Resolution No. 272

A RESOLUTION OF THE CITY OF WOODINVILLE, WASHINGTON, ADOPTING THE CITY OF WOODINVILLE LITTLE BEAR CREEK LINEAR PARK MASTER PLAN.

WHEREAS, the City of Woodinville has a goal of meeting recreation and open space needs through a planned program of facilities and programs as outlined in the Comprehensive Plan and the Park Recreation & Open Space Plan; and

WHEREAS, the City has a goal of creating a "pedestrian-friendly downtown" and a system of non-motorized facilities that link neighborhoods, schools, retail establishments, and public parks and facilities; and

WHEREAS, the City has adopted policies along with other jurisdictions designed to respond to the listing of Chinook salmon as an endangered species under the Endangered Species Act and is actively protecting and enhancing habitat and conducting public outreach and education in an effort to increase the number of Chinook salmon in the Sammamish River and its tributaries; and

WHEREAS, the Woodinville Parks and Recreation Commission and the Woodinville Planning Commission have completed a comprehensive public outreach effort to study the current condition of the Little Bear Creek Corridor and to consider a balance of needs and opportunities including economic development, protection of natural resources, transportation, recreation, and education; and

WHEREAS, the City Council has overseen the creation of the Little Bear Creek Linear Park Master Plan to ensure that it reflects public opinion, incorporates the recommendations of the Parks and Recreation Commission and the Planning Commission, and presents a conceptual architectural plan that can provide a basis for natural resource protection and collaboration with the private sector during development of this area; and

WHEREAS, the City intends to use the Little Bear Creek Linear Park Master Plan as a guide to future phasing and implementation of a unique trail system in order to enhance commercial and tourist activities, promote fitness and recreation activities for all ages and abilities, and preserve the beauty and tranquility of Little Bear Creek.

NOW, THEREFORE,

THE CITY COUNCIL OF THE CITY OF WOODINVILLE, WASHINGTON, DOES RESOLVE AS FOLLOWS:

Section 1. Adoption of the Plan. ***The City Council hereby adopts the City of Woodinville Little Bear Creek Linear Park Master Plan, as set forth on Attachment A to this Resolution.***

ADOPTED BY THE CITY COUNCIL AND SIGNED IN AUTHENTICATION OF ITS PASSAGE THIS 24th DAY OF MAY 2004.

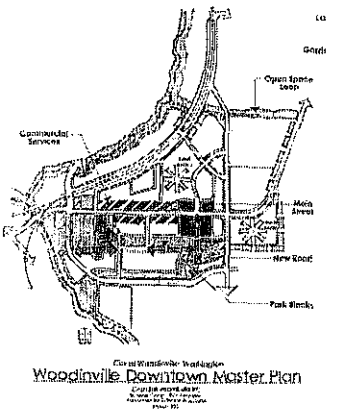
APPROVED:

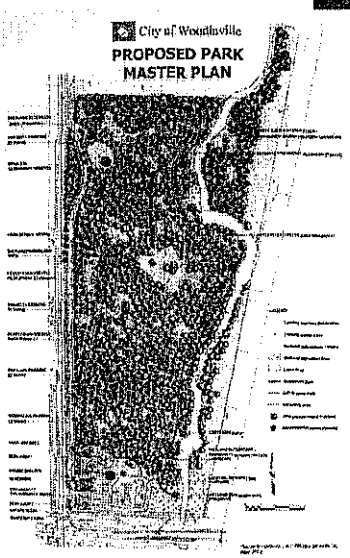
DON BROCHA, MAYOR

ATTEST/AUTHENTICATED:

SANDRA PARKER
CITY CLERK/CMC

LITTLE BEAR CREEK
LINEAR PARK
MASTER PLAN





CITY OF WOODINVILLE PARKS AND RECREATION
April 2004

TABLE OF CONTENTS

EXECUTIVE SUMMARY 3

ACKNOWLEDGEMENTS 4

INTRODUCTION 5

REGIONAL CONTEXT 7

EXISTING CONDITIONS 8

SITE CONDITIONS 10

PUBLIC INVOLVEMENT 16

ANALYSIS AND EVALUATION 18

SCHEMATIC MASTER PLAN 22

IMPLEMENTATION 29

ACTION PLAN 32

LIST OF APPENDICES

A – Little Bear Creek Corridor Habitat Assessment, David Evans & Associates
B – Vegetation, Fish & Wildlife Inventory
C – Zoning Classifications
D – Transportation Analysis & Street & Trail Design Concepts
E – Record of Public Meetings & Public Workshop Results

LIST OF FIGURES

1 – Master Plan – Little Bear Creek Linear Park
2 – City of Woodinville – Future Land Use Map
3 – Habitat Improvements – Little Bear Creek Linear Park
4 – Existing Land Use Survey
5 – Land Value Map
6 – Land Use Plan changes for Little Bear Creek Corridor
7 – Railroad right of way proposals
8 – SR 522 Overpass proposal

EXECUTIVE SUMMARY

The Little Bear Creek Linear Park Master Plan is a small and defined part of an ambitious vision for the City of Woodinville. It is an effort to define, protect, enhance, and manage a significant ecosystem within the Woodinville city limits. When adopted in final form, the Plan will assist the City in providing transportation and recreation benefits to the citizens of Woodinville, it will provide guidance in land use and zoning decisions, and will shape the visual and environmental resources of Woodinville for years to come.

It will also play a role in the economic development of the Little Bear Creek Corridor and thus, contribute to a vibrant and pedestrian-oriented downtown that is described in the City's Comprehensive Plan.

Like many of the visions discussed in the downtown planning process, the park can only be realized through collaboration between the private and public sectors. Few of the goals and objectives for the park can be achieved without active and enthusiastic participation by educators, citizen groups, business owners, landowners, and residents in the area.

The goals for the park that have been identified by the public reflect the complex nature of Little Bear Creek. Preservation of an endangered species and promotion of economic development appear to be at odds, however, this Plan reflects the desire to accomplish both. Relaxation and reflection alongside an important link in a regional trail system appear to be contradictory goals, yet this Plan seeks to accomplish both.

The public has defined goals to achieve a variety of complex objectives within a relatively small and constrained area of land. With this Plan as a guide, new policies, regulations, and design standards can be developed that encourage and promote the vision. If successful, the City will be on track to harness the beauty and tranquility of Little Bear Creek and make it part of the signature that sets Woodinville apart as a unique and innovative City.

ACKNOWLEDGEMENTS

The members of the Woodinville City Council, the Woodinville Parks and Recreation Commission and many citizens have worked together to learn about this Creek, collect public opinion, and analyze the results of reports and environmental studies. The citizens listed below have brought their technical expertise, policy guidance, passion for protecting environmental resources, interest in promoting economic development, and strong belief in the benefits of parks and recreation to bear on the document.

CITY COUNCIL

Don Brocha, Mayor

Cathy Wiederhold, Deputy Mayor

Scott Hageman

Michael Huddleston

Gina Leonard

Robert R. Miller

Chuck Price

PARKS AND RECREATION COMMISSION

Kari Powers, Chairman

Bob Vogt, Vice Chairman

Liz Aspen

Tiffany Bond

Michael Knotz, Sr.

Kimberly Nunes

Linda Sarpy

STAFF SUPPORT

Lane Youngblood, Director of Parks and Recreation

Bob Wuotila, Park Planner

Carl Smith, City Planner

INTRODUCTION

Shortly after it was incorporated in March, 1993, the City of Woodinville began to plan and develop park and recreation facilities to meet the goals of the Comprehensive Plan. In 1998, the City adopted a detailed inventory of existing facilities and a plan to meet future needs. This plan, the Parks, Recreation and Open Space Plan (PRO Plan) recommends a variety of open spaces, trails, and recreation areas, among them the development of a linear trail system along the length of Little Bear Creek from the Sammamish River to the City limits at NE 205th Street. The PRO Plan also recommends that land adjacent to the Creek be purchased for resource conservancy purposes and that certain features be enhanced and developed, including trail links, within the Creek corridor.

The Little Bear Creek Linear Park Master Plan seeks to bring into focus this linear park by delineating the trail system and proposing features within the park environs. In addition, it seeks to coordinate the park with adjacent land use and circulation within the Central Business District (C.B.D.) as they evolve in the development of the Downtown-Little Bear Creek Corridor Master Plan and other current planning efforts that seek to define and give character to the development of this young City.

While the Comprehensive Plan lays out the long-term direction and intent of the City, the Downtown-Little Bear Creek Corridor Master Plan addresses the core land use and objectives intended to bring about vibrant economic, social, and recreational objectives. The role of the Little Bear Creek Linear Park Master Plan is to provide a greater level of detail to the role of recreation within the area surrounding Little Bear Creek.

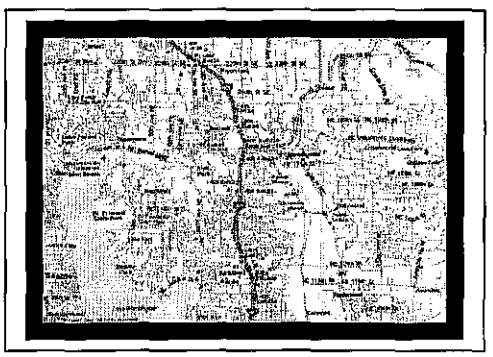
Interest in the Little Bear Creek Linear Park was heightened when the City purchased 17 acres of land at NE 195th Street and 7 acres of land at NE 134th Street for resource conservancy and resource activity use. These purchases triggered the need for greater understanding of the interplay between public and private development and the environmental and social networks that could potentially transform a narrow, constricted land mass between a major highway and a rail line into a vibrant and economically vital part of the City's core.

Along with the Sammamish River, Little Bear Creek is one of Woodinville's primary ecological resources. It has value to the citizens of Woodinville as fish and wildlife habitat, as a passive and active recreation amenity, as a surface water conduit for surrounding hillside and valley land use and as an ecological, visual and physical celebration of life. It also has the potential to provide a

practical and pleasing recreation amenity to support the current and future land uses that line the Creek and to provide a transportation conduit for connecting the neighborhoods to the C.B.D. Unification of the Park into a linear system of recreation and visual amenities is essential to making the City of Woodinville a place with identity; a place where people like to live, work, and play.

REGIONAL CONTEXT

The Little Bear Creek corridor, for purposes of this study, consists of the 2.2 miles of Little Bear Creek from its mouth at the Sammamish River to the crossing under N.E. 205th Street, along the northern City limits of Woodinville and the King and Snohomish County line. The Master Plan study area includes parcels of land adjoining the Creek, road rights of way that adjoin those parcels, and rights of ways that have been identified as trails in an adopted plan for Woodinville. In addition, City owned land and recreation sites within ¼ mile of the Creek are included as are the transportation routes connecting them to Little Bear Creek (See Figure 1). The area is generally characterized as a narrow (1,000 - 1,500 feet wide), north/south trending valley, enclosed by gently rolling 70 to 100 feet high rolling hills and slopes on the east and west until it coincides with downtown Woodinville where the narrow valley becomes a broad plain about ½ to ¾ mile wide. The broad plain is associated with the confluence of Little Bear Creek and the Sammamish River.



Little Bear Creek is the largest natural surface drainage system for the City of Woodinville. The entire watershed drains about 15 square miles of land area, 80 percent of which is in Snohomish County. Woodinville's contribution is about 1,920 acres. The mainstem length is approximately 7.7 miles, 2.2 miles of which are in the City of Woodinville. The Creek's overall gradient is very gradual with an average slope of 0.8 percent. The drainage basin was originally dominated by forested wetlands, and still contains a large amount of riparian wetlands, despite strong development pressures extending from urban areas.

The land use in the upper basin is primarily rural with numerous horse farms throughout the sub basin. The upper mainstem of the Creek has a predominantly young, deciduous riparian forest with several riparian wetlands. Below midstream, near Maltby Road, land use is predominantly suburban with the riparian zone narrow and broken throughout. The lower mainstem of the stream runs parallel to State Route 522, a major 4-lane commuter highway. The Creek is heavily impacted with a poor quality riparian corridor and extensive commercial development. The lower portion of the Creek, within this Master Plan area, runs through the commercial portion of downtown Woodinville before flowing into the Sammamish River.

EXISTING CONDITIONS

Land Use. The natural and cultural conditions along the Little Bear Creek have changed dramatically in the last several decades. Agricultural use replaced wetland forests at the turn of the 20th century and commercial-industrial uses replaced agriculture in the 1970s and 80s. Today the corridor contains a variety of retail, transportation, distribution, light-industrial and vacant land. Many businesses in the area are outdoor-storage oriented and do not take advantage of creekside views or protect streamside buffers. Some uses are of a nature that has the potential to present ground and water pollution concerns. Much of the land adjacent to the Creek is barren except for buildings and parking and is dominated by non-native invasive vegetation.

The area is fairly level and has good access to a major transportation route (SR 522). All major public services are available to the parcels within the corridor including water, sewer, power, and communications. As part of a dynamic investment plan to reduce congestion and promote development, the City Council adopted a utility tax that dedicates funds to the infrastructure of the Little Bear Creek Parkway, which runs parallel with the Creek and serves the businesses along NE 177th Street. Significant public investments are beginning to bridge the physical barriers that once prevented Little Bear Creek corridor parcels from being considered part of the urban core. These changes are expected to bring about more architecturally designed and landscaped development as is commonly seen in the Central Business District to the east.

Transportation. Roads in the study area that affect the Master Plan for the linear park are:

- 130th Ave. N.E.
- 131st Ave. N.E.
- 132nd Ave. N.E.
- 134th Ave. N.E.
- 136th Ave. N.E.
- 139th Ave. N.E. (a.k.a. 177th Pl. N.E./Little Bear Creek Parkway)
- 140th Ave. N.E.
- Woodinville-Snohomish Road
- N.E.177th Street
- N.E.178th Street
- N.E. 190th Street

- N.E. 190th Place
- N.E. 195th Street
- North Woodinville Way
- State Route 522

All of these roads and rights of way link the residential neighborhoods of Woodinville to the retail and service core of the City and to the Little Bear Creek Linear Park.

Water quality and habitat. The stream channel has current problems with water quality, riparian quality and quantity, bank structural problems, and with habitat quality and quantity that have Federal and State legal ramifications. Nine species of resident and anadromous species of fish utilize Little Bear Creek. A more complete study of the Creek habitat was undertaken as the Little Bear Creek Habitat Assessment Plan conducted by David Evan and Associates, Inc. in July of 2002.

SITE CONDITIONS

Surficial Geology. About 13,000 years ago, during the end of the Pleistocene Era, the melting of glaciers left the landforms that we find today in the lower Little Bear Creek valley. The uplands surrounding the Master Plan study area are composed of glacier till up to 50 feet thick, a cemented conglomeration of sands and gravels bound in clay, and compressed from the 2,000 feet thick glacial ice that once covered the area. In these areas drainage is poor, runoff is high and development potential is good due to the structural integrity of the surficial materials. On the hillsides overlooking the creek valley advance and recessional outwash sands and gravels are to be found. These are the best materials for both plant production and for urban development. Drainage is good, the land is easily workable and water infiltration is fast.

Recent alluvium, sands and silts fill the bottom of the valley and lie adjacent to the stream. These areas have a generally high water table, are locally unstable requiring creative structural engineering prior to building and are subject to flooding. The broad plain lying east of the confluence of Little Bear Creek and the Sammamish River is an area containing transitional beds where mostly sands were deposited at glacial recession and during the recent period when alluvial, erosional and depositional processes occurred. This transitional bed area is very good for urban development having stable materials, good runoff, and good infiltration capacity. The central business district of Woodinville is underlain by this material.

Hydrology. Eighty percent of the Little Bear Creek watershed is in Snohomish County. The remainder of the watershed transports runoff directly to the Creek or by entering four unnamed tributaries, mostly channelized and put into pipes (see Figure 3). These tributaries traverse residential, commercial and industrial land uses and transport pollutants to the Creek. Industrial land use adjacent to the Creek and elsewhere in the drainage basin are a cause of concern for the water quality of the Creek.

