bellingham Bay to the south.

Block 114
T38N R2E S14 and S15
Block Size: 65.65 (65.65) acres
Habitat Score: 079 – Fair Habitat
Risk Score: 031 – High Risk
Block 114 is comprised of mixed deciduous forest and fallow field with a few wetlands situated at the end of the Bellingham Airport north/south runway. The stream flowing through 112, 113 and 191 originates in the wetlands of block 114. The culvert under Marine Drive was long and the opposite end could not be seen. The streambed north of Marine Drive contained very nice gravel with good flow. A riparian overstory is non-existent until the stream enters the undeveloped forest behind the two residential lots.

Block 115

T38N R2E S14
Block Size: 8.11 (8.11) acres
Habitat Score: 024 – Impaired Habitat
Risk Score: 011 – Low Risk
Block 115 is an isolated forest and field block adjacent to Alderwood Elementary School. Its habitat value is limited for terrestrial species; however many passerines and other avian species will use this block extensively as it is an island of forest among the residences. An important plus is the lack of chain link fencing dividing the forest from the lawn of the school. Wildlife will be able to use this block more extensively because of clear passage between habitats.

Block 116
T38N R2E S14
Block Size: 7.30 (7.30) acres
Habitat Score: 041 – Poor Habitat
Risk Score: 017 – Low Risk
Block 116 is similar to other forested blocks in this area. It provides an island of habitat within a developing residential area. It has been recently isolated from block 120 by multi-family residential development. Wildlife passage is difficult for all but the most mobile species. Its importance is primarily for avian species for breeding and foraging.

Block 117
T38N R2E S14
Block Size: 3.85 (3.85) acres
Habitat Score: 034 – Poor Habitat
Risk Score: 020 – Moderate Risk
Block 117 is similar to Block 118, but without the aspen (*Populus tremuloides*) component. It is connected to block 118 across McLeod Road. It allows some connection with the backyard habitats in the Birchwood neighborhood, but the connections are low quality ones. Wildlife passage is difficult for all but the most mobile species. Its importance is primarily for avian species for breeding and foraging.

Block 118
T38N R2E S14
Block Size: 14.68 (14.68) acres
Habitat Score: 055 – Poor Habitat
Risk Score: 023 – Moderate Risk
Block 118 is a nice mixed forest and includes a large complex wetland. It has a great diversity of deciduous trees including alder, cottonwood, birch and aspen. Cedars and Douglas fir are also found here. A portion of the southern end of the block was recently logged further decreasing the habitat available for wildlife species in residence. It appears that the apartment buildings surrounding block 118 were built directly on wetlands. The Northwood Court complex is surrounded by a fence and a ditch to drain more of the wetlands has recently been excavated. This block was previously part of a larger block that included 116, 117 and 120. They were also connected by a wide corridor to block 89. With the development in the area and the lack of corridors many of the blocks have been completely isolated as far as terrestrial wildlife is concerned; however, the block is still valuable to avian species. Elimination of the fence will improve wildlife movement and access. Also, draining the wetlands should not be allowed as they are important for declining amphibian populations especially when associated with upland forest blocks.

Block 119
T38N R2E S14
Block Size: 8.76 (8.76) acres
Habitat Score: 041 – Poor Habitat
Risk Score: 014 – Low Risk
Block 119 is a mixed conifer/hardwood forest dominated by deciduous trees completely isolated from surrounding blocks by development and Airport Way. Its habitat value is limited to avian species and small animals without space limitations. With corridor restoration this block will no longer be a wildlife diversity sink. No wetlands are present.

Block 120
T38N R2E S14, S15
Block Size: 18.33 (18.33) acres
Habitat Score: 048 – Poor Habitat
Risk Score: 027 – Moderate Risk
Block 120 contains the Bellingham Airport wetland mitigation area. It is a mixed conifer/hardwood forest dominated by deciduous trees. The block is narrowly connected to block 114 and 121 across roads. The block provides good habitat for avian species, but is more limited for terrestrial wildlife due to its relative isolation.

Block 121
T38N R2E S14, S15

Block Size: 56.26 (56.26) acres
Habitat Score: 064 – Fair Habitat
Risk Score: 027 – Moderate Risk
Block 121 is primarily mixed deciduous with an occasional conifer. It contains lots of wetlands which provide good habitat for amphibians. Some less common plant species noted were aspen and red osier dogwood. This block is interspersed with airport commercial and industrial development. The low volume of traffic on Williamson Way and wide corridors allow this area to be considered one block. Fencing divides the block from the airport and prevents easy wildlife movement.

Block 122
T38N R2E S03, S04, S09, S10
Block Size: 890.59 (1,053.88) acres
Habitat Score: 110 – Good Habitat
Risk Score: 036 – High Risk
Block 122 is mixed conifer/hardwood forest. Deciduous trees dominate and include alder, cottonwood and birch. Also see are vine maple (*Acer circinatum*), willow and small aspen groves. A few medium snags are interspersed through the forest. Portions of the block do not have a conifer overstory, however the deciduous portions are multi-layered with an excellent understory. Block 122 had a lone bull moose (*Alces alces*) residing in it during the fall of 1993. This block is excellent habitat for all wildlife. It likely has large populations of amphibians including a variety of frogs and northwest salamanders. Bull frogs inhabit the wetlands and ponds of this block. Very large, high-quality, forested wetlands and small ponds are found throughout this block with the largest on the western side. The wetlands are an essential part of the Silver Creek regeneration system. The tributary connects with Silver Creek proper near its junction with the Nooksack River. Previous records of anadromous fish rearing habitat occurs in this reach of Silver Creek. Portions of this block are protected because they are on the Bellingham Airport property. Wildlife would benefit from a connection across I-5 along this block. Previously, 122 was connected to 125 via the grassy area at the end of the north/south runway; however, construction at the site has severed this connection at least temporarily. Wildlife inside the airport fencing is essentially isolated unless they can find a hole in the fence.

Block 123
T38N R2E S09
Block Size: 21.68 (98.16) acre
Habitat Score: 067 – Fair Habitat
Risk Score: 031 – High Risk
Portions of block 123 were previously a hayfield and is now a regenerating alder forest with a thick understory interspersed with reed canary grass meadows. Much of the block is fallow field or pasture which provides excellent foraging habitat for raptors. There are some small snags throughout the forested portions of the block. Also found here are cottonwood, willow and some conifers. Block 123 is a mixture of grass and trees is excellent habitat for deer and meadow associated species including foraging raptors. Portions of this block have been zoned industrial. The Burlington Northern Railroad tracks bisect the block. Blocks 123 and 124 are connected across fallow field and pasture along the railroad tracks and wildlife movement between these two block is only moderately limited.

Block 124
T38N R2E S04, S09
Habitat Score: 47.85 (108.83) acres
Block Size: 055 – Poor Habitat
Risk Score: 030 – High Risk
Block 124 is a combination of regenerating alder forest with a thick understory and fallow field or pasture. There are some small snags throughout the forested portions of the block. Also found here are cottonwood, willow and some conifers. This block also contained a large grand fir. Block 124 is a mixture of grass and trees is excellent habitat for deer and meadow associated species including foraging raptors. Portions of this block have been zoned industrial. The Burlington Northern Railroad tracks bisect the block. Blocks 123 and 124 are connected across fallow fields and pasture along the railroad tracks.

Block 125
T38N R2E S10, S11
Block Size: 105.79 (105.79) acres
Habitat Score: 063 – Fair Habitat
Risk Score: 025 – Moderate Risk
Block 125, parallels I-5 on the eastern side of Bellingham Airport. Forest content is similar to block 126 and 122 with mixed deciduous dominating occasional conifers. Previously, 125 was connected to 122 via the grassy area at the end of the north/south runway; however, construction at the site has severed this connection at least temporarily. A tributary of Silver Creek flows from the airport through the northern portion of 125 and under I-5 before meeting with another Silver Creek tributary. Block 125 is essentially isolated from surrounding habitat and wildlife using this block are at risk from traffic on I-5.

Block 126
T38N R2E S02, S03, S10, S11
Block Size: 686.80 (686.80) acres
Habitat Score: 111 – Good Habitat
Risk Score: 030 – High Risk
Block 126 is similar to block 122 in its forest component. It is dominated by mixed deciduous with occasional conifers. Block 126 parallels I-5 north and east of the Bellingham Airport and continues to Northwest Road on the east and north to Slater Road. Like block 122, block 126 also contains large forested wetlands which are essential for stream regeneration in Silver Creek. Where the southern branch of Silver Creek passes under I-5, water has pooled in the forest causing many trees to die and creating many snags for snag dependent species. The large size of the block allows many species to live here and dispersal occurs at great risk across the freeway to block 122 and 125. A wildlife corridor across the I-5 here would be helpful for animals traveling east/west between the area surrounding the Lummi Peninsula, Cherry Point and north. Much of this block is for sale for development. Due to its large size and stream regeneration capacity, this block is important habitat for Bellingham's wildlife and should be preserved intact. A complete wildlife inventory of these large northern blocks has not been performed and is necessary before wildlife diversity and stability can be determined.

Block 127
T38N R2E S02, S11
Block Size: 415.27 (459.31) acres
Habitat Score: 105 – Good Habitat
Risk Score: 030 – High Risk
Block 127 stretches from Northwest Avenue on the west to Aldrich Road on the east to Slater Road on the north. It is primarily mixed deciduous forest with occasionally conifers and rural residences with fallow fields and pastures similarly to 126. Its mosaic of forest and field provides excellent habitat for a variety of wildlife including amphibians in its wetlands. The wetlands in block 127 are a portion of the regenerating water for Silver Creek. Block 127 is part of the east/west corridor connecting through 126 and 122. A complete wildlife inventory of these large northern blocks has not been performed and is necessary before wildlife diversity and stability can be determined.

Block 128
T38N R2E S01, S12
Block Size: 1,281.33 (1,311.73) acres
Habitat Score: 109 – Good Habitat
Risk Score: 030 – High Risk
Block 128 is mixed conifer/hardwood forest with fallow field and wetlands. The forest has an excellent variety of deciduous trees including: alder, cottonwood, big-leaf maple, birch and a few aspens. As with the other blocks north of Bellingham, many of the cottonwoods are emergent. Conifers, primarily Douglas fir, hemlock (*Tsuga heterophylla*) and cedar with an occasional Sitka spruce, are scattered throughout the block. Many medium and a few large snags are scattered throughout the block increasing habitat for snag associated species. A large wetland complex, surrounded by single and multi-family residences bridges the border between fallow field and forest habitat. This very large wetland consists of open water and marsh areas. Cattails, lily pads and other aquatic plants are common. Frogs and red-winged blackbirds were heard. Small feeder streams from the grassy areas feed into these wetlands. It is supremely important that the wetland forest interface be maintained in this area. Many amphibians have already lost essential upland connector habitat on the east side of the wetlands due to residential development. Bird species, including red tailed hawks, nest in the forest portion and forage over the grass. The deforestation which produced the Cordata development corridor has cut off east/west movement for many wildlife species. Larger wildlife species will still be able to travel east toward King Mountain, but all of the small mammals are now isolated from the east. It is important to also note that because residences surrounding the large complex wetland have been built on land previously included in the wetland complex and have no setback buffer between the wetland and the residences, any herbicides or pesticides used in the area will drain directly to the wetland and affect the amphibian populations there. It is recommended that eco-friendly pest and weed controls be used in this area. Much of the fallow field area is for sale for commercial or residential development. These areas are vital to wildlife inhabiting the forest-field border and should be left as is. This block is one of the headwaters for Silver Creek and therefore, the wetlands must be maintained if Silver Creek is to maintain is anadromous fish rearing potential. This block has very high stream regeneration capacities. A complete wildlife inventory of these large northern blocks has not been performed and is necessary before a detailed wildlife diversity and stability can be determined.

Block 129
T38N R2E S13
Block Size: 44.62 (44.62) acres
Habitat Score: 064 – Fair Habitat
Risk Score: 035 – High Risk
Block 129 is a mixed conifer/hardwood forest block with approximately 1.5 acres of wetland including SQ-10, 12a, 12b. The world's largest paper birch is located within this block. The primarily deciduous forest has an excellent understory with a few small snags. The block links across West Bakerview Road to the large contiguous forest block within block 128. It also connect through block 130 and 131 to Spring Creek. Block 129 is excellent habitat for all wildlife and should have a good

amphibian population because of the upland/wetland association. Current development in this block is threatening its wildlife support capabilities.

Block 130
T38N R2E S13
Block Size: 17.58 (17.58) acres
Habitat Score: 055 – Poor Habitat
Risk Score: 021 – Moderate Risk
Block 130 will have a similar forest component to block 129. This block also has a fallow field component. The mixture of the two provides good habitat for species associated with both. It does not have any wetlands and is at risk for development.

Block 131
T38N R2E S13
Block Size: 8.39 (8.39) acres
Habitat Score: 048 – Poor Habitat
Risk Score: 029 – Moderate Risk
Block 131 is the narrow riparian strip associated with Spring Creek. This reach contains coho, steelhead and chum salmon. It does contain some overstory. Trees are a mixture of conifers and deciduous with some shrubs. Because of recent development to the west and its close association with the impervious surfaces of the local shopping areas, it is likely this reach is polluted and needs some restoration work. It does contain a hydrologically associated wetland SQ-11 having an area of 1.6 acres.

Block 132
T38N R2E S12
Block Size: 31.43 (31.43) acres
Habitat Score: 021 – Impaired Habitat
Risk Score: 015 – Low Risk
Block 132 is the fallow field surrounding Whatcom Community College. This area has limited habitat value to most wildlife. Grazing for deer and hunting for raptors are its best offers for habitat. The block's usefulness to wildlife could be enhanced by planting trees and shrubs.

Block 133
T38N R2E S01, S12
Block Size: 141.07 (141.07) acres
Habitat Score: 068 – Fair Habitat
Risk Score: 035 – High Risk
Block 133 spans the southwestern portion of the Cordata development corridor. Habitat is similar to block 128 with mixed deciduous forest including large emergent cottonwoods, alder and birch. Many small snags increase the variety of habitat. The forest includes wetland areas and a small pond. Small streams feed into the large wetland across Cordata Parkway into block 128. These feeder streams are crucial for recharging the wetlands and consequently Silver Creek. Much of the fallow field area is for sale for commercial or residential development. These areas are indispensable to wildlife inhabiting the forest-field border and should be left as is. More development in this area will compromise the small streams through siltation, lawn and roadway runoff. Development that is currently being conducted should be changed to include higher density housing with more open space. Tall residential and business towers would be perfect here and leave much of the area natural for wildlife and human use.

Block 134
T38N R3E S05, S06, S07, S08
Block Size: 909.77 (1,753.42) acres
Habitat Score: 121 – Good Habita5t
Risk Score: 037 – High Risk
Block 134 is a very large block of mixed conifer/hardwood forest and fallow field with rural residences. It stretches between the Guide Meridian and Hannegan to East Bakerview Road and Kline Road. Portions of the block are within the city limits or the UGA and portions are in the county; however, due to its continuity, the entire block will be assessed. This block has a huge variety of deciduous trees including emergent cottonwoods and a variety of conifers. Small groves of aspen including some very large individual trees are also scattered through the block. The block drapes over King Mountain and is interspersed with fallow field and pasture areas. A variety of amphibians including a large population of red-legged frogs are found within the wetlands and associated upland forest habitat. The wetlands within this block are portions of the headwaters of Spring and Baker Creeks and are essential in providing regeneration for these anadromous fish containing streams. Pileated woodpecker holes and flickers were seen near the King Mountain Church. This block is also part of the east/west corridor to the Cascades. A variety of mammals can also be found in this block including deer, raccoons, coyote, fox and opossum.

Block 135

T38N R3E S07
Block Size: 10.54 (10.54) acres
Habitat Score: 058 – Poor Habitat
Risk Score: 030 – High Risk
Block 135 is the Spring Creek riparian corridor as it flows south toward its confluence with Baker Creek near Bellis Fair Mall. The riparian buffer left when the surrounding upland was developed has limited value for wildlife. Avian and urban tolerant species will dominate. Many invasive plant species including knotweed and reed canary grass are replacing native species. The stream must flow through culverts to pass between blocks. Replacing the culverts with bridges would improve access for fish. Coho salmon are listed using this reach. Tree species include willow, alder and cottonwood. Many pieces of trash were seen along the stream including a shopping cart. This reach needs restoration work. The narrow corridor linking block 135 to block 134 needs some restoration work to improve its usefulness to wildlife.

Block 136
T38N R3E S07
Block Size: 5.53 (5.53) acres
Habitat Score: 053 – Poor Habitat
Risk Score: 029 – Moderate Risk
Block 136 occurs between Prince Avenue and East Bakerview Road and habitat is similar to block 135. The riparian area is very narrow, bisected by roads and full of trash. It contains a small stand of young Douglas fir and a variety of deciduous trees including alder and willow. Wildlife will be limited to avian and urban tolerant species. Coho salmon are known to use this reach and restoration work is needed.

Block 137
T38N R3E S06, T39N R3E S31
Block Size: 201.99 (201.99) acres
Habitat Score: 080 – Fair Habitat
Risk Score: 032 – High Risk
Block 137 is mixed conifer/hardwood forest which stretches from the Guide Meridian northeast into the county. Its composition will be similar to that of neighboring forest blocks with deciduous trees dominating. The open space is a mixture of rural residential and farmland. This block is part of a matrix of habitat extending east toward the Cascades. A thin finger of habitat stretches down from the county portion of the block contains essential tributaries and regenerating wetlands for Silver Creek.

Block 138
T38N R3E S09
Block Size: 148.94 (334.46) acres
Habitat Score: 112 – Good Habitat
Risk Score: 035 – High Risk
Block 138 is situated between Hannegan Road, East Bakerview Road, Dewey Road and the Bonneville Power corridor. Baker Creek and Upper Squalicum Creek flow through the block which spans the two watersheds. Portions of the block have been logged and are regenerating. Much of the block is mixed deciduous forest, with occasional conifers; however, the bluff that drops into Dewey Valley along Squalicum Creek is lined with large Douglas fir. An olive-sided flycatcher was seen at the end of Ross Road on the bluff above the bridge over Squalicum Creek. From the bridge, a very large crayfish and small fish were seen. Portions of the riparian area are shaded by small trees including alder and willow, but other portions flow through fallow fields or wet meadows. This reach of Squalicum Creek is very natural and portions of it are essential for flood control and water quality maintenance. Coho, steelhead and chum salmon along with cutthroat trout are found throughout these stream systems. At the crossing of Baker Creek and the Bonneville Power corridor, there was no flowing water in Baker Creek and only an occasional pool. However, the riparian area stretching from the power corridor to Hannegan Road is one of the nicest observed. It contains an excellent variety of trees with a thick shrub understory. The large wetlands and associated upland provide excellent habitat for amphibians. There is the potential for western toad here.

Block 139
T38N R3E S04, S09
Block Size: 39.66 acres
Habitat Score: 104 – Good Habitat
Risk Score: 031 – High Risk
Block 139 is mentioned because it is the continuation of block 138 on the northeast side of the Bonneville Power corridor. It is a continuation of the east/west corridor to the Cascades. Its habitat and value to wildlife is similar to that of block 138.

Block 140
T38N R3E S09, S10, S16
Block Size: 90.11 (119.40) acres
Habitat Score: 087 – Fair Habitat
Risk Score: 030 – High Risk

Block 140 is bordered on 2 sides by Dewey Road an on the other two by the Mount Baker Highway (SR542) and the Bonneville Power corridor. It provides the eastern upland portion of the Dewey Valley. Toad Creek flows under the Mount Baker Hwy from block 141 to 140 as it makes its way toward Squalicum Creek and provides a corridor between Squalicum Mountain and Dewey Valley. The culvert under the highway is fish usable, so coho and steelhead salmon can proceed all the way to Toad Lake, however the culvert is not useful to terrestrial wildlife species. A bridge at this stream crossing would improve the corridor's usage for all wildlife. The forest is a mixed conifer/hardwood forest. The riparian area on both sides of the highway is two to four hundred feet wide and is a nice deep ravine. Block 140 is connected to block 72 across Dewey Road. The road is not a busy one and connector is wide. Any agricultural pesticides used on the properties along the Dewey Road could easily flow into Squalicum Creek and harm fish residing there.

Block 141
T38N R3E S10, S15
Block Size: 44.99 (44.99) acres
Habitat Score: 091 – Fair Habitat
Risk Score: 034 – High Risk
Block 141 is the riparian strip along a fork of Squalicum Creek south of the Mount Baker Highway. This block provides a wildlife corridor between Squalicum Mountain, Toad Lake and Dewey Valley. The stream flows through a deep ravine and then a culvert under the Mount Baker Highway. A bridge at this spot would improve wildlife movement through this area. When the stream flows from block 143 under Britton Road into block 141, it uses a culvert that is perched at least 3 feet before it flows into a small residential pond. Coho salmon and searun cutthroat trout are listed and occurring all the way to Toad Lake; however, it seems unlikely they can pass between blocks 141 and 143. Block 141 and surrounding blocks were once a contiguous forest. Reconnection of the blocks in this neighborhood would stabilize wildlife diversity and prevent the formation of sinks. The development of the Barkley neighborhood has severed these connections. The habitat consists primarily of deciduous trees with the occasional conifer. The understory is excellent.

Block 142
T38 R3E S10, S11, S14
Block Size: 865.16 (3,608.94) acres
Habitat Score: 128 – Excellent Habitat
Risk Score: 029 – Moderate Risk
Block 142 is contiguous forest east of the Bonneville power corridor covering Squalicum Mountain. The are is working forest with some rural residential development. This block is excellent habitat for wildlife and connects Squalicum Creek and Lake Whatcom with the Cascades. It is essential that this block remain intact to continue good wildlife usage. A variety of mammal and bird species will inhabit this block including deer, raccoons, pileated woodpecker and the occasional large carnivore. A complete survey of this area is recommended so wildlife use is more fully understood.

Block 143
T38N R3E S14, S15, S23, S26
Block Size: 95.85 (406.57) acres
Habitat Score: 097 – Good Habitat
Risk Score: 034 – High Risk
Block 143 connects in the north to blocks 141 and 142. It then parallels block 142 on the west side of the Bonneville power corridor. Block 143 continues south to Lake Whatcom outside the city boundary. It is mixed conifer hardwood forest with numerous streams flowing into either Lake Whatcom or Squalicum Creek. A variety of wildlife will be found in this block including bear and cougar. Forested wetlands will provide excellent habitat for amphibians. A complete survey of the area is necessary to understand is use by wildlife.

Block 144
T38N R3E S15
Block Size: 2.76 (2.76) acres
Habitat Score: 023 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 144 is a small isolated island of habitat in the center of a housing development. Wildlife movement is cut off completely from surrounding blocks except for avian species. It was previously connected to block 143 and will contain the same plant species except where humans have planted ornamentals. Block 144 is now backyard habitat and residents should be encouraged to attract avian species.

Block 145
T38N R3E S15
Block Size: 4.60 (4.60) acres
Habitat Score: 030 – Impaired Habitat
Risk Score: 008 – Minimal Risk

Block 145 is a block of backyard habitat narrowly connected to block 65A through residential backyards. Wildlife may move through, but it is unlikely any permanent populations other than avian species are found here.

Block 146
T38N R3E S16
Block Size: 7.03 (7.03) acres
Habitat Score: 059 – Poor Habitat
Risk Score: 018 – Low Risk
Block 146 is a small patch of lowland conifer forest south of Squalicum High School. This block was previously connected to block 54 which was extensively cleared for the Barkley neighborhood. This block is connected with block 147 by a very narrow row (< 100 feet wide) of trees. It appears there is a ditch between houses and the overstory along the ditch was retained. The understory along this strip has been cleared, devaluing it for wildlife passage and essentially severing the connection between the two blocks for all but the most steadfast of wildlife. Residents should be encouraged to provide ground cover for wildlife passage between the blocks. Most of this connector's understory has been cleared leaving just the canopy. Wildlife movement through this area between blocks is difficult. The block's habitat value is primarily for avian species and small terrestrial wildlife. Larger wildlife such as deer and coyotes may use this block , but a sustainable population could not be supported. This block provides good habitat for passerines and daytime refuge for larger mammals.

Block 147
T38N R3E S16, S21
Block Size: 37.45 (37.45) acres
Habitat Score: 065 – Fair Habitat
Risk Score: 020 – Moderate Risk
Block 147 is lowland temperate coniferous forest formerly part of a much larger block which has since been developed for single family residences. It spans Northridge and has been designated Northridge Park. A system of trails winds through the block connecting it with the surrounding residential developments and Squalicum High School. Wetlands SQ- 57 and 58 having a total area of 0.7 acres is located on the eastern edge of the block. Wildlife presence likely includes deer, raccoons, opossum and a variety of small and urban tolerant animals. Habitat is good for forest dwelling passerines. A small pond is located on the south side of the block adjacent to Barkley Boulevard. Block 147 is separated from block 148 by Barkley Boulevard, but a pedestrian tunnel under the roadway could provide less hazardous passage for wildlife under the roadway. This block is connected to Block 146 by a very narrow row (<100 feet wide) of trees. It appears there is a ditch between houses and the overstory along the ditch was retained. The understory along this strip has been cleared, devaluing it for wildlife passage. Residents should be encouraged to provide ground cover for wildlife passage between the blocks.

Block 148
T38N R3E S21, S22
Block Size: 75.39 (75.39) acres
Habitat Score: 088 – Fair Habitat
Risk Score: 028 – Moderate Risk
Block 148 was formerly part of a larger contiguous block, including blocks 147 and 149, of habitat since developed for the Barkley neighborhood. This block contains Big Rock Garden and Park. Wetlands WH-89, 90, 91a, 91b, 92a, 92b and 93 having an area of 3.3 acres. Not included in the wetland inventory acreages from 1991 are Big Rock Pond and associated ephemeral pond just south of Barkley Boulevard. The pond has a good population of lilies and cattails. Tracks seen in the mud surrounding the ephemeral pool verify habitation by deer, raccoon and possible coyotes (canid tracks could be coyote or domestic dog). Upland habitat includes large diameter mature mixed conifer/hardwood forest. Understory is excellent with lots of shrubs, ferns, down woody material, small cliffs (< 5 feet) and snags. Block likely has a variety of animals including amphibians. Woodpecker evidence was abundant, but would be downy (*Picoides pubescens*) or hairy (*Picoides villosus*); no evidence of pileated was seen. Narrow paths wind through the block, but are not as developed as normal Greenway trails. Because of its isolation from contiguous upland, this block has lost value since the last evaluation. It is connected by a narrow strip to the forests around Fever Creek Pond. Block 148 is separated from block 147 by Barkley Boulevard, but a pedestrian tunnel under the roadway provides less hazardous passage for wildlife under the roadway.

Block 149
T38N R3E S16, S17, S20, S21
Block Size: 153.26 (153.26) acres
Habitat Score: 082 – Fair Habitat
Risk Score: 029 – Moderate Risk
Block 149 is a mixed conifer/hardwood forest. It is located between Barkley Boulevard and the Mount Baker Highway. This block contains many large wetlands including: WH-33a, 33b, 41a, SQ 51, 55, 56. These wetlands have an area of at least 64 acres. This block is an essential link between the Fever Creek Nature Area and the Squalicum Creek corridor. Due to the extensive wetlands and their upland forest interface amphibian populations are expected to be good. Regenerating shrub habitat runs in a strip from southwest to northeast in the center of the block. Raptors were seen perching on the poles holding up the driving range nets. The mixture of habitats provide homes and foraging possibilities for a variety of species.

It is recommended that wildlife crossing caution signs be placed along Barkley Boulevard where it passes between blocks 149 and 151 as this is likely to be a often used corridor.

Block 150
T38N R3E S17, S20
Block Size: 24.51 (40.87) acres
Habitat Score: 042 – Poor Habitat
Risk Score: 022 – Moderate Risk
Block 150 is located to the west of block 149 along Barkley Boulevard. A large portion of this block has been developed since the aerial photographs were taken in 2001. The habitat in this block is mixed deciduous forest and regenerating shrub/field habitat west of Barkley Shopping Center. The forested portion links to block 149 north of Britax across Woburn Street. It is essential to maintain and restore this connection to allow wildlife to continue using block 150. Wetlands SQ-47 and 50 having an area formerly of 39.7 acres provides good forested wetland habitat for amphibians. The forest field connection once again provides foraging habitat for raptors.

Block 151
T38N R3E S20, S21
Block Size: 80.63 (80.63) acres
Habitat Score: 087 – Fair Habitat
Risk Score: 030 – High Risk
Block 151 contains the Fever Creek Nature Area. Forest surrounding the nature area is mixed conifer/hardwood with deciduous trees dominating. A small pond provides habitat for waterfowl, fish and other aquatic dependent species. Many small and medium snags are found throughout the forest here. Garter snakes (*Thamnophis* sp.) were seen along the trail. On the south side of the dam, small fish were seen in the stream. The did not appear to be salmon. The riparian area is a regenerating mix of alder and cedar with a thick shrub understory. Fish were also seen in the upper and lower ponds. Red-winged blackbirds used the cattails in the upper pond which also contained water lilies. Surrounding the pond is an excellent shrub habitat. Human trails were minimal which increase the wildlife value of the habitat. Small patches of aspens were seen along the trail. Block 151 provides a connector along the trail system to Whatcom Falls Park and is the only connector between Whatcom Falls Park and the Squalicum Creek corridor. Wildlife and humans attempting to move into Block 57 have a difficult time crossing Alabama Street. A bridge over the street would aid movement along the greenway. Block 151 is excellent habitat for a variety of wildlife.

Block 151A
T38N R3E S20, S21
Block Size: 7.92 (7.92) acres
Habitat Score: 030 – Impaired Habitat
Risk Score: 015 – Low Risk
Block 151A was formerly connected to Block 151, however due to residential development that connection has been extensively narrowed. The block also previously consisted of contiguous forest and now contains two small forest blocks connected by an open shrub and lawn area.

Block 152
T38N R2E S14
Block Size: 3.29 (3.29) acres
Habitat Score: 031 – Impaired Habitat
Risk Score: 012 – Low Risk
Block 152 is a small block of shrub and mixed deciduous tree habitat. It is primarily useful for avian species and as daytime refuge for urban tolerant species. It will not be able to support any populations of wildlife due to its isolation.

Block 153
T38N R3E S20
Block Size: 27.74 (27.74) acres
Habitat Score: 035 – Poor Habitat
Risk Score: 022 – Moderate Risk
Block 153 is mixed forest and disturbed area regenerating into shrub and field habitat south of Barkley Boulevard and east of Woburn. The forest is primarily deciduous and occurs in a strip on the west and south sides of the block. The majority of the block is undeveloped cleared land which is for sale. It provides excellent foraging habitat for raptors and field associated species. Three wetlands, WH-26, 27 and 28 have a total area of 2.4 acres. These small wetlands provide habitat for amphibians and other species associated with forested wetlands. Deer, coyote and raptors can use this block for foraging and will be able to move along the greenway into the Block 151. Movement into Block 150 is currently not difficult; however, with recent residential and commercial development it is becoming more so.

Block 154

T38N R3E S20
Block Size: 7.11 (7.11) acres
Habitat Score: 025 – Impaired Habitat
Risk Score 010 – Low Risk
Block 154 is an isolated wetland along the Railroad Trail. A very small patch of trees was left by developers along the west side of this block. Wetland WH-25 having an area of 1.7 acres is located in block 154. Habitat value for wildlife is limited to avian species and mobile wildlife moving through. Tree planting and other native plant restoration will improve this block for wildlife use in the future.

Block 155
T38N R3E S08, S17
Block Size: 53.01 (53.01) acres
Habitat Score: 084 – Fair Habitat
Risk Score: 033 – High Risk
Block 155 is a mixed field/forest block. The south fork of Baker Creek having known use by coho, cutthroat and steelhead salmon meanders through the block. Small ponds and wetlands adjacent to forested uplands provide excellent habitat for amphibians and other wetland associated species. Block 155 helps connect block 158 to block 134. It is an important wildlife corridor.

Block 156
T38N R3E S32
Block Size: 3.19 (3.19) acres
Habitat Score: 022 – Impaired Habitat
Risk Score: 006 – Minimal Risk
Block 156 is Pacific View Park and an associated wetland in the Samish Hill neighborhood. It was formerly connected to block 11, but development has severed that connection since the 1995 assessment. This block is useful habitat to urban avian species.

Block 157
T38N R3E S18
Block Size: 71.27 (71.27) acres
Habitat Score: 083 – Fair Habitat
Risk Score: 033 – High Risk
Block 157 is located between Telegraph and East Bakerview Roads. The eastern half of the block is a mixed conifer/hardwood forest through which Baker Creek flows. Coho salmon and searun cutthroat trout are known to use this reach of the stream. The western half of the block is fallow field and pasture with rural residences. The two habitats combined provided excellent foraging and shelter opportunities for species using both. This block is also a connector between the Squalicum Creek corridor and King Mountain. It is essential to retain this connection and improve wildlife passage by placing a bridge over Baker Creek instead of the culvert. Amphibians and terrestrial wildlife likely use this block regularly. A complete wildlife and habitat inventory need to be performed.

Block 158
T38N R3E S18
Block Size: 69.78 (69.78) acres
Habitat Score: 083 – Fair Habitat
Risk Score: 033 – High Risk
Block 158 is similar in habitat content to block 157 and is part of the vital link between King Mountain and Squalicum Creek. A branch of Baker Creek runs through this block as well. This branch has known coho, chum and steelhead salmon use as well as searun cutthroat trout. Wetlands associated with the stream are also located in this block. Amphibians and terrestrial wildlife likely use this block regularly. A complete wildlife and habitat inventory need to be performed.

Block 159
T38N R3E S19
Block Size: 1.86 (1.86) acres
Habitat Score: 031 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 159 is similar to 160 and is situated just south of the St. Joseph Hospital complex. Previously blocks 159 and 160 were connected, but medical development has since severed this connection. It is a small forest block completely isolated from larger contiguous blocks. It could provide daytime refuge for mobile terrestrial mammals, but will not support a population. A variety of passerines can use the block for nesting.

Block 160
T38N R3E S19
Block Size: 1.14 (1.14) acres
Habitat Score: 031 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 160 is similar to 159 and is situated just south of the St. Joseph Hospital complex. Previously blocks 159 and 160 were connected, but medical development has since severed this connection. It is a small forest block completely isolated from larger contiguous blocks. It could provide daytime refuge for mobile terrestrial mammals, but will not support a population. A variety of passerines can use the block for nesting.

Block 161
T38N R3E S20
Block Size: 9.61 (9.61) acres
Habitat Score: 012 – Impaired Habitat
Risk Score: 004 – Minimal Risk
Block 161 is Sunnyland Memorial Park. This block is isolated from surrounding habitat blocks and consists of a lawn with scattered trees. It could provide habitat for urban associated birds, but not high quality habitat for other wildlife.

Block 162
T38N R3E S19
Block Size: 9.33 (9.33) acres
Habitat Score: 009 – Impaired Habitat
Risk Score: 002 – Minimal Risk
Block 162 is Broadway Park and is predominantly manicured lawn. Only urban associated birds will frequent this area. It is a nice open space, but not good habitat for wildlife due to its lack of multi-layered forest and freshwater and its completely isolation.

Block 163
T38N R2E S25
Block Size: 6.74 (6.74) acres
Habitat Score: 015 – Impaired Habitat
Risk Score: 004 – Minimal Risk
Block 163 is Elizabeth Park which consists of lawn with playground and picnic facilities. Because this block is isolated from other blocks with good quality habitat, it provides habitat only for avian or small mammalian species. It does possess a thick overstory which provides good habitat for passerines and arboreal mammals. With the lack of understory, ground dwelling wildlife is eliminated from using this block.

Block 164
T38N R2E S25
Block Size: 9.32 (9.32) acres
Habitat Score: 016 – Impaired Habitat
Risk Score: 002 – Minimal Risk
Block 164 is Zuanich Park and consist of rip rapped shoreline, marina and extensive lawns with very small trees. Primary wildlife users of this block will be urban birds and gulls. An occasional seal or sea lion may haul out on the shoreline, but the extensive usage by people discourages them so they tend to use the breakwaters further from shore. No terrestrial wildlife should be seen here due to its isolation by commercial and industrial development.

Block 165
T38N R3E S27, S34
Block Size: 93.08 (93.08) acres
Habitat Score: 099 – Good Habitat
Risk Score: 031 – High Risk
Block 165 is comprised of Euclid Park and interspersed forest within single family residences. This triangular shaped forest block of Euclid Park is a mixed deciduous forest with many alders and bigleaf maples. Several medium-sized snags were present as well as some large down trees. A stream flows through the park from Lookout Mountain. During the dry season, the stream has standing water, but no observable flow. The riparian area was well shaded with a thick understory. Wetland WH-95 having an area of 5.7 acres follows the stream corridor. This is the only good wildlife accessible connection to Lake Whatcom from the upland within the city limits. It is also one of the few shoreline areas with any naturalness to it. Improvements could be made to the block across Lakeway to aid this access. The rest of the block is a mixture of conifers and hardwoods. Open space between the single family residences can provide corridors for animals to move through to Bloedel-Donovan Park. This area has excellent habitat for avian species. Numerous deer tracks were seen in the mud along the slough's edge as were freshwater clam shells.

Block 166
T38N R3E S34
Block Size: 8.70 (8.70) acres
Habitat Score: 045 – Poor Habitat
Risk Score: 019 – Low Risk
Block 66 is a small patch of conifers with some snags across from the Firs grounds. It is good habitat for birds and a daytime refuge for terrestrial animals. It does not have permanent water which limits is value in supporting populations of terrestrial wildlife. It does connect to other forested habitat near the Firs and into block 165, therefore it is important for wildlife movement to and from block 52.

Block 167
T38N R3E S34, S35
Block Size: 25.28 (25.28) acres
Habitat Score: 045 – Poor Habitat
Risk Score: 018 – Low Risk
Block 167 is a strip of habitat jutting down from block 52 toward Lake Whatcom. It does not actually contact the lake; but provides some access. This block is divided from block 52 by Lake Louise Road. The corridor is wide and will allow medium and large terrestrial wildlife easy movement. The forest provides excellent habitat for forest dwelling birds and may even house some pileated woodpeckers. Deer, coyote, raccoons and other terrestrial species will be found in this block.

Block 168
T38N R3E S35, S36
Block Size: 52.21 (691.45) acres
Habitat Score: 123 – Good Habitat
Risk Score: 034 – High Risk
Block 168 contains Lake Louise and its associated wetlands. This block is one of the few places within Bellingham's City Limits or UGA where a large contiguous forest block touches Lake Whatcom. The forest is mixed conifer/hardwood and is excellent habitat for a variety of wildlife including amphibians. There is potential for western toad here with the pond/upland forest interface. Beavers are found throughout the pond/wetland complex. This block is one of the most diverse in the city as far as wetlands and uplands and their connectedness. It is critical that this block be maintained intact.

Block 169
T38N R3E S32
Block Size: 4.27 (4.27) acres
Habitat Score: 097 – Good Habitat
Risk Score: 023 – Moderate Risk
Block 169 is a triangle of regenerating forest between Old Lakeway and the current Lakeway Drive. The west fork of Cemetery Creek flows through this block and usage by resident fish including rainbow trout has been noted in the past. This block is a connector between block 68 and 11A. Due to the volume of traffic on Lakeway Drive and narrowness of the riparian area, wildlife movement through the area is difficult.

Block 170
T38N R3E S32
Block Size: 4.06 (4.06) acres
Habitat Score: 034 – Poor Habitat
Risk Score: 016 – Low Risk
Block 170 was formerly connected to block 11A. It is now an isolated island of forest between 11A and 169. Previously it would have been a good connector between Samish Hill and Whatcom Creek, but development has removed that connection. The block is most useful for a variety of forest dwelling birds.

Block 171
T38N R3E S31, S32
Block Size: 33.67 (33.67) acres
Habitat Score: 037 – Poor Habitat
Risk Score: 025 – Moderate Risk
Block 171 is a large wetland just north of Fred Meyer. It was previously cleared and is now regenerating shrub habitat and deciduous forest. Lincoln Creek runs through block. The culvert under Fred Meyer is likely a barrier to anadromous fish. Block 171 is completely isolated from other habitat blocks and is currently the residence of transient people. It could be a nice park with natural and interpretive trails.

Block 172

T38N R3E S32
Block Size: 3.52 (3.52) acres
Habitat Score: 028 – Impaired Habitat
Risk Score: 011 – Low Risk
Block 172 is a small patch of forested wetlands surrounded by recent development north of Consolidation Avenue. Its isolation prevents good usage by terrestrial wildlife and any amphibian populations using this block will most likely not survive the long term. This block contains wetland WH-10 having an original area of 6.5 acres. Development has decreased that amount by at least one-third. The highest value as far as wildlife goes is for avian species.

Block 173
T38N R3E S31
Block Size: 4.55 (4.55) acres
Habitat Score: 021 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 173 is a deciduous forest patch between High and Forest Streets. It is good habitat for passerines, but its lack of understory limits terrestrial mammal usability. During the winter months, the trash in the understory is visible. Removal of this garbage should be performed regularly.

Block 174
T38N R2E S36, R3E S31
Block Size: 26.83 (26.83) acres
Habitat Score: 035 – Poor Habitat
Risk Score: 012 – Low Risk
Block 174 is a greenway trail connecting Boulevard Park with downtown Bellingham and the bluff leading down to the Georgia Pacific warehouses. It has a wide trail with regenerating shrubs and deciduous trees. The block has good value to avian species and may be used by mobile terrestrial species. However, its heavy use by humans limits its value to wildlife. The bluff has some small trees and berry bushes. It is good habitat for shrub dwelling avian species. This block could be enlarged is the log storage areas at Georgia-Pacific were reclaimed.

Block 175
T37N R2E S01
Block Size: 5.21 (5.21) acres
Habitat Score: 033 – Poor Habitat
Risk Score: 021 – Moderate Risk
Block 175 is part of a greenway connecting Fairhaven with Boulevard Park. It contains small deciduous trees, picnic tables and recently cleared blackberry patches. It connects directly across the railroad tracks to Boulevard Park. Principle wildlife use will be for avian and small urban tolerant terrestrial species.

Block 176
T37N R2E S01
Block Size: 8.12 (8.12) acres
Habitat Score: 031 – Impaired Habitat
Risk Score: 018 – Low Risk
Block 176 is part of a greenway connecting Fairhaven with Boulevard Park. It contains shrubs and a few scattered small deciduous trees. Principle wildlife use will be for avian and small urban tolerant terrestrial species.

Block 177
T37N R2E S02
Block Size: 2.02 (2.02) acres
Habitat Score: 018 – Impaired Habitat
Risk Score: 010 – Low Risk
Block 177 is Marine Park. It principally manicured lawn with a few trees. The habitat is not suitable for terrestrial wildlife and used mainly by urban associated birds and marine birds frequenting the waterfront. The shoreline is rip-rapped. The mudflats off the park are used by recreational shellfish gathers and great blue herons. Herons from the adjacent colony use this stretch of beach extensively for foraging during the breeding season and are present year-round.

Block 178
T37N R2E S02, S11
Block Size: 52.93 (52.93) acres
Habitat Score: 0708 – Fair Habitat
Risk Score: 027 – Moderate Risk
Block 178 is the portion of Marine Park on the east side of the Burlington Northern Railroad tracks. A lagoon formed by the tracks is heavily used by dog owners as this is one of the few off leash parks in the city. A small seasonal stream flows

along the meadow/forest border. The bluff separating the park from Edgemoor is the location of the only known great blue heron colony within the city limits. The current nest count is 10. The colony is threatened by continued development along the bluff line and has already been displaced at least once.

Block 179
T37N R2E S11, S14
Block Size: 17.93 (17.93) acres
Habitat Score: 069 – Fair Habitat
Risk Score: 020 – Moderate Risk
Block 179 is adjacent to block 9. It is shoreline bluff habitat. Previously it was connected to Block 9, but with a small residential development, the connection has been severed. Mature Douglas fir, regenerating alder and other shrubs dominate the block. The north portion has the mature forest surrounding residential enclaves. The southern portion adjacent to the Madrone Point development is regenerating shrub habitat.

Block 180
T37N R2E S11, S12
Block Size: 7.65 (7.65) acres
Habitat Score: 029 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 180 is backyard habitat woven within the Edgemoor neighborhood. It consists primarily of a conifer tree canopy with lawn understory. A small wetland BB-2 having an area of 0.9 acres is located near the south end of the block. Wildlife use of this block is restricted to avian species and urban tolerant wildlife. The block is essentially isolated from blocks 6, 178 and 179; however, movement through the block by large highly mobile terrestrial species is likely.

Block 181
T37N R2E S01, T38N R2E S36
Block Size: 10.80 (10.80) acres
Habitat Score: 045 – Poor Habitat
Risk Score: 013 – Low Risk
Block 181 is Boulevard Park consisting primarily of lawn with a few scattered trees on the north end and a very nice shrub habitat on the south end. The shoreline has been rip-rapped. Block 181 is heavily used by the public and therefore has limited use by wildlife. Wildlife occurring on the north end are urban birds including crows, robins, starlings and gulls. The south end can support a variety of smaller shrub dwelling birds and small animals. Block 181 connects to blocks 174 and 175. The half developed idea is good for humans and wildlife.

Block 182
T38N R3E S30
Block Size: 8.59 (8.59) acres
Habitat Score: 067 – Fair Habitat
Risk Score: 025 – Moderate Risk
Block 182 consists of Maritime Heritage Park and the mouth of Whatcom Creek. The park has a fish hatchery which produces chinook, pink and chum salmon. Much of the restoration work recommended in the 1995 Habitat Assessment has been accomplished. The park is a mixture of lawn, regenerating shrub and saltmarsh habitat. Lots of foam was seen during the field visit floating on the water near the hatchery. An investigation revealed that the foam was entering the stream from a storm drain exiting from under the Bellingham Police Station and was soap. Storm drains should be treated before their contents are allowed to enter a known salmon bearing stream. Beaver, otter and muskrat are known to use the entire stream system. Lampreys use the stream to travel to Lake Whatcom.

Block 183
T38N R3E S30
Block Size: 1.63 (1.63) acres
Habitat Score: 062 – Poor Habitat
Risk Score: 024 – Moderate Risk
Block 183 is the portion of the Whatcom Creek corridor occurring between Dupont Street and Grand Avenue. It has received restoration work. A large, 12-inch plus, pipe was emptying a white foam (soap) into the stream from under the Bellingham Police Station. The foam was seen in large quantities downstream. A trail with picnic tables and benches has been created on the north side of the stream. This block has poplar trees lining the shore, but needs some spreading trees. Restoration work has been performed here and with time will improve the riparian habitat. Storm drains should be treated before their contents are allowed to enter a known salmon bearing stream. A variety of salmon, including chinook, have been

documented in the stream. Beaver, otter and muskrat are known to use the entire stream system. Lampreys use the stream to travel to Lake Whatcom.

Block 184
T38N R3E S30
Block Size: 1.07 (1.07) acres
Habitat Score: 060 – Poor Habitat
Risk Score: 024 – Moderate Risk
Block 184 is the portion of the Whatcom Creek corridor occurring between is the portion of the Whatcom Creek corridor between Grand Avenue and North Commercial Street. It has a few nice shade trees, but stream is primarily open to full sun. The stormdrains empty directly into the stream. Storm drains should be treated before their contents are allowed to enter a known salmon bearing stream. Some restoration work has been performed in this block. Primary wildlife use will be by fish and aquatic animals. Deer, raccoons and other urban tolerant wildlife can use the stream corridor for passage. A variety of salmon, including chinook, have been documented in the stream. Beaver, otter and muskrat are known to use the entire stream system. Lampreys use the stream to travel to Lake Whatcom.

Block 185
T38N R3E S30
Block Size: 2.77 (2.77) acres
Habitat Score: 060 – Poor Habitat
Risk Score: 024 – Moderate Risk
Block 185 is the portion of the Whatcom Creek corridor occurring between North Commercial Street and Cornwall Avenue. It has good shading for a hundred yards or so and then the stream is open to full sun again. Restoration work has been performed here. Primary wildlife use will be by fish and aquatic animals. Storm drains should be treated before their contents are allowed to enter a known salmon bearing stream. Primary wildlife use will be by fish and aquatic animals. Deer, raccoons and other urban tolerant wildlife can use the stream corridor for passage. A variety of salmon, including chinook, have been documented in the stream. Beaver, otter and muskrat are known to use the entire stream system. Lampreys use the stream to travel to Lake Whatcom.

Block 186
T38N R3E S30
Block Size: 2.00 (2.00) acres
Habitat Score: 059 – Poor Habitat
Risk Score: 026 – Moderate Risk
Block 186 is the portion of the Whatcom Creek corridor occurring between Cornwall Avenue and York Street crossing. It is more open to the sun than down stream blocks. Primary wildlife use will be by fish and aquatic animals. Storm drains should be treated before their contents are allowed to enter a known salmon bearing stream. Primary wildlife use will be by fish and aquatic animals. Deer, raccoons and other urban tolerant wildlife can use the stream corridor for passage. A variety of salmon, including chinook, have been documented in the stream. Beaver, otter and muskrat are known to use the entire stream system. Lampreys use the stream to travel to Lake Whatcom.

Block 187
T38N R3E S30
Block Size: 0.44 (0.44) acres
Habitat Score: 057 – Poor Habitat
Risk Score: 026 – Moderate Risk
Block 187 is the portion of the Whatcom Creek corridor occurring between York Street and North State Street. It is shrub habitat with limited value for terrestrial wildlife. A variety of salmon, including chinook, have been documented in the stream. Primary wildlife use will be by fish and aquatic animals. Deer, raccoons and other urban tolerant wildlife can use the stream corridor for passage. A variety of salmon, including chinook, have been documented in the stream. Beaver, otter and muskrat are known to use the entire stream system. Lampreys use the stream to travel to Lake Whatcom.

Block 188
T38N R3E S30
Block Size: 2.56 (2.56) acres
Habitat Score: 057 – Poor Habitat
Risk Score: 026 – Moderate Risk
Block 188 is the portion of the Whatcom Creek corridor occurring between North State Street and Meador Avenue downstream from Block 189. It is shrub habitat with limited value for terrestrial wildlife. A variety of salmon, including chinook, have been documented in the stream. Primary wildlife use will be by fish and aquatic animals. Deer, raccoons and other urban tolerant wildlife can use the stream corridor for passage. A variety of salmon, including chinook, have been documented in the stream. Beaver, otter and muskrat are known to use the entire stream system. Lampreys use the stream to travel to Lake Whatcom.

Block 189
T38N R3E S30
Block Size: 2.31 (2.31) acres
Habitat Score: 054 – Poor Habitat
Risk Score: 026 – Moderate Risk
Block 189 is the portion of the Whatcom Creek corridor occurring between Meador Avenue and James Street downstream from Block 190 to the west. It is shrub habitat and a few small trees with limited value for terrestrial wildlife. Primary wildlife use will be by fish and aquatic animals. Deer, raccoons and other urban tolerant wildlife can use the stream corridor for passage. A variety of salmon, including chinook, have been documented in the stream. Beaver, otter and muskrat are known to use the entire stream system. Lampreys use the stream to travel to Lake Whatcom.

Block 190
T38N R3E S29, S30
Block Size: 2.32 (2.32) acres
Habitat Score: 054 – Poor Habitat
Risk Score: 026 – Moderate Risk
Block 190 is the portion of the Whatcom Creek corridor occurring between James Street and I-5 adjacent to I-5 on the west. It is shrub habitat with limited value for terrestrial wildlife. Primary wildlife use will be by fish and aquatic animals. Deer, raccoons and other urban tolerant wildlife can use the stream corridor for passage. A variety of salmon, including chinook, have been documented in the stream. Beaver, otter and muskrat are known to use the entire stream system. Lampreys use the stream to travel to Lake Whatcom.

Block 191
T38N R2E S23
Block Size: 4.00 (4.00) acres
Habitat Score: 032 – Poor Habitat
Risk Score: 027 – Moderate Risk
Block 191 is backyard habitat off Marine Drive just south of the airport. A small stream flow through the block originating in Blocks 114 and 197. Habitat is primarily manicured lawn with a sparse overstory. Wildlife using this block will be primarily urban associated. Deer, raccoons and other tolerant wildlife will move through.

Block 192
T38N R3E S16
Block Size: 37.67 (37.67) acres
Habitat Score: 038 – Poor Habitat
Risk Score: 021 – Moderate Risk
Block 192 is the block of forest surrounding Squalicum High School. The block was formerly connected to blocks 141, 146, 147 and 149 until they were developed into the Barkley neighborhood. The habitat has a mixture of deciduous and conifer trees with some snags. During the field visit, standing water was noted in a portion of the forest. The school is surrounded by a chain link fence which restricts terrestrial wildlife movement. The blocks primary value is to avian species.

Block 193
T38N R2E S13
Block Size: 2.61 (2.61) acres
Habitat Score: 020 – Impaired Habitat
Risk Score: 008 – Minimal Risk
Block 193 is regenerating shrub habitat just west of Bellis Fair Mall. It is completely isolated from other blocks and occurs along I-5. Wildlife movement is restricted to intrepid very mobile terrestrial and avian species. The blackberry patches provide food for birds and wildlife.

Block 194
T38N R2E S13
Block Size: 1.63 (1.63) acres
Habitat Score: 027 – Impaired Habitat
Risk Score: 019 – Low Risk
Block 194 is the Spring Creek ditched stream corridor along Meridian Street directly east of Bellis Fair Mall. The stream channel is narrow and overrun with blackberries. Copious quantities of garbage find their way into the stream here. Steelhead, coho and cutthroat trout have occurred throughout this reach. Due to the lack of spawning habitat, it is likely, they use if for rearing. As with the other streams in this area, Spring Creek needs extensive restoration work. The shrubs and occasional trees in this block are useful to urban tolerant birds.

Block 195
T38N R2E S13

Block Size: 0.99 (0.99) acres
Habitat Score: 027 – Impaired Habitat
Risk Score: 019 – Low Risk
Block 194 is the Spring Creek ditched stream corridor along Meridian Street directly east of Bellis Fair Mall. The stream channel is narrow and overrun with blackberries. Copious quantities of garbage find their way into the stream here. Steelhead, coho and cutthroat trout have occurred throughout this reach. Due to the lack of spawning habitat, it is likely, they use if for rearing. As with the other streams in this area, Spring Creek needs extensive restoration work. The shrubs and occasional trees in this block are useful to urban tolerant birds.

Block 196
T38N R3E S23, S24, S25, S26
Block Size: 1.89 (856.12) acres
Habitat Score: 113 – Good Habitat
Risk Score: 030 – High Risk
Block 196 is the large contiguous upland forest block west of the Bonneville Power Corridor, north and east of Lake Whatcom and south of Academy Street. It is primarily lowland temperate coniferous forest and will have many of the same features as block 142. It is essential that this block remain intact to continue good wildlife usage. A variety of mammal and bird species will inhabit this block including deer, raccoons, pileated woodpecker and the occasional large carnivore. Block 196 has a few small streams which feed into Lake Whatcom. Cutthroat trout and other native fish species likely utilize the streams throughout this block. A complete survey of this area is recommended so wildlife use is more fully understood.

Block 197
T38N R2E S14
Block Size: 12.11 (12.11) acres
Habitat Score: 038 – Poor Habitat
Risk Score: 022 – Moderate Risk
Block 197 is backyard habitat and a strip along the stream in block 191. It is a potential backyard sanctuary. Residents should be encouraged to provide bird boxes and feeding stations for wildlife and fences that allow the passage of wildlife through the backyards.

Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale

Prepared by
The National Marine Fisheries Service
Environmental and Technical Services Division
Habitat Conservation Branch

August 1996

Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale

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Footnote:

1) The species narrative is intended to provide the biologist or evaluator with an up-to-date source of information on the general biological parameters associated with the particular species being evaluated. References for additional information sources are provided.

OVERVIEW

The following guidelines are designed to facilitate and standardize determinations of effect for Endangered Species Act (ESA) conferencing, consultations and permits focusing on anadromous salmonids. We recommend that this process be applied to individual or grouped actions at the watershed scale. When the National Marine Fisheries Service (NMFS) conducts an analysis of a proposed activity it involves the following steps: (1) Define the biological requirements of the listed species; (2) evaluate the relevance of the environmental baseline to the species' current status; (3) determine the effects of the proposed or continuing action on listed species; and (4) determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the environmental baseline and any cumulative effects, and considering measures for survival and recovery specific to other life stages. The last item (item 4) addresses considerations given during a jeopardy analysis.

This document provides a consistent, logical line of reasoning to determine when and where adverse effects occur and why they occur. Please recognize that this document does not address jeopardy or identify the level of take or adverse effects which would constitute jeopardy. Jeopardy is determined on a case by case basis involving the specific information on habitat conditions and the health and status of the fish population. NMFS is currently preparing a set of guidelines, to be used in conjunction with this document, to help in the determination of jeopardy.

This document contains definitions of ESA effects and examples of effects determinations, a matrix of pathways of effects and indicators of those effects, a checklist for documenting the environmental baseline and effects of the proposed action(s) on the relevant indicators, and a dichotomous key for making determinations of effect. None of the tools identified in this document are new inventions. The matrix, checklist, and dichotomous key format were developed by the US Fish and Wildlife Service (USFWS) Region 2 and the USDA Forest Service Region 3 for a programmatic ESA section 7 consultation on effects of grazing (USFWS, May 5, 1995). The matrix developed here reflects the information needed to implement the Aquatic Conservation Strategy (ACS)(appendix D) and to evaluate effects relative to the Northwest Forest Plan ACS Objectives, and the Ecological Goals in the Proposed Recovery Plan for Snake River Salmon (appendix D) and the LRMP consultation on the eight National Forests in Idaho and Oregon.

Using these tools, the Federal agencies and Non-Federal Parties (referred to as evaluators in the remainder of this document) can make determinations of effect for proposed projects (i.e. "no effect"/"may affect" and "may affect, not likely to adversely affect"/"may affect, likely to adversely affect"). As explained below, these determinations of effect will depend on whether a proposed action (or group of actions) hinders the attainment of relevant environmental conditions (identified in the matrix as pathways and indicators) and/or results in "take", as defined in ESA, section 3 (18) of a proposed or listed species.

Finally, this document was designed to be applied to a wide range of environmental conditions. This means it must be flexible. It also means that a certain degree of professional judgement will be required in its application. **There will be circumstances where the ranges of numerics or descriptions in the matrix simply do not apply to a specific watershed or basin. In such a case, the evaluator will need to provide more biologically appropriate values. When this occurs, documentation justifying these changes should be presented in the biological assessment, habitat conservation plan, or other appropriate document so that NMFS can use it in preparation of a section 7 consultation, habitat conservation plan, or other appropriate biologically based document.**

Description of the Matrix:

The "Matrix of Pathways and Indicators" (Table 1) is designed to summarize important environmental parameters and levels of condition for each. This matrix is divided into six overall pathways (major rows in the matrix):

-- Water Quality	-- Channel Condition and Dynamics
-- Habitat Access	-- Flow/Hydrology
-- Habitat Elements	-- Watershed Conditions

Each of the above represents a significant pathway by which actions can have potential effects on anadromous salmonids and their habitats. The pathways are further broken down into "indicators." Indicators are generally of two types: (1) Metrics that have associated numeric values (e.g. "six pools per mile"); and (2) descriptions (e.g. "adequate habitat refugia do not exist"). The purpose of having both types of indicators in the matrix is that numeric data are not always readily available for making determinations (or there are no reliable numeric indicators of the factor under consideration). In this case, a description of overall condition may be the only appropriate method available.

The columns in the matrix correspond to levels of condition of the indicator. There are three condition levels: "properly functioning," "at risk," and "not properly functioning." For each indicator, there is either a numeric value or range for a metric that describes the condition, a description of the condition, or both. When a numeric value and a description are combined in the same cell in the matrix, it is because accurate assessment of the indicator requires attention to both.

Description of the Checklist:

The "Checklist for Documenting Environmental Baseline and Effects of Proposed Action(s) on Relevant Indicators" (Table 2) is designed to be used in conjunction with the matrix. The checklist has six columns. The first three describe the condition of each indicator (which when taken together encompass the environmental baseline), and the second three describe the effects of the proposed action(s) on each indicator.

Description of the Dichotomous Key for Making ESA Determinations of Effect:

The "Dichotomous Key for Making ESA Determinations of Effect" (p. 15) is designed to guide determinations of effect for proposed actions that require a section 7 consultation or permit under Section 10 of the ESA. Once the matrix has been tailored (if necessary) to meet the needs of the evaluators, and the checklist has been filled out, the evaluators should use the key to help make their ESA determinations of effect.

How to Use the Matrix, Checklist, and Dichotomous Key

1) Group projects that are within a watershed.

2) Using the Matrix provided (or a version modified by the evaluator) **evaluate environmental baseline conditions** (mark on checklist), use all 6 pathways (identified in the matrix).

Matrix of Pathways and Indicators

Use to describe the Environmental Baseline Conditions

Water Quality, Habitat Access, Habitat Elements, Channel Condition and Dynamics, Flow/Hydrology, Watershed Condition

and

Then use the same Pathways and Indicators to evaluate the Proposed Projects

3) **Evaluate effects of the proposed action** using the matrix. Do they restore, maintain or degrade existing baseline conditions? Mark on checklist.

Mark Results on Checklist

4) Take the checklist you marked and the dichotomous key and answer the questions in the key **to reach a determination of effects.**

Checklist

Environmental Baseline			Effects of the Action		
Properly Funct.	At Risk	Not Properly Funct.	Maintain	Restore	Degrade

Use Professional Judgement

and the Checklist to

Work through the Dichotomous Key

Dichotomous Key

Yes/No

No Effect
May Effect
Not Likely to Adversely Affect
Likely to Adversely Affect

(Note: Actual Matrix is on page 9,10,& 11. Actual Checklist on page 13. Actual Dichotomous key on page 14)

DEFINITIONS OF ESA EFFECTS AND EXAMPLES

Definitions of Effects Thresholds

Following are definitions of ESA effects (sources in *italics*). The first three ("no effect," "may affect, not likely to adversely affect," and "may affect, likely to adversely affect") are not defined in the ESA or implementing regulations. However, "likely to jeopardize" is defined in the implementing regulations:

"No effect:"

This determination is only appropriate "if the proposed action will literally have no effect whatsoever on the species and/or critical habitat, not a small effect or an effect that is unlikely to occur." (From "*Common flaws in developing an effects determination*", Olympia Field Office, U.S. Fish and Wildlife Service). Furthermore, actions that result in a "beneficial effect" do not qualify as a no effect determination.

"May affect, not likely to adversely affect:"

"The appropriate conclusion when effects on the species or critical habitat are expected to be beneficial, discountable, or insignificant. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgement, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur." (From "*Draft Endangered Species Consultation Handbook; Procedures for Conducting Section 7 Consultations and Conferences*," USFWS/NMFS, 1994). The term "negligible" has been used in many ESA consultations involving anadromous fish in the Snake River basin. The definition of this term is the same as "insignificant."

"May affect, likely to adversely affect"

The appropriate conclusion when there is "more than a negligible potential to have adverse effects on the species or critical habitat" (*NMFS draft internal guidelines*). Unfortunately, there is no definition of adverse effects in the ESA or its implementing regulations. The draft Endangered Species Handbook (NMFS/USFWS, June 1994) provides this definition for "Is likely to adversely affect": "This conclusion is reached if any adverse effect to listed species or critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions. In the event the overall effect of the proposed action is beneficial to the listed species or critical habitat, but may also cause some adverse effects to individuals of the listed species or segments of the critical habitat, then the proposed action 'is likely to adversely affect' the listed species or critical habitat."

The following is a definition specific to anadromous salmonids developed by NMFS, the FS, and the BLM during the PACFISH consultation; "Adverse effects include short or long-term, direct or indirect management-related, impacts of an individual or cumulative nature such as mortality, reduced growth or other adverse physiological changes, harassment of fish, physical disturbance of redds, reduced reproductive success, delayed or premature migration, or other adverse behavioral changes to listed anadromous salmonids at any life stage. Adverse effects to designated critical habitat include effects to any of the essential features of critical habitat that would diminish the value of the habitat for the survival and recovery of listed anadromous salmonids" (From *NMFS' Pacfish Biological Opinion, 1/23/95*). Interpretation of part of the preceding quotation has been problematic. The statement "...impacts of an individual or cumulative nature..." has often been applied only to actions and impacts, not organisms. NMFS' concern with this definition is that it does not clearly state that the described impacts include those to individual eggs or fish. However, this definition is useful if it is applied on the individual level as well as on the subpopulation and population levels.

For the purposes of Section 7, any action which has more than a negligible potential to result in "take" (see definition at bottom of Dichotomous Key, p. 14 of this document) is likely to adversely affect a proposed/listed species. It is not possible for NMFS or USFWS to concur on a "not likely to adversely affect" determination if the proposed action will cause take of the listed species. Take can be authorized in the Incidental Take Statement of a Biological Opinion after the anticipated extent and amount of take has been described, and the effects of the take are analyzed with respect to jeopardizing the species or adversely modifying critical habitat. Take, as defined in the ESA, clearly applies to the individual level, thus actions that have more than a negligible potential to cause take of individual eggs and/or fish are "likely to adversely affect."

"Likely to jeopardize the continued existence of"

The regulations define jeopardy as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (*50 CFR §402.02*).

"Take"

The ESA (Section 3) defines take as "to harass, harm, pursue, hunt, shoot, wound, trap, capture, collect or attempt to engage in any such conduct". The USFWS further defines "harm" as "significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering", and "harass" as "actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering".

Examples of Effects Determinations

"No effect"

NMFS is encouraging evaluators to conference/consult at the watershed scale (i.e., on all proposed actions in a particular watershed) rather than on individual projects. Due to the strict definition of "no effect" (above), the interrelated nature of in-stream conditions and watershed conditions, and the watershed scale of these conferences, consultations, and activities "no effect" determinations for all actions in a watershed could be rare when proposed/listed species are present in or downstream from a given watershed. This is reflected in the dichotomous key, however the evaluator may identify some legitimate exceptions to this general rule.

Example:

The proposed project is in a watershed where available monitoring information indicates that in-stream habitat is in good functioning condition and riparian vegetation is at or near potential. The proposed activity will take place on stable soils and will not result in increased sediment production. No activity will take place in the riparian zone.

"May affect, not likely to adversely affect"

Example:

The proposed action is in a watershed where available monitoring information indicates that in-stream habitat is in good functioning condition and riparian vegetation is at or near potential. Past monitoring indicates that this type of action has led to the present condition (i.e., timely recovery has been achieved with the kind of management proposed in the action). Given available information, the potential for take to occur is negligible.

"May affect, likely to adversely affect"

Example:

The proposed action is in a watershed that has degraded baseline conditions such as excess fine sediment, high cobble embeddedness, or poor pool frequency/quality. If the action will further degrade any of these pathways, the determination is clearly "likely to adversely affect".

A less obvious example would be a proposed action in the same watershed that is designed to improve baseline conditions, such as road obliteration or culvert repair. Even though the intent is to improve the degraded conditions over the long-term, if any short-term impacts (such as temporary turbidity and sedimentation) will cause take (adverse effects), then the determination is "likely to adversely affect."

TABLE 1. MATRIX of PATHWAYS AND INDICATORS

(Remember, the ranges of criteria presented here are not absolute, they may be adjusted for unique watersheds. See p. 3)

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Water Quality:	Temperature	50-57° F[1]	57-60° (spawning) 57-64° (migration &rearing)[2]	> 60° (spawning) > 64° (migration & rearing)[2]
	Sediment/Turbidity	< 12% fines (<0.85mm) in gravel[3], turbidity low	12-17% (west-side)[3], 12-20% (east-side)[2], turbidity moderate	>17% (west-side)[3], >20% (east side)[2] fines at surface or depth in spawning habitat[2], turbidity high
	Chemical Contamination/ Nutrients	low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients, no CWA 303d designated reaches[5]	moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients, one CWA 303d designated reach[5]	high levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients, more than one CWA 303d designated reach[5]
Habitat Access:	Physical Barriers	any man-made barriers present in watershed allow upstream and downstream fish passage at all flows	any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows	any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows
Habitat Elements:	Substrate	dominant substrate is gravel or cobble (interstitial spaces clear), or embeddedness <20%[3]	gravel and cobble is subdominant, or if dominant, embeddedness 20-30%[3]	bedrock, sand, silt or small gravel dominant, or if gravel and cobble dominant, embeddedness >30%[2]
	Large Woody Debris	Coast: >80 pieces/mile >24"diameter >50 ft. length[4]; East-side: >20 pieces/ mile >12"diameter >35 ft. length[2]; and adequate sources of woody debris recruitment in riparian areas	currently meets standards for properly functioning, but lacks potential sources from riparian areas of woody debris recruitment to maintain that standard	does not meet standards for properly functioning and lacks potential large woody debris recruitment

	Pool Frequency channel width # pools/mile[6] 5 feet 184 10 " 96 15 " 70 20 " 56 25 " 47 50 " 26 75 " 23 100 " 18	meets pool frequency standards (left) and large woody debris recruitment standards for properly functioning habitat (above)	meets pool frequency standards but large woody debris recruitment inadequate to maintain pools over time	does not meet pool frequency standards
	Pool Quality	pools >1 meter deep (holding pools) with good cover and cool water[3], minor reduction of pool volume by fine sediment	few deeper pools (>1 meter) present or inadequate cover/temperature[3], moderate reduction of pool volume by fine sediment	no deep pools (>1 meter) and inadequate cover/temperature[3], major reduction of pool volume by fine sediment
	Off-channel Habitat	backwaters with cover, and low energy off-channel areas (ponds, oxbows, etc.)[3]	some backwaters and high energy side channels[3]	few or no backwaters, no off-channel ponds[3]
	Refugia (important remnant habitat for sensitive aquatic species)	habitat refugia exist and are adequately buffered (e.g., by intact riparian reserves); existing refugia are sufficient in size, number and connectivity to maintain viable populations or sub-populations[7]	habitat refugia exist but are not adequately buffered (e.g., by intact riparian reserves); existing refugia are insufficient in size, number and connectivity to maintain viable populations or sub-populations[7]	adequate habitat refugia do not exist[7]
Channel Condition & Dynamics:	Width/Depth Ratio	<10[2,4]	10-12 (we are unaware of any criteria to reference)	>12 (we are unaware of any criteria to reference)
	Streambank Condition	>90% stable; i.e., on average, less than 10% of banks are actively eroding[2]	80-90% stable	<80% stable
	Floodplain Connectivity	off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	severe reduction in hydrologic connectivity between off-channel, wetland, floodplain and riparian areas; wetland extent drastically reduced and riparian vegetation/succession altered significantly

Flow/Hydrology:	Change in Peak/ Base Flows	watershed hydrograph indicates peak flow, base flow and flow timing characteristics comparable to an undisturbed watershed of similar size, geology and geography	some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	pronounced changes in peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography
	Increase in Drainage Network	zero or minimum increases in drainage network density due to roads[8,9]	moderate increases in drainage network density due to roads (e.g., 5%)[8,9]	significant increases in drainage network density due to roads (e.g., 20-25%)[8,9]
Watershed Conditions:	Road Density & Location	<2 mi/mi^2[11], no valley bottom roads	2-3 mi/mi^2, some valley bottom roads	>3 mi/mi^2, many valley bottom roads
	Disturbance History	<15% ECA (entire watershed) with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area (except AMAs), 15% retention of LSOG in watershed[10]	<15% ECA (entire watershed) but disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area (except AMAs), 15% retention of LSOG in watershed[10]	>15% ECA (entire watershed) and disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; does not meet NWFP standard for LSOG retention
	Riparian Reserves	the riparian reserve system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in all subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% intact),and/or for grazing impacts: percent similarity of riparian vegetation to the potential natural community/ composition >50%[12]	moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian reserve system, or incomplete protection of habitats and refugia for sensitive aquatic species (70-80% intact), and/or for grazing impacts: percent similarity of riparian vegetation to the potential natural community/composition 25-50% or better[12]	riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia for sensitive aquatic species (<70% intact), and/or for grazing impacts: percent similarity of riparian vegetation to the potential natural community/composition <25%[12]

[1] Bjornn, T.C. and D.W. Reiser, 1991. Habitat Requirements of Salmonids in Streams. American Fisheries Society Special Publication 19:83-138. Meehan, W.R., ed.

[2] Biological Opinion on Land and Resource Management Plans for the: Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests. March 1, 1995.

[3] Washington Timber/Fish Wildlife Cooperative Monitoring Evaluation and Research Committee, 1993. Watershed Analysis Manual (Version 2.0). Washington Department of Natural Resources.

[4] Biological Opinion on Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH). National Marine Fisheries Service, Northwest Region, January 23, 1995.

[5] A Federal Agency Guide for Pilot Watershed Analysis (Version 1.2), 1994.

[6] USDA Forest Service, 1994. Section 7 Fish Habitat Monitoring Protocol for the Upper Columbia River Basin.

[7] Frissell, C.A., Liss, W.J., and David Bayles, 1993. An Integrated Biophysical Strategy for Ecological Restoration of Large Watersheds. Proceedings from the Symposium on

Changing Roles in Water Resources Management and Policy, June 27-30, 1993 (American Water Resources Association), p. 449-456.

[8] Wemple, B.C., 1994. Hydrologic Integration of Forest Roads with Stream Networks in Two Basins, Western Cascades, Oregon. M.S. Thesis, Geosciences Department, Oregon State University.

[9] e.g., see Elk River Watershed Analysis Report, 1995. Siskiyou National Forest, Oregon.

[10] Northwest Forest Plan, 1994. Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service and USDI Bureau of Land Management.

[11] USDA Forest Service, 1993. Determining the Risk of Cumulative Watershed Effects Resulting from Multiple Activities.

[12] Winward, A.H., 1989 Ecological Status of Vegetation as a base for Multiple Product Management. Abstracts 42nd annual meeting, Society for Range Management, Billings MT, Denver CO: Society For Range Management: p277.

TABLE 2. CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS OF PROPOSED ACTION(S) ON RELEVANT INDICATORS

PATHWAYS: INDICATORS	ENVIRONMENTAL BASELINE			EFFECTS OF THE ACTION(S)		
	Properly Functioning[1]	At Risk[1]	Not Propr. Functioning[1]	Restore[2]	. . Maintain[3]	Degrade[4]
Water Quality: Temperature						
Sediment						
Chem. Contam./Nut.						
Habitat Access: Physical Barriers						
Habitat Elements: Substrate						
Large Woody Debris						
Pool Frequency						
Pool Quality						
Off-channel Habitat						
Refugia						
Channel Cond. & Dyn: Width/Depth Ratio						
Streambank Cond.						
Floodplain Connectivity						
Flow/Hydrology: Peak/Base Flows						
Drainage Network Increase						
Watershed Conditions: Road Dens. & Loc.						
Disturbance History						
Riparian Reserves						

Watershed Name: __________ Location: __________

1 These three categories of function ("properly functioning", "at risk", and "not properly functioning") are defined for each indicator in the "Matrix of Pathways and Indicators" (Table 1 on p. 10).

2 For the purposes of this checklist, "restore" means to change the function of an "at risk" indicator to "properly functioning", or to change the function of a "not properly functioning" indicator to "at risk" or "properly functioning" (i.e., it does not apply to "properly functioning" indicators).

3 For the purposes of this checklist, "maintain" means that the function of an indicator does not change (i.e., it applies to all indicators regardless of functional level).

4 For the purposes of this checklist, "degrade" means to change the function of an indicator for the worse (i.e., it applies to all indicators regardless of functional level). In some cases, a "not properly functioning" indicator may be further worsened, and this should be noted.

FIGURE 1. DICHOTOMOUS KEY FOR MAKING ESA DETERMINATION OF EFFECTS

1. Are there any proposed/listed anadromous salmonids and/or proposed/designated critical habitat in the watershed or downstream from the watershed?

   NO . . . . No effect

   YES . . . . May affect, go to 2

2. Does the proposed action(s) have the potential to hinder attainment of relevant properly functioning indicators (from table 2)?

   YES . . . . Likely to adversely affect

   NO . . . . Go to 3

3. Does the proposed action(s) have the potential to result in "take"[1] of proposed/listed anadromous salmonids or destruction/adverse modification of proposed/designated critical habitat?

   A. There is a negligible (extremely low) probability of take of proposed/listed anadromous salmonids or destruction/adverse modification of habitat . . . . Not likely to adversely affect

   B. There is more than a negligible probability of take of proposed/listed anadromous salmonids or destruction/adverse modification of habitat. . . . Likely to adversely affect

[1] "Take" - The ESA (Section 3) defines take as "to harass, harm, pursue, hunt, shoot, wound, trap, capture, collect or attempt to engage in any such conduct". The USFWS (USFWS, 1994) further defines "harm" as "significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering", and "harass" as "actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering".

Appendix A
Overview of Some Key Habitat Elements and Activities Affecting Them

The following are excerpts from A Coarse Screening Process For Potential Application in ESA Consultations (CRITFC, 1994). The excerpts are intended to stimulate the biologist's thought processes into evaluating all of the pathways through which habitat degradation could occur. Unfortunately this is not an all inclusive list. However, it is a start. We recommend that biologists review the entire "Coarse Screening" document and any other documents that are available to them. The "Coarse screening" document is available from The National Marine Fisheries Service, Portland, Oregon. We also highly recommend reviewing a report prepared by ManTech Environmental Research Services Corporation while under contract to the National Marine Fisheries Service (NMFS), Environmental Protection Agency and US Fish and Wildlife Service. The document is entitled "An Ecosystem Approach to Salmonid Conservation". This document is also available from the NMFS in Portland, Oregon.

Channel Substrate:
"Salmon survival and production are reduced as fine sediment increases, producing multiple negative impacts on salmon at several life stages. Increased fine sediment entombs incubating salmon in redds, reduces egg survival by reducing oxygen flow,
alters the food web, reduces pool volumes for adult and juvenile salmon, and reduces the availability of rearing space for juveniles rendering them more susceptible to predation. Reduced survival-to-emergence (STE) for salmon caused by elevated fine sediment increases is of particular concern because it is a source of density-independent mortality that can have extremely significant negative effects on salmon populations even at low seeding.

The rearing capacity of salmon habitat is decreased as cobble embeddedness levels increase. Overwinter rearing habitat may be a major limiting factor to salmon production and survival. The loss of overwintering habitat may result in increased levels of mortality during rearing life stages."

Channel Morphology
"Available data indicate that the production of salmon is reduced as pool frequency and volume decrease. Large pools are required by salmon during rearing, spawning, and migration. Pools provide thermal refugia, velocity refugia during storm events, resting habitat for migrating salmon, and important rearing habitat for juvenile salmon."

"Fine sediment is deposited in pools during waning flows. Residual pool volume is the volume of a pool not filled by fine sediment accumulations. Fine sediment volumes in pools reduce pool quality and reduce residual pool volumes (the pool volume available for salmon use)."

"Available data indicate that salmon production increases as Large Woody Debris (LWD) increases. LWD provides cover, velocity refugia, and plays a vital role in pool formation and the maintenance of channel complexity required by salmon in natal habitat. LWD also aids in reducing channel erosion and buffering sediment inputs by providing sediment storage in headwater streams."

Bank Stability

"Bank stability is of prime importance in maintaining habitat conditions favoring salmon survival. Bank instability increases channel erosion that can lead to increased levels of fine sediment and the in-filling of pools. Unstable banks can lead to stream incisement that can reduce baseflow contributions from groundwater and increase water temperature. Bank instability can cause channel widening that can significantly exacerbate seasonal water temperature extremes and destabilize LWD."

Water Temperature

"Available information indicates that the elevation of summer water temperatures impairs salmon production at scales ranging from the reach to the stream network and puts fish at greater risk through a variety of effects that operate at scales ranging from the individual organism to the aquatic community level. Maximum summer water temperatures in excess of 60°F impair salmon production. However, many smaller streams naturally have much lower temperatures and these conditions are critical to maintaining downstream water temperatures. At the stream system level, elevated water temperatures reduce the area of usable habitat during the summer and can render the most potentially productive and structurally complex habitats unusable. Decreases in winter water temperatures also put salmon at additional risk. The loss of vegetative shading is the predominant cause of anthropogenically elevated summer water temperature. Channel widening and reduced baseflows exacerbate seasonal water temperature extremes. Elevated summer water temperatures also reduce the diversity of coldwater fish assemblages."

Water Quantity and Timing

"The frequency and magnitude of stream discharge strongly influence substrate and channel morphology conditions, as well as the amount of available spawning and rearing area for salmon. Increased peak flows can cause redd scouring, channel widening, stream incisement, increased sedimentation. Lower streamflows are more susceptible to seasonal temperature extremes in both winter and summer. The dewatering of reaches can block salmon passage."

<u>Some Major Activities and their Effects</u>

Logging

Regional differences in climate, geomorphology, soils, and vegetation may greatly influence timber harvest effects on streams of a given size. However, some broad generalizations can be made on how timber harvest affects the hydrologic cycle, sediment input, and channel morphology of streams:

1. Hydrologic cycle. Timber harvest often alters normal streamflow patterns, particularly the volume of peak flows (maximum volume of water in the stream) and base flows (the volume of water in the stream representing the groundwater contribution). The degree these parameters change depend on the percentage of total tree cover removed from the watershed and the amount of soil disturbance caused by the harvest, among other things. For example, if harvest activities remove a high percentage of tree cover and cause light soil disturbance and compaction, rain falling on the soil will infiltrate normally. However, due to the loss of tree cover, evapotranspiration (the loss of water by plants to the atmosphere) will be much lower than before. Thus, the combination of normal water infiltration into the soil and greatly decreased uptake and loss of water by the tree cover results in substantially higher, sustained streamflows. Hence, this type of harvest results in higher base flows during dry times of the year when evapotranspiration is high, but does not greatly affect peak flows during wet times of the year because infiltration has not decreased and evapotranspiration is low. On the other hand, if the harvest activities cause high soil disturbance and compaction, little rainfall will be able to penetrate the soil and recharge groundwater. This results in higher surface runoff and equal or slightly higher base flows during dry times of the year. During wet times of the year, the compacted soils deliver high amounts of surface runoff, substantially increasing peak flows. In general, timber harvest on a watershed-wide scale results in water moving more quickly through the watershed (i.e., higher runoff rates, higher peak and base flows) because of decreased soil infiltration and evapotranspiration. This greatly simplified model only partly illustrates the complex hydrologic responses to timber harvest (Chamberlain et al. 1991, Gordon et al. 1992).

2. Sediment input. Timber harvest activities such as road-building and use, skidding logs, clear-cutting, and burning increase the amount of bare compacted soil exposed to rainfall and runoff, resulting in higher rates of surface erosion. Some of this hillside sediment reaches streams via roads, skid trails, and/or ditches (Chamberlain et al. 1991). Appropriate management precautions such as avoiding timber harvest in very wet seasons, maintaining buffer zones below open slopes, and skidding over snow can decrease the amount of surface erosion (Packer 1967). Harvest activities can also greatly increase the likelihood of mass soil movements occurring, particularly along roads and on clear-cuts in steep terrain (Furniss et al. 1991, O'Loughlin 1972). Increased surface erosion and mass soil movements associated with timber harvest areas can result in an increase in sediment input to streams. Fine sediment may infiltrate into relatively clean streambed gravels or, if the supply of fine sediment is large, settle deeper into the streambed (Chamberlain et al. 1991).

3. Stream channel morphology. The hydrologic and sedimentation changes discussed above can influence a stream's morphology in many ways. Substantial increases in the volume and frequency of peak flows can cause streambed scour and bank erosion. A large sediment supply may cause aggradation of the stream channel, pool filling, and a reduction in gravel quality (Madej 1982). Streambank destabilization from vegetation removal, physical breakdown, or channel aggradation adds to sediment supply and generally results in a loss of stream channel complexity (Scrivener 1988). In addition, losses of in-stream large woody debris supplies (i.e., removal of riparian trees) also result in less channel complexity as wood-associated scour pools decrease in size and disappear (Chamberlain et al. 1991).

Roads
"Roads are one of the greatest sources of habitat degradation. Roads significantly elevate on-site erosion and sediment delivery, disrupt subsurface flows essential to the maintenance of baseflows, and can contribute to increased peak flows. Roads within riparian zones reduce shading and disrupt LWD sources for the life of the road. These effects degrade habitat by increasing fine sediment levels, reducing pool volumes, increasing channel width and exacerbating seasonal temperature extremes."

Grazing
The impacts of livestock grazing to stream habitat and fish populations can be separated into acute and chronic effects. Acute effects are those which contribute to the immediate loss of individual fish, and loss of specific habitat features (undercut banks, spawning beds, etc.) or localized reductions in habitat quality (sedimentation, loss of riparian vegetation, etc.). Chronic effects are those which, over a period of time, result in loss or reductions of entire populations of fish, or widespread reductions in habitat quantity and/or quality.

Acute Effects
Acute effects to habitat include compacting stream substrates, collapse of undercut banks, destabilized streambanks and localized reduction or removal of herbaceous and woody vegetation along streambanks and within riparian areas (Platts 1991). Increased levels of sediment can result through the resuspension of material within existing stream channels as well as increased contributions of sediment from adjacent streambanks and riparian areas. Impacts to stream and riparian areas resulting from grazing are dependent on the intensity, duration, and timing of grazing activities (Platts 1989) as well as the capacity of a given watershed to assimilate imposed activities, and the pre-activity condition of the watershed (Odum 1981).

Chronic Effects
Chronic effects of grazing result when upland and riparian areas are exposed to activity and disturbance levels that exceed assimilative abilities of a given watershed. Both direct and indirect fish mortality are possible, and the potential for mortality extends to all life cycle phases. As an example, following decades of high intensity season-long grazing on BLM lands in the Trout Creek Mountains of southeast Oregon, the Whitehorse Creek watershed had extensive areas of degraded upland and riparian habitat (BLM 1992). An extreme rain-on-snow event in late winter 1984 and subsequent flooding of area streams flushed adult and juvenile trout through area streams and into Whitehorse Ranch fields and the adjacent desert.

Although less extreme, increases in stream temperature and reduced allochthonous inputs following removal of riparian vegetation, increased sedimentation, and decreased water storage capacity work together to reduce the health and vigor of stream biotic communities (Armour et al. 1991, Platts 1991, Chaney et al. 1990). Increased sediment loads reduce primary production in streams. Reduced instream plant growth and riparian vegetation limits populations of terrestrial and aquatic insects. Persistent degraded conditions adversely influence resident fish populations (Meehan 1991).

Mining
"Mining activities can cause significant increases in sediment delivery. While mining may not be as geographically pervasive as other sediment-producing activities, surface mining typically increases sediment delivery much more per unit of disturbed area than other activities (Dunne and Leopold, 1978; USFS, 1980; Richards, 1982; Nelson et al. 1991) due to the level of disruption of soils, topography, and vegetation. Relatively small amounts of mining can increase sediment delivery significantly."

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Appendix B
Species Narrative

Umpqua River Sea-Run Cutthroat Trout (*Oncorhynchus clarki*)

Endangered Species Act Status: Proposed Endangered, July 8, 1994, Umpqua River Basin, in Southwestern Oregon. All life forms are included in this proposal.

Description. Sea-run cutthroat trout is a profusely spotted fish which often has red or sometimes orange slash marks on each side of the lower jaw. Coastal sea-run cutthroat trout often lose the cutthroat marks when in seawater. Some other trouts, such as Apache trout, Gila trout and Redband trout may also have yellowish or red slash marks. Other identifying marks include; the presence of basibranchial teeth, located on the basibranchial plate behind the tongue. The upper jaw is typically more than half the length of the head with the eye being well forward of the back of the maxilla.

The spots on cutthroat trout are small to medium, irregularly shaped, dispersed evenly over the entire body including the belly and anal fin. Coloration of sea-run fish is often silvery with a slight yellow tint. This silver coloration often masks the spots. Sea-run fish darken and take on spots after a period in freshwater. Freshwater fish are often more colorful with pale yellow colors on the body and red-orange or yellow on the lower fins. The gill plates sides and ventral areas may tinted a rosy color as spawning time draws nearer (description from Stolz and Schnell, 1991).

Distribution. Coastal cutthroat trout range from northern California to the Gulf of Alaska. The distribution of the proposed Umpqua River Sea-run cutthroat trout is the greater Umpqua River Basin located in Douglas County in southwestern Oregon. The Umpqua River Basin stretches from the Cascade Mountains in the east to the Pacific Ocean at Reedsport, Oregon. The drainages of the North and South Umpqua Rivers together make up about 2/3 of the greater Basin drainage, and each river is about 170 km long. The mainstem Umpqua River flows in a northwesterly direction another 180 km to the ocean. Together, the three rivers form one of the longest coastal basins in Oregon, approximately 340 km in length, with a drainage area of over 12,200 sq. km. Major tributaries of the mainstem Umpqua River include Calapooya (River Kilometer [RKm] 164), Elk (RKm 78), and Scholfield Creeks (Rkm 18) and the Smith River (Rkm 18). The estuary of the Umpqua River is one of largest on the Oregon coast and has a large seawater wedge that extends as far inland as Scottsburg, Oregon at Rkm 45. (From Status Review For Oregon's Umpqua River Sea-Run Cutthroat Trout, Johnson et al. 1994)

Life Forms
Sea-Run (anadromous) cutthroat trout

Cutthroat trout have evolved to exploit habitats least preferred by other salmonid species

(Johnston 1981). Unlike other anadromous salmonids, sea-run cutthroat trout do not over-winter in the ocean and only rarely make long extended migrations across large bodies of water. They migrate in the near-shore marine habitat and usually remain within 10 km of land (Sumner 1972, Giger 1972, Jones 1976, Johnston 1981). While most anadromous cutthroat trout enter seawater as 2- or 3-year-olds, some may remain in fresh water for up to 5 years before entering the sea (Sumner 1972, Giger 1972).

Resident (nonmigratory) cutthroat trout

Some cutthroat trout do not migrate long distances; instead, they remain in upper tributaries near spawning and rearing areas and maintain small home territories (Trotter 1989). Resident cutthroat trout have been observed in the upper Umpqua River drainage (Roth 1937, FCO and OSGC 1946 , ODFW 1993a)

During a radio tagging study Waters (1993) found that fish smaller than 180mm maintained home ranges of less than 14m of stream length and moved about an average of 27m during the study. Fish larger than 180mm had home ranges of about 76m and moved and average total distance of about 166m. This study was conducted in three tributaries of Rock Creek on the North Umpqua River drainage. (In Johnson et al. 1994)

River-Migrating (Potamodromous) cutthroat trout

Some cutthroat trout move within large river basins but do not migrate to the sea.

Life History/Migration.
The following descriptions are condensed from status review (Johnson et al. 1994)

Cutthroat trout spawning occurs between December and May and eggs begin to hatch within 6-7 weeks of spawning, depending on temperature. Alevins remain in the redds for a further few weeks and emerge as fry between March and June, with peak emergence in mid-April (Giger 1972, Scott and Crossman 1973). Newly emerged fry are about 25 mm long. They prefer low velocity margins, backwaters, and side channels, gradually moving into pools if competing species are absent. If coho fry are present they will drive the smaller cutthroat fry into riffles, where they will remain until decreasing water temperatures reduce the assertiveness of the coho fry (Stolz and Schnell, 1991). In winter , cutthroat trout go to pools near log jams or overhanging banks (Bustrad and Narver 1975).

Parr Movements
After emergence from redds, cutthroat trout juveniles generally remain in upper tributaries until they are 1 year of age, when they may begin extensive movement up and down streams.

Directed downstream movement by parr usually begins with the first spring rains (Giger 1972) but has been documented in every month of the year (Sumner 1953, 1962, 1972; Giger 1972; Moring and Lantz 1975; Johnston and Mercer 1976; Johnston 1981). As an example, from 1960 to 1963 (Lowry 1965) and from 1966 to 1970 (Giger 1972) in the Alsea River drainage, large downstream migrations of juvenile fish began in mid-April with peak movement in mid-May. Some juveniles (parr) even entered the estuary and remained there over the summer, although they did not smolt nor migrate to the open ocean (Giger 1972). In Oregon, upstream movement of juveniles from estuaries and mainstem to tributaries begins with the onset of winter freshets during November, December, and January (Giger 1972, Moring and Lantz 1975). At this time, these 1-year and older juvenile fish averaged less than 200 mm in length.

Smoltification

Time of initial seawater entry of smolts bound for the ocean varies by locality and may be related to marine conditions or food sources (Lowry 1965, 1966; Giger 1972; Johnston and Mercer 1976; Trotter 1989). In Washington and Oregon, entry begins as early as March, peaks in mid-May, and is essentially over by mid-June (Sumner 1953, 1972; Lowry 1965; Giger 1972; Moring and Lantz 1975; Johnston 1981). Seaward migration of smolts to protected areas appears to occur at an earlier age and a smaller size than to more exposed areas. On the less protected Oregon coast, cutthroat trout tend to migrate at an older age (age 3 and 4) and at a size of 200 to 255 mm (Lowry 1965, 1966; Giger 1972).

Timing of smolt migrations in the Umpqua River

Trap data from seven locations in the North Umpqua River in 1958 and from three locations in Steamboat Creek (a tributary of the North Umpqua River downstream of Soda Springs Dam) between 1958 and 1973 indicate that juvenile movement is similar to that reported by Lowry (1965) and Giger (1972) in other Oregon coastal rivers. Movement peaked in May and June, with a sharp decline in July, although some juveniles continued to be trapped through September and October. It is unknown whether Umpqua River cutthroat trout juveniles migrate from the upper basin areas to the estuary, but it seems unlikely considering the distance (well over 185 km) and the river conditions (average August river temperature at Winchester Dam (located on the main Umpqua River where the Interstate 5 highway crosses the Umpqua) since 1957 is 23.3° C) (ODFW 1993a).

Estuary and Ocean Migration

Migratory patterns of sea-run cutthroat trout differ from Pacific salmon in two major ways: few, if any, cutthroat overwinter in the ocean, and the fish do not usually make long open-ocean migrations, although they may travel considerable distances along the shoreline (Johnston 1981, Trotter 1989, Pauley et al. 1989). Studies by Giger (1972) and Jones (1973, 1974, 1975) indicated that cutthroat trout, whether initial or seasoned migrants, remained at sea an average of only 91 days, with a range of 5 to 158 days.

Adult Freshwater Migrations

In the Umpqua River, it is reported (ODFW 1993a) that cutthroat trout historically began upstream migrations in late June and continued to return through January with bimodal peaks in late-July and October. Giger (1972) reported a similar return pattern, but with slightly later modal peaks (mid-August and late-October to mid-November) on the Alsea River.

Spawning/Rearing

Cutthroat trout generally spawn in the tails of pools located in small tributaries at the upper limit of spawning and rearing sites of coho salmon and steelhead. Streams conditions are typically low stream gradient and low flows, usually less than 0.3 m^3/second during the summer (Johnston 1981). Spawn timing varies among streams, but generally occurs between December and May, with a peak in February (Trotter 1989).

Cutthroat trout are iteroparous and have been documented to spawn each year for at least 5 years (Giger 1972), although some cutthroat trout do not spawn every year (Giger 1972) and some do not return to seawater after spawning, but remain in fresh water for at least a year (Giger 1972, Tomasson 1978). Spawners may experience high post-spawning mortality due to weight loss of as much as 38% of pre-spawning mass (Sumner 1953) and other factors (Cramer 1940, Sumner 1953, Giger 1972, Scott and Crossman 1973).

Food.

In streams cutthroat trout feed mainly on terrestrial and aquatic insects that come to them in the drift. When in the marine environment cutthroat trout feed around gravel beaches, off the mouths of small creeks and beach trickles, around oyster beds and patches of eel grass. They primarily feed on amphipods, isopods, shrimp, stickleback, sand lance and other small fishes. (Stolz and Schnell, 1991)

Additional Information

Much of what is presented here was take from two sources. They are the Status Review for Oregon's Umpqua River Sea-Run Cutthroat Trout, June 1994, available from the National Marine Fisheries Service, Northwest Fisheries Science Center, Coastal Zone and Estuarine Studies Division, 2725 Montlake BLVD. E., Seattle, WA 98112-2097 and the book The Wildlife Series, Trout, Edited by Judith Stolz and Judith Schnell, Stackpole Books, Cameron and Kelker Streets, P.O. Box 1831, Harrisburg, PA 17105 (ISBN number 0-8117-1652-X). Both documents contain a lot more information for those that are interested.

Appendix C

A comparison between ACS Objectives, Ecological Goals, and the pathways and indicators used in the effects matrix.

Aquatic Conservation Strategy Objectives - Northwest Forest Plan	Ecological Goals - Snake River Recovery Plan/ LRMP	Pathways / Indicators
2,4,8,9	2,5,9,10	Water Quality / Temperature
4,5,6,8,9	5,6,7,9,10	Water Quality/Sediment./Turbidity.
2,4,8,9	2,5,9,10	Water Quality/Chemical Concentration/Nutrients
2,6,9	2,7,10	Habitat Access/ Physical Barriers
3,5,8,9	3,6,9,10	Habitat Elements/Substrate
3,6,8,9	3,4,7,9,10	Habitat Elements/Large Woody Debris
3,8,9	3,4,9,10	Habitat Elements/Pool Frequency
3,5,6,9	3,4,6,7,10	Habitat Elements/Pool Quality
1,2,3,6,8,9	1,2,3,7,9,10	Habitat Elements/Off-Channel Habitat
1,2,9	1,2,10	Habitat Elements/Refugia
3,8,9	3,9,10	Channel Condition/Dynamics/Width/Depth Ratio
3,8,9	3,9,10	Channel Condition/Dynamics/Streambank Condition
1,2,3,6,7,8,9	1,2,3,7,8,9,10	Channel Condition/Dynamics/Floodplain Connectivity.
5,6,7	6,7,8	Flow/Hydrology/Change in Peak/Base Flow
2,5,6,7	2,6,7,8	Flow/Hydrology/Increase in Drainage Network
1,3,5	1,3,6	Watershed Conditions/Road Density & Location
1,5	1,6	Watershed Conditions/Disturbance History
1,2,3,4,5,8,9	1,2,3,4,5,6,9,10	Watershed Conditions/Riparian Reserves

Appendix D
ACS Objectives and Ecological Goals

ACS Objectives

Forest Service and BLM-administered lands within the range of the northern spotted owl will be managed to:

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Ecological Goals

NMFS restated, refined, and expanded the PACFISH goals to provide added detail on ecological function needed for listed salmon and to include landscape and habitat connectivity perspectives. These goals provide consistency with NMFS' basin-wide Ecological Goals for all Federal land management agencies contained in the Proposed Recovery Plan for Snake River Salmon. Consistency with these goals will help NMFS determine whether land management actions avoid jeopardy or adverse modification of critical habitat during watershed-scale and project-scale consultations. However, although consistency with the goals and their associated guidelines generally is necessary to achieve informal concurrence under section 7 of the Endangered Species Act, concurrence cannot be guaranteed since the goals and other guidance were not structured to eliminate short-term adverse effects. Also, some of the guidelines (particularly with regard to grazing, mining, and how to proceed following watershed analysis) are not specific enough to eliminate the requirement for project-specific interpretation and analysis. The goals and guidelines described below do not include NMFS' long-term expectations for the eastside environmental impact statements. The Ecological Goals are as follows:

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

4. Maintain and restore timing, volume and distribution of large woody debris (LWD) recruitment by protecting trees in riparian habitat conservation areas. Addition of LWD to streams is inappropriate unless the causes of LWD deficiency are understood and ameliorated.

5. Maintain and restore the water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival,

growth, reproduction, and migration of individuals composing aquatic and riparian communities.

6. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

7. Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats, retain patterns of sediment, nutrient, and wood routing, and optimize the essential features of designated critical habitat. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows should be maintained, where optimum, and restored, where not optimum.

8. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

9. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

10. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

City of Bellingham

Wildlife and Habitat Assessment

an inventory of existing conditions and background information

and

Wildlife Habitat Plan

December 1995

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EXECUTIVE SUMMARY

PART I INTRODUCTION

Identifying wildlife species and wildlife habitat in the City of Bellingham is an initial step in achieving the goals about preserving wildlife as stated in the 1995 City of Bellingham Comprehensive Plan (see Section IX). The 1993 County-Wide Planning Policies include recommendations regarding protection of wildlife and reiterate such goals. The origin, however, of goals and policies about wildlife protection lies in the Growth Management Act (GMA) of 1990. This plan, the Bellingham Wildlife and Habitat Assessment, is a result of GMA requirements as well as the goals and policies described in the CWPP, the Comprehensive Plan, and the 1994 Open Space, Parks, and Recreation Plan.

It is proposed that this document serve as the primary source of information for wildlife planning and preliminary critical wildlife and habitat inventory. The recommendations included in this report are provided for consideration by City staff and elected officials and do not represent the policies or views of the City.

In The Plan
This report addresses wildlife and wildlife habitat. Wildlife includes fish, amphibians, and reptiles, birds, and mammals found either seasonally or year around in the City of Bellingham. Wildlife habitat is combination of environmental components with which a species is associated during any part of its life cycle.

Contained in this report are three principle elements: 1) information on planning for wildlife protection and applicable regulations, 2) a preliminary inventory of wildlife species and habitats and the status of wildlife, city-wide, and 3) recommendations for wildlife and habitat management, enhancement, restoration, and protection within the City.

Scope
The scope of this report encompasses 1) planning considerations for wildlife conservation and management including a discussion of wildlife survival requirements, biodiversity, wildlife law, conservation programs, habitat identification and function, and growth management; 2) an inventory of critical wildlife areas in eh City, and 3) recommendations for local application of the technical information provided.

Purpose
The purpose of this report is to provide planners with the information and methodology necessary for identifying and protection locally significant wildlife and habitat as stated in the 1990 GMA. It is one of the factors used along with other growth management considerations in order to achieve the goals stated in local planning documents. The report may be used as a basis for adopting policies for protection of critical wildlife and habitat areas or used for development of regulations.

Study Area
The study area is located within the City of Bellingham boundaries, situated in Whatcom County at the northwest corner of Washington State. The approximately 14,720 acres area consists of an urban core adjacent to Bellingham Bay, immediately surrounded by residential, commercial and light industrial land uses. The City's outer fringe area consists of the same uses to the north and a mix of residential, park and rural forest to the east and south. Bellingham is a growing community with a population of over 52,000 (1995 data).

PART II PLANNING FOR WILDLIFE

Filling the Information Gap
For the most part, wildlife concerns have been given secondary status, and considered only as an afterthought in the planning process. In part, this lack of consideration is due to the deficiency of site-specific species and habitat information. It is also due to the lack of impetus to seek the needed data for this application. This lack of empirical data is not a local phenomena; there is no systematic fish and wildlife species or habitat inventory for the Puget Sound region or any county therein. Even the State Environmental Policy Act (SEPA) ? discourages inventories of species as part of the environmental impact study.

Generally, the state-identified threatened and endangered species are the primary group given consideration and in many cases, only if their presence in the area has been previously established. This informational gap has created a planning vacuum; it is impossible to consider plant and animal communities in the planning process when the individuals and the dynamics of those natural communities have yet to be identified. Determining impacts on local wildlife and habitat has been for the most part ignored or based on inadequate information.

Effects of Urbanization
To further appreciate the plight of local wildlife, it is essential to consider the pressures and negative effects of urbanization on these populations. Virtually

every land use affects wildlife and its habitat. As biological organisms, wildlife, like humans, suffer from air, water, ground and noise pollution. Lacking the artificial filtration and treatment of air and water or protective structures and standardized transportation humans enjoy, wildlife are exposed directly to toxic runoff, pesticides, sedimentation, barriers, and the alteration or removal of habitat. Human disturbance is another impact deserving priority consideration, particularly relating to parks, recreation and residential development.

Ecosystem Approach
Locally, we are faced with the challenge of identifying, retaining and maintaining the present ecological diversity of Bellingham and its surrounding area. Managing for a list of "critical species" and protecting their associated habitat will assist in maintaining the present diversity locally, but will not guarantee it. The question remains, how do we protect and perpetuate whole wildlife communities to maintain the present ecological diversity?

Considering an ecosystem approach in landuse planning is a start. Utilizing watersheds as planning units is a valuable tool for landscape planning, habitat protection and monitoring. In order to take advantage of these, the wildlife and habitat inventory section of this report (Part V) has been organized by watershed. Developing baseline species and habitat information will provide the starting point from which populations may be monitored. Applying the criteria and guidelines presented to identify and protect a habitat network will greatly increase the probability of maintaining current populations and distribution of native wildlife.

The GMA directs each jurisdiction to protect biodiversity and stipulates the need to consider habitat connectivity across the landscape. In addition, it emphasizes the protection of riparian ecosystems, the restoration of salmonid habitat and maintaining larger habitat blocks and open space. Applying these two objectives at a landscape level results in a potentially functional habitat matrix or network. Such a network would combine natural corridors such as streams, valleys and ridges with a variety of large functional habitat reserves. A properly designed and permanently protected City-wide habitat network holds the potential for meeting all the requirements set forth in the GMA and perpetuating our local indigenous wildlife diversity well into the next century. ESA — Shorelines

Planning for wildlife at the local level presents new challenges. Adoption of wildlife planning policies and guidelines are needed to successfully protect native wildlife populations. Such policies as directed by the GMA will require that the local community and its government acknowledge wildlife as a priority public resource. In addition, there is the need for understanding and application of complex technical considerations, and a financial commitment to carry out the necessary actions to ensure a place for wildlife in Bellingham over time.

PART III HISTORICAL PERSPECTIVE

A Changing Landscape

Beginning in the 1850's, as settlers began their colonization of Northwest Washington, the abundant natural resources became a source of subsistence and capital. Entrepreneurism was a compelling factor in the settlement of this area. Fur, fish, timber and gold were sought by many as items for trade. The first white settlers in Whatcom County, Henry Roeder and Russell Peabody, upon arrival recognized the monetary wealth of timber and proceeded to construct a saw mill on Whatcom Creek. Soon, with the multiplying effects of similar actions, the landscape changed. As the landscape changed, habitat was altered or disappeared.

Virtually all of Bellingham's approximately 14,700 acre area was clearcut by the late 1920's. No contiguous stands of old growth remain within the City boundaries. However, occasional specimen trees and pockets of mature second growth forest can be found in the City, particularly within the City's parks and forests found in the urban fringe area.

Over the course of 140 years, Bellingham has been transformed from an old-growth forest wilderness to a developed city of 52,000 residents. The limitations in the quest for wildlife preservation in this urbanizing area are challenging. Space is limited, competition for the remaining space is expensive, certain forms of pollutants are uncontrollable, and land use planning historically has not included wildlife or habitat protection.

Loss of Wildlife from Urbanization

All of the described effects of urbanization are applicable in Bellingham to various degrees. The most serious effects are: the conversion of open space fields, forest and floodplain to commercial, industrial, and residential uses; the devegetation or alteration or replacement of native vegetation along shorelines, in parks and vacant lots; the fragmentation of contiguous habitats; increased biocide application; stormwater runoff and other water quality problems; the placement of barriers to wildlife utilization including pavements, culverts, roads, fences, retention walls, and other structures as well as the disturbance caused by human activities and domestic pets.

Impacts on wildlife from Bellingham's growth and development are difficult to quantify without scientific baseline information. There are, however, mathematical approaches to this problem, which if applied would project the impacts on certain local wildlife populations caused by the removal of habitat areas. Nevertheless the effect of habitat loss and alteration on local wildlife is evident. The disappearance of wild salmon from most local streams is but one indicator that urban pressures are negatively impacting habitat and wildlife. Other species may serve as indicators, yet waiting until a species is scarce or threatened with extirpation is not good management and counters the intent of GMA. Only by first determining and then monitoring present populations, distribution, numerical is in "trouble." Minimal viable populations must be maintained in order to perpetuate the species locally. In turn, only by providing adequate habitat will these minimum populations be maintained.

The development of Bellingham has affected local biodiversity. Large mammals such as cougar, black bear, gray wolf and elk which depend on large home ranges are no longer found in Bellingham. Bobcat, porcupine, mountain beaver, western toad, common snipe, and purple martin represent species that were relatively common thirty years ago and are now uncommon or rarely found in and around the City. These species represent the change of habitat and the loss of diversity locally. Species homogeneity is a typical result of urbanization and Bellingham is experiencing its increase.

Bellingham Has Wildlife

Unlike most urban centers, Bellingham has retained areas of valuable habitat. Three major stream corridors with adjacent floodplains, wetlands, steep slopes and viable commercial forestry have limited development in certain areas within the City, including downtown.

The Greenways Levy passed in 1990 by the citizens of Bellingham has enabled the City to acquire open space for trails and wildlife corridors. Together with land dedicated to the City through subdivisions, these open space acquisitions create functional wildlife habitat, and sometimes the only open space in a neighborhood.

Although Bellingham's City center, like most urban centers, is plagued with exotic wildlife such as rock doves, starlings, house sparrows and Norway rats, it is unlike most cities due to the marine shoreline and open semi-natural stream corridor. For example, Whatcom Creek which bisects the urban core, harbors wildlife normally intolerant of urban environments such as green heron, American dipper, merlin, red-tailed hawk, beaver, muskrat, river otter, salmon, wild sea-run cutthroat trout and the unusual Pacific lamprey.

Bellingham Bay provides habitat opportunities for shoreline- and marine-associated wildlife such as bald eagle, osprey, peregrine falcon, marine mammals and large concentrations of diving birds and seabirds.

In order to overcome the limitations created by urbanization, a combination of enabling factors are needed:

-community leadership
-technical guidance
-empirical data
-a functional plan and design for wildlife habitat protection and enhancement
-a mechanism to secure habitat through regulatory and/or non-regulatory means
-public support, education and involvement
-funding initiative

Bellingham citizens have identified wildlife as a priority concern and have demonstrated a willingness to voluntarily protect and enhance habitat. This demonstration continues to grow through stream enhancement and restoration, urban wildlife habitat projects, environmental education programs and dedication to open space acquisition. With the application of technical information, habitat plan guidelines, and City program recommendations contained in this report it is intended that wildlife will continue to be part of the Bellingham community. This report shall be instrumental in achieving that goal.

Part IV EXISTING INFORMATION

Collection and Review of Information
The Bellingham Wildlife and Habitat Assessment is primarily based on existing information. The process of information gathering and reviews was comprehensive. Information was collected from existing documents, both published and unpublished, reports, notes and maps; from interviews with wildlife experts, naturalists and agency personnel; review of databases, lists and historical records; and from field visits and incidental observations. The collection, review and application of information for this assessment was exhaustive, being completed over an extended period of time.

A few systematic wildlife studies have been conducted within the City. These include bird related surveys and counts, and faunal inventory of Sehome Hill and the Padden Creek Estuary. The majority of field work has involved fish, particularly
salmon which have been studied city-wide.

Annual surveys of bird species have resulted in the systematic collection of data (species and numerical abundance) over time. These surveys include the Christmas Bird Count sponsored by the North Cascades Audobon Society, and the Breeding Bird Atlas sponsored by the Seattle Audobon Society.

A review of the existing wildlife documents revealed a consistent lack of scientific documentation. Few reports, particularly Environmental Assessments and Environmental Impact Statements were prepared using empirical data, and particularly lacking were scientifically credible wildlife studies. Few site-specific, systematic wildlife inventories or field surveys have been conducted in Bellingham and of these studies, survey methods and duration varied greatly. Results and conclusions of these efforts also vary in detail and accuracy.

SEPA requires a full disclosure of potential impacts on "flora and fauna" at project sites. In order to technically assess impacts or complete a SEPA checklist, empirical data is needed. Gathering empirical data is rarely done for a SEPA determination. Instead, knowledge of the site or a quick literature review is done. In response to this gap in information, the City of Bellingham should set standard guidelines and requirements for baseline inventory of wildlife habitat and species.

Lists of vertebrate species occurring within the City range from guess work to scientifically based sampling records. Of the vertebrate groups, the only complete existing City list is for birds. Other groups may have been sampled or observed in specific areas within the City, but have not been the subject of city-wide inventory. With the existing lists and observation records from a variety of sources city-wide, we have constructed a baseline species list, containing all vertebrates known to occur within Bellingham. This list in Appendix C contains species common names, scientific names, status, occurrence by watershed (preliminary), abundance, seasonality and habitat association.

Summary of Existing Wildlife
In the City of Bellingham wildlife includes fish, amphibians and reptiles, birds, and mammals found either seasonally or year around. The following is a numerical summary of wildlife species occurring in Bellingham.

Fish
Over 16 species of fish are found in the fresh water streams and lakes of Bellingham. Of these 12 are resident species and six are anadromous (migratory); 13 are native species and six have been introduced. Of the native anadromous fish only the pacific lamprey and searun cutthroat populations are completely wild or untainted by hatchery stock. However remnant populations of wild salmon and steelhead still occur in the Chuckanut Watershed.

The economically important fish species of Bellingham Bay include nine anadromous and seven marine species (Becker et al 1989). In addition there are over six commercial shellfish species harvested from the bay. A complete list of vertebrate and invertebrate species occurring in Bellingham Bay was not available in the documents reviewed.

Amphibians and Reptiles
There are nine species of amphibians known to occur in Bellingham. All reside year round and reproduce locally. Of these, seven are native, two are introduced. Local amphibians are either aquatic or terrestrial depending on species and life phase. Distribution and abundance of amphibians in Bellingham is unknown. Site-specific observations are reported in the watershed inventory section of this document.

Five species of reptiles are native and known to occur in Whatcom County and Bellingham. All reside year round and reproduce locally. Of these reptiles there is one lizard and four snakes, all are terrestrial and non-venomous.

Birds
Based on recorded observations over a 30 year period, 258 bird species are known to occur in Bellingham. Of these, 64 are common year round residents, 43 are summer residents, 63 are winter residents, 45 are seasonal migrants and 43 are casual visitors or vagrants.

Of the total, 92 species are known to have bred locally between 1987 and 1991. Few non-native bird species have established breeding populations following introduction. Those introduced species now thriving are familiar by name and include European starlings, rock doves, ring-necked pheasant and house or English sparrows.

Mammals
Based on the documented observations and specimens collected since 1959, there are 37 commonly occurring mammal species in Bellingham. Of this total, 34 species are native and 3 are non-native or introduced. Local mammals represent 20 families representing eight orders including: Marsupialia (opossum), Insectivora (shrews and moles), Chiroptera (Bats), Lagomorpha (rabbits), Rodentia (rats, mice, voles, squirrels, muskrat, mt. beaver, porcupine and beaver), Cetacea (whales and porpoise-uncommon locally), Carnivora (seal, otter, raccoon, weasel, mink, coyote, fox, bobcat, bear, cougar), Artiodactyla (deer, moose). Non native species include the possum, norway rat and the eastern cottontail rabbit.

Species of Concern
Species of Concern and local significance were identified. The significant species list contains all federal and state endangered, threatened, candidate, proposed, monitor and State's Priority Habitats and Species (PHS). In addition, those species with declining regional populations, limited mobility and which are particularly vulnerable to habitat alterations have been included as species of local

significance. This list should be used as a preliminary master guide to those species that are at risk and/or are protected under law and require special planning and development considerations.

Habitat
Habitat is characterized by those components, singularly and collectively, with which a species is associated and likely dependent. Habitats, whether vegetative, geomorphic, aquatic, marine or human structures are also dynamic. Classifying habitat involves characterizing the current conditions of a landscape. A habitat classification system (Appendix B) was developed for Bellingham and Whatcom County, in the absence of a state-wide standardized system, and was utilized as the standard guide for describing habitats city-wide. This classification system is a compilation of the best available and most widely used classification systems for local application, notably two U.S. Forest Service references. Critical habitats are further described by specific criteria and recommendations set forth by the Washington Department of Fish and Wildlife's PHS program and GMA.

Part V INVENTORY BY WATERSHED

Bellingham contains four primary fresh water drainages and a major marine embayment. Each of these five watersheds were assessed for wildlife species and habitat values and are described in detail. Site-specific attributes are listed by section, township and range. Recommendations for habitat enhancement and conservation are also included at the end of each watershed section. The following is a summary of findings from each watershed, including Chuckanut, Padden, Whatcom, Squalicum Creeks and Bellingham Bay.

Chuckanut Watershed
The Chuckanut watershed encompasses a very large area, the downstream portion of which lies within the City boundary and will be addressed here. The Chuckanut Watershed contains the most intact habitat area in Bellingham, spanning from its headwaters to the bay. Although systematic survey data is lacking, what is known through reported sightings indicates the greatest complement of species for the habitat types and existing conditions within a City watershed. Chuckanut's thriving wildlife community represents nearly all the species and habitats found within the City, is with the exception of large fresh water lakes and fallow field habitats, the latter of which is locally scarce. Chuckanut contains significant habitat diversity and interspersion of habitat types, with extensive forested uplands, small cliffs, caves, snags, riparian areas, anadromous fish bearing streams, complex wetlands, marine shoreline, estuary and marine embayment. The most significant habitat feature of this watershed is its habitat connectivity and significant linkages with protected public lands.

Chuckanut's wildlife represents both species richness and diversity, unmatched in the City. The greatest diversity of amphibian species documented within the City is concentrated here, in addition to the last remaining wild salmon and steelhead population in Bellingham. These are of City-wide significance. Future planned development within the watershed would severely impact the primary function and value of its habitat for wildlife.

Padden Watershed
The Padden Watershed includes the Lake Padden, Padden Creek and Connelly Creek basins. This watershed area extends from Gailbraith Mountain and Samish Hill west to the Padden Creek outlet on Bellingham Bay. The Padden Watershed contains the largest protected contiguous open space within the City. This area harbors notable species richness, habitat diversity and Species of Concern. Comparatively, this watershed represents the greatest habitat diversity and is second only to Chuckanut in known species abundance.

Within the Padden Watershed are over 1,140 acres of public parks and Greenways including: Lake Padden Park and Natural Area, Connelly Creek Nature Area, Sehome Hill Arboretum, Fairhaven Park and Padden Lagoon. These constitute the core of existing habitat and the foundation on which a viable habitat network could be created within the watershed. There are also strategic habitats and major corridors linking Whatcom Watershed to the north and Chuckanut to the south that remain unprotected. Critical components to the network are currently missing and need to be added in order to complete a functional system. Unprotected reserves and corridors of importance include: the Padden Creek corridor west and east of the freeway and associated gorge and uplands west of Lake Padden, forest corridors and a reserve area on Samish Hill, Connelly Creek fallow field reserve and corridor links to Sehome Hill and the Interurban wetland/upland corridor.

Species occurrence within the Padden Watershed includes common upland forest-associated species, wetland and stream aquatic and semi-aquatic fish, amphibians, birds and mammals, some field and shrub-dwelling species and a variety of estuarine visitors. There are an estimated 178 species associated with the watershed including an undetermined number of fish species, four known reptile species, four known amphibian species, 140 bird species and an estimated 30 mammal species. Of these, there are 24 Species of Concern and PHS Species known to occur within the City's portion of the watershed.

Whatcom Watershed
The Whatcom Watershed has been an area of extensive study and great public debate over land management and water quality issues, with Lake Whatcom serving as the municipal water supply. However, very little is known about the watershed's wildlife. This rapidly developing watershed is linked to Whatcom

Creek as the central drainage and backbone of its habitat network. Although the watershed within the City's boundary is comprised of primarily urban residential, commercial and industrial land uses, it also provides and important corridor utilized by a variety of species uncommon to most urban environments.

It also harbors significant forested public park land and undeveloped private upland forests. These large conifer-dominated and mixed forest blocks are significant habitat in and of themselves and are increasingly more isolated, as many of the forest linkages via streams and other corridors have been severely reduced or severed by development. Rapid growth in this watershed has directly impacted wildlife by the fragmentation and removal of high quality wetland, riparian and upland habitats. Whatcom is also lacking any formidable wildlife information, despite project related environmental review processes resulting in significant habitat loss. For this reason, the Whatcom Watershed is identified as a high priority for baseline wildlife/habitat assessment and serious habitat conservation action beyond this document.

The fisheries resources of the Whatcom Watershed are significant from a management perspective. There are three fish hatcheries within this watershed, two are state facilities primarily managed for lake associated sport fisheries and the other, a city-owned educational complex located at the mouth of Whatcom Creek, is primarily a salmon enhancement facility. The fish of Lake Whatcom are an important component of the lake's ecology and recreation. Eight species are found in the lakeshore areas, including native and non-native populations of kokanee, resident cutthroat trout, rainbow trout, small and large-mouth bass, perch, catfish and crappie.

Species and site-specific data are lacking for reptiles and amphibians in the Whatcom Watershed. Although common species are likely, no verified records exist. A wide variety of upland and lake-associated birds utilize the Whatcom Watershed. Of the 258 bird species City-wide, there are an estimated 112 species that utilize available habitat in the Whatcom Watershed. Of these, 21 are designated Species of Concern or Priority Species. The diversity of species is less than that of Padden and Chuckanut due to the lack of marine shoreline and estuarine habitats. The mammals of the Whatcom Watershed are poorly documented. A variety of small mammals likely occur, with most, if not all of the Bellingham species represented. Medium and large mammals are also potentially diverse in the forested areas of the upper watershed.

Squalicum Watershed
Spanning most of north Bellingham, the Squalicum Watershed landscape has greatly changed in the past decade, particularly in the City's fringe where urbanization is increasing. The available habitat and wildlife concentrations within

the City are directly associated with the Squalicum Creek corridor and its tributaries. The riparian and upland vegetation associated with the creek forms a relatively intact habitat corridor. This corridor forms the central lifeline for Squalicum wildlife, with larger adjacent upland habitat blocks completing the habitat matrix necessary for species diversity and population maintenance over time. The Squalicum system also maintains remnant anadromous fish populations.

The Squalicum Watershed contains one of the smallest habitat areas in the City, a total of 1,252 acres. Yet, it harbors the greatest amount of fallow field (uncultivated agriculture land), approximately 119 acres, which constitutes nearly 40% of the city's fallow habitat. This habitat type is rare in the City and traditionally has been the first area to be developed, although in this locale it lies mainly in the floodplain and primarily consists of wet meadow. Its contribution to the City's biodiversity is significant and requires further protection.

Fish are a significant resource throughout the Squalicum Watershed, but have suffered severe impacts from alteration of in-stream habitat, loss of riparian habitat, stormwater runoff, low flow periods and degraded water quality. Loss of the native salmon and many other resident fish is irreversible, however, enhancement and restoration of the Squalicum fisheries are possible.

Species and site-specific data are lacking for reptiles and amphibians in the Squalicum Watershed. Although common species are likely, no verified records exist. A variety of upland and wetland associated birds utilize the Squalicum Watershed. Of the 258 bird species city-wide, an estimated 108 species utilize available habitat in the Squalicum Watershed. Of these, 14 are designated Species of Concern or Priority Species by the Washington Department of Fish and Wildlife. The diversity of species is less than that of any other watershed, due primarily to the lack of habitat diversity and complete data. The mammals of the Squalicum Watershed are poorly documented. A variety of small and medium mammals likely occur, with many of the Bellingham species represented. Large mammals are likely absent from most of the watershed within the City. Aquatic mammals including beaver, muskrat, and river otter are present and quite active within the system. Beaver are responsible for reclaiming portions of the stream corridor and lake shorelines. The beaver's success in stabilizing the stream's hydrology, creating flood abatement and naturalizing in-stream habitat is occasionally in conflict with the City's management approach to stream conveyance.

Bellingham Bay Watershed
The Bellingham Bay Watershed includes the combined areas of Bellingham Bay and immediate shoreline and uplands within the City boundary. The watershed is highly developed, consisting of the City's core, commercial districts, urban

Part VI WILDLIFE AND HABITAT PLAN

The Wildlife and Habitat Plan provides a non-regulatory guideline for the conservation and future enhancement of our natural heritage, including native fish and wildlife and their habitats throughout the City of Bellingham. The plan's goals and objectives are from two sources. First, all goals and objectives pertaining to wildlife and habitat that were included in the Open Space, Parks, and Recreation chapter of the City of Bellingham Comprehensive Plan were incorporated in this plan. Second, City staff added to and modified those existing goals and objectives based on the intent of the Wildlife and Habitat Plan.

The most important element of the plan is to foster sound stewardship of the City's living resources. This will be achieved through enhanced cooperation, communication and conservation action. The plan will provide the means for City government, personnel, neighborhoods, businesses and citizens to work together toward a greater understanding and appreciation of our wildlife community. The Wildlife and Habitat Plan reflects elements of other City policies and regulations.

Approval of this plan could be the basis for adopting new policies for protection of critical wildlife and habitat or used for the development of new regulations. It will also enable the City to comply with the wildlife requirements of the GMA and qualify for Urban Wildlife Habitat Account funding through the Washington Wildlife Recreation Program and other sources.

The Plan also lists those significant habitat areas identified through the City's assessment process. By targeting these areas of significant habitat, the City lays the foundation for long-term planning for habitat acquisition and protection necessary for the perpetuation of viable wildlife populations.

Part VII WILDLIFE LAW AND PROTECTION

Federal, state, and local laws regulate fish and wildlife resources to varying degrees. Under each level of government the discussion includes a general description of wildlife and habitat goals and major laws and how they pertain to the protection of these resources. Because tribes share co-management responsibilities for fisheries and wildlife with the state, tribal involvement in habitat protection is also discussed. An attempt has been made to include all key authorities and describe enforcement and applicability of the laws at the local level.

Despite at least 22 federal laws, 20 state laws, tribal treaty rights, the public trust doctrine, local laws and ordinances, which are intended to help protect fish and residential, industrialized shoreline, shipping and transportation facilities, railroad, marinas and municipal waste treatment facility. Parks, Greenways and protected open space occupy a small but important portion of the watershed's shoreline and upland. As an estuarine bay fresh water is a primary factor in the bay's ecological function. The influx of freshwater from the Nooksack River, Chuckanut, Padden, Whatcom and Squalicum Creeks contributes directly to the habitat value of the bay and its shoreline.

The marine area of this watershed has received more systematic scientific wildlife survey than any other area of the City. The interest in water quality analysis, commercial fisheries, biological function and spaces occurrence have prompted several studies which have either targeted the bay or included it as part of a larger study area.

Bellingham Bay has historically harbored a rich marine environment with abundant finfish and shellfish. With the expanding human population, development of the inner bay, past direct discharge of industrial and municipal effluent compounded by other environmental impacts, Bellingham Bay became contaminated and inhospitable to many marine species. With advances in effluent treatment and more effective water quality regulation, the bay's environment is recovering. Six species of anadromous fish utilize Bellingham's streams for spawning. Migrating adult and juvenile salmon are an important food source for a variety of waterbirds, bald eagles, osprey, marine mammals and shoreline scavengers.

As with most terrestrial species in Bellingham, little is known about the species occurrence, distribution and abundance of reptiles and mammals. Pacific chorus frogs occur infrequently within the watershed. Few wetlands remain and those are either saline or have been impacted by toxins (herbicides) to which amphibians are highly susceptible.

The most significant species occurrence in Bellingham Bay is the concentration of wintering western grebes. Over 26,000 western grebes were recorded during the 1991 Christmas bird count and this is claimed to be the highest single count in North America. Significant numbers of eight species of diving birds are also reported for Bellingham Bay. Seabirds are also relatively abundant and diverse. Rocky and mud intertidal areas are utilized by six species of shorebirds. A variety of gulls (Larus sp.) utilize most of the bay area, shoreline and uplands. Great blue herons are also common along the bay's shoreline and estuaries. Endangered, threatened and candidate bird species also occur frequently throughout the bay, these include: peregrine falcon, bald eagle, marbled murrelet, harlequin duck, common loon and Brandt's cormorant. Common marine mammals occurring in the inner bay are limited to harbor seal and California sea lion. Harbor porpoise utilize the off shore areas of the outer bay.

wildlife habitat, there are still many gaps and shortcomings in the actual protection of these resources. The most logical sources of the habitat regulatory authority are limited. For instance, Washington Department of Fish and Wildlife provides habitat recommendations only; the Endangered Species Act provides protection for species while provisions for habitat protection have yet to be developed or approved for most listed species; the Department of Natural Resources has authority to regulate habitat yet relies on a case by case evaluation; the weak language contained in SEPA has rendered it ineffectual for substantive wildlife habitat protection or functional mitigation.

Enforcement response to a potential violation of a fish or wildlife protection law is a shared responsibility at all levels of government. State and federal wildlife enforcement agents, fisheries patrol, county sheriff, state patrol and local police are all ex-officio fish and wildlife enforcement agents or deputies for their sister agencies. The initial response to a violation usually results in the responding enforcement personnel requesting assistance from the appropriate agents who may then take the lead.

Part VIII NON-REGULATORY WILDLIFE PROGRAMS

This section provides a complete summary of wildlife and habitat-related governmental and non-governmental programs that are available federally, within the state, and locally. The programs summarized include topics such as habitat restoration, enhancement, incentive, education, public involvement and funding. Programs vary from government grant funding sources to model programs for community application. All of the programs listed provide potential funding opportunities for local wildlife and habitat protection.

A list of local environmental organizations is also included as a resource for volunteer wildlife restoration and enhancement projects and future stewardship programs.

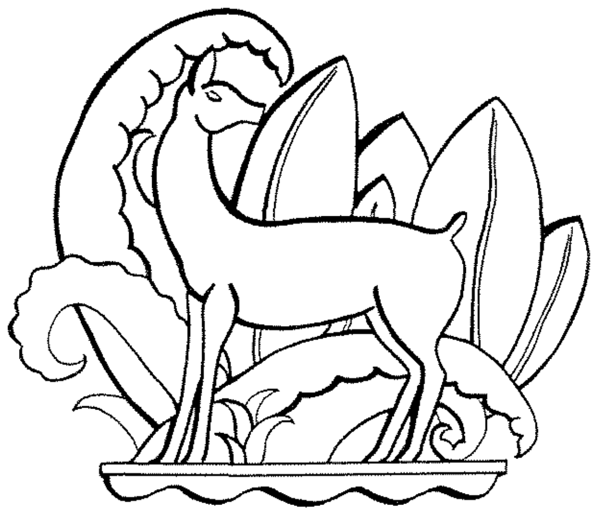
Appendices

Supplemental information and supporting documentation are included in the Appendices of this report. Key references consist of a complete annotated bibliography containing wildlife information specific to Bellingham, a complete City vertebrate species list, federal and state sensitive species lists, and the habitat classification system.

CONCLUSION

The purpose of this plan is to provide planners and citizens the information needed to identify and protect locally significant wildlife and habitat, as required by GMA. While there are existing policies and regulations that incorporate the concept of wildlife and habitat protection, there is no single policy or body of technical information available that specifically addresses wildlife. This plan will provided the missing link necessary for making decisions about wildlife and habitat that will meet the state GMA requirements and the existing goals and objectives in the Comprehensive Plan.

It is intended that this plan will be updated as we gain new information about the status of wildlife and habitat in the City. The maps showing wildlife habitat and corridors will be instrumental in the City's long-term planning process. We all recognize the difficulty and community-wide effort it takes to simply begin to see the return of native salmon to our streams. Knowing the value of our natural resources and knowing where they exist will help us avoid mistakes of the past.



PART I

INTRODUCTION

INTRODUCTION

"All organisms are greatly influenced by alterations in their environments. Change threaten some species, while survival of others is enhanced. In pursuing their own interests, humans have considerably altered the earth's environment and have decreased the probability of survival for many other species. There is a question whether humans as environmental manipulators have increased or decreased their own chance of survival. It might prove to be that humans would have persisted longer as a species if, as all other organisms on earth, they had pursued the course of adaptation rather than manipulation."

James O. Keith, 1991
(In *Wildlife Toxicology* by T.J. Peterle)

Purpose

The Bellingham Wildlife and Habitat Assessment is the first comprehensive planning document in Bellingham and Northwest Washington dedicated exclusively to wildlife. The primary purpose of this report is to fulfill the fish and wildlife conservation goals mandated by the 1990 Washington State Growth Management Act, Critical Areas Section (WAC 365-190). The secondary purpose for the report is to serve as a wildlife reference guide for city planning and administrative personnel. It is intended for application in the City's comprehensive planning update, project review, as well as in regulatory and policy development. The Wildlife Habitat Plan included in this document, provides specific goals for fostering stewardship of the City's living resources and further wildlife conservation through habitat protection.

Under the growth management requirements cities and counties have the responsibility to classify and inventory species and habitats of local importance and to map their associated locations for the purpose of protecting and conserving these as critical wildlife areas. Critical areas, once designated, shall then be protected under interim regulations and be included in the City's comprehensive plan update for permanent protection.

This report includes three principle elements: 1) wildlife planning and regulatory background information with suggested planning guidelines and considerations; 2) the status of wildlife in Bellingham past and present, which includes a preliminary inventory of species and habitats city wide and; 3) recommendations for local wildlife and habitat management, enhancement, restoration and protection within the City of Bellingham.

It is the intent of this report to emphasize wildlife as a public resource of economic, cultural and ecological value. As a resource that is poorly understood by most citizens, planners, city administrators, decision makers and developers, wildlife concerns have been neglected and related issues left unaddressed through Bellingham's growth and development, until now. The following text will expose the gaps and weaknesses in current laws and permitting procedures, provide detailed guidelines and means of correcting those voids, identify critical habitats and species within the city and recommend specific approaches to manage wildlife and its habitat effectively. By gaining a greater understanding and appreciation for wildlife and its complex needs, city staff and decision makers may use this document as a foundation on which to build the policies, regulations and programs necessary to protect and ensure the longevity of this irreplaceable resource.

Study Area

The study area is located within the City of Bellingham boundaries, situated in Whatcom County at the northwest corner of Washington State. The approximately 14,720 acre area, consists of an urban core, adjacent to Bellingham Bay, immediately surrounded by residential, commercial and light industrial land uses. The city's outer fringe area consists of the same uses to the north and a mix of residential, park and rural forest to the east and south. Bellingham is a growing community with a population of over 52,000 and a rapidly urbanizing landscape. Approximately 28% (City of Bellingham 1991) of the once vast natural landscape remains unbuilt. With the current 4% population increase forecast for the city and 7% for Whatcom County (Washington State, 1992), what remains unbuilt today is facing inevitable development pressure.

The city however growing, has maintained its unique northwest character, certain natural features and open space. These natural features provide a variety of habitat opportunities for wildlife including, the Bay's inland marine habitat and its diverse saltwater shoreline, tidal salt marsh, mudflats, sandstone cliffs and small estuaries. To the north and east of the city, four major stream courses originate from headwaters outside the city boundaries. The year-round streams are runoff from an annual average precipitation of 34 inches and large natural lakes which act a reservoirs for two of the four stream drainages. Originating from temperate forest and agricultural lands and flowing through an urbanizing landscape to the bay, these streams create natural riparian corridors. These corridors link their aquatic and riparian habitats with, wetlands, urban upland forests, fresh water lakes and a patchwork of parks, trails and open spaces. By virtue of their habitat value, natural connectivity and available data, the City's streams received the greatest attention within the study area.

Scope

The scope of this report encompasses wildlife conservation, management, biodiversity, law, conservation programs, habitat identification and function, growth management, an inventory of critical wildlife areas in the city and recommendations for local application of the technical information provided. The focus is vertebrate wildlife including fish, amphibians, reptiles, birds and mammals and their associated habitat. Invertebrates were not disregarded for lack of value or function. To the contrary invertebrates form the nutrient foundation for all vertebrate communities and are important bioindicators for aquatic environments, water quality, air quality and landscape deterioration (Jeffery & Madden 1991). The time and expertise to properly address invertebrates was beyond the resources available for this study. It is recommended however, that the city obtain expert direction on this subject and address locally significant macro invertebrates, hosts and habitats.

The background information contained in this document is the synthesis of reviewed current published literature, existing pertinent government documents, interviews and written contributions from local professional biologists specializing in wildlife, local, state and federal law enforcement officers and skilled naturalists. To the best of our knowledge, all of the vertebrate wildlife resource material pertinent to Bellingham and written in the past fifteen-twenty years was reviewed and cited in this report. The only known exception are the Port of Bellingham documents.

The background information compiled from the numerous sources is logically arranged and reference sources are cited. The subjects include the growth management mandate and planning theory, a brief historical perspective and changes in the landscape of Bellingham overtime, the status of wildlife in Bellingham including public perception, consideration in the planning process, a "complete" vertebrate species list, local wildlife and habitat inventory, wildlife law, voluntary resource protection and recommendations for local wildlife and habitat management, protection and restoration.

Partial compliance with the Growth Management Act is met with the preliminary identification of locally critical habitats and species, habitat reserves and corridors and recommendations for their protection based on existing information. Further compliance is needed in the form of adopted policies or regulations for the permanent protection of critical wildlife and habitat areas. The Wildlife Habitat Plan serves that purpose. Finally, in order to calculate the population status and viability of the critical species or to make informed decisions regard site specific projects, scientifically credible empirical data (information based direct observation) is needed. Currently, city-wide field inventory data does not exist and was not within the scope of this preliminary study. Yet, such a baseline study is suggested as the next step in the City's wildlife assessment.

The inventory section of this report focus's primarily on the natural features of Bellingham's land scape and will touch only briefly on the built/developed areas of the city. The natural areas within the city's boundaries were analyzed by aerial photo interpretation. The analysis included the classification vegetative communities as habitats, the areas of each habitat quantified and connectivity noted. Using overlaid wetland, park and greenway information corridors and currently protected areas were identified. With the combined habitat and corridor locations mapped, a natural habitat network was identified and documented.

Supplemental information and supporting documentation is included in the *Appendix* section of this report. Key references consist of a complete annotated bibliography of references containing wildlife information specific to Bellingham, a complete species list for the City's vertebrate species, federal and state sensitive species lists, the habitat classification system and pertinent city laws.

A set of "working maps" (topographic and aerial 1:200) accompany this report and contain habitat classifications, delineations, species specific locations, wildlife notes, corridor routes, PHS information and identified barriers. The working maps are intended for planning department staff use only and require some interpretation.

This document is presented to the City of Bellingham for its adoption and application as the City's primary wildlife planning document and preliminary critical wildlife and habitat inventory. The recommendations and suggestions included in this report are provided for consideration only and in no way represent the polices or views the city or its staff.

PART II

PLANNING for WILDLIFE
-a landscape approach

PLANNING FOR WILDLIFE: *a landscape approach*

"We cannot tuck species away in little preserves, as if we were storing pieces in a museum and then come back a century later and expect to find them all still there. The essence of life is change. Organisms are constantly growing, interacting , adapting and evolving.......In short an ecosystem is not a collection of plants and animals. It is a seamless swirl of communities and processes. If you don't save the processes, you won't save the parts."

Douglas Chadwick, 1991
(in *Landscape Linkages and Biodiversity,* W. Hudson Ed.)

THE BASIC ELEMENTS

Wildlife require four basic elements for survival. These elements consist of food, water, cover and space. Air and air space are also vital elements. The quality, quantity, type and placement of these elements in the environment determines the survivability and quality of life for each individual animal or wildlife community. The critical components of habitat include these elements in addition to climate, elevation and the natural features of the landscape. For each species the habitat requirement is different. It is the species unique adaptation to a specific set of conditions that differentiates it from another. When conditions result in a thriving, successfully reproducing population, that location and set of conditions would be identified as suitable habitat for that particular species.

A wide variety of food sources are utilized by wildlife. Food preferences and nutritional requirements are species specific. Examples of foods include seeds from trees, shrubs and herbaceous plants, new shoots and plant foliage, the cambium layer of bark, fungus, flying insects, invertebrates and their larvae found on plants, in woody substrates and in the soil, aquatic invertebrates and their larvae found in mud, on rocks, along shorelines or in the water column, marine invertebrates and of course, other vertebrate species, alive and dead.

Water is required by all wildlife. Water must be free from pollutants, sediment and harmful bacteria or algal growth. Freshwater must be available throughout the year, with ample sources dispersed across the landscape including springs, seeps, wetlands, small pools, streams, lakes and ponds. Freshwater mineral springs are required by certain species such as band-tailed pigeons for reproduction. Saltwater may not be substituted for freshwater by terrestrial species, it is however, utilized by marine mammals, seabirds and anadromous fish through special physiological adaptations.

Cover is a general term for what is in some cases a highly specialized species requirement. Cover is synonymous with forest canopy, water, a cavity or den, shrubby vegetation, bark, a cave, soil, down woody material, a built structure or whatever the animal requires to evade predation and adverse conditions. With the increased fragmentation of the landscape, connectivity of cover has become a significant consideration. A large contiguous forested area is for instance of greater habitat value to certain species than forest patches constituting the same total area.

Space is the basic element that varies the most from species to species. Vast areas up to 17 square miles are required by large predatory mammals such as cougar in their quest for prey. Air space required by migratory birds span thousands of miles. In contrast, area requirements for most terrestrial amphibians consist of one acre or less. The great variation in space required per species gives clear reason to carefully review and seriously consider this factor in the planning and development process. The space factor coupled with cover connectivity prompts us to begin planning on a watershed basis, considering a large landscape area instead of planning on a site by site basis.

Habitat requirements vary for each species. Although most species show a strong affinity for specific types of habitat, many require a diversity of habitats for different portions of their lifecycle. These translate into **daily** requirements, **seasonal** requirements and **lifestage** requirements.

Limitations placed on a species or populations are known as limiting factors. Limited food, water, oxygen (for fish), cover or space will restrict and seriously impact wildlife over time. Like habitat, limiting factors are very much species-specific. The species most affected by limitations are those with "specialized" life history or habitat requirements. It is clear that the more specialized a species, the greater its vulnerability to limitations or changes in its environment.

Consider the many variations of the basic survival elements (food, water, cover and space) available to local wildlife. The examples below describe a variety of habitats in terms of these four basic elements. The following habitat descriptions have been generalized and apply to distinctly different groups of wildlife to illustrate the diverse habitat needs of these local populations.

Fish-Salmonids: Suitable fresh water stream habitat requirements for salmonids (salmon and trout) consist of several factors. Water must be unpolluted, clear (sediment free), cool/shaded (not to exceed 55 deg.F) and well oxygenated. Stream flow, water volume and velocity should not fluctuate to extremes. Spawning salmonids require fine gravel in which to deposit their eggs. Salmon fry depend on calm waters such as pools or adjacent wetlands and some migrate to smaller stream systems. Rearing usually occurs in these same areas of the stream. Fry require cover from predators which may include undercut banks, logs, overhanging root wads or vegetation. Food for juvenile and resident adult fish consists primarily of aquatic invertebrates and their larva. Salmon migrating to and from spawning or rearing sites require clear passage. Barriers, pollution and increased water temperatures are the major limiting factors affecting salmonids locally.

Amphibians: Most locally occurring amphibians (frogs, toads and salamanders) require slow moving or still, clean, clear fresh water of cool temperature in which to lay their eggs and for the larva or tadpoles to live and eventually metamorphose. Mature amphibians are either aquatic or terrestrial. Terrestrial amphibians usually require moist, undisturbed, well shaded areas, with ample hiding cover in the form of down-woody material, logs, talus or natural cavities such as rodent borrows and leaf litter. Amphibians feed on invertebrates (aquatic and terrestrial), small fish (aquatic species) and in some cases other amphibians. Amphibians do not disperse far from their natal pond or stream, adult red-legged frogs for instance, may be found within 1,000 ft. of standing water (Nussbaum, Brodie, Storm 1983), yet for the individuals that do migrate, or disperse, they normally utilize stream and riparian corridors. Water pollution, loss of cover, soil disturbance or compaction, loss of wetland/riparian habitat and biocides are limiting factors for local amphibians.

Birds-Herons: Herons such as great blues and green-backs depend primarily on small fish and aquatic invertebrates as a food source. Herons forage along fresh and salt water (blue heron only) shorelines and mudflats. Great blue herons are closely associated with eelgrass beds during the breeding season and also frequently stalk voles and other small mammals found in fallow fields. Herons are easily disturbed and require vegetative hiding cover, screening or a tolerable distance from human intrusion. Herons construct stick nests concealed in deciduous or coniferous trees near water or major food sources. Summer range or area requirements are approximately a 5 mile radius for great blue and less for green-backed. Human disturbance, loss of riparian vegetation and food availability are the limiting factors for local herons.

Birds-Woodpeckers: Woodpeckers such as downy, hairy, pileated, red-bellied sapsucker and northern flicker require live and dead trees for food, cover and nesting. Mature forested habitats are preferred by woodpeckers. Woodpeckers forage on insects and their larva found in the bark or wood of live and dead trees or downed logs and stumps. Older forests provide a protective canopy cover and an open under story for easy and safe passage. As cavity nesters, woodpeckers either excavate their own nest cavity, or utilize a natural cavity, which for a pileated requires trees no less than 68 cm (27 in) diameter (dbh). Woodpeckers require large areas of suitable habitat, home range size varies from 7 acres for downys and hairys, and over 400 acres for pileateds (Brown 1985). Loss of large mature forest blocks and their associated snags and forested corridors pose major limitations for local woodpeckers.

Arboreal Rodents: Douglas squirrels, flying squirrels and chipmunks rely on mature forests for food, cover and space. Because seed production of most conifers increase with age, an older forest is preferred by Douglas squirrels and chipmunks. Flying squirrels, also prefer older forests where their primary food source consists of fungi and lichen which are in very limited supply in young forests. Like the Douglas squirrel and some chipmunks, the northern flying squirrel utilize woodpecker excavations or natural cavities for nest sites. All of the arboreal rodents depend on the forest canopy, tall trees and cavities for cover and protection from predation. The home range of arboreal rodents ranges from 1.5 to nearly 5 acres; interestingly- the estimated minimum habitat per population of northern flying squirrel is 360 acres (Brown 1985). The likely limiting factor for flying squirrel (and possibly the others) is the availability of cavities for nests (Carey, Biswell & Witt 1991). Food sources, as well as minimum habitat, should be considered as limiting factors.

As the above examples show, nearly all wildlife have limitations related to their habitat requirements. Urbanization, water pollution, storm run-off, roads, loss or fragmentation of large natural areas and removal of native vegetation are just a few artificially imposed limitations which adversely impact wildlife in developing areas. The identification and protection of local critical habitats, as well as determination of existing and potential limiting factors will be necessary for the protection and perpetuation of native species in Bellingham.

HABITAT DEFINED

When describing habitat and wildlife associations it is important to speak the same language as the natural resource management agencies. In an effort to provide a standardized set of definitions to describe local wildlife habitats, the best available reference was sought. The most widely accepted and applied wildlife habitat descriptions for Western Washington are contained in the USDA Forest Service publication Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington (Brown 1985). The primary definitions and descriptions of wildlife habitat referred to in this document are derived from the above reference. More recent habitat classification systems have been developed through other agencies and projects, but a state-wide standard has yet to be adopted.

Brown, as the above publication is referred to, is in two parts and provides a multiplicity of applications. Part One contains descriptive narratives under the following headings: Plant communities and stand conditions/wildlife relationships to plant communities and stand conditions/riparian zones and freshwater wetlands/estuaries/edges/snags/dead and down woody material/cave, cliffs and talus/salmonids/deer and elk/northern spotted owl/bald eagles/silvicultural options/ impacts on wood production. Part Two contains an incomparable listing of species, abbreviated life history information, habitat associations and a detailed reference section. The reference addresses 460 wildlife species and 178 fresh and selected marine fish species found west of the Cascade Crest.

The term habitat as mentioned before, translates into a set of localized environmental conditions of which a plant or animal species is dependent at any point during its lifecycle. Environmental conditions are determined by numerous factors including: latitude, longitude, elevation, climate, geology, hydrology and vegetation. Defining wildlife habitat is a process of identifying and describing existing conditions and associations. Habitat exists at varying degrees of structural complexity, ecological value and occurrence. Habitats are interspersed and interrelated - such as, a beaver pond with its associated streams, wetlands and riparian shrub or forest complex. Suitable habitat provides all the necessities for survival and reproduction (breeding areas) for a given species during the course of a temporary stay, a season or year around.

Most terrestrial wildlife habitats are determined by the interspersion of plant communities on land, by the structure of plant communities and by the mix of plant species within the community (Brown 1985). Additionally, each plant community and its structure create distinct environmental conditions that fulfill the habitat requirements of certain wildlife species. By examining plant communities and composition, it is possible to draw associations with particular wildlife species which are known to utilize a specific set of conditions and further define the habitat. These associations are helpful as indications of potentially sensitive areas, yet cannot substitute for field evaluation.

All habitats with which species have a known or probable relationship are shown to be of either primary or secondary importance to that species for one or more habitat uses i.e., breeding, feeding or resting. Primary habitat is a preferred or optimal habitat that predictably supports the highest population density of a species and upon which it is dependent for long-term population maintenance. Secondary habitat is that used by a species, but is clearly less suitable than primary habitat as indicated by lower population density (Brown1985).

When defining the space requirements of breeding populations of a particular wildlife species, defined areas of habitat are broken down into the following areas:

- Home Range: the area used by an individual of a species to meet biological requirements over a defined period of time

- Territory: the area which an animal actively defends, usually during the breeding season

- Minimum habitat: minimum habitat area or size required over time by a reproductive pair or by a population of a particular species

CRITICAL HABITAT

Growth Management Act Definitions

The Growth Management Act (GMA), WAC 365-190-030, requires high growth communities such as Bellingham to identify critical habitat areas and adopt land use guidelines to permanently protect such areas. The function and value of critical habitat is irreplaceable once lost to urbanization or isolated from other viable habitat. The following lists the minimum guidelines and general requirements for habitats and species of local significance and other critical habitats as defined by GMA.

Habitats of local importance include, a seasonal range or habitat element with which a given species has a primary association, and which, if altered, may reduce the likelihood that the species will maintain and reproduce over the long-term. These might include areas of high relative density or species richness, breeding habitat, winter range and movement corridors. These might also include habitats that are of limited availability or high vulnerability to alteration, such as cliffs, talus and wetlands.

Species of local importance are those species that are of local concern due to their population status or their sensitivity to habitat manipulation or that are game species.

Critical Areas are further described under WAC 365-190-080.

Fish and wildlife habitat conservation areas. Fish and wildlife habitat conservation means land management for maintaining species in suitable habitats within their natural geographic distribution so that isolated subpopulations are not created. This does not mean maintaining all individuals of all species at all times, but it does mean cooperative and coordinated land use planning is critically important among counties and cities in a region. In some cases, intergovernmental cooperation and coordination may show that it is sufficient to assure that a species will usually be found in certain regions across the state .

Critical habitats also include:

- Areas with endangered, threatened, and sensitive species.
- Habitats and species of local importance.
- Shellfish areas
- Kelp and eelgrass beds.
- Naturally occurring ponds over twenty acres.
- Waters of the state.
- Lakes, ponds, streams and rivers planted with game fish.
- State natural area preserves and natural resource conservation areas.

The GMA requires the consideration of six factors when classifying and designating local habitat conservation areas or critical habitat. These key considerations will assist in the evaluation of current habitat value and function in addition to habitat viability over time.

- Habitat connectivity between larger habitat blocks and open spaces.
- Level of human activity including roads and recreation activities.
- Protecting riparian ecosystems.
- Evaluating adjacent land uses.
- Establishing buffer zones around these areas to separate incompatible uses.
- Restoring lost salmonid habitat.

Washington State Department of Fish and Wildlife Definitions

The Washington Department of Fish and Wildlife identified those species and habitats of vital importance in the state as Priority Habitats and Species (PHS). These are defined in the 1991 *Management Recommendations for Washington's Priority and Habitats* Program. Species presence determines critical habitat, the two cannot be separated in nature. To gain a general understanding of species/habitat relationships, consider first the species of concern and then its critical habitat. The WDFW through its PHS program provides criteria for the identification of those species and habitats that are at greatest risk of human caused impacts. The definitions and criteria for species designation under the PHS program are as follows:

> - *Wildlife species of concern due to their population status and their sensitivity to habitat alteration.*
>
> - *Species determined to be in danger of failing, declining or vulnerable due to factors such as limited numbers, disease, predation, exploitation or habitat loss or change. These are both state listed and state candidate species for endangered, threatened and sensitive classification.*
>
> - *Uncommon species, including Monitor species, occurring in forest environments and that may be affected by habitat loss or change and uncommon species occurring in urban growth areas that are vulnerable to urbanizing influences.*

- Species in forest environments for which the maintenance of a stable population and surplus for recreation may be affected by habitat loss or change and for species in urban growth areas with a high public profile that are vulnerable to urbanizing influences.

A detailed discussion of priority species and a list identifying the species of local significance is included in the *Inventory* section of this document.

Priority Habitat are areas with one or more of the following attributes:

- comparatively high wildlife density
- high species richness
- significant wildlife breeding habitat
- significant wildlife seasonal ranges
- significant movement corridors for wildlife
- limited availability and/or high vulnerability

Priority habitats identified under the PHS program are critically important in the maintenance of local native plants and animals. These habitats offer opportunities for specialized plant and animal species and are currently threatened by human intrusion and fragmentation from surrounding development. Due to WDFW's lack of habitat regulatory authority, it is the responsibility of local government to designate and protect critical habitats through regulatory and non-regulatory means. All of the habitats as described using the following criteria have been identified and designated critical habitat in the Bellingham inventory process. The list below is limited to those WDFW Priority Habitats occurring in Bellingham and its fringe.

- CAVES
Criteria: *>one foot diameter and >three feet deep*
Justification: *Limited distribution; vulnerable to human disturbance, dependent species include, bats, colonial nesting/roosting birds and large mammals.*

- CLIFFS
Criteria: *>25 feet high and <5,000 feet elevation*
Justification: *Limited distribution; unique species assemblage (raptors, colonial seabirds...); difficult to mitigate or artificially create.*

-OLD-GROWTH/MATURE FOREST
Criteria: *Stands of at least 2 tree species; dominants >200 years old; at least 6 trees/acre >32" dbh; stand should have 1+ snag/acre >21" dbh and 3+ logs/ acre 25'+ long and 25"+ diameter at the butt , and 2-5 layers of vegetation in a multi-storied canopy. Stands should be at least 35-40 acres.*
Justification: *Limited and declining distribution; relatively high species diversity, especially for breeding.*

-RIPARIAN AREAS

Criteria: *150'-200' on both sides of a Type 1 or 2 stream, 100' on both sides of a Type 3 stream, 50' on both sides of a Type 4 stream and 25' on both sides of parts of Type 5 streams.*
Justification: *HIGH species diversity; high edge component; linkage to other habitats and provides travel corridor for many species; vital to fish species breeding, rearing, migration (also vital to many amphibian species).*

-SNAG-RICH AREAS

Criteria: *Areas established by survey to contain high snag (and large stump) densities, typically >1000 snags/100 acres (old burns, wind damaged trees, created snags in "new forestry" areas etc.).*
Justification: *Large number of cavity dependent species.*

-TALUS

Criteria: *Homogenous areas of rock rubble ranging in average size from 0.5" to 6.5", composed of basalt, andesite, and/or sedimentary rocks, including riprap slopes and mine tailings.*
Justification: *Unique species assemblages, including some dependent species; vulnerable to road construction and quarry operations.*

-URBAN NATURAL OPEN SPACE

Criteria: *A priority species resides within or is adjacent to the open space or may use it for regular feeding; and /or the open space functions as a corridor connecting other priority habitat areas, especially areas that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 10 acres and surrounded by urban development. Local consideration may be given to open space areas smaller than 10 acres.*
Justification: *Unique species assemblages in urban areas; provides travel corridors and minimizes island effects.*

-WETLANDS

Criteria: *At least one of the following attributes: areas with predominantly hydrophilic plants, at least periodically; substrate is predominately undrained hydric soils; and/or the substrate is non-soil and is saturated with water, also covered by shallow water at some time during the growing season of each year.*
Justification: *HIGH species diversity; dependent species, especially waterfowl; vulnerable to disturbance; declining wetland areas.*

MIGRATORY SPECIES AND CRITICAL HABITAT AREAS

Wildlife require mobility for survival. Mobility is necessary for feeding, breeding and seeking cover. The mobility of a species enables it to migrate in order to maximize survivability. One definition of migration is, the repeated movement or seasonal movement of animals from one habitat, elevation or climate to another. Migration is usually a two way movement between seasonally used home ranges. Commonly, migration patterns are repeated and routes are established. These routes usually include critical resting and feeding locations dispersed along the way. Many bird, mammal and fish species actively migrate. The local seasonal movement of species is considered local migration and in most cases is associated with climatic conditions, elevation and habitat suitability.

Whatcom County is situated on the 49th parallel, between the Cascade range and Georgia Strait providing a geographical link in a north-south migratory corridor, known as the Pacific Flyway. The Pacific Flyway extends south from the North American Arctic to South America. This flyway was identified by the U.S. Fish and Wildlife Service as the most significant route utilized by eastern Pacific migratory waterfowl. An estimated five million ducks, 1 million geese and forty thousand swans (USFWS 1990 Prospectus) travel along this corridor twice annually. The Pacific Flyway is also utilized by millions of shorebirds and numerous other bird groups.

Although the Pacific Flyway is very important and one of the most familiar flyways by name, it is not the only migratory route. In fact numerous migratory routes span North America and the world. Differences in species, distance traveled, timing, speed of flight, geographical position, latitudes of breeding and wintering grounds and other factors contribute to this infinite variety of routes covered during bird migration.

The temperate climate and diverse habitat of Northwest Washington, and specifically, Whatcom County provides suitable wintering and breeding habitat for many migratory birds. In Bellingham 43 summer migrant species, 63 winter migrant species and 45 seasonal migrant species have been recorded over a period of thirty years (Wahl 1992).
Noteworthy examples of the migratory bird species occurring in Bellingham are:

-neotropical migrants such as warblers, swifts, nighthawks, swallows, vireos, thrush, flycatchers, tanagers and hummingbirds which migrate from Mexico, Central and South America, to North America in the spring to reproduce;

-arctic or northern breeders such as certain shorebirds, sea ducks, loons, grebes, kestrels, sharp-shinned hawk, merlin, short-eared and snowy owl, pine grosbeaks, common redpolls, white-crowned and golden-crowned sparrows and northern shrikes which over-winter in or in close proximity to Bellingham;

-mountain or high elevation breeders also winter in high concentrations in Bellingham such as, juncos, chickadees, pine siskins, kinglets, varied thrush, evening grosbeaks, Cooper's hawks, sawwhet owls, bohemian waxwings, flickers, and ducks such as harlequins, goldeneyes , hooded mergansers, buffleheads, etc.

In addition to those species which migrate great distances to overwinter or to breed locally, there are the large flocks of migrants which stop to rest and feed while migrating or those which gather here enmasse prior to migrating. The geographical locations where such resting, feeding and gathering take place are known as staging areas and warrant strict protection.

Migration is not unique to birds. Fish, mammals and even insects migrate. Locally, salmon and steelhead are familiar migrants in the fall when they return to spawn. Terrestrial mammals usually maintain summer and winter ranges which provide suitable habitat for seasonal requirements such as: breeding, calving, denning and hiding cover for the young, winter cover, forage, open water, etc... Historically, large mammals such as elk, bear, cougar and deer would migrate in the fall from higher elevations to lowlands in and around what is now Bellingham and back again in the spring. Due to urbanization it is seldom that large mammals, other than deer venture into the City but instead may pass through the forested fringe areas.

The suitability of habitat and habitat links along any migratory route or travel corridor, be it local or spanning international boundaries, is critical to the survivability of the migrant. International concern for neotropical migrant birds is due primarily to lost habitat in tropical and temperate forests. Protection of seasonal habitats for migratory species is imperative. Bellingham and Whatcom County's diversity of habitats provide an equally diverse migratory and nonmigratory wildlife population, many with specialized habitat requirements. From this perspective Bellingham and Whatcom County's remaining habitat is of international significance.

EFFECTS OF URBANIZATION ON LOCAL WILDLIFE

As an urban center, Bellingham shares similar characteristics with most towns and cities in the United States. According to D.L. Leedy and L.W. Adams in *Wildlife in Urban and Developing Areas* (1986), certain characteristics shared by all urbanizing areas pose negative impacts on wildlife and habitat. These characteristics are summarized as follows:

- Buildings, streets, roads, parking lots and other structures occupy much of the ground surface and form an impermeable and sterile covering of the soil which once supported native vegetation and the macro/micro organisms that are associated with that cover.

- Fragmentation and isolation of larger habitat areas.

- Increased vertical glass surface area, resulting in one of the highest causes of bird mortality.

-Runoff from paved areas and roofs is of higher volume and greater velocity with little or no infiltration to the underlying strata, which means a reduced rate of recharging of natural ground water reservoirs and a lowering of the water table.

-Reduction in ground water results in increased variation of natural stream flows.

-Runoff, particularly the first surges following a storm, usually contains pollutants and toxic materials, particularly from road surfaces and other urban surfaces.

-Runoff from paved surfaces is warmer and in low flow conditions may increase the temperature of a stream above normal, resulting in serious impacts on the whole stream ecosystem.

-Runoff from new construction in urban areas carries greater sediment per unit of area to receiving waters, than runoff from developed areas or from agricultural areas.

-Loss of vital riparian habitat.

-Urban cores of cities are generally warmer than outlying areas contributing to the runoff problem mentioned earlier.

-Air and noise pollution often is considerably greater in urban areas, due to the concentration of vehicles, people, construction (and in Bellingham, nearby industry).

-Urban soils are likely to be modified detrimentally, contain pesticide residues, lack topsoil, contain leachate from pavement and tend to be heavily compacted.

-Urban development often results in a loss of wildlife species considered specialists and an increase of species considered generalists.

Additional impacts of urbanizing areas on wildlife habitat include:

-- Natural water courses are usually contained or channelized.

-- Dead trees or snags are considered hazards and removed.

-- Trees are routinely topped or cut down to provide views.

-- Native terrestrial rodents are discouraged from colonizing golf courses and parks.

-- Wildlife requiring subterranean habitat such as rodents, amphibians and reptiles are restricted by pavement, barriers and highly modified ground conditions.

-- Increased use of lawn and garden pesticides.

-- Introduced domestic and exotic animals compete with, chase and kill native wildlife.

-- Creation of artificial barriers to wildlife: fences, walls, bulkheads, culverts, roads, etc.

HABITAT LOSS

Rapid growth is occurring in Bellingham and the population is expected to increase by nearly ten thousand between 1990 and 2000. The Bellingham Department of Planning and Community Development report a record number of building and development permits issued in 1991. With growth, urbanization and associated activities pose the greatest threat to wildlife habitat. Permanent removal or alteration of habitat is the result of land conversion to commercial or residential use. Problems associated with development such as vegetation alteration or removal, introduction of non-native species, dredging, filling, gravel mining, road building, paving, toxic runoff and pesticide application, create a cumulative effect impacting local wildlife populations, diversity and health.

Virtually every land use action affects wildlife habitat. When recognizing the dependency of wildlife on soils, vegetation, clean air and water, one can appreciate the importance of minimizing the adverse impacts on wildlife through <u>careful</u> land use. Incremental habitat loss results in cumulative impacts and ultimately the need for crisis management or the local extirpation of a species.

What was once a considered common or abundant habitat a decade ago, such as lowland douglas fir forest, is now less common and in some areas scarce. Between 1979 and 1989, for example, about 170,000 acres (equivalent to nearly 250 square miles) were converted from forest to non-forest uses in the Puget Sound Basin, a permanent alteration or loss of forest habitat. Agricultural land is also the victim of growth. Urban sprawl has consumed much of the remaining open pasture lands in and around Bellingham. Pastures provide prime habitat for rodents, which in turn provide a preybase for hawks, owls, herons and carnivores such as coyotes and fox. Riparian habitat is heavily impacted by the removal of vegetation, the planting of lawns or alteration by grading and filling. The most serious impacts on stream habitat have been channelizing and rerouting through culverts or underground tunnels. Urban and developed land is beginning to dominate the landscape throughout Puget Sound and the pattern of growth has not incorporated the natural features of the land or habitat for wildlife. Fortunately in Bellingham, many of the natural attributes vital to fish and other wildlife remain in a functional, but somewhat degraded state today.

The rural-urban interface zone is said to offer the greatest opportunity for thoughtful planning to successfully include wildlife in the development process. In these areas, blocks of natural habitat can still be preserved, streams can be adequately buffered, wetlands allowed to function normally and more wildlife species will be present as a result (Adams & Dove 1989). Bellingham, unlike most of the nation's cities, has far more habitat potential than just the urban fringe. Bellingham is located at the head of a large saltwater bay with the associated shoreline habitat, through it flows four major fish bearing streams, at its boundaries are two large fresh water lakes and miles of regenerating forests. Few cities offer such diversity and habitat opportunity for their wildlife.

Cumulative adverse impacts on habitat are the greatest threat to wildlife generally and species diversity specifically. Potential cumulative impacts must be identified in the planning process. Further, the creation of clearly stated policies directly linking various land use elements with wildlife requirements are needed.

"The prevailing view that ecosystem risks are less important than threats to human health is inappropriate, because in the real world there is little distinction between the two. Over the long term ecological degradation either directly or indirectly degrades human health and the economy."

So asserts a major report of the EPA Science Advisory Board, called Reducing Risk, which recognizes the loss of critical wildlife habitats and species diversity as a serious ecological problem. The 1989 report advises the EPA to rank declining species diversity, habitat change and destruction as two of its top four priorities (Raloff 1990).

Agencies at the state level are also beginning to respond to the concerns of diminishing wildlife habitat and recognizing the need to change their focus from individual species on the brink of extinction to entire complements of wildlife populations. This is reflected in the Washington Department of Wildlife's Priority Habitats and Species Program, and the Growth Management Act mandate for local governments to identify and plan for wildlife conservation areas.

In the past, Bellingham plans and policies briefly mentioned wildlife, without providing protective guidelines or setting requirements for surveys or field assessment. As a result, little scientific information has been collected on the natural occurrence, abundance and diversity of wildlife resources in Bellingham. Also, the extent of wildlife depletion through habitat alteration and land development remains uncalculated.

BARRIERS

The movement of wildlife is often restricted by the natural features of the landscape, water bodies, climate or elevation. Examples of natural barriers are topography such as steep slopes, cliffs, ravines, mountains or hydrology such as lakes, rivers, streams, fast moving water, waterfalls, saltwater, or vegetation, the presence of which enables wildlife to move freely and the lack of which can be somewhat restrictive. Because natural barriers have played a major role in the evolution and distribution of native species they are accepted as integral parts of the landscape.

Since the introduction of man-made structures and the development of the landscape, the problem of barriers to wildlife has become life threatening. Artificial barriers have been identified as roads/freeways, railroads, bulkheads, embankments, building complexes, elevated or extended culverts, certain stormwater control systems, dams, chain link or small mesh fences, cleared areas, dense non-native vegetation (blackberries, hedges, reed-canary grass, etc.) and power/pipeline corridors.

Detailed studies have been conducted to determine the degree of restriction caused by artificial barriers and species affected. A complete review of the literature on this subject was not feasible under the scope and time available. However, two studies proved particularly interesting in their assessment of barrier effects on wildlife.

In the discussion of *The Effects of Roads On Populations of Small Mammals* (Oxley, Fenton & Carmondy 1974), the following points were made:

-roadways inhibit the movements of small forest mammals and some species of rain forest birds

-traffic alone does not inhibit road crossings by mammals, but factors relating to road surface, clearance or width are involved

-faster traffic results in higher mortality (related to gravel *vs* paved surfaces) particularly for medium mammals and for large mammals (Harris & Gallagher 1989)

-clearance (exposure) is the most important inhibiting factor; movement across four-lane freeways is rare

-divided highways with clearances of 90 m (295 ft) or more restrict the dispersal of small forest mammals to the same degree as bodies of fresh water twice as wide

-inhibited or limited movement of individual animals across a barrier is likely to result in the fragmentation of gene pools (and if a colony suffers high mortality, recolonization is also inhibited)

-regular mowing and/or spraying along road verges increases road clearance

In conclusion, the authors urge planners and engineers to seriously consider the detrimental impacts of roads on the movements of animals. Successful mitigation of these impacts may be achieved through wildlife sensitive development design, utilization of underpasses, bridges in place of culverts and leaving contiguous corridors of suitable habitat where possible.

Another applicable study discusses the barriers created by actively managed powerline corridors. In the discussion of *Powerline Corridors, Edge Effects and Wildlife in Forested Landscapes of the Central Appalachians* (Gates 1991), the author identifies a barrier located at the corridor-forest interface, which he describes as an edge barrier. The dense vegetative growth and abrupt edge resulting from herbicide management created an impermeable edge which was avoided by small and medium sized mammals. The effect of powerline and pipeline corridors is of ecological concern, as they have been noted as fragmenting habitat, isolating animal populations and restricting gene flow (citations in Gates 1991). However, corridors have a potential to connect habitats if they are managed in a wildlife sensitive manner (Gates 1991). Management methods are detailed in this and related studies and should be considered for utility corridors within the city.

A very different type of barrier is glass. Glass is perhaps more appropriately referred to as an obstruction, and is associated with the highest bird mortality of any documented single cause according to Daniel Klem (1991). Through extensive observation and experimentation, he has deduced that glass kills more birds than any other man-caused avian mortality, with the possible exception of hunting. Birds are unable to recognize the presence of glass, which makes it a potentially lethal obstacle. The use of vertical glass facades on buildings and the increased size of windows is contributing to this mortality. As the human population and number of buildings increase, windows may contribute to significant declines in select species and increased losses may affect bird populations in general. An estimated 1 million individuals die from plate glass collisions annually. The mortalities include endangered and threatened species, large numbers of neotropical migrants, as well as our common resident species; none are immune from a potential collision.

For new and remodeled buildings, architects and allied professional designers are encouraged by Klem, to install windows at an angle so that the pane reflects an uninviting image such as the ground, rather than sky or habitat. Placement of falcon silhouettes or owl decals or other images do not reduce collisions enough to be effective. Covering the entire external glass surface with an opaque cloth or geometric design which breaks up or eliminates the reflection is the only means to cease bird strikes. Building design and location considerations need to be included in the impact review process. For example, a new glass facade building placed along Whatcom Creek, will likely pose a greater impact to birds than the same building, located several blocks away in downtown. This is due to the greater density of birds utilizing the stream corridor resulting in a potentially higher glass collision rate and mortality.

Barriers to migratory fish are numerous in Bellingham and require immediate attention. Identified in this document are site specific barriers to local fish populations. Considering the potential high value of our local fisheries, these and other barriers identified in the Bellingham Watershed Study (prepared by David Evans and Associates, Inc. and HDR, Consultants Inc.) must be given top priority by the city for immediate correction or mitigation.

In order to counter the adverse effects of barriers, further locating and identification work on both serious structural barriers, as well as functional corridors is needed. A working map with descriptions of barriers, obstructions and isolated habitats, would enable future projects to integrate removal and/or enhancement at targeted locales.

PESTICIDES AND OTHER TOXINS

Pesticides, also referred to as biocides, insecticides and herbicides, represent an irony of modern society. In an age of "environmental conciseness" we continue to produce, purchase and apply toxic compounds in the form of pesticides at the expense of the living environment. This expense is subtle, cumulative and cycles back to the public to regulate, monitor, and clean up later. The economics of chemical "pest management" outside of food production is worth review and contemplation by all levels of government and by the public. However, the emphasis of this overview is the toxic effects of pesticides on local wildlife.

Pesticides, heavy metals, solvents, PCBs, PBBs, Dioxin's and residues of these compounds are present in urban areas, such as Bellingham, and pose a threat to the life and health of local wildlife. Toxic compounds are associated with certain industries, particularly wood treatment/preservation, pulp and paper production, ship maintenance, and fiberglass products manufacturing, among others. Toxins can be persistent in the environment and leach from dump sites and contaminated soils into aquatic systems or become airborne.

Many toxic substances that are long-lived, persist in the environment and ultimately end up in accumulations known as toxic "sinks". Little is known about rates of deposition, metabolism or breakdown in specific sites or the uptake by organisms or recirculation (Peterle 1991). Historically, the city, the port and local industry including Georgia Pacific, Brooks Lumber, Uniflight, etc., have dumped toxic waste, allowed uncontained leaching from sites and have accidentally spilled toxic substances into air, water and soil. Some of these spills have had direct lethal effects such as fish kills in Whatcom Creek or long term leaching, circulation and accumulation, the effects of which have yet to be quantified. An inventory of known dump sites, spills and potential toxic substance handling locations is needed including: wood treatment facilities, industrial discharge sites, commercial pesticide applicators, municipal pesticide handling sites, golf courses and others. A cooperative monitoring program of identified sites, particularly ditches and drainages from those sites would assist in tracing sources of spills, encourage proper handling of substances and disposal of waste. Additionally, development of efficient containment and filtration systems should be encouraged as a preventative measure. Such a program would be in the interest of public health, as well as wildlife.

Annual fish kills in Whatcom Creek and the Maritime Heritage hatchery have been attributed to toxic runoff from a wood treatment plant site upstream. These kills were a substantial economic loss and if the source is effectively traced action should be taken to eliminate the risk of future incidents.

One of the most familiar, yet tragic examples of the adverse effects of pesticides on wildlife is the accumulation of chlorinated hydrocarbon compounds. The best known of these is DDT. The effects of these compounds and their residues are global in scope and persist today, despite a national ban on most chlorinated hydrocarbon compounds. Locally, the bald eagle, osprey and most notable, the peregrine falcon were seriously affected through the food chain. Accumulation of the compounds in the fatty tissue of fish were passed on to these predatory birds. The effects were chronic, disrupting reproduction by direct estrogenic activity and reduced calcium levels causing eggshell thinning (Bitman, Cecil, Harris 1969 In Peterle 1991). Eggshell thinning has been reported in at least 10 orders and 54 species of birds (Stickel 1975 In Peterle 1991). Fortunately, local populations of these species are currently thriving and expanding. Although another incident similar to that which occurred from the 1940's to 1972 with the consequences of generous application of DDT is unlikely (Hall 1984 in Peterle 1991), monitoring wildlife populations is necessary as long as pesticides are applied through broadcast methods in this country and banned chemicals, such as DDT, continue to be manufactured and applied outside this country. Less than .01% of all pesticides applied reach the target pest; the remainder is absorbed into our water, air, and soil (Washington Toxins Coalition 1990). With this inefficiency in mind, perhaps broadcast applications could be prohibited locally and replaced with spot application or manual maintenance and manual vegetation removal.

Most people associate the word pesticide with agriculture, however, urban and suburban use of pesticides is the highest reported use in the Puget Sound region and will predictably increase with population growth (PSWQA 1989). In 1988, a report prepared by Tetra Tech. estimated that about 1.1 million pounds (one half) of pesticide active ingredients used annually within the Puget Sound Basin are in urban/suburban application, including golf courses, parks, schools, yards, and other public and private facilities. Other uses include agriculture, military and right-of-way applications.

Depending on where and how they are used, pesticides in the urban environment can be transported to natural water bodies in a variety of ways. Probably the greatest potential for transport is via surface water runoff, which flows through drainage systems and is usually discharged directly into streams, rivers, and marine waters. The effects on water quality depend on the substance, its concentration and sediment in the water column. The persistence of certain pesticides is evident by their potential to leach through soil substrates. There are about 60 pesticide compounds and metabolites that the Environmental Protection Agency included in the list of priority leachate chemicals or substances with a potential to contaminate ground water. Included on the list are commonly used pesticides such as 2,4-D, Carbaryl (Sevin), Alachlor, Diazinon, and others (PSWQA 1989). Lists provided in the PSWQA pesticide issue paper, identifies those pesticides of greatest concern in Puget Sound.

Golf courses are significant users of pesticides, including insecticides, herbicides and fungicides as well as fertilizers. Because of a continual application to maintain tees, fairways and greens, adverse impacts on wildlife, through direct contact, water and forage contamination is indicated. A field study conducted by WWU's Toxicology Institute, set out to measure the effects of diazinon on foraging waterfowl. Following the dilution and application of the compound according to the manufacturers instructions, the golf course site was visited by a large flock of wigeon. The near immediate effects of the diazinon proved lethal and hundreds of wigeon died as a result (Kendall 1987).

Among the compounds commonly used on golf courses are Diazinon, 2,4,D, PCNB, MCPP, Dicamba and a fungicide Macozeb. Macozeb and other related ethylene bisdithiocarbamate pesticides are currently under special review by EPA because of potential health risks (PSWQA 1989).

Due to current management practices, golf courses are not substitutes for natural open space as wildlife habitat. Golf courses may appear as open space to some; but, they are intensively maintained potentially toxic areas of human recreation offering little potential for preybase colonization, contiguous habitat due to fragmentation, hiding cover due to control of shrubs and grass, clean water due to residues from fertilizers and pesticides or freedom of movement due to chain link fences. New designs and management techniques are needed to make golf courses more compatible with wildlife. Allowing rodents to colonize the fairways, locating the course adjacent to natural open space and connecting wooded (divisions) with that open space, without fencing and utilizing alternative vegetation and ground covers in place of high maintenance lawn grasses. Although the human presence will limit its function as habitat for less tolerant and more specialized species, golf courses have potential to serve dual function in the urban environment.

Useful guidelines for golf course habitat enhancement and restoration are available from the New York Audubon Society. Through the Audubon Cooperative Sanctuary Program, golf courses may enhance their habitat potential and receive certification for doing so. More information is available from New York Audubon Society, Rt. 2 Box 131, Selkirk NY 12158.

Maintenance of Rights-of-Way

The continued application of herbicides to control unwanted vegetation along public rights-of-way needs to be addressed. Herbicides are routinely applied along roadways, pipeline and power corridors, railroads and parking lots. For example, herbicide applications along the Burlington Northern railroad through Bellingham, herbicides are sprayed along I-5 and county roads to maintain shoulders and over gravel parking lots to keep them devoid of vegetation. The close timing of a broadcast application of herbicide along the railroad, and on a ten acre gravel lot adjacent to Padden Creek and Padden Creek estuary, may have been related to a coincidental bird kill in that same area, following the application.

Most herbicides act on the growing plant and are most effectively applied during the plant's inflorescence. Application past this stage, when the plant is entering dormancy is much less effective, if at all (Colebrook pers. comm.). Plants bearing ripe fruit and releasing seed are sought by pre-migratory birds and other wildlife. Applying pesticides to these plants directly exposes wildlife, primarily birds, and possibly people, to the compound. Application along the railroad was estimated from the center of the tracks at a distance of 25 feet to the east and an unknown distance to the west since all vegetation appeared affected. The eastern bank of the railroad corridor is dominated by blackberry vines which at the time of spraying were laden with ripe fruit (Eissinger pers. obs.).

Following the herbicide application three birds were found dead in the vicinity from unknown causes. A wetland to the east of the right-of-way also showed evidence of direct application. Certain plants within ten feet of Padden Creek were killed. An observer was concerned with public health, since people were walking the creekside trail during the application; they also feared that due to the proliferation of ripe blackberries unwary berry pickers could be affected. The application of herbicide in both cases left a distinct visual trail. Unquestionably, the application in both locations was excessive and careless. Burlington Northern has a right-of-way of ten feet to the east and twenty feet to the west, in the section of the railroad where the observations were made. The Haskell property near Padden Creek was sprayed to control weedy plants. Despite the broadcast application, purple loosestrife was left unaffected in the southeast corner of the property.

Broadcast application of pesticides in the city for non-agricultural purposes should be discouraged. Maintenance of barren lots with routine application of herbicides should also be discontinued. Affecting non-target species when applying pesticides is unavoidable, therefore, alternatives to pesticides need to be encouraged and in certain locations required. Manual maintenance of rights-of-way and trails particularly along shorelines is one alternative. The issue of over-grooming needs addressing city-wide.

HUMAN RELATED DISTURBANCE

Passive, non-consumptive recreation, is considered by most planners as compatible with wildlife. However, according to a review of the literature including 536 references, negative impacts on wildlife are reported for hiking, camping, boating, wildlife observation, photography, swimming, on-shore recreation and others (Boyle & Samson 1985). In their review of actual data from 166 studies, Boyle and Samson summarized recreation related impacts for birds, mammals and herpetofauna. Passive recreation was cited as having negative impacts on birds in 42 studies, on mammals in 29 studies and on herpetofauna in none. Negative effects range from trampling vegetation, disturbance, displacement of animals from trails, nest losses through predation, nest abandonment, loss of shoreline habitat, air/water/noise pollution and local species extinction. In their recommendations, Boyle and Samson suggest separating wildlife and recreation as much as possible by managing specifically for wildlife in certain areas, providing large areas of contiguous habitat for area sensitive species and designating certain areas for recreation or "sacrifice areas."

Locally, recreational areas are assumed to provide for the needs of wildlife, yet many lack the habitat opportunities for maintaining wildlife diversity. Bellingham Parks are managed for people, and human disturbances in these areas are unavoidable. However, where adequate space and vegetative cover or screening is available wildlife and passive recreation are undeniably compatible. A fine example of compatibility is the Interurban Trail between Fairhaven Parkway and Old Samish Road. Currently, the trail is straight as opposed to curved or weaving, vegetative screening separates the trail from adjacent wetland habitat and overhead or canopy cover is 60 to 100%. The trail is encapsulated by the forest. Wildlife crossing the Interurban will not be accidentally surprised, noise is abated, dogs are less likely to penetrate the understory in most sections of the trail and the trail does not bisect the critical habitat, but instead skirts it to the east.

Stream corridors are particularly susceptible to incompatible uses. Functioning as natural corridors for most local species, aquatic and terrestrial, stream corridors are likely to provide for a greater abundance of species and individuals, particularly slow moving vulnerable species and medium/large mammals. Human activity in and adjacent to or in plain view of the water course have the highest impact. Without adequate stream side screening, most animals, be it a fish, bird or mammal will flee for cover if encountered by a human. Ideally, natural vegetation within the entire riparian area should be left undisturbed. Shoreline trails and multiple stream crossings are particularly disruptive to wildlife and should be avoided or corrected by placement well above the stream where possible.

BIODIVERSITY

Maintaining species or biological diversity is the ultimate goal of current conservation efforts (Lehmkuhl and Ruggerio 1991). Biological diversity is an umbrella term for the degree of nature's variety, including both the number and frequency of ecosystems, species or genes in a given assemblage. It is usually considered at three different levels, "genetic diversity," " species diversity," and " ecosystem diversity." Genetic diversity is a concept of the variability within a species, as measured by the variation in genes within a particular species, variety, subspecies or breed. Species diversity is a concept of the variety of living organisms on earth and is measured by the total number of species in the area under study. Ecosystem diversity relates to the diversity and health of the ecological complexes within which species occur and those ecological processes which support the biological function (OTA, 1987, Ricklefs, Naveh and Turner 1984, as cited by McNeely 1988). If biodiversity is not maintained or the techniques used in its maintenance prove ineffective, the result will be the homogenization of species, floral and faunal, throughout entire regions.

SPECIES AND HABITAT DIVERSITY

In discussing biological diversity, E.O. Wilson writes that it is a serious global resource to be indexed, used and above all preserved (Wilson 1988). For humans, with the loss of biological diversity *"Crop yields will be more difficult to maintain in the face of climate change, soil erosion, loss of dependable water supplies, decline of pollinators and ever more serious assaults by pests. Conversion of productive land to wasteland will accelerate; deserts will continue their seemingly inexorable expansion. air pollution will increase and local climates will become harsher"* (Ehrlich 1988).

Animals and plants are essential resources that provide humans with new foods and medicines, clean air and water, energy and building materials. For our biosphere, we need a certain base of functioning habitat, providing the living and nonliving elements through which energy, minerals and nutrients cycle and support biological diversity, including humans.

Maintaining biological diversity depends on protection of plants and animals within an ecosystem. In turn, ecosystem diversity is dependent on maintaining the naturally occurring habitats and the physical and hydrological interconnections between them. Habitat fragmentation and disruption of corridors or habitat linkages can lead to local extirpation, either because the species do not have enough habitat or cannot move between habitats (Murphy 1988). The greatest threat to the biological diversity of relatively intact natural communities in and around urban areas is the destruction of habitat and its conversion to other uses (Murphy 1988). Further, the disturbance or removal of habitat linkages also threatens species diversity.

The economics of biodiversity maintenance is a pertinent issue for Bellingham and Whatcom County as natural resource-dependent communities. Since future consumption depends to a considerable extent on the stock of "natural" capital, conservation may well be a pre-condition for economic growth. Conservation is certainly a pre-condition for sustainable development, which unites the ecological concept of carrying capacity with the economic concepts of growth and development. Instead of conserving the rich resources of forest, wetland and sea, current processes of development are depleting many biological resources at such a rate and reducing them to such low population levels, that they are rendered essentially non-renewable (McNeely 1988).

Conserving biological resources requires a wide range of management tools, varying from complete protection to intensive management. Technologies aimed at maintaining ecosystems generally include protecting areas, land-use planning, zoning systems and regulations on permissible activities (McNeely 1988). The Growth Management Act addresses all the available tools and directs their use.

THE GROWTH MANAGEMENT MANDATE and BIODIVERSITY

For too long, wildlife concerns have been given secondary status and considered, only as an afterthought in the planning process. In part, this lack of consideration is due to the paucity of site specific, species and habitat information. It is also, due to the lack of impetus to seek the needed data for this application. This lack of empirical data is not a local phenomena, there is no systematic fish and wildlife species or habitat inventory for the Puget Sound or any county thereof (PSWQA 1990). Even the State Environmental Protection Act discourages inventories of species as part of the environmental impact study. Only the T&E (threatened and endangered) species have been considered, if their presence in the area had been previously established. This informational gap has created a planning vacuum; it is impossible to consider plant and animal communities in the planning process when the individuals and the dynamics of those natural communities have yet to be identified. Determining impacts on local wildlife and habitat has been for the most part ignored or based on unverified information.

In 1990, the Washington State Legislature passed the Growth Management Act (GMA) which requires counties and cities to take a comprehensive, coordinated, proactive approach to land use planning that will guide land development away from sensitive areas. The GMA directs each city and county to classify and designate critical areas which include fish and wildlife conservation areas. But the act does not stop at independent site identification, it also stipulates a greater view in the identification and creation of a landscape linkage of habitat blocks, open spaces and protection of these with buffers to separate incompatible uses. The GMA is attempting mandated maintenance of biodiversity. Success of this goal will require tenacious communication and cooperation between all levels of government, public/private institutions/organizations, scientific disciplines and landowners, plus a fundamental willingness to bridge jurisdictional boundaries. Most importantly, implementing GMA will require direct action.

HABITAT NETWORKS: *function and design*

"..the best way to fight the deleterious effects of fragmentation is to prevent it. Where ever possible planners should insist on the linking of habitat elements by habitat corridors. This suggestion obviously assumes that it its necessary to do planning on a scale larger than the individual housing development."

Michael Soulé 1991

A NETWORK OF RESERVES AND CORRIDORS

The concept of the habitat network has been studied and discussed in numerous references under a variety of titles including *Nodes, Networks and MUMs* (Noss & Harris 1986), *Wildlife Reserves and Corridors in the Urban Environment* (Adams & Dove 1989), *Preserving Communities & Corridors* (Macintosh 1989), *Protecting Natural Areas in Fragmented Landscapes* (Noss 1987), *Landscape Ecology* (Forman & Godron 1986) *Landscape Linkages and Biodiversity* (Hudson ed. 1991). These authors along with others are pioneering the frontier sciences, of landscape ecology, island biogeography and conservation biology. The melding of disciplines is necessary to gain the required "holistic" view of an area, be it a small parcel of land or an entire region, to identify and attempt to understand the natural systems and their dynamics, their structure at the macro and micro level. These systems include geologic, hydrologic, climatic, biological and anthropomorphic components. Viewed in this manner, the overall complexity of the natural landscape is daunting and poorly understood by comparison.

Despite this vast wilderness yet to be discovered, there is a pressing need to identify and preserve as best we can the lifelines in our natural environment. These lifelines are the landscape linkages, the interconnection of habitat islands containing wildlife communities, bound together by natural corridors.

As discussed earlier wildlife have four basic requirements, 1) food 2) water 3) cover 4) space. These requirements appear to be a simple formula for survival, however, when one considers the species specific requirements for each basic heading, it is apparent that the multiple variables to be considered when planning for wildlife communities is quite complex. If a land use plan were to consider the longevity of the wildlife community within a particular area, these four factors in relation to the species present must be accounted for. Yet, accounting for all the possible variables in such a process would prove impossible. Alternately, certain factors and guidelines may be used to direct the planning process to benefit the wildlife community in question.

Habitat alteration and fragmentation has resulted in the local extirpation of several native species and the isolation of habitat islands. The theory of island biogeography is built on the predictability of this occurrence and has lead to the recognition that the habitat islands, even in an urban environment, are for a limited time valuable reserves of locally significant biological diversity. Isolation increases the rate of species extinction, and the risk of species extinction within an island is inversely related to its size (MacAurther and Wilson 1967, cited by Soule' 1991).

In an attempt to counteract the isolation of habitat, the creation and protection of *natural* corridors are the only practical alternative. The application of principles from island biogeography, conservation biology and landscape ecology to local planning goals to retain native species diversity and abundance, should result in the development of a functional habitat matrix. This matrix is made up of natural area reserves or nodes linked together by habitat corridors, which extend beyond the planned area into a larger regional matrix.

The importance of a habitat network is its function in the maintenance of viable wildlife populations and species diversity. This is done by assuring the free flow of individuals to and from habitat reserves. The secondary benefits of such a network are aesthetic and open space values which provide important natural functions as in buffering sound, water filtration and attenuation of stormwater, as an indicator of environmental health and if conditions allow, they may serve limited human recreational use.

NATURAL AREA RESERVES

It was once the accepted theory and practice that to preserve nature's splendor was to simply designate the area of outstanding beauty and unspoiled wilderness as a "preserve" and in most cases these areas became parks. Parks can be areas of regional ecological significance. Unfortunately, over time many parks have become islands of habitat. Surrounded by encroaching intensive resource extraction activities, development, intensive agriculture or rangeland, these island arks have become isolated. The vast size of these preserves, it was assumed, would provide all the elements necessary for species longevity. Unfortunately, it is now recognized that most national parks in the western United States are too small to prevent the extinction of many medium-sized and large mammals (Newmark 1987 cited by Soule' 1991). It is possible to recognize a similarity with our local parks. Ten years ago Cornwall Park, Fairhaven Park and Whatcom Falls Park all were buffered from development by surrounding undeveloped land which formed natural connections to rural valleys and vast forest lands. These valuable buffers and connecting habitats are nearly gone.

The purpose of a habitat network is to link the existing habitat islands in a functional manner to ensure the flow of species or genetic material. Genetic diversity may be insured by immigration and emigration of individuals, particularly dispersing juveniles. The potential for recolonization following a catastrophic event is also enhanced. Function of a network is dependent on the distance between parks or reserves, linkage effectiveness, species mobility and population abundance and distribution.

State and national parks, wilderness areas, national forests and other large reserves are the regional hubs of a far-reaching matrix of linked natural areas. In a local context, species diversity and abundance are dependent on the remaining functional natural areas or habitat fragments and what threads that might serve as links. In the urban and rural environments, habitat availability and area or size are the primary determinates of wildlife occurrence and population viability.

HABITAT CONSIDERATIONS: area and structure

Habitat area (size), degree of isolation and percentage of vegetative cover are three variables accounting for 91 percent of the variation in land vertebrate species richness of urban woodlots (Vizyov'a 1986, In Adams and Dove 1989). According to Vizyov'as research in Czechoslovakia, island size for managing land vertebrate communities in urban woodlands was determined to be a minimum of 20-30 ha (50-74 acres). Additionally, the vegetative structure, proximity to permanent water and connectivity with other habitat areas determined the overall habitat value of the site and its species association.

Other studies cited by Adams and Dove pertaining to habitat patch size include the work of Tilghman (1987) in Massachusetts. Tilghman compared breeding bird diversity and abundance to habitat patch size, isolation, vegetation characteristics and human activity. She concluded that woodland size accounted for 79% of the variation in total species richness for the areas studied. Results of a Delaware study show that dense populations of a large variety of breeding birds are found in urban woodlots of 8+ ha (20 ac) with adequate vegetative cover and structure. These characteristics were described as adequate shrub understory, mature and dead standing trees and edge vegetation of sufficient width and proper quality. Interestingly the author pointed out that forest interior species were rare or absent from the study areas, indicating that such species require areas >8 ha to breed, they are therefore an area-sensitive group that must be considered in the habitat network planning process.

To provide functional habitat for forest interior-dependent or associated species in Northwest Washington, it is necessary to calculate minimum stand size for the retention of the interior microclimate. Based on Franklin and Foreman (1987) and Harris (1984), the interior microclimate of old-growth Douglas fir begins a minimum of two tree lengths, or about 160 m (525 ft) inside the stand. Calculations for other forest types and age classes are similar. Washington Department of Fish and Wildlife Habitat Biologist Dana Base suggested, that second and third growth stand interiors may be estimated by determining the distance from the edge of the stand at least two average tree lengths (depending on stand composition) into the stand. For example assuming in Bellingham that the average tree height of a second growth lowland conifer forest (as described in the habitat classification) is 30 m or 98 ft, two tree lengths would equal 60 m or 196 ft. This is the minimum distance into that forest stand unaffected by edge effect and edge associated species which have been documented as competitive, aggressive and in some cases parasitic. For those species dependent on a forest interior condition, a minimum stand size could be generally estimated by first determining minimum viable population, then calculating the total area of home range or territory, whichever is applicable, plus minimum buffers. It is assumed that maintenance of minimum viable populations of interior species will depend on preservation of functional corridors wide enough to maintain an interior condition linking larger habitat blocks (Noss 1991).

Again, interior condition or micro climate is a function of forest patch size. Fragmentation of habitats has a deleterious effect on interior conditions causing an increased edge effect and decrease habitat value for most vertebrate animals (Soule' 1991).

"The prudent manager will realize that fragmentation - that is, habitat loss and isolation of remaining fragments - will nearly reduce the population of species associated with late successional forests and possibly result in their extirpation. The ability of populations that have been reduced by habitat loss to cope with the effects of habitat isolation is determined by the life history and population structural characteristics of the species and by the success of land managers (planners) in implementing low-fragmentation alternatives to current logging (and development) practices and managing the landscape as an interacting network of habitats (Lehmkuhl, Ruggerio & Hall 1991)."

Edge habitat is recognized for its diversity of species and its abundance of edge-associated species. This habitat occurs at the interface of two differing habitats and usually involves forest edges. Edge effect is also determined in part by patch size, the ratio of edge habitat to interior habitat increases as fragment size decreases (Soule' 1991). Due to the abundance of edge habitat in an urbanizing area such as Bellingham, it is important to minimize edge in favor of contiguous habitat where possible.

From studies in western Maryland, investigators found most neotropical migrant birds observed were least frequent in the smallest woodlots, while short-distance migrants (typical edge species) were found with increasing frequency as woodlot size decreased (Adams & Dove). While professional biologists are concerned with the steady decline of neotropical migrant populations, perhaps habitat fragmentation and decreasing patch size is influencing this trend. The retention of local native forests in large blocks will benefit a variety of species, including these seasonal visitors and breeders.

Closer to home, in Seattle, the relationship between urban parks size and vegetation to urban bird populations was studied by Carol Gavereski in the mid-seventies. The sites surveyed were parks ranging in size from small areas 2 ha (10 ac) to 8 ha (20 ac) to larger areas 69 ha

(170 ac) to 113 ha (280 ac). The larger parks are comparable in size to Bellingham's Sehome Arboretum and Whatcom Falls Park. The results of this study show that "a large forested park with a natural diversity of native vegetation was associated with a high diversity of native forest bird species, a diversity comparable to a forest tract outside the urban influence." While native diversity was preserved in the larger parks, so was the abundance of those species characteristic of this habitat (that of the Pacific Northwest lowland coniferous forest) despite the surrounding urban landscape. Those parks of smaller size or with highly modified vegetation contained fewer species and a greater proportion of urban-dwelling species. An interesting observation was that certain birds were noticeably fewer and occurred less frequently as clearing and modification of vegetation, particularly understory vegetation, increased and park size decreased; affected were those species associated with the shrub and ground vegetation within the northwest forest strata. This illustrates the need to retain not only the forest canopy but the understory vegetation as well as standing snags and dead/down woody material. It also proved the need to retain larger forest stands as reserves.

As demonstrated in the Gavereski study, removal or disturbance of any part of a vegetation community or habitat directly affects, by removing or disturbing, its associated species. Bird species are usually associated with certain vegetation communities as habitat. Each is species associated with a component of that community. In the forest community, the bird life can be generally divided according to the forest strata.

The following figure from *Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington* illustrates forest strata and associated bird species.

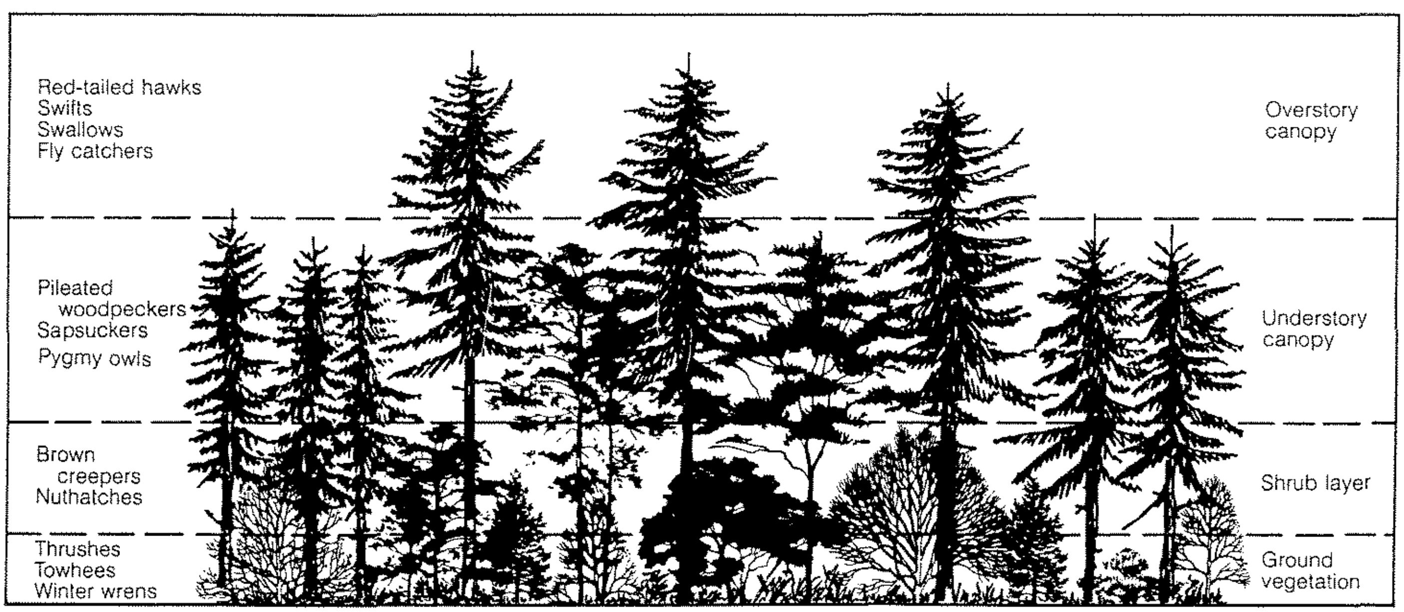


figure 1 . Four layers of a mature forest, with the birds that typically inhabit each.
Extracted from E.R. Brown 1985.

HABITAT RESERVES AND SPECIES CONSIDERATIONS

One of the most important resident bird species in the city of Bellingham is the Pileated woodpecker*(Dryocopus pileatus)*. The pileated is the largest cavity excavator. Its cavities are excavated in the understory canopy and are large enough for arboreal rodents, other small forest mammals including bats, owls and cavity nesting passerines, to nest, roost and/or overwinter. Pileateds are considered a primary excavator of sound wood and are estimated to excavate 3 cavities per year (Brown 1985). Providing cavity habitat for an estimated 8 or more species, the pileateds play a critical ecological role in mature conifer forest systems. The home range of pileated woodpeckers varies from 543 acres in eastern Oregon (Bull 1987) to 1000-1356 acres in western Oregon (Mannan 1984). A study of the area requirements of forest birds in the middle Atlantic States estimated an minimum breeding area of 400 acres for pileateds. Snag density is also a important habitat requirement for pileateds.

Mammals due to their varied body size, mobility and food requirements, have equally diverse habitat requirements. Large carnivores such as black bear and cougar, which still occur locally, have large home ranges and also traverse a variety of habitats and if necessary, travel great distances daily in search of food. Since elk are extirpated from the city and its fringe, deer are the only ungulate which roams locally and is quite adaptive.

Most medium sized mammals are carnivores, or omnivores. The degree to which a terrestrial mammal is carnivorous may affect its area requirement. Bobcat, which are exclusively carnivorous require a home range up to 1140 acres. Another locally occurring carnivore, the weasel, requires a home range of 640 acres. Animals that are occasionally omnivorous like the red fox, require larger areas than common omnivorous species for foraging and depend on small to medium vertebrates as a prey base. Their home range averages 640-1920 acres (Brown 1985) and denning requires isolation from human activity or disturbance. One study found that most foxes in the midwest located their dens 275 m or 900 ft from occupied buildings (Forman & Godron 1986).

Omnivores such as racoons and opossums, require less area, with home ranges averaging up to 20 acres for raccoons and 58 acres for opossums (Brown 1985). They are also very adaptive and tolerant of human activity, to the point of earning the reputation as local nuisances.

Another medium sized mammal which we tend to take for granted is the porcupine. This species has specialized food preferences and a home range of 250-360 acres (Brown 1985). In addition, it is slow moving and is said to have limited vision. Factoring porcupine habitat requirements into a network design will involve a detailed analysis of available food sources, safe corridors and the identification of potential barriers or other hazards.