Wetlands and floodplains, associated with the Creek pose environmental constraints to adjacent development. Many of these constraints have been surveyed and mapped by King County and others. Another wetland, Woodin Glen Pond, in the Wedge Neighborhood, is several acres in size and feeds a tributary to Little Bear Creek in a culvert under SR 522. Other mapped wetlands include the land between N.E. 195th Street and N.E. 205th Street, west of SR 522.

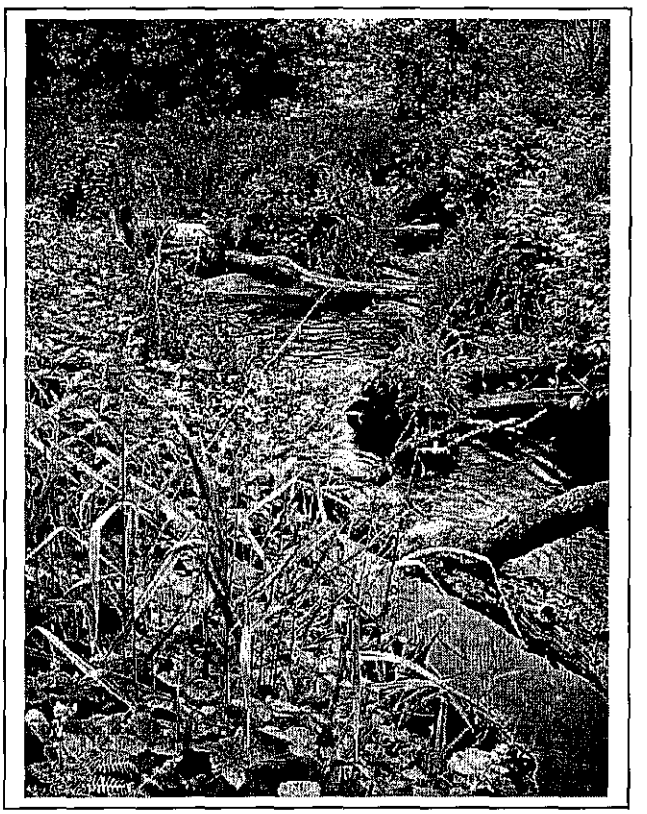
Much of the Little Bear Creek channel between the mouth and N.E. 178th Street extended (river mile 0.70) has undergone human improvements to straighten and control the channel. The Creek is approximately 10 to 25 feet wide between the mouth and 134th Street. Between river mile 0.70 and a point where it crosses

under SR 522 a wide riparian wetland exists with several side channels that store runoff during high flows. From there the Creek is piped under the freeway and meanders in its natural, approximate 50 feet wide corridor all the way to the northern City limits at N.E. 205th Street, except that it is piped under N.E. 195th Street. For purposes of later discussion Little Bear Creek is divided into three reaches. Reach one includes the length from the mouth to the downstream side of the 131st Street overpass. Reach two extends to the upstream side of the culvert under SR 522. Reach three ends at N.E. 205th Street. See Figure 3.

Creek hydrology is discussed in detail in the Little Bear Creek Corridor Habitat Assessment, referenced in Appendix A of this Report.

Soils. The soils of the study area were formed by glacial processes and consist of mostly sandy, good draining, building suitable materials except for the valley alluvial soil adjacent to Little Bear Creek Parcels of land adjacent to the Creek are generally overlain with a Norma soil having a high water table which is a severe constraint to low buildings. The south and east side of parcels adjacent to the Creek generally between N.E. 131st and N.E. 179th extended are the exception to the poor alluvial soils. These sites consist of sandy Indianola soil. The central business district is also Indianola as is the Wedge Neighborhood. The Woodin Glen Pond area is a mucky peat called Seattle. Further north around Woodinville High School the gravelly Everett soil covers the east facing slopes.

Plant Ecology. The forest in this area has changed considerably over time. The intrinsic plant nature of the study area in late stages is that of a Hemlock-Cedar dominant coniferous forest. Today, because of human intervention in the landscape, there are no examples of the late stage coniferous forests. But, several parcels of land on the slopes and upland terraces west of SR 522 and north of N.E. 195th Street consists of a mixed deciduous/coniferous native forest in mid-successional stages. The riparian areas adjacent to the Creek, having been logged by the early 1920s, contain only a few vestiges of a coniferous forest and generally resemble a riparian habitat of poor quality. Many sites



along the Creek contain noxious invasive species that prohibit the natural evolution of the native forest and have negative consequences for native fish and wildlife habitat. The Woodin Glen Pond area contains forested wetland species, together with introduced ornamental trees and shrubs. All other parts of the corridor are urbanized as commercial and industrial sites and as such have mostly been cleared, containing small amounts of ornamental landscaping. A complete inventory of the vegetation in the study area can be found in Appendix B of this Report.

Fish and Animal Ecology. At least eight resident and anadromous species of fish utilize Little Bear Creek. This includes anadromous and resident salmonids, sulpins and lampreys. At least 40 different non-native species of fish have been introduced into the Lake Washington watershed, but only 24 species currently remain and adversely affect salmonids. A complete list of these fish is found in Appendix B of this Report.

Biologists recorded bird, mammal, reptile and amphibian species along Little Bear Creek for the Little Bear Creek Corridor Habitat Assessment. Elsewhere in the study area, potential species presence can be extrapolated from vegetation types. The creek riparian area contains thirty-nine species of birds, ten species of mammals and four reptile and amphibian species, all of which have been documented and observed through site visits. It is likely that restoration of vegetative habitat abundance and quality will measurably increase the numbers and diversity of species.

History and Culture. The first record of human settlement in Woodinville was during the 1870s when a few families logged the local forests and established homesteads. By 1897 four families owned most of the land along Little Bear Creek. The railroad reached Woodinville in 1877 and was used for timber and coal transport. By the 1890s several stores, hotels, sawmills, meat markets and other enterprises were established.

Logging the old growth forest was the primary occupation during this period and the local rivers were used to transport timber prior to the arrival of the railroad. The disappearance of the first-growth trees gave way to farming so that by the early 1920s stump farms could be seen throughout the valleys. When the stumps were burned out and removed, farming became the primary occupation in the valley.

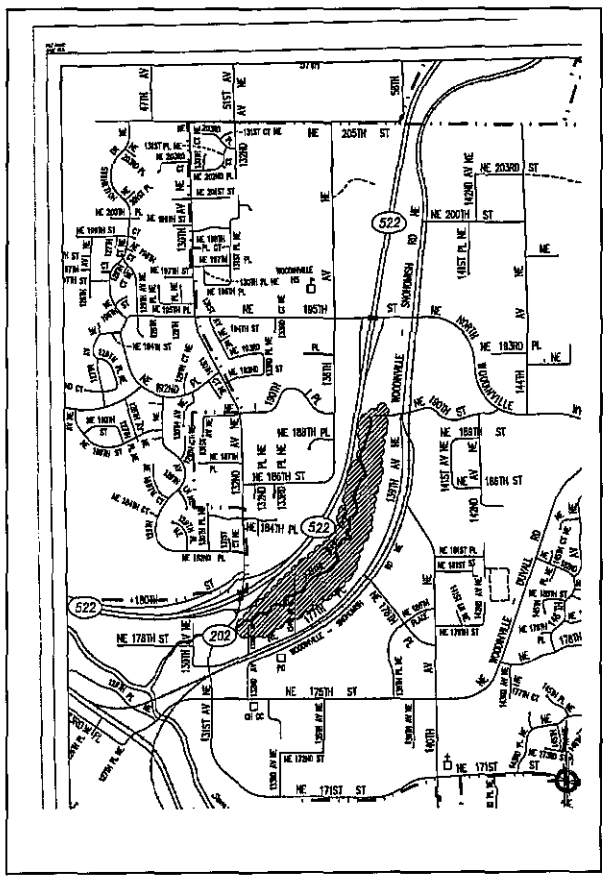
By the 1930s records indicate that the riparian zone of Little Bear Creek had been cleared and farming occurred right up to the banks of the Creek.

The population in the Woodinville area expanded rapidly after World War II. The post-war baby boom years between the 1950s and the 1970s and the creation of Interstate 405 and SR 522 led to an expansion of building and subdivision

development in to the valley. When the 1980s arrived Woodinville looked much as it does today. The once rural area of Woodinville with its uncontrolled land use pattern had become the greater Seattle metropolitan urban fringe accompanied by a new aesthetic with sophisticated urban problems.

Existing Land Use. Most of the present land use in the study area precedes the incorporation of Woodinville in 1993. The Comprehensive Plan for the City of Woodinville currently recognizes Little Bear Creek corridor as an area for General Business, a designation that encourages auto-oriented retail and business services and outdoor storage. Residential and office uses are not permitted in the General business land use category.

Properties adjacent to the general business area are designated a combination of Central Business District (retail), Multi-family and Office and Single-family residential (west of SR-522). Near the mouth of the Creek, several parcels are designated as Industrial (See Figure 2). Current planning underway on the Downtown-Little Bear Creek Corridor Master Plan has identified a need to encourage additional uses with emphasis on those uses that are more compatible with the Creek, such as office uses. Although current uses may be continued, the public has indicated a preference for new uses that through design review or incentives will protect and enhance Little Bear Creek.



Parcels adjacent to Little Bear Creek contain most of the high intensity and large-scale development, as well as parcels adjacent to Woodinville-Snohomish Road between 140th Ave. N.E. and N.E. 195th Street. Land uses along the Creek and west of 131st Ave. N.E. to the Sammamish River are a mix of large buildings used for industrial/warehouse and outside storage activity, small one-story office buildings, freeway services and retail stores. Land uses along the Creek and east of 131st Ave. N.E. are mostly a combination of retail, industrial warehousing and distribution, and auto repair, sales and rental. In addition, the City owns a 6.5 acre vacant, potential future park site just north of 134th Ave. N.E. and west of the Creek. Parcels west of SR 522 are vacant or contain single-family residential homes, except for

Woodinville High School and a 17 acre, city-owned, resource-conservancy park, north of N.E. 195th Street. See Figures 4 and 5 for existing land use.

There is a total of 89 acres of land adjacent to the Creek within the Little Bear Creek corridor north of 131st Ave. N.E. Of that acreage, business services utilize 42 percent, 33 percent is vacant and retail services use 18 percent. Business services include auto leasing, trucking, equipment rental, construction trade and storage yards, warehousing and wholesale trade. Uses in this category are outdoor-oriented businesses. Retail services include stores that sell goods to the public and tend to have more investments in the buildings than in the site. The area adjacent to Little Bear Creek, the focus of this Master Plan, contains much land that is either vacant or is outside use oriented, or that does not have a major structure on it. This is also true for parcels west of SR 522 and north of N.E. 195th Street.

Land Valuation. The land value of parcels in the study area follows the pattern of the land use breakdown, where the highest valued land is currently used as business service, and the second highest value is in the retail use category, followed by residential properties. The highest valued properties are found at the northern end of the study area, near the 522 freeway ramps at N.E. 195th Street, and at the southern extreme study area near the mouth of Little Bear Creek. The land near the creek mouth derives it value mainly from buildings while the value of land near N.E. 195th is due mainly to location.

Land Use Controls. As with all areas throughout the region experiencing development and urbanization, the Little Bear Creek corridor master plan area has land use regulations that have become more complex and more prescriptive over time. In addition, as population density and development increases, the public has become more sensitive to the value of the natural environment and has sought greater land use controls to protect these values. The City of Woodinville realizes it is subject to the same permit review processes as the private sector and will submit to appropriate local, regional and state authorities as required during development of this plan.

In 1999 the Federal government included Chinook salmon in the list of endangered species. Since Little Bear Creek was known to support Chinook spawning, this had the effect of placing a physically constrained area with major development challenges into even more challenging regulatory and political environment. Thus, new development in the study area is subject to design guidelines, critical area regulations, height and density parameters, zoning, and regulatory recommendations or guidelines for responding to the ESA. The combination presents complex challenges to landowners and developers as they attempt to redevelop or maximize their land investments. Only through the most collaborative processes with the owners can the City achieve common goals, economic vitality, recreation and aesthetics that enhance livability and property values, and protection and enhancement of the Creek.

West of SR 522, Woodinville has adopted single-family zoning. On the eastern side of the study area, along the Woodinville-Snohomish Road, there is industrial zoning. At the southern end of the Creek, industrial and retail can be found. The remainder of the corridor, on parcels adjacent to the Creek, the general business zone is used. A description of these zoning classifications is located in Appendix C of this Report.

Roads. Motorized access to Little Bear Creek Linear Park is from 177th Place N.E./139th Ave. N.E. (Little Bear Creek Parkway). This is currently classified as a minor arterial in the City and is proposed to be developed with a 74 foot cross section. Additional right of way will need to be purchased to accommodate those dimensions. This road carries the major amount of traffic in the study area. From Little Bear Creek Parkway, 134th Ave. N.E. provides a direct link to the linear park. N.E. 195th Street and 136th Ave. N.E. are also directs link to the Park. Other roads in the study area are not less important but are indirect routes to the Park and Little Bear Creek itself. Little Bear Creek Parkway and other roads in the area are discussed in the Transportation section of Appendix D of this Report.

Railroad. The Seattle Lake Shore and Eastern Railroad tracks (now Burlington Northern) run parallel to Little Bear Creek Parkway. This route is an element of the Little Bear Creek Linear Park Master Plan. Currently, these tracks are not used for commercial purposes, but they are seen as a future potential asset. The route runs between the City of Renton in the south and Snohomish County in the north. The right of way is 100 feet wide.

Utilities. The study area contains sewer, power and water, all of the necessary utilities required by intensive development.

PUBLIC INVOLVEMENT

Public Meetings. During the summer of 2001, the Woodinville Parks and Recreation Commission requested the Parks and Recreation Department begin the development of a Little Bear Creek Linear Park in response to two issues at the time. One was to coordinate parks planning with the transportation planning on 177th Place N.E. The other was to integrate the newly City-purchased parcels of land adjacent to Little Bear Creek into the linear park plan recommendations of the adopted PRO Plan.

The Parks and Recreation Commission held several public meetings throughout 2001 reviewing data developed by staff and developing visions of what the park would be. In October of 2001 the Planning Commission also began to review Little Bear Creek Linear Park data.

In the fall of 2001, the City began to work on the development of a plan for downtown Woodinville. These planning efforts continued during 2002 and included a joint public meeting with the Parks and Recreation Commission and the Planning Commission. During the remainder of 2002 several more public meetings with the Parks and Recreation Commission, with the Planning Commission, and at open-houses were held. Park concepts and features were being generated at this time for discussion at these meetings. A mailer was also sent out to the general public soliciting responses to plan proposals. See Appendix E of this Report for record of public meetings and a compilation of questionnaire results.

The public meetings generated a set of goals and design objectives to guide the development of a schematic master plan. The Little Bear Creek Linear Park Master Plan since has been taken into the community, presented at open-house meetings, and also to individual stakeholders and groups on an on-call basis.

Goals and Objectives.

Land Use

- To create a variety of recreational and public education opportunities within the corridor including Little Bear Creek.
- To protect, enhance and preserve valley vistas in and above the corridor area.
- To create a dynamic and visually pleasing link between the corridor and adjacent areas.
- To promote a viable economic future for the corridor.

Open Space

- To preserve, protect and enhance environmentally sensitive areas with a focus on wildlife habitat and mature vegetation within the corridor.
- To preserve and protect the mature trees that provide a visual and noise buffer along SR 522.

Circulation

- To define and develop gateways of the corridor from the entrance to Woodinville at the west end to the transition between King and Snohomish Counties.
- To ensure infrastructure improvements that meet the needs for development capacity.