Larry Harris and Paul Gallagher urge decision makers to consider large carnivores in habitat reserve and network design. They state that the growth of animal populations studied in Florida are inversely related to body size and trophic level (Harris & Gallagher 1989). The authors present several design examples that provide the area and habitat corridors necessary to facilitate the safe movement of these larger carnivores. They also raise the issue of human pressure and habitat loss selecting for generalist species. This category of species such as raccoon, opossum, cowbird, starling, etc. are enabled by the changing landscape to out-compete and eventually displace more specialized native species.

Terrestrial amphibians and reptiles, like small mammals (shrews, voles and mice) occupy comparatively small areas, yet they share a sensitivity to human disturbance, and particularly soil compaction. Amphibians are strongly associated with large well decayed logs and down woody debris, both hardwood and conifer (Welsh & Lind 1991).

To illustrate the area requirements of certain mammals the following figure lists estimated home range, and minimum habitat area.

Estimated Home Range and Minimum Habitat Area for Selected Mammals

species	estimated home range	minimum habitat
cougar *(Felis concolor)*	17.5 sq mi	NA
bobcat *(Lynx rufus)*	1140 ac	NA
black tailed deer *(Odecolius hemionus)*	74-640 ac	NA
black bear *(Ursus americanus)*	19 sq mi	3200 ac/ pair
striped skunk *(Mephitis mephitis)*	31-114 ac	640 ac/ pair
northern flying squirrel (*Glacomys sabrinus)*	4.9 ac per family	360 ac/ population
Douglas squirrel *(Tamiasciurus douglasi)*	1-2 ac	NA
beaver *(Castor canadensis)*	<500 ac	1 stream mile/colony
muskrat *(Ondatra zibethicus)*	<6 ac	1 stream/mile/pop.
porcupine *(Erethizon dorsatum)*	250-360 ac	6,400 ac/population
eastern cottontail *(Sylvilagus floridanus)*	<20 ac	NA
deer mouse *(Peromyscus maniculatus)*	3.5-4.7 ac	40 ac/population

Extracted From R.E. Brown, 1985

figure 2

Determining the minimum upland habitat reserve area or block size and location is based on two basic factors: 1) species present, 2) availability of suitable habitat. These factors are the subject of separate chapters in *Landscape Linkages and Biodiversity* (Hudson ed. 1991). Chapter 1, *Gap Analysis: assessing protection needs* by J.M. Scott, B.Csuti and S. Caicco describes methods for identifying and mapping available habitats, ownership, land use, sensitive areas, and predicting animal distributions, then overlaying the information for analysis. The final product is in essence a preliminary blueprint for a regional reserve system. Chapter 6, *Conservation Corridors - Theory and Strategy* by M. Soulé describes the necessity and method for selecting target species.

Although the context of the target species in this text is in reference to designing corridors, it is logical that those same species (target species) are likely to also dictate reserve size. Target species are those at greatest risk of extinction or local extirpation. Other criteria in their selection are abundance, variability in population size and mobility (Soulé 1991). Target species applicable to local planning would be locally significant species as listed in Inventory Section.

The general parameters for the identification and delineation of upland reserve areas are:

- species presence/mobility/habitat requirements/vulnerability
- species area requirements
- minimum viable population
- contiguous block size
- habitat suitability
- year-round water source
- adjacent land use
- habitat connectivity

Recommendations for Local Reserves

In Bellingham, based on locally significant species and their habitat requirements alone, a minimum upland reserve area is estimated at 640 acres. In theory, it can be assumed that one upland reserve per watershed would provide the necessary habitat and area to support viable populations of native wildlife that currently occur in Bellingham. To assure the function of these reserves over time, connecting habitat corridors would be required. This is a preliminary estimate of minimum reserve size and without a field verified species and habitat inventory it is difficult to substantiate. It is however, based on the best available published information to date.

Considering the remaining natural area in the city, current land use patterns, and growing housing and development pressures on available land, it may seem infeasible for the city to provide a contiguous 640 acre reserve per watershed. However, by considering smaller existing protected areas or parks and forest land both within and outside the city boundary linked together with greenways and existing natural linkages such as stream corridors or ridgelines, it is possible to achieve the recommended total area within each watershed. It must be kept in mind that the value of a habitat reserve depends on connectivity, a functional habitat link, so by utilizing smaller reserves more corridors are required.

Achieving long-term conservation goals by utilizing several smaller reserves rather than one contiguous reserve is cautioned. Several small reserves, however well placed, cannot approach the value of a single large reserve in conserving populations of obligate forest interior bird species, particularly warblers and pileated woodpeckers (Robbins, Dawson & Dowell 1989). The same authors state that, based on their results, several 50 ha (124 ac) forest reserves may approximate the value of a single large reserve for area sensitive bird species, but they did not indicate that these smaller reserves provide necessary habitat for breeding populations over time. It is therefore, recommended that the city consider the largest reserves possible to ensure our present species diversity and viable population into the future.

Presently, only one protected area within the city boundary would meet the recommended area requirement for upland reserves. That is the 1008 acre Lake Padden Park, a model reserve with a diversity of habitat including a fresh water lake, wetlands, contiguous maturing conifer forest, forest interior, snags and more.

In the Chuckanut Watershed, the 38 acre Arroyo Park provides a variety of habitats, a viable salmon spawning stream (the only stream in Bellingham with returning wild stock), and connections between the Chuckanut Bay estuary and the Chuckanut Mountain uplands. The Arroyo forest reserve is presently contiguous with the vast forest ecosystem of Chuckanut Mountain to the south and a diverse forest wetland complex to the north. The links to these larger blocks should be procured to ensure a protected corridor. Also, an addition to Arroyo to the north and south would achieve the minimum reserve area requirement for the watershed.

Whatcom Creek and Squalicum Creek watersheds are more developed and as a result the natural areas are fragmented. However, the upper watershed areas provide large contiguous habitat blocks that should be utilized as reserves. Networks of smaller habitat blocks will also be necessary to meet the minimum reserve area recommendations in both watersheds. For detailed recommendations please refer to the watershed inventory section of this document.

To propose minimum habitat reserve areas and their specifications without providing equal detail and explanation of habitat corridors could prove deleterious to the species we are planning for. Establishing habitat linkages is critical, particularly in a developing area such as Bellingham. Habitat reserves despite their size cannot function in isolation:

"The viability of these habitat islands as suitable wildlife habitat ...depends on the outside recruitment of animals, which is affected by the spatial arrangement of islands and the effectiveness of linkages of urban habitat patches with rural surroundings."

(Adams and Dove 1989).

LANDSCAPE LINKAGES AND CORRIDORS

"An obvious way to facilitate the flow of species, individuals, genes, energy and habitat patches is to widen existing corridors of appropriate habitat and eliminate barriers between preserves and other natural areas. In many landscapes riparian corridors can fulfill this function well and at the same time protect water quality ..."

(Noss and Harris 1986)

While human communities continue to sprawl and form developed connectors with the construction of roads and freeways, the natural linkages for animals are culverted, embanked, paved, bulkheaded, fenced or blocked by buildings. Habitat fragmentation is considered by many biologists to be the single greatest threat to biological diversity. One strategy offered to counter the fragmentation problem is that of landscape linkages, usually consisting of corridors of habitat that physically connect larger habitat patches in a landscape mosaic (Noss 1991). A corridor is a transitional habitat providing a critical link between habitat areas. It contains the elements necessary for survival and successful reproduction to sustain wildlife populations.

The authors of the Growth Management Act, recognized the deleterious effects of current urban growth and development on wildlife habitat, particularly the effects of fragmentation. The response to counter these negative impacts was included in GMA requiring the identification and designation of fish and wildlife habitat conservation areas. Additionally, GMA recommends creating a system of fish and wildlife habitat with connections between larger habitat blocks and open spaces, or in other words a habitat network of reserves and corridors.

THEORY and FUNCTION

Published research quantifying positive values and functions of habitat corridors is a fairly recent occurrence, but it clearly substantiates arguments favoring corridors in landscape planning and wildlife conservation. The early arguments favoring wildlife corridors were based on the principles of island biogeography, or the inevitability of local extinctions in isolated habitat fragments. A basic premise supporting the establishment of corridors is that the original landscape was connected, therefore efforts should be made to maintain or restore the natural landscape connectivity. This argument is in response to "*the most serious threat to biological diversity, habitat fragmentation*" (Wilcox and Murphy 1985). Two ways to counter fragmentation are to increase effective habitat area and to increase connectivity (Noss 1987). It is assumed that documented short term function of a corridor is a good indicator of the corridor's role in the long term maintenance of local wildlife populations.

The natural landscape prior to intensive development was interconnected with natural corridors. Corridors function as seasonal migratory routes, daily travel corridors, for foraging, and probably most importantly, as dispersal routes for the once-in-a-lifetime journeys by juveniles in search of a new home. Corridors function as conduits both in the landscape as well as in the flow of nutrients, energy and genes. The immigration and emigration of genetic stock to and from wildlife populations will contribute to local species survival over time.

A corridor's primary purpose is to connect the larger blocks of habitat or reserves. Potential advantages of corridors are listed by Reed Noss (1987), as follows:

1) Increase immigration rate to a reserve which could:
    a. increase or maintain species richness and diversity probability (as predicted by island biogeography theory);
    b. increase population sizes of particular species and decrease probability of extinction or permit re-establishment of extinct local populations;
    c. prevent inbreeding depression and maintain genetic variation within populations.

2) Provide increased foraging area for wide-ranging species.

3) Provide predator-escape cover for movements between patches.

4) Provide a mix of habitats and successional stages accessible to species that require a variety of habitats for different activities of stages of their lifecycles.

5) Provide alternate refugia from large disturbances (fire escape).

6) Provide "greenbelts" to limit urban sprawl, abate pollution, provide recreational opportunities (where suitable) and enhance scenery and land values.

Michael Soulé in his 1991 article *Land Use Planning and Wildlife Maintenance: guidelines for conserving wildlife in an urban environment,* suggests that corridors, including under-road links, can mitigate some of the deleterious effects of fragmentation (Forman & Godron 1986). A major consideration in urbanizing areas is that habitat fragmentation is virtually inevitable and one of the only mitigating devices is the establishment of corridors of natural habitat or linkages such as underpasses that permit dispersal across barriers. He recommends that corridors be analyzed and designed by teams of planners, engineers and biologists on a case-by-case basis. Wildlife corridors can be viewed as a kind of landscape health insurance policy; according to Soulé they maximize the chances that biological connectivity will persist, despite changing political and economic conditions. Finally, Soulé admits wildlife linkages involve capital investment up front; but it is considerably less expensive to construct underpasses and other linkage elements for wildlife during the construction of facilities than to retrofit existing "improvements."

NATURAL CORRIDORS

It is common to think of corridors as linear strips from one habitat to another. Unlike modern day road systems, wildlife corridors are usually meandering routes following valley bottoms, riparia, and topographic ridge systems (Harris 1985). Any area of habitat through which an animal or plant propagule has a high probability of moving is considered a corridor or linkage (Noss 1991). In urbanizing areas suitable natural habitat linkages are limited in area and availability. Interestingly, the areas identified as preferred wildlife corridors are usually the last areas to be developed due to flooding, wetlands, steep slopes, unstable soils or inaccessibility.

The most obvious natural habitat corridors are rivers and streams and their associated open floodplain, steep ravines and broad valleys. Aquatic species are certain to utilize these passages and provide a ready food source for a multitude of upland or terrestrial species. River and stream systems are by far the most important natural corridor feature for local native wildlife. Riparia is therefore a priority corridor and habitat area

<u>Priority Habitat Management Recommendations: Riparian</u> unpub. draft rep. March 1995. Washington Department of Fish and Wildlife, Priority Habitats and Species Division.

The wildlife value derived from riparian habitat include five characteristics: structural complexity of vegetation, connectivity with other ecosystems, high edge-to-area ratio, abundant food and water, moist and mild micro-climate.

Riparian habitat is vital to local fish populations. Undisturbed riparian areas filter pollutants and sediment from surface runoff. Vegetation stabilizes stream banks, provides shade necessary for water temperature regulation and cycles nutrients into the stream system. Nutrient cycling occurs through interactions of bacteria, fungi and aquatic insects utilizing leaves and woody materials dropped in the water, resulting in the release of proteins, sugars and minerals into the water column and the creation of a nutrient-rich detritus on which the aquatic food chain is built. Overhanging trees or multiple layered canopy provide the richest source of nutrients and habitat both as fallen plant materials, fungi, and insects, but also providing surface and in-stream cover for fish. When large trees fall into the stream course the stem provides a nutrient rich substrate for aquatic invertebrates and it also creates pools and oxygenating falls all of which provide food and habitat for migratory and resident fish. Large woody debris provides an in-stream structure representing multifunctional values through pool formation, added cover and stabilization of spawning gravel (Bisson et al, Sedell et al 1988, as cited by House & Crispin 1990) in addition, to controlling flow and bed load.

Riparian areas maintain fisheries habitat by providing shade, keeping water temperatures low enough in the summer to retain dissolved oxygen to support fish and to prevent lethal low temperatures in winter. By decreasing sediment, riparian buffers prevent siltation of essential spawning grounds and the destruction of aquatic invertebrates which are important fish food sources. Riparian buffers provide bank cover for fish and provide bank stability through the soil binding capacity of root systems and energy dissipation during flood periods (Riparian Habitat Technical Committee, 1985, as cited by Zeigler 1990).

Riparian habitat is of particular value to non-fish wildlife as well. Natural riparian corridors provide vegetative and structural diversity, cover, water, nutrients and energy inputs downstream (Ross 1991). For these reasons riparian areas are critical for fish and wildlife, producing more plant and animal life and structural complexity than most other habitats. *"The density and diversity of wildlife are greater in riparian areas than in any other habitat type"* (Odum 1979, in Brown 1985). Roughly 86% of all wildlife species in western Washington use riparian zones (Brown 1985), and it is conceivable that the same percentage utilize the same areas as movement corridors. Riparian zones frequently serve as connectors between other habitats or as transitional habitat.

In Washington State, as much as 70-98% of wetlands and riparian areas have been converted to urban, rural and agricultural lands. The greatest loss has been in the western lowlands and floodplains (Knopf 1985, Canning and Stevens 1989, as cited in WDFW 1995).

Because riparian habitat is the axis determining the function and value of adjacent aquatic and upland habitats, the health of the entire watershed pivots on the condition of riparia. Therefore, land-use decisions and subsequent activities effecting riparia need to be addressed on a watershed basis.

The wildlife and fish species associated with riparian areas are highly vulnerable to habitat modification. The importance of the riparian ecosystem has been clearly documented in the scientific literature and its protection specified in the GMA. Adequate buffers to protect riparian zones from modification are also specified in GMA and should be a priority regulatory goal throughout western Washington.

Washington Department of Fish and Wildlife
Recommended Riparian Buffer Widths or Riparian Habitat Areas (RHAs)

Shorelines of State Wide Significance or Type 1-2 Streams	250 ft.
Fish-Bearing Streams or Type 3 (5-20 ft. wide)	200 ft.
Perennial Fish-Bearing or Type 3 (<5 ft. wide)	150 ft.
Intermittent Streams or Type 4-5 (low mass wasting potential)	150 ft.
Intermittent Streams or Type 4-5 (high mass wasting potential)	225 ft.
Priority Species Areas: species specific recommendations	150-2600 ft.

figure 3

RHA's are intended as restricted-use zones.
RHA's are measured on the horizontal plane from ordinary high water mark upland on both sides of the stream.

In Bellingham riparian corridors are particularly important to wildlife, serving as the last remaining contiguous corridor system through the city. Despite the alteration of riparian habitat and other impacts, the four stream systems (Squalicum, Whatcom, Padden and Chuckanut) could provide the elements necessary for a functional corridor system naturally linking nearly all of the city's parks, upland forests, wetlands, estuaries and marine shoreline.

Ridgelines are also favored travel and foraging corridors by wide ranging mammals, particularly ungulates, as well as eagles, hawks and falcons. Incorporating ridgelines into the corridor network would not only serve wildlife, but would also preserve Bellingham's remaining natural viewshed. Ridgelines are often over-looked for their habitat value and require greater attention at the local planning and regulatory level.

CORRIDOR DESIGN

The analogy used by certain authors of wildlife corridors as freeways is a simplistic idea to illustrate a point. Corridors function to serve wildlife far and beyond merely providing a travel route, keeping in mind of course that in the animal world the mode of movement is not as standardized as it is for humans. The function of a corridor depends on the species present. The design of a corridor will need to accommodate their mobility, sensitivity to disturbance, habitat requirements and, in some cases, their area requirements.

Winged creatures are naturally more mobile then those that are land-dwelling or aquatic. Yet, birds are restricted by habitat requirements, and, in the case of forest interior species, avoid edges and large open areas. Natural and man-made barriers are another consideration that determines the success of corridor function. Barriers are not always structural or apparent without close examination; what may serve as a corridor for one species could serve as a barrier to the next. An example would be a forest corridor forming a barrier to such species as the meadow vole. A river facilitates movement of fish and aquatic mammals, but may be perceived as a barrier by a terrestrial mammal, case in point, the red fox *(Vulpes vulpes)* (Strom et.al. 1976, as cited in Forman and Godron). *Planners should bear in mind, that species differ markedly in habitat needs and tolerances and that the utility of particular corridors for wildlife (Harris & Gallagher 1989) depends on the behavior of the targeted species (Soule' 1991).*

Certain poorly designed corridors are described by Noss 1991 (and others) as "sink corridors" for the reason that they become net drains on a viable population. A sink corridor is a death trap to dispersing individuals, presenting such hazards as predation, roads and barriers, domestic pets, exposure and human disturbance. If high mortality occurs within a corridor, both immigrants and emigrants are affected, resulting in potential inbreeding and deteriorating health of the population due to the decreased genetic recruitment.

This concept also applies to habitat blocks in which only one habitat link or corridor exists. Using the local example of the Sehome Hill Arboretum, in 1986 seventeen mammalian species were present in the arboretum (Huxley College EIA 1986). Today, with the loss of connecting habitat to the south and southeast, the hill has become isolated from contiguous forest and natural habitat. As a result, it is predictable that those species incapable of traversing a built landscape, vulnerable to increased predation, requiring forest cover or a minimum habitat area greater then 165 acres will likely have disappeared from this nature preserve in the near future. Mountain beaver are already noticeably absent (Senger pers. comm.) and northern flying squirrel, porcupine and fox are likely to follow. Sehome Hill Arboretum has become a habitat sink as a result of the loss of its functional habitat link. What remains of the corridor is a series of disconnected vacant lots while the rest has been converted to high density housing and associated parking areas. This loss is irreconcilable unless land is immediately reclaimed and revegetated.

The outstanding and frequently asked question is: how wide must a corridor be, to function for wildlife? Corridor widths depend on species present, habitat type and structure, topography, surrounding habitat and development, human use patterns and other applicable factors (Adams and Dove 1989). Specific to stream or riparian corridors, "the stream corridor should be wide enough to effectively perform the functions of both controlling water and nutrient flows from upland to stream, and facilitating the movement of upland forest interior animals and plants along the steam system. To accomplish all these objectives the stream corridor should cover the floodplain, both banks and an area of upland-at least on one side-that is wider than an edge effect" (Forman & Godron 1986). Another reference echo's the need for maintaining the interior condition by designing the corridor three times wider than the distance penetrated by edge effect (Noss 1991). Reed Noss in his 1991 draft paper entitled *Protecting Habitats and Biological Diversity: guidelines for regional reserve systems* provides viable guidelines for corridor widths and other design considerations.

The following guidelines could serve as recommendations for local application.

- If centered on a river or stream, a corridor should extend up each slope to overlap the ridge line [or in the case of smaller drainages up over the brow of the slope and include enough area beyond the brow to ensure slope stability.]

- If centered on a ridge, the corridor should extend downslope on either side to encompass riparian zones.
- Longer corridors need to be wider.

- Corridors surrounded by inhospitable land uses (unbuffered) should be wider.

- Corridors at a landscape scale should be at least 3 times wider than the longest distance penetrated by edge effects (for example the earlier estimation of edge effect extending into a local stand 196 ft. would calculate into a corridor width of 588 ft. necessary to include a strip of forest interior the length of the corridor)

- Corridors should not bottleneck or narrow to half the mean width.

- A corridor with a particular species in mind will function better the more suitable the habitat is to the preferred habitat of the target species.

Outside the above references the bulk of published and applied guidelines pertain primarily to stream and wetland buffers and/or are oriented toward fish habitat. A review of the literature revealed a broad spectrum of corridor design guidelines and width considerations. In addition to the WDFW recommended riparian buffers mentioned earlier, the following table represents the <u>minimum</u> corridor or buffer width recommendations as they appear in selected literature.

EXAMPLES of CORRIDOR/BUFFER WIDTHS

300' upland & riparian corridors King County, East Sammamish Plan Update 1992
200' upland & riparian corridors Multnomah County, West Hills Study 1992
50-100' riparian buffer (for fish only) WDW- J. Johnston 1975 (100-200'min. corr.)
98' riparian buffer for salmonids USFWS-Raleigh 1986 (196' min. corr. width)
200' riparian buffer for headwater spawning habitat WDW-Zeigler 1988 (400' min.)

figure 4

Corridor width is one of the most important variables affecting corridor function (Forman 1983, Forman & Godron 1986; Noss & Harris 1986, as cited by Schaefer & Brown 1992). Schaefer and Brown go on to explain, that narrow strip habitats, shelter belts and hedgerows and trail right-of-way provide for a limited number of species. Additionally, three separate studies have shown that species richness and diversity increase significantly with the width of wooded riparian habitat. Schaefer and Brown suggest that an ecologically viable river or stream corridor would consist of a band of natural vegetation wide enough to accommodate habitat needs of <u>all</u> wildlife species using the system.

Schaefer and Brown propose a model built on resident species, home range size, home range shape and estimated minimal viable populations. They propose using the diameter of the home ranges to determine minimum corridor width. For example a red fox has a home range of 640 acres, calculated as a rectangle, the home range diameter equals approximately 3,500 ft. which would be the recommended corridor width. For species with small home ranges or linear home ranges corridor widths would be substantially less. However, extrapolating from the home range requirements of most local free ranging mammals, a corridor width less than 1,000 ft. would be unusual.

Washington Department of Fish and Wildlife's Wetland Biologist, Bob Zeigler reviewed the current scientific literature and summarized buffer needs relating to wetland associated wildlife species. Over time buffers are projected to retain their value and function only if they are of adequate size/width. The following summary was extracted and slightly modified from a wetland buffer summary prepared by B. Zeigler, 1990 and provides a generalized species approach to determining buffer widths for wetlands. These recommendations may also be applicable as stream corridor widths.

300 ft. buffer/side stream corridor in forested habitats (600 ft.min. corr. width)

- -salmonid habitat, including large organic debris
- -some warm water fishes present
- -waterfowl breeding and feeding retained
- -forested diversity of mammal habitat including beaver, mink, muskrat and deer
- -small mammal breeding and feeding
- -diverse bird habitat including raptors, woodpeckers, passerines and forest interior species
- -habitat for cavity nesting ducks

300 ft. buffer/side stream corridor in non-forested habitats (600 ft. min. corr.)

- -waterfowl breeding and undisturbed feeding
- -small mammal breeding and feeding

200 ft. buffer/side stream corridor in forested habitats (400 ft. min. corr.)

- -waterfowl breeding, but reduced numbers and species, some disturbance to waterfowl feeding
- -reduced species of mammals, muskrat and beaver remain, but beaver exhaust food source overtime
- -some woodpecker use restricted to largest wetland systems (or dependent on adjacent forested habitat reserve), passerines, forest interior species present (depending on forest age and structure)
- -full component of large organic debris for salmonids
- -some warm water fishes present

100 ft. buffer/side stream corridor in forested habitats (200 ft min. corr.)
-waterfowl reduced to tolerant species such as mallards/some nesting possible
-salmonid and non-salmonid fishes present but reduced large organic debris
-mammal habitat limited, reduced diversity and abundance of species
-passerine population diversity reduced, forest interior species missing

50 ft. buffer/side stream corridor (100 ft. min. corr.)
-warm water fishes other than yellow perch and bass present
-muskrat and small mammals only
-reduced passerine presence

RECOMMENDATIONS

Based on the literature reviewed and local considerations such as species presence and area limitations, the following corridor widths are recommended for application in the city of Bellingham.

300-400 ft <u>minimum</u> for all regulated stream corridors - local and state
(150-200 ft both sides of stream)

400 ft. <u>minimum</u> for all regulated and/or documented spawning streams in forested habitats (200 ft. both sides of stream)

600 ft. <u>minimum</u> for forest corridors (width necessary to retain interior condition)

1,000 ft. <u>minimum</u> for open-pastureland corridor (due to limited cover/tolerance)

Wildlife corridor areas should be given the highest protection possible and preferably buffered an *additional* 50-100 ft from moderate-high intensity land uses. The recommended corridor length is variable and dependent on available reserve habitat areas. Corridor length should be kept at a minimum.

In the literature reviewed pertaining to the identification and design of functional wildlife corridors the following reoccurring guidelines are summarized:

1) Know what species occupy the area, and utilize their habitat needs and sensitivity as basic design criteria.
2) Provide enough area/space for wildlife to move without disturbance.
3) Maintain the minimum upland corridor width necessary for the retention of interior condition.
4) Include the floodplain in the stream corridor design.
5) Provide buffers where possible.
6) Include adequate upland habitat in the stream/riparian corridor design.
7) Retain and enhance native vegetation.
8) Utilize natural corridors where possible.
9) Maintain a constant width.

Local Application

Locally, we are faced with the challenge of identifying, retaining and maintaining the present ecological diversity of Bellingham and its surrounding area. Managing for a list of "critical species" and protecting their associated habitat will assist in maintaining the present diversity locally, but will not guarantee it. The question remains, how do we protect and perpetuate whole wildlife communities and maintain the present ecological diversity? Considering an ecosystem approach in landuse planning is a start. Utilizing watersheds as planning units is a valuable tool for landscape planning, habitat protection and monitoring. Developing baseline species and habitat information will provide the starting point from which populations may be monitored. Applying the criteria and guidelines presented to identify and protect a habitat network will greatly increase the probability of maintaining current populations and distribution of native wildlife.

Cumulative adverse impacts in a watershed will ultimately reduce habitat and species diversity and should be prevented. Therefore, management strategies need to be developed to preserve and link habitats, protect wildlife species and perpetuate diversity locally. A comprehensive wildlife plan identifying a network of reserves, corridors, and suggesting viable means to permanently protect those areas is needed.

The results of the city-wide wildlife/habitat inventory in this document provides corridor location recommendations. Further analysis of species presence, habitat requirements, habitat presence and other landscape features is needed to maximize the value of the corridor for the local wildlife community.

PUTTING THE PIECES TOGETHER: *design of habitat networks*

Urban encroachment on the natural environment has forced the need to identify remaining habitat areas and the landscape linkages or habitat network in order to provide the habitat necessary to support local native wildlife populations. In light of fast paced development and fragmented habitat, a habitat network design will require integration into a human-dominated environment. A successfully designed and functional habitat network for wildlife depends on the collection and application of the best technical information and the cooperation of local government, development interests, environmental organizations and the general public.

With firm community support for wildlife and habitat protection, the process of network identification, design and preservation will proceed to fruition. Identification and design of habitat networks is usually a process of reviewing the existing information and identifying nodes or habitat blocks currently used by wildlife. This may be accomplished by examining the landscape using informational overlays including land use, natural features and wildlife habitat attributes to determine the existing valuable habitat areas and corridors. This process is referred to as gap-analysis. *"Gap analysis allows us to quickly identify particular habitats that lack protection-thus allowing public and private conservation agencies to move decisively and in unison toward protection. It provides a single technique that can be duplicated across many regions to systematically assess degrees of habitat protection over large areas....."*(Waller In Hudson 1991). Gap analysis utilizing watersheds as study units is recommended.

Designing a habitat network based on empirical data is necessary to ensure its function. Field reconnaissance to establish a baseline of information by assessing species and habitat values is a necessary step in the process. The baseline information will help verify the suitability of the proposed network for those species present, and assist in the identification of the vulnerable species, populations and available habitat. It may also be used to substantiate the need of certain segments of the network if controversy arises. Over time, the function of the network may be measured using the baseline species and habitat data.

Habitat networks function as a matrix of interconnected habitat blocks or reserves and linkages or corridors. The function of the network is design driven. Corridor length and width as well as reserve area size are determined by species specific needs and the available natural habitat area. Minimum design criteria for both corridors and reserves is outlined earlier in the text. The criteria are based on recommendations and models extracted from the current scientific literature and represent the best available information. The habitat network, if poorly designed, could have negative effects on the wildlife it is intended to protect, leading to a net loss of species abundance and possible extirpation. However, the no-corridor alternative would guarantee a loss of species and diversity.

Verifying the function of a network will require monitoring. Comparative data analysis using current species abundance and distribution as a baseline is the only method to accurately determine effectiveness of a network over time. Coordination with WWU for such a monitoring effort could be rewarding for students and benefit both the city and its wildlife. Once a design is achieved, an implementation and long term management plan will be needed for the necessary procurement and/or regulatory protection of the network, management and monitoring of the resources and restoration of degraded habitats.

To facilitate the movement of wildlife across developing landscapes, where roads have come to represent such major barriers, underpasses and other related technologies are recommended due to their proven effectiveness and widespread use (Harris & Atkins 1991). In addition to constructed access around barriers, certain barriers will require removal or refitting to accommodate wildlife movement. Habitat of degraded quality and/or lacking connectivity in identified sites will necessitate restoration and enhancement to ensure function. Community volunteer projects coordinated by the city are suggested for accomplishing the necessary habitat restoration and enhancement.

The results of the preliminary inventory of Bellingham's natural areas indicates a high potential for a viable habitat network utilizing existing natural corridors and undeveloped lands within the city and extending beyond the boundary. The reserve areas identified consist of existing parks, open space, forested blocks, wetland complexes, floodplain and fallow pasture lands. The reserves identified are connected by natural stream corridors, contiguous wetlands, forests and/or forested ridgelines. Other functional corridors identified are specifically the Burlington Northern Railroad, along Bellingham's waterfront and the natural shoreline bluff, which for the most part parallels the railroad.

A contiguous habitat network within Bellingham is limited by the built environment and fragmentation. A viable goal for wildlife is a network extending across jurisdictional boundaries, into the county. In view of available habitat and the minimum corridor and reserve criteria, there is a definite need to "tie-into" larger blocks of habitat outside the city. Achievement of a viable network goal will require a well thought-out plan, long- term monitoring and management, land acquisition and the cooperation of private land owners, business, industry, the county and state agencies. Finally, public support will determine the extent to which habitat is preserved in the city. Public education and involvement programs will potentially foster the support needed to bring the network plan to fruition.

SUMMARY

"When fragmentation is occurring, planners and conservationists should initiate a crash course program to determine the relative vulnerability of the local species and start planning for a system of corridors that will prevent local extinctions" (Soulé 1991).

It is time to heed the words of Michael Soulé and recognize that with the current rate of growth and development in Bellingham, natural habitat is becoming increasingly fragmented and certain native wildlife species are threatened with extirpation.

Planning for wildlife at the local level presents new challenges. Adoption of wildlife planning policies and guidelines are needed to successfully perpetuate our native wildlife populations into the future. Such policies as directed by the Growth Management Act, will require a willingness to acknowledge wildlife as a priority public resource, the understanding and application of complex technical considerations, and a financial commitment on the part of the city to carry out the necessary actions to ensure a place for wildlife in Bellingham over time.

The goals set forth in the GMA for wildlife and habitat protection are summarized as follows:

> The process of planning and policy-making for wildlife must begin with a thorough examination of existing habitats and species. The application of Growth Management Act guidelines for classifying and designating critical habitats and species of local importance coupled with the WDW's Priority Habitats and Species, facilitates this process by providing the necessary definitions and criteria. Local species-specific life history and habitat considerations as well as population and distribution information will provide the baseline for site specific policy and management development.

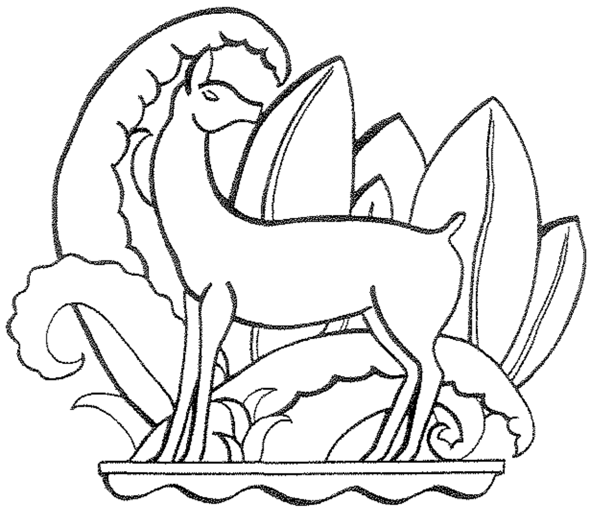
The maintenance of local biodiversity is emphasized in the GMA. Maintaining biological diversity depends on protection of plants and animals within an ecosystem. In turn, ecological diversity is dependent on maintaining the naturally occurring habitats and the physical and hydrological interconnections between them. The greatest threat to the biological diversity of relatively intact natural communities in and around urban areas is the destruction of habitat and its conversion to other uses (Murphy 1988). Further the disturbance or removal of habitat linkages also threatens species diversity. If biodiversity is not maintained or the techniques used in its maintenance prove ineffective, the result will be the homogenization of species, floral and faunal, throughout entire regions. This homogenization is evident in most urban core areas.

The economics of biodiversity maintenance is a pertinent issue for Bellingham as a natural resource-dependent community. Since future consumption depends, to a considerable extent, on the stock of "natural" capital, conservation may well be a precondition for economic growth. Conservation is certainly a precondition for sustainable development, which unites the ecological concept of carrying capacity with the economic concepts of growth and development (McNeely 1988).

For too long, wildlife concerns have been given secondary status and considered only as an afterthought in the planning process. In part, this lack of consideration is due to the paucity of site/species specific information and the technical background to apply appropriate actions. This informational and technical gap has created a planning vacuum which has resulted in major landuse decisions seriously impacting and fragmenting wildlife habitat and displacing wildlife communities.

To further appreciate the plight of our local wildlife, it is essential to consider the pressures and negative effects of urbanization on these populations. Virtually every land use affects wildlife and its habitat. As biological organisms, wildlife, like humans, suffer from air, water, ground and noise pollution. Lacking the artificial filtration and treatment of air and water or protective structures and standardized transportation humans enjoy, wildlife are exposed directly to toxic runoff, pesticides, sedimentation, barriers, and the alteration or removal of habitat. Human disturbance is another impact deserving priority consideration particularly relating to parks, recreation and residential development.

The Growth Management Act stipulates the need to consider habitat connectivity between larger habitat blocks and open space, in addition it emphasizes the protection of riparian ecosystems and restoration salmonid habitat. Applying these two objectives at a landscape level results in a potentially functional habitat matrix or network. Such a network would combine natural corridors such as streams, valleys and ridges with a variety of large functional habitat reserves. A properly designed and permanently protected city-wide habitat network holds the potential for meeting all the requirements set forth in the GMA and perpetuating our local indigenous wildlife well into the next century.



PART III

a HISTORICAL PERSPECTIVE *of* WILDLIFE in BELLINGHAM

...past and present...

HISTORICAL PERSPECTIVE OF WILDLIFE IN BELLINGHAM

....past and present...

"...we swept across the this continent so quickly, exterminating bison and wolves and so much of what was here. We destroyed the great patterns of migration and interaction. We destroyed the communities essential to our vision of what animals need. By the time we got around to reestablishing any, they were nearly all in tiny, isolated fragments, and that's how we went about managing them."

Larry Harris *Landscape Linkages and Biodiversity* 1991

FOREST AND UPLAND HABITATS

In 1792 when Captain George Vancouver sailed into the waters of what was to become Whatcom County, old growth forests flourished from the Cascade alpine to the Salish Sea shoreline. The great lowland coniferous forest gave way to expansive wetlands, water courses, lakes, talus slopes, cliffs, naturally occurring meadows and deciduous interludes. Journal accounts from the Vancouver Expedition describe Western Washington's mainland in Vancouver's words:

The country before us presented a most luxuriant landscape, and was probably not a little heightened in beauty by the weather that prevailed.... The whole had the appearance of a continued forest extending as far north as the eye could reach...

The wildlife inhabitants of the area were only briefly mentioned in journal accounts and usually associated with the descriptions of local indigenous people, trade items and game hunted by the ship's crew. By this time however, as a result of Captain Cook's earlier voyages, the northcoast fur trade was well under way, resulting in the harvest of sea otter pelts in quantities that nearly decimated the otter's population. Wildlife was clearly viewed as a commodity by the early explorers. As reported by Lt. Peter Puget in 1833, *The first whites to settle this region were the Hudson Bay Company men ...* "This region" is in reference to the lower Puget Sound, yet the fur trade was the early foot-hold for white settlers throughout Washington and British Columbia.

Beginning in the 1850's, as white settlers began their colonization of Northwest Washington the abundant natural resources became a source of subsistence and capital. Entrepreneuralism was a compelling factor in the settlement of this area. Fur, fish, timber and gold were sought by many. The first white settlers in Whatcom County, Henry Roeder and Russell Peabody, upon arrival recognized the monetary wealth of timber and proceeded to construct a saw mill on Whatcom Creek and soon the landscape changed. As the landscape changed the habitat was altered.

"The ever swelling tide of immigration that followed the blazes of the pioneer resulted in the sweeping away of the great forest. This, from the standpoint of ecology, was a stupendous transformation. Take away the forest and you take away all its rightful appurtenances and belongings as well. Nature's original layout has been thrown into confusion and all her balances disturbed or upset."

The preceding excerpt appears in the History of Whatcom County (Roth 1926) Chapter XXXIX, *Birds and Wild Animals*. The text in part describes an observed decline in abundance of particular species. The author John Edson, lists one hundred twenty three bird species which "*diminished in abundance to a greater or lesser extent in Whatcom County since 1890.*" In addition, Edson addresses mammalian species stating, "*the ecological changes which have so altered the bird fauna have had a similar and even greater effect on the mammalian life of Northwestern Washington. Many of the larger animals have been wholly driven out by the settlement of the county and are now to be found only occasionally in the wilds of the mountains.*"

Virtually all of Bellingham's present approximately 14,700 acre area was clear-cut by the late 1920's.

> *Between the years 1872 and well on into the early 1900's, the homesteaders came by the hundreds. The forest resounded to the ring of steel upon steel as the splitting mauls struck the wedges imbedded in the cuts made into the boles of the giant cedars. The sounds of axe and saw added to the crescendo which now reverberated through the forest vastness, heretofore completely silent, except for the occasional scream of the mountain lion calling for his mate. ...the Bostons required many more houses than the Nooksacks and in a very short time the giant cedars were being thinned out fast, and the sun rays were beginning to reach the ground and the dampness and moisture was being drawn back into the atmosphere, much faster than before. This in turn, upset the natural balance, and caused certain flowers and plants to wither and die, never again to be seen in those areas (Hunsby, undated).*

The wholesale removal of old growth forests which had existed locally in natural succession since the Eocene, had a devastating effect on the forests' wildlife, plants and animals alike. No contiguous stands of old growth remain within the city boundaries. However, occasional specimen trees and pockets of mature second growth forest can be found in the city, particularly within the city's parks and urban forests bordering the city in the fringe area.

FORESTED PARKS

Historically, certain natural areas were donated to or acquired by the City as parkland. Parks are generally viewed as multiple use areas with a primary emphasis on human recreation. Over the years many park lands, although protected from commercial development have suffered loss of habitat values due to recreational development, trails opening areas once inaccessible, devegetation and planting of lawns and increased human use. These areas include Community parks totaling 1,711 acres and smaller Neighborhood parks totalling 66 acres. Parks amount to nearly 12% of the total area of Bellingham. Parks provide over 1300 acres of forest habitat inside the city limits and account for the protection of significant mature forest, lake and riparian habitats. The following parks are historically significant remnant examples of this area's past natural character and today are important for providing wildlife habitat opportunities within the city. Current conditions of these sites are detailed in the invetory section of this report.

Arroyo Park was donated to the city of Bellingham in 1924. The 38 acre site is located in the Chuckanut Creek watershed and is dominated by a mature conifer forest cover. As the name suggests, the park is situated in a ravine, and spans both sides of the creek corridor providing a vegetative buffer and generous shading for the creek below. Chuckanut Creek maintains a historic fall coho migration and spawning event which is greatly enjoyed by local citizens. Arroyo is an important habitat link connecting Chuckanut mountain with Chuckanut Bay and to the north the Interurban trail corridor.

Connelly Creek Nature Area was acquired in the early 1980's and consists of 24 acres within the Padden Creek watershed. The site was purchased primarily as a storm water detention site, yet, immediately following the purchase concerned citizens successfully lobbied the city to have the site designated as a natural area. The nature area consists of open pasture land, wetlands and a forested belt of large conifers including sizable western red cedar, grand fir and Sitka spruce. Connelly Creek serves as a natural corridor indirectly linking Sehome Hill with Padden Creek and beyond. The Connelly Creek Nature Area is the home of a variety of wildlife. Public access through the site is provided by trails that will eventually connect with the city's Greenways. Prior to the development of Happy Valley and the construction of I-5 thirty years ago, Connelly Creek probably supported a thriving native fish population. Now however, due to surface and storm runoff and other pollution sources, the water quality of the creek is poor. Fisheries enhancement potential of the stream is questionable until the water quality is improved (J. Johnston interview 1992). Yet, because of the creek's easy accessibility and the site's favored use by schools as an outdoor classroom, school aged children have participated in efforts to reestablish fish in the system.

Cornwall Park was donated in 1908 by P.B. Cornwall's daughter in her father's honor (Edson, 1968). The 65 acre site is located in the Squalicum Creek watershed, and the creek bisects the parks northern half. The park boosts an impressive mature Douglas fir stand with interspersed ornamentals, open lawn areas and the creek. Once the park connected vegetatively with the Squalicum Creek corridor east and west. Today most of the understory of the forest has been removed and with the vegetative corridor nearly severed due to roads and development, the habitat value of Cornwall Park has diminished. Maintenance of the park grounds for intensive human use has also devalued the habitat for wildlife.

Fairhaven Park was donated in 1906 by Charles Larrabee and Cyrus Gates as a gift from the Pacific Realty Company. The 17.5 acre site located in the Padden Creek watershed is bordered to the north by the Padden Creek corridor. This segment of the corridor is significant in its conifer forest cover and partially vegetated riparian area which ties into a naturally vegetated corridor leading to Bellingham Bay. Fairhaven Park like Cornwall is maintained as a traditional park with lawns, play field and other amenities. It also provides a link in an extensive Greenway trail network which has potential to serve native wildlife as a habitat corridor.

Lake Padden Park was purchased in approximately 1925 was purchased by the city of Fairhaven for its municipal watershed and later in 1972 leased to the Bellingham Parks Department for recreational use. Surrounding Lake Padden, nearly 220 acres of the 1008 acre site have been developed for park purposes. Prior to the park's development, the lake was a pristine marsh with open water and heavily vegetated edges, riparian areas and a mature forest upland complex. The remaining 788 acres is dominated by mature conifer forest cover and a natural understory. Due to the park's size and relatively natural state outside the developed recreation areas, it provides habitat for forest interior wildlife, large mammals, and nesting habitat for many species of birds, including birds of prey such as bald eagle and barred owl. The lake and its shoreline also provide vital foraging, nesting, resting and cover habitat although intensive shoreline recreational use has markedly devalued the lakeside habitat.

Sehome Hill Arboretum is owned and managed cooperatively by the City of Bellingham and Western Washington University. The 165 acre native plant preserve is located on Sehome Hill which drains south into the Connelly Creek/Padden Creek watershed and north into both the Bellingham Bay and Whatcom Creek watersheds. The arboretum is described as second growth conifer/deciduous mixed forest, which in the past connected vegetatively with Connelly Creek south and Samish Hill east. The less vagile wildlife of the Arboretum, once relatively diverse, have become isolated by the loss of forested corridor links to other forested areas; their fate is uncertain.

Whatcom Falls Park, purchased in 1908, is a 241 acre site encompassing the upper Whatcom Creek corridor and retains some of the original (at the time of purchase) natural regenerated upland forest and riparian vegetation. The park offers a diversity of habitat opportunities for aquatic and upland species. The creek corridor forms a natural habitat link between Lake Whatcom and Bellingham Bay. Increased recreation use of the park has removed or disturbed riparian and understory vegetation. Encroaching development around the perimeter of the park has potential to sever upland forested corridors which over time could isolate the parks less vagile inhabitants.

The upland forests of Bellingham have regenerated from prior harvest and disturbances. Since the clearcutting of the area at the turn of the century, forest associated species have recolonized the second growth as it filled in and matured. None of the original forest was spared except for a few remanent trees, one of the last of which, a western red cedar located in Fairhaven Park, blew down in about 1967 (G. Beiry pers. comm. 1992). The second growth conifer and mixed conifer deciduous forests have been reduced to just a fraction of its original coverage city wide. Fragmentation of the city's remaining forests is apparent in aerial photographs and for the most part caused by the conversion of commercial timberlands for residential housing. Unlike the "great clearcut" ninety years ago, the conversion of forest land to housing and related uses relinquishes the potential for future wildlife recolonization.

MARINE/SHORELINE HABITATS

Bellingham Bay historically has supported a diverse and abundant marine biological community. The bay's biological significance is well documented (Becker et al 1989, Gardner, ed. 1981, Long, ed. 1983, Speich and Wahl 1989). Influenced by the drainage from eight watersheds, the largest belonging to the Nooksack, the bay receives a continual nutrient flow from a cumulative drainage totaling 1,688 km^2 (Becker et al 1989). The bay is also part of a complex of interconnected embayments that exchange water and nutrients with Rosario Strait.

Bellingham Bay's shoreline, past and present, provides diverse habitat opportunities for over 70 marine shoreline-associated species. All three federally protected species found in

Bellingham utilize the marine shoreline. The shoreline highlights within Bellingham are: harbor seal haulouts, foraging and resting sites for river otter, nesting bald eagles, the foraging activities of peregrine falcon, merlin and nearshore foraging of harlequin ducks, marbled murrelet and large aggregations of bay ducks and shorebirds.

The bay's historic recreational and commercial fisheries has left behind a legacy of productive harvests and profits. The economically important fisheries in Bellingham bay have included nine species of anadromous fish: five salmon and two trout species *(Oncorhycus)*, Dolly varden *(Salvenlinus malma)* and longfin smelt *(Spirinchus thaleichthys);* over seven species of marine fish: Pacific herring *(Clupea harengus pallasi), Pacific cod (Gadus macrocephalus), various rock fishes (Scorpaenidae), Lingcod (Ophiodon elongatus*), Rock cod *(Lepidopsetta bilineata)*, English Sole *(Parophrys vetulus)*, and Starry flounder *(Platichthys stellatus).* Shellfish have also been traditionally harvested from the bay including: Dungenss crab *(Cancer magister),* three species of shrimp *(Pandalus)* , several species of clams and Pacific oysters *(Crassostrea gigas).* In 1983 it is estimated that the total commercial catch of salmon, marine fishes and shellfish in Bellingham Bay was valued over $2.7 million (CH2M HILL 1984 cited in Becker et al 1989).

Located along the Pacific Flyway and in the flight path between the Fraser River estuary and Padilla and Skagit Bays, Bellingham Bay is a significant resting, foraging, staging and a wintering area for some species of waterfowl, shorebirds and raptors. The bay and its shoreline provides habitat for three federally protected avian species and is noted for the highest winter concentration of western grebe*(Aechmophorous occidentalis)* on the west coast (Wahl pers. comm. 1992).

The habitat value of the bay has been adversely impacted over the past one hundred years by shoreline industrial development and the related discharge of toxic waste into marine waters. In 1853 the first industry, a sawmill, was located on the bay at Whatcom Creek. By 1910, Whatcom Creek Waterway had been dredged and much of the area around the head of the waterway had been modified for street development. In 1920 a port commission was created to manage the development of the waterfront. Squalicum Creek was then dredged, and in 1934 breakwaters were placed to provide a sheltered harbor, which became Squalicum Harbor. Over time, Bellingham's waterfront became highly modified through dredging, filling, riprap, bulkheads and creation of artificial lagoons for the purpose of accommodating boat moorage, shipping and industry. During this process, approximately 346 acres (1.4 km^2) of the original intertidal areas in the inner bay were converted to upland uses (Becker et al 1989).

In 1902 the Great Northern Railway replaced the inland route with a nineteen mile shoreline road known as the Chuckanut Cut-Off (Edson 1968). The City's shoreline, particularly south Bellingham and Chuckanut was significantly altered by the railroad. The railway, originally on pilings for much of its shoreline route, was later built of large quarry rock placed on the shore, covering intertidal habitat and enclosing small coves, resulting in the blocking of vital tidal influence and circulation. This serious impact to the intertidal zone was mitigated in one location following a lawsuit brought by concerned and well informed citizens which in 1964 reopened the Edgemoor lagoon to tidal flow. However, the alteration of the shoreline to accommodate the railroad is permanent and intertidal areas were lost. One benefit of the railway is its function as a travel and habitat corridor through the city, connecting what would have otherwise been cut off by other shoreline development. Until nearly eight years ago, Burlington Northern manually controlled the right-of-way vegetation which provided forage opportunities and cover for numerous local wildlife. With the recent use of herbicides, applied broadcast, the function and value of this habitat has decreased, particularly the standing water and wetland areas adjacent to the railway corridor.

Further degradation of intertidal and shoreline habitat have occurred over the years of dredging and filling of Bellingham's waterfront. The most recent project significantly affecting the shoreline was the port's expansion of the Squalicum Marina. To achieve the expansion the Squalicum Creek esturay and associated tide lands were dredged from the mouth of creek and the outlet rerouted to discharge into the bay north of the marina. As a result of dredging and filling the rich estuarine and intertidal habitats were lost. Within the city today, only three intertidal mudflat habitat areas remain including: Padden Lagoon/Padden Creek Estuary totaling 3 acres (AMHS EIS 1989) with an estimated loss of approximately 20 acres from historic filling; Post Point Lagoon (2.6 acres); Edgemoor Lagoon (6.6 acres); and the expansive Chuckanut Bay (91 acres inner bay only, most of which is intertidal).

MARINE/SHORELINE PARKS

The city of Bellingham has acquired fourteen miles of marine shoreline for public use involving six public parks or access sites. Three of these park areas are maintained exclusively for recreational use and provide limited habitat opportunity due to groomed landscape and altered shoreline. The remaining parks provide diverse habitat opportunities, with natural shorelines, intertidal areas and adjacent naturally vegetated uplands. The purchase and preservation of Bellingham's remaining unbuilt marine shoreline would be beneficial to wildlife particularly the estimated 70 marine shoreline associated bird and mammal species.

Boulevard Park and Marine Park located on south Bellingham Bay provide limited habitat opportunities due to maintained lawns and ornamental plantings. In the earlier part of the century, these sites were industrialized and inaccessible to both wildlife and recreationalists. The acquisition and joint management of the sites by the city and port now provide 1.65 miles of shoreline that will remain unbuilt. These sites are considered gains for wildlife even though the existing habitat value is limited.

Chuckanut Bay The 47.5 acre site with over 1/2 mile of shoreline is located at the mouth of Chuckanut Creek and represents the most significant marine shoreline, estuarine mudflat, and saltwater marsh habitat remaining in the city. Historical impacts to the bay and surrounding uplands have been limited to logging and the railroad. Only recently has the pristine setting been permanently changed by residential development. The bay, its shoreline and the adjoining shoreline and uplands of Clark's Point, is one of the most biologically significant marine habitat areas in Whatcom County.

Maritime Heritage Center and Park is located near Bellingham's civic center and encompasses a section of Whatcom Creek including its lower falls and its mouth. The park includes a fish hatchery, lawn-covered open space, walkways along the creek and a remnant of the historical shoreline bluff which is naturally vegetated. Historically this site has been a garbage dump, a sewage treatment plant and various small industries. The filling of the Whatcom Creek estuary, the intensively maintained grounds and recreational use of the park devalue its existing habitat. However, the park and stream corridor hold great habitat potential and are strategic sites for habitat restoration and enhancement. In the spring of 1993 volunteers began a restorative planting of the riparian area.

Little Squalicum Park is presently a naturally vegetated shoreline and upland open space area. Due to its natural state and limited passive use by the neighborhood residents it is an important refuge for wildlife and a critical shoreline/upland link for wildlife utilizing the Squalicum Creek corridor.

Other saltwater shoreline losses include the removal and degradation of old wood piles and docks along the waterfront. These special features, although placed by humans, provided alternative cavity sites for purple martin, a species which is now a rare sighting in Bellingham, and pigeon guillemot, nesting platforms for gulls and daytime and nighttime roosts for great blue heron, king fishers and cormorants. Removal of these structures without mitigation have had a negative impact on the less adaptive species and have simply displaced the more tolerate species such as glaucous winged gulls to nearby sites. In the latter case, the gulls have re-established nesting activities on building roof tops in and around Squalicum Harbor. The net result of this type of habitat loss without mitigation is eventual extirpation of intolerant species, while the relocation of the tolerant or adaptive species is viewed as a nuisance.

FRESHWATER/SHORELINE HABITATS

CREEKS

The creeks and streams of Bellingham consist of four major drainages, Squalicum Creek, Whatcom Creek, Padden Creek and Chuckanut Creek. Historically, these creeks and their tributaries were fish-bearing and presumably more complex structurally with braided channels, sloughs, active flood plains and associated marshs. It is estimated that these streams supported over 11 species of wild anadromous and resident fish. To support the once abundant population, the creek drainages provided the critical habitats for fish migration (barrier-free water courses with high water quality), resting/feeding/rearing (pools, riffles, vegetative litter, connecting wetlands, clean-cool-clear water, shade) and spawning (shaded gravel beds with naturally controlled water flow, low sediment and high water quality). As development progressed throughout the city, streams became denatured by runoff, channelization, culvert installation and vegetation removal. Stream courses have been re-engineered to drain surface water efficiently and to control flooding in disregard for fish or other aquatic wildlife.

Squalicum Creek has suffered cumulative impacts from changing land uses, resulting in the loss of significant up-stream migrations of coho since 1977 (WWU EIA, 1989). The function of the lower reach of the creek as a wildlife corridor has diminished since the construction of Squalicum Way from Eldridge Ave. east to Bug Lake. The name Squalicum was a descriptive place name from the Salish language meaning "place of dog salmon" (Hitchman, 1985). According to Orrell 1980, Squalicum Creek supports small runs of coho, steelhead and trout, only a fraction of the historic population.

Whatcom Creek reportedly maintained native coho and chum salmon populations until the early 1940's, at which time industrial pollution and the diversion of water from Lake Whatcom caused the extirpation of the creek's native wild salmon (Orrell 1980). In 1981, 50 urban streams were assessed for various values including wildlife. Results from the study showed that, Whatcom Creek rated poorly for wildlife, yet was identified as one of six streams with "pristine headwaters"(DOE 1981). These headwaters require protection, while rehabilitation of the lower reaches will improve the overall quality of the stream (DOE 1981). The creek, although somewhat degraded, maintains an intrinsic corridor function for a variety of aquatic and terrestrial mammals as well as birds. Beaver, river otter and muskrat are active the entire length of the creek; deer, fox, coyote and black bear have all been recently observed east of I-5. Green-back heron, great blue heron, American dipper, raven, barred owl, merlin, red-tailed hawk, osprey, bald eagle, turkey vulture, Cooper's hawk, sharp-shinned hawk, Vaux's swifts, tree swallows, barn swallows and large flocks of finches, dunlin and crows have all been recently observed within or flying up/down the creek corridor.

Historically, Padden Creek supported coho and chum salmon (Orrell 1980), searun cutthroat trout and steelhead (Johnston cited by City of Bellingham 1990). With the alteration of stream flow due to the reservoir installed at Lake Padden in the early 1900's and the installation of impassible culverts along lower Padden Creek, the native salmon population was lost. Padden Creek's fish habitat and water quality continued to degrade with the construction of I-5, Old Fairhaven Parkway and associated residential development. However, volunteer restoration and enhancement efforts beginning the 1986 may reestablish salmon in the lower stream (City of Bellingham 1990).

Chuckanut Creek remains intact with unaltered shorelines for most of its length, minimal pollution due to limited development and few barriers. As a result, the creek continues to support native coho and chum salmon (Orrell 1980) and may support remnant wild populations (Johnston pers. comm. 1992). Native wild searun cutthroat trout and steelhead also naturally reproduce in the creek (Johnston 1992). Chuckanut is the most natural stream course and productive habitat remaining in the city today.

LAKES

The lakes of Bellingham have served an important habitat function for both aquatic and terrestrial species. Natural lakes include Lake Padden a 143 acre lake and the source of Padden Creek, and Lake Whatcom, over 300 acres of which lie inside the city limits, the source of Whatcom Creek. Early historical accounts of wildlife utilizing these lakes is lacking, however each lake offered unique habitat features such as complex shoreline or riparian vegetation, shoreline beaches, associated marshes, open water for resting, foraging, seasonal and migration use and easy access to contiguous forested uplands.

The northern end of Lake Whatcom is located inside the city boundary, and like the entire lake prior to the arrival of white settlers, was teaming with wildlife. "There was fishing as well as the hunting game--deer, elk, bear, smaller mammals and birds for--food and pelts. Bear and mink were trapped by dead-fall (Moore 1973)." Mention by Moore (1973) of reeds and willow indicate a diverse shoreline vegetation which would provide equally diverse habitat for wildlife. Also of significance is the historic native population of landlocked sockeye or Kokanee which continue to thrive in the lake. In reviewing the aerial photos of the lake dated 1963, it was evident that much of the lake's shoreline vegetation inside the city had been removed or altered as a result of residential development and the construction of docks. Results of bird surveys conducted by George Garlick on Lake Whatcom between 1966 and 1969 revealed high numbers of wintering western grebe *(Aechmohorus occidentalis)* and American coot *(Fulica americana)* as well as myriad dabbling and diving waterbirds. The greatest concentration of waterfowl observed during the survey was at the north end of the lake, along the Geneva and Bloedel Donovan shoreline. In the absence of comparative data it is not possible to determine population fluctuations over the past 20+ years, yet it can be speculated that shoreline development and the increased use of the lake for recreation has impacted the habitat value of the lake and its shoreline. A comparative study to document this point would be an excellent project for a graduate student.

Lake Padden, in the past, served as the municipal water reservoir for Fairhaven. In 1972 it was developed for park and recreational use. Prior to development the lake shoreline was heavily vegetated with aquatic and wetland plants, shoreline shrubs and trees. Lacking any known historical accounts of wildlife utilizing the lake, it may be speculated based on the undisturbed habitat, that it provided for an abundance and diversity of wetland and upland associated wildlife. Development of the lake's shoreline for trails and recreational access, and the conversion of some upland habitat to ball fields, picnic sites and golf course has devalued the habitat for many human intolerant shoreline and aquatic species. Lake Padden and its upland forest habitat remains accessible to most vagile species and is a critical habitat area.

Two man-made lakes were created by gravel extraction during the construction of I-5 in the 1960's. These lakes are known as Sunset Pond and Bug Lake, are located to the east and west of I-5 in the Squalicum Creek drainage. They are publicly owned and managed for passive recreation. The shorelines and adjacent upland have been allowed to revert to a natural state and now provide excellent habitat opportunities for both aquatic and upland wildlife. The location of these lakes in the Squalicum Creek corridor enhances the overall habitat value and function of the corridor.

WETLANDS

Fresh water wetlands were likely to have been abundant city-wide prior to development, as bogs and marshes were common in the Puget Sound trough at the turn of the century. The first wetlands to be filled were the waterfront saltwater marshes and estuaries. As the settlement of the inland progressed, wetlands were drained and cleared for agricultural uses. There has been no estimate of historic wetland loss in the City of Bellingham. Based on the 1991 field inventory, 350 remaining wetlands, totaling 971.4 acres were identified in Bellingham (Shapiro & Assoc. 1991). Because the wildlife habitat functions of wetlands are complex and are critical in the lifecycles of numerous invertebrate and vertebrate species, any loss of wetland habitat directly impacts those species present.

EXOTIC SPECIES

Not only has the displacement of wildlife been caused by habitat loss, but an additional stress and potential cause for displacement of sensitive native species are the numerous exotic species which have been introduced to the Bellingham area or have immigrated here from their point of introduction. Many of these exotic or alien species can be found within what is now the city limits. The 1926 list of non-indigenous species included: Bob-White, *(Colinus virginianus)*, a game species from the southern United States and introduced here roughly 1890 (Edson in Roth 1926). Although abundant at the turn of the century, the Bob-White was reportedly scarce in the mid-twenties and today is thought very rare. Similarly, Mountain Quail, (*Oreortyx picta)*, California Quail, (*Lorhortyx californicus*), and Hungarian or European Pheasant, (*Perdix perdix)*, followed a parallel course of introduction and decline within the same general time period. A hunting tradition emerged from the successful transplantation of Ring-necked Pheasant, (*Phasianus torquatus)*, from China to the Pacific Northwest in 1881. Although hunting in the city has ceased, the Ring-necked Pheasant is less abundant locally.

Opossum, Starling, English Sparrow populations have all multiplied since their introduction or expanded range into Washington State. Opportunists all, these species benefit from urbanization and in the case of Starlings and English Sparrows are now considered a nuisance species by the U.S. Fish and Wildlife Service.

LOCAL WILDLIFE MANAGEMENT

As a frontier community, Bellingham in the late 1800's did not concern itself with the management of wildlife. However, in 1907, the office of County Game Commissioner was created. For a period of over twenty years thereafter, this official was responsible for the county wide management of wildlife, primarily by regulating the hunting and trapping of game species, including gamefish and the stocking of local lakes with hatchery fish. The details of the Commissioner's job, subsequent decisions and reports are obscured by missing records from the Whatcom County Archives (Moore 1973).

In 1933 the Washington Game Commission and the Washington State Department of Game were established through legislative action to manage the state's wildlife and gamefish resources. The formation of the Department of Game and its Commission replaced the County's Game Commissioner position. The role of what is now known as the Washington Department of Wildlife, in Bellingham, is primarily that of law enforcement, fish management(rearing and stocking) and major project permit/SEPA review and comment.

Over the years the Bellingham City Council has passed several ordinances creating civil codes which protect the city's wildlife. Prior to 1985 codes were adopted that prohibit: the unlawful display of wild animals (7.16.090), experimentation using wild animals (7.16.130), trapping of wild animals (7.16.140), capture of wild animals (7.16.150), and intentional poisoning of any animal (10.12.120). In 1985 the city banned hunting with a firearm or bow inside the city limits (10.24.030). An additional code, 7.16.160 deems the violation of federal or state law or regulation protecting songbirds, gamebirds, migratory birds or water fowl a misdemeanor. There are no city codes that <u>specify</u> the protection of fish or wildlife habitat.

CURRENT CONDITIONS AND PLANS FOR WILDLIFE IN BELLINGHAM

EFFECTS OF URBANIZATION ON LOCAL WILDLIFE

Urban development fragments natural habitat into smaller and more isolated units. In the process, it destroys habitat of many species, modifies habitat of others and creates new habitat for some species (Adams & Dove 1989). Urbanized areas are characterized by three zones: 1) metropolitan complexes, 2) suburbia, and 3) the rural-urban interface (VanDruff 1979). Most metropolitan centers (downtown areas) are highly modified, paved and built and typically offering little habitat potential, resulting in few species and limited abundance. Most often, urban development results in a loss of wildlife species considered specialists which are displaced by generalists.

All of the described effects of urbanization are applicable to Bellingham to various degrees. The most serious effects are: the conversion of open space fields and forest to commercial and residential uses, the devegetation or alteration or replacement of native vegetation along shorelines, in parks and vacant lots, the fragmentation of contiguous habitats, increased biocide application, storm runoff and with it toxic substances, sediment and heat, the unintentional placement of barriers including pavement, culverts, roads, fences, retention walls, and other structures and of course the disturbance caused by human activities and domestic pets.

Impacts on wildlife from Bellingham's growth and development are difficult to quantify without scientific baseline information. There are, however, mathematical approaches to this problem, which if applied would project the impacts on certain local wildlife populations caused by the removal of habitat areas of varying values. Nevertheless the effect of habitat loss and alteration on local wildlife is evident. The disappearance of wild salmon from most local streams is but one indicator that urban pressures are negatively impacting habitat and wildlife. Other species may serve as indicators, yet waiting until a species is scarce or threatened with extirpation is not good management and counters the intent of GMA. Only by first determining and then monitoring present populations, distribution, numerical abundance and density, will planners or managers know when a species or faunal community is in "trouble." Minimal viable populations must be maintained in order to perpetuate the species locally. In turn, only by providing adequate habitat will these minimum populations be maintained.

The development of Bellingham has effected local biodiversity. Large mammals such as cougar, black bear, gray wolf and elk which depend on large home ranges are no longer found in Bellingham. Bobcat, porcupine, western toad, snowy owl and purple martin represent species that were relatively common twenty five years ago and are now uncommon or rarely found in and around the city. These species represent the change of habitat and the loss of diversity locally. Species homogeneity is a typical result of urbanization and Bellingham is witnessing its increase.

Unlike most urban centers, Bellingham has by default, retained areas of valuable habitat. Three major stream corridors with adjacent floodplains, wetlands, steep slopes and viable commercial forestry have limited development in certain areas within the city, including downtown. Although Bellingham's city center, like most urban centers, is plagued with exotic wildlife, i.e.

rock doves, starlings, house sparrows and Norway rats, it is unlike most cities due to the marine shoreline and open semi-natural stream corridor. Whatcom Creek, which bisects the urban core, harbors wildlife normally disassociated with urban environments such as, green back heron, american dipper, merlin, red tailed hawk, beaver, muskrat, river otter, sea-run cutthroat trout and the unusual Pacific lamprey, while Bellingham Bay provides habitat opportunities for shoreline and marine associated wildlife such as bald eagle, osprey, peregrine falcon, various ducks, seabirds and marine mammals.

CITY PLANNING AND WILDLIFE CONSIDERATIONS

Bellingham Comprehensive Plan

The Bellingham Comprehensive Plan, known as the *Bellingham Plan* was adopted by the city council in 1980. The twelve year old plan is composed of goals and policies, technical background appendices, neighborhood plans and administrative policy recommendations. The plan utilizes neighborhoods as planning units, combining detailed descriptive profiles with zoning and planning objectives for each neighborhood within the city. The *Goals and Policies* section of the comprehensive plan goes beyond the neighborhood boundaries and serves as the backbone for city wide planning policy. The plan incorporates technical summaries which address related urban planning topics and human concerns. Of the technical appendices from which the summaries were extracted only the open space, parks and recreation sections specifically mention wildlife habitat.

The native wildlife of Bellingham is not specifically addressed in the comprehensive plan, the goals and policies nor in any detail in the technical summaries. Mention of wildlife habitat occurs a total of twenty times in the entire 500+ page plan and surprisingly absent is any discussion of even the most obvious wildlife concern locally which are urban streams and their important economic value as a fisheries resource. The document was written from a purely anthropocentric perspective. Natural resources including fisheries, wildlife and their habitats, are public resources and must be described and factored into any planning process or document.

The *Bellingham Plan's* deficiency in addressing wild plant and animal communities has contributed to a exponential loss of habitat area, habitat quality and worse, habitat connectivity city wide during the past decade. It will require an educational effort to overcome this anthropocentric conditioning that has skewed our planning priorities over time. It is imperative that wildlife become a priority element in the planning process in order to maintain and enhance current wildlife habitat values in Bellingham.

Despite the comprehensive plan's lacking a wildlife element, there are reoccurring recommendations for greenbelts, trail corridors, 100'+ stream buffers on the major stream corridors, open space protection and acquisition, retaining natural stream courses, preservation of forested backdrops and planting street trees. All of these recommendations have a direct positive affect on wildlife by recommending the general protection of habitat. However, assuring a place for a native wildlife in Bellingham into the year 2000 will require specialized planning considerations and the implementation of uncompromised goals.

Bellingham Open Space, Parks and Recreation Plan

The 1994 update of the Bellingham *Open Space, Park and Recreation Plan* is an element of the Bellingham Comprehensive Plan. It includes many references to wildlife and habitat particularly in association with open space. The plan weaves natural features, sensitive areas (slopes and drainages), existing parks and open space into a planning design that has the potential to preserve and enhance select natural areas, shorelines, edges, backdrops and views that distinguish Bellinghams' unique character. With an increased emphasis on wildlife and habitat, the plan could also form the foundation for preservation of Bellingham's natural heritage.

The document identifies several goals and objectives that provide benefits to wildlife and habitat. In the Physical Goals section, the following points deal with wildlife and/or habitat:

Goal 2. Promotes a City-wide system of publicly owned or protected open space.

Objectives:
Preserve existing vegetation to the greatest degree feasible.
Provide continuous trail, railway, shoreline and wildlife movement corridors.
Preserve wooded hillsides.
Maintain buffers between diverse land uses that incorporate existing vegetation, restore native plant communities and include street trees as important ecosystem components.
Preserve natural drainage patterns.

Goal 3. Improve recreational access to shorelines.

Objectives:
Preserve wildlife habitat ponds, marshes, drainage courses, ravines and wetlands.
Preserve stream corridors.

Goal 4. Provide pedestrian and bicycle circulation network.

Objectives:
Revegetate and reforest disturbed areas along trails to enhance the trail experience.
Plan for restricted-access areas for habitat preservation.
Restrict access to water and educate the public about minimizing disturbance of wildlife.
Incorporate undeveloped street right-of-ways for habitat and trails.
Acquire critical privately-owned right-of-ways for trail and open space.

Goal 5. Provide a park system as integral to the city open space system.

Objectives:
Community and neighborhood parks should preserve the natural landscape while providing recreational opportunities.

The above goals with the addition of wildlife specific policies and habitat reserve protection are vital to the preservation of wildlife and its habitat in the city of Bellingham. If these goals were achieved using species specific considerations and technical guidelines, many wildlife and habitat concerns in the city would be addressed.

A need exists in Bellingham to detach the human value prerequisite from the justification of open space use and preservation. A balanced approach could be achieved by placing equal value on the ecological/biological function of the area in question. Although the *Open Space Plan* includes several good guidelines for wildlife habitat protection, many of these goals, polices and recommendations are contingent on human recreation and are potentially in direct conflict or competition with the perpetuation of wildlife and the protection of its habitat.

Recreation, particularly passive recreation, is considered by most planners as compatible with wildlife. However, according to a review of the literature that included 536 references, negative impacts on wildlife are reported for hiking, camping, boating, wildlife observation, photography, swimming, shoreline recreation and others (Boyle & Samson 1985). In their recommendations Boyle and Samson suggest separating wildlife and recreation as much as possible by managing specifically for wildlife in certain areas, providing large areas of contiguous habitat for area sensitive species and designating and defining those areas to be used for recreation. In Bellingham, the intensive use of parks by recreationalists and large groups such as students maybe detrimental to wildlife. Areas designated or protected for wildlife should be granted restricted human access.

Urban planners and administrators have been trained to manage humans, human movement, human dwellings, human safety, human health, etc. Obviously people management is important to wildlife, yet is often exercised without the technical considerations to adequately address wildlife concerns. Planning from a wildlife perspective introduces new factors and requires new considerations. Wildlife movement, behavior, and survivability is as much a function of the natural landscape and environmental conditions as it is a function of the animal. With this as a basic premise, planning for human development should first consider the natural features animate and inanimate, set aside those areas that are key to the function of the natural system, then proceed by designing and developing around those areas. According to Randall Arendt author of *Dealing with Change in the Connecticut River Valley: a design manual for conservation and development* (1986), by designing around the natural features of a landscape and providing contiguous open space with adjoining land, it has been demonstrated that the resulting development is of a higher economic value than its equivalent conventional design of the same density. What may appear at first to be an economic sacrifice is likely to become a future economic gain. Factoring wildlife into the planning equation will provide a potential long term economic benefit as well as environmental gain for all inhabitants of the city.

The City of Bellingham needs clear policies and guidelines necessary for the management of its wildlife resources. As a public resource and as a city responsibility defined in the Growth Management Act, local wildlife and its habitat requires the immediate attention and the highest degree of consideration and protection in the planning and community development processes, if our local native wildlife populations are to survive overtime.

Greenways

The Bellingham Greenways Program is a result of a six year $7 million levy passed in 1990. The goals of Greenways are reflected in the Bellingham *Open Space, Parks and Recreation Plan*, and outlined in the Action Plan section, primarily under the Open Space, Shoreline and Trail Priorities.

Bellingham's Greenways has moved forward with significant success in its planning, acquisition and trail development. Greenways have also incorporated some wildlife habitat priorities into its acquisition program. To date Greenways is actively linking existing and proposed parks and trails into a network for primarily human recreation in a natural setting. These areas also hold habitat values of varying degrees.

Areas acquired by Greenways as of December 1995, total approximately 130 acres. Additional acreages have been identified for greenways and are in the acquisition process. Important wildlife areas gained by this program include shoreline forest and open space along the south Bay Trail, from downtown to Fairhaven; a reserve and corridor network on Alabama Hill; and areas along Connelly Creek. Additional areas targeted for acquisition include important wildlife sites such as: upper Padden Creek and gorge area east of I-5, identified as a critical wildlife corridor; corridors across Samish Hill between Whatcom Falls Park and Lake Padden Park; and along both Whatcom and Squalicum Creeks.

The Greenways Volunteer Program has developed strong community support. The program coordinates habitat enhancement and restoration projects on Greenways city-wide. Involving hundreds of adults, families and school students, the volunteer program has added thousands of seedling trees and shrubs in disturbed areas along trails. These will significantly increase habitat over time. Volunteers also repair natural areas degraded by recreational overuse, coordinating restoration efforts with trail improvements and traffic barriers where needed.

The Greenways program prioritizes recreational function over natural function of most acquired sites. The planned trails do a fine job of connecting park lands through corridor links. However, the trails also bisect most of the corridors and fragment the available habitat, which in some cases are limited in size prior to trail development. Considering the recommended corridor widths discussed earlier in the document would help guide acquisition of corridors that will function for wildlife as well as for people. Corridor width requirements depend on potential species utilization, current conditions and available habitat or open space. If an area is functioning as a natural wildlife corridor, and people, with their associated disturbance, are introduced to the area the value of the habitat and corridor function is obviously reduced.

To enable Greenways to realize its wildlife goals fully, specific guidelines for wildlife corridors and reserve areas are needed. A wildlife and habitat inventory and prioritized habitat areas list are needed for Greenways to identify and procure these critical areas or factor in wildlife needs when an area or parcel is under consideration. The preliminary inventory and background information presented in this document will provide Greenways with much of the information necessary to integrate wildlife habitat into its program.

In addition to the Greenways trail and corridor purchases, the acquisition and protection of large habitat reserves City-wide is needed. With the Greenways levy ending in 1996, a new funding mechanism is needed for a wildlife habitat reserve network in Bellingham. A levy or bond initiative for habitat and open space acquisition is highly recommended. The availability of State grants providing a 50 percent match for urban wildlife habitat acquisition, would help leverage tax dollars and preserve an irreplaceable resource.

THE VISIONING PROCESS

(the following section is based on the preliminary results of Bellingham's visioning process and are extracted from *Visions for Bellingham: Survey Results. 1992* and *Visions for Bellingham: Agreeing on the Vision June 6, 1992.* Bellingham Department of Planning and Community Development)

One of the Growth Management Act's mandates is the community visioning process. The City of Bellingham completed their visioning process in June 1992. To kick off this lengthy process, questionnaires were mailed to city residents asking their response to: "What are the three issues critical to Bellingham's future?" and "What three things do you value most about the quality of life in Bellingham." Four hundred people responded with the Environment and Natural Resources, Open Spaces, Parks and Recreation as the second most important issue/ category referred to 195 times by respondents. Of the 195 responses, 57 or 29% specified the need for habitat protection and enhancement. However, only 5 or <3% of the respondents demanded opening natural areas along urban stream corridors, particularly Whatcom Creek for trails and human recreation. As mentioned earlier in this report serious adverse impacts on wildlife result from certain human recreational activities and park development. Under other categories such as Development Patterns and Community Character, maintaining and protection of the natural environment, particularly forests and open spaces were consistently stated as a priority by the participants.

The results of the Visions for Bellingham delegation presented an indisputable concern for wildlife and its habitat. One hundred forty citizens participated in the six week process to identify and prioritize the goals to guide Bellingham's future. The environment and natural resources category was effectively separated from parks and recreation thus providing a clearer distinction between open spaces as undisturbed natural areas and open space developed for human use.

Goals were identified by the delegation and certain priorities were identified. Under the Environment and Natural Resources category those goals relating to wildlife and habitat were:

> Goal #1 suggests public private cooperation to protect water quality of the city's fresh and salt water resources. This goal has direct positive implications for all aquatic, terrestrial and arboreal wildlife due to their common requirement for "clean" water.
>
> Goal #2 introduces the need to consider residential views while preserving trees in the urban landscape. This goal reflects a skewed value toward views over habitat and exemplifies the urgent need for community wildlife education.

Goal #3 reads "undisturbed open areas allow habitat for fish and wildlife, provide connections within greenway corridors and protect steep slope and sensitive areas."

Suggested mechanisms to retain the values identified in goals #1 and #3 include community education, performance based development standards, clustering development, public acquisition, regulatory incentives and regulatory requirements. One additional goal receiving a majority vote, encouraged the protection of functioning ecosystems through clear planning directives for development.

The visioning process has clearly identified wildlife habitat, particularly trees, urban forests(watersheds/viewsheds), open space, waterbodies, water courses and corridors (as part of Greenways) as community priorities for protection and enhancement. Achievement of this part of the vision will require a combination of community education and involvement, innovative planning and policy development.

PUBLIC PERCEPTION OF WILDLIFE

Wildlife is viewed differently by different people. The same species may be considered an amenity or a nuisance, harmless or a threat, cute or ugly, an animal for the taking or for protecting. Potential conflicts based on personal views and ignorance could arise during the planning and policy making process. An overwhelming need exists for on-going public education, providing factual information on wildlife needs, habitat function, protection and enhancement and related issues in order to balance the negative and positive values associated with wildlife.

The general public locally is not only aware of our wildlife but is appreciative and frequently protective of the resource. According to the public questionnaires included in the environmental assessments conducted by Huxley College students, the majority of respondents observe wildlife in their neighborhoods and have commented on the decline of fish or other wildlife in recent years (Squalicum EIA 1989, Lincoln Cr. EIA 1990). Occasionally citizens write letters to the editor of the Bellingham Herald sharing the concerns for area wildlife. One such letter appeared on June 23,1992, urging readers to pause and consider our " inescapable obligation to coexist with other species" and suggested one simple gesture to that end, would be to erect deer crossing signs at frequently used junctions. Consider also, the six hundred plus members of the local chapter of the Audubon Society; these individuals are paying their dues for and are actively participating in the conservation of the "natural world" and wildlife is certainly a focal point in their conservation activities.

Numerous reports have been published on the human-wildlife connection, interaction and the cultural value of wildlife. Although the scope of this project did not include review of this subject it is important to mention. For example, Edward Wilson in his book *Biophilia* argues that our natural affinity for life binds humanity to all other living species. Wildlife represents historical cultural values and without a doubt is a signature of the Northwest lifestyle. From wild salmon to the bald eagle we live among the remnants of a vast wilderness and identify ourselves with that wildness. Many residents of Bellingham were drawn here for that essence of nature or sense of wilderness.

Due to an affinity with wildlife, many citizens of this area are willing to volunteer their time to organized habitat restoration, enhancement and preservation activities. Evidence of this willingness is clearly reflected in the number of outdoor/conservation organizations active in Bellingham. Currently there are over twenty six volunteer organizations with wildlife habitat protection stated in their goals (see *Voluntary Habitat Protection* for a list of local conservation groups). These groups represent a critical link in public process, encompassing both lay and professional activities that define and seek to assure a future place for wildlife to thrive in Bellingham.

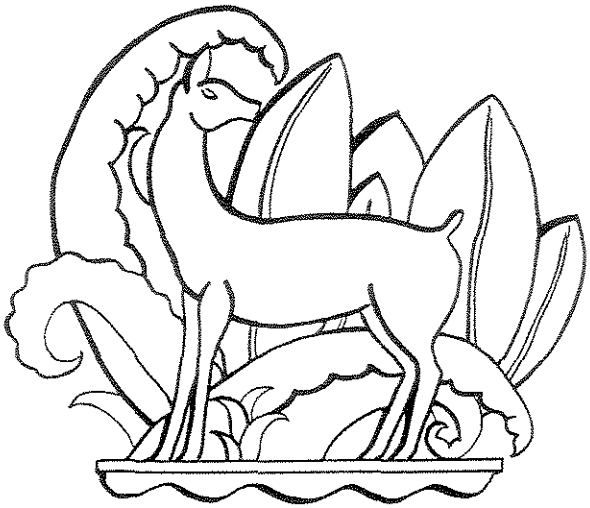
THE FUTURE

Over the course of 140 years, Bellingham has been transformed from an old-growth forest wilderness to a developed city of 52,000 residents. The quest for wildlife preservation in this urbanizing area present serious challenges. Space is limited, competition for the remaining buildible land is expensive, certain forms of pollutants are uncontrollable and increasing and human activity and structures dominate the landscape. All of the factors discussed earlier in the *Effects of Urbanization On Local Wildlife* are to be considered in planning for the future of Bellingham's natural heritage.

The future of wildlife in Bellingham will rely on the following factors:

-political will
-technical guidance
-empirical data, i.e. inventory and monitoring
-a functional plan/design for wildlife city-wide
-a mechanism to secure habitat-regulatory and/or non-regulatory
-public support/education and involvement
-funding

Bellingham citizens have identified wildlife as a priority issue and have demonstrated a willingness to voluntarily protect and enhance habitat. With the technical information, plan design suggestions and program recommendations contained in this report, in addition to the empirical data to be collected from subsequent field inventories, it is conceivable that wildlife will earn the recognition and appreciation that it deserves and be granted a permanent place in the Bellingham Community.



PART IV

EXISTING INFORMATION SUMMARY

BELLINGHAM WILDLIFE AND HABITAT:
Existing Information Summary

INFORMATION SEARCH and REVIEW

The Bellingham wildlife and habitat assessment is primarily based on existing information. The process of information gathering and review was comprehensive. Information was collected from existing documents, both published and unpublished, reports, notes and maps; from interviews with wildlife experts, naturalists resource agency personnel and law enforcement; review of databases, a variety of species lists and historical records. Additional information from field visits, personal records and incidental observation by the author was also included. The collection, review and application of information for this assessment was completed over an extended period and was exhaustive.

INFORMATION SOURCES

The first phase of the Bellingham wildlife inventory consisted of a thorough review of existing local information including: published and unpublished technical documents from city, state and federal sources, independent publications and private files. All of the existing Environmental Impact Statements in file with the City, Environmental Assessments from Huxley College and student thesis from Western Washington University applicable to the City of Bellingham were reviewed. In addition the following data sources were also reviewed: Bellingham Whatcom County Humane Society records, Washington Department of Wildlife Priority Habitats and Species tabular and mapped data and Nongame data files, Puget Sound Ambient Monitoring Data, Washington Department of Natural Resources Natural Heritage data.

To supplement the written documents, formal interviews were conducted in 1992 with seven area experts. The interviews provided site specific species accounts, the mapping of known wildlife concentrations and critical habitats, and included a discussion of historical wildlife trends locally. The participating experts were:

Herbert Brown, PhD. Department of Biology, WWU
James Johnston, Fisheries Biologist, Washington Department of Fish and Wildlife
David Mason, PhD. Fairhaven College
Mark Schuller, Fisheries Biologist, Washington Department of Fisheries
Clyde Senger, PhD. Department of Biology, WWU
Terence Wahl, Ornithological Consultant, Bellingham, Washington
Bert Webber, PhD. Huxley College of Environmental Studies, WWU (phone interview only)
Ralph Woods, Wildlife Enforcement Agent, Washington Department of Wildlife

In addition to the formal interviews, numerous local citizens were contacted or volunteered pertinent information relating to local wildlife sightings and issues. Lieutenant Dac Jamison of the Bellingham Police Department, Rick Fackler, Sally Manifold and Tim Wahl of Bellingham Greenways, James Luce and Dick Rothenbuhler of Bellingham Parks, Jay Taber private consultant, Jim Wiggins and Vicki Jackson wetlands consultants, Doug Huddle wildlife technician and George Garlick were all particularly helpful with their informational contributions.

To the best of our knowledge, all of the vertebrate wildlife resource material pertinent to Bellingham and written in the past fifteen to twenty years was reviewed and cited in this report. The only known exceptions are some Port of Bellingham documents.

Appendix A of this report provides an annotated bibliography of all local wildlife references published and unpublished, used as source information for this inventory.

PREVIOUS WILDLIFE STUDIES/INVENTORIES

Few systematic wildlife studies have been conducted within the City. These include short term bird related surveys and counts, faunal inventory of Sehome Hill, Padden Creek Estuary and the Chuckanut Ridge development and city wide stream surveys for fish. The majority of scientific field work in the city has involved fish.

Annual surveys of bird species have resulted in the systematic collection of data (species and numerical abundance) over time. These surveys include the Christmas Bird Count sponsored by the North Cascades Audubon Society, and the Breeding Bird Atlas sponsored by the Seattle Audubon Society. The data were collected and recorded by skilled volunteers and then compiled locally by Terence Wahl. The local data contributes to larger state and national studies. Christmas bird counts have been the source of valuable information for more than twenty five years, they are also considered a community tradition by most birders.

A review of the existing planning and other government documents revealed a consistent lack of scientifically based wildlife documentation. Few reports particularly EIA's and EIS's were prepared using empirical data (field generated data) and particularly lacking were scientifically credible wildlife studies. Few site specific, systematic wildlife inventories or field surveys have been conducted in Bellingham and of these studies, survey methods and duration varied greatly. Results and conclusions of these efforts also vary in detail and accuracy. Although theses studies do not collectively provide baseline data for the city in toto, the studies do provide, with careful interpretation, valuable area specific habitat and species information.

Another informational gap has resulted from the SEPA process. SEPA requires a full disclosure of potential impacts on "flora and fauna" at project sites. In order to technically assess impacts or even complete a SEPA check list earlier in the process, empirical data is needed. In the absence of such data it is necessary for a experienced professional to conduct the required field work. Casual observations and duplication of lists containing those species expected to occur at the site in question, have sufficed for the majority of EIS's prepared for projects inside the city limits since the promulgation of SEPA in 1976. The lack of on-site investigation or quantified biological assessments in the SEPA process has resulted in the bypass of real impact disclosure for wildlife. Determining impacts on wildlife in the absence of empirical data is purely speculative. This is a serious gap in the SEPA process locally and can be easily remedied with the lead agency requiring an assessment of impacts based on site specific scientific data prior to issuing its threshold determination.

In response to these obvious gaps in information the City of Bellingham could conduct a city wide baseline inventory of wildlife habitat and species. Relying on WWU, Huxley or SEPA's checklists or EIS's for such information is an ineffective approach to data collection and would consequently provide a patchwork of site specific information from varied methods and random timing. An accurate baseline would benefit the city, the development community and wildlife.

SPECIES LISTS

Lists of vertebrate species occurring within the City range from guess work to scientifically based sampling records. Of the vertebrate groups occurring locally, the only complete existing list is for birds. Other groups may have been sampled or observed in specific areas within the City, but have not been the subject of city-wide inventory. With the existing lists and observation records from a variety of sources city-wide, we have constructed a baseline species list, containing all vertebrates known to occur within Bellingham. This list in *Appendix C* contains species common names, scientific names, status, occurrence by watershed (preliminary), abundance, seasonality and habitat association.

The particular life history characteristics and habitat associations of locally occurring species are important factors to consider in the planning and development process. Species specific habitat needs and their limiting factors need to be discussed in detail, particularly for species of concern, and serve as a guide in the community planning process. In addition to the species list, the habitat and management guidelines for some of the local "priority" species are included in Appendix E *Management Guidelines for Select Species.*

Species of Concern *(Appendix D)* are those species which have been identified by resource agencies and scientists to be "at risk" and whose status is currently either under review or has been confirmed to be endangered or threatened and is protected under the Endangered Species Act.

Invertebrates were not disregarded for lack of value or posterity. To the contrary invertebrates form the foundation for the food pyramids of all ecosystems and are important bioindicators for aquatic and terrestrial environments, water quality, air quality and landscape deterioration (Jeffery & Madden 1991). The time and space required to properly address invertebrates was beyond the resources available for this report. It is recommended however, that the city obtain expert direction on this subject and inventory locally significant macroinvertebrates.

SPECIES OCCURRENCE IN BELLINGHAM: a summary

The following summary of vertebrate species known to occur in Bellingham is based on observations, surveys and specimens collected by local experts. The complete list of species compiled from accumulated lists provided by experts is printed in *Appendix C* of this document. Local species list was compiled using several independent sources including:

Amphibians and Reptiles: Herbert Brown, PhD., Bellingham
Birds: Terence Wahl, Bellingham and David Drummond, Bellingham
Mammals: Clyde Senger, PhD., Bellingham
Fish: Jim Johnston, Fisheries Biologist, Washington Department of Fish and Wildlife
Mark Schuller, Fisheries Biologist, Washington Department of Fish and Wildlife

Fish

Over 16 species of fish are found in the fresh water streams and lakes of Bellingham. Of these 12 are resident species and 6 are anadromous (migratory); 13 are native species and 6 have been introduced. Of the native anadromous fish only the pacific lamprey and searun cutthroat populations are completely wild or untainted by hatchery stock, however remanent populations of wild salmon and steelhead may still occur in the Chuckanut watershed.

The economically important fish species of Bellingham Bay include 9 anadromous and 7 marine species (Becker et al 1989). In addition there are over six commercial shellfish species harvested from the bay. A complete list of vertebrate and invertebrate species occurring in Bellingham Bay was not available in the documents reviewed.

Amphibians and Reptiles

There are nine species of amphibians known to occur in Bellingham. All, reside year round and reproduce locally. Of these, seven are native, two are introduced. Local amphibians are either aquatic or terrestrial depending on species and life phase. Distribution and abundance of amphibians in Bellingham is unknown. Site specific observations are reported in the watershed inventory section of this document.

Five species of reptiles are native and known to occur in Whatcom County and Bellingham. All reside year round and reproduce locally. Of these reptiles, there is one lizard and four snakes, and all are terrestrial and non-venomous.

Birds

Based on recorded observations over a thirty year period, 258 bird species are known to occur in Bellingham. Of these, 64 are common year round residents, 43 are summer residents, 63 are winter residents, 45 are seasonal migrants and 43 are casual visitors or vagrants. Of the total, 92 species are known to have bred locally between 1987 and 1991. Few non-native bird species have established breeding populations following introduction. Those introduced species now thriving are familiar by name and include, european starlings, rock doves, ring-necked pheasant and house or english sparrows.

Mammals

Based on the documented observations and specimens collected since 1959, there are 39 commonly occurring mammal species in Bellingham. Of the total species, 34 are native and 3 are non-native or introduced. Local mammals represent 20 families representing eight orders for including: Marsupialia (opossum), Insectivora (shrews and moles), Chirpotera (Bats), Lagomorpha (rabbits), Rodentia (rats, mice, voles, squirrels, muskrat, mt. beaver, porcupine and beaver), Cetacea (whales and porpoise-uncommon locally), Carnivora (seal, otter, raccoon, weasel, mink, coyote, fox, bobcat, bear, cougar), Artiodactyla (deer, moose). Non native species include the opossum, norway rat and the eastern cottontail rabbit.

CRITICAL HABITATS AND SPECIES

Factoring wildlife into the planning process requires baseline species and habitat information as well as specific guidelines that will in effect protect and perpetuate whole biological communities. These guidelines cannot be tailored to every species so a representative group of target species must be identified and their life history and habitat requirements be used to formulate these guidelines. Those species on which to base planning guidelines are identified in GMA as stated, "*..cities should determine which habitats and species are of local importance...and may be classified in terms of their relative importance.*" Species of local significance include "... *T&E&S species other species of local concern, species present which are sensitive to habitat manipulation. historic presence of species of local concern...*" The species of local significance or target species may be used to determine the biologically acceptable minimum habitat retention, connectivity, and buffer area necessary to maintain minimum viable populations, as well as the populations of less sensitive species.

Compiling a list of these species complete with their habitat requirements, limitations and management recommendations is needed if the species concerns are to be addressed in the planning process. The WDFW has developed the Priority Habitats and Species (PHS) manual which lists vulnerable species state wide in addition the PHS manual a technical summary and management recommendations for each species. Those species included in PHS fall under one of the following criteria:

-Wildlife species of concern due to their population status and their sensitivity to habitat alteration.

-Species determined to be in danger of failing, declining or vulnerable due to factors such as limited numbers, disease, predation, exploitation or habitat loss or change. These are both state listed and state candidate species for endangered, threatened and sensitive classification .

- Uncommon species, including Monitor species, occurring in forest environments and that may be affected by habitat loss or change and uncommon species occurring in urban growth areas that are vulnerable to urbanizing influences.

- Species in forest environments for which the maintenance of a stable population and surplus for recreation may be affected by habitat loss or change and for species in urban growth areas with a high public profile that are vulnerable to urbanizing influences.

Federally designated endangered, threatened and candidate species are also included on the state PHS list.

It is openly admitted by the WDFW that local conditions and habitat availability will likely dictate the consideration of additional locally vulnerable species to complete the target or critical species list. It is the responsibility of local governments to determine and designate those species which are at risk within their jurisdiction.

The obvious target species are those most vulnerable and likely of local extirpation as a result of anthropogenic pressures particularly species with large home range requirements and specialists. Generally the species most vulnerable to environmental change and habitat manipulation is that group known as specialists. Specialist usually have a specific and limited food source, and depend on specific habitat components again which are limiting and human structures or activity function as barriers, disturbances or stress to individuals or entire populations. In contrast, generalists such as raccoons, crows who utilize a broad spectrum of habitats and food sources and actually benefit from human development.

Following an examination of existing habitats, special features, current land use, local species, life history information and consultation with local experts, a list of locally significant species was developed. These species tend to be specialists, historically common and indigenous to the area. Maintenance of the minimum viable populations of these species over time will be the responsibility of the City of Bellingham under GMA. As indicators these species can be used as a gauge to monitor local ecological health/pollution, habitat function/loss, and species diversity/homogenization. Placing our attention on certain target species will, in theory, indicate trends for their associated biological communities. Quantified abundance and distribution of all locally occurring species is needed prior using the selected species for monitoring or gauging planning effectiveness and compliance with the intent of GMA. The many terms used to describe target species by various agencies and that appear in GMA may easily be confusing. In an effort to categorize all habitats and species that are locally significant (for what ever the reason), they will be referred to collectively as Bellingham Significant Habitats and Species.

Bellingham Significant Species

The following preliminary list of species are of local significance in the City of Bellingham and are identified as Bellingham's Significant Species. This list was derived from combining several references, species lists and comments from the local wildlife experts. It is however potentially incomplete and changeable as better, more complete information becomes available. Without local species occurrence, population and distribution data it is difficult to confirm those species or populations that are in need of special consideration. Locally documented observations or existing reports were lacking or unavailable for the following groups which should be reviewed for inclusion as potential significant species:

- all macro invertebrates, particularly beetles, butterflies, moths and others which appear on federal and state lists of concern or are endemic to Bellingham
-marine fishes and macro invertebrates
-fresh water sculpins which are a species are of concern
-other fresh water fish not identified as part of routine stream surveys

The significant species list contains all federal and state endangered, threatened, candidate, proposed, monitor and state PHS species. This list should be used as a preliminary master guide to those species that are at risk and or are protected under law and require special planning and development considerations.

F/e,t,c,p = Federal/endangered, threatened, proposed, candidate
S/e,t,s,c,m = Washington State/ endangered, threatened, sensitive, candidate, monitor
PHS = Washington Department of Wildlife Priority Species and Habitat
LS = locally significant

Fish

Pacific Lamprey *(Lampetra tridentata)*	LS	anadromous native/naturally reproducing
Chum Salmon *(Oncorhynchus keta)*	LS	anadromous native/naturally reproducing
Coho Salmon *(Oncorhynchus kisutch)*	LS	anadromous native/naturally reproducing
Kokanee *(Oncorhynchus nerka)*	PHS/LS	resident/native/naturally reproducing
Chinook Salmon *(Oncorhynchus tshawytscha)*	LS	anadromous/native
Searun Cutthroat Trout *(Salmo clarki)*	PHS/LS	anadromous/native/naturally reproducing
Rainbow Trout *(Salmo gairdneri)*	PHS/LS	resident form/native/naturally reproducing
Steelhead *(Salmo gairdneri)*	PHS/LS	anadromous/native/naturally reproducing
Dolly Varden*(Salvelinus malma)*	PHS/LS	anadromous/native
Sculpin *(Cottus sps.)*	Sc/LS	(for five species not yet identified in Bellingham)

Amphibians

Northwestern Salamander *(Ambystoma gracile)*	LS* vulnerable to habitat disturbance/region declines/limited mobility
Long Toed Salamander*(Ambystoma macrodactylum)*	LS* same as above
Ensatina *(Ensatina eschscholtzi)*	LS* same as above

Western red-backed salamander *(Plethodon vehiculum)*	LS* same as above
Western Toad *(Bufo boreas)*	LS* decline in local population
Tailed Frog (*Ascaphus truei)*	Sc/LS
Red Legged Frog *(Rana Aurora)*	Fc/LS

Reptiles

Rubber Boa *(Charina bottae)*	LS* rare

Birds

Common Loon *(Gavia immer)*	Sc/PHS/LS
Horned Grebe *(Podiceps auritus)*	Sc/PHS
Western Grebe *(Aechmophorus occidentalis)*	Sc/LS significant winter density on the bay
Brandt's Cormorant *(Phalacrocorax penicillatus)*	Sc/PHS
Great Blue Heron *(Ardea herodias)*	Sc/PHS/LS
Green Backed Heron *(Butorides striatus)*	Sc/PHS/LS
Trumpeter Swan *(Cygnus buccinator)*	PHS
Cavity Nesting Ducks	PHS/LS
wood duck *(Aix sponsa)*	
hooded merganser *(Lophodytes cucullatus)*	
bufflehead *(Bucephala albeola)*	
Harlequin Duck *(Histrionicus histrionicus)*	Fc/PHS/LS
Turkey Vulture *(Cathartes aura)*	Sc/PHS
Osprey *(Pandion haliaetus)*	Sc/PHS/LS
Bald Eagle *(Haliaeetus leucocephalus)*	Ft/St/PHS/LS
Northern Goshawk *(Accipiter gentilis)*	Fc/Sc/PHS
Red Tailed Hawk *(Buteo jamaicensis)*	PHS/LS
Merlin *(Falco columbarius)*	Sc/PHS/LS
Peregrine Falcon *(Falco peregrinus)*	Fe/Se/PHS/LS
Virginia rail *(Rallus limicola)*	LS* wetland associated, very secretive, lack data
Sora *(Porzana carolina)*	LS* wetland associated, very secretive, lack data
Snipe *(Gallinago gallinago)*	LS* wetland associated, secretive, lack data
Caspian Tern *(Sterna caspia)*	Sc/PHS
Marbled Murrelet *(Brachyramphus marmoratus)*	Ft/Sc/PHS/LS marine/old growth dependent, feeds near shore, susceptible to oilspills, gillnet entanglement & habitat loss.
Band-Tailed Pigeon *(Columba fasciata)*	PHS/LS
Great Horned Owl *(Bubo virginianus)*	LS*
Snowy Owl *(Nyctea scandiaca)*	Sc/PHS
Barred Owl *(Strix varia)*	Sc/PHS
Northern saw-whet owl *(Aegolius acadicus)*	LS*
Vaux's Swift *(Chaetura vauxi)*	Sc/PHS snag dependent, has adapted to man-

Vaux's Swift *(Chaetura vauxi)*	Sc/PHS snag dependent, has adapted to man-made chimneys
Pileated Woodpecker *(Dryocopus pileatus)*	Sc/PHS/LS, snag dependant, primary cavity excavator
Northern flicker *(Colaptes auratus)*	LS* primary cavity excavator, possible decreasing local population
Purple Martin *(Progne subis)*	Sc/PHS/ locally rare due to lost habitat
Brown Creeper *(Certhia americana)*	LS* forest interior indicator
American Dipper *(Cinclus mexicanus)*	LS* stream dependent/indicator of stream and riparian habitat quality
Rufous-sided Towhee *(Pipilo erythrophthalmus)*	LS* ground nester/vulnerable to urbanization
Ruffed Grouse *(Bonasa umbellus)*	LS* ground nester/vulnerable to urbanization

Mammals

Townsend's big-eared bat *(Plecotus Townsendii)*	Fc/Sc/PHS/LS
Long eared myotis *(Myotis evotis)*	Sc/LS
Long legged myotis *(Myotis volans)*	Sc/LS
Columbian black-tailed deer *(Odocoileus hemionus columbianus)*	PHS/LS
Northern Flying Squirrel*(Glaucomys sabrinus)*	LS* forest interior indicator/cavity dependent
Mountain Beaver*(Aplodontia rufa)*	LS* local population decline
Porcupine*(Erethizon dorsatum)*	LS* limited vagility/large home range requirement
Long tailed weasel*(mustula frenata)*	LS* riparian associated
Muskrat *(Ondatra zibethicus)*	LS* stream/riparian/wetland dependent
Beaver *(Castor canadensis)*	LS* stream/wetland dependent, requires forested riparian habitat
Harbor Seal *(Phoca vitulina)*	Sc/PHS/LS
River Otter *(Lutera canadensis)*	LS* shoreline dependent

-Other locally significant populations are:

-Shorebird concentrations, various species - seasonal	PHS/LS*
-Waterfowl concentrations, various species - seasonal	PHS/LS*

* denotes native species of local significance based on life history, habitat requirements and the local population vulnerability to habitat alteration or removal

Habitat Classification System: *a summary*

Wildlife communities are dynamic and complex systems with specific climactic, spatial, structural and nutritional requirements. These requirements are met independently by each species through special adaptations, associations and interactions with components within their environment. Habitat is characterized by those components, singularly and collectively with which a species is associated and likely dependent. Habitats, be it vegetative, geomorphic, aquatic, marine or human structures are also dynamic. Classifying habitat involves characterizing the current conditions of a landscape. Yet, the natural systems influence the landscape to change slowly overtime (in the absence of natural disaster) and when left undisturbed will generally succeed in a predicable fashion. Succession is most notably applied to vegetative communities. Each successional stage of a vegetative community provides a unique set of conditions with which certain wildlife species are adapt. It is therefore a well accepted practice to analyze and classify the landscape cover as a means of predicting species presence in a given area.

Classification systems are used:

- to reliably predict the successional development of habitats and related changes in wildlife communities;

- to identify vegetative conditions with which specific sets of wildlife populations may be associated or dependent;

- to predict responses to habitat conditions and wildlife populations to management activities;

- to serve as precursors to field inventories and enable monitoring;

- to provide a basis for planning and implementing for both research and management activities (Holthausen & Marcot 1991).

In the absence of a state-wide standardized habitat classification system, it is necessary to adapt the best available and most widely used classification systems for local application. Two primary references were used as the basis of the classification system, these are from the USDA Forest Service and USDA Fish and Wildlife Service. Other sources were also consulted for compatibility.

The classification system consists of 35 categories with additional qualifier codes. The complete system appears in *Appendix B* of this document.

Utilizing identical classification systems, the city and county will be at an advantage to share and compare data particularly in the fringe area, when linking corridors and to identify critical habitat areas that span city-county boundaries.

One element in the city's watershed inventory is habitat. The classification system was applied in the inventory as an interpretive tool to identify the vegetation communities and special habitats features within the city. With this preliminary inventory based on aerial photo-interpretation, the habitat information can be used to identify habitat blocks, corridors, potential critical habitats and their associated species.

Bellingham Significant Habitats

The encroachment of urbanization on wildlife habitats within the city of Bellingham in effect necessitates the designation of all natural habitats as sensitive. However under the GMA and PHS, critical habitat is specified by the following criteria and recommendations, which will be applied in the identification and delineation of Bellingham's critical or significant habitat areas:

- Areas with which endangered, threatened, and sensitive species occur.
- Habitats and species of local importance.
- Shellfish areas
- Kelp and eelgrass beds.
- Naturally occurring ponds over twenty acres.
- Waters of the state.
- Lakes ponds streams and rivers planted with game fish.
- State natural area preserves and natural resource conservation areas.
- Comparatively high wildlife density
- High species richness
- Significant wildlife breeding habitat
- Significant wildlife seasonal ranges
- Significant movement corridors for wildlife
- Limited availability and or high vulnerability

The GMA requires the consideration six factors when classifying and designating local habitat conservation areas or critical habitat. These key considerations will assist in the evaluation of current habitat value and function in addition to habitat viability over time.

- Habitat connectivity between larger habitat blocks and open spaces.
- Level of human activity including roads and recreation activities.
- Protecting riparian ecosystems.
- Evaluating adjacent land uses.
- Establishing buffer zones around these areas to separate incompatible uses.
- Restoring lost salmonid habitat.

The WDFW recommend the following habitats as "priority" or critical habitats:

- Caves
- Cliffs
- Natural Meadows
- Old-Growth Forests
- Riparian Areas
- Snag Rich Areas
- Talus

-Urban Natural Open-Space
-Wetlands

By combining both the significant species and habitat lists with accurately mapped distributional information, one could target the critical wildlife areas of the City. This is the ultimate goal. First, however an inventory of the City's natural resources is in order.

PART V

INVENTORY *of* HABITAT *and* WILDLIFE *by* WATERSHED

CHUCKANUT WATERSHED

INTRODUCTION

Chuckanut Creek and Chuckanut Bay watersheds have been combined for this report due to their connectivity topographically and hydrologically, and ecological function as a unit. The Chuckanut Watershed encompasses a very large area, the downstream portion of which lies within the city boundary and will be addressed here. The Chuckanut Watershed is the most intact watershed in Bellingham, spanning from its headwaters to the bay. Although systematic survey data is lacking, what is known through reported sightings indicates the greatest complement of species for the habitat types and existing conditions within a City watershed. **Chuckanut's thriving wildlife community represents nearly all the species and habitats found within the City**; this is with the exception of large fresh water lake and fallow field habitats, the latter of which is locally scarce. Chuckanut harbors great habitat diversity with extensive forested uplands, small cliffs, caves, snags, riparian areas, anadromous fish bearing streams, complex wetlands, marine shoreline, estuary and marine embayment. The most significant feature of this watershed is its habitat connectivity and significant linkages with protected public lands. Future planned development within the watershed, however, would severely impact the primary function and value of its habitat for fish and wildlife.

INFORMATION SOURCES

To date the Chuckanut Watershed has received wetland, stream and fisheries review, yet little wildlife investigation and documentation exist. The current available references pertaining to the City portion of the watershed are listed below. These constitute the primary baseline references utilized for this report. An abstract of each document is provided in the annotated bibliography, Appendix A of this document. In addition to published references are reports and observations from reliable sources, all of which have contributed to this section.

- *Priority Habitats and Species Database* and *Non-game Data System.* 1993. Washington Department of Fish and Wildlife.

-*Puget Sound Ambient Monitoring Project* - WDF&W 1992-1994 Harlequin duck aerial survey data and WDF Marine Resource Annotations 1994.

-*Chuckanut Watershed Study,* In the City of Bellingham Watershed Master Plan Study, draft. 1992. David Evans & Assoc. Inc. and HDR Engineering, Inc. Study area included Chuckanut Creek. [The study results to date provide a qualitative yet technical evaluation of wetland and stream habitats functions and values as well as a detailed descriptions of both. The results of this study provide a complete profile of the stream and riparian corridor habitat and will interface well with future species surveys.]

-*Puget Sound Environmental Atlas Update,* 1992. Puget Sound Water Quality Authority and DNR Division of Aquatic Lands.

-*Bellingham Bay Action Program: 1991 action plan.* 1991. Prepared by M.A. Jacobson and P.A. Canterbury of PTI Environmental Services, Bellevue, WA. For the U.S. Environmental Protection Agency.

-*A Guide to Bird Finding in Washington* , Wahl and Paulson, 1991.

-*Chuckanut Ridge Property Plants and Animals Reconnaissance.* 1991. Shapiro & Associates, Seattle, Washington.

-*Chuckanut Village Environmental Impact Assessment.* 1989. Huxley College, Bellingham, Washington.

-*Catalog of Washington Seabird Colonies*, 1989. by S.M. Speich and T.R. Wahl. Biological Report 88(6), U.S. Department of the Interior, Fish and Wildlife Service and Minerals Management Service.

-*Bellingham Bay Action Program: initial data summaries and problem identification*, 1989. Prepared by D.S. Becker, R. Sonnerup and J.J. Greene of PTI Environmental Services, Bellevue, WA. For the U.S. Environmental Protection Agency.

-*A Synthesis of Biological Data from the Strait of Juan de Fuca and Northern Puget Sound*, 1983, E.R. Long editor. Marine Ecosystems Analysis (MESA), Puget Sound Project. Pacific office of Marine Pollution Assessment, National Oceanic and Atmospheric Administration.

DESCRIPTION OF WATERSHED AND SIGNIFICANT HABITAT

The Chuckanut Creek watershed totals 13,500 acres (Becker et al. 1989); an estimated 2,000 acres lies inside the city limits and 11,500 acres in Whatcom County. Chuckanut Bay marine and shoreline area constitutes 240 acres. Of the City's watershed, 75 acres of upland and 78.5 acres of marsh and tidelands are publicly owned parkland, Greenways or privately protected and dedicated to passive recreation, natural open space. The watershed as a whole is predominately forested; however, within the City, contiguous forest, interspersed wetlands and riparian areas make up less than 50% of the upland totalling nearly 900 acres. These forested areas and wetlands represent a wide range of successional stages. Contiguous mature conifer forests dominate the watershed and provide the most significant habitat feature when combined with wetlands and riparia. These combined habitat values provide a significant matrix for which northwest vertebrate communities are adapted and on which they depend. For this reason among others, **the Chuckanut watershed supports the greatest known vertebrate species diversity in Bellingham.**

The watershed is fragmented by two secondary roads Chuckanut Drive and Old Samish Way and a major freeway, Interstate-5. I-5 bisects the watershed northwest to southeast. This four lane freeway creates a perpetual disturbance as it parallels Old Samish Road and Chuckanut Creek for over 3 miles. The freeway corridor spans over 200 ft. in width, and the combination of paved surface, lack of cover and fast moving traffic poses a potential barrier and hazard to all terrestrial wildlife species. The open, grassy freeway median and edge provides fallow field habitat supporting a limited prey base for freeway tolerant raptors and road kill for scavengers. This is the majority of field habitat within the watershed, yet is obviously limited in function and value.

The headwaters of the Chuckanut Creek are located outside the City to the southeast. The creek is fed by tributaries flowing from Chuckanut Mountain to the south and Lookout Mountain to the north. These areas are in the county and sparsely populated in a R-5 zoning corridor along Old Samish Road and Samish Way. Zoning upslope from the R-5 is Recreation and Open Space (ROS) both to the east and west. The forested condition of these upland areas and vegetated stream drainages ensure high water quality through natural filtration, bank stabilization, woody material and shading; these features maintain the excellent water quality of the Chuckanut Creek and its tributaries.

Chuckanut Creek provides the highest quality fish habitat and the greatest diversity of native, naturally reproducing fish species in the city. This is due in part to the minimal development in the watershed, resulting in undisturbed headwaters and feeder streams, as well as a natural mainstem stream course.

In 1980, Russ Orrell, Fisheries Biologist for WDFW, described Chuckanut Creek as follows.

> *"Only five percent of the watershed had been developed by 1973 along with construction of I-5. It is estimated that only ten percent of the basin will develop due to the rugged terrain. Problems include drainage and landslides occurring along I-5, floodplain encroachment near the mouth and limited flow under the bridge at Chuckanut Village. Chuckanut Creek supports fair runs of coho and chum salmon, steelhead and trout."*

Huxley College students prepared an Environment Impact Assessment of Chuckanut Village in 1989. The Flora and Fauna section of the document provides a brief yet interesting narrative describing the wildlife in and around Chuckanut Bay. The descriptions are based on observations made by area citizens and site-specific reports:

> *Within the estuary, three major communities occur. They are the invertebrates and fish of the benthic community, the fish, invertebrates and marine mammals of the water column, and the birds that roost, nest and feed above and on the water's surface.*
>
> *A numerous array of invertebrates live in the substrate. These organisms provide an important food source for the birds and mammals that live in the Chuckanut Bay Estuary. Burrowing species such as the lugworm, polychaetes and the acorn worm contribute the most dynamic influence on the estuarine community. The acorn worm has been noted as a unique species because of its rare occurrence in Washington State (Charles Flora pers. comm. 1989). Mud, sand and silt provide habitats for organisms such as blue mud shrimp, a variety of clams and small crabs. Within the eelgrass, dungeness crab, sanddollars, sea cucumbers and snails dwell. Among the rocks, limpets, barnacles, mussels, sea anemones, chitons and numerous other organisms make their homes. Fish of the benthic community include small fish such as gobies and blennies(Huggins1969) The Chuckanut Bay Estuary is used as a nursery area by juvenile coho and chum salmon and steelhead and cutthroat trout. Flatfish such as the starry flounder and several species of sole are found along the bottom. Smaller fish such as stickelbacks, gunnels,*

bay pipefish, shiner perch, sculpins and herring are found in the eelgrass and in open water (DeLacey 1972). Larger fish such as rockfish and lingcod dwell in the deeper areas of the estuary, near the opening on the railroad trestle.

Marine mammals such as the harbor seal and river otter occasionally inhabit and feed in this area. Beaver may use the estuary during migration (Tim Wahl pers. comm. 1989).

There is a daily average of about 300 birds in the Chuckanut Bay Estuary according to bird censuses (Tim Wahl pers. comm. 1989). More than 20 great blue herons at one time have been seen roosting within the site. Three species of gull, osprey, belted kingfisher and bald eagles feed and roost in the estuary.....[Other species occurring near the mouth of Chuckanut Creek] include green heron, common snipe and crow (George Garlick pers. comm. 1989).

The tideflats of the estuary abound with migratory birds. During fall and spring migrations, numerous waterfowl and shorebirds such as the wigeon, scaup, dunlin,western sandpiper, lesser and greater yellowlegs, killdeer and whimbrel occur (George Garlick pers. comm. 1989). During winter and migration, green-winged teal roost near the mouth of Chuckanut Creek. Three loon species, goldeneye, bufflehead and grebe roost and feed in the estuary during winter. Trumpeter and whistling swans occasionally winter in the estuary.

The fauna present in the upland areas is typical of that found in forested areas. In the Chuckanut Village area, black-tailed deer, coyote, fox, racoon, opossum, rabbits, flying squirrels and small rodents are found. There are also, over 25 species of birds using this area, including owls, woodpeckers, ruffed grouse, and band-tailed pigeons. Bald eagles, osprey, great blue herons, and belted kingfishers are also known in the upland areas and are far ranging species, so that they utilize areas both inside and outside the Chuckanut Village area.

The Chuckanut Creek Watershed was field inventoried by David Evans & Assoc. in 1992, as part of the Bellingham Watershed Study. Their assessment focused primarily on the physical features of the watershed and included detailed stream and streamside habitat descriptions, an inventory of wetlands - their functional values and known fisheries resources. A wildlife inventory was not included in the scope of the study, however wildlife habitat value of wetlands and streams were rated using a qualified analysis. Without site specific species inventory it is very difficult to adequately address potential impacts on wildlife or to establish the ecological value and sensitivity of a site. Subjective ratings resulting from this study will not suffice for actual wildlife values attained through inventory of the sites.

VERTEBRATE SPECIES INFORMATION

Lacking a systematic wildlife inventory of the watershed, the following accounts are based on the information collected through the inventory of existing references, recorded sightings and interviews. The following is not intended to serve as a complete account of species present in the watershed. It is however a current representation of those species observed and recorded by local biologists and naturalists.

Fish

Chuckanut Creek provides the highest quality fish habitat and the greatest diversity of native, naturally reproducing fish species in the City. According to Jim Johnston and Mark Schuller biologists with the WDFW, all of the Chuckanut Creek mainstem and many of its feeder streams are important for spawning, rearing and migration of steelhead *(Salmo gairdneri)* and sea-run cutthroat trout *(Salmo clarki)*; these species are native and naturally reproduce. Coho Salmon *(Oncorhynchus kisutch)* and chum salmon *(Oncorhynchus keta)* are also native to and naturally reproduce in Chuckanut Creek but their populations have been artificially enhanced with hatchery stock. Previous egg box locations are west of the box culvert under Chuckanut Drive (Chum) and east of the city limits (Coho). Other resident fish species utilizing Chuckanut Creek or its tributaries were not discussed in the available literature or interviews.

Inventories or references identifying the marine fishes inhabiting Chuckanut Bay were not available in the sources reviewed, but may be available in unknown source material.

Amphibians and Reptiles

Within the lower 3,000 feet of the Chuckanut Creek corridor, five species of amphibians have been identified, red-legged frog *(Rana aurora)*, the only population of tailed frog *(Asaphus truei)* in Bellingham, Pacific chorus frog *(Hyla regilla)*, a high density of red-backed salamander *(Plethodon vehiculum)*, and the rough-skinned newt *(Taricha granulosa)*. It is likely that northwest salamander*(Ambystoma macrodactylum)* are also present and possibly Pacific giant salamander*(Dicamptodon ensatus)* in association with the same habitat as the tailed frog.

Within the wetland complex north of Chuckanut Cr. (wetland CH-12 and14), west of the Interurban Trail, numerous amphibian species have been identified. In addition to the red-legged frog and red-backed salamander, there are, Ensatina *(Ensatina eschscholtzi)*, northwestern salamander *(Ambystoma gracile)* long-toed salamander *(Ambystoma macrodactylum)*, Pacific tree frog *(Hyla regilla)*, and western toad *(Bufo boreus)*. **This area represents the greatest diversity of amphibians known in the City.** More information is needed from this site, particularly migration and dispersal, breeding and density data. Migrations of amphibians have been reported to the west across Chuckanut Drive, an area which needs to be examined and formally documented. Development plans for this site are also a consideration. Alteration of the habitat would severely impact this amphibian community, particularly if its habitat requirements are not fully documented and protected.

The reptiles recorded for the Chuckanut Watershed include only the northern alligator lizard *(Elgaria coerulea)*. There are undoubtedly other reptiles including the three garter snake species *(Thamnophis sp.)*. Due to the lack of empirical data from existing sources, no other species are recorded for the area. Further species identification is needed.

Birds

Of the 231 bird species known to occur in Bellingham at least 141 species or 61% occur in the Chuckanut Watershed, representing the greatest diversity within a Bellingham watershed. This estimate was made based primarily on observations and records listing species occurrence. The birds listed for this watershed include terrestrial, fresh water and marine associated species. Of these, 23 are designated as species of concern by WDFW. Refer to the Master Species List (Appendix C) for a complete account of species in this watershed.

Species occurrence have been irregularly recorded for the lower reach of Chuckanut Creek, the wetlands north of the creek (100 Acre Interurban Woods), the Chuckanut Bay and Clark's Point. Species presence throughout the watershed differ somewhat depending on habitat. With the good connectivity of the watershed's habitats, many bird species will take advantage of this single feature and range throughout the watershed.

The 100 Acre Interurban Woods, or the site of the proposed Chuckanut Ridge development is a forested wetland/upland complex with excellent, diverse bird habitat. The species known to occur here are also diverse and include several groups: neotropical passerines, 3 vireo species, as many as 8 warbler sp., 4 flycatcher sp., likely 2 swallow sp., rufous hummingbird *(Selasphorous rufus)* and black-headed grosbeak *(Pheucticus melanocehalus)*. Resident species include: insectivorous black-capped and chestnut-backed chickadees *(Parus sp)*, brown creeper *(Certhia americans)*, red-breasted nuthatch *(Sitta canadensis)*, bushtit *(Psaltriparus minimus)*, Bewick's *(Thryomanes bewickii)* and winter wren *(Troglodytes troglodytes)*, ruby and golden-crowned kinglets *(Regulus sp)*, Swainson's and varied thrush *(Catharus sp)*, American robin *(Turdus migratorius)*; granivorous species, red and house finch *(Carpodacus)*, evening grosbeaks *(Coccothraustes vespertinus)*, red crossbills *(Loxia curvirostra)*, rufous-sided towhee *(Pipilo erythrophthalmus)*, dark eyed junco *(Junco hyemalis)* and variety of sparrows; at least four woodpeckers, pileated *(Dryocopus pileatus)*, northern flicker *(Colaptes auratus)*, downy and hairy *(Picoides sp)*; several raptors, including barred owl *(Strix varia)*, pygmy owl *(Glaucidium gnoma)*, sharp-shinned hawk *(Accipiter striatus)*.

Nearby Hoag Lake, to the east, provides open water for migratory and resident dabbling ducks, diving ducks, herons and possibly rails. Linked by contiguous forest, Hoag Lake and the 100 Acre Interurban Woods, share many of the same avian foraging guilds, forest dwelling birds and species with large home ranges.

The Chuckanut Creek corridor including Arroyo Park provide contiguous habitat for most of the species listed for the 100 Acre Woods, with the addition of species which include: bald eagles *(Haliaeetus leucocephalus)* ~6 of which reportedly roost east of the park on the north slope of Chuckanut Mountain, above the creek; red-tailed hawk *(Buteo jamaicensis)* which hunt the riparian areas, open grassy margins, freeway medians, as well as forest edges; Cooper's hawk *(Accipiter cooperii)* is strongly associated with riparia; green heron *(Butorides striatus)* and American dipper *(Cinclus mexicanus)* utilize the stream corridor and possibly hermit thrush *(Catharus guttatus)* and Hutton's vireo *(Vireo huttoni).*

To the west lies Chuckanut Bay and the estuarine habitat at the mouth of Chuckanut Creek. **This habitat is a WDFW Priority Habitat area for shorebird and waterfowl concentrations, endangered and threatened species (peregrine falcon and bald eagle) and eelgrass associated aggregations of great blue herons *(Ardea herodias)*.** Peregrine falcons *(Falco peregrinus)* hunt the estuary and roost along the shoreline. Bald eagles also hunt this area and nest on Clark's Point and Chuckanut Island. Merlin *(Falco columbarius)* and osprey *(Pandion haliaetus),* both monitor species, also utilize the bay and associated habitats. Great blue herons congregate on the mud flats and surrounding shoreline, as do gulls, crows and occasionally ravens. Large shoreline trees serve as important roosts for raptors, as well as herons and passerines. Although the estuary is protected, its habitat value and function is dependent on activities up-stream which determine water quality, shoreline management and upland habitat retention.

Associated with the bay are rocky sandstone shorelines, exposed cliffs and banks, a protected wetland area and upland conifer forest habitat. These habitats, expand the bird diversity by providing additional niches for species not yet mentioned. The open rocky/sandstone shoreline is favored by harlequin ducks *(Histrionicus histrionicus),* cormorant sp. and rock shorebirds. Exposed banks provide nesting opportunities for rough-winged swallows *(Stelgidopteryx serripennis)*, belted kingfishers *(Ceryle alcyon)* and possibly pigeon guillemots; while the sandstone cliff areas provide nesting opportunities for cliff swallows. The marine waters of the bay provide foraging and resting habitat for a variety of species including the threatened marbled murrelet *(Brachyramphus marmoratus)*, rhinoceros auklet *(Cerorhinca monocerata)*, common murre *(Uria aalge)*, common loon*(Gavia immer),* mergansers *(Mergus sp.)* goldeneye *(Bucephala sp.)* and grebe (sp.) among others.

Mammals

The mammalian life of the Chuckanut watershed is potentially abundant and diverse, but not well documented. The reported observations include the following resident species: red fox *(Vulpes vulpes)* ranging throughout the watershed and denning; black-tailed deer *(Odocoileus hemionus columbianus)* ranging through out, locally abundant and fawning areas, particularly in secluded areas near wetlands and riparia; coyote *(Canis latrans)* range throughout; Townsend's big-ear bat *(Plecotus townsendii)* likely forage throughout the watershed, as well as the long-eared bat *(Myotis evotis),* other bat species have yet to be identified; highly sensitive bat habitats, i.e. roosts, nurseries and hibernacula are also unknown; raccoon *(Procyon lotor)*, striped skunk *(Mephitis mephitis)*, mink *(Mustela vison)* and long-tailed weasel *(Mustela frenata)* are all likely present; aquatic species include river otter *(Lutra canadensis)* and muskrat *(Ondatra zibethicus)*; small mammals include deer mouse *(Peromyscus maniculatus)*, Trowbridge shrew *(Sorex trowbridgii)*, Douglas squirrel *(Tamiasciurus douglasii)* chipmunk *(Tamias townsendii)*, and likely flying squirrel *(Glacomys sabrinus)* and other forest dwelling rodents are possible. The occurrence of mountain beaver *(Aplidontia rufa)* needs verification. A recent cougar *(Felis concolor)* sighting was reported and may indicate occasional passage of this large, wide-ranging mammal through the watershed.

Marine mammals of Chuckanut Bay are limited to harbor seal *(Phoca vitulina)* as the common species. River otter are also common and utilize the shoreline areas. California sea lion *(Zalophus californianus)*, also occasionally occur in the bay. Rarely, whale or harbor porpoise enter the bay. Recent records of gray whale *(Eschrichtius robustus)* were associated with a migrating adult female and calf.

HABITAT INVENTORY: *per section area*

As a means to inventory habitat area and value within an urban landscape, a "block" system was applied. Blocks (blk) are a descriptive unit, representing an area of contiguous open space that contains one or more habitat types. Each block embodies an "island" of habitats and an associated wildlife community. Because habitat value and function is dependant on area (size), condition and connectivity, blocks serve as a comparative measure of available open space, connectivity and habitat diversity within each watershed.

The area of each block and general habitat type is listed by acreage and is based on aerial photo interpretation, using 1988 orthophotographic maps (1"=200'), 1990 city wetland inventory data, 1991 Department of Natural Resources orthophotos and other available reference information, as well as limited field truthing.

The Chuckanut Watershed within the city limits consists of the following habitat types as classified by the Bellingham-Whatcom Classification System. Starting at the eastern city boundary and proceeding downstream, habitats are listed per township/range/section. Contiguous habitats are identified as blocks and are listed by number. This numerical system remains constant even when blocks overlap section lines or watershed boundaries. Descriptions of large blocks will reflect only the area and habitats within the subject watershed and section. Notes for each entry may include: special habitat features, critical habitat as described in GMA/ PHS or the Natural Heritage Program, significant wildlife observed, identified corridors & barriers and publicly owned habitat areas such as undeveloped parks and greenways. **Terrestrial habitats are the primary focus of this inventory** but fish habitat may be noted as well. Stream and wetland habitat descriptions are available in the Bellingham Wetlands Inventory (1990) and the Bellingham Watershed Study, 1992 prepared by David Evans & Assoc. and HDR consultants.

T37N/R3E/S16

Blk#	Hab. Code(s)	Acres	Notes
1	24	17.61	contiguous forest to north w/Lake Padden Park/ bordered by I-5 to south and pipeline to the west/parkland/PHS-UNOS 2835
2	24/27	18.07	contiguous forest to north and west/parkland/PHS-UNOS 2835

T37N/R3E/S17

Blk#	Hab. Code(s)	Acres	Notes
2	24/27/28	49.19	contiguous forest north/east and west w/ Lake Padden Park/bordered south by I-5/PHS-UNOS 2835
2	22/23	(1.5)	interspersed wetlands: CH-49,50,51,56
3	28/9	26.71	contiguous east and west, bordered by I-5 north, interspersed w/rural residential/PHS-UNOS 2829
3	21/22	(3.1)	interspersed wetlands: CH-46,47,48,52,53,55
3	R/28		Chuckanut Cr. 2,000 lin. ft., steelhead and sea-run cutthroat, spawning and rearing habitat

T37/R3E/S18

Blk#	Hab. Code(s)	Acres	Notes
2	28	36.74	contiguous forest north/east and west w/ Lake Padden Park/bordered to south by I-5/ UNOS 2835
3	28	10.36	contiguous forest east, interspersed w/rural residential, bordered by I-5 north
3	22	(.1)	interspersed wetlands: CH-43
4	24/27/28	217.66	contiguous forest west, south and east w/ Arroyo Park, important forested corridor link to Larrabee Park (outside blk), bordered by I-5 and Old Samish Rd. to the north, interspersed w/ few rural residences, PHS-UNOS 2829. Species reported: shrew *(Sorex trowbridgii)*, deer mouse*(Peromyscus maniculatus)*
4	22/23	(6)	interspersed wetlands: CH 20,21a&b,25,26,27,28,29a&b, 30,31,39,40,42,43,44,45
4	R/24/27	- -	Chuckanut Cr. 6,600 lin. ft., chum, coho salmon, steelhead and sea-run cutthroat trout, spawning and rearing habitat

T37/R3E/S7

Blk#	Hab. Code(s)	Acres	Notes
2	24/27/28	42.02	Contiguous forest habitat into the Padden watershed to the north and east, bordered by I-5 to southwest, parallels targeted greenways open space to the north, forms a link in the wildlife corridor east to Lake Padden and west over I-5.

2	22/23	(2.1)	interspersed wetlands: CH-35,36,37,38
5	28/9	7.34	forest/field habitat strip parallel to the south of I-5, provides a travel corridor link between blk #2 and blk #6
5	22	(>.1)	wetland CH-34
6	20/21/22	(9)	interspersed wetlands: CH-17,18 (Hoag Lake),19,22,23, 24, species information lacking, although a resident fish population is known for Hoag Lake
6	9/24/28	76.54	interspersed forest-field and wetland habitats, and rural residences, species information is lacking

T37/R2E/S12

Blk#	Hab. Code(s)	Acres	Notes
6	24/27/28 22	115.36 (26)	contiguous forest, forested wetland complex, extending north into the Padden Cr. watershed and east to 30th St. Although this area is bordered by Chuckanut Dr. to the west/southwest and Old Samish Road to the south it is a centralized habitat node where corridors converge from Chuckanut Cr., Chuckanut Bay, Padden Cr. north and Padden Gorge east. This area consists of diverse vegetative communities and vegetative structure which is accentuated by the high topographic relief forming low protected areas, year-round wetlands, steep slopes, swales and ridgelines. The watershed division between Padden and Chuckanut bisects this block. Outflow from Hoag Lake meanders through this area draining to Chuckanut Cr. The forest cover is primarily mature mixed conifers including Douglas fir, western red cedar, grand fir and a successfully regenerating Sitka spruce grove. Patches of deciduous forest cover are interspersed within the block including red alder, bigleaf maple and black cottonwood. Refer to C.A. Houck, Shapiro & Assoc., letter to T. Gacek 1991, for a detailed description of vegetation within block. Wildlife species reported: red fox (denning), black tailed deer (fawning areas), coyote (denning), river otter, muskrat, mink, pileated woodpecker, hairy woodpecker, great blue heron, belted kingfisher, barred owl (nesting), breeding populations of northwest toad/pacific tree frog/red-legged frog/ensatina/long toed salamander/red backed salamander/northwest salamander/northern alligator lizards, sea-run cutthroat redd.
6	9	1.5	open pasture, bordered by road, residential development, horse arena and forest, limited habitat-disturbed.

7	28	25.88	see section 13 description, critical wildlife corridor function
8	28/24	35.21	disturbed, partially logged area isolated by residential development on all sides, noted deer habitat, species information lacking
8	23	(5.7)	Wetland: CH-16, noted snags and "bird nests" (wetland survey notes)

T37/R2E/S13

Blk#	Hab. Code(s)	Acres	Notes
4	24/28	80.07	Contiguous forest south and east, w/ Arroyo Park and Larrabee Park (outside blk), bordered by Chuckanut Drive and Old Samish Rd., interspersed with rural residences, PHS-UNOS 2829. Species reported: rough skinned newt, tailed frog, red-backed salamander, alligator lizard, bat *(Myotis evotis).*
4	22	(3.9)	wetlands: CH-5,6,8,9,10,11
4	R/28	- -	Chuckanut Cr. 600 lin. ft., chum, coho, steelhead, sea-run cutthroat trout
7	24/28	95.02	Contiguous forest connected by narrow corridors from Chuckanut Dr. west to the northeast corner of Clark's Point where the forested corridor connecting the Point was reduced for residential development , the corridors identified on the working map are critically important for wildlife, the block is bordered by Chuckanut Dr. to the east and Chuckanut Bay. Species Reported for uplands: bald eagle, osprey, great blue heron aggregation-possible roost, red fox, abundant deer, western tanager, kingfisher
7	21/22/16	(13.1)	wetlands: CH-1,2,3,4,7...critical salt marsh habitats
7	R/28/16		Chuckanut Cr. and estuary, 2,400 lin. ft., box culvert w/ fish ladder, chum, coho, steelhead, sea-run cutthroat trout, chum salmon egg box , red-legged frog, salamander sp. and those species listed earlier (Huxley 1989)
10	15	83 inside trestle 157 outside trestle	Chuckanut Bay, marine bay and intertidal critical habitat: recreational shellfish and eelgrass beds, shorebird concentration, waterfowl concentration; Species reported: river otter, harbor seal, gray whale, major migration route for dungeness crab, salmon, steelhead and cutthroat trout, plus those species listed earlier (Huxley 1989).
9	24	34.64	Clark's Point forest and shoreline critical habitat,

				contiguous with the Bellingham Bay watershed north. Designated critical bald eagle habitat area 0781/PHS. Species reported: bald eagle (nesting, peregrine falcon(roost), osprey, great blue heron, pileated woodpecker, red fox (denning), abundant deer, belted kingfisher(nesting), Cooper's hawk, red-tailed hawk.
9	22	(.2)	wetland: CB-2	

HABITAT TYPE TOTALS

10 contiguous habitat blocks: 9 forest-wetland/1 saltwater-marine-shoreline

<u>Total Available Habitat Area</u>

889.92 acres forest habitat (with interspersed fallow field/pasture habitat <30 ac)
70.8 acres wetlands interspersed within the forest habitat areas
240 acres open saltwater/marine and shoreline habitat
11,600 lin. ft. (2.2 mi) stream/riparian habitat (main stem of Chuckanut Creek only)

1,129.92 acres total habitat area

HABITAT BLOCK TOTALS

#1 = 17.61 acres
#2 = 146.02 acres (1.5 ac wetlands)
#3 = 37.07 acres (3.2 ac wetlands)
#4 = 297.73 acres (9.9 ac wetlands)
#5 = 7.34 acres (>.1 ac wetland)
#6 = 193.40 acres (9 ac wetlands)
#7 = 120.90 acres (13.1 ac wetlands)
#8 = 35.21 acres (5.7 ac wetlands)
#9 = 34.64 acres (.2 ac wetlands)
#10 = 240 acres (open marine and estuarine mudflat)

CHUCKANUT WATERSHED SUMMARY and RECOMMENDATIONS

The Chuckanut watershed supports significant wildlife and habitat diversity within the City boundary and is the most intact watershed. It is also one of the more popular areas in the City for casual study (bird watching), resulting in greater frequency of incidental wildlife sightings. The relatively natural state of the watershed, its connectivity and extensive contiguous forest stands compounds its value as wildlife habitat. Although certain barriers and non-point source pollution exist, these limitations are outweighed by the total remaining natural area, habitat opportunities present within the watershed and contiguous with other watersheds.

Of the total 889.92 acres of natural forest/wetland area within the watershed, an estimated 160 acres are publicly owned. Clark Pt. (34.64 ac within the watershed) is a designated natural area and permanently protected under a conservation easement. **Approximately 195 acres, 22% of the remaining natural area, or 10% of the watershed, is permanently protected.**

Preservation of existing habitat linkages is recommended. The forested habitat is in part, fragmented by roads and a four lane freeway. Residential development with the exception of the north end of Chuckanut Bay, is sparse. Isolation of habitat blocks due to development was identified for only 2 blocks #5 (7.34 ac.) & #8 (35.21 ac.). Narrow corridors link forested habitat through residential development within block #7 which enable wildlife to move from Clark's Pt. to suitable habitat eastward. These corridors although narrow, serve a critical function for wildlife and need protection.

Protection of habitat nodes is recommended. Block #6, totaling 193.4 acres is a centrally located habitat reserve identified as a node where natural corridors north, south, east and west converge. This locale has been identified as a pivotal point for mobile species within the watershed. Currently, 100 acres of block #6 is planned for a high density residential development which would adversely impact the present function and value of the habitat block. It is recommended that this site and as much of this block be preserved in its present contiguous state in order to retain the watershed's vital habitat value, function and wildlife diversity over time.

A functional network of reserves and corridors is needed to preserve habitat and species diversity within the watershed. In addition to the above mentioned corridors and reserves is the largest upland block within the watershed. Block #4, totaling 298 acres, is contiguous with the vast Chuckanut Mountain ecosystem, spanning thousands of acres of park and commercial forest lands. The habitat link between block #4 (Arroyo Park south and southeast) and Chuckanut Mountain is recommended for immediate protection through acquisition or conservation easement.

At a landscape level, the following habitat features are particularly significant within the watershed and should be considered as priority areas for protection and potential acquisition. First, the existing forest/wetland corridor linking the Padden Watershed with Chuckanut including the 100 Acre Woods in Block #6 south to Arroyo Park. Second, Hoag Lake and associated forest and corridor to the Interurban Trail. Third, is the Chuckanut Creek riparian corridor, in and outside of the City boundary. Fourth, the forested corridor linking Arroyo Park with Chuckanut Mountain and Larrabee State Park; a sliver of privately owned land separates city and state park lands. Fifth, the bald eagle roost site on Chuckanut Mountain. Sixth, a functional forested corridor linking Clark's Point with the Chuckanut Creek corridor. Seventh, shoreline vegetation, particularly large roost/perch trees. A high water quality needs to be maintained and monitored for Chuckanut Creek.

Barriers to fish and wildife movement in streams and along corridors need to be evaluated and corrected where feasible. The use of structural enhancement, vegetative restoration and other methods are available. Potential barriers to wildlife were identified as enhancement sites and include:

- I-5 for many terrestrial species,
- an approximate 1,000' stretch of I-5 east of Hoag Lake, noted as recurring road-kill area (porcupine, racoon and deer), needs wildlife passage route,
- the culvert draining Hoag Lake is impassible for fish,
- the culvert under Chuckanut Drive at the NE corner of Section 13, possible barrier to fish,
- the section of Chuckanut Dr. extending north approximately 1,000' from the culvert which has been noted as an area of recurring road-kill, amphibians and mammals; this is a likely wildlife corridor or migration route and passage needs to be developed.

Other barriers probably exist, particularly culverts along Chuckanut's tributaries and under roads. These need to be identified and corrected. Additionally, the movement of amphibians across Chuckanut Drive and small to medium sized mammals across I-5 could be enhanced by the installation of culverts under the roadway or the construction of underpasses.

Stormwater runoff needs to be diverted to swales and other detention areas for biofiltration, rather than directly discharging into streams. The David Evans & Assoc. study concluded with a summary of potential impacts from development in the watershed which identified the primary impact as stormwater runoff. The potential impacts to fisheries and wildlife identified are:

- storm water modifying the frequency and duration of wetland inundation, affecting the stability of existing vegetation and wildlife communities
- increased erosion and sedimentation
- increase of pollutants in the water column
- increased high flow events and flooding
- displacement of current wildlife and plant communities

Sensitive habitats and species need identification and protection from disturbance. Chuckanut Bay contains certain unique qualities that are sensitive. Sensitivity of habitats and species is, in many instances a measure of location. Situated between a metropolitan center and a high use state park, Chuckanut Bay is favored by kayakers, other boaters and recreationalists. Disturbance has resulted in reproductive failures of birds on Chuckanut Rocks and may account in part for the eagle nest relocation from Chuckanut Island to Clark's Point. **The Chuckanut shoreline is the last forested shoreline in the city and is even more important given the matrix of habitat blocks linking the shoreline areas with the upland.**

Another sensitive habitat consideration is the health of eelgrass in the bay. As a vascular plant, eelgrass requires sunlight for photosynthesis, high water quality and minimal sedimentation. Failing septic systems, sediment run-off and toxins carried in stormwater can contribute to significant eelgrass loss. Because eelgrass communities are an integral component of the Chuckanut Bay ecology, consideration of its requirements is essential for the maintenance of the bay's ecological diversity.

A systematic scientific inventory of specific habitat areas within the watershed is imperative. Such an inventory is necessary in order to understand and appreciate the intricacies of the Chuckanut system and to justify its protection. These areas include: Chuckanut Bay, Clark's Point, Chuckanut Village wetland (CH-4), Interurban 100 Acre Woods (wetlands and upland), Arroyo Park and Chuckanut Creek Corridor, and Hoag Lake. It is only with good, solid data that these areas and their associated species will be recognized for permanent protection.

PADDEN WATERSHED

INTRODUCTION

The Padden Watershed includes the Lake Padden, Padden Creek and Connelly Creek basins. These drainages have been combined due to their topographical and hydrological connectivity and ecological function as a complete watershed. This watershed area extends from Galbraith Mountain and Samish Hill west to the Padden Creek outlet on Bellingham Bay. **The Padden Watershed contains the largest protected contiguous open space within the City. Lake Padden Park with over 1,000 acres, is an area harboring notable species richness, habitat diversity and species of concern. Comparatively, this watershed represents the greatest habitat diversity and is second only to Chuckanut in known species abundance.** The watershed contains significant natural open space and habitats within five designated protected areas including Lake Padden Park, Sehome Hill Arboretum, Connelly Creek Nature Area, Fairhaven Park and Padden Lagoon. There are also strategic habitats and major corridors linking Whatcom Watershed to the north and Chuckanut to the south that remain unprotected. Fragmentation of the watershed by I-5, arterial streets and residential development continues to threaten the function and value of the remaining habitat blocks, particularly west of the freeway.

INFORMATION SOURCES

To date, the Padden Watershed has received limited wildlife related field study, the results of which are available in the references listed below. These constitute the primary baseline references utilized for this assessment. An abstract of each study document is provided in the annotated bibliography, *Appendix A* of this document. In addition to the references, are reports and observations from reliable sources, all of which have contributed to this Padden Watershed inventory.

-*Padden Watershed Study,* In the City of Bellingham Watershed Master Plan Study, draft. 1993. David Evans & Assoc. Inc. and HDR Engineering, Inc. The study area included Lake Padden, Padden Cr., and Connelly Cr. The study results to date, provide a qualitative yet technical evaluation of wetland and stream habitats functions and values, as well as a detailed descriptions of both. The results of this study provide a complete profile of the stream and riparian corridor habitat and will interface well with future species surveys.

- *Priority Habitats and Species Database* and *Non-game Data System.* 1993. Washington Department of Fish and Wildlife.

-*Puget Sound Environmental Atlas Update,* 1992. Puget Sound Water Quality Authority and DNR Division of Aquatic Lands.

-*A Guide to Bird Finding in Washington* , Wahl and Paulson, 1991.

-*Padden Creek Estuary Area Planning Study.* 1990. City of Bellingham Parks and Recreation Department.

-*Connelly Creek Nature Area Environmental Impact Assessment.* 1989. Huxley College, WWU, Bellingham Wa.

-*Catalog of Washington Seabird Colonies,* 1989. by S.M. Speich and T.R. Wahl. Biological Report 88(6), U.S. Department of the Interior, Fish and Wildlife Service and Minerals Management Service.

-*Sehome Hill Arboretum Vertebrate Inventory.* 1986. [limited to birds and mammals observed during four site surveys]. Environmental Assessment Class, Huxley College, WWU, Bellingham, Wa.

DESCRIPTION OF WATERSHED AND SIGNIFICANT HABITATS

The Padden watershed is an area of approximately 3,952 acres (Becker et al. 1989) and extends from the foot of Galbraith Mountain and the crest of Samish Hill, west to the Padden Creek estuary on Bellingham Bay. Approximately 3,000 acres lies within the City boundary. Three drainage basins constitute the Padden watershed, Lake Padden, Padden Creek and Connelly Creek. The area within the City limits includes Lake Padden, the entire Padden Creek corridor and gorge, the southern half of Samish Hill, the southern half of the Sehome Arboretum, the Connelly Creek drainage, the northern portion of the Interurban 100 Acre Woods, Fairhaven Park and the Padden Lagoon.

The watershed is primarily residential with a core of commercial use. Forested park and single family residential use dominate the upper reaches of the watershed. Outside the City boundary commercial forest is a major use. Higher density (multi family) residential, commercial and light industrial land uses are more prevalent west of I-5. The area occupying Samish Hill, Happy Valley and Fairhaven, are rapidly developing residential magnets. Although the watershed is noted for its wildlife diversity particularly within the Lake Padden basin, wildlife habitat opportunities progressively diminish downstream.

The Padden watershed forms the interface between intensive urban land uses and rural residential and forest land uses. Habitat quality is inherently affected in this transitory zone. Less than one half, approximately 1,400 acres, of the City's watershed area is forested. A good part of this forested area is designated park and open space and constitutes significant habitat reserves.

The Padden watershed contains the greatest protected park and open space area in the City. Over 1,140 acres consist of public parks and Greenways including: Lake Padden Park and Natural Area, Connelly Creek Nature Area, Sehome Hill Arboretum, Fairhaven Park and Padden Lagoon. These constitute the core of existing habitat and the foundation on which a viable habitat network would be created within the watershed. However, critical components to the network are currently missing and need to be added in order to complete a functional system. Unprotected reserves and corridors of importance include: the Padden Creek corridor west and east of the freeway and associated gorge and uplands west of Lake Padden, forest corridors and a reserve area on Samish Hill, Connelly Creek fallow field reserve and corridor links to Sehome Hill and the Interurban wetland/upland corridor.

The eastern area of the watershed includes contiguous upland forests forming corridors east to Lookout Mountain, north into the Lake Whatcom Watershed, south to I-5 and west along Padden Creek. These corridors are very important features and necessary to maintain the genetic diversity in the forest community. Additionally, there are numerous interspersed wetlands and small streams of varying size and quality throughout the forested area. The contiguous open fallow field and forest habitats of the watershed west of the freeway have been fragmented by increased residential and commercial development. The habitat remaining is concentrated within narrow riparian strips along Padden and Connelly Creeks, adjacent random patches of open space and parkland. **As fallow field has become a limited resource for wildlife throughout the region, protecting areas around Connelly and Padden Creek containing this habitat are a priority.**

The connectivity of the watershed's habitat has been severed by major roadways and associated development. The watershed is bisected north and south by I-5, spanning over 200 ft. in width, forming a serious hazard to wildlife and major barrier without under-or over-passage for terrestrial species. In addition to the physical effect of the freeway, its impervious surface contributes substantially to storm water runoff and non-point source pollution impacting Padden Creek. The construction of Fairhaven Parkway through the Padden Creek floodplain and in segments over the creek, is another area of lost habitat, structural barriers and source of storm water pollutants.

The loss of habitat and habitat corridors has resulted in the displacement and extirpation of native wildlife. Lake Padden, once a natural freshwater marsh with limited human access, has been converted to one of the most popular recreational sites in the City. The alteration of habitats has resulted in the loss of an intact wetland community and loss of certain obligate species. Historically, wide ranging large mammals including black bear and cougar were relatively common throughout the watershed. Today, these large mammals have been extirpated from the City area and are rarely seen in the upper watershed. Native wild salmon runs have also been extirpated from the Padden system, however, native trout and planted anadromous fish populations are persisting through enhancement measures. Chronic sediment loading and polluted runoff coupled with the channelization of Padden Creek, impassable culverts, and various other stream alterations challenge survivability for most fish populations. Additional species loss in the watershed are suspected, particularly in wildlife populations once resident on Sehome Hill, for example mountain beaver *(Aplodontia rufa)*. **With the severing of corridors, increased human development and related disturbances, clearing, wetland loss and more domestic predators, the Padden wildlife community is in need of baseline study, monitoring and habitat restoration.**

VERTEBRATE SPECIES INFORMATION

Although published information for the Padden Watershed is limited to site specific interests, the combined information and observations indicate an excellent species representation for a City watershed. Species lists have been compiled for Sehome Hill (Jones and Jones 1976)(Huxley 1986), Connelly Creek (Huxley 1989) and Padden Lagoon (City of Bellingham 1990). Unfortunately, all of the lists contain some very rare species, species out-of-season and an element of speculation with species added that are "expected" but not observed. Overall, methodologies lack scientific systematic field sampling over a twelve month period. Nonetheless, valuable information has resulted from the efforts of mostly WWU students. Follow-up surveys encompassing the whole watershed using more scientifically credible sampling methods would help verify species occurrence, distribution and habitat association.

Species occurrence within the Padden Watershed includes common upland forest-associated species, wetland and stream aquatic and semi-aquatic fish, amphibians, birds and mammals, some field and shrub dwelling species and variety of estaurine visitors. There are an estimated 178 species associated with the watershed including an undetermined number of fish species, 4 known reptile species, 4 known amphibian species, 140 bird species and an estimated 30 mammal species. Of these, there are 24 Species of Concern and PHS Species known to occur within the City's portion of the watershed. See Bellingham Species List in *Appendix C*. The following summaries are based on the best available published information and observations from reliable sources.

Fish

Lake Padden contains resident cutthroat and Kokanee. A netpen for rearing chinook salmon was located in the lake within the past five years. The lake is planted annually for sports fishing and results in attracting scores of cormorants, mergansers and other diving birds. **The Padden Creek gorge area from the outfall of the lake downstream to I-5 is the least disturbed forested riparian corridor in the city and constitutes some of the best fish and wildlife habitats.** This part of the creek offers excellent water quality, excellent riparian vegetation, diverse in-stream habitats, low sediment and nutrient content, expansive undisturbed contiguous upland forest and little if any human access.

The following section was extracted from the *Padden Creek Estuary Area Planning Study* (Bellingham Parks and Recreation 1990) and is entitled Salmon and Trout Utilization of Study Area Waters, In a Watershed Context, by Ken Friedman, Huxley College.

> Salmonid species presently using Padden Creek include steelhead *(Salmo gairdneri)* cutthroat trout *(Salmo clarki)* and coho *(Oncorhynchus kisutch)* chinook *(Oncorhynchus tshawytcha)* and chum *(Oncorhynchus keta)* salmon. The only native fish surviving in limited numbers are sea-run cutthroat trout and steelhead (Johnston 1990).
>
> Historically, Padden Creek has supported populations of steelhead, resident sea-run cutthroat, chum and coho salmon. Construction of the Fairhaven and Southern Railway in 1889 included installation of a series of culverts making fish passage difficult during low flows. In the early 1900's a 2000' long 4' X 6' tunnel was installed between approximately 22nd and 17th Streets. Development and urbanization in the watershed has greatly reduced fish populations in the creek. In the 1960's fish migration upstream was limited by construction of a culvert under the intersection of 10th Avenue and Donovan Street.
>
> In 1986, baffles were placed in the above culvert and fish ladders were installed at the railroad culvert just west of 12th Street and at another railroad culvert at the northeast

corner of Fairhaven Park (16th St.) The work was executed by the Department of Fisheries with funding from a Community Development Block Grant and the Northwest Steelhead and Salmon Council of Trout Unlimited. Following completion of the project, coho were seen above the ladders and chum have been sighted above the Donovan culvert.

Since the installation of baffles and fish ladders, several plantings of fall chinook chum, coho and sea-run cutthroat trout have been made by the Department of Wildlife, the Bellingham Bay Association and the Department of Fisheries (City of Bellingham, 1989).

Most fish reported are presumed to be hatchery juveniles. Few adult fish have been reported above the fish ladder at 16th Street. The Hatchery Management Program at Bellingham Vocational Technical Institute (BVTI) is involved in the ongoing introduction of hatchery stocks to Padden Creek. Bellingham Cooperative School and BVTI maintain egg boxes on Connelly Creek and Padden Creek for hatching chinook, coho and chum salmon and cutthroat trout (WWU 1989).

Background data on fisheries resources in Padden Creek indicate that annual adult returns are low and survival of juveniles is poor (Huxley College 1989). Because of the degraded habitat the current fish carrying capacity for Padden Creek is speculated at "1/100th of a healthy stream" (Johnston 1990). Whether this low use is due to mortality during the juvenile stage after the fish have left the creek is unknown; no studies have been done to determine the numbers of outward migrants. Studies are needed to determine the carrying capacity of the creek and limitations of habitat for juveniles. Since Padden Creek is well seeded with young fish and nearby Chuckanut and Oyster Creeks support good returns of adults, it is speculated that poor conditions in Padden Creek are responsible for low returns (City of Bellingham 1989).

Jim Johnston of the Department of Fish and Wildlife and others note that water quality is poor west of the freeway. Urbanization has caused loss of streambank cover, siltation of spawning beds, and an increase of heavy metals and other toxins from stormwater runoff, oil and gas spillage. Invertebrates serving as salmonid food have been reduced by poor water quality and siltation. Flow regimes have been altered with heavy storm runoff events and low summer flows. Residential development has diverted feeder stream flows to impervious road surfaces and culverts causing higher peak flows (City of Bellingham 1989). Also, failing septic tank effluent from Samish Hill emptying into Connelly Creek is a source of non-point pollution. Bank erosion and surface runoff create a high silt load in Padden Creek which seriously reduces the viability of gravel spawning beds. Streamside vegetation which is important for protective cover, moderating water temperature and reducing potential flood peaks is lacking along most of the creek.

Loss of wetlands in the Padden Creek basin has been detrimental for fisheries. Wetlands detain and store stormwater, reducing floodwater and augmenting low stream flows during drought periods. Restoring wetlands and constructing settling basins would detain drainage waters, improve water quality and remove suspended sediments.

Because the volume of water is low during the summer, pool formation in Padden Creek is very limited. Thus, habitat suitability for coho is low, due to their preference for pools. A suggested solution for augmenting minimum stream flows has been to release more water from Lake Padden. However, according to Jim Johnston, the warm lake water temperature would raise creek temperatures to unhealthy levels for fish. Cooler water from the lake's bottom would be more suitable.

Aquatic and riparian-edge insect species have an important role in determining fishery viability. Mayflies and caddisflies, the larvae of which are important food sources, are also very sensitive to pollution. Invertebrate species numbers and diversity were found to decline considerably from the pristine headwaters east of the freeway to the lower reaches of the stream (Hachmoller 1988).

Downstream from the discharge of Connelly Creek, Padden Creek enters the 2000 foot long culvert under Old Fairhaven Parkway. This extended culvert is a difficult passage for salmon attempting to reach the better spawning grounds above the culvert. For certain species, the complete darkness and sheet flow of the culvert makes upstream migration nearly impossible.

Fisheries Management Issues and Recommendations

Each fish species has particular habitat requirements which need careful management. Steelhead, cutthroat trout and coho overwinter in Padden and Connelly Creeks and may move to saltwater the following spring or later. Chum salmon move toward salt water almost immediately and chinook usually remain in the stream only briefly. Coho salmon favor large pools and need a year in freshwater, until they move out to sea during the first fall storms, (Schuller 1990). Steelhead and cutthroat trout are bigger as fry and require more water and stream residence time, which makes them more vulnerable than the chum and chinook to disturbances and pollution.

The Padden Lagoon is an important transition environment for fish adapting to saltwater (smoltification). The lagoon protects fish from tidal action and provides rich and accessible food. Sea-run cutthroat and chinook utilize lagoon habitats extensively (Johnston 1990). The lower Padden marsh serves as a valuable food and shelter basin for overwintering coho juveniles.

There is increasing interest from fishery managers and the general public in restoring disturbed urban watersheds for spawning-cycle fisheries. On a degraded urban stream like Padden Creek, yet one with much of its natural watershed "structurally intact," fishery managers typically take two very contrasting approaches. One approach involves restoration of a complete habitat for spawning and rearing of native and wild fish (without hatcheries). Commercial fishery interests advocate hatchery-based programs of continual plants using eggs and fry from adult fish who, due to habitat loss, are unable to successfully reproduce. There is increasing support among fisheries and environmental educators for teaching the public about fisheries and environmental protection through the restoration of functional watersheds and urban "sport and watch" fisheries involving naturally spawning species like cutthroat trout.

Releases of hatchery stock compete with native and wild fish stocks for food, shelter and favorable stream habitat. Also, native and wild juveniles are subject to some predation from hatchery fish. For successful coexistence of hatchery and native wild fisheries, hatchery-produced fish must often be closely managed according to variables of timing, size, location and density to minimize competition and predation.

One management strategy for creeks such as Padden has been suggested by Jim Johnston WDFW Biologist. It involves switching from the current hatchery coho stock to chum. Chum salmon are less competitive because they need less stream residence time than coho and occupy different stream niches than native cutthroat and other anadromous species.

Reptiles and Amphibians

The reptiles and amphibians of the Padden Watershed are poorly understood and to date have not been the subject of inventory. The numerous wetlands and undeveloped terrestrial habitats of the upper watershed likely harbor a variety of native species.

Of the six possible species of reptiles within the City, five are likely to occur in the Padden Creek watershed. Observations made along the lower Padden Creek corridor by Dr. David Mason in 1990 resulted in the identification of wandering garter snake *(Thamnophis elegans vagrans)*, a subspecies of the western terrestrial garter snake. Other species likely to occur are: common garter snake *(Thamnophis sirtalis)*, Northwestern garter snake *(Thamnophis ordinoides)*, terrestrial garter snake *(Thamnophis elegans)*, and Northern alligator lizard *(Elgaria coerulea)*.

Of the seven native amphibian species occurring in Bellingham, five are likely to occur in the Padden Watershed based on habitat availability. Pacific chorus frog *(Hyla regilla)*, red-legged frog *(Rana aurora)*, and western toad *(Bufo boreas)* have been identified. Other possible species include terrestrial salamanders such as rough skinned newt *(Taricha granulosa)* and ensatina *(Ensatina eschscholtizi)*. Other species of salamanders may also occur within the watershed and should be considered as potential occurrences. The reported occurrence of western toads breeding in Our Lake, if confirmed, would represent one of the only viable breeding sites known for Bellingham.

It is not known if non-native bull or green frogs have been introduced to the Padden system.

Birds

Padden Watershed provides habitat for a great diversity of avian species. Associated species richness and abundance is indicated by high quality extensive forest, riparian, wetland, lake habitats and diminutive but important fallow field, estuarine and marine shoreline areas. Of the 231 avian species recorded for Bellingham, there are an estimated 140 species that utilize the available habitat in the Padden Watershed. Of these species, 21 are designated species of concern by WDFW.

Lake Padden with its approximately 143 acres of open fresh water, shoreline and associated forested uplands is a magnet for waterbirds and upland birds. The lake is a designated Priority Habitat by the WDFW, and an area of avian concentration and diversity. Lake Padden and associated forest provides the best representation of the Padden Watershed upland and wetland bird species. Although much of the isolated shoreline vegetation has human recreational access or has been removed over time, the remaining thin riparian habitat provides hiding cover and some nesting opportunities for common and tolerant breeding species including mallards *(Anas platyrhynchos)* and red-winged blackbird *(Agelaius phoeniceus)*. Past reports of (now uncommon) pied-billed grebe *(Podilymbus podiceps)* nesting on the lake have not been renewed. Canada goose *(Branta canadensis)*, American wigeon *(Anas americana)*, mallards and coots *(Fulica americana)* are abundant during winter. Many other waterfowl species, usually in large flocks, occur during winter and migration. The contiguous upland mature conifer and mixed forests to the south, east and west of the lake provide habitat for the majority of forest associated species that occur in the city, and currently provide enough area and connectivity with larger reserves to maintain viable populations of certain species.

Several Priority Species and Species of Concern are associated with the basin and include: bald eagle *(Haliaeetus leucocephalus)*, osprey *(Pandion haliaetus)*, red-tailed hawk *(Buteo jamaicensis)*, merlin *(Falco columbarius)*, pileated woodpecker*(Dryocopus pileatus)*, band-tailed pigeon *(Columba fasciata)*, ruffed grouse *(Bonasa umbellus)*, occasionally Vaux's swift *(Chaetura vauxi)*, and black swift *(Cypseloides niger)*, common nighthawk *(Chortdeiles minor)*, barred owl *(Strix varia)*, great blue heron *(Ardea herodias)*, green-backed heron *(Butorides striatus)*, hooded merganser *(Lophodytes cucullatus)*, wood duck *(Aix sponsa)*, double-crested cormorant *(Phalacrocorax auritus)* and western grebe *(Aechmophorous occidentalis)*.

A pair of bald eagles have successfully nested on the lake's south side for over a decade and fish on the lake, as well as hunt Samish Hill, the Padden Creek corridor and Bellingham Bay. Osprey also utilize the lake's fish stocks, as do cormorants, grebe, diving ducks and herons. Barred, great horned, pygmy and likely saw-whet and screech owls reside in the lake's associated forests. Accipiters including Cooper's *(Accipiter cooperii)* and sharp-shinned hawks *(Accipiter striatus)* utilize the forest and open areas for hunting small birds. Forest interior species such as brown creeper *(Certhia americana)*, red-breasted nuthatch *(Sitta canadensis)*, red-breasted sapsucker and other woodpeckers including northern flicker *(Colaptes auratus)*, pileated woodpecker, downy and hairy woodpecker *(Picoides sp)*, all occur here and excavate cavities for nesting. Additionally, all three northwest corvid species can be observed here, northwest crows *(Corvus caurinus)*, common raven *(Corvus corax)* and Steller's jay *(Cyanocitta stelleri)*. Neotropical migrant passerines (migratory perching birds) such as warblers, vireos, flycatchers, tanagers, thrushes, black-headed grosbeak, swallows, swifts, nighthawks and hummingbirds are all found in the vicinity of the Lake and are closely associated with riparian habitats. Due to the large size and variety of available habitats of the Lake Padden forest reserve, other forested areas within the watershed may harbor only a fraction of the species represented here.

Padden Creek is a critical corridor habitat feature across the watershed. This corridor is particularly valuable to maintaining bird populations and diversity within the watershed for dispersal, foraging, nesting, cover, travel and water. The corridor's configuration of riparian and forest vegetation associated with intermittent blocks of open field, forest and wetland habitats provides a matrix of quality habitats supporting a variety of birds and other wildlife. Linked by contiguous forest to Padden Creek, both Hoag Lake and the Interurban 100 Acre Woods share many of the same avian foraging guilds, forest dwelling birds and riparian associated species. To the north of Padden Creek, Connelly Creek provides a variety of more open habitats for birds including fallow field and shrub associated species found less frequently elsewhere in the watershed. The Sehome Arboretum, although narrowly linked to Connelly and Padden, is noted for excellent upland avian species richness and has served as an inventory site for university students.

Another important habitat area representing the remaining bird species occurrence in the watershed, is lower Padden Creek and the Padden Lagoon. In this area, there are secretive marsh dwellers, common songbirds and approximately 66 marine and estuarine associated bird species; a list of 137 bird species was compiled by Terry and Tim Wahl (City of Bellingham 1990) for the Padden Lagoon and associated marsh site.

Mammals

The mammalian life of the Padden watershed as a whole is not well documented. However, the only scientific inventory of mammals in the city was conducted ten years ago on Sehome Hill. At that time, habitat corridors and general conditions were more favorable for mammalian life throughout the watershed. Additional occurrence data was provided by Clyde Senger, PhD, a mammalogist from WWU. Recorded species for the watershed include the following resident mammals. Small mammals include: deer mouse *(Peromyscus maniculatus),* Townsend's vole *(Microtus townsendii),* Western jumping mouse *(Zapus princeps),* Trowbridge's shrew *(Sorex trowbridgii),* vagrant shrew *(Sorex vagrans),* coast mole *(Scapanus orarius),* shrew-mole *(Neurotrichus gibbsii)* eastern cottontail *(Sylvilagus floridanus),* Douglas squirrel *(Tamiasciurus douglasii),* chipmunk *(Tamias townsendii),* and flying squirrel *(Glaucomys sabrinus)* and other forest dwelling rodents are possible.

Bats are of particular interest in this watershed, as the only bat nursery in the area has been identified along Padden Creek in Fairhaven (T. Wahl and P. Otto pers. comm.). It is thought to be a *Myotis* colony, but the species has yet to be determined and may involve more than one species which is common. Other known bat species include: little brown myotis *(Myotis lucifugus),* Townsend's big-eared bat *(Plecotus townsendii)* and silver-haired bat *(Lasionycteris noctivagans);* additional bat species are likely, but will require further specialized survey.

Medium sized native mammals include: raccoon *(Procyon lotor)*, striped skunk *(Mephitis mephitis)*, mink *(Mustela vison)* and long-tailed weasel *(Mustela frenata)*; porcupine *(Erethizon dorsatum)* is a species of concern locally due to high morality and poor mobility; red fox *(Vulpes vulpes)* likely ranges throughout the eastern watershed and probably dens; coyote *(Canis latrans)* are particularly common in the vicinity of Connelly Creek and Sehome Hill where denning occurs, but coyotes range throughout the watershed; black-tailed deer *(Odocoileus hemionus columbianus)* ranging throughout.

Wide ranging large mammals such as bobcat *(Lynx canadensis)*, cougar *(Felis concolor)*, and black bear *(Ursus americanus)*, occasionally occur in the upper watershed. Bobcat tracks were reported at Connelly Creek, yet no sightings have been made. A black bear den was reported east of Lake Padden over ten years ago and the site has since been developed. Aquatic mammals associated with the lower creek area include river otter *(Lutra canadensis)* and muskrat *(Ondatra zibethicus)*. The common beaver *(Castor canadensis)* seem to maintain relatively small numbers, with no active beaver complexes and few signs of activity reported, most of which is for the upper watershed.

The occurrence of mountain beaver *(Aplodontia rufa)* as a terrestrial species was recorded twenty years ago and is suspected to be extirpated, both on Sehome and Samish Hills. The loss of mountain beaver may be explained by a combination of factors including: habitat fragmentation and alteration, loss of corridors, increased pressure by natural predators due to shrinking habitat and preybase, and an increase in domestic predators. The Sehome Hill population likely suffered isolation beginning in the early sixties, with the construction of I-5 and later Fairhaven Parkway and subsequent development which severed remaining habitat corridors to suitable habitat.

Fragmentation of habitat and loss of adequate corridors has become the greatest challenge to mammalian survival within the Padden Watershed. Small, medium and large mammals are all victims of motorized vehicles, domestic predators, loss of habitat and preybase or forage. **Providing the necessary corridors so that populations are not isolated will require forethought in planning and restorative and enhancement action by the City and its citizens.**

HABITAT INVENTORY: *per section area*

As a means to inventory habitat area and value within a fragmented urban landscape, a "block" system was applied. Blocks (blk) are a descriptive unit, representing an area of contiguous open space that contains one or more habitat types. Each block embodies an "island" of habitats and an associated wildlife community. Because habitat value and function is dependant on area (size), condition and connectivity, blocks serve as a comparative measure of available open space, connectivity and habitat diversity within each watershed.

The area of each block and general habitat type is listed by acreage and is based on aerial photo interpretation, using 1988 orthophotographic maps (1"=200'), 1990 city wetland inventory data, 1991 Department of Natural Resources orthophotos and other available reference information, as well as limited field truthing.

The Padden Watershed, within the City limits, consists of the following habitat types as classified by the Bellingham-Whatcom Classification System. Starting at the eastern City boundary and proceeding downstream, habitats are listed per township/range/section. Contiguous habitats are identified as blocks and are listed by number. This numerical system remains constant even when blocks overlap section lines or watershed boundaries. Descriptions of large blocks will reflect only the area and habitats within the subject watershed and section. Notes for each entry may include: special habitat features, critical habitat as described in GMA/PHS and by the Natural Heritage Program, significant wildlife observed, identified corridors & barriers and publicly owned habitat areas such as, undeveloped parks and greenways. Terrestrial habitats are the primary focus of this inventory but fish habitat is noted as well. Stream and wetland habitat descriptions are available in the Bellingham Wetlands Inventory (1990) and the Bellingham Watershed Study, 1992 prepared by David Evans & Assoc. and HDR consultants.

T37N/R3E/S5

Blk#	Hab. Code(s)	Acres	Notes
11	28	~160	expansive contiguous forested area extending north into Whatcom Watershed and east into County, with wetlands, corridor target area for open space acquisition, wildlife information lacking
- -	PA-43	(.6)	
- -	PA-44	(.5)	
- -	PA-45	(.1)	
- -	PA-46	(.1)	
- -	PA-47	(.5)	
- -	PA-48	(.3)	
- -	PA-49	(.2)	
- -	PA-50	(2.8)	
- -	PA-51	(.1)	

T37N/R3E/S9

Blk#	Hab. Code(s)	Acres	Notes
2a	7	63.16	golf course, interspersed mixed conifer/hardwood forest and wetlands, the stream flowing from Our Lake to Lake Padden provides spawning areas for kokanee and cutthroat trout.
- -	PA-92a	(1.8)	
- -	PA-92b	(0.4)	
- -	PA-91	(<0.1)	
- -	wetland		Outside the city boundary, Our Lake and its feeder stream north, harbors important species including: resident cutthroat trout, river otter, beaver and one of few western toad breeding sites in Whatcom County. To the east of Our Lake, black bear had been known to den fifteen to twenty years ago.

T37N/R3E/S16

Blk#	Hab. Code(s)	Acres	Notes
2a	7	78.69	golf course with interspersed wetlands and mixed forest strips (corridors) between fairways
- -	PA-83	(1.0)	
- -	PA-87	(0.5)	
- -	PA-88	(0.1)	
- -	PA-89	(0.8)	
- -	PA-90	(0.1)	
- -	~~PA-82~~	~~(4.0)~~	converted to playfield
2			continuation of block #2 with mixed forest cover interspersed wetlands; bisected by an 80' wide cleared gas pipeline corridor running north and south; important forest habitat linkage east; high quality habitat area, but little known
- -	24	4.1	
- -	PA-81	(0.3)	
- -	PA-84	(0.5)	
- -	27	81.60	critical corridor between golf course and lake
- -	PA-85	(0.2)	
- -	PA-86	(2.3)	
- -	PA-93	(0.3)	
- -	PA-94	(6.1)	
- -	24	35.63	

- -	PA-96	(0.4)	
- -	PA-95	(<0.1)	
- -	24	5.34	
2b			contiguous forest habitat extending beyond city boundary to the east important linkage, border to south by I-5, to north by Old Samish Way and west by the pipeline corridor which constitutes a break in habitat, but not a barrier unless actively managed and devegetated
- -	28	115.34	
- -	PA-97	(2.2)	
- -	PA-98	(2.0)	
- -	PA-99	(0.3)	
- -	27	53.75	
- -	2	6	

T37N/R3E/S8

Blk#	Hab. Code(s)	Acres	Notes
11	28/27A	192.8	expansive contiguous forested area, with interspersed wetlands, extending east beyond city boundary and south to Lake Padden, parts of block has been logged and replanted - important habitat area with diverse micro habitats including: caves, swales, cliffs, balds and occasional snags, abundant deer, coyote, porcupine, amphibians in wetlands and diverse resident and bird populations are noted- maintaining wildlife diversity in this block will require further study and coordinated planning; the retention of adequate habitat blocks with corridor linkages are particularly important
- -	PA-60	(0.6)	
- -	PA-74	(0.2)	
- -	PA-75	(0.2)	
- -	PA-76	(0.9)	
- -	PA-73	(2.0)	
- -	PA-62	(4.5)	
12	PA-61	(5.2)	
- -	9/28	15.15	interspersed early successional forest and fallow field
2	19		Lake Padden is contained in part within this block and constitutes one of the most important habitat features within the city. The area is part of a PHS-bald eagle territory (#0783). The total surface area of the lake is 142.76 acres and is a wildlife magnet, providing habitat for

both prey and predators. Fish include native and planted species. Numerous bird species utilize the lake, shoreline and surrounding upland including species of concern, priority species and locally significant species. Large numbers of waterfowl winter on the lake including mallards, coots and American widgeon. Mammals utilizing the lake and adjacent habitats include beaver, river otter, deer, coyote, common arboreal rodents and bats. Little is known about the amphibian life of the lake, yet, both aquatic and terrestrial species likely occur here. Since the alteration and conversion of the area to a park, much of the shoreline and marsh vegetation has been converted to lawn or altered by human activity. This change over time has likely effected populations of marsh birds, nesting waterfowl, amphibians and mammals.

- -	24-27	20.20	w. side of Lk Padden-parkland
- -	R/28/24/27	25.3	e. side of Lk Padden-parkland
- -	7	2.3	golf course
- -	PA-68	(0.2)	
- -	PA-69	(0.2)	
- -	PA-70	(0.1)	
- -	PA-71	(0.4)	

T37N/R3E/S17

Blk#	Hab. Code(s)	Acres	Notes
2			Continuation of block #2 includes the south side of Lake Padden and represents a contiguous habitat area of very high quality, diversity and wildlife value. This includes a productive bald eagle nest site and territory (#0783), shoreline and upland perches utilized by eagle, osprey, and other raptors. Another PHS record, is the city's only for Compton tortoiseshell butterfly *(Nymphalis vaualbum watsonii),* which is a state monitor species. The lake's southern shoreline represents the best uninterrupted riparian vegetation and provides water access to most terrestrial species, with only well used trails posing minor barriers. The expansive second growth mature Douglas fir forest is uncommon in the city and likely harbors the full complement of species commonly occurring in this type of habitat. This area also provides an intact forest linkage east to Lookout Mountain and west to the Padden Creek corridor.
- -	24	23.79	
- -	28	54.82	

- -	28	10.92	
- -	24	27.31	
- -	PA-77	(1.0)	
- -	PA-78	(1.0)	
- -	PA-79	(0.4)	
- -	PA-80	(0.1)	
- -	PA-84	(0.3)	S16 overlap
- -	PA-81	(0.4)	" " cutthroat trout spawning upstream from the lake; records of nesting pied-billed grebe at mouth of creek in the 1970's
- -	PA-82	(1.3)	S16 overlap - altered wetland

T37N/R3E/S7

Blk#	Hab. Code(s)	Acres	Notes
6 area	28/27/24	41.82	see description under section 12-very important habitat
- -	PA-20	(5.2)	
- -	PA-23	(1.0)	
- -	PA-25	(0.8)	
26	~~9~~	~~12.02~~	(developed) corridor to Connelly Creek via Fairhaven Parkway
25	PA-22	(0.8)	
- -	2	2.27	
23	PA-53	(0.9)	
- -	2	3.7	
24	27	2.03	
- -	28/9+24	8.90	
22	PA-27	(8.8)	
- -	PA-26	(2.3)	
- -	9	17.8	Connelly/Padden Creek riparian corridor, excellent fallow field habitat
21	~~PA-52~~	~~1.3~~	developed
- -	~~9/28~~	~~3.8~~	developed
20	2	2.8	
- -	PA-54	(0.1)	
19	2	2.19	strip habitat along I-5
18	28	3.5	" " " "
17	PA-55	(0.7)	
- -	1/2B	5.14	
16	2	1.8	
14	28	5.24	
- -	24	2.16	
13 large	28/D	34.53	part of area disturbed due to clearing, contiguous to east, habitat area >100 acres needs assessment

- -	PA-57		
15	~~9/28/28-D~~	~~15.56~~	developed
- -	PA-59	(2.9)	
2	28/27/24/9	108.17	important contiguous forested riparian corridor and upland habitat, contiguous south and west to I-5 and east to Lake Padden, (Padden Creek corridor targeted by Greenways), and extends beyond watershed and city boundary-forested corridor to Galbraith and Lookout Mountains-expansive area of excellent habitat with interspersed streams, wetlands and Padden Creek gorge, little known area needs wildlife assessment-I-5 major barrier needing passageway for terrestrial species
- -	28/27	(80)	Greenways target parcel, included in above
- -	9	15	
- -	PA-56	(1.8)	
- -	PA-58	(2.7)	
- -	PA-63	(0.6)	
- -	PA-64	(0.3)	
- -	PA-65	(0.1)	
- -	PA-66	(0.3)	
- -	PA-67	(0.4)	

T37N/R3/S6

Blk#	Hab. Code(s)	Acres	Notes
13	24	19.5	
16	24	10.5	
- -	27	8.1	
- -	28	6.6	
- -	PA-40/42	(1.5)	
35	24/mixed	18.54	Potential Corridor to the east
- -	PA-41	(0.2)	
38	2	~15	strip of varied habitat located along I-5
39	2	~15	" " " "
40			Connelly Creek Nature Area is contained within this block; the protected area totals 26 acres and is concentrated along the stream corridor north and south, the remaining adjacent open space, which is privately owned and predominately fallow field and shrub habitat, is critical to the overall habitat function and value of this urban natural area; **this is an important wildlife area, forming the only functional corridor from Sehome Hill** (although weakly linked). There is no formal wildlife inventory data for the Connelly Creek corridor and the species list that appears in the *Connelly Creek*

			Environmental Assessment (Huxley 1989) is in serious error; a variety of species occur including: field and forest dwelling birds and mammals; species of note include: raptors, bald eagle, Cooper's hawk, sharp-shinned hawk, red-tailed hawk and great horned owl, passerines, both resident and neotropical migrants (breeding), woodpeckers-downy, hairy and occasional pileated, ruffed grouse, great blue heron, corvids, both crows and stellar's jays, myotis bats, coyote (denning) who depend in part, on the field vole and other small mammals dwelling in the field/shrub habitats as well as mustelids (weasel/mink) raccoon, skunk and black-tailed deer. The in-stream and associated habitats have been heavily impacted and water quality is poor, resulting in limited fish and aquatic amphibian species.
- -	9	38.5	
- -	28	23.43	
- -	9	17.72	
- -	28	4.7	
- -	28/9	10.03	
- -	9	1.3	
- -	PA-28	(7.5)	
- -	PA-29	(4.1)	
- -	PA-30	(0.4)	
- -	PA-31	(0.9)	
- -	PA-32	(6.0)	
- -	PA-33	(5.8)	
- -	PA-34	(2.2)	
41	28/9	28	
- -	8	~8	Joe's Garden
- -	PA-35	(1.3)	
- -	PA-36	(0.3)	
42	24	37.5	
- -	PA-16	(??)	wetland area not listed in inventory
N/A	PA-37/38/39	(6)	6 acre isolated wetland/upland shrub habitat of unknown value, located behind Sehome Plaza

T38N/R3E/S31

Blk#	Hab. Code(s)	Acres	Notes
42	24	30.10	South half of the 165 acre Sehome Arboretum, a natural area of mature Douglas fir forest and extensive trail systems, habitat linkages are lacking for terrestrial species, however a thin treed corridor provides passage for birds and cover for mobile species
- -	28	46.37	

- -	PA-39	(0.4)	

T38N/R2E/S36

Blk#	Hab. Code(s)	Acres	Notes
48	28/2	2.53	this section includes patches of wooded area interspersed with single family residences and WWU on the South Hill; good passerine and neotropical migrant bird habitat made up of a variety of native and ornamental trees and shrubs
- -	2	2.68	
43	2	2.36	
47	2	9.41	

T37N/R2E/S1

Blk#	Hab. Code(s)	Acres	Notes
42	24	~2.5	Sehome Arboretum southern corridor extending to Bill McDonald Parkway which forms a barrier for many terrestrial species
- -	2	~2	
- -	PA-16	(0.3)	
43	28	~28	South Hill crest, deer, coyote, woodpeckers, passerine birds and likely owl habitat, also serves as dispersal habitat from Sehome Arboretum
- -	BB-7a	(0.1)	
- -	BB-7b	(0.6)	
44	2	~10	shrub-scrub habitat
- -	PA-12	(2.5)	
45	29	~5.2	linear swale-wetland wooded area and densely developed around, wildlife value unknown
- -	PA-15	(3.0)	
- -	PA-14	(0.3)	
--	PA-13	(0.2)	

T37N/R2E/S12

Blk#	Hab. Code(s)	Acres	Notes
32	28	4.45	Padden Creek riparian corridor links to east under 12th St. bridge-Greenways target. Very sensitive bat *(Myotis sp)* nursery colony located under bridge
33	2	>2	potential backyard sanctuary
34	24	34.25	clearing and development has decreased habitat value, remaining forest serves as buffer and habitat corridor for a

			variety of species
- -	PA-7	(0.1)	Pacific chorus frog breeding, other species possible
27	PA-11	(2.9)	riparian-Greenways target
- -	2	6.38	" " "
31	2	3.6	potential backyard sanctuary
30	2	5.3	" " "
29	2	1.5	" " "
28	~~R/28~~	~~1.5~~	riparian developed
6	- -	- -	Block 6 includes a forest upland and wetland complex extending into the Chuckanut watershed and forming a functional linkage between the Padden and Chuckanut drainages and constitutes one of the most important, diverse and intact urban habitat areas in the city.
- -	PA-4	(12.4)	riparian-most within Fairhaven Park
- -	PA-5	(0.3)	
- -	PA-6	(7.7)	forested/shrub and wetland area
- -	PA-8	(0.6)	
- -	PA-9	(1.8)	
- -	PA-10	(0.7)	riparian-in-part, Greenways target
- -	PA-17	(8.9)	riparian
- -	PA-18	(2.7)	
- -	PA-19	(0.2)	
- -	24	37.96	
- -	2	4.1	
- -	5	- -	Fairhaven Park lawn/recreational facilities-low habitat value
- -	28	19.58	riparian corridor-contains PA-4 and 10, most parkland
- -	~~9~~	~~11.87~~	developed
- -	9	2.94	wetland PA-9
- -	28/27/9	18.54	riparian/upland corridor Pa-17 and 19 -important habitat linkage-Greenways acquiring

T37N/R2E/S2

Blk#	Hab. Code(s)	Acres	Notes
32b	PA-1	(8.2)	Padden lagoon and associated creek corridor, a variety of water birds, shorebirds and gulls; otter and muskrat observed; steelhead, coho, chum, sea-run cutthroat occur from lagoon to Fairhaven Parkway culvert
32a	R/27	~5	lower Padden Creek corridor, marsh and riparian complex, faunally rich and diverse area
- -	PA-2	(1.0)	also in Sec. 1
- -	PA-3	(0.2)	
- -	10	~5	gravel parking lot-killdeer breeding, should be targeted for addition to Padden Creek park corridor
- -	2	3	

HABITAT TYPE TOTALS

code	type	acres
2.	Urban open space	101.9
7.	Golf course	144.15
8.	Cultivated land	8.0
9.	Fallow field	108.41
10.	Parking lot	5.0
24.	Lowland conifer forest	332.38
27.	Red alder forest	150.48
28.	Mixed conifer-hardwood	934.99
29.	Mixed deciduous	5.2

Total forest habitat 1,423 acres (79% of total natural open space area)
Total wetlands ~165

Total natural open space/habitat area 1,790.42 acres

Habitat loss within watershed 1990-1995 = 50 acres

HABITAT BLOCK TOTALS

36 blocks, listed in acres

Block #	Total acres
2	414.48
2a	141.85
2b	175.09
6	124.94
11	352.8
12	15.15
13	54.03
14	7.4
16	27

17	5.14
18	3.5
19	2.19
20	2.8
22	17.8
23	3.7
24	10.93
25	2.27
27	6.38
29	1.5
30	5.3

block totals continued,

31	3.6
32	4.45
32a	13
33	2.0
34	34.25
35	18.54
38	15.00
39	15.00
40	95.68
41	36.00
42	118.47
43	30.36
44	10.00
45	5.2
47	9.41
48	5.21

PADDEN WATERSHED SUMMARY and RECOMMENDATIONS

The Padden Watershed is an area of species and habitat richness. **The watershed harbors the largest protected open space/park area within the City and the largest contiguous blocks of habitat. Additionally, there is continuity of habitat blocks into adjacent watersheds including Chuckanut, Whatcom and into Whatcom County.** Within the Padden watershed however, adequate corridors are few. Although this watershed holds the elements for a functional habitat network, it lacks major linkages necessary for its viability over time.

Of the estimated 3,000 acres within the watershed approximately 1,790 acres (or 60%) is open space and potential habitat. Of that, 79% is forested and nearly 9% is wetlands. The wetland area includes inventoried wetlands. In addition to the wetlands is Lake Padden which provides over 140 acres of fresh water habitat.

The habitat blocks within the watershed vary greatly in size, isolation and quality. A total of 36 blocks were identified with the largest totalling 414 acres (block 2). The largest combined block is 2, 2a and 2b which are separated by minor clearings and extend into Chuckanut watershed, totaling 731 acres. Block 11, extending into the Whatcom Watershed to the north and Whatcom County to the east, is an important linkage and totals 352 acres. Of the total blocks, 16, or 44%, are under 10 acres. Unless these smaller blocks are providing a critical link in a corridor are have the potential to do so, they are of diminished habitat value based on size.

The major habitat reserves within the Padden Watershed include: Lake Padden Park (public) and Padden Creek Gorge (private/some public), Samish Hill (private), Sehome Arboretum (public), Connelly Creek (public/private) including adjacent open space, the Interurban forested wetlands (private) and the lower Padden Creek Marsh (public/private). **Adequately protected habitat linkages between reserves is however, currently lacking.**

Identification and preservation of viable habitat corridors is needed throughout the Padden Watershed. Biologically valuable habitat links are located along creek corridors and should be utilized to the fullest for this purpose. **Wide riparian buffers (>100') would provide the necessary corridor cover for passage of the majority of species.** On the west side of the freeway, a corridor is needed either south to the Chuckanuts, or east under or over the freeway to the Padden gorge. Due to the lack of functional habitat corridors, **Sehome Hill has been identified as a potential habitat sink and is in need of immediate action to restore connectivity to other natural areas.** It is recommended that current efforts to link Connelly Creek with Sehome Hill and Padden Creek be evaluated for adequate width, cover, road crossings and further links to other major reserves.

Fish habitat improvement goes hand-in-hand with overall improvements for wildlife in the Padden Watershed. Detailed recommendations are covered in the previous description of fisheries resources and emphasize in-stream and riparian habitat restoration, coupled with improved water quality as a means to encourage the return of naturally reproducing native anadromous fish species.

Of particular note, The degraded and sparsely vegetated streambanks throughout this watershed should be replanted with a mix of conifers, fast-growing deciduous trees, and suitable shrubs. Where native vegetation exists, it should be protected. Waterquality and quantity problems effecting fish, are directly linked to development in the watershed. Stormwater runoff should be treated and detained prior to entering Padden Creek. Riparian repair and wetland conservation will greatly enhance water absorption during peak flows and meter water out during dry summer months. Siltation must be controlled. Silt is deleterious to aquatic invertebrates (on which fish depend for food) and to young fish. It also builds up in stream channels resulting in the loss of in-stream habitat, particularly the loss of spawning gravel.

Eventually, the long culvert under Fairhaven Parkway should be replaced or modified in such a way to allow fish passage upstream in all flow conditions. The restoration of stream/riparian habitat and the return of natural fish migration would greatly benefit the greater wildlife community of the watershed.

Water quality monitoring and stream enhancement is needed throughout the watershed. Currently water quality of Connelly Creek and Padden Creek is poor. Stormwater runoff, commercial and industrial runoff and failing septic systems have been identified as the primary causes. As all wildlife depends on clean water, water quality is a essential consideration for wildlife conservation. Stormwater needs to be diverted from present direct outfall into streams, to swales or detention areas where biofiltration will be used as a primary treatment. Septic failures, commercial and industrial runoff should be corrected. The creation of a citizens task force or implementation of an Adopt-A-Stream program would greatly assist the city in stream monitoring and enhancement efforts.
Improvement and protection of riparian habitat along streams, lakes and wetlands is needed to maintain habitat and corridor function of these areas throughout the watershed. **Riparia is the single most important wildlife habitat area in the City.** Restoration of riparian areas is also indicated, primarily by revegetating with native plants and trees. The planting of conifers for screening is important as is the creation of snags to diversify habitat opportunities along the stream corridors.

On site assessment is needed for all projects that may alter important wildlife habitat. Those areas that are of particular importance are corridors, large reserve areas and potential amphibian habitat. Sensitive and rare species of amphibians as well as large assemblages of amphibians, such as the western toad, occurring in the Padden Watershed require further investigation, identification and habitat assessment. Development projects, improvements or land clearing activities in areas containing or adjacent to natural wetlands, lakes, ditches and streams will potentially affect amphibians and their habitat. These sites should be subject to a minimum site evaluation between February and June for amphibians, and breeding birds as part of the permitting process.

Implementation of backyard sanctuary or wildlife landscaping program would provide wildlife stewardship and habitat enhancement opportunities to citizens and neighborhoods. The program also has the potential to extend habitat through developed areas where public land is lacking. Many well vegetated yards linked through a neighborhood or along a stream, provides corridors where habitat is otherwise scarce and pubic ownership limited. The large yards of the Samish Hill, South Hill and Happy Valley are excellent backyard sanctuary areas. **Targeting sites adjacent to Greenways, parks and streams are a priority and should be coordinated in order to create contiguous habitats.**

Street tree plantings to compliment neighborhoods is encouraged. Trees provide valuable habitat in urban areas. Compatible tree size should be a consideration. Large street trees in the Fairhaven and the Happy Valley neighborhoods, short street trees or clumps in view areas such as Samish and South Hills will expand habitat opportunities throughout the watershed. Rows of trees create corridors for arboreal species and serve as breeding habitat as well as linkages to more suitable areas. Appropriate species should be used to avoid future conflicts with home owners and to provide the maximum benefit for wildlife. Wildlife biologists, arborists and neighborhood organizations should be consulted.

Adopting wildlife friendly policies for drainage system development, street placement and improvement, lighting, etc., would greatly enhance wildlife opportunities city-wide.

Enhancement of school grounds and public facilities with wildlife habitat is highly recommended. Landscaping for wildlife improves options for many species where little habitat now exists. Wildlife enhancement projects for school children will foster stewardship in their schools and wildlife, as well as promote experiential education opportunities.

Finally, the acquisition and protection of habitat areas and corridors is necessary to maintain biodiversity within the watershed and to link existing habitats with other watersheds. **Expanding the Greenways program to include wildlife functional habitat is highly recommended.** Priority areas for protection include the Padden Creek gorge and associated upland and ridgeline, forested corridor and reserve on Samish Hill, additional fallow field adjacent to Connelly Creek, unprotected wetlands, and all stream corridors.

WHATCOM WATERSHED

INTRODUCTION

The Whatcom Watershed includes the combined Lake Whatcom and Whatcom Creek Watersheds, spanning an area from the forested Lake Whatcom watershed to the industrialized Bellingham waterfront. The Whatcom Watershed has been an area of extensive study and great public debate over land management and water quality issues. As the municipal water supply, it is also the only watershed with a management plan. Contrary to management concern, very little is known about the watershed's wildlife. This rapidly developing watershed is tied to Whatcom Creek as the central drainage and backbone of its habitat network. Although the watershed within the City's boundary is comprised of primarily urban residential, commercial and industrial land uses, it also provides an important corridor utilized by a variety of species uncommon to most urban environments. It also harbors significant forested public park land and undeveloped private upland forests. These large conifer-dominated and mixed forest blocks are significant habitat in and of themselves and are increasingly more isolated, as many of the forest linkages via streams and other corridors have been severely reduced or severed by development. Rapid growth in this watershed has directly impacted wildlife by the fragmentation and removal of high quality wetland, riparian and upland habitats. Whatcom is also lacking any formidable wildlife information, despite project related environmental review processes resulting in significant habitat loss. For this reason, **Whatcom is identified as a high priority watershed for baseline wildlife/habitat assessment and serious habitat conservation action beyond this document.**

INFORMATION SOURCES

To date, the Whatcom Watershed has received considerable planning and fisheries review, yet wildlife inventory and documentation is lacking. The current available references pertaining to the City portion of the Whatcom watershed are listed below. These constitute the primary baseline references utilized for this report. An abstract of each document is provided in the annotated bibliography, Appendix A of this document. In addition to published references, are reports and observations from reliable sources, all of which have contributed to this section.

-*Whatcom Creek Trail Master Plan*, 1995 (draft). City of Bellingham Parks and Recreation Department.

- *Bellingham Christmas Bird Count Data.* 1967-1994. Terence Wahl, Bellingham, Washington.

- *Priority Habitat and Species Database and Non-game Data System.* 1993. Washington Department of Fish and Wildlife.

-*Whatcom Watershed Study*, In the City of Bellingham Watershed Master Plan Study, draft. 1993. David Evans & Assoc. Inc. and HDR Engineering, Inc. Study included Fever Cr., Lincoln Cr., Cemetery Cr., Silver Beach Basin and Hannah Cr. (wetlands mapping only for Hannah). The study results to date provide a qualitative evaluation of wetland and stream habitats functions and values, as well as a detailed descriptions of both. The findings of this study provide a complete profile of the stream and riparian corridor habitat and will interface well with future species surveys.

-*Big Rock Pond.* 1990. Single site visit conducted by Dana Base WDFW and Susan Taylor. Includes description of habitat, bird species observed and brief life history information.

- *Lake Whatcom Watershed Management Plan.* 1987. Western Washington University, Bellingham, Washington.

-*Woburn Park draft Environmental Impact Statement.* 1981. Casual observations recorded by Susan Taylor and Dana Base WDFW.

-*Washington Urban Stream Assessment.* 1981. Washington Department of Ecology

-*Whatcom Creek Fisheries Summary.* 1980. Russ Orrell, Washington Department of Fisheries. This summary provides complete descriptions of fish species and fish habitat of Whatcom, Lincoln, Cemetery and Fever Creeks.

- *A Guide to Bird Finding in Washington.* 1991. Wahl & Paulson. Bellingham Washington.

- *Lake Whatcom Avian Field Data Collected from 1966-68 (unpublished).* George Garlick. Bellingham, Washington. Baseline/historical species occurrence and numerical abundance of birds on Lake Whatcom.

DESCRIPTION OF WATERSHED AND SIGNIFICANT HABITATS

The Whatcom Watershed encompasses a total area of approximately 72,371 acres (Becker et al, 1989), including the Lake Whatcom basin and Whatcom Creek drainage. The component of the watershed area within the City includes the northwestern part of Lake Whatcom (310 acres), the entire Whatcom Creek drainage and five associated subbasins. This area is approximately 5,500 acres. Whatcom Creek forms the central habitat corridor extending from the lake to Bellingham Bay and has recently been the subject of a master planning process that will greatly enhance its habitat value. Although highly developed, the watershed contains significant habitat blocks including Whatcom Falls Park, upper Hannah, Cemetery and Lincoln Creeks and the northern quarter of the Sehome Arboretum. The northeast portion of the watershed has experienced recent development which has and will continue to fragment and remove much of a 200 acre contiguous forest block, with the exception of Greenways corridors and small habitat patches which remain.

Lake Whatcom and its immediate watershed include a vast area with diverse habitats. Lake Whatcom represents the largest fresh water body in the county and is situated at an elevation of 315 feet above sea level, in an expansive forested basin rising to 3000 feet in elevation. With 26 miles of shoreline, and 5003 acres of surface area, the lake has historically offered critical habitat for thousands of wintering waterbirds and sensitive shoreline habitat for a variety of breeding birds, resident mammals, amphibians and fish. Under the Shoreline Act, the Lake Whatcom shoreline has been designated as a Shoreline of Statewide Significance and its management is regulated under the State Shoreline Management Act and locally by the City of Bellingham. The lake's only outflow is Whatcom Creek which is dammed to maintain lake water levels and prevent downstream flooding. The lake is used intensively for recreation which has had untold impacts on the lake's wildlife value. Additionally, Lake Whatcom is the primary drinking water source for the City of Bellingham and parts of Whatcom County. Pollution of the lake from storm sewers and failing septic systems is of immediate concern including, Whatcom Creek and their associated tributaries.

The Lake's shoreline is zoned urban and is a fully developed residential area, with Bloedel-Donovan Park providing little in the way of upland or shoreline habitat other than mature ornamental trees and lawns for grazing by coots, dabbling ducks and Canada geese. Of the total 3.3 miles of lake shoreline in the city, only 2,000' contains native shoreline vegetation. The 300+ acres of open fresh water lake habitat within the city provide important wintering habitat for a variety of native waterbirds. The most significant habitat immediately associated with the lake is at the outlet pond and Scudder Pond marsh totaling 20 acres of high quality wetland, plus upland shrub and early successional deciduous forest. Along the northern edge of these wetlands are tall mature cottonwoods in which a bald eagle pair have recently constructed a nest, establishing the second bald eagle territory in the city. Bald eagles also hunt throughout this area year-round.

The Whatcom Creek basin is made up of five primary subdrainages including Hannah, Park, Cemetery, Lincoln, Silver Beach and Fever Creek, each of varying habitat quality and quantity. Upper Whatcom Creek, from Lake Whatcom west to Woburn Street, consists of park and open space (with the exception of the lower 600' which is a planned development). Scudder Pond and Whatcom Falls Park create a combined 245+ acre area of wetland, riparian and upland mixed and mature Douglas fir forest habitat and stream corridor extending 2.5 miles. This section contains a moderate to steep gradient where Whatcom Creek cascades through a gorge and over a series of falls creating a barrier for fish. Common terrestrial and semi-aquatic species are found in this urban refuge. However, disturbance from heavy recreational use of the area and the paucity of habitat corridors for population dispersal and immigration to habitat blocks outside the park will likely adversely effect population viability and the species diversity over time. Specific bird populations will, however, continue to thrive as the habitat matures and is enhanced.

Between Woburn Street and I-5, Whatcom Creek is shaded by deciduous trees and in-stream habitat is good. Habitat diminishes, however toward I-5 with a decline in riparian vegetation and progressively greater channelization. In addition water quality is questionable due to the storm sewer outfalls discharging into the creek from Iowa Street, which is a heavily developed area just north of the creek corridor. An obstacle for upstream fish migration is the sewer line located near the mouth of Lincoln Creek. The habitat between Woburn and I-5 includes a 140 acre tract stemming from Whatcom Creek containing mixed forest habitat and the largest wetland in the watershed (~84 acres). This and an adjacent 15 acre open space parcel along the creek are either slated for development or under construction. Greenways acquisitions have preserved some of the wetland area adjacent to the creek corridor. Comprehensive species and habitat data were not collected as a development requirement and are lacking for this general area.

From I-5 to Bellingham Bay, Whatcom Creek narrows to a thin corridor averaging 100' wide. The stream course is entirely channelized, lacking in-stream habitat diversity and in places retained by gabion walls. Streamside vegetation is also limited and primarily shrub-dominated with blackberries and occasional cottonwood, alder and few conifer trees. Portions of the stream have been invaded by reed-canary grass and in places choke the stream channel. The lower riparian area has been improved through volunteer revegetation efforts. Although degraded by urbanization, this section of Whatcom Creek is utilized by a variety of species not commonly associated with urban environments, as well as expected species.

Each of the watershed's five sub-basins vary in habitat features and quality. They range from extensive contiguous forests, to altered landscapes of severely fragmented habitats and residential development. As mentioned above, the upper Silver Beach and Fever Creek areas have been severely altered by the construction of Barkley Boulevard and associated residential development. The remaining habitat is concentrated within Greenways, Big Rock Garden Park, Big Rock Pond, Fever Creek Detention Pond and some patches along the railroad trail. The City in cooperation with Washington Department of Fish and Wildlife will develop an urban wildlife habitat demonstration site north of Roosevelt Elementary, on Fever Creek. In the center of the watershed is Whatcom Falls Park and associated undeveloped open space. To the south edge of the watershed, the upper Hannah and Cemetery Creek drainages provide hundreds of acres of combined alder, mixed and coniferous forests. These forests extend south, over Samish Hill to Lake Padden Park and east into the contiguous block of Lookout Mountain. **This and Chuckanut Creek are the only habitat areas within the city with uninterrupted connectivity (lacking major roads/barriers) with thousands of forested acres.** This connectivity is crucial in maintaining breeding populations of forest species with large home range requirements such as pileated woodpecker and bobcat, and also allows for occasional occurrence of elk, black bear and cougar. This area is currently an urban wilderness that likely harbors a full complement of forest associated species and is large enough to maintain viable populations of these species over time. Upper Lincoln Creek also offers expansive contiguous forest habitat extending south into Samish Hill and the Padden Watershed. This area also contains large wetland areas and diverse habitats.

In 1990 approximately 335 acres of wetlands were inventoried for the Whatcom watershed, today 305 acres of wetland habitat remain with significant additional acreages planned for development. Lost with this habitat, were numerous associated species which, in most cases, were not identified. The combined loss of upland/wetland habitats and the fragmentation of remaining habitat constitutes a significant loss of diversity and connectivity. The Whatcom Watershed wetland area is by far the greatest within the City and an important component of the remaining ecosystem.

VERTEBRATE SPECIES INFORMATION

The vertebrate wildlife of the Whatcom Watershed has not received any systematic inventory, with the exception of certain fish species. Given the lack of scientific data, the following summaries are based on the best available information from reliable sources.

Fish

The fisheries resources of the Whatcom Watershed are significant from a management perspective. There are three fish hatcheries within this watershed, two are state facilities primarily managed for lake associated sport fisheries and the other, a city-owned educational complex located at the mouth of Whatcom Creek and is primarily a salmon enhancement facility.

The fish of Lake Whatcom are an important component of the lake's ecology and recreation. Eight species are found in the lakeshore areas, including native and non-native populations of Kokanee, resident cutthroat trout, rainbow trout, small and large-mouth bass, perch, catfish and crappie.