Design Objectives. (Parks and Recreation Commission)

I. Education-Preservation

- Provide ¼ mile markers for information and rest stops along the trail.
- Provide an interpretive trail system.
- Restore Little Bear Creek and adjacent wildlife habitat.
- Provide for human access to the Creek.

II. Economic Development

- Redevelop general business zone.
- Examine zoning to facilitate land use conversion and parkway improvements.
- Insure high quality aesthetics in building development.
- Provide for a wide range of land use.

III. Accessibility-Transportation (Bicycle & Pedestrian)

- Continue the Wood-Snoh. Road design to Snohomish County.
- Enhance landscape quality of the S.L.S. & E. railroad right of way.

ANALYSIS AND EVALUATION

Recreation Suitability. The study area was reviewed for its suitability for the various types of recreation activities defined in the PRO Plan. There are 5 basic broad categories of recreation activity in Woodinville:

- Playgrounds, fields and courts
- Walking and hiking trails
- Bicycle trails
- Environmental resource parks, and
- Resource conservancy parks

The first three categories are considered to be active recreation where physical activity occurs, and the last two are more or less passive recreation amenities where physical exercise is not required to enjoy the park. The natural factor maps were reviewed for the above recreation activities.

Good soils, permeability and drainage, presence of mature trees, favorable slope and land workability make the upland sites west of SR 522 suitable for some types of recreation. The large, 20-acre site directly north of the high school could be a good candidate for active recreation if it could be combined with environmentally sensitive development. However, Woodinville High School provides many types of active recreation for the area and demand for more space does not exist at this time.

The downtown area is built on Indianola soil, which for the same reasons as above is the best soil in the region for any type of land use activity, especially recreation. But here land is generally more valuable for commercial use.

The Woodin Glen Pond area in the Wedge neighborhood is not suitable for structural development due to peat soil but could be used for a trail or boardwalk element if sensitive design parameters were followed. Some parts of this site consist of Indianola soil.

The valley sites adjacent to Little Bear Creek consist of Norma soils, which have severe limitations for most development due to high water table, poor drainage, and low structural stability. Some of the valley parcels partially contain Indianola soil. These parcels are located southeast of 140th Ave. N.E. and east of 130th Ave. N.E. on both sides of the Creek, and including the newly purchased City park site. This park site would be suitable for active recreation based on the presence of favorable natural factors.

Even when natural factors offer constraints to active recreation development, they can provide opportunities for passive, interpretive/educational activities and sensitive trail construction.

Many parcels adjacent to the Creek involve the 100-year floodplain and wetlands. Those parcels or parts of them may also be good candidates for environmental education or other passive recreation activities.

A continuous, uninterrupted Little Bear Creek Linear Park will need to traverse what is currently private and public property adjacent to the Creek, some of which is owned by the State of Washington for freeway right of way. All of these parcels adjacent to the Creek and north of the Creek between Wood-Snoh. Road to the northern city limits have commercial and industrial value. However, this value may be tempered by the adoption of restrictive creek buffers in response to the federal Endangered Species Act (ESA) mandates to protect fish habitat. The City is pursuing Best Available Science to determine how best to regulate and encourage development in light of the ESA.

Recreation is permitted throughout all of the City's zone classifications, and even in buffer areas, some recreation of a passive nature may be allowed, especially if doing so would promote stewardship of the resources.

Recreation is a land use that requires a visually pleasing and aesthetic environment. Park usage depends on this. People go to parks for enjoyment, relaxation and rest. Many parcels within the linear park corridor are not visually compatible with the notion of a park-like atmosphere. Land use conversion or implementation of visual mitigation measures such as landscaping would be necessary to make them compatible with the purposes of recreation activity.

Physical factors within the study area offer both opportunities and constraints for recreation. The railroad can be a vehicle for amusement and enjoyment but brings with it an odor and noise. Tree-lined streets provide shade and visual relief and reduce glare and particulate matter. SR 522 is adjacent to the linear park and will be noisy and a source of pollution, light and glare.

Obviously, vacant parcels of land and parcels that have low improvement value or inexpensive structures will be the best choices for purchase as recreation opportunities than will parcels that have big buildings and large parking lots.

Circulation Suitability. The basic motorized transportation system for the Little Bear Creek Linear Park area is established. However, additional right of ways need to be acquired to effect long-range circulation goals in and adjacent to the downtown area and the linear park study area.

Several streets linking various parts of the City with the Little Bear Creek study area are good candidates to carry pedestrians and bicyclists as well as motor traffic to park sites, the C.B.D. and residential neighborhoods. It will be important to make these routes a pleasant and safe traveling experience. Trees for shade and interest, separated walks from traffic lanes and wide, delineated bike lanes are needed to make these linkages functional. See the Road Cross Sections in Appendix D of this Report for design and location recommendations.

Trails are relatively inexpensive to develop and add immeasurable opportunities to any recreation experience. Trails can be hard or soft depending on the location and the nature of the ground surface where they are to be built. Within wetland buffers trails need to be as sensitive to their environment as possible, and synthetic, permeable grid structures that anchor soil particles and allow water infiltration can be functional and environmentally friendly. If done properly, trail development can be consistent with restrictive regulatory parameters regarding materials and location.

Scenic views are important to any travel experience. Places of interest, destinations and scenic qualities and benefits can create incentives to travel. It is important to identify and pursue those elements and features in the study area prior to designing the trail system.

Land Use Suitability. A large percentage of land within the study area is either vacant or involves uses that have relatively small investments in permanent structures. These are generally located between Little Bear Creek/SR 522 and Little Bear Creek Parkway. Development on these parcels may be hindered by the presence of structurally poor alluvial soils, high water table, wetlands or floodplains. Some parcels adjacent to the Creek and between 131st Ave. N.E. and 140th Ave. N.E. have soil conditions good for development. Some parcels are developmentally restricted because of their narrowness, existence of creek buffer zone and street setback requirements. Other parcels are sufficiently large to have flexibility in redevelop. Generally, a high building valuation on a small parcel means a low potential to redevelop. Large parcel size and low building value increases the redevelopment propensity. So, it is reasonable to assume that many pieces of property in the study area will remain static for some time, while others will be prime for development or redevelopment as soon as demand for building space catches up with the supply in Woodinville.

Except for land use on parcels adjacent to Little Bear Creek, most buildings and uses in the study area are in harmony with their surroundings. Mainly due to native vegetation and ornamental landscaping, much of downtown Woodinville and the residential neighborhoods in the Wedge and the west side hills overlooking downtown have a positive visual quality about them. Creek side parcels have little riparian vegetation and little street side landscaping. This causes an aesthetic disparity with their neighbors on all sides.

Many of the land parcels in the vicinity of the Creek, particularly near the 195th Street N.E./SR 522 ramps are potential soil and water pollution sources and could be contributing to the degradation of the Little Bear Creek environment leading to a loss of fish and wildlife and a potential quality recreation resource. See Figure 3 and the David Evans & Associates, Corridor Habitat Assessment referenced in Appendix A of this Report.

Much of the Little Bear Creek environment is in need of habitat improvement due to land use in the study area. Roads contribute polluting runoff and sediment causing water quality to be poor, stream bank erosion and deposition. Lack of riparian habitat causes negative temperature modification to stream waters resulting in decreased quality of salmonid habitat and less diversity in wildlife habitat.

Conversion of land use, application of design guidelines, improvements to and creation of riparian habitat is needed to restore health and environmental quality to the Little Bear Creek environs and set the stage for the creation of a new environmental, recreational and human activity system that is the Little Bear Creek Linear Park for the City of Woodinville.

SCHEMATIC MASTER PLAN

The Schematic Master Plan (Figure 1) for the Little Bear Creek Linear Park shows the 2.2 mile long Little Bear Creek as it begins at the Sammamish River and meanders through downtown Woodinville under the freeway and up through residential neighborhoods, past the high school, and up to the city limits at N.E. 205th Street.

This Master Plan Report proposes many changes to the existing conditions within its study area. These future proposals are outlined and described below.

Land Use. The City's Comprehensive Plan identifies the study area as having the potential for more intensive uses. As the need for additional office space increases, the demand for office-zoned land in Woodinville and parcels in the Little Bear Creek corridor are considered to be prime candidates for this type of land use development.

Proposed changes to the land use classifications in the study area are located, exclusively, in the general business zone east of SR 522. To enhance the flexibility in commercial use of properties within this zone, the Downtown-Little Bear Creek Corridor Master Plan proposes to retain most currently permitted General Business uses, and add most uses permitted in the Office Zone. Parcel development shall be in harmony with the Little Bear Creek natural environment. See Figure 6.

The intent of proposed Comprehensive Plan changes for these areas is to accommodate uses that have not been adequately provided for by the City such as high-tech companies and other employee or visitor intense uses, making the area an active pedestrian oriented center. In addition to encouraging greater economic vitality these land use changes can lead to new opportunities to realize other comprehensive plan goals, such as restoration activities and public access to Little Bear Creek. Improved development aesthetics may also result from the application of design standards and regulations during development approval. The City's Design Guidelines attempt to ensure that new development or redevelopment will be sensitive to the goals and objectives of the Little Bear Creek Linear Park Master Plan.

Circulation. Once development of the linear park is implemented, the overall circulation system will become an important element, transporting park users within and to the park from activity centers or living environments.

This Master Plan accounts for existing and future transportation considerations related to land use, trails and transit. It is also coordinated with the Downtown-

Little Bear Creek Corridor Master Plan being developed concurrently with this plan. The new transportation recommendations rely on existing infrastructure including projects that are scheduled for funding.

The Master Plan for the Linear Park recommends improvements to the motorized circulation network, to the transit network and to the non-motorized circulation network.

The motorized element recommendations include:

- SR 522 access ramps
- Mill Place intersection enhancements
- 132nd Ave. N.E. at-grade RR Crossing
- Little Bear Creek Parkway right of way and amenities
- Woodinville-Snohomish Road right of way and amenities

Street design concepts are illustrated in Appendix D of this report.

The transit element recommendations include:

- S.L.S.& E. Railroad improvements (structures and amenities)

Rail corridor design concepts are illustrated in Appendix D of this report.

The non-motorized element recommendations include:

- Integration with the downtown and neighborhood trails
- N.E. 195th Street pedestrian/bike route
- 136th Ave. N.E. pedestrian/bike route
- N.E. 190th Street pedestrian/bike route
- N.E. 190th Street extended (Wood-Snoh. Rd. to the Creek, with footbridge)
- N.E. 190th Pl. to Woodin Glen Pond pedestrian/bike route
- 140th Ave. N.E. pedestrian/bike route
- 140th Ave N.E. extended (Wood-Snoh. Rd to the Creek, with footbridge)
- Mill Place pedestrian/bike route
- Mill Place extended (Wood-Snoh. Rd. to the Creek, with footbridge)
- 134th Ave. N.E. pedestrian/bike route (vehicle bridge to remain)
- 132nd Ave. N.E. pedestrian/bike route and footbridge over the Creek
- 131st Ave. N.E. pedestrian/bike route
- A pedestrian/bike SR 522 overpass at the intersection of N.E. 186th Street & 136th Ave. N.E.
- 131st Ave. N.E. pedestrian/bike underpass
- Wood-Snoh. Rd. east side pedestrian/bike route
- Little Bear Creek Parkway west side pedestrian/bike route
- A pedestrian soft trail along the Little Bear Creek 100' buffer on the north and west side of the Creek between the Sammamish River and 190th Street extended

- A hard surface/pervious material trail within the Little Bear Creek 100' buffer on the east and south side of the Creek between 132nd Ave. N.E. and N.E. 190th Street extended

Some trail design concepts are illustrated in Appendix D of this report, and a general discussion of trail location and design parameters is discussed under Recreation below.

Non-motorized trails, located within multi-modal right of way, are proposed to be striped, and tree-lined for safety, security, comfort and aesthetics. Design details for the landscape treatment and features within these routes is beyond the scope of this Master Plan.

Where trails meander into or along creek buffer zones, earth mounds, fencing and/or vegetative plantings are proposed to provide for the privacy, security, safety and visual serenity for adjacent lands, both private and public. Proposals for trail surfaces will provide for the most current environmentally safe products and materials. And, trail locations will be situated so as to take advantage of interesting vegetation, naturally significant features in the Creek and other environmental and sensory features in the landscape.

Environment. The central environmental feature of the Master Plan study area is Little Bear Creek. It has been studied considerably and recommendations for improvements are not lacking. This Master Plan is confirming many of those recommendations by proposing measures for habitat in-stream improvements, riparian habitat improvements and off-site mitigation projects. See Figure 3 for locations and descriptions of habitat improvement recommendations associated with this Master Plan; and see the Little Bear Creek Corridor Habitat Assessment for detailed proposals adopted herein by reference.

Recreation. A survey conducted for the PRO Plan in 1998 revealed the recreation preferences of the citizens of Woodinville. The Little Bear Creek Linear Park was considered a major recreation resource to be conserved in areas of environmental sensitivity, but also developed as a trail system linked to park sites and activity centers.

PRO Plan land and facility demand analysis of the park planning area for Woodinville indicates that there is a deficiency in trail miles, active recreation activities, in resource conservancy land and in resource activities.

PRO Plan recommendations for acquiring additional trail miles are as follows:

Local Park Walking Trails	1.5 miles of soft trail
	5.5 miles of hard trail

Separate Corridor Trails:		
	Walking	6.7 miles of soft trail
		13.2 miles of hard trail
	Bicycle	4.5 miles of soft trail
		5.7 miles of hard trail
On-Road Bicycle Trail		7.5 miles of improved bike lanes

The PRO Plan recommends developing active recreation activities as follows:

3 outdoor volleyball courts
4 outdoor basketball courts
6 tennis courts
128 picnic tables
9 picnic shelters

The PRO Plan recommends the acquisition of 98.8 acres of resource conservancy land. The City has recently acquired through fee simple purchase and donation approximately 65 acres, leaving 35 needed acres to sustain the existing level of service to meet demand.

The PRO Plan also recommends developing an additional 19 acres for resource park activities such as picnicking, camping and open grassy playfields.

The documented needs in the PRO Plan for acquisition and development of additional active and passive recreation lands can be partially achieved by implementing the proposed features within the Schematic Master Plan for Little Bear Creek.

Features. While the original concept of a Little Bear Creek Linear Park was born in the PRO Plan, most of the features proposed for the park were derived by consensus of the Parks and Recreation Commission, Parks department staff and citizen workshops.

The proposed features are delineated on the Schematic Master Plan (Figure 1) and explained below.

Foot Trails. These are walking and hiking trails, and may be hard or soft surfaced, depending on their location. Foot trails that are part of dedicated right of way will be hard surface paths. In separate trail corridors, not on sensitive lands, foot trails may also be hard surface. On sensitive lands, foot trails should be of a soft surface. Sensitive land trails in the study area will be built on the north and west side of Little Bear Creek, meandering along the edge of the 100 foot creek buffer. See Figure 1 for locations of walking and hiking trails.

Bike Trails. Bike trails require hard surfaces for safety and efficiency reasons. On road rights of way, these trails will be hard surfaced. In sensitive areas such as creek buffers synthetic, water-permeable, structural, grid systems may be used. The Master Plan envisions a synthetic surface trail on the east side of Little Bear Creek, meandering along the 100 foot buffer zone linking business uses with other business uses in the corridor and with the recreation and visual resources associated with the Linear Park. The location and design details of this east side trail must consider the existing and future land uses on adjacent parcels to find the right fit. See Figure 1 for locations of bicycle trails.

Railroad. The old S.L.S. & E. Railroad (now Burlington-Northern) is projected to provide a future multipurpose trail with amenities through Woodinville with the possibility of future connections to trails in Snohomish County (See Figure 7). Although commuter rail and a train station appear to be dependent on cooperation with Sound Transit and other agencies, the City should preserve the potential for active rail service that might enhance commuter or tourist potential in the Corridor.