The fisheries resource of Whatcom Creek has suffered continuous environmental insult over the past fifty years. Despite the challenges, certain anadromous and resident species have persisted in the lower stream, including chum, coho and chinook salmon, steelhead and sea-run cutthroat trout, sea-lamprey and smelt. Dolly Varden or bull trout are also reported to occasionally feed in the lower reaches of Whatcom Creek. A storm sewer at the Fever Creek outfall is a barrier to all species with the exception of steelhead, cutthroat and some coho. Another barrier located at Woburn Street, further limits passage allowing only steelhead to the upper creek corridor where natural falls block further up-stream migration.

The following description of Whatcom Creek fisheries is an excerpt from a letter written by Russ Orrell, Washington Department of Fisheries, to the Maritime Heritage Center Technical Committee in April 1980.

Both coho and chum salmon reportedly utilized Whatcom Creek until the early 1940's. However, because of the falls near the mouth, it is unlikely that chum salmon used the stream. As the city grew and industry and development progressed in the watershed, salmon disappeared. Major influences early in the development of the watershed were industrial pollution and the diversion of water from Lake Whatcom. Suitable spawning habitat remains, but the few salmon are evidence of severe problems related to water quality and quantity.

.....Fish habitat in the Whatcom Creek basin has been greatly reduced by the impacts of commercial, residential and industrial development and by the lack of outflow from Lake Whatcom during the summer and early fall months. Lincoln and Fever Creek are past the point of rehabilitation while lower Whatcom Creek appears to have marginal water quality conditions. It is estimated that the basin at present (1980), (without rehabilitation) could produce 20% of the pre-development level of salmon production. If habitat and water quality were not further degraded, rehabilitation would potentially produce 80% of the pre-development salmon production.

Whatcom and Cemetery Creeks contain all the remaining viable and potential fish habitats. Habitat in Cemetery Creek does not require rehabilitation, it only requires protection. Whatcom Creek can be rehabilitated with sufficient flow of water out of Lake Whatcom, which will provide summer rearing area and the stocking of fry in the stream section from river mile 2.8 to 3.8.

Water quality is presently marginal and has impacted the hatchery facility and natural production in lower Whatcom Creek. Problems include low pH, above critical levels of cadmium, copper, lead , zinc and sediment levels. Uncontrolled development will further compound these problems and treatment would be costly or ineffective. The best approach to protecting water quality is to try to avoid creating the problem... drainage and runoff control...can provide a means of reducing impact. Success of the Heritage Center hatchery facility and re-establishing Whatcom Creek as a spawning and rearing area are all dependent upon good water quality.

The loss of salmon in Whatcom Creek can be at least partially regained by providing vital stream flow during summer months and controlling development. By "controlling" we do not mean restricting, but doing all that can be done to protect natural streams (and riparian areas). Monetary gains for fish production will not even compensate reduced revenue for the City, however, the primary benefits cannot be measured monetarily. Part of the maritime heritage is pride in preservation of salmon runs and cities throughout the Puget Sound Basin cannot be proud of what has happened to metropolitan streams. The value of seeing salmon return to spawn or knowing that you are doing your best to protect a natural resource is immeasurable.

A detailed site specific description of present in-stream conditions, habitat and barriers within the Whatcom Creek basin is available in the *Watershed Master Plan* (City of Bellingham, 1993). Additional fisheries information, including enhancement recommendations for Whatcom Creek are described in the *Whatcom Creek Trail Master Plan* (City of Bellingham Parks and Recreation, 1995). A record of stream enhancement projects can be obtained from the Bellingham Planning and Community Development Department.

Reptiles and Amphibians

Species and site-specific data are lacking for reptiles and amphibians in the Whatcom Watershed. Although common species are likely, no verified records exist. Given habitat availability, viable populations are expected. Wetlands and riparian margins, particularly with associated undisturbed upland forests, provide necessary habitat complexes and likely harbor a variety of reptilian and amphibian species. Isolation of current populations and destruction of habitat are of concern in this watershed. A systematic inventory of species and assemblages is strongly recommended. For an updated listing of species identified in this watershed, refer to the Bellingham Master Species List, *Appendix C*.

Birds

A wide variety of upland and lake associated birds utilize the Whatcom Watershed. Of the 231 bird species City-wide, there are an estimated 112 species that utilize available habitat in the Whatcom Watershed. **Of these, 21 are designated Species of Concern or Priority Species.** The diversity of species is less than that of Padden and Chuckanut due to the lack of marine shoreline and estuarine habitats.

Although highly developed overall, the central stream corridor, upper watershed forests and open space areas contain enough habitat diversity to support common and uncommon species. Whatcom Creek corridor is a natural flyway for bald eagle *(Haliaeetus leucocephalus)*, osprey *(Pandion haliaetus)*, merlin *(Falco columbarius)*, double-crested cormorant *(Phalacrocorax auritus)*, kingfisher *(Ceryle alcyon)*, great blue heron *(Ardea herodias)*, green-backed heron *(Butorides striatus)*, gulls *(Larus sp)* and a variety of dabbling and diving birds flying between Bellingham Bay and Lake Whatcom. The creek also offers unique narrow gorges with cascading water which is habitat favored by American dipper *(Cinclus mexicanus)*, which is uncommon in the City; dense riparian vegetation offers preferred habitat for green-backed heron, possibly rails, and a multitude of passerines, including neotropical migrants and resident species; creek-side snags (many created by beaver) are utilized by great blue heron for roosting; small falcons and accipiters use the snags as hunting perches, and a variety of woodpeckers forage and nest in the snags. Notable aggregations of swallows and swifts are observed regularly during the summer feeding on insects rising from the creek corridor. Common mergansers *(Mergus merganser)* and bufflehead *(Bucephala albeola)* are also occasionally observed foraging in the creek.

Common loon *(Gavia immer)*, a state candidate species, has been observed along Lake Whatcom's Geneva shoreline with young in 1994. Solitary loon are also regularly noted on the lake within the City boundary. The loon is a rare breeder in Washington State and highly sensitive to disturbance; its breeding habitat elsewhere in the state is protected. A study of the loon's occurrence and possible breeding on Lake Whatcom is needed in order to confirm and protect this sensitive species. Other species reported for this lake area include significant winter concentrations of American coot *(Fulica americana)*, western grebe *(Aechmophorous occidentalis)*, American wigeon *(Anas americana)*, a variety of diving and dabbling ducks and glaucous-winged gulls. Historically, purple martin nested in cavities of lakeside pilings. As the pilings were removed over time, the martins disappeared and no longer occur in Bellingham.

A list of bird species compiled by a resident for the upper Hannah Creek ridge included 23 species which represent: 4 raptors, 6 woodpeckers, 3 corvids, 1 grouse, 1 native pigeon and 7 passerine species (perching birds). With the exception of five species, all of the birds identified are forest dependent and 8 are cavity dependant/reliant on snags (Taber 1991).

Another list compiled by in 1990 identified 51 bird species, including seven "species of concern", in the vicinity of Big Rock Pond (Base 1990). This list also contained forest dependent species including cavity nesters and 10 neotropical passerine species (perching birds which breed here and migrate to the neotropics i.e., Mexico and South America, during winter).

Species of concern utilizing the Whatcom Watershed on a regular basis include the following: bald eagles hunt over most of the watershed, particularly for fish from Lake Whatcom and utilize large trees and snags along the lake shore and Whatcom Creek for perches. One known pair is nesting adjacent to Scudder Pond. Pileated woodpecker *(Dryocopus pileatus)* require over 500 acres and a high percentage of available stumps and snags for nesting and foraging requirements. There is one known pair nesting in Whatcom Falls Park and likely others in upper Hannah, Cemetery or Lincoln Creeks. Upper Hannah Creek was prime habitat for pileated's prior to clear-cutting. The availability of insects, particularly ants within large old-growth Douglas fir stumps situated in a relatively mature forest, provided an optimal condition for this species. Pileated woodpeckers may be observed elsewhere in forest habitat, but that does not indicate nesting. Further investigation is needed to determine their nesting locations. Merlin are an uncommon falcon that are frequently observed hunting the Whatcom Creek corridor primarily as a winter resident. Green-backed heron are small, secretive herons known to nest and forage along Whatcom Creek. Great blue heron are common year-round hunters of fish, amphibians and crustaceans along streams, wetlands and the lake and also hunt rodents in open fields throughout the watershed. Wood duck are reported on secluded ponds throughout the watershed and may be nesting where cavities or boxes are available. Red-tailed hawk also require a relatively large home range (2-3 square miles) and are commonly observed between Roosevelt School and the Fever Creek Wildlife Pond and are likely nesting in that area. They rely on snakes, rodents and other small mammals and prey found in open fields and along forest edges. Purple martin *(Progne subis)* at one time were a regular breeder along Lake Whatcom and now have become extirpated by competing starlings and possible habitat loss. Purple martin are cavity nesters and require suitable, usually shoreline, cavities in pilings, trees or boxes. Enhancement efforts to encourage recolonization along the lake is a recommended volunteer project. The other bird species of concern are: western grebe, common loon, horned grebe *(Podiceps auritus)*, black-crowned night heron *(Nycticorax nycticorax)* (only one account), hooded merganser *(Lophodytes cucullatus)* (cavity nester), peregrine falcon *(Falco peregrinus)* (occasional hunter), ruffed grouse *(Bonasa umbellus)*, band-tailed pigeon *(Columba fasciata)* (common upland forest species) and barred owl *(Strix varia)*.

Mammals

The mammals of the Whatcom Watershed are poorly documented. A variety of small mammals likely occur, with most, if not all of the Bellingham species represented. Medium and large mammals are also potentially diverse in the upper watershed forest areas. Common urban mammals such as raccoons and opossum range throughout the watershed. Beaver, muskrat and river otter utilize most of the Whatcom Creek corridor and lake shoreline. Resident beaver have in the past established lodges and maintained water levels of Scudder Pond and associated wetlands. The current status of their population or activities in the watershed are unknown. Weasel and mink are also commonly found near wetlands, lakeshore and along streams. Coyote and fox are frequently sighted along corridors and areas associated with large habitat blocks, particularly the field /forest interface, as are deer. Porcupine and striped skunk are uncommon residents. Black bear have been seen as recently as 1992 near Woburn Street and Whatcom Creek, and were reported by residents as regular visitors to upper Cemetery Creek fifteen years ago. However, bear are likely uncommon to even the upper watershed. Other wide ranging mammals including elk, cougar and bobcat are all possible visitors where forest corridors from Lookout Mountain allow passage.

Additional empirical data is needed to provide an accurate assessment of the mammals in this watershed. Habitat loss to development has greatly impacted the suitability of particularly the lower watershed for mammals. Currently, the best habitat reserves for mammals are limited to the large upland forest blocks with adequate corridors for dispersal. Fragmentation and loss of corridors has become the greatest challenge to mammalian survival City-wide. Small, medium and large mammals are all victims of motorized vehicles, domestic predators, loss of habitat and preybase. Providing the necessary corridors so that populations are not isolated will require restorative and enhancement action by the City and its citizens.

HABITAT INVENTORY: *per section area*

As a means to inventory habitat area and value within a fragmented urban landscape, a "block" system was applied. Blocks (blk) are a descriptive unit, representing an area of contiguous open space that contains one or more habitat types. Each block embodies an "island" of habitats and an associated wildlife community. Because habitat value and function is dependant on area (size), condition and connectivity, blocks serve as a comparative measure of available open space, connectivity and habitat diversity within each watershed.

The area of each block and general habitat type is listed by acreage and is based on aerial photo interpretation, using 1988 orthophotographic maps (1"=200'), 1990 City wetland inventory data, 1991 Department of Natural Resources orthophotos and other available reference information, as well as limited field truthing.

The Whatcom Watershed within the City limits consists of the following habitat types as classified by the Bellingham-Whatcom Habitat Classification System *Appendix B.* Starting at the eastern City boundary and proceeding downstream, habitats are listed per township/range/section. Contiguous habitats are identified as blocks and are listed by number. This numerical system remains constant even when blocks overlap section lines or watershed boundaries. Descriptions of large blocks will reflect only the area and habitats within the subject watershed and section. Notes for each entry may include: special habitat features, critical habitat as described in GMA, PHS-NGDS, Natural Heritage sites, significant wildlife observed, identified corridors & barriers and publicly-owned habitat areas such as undeveloped parks and greenways. Terrestrial habitats are the primary focus of this inventory. Stream and wetland habitat descriptions are available in the Bellingham Wetlands Inventory (1990) and the Bellingham Watershed Study, 1993 prepared by David Evans & Assoc. and HDR consultants.

T38N/R3E/S33

Blk #	Habitat Code	Acres	Notes
General notes for section 33			Upper Cemetery and Hannah Creeks are a contiguous habitat block with high wildlife diversity and species richness, **this is a significant wildlife area.** The habitat block bisected by three linear (minor) breaks, including east-west power corridor and two north-south pipelines, area known for past black bear and deer, most forest associated species are expected
53	28	7.09	island habitat within housing development
54	28	2.03	" " " " "
55	2	3.97	" " " " "
52	28	184.40	upper Hannah Creek-significant habitat block contiguous with Cemetery Creek and beyond City boundary, abundant wildlife, numerous pileated woodpecker and diverse upland birds
- -	WH-74	(1.3)	

- -	WH-75	(0.4)	
- -	WH-76	(0.2)	
- -	WH-77	(1.0)	
- -	WH-78	(6.1)	
- -	24	12.70	ridgeline-target Greenways parcel, mature Douglas fir, high quality raptor perches and snags present, north-south wildlife travel corridor, **very important habitat area**
52A	27/28	151.14	upper Cemetery Creek, contains some disturbed areas, significant habitat block contiguous with Hannah and beyond City boundary
- -	24	4.01	
- -	24	4.90	
- -	2	6.89	
- -	WH-58	(1.5)	
- -	WH-59	(0.1)	
- -	WH-60	(0.2)	
- -	WH-61	(1.6)	
- -	WH-62	(0.6)	
52A	28	27.29	peninsula of habitat, north-south corridor, containing four wetlands
- -	WH-72	(0.1)	
- -	WH-70	(0.2)	
- -	WH-71	(0.7)	
- -	WH-73	(1.0)	

T38N/R3E/S32

Blk #	Habitat Code	Acres	Notes
			This section contains upper Lincoln and West Cemetery Creeks
11A	28	10.54	
- -	WH-44	(1.2)	
- -	28	8.77	W. Cemetery Creek-important corridor north-south
- -	WH-45	(0.7)	" "
- -	28	4.95	" "
- -	WH-48	(12.9)	" "
- -	2	3.53	
- -	27	38.55	3.5 acres developed on west side of block - W. Cemetery Creek habitat corridor
- -	WH-46	(0.8)	
- -	WH-47	(0.9)	
- -	WH-49	(0.4)	
- -	WH-50	(0.5)	
	~~28~~	~~65.49~~	partially developed-construction of San Juan Blvd. severed corridor connecting Lincoln and Cemetery Ceek habitat

			blocks, resulting in two separate blocks 11 and 11A
- -	28	~15	
- -	WH-54	(0.4)	
	~~WH-51~~	~~(0.9)~~	developed
	~~WH-52~~	~~(1.7)~~	"
	~~WH-53~~	~~(1.0)~~	"
	~~WH-55~~	~~(1.0)~~	"
- -	WH-56	(0.2)	1/2 in City-partially developed
- -	WH-57	(0.7)	" in block
11	27	52.89	Upper Lincoln Creek watershed-contiguous with Samish Hill and Padden Watershed habitat
- -	WH-6	(6.9)	
- -	WH-7	(11.4)	
- -	28	44.98	
- -	28	7.85	
- -	2	3.16	
- -	WH-13	(0.3)	
- -	2	8.45	
- -	WH-10	(6.5)	
- -	9	6.60	
- -	9	2.62	
- -	2	5.62	E side of trailer court
- -	11	8.33	forested wetland area-poorly connected with thin corridor
- -	WH-5	(3.9)	

T38N/R3E/S27

Blk #	Habitat Code	Acres	Notes
	19	(309)	Lake Whatcom (within City boundary) open water habitat
51	5	~5	Bloedel-Donovan Park
- -	2	7.47	
- -	2	2.0	
- -	2	6.46	
- -	29/22	15.24	Lake outlet and associated wetland complex, potentially
good			waterbird breeding and wintering habitat, if riparian area enhanced
- -	WH-96	(7.3)	
- -	29/B	2.41	
- -	29/B	2.73	
- -	29	3.42	
- -	29	3.82	
- -	WH-97	(1.6)	
- -	2	3.06	

T38N/R3E/S28

Blk #	Habitat Code	Acres	Notes
General notes for section 28			Whatcom Falls Park, upper Bayview Cemetery and Railroad Trail are contiguous open space and a significant/ valuable urban habitat area spanning over 300 acres from Lake Whatcom west to Woburn Street; encroaching residential development along the park's edges continues to whittle down the total habitat area and in turn devalue the area for wildlife.
~~N/A~~	~~2~~	~~5.47~~	developed
N/A	5	3.06	St. Clair Park, questionable habitat value, hedgerows buffer between park and adjacent homes
N/A	28	4.23	Strip habitat in residential development
60	29	74.92	deciduous forest, Railroad Trail corridor, partially developed; vital wildlife corridor north-south for species migration in an out of park, dispersal corridor-connectivity needs to be restored
- -	~~"~~	~~30~~	estimated developed area
- -	WH-83	(0.4)	outside park boundary, areas to be excellent habitat-target
- -	WH-81	(5.0)	
- -	24/28	213.12	Whatcom Falls Park, forested, forested wetland and riparian habitat
- -	WH-63a	(4.5)	
- -	WH-63b	(1.9)	
- -	WH-64	(0.2)	
- -	WH-65	(<0.1)	
- -	WH-66	(<0.1)	
- -	WH-67	(0.6)	
- -	WH-68	(1.0)	possible affected area of new water tank
- -	WH-69	(0.4)	
- -	WH-79	(1.8)	
- -	5	N/A	developed park areas
- -	2	2.42	cleared area, public works fill site
- -	6	18.53	Bayview Cemetery
- -	6	8.56	" "
- -	R	1.13	Cemetery Creek, through cemetery
- -	R	2.16	" " " "
Riparian corridors south of Lakeway and tie into Section 33			
- -	R	2.7	West Cemetery Creek.
- -	R	2.86	Cemetery Creek.
52	R	7.5	Hannah Creek.
- -	28	4.53	contiguous with Hannah Creek. drainage
N/A	28	9.74	island forest separated from like habitat by only one street

T38N/R3E/S29

Blk #	Habitat Code	Acres	Notes
General notes for section 29			Whatcom Creek (mid section), Civic Field, Lower Cemetery Creek wetland complex, floodplain area slated for development, major wetland/floodplain loss, drainage systems causing numerous fisheries problems (see working map for fish comments), dead-end corridors constitute wildlife sinks; this section requires immediate replanning in cooperation with land owners, rehabilitation and enhancement measures are necessary to maintain fish viability within the system and the riparian areas continue to be degraded.
WC10	R/1	1.57	Diehl Ford-stream corridor needs enhancement due to invasive plants, lack of structural diversity and shading
68	R/1	7.5	Stream corridor and designated wetland
- -	WH-1	(7.5)	
- -	~~2~~	~~14.93~~	future site of City transit bus garage, some riparian and flood plain area to be developed, currently cleared open space
- -	2	6.56	undeveloped open space adjacent to stream corridor
71	2/X	26.0	Kentucky Street wetlands, habitat sink-no connectivity
- -	WH-29	(1.7)	
- -	WH-30	(0.2)	
N/A	~~2~~	~~10.20~~	developed
- -	~~WH-100~~	~~(3.5)~~	same site/developed
60	~~3~~	~~3.6~~	Whatcom Reach (cleared)
- -	~~24/X~~	~~.7~~	Whatcom Reach (cleared), Whatcom Creek corridor, contains critical habitat for steelhead, American dipper and wildlife associated with this corridor
- -	24	14.38	Park-contiguous with Whatcom Falls, creek and uplands
- -	6/5	16.82	Park/Cemetery (developed)
- -	R/6	3.44	Cemetery Creek/Cemetery...natural corridor
- -	6/5	16.55	Park/Cemetery
68	29/24	142.23	mostly deciduous with patches of conifers, planned development on site, fragmentation of habitat and wetland loss; island habitat, major barriers on all sides, prior to the Woburn Street construction wildlife could access Whatcom Falls Park corridor
- -	~~" "~~	~~.60~~	developed at southeast portion of block
- -	WH-42	(84.2)	largest contiguous wetland area in watershed, three times the size of second largest wetland! -contains forested wetland, flood plain, riparian and upland islands, vital and diverse habitat area, slated for development in part.
- -	2	2.6	
- -	~~9~~	~~8.72~~	developed, commercial, black bear sighted in 1990

69	24	19.35	
- -	WH-3	(0.3)	
- -	4	N/A	Civic Field, groomed play field, poor habitat value, limited to worm foraging
- -	WH-2	(1.6)	
70	R	2.46	Lincoln Creek corridor, narrow wooded strip and associated wetland
- -	WH-4	(1.1)	
- -	R	0.85	Lincoln Creek

T38N/R3E/S30

Blk #	Habitat Code	Acres	Notes
			Lower Whatcom Creek Corridor, I-5 west. Linear riparian corridor with some trees and shrubs, no available upland habitats
WC1	5	2.39	Maritime Heritage Park and hatchery, shoreline and riparian restoration needs to extend to both sides of the creek and bluffline, public access particularly during fishing season has caused significant trampling of shore line vegetation, recommend limiting fishing to fishing pier and revegetating eroded banks.
- -	5	2.76	
- -	R/29	4.75	
WC2	R/2/29	1.60	
WC3	R/2/29	1.24	
WC4	R/2/29	4.07	
WC5	R/2/29	~7.5	
WC6	R/1	0.18	
WC7	R/29-1	3.19	
WC8	R/1	2.56	
WC9	R/1	0.53	

T38N/R3E/S22

Blk #	Habitat Code	Acres	Notes
			North Lake Whatcom, open water lacustrine habitat, natural shoreline habitat negligible, immediate uplands highly developed
54	~~24~~	~~41.72~~	partially developed/Barkley Blvd.
- -	24/28/2	~70	south of Barkley Blvd includes Big Rock Garden (3.8 ac), plus seven wetlands
- -	WH-90	(0.1)	
- -	WH-91a/b	(0.2)	
- -	WH-92a/b	(2.0)	

- -	WH-93	(1.0)	
--	WH-94	(0.2)	
64	2/24	6.45	vacant lots, isolated habitat but diverse vegetation
65	24/2	12.29	Silver Beach Creek corridor, cutthroat trout (possible spawning), contiguous upland forest habitat into county north
- -	9	3.35	
- -	9	3.66	
- -	2	2.89	
66	24	29.35	contiguous upland forest habitat north into county and east, if corridor still exists, extending onto Squalicum Mountain, cougar and other wide ranging mammals possible.
- -	9/2	~6	
67	24	14.71	
- -	2	4.19	
- -	2	3.65	
- -	24	9.29	
N/A	5	4.82	Bloedel-Donovan Park

T38N/R3E/S21

Blk #	Habitat Code	Acres	Notes
			recently altered area, due to Barkley Blvd and associated development, large contiguous blocks have been fragmented since 1992 and initial aerial inventory, no species/habitat assessment or inventory, despite multiple major development projects
54	~~29~~	~~4.67~~	cleared/developed
- -	~~29~~	~~38.69~~	cleared
- -	9	7 remain	remaining area Greenway acquisition
	~~"~~	~~7 developed~~	
54	WH-33a	(33+)	(~14 lost to development/Barkley Blvd.)
- -	~~24~~	~~15.80~~	developed
- -	"	15	remain w/ wetlands and ~6 acres of Greenway
- -	~~24~~	~~102.43~~	Barkley Blvd./development
- -	~~WH-33b~~	~~(0.4)~~	
- -	~~WH-34~~	~~(0.3)~~	
- -	WH-35	(0.4)	in Greenway
- -	WH-36	(0.1)	part in Greenway
- -	~~WH-37~~	~~(?4)~~	
- -	" "	(1)	in Greenway/undeveloped
- -	~~WH-38~~	~~(0.1)~~	
- -	WH-39	(0.7)	" "
- -	WH-40	(0.8)	" "
- -	24	50.50	Mt. Baker Park/Greenway

- -	2	9.20	Big Rock Garden Park
- -	24	3.80	Big Rock Garden Park
- -	WH-86&87	(N/A)	Big Rock Pond
55	~~2~~	~~3.21~~	developed
56	24/2	18.34	
- -	WH-85	(2.2)	
- -	WH-84	(1.4)	
56a	2	5.24	backyard sanctuary/ thin strip
62	2	2.53	
- -	WH-86?	(0.3)	
61	2	3.98	
60	28/B	6.77	Scudder Pond/Whatcom Lagoon habitat area/bald eagle nesting in cottonwoods, significant wildlife area, contiguous habitat downstream through Whatcom Falls Park
- -	WH-81	(12.0)	Lk. Whatcom Lagoon
- -	WH-82	(2.8)	Scudder Pond
59	2	2.55	vacant lot(s)
58	22	3.51	" " , wooded
57	28	9.95	" " "
54	~~28~~	~~29.23~~	corridor/part developed
54a	28	~12	remaining habitat
- -	WH-80	(0.2)	
54	~~2~~	~~3.06~~	
- -	~~9~~	~~3.30~~	
- -	~~9~~	~~5.44~~	
- -	9	3.12	
- -	9	10	
- -	~~9~~	~~2.22~~	
- -	9	5.86	
- -	28	9.98	Coppice, possible red-tailed hawk nesting, significant area of open field/forest interface offering both diverse and unique habitat for Whatcom Watershed, only fallow field habitat area in watershed
- -	WH-31	(27.3)	large wetland area, second in size remaining in watershed
- -	4	N/A	play field/school yard
55	2	4.31	large vacant area/shrub/scrub habitat with some trees

T38N/R3E/S31

Blk #	Habitat Code	Acres	Notes
42	28	~54	Sehome Arboretum eastern quarter
- -	WH-22	(1.0)	
50	28	10.3	
- -	WH-16	(10.3)	
NA	WH-8&9	(19.7)	commercial development site - disturbed habitat - sink

T38N/R3E/S20

Blk #	Habitat Code	Acres	Notes
			highly developed area and substantial habitat loss due to commercial development, only single thin (<200') corridor to east to Fever Creek Wildlife Pond
N/A	~~2~~	~~7.36~~	partially developed
53	28	18	
- -	WH-28	(0.4)	
- -	WH-26	(2.1)	
- -	WH-27	(0.3)	
53A	2	~7	contains Greenway, disturbed habitat
	WH-25	(1.7)	
	~~9~~	~~2.04~~	developed
	~~9~~	~~2.73~~	developed
	~~2~~	~~40.07~~	developed
	~~2~~	~~25.56~~	"
54	28	5.88	Greenways corridor, contiguous to east, additional open space adjacent to Roosevelt Elementary School
N/A	2	3.09	isolated lawn

HABITAT TYPE TOTALS

code	type	acres
2.	Urban open space	143.27
5/6.	Park/cemetery	81.93
9.	Fallow field	48.21
11.	Utility corridor	8.33
24.	Lowland conifer forest	476.74
27.	Red alder forest	242.58
28.	Mixed conifer-hardwood	458.28
29.	Mixed deciduous	244.77
R.	Riparian corridor	56.31

Total natural open space area	1,764 acres
Total forest habitat	1,422.37 acres
Total wetland habitat	305.4 acres

Total lost habitat 1990-1995 = 532.94 acres

HABITAT BLOCK TOTALS

38 blocks (10 of which are riparian strips along lower Whatcom Creek) listed by acreage

N/A	24.94
11	140.5
11a	81.34
42	54
50	10.3
51	51.61
52	209.13
52a	194.23
53	25.09
53a	7
54	182.39
54a	12
55	4.31
56	18.34
56a	5.24
57	9,95
58	3.51
59	2.55
60	384.36
61	3.98
62	2.53
64	6.45
65	22.19
66	35.35
67	31.84
68	158.89
69	19.35
70	3.31
71	26

WC1-10 32.34 (riparian strips along lower creek corridor)

WHATCOM WATERSHED SUMMARY and RECOMMENDATIONS

Whatcom Watershed is the largest watershed within the City boundaries and one of the fastest growing areas. Of the estimated 5,500 acres within the watershed, 32 percent is open space and viable habitat. Of the 1,764 acres of open space, 81% is forested and nearly 17% wetland area. Expansive tracts of native forest dominate portions of the upper watershed, providing connectivity into other watersheds and the county. The wetland area includes inventoried wetlands. The largest contiguous wetland in the City of 84.2 acres is situated centrally along Whatcom Creek and is the subject of future development. In addition, Lake Whatcom provides over 300 acres of open water habitat in the City.

Public ownership of viable habitat is limited. Of the total watershed area, public parks and open space account for about 9 percent (490 acres) and of this only 6 percent (~350 acres) is undeveloped protected habitat. Given the 1,764 acres of total open space/habitat inventoried for the Whatcom Watershed, a mere 20 percent is protected by public ownership or conservation easement. None of the existing protected open space/habitat areas extend into or are contiguous with other protected reserves.

Habitat blocks resulting from the watershed habitat inventory vary greatly in size, isolation and quality. Within the watershed, 38 blocks were identified with the largest, #60, totalling 384 acres, and includes Scudder Pond west to Whatcom Falls Park, the cemetery and Whatcom Reach property. Because this area is poorly linked to outside reserves, its quality and function needs further examination. Four Blocks 11/11a, and 52/52a total 220 acres and greater than 400 acres respectively, or a combined 620 acres. This is by far the most intact and valuable upland habitat area in the watershed. These blocks form the upper Lincoln, Cemetery and Hannah Creek drainages and are contiguous with Samish Hill and expansive forest lands, stream corridors and excellent habitat to the south and east. Block 54, although large, approximately 183 acres, is located in the Barkley Boulevard area, an area of rapid clearing and development. Given the lack of baseline data, habitat values and functions of this block need greater consideration in the permitting process. Small blocks of 10 acres or less make up 53 percent of the total blocks inventoried. At least ten of these smaller units form a riparian corridor along Whatcom Creek and should be used as building blocks to create a contiguous stream-side habitat corridor. Although small blocks are of diminished habitat value due to size, they are important microcosms for wildlife and have the potential to provide a critical links in corridors.

The significant habitat reserves within the Whatcom Watershed include: Lake Whatcom (public/private), Scudder Pond (public/private), Upper Lincoln Creek (private), Upper Cemetery Creek (private), upper Hannah Creek (private), Whatcom Falls Park (public), Whatcom Creek corridor (public/private), Whatcom Creek wetlands complex (private-to be developed/public), Fever Creek Wildlife Pond (public private), Mt. Baker Park/Greenway (public) and the Barkley Boulevard - Mt. Baker Hwy area (private). **In order to create a functional habitat network in this watershed, high quality privately owned reserve areas should be targeted for acquisition and/or some other means of protection and linked by corridors to protected areas such as public lands.**

Identification and preservation of viable habitat corridors is needed throughout the Whatcom Watershed. Biologically valuable wildlife habitat links are located along creek corridors and should be utilized to the fullest for this purpose. Wide riparian buffers (greater than 100 feet each side) would provide corridors of at least 200 feet and are necessary for the passage, protection and maintenance of the majority of species using these areas. Rapid development in the watershed has severely fragmented remaining contiguous habitat tracts, removed numerous wetlands and severed corridors without baseline assessment of wildlife resources and consideration of potential cumulative effects. Adequately protected habitat linkages between reserves are currently lacking. **Acquisition/protection of habitat reserves and corridors that link into other watersheds is necessary to maintain biodiversity in Bellingham.**

Recommended target reserve areas and corridors in the Whatcom Watershed include:

-Upper Lincoln Creek: approximately 300 acres of forest/riparian/wetland habitats, tie into upland and wetland reserve extending into Padden Watershed for a total contiguous reserve area of 600 acres plus corridors.

-Upper Cemetery/Hannah Creeks: forested ridge/riparian habitat and stream corridors leading to a 500 acre apex reserve consisting of upland forest.

-Fever Creek Wildlife Pond, all fallow field and adjacent forest habitats, plus Greenway corridor widening for wildlife, extending west to Roosevelt Elementary School.

-Barkely Boulevard/Mt. Baker Park area, a forest habitat and habitat linkage to Squalicum Watershed.

-Silver Beach Creek: from Lake Whatcom riparian corridor north and forested reserve area.

-Whatcom Creek Corridor: riparian protection and enhancement-this means expanding the riparian corridor width, restoring with native plants, and limiting access to designated locations.

-Whatcom Creek Wetlands Complex and Civic Field enhancement: create a wetland/upland reserve extending to Whatcom Creek, include enhancement of Civic field for wildlife.

-Whatcom Falls Park to St. Claire Detention Basin, Railroad Trail Greenway corridor: expand width and enhance vegetation for wildlife, and continue to acquire or otherwise preserve habitat links associated with the Greenways trail.

Wildlife passage is an important City-wide issue that requires further examination and serious consideration. Roads have fragmented habitat and threaten all wildlife. Corridors bisected by roads usually are graveyards for animals. Roads have also been the primary motivator for culverting and tunnelling streams. Long box culverts, in some cases are too dark for fish entry, and although passage is not obstructed, the barrier is darkness and inadequate stream flow.

Impacts to fish and wildlife through road placement, construction and use need to be effectively mitigated. **It is recommended that wildlife passage become a subject of review by the City for all major projects, and that expert resources be consulted to assist in addressing and correcting current and future barriers.** Development of functional wildlife passages are needed across Woburn, Alabama, Barkley Blvd, Lakeway, Yew Street and San Juan Blvd. Integrate passage techniques/structures in site plans for new roads, particularly arterials, and at corridor crossings.

Recommendations for fisheries resources in Whatcom Watershed include: in-stream and riparian habitat restoration and enhancement, fish barrier identification and removal, water quality improvement and citizen involvement. A restoration oriented assessment of the Whatcom Watershed is needed to evaluate potential enhancement possibilities and limitations within the system. Complete baseline information exists (Whatcom Watershed Study, 1993) for much of the system and should be used to formulate a fisheries plan. The goal is to encourage the return and sustainability of naturally reproducing anadromous and resident fish populations. Habitats could be created such as spawning channels and rearing wetlands/ponds adjacent to Whatcom Creek that would provide a recreational/educational attraction, as well as a resource enhancement. Currently, all enhancement activity is hatchery based and limited to those facilities. Additionally, the restoration of stream habitat and natural fish populations would significantly benefit the greater wildlife community of the entire watershed.

Water quality monitoring and stream enhancement is needed throughout the watershed. Currently water quality of Whatcom Creek is poor. Improvement of water quality and flow for fisheries and other aquatic associated wildlife is needed. Stormwater runoff, commercial and industrial runoff, failing septic systems and non-point source pollution have been identified as the primary causes. As all wildlife depends on clean water, water quality is a essential consideration for wildlife conservation.

Stormwater needs to be diverted from present direct outfall into streams to swales or detention areas, where biofiltration will be used as a primary treatment. Commercial and industrial runoff should be corrected. The creation of a citizens task force or implementation of an Adopt-A-Stream program, would greatly assist the City in stream monitoring and enhancement efforts.

Improvement and protection of riparian habitat along streams, lakes and wetlands is needed to maintain habitat and corridor function of these areas throughout the watershed. Restoration of the lower Whatcom Creek riparian area is strongly indicated. Increasing riparian buffer width to WDFW recommendations or 100 feet, would contribute to improved water quality and in-stream conditions for aquatic and semi-aquatic wildlife.

Wetland protection is critical for flood abatement, stream flow regulation wildlife habitat and maintaining water quality watershed-wide. Wetland losses require greater mitigation to effectively replace values and should depend on a measurable outcome. In most cases, natural wetland habitat function cannot be fully replaced and requires protection to the fullest extent possible. Wetland associated amphibian populations are declining in the Pacific Northwest (and world-wide) and need inventory prior to any land use activity affecting their habitat. All wetland mitigation projects should include a wildlife habitat function as well as all other functions impacted.

On-site assessment is needed for all projects that may alter or impact important wildlife habitat. Those areas that are of particular importance are corridors, large reserve areas and potential habitat harboring sensitive, rare or protected species or assemblages. Assessment include on-site evaluation by a qualified wildlife biologist using field methodologies that will address species presence and occurrence, habitat function and value and measure potential effects of the planned project. Development or utility projects, improvements or land clearing activities in areas containing or adjacent to natural wetlands, lakes, ditches and streams and associated forests will potentially affect the greatest number of wildlife, particularly amphibians and their habitat. Due to the absence of amphibian data for this watershed, these sites should be subject to a minimum site evaluation between February and June for amphibians and breeding birds as part of the permitting process.

Proposed project area containing contiguous undeveloped natural areas need comprehensive fish and wildlife plans. These plans should be based on field data and contain resource requirements for connectivity, management, long term viability and maintaining diversity within the watershed. It is suggested that the Rapid Wildlife/Habitat Inventory Process be applied to the remaining high quality habitat areas within the watershed. With site specific information the City can then direct site plans to meet Growth Management requirements.

Professional recommendations for routing the street, design, wetland and upland habitat mitigation, habitat corridors, buffers and leave areas would have greatly improved that particular project for wildlife. By integrating the expertise of a professional wildlife biologist early in project design and development stages, serious impacts on native wildlife populations can be avoided in a cost-efficient manner.

Adopting wildlife friendly policies for drainage system development, street placement and improvement, lighting, etc., would greatly enhance wildlife opportunities City-wide.

The implementation such as the Backyard Sanctuary Program or Landscaping for Wildlife would provide wildlife stewardship and habitat enhancement opportunities to citizens, students and neighborhoods. This program also has the potential to extend habitat through developed areas where public land or habitat is lacking. Many well vegetated yards linked through a neighborhood or along a stream provide corridors where habitat is otherwise scarce. **Targeting sites adjacent to Greenways, parks and streams are a priority and should be coordinated in order to create contiguous habitats. Enhancement of school grounds and public facilities with wildlife habitat is highly recommended.** Landscaping for wildlife improves options for many species where little habitat now exists. Wildlife enhancement projects for school children will foster ownership in their schools and wildlife, as well as promote experiential education opportunities. Development of backyard sanctuary projects City- wide as part of a City Wildlife Program is recommended. Targeting the following areas in this watershed:

Whatcom Creek:
-businesses along lower reaches
-adjacent residences
-land owners along all tributaries to Whatcom Creek

Whatcom Falls Park: -adjacent landowners

Railroad Trail: -all adjacent landowners, vital north-south habitat corridor but fragmented and narrow

Also include: -all public schools
-all government buildings
-interested businesses and commercial establishments

Street tree plantings to suit neighborhoods are encouraged. Large street trees in level areas help avoid view conflicts and provide optimal coverage. Medium to short street trees or clumps planted in neighborhoods with views will expand habitat opportunities throughout the watershed. Rows of trees create corridors for arboreal species and serve as breeding habitat, as well as linkages to more suitable areas. Appropriate species should be used to avoid future conflicts with home owners and to provide the maximum benefit for wildlife. Wildlife biologists, arborists and neighborhood organizations should be consulted.

The shoreline of Lake Whatcom has become de-naturalized with the removal of riparian vegetation and replacement with lawns and bulkheads. The loss of shoreline habitat coupled with increasing recreational activities indicate a serious need to evaluate impacts to wildlife and make needed adjustments. Wildlife data collected on Lake Whatcom 30 years ago will be useful in a recommended comparative study to measure changes in species occurrence, numerical abundance and changes to habitat over time. **Rehabilitation of Lake Whatcom's shoreline with native vegetation and implementation of a shore owner wildlife education program is recommended at this time.**

Retaining native vegetation on vacant lots and undeveloped land is vital for wildlife. Vacant lots and undeveloped lands in Bellingham provide vital micro-habitats for a variety of wildlife. Migratory birds, breeding birds, dispersing mammals and others utilize these microcosms for brief or extended periods. Leaving native vegetation on these sites improves their habitat value and attractiveness to both wildlife and humans.

SQUALICUM WATERSHED

INTRODUCTION

The Squalicum Watershed includes the combined Squalicum and Little Squalicum Watersheds. Spanning most of north Bellingham, a rapidly urbanizing area, the Squalicum Watershed landscape has greatly changed in the past decade, particularly in the City's fringe. The available habitat and wildlife concentrations within the City are directly associated with the Squalicum Creek corridor and its tributaries. The riparian and upland vegetation associated with the creek forms a relatively intact habitat corridor. This corridor forms the central lifeline for Squalicum wildlife, with larger adjacent upland habitat blocks completing the habitat matrix necessary for species diversity and population maintenance over time. The Squalicum system also contains a remnant anadromous fish population which is in need of careful study and assistance.

Squalicum Watershed contains one of the smallest habitat areas in the City, a total of 1,252 acres. Yet, it harbors the greatest amount of fallow field (uncultivated agricultural land), nearly 119 acres. **This constitutes nearly 40 percent of the City's fallow field habitat.** This habitat type is rare in the City and traditionally has been the first area to be developed, although in this locale lies mainly in the flood plain and primarily consists of wet meadow. **Squalicum's contribution to the City's biodiversity is significant and requires further protection.**

Little Squalicum, although linked with Squalicum, is affiliated more closely with Bellingham Bay where the majority of its habitat is situated. Therefore the marine component of Little Squalicum beach is addressed under Bellingham Bay.

INFORMATION SOURCES

To date, the Squalicum Watershed has received considerable planning and fisheries review, yet a comprehensive wildlife inventory or documentation for the watershed is lacking. The current available references pertaining to the City's portion of Squalicum are listed below. These constitute the primary baseline references utilized for this report. An abstract of each document is provided in the annotated bibliography, Appendix A of this document. In addition to published references, are reports and observations from reliable sources, all of which have contributed to this section.

-*Squalicum Creek Floodplain Management Plan*: Final Plan and Final EIS. 1994. R.W. Beck and Associates.

-*Squalicum Creek Project Area Comments on Wildlife Habitats*. 1993. A letter by Al Hanners to Kim Hyatt, City of Bellingham, Washington.

- *Bellingham Christmas Bird Count Data.* 1967-1994. Terence Wahl, Bellingham, Washington.

- *Priority Habitat and Species Database and Non-game Data System.* 1993. Washington Department of Fish and Wildlife.

-*Squalicum Creek Floodplain Management Plan: Phase 1.* (Squalicum Creek Corridor from the Guide Meridian to Hannegan Road) (Interim Draft)1992. Conducted by Adolfson Assoc., Inc. for the City of Bellingham. The study included on site assessment of wetlands, fish and fish habitat, wildlife (casual observations) and wildlife habitat with detailed habitat descriptions. The results of this study provide a complete profile of the stream and riparian corridor habitat and will interface well with future wildlife surveys.

- *A Guide to Bird Finding in Washington.* 1991. Wahl & Paulson. Bellingham Washington.

- *Squalicum/Silver Creek Watershed Environmental Impact Assessment.* 1990. Huxley College, Bellingham, Washington.

-*Squalicum Beach Environmental Assessment.* 1988. Huxley College, Bellingham, Washington. Detailed bird list (based on casual observations over 20 years)

DESCRIPTION OF WATERSHED AND SIGNIFICANT HABITATS

The Squalicum Watershed includes the Squalicum Creek, Little Squalicum Creek, Spring Creek and Baker Creek drainages and encompasses nearly all of north Bellingham. This watershed spans from the mouth of Squalicum Creek at Bellingham Bay into the County north to E. Smith Road, east to Mission Road and south to Squalicum Lake. Much of this lowland area east of the Hannegan Road is known as the Dewey Valley. The Squalicum Watershed covers an area of 25 square miles (Becker 1989). The area within the City boundary constitutes approximately 20 percent of the total watershed area or about 3200 acres (City of Bellingham/HDR 1993). The upper reaches of the watershed are primarily forested and agricultural areas with increasing residential land use. The area of watershed within the City is predominately developed with residential, commercial and industrial uses. Open space constitutes approximately 39 percent of the watershed (within the City) and is concentrated along the creek corridor and upper watershed.

Squalicum Creek is designated Conservancy I by the Bellingham Shoreline Master Program, with the exception of a segment east of Meridian Street (Cornwall Park) which is designated Conservancy II. This designation maintains vegetation within 50 feet of the stream and is intended to maintain a total of 100 feet of pervious surface from the stream. These are essential minimum setbacks for fish and unless fully vegetated with shrub and overstory trees, 100 feet is the minimum for moderate wildlife habitat value. Reclaiming and revegetating the stream corridor using 100 foot minimum each side, for a total corridor width of 200 feet, would maximize the habitat function and value of the length of Squalicum Creek, benefitting both wildlife and fish.

The majority of available habitat within the City's watershed is concentrated along Squalicum Creek forming a matrix of large habitat blocks linked by the creek and associated corridor. This corridor is the most important habitat feature of the watershed. Connectivity of this corridor is disrupted by a major intersection at the Guide Meridian, a new Birchwood Ave. east extension, James Street and Hannegan Road. Despite these barriers, Squalicum is afforded unobstructed and undeveloped passage under I-5, unlike any other watershed that is divided by major freeway. Recent development in the floodplain has fragmented some remaining habitat. Significant stretches of the natural corridor extend relatively uninterrupted, however, planned industrial development could fragment and severely impact this riparian/floodplain corridor.

The Squalicum Creek water course has been manipulated by channelization, culverts, re-routing and dredging. The most significant impacts to the stream have resulted directly from City and Port related projects, i.e., dredging of the Squalicum estuary for the new marina, the construction of Squalicum Parkway, the Birchwood extension and the Hannegan light industrial improvement area. Other alterations have included routing portions of the stream into channelized ditches through highly developed settings with little potential for riparian growth or in-stream habitat recovery. Redirecting the stream course, ditching and filling and building on wetlands are all factors which exacerbate low-flow episodes and high-flow storm events. Additionally, the adjacent upland development also directly impacts water quality, temperature, sediment load and runoff. Squalicum's associated aquatic wildlife would greatly benefit from the restoration of full flow potential and allowance for the stream to flood into wetland areas in storm events.

Although impacted and altered over time, the creek and creek corridor continue to provide a significant habitat function and from a valuable wildlife area within the City. Its future function and value depends on preservation of large habitat blocks, retainment and improvement of connectivity and the rehabilitation of degraded riparian areas and disturbed sites. The network of habitat and connectivity needs to extend outside the City, into the county and foothills. An assessment of habitat and recommendations to maintain habitat values on a larger scale could guide development within the greater watershed and preserve the wildlife community therein.

Protected areas in public ownership providing wildlife habitat opportunities are limited to five reserves totalling 110.4 acres. This area approximates 3 percent of the watershed (within the City) or 9 percent of the total open space. These reserves constitute areas which are inadequate in size to support species requiring large home ranges, but if linked by a functional corridor are increased in habitat value by functioning as part of a larger network of habitats, in and out of the City. These areas include: Little Squalicum Creek Park (13.10 acres), Cornwall Park (65 acres), Bug Lake (9.80 acres), Sunset Pond (20.10 acres), and Spring Creek Detention site (2.40 acres), an area of park and open space totalling 110.4 acres.

Significant unprotected natural areas within Squalicum include critical corridor linkages and reserves that will likely determine the future viability of the watershed's wildlife. The areas identified are: the upper creek corridor and floodplain from Hannegan Road north into the County, Hannegan Road west includes open field/shrub/wetland and floodplain associated habitats, large forested wetland areas associated with Sunset Pond, potential corridors to King Mountain, associated forests around Bug Lake, Baker Creek corridor, Bellingham Golf and

Country Club and open space associated with Squalicum Creek corridor west of Cornwall Park. A mixed deciduous forest described in the Squalicum Floodplain Management Plan (1992), is dominated by black cottonwood, and covers an area exceeding 225 acres, between Irongate, Racine and I-5. **This represents the largest forested tract within the watershed and constitutes a critical habitat node at the center of the watershed, by providing a reserve and linkage in three directions.** Also, the abundance of cottonwood indicates frequently saturated soils, and potential wetland conditions throughout.

Fallow field habitat and its associated wet meadow and shrub elements are valuable habitat for at least 70 vertebrate species occurring in Whatcom County. Fallow field accounts for 119.26 acres of habitat in the Squalicum basin. **This area represents nearly 40 percent of the City's fallow field habitat and is a very significant habitat feature.** As a habitat type which is relatively rare within the City, it is particularly valuable in maintaining the unique wildlife populations associated with it. Al Hanners, a local naturalist (1993) describes the loss of high quality fallow field/wet meadow habitat where common snipe *(Gallinago gallinago)* thrived, an area which was converted to the Hannegan Business Park and further altered by the placement of a gas pipeline. Now, the habitat along pipeline corridor is diminished as a result of disturbance. This is only the second area within the City identified as snipe habitat. Common snipe likely still occur within wet meadows east and west of Hannegan, but need verification. Due to the near extirpation of snipe from Bellingham, it is recommended that snipe habitat requirements be accounted for prior to any further alteration of this general floodplain area. Squalicum's fallow field habitat is also important due to its connectivity with like habitat to the northeast, where it is more abundant. Fallow field and pasture lands are prevalent throughout the Dewey Valley and would make it possible for wildlife to disperse to and from the lower watershed if corridors are maintained.

The City's 1993-94 Coastal Zone Management grant resulted in a list of land use recommendations for priorities in the Squalicum Creek Valley between the Hannegan Road and Meridian Street. These recommendations are designed to address the regulatory restrictions, industrial zoning, and biological values in the valley. The grant's advisory committee studied the natural features and development suitability of each parcel in the valley in an effort to design a comprehensive plan to protect the most important attributes. The top priority issue according to the advisory committee was to improve stream flow patterns and restore higher value natural areas while making development opportunities available when not competing with these values.

Additional habitat descriptions and species information is available in the *Squalicum Creek Floodplain Management Plan,* Final Plan and Final EIS (Beck 1994) and *Proposed Fisheries Enhancement to Squalicum Creek* (Wiggins 1994). These more recent documents were not fully reviewed or applied in this document. Referral to these reports for more detailed information is recommended.

VERTEBRATE SPECIES INFORMATION

The vertebrate wildlife of the Squalicum Watershed has not received any systematic inventory, with the exception of certain fish species. Given the lack of scientific data, the following summaries are based on the best available information from reliable sources.

Fish

Fish are a significant resource throughout the Squalicum Watershed, but have suffered severe impacts from alteration of in-stream habitat, loss of riparian habitat, stormwater runoff, flooding and scouring, low flow periods, degraded water quality and over fishing. Loss of the native salmon and many other resident fish is irreversible, however, enhancement and restoration of the existing Squalicum fisheries are possible. The only remaining native salmon and steelhead runs occur in the Chuckanut Creek system and require top priority for conservation action, throughout the City. Squalicum maintains remnant populations of native sea-run cutthroat and possesses good salmon habitat. Squalicum Creek holds significant promise for future viable anadromous fish if restoration and enhancement of this system is implemented.

Studies of the Squalicum system by fisheries biologists have resulted in the identification and evaluation of stream associated habitats, barriers to fish, limitations to fish and species specific baseline data. Reference to these studies is provided through the following excerpts. Complete accounts are found in the reports listed above and should be referred to for greater detail.

Washington Department of Fish and Wildlife summarized historical information on the fishery resources on Squalicum Creek as follows.

> Steelhead smolt were previously planted near Meridian Street and Bug Lake. These plants were discontinued in 1987 due to low returns and the fact that they returned at the same time as searun cutthroat. Steelhead spawning has been observed in the stream section below Meridian Street.
>
> All cutthroat trout in Squalicum Creek are wild. Spawning occurs primarily in the upper reach of the drainage and in tributaries. The tributaries of Squalicum Creek have good populations of cutthroat.
>
> Coho salmon are raised in netpens in Sunset Pond in a cooperative effort by the Washington Department of Fisheries, the Port of Bellingham and the Bellingham Bay Salmon Association. In early March, Coho yearlings are obtained from the Department of Fisheries and raised for 60-90 days. They are then released in Sunset Pond. This program has been in operation for three years.

Extracted from Squalicum Creek Floodplain Management Plan: Interim Report (1992).

> ...Squalicum Creek (from Meridian Street to Hannegan Road) has the potential to rear a significant number of salmonids. Rearing habitat is abundant, but apparently under used. Spawning habitat is available only in one section and even there is sparse. The primary deficiency for spawning appears to be a lack of suitable sized substrates. Sedimentation is not perceived to be a major problem, but some embeddness was noted.

Jim Johnston, WDFW, indicated that good spawning habitat does exist (outside the City boundary) in the upper watershed.

Habitat Suitability:

While much of Squalicum Creek between Meridian Street and Hannegan offers good rearing habitat for salmonids with respect to cover and water quality, substrate over much of this reach is too fine and embedded with sand and silt to serve as spawning habitat. Where gradients are low this condition may prevail naturally; however additions of fines from sediment sources in the reach and upstream have probably contributed to the degradation of the stream's capaCity to support spawning population of fish.

In sections of stream traversing fields where livestock are pastured, riparian vegetation is either greatly reduced or absent entirely and stock crossings have resulted in bank deterioration and stream siltation. The lack of riparian vegetation contributes to significant increases in water temperature. During periods of low flow and warm weather, water temperatures may exceed threshold levels for salmonids, leading to stress or mortality. This condition is compounded where runoff from expansive impervious surfaces occurs during warm weather, heating the runoff before entering the stream system.

The control of major sedimentation sources (such as development sites), hardening of livestock fords or their replacement with bridges and re-vegetation of streambanks to increase bank stability, reducing solar insolation and providing cover, would greatly improve this reach of Squalicum Creek as fish habitat for both resident and anadromous fishes.

Problems related to fish and fish habitat in this section were also identified as follows:

Fish Passage:

Six partial barriers to fish movement were identified. The degree to which each barrier impedes fish movement varies with the amount of water flow. Certain beaver dams may pose migration problems for returning cutthroat if water flows are below normal. Stranding may also occur in certain sections of braided channel, again if flow is below normal. Other barriers include a culvert outflow area at the northeast end of Bug Lake, Bug Lake outlet at low flow, culvert under Ellis Street and a footpath culvert in Cornwall Park.

More recent evaluation of the Squalicum fisheries resources and associated habitats is available from the City and should be referred to for greater detail and updated information.

Reptiles and Amphibians

Species and site-specific data are lacking for reptiles and amphibians in the Squalicum Watershed. Although common species are likely, no verified records exist. Given habitat availability, viable populations are expected. Wetlands and riparian margins, particularly associated with the floodplain and upland forests provide necessary habitat complexes and likely harbor a variety of reptilian and amphibian species. Isolation of current populations and destruction of habitat are of concern in this watershed. A systematic inventory of species and assemblages is strongly recommended. For an updated listing of species identified in this watershed, refer to the Bellingham Master Species List, *Appendix C.*

Birds

A variety of upland and lake associated birds utilize the Squalicum Watershed. Of the 231 bird species City-wide, an estimated 108 species utilize available habitat in the Squalicum Watershed. Of these, 14 are designated Species of Concern or Priority Species by WDFW. The diversity of species is less than that of any other watershed, due primarily to the lack of habitat diversity and complete data.

Existing bird lists and reports addressing species occurrence in the watershed are misleading and either incomplete or exaggerated by virtue of timing or area of observation. Data used for most of those reports listed as references are based on observations made during non-breeding seasons and for limited periods in the field. The result is a poor representation of species presence. Another list was the result of several years of casual observation and included rare species, as well as marine species, which are not otherwise associated with the Squalicum Watershed. The list provided for this assessment is based on the best available data and additional observations made by reliable sources. A systematic inventory is needed for a complete and accurate baseline of presence and seasonal occurrence.

Although the watershed is highly developed overall, the central stream corridor and associated open spaces contain enough habitat to support common resident and seasonal populations. Squalicum Creek corridor is a natural flyway for a variety of raptors and waterbirds. Bald eagle *(Haliaeetus leucocephalus)*, osprey *(Pandion haliaetus)*, sharp-shinned hawk *(Accipiter striatus),* Cooper's hawk *(Accipiter cooperii),* American kestrel *(Falco sparverius),* merlin *(Falco columbarius)* and red-tailed hawk *(Buteo jamaicensis)* are known to utilize the watershed for hunting. Red-tailed hawk is thought to nest in the watershed but nest locations, have not been mapped. They select a mixed habitat of forest and field for optimal nest location and prey selection. Osprey was also rumored to be nesting near Sunset Pond and needs verification. Owls within the watershed include only three known species: great horned *(Bubo virginianus),* Western screech *(Otus kennicottii)* and northern saw-whet *(Aegolius acadicus),* all of which are associated with forested habitats. Short-eared *(Asio flammeus)* and the rare snowy owl *(Nyctea scandiaca)* are possible winter visitors in the upper watershed's fallow fields. Barn owl *(Tyto alba)* once occupied the barn on Hannegan and Mt. Baker Hwy. but have not been observed since the barn burned in the early nineties.

Waterbirds are common throughout the creek corridor and lakes. Common species include: a variety of dabbling and diving ducks, mallards, American wigeon *(Anas americana)*, American coot *(Fulica americana)*, green-winged/blue-winged and cinnamon teal *(Anas sp)*, common and hooded merganser *(Mergus sp)*, wood duck *(Asix sponsa)*, bufflehead *(Bucephala albeola)*, gadwall *(Anas strepera)*, northern shoveler *(Anas clypeata)* and possible ruddy *(Oxyura jamaicensis)* and ringed-neck duck *(Aythya collaris)*. Other waterbirds include: double-crested cormorant *(Phalacrocorax auritus)*, western grebe *(Aechmophorous occidentalis)*, kingfisher*(Ceryle alcyon)*, great blue heron *(Ardea herodias)*, green-backed heron *(Butorides striatus)*, gulls *(Larus sp)* and possible American dipper *(Cinclus mexicanus)* which is uncommon in the City. Dense riparian vegetation offers preferred habitat for green-backed heron and possibly rails. Rails are poorly recorded county-wide, and given the presence of suitable habitat in Squalicum, need an inventory to verify presence and breeding status. Shorebirds including spotted sandpipers *(Actitis macularia)*, yellowlegs *(Tringa sp)*, dowitcher *(Limnodromus sp)* and killdeer *(Charadrius vociferus)* are all possible along lake shorelines and wetlands including wet meadows.

It is likely that at least three of the five local woodpecker species occur in Squalicum. Northern flicker *(Colaptes auratus)*, downy and hairy *(Picoides sp)* can be readily found in those habitats of Squalicum. Pileated *(Dryocopus pileatus)* requires mature conifer-dominated forest with abundant snags and woody material for foraging and nesting. Although there are mature conifer cover types in the watershed, i.e. Cornwall Park and the Bellingham Golf and Country Club, they lack the necessary snag and dead downed wood components. These areas are highly manipulated and also lack much of the natural understory found in forests of this age. This may be a limiting factor for other species as well.

An unknown number of passerines occur in this watershed, including neotropical migrants and resident species. Passerines or "perching birds" include, corvids, hummingbirds, swifts, flycatchers, swallows, chickadees, wrens, kinglets, thrush, waxwings, warbler, vireo, sparrows, finches, blackbirds, meadowlark and grosbeaks. Riparian/upland habitat is an important habitat area for passerines and has the potential to harbor the greatest diversity of any habitat type. For its value, the riparian/upland interface is a critical component in the habitat network of the Squalicum Watershed. Neotropical migrants are a group of species of particular concern to conservation biologists, due to their apparent population declines and loss of habitat in both wintering tropics and summer breeding range including here. For this reason alone, **a complete inventory of avian species associated with the remaining habitat in the watershed would be extremely useful in guiding landuse decisions.**

Creek and lake-side snags created by beaver are important habitat features. Snags are utilized by great blue heron for roosting and kingfishers for perching. Small falcons and accipiters use the snags as hunting perches, and a variety of woodpeckers forage and nest in the snags.

Two keystone bird species for Squalicum Creek are Common snipe and red-tailed hawk. Both have been previously mentioned but warrant further discussion. Both are year-round residents and local breeders. Red-tails require a relatively large home range (2-3 sq mi) and a mixed habitat of forest (containing large enough trees for nesting), edge and open field for hunting rodents, reptiles and occasionally small birds. Snipe are relatively secretive and require wetlands, particularly wet meadows with enough shrub cover and small trees to hide and forage.

Species of concern utilizing the Squalicum Watershed on a regular basis include the following: Bald Eagles hunt over most of the watershed, utilize large trees and snags along Squalicum Creek for perches; this is the only watershed within a nesting pair of bald eagles. The merlin is an uncommon falcon that hunts the creek corridor during the winter months. Green-backed heron are small, secretive herons thought to nest and forage along Squalicum Creek. Great blue heron, common year-round hunters of fish, amphibians and crustaceans along streams, wetlands and the lake, also hunt rodents in open fields of the upper watershed. Wood duck are reported on both Bug Lake and Sunset Pond and are likely nesting where cavities or boxes are available. The other species are: western grebe, possible common loon, horned grebe *(Podiceps auritus)*, black-crowned night heron *(Nycticorax nycticorax)* (only one account), hooded merganser *(Lophodytes cucullatus)* (cavity nester), peregrine falcon *(Falco peregrinus)* (occasional hunter), ruffed grouse *(Bonasa umbellus)* and band-tailed pigeon *(Columba fasciata)* (common upland forest species).

Mammals

The mammals of the Squalicum Watershed are poorly documented. A variety of small mammals likely occur, with many of the Bellingham species represented. Large mammals are likely absent from most of the watershed within the City. However, black-tailed deer *(Odocoileus hemionus columbianus)* potentially utilize segments of the upper watershed and forest areas. Common medium-sized mammals such as: coyote *(Canis latrans)*, striped skunk *(Mephitis mephitis)*, raccoon *(Procyon lotor)* and opossum *(Didelphis virginiana)* range throughout the watershed. Porcupine *(Erethizon dorsatum)*, although uncommon in Bellingham, likely resides in upper Squalicum in small numbers. Aquatic mammals include beaver*(Castor canadensis)*, muskrat *(Ondatra zibethicus)* and river otter*(Lutra canadensis)*. Semi-aquatic, mink *(Mustela vison)*, long-tailed weasel *(Mustela frenata)* and possibly marsh shrew *(Sorex benderii)* may utilize most of the Squalicum Creek corridor and lake shorelines.

A resident beaver population is well established and their signs are found over most of the creek corridor, lake edges and associate side channels. Given the beavers ability to re-engineer and improve altered wetlands to benefit fish and wildlife, perhaps allowing the local beaver to reclaim portions of the Squalicum floodplain would improve the hydrology, flood abatement and habitat value, without costly human intervention. The current status of their population, distribution or activities in the watershed is lacking. It is recommended however, that this natural reclamation project be further evaluated with the help of fish and wildlife biologist in conjunction with the City Public Works Department.

Small mammals including arboreal rodents, terrestrial rodents, lagomorphs and bats are all likely represented within the watershed, but species and site specific data are lacking. Habitat associations for this group indicate the potential for at least 15 common species within the watershed.

Additional empirical data is needed to provide an accurate assessment of the mammals in this watershed. Habitat loss due to development has greatly impacted the suitability of particularly the lower watershed for mammals. Currently, the best habitat reserves for mammals are limited to the large upland forest blocks with adequate corridors for dispersal. Fragmentation and loss of corridors has become the greatest challenge to mammalian survival City-wide. Small, medium and large mammals are all victims of motorized vehicles, domestic predators, loss of habitat and preybase or forage. Providing the necessary corridors so that populations are not isolated will require restorative and enhancement action by the City and its citizens.

HABITAT INVENTORY: *per section area*

As a means to inventory habitat area and value within a fragmented urban landscape, a "block" system was applied. Blocks (blk) are a descriptive unit, representing an area of contiguous open space that contains one or more habitat types. Each block embodies an "island" of habitats and an associated wildlife community. Because habitat value and function is dependant on area (size), condition and connectivity, blocks serve as a comparative measure of available open space, connectivity and habitat diversity within each watershed.

The area of each block and general habitat type is listed by acreage and is based on aerial photo interpretation, using 1988 orthophotographic maps (1"=200'), 1990 City wetland inventory data, 1991 Department of Natural Resources orthophotos and other available reference information, as well as limited field truthing.

The Squalicum Watershed within the City limits consists of the following habitat types as classified by the Bellingham-Whatcom Classification System *Appendix B*. Starting at the eastern City boundary and proceeding downstream, habitats are listed per township/range/section. Contiguous habitats are identified as blocks and are listed by number. This numerical system remains constant even when blocks overlap section lines or watershed boundaries. Descriptions of large blocks will reflect only the area and habitats within the subject watershed and section. Notes for each entry may include: special habitat features, critical habitat as described in GMA, PHS-NGDS, Natural Heritage sites, significant wildlife observed, identified corridors & barriers and publicly owned habitat areas such as undeveloped parks and greenways. Terrestrial habitats are the primary focus of this inventory. Stream and wetland habitat descriptions are available in the Bellingham Wetlands Inventory (1990) and the Bellingham Watershed Study, 1993 prepared by David Evans & Assoc. and HDR consultants.

T38N/R3E/S16

Blk #	Habitat Code	Acres	Notes
			Section 16 (Dewey Valley) represents an area containing large blocks of forest (DNR), fallow field and wetland habitats; it also provides significant corridor opportunities for wildlife migrating from the Upper Whatcom Watershed to King Mountain or into the Squalicum Creek Corridor, however, Hannegan Rd. and Mt. Baker Hwy. pose barriers to certain species; bridges across Squalicum Cr. replacing culverts would provide needed passage for fish and wildlife; defined as an area in transition with large tracts cleared for housing (east side) and a new school is planned for part of the northeast quarter just north of City boundary. To the south the contiguous forests extended well into section 21, connectivity is now severed by Barkley Blvd. and assoc. development.
54	28	~70	partially cleared and lost wetlands

- -	~~“~~	~~~28~~	cleared for development
- -	~~SQ-57~~	~~(0.4)~~	developed
- -	~~SQ-58~~	~~(0.3)~~	developed
- -	SQ-56	(10+)	wetland extends north into County and south into Whatcom Watershed
- -	24	33.01	
- -	SQ-55	(2.4+)	bisected by utility corridor
54	9	10.18	fallow-wetland, excellent field habitat
- -	SQ-51	(9.4)	
72	9	9.17	fallow field with shrub, forest edge, Squalicum Creek flow through and designated wetland (SQ-52), excellent habitat interface
- -	28	39.86	forested block, valley bottom corridor contains wetland, snags (large and small), deer and coyote reported, excellent habitat, DNR owned, possible corridor south across Mt. Baker Hwy.
- -	SQ-52	(23)	significant wetland area, part forested, part meadow, extends north into county
- -	SQ-53	(0.4)	
- -	9	5.0	possible corridor across Mt. Baker Hwy
- -	SQ-54	(6.2)	extends north into county

T38N/R3E/S17

Blk #	Habitat Code	Acres	Notes
			Section 17 is an area of excellent wildlife habitat diversity - forest, fallow field, wetland, riparian, lake - forming an contiguous corridor for 1 mile and adjacent upland forested wetlands; 15 wetlands delineated for this section just within the City residential and light industrial area expanding from north, mostly north of City boundary.
73	9	12.05	disturbed area
- -	SQ-49c	(10.1)	
- -	28/24	27.45	
- -	SQ-49b	(7.9)	
- -	9	7.31	fallow field-early successional stage/wetland
- -	SQ-39c	(9.4)	sea-run cutthroat trout spawn in this section of Squalicum Cr., culverts at Hannegan are a barrier
- -	20	~11	Sunset Pond-man made, contains crappie, largemouth bass, sunfish, perch bullhead, cutthroat trout and seasonally chum and coho salmon; the lake is deep with little shoreline ledge; beaver lodges present at east end, muskrat, mink and otter utilize shoreline areas
- -	28/29	102.55	abundant deer east-west corridor, fawning near wetlands, variety of birds possible, Al Hanners lists over fifty species for this corridor area and around the lake, his list

			is based on limited visits and would likely be greater given more time, he also describes the vegetation in detail-; in review there are several species to add, one species in particular that stands out is common snipe, **this area offers prime snipe habitat and is the only breeding site for this species remaining in the City.**
- -	SQ-39a	(41.4)	
- -	SQ-39b	(5.4)	
- -	SQ-40	(16.2)	
- -	SQ-45	(7)	
- -	SQ-48	(7.8)	
- -	28/29	53.61	
- -	SQ-43	(10.3)	
- -	SQ-41	(5)	
- -	9	14.54	fallow field/wetland
- -	SQ-42b	(5.0)	
- -	SQ-42a	(8.8)	
- -	~~2~~	~~15.40~~	cleared/graded, no habitat value
- -	~~2~~	~~3.09~~	cleared/graded "
- -	~~SQ-49a~~	~~(4.5)~~	" " "
- -	5-10	3.14	little habitat value
- -	~~2~~	~~3.87~~	developed
- -	2	2.22	
- -	SQ-46	(.7)	
53	SQ-50	(7.9)	forested wetland, contiguous south with larger block - potential sink area

T38N/R3E/S20

Blk #	Habitat Code	Acres	Notes
53	28	42.30	Large forested wetland block isolated by development, thin corridors to north and south vital to wildlife maintenance within block
- -	2	8.97	
- -	SQ-47	(31.8)	
- -	SQ-50	(7.9)	
55a	29	8.85	isolated forest/field or yard and wetland habitat block; located at Sunset and I-5, commercial and residential development surrounding site-sink for terrestrial species, primarily bird habitat
- -	2	4.5	
- -	SQ-44a&b	(8.3)	

T38N/R3E/S18

Blk #	Habitat Code	Acres	Notes
74	29	~3	between James and I-5, narrow strip-sink habitat
- -	SQ-33	(1.74)	
- -	SQ-34	(2.4)	disturbed site
- -	2	15.47	
- -	SQ-35	(10.3)	disturbed site
74	29	90.43	large cottonwoods and numerous snags and wetlands, high quality wildlife area, deciduous habitat-unique habitat block in City; I-5 underpass with linking habitat-allows for unobstructed wildlife passage, also unique in City; potential habitat linkages north to King Mountain
- -	SQ-36	(7.2)	
- -	SQ-37	(4.0)	
- -	SQ-38	(9.0)	
75	29	15.22	public reserve, beaver sign, small snags, shrubs....
- -	SQ-30	(11.5)	important wetland and overflow channel
- -	SQ-29	(8.2)	Bug Lake, wildlife area (9.8 ac) owned by Washington Department of Fish and Wildlife, contains sea-run cutthroat trout, steelhead, possibly coho and chum, as well as crappie, large-mouth bass, sunfish, perch and bullhead; this lake forms a linkage in Squalicum Creek
- -	2	9.75	disturbed site-previously cleared, mostly wetland
- -	SQ-28	(7.6)	
~~- -~~	~~SQ-20~~	~~(.2)~~	developed
76	9	15.25	grazed by livestock, contains Squalicum Cr. corridor, riparia needs re-vegetation
- -	SQ-26	(0.2)	waterfowl, creek passage
- -	SQ-27	(5.9)	"
- -	24	16.14	north part of Cornwall Park
- -	SQ-25	(0.6)	creek corridor
- -	5	3	park lawn
77	29	5.43	island habitat
- -	SQ-19	(0.6)	beaver dam
78	28	26.71	developing area
- -	SQ-21	(0.6)	
- -	SQ-22	(2.2)	
- -	SQ-23	(0.3)	
- -	SQ-24	(0.6)	
- -	9	12.00	
79	9	8.79	
80	9	~15	
- -	SQ-13	(2.2)	

T38N/R3E/S19

Blk #	Habitat Code	Acres	Notes
			no aerial, estimated cover types from adjacent sections
76	24	~45	south Cornwall Park
- -	9	~10	grazed pasture with some trees
75	29	~8	contiguous with Bug Lake
N/A	2	~15	potential backyard sanctuary areas (estimated)

T38N/R2E/S13

Blk #	Habitat Code	Acres	Notes
81	7-24	145.22	Bellingham Country Club/golf course modified habitat area; Baker Creek meanders through course with little setback of vegetative buffering, corridor provides potential riparian and in-stream habitat if enhanced; sea-run cutthroat and steelhead found in this reach, although poor fish passage at Birchwood; mature Douglas fir dominate strips between fairways and perimeter; although isolated, fenced and altered, this is a vital urban habitat and should be preserved via conservation easement or transfer of development rights; site needs enhancement for wildlife, primarily birds and riparian re-vegetation. Island habitat.
- -	SQ-9	(0.4)	
- -	SQ-8	R (0.6)	
81a	28/R	3.47	Squalicum Cr. corridor, west of Cornwall Park
82	~~2~~	~~2.62~~	developed
83	2	6	vacant lots/backyards
84	2	4.62	" "
85	2	5.57	fallow field/yard with a few trees
86	2	2.82	good shrub habitat
87	2	2.17	adjacent to I-5, questionable value
88	2	3.15	" " " " cleared site

T38N/R2E/S14

Blk #	Habitat Code	Acres	Notes
			Squalicum/Little Squalicum - Birchwood Neighborhood, little habitat available inside City boundary, tremendous backyard sanctuary opportunities; highly fragmented habitat with little surface water areas for fish or amphibians, most have been diverted underground; developing area due to airport to north and west; need for neighborhood wildlife enhancement plan- through a citizen education/planning process.

89	29	~24	habitat island located next to I-5, contains large snags and forested wetlands, potential sink habitat if corridor to southwest is not maintained.
- -	SQ-5	(1.2)	large snags
- -	SQ-6	(0.5)	
90	28	8.00	
- -	SQ-4	(2.0)	
- -	2	9.45	potential backyard sanctuaries
91	2	13.81	" "
92	2	14.06	" "
93	2	6.16	" " disturbed area
94	2	4.77	" " "
95	2	1.96	" "

T38N/R2E/S24

Blk #	Habitat Code	Acres	Notes
			Section 24 includes Squalicum Creek corridor west from Cornwall Park to Eldridge; stream/riparian corridor ranges in width from ~75' to 350', with the stream passing through box culverts in three locations; stream corridor is paralleled on the north by Squalicum Parkway/truck route; overpasses divert main arterial traffic over creek corridor; all uplands developed as single family residential and commercial with sparse habitat available only in undeveloped lots and large combined backyards.
81a	29/R	10.43	Squalicum Cr. corridor
98	29	5.58	Baker Creek outlet
- -	SQ-8	(0.6)	"
100	29/R	14.47	Sq. Cr. Corridor/well vegetated riparian area averaging 200 feet wide, vegetation extends up bluff face, Greenways target
101	29/6	11.34	continuation of stream corridor, variable width, well vegetated including bluff line, Greenways target
99	29	2.14	
- -	1	21.88	gravel pit, possible future reclamation site, not currently habitat
- -	2	22.10	disturbed site adjacent to gravel pit, regrowth
- -	SQ-3	(1.2)	beaver, deer and great blue heron
- -	SQ-2	(0.4)	beaver dam
- -	28	8.00	bluff face, corridor Greenways target
- -	SQ-4	(1.5)	snags
- -	2	1.35	large yard adjacent to corridor
96	2	8.89	potential backyard sanctuary
97	2	5.5	" "
108	2	1.25	" "

104	2	4.83	"	"
105	2	5.37	"	"
106	2	11.29	"	"
107	2	7.74	"	"

T38N/R2E/S23

Blk #	Habitat Code	Acres	Notes
			Little Squalicum and mouth of Squalicum Creek: rerouted and channelized in 1967 resulting in dredging of estuary and tide flats
108	2	5.70	
- -	2	~26	lawn/shrub edge-Greenway target
- -	29	~13	Little Squalicum Park/Greenway
- -	2	2.78	
- -	LS-1	(2.5)	
109	2	9.5	potential backyard sanctuary
110	2	17.3	" "
93	2	2.78	" "
94	2	7.90	" "

HABITAT TYPE TOTALS

code	habitat type	acreage
1.	Commercial/Industrial	21.88
2.	Urban Open Space	270.76
5.	Park (developed)	6.14
7/24.	Golf Course/Mature Conifers	145.22
9.	Fallow Field	119.26
24.	Conifer Forest	94.92
28.	Mixed Conifer-Hardwood Forest	381.95
29.	Mixed Deciduous Forest	211.89

Total natural open space	1,251.52 acres
Total forest habitat	688 acres
Total wetland habitat	328.35 acres

Total lost habitat 1990-1995 = 53.88 acres

HABITAT BLOCK TOTALS

43 blocks...most fragmented watershed within the City

53.	51.27
54.	113.19
55a.	13.35
72.	54.03
73.	222.87
74.	108.90
75.	32.97
76.	89.39
77.	5.43
78.	38.71
79.	8.79
80.	15
81.	145.22
81a.	13.9
82.	
83.	6
84.	4.62
85.	5.57
86.	2.82
87.	2.17
88.	3.15
89.	24
90.	18.45
91.	13.81
92.	14.06
93.	8.94
94.	12.67
95.	1.96
96.	8.89
97.	5.5
98.	5.58
99.	55.47
100.	14.47
101.	11.34
104.	4.83
105.	5.37
106.	11.29
107.	7.74
108.	48.73
109.	9.5
110.	17.3
NA	15

SQUALICUM WATERSHED SUMMARY and RECOMMENDATIONS

The Squalicum Watershed is an area of limited habitat area, but represents important diversity and a major stream corridor with significant riparian and forested wetland. The watershed harbors the largest fallow field habitat area in the City, which is associated with like habitat extending into the county of nearly contiguous habitat. Squalicum Creek is forms the central habitat feature in the watershed and contains most of the habitat requirements for a viable anadromous fishery. Wildlife species presence and seasonality data is lacking and is needed to fully address landuse considerations. Recommendations herein are based on the best available information and comparable concerns from other watersheds.

Of the estimated 3,200 acres within the watershed, 39 percent is open space and viable habitat. Of the 1,252 acres of open space, 55 percent is forested and nearly 26 percent wetland area. The wetland area includes City inventoried wetlands. Bug Lake and Sunset Pond (both man-made) provide an additional ~20 acres of fresh water habitat. The habitat blocks inventoried in the Squalicum Watershed vary greatly in size, isolation and quality and represent the most fragmented area in the City. Within the watershed, 43 blocks were identified with the largest totalling 223 acres (block 73) and the next largest block 81, at 145 acres. The smallest blocks under ten acres, and account for 40 percent of the total number of blocks. This indicates a high degree of fragmentation of habitat within the watershed.

The major protected habitat reserves within the Squalicum Watershed include: Bug Lake (public), Sunset Pond (public), Cornwall Park (public) and Little Squalicum Beach (public). The total protected area within the watershed, primarily public parks and a wildlife preserve, is 108 acres or 9 percent of the total open space remaining in the watershed. Unprotected reserves include the east Squalicum floodplain fallow field and contiguous upland forest (private), field/pasture and wetlands east of Cornwall Park (private), Bellingham Golf and Country Club (private), Squalicum Creek corridor uplands (private). The unprotected areas total 1,144 acres and constitute 91 percent of the total open space. These figures reflect a serious need to address habitat preservation while much of the upper corridor and adjacent forests are still intact.

Current zoning of the Squalicum Corridor's northern half, from Meridian Street east, is industrial. This zoning strip could permanently jeopardize Squalicum as a viable wildlife area.

Further fragmentation of the corridor and habitat loss and impacts, from major industrial development, both indirect and indirect, will be irreversible. Enhancement and mitigation planning efforts will beginning in 1993 through Coastal Zone Management will continue.

Identification and preservation of viable habitat corridors is needed throughout the Squalicum Watershed. Logically and biologically valuable habitat links are located along creek corridors and should be utilized to the fullest for this purpose. Wide riparian buffers (>100') would provide the necessary corridor cover for passage for the majority of species. Improvement and protection of riparian habitat along streams, lakes and wetlands is needed to maintain habitat and corridor function of these areas throughout the watershed. Corridors north to King Mountain and east through the Dewey Valley are the last remaining for this watershed.

Restoration of certain riparian areas is also indicated. The steep banks of the lower Squalicum Creek corridor are important upland habitats and should remain undeveloped.

Fisheries enhancement and habitat restoration is a priority for Squalicum. Bringing a viable salmon run back to the Squalicum system could involve a public/private effort with citizen involvement, including an ongoing class project for high school students, the Nooksack Salmon Enhancement Association, businesses within the watershed and the City of Bellingham. Site specific recommendations are covered in the previous description of fisheries resources and emphasize in-stream and riparian habitat restoration coupled with water quality enhancement as a means to encourage the return of naturally reproducing, native, anadromous fish species. The enhancement of streams and the return of natural fish migration would greatly benefit the greater wildlife community of the watershed.

Water quality monitoring and stream enhancement is needed throughout the watershed. Currently water quality of Squalicum Creek is poor. Stormwater runoff, commercial and industrial runoff, failing septic systems and non-point source pollution have been identified as the primary causes. As all wildlife depends on clean water, water quality is a essential consideration for wildlife conservation. Stormwater needs to be diverted from present direct outfall into streams to swales or detention areas where biofiltration will be used as a primary treatment. Septic failures, commercial and industrial runoff should be corrected. The creation of a citizens task force or implementation of an Adopt-A-Stream program would greatly assist the City in stream monitoring and enhancement efforts.

On site assessment is needed for all projects potentially affecting wildlife and their habitat. With the paucity of data for wildlife in Squalicum, **it is imperative that baseline inventories precede development, utility or other habitat altering activities.** Sensitive, rare and protected species of amphibians, reptiles, birds and mammals could be present without previous record. Watershed wildlife resources require further on-site investigation, identification and habitat assessment. Project sites should be subject to a field evaluation between February and June as part of the permitting process. Adopting wildlife friendly policies for drainage system development, street placement and improvement, lighting, and other development features, would greatly enhance wildlife opportunities City-wide.

Implementation of a backyard sanctuary program, or landscaping for wildlife, would provide wildlife stewardship and habitat enhancement opportunities to citizens and neighborhoods. Many well vegetated yards linked through a neighborhood or along a streams provides corridors where habitat is otherwise scarce and pubic ownership limited. The large, contiguous yards of the Birchwood neighborhood are excellent backyard sanctuary areas, the best in the City. These areas constitute a significant portion, 22 percent of the watershed's open space, approximately 270 acres. **Birchwood is recommended as a priority area for the Backyard Sanctuary Program and a choice pilot project locale.**

Street tree planting to suit neighborhoods is encouraged. Large street trees could be planted and will expand habitat opportunities throughout the watershed. Rows of trees create corridors for arboreal species and serve as breeding habitat as well as linkages to more suitable areas. Appropriate species should be used to avoid future conflicts with home owners and to provide the maximum benefit for wildlife. Wildlife biologists, arborists and neighborhood organizations should be consulted.

Enhancement of school grounds and public facilities with wildlife habitat is highly recommended. Landscaping for wildlife improves options for many species where little habitat now exists. Wildlife enhancement projects for school children will foster ownership in their schools and wildlife, as well as promote experiential education opportunities. In addition, development of school properties should take into account wildlife features of the property.

INTRODUCTION

The Bellingham Bay Watershed includes the combined areas of Bellingham Bay and immediate shoreline and uplands within the City boundary. The watershed is highly developed, consisting of the City's core, commercial districts, urban residential, industrialized shoreline, shipping and transportation facilities, railroad, marinas and municipal waste treatment facility. Parks, greenways and protected open space occupy a small but important portion of the watershed's shoreline and upland. The most significant feature of this watershed is the bay and its associated marine and shoreline habitats. Secondary habitat features include the historic marine bluff which forms a significant corridor along the perimeter of the Bay, as well as natural upland areas such as: Clark's Point and Little Squalicum; developed parks including Marine, Boulevard and Maritime Heritage. As an estuarine bay, fresh water is a primary factor in the bay's ecological function. The influx of freshwater from the Nooksack River, Chuckanut, Padden, Whatcom and Squalicum Creeks contribute directly to the habitat value of the bay and its shoreline.

INFORMATION SOURCES

The Bellingham Bay Watershed has received more systematic scientific wildlife survey than any other area of the City. The interest in water quality analysis, commercial fisheries, biological function and species occurrence have prompted several studies which have either targeted the bay or included it as part of a larger study area. Available avian species data for the Bellingham Bay Watershed is mainly a result of observations made by Terence Wahl and the results of the MESA study (Wahl et al. 1981). The list of references used for this watershed are as follows, with additional sources cited in the text:

- *Priority Habitats and Species Database* and *Non-game Data System* 1993. Washington Department of Fish and Wildlife.

-*Puget Sound Ambient Monitoring Project* - WDF&W 1992-1994 Harlequin duck aerial survey data and WDF Marine Resource Annotations 1994.

-*Puget Sound Environmental Atlas Update*, Prepared by Puget Sound Water Quality Authority 1992. prepared by Puget Sound Water Quality Authority and DNR Division of Aquatic Lands.

-*Bellingham Bay Action Program: 1991 action plan*, 1991. Prepared by M.A. Jacobson and P.A. Canterbury of PTI Environmental Services, Bellevue, WA. For the U.S. Environmental Protection Agency.

-*A Guide to Bird Finding in Washington* , Wahl and Paulson, 1991.

-*Catalog of Washington Seabird Colonies*, 1989. by S.M. Speich and T.R. Wahl. Biological Report 88(6), U.S. Department of the Interior, Fish and Wildlife Service and Minerals Management Service.

-*Bellingham Bay Action Program: initial data summaries and problem identification*, 1989. Prepared by D.S. Becker, R. Sonnerup and J.J. Greene of PTI Environmental Services, Bellevue, WA. For the U.S. Environmental Protection Agency.

-*A Synthesis of Biological Data from the Strait of Juan de Fuca and Northern Puget Sound*, 1983, E.R. Long editor. Marine Ecosystems Analysis (MESA), Puget Sound Project. Pacific office of Marine Pollution Assessment, National Oceanic and Atmospheric Administration.

-*Washington Coastal Areas of Major Biological Significance*, 1981, F. Gardener editor. Washington Department of Ecology, Olympia WA.

-*Marine Mammals of Northern Puget Sound and the Strait of Juan de Fuca*, 1978, by R. Everitt, C. Fiscus and R. DeLong.

-*Edgemoor Pond and Beach* limited to marine invertebrates identified , 1970 by Institute for Fresh Water Studies, WWU, Bellingham WA.

DESCRIPTION OF WATERSHED AND SIGNIFICANT HABITAT

The Bellingham Bay Watershed includes the marine embayment, shorelines and adjacent uplands which drain directly to the bay. This watershed constitutes 4,000 acres of upland; less than half that area is within the city limits. The uplands are highly developed and closely associated with the city's core and inner bay. The description of habitat and wildlife for this watershed generally overlaps, and in most cases excludes, the lower reaches of each of the city's four major watersheds. Because the stream outfalls and estuarine areas are described with the associated watershed, the Bellingham Bay watershed boundary is somewhat fragmented.

Bellingham Bay is the largest embayment and dominant marine feature encompassing most of southwest Whatcom County. Located within townships 37 and 38 north and ranges 1 and 2 east, the bay extends from the Nooksack River delta south approximately ten miles to the Whatcom-Skagit County line. On the west side of the bay lies the Lummi Peninsula, Portage Island, Lummi Island and Eliza Island. Along the eastern shoreline lies the City of Bellingham, Chuckanut Bay and Larrabee State Park. The bay's inner shoreline encompasses 7.5 miles within the City.

The bay is relatively shallow, rarely exceeding 100 feet in depth. An extensive delta has formed at the mouth of the Nooksack River at the head of the bay just west of the city boundary, and extends an estimated 1.24 miles south, much of which is exposed at mean low tide. This delta area alone accounts for one of the most significant wildlife habitat features of the bay. In addition to the Nooksack River, several other fresh water sources flow into the bay. Only two creeks within the City provide estaurine habitats; they are Chuckanut and Padden Creeks. Whatcom and Squalicum Creeks have lost most or all estaurine values to dredging, channelization and shoreline development.

The Bay is greatly influenced by the fresh water inflow of the Nooksack River located at the head of the bay west of Bellingham. The river's discharge forms a brackish surface layer ranging 5 to 12 feet in depth and frequently a heavy sediment load following high flow or flood episodes. The underlying water and salinity is comparable to Rosario Strait and it contains less sediment. The sediment discharge from the Nooksack is estimated to be 650,000 m^3 (850,000 yd^3) annually (Kramer et al. 1977, as cited by Becker et al. 1989). The nutrients from the river contribute to the food availability in the bay, enhancing the bay's productivity.

As an estaurine bay, its ecological diversity and productivity is significant. Birdlife associated with the bay is particularly diverse and numerically abundant primarily during winter months. Situated along the Pacific flyway and between Skagit Bay and the Fraser Estuary, tens of thousands of waterfowl pass over, some of which stop over during migration. The most notable population found on the bay is the western grebe *(Aechmophorous occidentalis)* which has been recorded numbering over 26,000; one of the largest known flocks occurring anywhere within the species range (Wahl et al. 1981). Sensitive species such as bald eagle, peregrine falcon, marbled murrelet and trumpeter swan are also seasonally common around the bay. As a result of a systematic censusing of the region for marine birds, the MESA study identified Bellingham Bay as a *Significantly Important Subregion* (Wahl et al. 1981).

The ecological value of the bay has direct economic value. Fisheries including salmon, bottom and shell fish have not only been an economic mainstay locally but also a significant part of our nature heritage. Tourism, boating, recreational fishing and Port associated facilities on the bay contribute to the local economy and lifestyle.

Bellingham Bay encompasses 27 linear miles of shoreline, less than a third of which is inside the City limits. The shoreline ranges from steep rock faces to sand and mud flats. The intertidal area as of 1989 is estimated to total over 26 square miles. The southern shorelines of the bay are generally narrow and steep, consisting primarily of rock outcroppings, bluffs, occasional cliffs and pocket beaches of coarse sediment. The western shoreline including Portage Bay, is characterized by gently sloped, shallow rocky beaches and intertidal areas, as well as extensive sand and mud flats. The inner bay shoreline area adjacent to the City of Bellingham has been extensively modified by dredging, fill, riprap, bulkheads, artificial lagoons and channelized stream courses. The railroad located along most of the eastern rim of the bay has resulted in the alteration of shoreline including fill, riprap, trestles, and in some cases causing the separation of small natural coves from marine influence by blocking tidal flow.

The uplands surrounding the bay range from natural, forested and undeveloped, to heavy industrial, developed and modified landscapes. The latter condition is the most common within the City. The Chuckanut shoreline and associated uplands are sparsely to moderately developed with large tracts of forest and low density single family homes. The immediate upland areas of South Bellingham and North Bellingham are primarily residential, altered by roadways, railroad and residential development. Most of the urban and industrial activity of Bellingham Bay is concentrated within the inner bay along the City of Bellingham's waterfront and a portion of Fairhaven. These shoreline and upland areas have been fully developed with little open space and natural/native vegetation remaining, with the exception of the bluff parallelling the shoreline. The bluff represents the historical marine shoreline prior to filling and alteration for industrial expansion.

Bellingham Bay has changed significantly as a result of human activity this century. Major development around the bay since the late 1800's has severely modified the bay's shoreline and impacted its biological function and value. The diversion of the Nooksack River from Lummi Bay to Bellingham Bay, dredging, filling and development of the Bellingham waterfront, installation of the railroad and combined industrial/residential effluent discharged into the bay have contributed to major ecological change over time. An excerpt from the 1983 MESA study describes the impacts:

> *This subregion along with Port Angeles bay has been the most heavily impacted by human activities in the study area. Dredge and fill of tidelands has been extensive along the north end of the bay. Disposal of large amounts of industrial effluent for many years has affected water quality. Log raft storage in the north bay has affected bottom sediments and water quality. Logging practices in the Nooksack River watershed have probably increased siltation rates, and this along with the diversion of the Nooksack River outfall from Lummi Bay into Bellingham Bay many years ago has undoubtedly affected the extent and quality of marine bird habitats. While numbers of dabbling ducks, geese, swans and shorebirds using the intertidal areas of the bay have unquestionably declined greatly since settlement began, the condition of some of the remaining nearshore areas along the southern shores and the offshore waters evidently remains productive. Presently, seasonally large numbers of diving ducks and fish-eating species, particularly western grebes, attest to Bellingham Bay's importance.....The Nooksack delta is one of the most important estuaries in the study area....wintering Whistling (Trumpeter) swans occurred here and important numbers of bald eagles concentrate here as well.*

Serious degradation of the bay has occurred over 50 years with the direct outfall of industrial effluent, leachate from shoreline landfills, and untreated stormwater runoff flowing into the bay. The results have been contamination of subtidal areas and bioaccumulation in marine organisms. Of particular concern is the persistence of heavy metals and toxic organic compounds which remain in the ecosystem indefinitely. Examples of toxic chemicals detected in leachate samples include chloroform, phenols, toluene, arsenic, copper, lead, mercury, among others (Becker et al 1989). With the construction of the Georgia Pacific settling pond in 1979 and other water quality improvements by industry, marine life of the bay appears to be rebounding. Best management practices should be applied to effluent and stormwater in an effort to protect marine resources. On-going monitoring of industrial and municipal effluent is needed, in addition to monitoring of marine sediments and organisms which serve as indicators of toxins in the environment.

As a multijurisdictional area, Bellingham Bay, its associated shorelines and immediate uplands are managed under a variety of mandates administered by local, state and federal agencies. The resulting management regimes have become quite complex, yet involve little habitat or wildlife monitoring.

VERTEBRATE SPECIES INFORMATION

Fish

Bellingham Bay has historically harbored a rich marine environment with abundant finfish and shellfish. With the expanding human population, development of the inner bay, direct discharge of industrial and municipal effluent compounded with other degrading environmental factors, Bellingham Bay became contaminated and inhospitable to many marine species. With advances in effluent treatment and more effective water quality regulation, the bay's environment is recovering.

The following information was extracted from the *Bellingham Bay Action Program: Initial Data Summaries and Problem Identification* (Becker et al 1989).

Bellingham Bay provides habitat for both anadromous and marine fishes (Shea et al. 1981). Common anadromous species utilizing the bay include: coho salmon *(Oncorhyncus kisutch)*, chum salmon *(Oncorhyncus keta)*, chinook salmon *(Oncorhyncus tschawytscha)*, pink salmon *(Oncorhyncus gorbuscha)*, sockeye salmon *(Oncorhyncus nerka)*, steelhead trout *(Oncorhyncus mykiss)*, cutthroat trout *(Oncorhyncus clarkii)*, Dolly varden *(Salvelinus malma)*, longfin smelt *(Spirinchus thaleichthys)* and Pacific lamprey *(Lampetra tridentata)*. Of these anadromous fishes, six species utilize Bellingham streams for spawning. During the late spring and early summer, juvenile salmon leave streams and migrate within approximately .6 mile (1km) of the shoreline, including inner Bellingham Bay. Migrating adult and juvenile salmon are an important food source for a variety of waterbirds, bald eagles, osprey, marine mammals and shoreline scavengers.

Major commercial non-anadromous marine fishes of Bellingham Bay include: Pacific herring *(Clupea harengus pallasi)*, Pacific cod *(Gadus macrocephalus)*, rockfish *(Scorpaenidae sp.)*, lingcod *(Ophiodon elongatus)*, English sole *(Parophrys vetulus)*, starry flounder *(Platichthys stellatus)*. In addition to these, are numerous non-commercial species which provide a food base for larger fish, diving birds and supplement the diets of marine mammals.

Common shellfish of the bay include Dungeness crab *(Cancer magister)*, purple shore crab *(Hemigrapsus nudus)*, edible blue mussel *(Mytilus edulis)*, heart cockle *(Clinocardium nuttallii)*, introduced Pacific oyster *(Crassostrea gigas)*, Manila clam *(Tapes japonica)*, horse clam *(Tresus capax)*, and butter clam *(Saxidomus giganteus)*. In addition to these commonly encountered or harvested marine invertebrates are hundreds of species including marine worms, molluscs, crustaceans, echinoderms, phytoplankton, zooplankton and algae which occur in Bellingham Bay.

Reptiles and Amphibians

As with most terrestrial species in Bellingham, little is known about the species occurrence, distribution and abundance of reptiles. The most common group are the garter snakes, of which, two species are known to occur along Bellingham Bay, including the western terrestrial garter snake *(Thamnophis elegans)* and subspecies *vagrans* or wandering garter snake, and the

Northwestern garter snake *(Thamnophis ordinoides)*. An uncommon snake, the rubber boa *(Charina botae)* is only known in one location in south Bellingham and prefers the sunny exposed banks above the bay. Another uncommon resident of the warm exposed bluff areas, is the northern alligator lizard *(Elgaria coerulea)*. More study is needed to determine reptilian occurrence city-wide.

The songs of Pacific chorus frogs are sadly lacking in most of this watershed. Few wetlands remain and those are either saline or have been impacted by toxins (herbicides) to which amphibians are highly susceptible. This is particularly true along the Burlington Northern Railroad right-of-way where herbicides are sprayed once or twice a year. Natural springs once laced the South Hill and other parts of Bellingham, with small rivulets and fresh water puddles, but have since been diverted into a comprehensive drainage system which leaves little free flowing water for wildlife outside of large ditches and stream corridors. The major stream corridors, temporary puddles and ditches likely attract Pacific chorus and red-legged frogs and other amphibians during breeding, but little is known about amphibian species (frogs, toads, salamanders and newts) occurrence and site specific concentrations within this watershed.

Birds

Significant numbers of diving birds are found in Bellingham Bay, particularly western grebe *(Aechmophorous occidentalis)*, cormorants *(Phalacrocorax sp)*, scoters *(Melanitta sp.)*, goldeneye *(Bucephala sp.)*, common mergansers *(Mergus merganser)*, greater scaup *(Aythya marila)*, red-necked grebe *(Podiceps grisegena)*, and common loon *(Gavia immer)*. Alcids including: pigeon guillemots*(Cepphus columba)*, marbled murrelet *(Brachyramphus marmoratus)*, common murre *(Uria aalge)* and rhinoceros auklet*(Cerorhinca monocerata)* are less abundant and generally uncommon inside the City boundary. Rocky intertidal areas are utilized by shorebirds including sanderling *(Calidris alba)*, western sandpipers *(Calidris mauri)*, dunlin *(Calidris alpina)*, surfbirds *(Aphriza virgata)* and black turnstones *(Arenaria melanocephala)* and occasionally black oystercatcher*(Haematopus bachmani)*. A variety of gulls *(Larus sp.)* utilize most of the bay area, shoreline and uplands. Great blue herons *(Ardea herodias)* are also common along the bay's shoreline and estuaries.

Endangered, threatened and candidate species also occur frequently throughout the bay, including: Peregrine falcon *(Falco peregrinus)* hunt the marine bluff, shoreline and utilize perches where available; bald eagle *(Haliaetus leucocephalus)* nest on Clark's Point and are observed regularly hunting, soaring or perching along Bellingham's waterfront; marbled murrelets*(Brachyramphus marmoratus)* forage near shore from Post Point to Chuckanut Bay, the same area where harlequin duck *(Histrionicus histrionicus)* concentrate, forage and roost; in addition, common loon *(Gavia immer)* occur throughout the bay and Brandt's cormorant *(Phalacrocorax penicillatus)* roost on the Post Point buoy and forage in the area.

The southern shoreline and City boundary encompasses Chuckanut Bay. This area consists of natural shoreline and a richly diverse estuary. A detailed description of Chuckanut Bay is found in the Chuckanut Creek Watershed section of this document.

West of Chuckanut Bay is Clark's Point and a sandstone shoreline extending north with intermittent riprap from railroad development. This shoreline north to Fairhaven and South Bellingham area has been modified, however it retains certain valuable habitat features and regular species occurrence. The southern shoreline is frequented by marbled murrelet, horned grebe *(Podiceps auritus)*, Barrow's and common goldeneye *(Bucephala sp)*, bufflehead *(Bucephala albeola)* and harlequin duck. As many as 27 harlequin ducks have been recorded during a Bellingham Christmas Bird Count, and commonly concentrate near Post Point. Double-crested cormorants *(Phalacrocorax auritus)* a variety of gulls and both common and caspian terns *(Sterna sp.)* forage in this area as well.

Padden Creek estuary, although small (about 6 acres), provides mud flat foraging area for small numbers of migrating shorebirds, dabbling ducks and heron. The fresh water from the creek provides a daily bathing site for gull species. A study of the Padden Creek estuary revealed 67 species of birds that have been observed utilizing the lagoon area (Wahl & Wahl 1990). Of those species, common winter birds include three species of loon *(Gavia sp)*, two species of mergansers *(Mergus sp)*, common and Barrow's goldeneye *(Bucephala sp)*, four gull species *(Larus sp)*, bufflehead *(Bucephala albeola)*, mallard *(Anas platyrhynochos)* and western grebe. Migratory species include dunlin *(Calidris alpina)*, greater yellowlegs *(Tringa melanoleuca)*, whimbrel *(Numenius phaeopus)*, western sandpiper *(Calidris mauri)*, Bonaparte's gull *(Larus philadelphia)* and green-winged teal *(Anas crecca)*. Merlin *(Falco columbarius)* and peregrine falcon have also been observed on the site (T.T. Wahl et al. 1990)(Drummond unpub. data).