Bridges & Tunnels. A pedestrian and bicycle overpass is proposed over SR 522 at 136th Ave. N.E. and N.E. 186th Street that will connect the Wedge neighborhood with the linear park and downtown. See Figure 8.

A direct connection is needed at 131st Avenue NE to provide uninterrupted creek-side trail passage along Little Bear Creek between reaches one and two. This could be accomplished via an underpass or constructed at-grade as part of proposed roadway improvements to the intersection of SR 202 and SR 522.

Other, less prominent non-motorized bridges (footbridges) are proposed to cross the Creek at 132nd Ave. N.E., at Mill Place extended on or over property lines, at 140th Ave. N.E. extended and at N.E. 190th Street extended. See Figure 1 for locations of these Master Plan features.

Lookouts/Interpretive Sites/Environmental Interest. Throughout the length of the Creek are places of significant vegetation, and in-stream features such as riffles, pools and glides that salmon and other fish may find functional and that provide visual and educational interest to humans. Many of these places are identified in the Schematic Master Plan as the Confluence overlook, interpretive sites, or viewing platforms. These sites will be developed with decks for viewing, interpretive and educational signage, picnic tables if space permits and trail furniture. Some of these locations have been identified on the Schematic Master Plan, Figure 1.

Picnic & Social Areas. Several areas are proposed for development as picnic sites or gathering areas. These are: the proposed confluence park where Little Bear Creek empties into the Sammamish River; north of 131st Ave. N.E. on

State-owned land; at the proposed City-owned park north of 134th Street N.E; and on City-owned land in the Wedge neighborhood, near Woodin Glen Pond.

Active Recreation areas. Active recreation and associated parking is proposed at the 6.5 acre City-owned park site at 134th Ave N.E. On-site investigations will have to be performed prior to design development studies. But, Master Plan inventory data suggests that part of the property is suitable for game courts and structural development. These activities would be combined with passive and resource conservancy activities as shown on Figure 1. The skate park and 17 acre resource conservancy park located north of N.E. 195th Street is also part of the Little Bear Creek Linear Park but, is not mentioned here as a proposed active recreation feature because it is currently under construction.

Woodin Glen Pond/Park is proposed for semi-active recreation features of a small scale. If neighborhood demographics are suitable, this 1-acre site might be developable for some components of a neighborhood park such as a Children's play structure and an open lawn games area. Interpretive facilities such as a boardwalk for birdwatching on the pond should also be considered.

Water Features. There are several natural water features associated with the existing Little Bear Creek. The Master Plan proposes to take advantage of these as areas of human interest where a trail and viewing platform may be developed. But this plan also proposes to create new water features that may be mitigation sites for private developers to purchase for projects requiring wetland mitigation, or as sites for public development as educational resources. The nature of these areas, referred to on the Master Plan map as Ox Bow Ponds, may range from a shallow pothole to a creek diversion. The locations, design decisions and details are beyond the scope of this document.

Quarter Mile Markers. The Schematic Master Plan map indicates locations for markers every ¼ mile along the walking trail on the west side of the Creek from the mouth of Little Bear Creek to the City limits. It is proposed that these be river stone pillar with pre-cast concrete bear-holding-fish sculpture on top.

Trailheads. Trailheads are proposed for points of access to Little Bear Creek from arterials in the study area. Signage will indicate where to go and what the feature(s) are at the destinations. Proposed trailheads are shown on Figure 1.

Gateways. There are several places in the City where upon arrival the perception of the traveling public is one of confusion and disorientation caused by the nature of the road network, heterogeneous land use, signage and a general lack of structural elements in the landscape that serve to unify and harmonize the visual character of the City. The lack of visual acuity at important nodes in the City can be changed to reflect the nature of a place that is safe, comfortable and prosperous. The Master Plan proposes entry treatments at the following locations:

1. Wood-Snoh. Road at the northern City limits on State right of way.
2. SR 522 ramps and N.E. 195th Street on the north side (industrial district).
3. Mill Place and Little Bear Creek Parkway entrance to C.B.D.
4. S.E. corner of SR 202 (131st) and Little Bear Creek Parkway.

A system of arbor/trellis structures is proposed for these locations. Design development of these features is beyond the scope of this Plan and should be coordinated with efforts to promote tourism, "way finding" signs that direct out of town visitors, and the park signage system.

IMPLEMENTATION

The Master Plan for the Little Bear Creek Linear Park has examined the potential for recreational resource development along the Little Bear Creek and within the Linear Park study area. Discussions with Woodinville citizens, public meetings with the Parks and Recreation Commission and the Planning Commission indicate the need and desire of trail and recreational development that integrates Little Bear Creek Linear Park with residential neighborhoods and downtown Woodinville.

The implementation phase of this Report will discuss steps to bring the proposed use concepts contained herein to reality.

Comprehensive Plan – Land Use. There is a diversity of land use designations within the Master Plan study area. Reach number one contains industrial and central business plan classified parcels. Reach number two is classified as general business (auto/general commercial). Reach number three parcels are classified as moderate density residential.

Reach one and reach three are considered to have Comprehensive Plan classifications that are consistent with Linear Park objectives, and are not proposed for change as a result of this Master Plan. The Master Plan recognizes the need to reclassify lands within reach two so that the goals and objectives of the public participation process of this plan are met. That is, to promote environmental quality for fish and wildlife habitat, to promote a viable economic future for land use, provide for a wide range of land use, insure high quality aesthetics and provide for an interpretive trail system and human access to the Creek.

Realizing these goals and recognizing the constraints to fulfilling them will require consideration of a wide range of planning tools. Sensitive area constraints, parcel size and shape will require creative site planning in order for development and redevelopment to be compatible with an aesthetically pleasing linear park and associated uses. This is true for development of the trail system and park sites as well as development of parcel land use.

Compatibility must work both ways. Sensitivity to environmental features, privacy and access are important considerations. Reclassification of lands adjacent to the Creek will attempt to encourage employment, increase the economic base of the City, and promote human access to the trail and the Creek. Encouraging office uses, retaining current uses that are economically viable, and sharing

infrastructure development will be part of the palette of plan implementation features in the Little Bear Creek Linear Park Master Plan.

Developing the trail system will also require creative solutions. Much of the proposed soft trail on the west side of the Creek will be over publicly owned land. Where the City does not own such lands, acquisition may occur in a variety of ways. Where fee simple purchases are not feasible other means of acquisition could include the purchase or granting of easements.

The trail proposed on the east side of the Creek would be over private property. This location would be in sensitive area buffers. Acquisition alternatives would be similar to those discussed for the west side trail. In addition, easements or donation of lands on these private parcels could benefit property owners by reducing property taxes on affected areas. Finally, development bonuses for granting trail easements will be considered as implementation methods. These could include tradeoffs for landscape requirements and parking requirements.

Trail Implementation Schedule
The west side trail and key access points from NE 177th Place would be developed as phase I of the plan implementation. The second stage of trail development on the east side would not occur until such time as the land use and redevelopment warranted the need to connect buildings, and provide non-motorized transportation access through the corridor on the east side. Trail demand would be documented prior to implementation of phase II. This alternative preserves the dual nature of the facilities as originally conceived, but focuses resources on the west side trail at this time. It also avoids conflicts that could occur with current land use, where trail development may not be compatible. The trails and their implementation are distinguished through color code on the Master Plan.

Sensitive Areas. Habitat improvements to Little Bear Creek are a major part of this Master Plan. Much of the work on the identified improvement needs will occur on private lands. The City will find that the tools available to perform this work will be the same as for acquiring trail rights of way. Fee simple purchase of the Creek, easements and development bonuses will be the preferred methods to work to improve habitat.

Funding. Funding for the plan elements is competitively available through a variety of sources. Outside of fee simple and less than fee simple acquisition funding sources include:

- IAC grants: Washington Wildlife & Recreation Program (WWRP); Aquatic Lands Enhancement Account (ALEA);
- Land & Water Conservation Fund (LWCF); and Urban Wildlife Habitat (UWH).
- Inter-modal Surface Transportation Enhancement Act (ISTEA) for using RR right of way for pedestrian and bicycle use and landscape improvements.

- Use Park Impact Fees for property acquisition and/or development.
- Develop a parks general obligation bond.

Capital Program. The capital improvement program will outline the sequence for acquisition, renovation and development; identify specific projects, project phasing, associated costs and dates.

ACTION PLAN

1. Pursue development of City owned parcels for purposes of providing needed recreation benefits and promoting awareness of Little Bear Creek and the Plan.

2. Research opportunities to achieve public and private objectives such as stormwater management in ways that promote Plan objectives.

3. Continue habitat restoration and protections as described in the Little Bear Creek Corridor Habitat Assessment.

4. Create or employ methods of encouraging land donations and granting of easements through tax benefit reduction programs, where appropriate.

5. Seek grants and donations that can supplement City funds for acquisition and development.

6. Work collaboratively with the private landowners to develop design standards that can promote compatible land uses along the Creek.

7. Develop interpretive signage and facilities in conjunction with school officials.

8. Conduct volunteer activities in the area that promote stewardship and awareness and assist in restoration of damaged creek habitat.

9. Use environmentally supportable construction methods and techniques to reduce trail development impacts in the area.

10. Promote pedestrian friendly connectivity to new or existing businesses where employees and businesses would benefit from recreation amenities.

11. Explore buffers, screening, and other methods of access management where connectivity is not yet feasible or is still undesirable.

12. Employ incentives that help to preserve significant trees and other significant natural features.

13. Explore reduction of currently required greenrows in favor of flexibility that would promote Plan objectives.

14. Explore shared or reduced parking concepts and technological improvements to reduce impervious surfaces and impacts to habitat.

15. Encourage additional heights where this would encourage compatible land uses along the Creek.

16. Consider Transfer of Development Rights if such a system would promote compatible development or achieve other Plan goals.

APPENDIX A

LITTLE BEAR CREEK HABITAT ASSESSMENT

(Excerpted Portion due to Report size)

LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT

Woodinville, Washington

Prepared for:

THE CITY OF WOODINVILLE
17301 133rd Avenue NE
Woodinville, Washington 98072-8534

WOOD0000-0010

Prepared by:

DAVID EVANS AND ASSOCIATES, INC.
415 – 118th Avenue SE
Bellevue, Washington 98005-3518

DAVID EVANS AND ASSOCIATES INC.

July 2002

LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT

Woodinville, Washington

Prepared for:

THE CITY OF WOODINVILLE
17301 133rd Avenue NE
Woodinville, Washington 98072-8534

WOOD0000-0010

Prepared by:

DAVID EVANS AND ASSOCIATES, INC.
415 – 118th Avenue SE
Bellevue, Washington 98005-3518

July 2002

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY v

1.0 INTRODUCTION 1

2.0 METHODOLOGY 9

2.1 EXISTING DATA 9
2.2 FISHERIES RELATED DATA 10
2.2.1 In-stream Habitat 10
2.2.2 Fish Abundance and Distribution 10
2.2.3 Riparian Habitat 11
2.2.4 Water Quality and Hydrology 11
2.3 WILDLIFE RELATED DATA 12
2.3.1 Habitat Availability 12
2.3.2 Wildlife Presence 12

3.0 HISTORIC CONDITIONS 13

3.1 PRE EUROPEAN SETTLEMENT 13
3.2 ARRIVAL OF EUROPEAN SETTLERS 14

4.0 EXISTING CONDITIONS 15

4.1 LITTLE BEAR CREEK WATERSHED 15
4.2 CITY OF WOODINVILLE 16
4.3 FISHERIES 16
4.3.1 Chinook Salmon 20
4.3.2 Coho Salmon 21
4.3.3 Sockeye Salmon 23
4.3.4 Chum Salmon 24
4.3.5 Pink Salmon 24
4.3.6 Cutthroat Trout 24
4.3.7 Western Brook Lamprey 25
4.3.8 Coastrange Sculpin 25
4.3.9 Mollusks and Crawfish 25
4.4 STREAM HABITAT 26
4.4.1 Pool/Riffle Habitat 26
4.4.2 Large Woody Debris 29
4.4.3 Sediment and Substrate 31
4.4.4 Off-Channel Habitat/Refugia 33
4.4.5 Channel Condition and Dynamics 33
4.4.6 Riparian Habitat 35
4.4.7 Water Quality 41

4.4.8 Flow/Hydrology 44
4.4.9 Watershed Conditions 51
4.4.10 Habitat Access 52
4.5 WILDLIFE 53
4.5.1 Bird Observations 53
4.5.2 Mammal Observations 55
4.5.3 Reptile and Amphibian Observations 55
4.5.4 Wildlife Habitat 55

5.0 RESTORATION POTENTIAL 57

5.1 WATER QUALITY 58
5.2 HABITAT ACCESS 59
5.3 HABITAT ELEMENTS 59
5.4 CHANNEL CONDITIONS AND DYNAMICS 61
5.5 FLOW/HYDROLOGY 61
5.6 WATERSHED CONDITIONS 61
5.7 WILDLIFE HABITAT 63

6.0 REFERENCES 65

LIST OF FIGURES

Figure 1: Vicinity Map 3
Figure 2: USGS Site Location Map 5
Figure 3: Site Map 7
Figure 4: WDFW - Lower Sammamish River Drainage Map 17
Figure 5a: Fourth Quarter 1999 Hydrograph, Little Bear Creek 45
Figure 5b: 2000 Hydrograph, Little Bear Creek 47
Figure 5c: January through August 2001 Hydrograph, Little Bear Creek 49

LIST OF TABLES

Table S-1: Matrix of Pathway and Indicators Summary viii
Table 1: Stream Habitat Types 10
Table 2: Fish Species Documented in Little Bear Creek 19
Table 3: Additional Fish Species Documented in the Greater Lake Washington Watershed 19
Table 4: Chinook Salmon Summary for Little Bear Creek based on WDFW Salmon Spawning Ground Survey Data 20
Table 5: Survey Summary for Reach 1, 2, and 3 of Little Bear Creek in Woodinville, Washington (WDFW Stream Number 08-0080) 26
Table 6: Pool Frequency Data for Little Bear Creek, Woodinville 27
Table 7: Pool, Riffle, and Glide Habitat Summary for Reach 1, 2, and 3 of Little Bear Creek 29
Table 8: Woody Debris Summary for Reach 1, 2, and 3 of Little Bear Creek 30

Table 9: Substrate Composition Based on Wolman Pebble Counts in Little Bear Creek, Woodinville 32
Table 10: Bank Armoring Along Little Bear Creek in Woodinville 34
Table 11: Land Use Based on 1999 Aerial Photograph Along Little Bear Creek, Woodinville 36
Table 12: Tree Composition Along Little Bear Creek, Woodinville 37
Table 13: Shrub and Vine Composition Along Little Bear Creek, Woodinville 38
Table 14: Herb Composition Along Little Bear Creek, Woodinville 38
Table 15: Ornamental Composition Along Little Bear Creek, Woodinville 40
Table 16: 7-day Average Maximum Stream Temperatures for Little Bear Creek, Woodinville 42
Table 17: Water Quality Data on 9/25/01 for Little Bear Creek, Woodinville 44
Table 18: Bird Observations Along Little Bear Creek, Woodinville 53
Table 19: Mammal Observations Along Little Bear Creek, Woodinville 55
Table 20: Amphibian and Reptile Observations Along Little Bear Creek, Woodinville 55
Table 21: Little Bear Creek Environmental Baseline Condition Summary 57
Table 22: Not Properly Functioning Baseline Conditions Summary 62

LIST OF APPENDICES

Appendix A: Existing Literature Status Update Letter to the City of Woodinville
Appendix B: King County 1991 Protocol
Appendix C: King County 2001 Protocol
Appendix D: Stream Photos: Reach 1, Reach 2, and Reach 3
Appendix E: Plat Map
Appendix F: 1936 Aerial Photos
Appendix G: 1999 Aerial Photos
Appendix H: Hatchery Plant Data for Little Bear Creek
Appendix I: Hatchery Plant Data for Issaquah Creek
Appendix J: WDFW Salmon Spawning Ground Survey Data
Appendix K: Electrofish Data
Appendix L-1: NMFS Matrix (1996)
Appendix L-2: NMFS Matrix as Modified by the Mt. Baker Snoqualmie National Forest
Appendix M: DEA Stream Habitat Survey Data
Appendix N: DEA Large Woody Debris Survey Data
Appendix O: DEA Wolman Pebble Count Data
Appendix P: 2001 Reach 1 Data Logger Stream Temperature Results
Appendix Q: 2001 Reach 3 Data Logger Stream Temperature Results
Appendix R: On-going City of Woodinville Restoration Projects
Appendix S: Potential Wildlife Species List

This page intentionally left blank.