Inner Bellingham Bay, although industrialized and severely modified by shoreline development harbors significant wildlife aggregations. The riprap surrounding the Georgia Pacific settling pond is a frequent haulout site for harbor seals. Bellingham Cold Storage and the Squalicum Harbor boat houses are glaucous-winged gull nesting sites with over 34 pairs nesting in 1982 (Speich & Wahl 1989). The cold storage site is also used by ringed-billed gulls and caspian and common terns for roosting and possible but unconfirmed nesting. The old cement plant dock provides a nesting site for pigeon guillemot and the pipeline extending to the dock attracts gulls and an estimated 600 double-crested cormorants to roost (Wahl, unpublished data).

Wintering marine birds are relatively abundant in Bellingham Bay as documented by high counts recorded during the MESA study (Wahl et al 1981) and National Audubon's annual Christmas Bird Count (Wahl unpub. data). High counts have included: 70 red-throated loon *(Gavia stellata)*, 24 common loon *(Gavia immer)*, 3 yellow-billed loon *(Gavia adamsii)* (a regional high count), 101 red-necked grebe*(Podiceps grisegena)*, 301 double-crested cormorant *(Phalacrocorax auritus)*, 58 great blue heron *(Ardea herodias)*, 780 surf scoter*(Melanitta perspicillata)*, 218 common goldeneye *(Bucephala clangula)*, 261 Barrow's goldeneye *(Bucephala islandica)*, 32 hooded mergansers *(Lophodytes cucullatus)*, 620 common mergansers *(Mergus merganser)*, 258 red-breasted mergansers *(Mergus serrator)*. Outside the winter months other species have also occurred in high numbers including: 32 black turnstone *(Arenaria melanocephala)*, 4 parasitic jaeger*(Stercorarius parasiticus)*, 762 Bonaparte's gull *(Larus philadelphia)*, 439 mew gull *(Larus canus)*, 52 ring-billed gull *(Larus delawarensis)*, 341 California gull *(Larus californicus)*, 148 Thayer's gull *(Larus thayeri)*, 600 common murre *(Uria aalge)*, 61 pigeon guillemot *(Cepphus columba)* and 199 marbled murrelet *(Brachyramphus marmoratus)*. Oldsquaw *(Clangula hyemalis)* also regularly winter here.

Probably the most significant bird species occurrence in Bellingham Bay is the concentration of wintering western grebes. Over 26,000 western grebes were recorded during the 1991 Christmas bird count and this is claimed to be the highest single count in North America (Wahl unpublished data). High numbers of this species were also recorded during the MESA study 1978-79, which represented 33% of all western grebes wintering in the Strait of Juan de Fuca, Georgia Strait and adjacent waters (Wahl et al. 1981). Smaller numbers of grebes remain during the summer, however most migrate east, inland to nest on fresh water lakes. Grebes forage in large flocks and feed on small fish. They are reported to be flightless during their winter sojourn which makes them particularly vulnerable to fish net mortality, disturbance and oil spills.

Mammals

Terrestrial and arboreal mammals are poorly understood in this watershed. Due to the lack of large habitat reserves, large and medium sized mammals are less common. The contiguous natural vegetation along the marine bluff provides some continuity and corridor opportunities for those mammals that do reside in this watershed. In addition, Clark's Point harbors probably the greatest diversity of mammals, given its mature forest cover and foraging opportunities. The most common species occurring in this watershed are native and non-native urban dwellers such as norway rats *(Rattus norvegicus)*, black rats *(Rattus rattus)*, house mouse *(Mus musculus)*, deer mouse *(Peromyscus maniculatus)*, raccoons *(Procyon lotor)*, coyotes *(Canis latrans)*, opossum*(Didelphis virginiana)*, black-tailed deer*(Odecolius hemionus columbiana)* on the outskirts and occasional long-tailed weasel *(Mustela frenata)*, ermine *(Mustela erminea)*, mink *(Mustela vison)* and red fox *(Vulpes vulpes)*. Douglas squirrel *(Tamiasciurus douglasii)* and Townsend's chipmunk *(Tamias townsendii)* only occur in well forested areas where seeds are readily available. Additional native species might also occur here but have not been identified.

Marine mammals occurring in the inner bay are limited to common harbor seal *(Phoca vitulina)* and occasional California sea lion *(Zalophus californianus)*. Harbor porpoise *(Phocoena phocoena)* utilize the off shore areas of the outer bay. Whales, including orca, gray and minke have been rarely observed in the bay and usually in the outer deeper waters.

Priority Habitats and Species associated with Bellingham Bay are:

Breeding Seabird Colony: state priority habitat, gull breeding colony at Squalicum Harbor.

Waterfowl Concentrations: state priority habitat, encompassing all of Bellingham Bay area utilized by wintering western grebes and delta area utilized by wintering/migratory water fowl and swans.

Common loon *(Gavia immer):* state candidate species, widespread winter visitor; loons are diving birds which forage for small fish.

Horned grebe *(Podiceps auritus):* state monitor species, common winter visitor, diver, forages for small fish.

Western grebe *(Aechmophorus occidentalis):* state monitor species, common winter visitor, diver, forages in large flocks, feeds on small fish.

Red-necked grebe *(Podiceps grisegena):* a state monitor species, common winter visitor, diver, forages in small flocks, feeds on small fish.

Brandt's Cormorant *(Phalacrocorax penicillatus):* a state candidate species, aggregate and forage in deep water areas, roost on Post Point buoy.

Great blue heron *(Ardea herodias)* : a state monitor species, major heron nesting colony within one mile of shoreline, species dependent on intertidal and shoreline habitat for foraging, shoreline trees for staging and roosting particularly along northwest and southeast shorelines and intertidal areas.

Harlequin duck *(Histrionicus Histrionicus):* federal candidate species, rocky shoreline dependant, large winter and summer concentrations along southern shoreline.

Turkey vulture *(Cathartes aura):* state monitor species, common summer resident, forages primarily on carrion, often observed along shorelines, breeding status in Whatcom County unknown.

Osprey *(Pandion haliaetus):* state monitor species, relatively common resident, forages for fish on Bellingham Bay, local roosts and nest sites unknown.

Caspian tern *(Sterna caspia):* a state monitor species, summer resident, expanding range, becoming more abundant, forages for fish near water's surface; roost on roofs of waterfront buildings.

Bald eagle *(Haliaeetus leucocephalus):* resident breeders, sub-adult non-breeders occur year-round; migratory and wintering eagles are found in significant numbers along shorelines where they scavenge along the intertidal areas, fish in open water or hunt ducks and gulls.

Peregrine falcon *(Falco peregrinus):* federal and state endangered species, regular winter resident and migrant, forages along shoreline for birds and ducks.

Merlin *(Falco columbarius):* a state monitor species, regular-uncommon winter resident, migrant bird predator, forages along shoreline, forest edge, riparian and urban areas, breeding status in Whatcom County unknown.

Marbled murrelet *(Brachyramphus marmoratus):* a state and federal threatened species, resident alcid, nests in old growth forests, forages nearshore on small fish.

California sea lion *(Zalophus californianus):* a state monitor species, a large pinniped, forages primarily on fish, and appears to be expanding its range becoming a regular occurrence locally.

Harbor seal *(Phoca vitulina):* a state monitor species, common year-round resident, forages on fish, hauls out on rock breakwaters, log booms and boulders near shore.

Pacific harbor porpoise *(Phocoena phocoena):* a state candidate species, utilizes open water habitat offshore in depths >60 feet, occurs infrequently in outer bay, i.e. Eliza island.

HABITAT INVENTORY: *per section area*

The habitat inventory for this watershed will concentrate on shoreline and upland areas not previously discussed in other watershed sections. The expansive marine area of Bellingham Bay is the watershed's primary and most important habitat feature and will be referred to but not inventoried as a habitat "block," which are intended for upland areas.

Due to the lack of significant contiguous habitat within the Bellingham Bay Watershed (other than the bay), the inventory will concentrate on habitat descriptions, known species occurrence and site specific attributes by township section. Only those "blocks" which overlap into other watersheds and selected habitat acreages will be listed.

T37N/R2E/S14

This section constitutes the southern most portion of the Bellingham Bay Watershed. It includes the west side of Clark's Point, the Madrona Point and a portion of the Clarkwood Developments. The natural sandstone shoreline and upland areas of this section are significant and unique habitats within the City. Clark's Point's west side plant community is consistent with that of the San Juan archipelago and is described as both unique in Whatcom County and sensitive (Colebrook pers. comm.). Clark's Point is protected under a conservation easement with the owner and the Whatcom County Land Trust. It is also a popular recreation destination, although has suffered impacts by excessive foot traffic and garbage, and risks further degradation and has a high fire potential.

The Point is utilized by a number of terrestrial species. The unusual rubber boa *(Charina bottae)* and northern alligator lizard *(Elgaria coerulea)* are found along the exposed banks at the north end of the point. This area also serves as an important corridor for terrestrial mammals such as fox, coyote, deer, raccoon, Douglas squirrel, chipmunk and other rodents. Raptors, particularly hawks, eagles and falcons perch and hunt from large snags and mature Douglas firs along the point and shoreline north. A pair of bald eagles are currently nesting on the east side of the Point and utilize both Bellingham and Chuckanut Bays for hunting. Peregrine falcons, merlins, sharp-shinned and red-tailed hawks also frequent the Point. Great blue heron forage and perch along the shoreline. The relatively steep sandstone shoreline creates a unique near-shore sub-tidal habitat. This area offers foraging habitat for Harlequin ducks, oldsquaw, marbled murrelets, pigeon guillemots, a variety of grebes, mergansers, cormorants, goldeneyes, loons, scoters and gulls. This area is also used by harbor seal and river otter on a regular basis.

North of Clark's Point, the shoreline has been altered by the placement of a railroad and associated rip-rap. Much of Bellingham's natural shoreline intertidal area has been filled for or affected by the railroad, from Chuckanut north through the City. The remaining bluff line which parallels the shoreline serves as an important, relatively natural habitat feature. Bellingham's marine bluff extends north from the Chuckanuts through the City and provides a vegetated corridor utilized by a variety of species from migratory and resident passerines, raptors in pursuit of prey, herons for resting, roosting, small to large mammals for travel, denning and foraging, etc.

T37N/R2E/11

This section of the Bellingham Bay Watershed consists of a well established single family neighborhood situated above the shoreline of Post Point. Although Edgemoor is built on large well vegetated lots, little native vegetation remains and much of the area is intensively managed lawn and ornamental plants. The shoreline bluff and lagoon area remains relatively natural. Few large trees remain along the bluff in order to maximize views. A small cove situated west of Edgemoor became partially enclosed by the construction of the Burlington Railroad. The lagoon was slated to be fully enclosed. However, citizen protest resulted in the placement of a trestle and a gap in rip rap was created to allow for tidal flow. The lagoon provides refuge and foraging for marine associated diving and dabbling ducks, herons and possibly shorebirds utilizing the soft mud intertidal area. Certain unique plant species have been identified for this section including garry oak *(Quercus garryana)* occurring along the bluff, and harvest brodea *(Brodea coronaria)*. Once a relatively common species, brodea is now rarely found and was recorded occurring on Post Point in the early 1980's.

Due to its proximity to the Chuckanuts and large lot size, Edgemoor has much greater habitat potential. Habitat enhancement would involve more native plantings, more clumps of trees, a reduction of lawn area and the creation of fresh water sources. Backyard sanctuaries would be beneficial, particularly adjacent to the lagoon and marine bluff.

The shoreline and near shore waters from Post Point south to Chuckanut Bay is critical habitat for a number of species including harlequin ducks, marbled murrelet, bald eagle, sea-run cutthroat trout and three species of juvenile salmon; chinook, chum and pink. Other significant species include river otter, great blue heron, oldsquaw, horned grebe, osprey, kingfisher, goldeneye and bufflehead. Post Point and Chuckanut Rocks are the only harlequin duck concentration and loafing sites in Bellingham. As a proposed threatened species these sites are in need of protection from boats, people and their pets.

A shoreline bluff corridor is contiguous from Post Point Treatment Facility south extending over one mile. This vegetated corridor ranges from 50 to 200 feet wide. The bluff trees in places have been cleared for views and vegetation has been spot-sprayed with herbicides by the railroad. This has fragmented the habitat and negatively impacted the bluff corridor,

T37N/R2E/S2

This section includes the South Terminal, Marine Contractors, Inc. (a commercial shipyard), Post Point Municipal Waste Treatment Facility, Padden Lagoon, Marine Park.

The Post Point Lagoon (wetland BB-4) is a tidal lagoon of 2.6 acres. The lagoon is frequented by migratory and wintering waterfowl particularly American wigeon, with other common species including great blue heron, glaucous-winged gull, ring-billed gull, bufflehead, goldeneye, red-breasted mergansers and occasional hooded mergansers. The open, grassy perimeter of the lagoon limits its habitat value and would be improved with the planting of berry or seed bearing shrubs and trees that would provide food as well as screening/cover and perches.

The bluff line extends inland from the shore and provides a corridor connecting a Greenway from Padden Creek to the Waste Treatment site. Although two streets break up this corridor, it is still important for birds and certain mammals. Enhancement of the bluff area and corridor north would improve its function and value considerably. Tall trees, particularly evergreens, lost along the bluff need replacement, as they serve an irreplaceable function as raptor perches. Remaining mature conifers above the treatment plant have been reported as roosting sites for great blue heron and should be retained.

Clumps of three to five Douglas fir planted throughout this section (particularly along the bluff) and allowed to mature would serve as future hunting and resting perches for falcons, hawks, eagles, herons and passerines. The creation of snags would also diversify and benefit this area's habitat.

Padden Lagoon and associated Creek area is described in the Padden Watershed section.

T37/R2E/S1

This section includes Fairhaven and the South Hill. This area was developed in the late 1800's and represents highly altered landscape. Little natural habitat remains and is concentrated along the marine bluff-line.

Sharp-shinned hawks and merlins are frequently observed hunting along the bluff and hillside yards for small birds. Bald eagles, peregrine falcons and occasionally Cooper's hawks are seen moving along the shoreline bluff or above the treed areas of the South Hill.

The South Hill neighborhood consists of relatively large lots with certain streets lined with trees. Fourteenth Street is an excellent example of urban habitat created by street trees. In this case mature American elms provide cavities, seeds, twigs, habitat for insects and cover which translates into food and shelter for a variety of birds and small mammals.

The bluff-line extends north from Harris Avenue and is fragmented by streets, residential development and a few small businesses.

T38/R2E/S36

This section includes an important marine bluff habitat corridor of approximately 18 acres, extending just over one mile paralleling the marine shoreline, including a Greenway system and Boulevard Park. The bluff area is utilized by falcons, hawks, eagles for hunting and perching, crows and other passerines for nesting and foraging, occasional woodpeckers, small mammals, raccoon, opossum, coyote, fox, deer, ermine and even a wayward muskrat have been observed. The corridor consists of steep vegetated slopes with occasional exposed sandstone. Many of the tall trees have been topped or removed along the bluff, however younger trees are filling in and should be protected as habitat. Shrubs and deciduous trees currently provide adequate cover but could be added in areas in need of enhancement. Conifers are few and provide the best perches for large birds, particularly raptors. Enhancement of the bluff could include the addition of native plants valuable to wildlife including: wild rose, red-flowering currant, thimbleberry, snowberry, mountain ash, madrone, willow, birch and plantings of Douglas fir in clumps at irregular intervals along the bluff to avoid blocking views.

The waterfront and port area to the north is developed and utilized by industry. A well established log dump facility attracts 20 to 50 harbor seals who haul-out on the log rafts daily. In the event this facility is closed, a valuable wildlife enhancement project would be to create permanent floating rafts for the seals, cormorants, gulls and occasional sea lions. This could be done else where along the shoreline, such as just north of Boulevard Park.

The powerline along the Boulevard has been fitted with large (~8") spikes to deter gulls and other large birds from perching on the tops of the vertical poles. Unfortunately, these spikes only work part time, as gulls and bald eagles have been observed attempting to balance on the edge of the poles to avoid injury. It is not known the original intent for the placement of these spikes, but given their tremendous hazard to birds and potential to inflict serious injury on a protected species, their removal is highly recommended. Replacement of the spikes with sturdy perches is also recommended given that Bald eagles depend on perches in high places for hunting and survival. **Similar animal control measures within the City should be evaluated by both a trained wildlife biologist and a specialist for the target species.**

The area of Morey Drive and Garden Terrace provides approximately 23 acres of mixed forest spanning the steep slopes from Garden Street to the South Hill's crest. Although fragmented by residential development and narrow streets, the forested area provides a nearly contiguous canopy and habitat for migratory and breeding passerines, hunting area for small hawks and falcons and an urban refuge for some adaptable mammals.

T38/R3E/S31

This section includes the northwest corner (27.26 acres) of the Sehome Arboretum, the northern portion of WWU, part of the Sehome neighborhood and a segment of the marine bluff (8.33 acres) to the east of Georgia Pacific. The arboretum is discussed at length in the Padden Creek Watershed section of this document and will not be repeated here, other than to mention the lack of a corridor linkage from the arboretum to any part of the Bellingham Bay Watershed.

Little wildlife information is available for this section and little wildlife habitat exists with the exception of the arboretum, marine bluff which extends south along the boulevard, Laurel Park, a few vacant lots and three acres between Forest and Garden Streets, part of which has recently been developed. Enhancement of the park for wildlife would benefit breeding birds, as would the addition of street trees throughout the neighborhood. The addition of conifers to the bluff would diversify the habitat and provide year-round cover.

T38N/R3E/30 and T38N/R2E/25

These sections represent the central district of Bellingham, Georgia Pacific Pulp and Paper facility, Squalicum Harbor and other associated waterfront business and industry. Little natural habitat remains within this area, yet the potential for significantly increasing habitat value through enhancement exists. The marine bluff, which has been a contiguous feature from around the bay, continues here, extending just east of Georgia Pacific to Whatcom Creek and west from Broadway. The present habitat quality of the bluff corridor is moderate to poor due to fragmentation and domination by blackberries. The restoration of the native vegetation along Whatcom Creek could be applied along the bluff and greatly enhance its habitat value. Again, trees, particularly native evergreens would improve the bluff for many wildlife species, in addition to screening the industrial complex of Georgia Pacific from downtown and buffer noise from the Burlington Northern switching yard.

Street trees were planted in portions of the downtown commercial district. Non-native sycamores were used and are becoming quite large. As these trees mature they provide good cavities and nesting opportunities for urban species. For future plantings, native species should be considered, including dogwood, cedar and black birch. **Public buildings and willing private businesses would benefit wildlife by providing seed and berry producing trees and shrubs as well as evergreens.** These plantings should be clumped and tie into adjacent habitats where possible. In addition, the placement of bird nesting boxes, bat boxes, bird feeding stations, baths, artificial snags and other wildlife enhancement structures are encouraged, particularly along the marine bluff and Whatcom Creek corridor.

Along the waterfront, habitat is limited to human built structures. The dredging of the Whatcom Creek waterway and loss of the Squalicum Creek estuary for marina construction are two major alterations and permanent losses of important habitat in this area. An additional loss was the removal of an artificial breakwater which served as a major glaucous-winged gull nesting colony. The displacement of these gulls resulted in their resettling on the roof tops of boat houses and warehouses in and around the Squalicum Harbor marina. This influx of nesting gulls was unwelcome and control measures were implemented in 1991 by the Port of Bellingham. Unfortunately, many gulls were injured and the control proved only partially successful. The current status of the gull colony and controls are unknown. The rip-rap around the Georgia Pacific waste water pond provides haulout areas for harbor seals and occasional California sea lion.

BELLINGHAM BAY WATERSHED SUMMARY and RECOMMENDATIONS

The Bellingham Bay watershed is an area of marine, shoreline and upland habitat. The existing upland and shoreline area represents the most degraded habitat value in the City and is limited by residential and industrial development. The marine habitat represents a vast area of significant value in the region. As a multijurisdictional area, management of the bay and its wildlife requires serious cooperation by all regulatory agencies. Wildlife consideration has lacked the cooperative management attention needed for preservation of the resources. The primary recommendation for this watershed is to evaluate, enhance, restore and monitor.

In 1988, the U.S. Environmental Protection Agency analyzed available data from systematic sampling of Bellingham Bay. High levels of chemical and bacterial contamination, eutrophication and related adverse biological effects were found. In order to correct the degraded environmental condition of the Bay a multiagency and citizen task force was brought together to devise an action plan. The Bellingham Bay Action Program: 1991 Action Plan (Jacobson and Canterbury, 1991), outlines a six-point action plan resulting from the task force's recommendations and is designed to improve the environmental quality of Bellingham Bay. The six points of the plan include: planning and program development, pollution control, remedial action, sampling and monitoring , resource protection and education. Although the Action Plan does not specifically address the management of wildlife, it does discuss the contamination of the food chain which has a direct effect on the ecological condition of the bay and the health of its associated vertebrate fauna. The Action Plan outlines an ongoing process in which wildlife could be incorporated and addressed. It is recommended that this Action Plan be implemented and perpetuated.

Further contingency planning and response consideration is needed for oil and toxic spills. The presence of large quantities of toxic substances at industrial and terminal sites, and transported by rail along the marine shoreline is reason to monitor and refine response plans so that wildlife is protected. The City, the Department of Ecology, Port of Bellingham, Burlington Northern, Georgia Pacific, Maritime Contractors Inc., Alaska Marine Highways and other major shoreline users should be involved in response planning and wildlife protection.

Evaluation of the existing and potential shoreline and upland habitats is needed. This evaluation should include a feasibility study to restore and enhance the marine bluff habitat; an assessment of the shoreline for habitat enhancement opportunities, abatement of impacts and naturalization; identification of structural habitat locations; Creation of fresh water opportunities; and a map of existing habitat and enhancement sites.

Backyard sanctuaries, street trees and enhancement of publicly owned facilities would provide small habitat islands throughout the watershed. Although this approach is suboptimal for most terrestrial species, birds do benefit. The development of a wildlife enhancement manual for households as well as businesses would assist in facilitating enhancement of this watershed. Educational information tailored to the local landscape features, target species and habitat opportunities would be helpful. The manual could provide suggestions for established sites and new construction and include preferred native and non-native plants, structures, designs and material sources using local material sources.

T38N/R2E/S24

This section is within the Squalicum Watershed primarily, however the upland falls within the Eldridge neighborhood, including a portion of the marine bluff. The habitat value of this area is limited. Habitat opportunities are restricted to yard vegetation, the approximate 2 acres of bluff and vacant lots. There is a tremendous need for street trees, schoolyard habitat enhancement and backyard sanctuaries. Fresh water is available from Squalicum Creek, but the upland areas habitat value would be increased if fresh water was readily available elsewhere, i.e. birdbaths, small ponds and the creation of a park with habitat including water and vegetation. The Columbia Elementary school yard could be utilized for wildlife enhancement project and involve the students and neighbors in year-round wildlife and nature education activities.

The contiguous bluff-line continues from the Squalicum Creek corridor, southeast to Broadway. This area consists of intact and disturbed vegetation, as bluff-top residents have cleared for views of the bay. This has resulted in fragmentation of the vegetative cover and de-valued habitat. **Restoration of the bluff's native vegetation and replanting of some trees is needed.**

T38N/R2E/S23

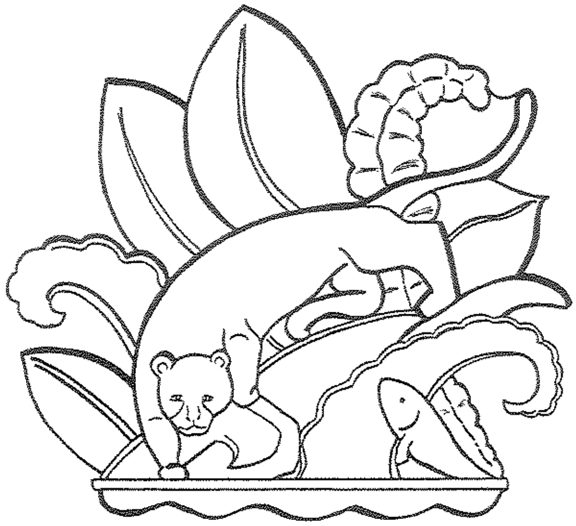
Although the upland area in this section lies within the Squalicum and Little Squalicum Watershed, the marine bluff, shoreline, intertidal and subtidal areas are a part of the Bellingham Bay Watershed. The habitat attributes of this area are described, in part, in the Squalicum Watershed section of this document and the Little Squalicum Beach Environmental Assessment (Huxley, 1988).

The marine bluff is an important habitat feature as it extends west, uninterrupted, to the Nooksack River and its delta. The bluff is bisected by the Burlington Northern railroad which runs parallel and, by fragmenting the habitat, creates a barrier to certain species and diminishes the function and attributes of the habitat. This bluff line is frequented by small passerines, crows, bald eagles, gulls and occasional peregrine falcons and other raptor species.

Of particular value is the relatively natural, rocky beach and subtidal marine waters which provide important habitat for diving birds, and shoreline opportunists such as gulls and bald eagles. Shorebirds may also use the shoreline and intertidal area. Double-crested cormorants are reported roosting on the pipeline, numbering up to 600 (Wahl, unpub. data). Common loon, western grebe, scoters, goldeneye, mergansers, bufflehead and oldsquaw are observed wintering from nearshore to deeper waters offshore.

Wildlife control and deterrent measures including power pole spikes, roof-top wires and other poorly designed devices need to be evaluated for injury potential and replaced with functional and preferably beneficial alternatives. Posing injury to wildlife in the name of management is not in the public's best interest, particularly if the species affected has endangered or threatened status.

A multitude of species and habitat issues need to be considered for the long-term maintenance of species diversity and viability in and around Bellingham Bay, particularly the marine area and shoreline. Due to the complexity and volume of these issues, it is recommended they be further identified and discussed in a cooperative Bellingham Bay wildlife habitat enhancement and protection plan.



PART VI

BELLINGHAM WILDLIFE and HABITAT PLAN

WILDLIFE HABITAT PLAN

INTRODUCTION

The presence of wildlife in and around Bellingham is an important feature of the area and an integral part of the City's livability. No other comparable City in Western Washington harbors the rich habitat and abundant wildlife as Bellingham. From viable native salmon returns of the Chuckanut, to peregrine falcons hunting over downtown and beaver lodges along the Squalicum, Bellingham has reason to be proud of its wildlife heritage. The Wildlife Habitat Plan provides a non-regulatory guideline for the conservation and future enhancement of this natural heritage, including native fish, wildlife and their habitat throughout the City of Bellingham.

The most important element of the plan is to foster sound stewardship of the City's living resources. This will be achieved through enhanced cooperation, communication and conservation action. The plan will provide the means for City government, personnel, neighborhoods, businesses and citizens to work together toward a greater understanding and appreciation of our wildlife community. The Wildlife Habitat Plan is compatible with existing City policies and regulations.

Adoption of this plan will enable the City to comply with the wildlife requirements of the Growth Management Act and qualify for Urban Wildlife Habitat Account funding through the Washington Wildlife Recreation Program and other sources. The Plan also lists those significant habitat areas identified through the City's assessment process. By targeting these areas of significant habitat the City lays the foundation for long-term planning for habitat acquisition and protection necessary for the perpetuation of viable wildlife populations.

PLAN GOALS AND OBJECTIVES

GOAL 1: PROTECT AND ENHANCE WILDLIFE HABITAT

Ensure a City-wide system of public and private open space which maintains or improves the quality of wildlife habitat in the City of Bellingham.

Objectives:

1. Preserve and acquire public open space in order to achieve a City-wide network of connected corridors and blocks of land as wildlife habitat.

2. Preserve wildlife habitat through a cooperative effort between the City, developers, and property owners prior to and during the review process for subdivision, planned contracts and shoreline, wetland/stream and clearing permits issued by the City of Bellingham.

3. Preserve existing vegetation in site planning, and where revegetation is required, utilize native plant landscaping in order to provide wildlife habitat to the greatest degree feasible.

4. Identify and protect a habitat base necessary to maintain current species diversity within the City and Urban Fringe, including native forests, particularly mature forest communities, fallow fields, wetlands, lakes, streams, shorelines, estuaries, marine areas, and any biologically unique plant communities.

5. Identify and protect Priority Habitats as defined by the Washington Department of Fish and Wildlife.

6. Enhance degraded habitats or viable linkages in fragmented habitats either by the property owner if it is a new development, the City if it is public land, or by voluntary action by a group or individual.

GOAL 2: PROTECT AND ENHANCE WILDLIFE HABITAT ALONG SHORELINES, INCLUDING MARINE WATERS AND FRESHWATER LAKES, PONDS, WETLANDS STREAMS AND RIPARIAN AREAS.

Protect and enhance water resources, recognizing them as among the most valuable wildlife resources in the City of Bellingham.

Objectives:

1. Develop a City-wide habitat network to include functional interconnected corridors which utilize riparian/stream corridors, ridgelines, upland reserves, wetlands, lakes, streams, and marine shorelines.

2. Continue preservation and management of regulated wetlands and streams in the City of Bellingham in accordance with Ordinance No. 10267 in order to achieve a no-net-loss, and overall increase of function and habitat value of these areas.

3. Preserve and restore riparian habitat along the City's major streams and significant tributaries, recognizing its value as habitat to fish and wildlife. Whenever possible improve salmonid habitat, and strive to establish the largest riparian corridor possible, recognizing that width, length and connectivity are critical factors for wildlife utilization and survival.

GOAL 3: PROTECT AND ENHANCE NATIVE WILDLIFE POPULATIONS

Protect and enhance wildlife populations in the City of Bellingham, especially those of local significance.

Objectives:

1. Adopt the Washington State Department of Fish and Wildlife's Priority Habitat and Species Program recommendations as guidelines.
2. Identify and maintain current species diversity within the City on a watershed basis.
3. Identify species of local significance for protective management consideration.
4. Maintain a wildlife inventory.
5. Refer to the Wildlife and Habitat Assessment in the land use planning process to determine where development and other land activities would best be located to protect wildlife populations.
6. Acquire or otherwise preserve significant parcels, as identified in the Wildlife and Habitat Assessment, that support native wildlife.
7. Develop incentives for private property owners to preserve habitat through conservation easements, dedication, or other mutually beneficial mechanisms.
8. Adopt a policy for wildlife protection in the City and coordinate enforcement with City, county and state officials.
9. Maintain a no hunting/trapping policy within the City and extend it to developed Urban Fringe areas.

GOAL 4: DEVELOP AND IMPLEMENT A WILDLIFE PROGRAM CONTAINING TECHNICAL AND EDUCATIONAL COMPONENTS

Develop a Wildlife Program to include City staff and volunteers in an effort to best maximize existing local resources.

Objectives:

1. Appoint a wildlife program specialist to coordinate and manage wildlife resources in the City. The specialist would serve as a technical and educational resource and coordinate City wildlife management, education, conservation and enhancement projects.

The specialist would build public-private partnerships for wildlife protection and enhancement, and serve as liaison to other resource agencies.

TECHNICAL

2. Maintain a City habitat/wildlife database with baseline, inventory, and current monitoring information. Add to the database when land is annexed to the City.

3. Provide wildlife planning and management expertise for citizens, businesses, and for projects requiring City approval.

4. Coordinate with Parks & Recreation and Planning and Community Development Departments in the acquisition of land for wildlife habitat.

EDUCATIONAL

5. Promote volunteer involvement and participation in wildlife program and projects.

6. Develop educational workshops for City personnel, decision makers, schools and the general public.

7. Encourage individuals and neighborhoods to develop and maintain backyard sanctuaries. Demonstrate to and encourage developers, schools and public facilities to landscape for wildlife whenever possible.

GOAL 5: ADOPT POLICIES THAT FACILITATE WILDLIFE AND HABITAT PROTECTION AND ENHANCEMENT

Adopt new policies and use existing ones that aim to protect and enhance wildlife and habitat in the City of Bellingham.

Objectives:

1. Designate a responsible City division or department to manage wildlife resources and oversee the Wildlife Program.

2. Implement a standard method of wildlife and habitat assessment when reviewing land use proposals. The Rapid Wildlife and Habitat Inventory Process (RWHIP) is recommended for its cost efficiency and reliable results.

3. Integrate Habitat Conservation Goals and Objectives with open space and Greenway plans to further protect viable habitat areas and functional corridors.

4. Establish an acquisition fund for the purchase of habitat. These funds are needed for fee simple acquisitions and for the purchase of easements or development rights and can be used as matching funds for Washington Wildlife Recreation Program grants.

5. Promote interdepartmental and interagency cooperation to protect wildlife.

6. Establish a system of project review whereby City staff with expertise in wildlife can advise on project designs or make recommendations to other City departments in order to protect or enhance wildlife and habitat.

7. Integrate street tree and other landscaping requirements with parks and open spaces landscape recommendations to increase the value of wildlife habitat.

SIGNIFICANT HABITAT CONSERVATION AREAS

Significant habitat conservation areas were identified through a City-wide wildlife and habitat assessment process. The assessment was based on existing information, aerial photo interpretation, expert testimony and limited field observation (see *Inventory by Watershed*).

The significant habitats of the City consist of both protected and non-protected areas. Recommended areas for protection, conservation or enhancement are identified within the text below. A map (Figure 11) illustrates these areas. This list is the most comprehensive at this point in time, however as new information becomes available, the importance of certain areas may be enhanced, and additional areas will likely be identified. For most habitat areas within the City species specific inventory data is lacking. With the application of more detailed information, the identification and protection of the most significant sites could be achieved with the necessary supporting data. In order to proceed with conservation planning and action, further study of the proposed protected areas should include: wildlife species occurrence, seasonality, habitat characteristics, conditions, land ownership and regulatory limitations.

Following are those areas identified as significant habitats within the City.

Chuckanut Creek: The total length extending outside of the City and major tributaries needs protection to maintain water quality and sustain present native fish and wildlife communities. This includes in-stream habitat, riparian areas and upland interface where possible. A portion of the stream is protected through Arroyo Park. Stormwater runoff from I-5 needs evaluation. Chuckanut is the most viable salmon stream in the City and harbors the greatest potential for enhancement to fully restore native salmon and steelhead populations. Attributes include: in-stream and riparian habitat is relatively intact and water quality good, riparian and upland habitat corridors, presence of species of concern and locally significant species, wildlife species richness, bald eagle roost, anadromous and resident fish populations, the only City stream with returning native salmon fish stocks.

Chuckanut Bay: The total area of the bay and its shoreline needs protection in and outside the City. The inner Bay and Clark's Point are currently protected. Recreational boating activities are causing disturbance to wildlife throughout the bay. Shoreline development is also encroaching on shoreline and near shore habitats. Water quality of residential runoff and creek input require monitoring. Attributes include: the largest estuarine habitat area in the City, eelgrass meadow, rocky shore, shoreline cliffs, some forested shoreline with snags, inner bay marsh, species richness and diversity, resident endangered, threatened and candidate species, and species of local significance present.

Clark's Point: The Point is one of the most important habitat areas in the City. Under permanent protection by a conservation easement the Point is still inhabited by the Clark family, but its resources are protected under an conservation easement and monitored by the Whatcom County Land Trust. Although protected, threats remain including fire, overuse by the public, trash and disturbance to wildlife. Also, connectivity to the mainland is limited, with existing corridors reduced to the shoreline and a thin bluff-line corridor. Restricted access and corridor enhancement are needed. Attributes include: intact upland mature conifer forest with snags, natural shoreline habitat, shoreline cliffs, unique plant community, resident endangered, threatened and rare species, presence of species of concern and species of local significance, last remaining fully forested marine shoreline in the City.

Interurban 100 Acre Woods: The total area is significantly valuable habitat which is currently in the planning stages for a major residential development. Preservation of wetland and upland habitats, as well as the Interurban corridor are necessary for the function of this area to support current species composition, which require both wetland and terrestrial habitats. Attributes include: significant intact wetland/upland complex, the greatest diversity of amphibians in the City, species rich and abundant breeding and resident birds, red fox and other uncommon medium-small mammals, a Sitka spruce community (rare within the City), fawning areas, presence of species of concern and species of local significance, major corridor connecting Padden and Chuckanut watersheds.

Hoag Lake: The total lake area, adjacent forest and forested corridor to Interurban and possibly Padden Creek need protection from encroaching development. Attributes include: lacustrine habitat with emergent vegetation, intact riparian area and forested corridor, waterfowl, wood ducks, resident fish population.

Padden Creek: The total length of the creek is significant, from Lake Padden west to Bellingham Bay. The eastern segment of the creek is a particularly significant wildlife corridor and gorge habitat area of potential species richness and diversity with extensive contiguous upland mature forest, and little disturbance. The western portion, although altered, remains a valuable riparian corridor and aquatic habitat feature where it remains exposed. Protection is afforded to segments through parks and greenways. Enhanced riparian habitat protection is needed. Water quality improvement is imperative. Future restoration of culverted sections is also advised. This re-opening of the stream course or recreating a new course would improve the stream for all wildlife. Attributes include: a major urban stream, aquatic and riparian habitat, sections of multi-layered forest habitat abundant and diverse bird occurrence, valuable raptor habitat, some resident and anadromous fish, on-going salmon enhancement projects, major corridor function.

Lower Padden Creek & Padden Lagoon: The total creek and lagoon area, associated wetland, riparian and immediate upland areas are valuable wildlife habitat and park. All of the creek area is protected as a park and greenway. The lagoon is currently undergoing vegetative restoration on the south side and needs further restoration on its north side. The gravel parking area adjacent to the creek corridor is of value as open habitat and should be reseeded in native grasses; this area serves as a very important buffer to this segment of stream. Attributes include: valuable wetland, stream and riparian habitat, estuarine lagoon, resident and anadromous fish, avian species rich area, occurrence of species of concern.

Padden Creek Gorge: The eastern segment of Padden Creek, located between Lake Padden and I-5 is a significant stream corridor, gorge and upland forested area. This is an extremely valuable contiguous habitat reserve area, with uplands, ridgeline and riparian corridor, which tie directly into the lake Padden Park open space. The gorge is a unique feature which is both undisturbed and a potentially species rich area given habitat structure and diversity. Attributes include: intact stream and riparian corridor, good water quality, unique gorge habitat feature with potential for unique associated species, large contiguous mature forest habitat area, species rich and diverse area. This area requires thorough biological study.

Lake Padden: The total lake area and adjacent uplands are significant habitat and protected as park/open space. The forested uplands constitute the largest protected open space area within the City. Recreational development around the lake includes golf course, ball fields, swimming area, shoreline picnic sites and play areas, which have altered the natural habitat and removed the once extensive marsh habitat. Restoration of portions of the lake's shoreline and riparian areas is needed. Expansion of the protected open space area should include needed habitat corridors, west along Padden gorge, north to Samish Hill and east to Galbraith Mountain. Attributes include: extensive contiguous mature conifer forest habitat, forested wetlands, snags, resident threatened (nesting)candidate and monitor species as well as species of local significance, full complement of forest associated species (high diversity and richness), designated priority habitat, seasonal waterfowl concentrations, sensitive amphibian habitat (Our Lake).

Samish Hill: Significant hilltop forest habitat constituting one of the largest contiguous forested areas in the City extending into the County to the east. Targeted Greenway corridor and valuable habitat reserve area. Attributes include: contiguous forest and wetland habitat complexes, habitat bridge between two watersheds, head waters of Lincoln Creek, talus caves, wetland and forest wildlife communities including species of concern and species of local significance.

Sehome Arboretum: Total area protected with the exception of small peripheral lots which are needed in the reserve to maximize area. The Arboretum is a high priority area due to its isolation. It is in serious need of at least one functional habitat corridor connection to allow the immigration and emigration of individuals in order to perpetuate terrestrial wildlife populations. Attributes include: extensive mature forest reserve, species rich and abundant breeding and resident avian populations, roost locale for raptors, occurrence of species of concern, native plant reserve, past comprehensive inventory data available.

Connelly Creek: The creek corridor and associated open space forms a partially protected reserve and corridor area extending from the base of Sehome Hill south to Padden Creek. The Connelly Creek Natural Areas constitutes the core of the reserve, with a significant area of open space remaining unprotected. Attributes include: the second most significant fallow field habitat areas in the City, one of two known native Sitka spruce communities in the City, natural stream corridor with on-going fish enhancement projects, diverse avian species, frequent raptor utilization and possible nesting, coyote denning and abundant small mammals, occurrence of species of concern.

Lake Whatcom: Largest natural lake in Whatcom County and extensive freshwater habitat with historical accounts of avian abundance and richness. Tributaries to the lake are utilized for spawning by cut throat trout and kokanee. Preservation and restoration of these vital stream habitat areas is critical. Development of the lake's shoreline, loss of shoreline marshes, riparian habitat and use by recreational boaters and jet ski's has likely contributed to the decline in wildlife occurrence around the lake. However, with the year-round presence of common loon and possible nesting of this species may represent remnants of historical populations. The lake and shoreline requires further wildlife inventory, monitoring and conservation of sensitive areas. Restoration of the lakes' shoreline vegetation was identified as a priority enhancement area. Maintenance of the Lake's water quality is vital to both human and wildlife health.

Silver Beach Creek: A tributary to north Lake Whatcom, containing valuable in-stream and riparian habitat. Good fish habitat and spawning habitat. Valuable lake-riparian-upland habitat linkage and corridor.

Geneva Creek: Outside City boundary, but included in the Bellingham Parks and Open Space Plan due to its ownership by County Parks. A tributary to Lake Whatcom with intact riparian habitat and adjacent upland cover. Valuable lake-upland corridor in need of protection upstream from park boundary in order to maintain corridor function and habitat value overall. Bald eagles are observed here regularly during winter.

Scudder Pond: Lake-side marsh, lake out-fall and head of the Whatcom Creek corridor. The marsh is protected in part and held in ownership by North Cascades Audubon Society. Important and uncommon wetland habitat with a resident beaver population, abundant bird life including threatened and locally significant species. Open space or vacant lots adjacent to the wetland and stream corridor, particularly where bald eagles are currently nesting, need protection.

Whatcom Creek: From Lake Whatcom west to Bellingham Bay, Whatcom Creek is in need of in-stream and riparian restoration, enhancement and protection. A segment of the creek from the lake through Whatcom Falls Park is protected from development but has suffered cumulative impacts by recreationalists. Whatcom Creek has the potential to be a wildlife showpiece for the City if the return and perpetuation of native species is the guiding principle applied in the restoration and development of this corridor. Greater riparian buffers, revegetation with native species and trees, de-channelization, spawning area creation (side channels) and storm water abatement is needed to maximize the creek's habitat quality and function. Attributes include: a stream corridor utilized regularly by aquatic, semi-aquatic and avian species, including threatened, endangered and monitor species, anadromous and resident fish populations, presence of a significant associated wetland (largest in the City), associated large mature forested area, unique gorge habitat, existing riparian area with a high degree of restorative potential, and a high quality natural feature in the heart of the City.

Park and Hannah Creeks: The upper Hannah Creek watershed is an intact unprotected forest reserve spanning hundreds of acres and extending into the Lake Whatcom watershed and south into the Padden Watershed. This forested upper watershed area is critically important in the maintenance of water quality downstream, air quality and genetic diversity within the City. Protection of a substantial contiguous area is needed to maintain the forest community. Attributes include: a large mature forest reserve and associated wildlife community, stream/riparian corridor, good water quality, ridgeline corridor, abundant snags and large stumps, abundant pileated woodpeckers, species rich area, excellent connectivity.

Cemetery Creek: The upper Cemetery Creek watershed is an extensive forest reserve contiguous with the higher elevation headwaters of Lincoln, Park and Hannah Creeks. This forested upper watershed is critically important to downstream water quality and stream conditions. As the upper-middle watershed becomes more developed, water quality has been degraded and higher peak flows have resulted in scouring and erosion downstream. North of Lakeway Drive both the east and west forks of Cemetery Creek flow through forested corridors. The east fork flows through Bayview Cemetery with narrow riparian cover, but the west fork flows through a wide forested corridor which was established when the adjacent subdivisions were approved. The two forks converge near the confluence with Whatcom Creek. Upstream of this spread out in braided channels which are part of an undisturbed forested wetland system. An 11 acre development near the E. fork of Cemetery Creek will likely result in construction of an east-west connector road (Fraser Street) bisecting this otherwise continuous corridor.

In addition to the attributes listed for Hannah, Cemetery Creeks lower reaches are in relatively good condition, it provides braided channels, good fish habitat, forested wetlands with mixed deciduous/coniferous cover and provides a corridor to the upper forested watershed and Whatcom Creek which if restored and expanded would serve as an important wildlife linkage between the Whatcom Falls forest reserve and the upper watershed.

Lincoln Creek: Upper Lincoln Creek ties into the expansive Samish Hill forest reserve. This is an important natural area necessary to maintain water quality of Lincoln Creek and support resident and anadromous fish populations as well as providing a corridor for wildlife. The mouth of Lincoln Creek provides an important spawning area and refugia for resident fish.

Railroad Trail Greenway: A Greenway trail corridor extending from I-5 to Whatcom Falls Park serves as one of the few remaining open space features in the more densely developed older neighborhoods. While much of the trail is surrounded by streets and homes, it is narrowly lined with trees in parts and flanked by City acquired open space in others. The trail, although only a narrow corridor in some areas, has associated open water and forested wetlands, fallow fields, forests and potential for acquisition of additional open space. The trail passes Roosevelt Elementary School and over the Fever Creek Detention Dam. The detention basin was converted to 1.75 acres of open water wetland and 1.5 acres of vegetated upland now known as the Fever Creek Wildlife Pond. There Fever Creek flows through the adjacent forest and is partially diverted into the pond. A 3.5 acre forested wetland to the south of the trail in this vicinity was dedicated to the City but development proposals threaten to diminish the surrounding open space. Native trees and shrubs should be retained and augmented as buffers to this trail corridor.

The corridor extending north from Whatcom Falls Park, is the only north-south habitat corridor in the City. Development adjacent to the corridor threatens to severely limit it function and value for wildlife. Greater protection and expansion of this corridor is needed and should be a priority area. Attributes include: proximity to Roosevelt Elementary School, City ownership, Fever Creek Wildlife Pond and associated uplands, connection with Greenways on Alabama Hill and to Whatcom Falls Park.

Squalicum Creek: The total creek area and undeveloped floodplain provides the most significant habitat within the Squalicum Watershed. This riparian/fallow field/forest habitat extends northeast linking into Dewey Valley and north to King Mountain, forming an extensive and diverse habitat area. Attributes include: anadromous and resident fish populations, good riparian and some spawning habitat, viable and active beaver complex, extensive fallow field/wet meadow habitat, common snipe breeding areas, upland mature forest blocks, safe passage under I-5, avian species diversity and richness, species of concern present.

Squalicum floodplain: The eastern segment of Squalicum Creek, up to and beyond the City boundary, is a valuable habitat area consisting of wet meadow, fallow field, shrub scrub and riparian habitat. With the exception of established parks, the area is zoned industrial. This are is a critical habitat link and needs immediate protection if Squalicum Creek is to continue as a salmon bearing stream and high quality wildlife corridor. Attributes include: the largest fallow field habitat area in the City, forested wetlands, wet meadow, riparian and shrub habitats, the only common snipe breeding site in the City, abundant small and medium mammals, vital corridor leading to county and uplands, raptor hunting area, avian diversity.

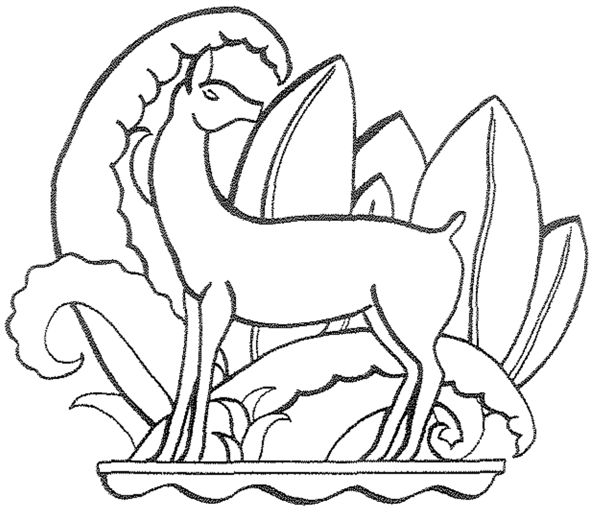
DNR lands: Identified in Bellingham Parks and Open Space Plan, these lands form a contiguous forest corridor northeast along the Squalicum Creek through the Dewey Valley. Important habitat reserve for the Squalicum Watershed.

Squalicum/Mt. Baker Uplands: Extensive forested area, currently undergoing major development. Important reserve area and habitat linkage from Whatcom Watershed to Squalicum Watershed. This area requires greater review and planning for wildlife corridors and habitat reserve.

Little Squalicum: Significant marine shoreline-upland habitat interface. Attributes include: natural area and park of early successional forest, shrub and riparian habitat; provides a natural corridor inland from shoreline; diverse avian species; species of concern include endangered, threatened and candidate species occurrence.

Marine Bluff: The historical marine shoreline bluff remains today as a relatively natural corridor parallelling the developed shoreline extending from north to south Bellingham. Although lacking formal protection, the bluff maintains a natural quality that could be enhanced for habitat and aesthetic value. Attributes include: connectivity, valuable habitat utilized by endangered, threatened and monitor species, diverse avian species, corridor function for a variety of small and medium mammals as well as deer, aesthetically pleasing open space in an urban area.

Bellingham Bay: The Bay harbors significant marine and shoreline habitats. The shallow shore and deep off shore waters provide valuable wintering habitat for some the largest concentrations of diving birds in Puget Sound. It also is habitat for year-round habitat for a variety of marine birds, shorebirds and mammals. Important marine migratory and resident fish populations. Abundant bivalve and crustacean. Endangered and threatened raptors frequently hunt or forage along shoreline area as do candidate species such as harlequin ducks. Water quality must be protected by treatment of stormwater runoff into the bay and enforcement of existing regulations governing industrial discharge and shoreline uses.



PART VII

LEGAL STRUCTURE *for* WILDLIFE and HABITAT PROTECTION

LEGAL STRUCTURE FOR WILDLIFE & HABITAT PROTECTION

"various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern for conservation"

Endangered Species Act, Sec. 2.(a)(1)

INTRODUCTION

This chapter examines federal, state, and local laws that regulate fish and wildlife resources and their habitat. Under each level of government the discussion includes a general description of wildlife and habitat goals and major laws and how they pertain to the protection of these resources. Because tribes share co-management responsibilities for fisheries and wildlife with the state, tribal involvement in habitat protection is also discussed. An attempt has been made to include all key authorities and describe enforcement and applicability of the laws at the local level.

Enforcement response to a potential violation of a fish or wildlife protection law is a shared responsibility at all levels of government. State and federal wildlife enforcement agents, fisheries patrol, county sheriff, state patrol and local police are all ex-officio fish and wildlife enforcement agents or deputies for their sister agencies. The initial response to a violation usually results in the responding enforcement personnel requesting assistance from the appropriate agents who may then take the lead.

In order to limit this section to wildlife law, regulatory structure and enforcement, non-regulatory programs are presented in the following section. Both sections are divided into four parts, federal, tribal, state and local, with laws and programs arranged in alphabetical order under each heading.

FEDERAL LEGISLATION, REGULATION AND POLICY

Wildlife is a public resource. Through an evolutionary process, the laws governing wildlife have placed the responsibility of stewardship into the Public Trust. This process begging in Rome when wild animals, *ferae naturae*, were the property of no one, progressed to the King's power over wildlife in a system of royal forest laws, to the Magna Carta and Parliamentary control over wildlife, until the British laws gave way to state sovereignty following the American Revolution. Today federal wildlife law continues to evolve providing the framework on which the States wildlife management authority is built.

THE LACY ACT OF 1900

The oldest national wildlife law regulates the importation, exportation, shipment and interstate wildlife trade and commerce. This law, although nonessential in relation to the GMA, it is significant historically and continues as the primary wildlife trade law cited today. Interestingly, the most important purpose of the Lacey Act was to supplement the State laws for the protection of game and birds. In order to bolster state wildlife laws, the Lacy Act sought to prevent game from being shipped into a state in order to circumvent prohibitions on the sale of local game killed in violation of a state's laws (Bean 1983). As a result of the Lacy Act and earlier case law, the states gained management control of their native wildlife resources.

MIGRATORY BIRD TREATY ACT OF 1918

Although the title implies a limited application, the Act applies to most indigenous bird species occurring in the United States (as described in 50 CFR Part 10 of the general provisions.) (note: English Sparrows and Starlings are exempt from protection under Washington State Game Code) The Act is the oldest wildlife protection law by restricting the "taking" or killing of migratory birds, and is still actively cited today. The Migratory Bird Treaty Act declares it unlawful to:

pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer for sale, offer to barter, barter, offer to purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or caused to be carried, or receive for shipment, transportation, carriage, or export any migratory bird any nest, or eggs of any such bird...this also includes birds in danger of extinction, and their environment...

In short the Act prohibits the "taking" (capturing, killing, or collecting) of any bird, its nest or eggs.

The penalty for a take is a misdemeanor, upon conviction of which could be a fine not more than $500 and or imprisonment not more than six months. The penalty for a take with intent to sell or to sell or barter any migratory bird is a felony, with a resulting fine of no more than $2,000 and or imprisonment of no more than two years.

The Migratory Bird Treaty Act is the most commonly cited federal wildlife law and the easiest to enforce according to the USFWS enforcement personnel. Cases originating in Whatcom County have been tried recently as the 1980's.

The Migratory Bird Treaty Act allows for a legal taking through a permitting process or regulated season and provides for the States to do the same within the provisions of the Act.

International agreements further the conservation of migratory birds through treaties and conventions with Canada, Great Britain, Mexico, Japan and the Soviet Union. These agreements parallel the Acts terms and provisions.

Locally occurring native birds, migratory and nonmigratory, are protected under this law. Destruction of nests, eggs or chicks is prohibited by this law and must be enforcemed. Nests can be located anywhere including man-made structures. Clearing vegetation, particularly logging during the breeding season, is a violation of the act if nests, eggs or young are destroyed.
The Migratory Bird Treaty Act is enforced by USFWS Enforcement Division. Washington State Game Code furthers the purposes of the Act under RCW 77.16.120, however the state law is infrequently cited by enforcement, opting instead for the federal law which carries more significant penalties.

ENDANGERED SPECIES ACT OF 1973

The purpose of the Endangered Species Act is to identify and protect the ecosystem upon which endangered and threatened species depend and to provide a recovery plan for restoring the species populations to self-sustaining numbers. The act also authorizes actions to achieve the purposes of the various international treaties and conventions to which the United States is signatory for conservation of endangered and threatened species (PSWQA 1990).

Following two previous versions, separate Acts from 1966 and 1969, the 1973 Act surpassed the inadequacies of the previous Acts by providing protective provisions earlier, to consider all phyla of animals and plants and to base conservation on a ecosystem approach (Bean 1983). The 1973 Act builds its program of protection on three fundamental units, including two species classifications "endangered" and "threatened," and a classification of geographic area as "critical habitats." The philosophical scope of the 1973 Act was also broadened by stating that endangered "*species of fish, wildlife and plants are of aesthetic, ecological, educational, historical, recreational and scientific value to the Nation and its people.*"

SInce 1980, almost 100 species have been added to the federal endangered species list, and approximately 400 others have been listed as threatened. The act defines "endangered species" as: "*...any species which is in danger of extinction throughout all or a significant portion of its range...*" A threatened species is defined as "*...any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.*" The act requires the Secretary of the Interior to determine whether a species is endangered or threatened on the basis of five factors, including past and threatened future habitat destruction or modification, inadequate enforcement of laws and regulations, and other natural or manmade factors.

The act sets forth detailed procedures and timetables for determining whether a species is endangered or threatened and for designating areas of its range as critical habitat. Such determinations must be made on the basis of the best scientific information available. Areas cannot be excluded from critical habitat on economic grounds if this if this would result in the extinction of a listed species. The act also requires the formulation of recovery plans for each listed species, with priority given to species most likely to benefit from such plans. The act requires the Departments of Interior and Agriculture to carry out a program to conserve fish, wildlife and plants including (but ont limited to) those which are endangered or threatened, through land acquisition and other means.

The act directs the USFWS to cooperate to the maximum extent practicable with the states on carrying out the provisions of the act. It also recognizes that states have authority to conduct their own endangered species programs as long as they are consistent with and exceed the purposes and policies of the act.

The act requires all federal agencies to use their authorities to further the purposes of the act. Federal agencies must also insure that none of their actions jeopardize the continued existence of any listed species, or destroy or adversely modify critical habitat, unless an exemption has been granted. Federal agencies, the states and individual permit applicants may apply for an exemption to the act if they can satisfy certain stringent requirement. As a result the act has led to a steady and significant increase in interagency consultations on projects with potential impacts on listed species. It has also changed the focus of wildlife management in federal wildlife refuges and national forests so that nongame species are better protected.

The fundamental flaw in the implementation of the Endangered Species Act is the single species approach rather than the intended ecosystem approach. Ecosystems nor associated habitats are protected. Due in part to the cumbersome procedures for designating critical habitat, there are no such federally designated habitats in Washington for any listed species.

Based on the best available current information, the following list of species known to occur in Whatcom County which are federally listed endangered, threatened, or candidate (non-fish) species:

<u>Endangered</u>
Gray Wolf *(Canis lupus)*
Peregrine Falcon *(Falco peregrinus)**

<u>Threatened</u>
Bald Eagle *(Haliaeetus leucocephalus)**
Marbled Murrelet *(Brachyramphus marmoratus)**
Grizzly Bear *(Ursus arctos horribilis)*
Northern Spotted Owl *(Strix occidentalis caurina)*
Steller sea lion *(Eumetopias jubatus)*

<u>Candidate Species</u>
Red-legged frog *(Rana aurora)**
Cascades frog *(Rana cascadae)*
Spotted frog *(Rana pretiosa)*
Harlequin duck *(Histrionicus histrionicus)**
Northern goshawk *(Accipiter gentilis)*
Townsend's big-eared bat *(Plecotus townsendii townsendii)**
Fisher *(Martes pennanti)*
Wolverine *(Gulo gulo)*
Lynx *(Lynx canadensis)*

*= species known to occur in Bellingham
see the State Law Section for the Washington State Endangered Species

Local Applicability/Enforcement

Within the boundaries of the City of Bellingham endangered and threaten species reside. Without a city wide wildlife inventory, however it is not possible to determine the presence of T&E species occurring within specific areas.

Enforcement of the Endangered Species Act is the responsibility of USFWS Enforcement Division. However, management decisions are the responsibility of USFWS wildlife biologists and to a limited degree a shared responsibility with WDW wildlife management. When T&E, proposed or candidate species or their habitat is potentially at risk, USFWS and WDW should be consulted.

BALD EAGLE PROTECTION ACT

Federal protection specific to eagles, both bald and golden, was the result of an act of Congress in 1940. Following 1962 and 1972 amendments the act is an interesting mix of restrictions, penalties and exceptions.

The act restricts the "take" of any eagle, dead or alive or any part, nest or egg thereof. However, exception is made through a permitting process for the taking, possessing and transporting of eagles for scientific, exhibition, religious purposes by Indian tribes or falconry uses.

Civil penalties for each violation under the act will not exceed $5,000 and/or imprisonment for one year. Additionally, any holder of a federal grazing permit will automatically loose that permit if convicted of violating the Bald Eagle Protection Act. An incentive is offered to informants whose information leads to a conviction. The informant will be paid fifty percent of the fine or up to $2,500.

Since 1940, the Secretary of the Interior has listed the Bald Eagle as and endangered species in all but five of the lower 48 states. It was recognized that the eagle population was in jeopardy and recovery could not be assured without habitat protection afforded by the Endangered Species Act.

Responsibilities for eagle management amd recovery fall to the State and are outlined in the Washington State Bald Eagle Protection Rules.

Local Applicability/Enforcement

The Bald Eagle Protection Act applies to migratory, resident and breeding bald eagles and their habitat in the Bellingham area.

Enforcement response may occur at the federal, state and local levels, but ultimately the enforcement of the Act i.e., the laying of charges, is the responsibility of the U.S. Fish and Wildlife Service. If an incident occurs locally Bellingham Police immediately inform Washington State Wildlife Enforcement Agents and U.S. Fish and Wildlife Enforcement Agents, both of which maintain offices in Bellingham.

FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act of 1958 requires that fish and wildlife conservation receive equal consideration with other features of federal water resource development projects. It also requires federal agencies proposing or authorizing projects that control or use the waters of any waterbody, including wetlands, to consult with the USFWS and state fish and wildlife agencies. In conduction such projects, the act requires the responsible federal agencies to adequately provide for the "conservation, maintenance and management of wildlife resources and its habitat, including the development and improvement of wildlife resources," The act also directs the Secretary of the Interior to recommend mitigation measures to lessen the impacts of water resource projects on wildlife resources. These recommendations must be given full consideration on project plans. however, agencies often reject habitat protection measures because the costs of mitigation exceed the benefits derived by avoiding losses to wildlife resources.

The act authorizes federal agencies to modify water resource projects or acquire land in order to develop or improve wildlife resources and " assure for the public benefit the wildlife potential of the particular area." The Secretary of the Interior either solely or jointly with fish and wildlife agencies, would acquire these lands for the conservation, maintenance and management of wildlife resources and habitat. Lands having value to migratory bird species may be given to the state agency having jurisdiction over such species.

The act authorizes the Secretary of the Interior to investigate and report to Congress on the effects of a broad variety of pollution sources affecting wildlife, including sewage, mining petroleum and industrial wastes, erosion and silt "and other polluting substances." One of the strengths of the act is that it provides a powerful tool for interagency coordination because it encompasses all forms of wildlife. For example, the act requires consultation with the USFWS and state fish and wildlife agencies on the wildlife impacts of virtually any federal or federally permitted project affecting water resources.

Local Applicability/Enforcement

The Act requires consultation with the USFWS and state fish and wildlife agencies on the wildlife impacts of virtually any federal or federally permitted project affecting water resources.

NATIONAL ENVIRONMENTAL POLICY ACT

Congress enacted the National Environmental Policy Act (NEPA) in 1970. NEPA was originally proposed as an amendment to the Coordination Act, but became an independent directive to all federal agencies to evaluate, through the preparation of detailed environmental impact statements, the impacts of all major actions "significantly affecting the quality of the human environment" (Bean 1983). It is the " best known, the most written about and surely the most litigated federal environmental statute ever enacted" (Bean 1983). NEPA is also one of the most important statutes for the protection of wildlife.

The broad scope of NEPA recognizes "the profound impact of man's activity on the interrelations of all components of the natural environment." In addition it sets forth to " promote efforts which will prevent or eliminate damage to the environment and biosphere," to "create and maintain conditions under which man and nature can exist in productive harmony," to " fulfill the responsibilities of each generation as trustees of the environment for succeeding generations," to "preserve important....natural aspects of our national heritage and maintain wherever possible an environment which supports diversity," and to " enhance the quality of renewable resources."

The purpose of NEPA is "to ensure that environmental considerations are considered and weighed appropriately in government planning, policy making and action." The preparation of the EIS must describe the anticipated effects of the proposed action, any adverse environmental effects that cannot be avoided and proposed alternatives to the action. Also included must be a discussion of the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity as well as, any irreversible and irretrievable commitments of resources that the proposed action would entail.

One of the act's most important effects is that it provides substantial opportunities for the public to review and comment on actions by federal agencies that have significant environmental impacts. Federal agencies are required to circulate NEPA documents for review and comment to federal, state and local environmental agencies as well as to the President , the Council on Environmental Quality and the public. Federal agencies are also required to formally respond to all comments received on EISs.

Local Applicability/Enforcement

NEPA applies to all proposed federally funded projects in Bellingham. The lead agency is usually that agency issuing the permit(s) for the project be it the city, state, port, federal government. The review process is much like SEPA and involves public notification, hearings and EIS for those projects determined to have a potential impact on the environment. Enforcement of NEPA is a function of peer agencies and the public who may formally appeal during the NEPA process.

MARINE MAMMAL PROTECTION ACT

The purpose of this act is to prevent marine mammal species from diminishing below their optimum sustainable populations. The act also calls for measures to be taken to replenish populations that have already so diminished. In particular, Congress called for efforts to protect "the rookeries, mating grounds, and areas of similar significance for each species of marine mammal from the adverse effect of man's actions..." The act has curbed the deliberate commercial exploitation of numerous marine mammal species, which has resulted their recovery and expansion of their populations in Puget Sound.

An amendment to the act provides for issuance of incidental "take" permits and according to the National Marine Fisheries permits are issued for local use by the fishing industry and results in occasional seal carcasses washing up on county beaches and the frequent discharging of firearms from fishing boats during season openings.

The act does not explicitly require habitat protection, despite a statement in the preamble stating the need to protect areas of significance to marine mammals. As a coastal community it is important that Whatcom County assess its marine mammal population, be it transient or resident, and identify significant marine and shoreline habitats for protection.

Local Applicability/Enforcement

Bellingham Bay is an ecologically significant component of the inland marine ecosystem. Bellingham's constructed and natural shorelines alike provide haulouts for harbor seals, sea lions and potential denning sites for river otter. The bay serves as a foraging area for harbor seals, river otter and occasional transient whale and porpoise. Any shoreline or waterfront project plan should first identify and accommodate marine mammal haulouts or provide mitigation for lost habitat.

Enforcement of the Marine Mammal Act the responsibility of NOAA's National Marine Fisheries Service. An enforcement office is located in Bellingham.

THE MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT

The Marine Protection, Research and Sanctuaries Act of 1972 gives the Secretary of Commerce authority to designate areas of ocean waters as marine sanctuaries in order to preserve their conservation, recreational, ecological or aesthetic values. The act provides funding to NOAA to develop comprehensive management plans for the proposed sanctuaries. Various activities may be regulated or banned in order to afford this protection, including shipping and oil and mineral exploration and extraction. Commercial and recreational fishing may also be regulated in marine sanctuaries if necessary to protect existing resources. Enforcement of the act is the joint responsibility of NOAA and the Coast Guard.

The 1987 reauthorization of the Marine Protection, Research and Sanctuaries Act directed NOAA to begin formal consideration of the Northern Puget Sound for future designation as a marine sanctuary.

Local Applicability/Enforcement

The significance of the currently proposed sanctuary is that it may include Bellingham Bay's waters and shoreline. City participation in the sanctuary process is strongly advised.

CLEAN WATER ACT, SECTION 404

Section 404 of the Clean Water Act is the principal federal statute protecting waters of the United States from dredging, filling, or other construction. The 1977 amendments to the act clarify that the act applies to all navigable waters of the United States and wetlands adjacent to those waters. The intent of the program is to protect water quality by regulating the discharge of dredged or fill material into waters and wetlands. The program is guided by formally published regulations and policies which are the jurisdictional responsibility of the Army

Corps of Engineers.

Local Applicability/Enforcement

Permit applications under Section 404 of the Clean Water Act must first conform to EPA's 404 (b)(1) guidelines. The application is then circulated to local, state and federal fish and wildlife agencies, tribes and the public for additional review prior to issuance. If the proposed project violates any state water quality standards the permit will not be issued.

Terrestrial habitats important to the protection of fish and wildlife resources (such as riparian areas) do not fall under Section 404 jurisdiction. The Corp's jurisdiction stops at mean high water of tidal areas and ordinary high water in non tidal areas. If wetlands are adjacent to the regulated waters, they may also be in the Corp's jurisdiction.

Enforcement of Section 404 is the responsibility of the U.S. Environmental Protection Agency. Enforcement, however, is limited due to lack of resources. Violators are usually allowed to file after the fact permit applications.

TREATY TRIBES

Federal judicial decisions over the past decade and a half have established the right of Western Washington treaty tribes to 50 percent of treaty area salmon and steelhead runs. Puget Sound Indian tribes assert that their treaty right to harvest half of the fish resources, which was recognized in *United States v. Washington* ("Boldt I"), implies a right to prevent degradation of the fish habitat. These decisions give tribal governments strong interest in Puget Sound fish and wildlife habitat protection including water quality and water rights issues.

In 1974 tribal governments began to put considerable effort into improving their own fisheries management capacity. Each tribe has on staff professional fisheries managers, biologists and in some cases geologists and wildlife biologists. With the assistance of their professional staff the tribes routinely comment on development proposals, hydraulic project approvals, Section 404 permit applications, shoreline permits among others. As participants in Washington's Timber, Fish and Wildlife Agreement, tribes take an active role in the review of forest practices applications. Although, the focus of project review is primarily on water quality and fish habitat, there exists an overlaying benefit for some wildlife species.

Tribal nations are autonomous. They have established and maintain a constitution, decision making policies, management of their land and resources. Wildlife is managed as a resource on tribal lands, yet, the tribes take great interest in the protection and perpetuation of native wildlife populations.

Local Applicability

The Lummi Nation and Nooksack Tribe as representative of the local indigenous society are interested in and should be informed of and voluntarily involved in wildlife and habitat protection plans within the City.

NATIONAL WILDLIFE REFUGE SYSTEM ADMINISTRATION ACT OF 1962

The precedent for establishment of a National Wildlife Refuge System was set in 1903 with the designation of Pelican Island, Florida as a game refuge. The act consolidated all of the wildlife or game refuges, ranges and such areas under one system managed by the U.S. Fish and Wildlife Service and in some cases jointly managed with the Bureau of Land Management. The refuges are managed for wildlife and public use benefits, as long as public use is compatible.

Lands are added to the system in one of two ways: the Secretary of the Interior may acquire lands for inclusion in the system under various forms of statutory authority, or Congress may pass legislation designating a specific area as a refuge. Funding for the refuge system and acquisition of new lands is derived primarily from the Migratory Bird Conservation Fund and the Wetlands Loan Act.

Numerous National Wildlife Refuge sites (primarily seabird rookeries) are located in neighboring San Juan and Skagit Counties, two small refuge sites are located near Bellingham Bay.

OTHER FEDERAL LAWS PERTAINING TO WILDLIFE/HABITAT

Clean Water Act, Section 404 (refer to wetlands section)
Electric Consumers Protection Act
Executive Order #11988 (Floodplain Protection)
National Forest Protection Act
National Wilderness Preservation Act
Northwest Power Planning Act
Sikes Act, 1974 Amendments
Wild and Scenic Rivers Act

STATE LAWS

This section reviews Washington State statutes and regulatory code that pertain, either directly or indirectly, to fish and wildlife management and/or habitat protection. The Washington Departments of Wildlife and Fisheries have the key responsibility for species management, yet hold very limited authority over habitat.

Together they implement the State Hydraulics Code. Other agencies play important roles, and while none co-lead a single program as do Fisheries and Wildlife, most implement more than one habitat related program or review and comment on other agencies' permit applications. Thus, the sheer number of agencies and programs involved in habitat protection has resulted in a complex and serious effort on the part of hundreds of state employees to carry out their agencies' statutory mandates to protect fish and wildlife and certain habitats.

WASHINGTON STATE GAME CODE

The body of laws governing Washington's wildlife resources are stated in the Washington Administrative Code (WAC) Chapter 232 and the Revised Code of Washington (RCW) Title 77, better known as the Game Code.

WASHINGTON STATE DEPARTMENT OF FISH AND WILDLIFE

note: The Washington Department of Wildlife was merged with the Department of Fisheries in 1994 to form the Department of Fish and Wildlife (WDFW). Due to the recent merger and reorganization that is underway, the following section will likely be somewhat outdated in the near future. Reference to both WDW and WDFW is made interchangeably throughout this document.

The Department of Game was established in 1933 as the States' game management agency. The department was later renamed in 1987 to the Department of Wildlife to reflect its commitment to all wildlife in the state. The Game Code of Washington defines the Department of Wildlife's specific responsibilities and legal parameters for meeting their mandate. Among the responsibilities of the Washington Department of Wildlife (WDW) their primary function is to preserve and protect the state's wildlife, and wildlife habitat. This includes all birds, mammals and game fish along with all those marine, estuarine, fresh water and terrestrial animal species not classified for human consumption. The Washington Wildlife Commission is an appointed citizen board that functions to review and update the department's goals and objectives and sets hunting, fishing and trapping seasons and provide a link between the general public and the department. The commission's primary objective is to maximize hunting and fishing recreational opportunities.

An integral program under the WDFW is the Nongame Program. The mission of the nongame program is to preserve, protect, perpetuate and enhance the nongame wildlife and habitat resources of the stat for the benefit of present and future generations. The responsibility of the nongame program is primarily to identify, inventory and monitor sensitive wildlife species. The program goals include: identification of nongame species and acquire a knowledge of their numbers, distribution, habitat requirements, natural history and ecology; preserve natural habitats and native nongame wildlife species at self-sustaining levels and thereby perpetuate the diversity of wildlife in the state; Provide for the public eduction and enjoyment of nongame wildlife while ensuring minimal impact in the resources.

An integral instrument to the growth management mandate and the identification of critical wildlife areas, is the PHS database. This database incorporates the nongame database with the Washington Natural Heritage Program information and other sources, and has served as the foundation for local identification of the critical wildlife habitat. Data systems staff are integrating various source information, updating and mapping priority habitats and species locations for each region in the state. In addition management recommendations for priority habitats and species have been complied and distributed by WDFW's Wildlife, Fish and Habitat Management Divisions.

WDFW lacks legislative authority to protect wildlife habitat, except for Bald Eagle management areas, refuges and other specifically protected publicly owned lands. The Department frequently makes habitat protection recommendations through the TFW process, SEPA and GMA, yet actual protection can only be achieved through voluntary action by the landowner or through acquisition of the habitat.

The structure of the WDFW includes six divisions including:

-Administration
-Engineering and Lands
-Habitat Management
-Wildlife Management
-Fisheries Management
-Enforcement

The WDFW is represented state wide within six management regions. Bellingham is located in Region 4. The Region 4 office is located in Mill Creek, Washington. Although the Mill Creek office is two counties away, a local presence of WDFW staff exists. Several enforcement agents and biologists reside and work locally for the department. The central administrative office of WDFW is located in Olympia.

Priority Habitats and Species (PHS)

The Washington Department of Fish and Wildlife has defined species and habitats of concern as part of the 1991 Priority Habitats and Species Program (PHS). The definitions and criteria under the PHS program are as follows.
Priority Species:

- Priority species are wildlife species of concern due to their population status and their sensitivity to habitat alteration.

Priority Species Criteria:

1) Species determined to be in danger of failing, declining or vulnerable due to factors such as limited numbers, disease, predation, exploitation or habitat loss or change. These are both state listed and state candidate species for endangered, threatened and sensitive classification .

2) Uncommon species, including Monitor species, occurring in forest environments and that may be affected by habitat loss or change and uncommon species occurring in urban growth areas that are vulnerable to urbanizing influences.

3) Species in forest environments for which the maintenance of a stable population and surplus for recreation may be affected by habitat loss or change and for species in urban growth areas with a high public profile that are vulnerable to urbanizing influences.

State Classifications For Priority Species Include:

- *State/Federal Endangered*
- *State/ Federal Threatened*
- *State/Federal Candidate (for endangered, or threatened status)*
- *State Monitor*

All wildlife including priority species occurring within the State of Washington is divided into two categories as follows.

- *Game: those species subject to hunting and fishing regulations and managed for recreational use.*

- *Non Game: those species which are not hunted or fished* (however, numerous species can be killed or collected under special federal or state permits).

Priority species include all T&E species, candidate and selected monitor game and nongame species. There are twenty "PHS" species known to commonly occur in Bellingham.

Priority Habitats are areas with one or more of the following attributes and are protected to varying degrees:

- *comparatively high wildlife density*
- *high species richness*
- *significant wildlife breeding habitat*
- *significant wildlife seasonal ranges*
- *significant movement corridors for wildlife*
- *limited availability and/or high vulnerability*

Six of the ten priority habitats described by WDFW are known to occur in Bellingham. Their location, area and local importance is described in the Watershed Inventory. The critical habitat areas identified by WDFW mainly consist of wetlands, riparian areas and UNOS areas within the city; these will serve as one layer of site specific information considered in the process of determining local critical habitat areas.

PHS habitats, species, management guidelines and mapped sites will be an integral part of Bellingham's critical habitats and species identification and designation process as well as Bellingham's Wildlife Program functions.

WASHINGTON DEPARTMENT OF FISHERIES

*NOTE: with the merger of the Departments of Fish and Wildlife, the following elements of the fisheries department have become incorporated in the larger resource agency, the Washington Department of Fish and Wildlife.

The mission of the Department of Fisheries is to preserve, protect, perpetuate, manage, and enhance the food fish and shellfish resources of Washington. The management of commercial salmon, wild and hatchery stocks, is a primary responsibility of the Fisheries Department. With management goals shifting toward protection of wild stocks, it is reasonable to assume that streams bearing naturally reproducing salmonids will require greater protection, both in terms of habitat protection, water quality and water quantity.

The primary authority of the WDF for habitat protection is the shared administration and enforcement of the Hydraulic Code with WDW.

The Habitat Management Division is responsible for the protection of salmon, other food fish and shellfish in their natural habitat and for the improvement and maintenance of the habitat. Implementation of the Hydraulic Code, fish passage maintenance and improvement, habitat surveys and enhancement, and production evaluations are examples of habitat management activities (WOFM, 1988).

The Puget Sound Marine Fish Program emphasizes research , management and conservation of baitfish and ground fish in Puget Sound. Most of the work in this division of WDF is monitoring fishery resources for both recreational and commercial interests. Research activities include the identification of natural habitats and regulatory recommendations for the protection of these habitats particularly in nearshore areas such as eelgrass and kelp beds.

WDF has been directed by the Governor's Executive Order on Wetlands (signed April 21, 1990) to protect fish life by assuring protection for the value and function of wetlands by adding conditions to or denying HPAs to the fullest extent of WDF's authority. WDF must show that any alteration to a wetland has a positive impact on fish life.

Local Applicability/Enforcement

WDF operates a fish hatchery in Whatcom Falls Park, and cooperates in the operation of a the fish hatchery at the Maritime Heritage Center. The coho salmon raised at the Whatcom Creek hatchery suffer a high mortality rate nearly every year. The suspected cause is poor water quality (e.g., toxic contaminants) in Whatcom Creek (PSEP 1991).

With the presence of regulated streams within the city of Bellingham and the majority fish-bearing (to some degree) it is imperative for the City to cooperate with the State to ensure the continued health and future enhancement of our fisheries resource. Such cooperation could be in the form of the development and implementation of a fisheries management plan for Bellingham.

Enforcement for the Department of Fisheries is now performed by the Department of Fish and Wildlife Enforcement Division. However, the State Patrol and the Bellingham Police are Ex-Officio fisheries officers.

WASHINGTON ENDANGERED SPECIES PROGRAM

The Washington Department of Fish and Wildlife (WDFW) Nongame Program is responsible for reviewing species for endangered or threatened status in the state, monitoring their status and their recovery progress. A species in the state **endangered** category is seriously threatened with extirpation throughout all or a significant portion of its range within Washington. A species classified as **threatened** is not presently endangered but could be in the foreseeable future. All federally endangered or threatened species that occur in Washington are automatically included on the state's endangered and threatened lists and are protected by state as well as federal law. The goal of the listing process is to develop recovery plans to restore the species' populations to self-sustaining levels.

To initiate management efforts before a species becomes threatened with extirpation from the state the department has established an additional classification: **State Monitor**. These species receive active management consideration. Monitor species warrant research efforts to determine life history information and habitat requirements in order to maximize effective management and avoid listing.

Currently twenty-one species are classified as endangered and seven are listed as threatened in Washington State. Recovery efforts for these species involve all natural resource agencies, tribes, certain landowners, organizations and private citizens.

Following are the species from Washington State Species of Concern List which occur in the City of Bellingham:

<u>Endangered</u>
Peregrine Falcon *(Falco peregrinus)*

<u>Threatened</u>
Bald Eagle *(Haliaeetus leucocephalus)*

<u>Candidate Species</u>
Common Loon *(Gavia immer)*
Harlequin Duck *(Histrionicus histrionicus)*
Marbled Murrelet *(Brachyramphus marmoratus)*
Vaux's Swift*(Chaetura vauxi)*
Pileated Woodpecker *(Dryocopus pileatus)*
Purple Martin *(Progne subis)*
Pacific Western Big-eared Bat *(Plecotus townsendii townsendii)*

<u>Monitor Species</u>
Species native to Washington State that are vulnerable or declining are likely to become endangered or threatened in a significant portion of their range state wide are in review by the Department of Wildlife for designation as sensitive. Sensitive species are legally designated in WAC 232-12-011.

Local Applicability/Enforcement

The WDFW is responsible for writing and implementing recovery plans for those species listed as endangered or threatened only. In addition to the recovery plan, site specific management plans are prepared for all bald eagle nest sites, communal roosts and peregrine eyries. The plans serve as cooperative agreements with land owners to ensure the protection of the site and associated habitat.

In Bellingham the known sites of an endangered and threatened species are protected from private development. However, site management plans are currently in draft by the WDFW.

BALD EAGLE PROTECTION RULES

In 1986, WDW adopted rules (WAC 232-12-292) pursuant to RCW 77.12.655 to protect Bald Eagle habitat and thereby increase and maintain its populations in Washington. The ultimate goal of the rules is removal of the eagle from the endangered species list. This is accomplished by writing and implementing an effective species recovery plan which includes promoting cooperative management for site-specific eagle habitat through a process that is sensitive to landowner concerns.

The rules define several vital Bald Eagle habitat elements, including communal roost sites, nest and perch trees and nest sites. When a proposed land use activity involves land containing or adjacent to an eagle nest or communal roost, the permitting agency must immediately inform WDW of the permit application. Activities that may have adverse habitat impacts include land clearing, construction, land conversion and application of pesticides. If WDW finds that the actively will adversely affect eagle habitat, the department actively negotiates workable site specific guidelines with the landowner and the permitting agency as part of the eagle management plan.

Many factors are considered in developing a site management plan such as, relative ecological quality of the site, the ability to effectively manage the site to maintain suitable habitat, proximity to food, the history and density of eagle populations in the area, and the degree of threat. Each management plan is tailored to the specific site and to potentially disturbing activities. Each plan is subject to periodic review and may be altered in response to changes in eagle or landowner circumstances.

Local Applicability/Enforcement

Two active Bald Eagle nests are known within the boundaries of the City. Each nest should have an eagle management plan, however, currently neither have plans, due in part to one nest's recent discovery and the other nest's current protection within a City park.

Enforcement of the State Eagle Protection Rules usually involves coordination between state and federal enforcement agents.

HYDRAULIC CODE RULES

The Hydraulics Code is administered by Washington Department of Fish and Wildlife. Under the Hydraulic Code Rules, approval is required from the WDFW for certain activities involving those state waters that support fish life. This permit is commonly termed a hydraulic project application (HPA). Approval is required for ". . . any person or government agency desiring to construct any form of hydraulic project or other work that will use, divert, obstruct, or change the natural flow or bed of any river or stream or that will utilize any of the salt or fresh waters of the state. . . ."

The purpose of the rules is to protect fish life. WAC 220-10-030 (11) states: *A hydraulic project approval will be denied when, in the judgment of these departments, the project is directly or indirectly harmful to fish life unless adequate protection, mitigation, or restoration can be assured by conditioning the approval or altering the proposal.* The rules contain strong provisions for civil and criminal penalties. They also list typical provisions that may be used to protect fish life and may set timing for construction, designate construction methods, specify design criteria, and place other restrictions on the proposed hydraulic project. The rules specify that loss of habitat is unacceptable without complete compensation.

In the process of reviewing permit applications and issuing permits, local WDFW habitat managers accomplish a considerable amount of informal public education of individuals and government agency officials about fisheries resource protection. For example, they are active participants in the TFW process (discussed below), and they review forest practices applications. They also work with local citizen groups, providing technical advice and assistance in volunteer fish enhancement projects. HPAs are also generally subject to the State Environmental Protection Act (SEPA), but are exempt when no other agencies involved that have permits subject to SEPA.

<u>Local Applicability/Enforcement</u>

The Hydraulics Code only applies to areas up to the ordinary high water mark and permits can be conditioned or denied only for the protection of fish life and fish habitat.
HPAs primarily cover construction of in-water projects, not operations, and sometimes cannot cover in-stream problems. For example, even though an existing storm water outfall lies within the ordinary high water line of a stream, new storm lines up hill from the stream can be attached to the system altering the flow or quality of the water without the need of WDFW HPA approval. Direct outfall of storm water into Bellingham's streams is a major cause for intermittent pollution, sediment load and overflow and is not addressed by the HPA process.

Due to lack of agency resources, monitoring of compliance with permit requirements is sometimes lacking. However, the loss of two court cases on Lincoln Creek, the city's installation of countless culverts and outfalls, lost wetlands and the general condition of streams in Bellingham indicate the effectiveness of the hydraulics code and other State permits in the protection of fish habitat (Orrell 1980).

WASHINGTON DEPARTMENT OF NATURAL RESOURCES

The Department of Natural Resources (DNR) is the state's major owner of marine, intertidal and upland property. The properties are managed as a public trust. As the manager of these lands the DNR is responsible for commercial forest practices, state forest management, aquatic lands management, rangeland management, conservation of sensitive lands and meeting the fiduciary responsibility set forth in the trust mandate. Marine lands are managed for the maximum public benefit, while uplands are managed to provide revenue to the state's schools. The DNR served a vital role in the creation and implementation of the1986 Timber/Fish/Wildlife Agreement. In 1988, in conjunction with EPA, the Aquatic Lands Division of DNR carried out a pilot project to inventory near shore habitat, primarily salt marsh and kelp beds which are important rearing habitat for juvenile salmonids and many marine fish species. Under the Puget Sound Ambient Monitoring Program, DNR plans to expand this pilot program into a sound-wide program.

TIMBER, FISH, AND WILDLIFE

The Timber/Fish/Wildlife (TFW) agreement, initiated in 1986 and effective in 1987, was developed by state resource agencies, environmental groups, timber industry representatives, and treaty Indian tribes, and it represents an important step toward better protection and management of Washington's valuable forest resource. TFW has significantly enhanced cooperative resource management for forest practices, especially in the areas of fisheries habitat and water quality protection. TFW is now the major force in the management of forest resources on nonfederal lands in the state of Washington.

The TFW agreement provides a framework for cooperative management by bringing together landowners and resource managers from a variety of disciplines. To a large extent it has ended historic disagreement and litigation over forest management and environmental protection issues on state and private forest lands. The agreement has given state and tribal fisheries biologists and, to a lesser extent, wildlife biologists, increased influence in recommending habitat protection measures as a condition of approval of forest practice applications. Issues directly addressed by the agreement include riparian management zones (RMZs) to protect fish and wildlife habitat and water quality and upland management areas (UMAs) to protect wildlife habitat. Other forest practices with potential impacts on habitat, such as timber harvesting methods, road building and maintenance, unstable slopes, old growth, and cumulative effects, are also addressed.

Local Applicability/Enforcement

Due to the limited authority of TFW, it serves primarily as an advisory process. TFW participants review forest practice applications in the city and provide their comment and recommendations to both DNR and the city's planning department. This is the only mechanism for wildlife and habitat review prior to forest harvest with the exception of public comment. The comments and recommendations prepared by TFW wildlife biologists are vital to proper management of the harvest area, yet many times these suggestions are severely compromised.

FOREST PRACTICES RULES AND REGULATIONS

The Washington Forest Practices Act (RCW 76.09) and its implementing regulations, Chapter 222 WAC, authorized the development of statewide regulations and performance standards for forest practices such as road construction and maintenance, site preparation, and use of chemicals. The act also gave authority to the DNR to administer these regulations, and created the Forest Practices Board, an appointed body consisting of the Commissioner of Public Lands, an elected county official, six members of the public, and directors of the Departments of Trade and Economic Development, Agriculture, and Ecology.

The forest practices rules require that harvest and reforestation be accomplished to protect streambank integrity and stream temperature. Riparian management zones (RMZs) are required along fish-bearing streams and may include adjacent wetlands. Within RMZs trees must be left in specified numbers and sizes and in specified ratios of deciduous to coniferous trees. This is done both for wildlife habitat and to provide stream shading and an instream source of large woody debris which provides good fish habitat.

Certain methods of operation, such as felling or yarding, require a hydraulic permit (HPA) if done within the ordinary high water line and must be kept to a minimum within RMZs. Operators must also avoid disturbing habitat. If Ecology, WDFW believes that the law's water quality provisions are being violated, it may request that DNR issue a stop work order.

Forest practices applicants are encouraged to cooperate with the Department of Wildlife to identify critical wildlife habitats. They are required to consider reasonable means of protection for these areas during timber harvesting.

Many changes to the Forest Practices Act have been made recently and are included in the updated forest practices Rules and Regulations, Title 222 WAC. Effective August 1, 1992, the new rules provide increased environmental protection and requires forest land management through watershed analysis. However, the new rules, consistent with the old, lack directives for wildlife or habitat assessment or protection; this is with the exception of fish which are included in the watershed analysis.

<u>Local Applicability/Enforcement</u>

Forest practices within the city should be designated Class IV special, allowing the City to assume lead agency in review, conditioning and monitoring of the forest practice. Bellingham planning personnel have in the past thoroughly reviewed each forest practice application and actively conditioned applications as needed on a case by case bases. The City has demonstrated a leading role in the protection of ecologically sensitive areas through their direction of local forest practices. Identification of critical wildlife habitat will further the City's ability to effectively manage urban forest lands with respect to fisheries and wildlife resources.

Due to the continuing loss of forested habitat both in the City and its fringe, Bellingham must immediately identify the important forested habitat blocks and linkages both within and beyond the city limits, then work in cooperation with the County and DNR to protect and possibly procure those areas for the Public Trust.

WASHINGTON DEPARTMENT OF ECOLOGY

The Department of Ecology (DOE) is the state's primary environmental agency to manage, protect, and enhance the state's air, land, and water resources. The responsibilities and opportunities for protecting habitat are legislatively mandated as well as delegated by the federal government.

Section 401 of the Federal Clean Water Act

Ecology coordinates state review of all federal licenses and permits to certify that permitted discharges comply with the Clean Water Act. The Corps will not issue a Section 404 permit unless Ecology issues 401 certification that the proposed action will not violate state water quality standards. This section gives Ecology substantial authority to condition proposed projects to minimize water quality related habitat effects.

From a state standpoint, Section 401 could be an effective mechanism to protect those habitats subject to Corps permit requirements through the water quality certification process. However, state review under Section 401 is usually limited to an interpretation of water quality factors. This is a narrower interpretation of the CWA than that used by the federal agencies. For example, the 404(b)(1) guidelines provide strong guidance for protection of important habitats.

Local Applicability/Enforcement

The guidelines prepared by Ecology for evaluating certification requests do not provide guidance on habitat evaluation or protection.

SHORELINE MANAGEMENT ACT

Passed by the Washington State Legislature in 1971, the Shoreline Management Act (SMA) mandates development of local plans for all Puget Sound shorelines. It also establishes a state permit program for construction activities in and on shorelines of the state of Washington. In enacting the SMA, the legislature found that *"...the shorelines of the state are among the most valuable and fragile of its natural resources and there is great concern throughout the state relating to their utilization, protection, restoration, and preservation."*

Shoreline permits are required for certain activities that occur within 200 feet of the ordinary high water mark of waters of the state, which are streams and rivers with average flows greater than 20 cubic feet per second (cfs), lakes greater than 20 acres, and Puget Sound. Jurisdiction also extends to wetlands associated with the shorelines of the above waters. However, with SMA, jurisdiction is limited to shorelines of the state; the riparian areas and wetlands associated with smaller streams, lakes, and ponds are not regulated or protected under SMA.

Numerous activities in and on shorelines are subject to the act. All uses in the 200 foot zone must be consistent with the local SMP, but not all have to get the permits. Activities exempt from the permit process include: Developments valued at less than $2500; Maintenance and repair of existing structures; construction of single family bulkheads; construction and practices necessary for farming, agriculture, and ranching; construction of single family residences; construction of federal facilities; and clearing of single family lots on shorelines of the state.

The SMA establishes a cooperative state/local administrative process. Lead responsibility rests with local governments. They are required to develop shoreline master programs (SMPs) for all shorelines within their jurisdiction. SMPs must comply with state guidelines and are subject to review and approval by Ecology. Each SMP includes a shoreline inventory and classification of shorelines based on a hierarchy of appropriate uses. For example, the act provides for a designation of certain sensitive shoreline areas as natural or conservancy areas. Such designation can bring about some protection of important saltwater shoreline and riparian habitats. The act also requires a balancing of shoreline development with habitat protection and other shoreline uses (e.g., public access).

Local SMPs are implemented through a permit system administered by local governments for certain shoreline developments. All "shoreline substantial development permits," (SSDPs) and exemptions are reviewed by Ecology to ensure consistency with provisions of the Act. The public and interested natural resource agencies must be notified of all applications for SSDPs and their comment must be considered in decisions regarding issuance of permits.

The act also sets forth a permit appeal process for citizens, citizen groups, and/or government agencies (including Ecology). Such appeals are heard by the Shorelines Hearings Board, a six member quasi-judicial body appointed by the governor. The Shorelines Hearings Board provides an important mechanism for independent permit review without court action.

The primary effect of SMA has been land use planning, not habitat or wetlands protection. Public access and water dependent developments are often favored over habitat protection. In addition, the majority of shoreline master programs do not reflect a current understanding or consideration of riparian habitat and wetland functions and values as they relate to aquatic and terrestrial wildlife.

Single family residence exemptions permit clearcutting, grading, and filling on shorelines of the state, although clearing on shorelines of statewide significance is limited to 30 percent of standing trees in any ten year period.

The SMA, its implementing regulations, and SMPs are frequently quite general in their policies and requirements. For example, most SMPs do not contain explicit policies stating fish and wildlife habitat protection objectives, or policies for mitigating effects to fish and wildlife habitats.

<u>Local Applicability/Enforcement</u>
Refer to local section, Shoreline Master Program.

STATE ENVIRONMENTAL POLICY ACT

The State Environmental Policy Act (SEPA) is modeled after the National Environmental Policy Act (NEPA) and has similar provisions and requirements. The SEPA rules are defined in WAC 197-11 and RCW 43.21C. The act is administered by the Department of Ecology, who publishes the state-wide SEPA register and a citizen guide to the SEPA process. SEPA applies to actions by all state and local agencies that have potential effects on the environment. In essence, it is an overlay law intended to infuse consideration of environmental protection into all levels of government decision-making.

SEPA sets a standard process for the evaluation and review of land use activities/projects by agencies and the public. Milestones along the SEPA process include: the initial review by the lead agency, threshold determination of significance or nonsignificance. A determination of significance initiates the environmental impact statement (EIS) process, which includes scoping, draft review, and final review. The act provides a reliable mechanism for public notification through weekly SEPA register publication and announcement of SEPA determinations in local newspapers.

Projects receiving a determination of nonsignificance may still be conditioned with mitigation requirements to protect habitat. Judgements about the adequacy of mitigation are largely at the discretion of local government staff. While some habitat impacts may be reduced or avoided through conditions for mitigation, many are not. As a result, permitted habitat losses have rarely been compensated for!

The SEPA rules provide clear authority to require mitigation as a condition of approval for any action subject to SEPA in order to minimize the environmental impacts of the action. This authority, based on a very broad definition of mitigation, represents a significant potential for habitat protection and restoration. Mitigation measures must be based on formally adopted policies, plans, or regulations.

Agencies may designate clearly mapped areas within their jurisdiction as "environmentally sensitive." In these areas, proposals that otherwise might have been exempted from SEPA, must undergo an environmental review.

Typically, evaluation of impacts to plants and animals has consisted of a general literature review of the region and a request for sensitive species information from WDW data systems. The lack of known occurrences of wildlife species and verifiable site specific information leaves the review open to speculation and generalization. Field surveys are needed to determine presence or absence of species and to evaluate the biological sensitivity of the site. The SEPA rules specifically state that - *The lead agency may require field investigation of research by the applicant reasonably related to determining a proposal's environmental impacts* (197-11-335). Lead agencies must acknowledge this informational gap and require the necessary field investigation. Attempting to determine the potential impacts of a project on wildlife is only possible if the species present are known. Basing determinations of significance or nonsignificance on unknowns is a potential violation of SEPA.

Categorical exemptions remove many actions from even threshold determinations including most forest practices and waste water discharge permits.

Local Applicability/Enforcement

Refer to Local Section, SEPA.

WATER POLLUTION CONTROL ACT

The state Water Pollution Control Act (RCW 90.48) prohibits the discharge of pollutants into state waters, except under certain permitted conditions. Waters of the state are defined as lakes, rivers, ponds, streams, inland waters, underground waters, salt waters and all other surface waters and watercourses within the jurisdiction of the state of Washington. The act also prohibits pollution that is detrimental or injurious to aquatic life or the general ecosystem.

The act is administered by Ecology, which has been delegated the federal authorization to issue National Pollutant Discharge Elimination System (NPDES) waste discharge permits and to enforce the provisions of the act. Ecology also has authority to levy civil penalties and recover monetary payment for damages involving the death or injury of fish, animals, vegetation, or other resources of the state.

Local Applicability/Enforcement

The enforcement of the Act is challenging and in certain situations impossible due to lack of staff and/or difficulty to trace point sources of pollution and prove the polluter's identity.

Citizen water monitoring programs will assure early reporting of spills or discharges and could assist in tracing pollution sources. Citizen monitoring is proposed as part of the Bellingham Wildlife Program.

MINIMUM WATER FLOWS AND LEVELS ACT AND SURFACE WATER CODE

Maintaining adequate levels and flows of surface and groundwater is critical in maintaining healthy freshwater ecosystems. The Minimum Water Flows and Levels Act as reauthorized in 1987 gives the Department of Ecology authority to establish minimum flows or levels for public waters to protect fish and wildlife resources, water quality, or recreational or aesthetic values of such waters whenever it appears to be in the public interest to do so. In addition, Ecology must establish minimum flows when requested to do so by the Departments of Fisheries or Wildlife, or when necessary to protect water quality.

The Surface Water Code of 1917 declares that water is a public resource, that diversion and beneficial uses of water are to be regulated under a permit system, and that the prior appropriation doctrine is the basis for allocating water in the state of Washington. Under the code all withdrawals of surface water must have a permit called a water right. The water right states the amount of water that may be withdrawn for a beneficial use. Ecology must deny a water right application when there is no unappropriated water in the proposed source, when the proposed use conflicts with existing rights, or when the proposed use "proves detrimental to the public interest." Whenever a permit is approved for a source for which minimum flows and levels have been determined and are in effect, the permit must be conditioned to protect minimum flows or levels.

Local Applicability/Enforcement

Ecology has inadequate resources to establish minimum flows on all streams and rivers or to monitor actual surface and groundwater withdrawals. In some areas, minimum flows have not been designated, and excessive and unpermitted withdrawals and drainage diversions jeopardize minimum flows needed to maintain fish and wildlife habitat. It was estimated that low stream flows due to drought conditions and high temperatures during the 1992 summer, could cause 75% of Bellingham's fish stocks to be lost (J. Johnston pers. comm.).

An additional problem locally is storm runoff creating flash peak flows which also threaten aquatic wildlife. The frequent extreme high/low flows occurring in most city streams must be addressed and corrected.

MANAGEMENT OF NONPOINT SOURCE POLLUTION

Chapter 400-12 WAC, Local Planning and Management of Nonpoint Source Pollution, was adopted in 1988 by the Puget Sound Water Quality Authority in cooperation with the Department of Ecology. The rule provides direction for local watershed planning and management activities in the 12 Puget Sound counties under the Nonpoint Source Pollution Program in the Puget Sound Water Quality Management Plan. Under this program a watershed ranking committee in each Puget Sound county has evaluated and ranked local watersheds to set priorities for future planning to reduce or prevent nonpoint pollution. Ranking was based on information on beneficial uses (including fish and wildlife habitat), biological conditions, and severity of water quality impairments. With funding provided by the Centennial Clean Water Fund, watershed management committees are developing action plans to reduce nonpoint pollution in the top ranked watersheds. Sources addressed may include stormwater runoff, on site septic systems, agricultural practices, and other sources. Most plans address habitat protection; however, nonpoint source pollution is difficult to correct or control particularly in storm water.

Local Applicability/Enforcement

Bellingham Bay and a portion of Whatcom Creek were identified as Impaired Waterbodies through the Washington Nonpoint Source Assessment and Management Program. These areas were determined by DOE as having not met Clean Water Act goals or state water quality standards. The major causes of impairment to these waterbodies were bacteria, thermal modifications and the removal of riparian vegetation (DOE 1989).

GROWTH MANAGEMENT ACT OF 1990

The Growth Management Act (SHB 2929) was enacted to ensure orderly growth in Washington's fastest growing counties through the adoption of local comprehensive land use plans and development regulations. Advisory goals to guide the formation of comprehensive plans are to: encourage concentrated urban growth and reduce sprawl, encourage efficient regional transportation systems, encourage availability of affordable housing; encourage retention of open space and recreational opportunities; and to protect the environment. Because it is among the state's fastest growing counties, Whatcom County and its cities, including Bellingham, are required to comply with the Act.