EXECUTIVE SUMMARY

The City of Woodinville is bisected by several creeks, the largest of which is Little Bear Creek. Little Bear Creek is recognized as an important salmon-bearing stream within the Lake Washington – Cedar – Sammamish Basin (Water Resource Inventory Area 8). With the listing of chinook salmon as a threatened species under the Endangered Species Act (ESA), numerous cities, including the City of Woodinville, have undergone stream inventories to document existing habitat conditions in streams within their jurisdiction. The City of Woodinville contracted with David Evans and Associates, Inc. (DEA) to prepare this Little Bear Creek Corridor Habitat Assessment. The project goals were to document existing fish and wildlife habitat conditions and utilization, and identify potential restoration opportunities along Little Bear Creek within the City of Woodinville. This assessment provides a detailed analysis of stream and riparian habitat conditions, fish and wildlife utilization, and includes data that assisted in the determination of limiting factors as they relate to ESA listed salmon.

Because of project specific goals, and a desire to have the results comparable to other on-going stream inventory efforts, DEA utilized the *Inventory Methods for Wadable Streams in King County* (King County, 2001a) as the primary methodology. Both the King County 1991 (Appendix B) and 2001a (Appendix C) protocols are based on the methods defined in the *USDA Forest Service Stream Habitat Classification and Inventory Procedures for Northern California* (McCain et al., 1990) as modified by King County staff. Additional data as outlined in the United States Forest Service (USFS) – *Stream Inventory Handbook for Region 6, Version 2.1* (USFS, 2001) was included.

Existing stream and watershed conditions were quantified by using watershed and habitat parameters as defined by the "Matrix of Pathways and Indicators" developed by the National Marine Fisheries Service (NMFS) (Table S-1). The "Matrix of Pathways and Indicators" summarizes important parameters for six major pathways that are vital for the continued survival of salmon including:

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

These six major pathways are further broken down into a total of 18 "indicators." As an example, the water quality pathway is composed of three indicators: temperature, sediment/turbidity, and chemical contamination/nutrients. Scientifically sound data was collected during this assessment to accurately assign the appropriate "condition" to each indicator as defined by the NMFS. The indicator conditions are classified as either: "properly functioning," "at risk," or "not properly functioning." Criteria for each condition is defined by a range or goal based on the best available scientific data available, but criteria are not absolute, and may be adjusted for unique watersheds (NMFS, 1996). Within this report, definitions and determinations of an indicators status are distinguishable by font. Definitions are italicized and determinations are in bold font. Existing conditions were documented to a level of detail that would allow for future trend analysis. Should

the criteria for the Matrix of Pathways and Indicators change, an appropriate condition for each indicator could be assigned based on the results presented in this report.

This report has also consolidated numerous supporting references such as salmon spawning survey data from the Washington Department of Fish and Wildlife (WDFW), and presents all the raw data for ease of record keeping and as an aid to future researchers. Furthermore, opportunities for restoration have been listed and prioritized based on the findings present within this report.

Little Bear Creek is currently utilized by at least nine species of fish including resident, adfluvial, and anadromous species. Resident fish spend their entire life in a specific stream. Adfluvial fish spawn and sometimes rear in a stream, but migrate to a lake to mature before returning to a stream to spawn. Anadromous fish spawn and rear in freshwater, but reach maturity at sea prior to returning to freshwater to start the process over again. Resident species documented in Little Bear Creek include coast range sculpins (*Cottus aleuticus*), western brook lampreys (*Lampretra richardsoni*), and cutthroat trout (*Oncorhynchus clarki*). Cutthroat trout are somewhat unique in that resident, adfluvial, and anadromous forms may utilize the same stream depending upon watershed conditions, life history type, and access to the ocean. Species that utilize the adfluvial life history include cutthroat trout and kokanee salmon (*O. nerka* [freshwater sockeye]). Anadromous species documented in Little Bear Creek include chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), and sockeye salmon (*O. nerka*). Some species such as pink (*O. gorbuscha*) and chum (*O. keta*) salmon have rarely been observed in Little Bear Creek. However, due to their scarcity, they are not part of an established population, rather, they are strays from another watershed. Undocumented species such as steelhead trout (*O. mykiss*) could potentially utilize Little Bear Creek.

The results of this assessment indicate that Little Bear Creek is very similar to most urbanized Puget Sound lowland streams in that it has been severely impacted by past and current land-use activities. The percentage of total impervious surface has increased to about 37 percent and road density to 5.9 kilometers per square kilometer (km/km^2) (2.28 mi/mi^2) in the past 12 years (Purser and Simmonds, Snohomish County Surface Water Management, unpublished data as reported by Kerwin, 2001). Out of the 18 indicators examined, one was found to be partially **properly functioning** (temperature). Three were found to range from **not properly functioning** to **at risk** (varied by reach), three were **at risk**, while the remaining 11 were **not properly functioning**. The results are summarized below.

Although the existing habitat conditions reflect those frequently associated with an urbanized basin, Little Bear Creek is still an important salmon-bearing stream. Little Bear Creek possess numerous opportunities for enhancement and restoration that could significantly improve conditions for salmonids. The City of Woodinville is currently undertaking several stream restoration projects along the Little Bear Creek Corridor. Appendix R outlines current habitat enhancement projects along the corridor.

Little Bear Creek was segmented into three reaches based on land use and permanent landmarks. Reach 1 is defined as extending from the mouth to the SR 202 culvert crossing. Reach 2 is defined as extending from the SR 202 culvert crossing to the SR 522 culvert crossing. Reach 3 is defined as extending from the SR 522 culvert crossing to the NE 205th Street culvert crossing.

The majority of Reach 1 is developed up to the banks. The banks are armored with riprap and there are signs of localized erosion. This riprap should be removed. It is recommended that the banks be restored and stabilized using bioengineering methods. Improvements to the mouth such as the installation of large woody debris and create scour pools would also improve existing habitat conditions.

The amount of bank armoring (riprap) in Reach 2 is significantly less than in Reach 1. However, there are opportunities for riprap removal, and bank restoration and stabilization using bioengineering methods. There are areas of riparian habitat between Little Bear Creek and SR 522 that are candidates for acquisition. Connectivity between these areas and Little Bear Creek could be improved. In this reach there are culverted outfalls from regional and private storm drainage systems, and tributaries that could be used to create off-channel habitat.

There are similar opportunities in Reach 3, especially in the lowermost section. Riprap removal, bank restoration and stabilization using bioengineering methods, installation of large woody debris, and improved connectivity between remaining riparian habitat would improve existing conditions in Reach 3.

The majority of the Little Bear Creek corridor is privately owned. The City has acquired four parcels along the corridor. The Washington State Department of Transportation owns one parcel, and the SR 522 right-of-way through which segments of Little Bear Creek flow. It is recommended that the City look for opportunities to partner with residents, property owners, business owners, and other agencies on habitat enhancement projects. As redevelopment occurs along this corridor, an evaluation of potential habitat improvement opportunities should be undertaken to determine what could be done to restore and enhance the habitat. Potential improvements are outlined later in this report.

The following properties are outside the Little Bear Creek corridor, but within the watershed, that the City should evaluate for possible acquisition to preserve undeveloped upland forest habitat:

- North of Woodinville High School and west of 136th Avenue NE
- Northeast of 144th Avenue NE and NE 195th Street
- Southwest of North Woodinville Way and NE Woodinville Duvall Road

Purchase of these properties would help to maintain the amount of impervious area within the watershed, provide areas for groundwater recharge, and provide water quality benefits.

Table S-1:
Matrix of Pathway and Indicators Summary

PATHWAY	INDICATORS	BASELINE CONDITIONS
Water Quality	Temperature	Juvenile Migration and Rearing = Not Properly Functioning to At Risk Adult Migration and Spawning = Properly Functioning
	Sediment	Not Properly Functioning
	Chemical Contamination & Nutrients	Not Properly Functioning
Habitat Access	Physical Barriers	At Risk
Habitat Elements	Substrate	At Risk
	Large Woody Debris	Not Properly Functioning
	Pool Frequency	Not Properly Functioning
	Pool Quality/Depth	At Risk (not properly functioning in Reach 1)
	Off-Channel Habitat	Not Properly Functioning
	Refugia	Not Properly Functioning
Channel Conditions and Dynamics	Width/Depth Ratio	Reach 1: Not Properly Functioning Reach 2 and 3: At Risk
	Streambank Condition	Not Properly Functioning
	Floodplain Connectivity	Not Properly Functioning
Flow/Hydrology	Change in Peak/Base Flows	At Risk
	Increase in Drainage Network	Not Properly Functioning
Watershed Conditions	Road Density and Location	Not Properly Functioning
	Disturbance History	Not Properly Functioning
	Riparian Reserve/Conservation Areas	Not Properly Functioning (at risk in Reach 3)

Based on the results of this assessment, several additional actions have been outlined that could potentially improve existing habitat conditions in Little Bear Creek. These recommended actions include:

1. Obtain, preserve, and enhance land along Little Bear Creek to minimize further habitat degradation from continued development along the Little Bear Creek corridor. Undeveloped properties along the corridor with quality riparian habitat should be high priority acquisitions, such as, the properties to the north of the City's "Lumpkin" property (east of 134th Avenue NE crossing). Another area to consider would be the properties to the west of 134th Avenue NE as described in item 7.
2. Immediately initiate a program to reestablish conifers within the riparian zone throughout the Little Bear Creek corridor.
3. Restore hardened rip/rap banks along Little Bear Creek. Include creation of pool, and addition of large woody debris as part of the restoration plan.
4. Retrofit potential pollution-generating sites such as large parking lots and roadways with pollution prevention and storm flow retention facilities where such facilities are presently absent.
5. Reforest upland areas dominated by introduced species such as reed canarygrass and Himalayan blackberry.

6. Create off-channel habitat at each culverted tributary confluence with Little Bear Creek. This can be accomplished by daylighting the maximum extent of culverted tributary possible at each confluence.
7. The City of Woodinville should investigate the feasibility of purchasing the wrecking yard on 134th Avenue NE along the west side of Little Bear Creek. If this lot could be purchased several stream enhancement opportunities could occur. The first goals would be to remove soil contaminants within the lot and remove all structures. The second goal would be to use this crossing for enhancement efforts between Little Bear Creek and Highway 522 within Reach 2. Once these actions were completed the 134th Avenue NE crossing could be permanently removed, or replaced with a bridge.
8. The newly purchased city property immediately upstream of NE 195th Street is an ideal site for intensive in-stream, riparian, and upland habitat restoration activities. Actions that would benefit Little Bear Creek at this site include removal of bank armoring, creation of pool habitat, removal of impervious surface (pavement) and non-native vegetation, and installation of large woody debris, and riparian and upland vegetation.
9. Maintain regular street sweeping, storm drainage system cleaning, and add sediment traps where feasible. This will reduce the amount of sediment entering Little Bear Creek.

This page intentionally left blank.

1.0 INTRODUCTION

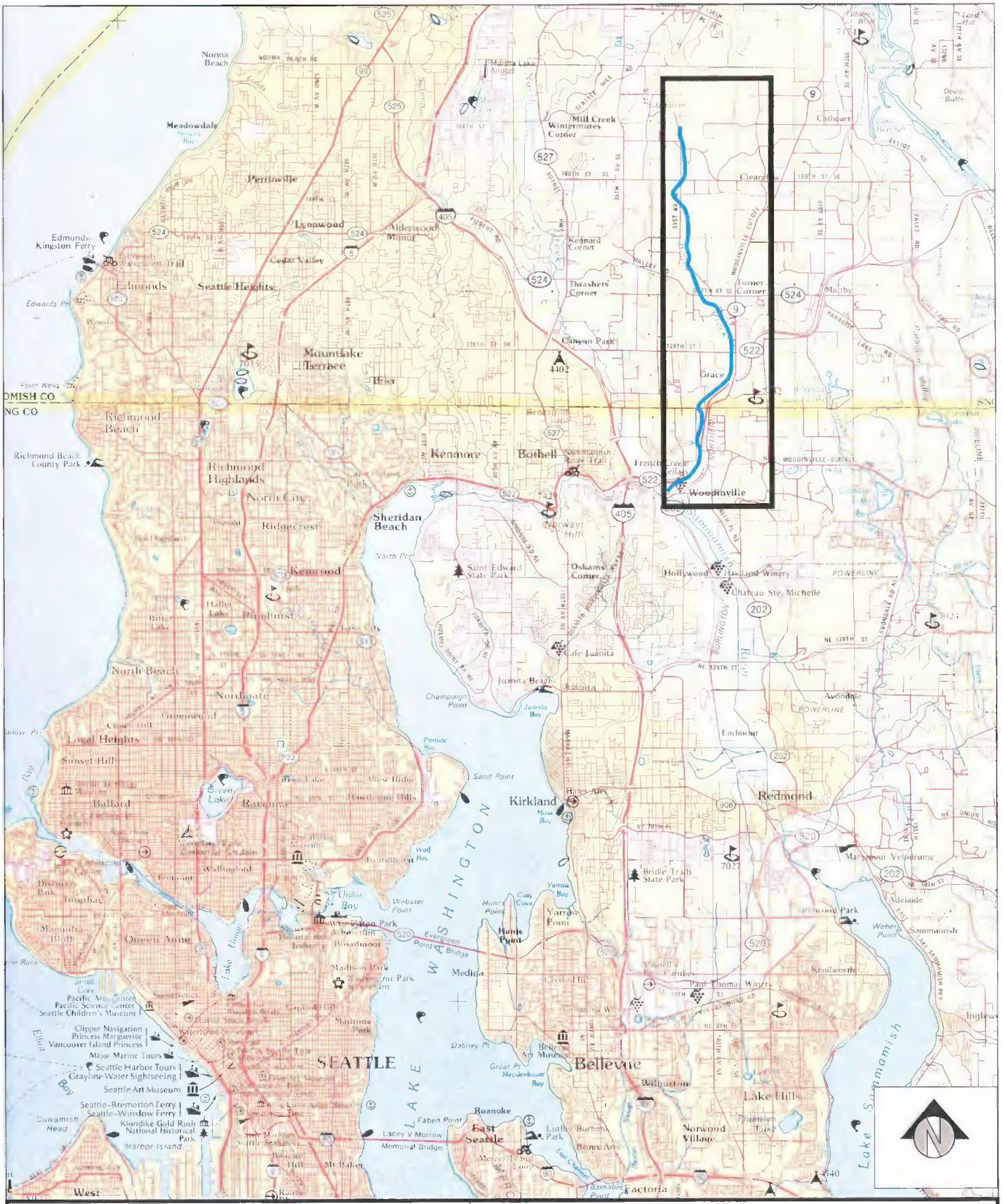
At the request of the City of Woodinville, David Evans and Associates, Inc. (DEA) conducted a Corridor Habitat Assessment along Little Bear Creek in King County during 2001. This assessment was carried out by accomplishing several tasks including: existing data collection and review, habitat and presence surveys for fish and wildlife, and documentation of findings.

The project goals were to document existing fish and wildlife habitat conditions and utilization, and identify potential restoration opportunities along Little Bear Creek within the City of Woodinville (Figures 1 and 2). DEA initially focused on collecting existing data for review and determination of data gaps. Once all readily available information was obtained and reviewed, the specific parameters and methods to be documented by DEA biologists were finalized. Fieldwork began during the spring of 2001 and continued through October 2001.

DEA biologists surveyed the entire stretch of Little Bear Creek that occurs within the City of Woodinville from June 25, through August 1, 2001. A total of 3,484.1 meters (2.2 miles) of stream was surveyed from the mouth of Little Bear Creek at the Sammamish River to the crossing under NE 205th Street along the City of Woodinville and Snohomish County line. Little Bear Creek was segmented into three reaches based on current land use and location of permanent landmarks (Figures 2 and 3). Reach 1 began at the mouth of Little Bear Creek and extended to the downstream end of the culverts under State Route (SR) 202. Reach 1 is composed of primarily industrial and commercial development. Reach 2 began at the downstream side of the culverts under SR 202 and extended to the upstream side of the culverts under Highway 522. Reach 2 is composed of primarily commercial development and public park/open space. Reach 3 began at the upstream side of Highway 522 and ended at NE 205th Street, which follows the City of Woodinville and Snohomish County line. Reach 3 is composed primarily of residential development.

Because Endangered Species Act (ESA) considerations are an important facet of current stream-related surveys, DEA also focused on collecting data that would assist in the determination of limiting factors as they relate to ESA listed salmonids. This included data required to address the Matrix of Pathways and Indicators developed by the National Marine Fisheries Service (NMFS). DEA utilized two versions of the Matrix. The original version was developed by the NMFS in 1996 and encompasses the entire Pacific Northwest (Appendix L-1). The Mt. Baker – Snoqualmie National Forest modified several of the indicators as originally outlined by the NMFS (Appendix L-2). In each case where the modified NMFS version is used it is cited as "NMFS as modified by the Mt. Baker – Snoqualmie National Forest." If the original NMFS version is used it is cited as "NMFS, 1996." A definition of *properly functioning*, *at risk*, and *not properly functioning* is provided for each condition, and a copy of the modified version is provided as an appendix.

This page intentionally left blank.



Vicinity Map

City of Woodinville - Little Bear Creek

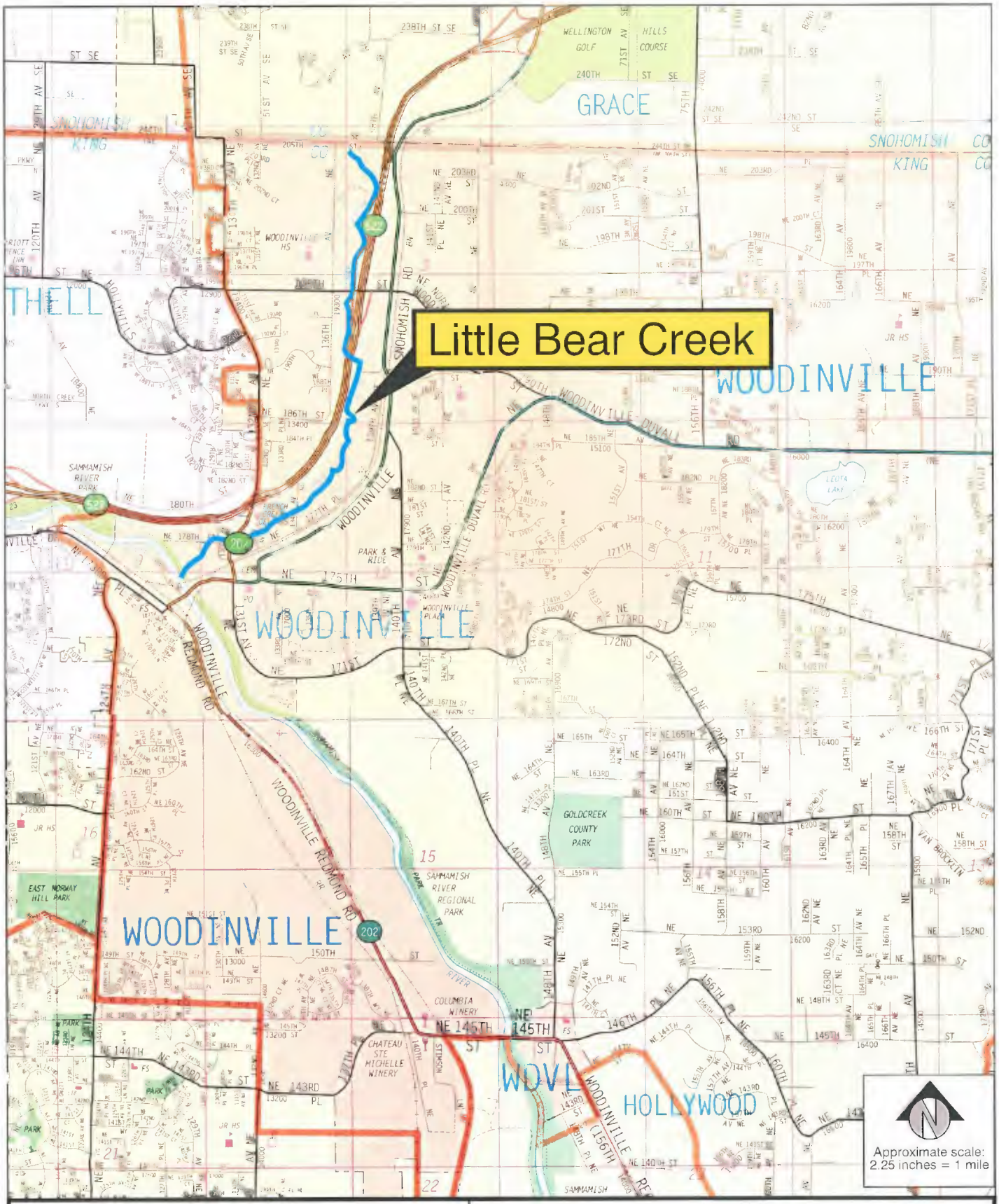
WOOD0000-0010

September 2001

FIG. 1

DAVID EVANS AND ASSOCIATES INC

Gx0317



Site Map

City of Woodinville - Little Bear Creek

WOOD0000-0010

September 2001

FIG. 2

DAVID EVANS AND ASSOCIATES INC

Gx0317

SOURCE

Aerial photo provided by City of Woodinville, representing 1999 conditions.

Site Map
Little Bear Creek Corridor Habitat Assessment

City of Woodinville - Little Bear Creek

WOOD0000-0010

May 2002

FIG. 3

DAVID EVANS AND ASSOCIATES INC

Gx0471

2.0 METHODOLOGY

A Little Bear Creek Corridor Habitat Assessment was conducted between June 25, 2001, and September 1, 2001, to evaluate existing habitat conditions of Little Bear Creek within the City of Woodinville, King County, Washington. The methodology utilized was an enhanced combination of several protocols that results in collecting data for 16 general tasks. DEA used aspects of two King County protocols (1991 and 2001a), and the U.S. Forest Service (USFS) protocol (USFS, 2001). The combining of aspects from all three methodologies results in a comprehensive habitat analysis that is compatible and comparable with other data collected using any of these methodologies. The stream survey included the following tasks:

1. Measure temperature, dissolved oxygen, conductivity, turbidity, and pH at the beginning and end of each project stream utilizing a Horiba U-10 water quality meter.
2. Measure stream flow with a Swoffer flow meter.
3. Measure stream gradient in each reach.
4. Document condition, type, and size of every culvert encountered within each stream to include sediment accumulation, fish passage, and photo documentation.
5. Categorize each habitat type into one of the 22 channel geomorphic types as outlined by McCain et al., 1990.
6. Measure the length, average depth, and average width of each habitat type.
7. Measure the length, tailout depth, maximum depth, average depth, and width of each pool encountered.
8. Measure bankfull width at several representative riffles within each reach.
9. Document the length, diameter, species, decay class, and zone of influence for each piece of woody debris longer than 2 meters (6.6 feet) and wider than 10 centimeters (3.9 inches) encountered within the stream channel.
10. Conduct a Wolman Pebble count in at least two representative riffles per reach. Increase the number of measures as reach length and complexity increase.
11. Document substrate composition visually throughout the stream.
12. Document riparian species composition and age.
13. Document the species and location of any fish or wildlife observed during the survey.
14. Document the location of all side channels or tributaries encountered.
15. Document the degree of bank armoring and severe erosion along each stream reach.
16. Photo document representative stream reaches and features of note encountered during the survey.

2.1 EXISTING DATA

A listing of initial existing data collected on fish and wildlife habitat, species presence and abundance, water quality and hydrology, and land use along Little Bear Creek was previously presented to the City of Woodinville (Appendix A). Additional literature collected after the initial review of existing data is cited within the text and reference section as appropriate.

2.2 FISHERIES RELATED DATA

2.2.1 In-stream Habitat

DEA utilized the *Inventory Methods for Wadable Streams in King County* (King County, 2001a) as the primary methodology. Both the King County 1991 (Appendix B) and 2001a (Appendix C) protocols are based on the methods defined in the *USDA Forest Service Stream Habitat Classification and Inventory Procedures for Northern California* (McCain et al., 1990) as modified by King County staff. Habitat units are defined as one of 22 habitat types listed in Table 1 below. Additional data as outlined in the USFS – *Stream Inventory Handbook for Region 6, Version 2.1* (USFS, 2001) was included.

Table 1:
Stream Habitat Types

1.	Low gradient riffle	12.	Lateral scour pool - bedrock formed
2.	High gradient riffle	13.	Dammed pool
3.	Cascade	14.	Glide
4.	Secondary channel pool	15.	Run
5.	Backwater pool - boulder formed	16.	Step run
6.	Backwater pool – rootwad formed	17.	Mid-channel pool
7.	Backwater pool – log formed	18.	Edgewater
8.	Trench/chute	19.	Channel confluence pool
9.	Plunge pool	20.	Lateral scour pool - boulder formed
10.	Lateral scour pool - log formed	21.	Pocket water
11.	Lateral scour pool - rootwad formed	22.	Corner pool

Source: McCain et al., 1990.

King County surveyed most of the entire length of Little Bear Creek in 1999 (King County, 2001b). Because of variations in project goals and methodologies only select results from their previous survey were incorporated into this report. Specifically, DEA used their bankfull width to depth ratio, scour, and bank stability data.

A hip-chain was used to measure habitat lengths and create station numbers. The hip-chain was zeroed at the lowermost starting point at each stream reach and utilized to document the location of each feature or action taken along the stream reach. Each habitat unit was defined as occupying only the area actually wetted at the time of the survey. Habitat width was measured with a 22.9-meter (75-foot) tape, habitat length with a hip chain, and habitat depth with a 1.2-meter (4-foot) stick graduated in centimeters. DEA biologists used the U.S. Geological Survey (USGS) standard of defining "left bank" (LB) and "right bank" (RB) as when facing downstream.

2.2.2 Fish Abundance and Distribution

Data collected by the Washington State Department of Fish and Wildlife (WDFW) and King County was used to document the presence, abundance, and distribution of salmonids in Little Bear Creek (WDFW, 2001a). Additional data was collected through field investigations.

DEA biologists electrofished four locations along the mainstem of Little Bear Creek on August 24 and 31, 2001, prior to the arrival of returning adult salmon. Sites electrofished included

immediately upstream of the mouth, upstream of SR 202, downstream and upstream of 134th Avenue NE, upstream of NE 195th Street, downstream of NE 205th Street (Figure 2), and several sites in one unnamed tributary (Figure 3 – Unnamed Tributary D). DEA utilized a Smith-Root Model 12 electrofisher with a frequency setting of 60 Hz and output voltage of 500 volts. All fish captured were first placed in a bucket of water containing a "pinch" of Tricaine Methanesulfonate prior to species identification and measurement of total length. Tricaine Methanesulfonate relaxes the fish for ease of handling, and reduces injuries and oxygen consumption. After handling, all fish were placed in a second bucket with fresh water to recuperate prior to release.

All fish observed during the habitat survey from June 25, 2001, to September 1, 2001, were identified to the species level when possible. Additional surveys directed at encountering returning/spawning adult salmonids were conducted between September 20, and October 18, 2001. The number and location of redds, and whether spawning behavior was occurring was also noted. Accessible points such as trail and road crossings were surveyed. DEA biologists also surveyed extended sections of various reaches to document the upper extent of spawning and potential presence of barriers.

2.2.3 Riparian Habitat

DEA biologists used aerial photo interpretation and ground truthing to document riparian scale and composition. The width of potential riparian habitat analyzed incorporated 61 meters (200 feet) from the stream edge along each side of the stream for a total corridor width of 122 meters (400 feet). The amount of riparian habitat and impervious surface within the 122-meter (400-foot) corridor was then calculated. DEA used aerial photographs from 1999 that were expanded to a scale of 2.54-centimeter (1-inch) equaling 31.40 meters (103 feet). The amount of forest, shrub/grass, gravel, and impervious area within 60.96 meters (200 feet) of each side of the stream was then calculated with a PLANIX 7 – Tamaya digital planimeter. The species composition, age, and structure were then listed and documented by ground truthing. The stream side vegetation was also classified as coniferous, deciduous, or mixed. Plant species were identified according to Cooke (1997), Pojar and MacKinnon (1994), and Hitchcock and Cronquist (1973).

2.2.4 Water Quality and Hydrology

2.2.4.1 Water Quality

Existing water quality data for Little Bear Creek was obtained from both King and Snohomish counties. Published water quality data for Little Bear Creek as it flows through the City of Woodinville is available in *Water Quality of Small Streams – Western King County 1990 – 1993* (King County, 1994).

Published water quality data for Little Bear Creek in Snohomish County is available in *The State of the Waters: Water Quality in Snohomish County's Rivers, Streams, and Lakes – 2000 Assessment* (Snohomish County, 2000). Additional water quality data for Little Bear Creek in Snohomish County was obtained by contacting the Snohomish County Public Works – Surface Water Management (Thornburgh, personal communication, 2001).

Additional water quality data was collected by DEA. A Horiba U-10 water quality meter was used on several occasions to document temperature, pH, conductivity, dissolved oxygen, and turbidity.

Furthermore, two temperature monitors were deployed in Little Bear Creek between June 15, and October 18, 2001, to document stream temperature on an hourly basis. DEA utilized two 32K waterproof Stowaway Tidbit monitors set to collect hourly readings. One was installed in Little Bear Creek near its confluence with the Sammamish River, and the other was installed near the King and Snohomish county line immediately downstream of NE 205th Street.

2.2.4.2 Hydrology

Hydrology data for Little Bear Creek was obtained from King County (2001c). Hydrology data is collected in King County at the SR 202 crossing of Little Bear Creek in the City of Woodinville (Station #30). DEA biologists also used a Swoffer Model 2100 flow meter on two occasions to document site specific conditions. The first measurement was made on June 25, 2001, at the beginning of the in-stream habitat survey near the confluence of Little Bear Creek and the Sammamish River. The second event occurred on August 29, 2001, to document variation of flow at Little Bear Creek as it enters Woodinville at NE 205th Street, and near its confluence with the Sammamish River.

2.3 WILDLIFE RELATED DATA

2.3.1 Habitat Availability

DEA biologists mapped plant communities by interpreting aerial photographs and ground-truthing. DEA translated plant communities into habitat types. Biologists established 17 circular plots with a 10-meter (32.8-foot) radius in representative locations between the creek and the nearest development in all habitat types. DEA identified dominant, common, and infrequent plant species; estimated tree diameter at breast height (DBH); counted snags, stumps, and logs; observed trees for raptor nests; and assessed overall condition of each habitat area.