To preserve the natural environment, the Act defines environmentally critical areas with the provision that jurisdictions classify, designate and protect them. Critical areas are: wetlands, aquifer recharge areas, fish and habitat conservation areas, frequently flooded areas, and geologically hazardous areas. Bellingham is required to establish a set of classes or categories for each kind of critical area. Then the critical areas are to be inventoried and designated. Designation means, at least, adoption of an official policy statement recognizing the location and character of critical areas within the city. In 1991, Bellingham was required to approve interim development regulations that protect critical areas, by precluding incompatible land uses, and to eventually adopt final regulations.

Additionally, the Growth Management Act mandates Bellingham and Whatcom County to identify open space corridors within and between adjacent urban growth areas. The corridors must be useful for recreation, wildlife habitat, trails, and for connecting critical areas.

Minimum Guidelines for Classifying and Designating Natural Resources Lands and Critical Areas

In Section 5 of the GMA the legislature requested the Department of Community Development to develop guidelines that counties and cities could use to guide them in the classification of resource lands and critical areas. These give broad guidance with which local planners may work. By not being directive, the guidelines ensure that regional differences will be reflected in the designations. The guidelines direct planners toward data sources, and suggest criteria and factors to consider when classifying parcels.

Fish and wildlife habitat conservation areas means land management for maintaining species in a wild state in suitable habitats within their natural geographic distribution so that isolated subpopulations are not created. This does not mean maintaining all individuals of a species at all times, but it does mean cooperative and coordinated land use planning is critically important among counties and cities in a region. In most cases, intergovernmental cooperation and coordination will be imperative to assure that native species continue to thrive in their natural ranges throughout the state.

Below are excerpts from GMA stating the minimum guidelines and general requirements defining critical habitats under WAC 365-190-030.

> *Habitats of local importance include, a seasonal range or habitat element with which a given species has a primary association, and which, if altered, may reduce the likelihood that the species will maintain and reproduce over the long-term. These might include areas of high relative density or species richness, breeding habitat, winter range and movement corridors. These might also include habitats that are of limited availability or high vulnerability to alteration, such as cliffs, talus and wetlands.*
>
> *Species of local importance are those species that are of local concern due to their population status or their sensitivity to habitat manipulation or that are game species.*

Critical Areas are further described under WAC 365-190-080.

> *Fish and wildlife habitat conservation areas. Fish and wildlife habitat conservation means land management for maintaining species in suitable habitats within their natural geographic distribution so that isolated subpopulations are not created. This does not mean maintaining all individuals of all species at all times, but it does mean cooperative and coordinated land use planning is critically important among counties and cities in a region. In some cases, intergovernmental cooperation and coordination may show that it is sufficient to assure that a species will usually be found in certain regions across the state .*
>
> Fish and wildlife habitat conservation areas include:
>
> - *Areas with which endangered, threatened, and sensitive species have a primary association, including seasonal ranges and habitat which if altered, may reduce the likelihood that the species will maintain and reproduce over the long term.*
> - *Habitats and species of local importance*
> - *Commercial and recreational shellfish areas*
> - *Kelp and eelgrass beds; herring and smelt spawning areas*
> - *Naturally occurring ponds over twenty acres and their submerged aquatic beds that provide fish and wildlife habitat*
> - *Waters of the state*
> - *Lakes, ponds, streams and rivers planted with game fish by a governmental or tribal entity*
> - *State natural area preserves and natural resource conservation areas*

Considerations when classifying and designating habitat conservation areas include:

- *Creating a system of fish and wildlife habitat with connections between larger habitat blocks and open spaces*

- *Level of human activity in such areas including roads and recreation activities (passive or active recreation)*

- *Protecting riparian ecosystems*

- *Evaluating land uses surrounding ponds and fish and wildlife habitat areas that may negatively impact these areas*

- *Establishing buffer zones around these areas to separate incompatible uses from habitat areas*

- *Restoring lost salmonid habitat*

The proposed habitat network as described in the *Bellingham Wildlife Habitat Plan* contains nearly all of the elements described above for inclusion and considered in the designation of local critical habitat areas. The local identification, design and application of the habitat network will: address T&E species habitat protection; identify habitats and species of local significance (both aquatic and terrestrial); provide the habitat connections inherent in the design-including riparian systems; suggest functional buffers; and target all salmonid habitat.

The City would benefit from a two part classification scheme for designating critical wildlife areas. Part 1 would include agency species and habitat lists (i.e., PHS, nongame, natural heritage and federal T&E) that would serve as the primary species and critical habitats designation. Part 2 would include species and habitats of local significance. This second classification is the product of the current inventory of existing information and associated mapping. Combined Parts 1 and 2 will provide a list of Bellingham's Significant Habitats and Species. The proposed list od locally significant habitats and species for Bellingham appears in the *Historical Perspective* section of this document.

As mentioned before, field inventory by experienced wildlife biologists is necessary to verify existing conditions and species presence in addition to determining species abundance and distribution, which is currently unquantified for the City. The significant species and critical habitat areas identified in this document, will require field verification which would be an integral part of the proposed Bellingham Wildlife Program. Through this program critical habitat and species will be thoroughly documented and biodiversity can be protected City-wide.

It will be the responsibility of the City of Bellingham to designate, record, monitor and update the species lists, habitat maps and classification schemes over the long term. It is important that well trained staff are assigned to this task. Ongoing coordination with Whatcom County, WDFW, and USFS will also be essential.

LOCAL GOVERNMENT

CITY OF BELLINGHAM: City Code

Title 7 Laws Pertaining to Animals

Most of the laws in Chapter 7 involve domestic animals. The following are summaries of those sections in Chapter 7 that pertain to wild animal or wildlife. For full legal text, please refer to Appendix E., *City Codes.*

Enforcement of Title 7 is the responsibility of Animal Control Officers as defined in 7.08.350. Most cases involving wild animals the WDW enforcement agents are notified by local Animal Control officers or the Bellingham Police.

7.16.090 : Displaying any wild animal or bird from any business or home window is forbidden.

7.16.140: Trapping of animals other than rats and mice is unlawful unless a live trap is used.

7.16.150: Capturing and holding captive wild animals is unlawful except to return them to their native habitat or to allow them to recover from minor injury.
[Wildlife rehabilitation efforts are carried out primarily by the Bellingham-Whatcom Humane Society. Injured wild animals that end up at the Humane Society may be cared for there or transferred to other facilities. Wounded birds are often taken to local biologist and rehabilitation expert Lois Garlick. Animals whose condition requires extensive medical attention are sometimes transferred to the Sardis Animal Clinic]

7.16.160: Violation of federal and state laws related to songbirds, migratory birds, waterfowl or gamebirds may be prosecuted as a misdemeanor under this chapter.

7.16.190: Any person who hits or injures any animal on a public road must stop and render aid as is possible.

Title 10 Criminal Code

10.24.030: It is illegal to hunt in the city. It is unlawful to discharge a firearm, shoot a bow and arrow, or any other projectile from any device at a person, animal or bird within the city.

10.12.120: It is unlawful to lay out poison or leave out a poisonous substance in any form that injures or kill an animal. Poisoning animals and causing injuring is considered a class A misdemeanor.

LAND CLEARING AND VEGETATION PRESERVATION ORDINANCE

The purpose of the ordinance is to minimize the removal and disturbance of vegetation on planned project sites prior to development. The ordinance encourages the preservation of existing vegetation, with the aim of preventing clearing prior to the creation of a final site plan and issuance of building permits. On site native vegetation could be included in the final site and landscape plans and is encouraged for wildlife habitat. For subdivisions, vegetation would be preserved on lots until they receive building permits. This allows buyers of vacant lots to make their own choices about the vegetation. Effects of the ordinance will include the preservation of wildlife and fish habitat, reduction of soil erosion, and the maintenance of air and water quality. Violators are subject to fines, stop work orders, and restoration requirements.

Administration of this ordinance is through Bellingham Department of Planning and Community Development.

<u>Comments</u>

The ordinance may slow or reduce the displacement of wildlife from new construction sites. Impacts on wildlife maybe further reduced by retaining vegetated bands and clumps that will serve as habitat linkages to the larger city-county habitat network. **Clear policy is needed instructing landowners to retain habitat connectivity by leaving undisturbed tracks of vegetation in developing areas which will form corridors for wildlife.** Retained vegetation should be clearly presented in all development designs that involve sites with vegetative cover, particularly forested or natural areas of the city.

WETLAND AND STREAM REGULATIONS (Ordinance 10267)

The Bellingham City Council, on December 9, 1991, adopted the city's first wetland and stream regulatory ordinance in response to Washington State's 1990 Growth Management mandate. The intent of this ordinance is to protect, preserve, restore and enhance the streams and wetlands in the city of Bellingham and to acknowledge their value as an important natural resource providing numerous functions including fish and wildlife habitat. With the adoption of this ordinance, the City has committed to the No-Net-Loss of regulated wetland and stream functions.

The ordinance defines the physical parameters of regulated streams and wetlands such as, wetland categories, minimum area and criteria, delineation of wetland boundaries, buffers, and permit process, i.e., permitted uses, permit procedures, exemption, enforcement and conditional restoration, enhancement and creation guidelines. The functions of wetlands an streams are listed in relation to soil stabilization, surface and ground water flow, water quality, micro climate, flora and fauna habitat, recreation and open space.

A practical alternative test and a public interest test are included in the ordinance as a means to demonstrate that no reasonable alternatives exist for the proposed project location and design, and as a means of evaluating the projects potential impacts. The public interest test provides a means of evaluating proposed projects public benefit and potential environmental impact and identifying alternatives to avoid impacts. It is the City's PCDD responsibility to perform these tests based on the best available information. the public interest test specifies the factoring of fish and wildlife values, determining the probable impact of the proposed regulated activity and the health and welfare of plants, fish and wildlife and people. Predicting real wildlife impacts can only be accomplished using empirical data from the site in question. Failure to utilize such baseline information will render any determination of impacts as simple speculation nothing more.

Buffer standards for streams and wetlands are critical to wildlife survivability. Riparian habitat along streams and wetlands is considered the most important habitat for wildlife in Western Washington, refer to Part II for a description of riparian habitat function. Again, determining the adequacy of a buffer for wildlife is dependent on the species present and their habitat needs. The minimum wetland buffers defined in the ordinance "....." do not reflect the needs of the City's more common species. However it does allow for buffer increases to " protect identified function." The opportunity to provide adequate wetland buffers for wildlife is within the scope of the ordinance but lacks clear definition. However, reduction of buffers is defined. Regulated stream buffers are restricted by the ordinance to a 50' maximum. Considering the habitat requirements of many aquatic and terrestrial amphibians and mammals, 50 feet is inadequate. Part II of this document *Planning for Wildlife,* discusses riparian habitat function and stream corridor function in more detail.

Because the regulated streams are the major tributaries to the main streams including Squalicum, Whatcom, Padden and Chuckanut, these smaller streams serve as the critical link between the headwaters and mainstem. These mostly unnamed streams, ensure water quality from the headwaters, provide the majority of spawning habitat for anadromous species, and links riparian habitat to upland habitat areas serving as a natural corridor.

Permit exemptions is standard for public utilities and drainage facilities. This exemption holds far-reaching connotations. Surface water and stormwater runoff is directly routed to natural drainages and Bellingham Bay. The greatest source of non-point source pollution in Puget Sound is storm and surface water runoff. Providing exemption to this management practice directly conflicts with the intent of this ordinance.

The inventory of Bellingham's wetlands did not include wildlife data collection or habitat assessment. The recent watershed study for the City included in-stream and stream-side habitat descriptions and qualified habitat values, it did not however, involve any wildlife data collection. In acknowledgment of these gaps, the city in order to weigh wildlife value and function of a given stream or wetland will need to either conduct a city wide baseline inventory or implement standardized methods for site by site inventory. working from a baseline inventory would simplify and speed the process for both the city staff reviewing project proposals and for property owners who would likely be delayed otherwise.

Consideration of species specific habitat needs to be identified and addressed if current populations are to be preserved and are to thrive overtime. The ordinance requires a description of " predominate vegetative, wildlife and fisheries communities that utilize or occupy the wetland or stream," any relevant information or the presence of endangered, threatened, rare or sensitive species but fails to specify required field reconnaissance, using standard field method to collect or verify such information. The result could be information duplicated from previous documents, based on species/habitat associations with not field collection or information based on field collection using any number of techniques or methods, scientifically valid or not, or any combination of these. Similar to gaps in the SEPA process, permit review under this ordinance should include the documentation of on site species and habitats using standard methods and analysis.

Mitigation or replacement of stream and wetland function is a requirement under certain permit or enforcement conditions. Prior to approval of a mitigation project its plan must meet review based on shot and long range ecological impacts, lost resource benefits, size, type and location of wetland or stream, potential impacts within the watershed and effects on natural as well as human processes, excepted costs and success of mitigation. Mitigation proposals are required to include "a complete ecological assessment (flora, fauna, hydrology, functions etc) of the wetland/stream being restored..enhanced or created.." and provide detailed plans and schedules for the project. The question arises about replacement or enhancement of wildlife values on a proposed site. There is no documented proven method for ensuring successful colonization of a newly created site with the wildlife species lost or soon to be lost in the alteration or development of the original wetland or stream. Replacing the functions and values of a natural system is a bit like playing god. The complexity of these natural systems and the hundreds of species that may occupy stream and wetland communities require much scrutiny and technical assessment prior to making any attempts at duplicating their function or value. At best a proofing period should be included in the mitigation scheme so that once the replacement project has reached the function or value to replace the projected loss of the original site prior to its destruction.

Mitigation Banking is also a provision in the ordinance which if all alternatives for on-site mitigation fail.

OPEN SPACE PLAN

Bellingham's open space goals and plans are addressed in the Bellingham Comprehensive Plan, *Open Space Parks and Recreation.* The goals section recommends preserving existing vegetation, providing for wildlife movement corridors, and encouraging wildlife habitat. Also recommended is the preservation and/or restoration of open space along the city's major creeks. The document's plan section identifies priority buffers, edges, backdrops, and drainage courses that should be procured and preserved by the city, other public agencies, or private conservation interests.

Refer to the Comprehensive Plan for more details.

STATE ENVIRONMENTAL POLICY ACT

The Planning Department is the SEPA agency for the City of Bellingham and is responsible for reviewing SEPA checklists and making determinations on environmental impact from proposed private and public actions. Impacts to wildlife and habitat are considered on a case-by-case basis. No mitigation policies or environmentally sensitive areas directly applicable to wildlife habitat have been adopted. However, several suggestions are included in this document.

Review of the existing Environmental Impact Statements and planning documents revealed a lack of reports based on empirical data, particularly lacking are past scientifically credible wildlife studies. Despite SEPA requirements for full disclosure of impacts on "flora and fauna" at project sites, casual observations and duplication of lists containing those species expected to or thought to occur at the site in question, have sufficed for the majority of EIS's prepared for projects inside the city limits. The lack of required on-site study's or quantified biological assessments in the SEPA process has resulted in the actual impacts on existing wildlife left unaddressed. This is a serious gap in the SEPA process locally and can be easily remedied with the lead agency requiring an assessment of impacts based on site specific data prior to issuing its threshold determination. As stated in the SEPA rules *When there are gaps in relevant information or scientific uncertainty concerning significant impacts, agencies shall make clear the such information is lacking or that substantial uncertainty exists* (WAC 197-11-080 (2)),*If information on significant adverse impacts essential to the reasoned choice among alternatives is not known and the costs of obtaining it are not exorbitant, agencies, shall obtain and include the information in their environmental documents* (WAC 197-11-080 (1)) ...*The lead agency may require field investigation or research by the applicant reasonably related to determining a proposal's environmental impacts* (WAC 197-11-100(2)), *the lead agency shall make its threshold determination based upon information reasonably sufficient to evaluate the environmental impact of a proposal* (WAC197-11-335).

In response to this obvious gap in information the city of Bellingham should consider city wide inventory of wildlife habitat and species as a baseline. Relying on SEPA process, checklists or EIS's for such information will lack continuity on a "watershed" level and consequently provide a patchwork of site specific information collected at random and lacking comparability.

SHORELINE MASTER PROGRAM

Bellingham's Shoreline Master Program (SMP) was adopted in 1973 and updated in 1989. The SMP is a composite of portions of the state's Shoreline Management Act and local regulations developed by the Shoreline Citizen Committee and the update Task Force. The Program applies to areas generally within 200 feet of the ordinary high water mark of streams and rivers with greater than 20 cubic feet per second mean annual flow, lakes larger than 20 acres in size, and Puget Sound or locally Bellingham Bay. The purpose of the Shoreline Program is to provide for the protection, restoration, and preservation of the city's significant shorelines. A Shoreline Designations Map is used in conjunction with the written text to identify the shorelines and their designations. In this respect, the shorelines program is similar to zoning control. However, the Shorelines Management Program does not replace standard zoning regulations, it simply adds additional regulation to the shoreline area. Shorelines covered by both ordinances are subject to the regulations of both.

Covered by the SMP are the shorelines of Bellingham Bay, Lake Whatcom, Lake Padden, Chuckanut Creek, Padden Creek, Whatcom Creek, and Squalicum Creek. The SMP leaves smaller water courses unprotected.

Under the SMP these shorelines are designated with one of the following land use classifications: Natural, Conservancy I, Conservancy II, Conservancy III, Rural, Urban I, Urban Maritime, and Urban Multi-use. These categories are arranged in a continuum with the most restrictive designation being Natural and the least being Urban Multi-use. Of these, only the Natural classifications purpose is to preserve habitat. In shorelines designated as Natural no substantial development is permitted. The Conservancy I designation also offer some protection of shorelines based on their environmental importance.

The $2,500 project minimum allows for potentially destructive small scale development. Cumulative effects are not accounted for. For instance, one dock on Lake Whatcom is not significant, but scores of them have adversely impacted shoreline habitats and have displaced human intolerant shoreline dependent species.

The SMP addresses seven elements: Shoreline Use, Economic Development, Access Development, Circulation, Recreation, Conservation, and History/Culture. The goal of the Conservation Element is to "preserve, protect, and restore shoreline areas to optimize the support of wild, botanic and aquatic life. Key to this section are the objectives that read:

-Identify those areas of unique geological or biological significance and prohibit or severely restrict development in those areas.

-Conservation efforts should be aimed at preserving the natural function of the watercourse as well as the aesthetic and ecological qualities of the shoreline.

-Some areas, because of unique and/or fragile geological or biological characteristics should be protected from public access.

-Standards should be developed for shoreline use which will insure the optimal harmonious integration of human use of the shorelines with the shorelines' natural system.

-The continuous scientific study of Bellingham's shorelines should be encouraged and areas with unique attributes for scientific study should be identified and protected.

Attaining these objectives without compromise will clearly preserve and protect shoreline habitat for all forms of wildlife. The recommendations concluding this document encourage immediate action to fulfill these objectives.

Through the process of literature review and expert interview it is concluded that all of the fresh water stream shorelines, remaining natural saltwater shorelines and unbuilt lake shorelines, within the jurisdiction of the Bellingham Shoreline Master Program are biologically significant. Details of this finding are included in the watershed inventory section of this document.

Of particular importance is the natural function of freshwater streams and associated shorelines. These areas include habitat for benthic invertebrates, anadromous and other fish species, aquatic amphibians, aquatic mammals, riparian dependant amphibians, reptiles, birds and mammals and most other species which depend on the fresh water. They also provide natural habitat corridors created by topography and the riparian vegetation. It must also be mentioned that the streams harbor a yet to be assessed economic value in its anadromous fisheries resource.

Comments

It is the recommendation of this report that those biologically significant shorelines be redesignated under the existing shorelines program and shoreline regulations or through a sensitive areas ordinance to protect the stream, and remaining natural riparian habitat, and to set forth restoration guidelines for disturbed or developed areas within the protected corridor. A minimum setback of 150' on both sides of the stream is recommended (the minimum setback recommended by WDW-PHS for riparian areas involving class 1 and 2 streams). This would create an approximately 300' wide habitat corridor which is the minimum recommended corridor width based on the best available scientific literature (see *Planning for Wildlife* for citations).

CITY OF BELLINGHAM PUBLIC WORKS DEPARTMENT

The City Public Works Department is responsible for controlling stormwater runoff. City Public Works issues permits for development or clearing projects within the city limits that are also in the Lake Whatcom watershed to protect the lake from water quality degradation. In January 1990, City Public Works began a monthly testing program for all creeks within the Bellingham City limits. Testing parameters include temperature, pH, turbidity, dissolved oxygen, and fecal coliform bacteria.

As one element of a floodplain management grant from the Department of Ecology, City Public Works has performed wetlands assessment of Squalicum Creek. Open space and wildlife habitat are also being assessed. The results are included in a master plan for Squalicum Creek. Additionally, other watersheds will be assessed and the results compiled and incorporated with the Squalicum study. These results will then be published as the Bellingham Watershed Master Plan.

SUMMARY OF LEGAL STRUCTURE

In spite of at least 22 federal laws, 20 state laws, tribal treaty rights, the public trust doctrine, local laws and ordinances, which are intended to help protect fish and wildlife habitat, there are still many gaps and shortcomings in the actual protection of these resources (PSWQA 1990). The most logical sources of the habitat regulatory authority are limited. For instance, Washington Department of Wildlife provides habitat recommendations only; the endangered species act provides protection for species while provisions for habitat protection have yet to be developed or approved for most listed species; the Department of Natural Resources has authority to regulate habitat yet relies on the TFW process to identify areas and on SEPA for evaluation and both processes have weak records for substantive wildlife habitat protection or mitigation.

The state hydraulics code co-administered by WDW and WDF provides effective regulatory authority for stream and drainage alterations but lacks riparian habitat regulatory guidelines.

The Puget Sound Water Quality Authority in their 1990 Issue Paper Protecting Fish And Wildlife Habitat In Puget Sound, identified habitat regulatory authority as Finding #3:

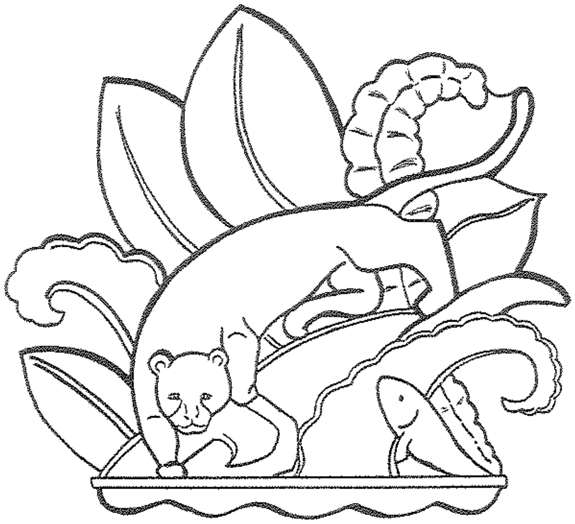
> *The major regulatory gap pertaining to the management and protection of fish and wildlife habitat in Puget Sound is that there is no authority for those agencies responsible for those habitats, especially the state Department of Wildlife, to require habitat protection beyond the scope of fish life within the ordinary high water mark. A regulatory system is needed that can comprehensively and holistically protect fish and wildlife habitat within an ecosystem framework for Puget Sound.*

Their recommendation was as follows: *Create new legislation giving the agencies responsible for managing fish and wildlife habitat in Puget Sound authority to require protection for habitats not protected under current legislation.*

Some of the gaps in habitat regulation may be filled on the local level with a Critical Areas Ordinance and subsequent land use guidelines. The greatest gap lies in the lack of clear habitat protection goals and interagency coordination to meet those goals. Language exists in city regulatory documents that provides strong statements of will to preserve and protect wildlife and its habitat in the city. Extracting this language, defining wildlife and habitat and delineating areas for protection is the intent of this document.

With the passage and implementation of the Growth Management Act, local governments have been empowered with the authority that is key to wildlife protection and proper management, that is the authority to regulate habitat. By regulating land use, restricting land clearing, protecting shorelines, ensuring water quality, educating citizens and adopting a wildlife protection plan/program, local governments collectively will take the lead in preserving the habitat necessary for the long term survival and evolution of northwest wildlife species.

Bellingham particularly has an opportunity to demonstrate that a viable fisheries and a diversity of wildlife may coexist within an urbanizing area. The city may achieve regional notoriety if it protects the unique stream corridors, shorelines and forest lands that set Bellingham apart from other cities. The city may achieve protection of vital wildlife habitat through regulatory and non-regulatory means, by cooperating with private interests in creative planning schemes, instituting beneficial mitigation programs and following a long term vision of protection, restoration and enhancement of existing habitat areas. If local governments like Whatcom County and the City of Bellingham seize this opportunity to protect wildlife resources at a landscape level, they will be accomplishing what the federal and state governments are incapable of.



PART VIII

NON-REGULATORY WILDLIFE and HABITAT PROGRAMS

NON-REGULATORY WILDLIFE AND HABITAT PROGRAMS

INTRODUCTION

This section provides a current summary of wildlife and habitat related governmental and non-governmental programs that are available federally, within the state and locally through community organizations. The programs summarized below include topics such as habitat restoration, enhancement, incentive, education, public involvement and funding. Programs vary from government grant funding sources, to model programs for community application. All of the programs listed provide potential funding opportunities for local wildlife and habitat protection.

FEDERAL PROGRAMS

COASTAL ZONE MANAGEMENT ACT

The Coastal Zone Management Act (CZMA) of 1972 has three main purposes. First, it is intended to improve coastal zone management through adoption and effective implementation by the states of coastal zone management programs (CZMPs) that meet federal standards. Second, the act provides funding to states to accomplish their CZMPs. States may in turn allocate a portion of these funds to local governments to carry out local programs. Third, the act authorizes federal agencies to implement requirements under approved state CZMPs. This means that before a federal permit or license can be issued for a federal action that affects a state's coastal zone, the applicant must show the federal permitting or licensing agency that the proposed project is consistent with a state's CZMP.

Projects affecting Washington's coastal zone are regulated through the Shoreline Management Act, which is administered by the Washington State Department of Ecology and local city and county governments.

The act states that CZM programs "*should at least provide for the protection of natural resources, including wetlands, floodplains, estuaries, beaches, dunes, barrier islands, coral reefs, and fish and wildlife habitat...*" while also providing for reasonable coastal development growth. In practice, habitat protection through the act is much as under the Shoreline Management Act since the local shoreline master programs comprise the state CZM program. Through the act's consistency requirement, coastal zone habitat protection may also be strengthened by permit requirements under state laws that have been approved by the National Oceanic and Atmospheric Administration.

Coastal states are also eligible for grants that may be used to acquire lands designated for preservation or restoration because of their conservation, recreational, ecological or aesthetic values. The act defines "coastal resource of national significance" in part as "any coastal wetland...or fish and wildlife habitat...determined by a coastal state to be of substantial biological value." Numerous projects and programs benefiting fish and wildlife habitat receive funding on a cost share basis.

A fine example of a local application of CZM funding, is the City of Bellingham's Padden Creek Lagoon habitat restoration and protection project. Through a CZM grant, the city's Park and Recreation Department conducted a formal site study of the lagoon, creek and adjacent wetlands. The study not only assessed habitat functions and human impacts, but also provided site specific plans for restoration, public access and area management. The subsequent implementation of the recommendations and plans presented in the *Padden Creek Estuary Area Planning Study*, have proven effective in the enhancement of the lower Padden Creek system. The Padden Creek Estuary project serves as a highly successful demonstration project for the city and a model for the region.

FISH AND WILDLIFE CONSERVATION ACT OF 1980

The Fish and Wildlife Conservation Act was enacted by Congress in 1980 to help states pay for nongame wildlife protection programs. The bill authorized the Department of Interior to provide three dollars for every dollar the state spend to develop comprehensive management plans for nongame wildlife species.

Congress has severely cut funding under the Conservation Fund. Washington Department of Wildlife spends over $1.4 million annually on its nongame program and relies on the revenue from the sale of personalized license plates for this program. Limitations in the nongame program due to underfunding are serious, allowing only for selective species monitoring, management and some research activities.

Due to the budgetary shortfalls of the WDW nongame program and the subsequent lack of available personnel, it is important for the city to employ a wildlife biologist or a person with wildlife expertise to oversee the wildlife resources within the city.

MIGRATORY BIRD CONSERVATION LEGISLATION

The Migratory Bird Conservation Act authorizes wetlands acquisition for migratory waterfowl refuges. A related statue, the Migratory Bird hunting and conservation Stamp Act, authorizes acquisition of properties or conservation easements, or lease of small wetlands for use as "waterfowl production areas." The Wetlands Loan Act speeds purchase of waterfowl habitat by making duck stamp receipts available for expenditure without congressional approval. The loan fund also authorizes purchase of upland habitat needed to buffer adjacent wetlands. These programs provide nearly all the funding for acquisition of National Wildlife Refuge lands. Program funding levels fluctuate widely with the level of congressional appropriations.

Although there are no national wildlife refuge lands in the city of Bellingham it remains a remote but viable option for the procurement of locally significant wetland and adjacent upland habitats.

NATIONAL ESTUARY PROGRAM

The purpose of the National Estuary Program is to promote conservation and management of nationally significant estuaries that are threatened by pollution, development or overuse. The Puget Sound was formally designated an estuary of national significance under the program in 1988. The program authorizes a comprehensive conservation and management plan. The 1991 Puget Sound Water Quality Management Plan provides all the program elements required under the program including protection of wetlands, nearshore habitat, shellfish, sediment quality, and fish and wildlife restoration and maintenance.

Local application of this program is uncertain due to funding limitations.

NORTH AMERICAN WATERFOWL MANAGEMENT PLAN (PACIFIC COAST JOINT VENTURE)

In 1986 the Secretary of the Interior for the United States and the Minister of the Environment for Canada signed the North American Waterfowl Management Plan, establishing a 15 year framework for international cooperation. The Plan's emphasis on creating and restoring wetlands and habitat protection for migratory waterfowl is projected to cost $1.5 billion. In an effort to implement the goals of the Plan, important geographic/habitat areas were identified and a cooperative structure in each area was established, with USFWS as lead in the U.S. The Pacific Coast Joint Venture involves interested representatives from government and private entities from the area stretching from San Francisco to the Skeena River, British Columbia.

In the Pacific Coast Habitat: A Prospectus the Pacific Coast Joint Venture has identified over 82,000 acres of "high-priority" waterfowl habitat targeted for acquisition in Washington State. Of that, 2,200 acres of habitat have been identified in the Bellingham Bay area. Site specific acquisition lands were not identified.

PITTMAN-ROBERTSON FEDERAL AID IN WILDLIFE RESTORATION & DINGELL-JOHNSON FEDERAL AID IN FISH RESTORATION ACTS (1937-1950)

These programs provide federal matching grants to states for habitat restoration. In both of these programs the funds are used primarily for habitat enhancement, development and maintenance, research, and some acquisition. The funding source is a tax on hunting and fishing equipment. Currently, the WDW and WDF receive $4.8 and $2.4 million, respectively under both programs. The WDW dedicates most of the Pittman-Roberts funds for operations and maintenance of existing habitat while also allocating some funding to habitat restoration in eastern Washington. Half of the Dingell-Johnson funds are also administered by WDW and used for sport fishing restoration projects. Priority project sites are those involving salmonid habitat. Also a priority are lakes, ponds, streams, and rivers planted with game fish by a government or tribal entity.

STATE PROGRAMS

INTERAGENCY COMMITTEE FOR OUTDOOR RECREATION (IAC)/WASHINGTON WILDLIFE RECREATION PROGRAM (WWRP)

Since 1990, the Washington State Legislature has appropriated $113.4 million for the acquisition and preservation of wildlife and recreation lands. The account in which these funds are dispersed is the Washington Wildlife Recreation Program. Administered by the IAC, the funds from the WWRP are disseminated to local and state agencies specifically for acquisition of significant wildlife habitat, natural areas and parks state wide. Program funding is divided into two accounts equally, which are Habitat Conservation and Outdoor Recreation.

WWRP matches funding for wildlife related projects under the Habitat Conservation Account. The habitat account is divided into three categories:

1) Critical Habitat (state agency eligibility only)
2) Natural Areas (state agency eligibility only)
3) Urban Wildlife Habitat (state and local agency eligibility)

The Outdoor Recreation Account provides matching funds for local and state parks, trails and water access. Obviously, park acquisition has a positive spin-off for wildlife by protecting more open space. Generally speaking, wildlife may benefit from projects funded through both accounts.

As of July 1, 1993, any agency, such as the City of Bellingham, who wishes to submit a grant application for Urban Wildlife funds under the WWRP, must adopt a conservation plan or include an element in the comprehensive plan which assesses habitat types, inventory, needs, goals, opportunities, priorities, management program and implementation strategies (IAC:Guide to Planning Requirements -draft-, June 28, 1991).

PUGET SOUND WATER QUALITY AUTHORITY (PSWQA)

In 1985 the Washington State Legislature enacted Chapter 90.70 RCW restructuring the Puget Sound Water Quality Authority and charging it with responsibility to develop, adopt, and oversee the implementation of a comprehensive water quality management plan for Puget Sound and its watersheds.

The 1989 Puget Sound Water Quality Management Plan includes action programs for cleaning up and preventing pollution of Puget Sound. Each program contains a statement of goals and objectives for long and short-term water quality management. Several of these action programs contain elements which directly or indirectly protect fish and wildlife habitat. The most significant of these are the programs addressing public education and involvement, nonpoint source pollution, shellfish protection, municipal and industrial discharges, contaminated sediments and dredging, stormwater, wetlands protection, and spill prevention and response.

Public Involvement and Education Projects Fund (PIE)

The Public Involvement and Education Fund or PIE is part of a more comprehensive education program in the Puget Sound plan. The goal of the program is to increase understanding of Puget Sound and its resources and the effect of human activities on them and to facilitate public involvement in decisions to clean up and protect the Sound. To achieve this goal, PIE provides funding to community organizations, tribes, local governments, trade associations etc. who develop projects that serve as models that will encourage, educate and involve citizens in the cleanup, monitoring and protection of the Puget Sound. Specific project topics suggested are wetlands, fish and wildlife habitat, growth management, recycling, shellfish protection, stormwater etc.

Since 1987, the Washington State Legislature has appropriated approximately $1 million each biennium from the Centennial Clean Water Fund for the PIE program. The funds are administered by PSWQA. PIE grants are awarded to eligible projects on a cyclic bases. Project proposals are accepted in four categories which include, peer education, Puget Sound Plan Implementation, model project implementation and translating and disseminating Puget Sound research results.

The PIE fund would be a logical source of funding for education and hands on restoration, enhancement and demonstration projects implemented by the City as part of its wildlife program.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Regional Stream Enhancement Program

Implemented in 1990 by the WDFW, the Regional Stream Enhancement Program offers technical coordination and funding for local stream and riparian habitat restoration and fisheries enhancement projects. The WDFW provides staff coordinators, technical assistance and funding. The program is administered through twelve regional councils which manage an annual $600,000 program budget. The Nooksack Salmon Enhancement Association coordinates with WDFW staff to implement the program locally utilizing a volunteer work force and cooperating landowners.

Small streams are the backbone of fisheries resources and the focus of the programs efforts. An additional advantage of this restoration and enhancement program is that stream and riparian improvements benefit all wildlife dependent on these habitats.

Local Applicability

This is yet another program that would benefit local wildlife through volunteerism, agency cooperation and non-regulatory means. The program is currently operating without a plan but instead addressing projects as they are brought to the attention of the council or staff. Presenting to the program staff a plan or list of priority project sites within the city would facilitate activities on those sites. Stream and riparian habitat restoration should be a priority in the city, and efforts should be made to coordinate with the Regional Enhancement Program and Adopt-A-Stream to achieve restoration, enhancement and monitoring of all fish bearing streams within the city.

Cooperative Wildlife Program

The WAC 232-32 sets forth a structure for funding volunteer wildlife projects state wide. Funding for the Co-op Program is through the DNR's Aquatic Lands Enhancement Account. The WDW administers the Co-op Program by accepting, reviewing, awarding and managing project contracts with qualified volunteer organizations.

Examples of the types of projects funded through the Co-op Program include public education, stream enhancement and monitoring, rearing and planting of fish stocks, habitat restoration, and other enhancement and public awareness projects. Funding is limited to material costs only.

Opportunities for local Co-op projects are nearly unlimited. The City of Bellingham could, through its wildlife program, encourage and collaborate with private community groups by providing site specific suggestions and guidelines for projects, and by offering assistance in securing funds from WDW for such projects.

Nongame Program

An integral division of the Washington Department of Wildlife is the Nongame Program. The mission of the nongame program is to preserve and enhance the nongame wildlife and habitat resources of the state for the benefit of present and future generations. This mission is without the necessary habitat regulatory authority. The responsibility of the nongame program is primarily to identify, inventory and monitor sensitive wildlife species. The program goals include:

- identification of nongame species and to acquire data, through scientific study of their population, abundance, distribution, habitat requirements, natural history and ecology

- preserve natural habitats and native nongame wildlife species at self-sustaining levels and thereby perpetuate the diversity of wildlife in the state

-provide for the public eduction and enjoyment of nongame wildlife while ensuring minimal impact on the resources.

Unfortunately, the lack of habitat regulatory authority has hindered the WDFW's ability to effectively achieve its mandate. The current loss of habitat estimated at 30,000 acres per year and sixty-three state species considered for, and twenty-eight species presently protected under the Endangered Species Act suggests a resource management crisis.

Crucial to the Growth Management mandate to identify critical wildlife areas, the WDFW has dedicated considerable staff and resources to the identification of critical habitats throughout the state. The Nongame Program database and species files in addition to the Washington Natural Heritage Program and other sources of information serve as the foundation for this effort, known as Priority Habitats and Species (PHS). PHS staff rely on Nongame data systems for baseline information, updates and nongame management recommendations.

Backyard Wildlife Sanctuary Program

When undeveloped lands are converted to residential use, significant amounts of wildlife habitat are lost as forests and pasture lands are transformed into flat lawns landscaped with non-native trees and shrubs lacking in structural and species variety.

In 1985 the Department of Wildlife began its Backyard Wildlife Sanctuary Program to assist homeowners interested in enhancing their yards for wildlife. So far, over a thousand homeowners in Whatcom, Skagit, Snohomish, King, and Pierce Counties have joined the program. Homeowners inventory the habitat resources in their yards, and WDW suggests ways to improve the value of their yards for wildlife. Enhancements may include landscaping with plants that provide food and cover, leaving brush and rock piles that can shelter small animals, and providing sources of water. Native plant species are encouraged. Participants also receive a certificate that can be displayed as a symbol of their concern for wildlife resources.

In addition to its educational value, as the program expands it is expected to protect and enhance significant amounts of wildlife habitat, especially in urbanizing areas. Neighborhood backyard sanctuary projects should be encouraged. Several target neighborhoods throughout the city have been identified as having the greatest potential for increasing the habitat function to benefit local wildlife. However, all neighborhoods will contribute to habitat enhancement by participating in the program, by simply planting street trees, erecting bat and bird boxes, utilizing native vegetation and allowing a portion of a neighborhood park lot to revert to its natural state. Neighborhoods adjacent to natural areas, parks or open space may effectively create a backyard sanctuary buffer if enough households participate in the program. Such a buffer would increase the value of park or open space to wildlife and enhance the neighborhood character.

WASHINGTON DEPARTMENT OF NATURAL RESOURCES

Natural Area Preserves Act

The Natural Area Preserves Act of 1972 directs DNR to cooperate with other federal, state and local government agencies, private organizations and individuals in the protection of natural areas. In 1981 the legislature amended the act to establish the Natural Heritage Program whose purposes are to:

1) develop a classification of natural heritage resources;
2) maintain an inventory of the location of these resources;
3) maintain a database for this information;
4) provide assistance in the selection and nomination of areas containing natural heritage resources for registration or dedication.

The act also requires DNR to prepare and update biennially a Natural Heritage Plan. The plan must present the criteria for selection and approval of natural areas and list the resources to be considered for protection. The Natural Area Preserves System is a focused, limited effort to protect the best examples of Washington's natural heritage. It is not intended to protect all habitats and wetlands that may be of value in an area.

Natural areas are designated to preserve significant examples of typical and rare terrestrial, aquatic and marine ecosystems, special species and rare geological features. In addition to their functional and educational value, these areas also serve as baselines for comparisons with similar, altered ecosystems. Natural areas are managed to allow natural ecological and geological processes to predominate, although threats to the natural values of a preserve (such as invasion of a noxious plant) may be controlled.

The program has identified high-quality intertidal and freshwater wetlands throughout the lowlands and commercial forest lands of the Puget Sound basin. These sites have been entered into the Natural Heritage Database, from which information can be disseminated to land managers, developers, protection organizations, state and local agencies and others in need of this information.

Although there are no Natural Heritage sites located in the Bellingham, there are two sites that tie into habitat blocks originating from the city, they are:

1) Lake Louise: 137 acre wetland, bog and associated conifer/mixed forest of exceptional biological diversity. Will be managed by DNR as a natural area for educational purposes.

2) Chuckanut Mountain: Larrabee addition

<u>Aquatic Lands Enhancement Account (ALEA)</u>

The ALEA was established by the 1984 Legislature. Funding for the ALEA is from lease revenues received by DNR for state-owned aquatic lands. Commercial use of leased aquatic lands restrict public access and in some cases negatively impact the ecological value of the site. In an effort to offset these impacts, the DNR administers the ALEA to provide public access, recreation and interpretive projects that are water dependent.

The ALEA grants are available to local and state agencies for projects that meet project guidelines and application requirements. Bellingham Greenways has received project funding from this program.

LOCAL PROGRAMS

BELLINGHAM DEPARTMENT OF PARKS AND RECREATION

Greenway Program

In May 1990, Bellingham voters approved a six-year levy to raise seven million dollars to acquire greenways throughout the city. Greenways include land for trails, habitat and parks. A citizens' advisory committee guides the land acquisition process and Bellingham Parks and Recreation Department staff implement the program. Parks staff also procure matching grants for land acquisition and program operations. Greenway procurement is accomplished through various means including trail easements, land donations, and fee simple purchase. Efforts have focused on creek corridors and abandoned rights-of-way, linking existing trails and parks. The program has also hired a part time volunteer coordinator to organize and lead volunteer activities such as revegetation and restoration projects in addition to the Adopt-A-Trail program. Volunteer programs leverage funds, actively involve citizens and build community support for habitat enhancement and protection.

Current Use Taxation Program

The state legislature established a process whereby parcels of land can be taxed on the basis of their current use value rather than the usual assessment practice of using highest and best use market value. The purpose of this legislation was to preserve agricultural and forestry land and to provide incentives for land near urban areas to remain natural rather than being developed.

This program allows land owners to reduce their property tax in exchange for leaving their land undeveloped and allowing appropriate public access. Land involved in this program may be unilaterally withdrawn by the owner, but there may be tax penalties if the land did not remain undeveloped for the agreed-to amount of time.

In 1988, roughly 250 acres of undeveloped land in Bellingham were registered in the program.

PRIVATE SECTOR

Many valuable habitat sites have been preserved through voluntary efforts and public-private partnerships. Local non-profit community organizations, conservation groups, neighborhood organizations, schools and dedicated individuals have played a vital role in protection of our natural environment including wildlife and its habitat. Many of these groups have held environmental education programs, sponsored local habitat restoration/enhancement projects, promoted acquisition programs such as Greenways, lead educational field trips, and participated in public process to protect wildlife habitat.

The following is an overview of these volunteer groups and programs and their current role in the community and potential role working in cooperation with the City of Bellingham to implement the proposed Wildlife Program. By providing a program structure and coordinating these community groups, a city wide Wildlife Program would leverage funding, involve interested citizen volunteers of all ages, promote stewardship and accomplish the goals and objectives of the program on a community level.

Portions of this section were extracted from *The Whatcom County Outdoor Organizations Directory 1992.* The directory was complied by Bill McCallum for the North Cascades Audubon Society, P.O. Box 5805, Bellingham WA 98227.

ADOPT-A-STREAM FOUNDATION

The Adopt-A-Stream Foundation was started in 1982 as an outgrowth of efforts by the Snohomish County Department of Public Works to protect and enhance salmon habitat in Snohomish County. The foundation publishes a quarterly newsletter and provides advice and encouragement to numerous volunteer groups interested in translating their concerns about habitat degradation into actions that benefit fish and wildlife habitat. The foundation has hosted two Adopt-A-Stream conferences for those interested in developing similar programs around the Sound.

An example of the foundation's work is Pigeon Creek which flows through the city of Everett. The creek was adopted in 1982 by the entire Jackson Elementary School and the Salmon Club of Evergreen Middle School. Since then, coho salmon have returned to the creek for the first time in many years. Adopt-A-Stream provided funds for an egg box, aquarium, water quality testing kits, and paint and templates so that "No Dumping" signs could be painted on curbs throughout the creek's watershed. The school children provided the labor and enthusiasm to clean up and inventory the creek and to distribute educational pamphlets. They also successfully lobbied the city council to fund educational signs and to buy property at the headwaters of the creek for stormwater control.

Due to the importance of Bellingham streams for fisheries, wildlife and aesthetics, it is logical to suggest that the City organize an on-going volunteer Adopt-A-Stream program as a component of the larger Wildlife Program. Neighborhood groups, schools, environmental organizations, scout troops or other community organizations could be coordinated to restore, enhance and monitor our streams. As stream stewards, the Adopt-A-Stream participants would gain a sense of ownership, appreciation and understanding of the complex yet fragile stream ecosystem.

ALABAMA HILL ASSOCIATION

To promote the interests of the Alabama Hill neighborhood in matters of land use, zoning and others laws, regulations and ordinances which affect the quality of life of the neighborhood. To obtain and disseminate information of a public nature to residents of the neighborhood.

ASSOCIATED STUDENTS ENVIRONMENTAL CENTER

The Associated Students Environmental Center provides a resource center with over 100 books, dozens of magazines, filing cabinet of information for research and education, current news and action opportunities network. Educational programming: environmental speakers, forums, music, films, and Earth Day Fair. Environmental Activism Center: opportunities for action, letter writing, networking with action groups.

BELLINGHAM MOUNTAINEERS

To explore and study the mountains, forests and water courses of the northwest; to gather into permanent form the history and traditions of this region; to preserve by the encouragement of protective legislation or otherwise the natural beauty of the northwest; to make expeditions into these regions in fulfillment of the above purposes; to encourage a spirit of good fellowship among all lovers of outdoor life.

CONCERNED SOUTHSIDE CITIZENS

Concerned Southside Citizens (CSC) is a citizens group concerned about environmental protection of south Bellingham and Bellingham Bay. The group cooperates with the City Parks Department to enhance habitat in the 100-foot setback west of Padden Lagoon, obtained through CSC's 1989 agreement with the Port of Bellingham and the City of Bellingham.

ENVIRONMENTAL PERSPECTIVES

To provide print, radio and video services to educate and inform the general public about a wide range of environmental issues. We work with citizens groups, government agencies, and other organizations.

FAIRHAVEN NEIGHBORS

The protection and enhancement of the Fairhaven residential neighborhood and surrounding environment.

FRIENDS OF CHUCKANUT

To protect the beauty of Chuckanut Drive by securing reasonable development and ensuring the health, safety and welfare of community members in the vicinity of Chuckanut Drive.

FRIENDS OF LAKE WHATCOM

The preservation and improvement of the water quality of Lake Whatcom and environmental protection of the Lake Whatcom watershed area.

INTERURBAN NEIGHBORS

Citizens united to preserve:

- — Quality of life in Bellingham
- — Character of Bellingham neighborhoods
- — Local ecology

MT. BAKER HIKING CLUB (a.k.a. Mt. Baker Club, Inc.)

The purpose of the club is to provide regular opportunities for hiking, camping, and related social and outdoor activities. It also promotes the conservation of recreational areas of interest to the club. It has a potluck dinner or other social activity once a month.

NOOKSACK SALMON ENHANCEMENT ASSOCIATION (NSEA)

To improve and protect salmon production through habitat restoration, education and artificial production facilities i.e. net pens and remote site incubators. NSEA has improved riparian habitat throughout Whatcom County and is creating an endowment for future project funding.

NORTH CASCADES AUDUBON SOCIETY (NCAS)

The North Cascades chapter of the National Audubon Society was founded in 1972 has been actively involved in local conservation issues and habitat protection. The objectives of this chapter are to promote the study and conservation of birds and other wildlife, their habitat, plants, soil and water. To increase public appreciation of the values of wildlife, plants and the natural environment, and to stimulate action to preserve and protect them.

NCAS provides monthly educational programs, field trips and newsletter. Wildlife and habitat preservation is consistently addressed in organization functions.

NCAS also sponsors the annual Christmas Bird Count. The local count is part of a national survey. The Bellingham/Whatcom County Christmas Bird Count started in 1967, for an area encompassing a 7.5 mile radius which includes most of Bellingham. Christmas bird count data provides the most comprehensive biological survey information within the city, it is however limited to birds.

North Cascades Audubon is the owner and steward of Scudder Pond near Lake Whatcom. This open water wetland provides habitat for beaver, muskrat, amphibians and a plethora of wetland associated birds. It also provides public access by trail and is a popular destination for local school field trips.

NORTHWEST ECOSYSTEM ALLIANCE

The Greater Ecosystem Alliance promotes protection of biodiversity, using principles of conservation biology applied through education, research and advocacy. Our efforts to sustain biodiversity focus on conserving the Greater North Cascades, Mongshee, Selkirk and Olympic Peninsula ecosystems.

NORTHWEST MUSHROOMERS

To encourage the understanding and appreciation of mycology for the amateur and scientist alike.

NORTHWEST STEELHEAD AND SALMON COUNCIL OF TROUT UNLIMITED: WHATCOM CHAPTER

The conservation, preservation and protection of trout, steelhead and salmon and their cold water habitat.

PUGET SOUNDERS

Puget Sounders promote and sponsor public education and environmental conservation. Puget Sounders responds to questions and concerns it provides informational referral, program support and services to neighborhood groups, and educational programs.

RAPTOR ROOST

To rehabilitate injured wild birds and animals. To promote education of dangers our wild birds/animals face in sharing the planet with hominids. Lobby for better wild bird care, increase of habitat, and safer handling of oil on land and water.

SAMISH NEIGHBORHOOD ASSOCIATION, INC.

To keep neighbors educated on current neighborhood and citywide issues. The main purpose is to watchdog construction to see that drainage is addressed and developments are compatible with existing neighborhoods.

SIERRA CLUB: MT. BAKER GROUP

The group's focus is to actively promote environmental conservation. Also important are outings to enjoy and learn about the environment, and group social activities.

SQUALICUM BEACH COMMITTEE

A group of open space and wildlife habitat advocates involved in development of the Little Squalicum Park Site Plan and concerned with the management and preservation of tidelands, beaches and open areas adjacent to the 13-acre park site. Many of the committee members are Birchwood and Columbia neighborhood residents.

WHATCOM COUNTY LAND TRUST

In 1979 the Washington legislature passed a law (RCW 64.04.010) that allows any government agency or nonprofit natural conservancy corporation to hold or acquire development rights or conservation easements "to protect, preserve, maintain, improve, restore, limit the future use of, or conserve for open space purposes, any land or improvements upon a piece of land." The law defines "nonprofit nature conservancy corporation" as an organization that qualifies as being tax exempt under requirements of the federal Internal Revenue Code. The organization must also have as one of its principal purposes scientific research, the conservation of natural resources for the general public, or the conservation of natural areas including but not limited to wildlife or plant habitats.

The Whatcom County Land Trust is dedicated to the preservation and protection of unique natural, scenic, agricultural and open space land in Whatcom County through acquisition of perpetual conservation easements or other land interests that insure the protection of the resource value. The WCLT holds conservation a easement to protect the ecological integrity of the 78 acre Clark Point peninsula and it also oversees the development and use on Teddy Bear Cove Park on the city's southern fringe.

WASHINGTON NATIVE PLANT SOCIETY: KOMA KULSHAN CHAPTER

1. Preservation of endangered flora
2. Conservation of threatened habitat
3. Education of the public to the value of native plants
4. Enjoyment and study of native plants

WASHINGTON SEA GRANT PROGRAM (University of Washington)

Address needs of marine resource users in North Sound area through education programs, applied research and by providing information to individuals on request.

WASHINGTON TROUT

To preserve, protect and restore Washington's wild fish populations and their habitat.

WHATCOM FALLS NEIGHBORHOOD ASSOCIATION

Informal network for responding to neighborhood and community issues.

With approximately one-third of the neighborhood in public land to the north (Whatcom Falls Park and Bayview cemetery), one-third undeveloped steep-sloped forest land to the east, and numerous creeks, springs and wetlands to the south, the quiet rural atmosphere is our most precious asset and the focus of our efforts.

WHATCOM INDEPENDENT MOUNTAIN PEDDLERS (WHIMPY)

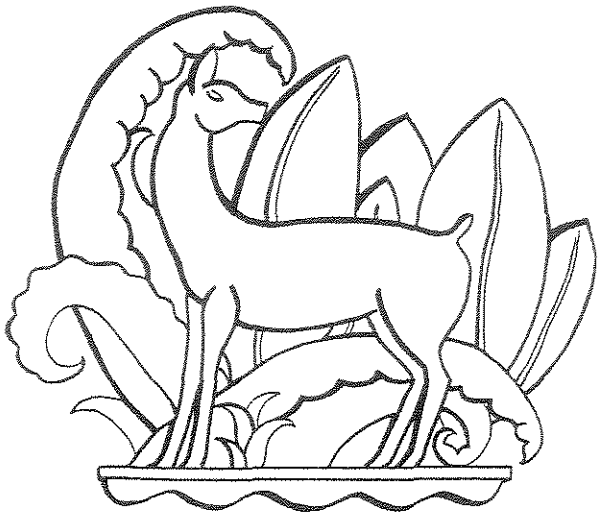
Mountain bicycle trail etiquette, trail building, education, and exploration. Working with public schools on helmet safety for kids, flagging trails for repair, encouraging the involvement of mountain bikers in local trail and bicycle related issues.

WILDLIFE CONSERVATION TRUST

A regional independent non-profit wildlife conservation organization. The WCT provides support for conservation oriented wildlife research, education and stewardship. The Trust is dedicated to the advancement our current understanding of indigenous wildlife communities to further their conservation through informed decision making.

YORK NEIGHBORHOOD ASSOCIATION

To provide a forum for discussion of neighborhood issues; to carry out projects to improve the quality of life in the neighborhood; to provide neighborhood representation at relevant meetings.



PART IX

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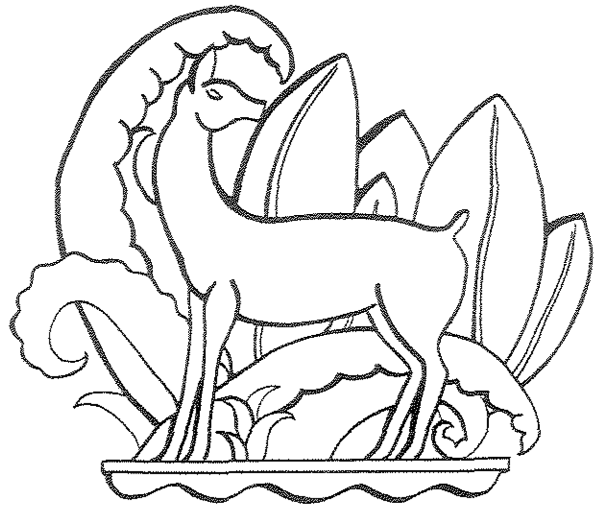

PART X

APPENDICES

APPENDIX A

ANNOTATED BIBLIOGRAPHY

ANNOTATED BIBLIOGRAPHY

The following annotated bibliography is limited to local documents, and represents only those available in 1992, which were reviewed during the first phase of this project. The bibliography (page 231) provides a complete list of references utilized in the writing of this document.

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This student project reports on environmental features and human use patterns at the 165 acre Sehome Hill Arboretum, located in central Bellingham. Bird and mammal inventories were compiled based on information from local experts, systematic field checks, and previous literature (pgs. 13-16). A pair of the proposed sensitive species pileated woodpeckers were observed nesting in the arboretum. The extensive species lists (Appendix A) are thought to be accurate because of the involvement of respected local experts (Wahl, Lacher, and Senger). The sampling and trapping methodologies are explained (Appendix A).

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This letter responds to a request for input regarding impacts on a list of 37 species from a forest practice application near Big Rock Pond in northeast Bellingham. The author defines minimal habitat needs for the 15 species likely to be detrimentally impacted by logging activities. The list of birds, which accompanies the letter, was prepared by local ornithologist Susan Taylor based on direct observation in March 1990. Significant species include great blue heron and pileated woodpecker.

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As required by the Shoreline Management Act of 1971, this inventory covers land use, topography, soils, and natural characteristics of Bellingham's shorelines included under the Act. The survey of plant and animal communities contains an extensive list of species for each of thirteen distinct habitat types (pgs. 6-21). Sightings by the report authors and citizens, and assumptions of species historically present in particular Puget Sound habitats were used to compile the species lists.

Bellingham Department of Planning and Economic Development. 1981. Draft Environmental Impact Statement: Woburn Park. City of Bellingham, Bellingham, WA.

This draft EIS reports on environmental conditions at a 200 acre site west of Interstate 5 and south of Sunset Drive in northeast Bellingham. Dominant tree, shrub, and herbaceous species were given for distinctive areas of the site (pgs 3-28 to 3-29). Fran Murlock, amateur ornithologist, supplied a bird species list that was partially confirmed by independent field observation (pg. 3-30). Raccoon, opossum, and black-tailed deer were observed at the site (pg 3-29).

Bellingham Department of Planning and Economic Development. 1982. Draft Environmental Impact Statement: Squalicum Property Owners Association Institutional Master Plan. City of Bellingham, Bellingham, WA.

This draft EIS reports on flora and fauna at a several hundred acre site between Cornwall Park and Interstate 5 (pgs. 37-38). Trees, shrubs, and other plants are generally described. Coho and chum salmon, along with steelhead and cutthroat trout are reported to use Squalicum Creek and Bug Lake on the site. Birds observed frequenting the area include green and great blue heron. Sources for this information are not given.

Carlstrom, J., C. CdeBaca, J. Funsch, R. Hemple, S. Madsen, and M. Sauvage. 1987. Environmental Impact Assessment: An Urban Beaver Pond. Huxley College, Western Washington University, Bellingham, WA.

This student project assesses the beaver pond and adjacent habitat on the southwest corner of Alabama Street and Electric Avenue, located in east Bellingham. Included in the assessment is an informative discussion of beaver of ecology (pgs. 19-24). Physical, functional, and vegetative descriptions are given for the site's aquatic and terrestrial habitat (pgs. 35-36). Commonly found mammals, birds, fish, reptiles, and amphibians are listed in an appendix (pgs. 69-71). A large, though undetermined, portion of the wildlife data appears come from field verification. The bibliography contains numerous entries on beaver ecology and Bellingham history (pgs. 90-92).

Entranco Engineers, Inc. 1990. Draft Environmental Impact Statement: Barkley Boulevard. Prepared for the Bellingham Public Works Department, Bellingham, WA.

Depicts environmental conditions at the proposed site of the Barkley Boulevard connector between Britton Road and Woburn Street. Describes the overstory, understory, and herbaceous vegetation of upland forests, forested wetlands, and riparian (Fever Creek) communities (pgs. 23-24). Lists mammals reported at the site, including a black bear, and important bird species such as a pair of great blue heron,

pileated woodpecker, and wood ducks (pg. 25). Fish above the Fever Creek Regional Detention Pond have not been observed. Appendix D contains plant and bird species lists. Information about wildlife came from the Natural Heritage Information System, a professional wetland delineation, Department of Fisheries and Department of Wildlife personnel, previous EISs, and local experts.

Farrow, L., J. Garrett, J. Langton, R. Larson, S. Olsen, J. Parsons, B. Pfaff, R. Sahakian, and D. Van Doornik. 1989. Environmental Impact Assessment of Chuckanut Village. Huxley College, Western Washington University, Bellingham, WA.

This student project reports on the natural, cultural, and built environments of Chuckanut Village, located on Chuckanut Bay in south west Bellingham. Flora and fauna are described for the estuary, marsh, Chuckanut Creek, and upland communities (pgs. 28-31). Wildlife and habitat information for the site was gathered from existing literature and personal communications with local experts. Important species reportedly using the site include bald eagle, blue heron, osprey, green-back heron, and trumpeter swan. Dominant plant species for each community are listed, including eelgrass. Coho and chum salmon, and steelhead and cutthroat trout are known to use the estuary and creek.

Gacek and Associates. 1986. Draft Environmental Impact Statement: Modifications to Bug Lake and Squalicum Creek and Amendment of the Cornwall Park Neighborhood Plan. Prepared for Bellingham Department of Planning and Economic Development, Bellingham, WA.

This draft EIS describes environmental conditions at a four acre site between Cornwall Parks and St. Joseph Hospital in north Bellingham (pg. 17). The vegetation, birds, mammals, and fish reported to use the site are the same as those given in the Squalicum Property Owners Association Institutional Master Plan DIES. The presence of the listed fish and mammals were confirmed by Dr. Susan Cook.

HDR Engineers, 1992. Squalicum Creek Floodplain Management Plan: Phase 1 -- Interim Report. Prepared for the Bellingham Public Works Department, Bellingham, WA.

This study reviews wetlands, drainage features, fisheries, and wildlife in the Squalicum Creek drainage basin from the Guide Meridian to Hannegan Road. Based on an on-site assessment, seven types of wetland habitats are described. Dominant and indicator tree, shrub, and herbaceous species are given. A wildlife inventory, compiled from direct observation during field visits and from Washington Department of Wildlife data, yielded the bird, mammal, reptile, and amphibian species lists. Fish habitat was evaluated in terms of passage barriers and habitat suitability for resident and anadromous fishes.

Houck, C. A. 1991. Chuckanut Ridge Property Plants and Animals Reconnaissance. Prepared for Gacek & Associates, Bellingham, WA.

A 100 acre site, located on the northeast side of Chuckanut Drive between Old Fairhaven Parkway and the Old Samish Highway, was surveyed twice in the spring of 1991 for habitat and wildlife. Detailed descriptions of the overstory, understory, and herbaceous layers are given for four main vegetative communities. A map of transects walked is included. The author discusses likely wildlife associations at the site, based on its diverse habitat and connection to adjacent forested areas and Chuckanut Bay to the southwest. Pileated woodpecker, red-tailed hawk, bobcat, and red fox are among the species expected to occur on the property. The report also includes a list of plant species found in each of the vegetative communities.

Huckell/Weinman Associates, Inc. 1992. Draft Environmental Impact Statement: West Bakerview Annexation Comprehensive Plan Amendment. Prepared for the Bellingham Department of Planning and Economic Development, Bellingham, WA.

This draft environmental impact statement analyzes three alternative comprehensive plan amendments covering the 197 acre West Bakerview annexation in north Bellingham. A list of dominant tree, shrub, and herb species in the wetland and upland portions of the planning area were compiled. These were based upon direct observation. The list of birds, mammals, amphibians, and reptiles denotes which species were observed during field surveys and which were expected to occur in the area. Among the wildlife observed were black-tailed deer, coyote, bald eagle, and red-tailed hawk. The report notes that the planning area is adjacent to a large wooded corridor running along Aldrich Road that could be an important regional link for wildlife movement.

Humane Society. "Internal Records". Humane Society, Bellingham, WA.

The Humane Society maintains a list, as part of their wildlife rehabilitation program, that contains the common name, pick-up location, outcome, and date for each wild animal picked-up. The location and date of wildlife killed on city roads and retrieved by animal control officers are noted in the front desk log. In addition, records are maintained for the rental of traps, with which citizens capture and relocate wild animals posing a nuisance or threat.

King County Environmental Division, 1991. Development of Guidance for Managing Urban Wetlands and Stormwater. King County Environmental Division, Seattle, WA.

This report is from an ongoing research project on how stormwater runoff from urban areas affects wetlands around Puget Sound. Pages 27-32 briefly describe their

wildlife studies and key findings from amphibian, bird, and mammal inquiries. The findings identify specific threats to wetland animal species and make useful characterizations about wetland species diversity.

MacGregor, B., K. Higman, M.P. Kent, N. Kohn, M. Lamb, P. LaPlante, S. Swan, and E. Thompson. 1988. Environmental Impact Assessment of Squalicum Beach. Huxley College, Western Washington University, Bellingham, WA.

This student project describes environmental features and human use patterns at Squalicum Beach. Covering 320 acres, the site is located west of the Bellingham city limit on the north east shore of Bellingham Bay. A vegetative analysis, based on a field survey, listed easily identified tree and plant species. Local ornithologist Terry Wahl provided information on terrestrial animals, terrestrial birds, and waterfowl and shorebirds (pgs. 19-20). He also provided a species list of birds observed in the area (pgs. 65-69). A description of marine plants and animals, including a species list (pgs. 71-72), was based on previous literature. The extensive bibliography identifies people and publications useful in assessing wildlife and habitat near Bellingham Bay.

Matheson, V., T.T. Wahl, and K. Reddell. Bellingham Wetlands Database Bellingham Department of Planning and Economic Development. Bellingham, WA.

This preliminary inventory lists Bellingham sites having wetland characteristics. Each site is documented on a quarter section map and a four page data sheet, which notes water flow characteristics and indicator plant and animal species present at the site. Seventy-two potential wetlands covering 345 acres were identified based on field inspection. The database is contained in two volumes, one entitled "Quarter Section Maps" and the other "Field Notes."

Muller, G. and B. Lighhart. 1970. Survey of Fauna and Flora of the Pond and Beach Below Edgemoor (Bellingham, WA). Institute for Freshwater Studies, Western Washington State College, Bellingham, WA. Technical Report Number 8.

Fauna and flora species found in the sediments in Edgemoor Pond are indicative of a marine habitat with an abundance of marine species. The absence of marine species in the pond's deep water benthos is possibly due to anoxic conditions during summer stagnation. The fauna and flora at Edgemoor Pond are the same as are found at other sites along Bellingham Bay. This indicates no deterioration of fauna and flora in Edgemoor Pond due to sewer pollution.

Schneider, B. R. 1986. Winter Time Budget and Population of Goldeneye Ducks (Genus Bucephala) on Bellingham Bay, Washington. Western Washington University, Bellingham, WA.

This masters thesis reports on observations of goldeneye ducks on Bellingham Bay between January and April of 1985. The study site covered the area from Marine Park to the first sandstone bluff south of Post Point (pg. 11).

Schott, Martin. 1990. Jurisdictional Wetland Determination for Chuckanut Ridge Planned Development. Prepared for Ted Gacek and Associates, Bellingham, WA.

As part of a wetland determination, a vegetative analysis was done at the site, located in south east Bellingham between Chuckanut Drive and the Interurban Trail. Aerial photographs and a field survey were used to identify significant forest communities. Dominant species of the canopy, shrub, and herbaceous layers for each community were described (pg. 7).

Senger, C. M. 1992. Checklist of Mammals of Whatcom County, Washington. Western Washington University, Bellingham, WA.

This list contains a section on mammals generally found in the lowlands and foothills of the county. Orders covered are: insectivores, bats, lagomorphs, rodents, carnivores, and even-toed ungulates.

Senger, C. M. 1992. List of Mammals form Bellingham in the Western Washington University Catalogue. Western Washington University, Bellingham, WA.

Western Washington University maintains a computerized database of information about specimens in its mammal collection. Data for each specimen includes the scientific name, entry date, and source. Specimens are represented by skins, skulls, or skeletons.

Shapiro and Associates, Inc. 1991. Bellingham Wetland Inventory. Prepared for the Bellingham Department of Planning and Economic Development, Bellingham, WA.

A team of local scientists, using the Unified Federal Method of wetland delineation, inventoried wetlands in and adjacent to Bellingham. Previous studies, infrared aerial photographs, and topographic maps were used to locate potential wetland sites. For each site a field reconnaissance was conducted to assess vegetation, soils, hydrology, wildlife use, and adjacent habitats (November 1990 to April 1991). Wetland vegetation and habitats were classified using United States Fish & Wildlife Service "Classification of Wetlands and Deepwater Habitat" manual. Vegetation types were characterized into large homogenous classes, such as marsh, scrub-shrub, and forest. Trees, saplings, shrubs, and herbs were considered. The 350 wetlands inventoried occupy 971 acres. They are mapped on orthophotographs.

Tabor, J. 1991. Animals Observed within Alignment Area of Proposed Whatcom Connector on North Lookout Mountain. Report prepared for Donovan Kehrer and Associates, Bellingham, WA.

Thirty-two species are listed that were observed on north Lookout Mountain, east of the Bellingham City limit. Significant species include bald eagle and pileated woodpecker.

Vitt, L. J. 1971. Reproductive Biology of the Anguid Lizard. Western Washington University, Bellingham, WA.

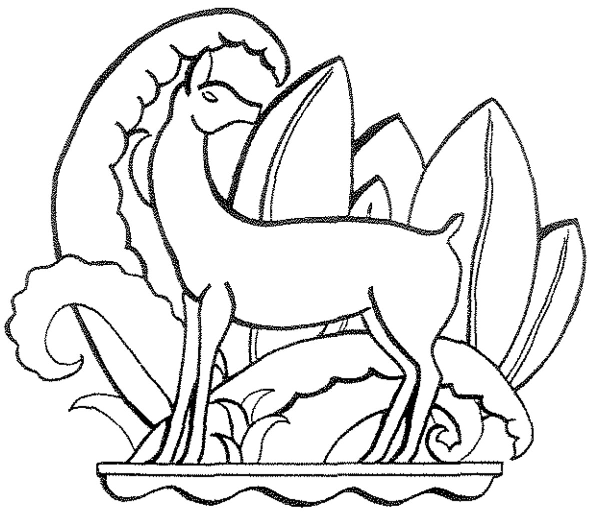
In this masters thesis the author describes collecting three anguid lizards in Whatcom Falls Park, located in east Bellingham, in July 1969 (pg. 8).

Wahl, T.R. and D.R. Paulson. A Guide to Bird Finding in Washington. Published by Terry Wahl, Bellingham, WA.

This book tells where various birds and mammals can be observed in and around Bellingham. Sites mentioned are Sehome Hill, Whatcom Falls, Bayview Cemetery, Lake Whatcom, Marine Park, Post Point, Chuckanut Mountain, and Larrabee State Park. Species reported to occur at these sites include cougar, bobcat, river otter, and pileated woodpecker. Each group of birding locations includes information on which of 14 possible habitat types are found in that area (pgs. 3-5). Also included is a graph showing the seasonal occurrence and commonness of over 300 bird species in Washington.

Wahl, T.T. and K. Friedman. 1990. Padden Creek Estuary Area Planning Study. Bellingham Parks and Recreation Department, Bellingham, WA.

Part II of this study assesses wildlife, habitat, and habitat function in the Padden Creek basin. The Padden Creek corridor, lagoon, and Lower Padden Marsh areas are each examined. Extensive species lists are provided for plants (pgs. 17-19) and birds (pgs. 22-24) of the Padden Creek lagoon. A salmon and trout utilization assessment of the watershed was compiled based largely on interviews with Washington Department of Fisheries personnel Mark Schuller and Jim Johnston (pgs. 25-28). The ecological functions of the creek corridor and estuary habitats are discussed. Significant species known to use the study area include: green-backed and great blue heron, peregrine falcon, steelhead salmon and cutthroat trout, coho, chinook, and chum salmon.



APPENDIX B

WILDLIFE HABITAT CLASSIFICATION SYSTEM

WILDLIFE HABITAT CODES
BELLINGHAM/WHATCOM COUNTY

0. No Data

URBAN/RURAL HABITAT & HUMAN STRUCTURES

1. Commercial/Industrial
2. Urban Open Space/Vacant Lots/Residential Yards
3. Multi-family
4. Playfield/School Ground
5. Park (developed/landscaped)
6. Cemetery
7. Golf Course
8. Cultivated Agricultural Land
9. Uncultivated Agricultural Land
10. Roadways/Parking Lots
11. Pipeline/Powerline

WETLAND COMMUNITIES

<u>Salt Water Habitats</u>

12. Saltwater-open water (marine/subtidal)
13. Saltwater Shoreline (marine/intertidal)
14. Estuary-open water (estuarine/intertidal)
15. Estuary-mudflat (estuarine/intertidal)
16. Estuary-salt marsh (estuarine/intertidal)

<u>Fresh Water Habitats</u>

17. River-deep water (riverine > 2 meters deep) (6.6ft)
18. Stream-shallow water (riverine < 2 meters deep)
19. Lake (lacustrine > 8 ha) (20 acres)
20. Pond (palustrine < 8 ha) -
21. Herbaceous Wetland/Wet Meadow (palustrine - moss-lichen/emergent)
22. Hardwood/Shrubby Wetland (palustrine - shrub-scrub/forested)
23. Coniferous Wetland (palustrine - forested)

UPLAND COMMUNITIES

<u>Forested Habitats</u>

24. Lowland/Temperate Coniferous Forest
25. Lodgepole Pine Forest
26. High Elevation Coniferous Forest
27. Red Alder Forest
28. Mixed Conifer-Hardwood Forest
29. Mixed Deciduous Forest

SPECIAL HABITAT FEATURES

30. Snags/Cavities
31. Down Logs and Woody Material
32. Cliffs
33. Talus
34. Caves
35. Coppice

QUALIFIER CODES (to be used with other habitat codes)

M/_. Man Made
E/_. Edges
R/_. Riparian (Riparian areas are the transistion zones between and always associated with adjacent fresh water and upland habitats),
X/_. Disturbed site-vegetation/patrially de-veg./backyards or expansive lawns

<u>Sucessional Stages</u>

A/_. Grass-Forb
B/_ Shrub
C/_. Open Sapling-Pole
D/_. Closed Sapling-Pole
SG/_. Large Second/Third Growth
OG/_. Mature-Old Growth

AME:12/92

WILDLIFE HABITAT CLASSIFICATION SYSTEM

Cover Types, Vegetation Communities and Special Habitats for the City of Bellingham and Whatcom County, Washington

For use with E. Reade Brown, ed. 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington USDA Forest Service

prepared by: A.M. Eissinger, NAHKEETA NORTHWEST 1992 (7/93 revision)

Wildlife communities are dynamic and complex systems with specific climactic, spatial, structural and nutritional requirements. These requirements are met independently by each species through special adaptations, associations and interactions with components within their environment. Habitat is characterized by those components, singularly and collectively with which a species is associated and likely dependent. Habitat, be it vegetative, geomorphic, aquatic or anthropic, is also dynamic, changing over time. Classifying habitat involves characterizing the current conditions of a landscape. Yet, the natural systems influence the landscape to change slowly overtime (in the absence of natural disaster) and when left undisturbed will generally succeed in a predicable fashion. Succession is most notably applied to vegetative communities. Each successional stage of a vegetative community provides a unique set of conditions with which certain wildlife species are adapt. It is therefore a well accepted practice to analyze and classify the landscape cover as a means of predicting species presence in a given area.

Classification systems are used to reliably predict the successional development of habitats and related changes in wildlife communities; to identify vegetative conditions with which specific sets of "dependent" wildlife populations may be associated; to predict responses to habitat conditions and wildlife populations to management activities; to serve as precursors to inventories and monitoring; and to provide a basis for planning and implementing both research and management activities (Holthausen & Marcot 1991. Wildlife and Vegetation of Unmanaged Douglas-Fir Forests USDA Forest Service).

In the absence of a state-wide standardized habitat classification system, it is necessary to adapt the best available and most widely used classification systems for local application. Two primary references were used as the basis of the following system, these are:

- E. Reade Brown, ed. 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington U.S. Department of Agriculture Forest Service. Parts 1&2
This reference provides habitat classification, definitions, detailed descriptions of wildlife and habitat associations, and a comprehensive listing of 460 wildlife and 78 freshwater and selected marine fish species found west of the Cascade Range in Oregon and Washington, their habitat requirements, life history information and more. Unfortunately, this reference is becoming outdated.

- Jan Henderson, Lesher R., Peter D., Shaw D., 1991. Forested Plant Associations of the Mt. Baker-Snoqualmie National Forest: a field guide. USDA Forest Service, Pacific Northwest Region, Technical Paper 028-91.
This reference is the field guide version of the classification of potential forest vegetation of the Mt. Baker-Snoqualmie National Forest. The guide identifies plant assemblages based on dominate species and characteristics of late-successional forest plant communities

- Lewis M. Cowardin, Carter V., Golet F., LaRoe E., 1979. Classification of Wetlands and Deepwater Habitats of the United States. Office of Biological Services, U.S. Fish and Wildlife Service, U.S. Department of the Interior. FWS/OBS-79/31
This reference is the standard wetlands classification system uses by both city and county in their wetlands inventory process. The systems and subsystems levels of classification have been incorporated with identical definitions into the local classification system.

Three other pertinent references were used in the refinement of the local system. The King County's *Wildlife Habitat Profile 1987* and *Wildsight Database1992* habitat dictionary provided urban designations and a similar system for cross classification. Washington State Departments of Wildlife and Natural Resources in cooperation with the University of Washington are developing the Washington State Gap Analysis Vegetation Classification as part of a state wide mapping project. The Gap Analysis system is preliminary and comparable only generally as a framework.

The following classification system was developed for county-wide use as a standardized system. It is to be used for all cover type, vegetative and habitat analysis, based on field survey, aerial or satellite imagery.

0. No data

URBAN/RURAL HABITAT & HUMAN STRUCTURES

1. Commercial/Industrial
2. Urban Open Space, Vacant Lots, Residential/Yards and Lawns
3. Gravel Pit
4. Playfield/School Ground
5. Park (developed/landscaped)
6. Cemetery
7. Golfcourse
8. Cultivated Agricultural Land
9. Uncultivated Ag. Land/Pasture/Orchard
10. Roadways/Parking Lots
11. Pipeline/Powerline Corridor

MARINE COMMUNITIES

INLAND MARINE HABITATS

12. Saltwater-open water (marine/subtidal)
13. Saltwater Shoreline (marine/intertidal)
14. Estuary-open water (Estuarine/subtidal)
15. Estuary-mud flat (Estuarine/intertidal)
16. Estuary-salt marsh (Estuarine/intertidal)

WETLAND COMMUNITIES

FRESH WATER HABITATS

17. **River- deep water** (riverine > 2 meters or 6.6ft. deep)
18. **Stream-shallow water** (riverine < 2 meters or 6.6ft. deep)
19. **Lake** (lacustrine > 8 ha or 20 acres)
20. **Ponds** (plaustrine < 8 ha) aquatic bed (rooted plants in pond)

21. Herbaceous Wetland/Wet Meadow (Palustrine - moss-lichen/emergent)

Bogs, marshes and meadows dominated by herbaceous plants and having a site potential for minimal shrub cover (less than 60%). The herbaceous wetland include sphagnum bogs with low shrubs, prostrate herbs and mosses; cat-tail, bulrush, standing water marshes; meadows dominated by sedges, rushes, grasses which are subirrigated.

22. Hardwood/Shrubby Wetland (Palustrine - shrub-scrub/forested)

Wetlands dominated by woody vegetation with crown cover exceeding 60%, including shrub and forested wetlands. Shrubby marshes and swamps with willow, alder, ash and many other shrub species or hardwood wetland forest wetlands with black cottonwood, alder, maple, with a shrub component are characteristic of this wetland type.

23. Coniferous Wetland (Palustrine - forested)

Coniferous forest with standing water part of the season; always with a high water table making it different from a dryland coniferous forest. Dominate tree species maybe the same as dryland site such as red cedar, western hemlock, yet Sitka spruce and distinctive ground vegetation, skunk cabbage, sedges, lady fern, water parsley, are indicative of the this wetland type.

UPLAND COMMUNITIES

FORESTED HABITATS

CONIFER DOMINATED FOREST

24. Lowland/Temperate Coniferous Forest

Western Hemlock Zone: Forest stands dominated by western red cedar, western hemlock, grand fir, Sitka spruce or douglas fir with conifers exceeding 70% of the crown cover. A stand is usually made up of more than one conifer species, often with one species dominating the overstory with codominates. Common shrubs are vine maple, salal, evergreen huckleberry, Pacific rhododendron, salmonberry, thimbleberry, oregongrape, pacific yew, hazelnut. Common herbs are sword-fern, vanillaleaf, trillium, twinflower, deer-fern, lady-fern.

25. Lodgepole Pine Forest

Lodgepole pine (Pinus contorta) usually occurs in isolated patches or bands (particularly along ridgelines) interspersed in a temperate coniferous forest communities. Lodgepole pine must dominate by 70% or more in the isolated patch or forest stand.

26. High Elevation Temperate Coniferous Forest

Silver Fir/ Mountain Hemlock Zone: Forest stands dominated by silver fir or mountain hemlock. The silver fir zone occurs in the upper reaches of the Nooksack river drainage generally occurring from 2,000 ft. and extending to 4,000 ft. elevation or above, while the mountain hemlock zone ranges between 2,500 ft. and 5,500 ft. elevation. Stand composition is influenced by aspect, soils and moisture.

27. Subalpine Forest Park

Subalpine Fir Zone: Forest and subalpine meadows occurring above 5,500 ft. depending on aspect, soils and moisture.

HARDWOOD DOMINATED FOREST

28. Red Alder Forest

Alder must exceed 70% of the stand's composition which may also contain big leaf maple, western hemlock, western red cedar or Sitka spruce. Ground vegetation is commonly dominated by salmonberry, sword-fern and herbs. Red alder forests occur on upland or wetland sites depending on soil conditions, aspect or disturbance (most notably clear cutting). Red alder forests are considered a successional plant community to western hemlock or western red cedar, however, red alder can dominate sites in nearly pure stand conditions for long periods of time and thus creates a unique wildlife habitat. Red alder stands may occur within temperate coniferous forests.

MIXED FOREST

29. Conifer-Hardwood Forest

Hardwoods make up 30% to 70% of the tree crown cover. According to Brown 1985, when hardwoods exceed 70% of the crown cover the stand type is considered *hardwood,* when the hardwoods are less than 30%, the type is *conifer.* Despite this distinction the *conifer-hardwood forest* applies in Appendix 8 without breakdown into *hardwood* or *conifer.* Hardwoods may include deciduous types such as maple, alder, birch, cherry or oak; or evergreen hardwoods such as Pacific madrone. Conifers may include western hemlock, Douglas-fir, white fir and western red cedar. Shrubs vary depending in part on canopy closure and herbs are common. The mixed forest is an interspersion of tall conifers and shorter but codominate hardwoods.

30. *Mixed Deciduous Forest

In areas of persistent disturbance by flooding or other conditions, a mixture of cottonwood, big leaf maple, vine maple, cherry and alder or any combination of the above may occur. This type of stand is most prevalent in flood plains and near complex wetlands.
*This vegetative community is not described in Brown 1985.

QUALIFIER CODES (to be used with other habitat codes)

Riparian Habitat

Riparian areas occur along rivers, streams, ponds, lakes and wetlands. The riparian area is a transitional zone between true wetland and upland/ terrestrial habitats. It is influenced by perennial and/or intermittent surface water flooding. The vegetation of an undisturbed riparian area is usually complex in structure and diverse in species. Riparian areas are associated with water bodies/systems and may vary in vegetative structure and habitat function depending on topography, soils, surface water, climate and disturbance.

The riparian code will be "R" and used as a qualifier since riparian areas are the transition zones between and always associated with adjacent fresh water and upland habitats.

R/ Riparian

Successional Stages

For each vegetation community listed above the following successional stages or stand conditions may apply. Each sere provides further descriptive detail of vegetative communities which provide wildlife habitats. This breakdown facilitates the application and interpretation of Appendix 8 (Brown 1985) charting the occurrence and orientation of wildlife species to western Washington plant communities, stand conditions and special or unique habitats.

A/ Grass-Forb: A condition occurring naturally as in a meadow or following timber harvest, burning or other removal of a forest cover. Vegetation consists of herbaceous plants, grasses and possibly shrub and tree seedlings.

B/ Shrub: Shrubs dominate vegetation. Tree saplings 1-3.5 meters in height and less than 40% of the crown canopy. (3-10 possibly 30 years)

C/ Open Sapling-Pole- Young Forest: Trees exceed 3.5 meters in height, but make up less than 60% of the crown canopy. Average tree d.b.h. > 3cm. A dominate shrub understory is common.

D/ Closed Pole- Young Forest: Tree crown canopy closure exceeds 60% and may reach 100%. Average tree d.b.h. < 50cm (20 in.). Very little understory vegetation results from the dense canopy. Only shade tolerant under story vegetation present.

SG/ <u>Large-Second Growth Forest</u>: Mean d.b.h. >53 cm (21 inches). Conifers may exceed 30 m (100 feet) in height and their crown cover is <100 percent. Forest understory vegetation is present with one or two layers. Stand lacks significant down woody material and snags. Generally <80 yrs old.

OG/ <u>Mature-Old Growth</u>: Dominate overstory trees mean d.b.h. range from 50-80 cm (21-32 in.) for mature forests and greater than 80 cm (30 in.) for old-growth. Dead and down woody material and snags at varying stages of decay present, understory vegetation present in 2 or more layers. Dominate overstory trees <100% crown closure. Mature forests are generally >80 yrs old and old-growth forests are >200 yrs old.

<u>Other Qualifiers</u>

M/ **Man Made**
E/ **Edge Habitat**
X/ **Disturbed Site:** disturbed vegetation/partaially de-vegetated/expansive homogeneous vegetation, i.e. backyards or lawns

SPECIAL HABITAT FEATURES

31. Snags/Cavities

Snags are a vital component of forest, riparian and wetland habitats, providing habitat for many species of wildlife (see SNAGS in this document). The size, structure, hardness and stage of decomposition of a snag are important characteristics in determining its value for nesting or foraging. Five stages of deterioration are described below. These stages are adapted from Cline et al. 1980 and are based on a Douglas-fir model. When recording snag characteristics in the field it is import to note tree species if possible or record as a deciduous or conifer. Cavities should also be noted including height from the ground, size of entrance and estimated depth, shallow/moderate/deep. Specify natural or excavated cavity.

The generalized five class scheme of snag deterioration is listed below:

Stage 1) snag standing, limbs, branches and bark intact, top present
Stage 2) snag standing, limbs broken, no fine branches, bark deteriorating, top broken
Stage 3) snag standing but height decreasing, limb stubs only, bark sloughing, heartwood firm
Stage 4) snag standing, height decreasing, few or no limb stubs, bark sloughing or absent, heartwood soft, advanced decay
Stage 5) snag standing, advanced decay, soft snag condition, bark 20% or absent, height decreasing

** Stages should be noted when recording snag occurrence
note: attachment i.e., detailed snag decay chart.

32. Logs & Down Woody Material

Dead and down woody material in the form of stumps, root wads, bark, limbs and logs in various stages of decay serve a vital role in nutrient cycling and natural forest regeneration. It also creates a structural and diverse habitat for a multitude of invertebrate and vertebrate, terrestrial and aquatic species.

Similar to snags, logs and down woody material are broken down into five stages of decomposition as follows:

Stage 1) bark intact, branches and twigs present, no epiphytes, log shape round
Stage 2) bark mostly intact, twigs/small branches absent, large limbs present, wood intact to part soft, no epiphytes, log shape round
Stage 3) bark part intact and sloughing, large limbs present, wood in large hard pieces, conifer seedlings present, log shape round
Stage 4) bark absent, large limbs present, wood in small soft pieces, moss and seedlings present, log shape round
Stage 5) bark absent, large limbs absent, wood soft and crumbling, moss and seedlings present, log shape oval

**Stages should be noted when recording downed log occurrence
note: attachment i.e., detailed log decay chart.

33. Cliffs
WDW-PHS definition: > 7.6 m or 25 ft high and < 1,500 m or 5,000 ft

34. Talus
WDW-PHS definition: areas of homogenous rock rubble ranging in size from .15 m or .5 ft. to 2m or 6.5 ft.

35. Caves
WDW-PHS definition: > .3m or 1 ft. diameter and > 1m or 3 ft. deep

36. Coppice
Isolated woodlot of conifer, deciduous or mixed tree species usually interspersed in pasture or agricultural land.

37. Eelgrass beds
Marine feature.

38. Clear-Cut Forest

39. Kelp beds
Marine Feature

APPENDIX C

SPECIES LIST
for
the CITY of BELLINGHAM

VERTEBRATE WILDLIFE SPECIES OF BELLINGHAM, WASHINGTON: *a master list*

The following species list is the most comprehensive list for the City of Bellingham to date and is based on reliable local sources. The list is structured in taxonomic order by class, family and species. Species are listed. Under each family heading, species are then listed by species code which represents the first two letters of the genus/species, followed by common name, scientific name, and codes depicting status, known watershed occurrence, abundance, seasonality and primary habitat associations (see habitat classification Appendix. B).

The master list represents a compendium of specialized lists, historical accounts and reported sightings. Updated field verification is needed for most species particularly amphibians, reptiles and small mammals. The bird list is the result of over twenty years of accumulated field data and includes common, breeding, migratory and rare species. The collective list includes terrestrial, aquatic, semi-aquatic and marine associated vertebrate species. Freshwater and anadromous fish are listed separately.