2.3.2 Wildlife Presence

2.3.2.1 Birds

DEA biologists surveyed birds on May 18, May 31, and June 18, 2001, using the variable circular-plot method (Reynolds et al., 1980). Surveys began at sunrise and ended by 9:15 AM (Robbins, 1981). DEA established 20-meter (65.6-foot) radius plots in all habitat types and surveyed for 10 minutes in each plot, recording species observed visually and aurally both in and outside of the plots. Biologists surveyed 16 plots on May 18, and 13 plots on subsequent survey days.

2.3.2.2 Bats and Owls

DEA biologists surveyed for owls at seven stations on June 19, and July 7, 2001, by soliciting birds with amplified taped recordings and listening for a response with the unaided ear. At each of 7 stations, located in each habitat type in the study area, biologists broadcast calls for approximately 1 minute and listened for a period of approximately 3 minutes. DEA repeated this procedure 3 times at each station. Although there was no standard distance between stations, we chose stations that were far enough apart to avoid double counting while still covering the entire study area. Biologists scanned each station and the surrounding areas with a 20 to 160 kHz bat detector at 1- to 2-minute intervals for approximately 10 minutes and recorded all frequencies of all detections.

2.3.2.3 Mammals

DEA biologists recorded all mammal species observed during all visits to the study area. Biologists searched for, examined, and recorded all mammal sign, including tracks, scats (wildlife excrement), and runways (animal trails). In addition to the site visits conducted for the wildlife and habitat analyses, DEA biologists also documented mammal observations while conducting the stream survey.

2.3.2.4 Reptiles and Amphibians

DEA biologists conducted reptile and amphibian surveys on May 31, and conducted searches during stream surveys. Biologists overturned logs and debris and searched at the bases of plants and along Little Bear Creek. DEA biologists identified and recorded all individuals observed. All captured specimens were returned to the point of capture unharmed and all overturned logs and debris were placed back in their original location.

3.0 HISTORIC CONDITIONS

To better understand existing conditions and possible future trends, historic conditions must be considered. The focus of this report is on fish, wildlife, habitat, and restoration potential along the Little Bear Creek corridor through the City of Woodinville. Although very little site-specific information on the historic conditions of Little Bear Creek as they relate to fish and wildlife is known, some data is available. The "historic conditions" defined as that time from the retreat of the Vashon Glacier approximately 14,000 years ago to the present can be segmented into pre European settlement and post European settlement time periods. The transition between pre and post European settlement time period near Woodinville occurred during the early 1870s. A brief overview is provided below.

3.1 PRE EUROPEAN SETTLEMENT

For the purposes of this report the pre European time period began approximately 14,000 years ago with the retreat of the glaciers and lasted until the arrival of the European settlers in 1870. The Sammamish River Valley was historically dominated primarily by giant western red cedar trees (*Thuja plicata*). Other conifers such as Douglas fir (*Pseudotsuga menziesii*) and Sitka spruce (*Picea sitchensis*) were also present. Several stumps of these remnant trees were observed along the banks of Little Bear Creek during the 2001 survey conducted by DEA. They often had burn marks and "spring board" notches where planks were used by loggers to reach the desired cut location above the tree buttress. Furthermore, old cedar tree stump fragments were also encountered during the in-stream habitat survey and classified as woody debris when they met or exceeded the length and width parameters.

Lake Washington was larger and deeper than at present, and the Sammamish River was longer, and contained numerous meanders and oxbows. The Sammamish River was about 30 miles long, heavily forested to its banks, and very difficult to navigate due to the abundance of fallen trees (King County, 2001d). Besides being lined with large trees, "swamp land" abutted both banks especially near its mouth. The Sammamish River was previously known as Squak Slough, and while the local Indians

were also known as the Squaks, they were really part of the Simump tribe (Stickney and McDonald, 1977). The native Americans lived primarily near Lake Sammamish, but traveled and camped along the Sammamish River. The Sammamish River corridor was also likely utilized by several other tribes as an east-west route.

3.2 ARRIVAL OF EUROPEAN SETTLERS

One of the first Europeans known to have traveled up the Sammamish River was Sam Hancock, who in 1850 explored for coal in the region (Stickney and McDonald, 1977). The earliest land claims in the Woodinville area were by George Wilson and Columbus Greenleaf in 1870 (King County, 2001d). In 1871 the Woodins became the first settlers after rowing across Lake Washington with all their goods and building a log cabin along the bank of the Sammamish River. They passed a couple other homesteads on their journey up the Sammamish River. Other families slowly moved into the area to log the local forests and establish homesteads. By 1897 four families owned most of the land along Little Bear Creek in Township 26 North, Range 5 East (Appendix E). Each of these landholders owned approximately one-quarter section along Little Bear Creek in what today is known as the City of Woodinville. The City of Woodinville was given its name in honor of the first pioneers, Ira and Susan Woodin sometime around 1887. The railway network grew rapidly in the area from 1877 through 1888 and was used extensively for both timber and coal transport. The railroad reached Woodinville in 1877 and Issaquah in 1888. By the 1890s several stores, hotels, saw mills, meat markets, and other enterprises became established.

Logging the old-growth forest was the primary occupation during this period. The local rivers played an important role in the transport of timber prior to the arrival of railroad. However, as the land was cleared and large first-growth trees became more distant, farming became more prevalent. The Sammamish River valley had been mostly cleared of giant western red cedar trees by the early 1920s. What was referred to as "stump farms" dotted the landscape during this time, but were gradually being cleared. Because heavy equipment was scarce and consisted primarily of horse drawn devices, the most common method of stump removal was by dynamiting and then burning the stump. As the stumps were removed, farming the rich river valley became the primary occupation in the area and the local population grew.

Other events related to logging and navigation that would result in changes to Little Bear Creek were occurring closer to Seattle during this same time period. In the 1880s a small channel and lock was built at Montlake to carry logs to mills. Lake Washington originally drained into the Black River that flowed into the Duwamish River prior to reaching Elliott Bay. In 1912 the Cedar River was diverted from the Black River into Lake Washington. This resulted in the replacement of the Black River as Lake Washington's outlet with the Cedar River as a new inlet. The Hiram M. Chittenden Locks and a fish ladder were completed by 1916 resulting in Lake Washington being lowered 2.7 meters (9 feet). In the early 1920's the historically slow and meandering Sammamish River was straightened, narrowed, and later dredged. By the 1930s stocks of chum and pink salmon had been extirpated, but three new stocks including Baker River sockeye, Green River coho and chinook salmon had been introduced (Goetz, proceedings from Conference, 2000).

Little is known about the composition and distribution of fish and wildlife during the early days of Little Bear Creek. Early accounts say the land was occupied by deer, cougar, bear, and migratory

waterfowl (Stickney and McDonald, 1977). Additional stories mention settlers being confined to their cabins during bad weather and hearing the howling of wolves, and others mention trapping bear, otter, raccoon, muskrat, and mink. Waterfowl were apparently abundant in the adjacent marshes since hunters would travel from Seattle to hunt the area, and Indians used the area extensively to hunt ducks. Duck clubs were present along the river that catered to wealthy Seattle residents. They hunted mallards, teal, and widgeon using decoys and feed to attract them within the marshy areas. Many of the adjacent marshes were drained as a result of the lowering of Lake Washington.

Settlers make no mention of salmon in the early accounts. Although it was noted that the local Indians hunted ducks along the marshy land adjacent to the Sammamish River, no reference to salmon is made. According to one resident, fishing in the Sammamish River during the early 1920s was not very good (Repman, personal communication, 2001). Mr. Repman recalled catching bullheads, chub, and an occasional chum salmon as a youth. It is likely that native populations of anadromous salmonids had drastically declined by this time. However, populations of resident kokanee (land-locked sockeye) were very abundant in the Lake Washington System during this time period (King County, 2000a). Mr. Repman was also an avid hunter who targeted grouse, quail, and pheasant (introduced). Between 1925 and 1970 he did not see any bear, cougar, or deer. According to Mr. Repman, deer showed-up later, after the surrounding uplands had been logged, and were more prevalent after the 1970s.

Based on a review of the first aerial photographs of Little Bear Creek during 1936 (Appendix F), riparian vegetation had been cleared from much of the stream by this time. The lower most reach downstream of what would become SR 202 was totally devoid of riparian vegetation by this time. Further upstream, thin segments of riparian vegetation lined some sections of the stream. The stream banks became more forested upstream of what would become NE 195th Street during 1936.

The local population around Woodinville began to expand rapidly after World War II. The City of Woodinville had been agricultural and very rural until a large influx of people began arriving from the 1950s through the 1970s. The creation of Interstate 405 in the 1960s and Highway 522 allowed for the exponential expansion of the area as developers began building and selling entire neighborhoods. By the 1980s, rural Woodinville had completely changed into its current suburban landscape. Woodinville was part of unincorporated King County until 1993.

4.0 EXISTING CONDITIONS

4.1 LITTLE BEAR CREEK WATERSHED

Little Bear Creek is a 12.4-kilometer (7.7-mile) long second order stream that drains a 3,885-hectare (9,600-acre) watershed in both Snohomish and King counties, Washington. Approximately 3,108 hectares (7,680 acres) (80 percent) of the upper watershed are located in Snohomish County while 777 hectares (1,920 acres) (20 percent) are in King County. While in King County, Little Bear Creek flows through the City of Woodinville for approximately 3.5 kilometers (2.2 miles) from NE 205th Street to its mouth on the Sammamish River at River Mile (RM) 5.4 (Figure 4). The headwaters of Little Bear

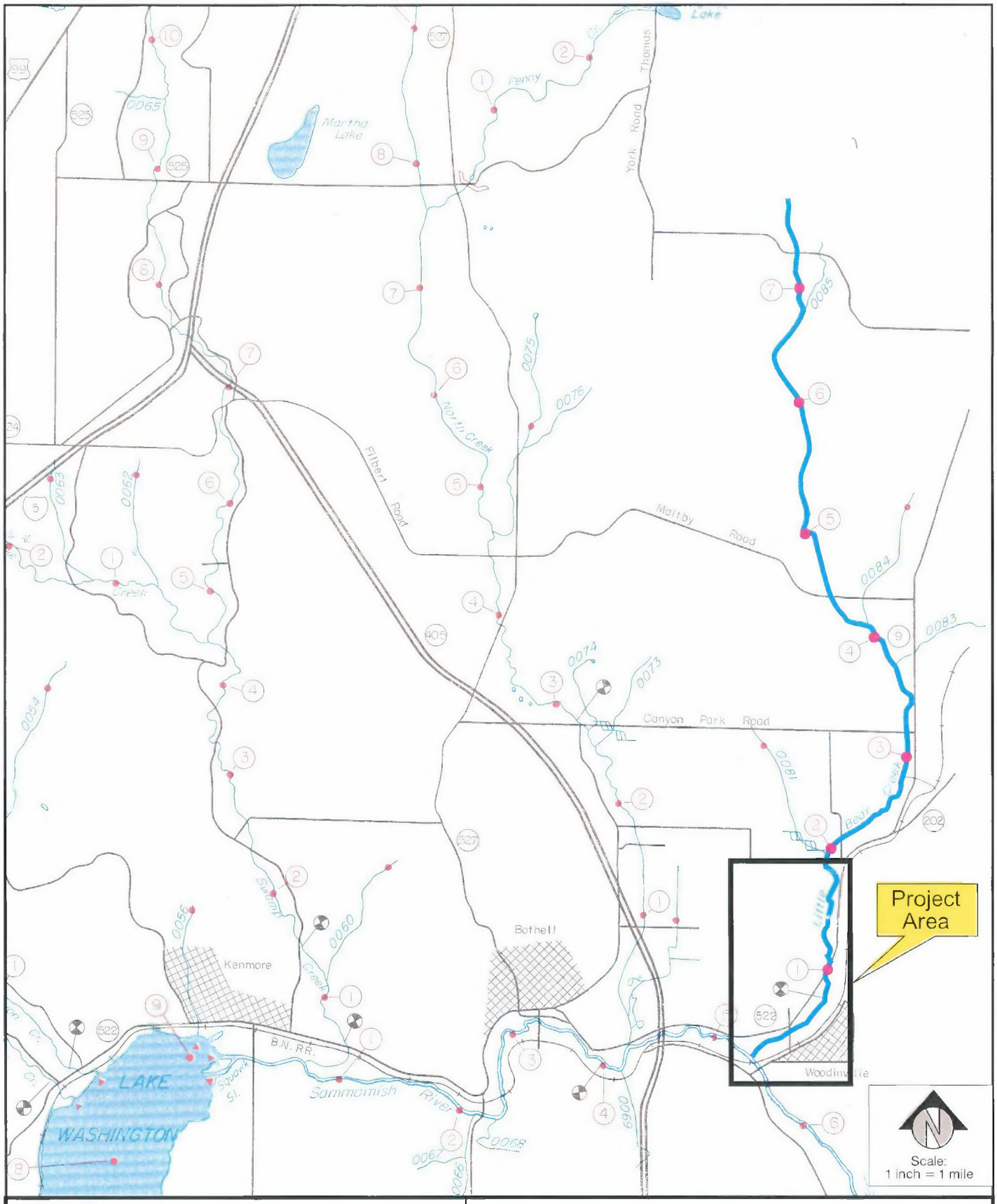
Creek are located in a peat bog 2.4 kilometers (1.5 miles) west of Clearview in Snohomish County. The elevation along Little Bear Creek varies from 76 meters (250 feet) near its headwaters to 6 meters (20 feet) at its confluence with the Sammamish River. Based on these elevations, the overall gradient of Little Bear Creek is about 0.6 percent. Other reports state the overall gradient is about 0.8 percent based on an elevation of 94.50 meters (310 feet) near Clearview (Kerwin, 2001).

4.2 CITY OF WOODINVILLE

The City of Woodinville currently covers 1,461 hectares (3,610 acres) and has a population of 9,294 people. The population is expected to reach 13,400 people by the year 2010 based on 1990 census data. Land use within the city is composed of residential (59.0 percent), commercial (9.2 percent), industrial (13.4 percent), park/open space (1.2 percent), public right-of-way (11.8 percent) and other (5.4 percent) designations.

4.3 FISHERIES

Little Bear Creek has been utilized by at least nine resident and anadromous species of fish. This includes anadromous, adfluvial, and resident salmonids, and sculpins and lampreys. Table 2 below lists the common name, scientific name, and documentation source for each species known to have utilized Little Bear Creek. Some species such as chum and pink salmon have been documented only once. Chinook salmon occur seasonally in low numbers, while other species such as sockeye and coho salmon, and cutthroat trout can be very abundant. Undocumented species could also occasionally utilize Little Bear Creek as well. An example of undocumented species that could be present includes steelhead trout (*Oncorhynchus mykiss*) and other species of sculpin (*Cottus* spp.). Native char (bull trout/Dolly varden) were not considered in this report due to a lack of documentation and absence of suitable habitat. Native char have never been documented in Little Bear Creek, and although it is theoretically possible that if they were to enter the Sammamish River they could investigate Little Bear Creek, the downstream limit of successful char spawning is always upstream of the winter snow line (WDFW, 1999). Because the headwaters of Little Bear Creek originate at an elevation of about 94.50 meters (310 feet), suitable char spawning habitat is not present in Little Bear Creek due to elevated stream temperatures throughout the basin. If bull trout were to ever be present in Little Bear Creek, it would likely be foraging adults or sub-adults, or possibly wayward adults searching for suitable spawning habitat.



SOURCE

Williams et al. 1975

WDFW - Lower Sammamish River Drainage

City of Woodinville - Little Bear Creek

WOOD0000-0010

November 2001

FIG. 4

DAVID EVANS AND ASSOCIATES INC.