<u>Species list sources and contributors:</u>

Brown, Herbert. 1992. *Amphibians and Reptiles of Whatcom County and Bellingham.*
Drummond, David. 1995. Consulting Biologist (unpubl. field data).
Eissinger, Ann. 1995. Consulting Biologist (unpubl. data).
Manifold, Sally. 1995. Bellingham Greenways Volunteer Coordinator (unpubl. field data).
Senger, Clyde. 1992. *Checklist of Mammals of Whatcom County, Washington.*
Wahl, Terence. 1993. *A List of Avian Species Occurring in Bellingham, Washington.*
" " 1995. *Birds of Whatcom County, Washington.*

<u>Codes used to indicate status, abundance and seasonality are as follows:</u>

<u>Status</u> = * species that are expected, but not currently verified ** introduced species (non-native) X extirpated native species
SS sensitive species: (1995) endangered, threatened, candidate, monitor, PHS LS species of local significance

<u>Watershed</u> = **C** -Chuckanut **P** -Padden **W** -Whatcom **S** -Squalicum **B** -Bellingham Bay

<u>Abundance</u> = **C** (common), **U** (uncommon), **R** (rare), - (undetermined)

<u>Seasonality</u> = **P** (permanent residence, breeder), **S** (summer, breeder), **W** (winter resident), **SF** (spring/fall, migrant), - (undetermined)

AMPHIBIANS

species code	common name	genus/species	status	watershed	abundance/seasonality		primary habitat breed	feed
AMBYSTOMATIDAE								
AMGR	northwestern salamander	*Ambystoma gracile*	LS	C	U	P	20	24,32
AMMA	long-toed salamander	*Ambystoma macrodactylum*	LS	C	U	P	20	24,26,32
DICAMPTODONTIDAE								
DIEN	Pacific giant salamander	*Dicamptodon ensatus*	LS	C	R	P	18,20	24,26,32
PLETHODONTIDAE								
ENES	ensatina	*Ensatina eschscholtzi*	LS	C,P	U	P	29	29,32
PLVE	western redback salamander	*Plethodon vehiculum*	LS	C	U	P	24	24,32
SALAMANDRIDAE								
TAGR	roughskin newt	*Taricha granulosa*	LS	C	U	P	20,21	29,9
BUFONIDAE								
BUBO	western toad	*Bufo boreas*	LS	P	R	P	20	28
HYLIDAE								
HYRE	Pacific chorus frog	*Hyla regilla*		all	C	P	20	28,32
RANIDAE								
RAAU	red-legged frog	*Rana aurora*	SS	all	C	P	20	18,24
RACAT	bullfrog	*Rana catesbeiana*	**		-	P	20	18,20

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed

REPTILES

ANGUIDAE

ELCO	northern alligator lizard	*Elgaria coerulea*	LS	C,P,B	-	P	29	29/E,34

BOIDAE

CHBO	rubber boa	*Charina bottae*	LS	B	R	P	24	24 A,26

NATRICINAE (subfamily)

THOR	northwestern garter snake	*Thamnophis ordinoides*	*LS	P	-	P	21,22	22,34
THSI	common garter snake	*Thamnophis sirtalis*	*LS	P	-	P	21	21,24
THEL	terrestrial garter snake	*Thamnophis elegans*	*LS	P,S	-	P	21,20	21

BIRDS names and order based on the *Check list of North American Birds* from the American Ornithologists' Union, 1985.

species code	common name	genus/species	status	watershed	abundance/seasonality		primary habitat breed	primary habitat feed
GAVIIDAE								
GAIM	common loon	*Gavia immer*	SS	C,P,W,B	U/C	P	19	19,12
GAAD	yellow-billed loon	*Gavia adamsii*		C,B	R	W		12
GAPA	pacific loon	*Gavia pacifica*		C,P,B	C	W		12
GAST	red-throated loon	*Gavia stellata*		C,P,B	U	S/W		12
PODICIPEDIDAE								
AECL	Clark's grebe	*Aechmophorous clarkii*	SS	B	R	W		12
AEOC	western grebe	*Aechmophorous occidentalis*	SS	all	U/C	W	12	19,12
POGR	red-necked grebe	*Podiceps grisegena*	SS	B,C	C	W		12
POAU	horned grebe	*Podiceps auritus*	SS	all	U/C	W	12	19,12
PODNI	eared grebe	*Podiceps nigricollis*		B,C	U	W		12
POPO	pied-billed grebe	*Podilymbus podiceps*	LS	C,P,W,S	U	P	19	19,12
PELICANIDAE								
PEER	American white pelican	*Pelalicanus erythrorhynchos*	SS	-	R	SF		12,20
PEOC	brown pelican	*Pelalicanus occidentalis*	SS	-	R	F		12
PHALACROCORACIDAE								
PHAU	double-crested cormorant	*Phalacrocorax auritus*		all	C	P	13	12,20
PHPE	Brandt's cormorant	*Phalacrocorax penicillatus*	SS	C,B	C	P	13	12
PHPEL	pelagic cormorant	*Phalacrocorax pelagicus*		C,B	C	P	13	12
ARDEIDAE								
BOLE	American bittern	*Botaurus lentiginosus*		S	R	Su	21	21
NYNY	black-crowned night-heron	*Nycticorax nycticorax*	SS	W	R	F		20,21
BUST	green-backed heron	*Butorides striatus*	SS	C,P,W,S	U	Su	17,18 R	17,18 R
BUIB	cattle egret	*Bubulcus ibis*	-	-	R	F		

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
CASAL	great egret	*Casmerodius albus*	SS	-	R	F		9,13,20
ARHE	great blue heron	*Ardea herodias*	SS	all	C	P	29	13,20 R
ANATIDAE								
CYCO	tundra swan	*Cygnus columbianus*	SS	B	C	W		9,12,13,19
CYBU	trumpeter swan	*Cygnus buccinator*	SS	B	C	W		9,12,13,19
ANAL	greater white-fronted goose	*Anser albifrons*		-	R	SF		9,19
CHCA	lesser snow goose	*Chen caetulescens*		-	R	W		9,19
BRCA	Canada goose	*Branta canadensis*	* *	all	C	P	19,20	12,8,9
BRBE	brant	*Branta bernicla*	SS	B	C	SF,W		12,13
ANPL	mallard	*Anas platyrhynchos*		all	C	P	20	12,13,8
ANST	gadwall	*Anas strepera*		P,S	U	W		12,20,8
ANCR	green-winged teal	*Anas crecca*		all	C	W		12,13,20,8,9
ANAAM	American wigeon	*Anas americana*		all	C	W		12,13,20,8,9
ANPE	eurasian wigeon	*Anas penelope*		-	R	W		12,13,20,8,9
ANAC	northern pintail	*Anas acuta*		all	C	W		12,13,20,8,9
ANCL	northern shoveler	*Anas clypeata*		C,P,W,S	C	SF		12,20
ANDI	blue-winged teal	*Anas discors*		P,S	U	SF		12,20
ANCY	cinnamon teal	*Anas cyanoptera*		P,S	U	SF		12,20
OXJA	ruddy duck	*Oxyura jamaicensis*		P,S	U	W		12,19
AISP	wood duck	*Aix sponsa*	SS	C,P,W,S	C	S	20	20
AYVA	canvasback	*Aythya valisineria*		P,W	U	W		12,20
AYAM	redhead	*Aythya americana*		B	U	W		
AYCO	ring-necked duck	*Aythya collaris*		-	U	W		
AYMA	greater scaup	*Aythya marila*		B	C	W		12,20,19
AYAF	lesser scaup	*Aythya affinis*		W,B	U	W		12,20,19
SOSP	king eider	*Somateria spectabilis*		-	R	W		12
MENI	black scoter	*Melanitta nigra*		B	U	W		12
MEFU	white-winged scoter	*Melanitta fusca*		C,B	C	W		
MEPE	surf scoter	*Melanitta perspicillata*		C,B,P	C	W		12,20

species code	common name	genus species	status	watershed	abundance/seasonality		breed	feed
HIHI	harlequin duck	*Histrionicus histrionicus*	SS	B,C	C	P	17,18	12,13
CLHY	oldsquaw	*Clangula hyemalis*		B,C	C	W		12,19
BUIS	Barrow's goldeneye	*Bucephala islandica*		all	C	W	20	12
BUCL	common goldeneye	*Bucephala clangula*		all	C	W		12,20
BUAL	bufflehead	*Bucephala albeola*		all	C	W		12,20
MERME	common merganser	*Mergus merganser*		B,P,W	C	W	17	12
MESE	red-breasted merganser	*Mergus serrator*		B,P	C	W		12,20
LOCUC	hooded merganser	*Lophodytes cucullatus*	SS	all	U	P	20	12
CATHARTIDAE								
CAAU	turkey vulture	*Cathartes aura*	SS	all	C	S,SF	24,29 R	13,24,29 R
ACCIPITRIDAE								
AUCH	golden eagle	*Aquila chrysaetos*	SS	-	R	SF	24,26	24,26,29
HALE	bald eagle	*Haliaeetus leucocephalus*	SS	all	C	P	24,29	12,13,19,24,29
CICY	northern harrier	*Circus cyaneus*	LS	P,S	C	SF	21	20,21,8,9
ACST	sharp-shinned hawk	*Accipter striatus*	LS	all	U	P	24	29,22,9
ACCO	Cooper's hawk	*Accipiter cooperii*	LS	C,P,W,S	U	P	29,R	29,22,9
ACGE	northern goshawk	*Accipiter gentilis*	SS	-	R	SF,W	26	26,24,8,9
BUJA	red-tailed hawk	*Buteo jamaicensis*	SS	all	C	P	9,29,30R	9,21
BULA	rough-legged hawk	*Buteo lagopus*		P,S	U	SF,W		21,8,9
PAHA	osprey	*Pandion haliaetus*	SS	all	C	P	23,24	17,19,20
FALCONIDAE								
FASP	American kestrel	*Falco sparverius*	LS	P,S	U	SF,W	29,24	21,8,9,5,7,11
FACO	merlin	*Falco columbarius*	SS	all	U,C	SF,W		1,29,8,9,2
FAPE	peregrine falcon	*Falco peregrinus*	SS	all	C	P	29,33	12,29,24,13,8,
FARU	gyrfalcon	*Falco rusticolus*	SS	-	R	W		13,8,9

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
PHASIANIDAE								
BOUM	ruffed grouse	*Bonasa umbellus*	SS	C,P,W,S	C	P	28,29	24,29
PHCO	ringed-necked pheasant	*Phasianus colchicus*	* *	all	U	P	9,22	21,29,9,8
GRUIDAE								
GRCA	sandhill crane	*Grus canadensis*	SS	-	R	SF		20,21,8,9
RALLIDAE								
RALI	Virginia rail	*Rallus limicola*	LS	P,W	U	P	21	21
PORCA	sora	*Porzana carolina*	LS	-	U	P	21	21
FUAM	American coot	*Fulica americana*		W,P	C	P	21	21,12
CHARADRIIDAE								
CHSE	semipalmated plover	*Charadrius semipalmatus*		C,P,B	C	SF		12,28
CHVO	killdeer	*Charadrius vociferus*		all	C	P	9,21,20	13,8,9,21
PLSQ	black-bellied plover	*Pluvialis squatarola*		C,P,B	C	W		13,18,9
SCOLOPACIDAE								
NUPH	whimbrel	*Numenius phaeopus*		C	U	SF		13
CASE	willet	*Catoptrophorus semipalmatus*		C	R	SF		13,18
TRME	greater yellowlegs	*Tringa melanoleuca*		C,P,B	U	SF		13,20
TRFL	lesser yellowlegs	*Tringa flavipes*		C,B	U	SF		13,20
SCOLOPACIDAE								
ACMA	spotted sandpiper	*Actitis macularia*	LS	all	C	Su	17,19	18,21
LIGR	short-billed dowitcher	*Limnodromus griseus*		C,B	U	SF		13
LISC	long-billed dowitcher	*Limnodromus scolopaceus*		B	U	SF		13,18,20
GAGA	common snipe	*Gallinago gallinago*	LS	C,P,W,S	U	P	20,21	21,13,9
AREIN	ruddy turnstone	*Arenaria interpres*		-	R	SF		13
ARME	black turnstone	*Arenaria melanocephala*		C,B	C	W		13

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
APVI	surfbird	*Aphriza virgata*		B	C	W		13
CAPT	rock sandpiper	*Calidris ptilocnemis*		C,B	R	W		13
CALAL	sanderling	*Calidris alba*		C,B	C	W,S/F		13
CAMAU	western sandpiper	*Calidris mauri*		C,P,B	C	SF		13
CAMI	least sandpiper	*Calidris minutilla*		P,C	C	SF		13,18,20
CABA	Baird's sandpiper	*Calidris bairdii*		-	U	F		13,18,21
CAMEL	pectoral sandpiper	*Calidris melanotos*		-	C	SF		13,18,20
CAAL	dunlin	*Calidris alpina*		C,P,B	C	SFW		
HAEMATOPODIDAE								
HABA	black oystercatcher	*Haematopis bachmani*		C,B	C	P		
LARIDAE								
STPA	parasitic jaeger	*Stercorarius parasiticus*		B	C	SF		12,13
LAHE	Heermann's gull	*Larus heermanni*		C,B	U	SF		12,13
LAPI	Franklin's gull	*Larus pipixcan*		P,W,B	R	F		12,13,20
LAPH	Bonaparte's gull	*Larus philadelphia*		all	C	SF		12,13,20
LADE	ring-billed gull	*Larus delawarensis*		all	C	P	19	12,13,8,9
LARCAN	mew gull	*Larus canus*		all	C	W		12,13,20,8,9
LACAL	California gull	*Larus californicus*		B	U	P	19	12,13,8,9
LATH	Thayer's gull	*Larus thayeri*		B	U	W		12,13
LAOC	western gull	*Larus occidentalis*		B	R	W		12,13
LAGL	glaucous-winged gull	*Larus glaucescens*		all	C	P	1,13	12,13,20,8,9
RITR	black-legged kittiwake	*Rissa tridactyla*		B	R	W		12,13
XESA	Sabine's gull	*Xema sabini*		B	R	SF		12
STHI	common tern	*Sterna hirundo*		B	C	SF		12,13,20
STPAR	arctic tern	*Sterna paradisaea*	SS	-	R	SF		12,13
STCA	caspian tern	*Sterna caspia*	SS	B,P	C	Su		12,13,20

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
ALCIDAE								
URIA	common murre	*Uria aalge*		C,B	C	P		12
CECO	pigeon guillemot	*Cepphus columba*	LS	C,B	C	P	13	12,13
BRMA	marbled murrelet	*Brachyramphus marmoratus*	SS	C,B	U	P	26	12
CEMO	rhinoceros auklet	*Cerorhinca monocerata*		C,B	C	Su		12
COLUMBIDAE								
COFA	band-tailed pigeon	*Columba fasciata*	SS	C,P,W,S	U	Su	5,24,29	9,24,29
COLI	rock dove	*Columba livia*		all	C	P	5,8,1,2	5,8,1,2
ZEMA	mourning dove	*Zenaida macroura*	*LS	-	U	P	22,8	22,8
TYTONIDAE								
TYAL	barn owl	*Tyto alba*		P	U	P	29R,5,9,2	29,5,9
STRIGIDAE								
ASFL	short-eared owl	*Asio flammeus*	*	-	U	W		21,9,27
ASOT	long-eared owl	*Asio otus*	*	-	R	W		24,9
BUVI	great horned owl	*Bubo virginianus*	LS	C,P,W,S	U	P	24,29R,30	29R,30
STVA	barred owl	*Strix varia*	SS	C,P,W	U	P	29,R	29,24,26
NYSC	snowy owl	*Nyctea scandiaca*	SS	-	R	W		2,13,21,8,9
OTKE	western screech owl	*Otus kennicottii*	LS	C,P,W,S	U	P	29,R	29,5
GLGN	northern pygmy owl	*Glaucidium gnoma*	LS	C,P,W	U	P	24,26	24,26
AEAC	northern saw-whet owl	*Aegolius acadicus*	LS	all	U	P	24	29,5
CAPRIMULGIDAE								
CHMI	common nighthawk	*Chortdeiles minor*		all	U	Su	5,24,26	8,9,29
APODIDAE								
CYNI	black swift	*Cypseloides niger*	SS	C,P,W	U	Su	33	24,29,26
CHVA	Vaux's swift	*Chaetura vauxi*	SS	C,P,W	U	Su	1,24,26	1,24,26

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
TROCHILIDAE								
SERUF	rufous hummingbird	*Selasphorus rufus*		all	C	Su	5,22,24,R	2,5,22,24
CAAN	Anna's hummingbird	*Calypte anna*			U	P		
ALCEDINIDAE								
CEAL	belted kingfisher	*Ceryle alcyon*		all	C	P	17,13,19	13,17,20
PICIDAE								
COAU	northern flicker	*Colaptes auratus*	LS	all	C	P	24,29	24,29,5,9
SPRU	red-breasted sapsucker	*Sphyrapicus ruber*		C,P,W,S	U	P	5,24,29R	5,24,29R
PIPU	downy woodpecker	*Picoides pubescens*	LS	all	C	P	5,28,29R	28,29R,5
PIVI	hairy woodpecker	*Picoides villosus*	LS	C,P,W,S	C	P	24,29,5	24,29,5
DRPI	pileated woodpecker	*Dryocopus pileatus*	SS	C,P,W	U	P	29,26	29,26
TYRANNIDAE								
TYTY	eastern kingbird	*Tyrannus tyrannus*		-	R	SF		R,5
TYVE	western kingbird	*Tyrannus verticalis*		-	R	SF		29R,9
COBO	olive-sided flycatcher	*Contopus borealis*		C,P,W	U	Su	24,R	24,R,5
COSO	western wood-pewee	*Contopus sordidulus*		C,P,W	U	Su	29,R	29,R
EMHA	Hammond's flycatcher	*Empidonax hammondii*		-	U	Su	24,29	24,29
EMTR	willow flycatcher	*Empidonax trallii*		C,P,W,S	C	Su	29,R	29,R
EMDI	pacific slope flycatcher	*Empidonax difficilis*	LS	C,P,W,S	C	Su	24,29,R	24,29,R
ALAUDIDAE								
ERAL	horned lark	*Eremophila alpestris*		-	R	P	21,27	21,27,13,8,9
HIRUNDINIDAE								
TABI	tree swallow	*Tachycineta bicolor*	LS	all	C	Su	20,R,M	20,R,5
TATH	violet-green swallow	*Tachycineta thalassina*		all	C	Su	5,20,29,R,9,M	5,20,29,R,9
PRSU	purple martin	*Progne subis*	X,SS	P,W,B	R	SF		19

STSE	northern rough-winged	*Stelgidopteryx serripennis*		C,P,B	U	Su,SF	R,33	R,29,17,20
HIPY	cliff swallow	*Hirundo pyrrhonota*		?	U	Su,SF	9,33,M,17,20	17,20,9,5
HIRU	barn swallow	*Hirundo rustica*	LS	all	C	Su	M,17,19,20,9	17,19,20,9
CORVIDAE								
CYST	Steller's jay	*Cyanocitta stelleri*		all	C	P	24,29	24,29,5,2
NUCO	Clark's Nutcracker	*Nucifraga columbiana*		-	R	SF		26,27
PIPI	black-billed magpie	*Pica pica*		-	R	SF		29,9
COCA	northwestern crow	*Corvus caurinus*		all	C	P	24,29,R	13,18,19,24,29,R,8
COCO	common raven	*Corvus corax*		all	C	P	24,26	13,19,8,24,26,27
PARIDAE								
PAAT	black-capped chickadee	*Parus atricapillus*		all	C	P	29,R	29,R
PAGA	mountain chickadee	*Parus gamblei*		-	U	W		24,26
PARU	chestnut-backed chickadee	*Parus rufescens*		all	C	P	24,29	24,29,5
AEGITHALIDAE								
PAMI	bushtit	*Psaltriparus minimus*		all	C	P	22,5,29,R	29,R,22,5
CERTHIIDAE								
CEAM	brown creeper	*Certhia americana*	LS	C,P,W,S	U	P	5,24	24,29,R,5
SITTIDEA								
SICA	red-breasted nuthatch	*Sitta canadensis*		all	U	P	29	29,R,5
TROGLODYTIDAE								
TRAE	house wren	*Troglodytes aedon*		-	R	Su	29R,22,5	29R,22,5
TRTR	winter wren	*Troglodytes troglodytes*		C,P,W,S	C	P	24,26	24,26,22,5
THBE	Bewick's wren	*Thryomanes bewickii*		all	C	P	5,22,29,R	5,22,29,R
CIPA	marsh wren	*Cistothorus palustris*		?	U	P	21	21

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
MUSCICAPIDAE								
RESA	golden-crowned kinglet	*Regulus satrapa*	LS	C,P,W,S	C	P	24,26R	24,26R,22,5
RECA	ruby-crowned kinglet	*Regulus calendula*		C,P,W,S	C	W		26,29,R,22,5
SICU	mountain bluebird	*Sialia currucoides*		-	R	W,Su	26,21	26,21,22,9
SIME	western blubird	*Sialia mexicana*	X/SS	-	R	-		
CAUS	Swainson's thrush	*Catharus ustulatus*	LS	C,P,W	C	Su	24,29R	24,29R,22,5
CAGU	hermit thrush	*Catharus guttatus*		C,P,W	U	W		26,22,5
IXNA	varied thrush	*Ixoreus naevius*		all	C	P,W	24,26R	24,26,30,22,5
TUMI	American robin	*Turdus migratorius*		all	C	P	5,24,30R	5,24,30R
LANIIDAE								
LAEX	northern shrike	*Lanius excubitor*	LS	S,P	U	W		R,21,22,9,5
MIMIDAE								
DUCA	gray catbird	*Dumetella carolinensis*		-	R	Su,F		22
MIPO	northern mockingbird	*Mimus polyglottos*		-	R	W		22,5
MOTACILLIDAE								
ANRUB	American pipit	*Anthus rubescens*		P	U	SF	27/21	20,21,8,9
CINCLIDAE								
CIME	American dipper	*Cinclus mexicanus*	LS	C,P,W	C	P	18 R	18,17 R
BOMBYCILLIDAE								
BOGA	bohemian waxwing	*Bombycilla garrulus*		P,S	U	W		24,26,30,R,5
BOCE	cedar waxwing	*Bombycilla cedrorum*		all	C	P	5,30,R	5,30,R,24
STURNIDAE								
STVU	european starling	*sturnus vulgarus*	* *	all	C	P	M,30,R,5	M,5,R,30

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
VIREONIDAE								
VIHU	Hutton's vireo	*Vireo huttoni*		C,P	U	P	24,30,5	24,30,5
VISO	solitary vireo	*Vireo solitarius*	LS	C,P	U	Su	24,30	24,30,22
VIOL	red-eyed vireo	*Vireo olivaceus*	LS	C,P	C	Su	30,R	30,R,5
VIGI	warbling vireo	*Vireo gilvus*		P,W,S	C	Su	24,26,R,30	24,26,30R,5
EMBERIZIDAE								
VECE	orange-crowned warbler	*Vermivora celata*	LS	C,P,W,S	C	Su	30,22,5	30,22,5
VERU	Nashville warbler	*Vermivora ruficapilla*		-	U	SF	24,30	24,30,R,22,5
DETI	Cape May warbler	*Dendroica tigrina*		-	R	SF		
DECOR	yellow-rumped warbler	*Dendroica coronata*		all	C	Su,P	5,24,22	5,26,24,22
DENI	black-throated gray warbler	*Dendroica nigrescens*		C,P,W,S	U	Su	24,26,30	24,26,30,5
DETO	Townsend's warbler	*Dendroica townsendii*		C,P,S	C	Su	24,26	24,26,5,30,R
DEPE	yellow warbler	*Dendroica petechia*		C,P,S	C	Su,F	22,30,R	22,30,R
OPTO	MacGillivray's warbler	*Oporonis tolmiei*		C,P,W,S	U	S	24,30,22,R	22,24,30R,5
WIPU	Wilson's warbler	*Wilsonia pusilla*	LS	C,P,W,S	C	S	30,22,R	30,22,R
GETR	common yellowthroat	*Geothlypis trichas*		C,P,S	C	S	19,20,21	19,20,21
SERU	American redstart	*Setophaga ruticilla*		-	R	SF		30R
PHME	black-headed grosbeak	*Pheucticus melanocephalus*		S,W,P,C	C	S	5,30,24,R	5,24,30,R
PAAM	lazuli bunting	*Passerina amoena*		-	R	SF	11,22,R	22,R
PIER	rufous-sided towhee	*Pipilo erythrophthalmus*	LS	all	C	P	22,5,30,R	5,22,30,R
PASA	savannah sparrow	*Passerculus sandwichensis*		P,S	C	Su,F	21,9	9,21,13
MELME	song sparrow	*Melospiza melodia*		all	C	P	22,30R,5	5,22,30,R,9
SPAR	American tree sparrow	*Spizella arborea*		-	R	W		R,21,22,9
SPPA	chipping sparrow	*Spizella passerina*		-	R	Su		
JUHY	dark-eyed junco	*Junco hyemalis*		all	C	P	29,24,26	24,26,29,R,2
ZOAL	white-throated sparrow	*Zonothrichia albicollis*		W,S	R	W		21,22,5
ZOLE	white-crowned sparrow	*Zonotrichia leucophrys*		all	C	P	5,22	30,R,5,22,9
ZOAT	golden-crowned sparrow	*Zonotrichia atricapilla*		all	U	F,W		R,22,5,9
PAIL	fox sparrow	*Passerella iliaca*		all	U	W		22,26,R,5

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
MELI	Lincoln's sparrow	*Melospiza lincolnii*		P,S	U	SF		22,R,5
CALA	lapland longspur	*Calcarius lapponicus*		-	R	W,SF		13,18,9
PLNI	snow bunting	*Plectrophenax nivalis*		P	R	W		13,9
STUNE	western meadowlark	*Sturnella neglecta*		P,S,B	U	W		9,21
AGPH	red-winged blackbird	*Agelaius phoeniceus*		all	C	P	19,20,21	19,20,21R
EUCY	Brewer's blackbird	*Euphagus cyanocephalus*		all	C	P	5,9	5,9,8
MOAT	brown-headed cowbird	*Molothrus ater*		all	C	S	22,5,24,30,R	5,22,24,30,R,8
ICGA	northern oriole	*Icterus galbula*		W	U	S	30,R	30,R,5
PILU	western tanager	*Piranga ludoviciana*	LS	C,P,W	C	S	24,26	24,26,5,R
PASSERIDAE								
PADO	house sparrow	*Passer domesticus*	**	all	C	P	2,5,M	2,5,M,22,9,M
FRINGILLIDAE								
CAPI	pine siskin	*Carduelis pinus*		all	C	P	24,26	24,26,R,22,5,9
CATR	American goldfinch	*Carduelis tristis*		all	C	P	30,R,5	30,R,5,22,9
LOCU	red crossbill	*Loxia curvirostra*	LS	P,C	C	P	24,26	24,26,27
LOLE	white-winged crossbill	*Loxia leucoptera*		-	R	-		24,26
PIEN	pine grosbeak	*Pinicola enucleator*		C,P,W,S	U	W		27,21,24,26
CAFL	common redpoll	*Carduelis flammea*		-	R	W		R,5,9
LEAR	rosy finch	*Leucosticte arctoa*		-	R	-		13,21,27
CAPU	purple finch	*Carpodacus prupureus*		all	U	P	24	24,30,R,22,5,9
CAME	house finch	*Carpodacus mexicanus*		all	C	P	5	5,R,22,9
COVE	evening grosbeak	*Coccothraustes vespertinus*		all	C	P	24,26	24,26,R,5

MAMMALS

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
Order MARSUPILIA								
DIDELPHIDAE								
DIVI	Virginia opossum	*Didelphis virginiana*	**	all	C	P	28,29,32	28,29
Order INSECTIVORA								
SORICIDAE								
SOBE	marsh shrew	*Sorex benderii*	*		-	P	21	21,32
SOTRO	Trowbridge's shrew	*Sorex trowbridgii*		all*	-	P	A/,24	A/,24
SOCI	masked shrew	*Sorex cinereus*	*		-	P	21	9,28
SOVA	vagrant shrew	*Sorex vagrans*		all*	-	P		
TALPIDAE								
NEGI	shrew-mole	*Neurotrichus gibbsii*		all*	-	P	18,24	18,24
SCTO	Townsend's mole	*Scapanus townsendii*	*	all	-	P	9,21,24	9,21,24
SCOR	coast mole	*Scapanus orarius*		all*	-	P	28	28
Order CHIROPTERA								
VESPERTILIONIDAE								
MYLU	little brown myotis	*Myotis lucifugus*	LS	P,C,W	-	-	24	19,29,2
MYEV	long-eared myotis	*Myotis evotis*	SS	?	-	-		19,29
MYOCA	California myotis	*Myotis californicus*	LS	?	-	-	24	19,29
?MYKE	Keen's myotis	*Myotis keenii*	*SS	-	-	-		19,29
LANO	silver-haired bat	*Lasionycteris noctivagans*	LS	?	-	-	24	19,29
EPFU	big brown bat	*Eptesicus fuscus*	LS	?	-	-	24	19,29,2
PLTO	Townsend's big-eared bat	*Plecotus townsendii*	SS	C,P	-	-		19,24
MYVO	long-legged myotis	*Myotis volans*	SS	?	-	-		

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
Order LAGOMORPHA								
LEPORIDAE								
SYFL	eastern cottontail	*Sylvilagus floridanus*	**	all	C	R	9,29	9,29
LEAM	snowshoe hare	*Lepus americanus*	LS	?	?	P		
Order RODENTIA								
APLODONTIIDAE								
APRU	mountain beaver	*Aplodontia rufa*	LS	C,P,W	-	P	18,21	18,21
SCIURIDAE								
TATO	Townsend's chipmunk	*Tamias townsendii*	LS	C,P,W	-	-	29	29
SCCA	eastern gray squirrel	*Sciurus carolinensis*	**	W	-	-	29	29
TADO	Douglas squirrel	*Tamiasciurus douglasii*	LS	C,P,W,S	-	-	24,29	24,29
GLSA	northern flying squirrel	*Glaucomys sabrinus*	LS	C,P,W	-	-	24,29	24,29
CASTORIDAE								
CASCAN	beaver	*Castor canadensis*	LS	W,S	U	P	19	20,22
MURIDAE								
subfamily sigmodontidae								
PEMA	deer mouse	*Peromyscus maniculatus*		all	C	P	21,24,29	21,24,29
NECI	bushy-tailed woodrat	*Neotoma cinerea*		-	-	-	24	24
subfamily arvicolinae								
MITO	Townsend's vole	*Microtus townsendii*	LS	all*	C	P	9	9
MILO	long-tailed vole	*Microtus longicaudus*		-	-	P	21/26	21/26
MIOR	creeping vole	*Microtus oregoni*		-	-	P	21/29	21/29/32
ONZI	muskrat	*Ondatra zibethicus*	LS	P,W,S	-	P	20/21	20/21

subfamily	**murinae**								
RARA	black rat	*Rattus rattus*	* *	all*	-	P	2	2	
RANO	Norway rat	*Rattus norvegicus*	* *	all*	-	P	1,2	1,2	
MUMU	house mouse	*Mus musculus*	* *	all*	-	P	2,9	2,9	
DIPODIDAE									
ZATR	pacific jumping mouse	*Zapus trinotatus*		all*	-	P	21,24	21,24	
ERETHIZONTIDAE									
ERDO	porcupine	*Erethizon dorsatum*	LS	C,P,W	U	P	29	29	
Order CARNIVORA									
CANIDAE									
CALAT	coyote	*Canis latrans*	LS	all	C	P	9,26,29	9,26,29	
VUVU	red fox	*Vulpes vulpes*	LS	C,P,W	U	P	9,26,29	9,26,29	
URSIDAE									
URAM	black bear	*Ursus americanus*	LS	P,W	UC	P	26,29A,32	18,20,26,29A	
OTARIIDAE									
ZACA	California sea lion	*Zalophus californianus*	SS	B	C	-		12	12
PROCYONIDAE									
PRLO	raccoon	*Procyon lotor*		all	C	P	18,19,21,29	18,19,21,29	
MUSTELIDAE									
MUER	ermine	*Mustela erminea*		all*	R	P	24,26	24,26	
MUFR	long-tailed weasel	*Mustela frenata*		all*	-	-	24,26	24,26	
MUVI	mink	*Mustela vison*		C,P,W	R	P	18,19,21	18,19,21	
MEMEP	striped skunk	*Mephitis mephitis*		C,P,W,S	C	P	24,32	24,26	
LUCA	river otter	*Lutra canadensis*	LS	C,P,W	-	-	17,19,35	17,19,21	

species code	common name	genus/species	status	watershed	abundance/seasonality		breed	feed
PHOCIDAE								
PHVI	harbor seal	*Phoca vitulina*	SS	B	C	P	12,13	12,13
FELIDAE								
FECO	cougar	*Felis concolor*	LS	- -	R	-	29	29
LYRU	bobcat	*Lynx rufus*	LS	- -	R	-	26,29	26,29
CERVIDAE								
ALAL	moose	*Alces alces*		- -	R		24,26	19,20,24,26
ODHEC	black-tailed deer	*Odocoileus hemionus columbianus*	SS	all	C	P	9,26,29E/	9,26,29E/
ODHEH	mule deer	*Odocoileus hemionus hemionus*		?	C	P	9,26,29E/	9,26,29E/

Fish Species Occurring In Bellingham's Lakes and Streams

Order Petromyzontiformes:

Pacific Lamprey *(Lampetra tridentata)*
anadromous
-native/naturally reproducing

Order Salmoniformes:

Chum Salmon *(Oncorhynchus keta)*
anadromous
-native/naturally reproducing (Chuckanut, Padden and Squalicum Crs.),
-hatchery stocks (Chuckanut, Padden, Squalicum and Whatcom Crs.)

Coho Salmon *(Oncorhynchus kisutch)*
anadromous
-native/naturally reproducing (Chuckanut, Padden and Squalicum Crs.)
-hatchery stocks (Chuckanut, Padden, Squalicum and Whatcom Crs.)

Kokanee or (landlocked) Sockeye *(Oncorhynchus nerka)*
resident
-native/naturally reproducing (Lk. Whatcom)
-hatchery stock derived from native resident (Lk. Whatcom) stock /naturally reproducing and hatchery plants

Chinook Salmon *(Oncorthynchus tshawytscha)*
anadromous
-native/hatchery stocks (Whatcom Cr.) fall run only

White Fish *(Prosopium sps.)*
resident
-native/naturally reproducing

Cutthroat Trout *(Salmo clarki)*
resident form
-native/naturally reproducing
-hatchery stock derived from native resident (Lk. Whatcom) stock /naturally reproducing and hatchery plants

anadromous form (Searun Cutthroat)
-native/naturally reproducing only

Rainbow Trout *(Salmo gairdneri)*
resident form
-native/naturally reproducing
-non-native/naturally reproducing and hatchery plants

anadromous form (Steelhead)
-native/naturally reproducing
-non-native/naturally reproducing and hatchery plants
(locally winter run only)

Dolly Varden or Bull Trout *(Salvelinus malma)*
anadromous
-native (native to Nooksack, occur occasionally in Whatcom Cr. to feed)

Order Cypriniformes:

Goldfish *(Carassius auratus)*
resident
-non-native (naturally reproducing in Toad Lake)

Order Siluriformes:

Brown Bullhead or Catfish *(Ictalurus catus)*
resident
-non-native/naturally reproducing from past hatchery plants

Order Gasterosteiformes:

Three Spine Stickelback *(Gasterosteus aculeatus)*
resident
-native/naturally reproducing

Order Perciformes:

Family Centrachidae:

Largemouth Bass *(Micropterus salmoides)*
resident
-non-native/naturally reproducing from past hatchery plants

Smallmouth Bass *(Micropterus dolomieui)*
resident
-non-native/naturally reproducing from past hatchery plants

Crappie *(Pomoxis annularis)*
resident
-non-native/naturally reproducing from past hatchery plants

Family Percidae:

<u>Yellow Perch *(Perca flavescens)*</u>
resident
-non-native/naturally reproducing from past hatchery plants

Family Cottidae:

<u>Sculpin *(sp)*</u>
resident
-native/naturally reproducing

APPENDIX E

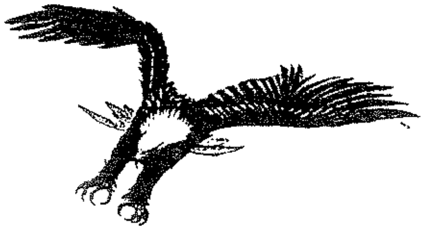
MANAGEMENT GUIDELINES
for
SELECT SPECIES

May
1991

Management Recommendations for Washington's Priority Habitats and Species

Elizabeth Rodrick and Ruth Milner, Technical Editors

Washington Department of Wildlife
Wildlife Management, Fish Management, and Habitat Management Divisions



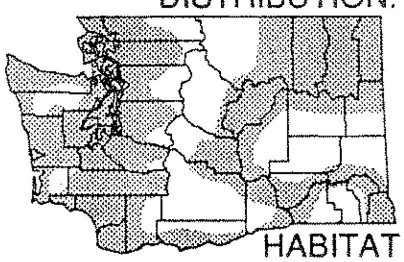
Washington Department of Wildlife
Management Recommendations for Priority Species

Bald Eagle

Haliaeetus leucocephalus

RANGE: Breeds mainly in Alaska, Canada, the Pacific Northwest states, the Rocky Mountain states, the Great Lake states, Florida, and Chesapeake Bay. Winters over most of the breeding range, primarily from southern Alaska and southern Canada southward (USFWS 1986, AOU 1983).

WASHINGTON DISTRIBUTION: Resident near large waters west of the Cascade Mountains, with scattered breeding areas in eastern Washington. Primary winter range includes the Olympic Peninsula, the San Juan Islands, Puget Sound and its major tributaries, the Cowlitz and Columbia rivers, and Hood Canal.



HABITAT REQUIREMENTS: The bald eagle is found along the shores of saltwater, and freshwater lakes and rivers. In Washington, breeding territories are located in predominantly coniferous, uneven-aged stands with old-growth components (Anthony et al. 1982). Territory size and configuration are influenced by a variety of habitat characteristics, including availability and location of perch trees for foraging, quality of foraging habitat, and distance of nests from waters supporting adequate food supplies (Watson, pers. comm.). Habitat models for nesting bald eagles in Maine show that the eagles are selecting areas with 1) suitable forest structure, 2) low human disturbance, and 3) highly diverse or accessible prey (Livingston et al. 1990).

Breeding - Bald eagles typically build large stick nests in mature or old growth trees, which are generally used over successive years. In Washington, courtship and nest building activities generally begin in January and February. Egg-laying begins in March or early April, with eaglets hatching in mid-April or early May. Eaglets usually fledge in mid-July and often remain in the vicinity of the nest for another month (Anderson et al. 1986). On portions of the breeding range where waterways do not freeze, adult eagles may remain on the territory year-round. Juvenile eagles often drift from their nest area during winter to gather at areas with concentrated food (Watson, pers. comm.).

Sizes of eagle nest trees are dictated by the forest type and tree species found within a geographic area; eagles apparently select for structure rather than tree species (Anthony et al. 1982, Anthony and Isaacs 1989). A typical nest tree is dominant or co-dominant with the overstory, and is usually live, but often has a dead or broken top with a limb structure to support the nest. The nest tree usually provides an unobstructed view of nearby water, and has stout upper branches that form flight windows large enough to accommodate the bird's large wingspan (Grubb 1976).

Bald eagle nests typically are located within the top 7m (20') of the tree (USFWS 1986). Territories may contain alternate nests. Grubb (1980) found that alternate nest trees in territories of Washington birds were located an average of 322m (1050') from occupied nests. Although the reasons for construction of alternate nests are unclear, they may facilitate successful reproduction if the primary nest is disturbed or destroyed. Within a territory, additional snags and trees with exposed lateral limbs or dead tops are used as perches, roosts, and defense stations (USFWS 1986).

The three main factors affecting distribution of nests and territories are 1) nearness of water and availability of food, 2) suitable trees for nesting perching, and roosting, and 3)the number of breeding-aged eagles(Stalmaster 1987). Grubb (1980) found an average territory radius of 2.5km (1.6 mi.) in western Washington. However, on the lower Columbia River where productivity is low, the mean home range size and minimum distance between eagle nests were 22 km^2 (13.6 mi^2) and 7.1 km (4.4 mi), respectively (Garrett et al. 1988). Distances between concurrently occupied territories may be important in maintaining productivity when the above factors are limiting.

Wintering - Migrant eagles begin arriving at their traditional wintering grounds during late October (Anderson et al. 1986). Wintering bald eagles concentrate in areas where food is abundant and disturbance is minimal. The birds use perches during the day, which mainly are selected according to their proximity to a food source (Steenhof et al. 1980 in USFWS 1986). Perch trees tend to be the tallest available, and preferred branches are consistently used. A variety of tree species, both alive and dead, are used for perching (Stalmaster 1976).

Wintering birds may roost communally at night near major foraging areas. Studies have shown that eagles conserve energy by roosting in protected habitat. Tree species type varies with geographic area, but communal roost stands generally are uneven-aged with a multi-layered canopy. Roosts typically are established in isolated areas in old-growth stands that have trees larger than the surrounding trees. Roost trees apparently are selected according to their height, diameter, and growth form, and for the protection they offer from wind, inclement weather, and human disturbance. Eagles may gather in staging trees located between the feeding grounds and the roost trees, prior to entering the night roost (Hansen et al. 1980, Anthony et at. 1982, Stalmaster 1987).

Feeding - Sufficient, consistent, accessible, and uncontaminated food resources may be the most critical components of winter and breeding habitat for bald eagles (USFWS 1986, Stalmaster 1987). Because eagles often depend on dead or weakened prey, their diet may vary locally and seasonally. Various carrion, including spawned salmon taken from gravel bars along wide, braided river stretches, are important food items during fall and winter (Stalmaster et al. 1985, Stalmaster 1987). Waterfowl often are taken as well, especially near hunting areas where crippled and dead birds occur (Watson, pers. comm.). Anadromous and warm-water fishes, small mammals, carrion, and seabirds are consumed during the breeding season (USFWS 1986, Anderson et al. 1986).

In Maine, bald eagles nested near waters with abundant prey, shallow lakes with high diversity of warm water fishes, and marine habitats with a high variety of diadromous fish (Livingston et al. 1990).

Activities that disturb eagles while feeding, especially during winter, can cause them to expend more energy, which increases their susceptibility to disease and poor health (Stalmaster 1987).

LIMITING FACTORS:

Prey availability and temporal disturbances from human activities probably are most critical to bald eagle productivity and survival. Availability of suitable nesting and roosting habitat will limit distribution.

Although bald eagle populations recently have increased, cumulative habitat changes over time may cause eagles to move, confine them to small areas, and cause gradual population decline (Stalmaster 1987).

MANAGEMENT RECOMMENDATIONS:

Under the Washington State Bald Eagle Protection Rules (WAC-232-12-292) a cooperative Site Management Plan is developed whenever activities that alter habitat are proposed near a verified nest territory or communal roost. Each Site Management Plan is based on the unique characteristics of individual eagles and their home range, as well as surrounding land uses, in relation to the proposed activity and landowner goals.

Nests - Management strategies for bald eagles are evolving as researchers conduct more studies on eagle nesting and the effects of human activities on nesting success.

Anthony and Isaacs (1989) indicate that management of nest sites for older and more contiguous forests with low human disturbance will result in higher productivity. High tree density and moderate canopy closure are important to visually buffer human activities and to protect the nest and nest-tree from blowdown. Management for an uneven-sized forest dominated by Douglas fir west of the Cascades, and ponderosa pine east of the Cascades, will enhance the potential for nesting in the future. They also propose minimum nest-tree and forest stand requirements for bald eagle nest sites in three forest types. As many mature trees as possible should be maintained to ensure that forage, perch, and roost trees are protected. Large trees are also important sources for alternate nests.

Selective logging may be prescribed to maintain or enhance desired characteristics of nesting or roosting habitat (Stalmaster 1987). Livingston et al. (1990) found that eagle nests may occur near habitat edges, but excess forest edge appears to degrade habitat quality. Clearcut practices seem to deter breeding eagles from using otherwise suitable lakes.

Human activities around nest trees during the nesting season can disturb the eagles causing abandonment or reduced reproductive success and should be avoided (Anthony et al 1982).

In Washington, Grubb (1980) found that productive nests were further from permanent human activity, an average of 120m (400'), than from unproductive nests. Fraser et at. (1985) found that eagle nests were further from the shoreline in developed areas, that nests were further from clusters of houses than random points, and that 79% of eagles flushed from the nest at 300m (1000') at the approach of pedestrian. In Maine, nesting bald eagles avoided disturbed areas near lakes and marine shorelines (Livingston et al. 1990).

The Pacific States Bald Eagle Recovery Plan advises that site specific management plans should be developed by local groups or agencies. The plan further suggests temporary restrictions during the critical nesting and wintering periods on disturbing activities such as camping, blasting, fireworks, and timber harvest within 400m (1300') of screened nests or within 800m (2600') of visible nests (USFWS 1986).

Anthony and Isaacs (1989) recommend that habitat alterations not occur within 400m (1300') of nests and that disturbing activities within 800m (2600') of nests should be time restricted. This is based on their research and Harris' (1984) work on maintaining the integrity of old-growth forest stands.

While maintaining unaltered old-growth stands may provide optimum bald eagle habitat, the necessary structural characteristics may be supplied in a properly managed forest overtime. The long term viability of nest sites in managed stands should be studied.

The Washington Department of Wildlife does not recommend standard buffer distances, but works with landowners using the flexible, territory zoning concept (fig. 1) to design site-specific management plans. The regional zoning technique (fig. 1) is used where concentrated nesting occurs.

Activities that render nesting habitat undesirable, such as logging, construction and frequent human intrusion, are restricted within the core nest area (protected area), near perch, forage and roost trees or foraging habitats. Topography and vegetation can provide screening that will minimize the impacts of disturbing activities.

Bald eagles are generally intolerant of human activities during the nesting season, but individual pairs may vary in the amount of activity that they will tolerate. In order to minimize the risks of causing a nest failure, logging, construction, camping, blasting and other activities that potentially could disturb eagles are restricted within the buffer zone (conditioned area) from January 1 through August 15(Anderson, pers. comm., Watson, pers. comm., McMillan pers. comm., Anthony and Isaacs 1989). However, if an eagle pair has been productive with specific ongoing activities or if the nest is verified as unoccupied, these activities may be allowed to continue.

Roosts - Bald eagle communal roosts (all trees used by three or more birds on consecutive nights) also warrant a Site Management Plan. Management typically involves restricted timber harvest and road closures near winter roosts from November 1 through April 1, maintenence of a permanent buffer around core roosting areas and protection of all staging trees. Permanent developments or alterations should not occur in the core or buffer areas.

The Pacific States Bald Eagle Recovery Plan recommends temporary buffers of 400m (1300') around screened roosts and 800m (2600') around visible roosts (USFWS 1986).

Perching and Foraging Areas - Stalmaster and Newman (1978) found that 50% of wintering eagles in open areas flushed at 150m (500') but 98% would tolerate human activities at 300m (1000').

Eagles should be allowed to feed unmolested, particularly during the morning hours when they are most active. They often ground feed in open areas with concentrated food resources and need at least a 450m (1500') buffer distance from human activity and permanent structures. Timing restrictions may be needed for activities that disturb feeding eagles, such as fishing and boating. Artificial feeding may be warranted during critical winter periods when food is temporarily unavailable (Stalmaster 1987, USFWS 1986).

Leave strips of tall perch trees from 50-100m (160'-330') wide along shorelines of major feeding areas. The wider strips are recommended in areas with greater human activity. In perching areas where little screening cover is present, buffer zones of 250-300m (800'-1000') are suggested (Stalmaster 1987).

Carefully review the following activities that may impact major eagle habitat: hydro-projects, irrigation, dredging, transportation of oil and other toxic compounds, application of herbicides and pesticides, introduction of exotic species, etc.

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Young, L. Wildlife biologist, Washington Department of Natural Resources, Olympia, WA.

KEY POINTS:

Habitat Requirements:

- Breeding - Uneven-sized forest stands with old-growth-like structural components along shorelines, and adequate food resources.
- Wintering - Day Perches: Tall trees, especially deciduous and snags along shorelines.
  Night Roosts: Uneven-sized, multi-layered, mature/old-growth stands that provide protection from weather.
- Feeding - Adequate food resources including spawned salmon, carrion, and waterfowl near nesting, perching, and roosting areas.
- Freedom from disturbance.

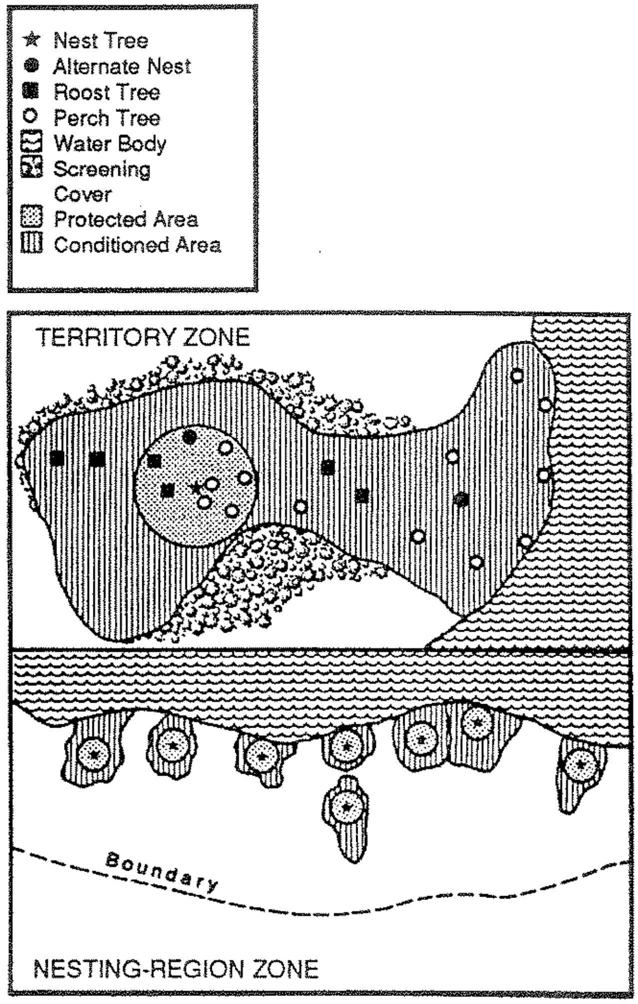
Management Recommendations:

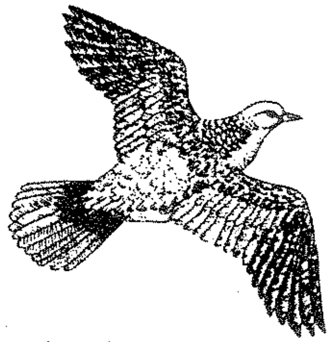
- Develop site-specific management plans using the flexible, territory zoning concept.
- Design a protected core area and a conditioned buffer area surrounding nesting territories and communal roosts. Consider eagle habitat use, topography, habitat fragmentation, food resources, and human activities.
- Use timing restrictions for activities that may disturb eagles during critical periods: Breeding - Jan. 1-Aug. 15 and Wintering - Nov. 1-Apr. 1.
- Avoid use of toxic biocides.
- Leave strips of perch trees along shorelines.
- Provide a buffer around major foraging areas.

Figure 1: Management strategy for protecting bald eagles
(Adapted from Stalmaster 1987).

Nest Site Management Plan:

For Areas of Concentrated Nesting:





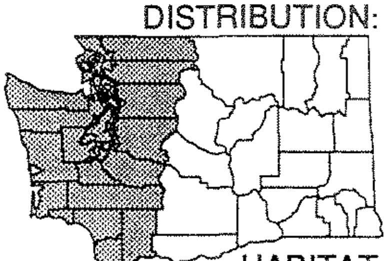
Columbia fasciata

Washington Department of Wildlife Management Recommendations for Priority Species

Band-tailed Pigeon

RANGE: The Pacific Coast Population of band-tailed pigeons breeds from mid-British Columbia south to Baja California. The eastern limit of distribution is generally the western slope of the Cascade and Sierra Nevada mountain ranges, to 4200m elevation (Pacific Flyway Council 1983). Winter range of the species is mainly in California south of Redding, although a limited number of band-tails winter in Mexico.

WASHINGTON DISTRIBUTION: The band-tailed pigeon occurs mainly in Western Washington. During breeding season most of the population occurs below 300 m (1000 feet) elevation (Jeffrey 1989). In late summer these birds move into higher elevations in response to ripening fruits and berries, and by late September most band-tails depart for southern wintering areas (Jeffrey 1989).



HABITAT REQUIREMENTS: During spring migration, band-tails are known to use agricultural crops for food, including peas and grains, as well as acorns, buds, blossoms, young leaves and needles, and persistent fruits and berries (Sanderson 1977). During the breeding season (April-September), band-tails are most common in coast forests with good interspersion of seral stages and openings, abundant food resources, and mineral springs (Sanderson 1977). Band- tail nests occur in conifers or broad-leaf trees, typically 4.5 to 12 m (15 to 40 feet) above ground, and may be loosely colonial in distribution or well dispersed (Sanderson 1977). Primary food sources include cascara, elderberry, wild cherry, huckleberry, dogwood, and madrone (Sanderson 1977). During fall, primary food includes acorns, other nuts, berries, and fruits (Jeffrey 1989).

During the breeding season, band-tails are known to seek sources of mineral salts necessary for the production of "crop milk" for feeding young (Sanderson 1977). Natural sources of these minerals are from mineral springs and specific marine shorelines, although some birds are known to use areas where salt blocks are placed for livestock (Sanderson 1977). Use of mineral springs by the same birds year after year has been documented by banding analysis (Jarvis, pers. comm.).

LIMITING FACTORS: Distribution of mineral sources in relation to food resources may limit band-tail nesting use of an area. Development or land management practices which degrade or destroy mineral springs and foraging areas may limit band-tail use of an area.

MANAGEMENT RECOMMENDATIONS: Protect mineral springs and other mineral sources which are extremely important if not critical for band-tailed pigeons. These must be protected from destruction and/or degradation, which includes removal of surrounding trees used for perching. In some cases, mineral sources can be enhanced by removal of dense vegetation limiting bird access, and springs can be created from natural seeps in pigeon use areas by burying mineral salts. Maintain berry, fruit and mast producing shrubs and trees which provide food sources for this species, particularly in clearcuts in proximity to mineral sources. Avoid herbicide applications which impact food resources.

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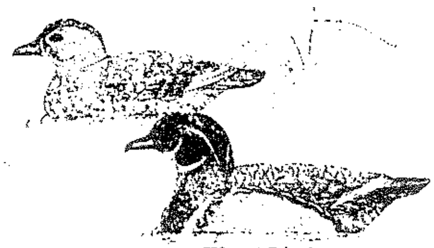
KEY POINTS:

Habitat Requirements:

- Mineral springs or other mineral sources.
- Mixed coniferous and deciduous forests, mixed seral stages, with openings.
- Availability of berry, fruit, and mast producing shrubs and trees.

Management Recommendations:

- Protect and enhance mineral springs and other mineral sources.
- Maintain berry, fruit, and mast producing shrubs and trees by limiting herbicide applications, particularly near mineral springs but also throughout the foraging range of band-tails.



Wood Duck

Washington Department of Wildlife Management Recommendations for Priority Species

Cavity-Nesting Ducks

Bucephala islandica
Barrow's Goldeneye
Bucephala clangula
Common Goldeneye
Bucephala albeola
Bufflehead
Aix sponsa
Wood Duck
Lophodytes cucullatus
Hooded Merganser

RANGE: These five species of cavity-nesting ducks vary in distribution by species. Along the Pacific Coast, the goldeneyes and bufflehead winter from Alaska to California, while the wood duck and hooded merganser occur south of Alaska during winter. The Barrow's goldeneye and bufflehead breed from Alaska to California. Hooded mergansers and wood ducks breed from British Columbia southward, while the common goldeneye breeds mainly in isolated areas of Washington northward to Alaska (Bellrose 1976).

WASHINGTON DISTRIBUTION: The wood duck and hooded merganser breed mainly in western Washington, but are also found in some areas of eastern Washington. The bufflehead and Barrow's goldeneye are more restricted to the Cascades, the Columbia Basin, and highland areas of northcentral and northeastern Washington. The common goldeneye is restricted to the extreme northeast corner of the state. All species are more common in the winter west of the Cascades, except for the wood duck which winters in the greatest numbers in the Yakima Valley (Bellrose 1976).

HABITAT REQUIREMENTS: Cavity nesting ducks in Washington (in descending order of importance: wood duck, Barrow's goldeneye, hooded merganser, bufflehead, and common goldeneye) nest primarily in late forest successional stages, adjacent to low gradient rivers, sloughs, lakes, and beaver ponds (Thomas 1979, Brown 1985, Parker 1990). All species except wood ducks (adults) feed primarily on animal matter in wetland areas, ranging by species from aquatic insects to small fish. Adult wood ducks feed mainly on aquatic and emergent plants, acorns and other seeds, including waste grain; young wood ducks are more dependent on animal matter (Bellrose 1976).

All five species nest almost exclusively in tree cavities, either made by other avian species or occurring naturally. Cavity nesting duck population levels are related to the availability of nesting sites (Dow and Fredga 1983). Cavities offer protection from weather and predators, and the same cavities are often used by the same birds annually (Dow and Fredga 1983). As a general rule, minimum cavity dimensions to accomodate these species should include an entrance hole at least 9 cm in diameter, with the internal cavity at least 25 cm deep and 1.9 cm in diameter (3.5" hole, 10" x 7.5") (Bellrose 1976). The minimum dbh of nest trees should be 30 cm (12 inches) (Soulliere 1988). Wood ducks and hooded mergansers prefer natural cavities (20-65 feet) above ground or water (McGilvrey 1968, Bellrose 1976) while the other species are most often found in natural cavities 4.8 - 7.6 m (10-25 feet) above ground or water (Johnsgard 1975). Optimal density of potential nest sites is 2 or more per hectare (five or more per acre) (Sousa and Farmer 1983).

Cavity use is also dependent upon cavity orientation and canopy height (Soulliere 1988) as well as proximity of suitable brood habitat, predator levels, and competition from other cavity nesting species (Peterson and Gauthier 1985). The canopy around the cavity should be open and not overhang the entrance (Bellrose 1976). Optimal brood habitat includes shallow wetlands within 0.8 km (0.5 mile) of cavities, with 50-75% overhanging woody vegetation and/or emergent vegetation for brood escape cover (Sousa and Farmer 1983), and abundant downed logs or low islands (Webster and McGilvrey 1966).

LIMITING FACTORS:

Lack of suitable cavities near water, as well as lack of adequate brood escape cover and foraging areas can be limiting for these species. Nest predation and competition from other cavity-nesters can also limit population levels, in addition to lack of mast or waste grain for wood ducks.

MANAGEMENT RECOMMENDATIONS:

Maintain and create snags near suitable wetlands to meet the minimum cavity size and density requirements noted above, and maintain mast producing trees and shrubs (e.g. oaks, hazelnuts). Provide downed timber and create low islands for breeding/brood use (McGilvrey 1968). Avoid logging flooded timber and leave woody vegetation along the shores of nesting and brood areas (McGilvrey 1968). Use of herbicides/pesticides near wetlands may adversely impact invertebrate levels, as well as aquatic and emergent vegetation. Backflood trees/downed timber to create snags/brood habitat.

Provide predator-proof nest boxes for wood ducks in areas where natural cavity sites are limited (less than five per acre) but other habitat requirements above are met (Bellrose 1976). The decision to provide nest boxes to supplement existing cavities/nest boxes should consider occupancy rates of existing suitable nest sites, i.e. if existing sites are underutilized, other habitat factors may be limiting. Nest boxes should be annually maintained, located over water if possible, wood duck boxes should be designed and placed following Shay (1990) or Bellrose (1976), and other species' boxes should follow Lumsden et al., 1988.

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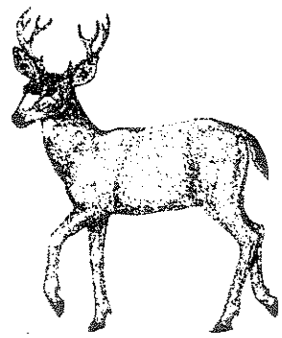
KEY POINTS:

Habitat Requirements:

- Natural cavities with entrance 3.5 inches in diameter and minimum internal dimensions of 10 inches deep, 7.5 inches diameter.
- Minimum dbh of nest trees 12 inches.
- Natural cavities preferred by wood ducks and hooded mergansers are 20-65 feet high, 10-25 feet high for other species.
- Optimal density of potential nest sites is five or more per acre, within one-half mile of suitable brood habitat.
- Suitable brood habitat consists of shallow wetlands with 50-75% cover and abundant downed logs or low islands.

Management Recommendations:

- Maintain and create snags near suitable wetlands to meet the minimum cavity requirements noted above.
- Avoid logging flooded timber and maintain 50-75% woody and emergent vegetation in shallow wetlands.
- Provide and maintain nest boxes where lack of suitable cavities is limiting potential production.



Washington Department of Wildlife Management Recommendations for Priority Species

Columbian Black-tailed Deer

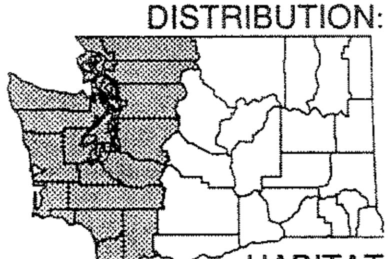
Odocoileus hemionus columbianus

RANGE:

The Columbian black-tailed deer represents one subspecies of the mule deer/ black-tailed deer group. It occurs in coastal coniferous forests from central British Columbia south to northern California as well as in the coastal chaparral regions of central California (Wallmo 1981).

WASHINGTON DISTRIBUTION:

Black-tailed deer occur in all forested habitats west of the Cascade Crest. Along the crest, there is a region of integration with adjacent populations of Rocky Mountain mule deer (O. h. hemionus).



HABITAT REQUIREMENTS:

Like other cervids, black-tailed deer require the juxtaposition of food, water, and cover. Water is generally available in western Washington. Cover is used by deer for purposes of hiding and thermal regulation, as well as for foraging during times when open forage areas may not be available (Brown 1985).

Forage areas are all areas with less than 60 percent combined canopy cover where trees and shrubs are more than 2m (7') tall and there is an understory of shrubs and herbaceous vegetation.

Habitat elements include hiding, thermal, and optimal cover for deer. Hiding cover provides screening vegetation that covers 90 percent of a standing deer, at 60m (200') or less (Brown 1985).

Thermal cover includes forest stands at least 12m (40') tall, with tree canopy cover of at least 70 percent. Optimal cover is a forest stand with four layers (overstory, canopy, sub-canopy, shrub layer, and herbaceous layer) and an overstory canopy with trees that average over 53cm (21") in diameter at breast height. Optimal cover has 70 percent or greater crown closure and is in the old growth or large saw timber stand condition (Brown 1985). This combination of characteristics provides a relatively snow-free, sheltered environment with available forage even during winter storms.

Extensive open roads, particularly arterial roads, reduce deer use of habitat for some distance from the road perimeter (Perry and Overly 1977, Willms 1971, Witmer 1981).

LIMITING FACTORS:

Deer numbers decline rapidly following canopy closure of regenerated timber stands. Deer population studies on the Clemons Tree Farm (Taylor and Johnson, 1976) reveal favorable forage declines as conifer overstory shades out smaller plants. A system of small patch or block clearcuts is important to provide forage and cover in close proximity. The availability of adequate browse on deer winter range is the most crucial factor in deer survival and successful reproduction (Brown 1961). Silvicultural practices that suppress browse reduce habitat for deer. Deer generally decline if elk increase (Taber and Radaeke 1981).

MANAGEMENT RECOMMENDATIONS:

Winter range may be generalized as being below 670-820m (2,200- 2,700') in elevation on slopes less than 60 percent, depending on the severity of the winter, in the western Cascades; below 600m (2,000') and above urbanized areas in the Puget Sound trough and lowlands of southwest Washington; below 460m (1,500') with slopes less than 60 percent on the Olympic Peninsula.

Forage and cover blocks should be sized as described under habitat requirements and well-distributed on summer range with a minimum of 40 percent of a 2.6 sq. km (one-square-mile) area in cover, of which at least half is thermal cover.

On winter range, roads open to public use should be limited to 0.5 mile of road per one square mile of habitat. Construction standards should be of the lowest that is feasible, with screening vegetation adjacent.

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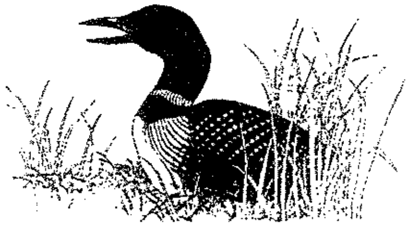
KEY POINTS: Habitat Requirements

- Average seasonal use area is about one square mile.
- Early successional stages are primary feeding areas.
- Cover and forage areas need to be interspersed.
- Browse plants are important forage components.
- Optimal cover stands are necessary during periods of heavy snow.

Management Recommendations

- A mixture of cover and forage areas must occur at the scale of a typical deer seasonal home range (one square mile).
- Maintain a mixture of cover and forage through time.
- Encourage the growth of browse species.
- Manage the open road system at minimum feasible levels and densities.



Washington Department of Wildlife

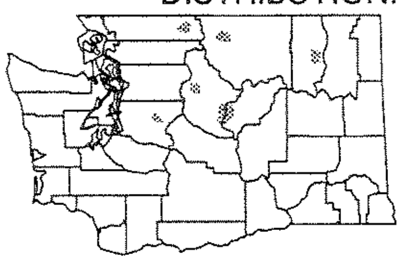
Management Guidelines for Species of Concern

Gavia immer

Common Loon

RANGE: Alaska, Canada, Iceland, Greenland, and the northern tier of the lower 48 United States.

WASHINGTON DISTRIBUTION: Abundant migrants arrive from the north to winter along the coast of Washington. Migrants are also seen annually on lakes in northeastern Washington. Summer populations are very low; single breeding pairs are confirmed in lakes in King, Whatcom, Chelan, Douglas, Ferry and Okanogan Counties. (Only breeding distribution is shown on map.)



HABITAT REQUIREMENTS: Common loons breed on large wooded lakes with large populations of fish. Studies of feeding habits on loon breeding grounds are limited. However, Vermeer (1973) found that lakes where breeding loons were present were also used by successful anglers. Loons were absent from many lakes and sloughs that offered poor fishing to anglers, suggesting that healthy fish populations are requisite for breeding pairs.

Common loons nest on both islands and the mainland at the waters' edge or within 1.5 m of shore (Vermeer 1973). Several studies have shown that loons prefer to nest on islands (McIntyre 1975, Ream 1976, Titus and Van Druff 1981, Vermeer 1973) and breeding success is probably higher on insular sites (McIntyre and Mathisen 1977, Titus and Vandruff 1981). Nests may also be located in emergent vegetation. The same nest site may be re-used in successive years (Strong et al. 1987).

Heavy recreational use may be a key factor causing declines in loon productivity because the birds are very susceptible to disturbance during nesting. Titus and Vandruff (1981) found that loons in lakes where motorboats were absent were more successful at hatching eggs compared to those nesting in lakes where motor boats were present. Vermeer (1973) found more breeding pairs in areas with fewer resorts, cottages, and campsites; this was also observed in Finland (Lehoten 1970 in Vermeer 1973). Heimberger et al. (1983) showed that breeding success declined as the number of cottages within 150 m of the nest increased.

LIMITING FACTORS: The availability of isolated lakes with undisturbed shoreline or undisturbed island nesting sites may limit loon breeding in Washington.

MANAGEMENT RECOMMENDATIONS: Because common loons may re-use nests from year to year, protection of known nesting and nursery areas is essential. Access to nesting islands by campers and other visitors should be restricted during the breeding season from April 1 to September. Camping on islands can adversely affect loon productivity and may cause nest abandonment (Ream 1976). Building within 150 m of a loon nest should be avoided year round in order to maintain a permanent buffer around nests.

The absence of suitable nesting islands may limit breeding common loons. In areas where natural islands are unavailable, artificial islands can be provided. In one study, McIntyre and Mathisen (1977) successfully used sedge mat obtained from boggy lakes and bounded on the edges with poles to create nesting islands. Cedar log rafts were also found to be effective. An artificial nest island was successfully used on Lake Chester Morse in 1990.

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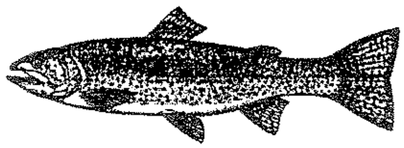
KEY POINTS:

Habitat Requirements:

- Breed on large wooded lakes.
- Large fish populations.
- Nest on islands or within 1.5 meters of shore.
- Nesting preference of islands.
- May nest on emergent vegetation.
- Nests may be reused.
- Very susceptible to nest disturbance.
- Intolerant of recurrent disturbance within 150 meters.

Management Recommendations:

- Protection of known nest and nursery sites.
- Restrict disturbance of nest sites from April to September.
- Erect no structures within 150 meters of nesting sites.
- Provide artificial islands - (sedge mats, cedar log rafts).



Washington Department of Wildlife
Management Recommendations
for Priority Species

Cutthroat Trout

Oncorhynchus clarki clarki
Coastal Resident and Anadromous Cutthroat Trout
Oncorhynchus clarki lewisi
Westslope Cutthroat Trout

RANGE: Cutthroat trout occur in North American generally west of the Rocky Mountains.

WASHINGTON DISTRIBUTION: The coastal cutthroat trout is widely distributed in the lower Columbia River, Coastal, and Puget Sound drainages, and wherever there is access to the ocean. Westslope cutthroat trout is present in the Cascade Mountains and in many waters of central and eastern Washington.

HABITAT REQUIREMENTS: Two subspecies of *Oncorhynchus clarki* are recognized in Washington state. There are both anadromous (sea-run) and resident coastal cutthroat trout. However, the critical habitat requirements for these two species while in freshwater are generally thought to be similar.

Cutthroat trout habitat consists of gravelly coastal streams and lakes, inland alpine lakes, and small rivers and estuaries (Scott and Crossman 1973, Wydoski and Whitney 1979). They are frequently found in well oxygenated cool headwater of tributaries. Spawning occurs in fine gravel and eggs are deposited in redds in well oxygenated running water. Anadromous cutthroat favor spawning in the headwater tributaries to larger streams with summer low flows ranging from 4 cfs - 10 cfs (Johnston 1981). Anadromous juvenile cutthroat will remain in their spawning streams for one or more years before migrating to salt water. The primary diet consists of aquatic and terrestrial insects, planktonic crustaceans, crayfish, salmon eggs, and small fish.

LIMITING FACTORS: Stream temperatures which exceed the normal spawning range, a lack of spawning and rearing habitat, high sedimentation of spawning grounds, and/or a lack of preferred food items will also limit the population and range of cutthroat trout. Exposure to heavy metals and other pollutants during "smolting" can inhibit migratory behavior in anadromous cutthroat trout.

MANAGEMENT RECOMMENDATIONS: The maintenance of riparian vegetation is essential for controlling stream temperature, providing cover, and protecting against lateral erosion. Removal of streamside vegetation lowers canopy density (shading) and increases sedimentation. Increases in solar radiation raise stream temperatures thereby negatively impacting spawning, hatching, and rearing survival. Increased sedimentation contributes to the loss of spawning habitat and decreases the diversity of aquatic invertebrates and other food items (Newbold et al. 1980, Noss 1983, Heede 1985). Buffer zones along stream banks should be at least the width of the height of the tallest tree or 15.2 m (50 ft) whichever is larger. This vegetative buffer will provide erosion control, and maintain natural stream temperatures and the diversity of aquatic invertebrates (Meehan et al. 1977, Newbold et al. 1980). In Washington, this can range up to 60 m (200 ft.). This "zone of influence" (Meehan et al. 1977) should be maintained along stream banks which provide cutthroat trout habitat, and any other stream which directly or indirectly influences cutthroat trout. Road construction and maintenance activities should be avoided adjacent to streams with cutthroat trout. In-stream structures such as bridges, piers, boat ramps, or culverts must not impede the natural movements of cutthroat trout.

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KEY POINTS:

Habitat Requirements:

- Inhabit gravelly lowland coastal streams and lakes, inland alpine lakes, and small rivers and estuaries.
- Prefer cool, well oxygenated water in tributary headwaters.
- Spawn in redds on bottoms consisting of fine gravel in well oxygenated running water with summer low flows ranging from 5 cfs - 10 cfs.
- Newly hatched fry remain in their redds for several weeks. *Anadromous juveniles migrate after one to two years.
- Feed on aquatic and terrestrial insects, planktonic crustaceans, crayfish, salmon eggs, and dead salmon.

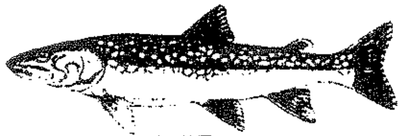
Management Recommendations:

- Buffer zones of at least the width of the height of the tallest tree (or 15.2 m (50 ft) whichever is wider) should be maintained along stream banks which provide cutthroat trout habitat, and any other stream which directly or indirectly influences cutthroat trout habitat.

- Road construction and maintenance activities should be avoided adjacent to streams which provide cutthroat trout habitat.
- In-stream structures such as bridges, piers, boat ramps, or culverts must not impede the natural movements of cutthroat trout.
- Waters inhabited by anadromous cutthroat parr should not be treated with metal based herbicides during the period March 11 - June 15.

Washington Department of Wildlife
Management Recommendations for Priority Species

Dolly Varden



Bull Trout

Dolly Varden/Bull Trout

Salvelinus malma
Dolly Varden
Salvelinus confluentus
Bull Trout

RANGE: The historical distribution of the bull trout and Dolly Varden extended from 41 to 60 degrees north latitude. North of the 49th parallel, the bull trout is found in most drainages on both sides of the continental divide (Cavender 1978).

WASHINGTON DISTRIBUTION: Bull trout and Dolly Varden are found throughout the coastal and inland streams and lakes of Washington.

HABITAT REQUIREMENTS: Dolly Varden/bull trout share similar life histories, which include residents to headwater streams, fluvial, adfluvial, and/or anadromous. They have been categorized as opportunistic feeders, feeding on a variety of water column organisms (fish) and bottom dwellers (insects) (Thompson and Tufts 1967, Shepard et al. 1984, Pratt 1984). Spawning occurs in the upper reaches of clear streams in areas of flat gradient, uniform flow and uniform gravel or small cobble. Juveniles (less than 100 mm) are primarily bottom- dwellers, occupying positions above, on, or below the bottom. Fry are found in shallow, slow backwater side channels and eddies (Shepard et al. 1984, Elliott 1986). Older individuals are found in deeper and faster water compared to juveniles. Adults are often found in pools sheltered by large, organic debris or "clean" cobble substrate (McPhail and Murray 1979).

LIMITING FACTORS: Stream temperatures which exceed the normal spawning and egg incubation range, 2-4 degrees C (35-39°F), a lack of spawning and rearing habitat, high sedimentation on spawning grounds, and/or a lack of preferred food items will also limit the population and range of bull trout and Dolly Varden.

MANAGEMENT RECOMMENDATIONS: The maintenance of riparian vegetation is essential for controlling stream temperature, providing cover, and protecting against lateral erosion. Removal of streamside vegetation lowers canopy density (shading) and increases sedimentation. Increases in solar radiation raises stream temperatures thereby negatively impacting spawning, hatching, and rearing survival. Increased sedimentation contributes to the loss of spawning habitat and decreases the diversity of aquatic invertebrates and other food items (Newbold et al. 1980, Noss 1983, Heede 1985). Buffer zones along stream banks should be at least the width of the height of the tallest tree or 15.2 m (50 ft), whichever is wider. The vegetative buffer will provide erosion control, and maintain natural stream temperatures and diversities of aquatic invertebrates (Meehan et al. 1977, Newbold et al. 1980). In Washington, this can range up to 60 m (200 ft.). This "zone of influence" (Meehan et al. 1977) should be maintained along stream banks which provide bull trout and Dolly Varden habitat, and any other stream which directly or indirectly influences bull trout. Road construction and maintenance activities should be avoided adjacent to streams with bull trout and Dolly Varden. In-stream structures such as bridges, piers, boat ramps, or culverts must not impede the natural movements of bull trout and Dolly Varden.

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KEY POINTS: Habitat Requirements:

- Cool waters of lakes or pools in streams sheltered by large organic debris and clean cobble substrate.
- Spawning habitat consists of gravel or small cobble in upper reaches of clear streams in areas of flat gradient.
- Fry inhabit shallow, slow backwater and side channels.

Management Recommendations:

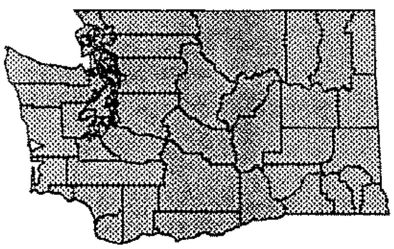
- Buffer zones of at least the width of the height of the tallest tree (or 15.2 m (50 ft), whichever is wider) should be maintained along stream banks which provide bull trout and Dolly Varden habitat, and any other stream which directly or indirectly influences bull trout and Dolly Varden habitat.
- Road construction and maintenance activities should be avoided adjacent to streams which provide bull trout and Dolly Varden habitat.
- In-stream structures such as bridges, piers, boat ramps, or culverts must not impede the natural movements of bull trout and Dolly Varden.

Washington Department of Wildlife Management Recommendations for Priority Species

Great Blue Heron

RANGE: Found throughout most of North America south of 55° north latitude and extends into much of Central and South America. Breeding pairs on the Pacific coast occur only to about 52°N.

WASHINGTON DISTRIBUTION: Statewide.



HABITAT REQUIREMENTS: Great blue herons occur near all types of fresh and saltwater wetlands including seashores, rivers, swamps, marshes, and ditches. They are found at most elevations, but are more common in the lowlands. These herons are colonial breeders, generally nesting in tall deciduous or coniferous trees near wetlands. Although occasionally smaller trees, bushes, and artificial structures have been used (Bruce 1986, Blus et al. 1980), nests are usually constructed in the largest trees available. For example, a study in British Columbia found that most heronries occurred in trees over 14m (50') tall and no nests were found in trees under 10m (30') high (Mark 1976). In an Oregon study, the birds nested in trees averaging seven to 25m height (23' to 82') (Werschkul et al. 1976).

Great blue herons feed on aquatic and marine animals found in shallow water. Feeding in upland fields upon mice and voles also occurs (Calambokidis, et al. 1985) and may be important in winter, especially for herons in coastal areas (Simpson, pers. comm.). Although documented distances from an active heronry to a foraging area range from four to 29km (2.5 to 18 mi.), most are located within a radius of about four to five km (2.5 to 3 mi.) from the heronry (Short and Cooper 1985). Feeding territories may vary from year to year with respect to size or location (Hoover and Wills 1987). Birds from Pacific coastal colonies may depend on specific nearby shallow water areas which provide consistent, abundant food during the critical nesting and young rearing periods (Kelsall, pers. comm.).

Alternative nesting and feeding habitat is probably critical to great blue herons. Colonies usually exist at the same location for many years, but some herons may naturally relocate their colonies in response to increased predation on eggs and young by mammals or other birds, or declines in food availability (Simpson et al. 1987). Heronries built in spruce or Douglas-fir trees may damage the host trees over time, which may also influence natural colony relocation (Julin 1986).

Great blue herons are shy birds, generally sensitive to human disturbance and frequently the target of vandalism (Parker 1980, English 1978). Herons have abandoned heronries because of housing and industrial development, highway construction, logging, actively used roads, and repeated human intrusions into colonies (Leonard 1985, Parker 1980, Kelsall and Simpson 1979, Werschkul et al. 1976). Herons that have experienced few past disturbances are unlikely to tolerate human activities near their colonies (Bowman and Siderius 1984).

Other studies suggest that some herons, which are frequently or consistently exposed to disturbance, may habituate to human activities (Webb and Forbes 1982, Vos et al. 1985, Calambokidis et al. 1985, Shipe and Scott 1981). Thus, herons nesting in different locales may have different tolerance levels to humans, with colonies located close to human activities responding less to disturbance than those in remote areas (Simpson 1984). Certain colonies may tolerate disturbance because nests are built in coniferous trees, whose foliage naturally buffers the effects of human activity, or they may be influenced by proximity to heavily used foraging areas (Webb and Forbes 1982).

LIMITING FACTORS:

Availability of suitable habitat which provides adequate nest sites and feeding areas located in the vicinity of breeding colonies.

MANAGEMENT RECOMMENDATIONS:

Site specific management plans should be developed for individual heronries whenever activities that might affect herons are proposed. Factors to consider include, but are not limited to:

1) The heronry's relative isolation (Henny and Kurtz 1978). Some evidence suggests that colonies located in close proximity to existing human activities can tolerate more disturbance compared to colonies located in undisturbed areas (Simpson 1984, Webb & Forbes 1982, Bowman and Siderius 1984).

2) The timing of a proposed activity relative to the heron's nesting cycle. Herons are most vulnerable to disturbance early in the breeding cycle. It is generally agreed that herons are less tolerant of disturbance during the pre-nesting courtship period and egg laying, becoming progressively less likely to abandon nests after the young have hatched (Kelsall 1989, Bowman and Siderius 1984).

3) Topographic features surrounding the heronry and type of habitat surrounding the colony.

4) Proximity of a heron colony to likely feeding grounds (Simpson 1984, Gibbs et al. 1987).

5) Proximity to, and availability of, forest stands which might be used as alternative nest sites (Simpson 1984, Julin 1986, Gibbs et al. 1987).

6) The numbers of potential predators, such as bald eagles or crows, in the area (Simpson et al. 1986, Kelsall and Simpson 1979).

7) Degree of habituation to disturbance (Bowman and Siderius 1984).

All authors on heronry management recommend buffer zones around the periphery of nesting sites (Kelsall 1989). Recommended buffer distances vary from 1,000m (3280') during the nesting season (Bowman and Siderius 1984) to a year-round "no activity" buffer of 25m (75') encompassed by a 0.25km (0.4 mi.) zone off limits from March through mid-May (Parker 1980).

Establishment of buffer distances should be determined by the factors discussed above, and by any other factors that may pertain to a specific heron colony. Whenever possible, a minimum buffer zone within a range of 250 to 300m (820' - 980') from the peripheries of a colony should be established (Bowman and Siderius 1984, Quebec 1986 in Kelsall 1989, Vos et al. 1985, Buckley and Buckley 1976, Pullin 1988, Short and Cooper 1985, Parker 1980). All human activities should be restricted in this zone during the early nesting period, from February 15 to July 31 unless site specific nesting chronology is known (Kelsall, pers. comm.). If dates of courtship through incubation are known to differ from these prescribed dates for a specific heronry, then timing of restrictions should reflect this local knowledge. Activities, such as logging, mechanized agriculture, road building, and housing construction, should be avoided within this zone, in order to protect the structural integrity of the buffer area (Short and Cooper 1985, Bowman and Siderius 1984).

Nesting tree loss, either naturally or through disturbance, may represent a serious problem if availability of suitable alternative great blue heron habitat becomes limited. Therefore, stands of large trees at least 17m (50') high and at least 4 ha (10 acres) in extent which can be buffered from disturbance, should be left in the vicinity of heron breeding colonies and feeding areas (Parker 1980). Large colonies would likely require more alternative habitat. Kelsall (pers. comm.) suggests leaving large nesting trees in the center of an area having 300m or more of isolation during the breeding season.

Surrounding feeding areas, especially wetlands, should be protected within a minimum radius of 4km (2.5 mi.) of existing colonies. This is especially critical where herons coexist in areas with high human activity (Hoover and Wills 1987).

Efforts to increase awareness of great blue heron nesting colonies should concentrate on inventories, information exchange, and education. Nest sites occupied currently or in the past should be inventoried regularly, and local and state agencies should be made aware of their existence.

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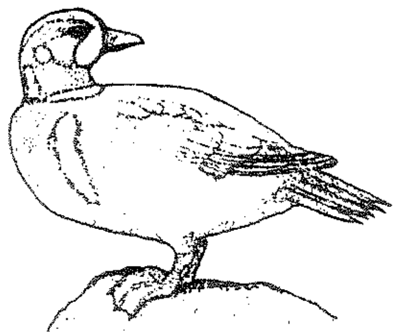
KEY POINTS: Habitat Requirements:

- Colonial breeders, generally nest in tall trees near wetlands.
- Usually forage within four-five km of colony.
- Alternate nesting and feeding habitat important.
- Sensitive to human disturbance.

Management Recommendations:

- Maintain habitat within 250-350m buffer zone around colony.
- No human instrusion in buffer zone between February 15 and July 31.
- Maintain alternate nesting habitat nearby.
- Protect wetlands and other feeding areas within four km of colony.
- Develop a site-specific management plan for each heronry (see text).



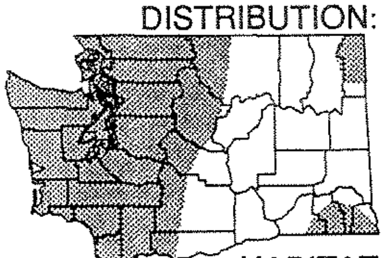
Washington Department of Wildlife
Management Recommendations for Priority Species

Histrionicus histrionicus

Harlequin Duck

RANGE: Harlequin ducks winter along the Pacific Coast from the Aleutian Islands to northern California and along the Atlantic Coast. Harlequins summer/breed from coastal mountains of Alaska to California, along the northern Rocky Mountains to Yellowstone, and along the Atlantic Coast.

WASHINGTON DISTRIBUTION: Harlequins breed in the Olympic Mountains, the Cascades, and the Blue and Selkirk Mountains. Wintering areas include northern Puget Sound, northern Hood Canal, Strait of Juan de Fuca, San Juan Islands, and the outer coast.



HABITAT REQUIREMENTS: During the nesting season (April-June) adult harlequin ducks require fast-flowing water with one or more loafing sites nearby, dense shrub or timber/shrub mosaic vegetation on the banks, and an absence of human disturbance (Cassirer and Groves 1989). Harlequins nest on the ground (Bergston 1972). Midstream loafing sites are very important (Cassirer and Groves 1990). Since adult harlequins show fidelity to nest sites, it is unlikely that they will relocate to new nesting areas once they are disturbed (Wallen and Groves 1989).

Broods remain near nesting areas for the first few weeks after hatching then move downstream during the summer (Kuchel 1977, Wallen 1987, Cassirer and Groves 1989). Broods prefer low-gradient streams with adequate macroinvertebrate fauna (Bengton and Ulfstrand 1971). Preferred prey include crustaceans, molluscs, and aquatic insects (Cottam 1939). In general, there is a direct relationship between aquatic plant biomass and macroinvertebrate biomass (Krull 1970). In one study, ninety percent of all brood observations occurred near mature or old growth stands (Cassirer and Groves 1990).

During winter, harlequins forage and loaf along boulder- strewn shores, points, and gravel substrates and in kelp beds. Seventy percent of their prey species occur chiefly on rock substrate and twenty-two percent on gravel substrate (Vermeer 1983). Most wintering harlequins occur within 50 meters of shore in saltwater areas (Gaines and Fitzner 1987).

LIMITING FACTORS: Low benthic macroinvertebrate biomass limits the number of harlequin ducks and productivity. Human disturbance discourages nesting at traditional sites and thereby decreases productivity.

MANAGEMENT RECOMMENDATIONS:

Maintain woody debris and riparian vegetation in and adjacent to streams. A 30 meter (100') buffer along nesting streams is necessary to recruit suitable LOD for loafing sites (Murphy and Koski 1989). A larger buffer may be necessary on second growth stands. Logging activity in the riparian corri[dor] should be avoided (Cassirer and Groves 1989). Stream alterations that wo[uld] cause greater surface runoff, changing water levels, or lower macroinvertebrate levels should be avoided (Kuchel 1977).

To limit disturbance, trails or roads should be farther than 50 meters (165 feet) from streams used by harlequin ducks, and should not be visible from the stream (Cassirer and Groves 1989). Fishing activity should be limited on streams used by nesting harlequins (Wallen 1987). The May through August nesting and brood rearing period are the critical months to reduce disturbance.

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KEY POINTS:

Habitat Requirements:

- Adults — fast-flowing streams, loafing sites, dense bank vegetation, absence of human disturbance. Broods — low gradient streams with adequate macroinvertebrates. Winter — rocky marine shoreline areas.

Management Recommendations:

- Maintain woody debris, riparian vegetation next to streams, macroinvertebrates. Locate roads and trails further than 165 feet from streams. Manage human disturbance during breeding/brood-rearing season (May-August). Protect rocky shoreline areas used during winter.

Washington Department of Wildlife Management Recommendations for Priority Species

Oncorhynchus nerka

Kokanee

RANGE: In North America, kokanee occur from the Klamath River, California to Point Hope, Alaska. Kokanee occur naturally outside North America in Japan and the USSR.

WASHINGTON DISTRIBUTION: Kokanee occur in many lakes throughout Washington. Some of the larger populations occur in Banks Lake and Loon Lake in eastern Washington and Lake Whatcom in Western Washington (Wydoski and Whitney 1979).

HABITAT REQUIREMENTS: Kokanee inhabit deep, cool lakes and reservoirs. They inhabit the upper third of the lake's water column and feed primarily on zooplankton and aquatic insect larvae (Scott and Crossman 1973, Wydoski and Whitney 1979). Adult kokanee migrate to tributaries where spawning occurs in redds dug in fine gravel located in clean riffles (Scott and Crossman 1973). Some spawning also occurs along gravel lake shores. Newly emergent fry migrate to the lake where they will live until adults.

LIMITING FACTORS: The presence or absence of deep cool lakes and associated tributaries are the primary factors which limit the distribution of kokanee. Because spawning occurs in tributaries, high stream temperatures or high sedimentation during spawning, a lack of spawning habitat, and/or a lack of zooplankton in the lake will limit the population and range of kokanee.

MANAGEMENT RECOMMENDATIONS: The maintenance of riparian vegetation is essential for controlling stream temperature, providing cover, and protecting against lateral erosion. Removal of streamside vegetation lowers canopy density (shading), and increases sedimentation and stream scouring. Increases in solar radiation raises stream temperatures thereby negatively impacting spawning, hatching, and rearing survival. Increased sedimentation contributes to the loss of spawning habitat and decreases the diversity of aquatic invertebrates and other food items (Newbold et al. 1980, Noss 1983, Heede 1985). Buffer zones along stream and lake banks should be at least the width of the height of the tallest tree or 15.2 m (50 ft) whichever is wider. The vegetative buffer will provide erosion control, and maintain natural stream temperatures and diversity of aquatic invertebrates (Meehan et al. 1977, Newbold et al. 1980). In Washington, this can range up to 60 m (200 ft.). This "zone of influence" (Meehan et al. 1977) should be maintained along stream banks which provide kokanee habitat, and any other stream and lake which directly or indirectly influences kokanee. Road construction and maintenance activities should be avoided adjacent to streams with kokanee. In-stream structures such as bridges, piers, boat ramps, or culverts must not impede the natural movements of kokanee.

REFERENCES:

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KEY POINTS:

Habitat Requirements:

- Kokanee require a lake environment for most of their lives.
- Tributaries are used for spawning habitat and for newly emerged fry.
- Spawning occurs in redds dug in fine gravel located in clean riffles.
- Newly emergent fry migrate to the lake where they will live until adults.

Management Recommendations:

- Buffer zones of at least the width of the height of the tallest tree (or 15.2 m (50 ft) whichever is wider) should be maintained along stream banks which provide kokanee habitat, and any other stream which directly or indirectly influences kokanee habitat.
- Road construction and maintenance activities should be avoided adjacent to streams which provide kokanee habitat.
- In-stream structures such as bridges, piers, boat ramps, or culverts must not impede the natural movements of kokanee.

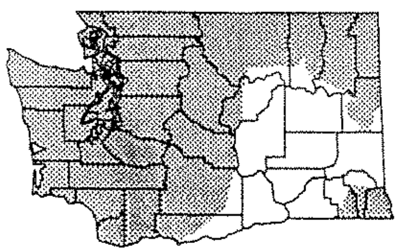
Dryocopus pileatus

Washington Department of Wildlife
Management Recommendations
for Priority Species

Pileated Woodpecker

RANGE: Resident from northern British Columbia, and southern Canada east to Nova Scotia; south to northern California, Idaho, Montana, eastern Kansas, and south to the Gulf Coast and Florida.

WASHINGTON DISTRIBUTION: Forested areas of the state.



HABITAT REQUIREMENTS: Pileated woodpeckers inhabit mature and old growth forests and second growth forests with significant numbers of large snags and fallen trees. The best habitat is conifer stands with two or more canopy layers, the uppermost being 25-30 m (80-100') high (Bull 1987).

Nesting - Breeding season is from mid-March to mid-July. Pileateds spend most of their time in stands older than 70 years. They excavate nest cavities in snags or live trees with dead wood, generally excavating through hard outer wood into rotten heartwood. Pileateds excavate large nest holes (3/yr/pair) and may excavate winter roost cavities in the fall or use previous nests (Mannan 1984, Bull 1987, Mellen 1987).

Five studies in Oregon and Washington report similar nest tree characteristics for pileateds: mean dbh > 68 cm (27") and mean height > 27 m (87') (Mannan 1984, Madsen, 1985, Mellen 1987, Bull 1987, Nelson, 1988). The preferred tree species are western larch, pondersoa pine, and black cottonwood east of the Cascade Mountains (Madsen 1985, Bull 1987) and Douglas fir and grand fir west of the Cascades (Mellen 1987, Nelson 1988). Most nest trees were hard snags with bark and broken tops.

Feeding - Pileated woodpeckers forage primarily within forests 40 years or older. They seldom use clearcuts, but do forage in shelterwood cuts if logging debris is left (Mannan 1984, Irwin 1987, Mellen 1987). Pileateds forage on large snags (>50 cm or 20" dbh), logs (>18 cm or 7" dbh), and stumps (especially naturally formed versus cut). They feed mainly on carpenter ants, beetle larvae, and other insects. Snags take on special importance in winter for roosting and foraging when logs and stumps may be covered with snow (McClelland 1979). They may excavate large rectangular holes during foraging that may be used by smaller birds for nesting and roosting.

Roosting - Fall and winter roosts generally are in the same nest tree and cavity that was previously excavated. Consequently, the roost tree characteristics are similar to those of nest trees (McClelland 1977, Bull 1987).

Home range varies from an average of 480 ha (1200 ac) in western Oregon (Mannan 1984, Mellen 1987) to 220 ha (540 ac) in northeast Oregon (Bull 1987). In western Oregon home ranges, the amount of nesting and roosting habitat averaged 200 ha (500 ac) and the foraging habitat averaged 306 ha (750 ac) (Mellen 1987). Several studies found that the density of pileateds increased with the abundance of large conifers and snags.

MANAGEMENT RECOMMENDATIONS:

For areas that must be harvested, leave at least 32 snags > 50 cm dbh/100 ha (14> 20"/100 ac) to maintain nesting habitat for pileated woodpeckers (Neitro et al. 1985).

In addition, to provide foraging habitat, large stumps and numerous large logs should be left in various stages of decay. During thinning and cutting the following types of trees should be left standing where it is safe to do so: dying trees, trees with heartwood rot, insect-infested trees, and trees with distorted shape or wind breakage. Trees with greatest potential for immediate use by pileated woodpeckers have old pileated cavities, broken tops, about 33% of limbs and bark remaining, and some decay (Bull 1987). Trees with broken tops (both live and dead) are the most heavily used for foraging.

Retention of nest snags can be accomplished in two ways: 1) clustering potential nest trees in small areas, or 2) dispersing the trees throughout each territory. The second method may be preferable because it reduces loss to wind, fire, and woodcutters. Safe logging techniques for snag retention are outlined in Neitro et al. (1985) and a U.S. Forest Service publication (1986). In areas where snags are lacking, they can be created by topping live trees inoculating them with heartrot fungus at nest height (> 12 m or 40') (Bull 1986).

The U.S. Forest Service (1986) has a mandate to maintain viable populations of wildlife on public lands. They developed Minimum Management Recommendations based on this legal requirement. The pileated woodpecker was selected as a management indicator species for old growth conifer forests because its highest densities occur in old growth. The MMRs for the pileated woodpecker apply to a 400 ha (1000 ac) unit. Within the unit, 240 ha (600 ac) are managed for one pair of pileated woodpeckers: a 120 ha (300 ac) old growth or mature nesting area and an additional 300 ac for feeding. One such habitat area is retained for every 4850 ha (12,000 ac) dispersal area. Specific requirements for the 300 ac nesting area include maintaining at least two hard snags/ac > 30 cm (12") dbh and of these 600 snags, 45 should be > 50 cm (20") (15 snags/100 ac). A minimum of two hard snags/ac > 25 cm (10") dbh should be maintained in the additional 300 ac feeding area.

The MMRs were based on data from northeast Oregon where there are high densities of pileateds with small home ranges (Bull 1987). Recent studies for western Oregon show lower densities and a mean home range that is twice the size found in northeast Oregon (Mannan 1984, Mellen 1987). The MMRs should be adjusted to reflect these regional differences. Mellen (1987) recommends a 50% increase in the size of the nesting and feeding areas for each breeding pair in western Oregon and Washington.

Also, Conner (1979) notes that managing for the minimum habitat components may cause gradual population declines. Instead, he suggests that average values for habitat elements be used in forest management. The average dbh for pileated nest trees in the Northwest is 76 cm (30"). Since Douglas fir in Washington will not reach this size until after 100 years, nesting areas should be managed for long rotations. Perhaps the MMRs should be revised using mean values of habitat components rather than minimum values.

Mannan (1984) and Mellen (1987) question the suitability of the pileated woodpecker as an indicator species for other snag-dependent species that may need higher snag densities, and for the old growth community since pileateds also use riparian hardwoods and forage in immature stands. The pileated may be a better indicator species for mature forests west of the Cascade Range.

Irwin (1987) also questions several assumptions about the pileated woodpecker as an indicator species and the MMRs. He contends that pileated woodpeckers may be more adaptable than indicated by the MMRs based on available research in fragmented forests. He suggests a hypothesis for testing: that pileated woodpecker populations can be maintained or enhanced in managed forests by maintaining a minimal total amount of habitat components distributed through time and space. This would occur by using existing forest reserves and riparian zones along major streams and retaining or creating standing dead and down woody debris. Such a test could be conducted through monitoring programs.

Bull et al. (1990) discuss techniques for monitoring pileated woodpecker populations including: 1) density of breeding pairs, 2) reproduction, and 3) presence or absence of birds. Pileated nests can be located by using vocal or recorded calls and locating nests and roost trees or foraging signs. The monitoring method will depend on the size of the area, the work resources and time available, and the amount of information desired.

Woodpeckers, along with other insectivores, play an important role in reducing insect populations at endemic levels. Biological control of forest insects is preferred over use of insecticides. It has a longer term effect to regulate future insect outbreaks and is less costly and nontoxic. Management to increase woodpecker populations should have the secondary benefits of increasing other insectivorous birds and controlling insect outbreaks (Takekawa et al. 1982).

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KEY POINTS

Habitat Requirements:

- Pileateds inhabit mature and old growth forests and second growth forests with numerous large snags and fallen trees.
- Nest trees are mostly snags > 27" dbh and taller than 87'.
- They forage on large snags, logs, and stumps for ants, beetle larvae, and other insects.
- Home range west of Cascade Crest is 1200 ac, east of Cascades 540 ac.

Management Recommendations:

- Pileateds are sensitive to forest management that removes large standing and down woody material.
- U. S. Forest Service Minimum Management Recommendations:
  Maintain one 600 ac habitat area for one pair every 12,000 ac.
  Nesting area - 300 ac with two hard snags/ac > 12" dbh, 45 of which are > 20" dbh (15/100 ac).
  Foraging area - 300 ac with two hard snags/ac > 10" dbh (200/100 ac).
- During logging, retain 14 snags > 20"/100 ac and green trees in clusters

or dispersed throughout a habitat area. Where snags are lacking, top live trees or inoculate them with fungus above nest height.

- Leave large logs and stumps ~~in~~ various stages of decay. During thinning and harvesting, leave deformed or dying trees and green replacement trees of sufficient size such that they will replace existing snags when they fall.
- Limit insecticide use and promote biological insect control.

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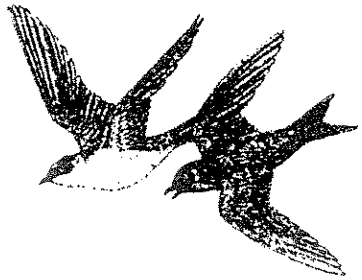


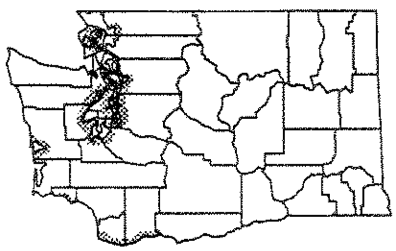
Washington Department of Wildlife Management Recommendations for Priority Species

Progne subis

Purple Martin

RANGE: Breeds locally from southern Canada to northern Mexico. Winters in South America.

WASHINGTON DISTRIBUTION: Breeds primarily near water around Puget Sound and the Columbia River. Breeding pairs have been confirmed in San Juan, King, Pierce, Thurston, Mason, Clark, Skamania, and Gray's Harbor counties.



HABITAT REQUIREMENTS: Purple martins are insectivorous swallows that nest in cavities. In Washington, most of the birds have been reported nesting in manmade structures near cities and towns in the lowlands of western Washington. Historically, they probably bred in old woodpecker cavities in large dead trees. Only a few such nests are known today. Nesting is more common now in bird boxes.

Purple martins feed in flight on insects. Favorable martin foraging habitat includes open areas, often located near moist to wet sites where flying insects are abundant.

LIMITING FACTORS: Availability of nesting cavities, which are not usurped by starlings and house sparrows.

MANAGEMENT RECOMMENDATIONS: Purple martins are known to nest in cavities located in old pilings and occasionally in snags with clear air space and easy access. These pilings and snags (especially snags near water) should be protected and left standing. Snags should be retained during timber harvesting operations, including salvage operations after burns, blow-downs, and insect infestations. Prescribed burns can be used as a tool to create favorable martin foraging habitat. Create snags in forest openings, or at forest edges (e.g., by topping) where nesting cavities are lacking, especially within 10 miles of an existing purple martin colony. Insecticides should not be applied within at least seven and a half miles of martin nesting colonies in order to maintain a food base and avoid chemical contamination.

If natural sites are lacking and cannot be provided by manipulating habitat, artificial nesting sites can be provided according to the following specifications:

1) Construct nest boxes according to the designs such as that shown in

Figure 1. Box dimensions should be at least 7" x 7" x 7", and preferably at least 10" deep. It is important to make the entrance exactly 1 1/4" high, without a threshold (i.e. continuous with the porch floor). The top of the opening should be sanded smooth. The porch is a necessary feature, and the floor board should be rough to provide traction. These features will aid in dissuading starlings from taking over the nest boxes.

2) Protect boxes from wet weather by sealing edges with caulking material, painting or varnishing wood, using cedar for construction or protecting the roof with galvanized tin. Provide drainage holes in the box floor and ventilation holes near the top.

3) Locate boxes in existing colonies first. Locate additional boxes within 10 miles of existing colonies.

4) Locate boxes near water or wetlands with minimum clear air space of 15' (preferably 100') for circling and foraging about the nest. Erect houses 10' or more above the ground or water.

5) It is not necessary to remove martin nests from previous years. If you clean out old nesting material, do so in the spring and place the contents in a dry place beneath the nest. This is to allow for the emergence of chalcid wasps, which help to control Protocalliphora, a nestling parasite. The wasp larvae live in nest materials and will return to the martin boxes if old nests are left nearby.

6) Where starlings and house sparrows are a problem, plug the box entrances from October to mid-April. If starlings establish themselves in a box, remove their nests, eggs, and young on a routine basis (they will renest several times in a breeding season).

The same measures can be taken with house sparrows early in the breeding season, however removal of sparrow nests later in the cycle may cause sparrows to wander into martin nests and destroy their young. Adult sparrows may be controlled. If this is impossible, remove eggs and young, but leave sparrow nests in later months to prevent sparrows from taking over martin nests.

Starlings and house sparrows are not classified as a protected species. Their numbers may be controlled by trapping or shooting them around a martin colony.

REFERENCES:

Adapted from:

Milner, R.L. 1988. Guidelines for establishing and maintaining a purple martin nest box colony. Unpublished report for the Washington Department of Wildlife.

United States Fish and Wildlife Service. 1985. Guidelines for the management of the purple martin, Pacific Coast population. USDI Fish and Wildlife Service, Portland, OR.

KEY POINTS:

Habitat Requirements:

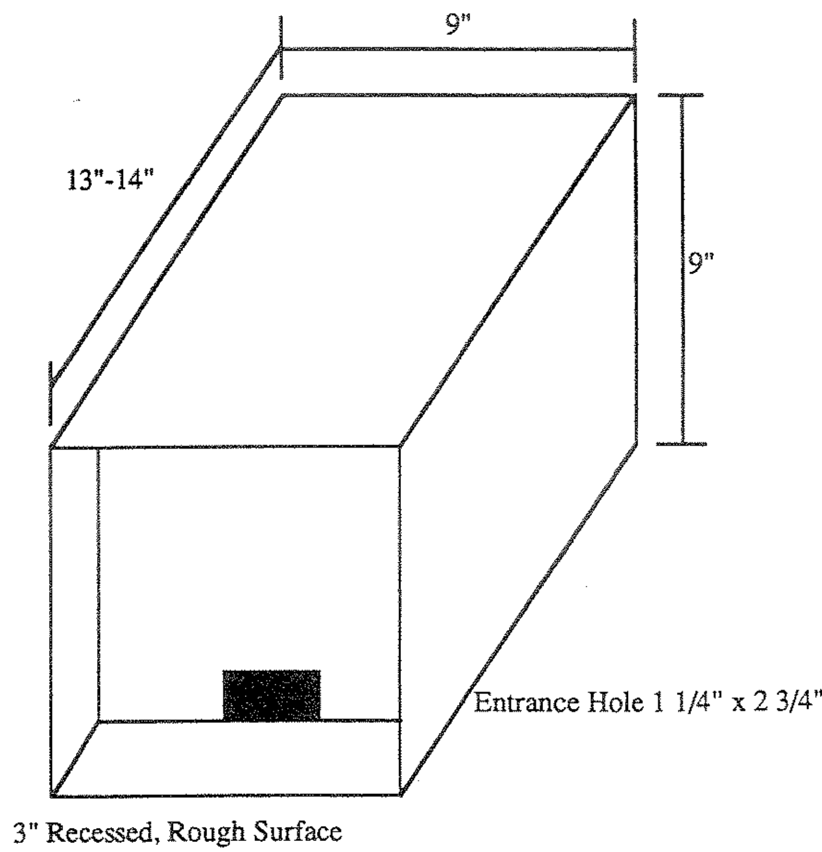
- Nest in natural and man-made cavities.
- Readily nest in bird boxes in areas where the species is already established.
- Usually nest in colonies.
- Feed on flying insects.

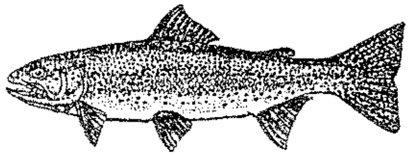
Management Recommendations:

- Retain snags during timber harvesting.
- Retain old pilings.
- Use fires in favorable martin foraging habitat, where appropriate.
- Create snags in forest openings and along forest edges if snags are lacking or limited.
- Avoid applying insecticides within 12 km (7.5 miles) of martin nesting colonies.
- Place nest boxes if cavities are lacking or limited and cannot be created (see text for details).

Figure 1
(Courtesy of Tom Lund, USFWS, 1985)

Purple Martin Nest Box Plan





Oncorhynchus mykiss

Rainbow Trout and Steelhead

RANGE: The native range of rainbow trout was from the eastern Pacific Ocean and the fresh water, mainly west of the Rocky Mountains, from northwest Mexico, to the Kuskokwim River, Alaska. Following its widespread introduction outside its normal range, it now occurs throughout the United States in all suitable localities (Scott and Crossman 1973).

WASHINGTON DISTRIBUTION: In western Washington, resident and anadromous (steelhead) rainbow trout are present in most drainages of Puget Sound, coastal streams, and the lower Columbia River. East of the Cascade Mountains they are found in tributaries of the Columbia drainage and tributaries of the Snake River (Scott and Crossman 1973, Wydoski and Whitney 1979).

HABITAT REQUIREMENTS: Rainbow trout and steelhead (when in freshwater) inhabit river bottoms in riffle and pool areas in summer and pools during other seasons. They both prefer cool water and plenty of oxygen. If the water temperature in lakes exceeds 21 degrees C (70 degrees F), rainbow trout will move to deeper and cooler water. Both rainbow trout and steelhead are tolerant of a wide range of salinities (Scott and Crossman 1973, Wydoski and Whitney 1979).

Rainbow trout and steelhead deposit their eggs in redds on bottoms consisting of fine gravel, and larger (12 cm or 5") rocks, respectively, in well oxygenated running water. Lake populations of rainbow trout move into tributaries to spawn. Newly hatched fry are found in the peripheral waters of pools until they become large enough to maintain themselves in the current riffles. Steelhead will migrate to saltwater at one to three years of age (Scott and Crossman 1973, Wydoski and Whitney 1979).

Preferred food of rainbow trout and juvenile steelhead consists of organisms associated with the bottom such as aquatic insects including diptera, mayflies, stoneflies, and beetle larvae, amphipods, aquatic worms, and fish eggs (Scott and Crossman 1973, Wydoski and Whitney 1979).

LIMITING FACTORS: Stream temperatures which exceed the normal spawning range, a lack of spawning habitat, high sedimentation in spawning areas, and/or a lack of preferred food items will also limit the population and range of rainbow trout and steelhead. Exposure to heavy metals and other pollutants can inhibit migratory behavior.

MANAGEMENT RECOMMENDATIONS: The maintenance of riparian vegetation is essential for controlling stream temperature, providing cover, and protecting against lateral erosion. Removal of streamside vegetation lowers canopy density (shading) and increases sedimentation. Increases in solar radiation raises stream temperatures thereby negatively impacting spawning, hatching, and rearing survival. Increased sedimentation contributes to the loss of spawning habitat and decreases the diversity of aquatic invertebrates and other food items (Newbold et al. 1980, Noss 1983, Heede 1985). Buffer zones along stream banks should be at least the width of the height of the tallest tree or 15.2 m (50 ft), whichever is wider. The vegetative buffer will provide erosion control, and maintain natural stream temperatures and diversity of aquatic invertebrates (Meehan et al. 1977, Newbold et al. 1980). In Washington, this can range up to 60 m (200 ft.). This "zone of influence" (Meehan et al. 1977) should be maintained along stream banks which provide rainbow trout and steelhead habitat, and any other stream which directly or indirectly influences rainbow trout and steelhead. Road construction and maintenance activities should be avoided adjacent to streams with rainbow trout and steelhead. In-stream structures such as bridges, piers, boat ramps, or culverts must not impede the natural movements of rainbow trout and steelhead.

REFERENCES:

Heede, B.H. 1985. Interactions between streamside vegetation and stream dynamics. in Proceed. Symp. of Riparian Ecosystems and their Management: Reconciling Conflicting Uses, April 16-18, 1985, Tucson, AZ.

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Wydoski, R.S. and R.R. Whitney. 1979. Inland fishes of Washington. Univ. of Wash. Press, Seattle, WA.

KEY POINTS:

Habitat Requirements:

- Rainbow trout and steelhead inhabit river bottoms in riffles and pools in summer and pools during the other seasons.
- Rainbow trout and steelhead spawn in redds on bottoms consisting of fine gravel, and larger (4-5") rocks, respectively, in well oxygenated running water.
- Newly hatched fry are found in peripheral waters of pools.
- Preferred food consists of bottom dwelling organisms.

Management Recommendations:

- Buffer zones of at least the width of the height of the tallest tree should be maintained along stream banks which provide rainbow trout and steelhead habitat, and any other stream which directly or indirectly influences rainbow trout and steelhead habitat.
- Road construction and maintenance activities should be avoided adjacent to streams which provide rainbow trout and steelhead habitat.
- In-stream structures such as bridges, piers, boat ramps, or culverts must not impede the natural movements of rainbow trout and steelhead.
- Waters inhabited by steelhead parr should not be treated with metal based herbicides during the period March 1 - June 15.

C: 4/23/91 GH