Gx0317

Table 2:
Fish Species Documented in Little Bear Creek

#	Common Name	Scientific Name	Source
1.	Coast Range Sculpin	*Cottus aleuticus*	DEA
2.	Western Brook Lamprey	*Lampretra richardsoni*	DEA
3.	Cutthroat Trout	*Oncorhynchus clarki*	DEA
4.	Pink Salmon	*Oncorhynchus gorbuscha*	WDFW
5.	Chum Salmon	*Oncorhynchus keta*	WDFW
6.	Coho Salmon	*Oncorhynchus kisutch*	WDFW, King County, & DEA.
7.	Sockeye Salmon	*Oncorhynchus nerka*	WDFW & King County, & DEA
8.	Kokanee	*Oncorhynchus nerka*	WDFW & King County, & DEA
9.	Chinook Salmon	*Oncorhynchus tshawytscha*	WDFW, NMFS, & King County.

At least 40 different non-native species of fish have been introduced into the Lake Washington watershed since the arrival of the first European settlers. However, many of these introduced species did not survive and today approximately 24 species remain (Kerwin, 2001). A listing of 21 species of native and non-native fish that have been documented within the greater Lake Washington watershed are included in Table 3 below. Introduced species have become prevalent in both Lake Washington and Lake Sammamish, and continue to adversely impact native salmonids. Although the list presented in Table 3 below is not all-inclusive, it provides evidence of the shear abundance of non-native species of fish that still inhabit the Lake Washington watershed. Some of these species listed in Table 3 likely utilize the Sammamish River and therefore potentially the lowermost reach of Little Bear Creek. The likelihood of any of these additional undocumented species being present in Little Bear Creek varies by species.

Table 3:
Additional Fish Species Documented in the Greater Lake Washington Watershed

#	Common Name	Scientific Name	Native or Introduced	Resident or Anadromous	Status
1.	White sturgeon	*Acipenser transmontanus*	Locks created access	Anadromous	Rare visitor
2.	Largescale sucker	*Catostomus macrocheilus*	Native	Resident	Unknown
3.	Lake whitefish	*Coregonus clupeaformis*	Introduced in 1899	Resident	No longer present
4.	Prickly sculpin	*Cottus asper*	Native	Resident	Abundant
5.	Shorthead sculpin	*Cottus confusus*	Native	Resident	Abundant
6.	Carp	*Cyprinus carpio*	Introduced	Resident	Locally abundant
7.	Three-spine stickleback	*Gasterosteus aculeatus*	Native	Both	Unknown
8.	Brown bullhead	*Ictalurus nebulosus*	Introduced	Resident	Unknown
9.	Pumpkinseed	*Lepomis gibbosus*	Introduced	Resident	Sparse
10.	Pacific staghorn sculpin	*Leptocottus armatus*	Native	Both	Sparse
11.	Smallmouth bass	*Micropterus dolomieui*	Introduced	Resident	Abundant
12.	Largemouth bass	*Micropterus salmoides*	Introduced	Resident	Abundant
13.	Peamouth	*Mylocheilus caurinus*	Native	Resident	Unknown
14.	Olympic mudminnow	*Novumbra hubbsi*	Unknown	Resident	Rare: one siting
15.	Steelhead trout	*Oncorhynchus mykiss*	Native	Both	Stock depressed
16.	Yellow perch	*Perca flavescens*	Introduced	Resident	Abundant
17.	Black crappie	*Pomoxis nigromaculatus*	Introduced	Resident	Sparse
18.	Northern Squawfish	*Ptychocheilus oregonensis*	Native	Resident	Unknown
19.	Bull trout	*Salvelinus confluentus*	Native	Both	Rare
20.	Longfin smelt	*Spirinchus thaleichthys*	Native	Resident	Unknown
21.	Tench	*Tinca tinca*	Introduced	Resident	Unknown

4.3.1 Chinook Salmon

The Puget Sound chinook salmon evolutionarily significant unit (ESU) was designated as threatened on March 24, 1999 (64 FR 14308). This ESU includes all naturally spawned spring, summer, and fall runs of chinook salmon in the Puget Sound region. Puget Sound chinook salmon critical habitat was designated on February 16, 2000 (65 FR 7777). Critical habitat is designated to include all marine, estuarine and river reaches that could be utilized by chinook salmon in the Puget Sound region. This incorporates the riverbed, bank, and riparian zone in all rivers currently or historically utilized by Puget Sound chinook salmon. Based on the fact that fall run chinook salmon utilize Little Bear Creek, the stream and shoreline are designated critical habitat.

Salmon spawning ground survey data from the WDFW from 1952 through 2000 indicates that chinook salmon utilization of Little Bear Creek is typically limited to less than 8 individuals (Table 4). The maximum daily count was 28 chinook salmon on October 21, 1981, but was typically between 1 and 5 (Appendix J). The highest yearly count occurred in 1981 when a total of 62 chinook salmon were counted (Table 4). The majority of higher counts occurred between RM 4.4 and 5.5. Sightings were made as early as September 29, and live fish were observed as late as November 3. Although the WDFW has surveyed Little Bear Creek since 1952, the first documented adult chinook salmon did not occur in Little Bear Creek until 1971 when one carcass was found on November 11 between RM 4.4 and 5.4.

Table 4:
Chinook Salmon Summary for Little Bear Creek based on WDFW Salmon Spawning Ground Survey Data

Year	Live Count	Dead Count	Total Count
1971	0	1	1
1972	0	1	1
1973	0	1	1
1974	3	3	6
1975	4	1	5
1976	13	12	25
1977	2	16	18
1978	11	40	51
1979	0	1	1
1980	0	2	2
1981	20	42	62
1982	0	3	3
1983	0	3	3
1984	0	4	4
1985	11	4	15
1986	0	5	5
1987	7	3	10
1988	0	6	6
1989	1	3	4
1990	0	0	0
1991	0	0	0
1992	0	0	0

Table 4 continued

Year	Live Count	Dead Count	Total Count
1993	0	0	0
1994	0	7	7
1995	0	0	0
1996	1	4	5
1997	0	0	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
Total	73	162	235
Average	2.4	5.4	7.8

During the King County surveys from 1996 to 1999, year to year sightings have varied from zero to 12 observations. These numbers represent the minimum number of fish present since the entire stream was not surveyed. However, it does further indicate that Little Bear Creek is not heavily utilized by chinook salmon.

The origin of chinook salmon in Little Bear Creek is uncertain. Straying from either Bear Creek and/or the Issaquah Creek Hatchery is highly probable. Plants of fry and fingerling chinook salmon directly into Little Bear Creek totaled 1,083,300 from 1983 through 1992 (Appendix H). These were all fall chinook from the Issaquah Hatchery. No more plants by the WDFW are currently planned for Little Bear Creek (Foley, personal communication, 2001). In May of 2001, the Issaquah Creek Hatchery released 2,194,773 juvenile chinook salmon into Issaquah Creek. Some of the juveniles from the Issaquah Creek Hatchery and from naturally produced spawners in Bear Creek may utilize the lower segment of Reach 1 during their outmigration through the Sammamish River.

Juvenile chinook salmon typically exhibit either ocean-type or stream-type life history strategies. The primary difference between these strategies is residence time and growth rates. For the purposes of this report, residence time is important. Juvenile chinook salmon within the Lake Washington watershed exhibit the ocean-type strategy which means they rapidly exit their natal stream after emergence from the gravel (Fresh, personal communication, 2000). Data collected and analyzed by the WDFW indicate that the majority of the total juvenile out-migration in Bear Creek (immediately east of Little Bear Creek) occurred after mid-April, but varied between years (Seiler, 2001). The overall out-migration period ranges from mid-January through late June, but spikes between March and June. These trends can be expected to be "similar" to what occurs in Little Bear Creek.

4.3.2 Coho Salmon

Puget Sound/Strait of Georgia coho salmon was designated as a candidate for listing under the ESA on July 25, 1995 (60 FR 38011). If its status is changed to either threatened or endangered in the future, critical habitat may be designated at that time.

Salmon spawning ground survey data from the WDFW from 1952 through 2000 indicates "fair" numbers of coho salmon consistently spawn in Little Bear Creek, but during some years they are very abundant. The average total number of coho salmon observed each year in Little Bear Creek is

approximately 380 (1952 through 2000 excluding 1962 and 1969 [no data]). However, from 1976 to 1978 when the WDFW conducted intensive salmon spawning surveys at Little Bear Creek an average of approximately 2,700 coho were observed per year (range = 1,448 to 4,852). The abundance of coho salmon in Little Bear Creek appears to have dropped in the late 1980s to early 1990s. Prior to 1991 the yearly average total number of observations was approximately 460, after 1991 the yearly average was 68 with a high of 168 in 1995.

The two highest single day counts included 197 on December 14, 1979, and 191 on December 11, 1987 (Appendix J). Both of these daily counts only represent the adults observed between RM 4.4 and 5.5 on a specific day, and therefore, do not represent the total number of spawning adults in Little Bear Creek. From 1988 through 2000, the highest daily counts have been 40, 45, 46, 36, 9, 26, 4, 48, 38, 68, 25, 12, and 36, respectively. As previously stated, these numbers are not absolute in that they can only be used as an indicator of abundance. Numerous factors such as time of year, observer bias, survey effort, survey timing, flow, water clarity, and weather can all play a role in the total number of observations.

Unlike chinook salmon, coho juveniles spend from 1 to 2 years in freshwater before heading to sea. Their extended period of rearing in freshwater makes them especially vulnerable to changes in habitat, water quality, and hydrology. Following this period of freshwater residence, the juveniles migrate downstream to Lake Washington and then the ocean. They then spend about 18 months at sea before returning to their stream of origin for spawning (Wydoski and Whitney, 1979). Returning adult coho salmon stray within a watershed, and between watersheds.

Low numbers of juvenile coho salmon were captured in Reach 1, 2, and 3 during our electrofishing survey on August 24, and 31, 2001 (Appendix K). The total coho catch in Reach 1 was three juveniles during 110 seconds of effort, or one per 36.7 seconds. Juvenile coho represented 8.3 percent of the catch in Reach 1. One of the three coho had a clipped adipose fin and was therefore likely from the Issaquah Hatchery. The hatchery coho was much larger than the others with a total length of 10.7 centimeters (4.2 inches) versus an average length of 8.6 centimeters (3.4 inches) for the naturally produced coho (range: 8.4 to 8.9 centimeters [3.3 to 3.5 inches]). Two coho were captured in Reach 2 during 320 seconds of effort.

Electrofishing in Reach 3 produced the most coho, except that all the captures occurred in the upper-most section downstream of NE 205th Street. A total of nine juvenile coho were captured in the upper section of Reach 3 during 141 seconds of effort. This equates to one coho per 15.7 seconds of effort. Juvenile coho represented 20.4 percent of the salmonid catch in the upper section of Reach 3. Juvenile coho in the upper section of Reach 3 were smaller than those captured in Reach 1 with an average length of 7.8 centimeters (3.08 inches) ranging from 7.6 to 8.3 centimeters (3 to 3.25 inches). Overall, juvenile coho represented 7.7 percent of the total catch in Little Bear Creek. No coho were captured immediately upstream of NE 195th Street although 29 cutthroat trout and six sculpins were caught. No hatchery coho were captured in any section of Reach 2 or Reach 3.

The WDFW has planted 2,927,707 emergent, fingerling, fry, pre-smolt, and smolt coho salmon into Little Bear Creek between 1952 and 1978, and 1,161,763 between 1984 and 1997 (Appendix H). This does not include additional plants by the tribes, schools, or other organizations. During March of 2001, the Issaquah Creek Hatchery released two different size classes into Issaquah Creek totaling

2,250,549 (Appendix I). One of these juvenile coho was captured in Reach 1 of Little Bear Creek on August 24, 2001.

4.3.3 Sockeye Salmon

Sockeye salmon differ from other species of salmon in that juveniles require a lake environment to exist, where they spend 12 to 15 months maturing prior to going to sea (Wydoski and Whitney, 1979). Returning adult sockeye enter Lake Washington in late June and July, reside in Lake Washington until late August, and then spawn in numerous tributaries between September through early December (peaking in mid-October). An average female will produce approximately 4,000 eggs that hatch in 6 to 9 weeks, and then reside within the substrate for another 2 to 3 weeks. The newly hatched juveniles migrate from the tributaries into Lake Washington between January and April, but typically peak during March. These fish are the progeny of transplants from Baker River around the 1930s.

Kokanee are sockeye salmon that spend their entire life in freshwater. They are segmented into early-run and late-run races. Early-run kokanee spawn from August through September while the late-run spawns from October through December (King County, 2000a). The early-run variance is native to the Lake Washington system and has received much notice lately due to a decline in abundance. The late-run are the progeny of hatchery fish from Lake Whatcom planted in Big Bear Creek in the 1930s and 3.5 million planted in Lake Sammamish between 1976 and 1979 (King County, 2000a). However, the total number of kokanee planted in the Lake Washington system was approximately 35 million fry and fingerlings.

Several organizations have petitioned the United States Fish and Wildlife Service (USFWS) to list the early-run kokanee as an endangered species. To date, the USFWS has not responded to these petitions despite the population crash that occurred in the 1980s. During 2000, efforts were initiated to capture, rear, and then release early-run kokanee in order to increase the egg-to-fry survival rate. As of yet, these efforts have failed due to a lack of captured adult spawners.

Kokanee have been documented in Little Bear Creek (King County, 2000a). According to King County, up to 221 kokanee spawned in the lower most section of Reach 1 between September 27, through November 8, 1999. Kokanee were observed spawning in Little Bear Creek by DEA biologists during a water quality-monitoring event on September 20, 2001. Between 6 and 10 kokanee ranging from 17.8 to 35.6 centimeters (7 to 14 inches) long were observed immediately below the NE 178th Street culvert. The exact number is uncertain due to a lack of visibility under the overhanging cluster of Japanese knotweed where several more were hiding. One female between 17.8 to 20.3 centimeters (7 and 8 inches) long was observed digging a redd immediately under the downstream culvert edge in the center of a low-gradient riffle. Several others, suspected to be males, would occasionally be by her side, but dart between the redd and the cluster of Japanese knotweed along the left-bank. A minimum of four were observed, and several others were under the overhanging cluster of Japanese knotweed, and "thrashing/splashing noises" were emanating from under the cluster of knotweed. One additional redd was identified immediately downstream of the railroad crossing near the mouth (upstream of the Sammamish River trail crossing). The timing of these observations does not conclusively categorize them as either early or late-run kokanee, but leads to the possibility that they could be either. Some researchers have stated that during 1996, the timing of the early-run in Issaquah Creek extended from August 14, through September 16 (Ostergaard 1988 as reported by King County, 2000). Due to yearly

variations in water temperature and run timing, these dates are not absolute. However, due to the closeness between the observed spawning of kokanee in Little Bear Creek on September 20th, it is possible that these fish were a component of the early-run race.

Sockeye salmon are occasionally the most abundant spawning anadromous salmonid in Little Bear Creek. Based on salmon spawning ground data from the WDFW, adult sockeye salmon were first observed in Little Bear Creek in 1970 (WDFW, 2001). Low numbers (n) were observed in 1970 (n = 14), 1975 (n = 1), 1976 (n = 8), 1977 (n = 2), 1978 (n = 34), 1979 (n = 91), but began to increase substantially during 1987 when over 2,000 spawning adults were observed (Appendix J). Exceptionally large numbers of sockeye salmon spawned in Little Bear Creek in 1996 when 4,716 were recorded. Based on observations during field visits this year, 2001 will be another productive year for sockeye in Little Bear Creek.

4.3.4 Chum Salmon

Chum salmon often spawn near tidewater and begin to migrate back to the ocean soon after emergence. Spawning primarily occurs between October through December, and outmigration between March and June (Wydoski and Whitney, 1979). Chum salmon were considered extirpated from Lake Washington by the early 1930s (Goetz, proceedings from Conference, 2000). However, they are occasionally observed in tributaries to both Lake Washington and Lake Sammamish. Only two chum salmon have been observed in Little Bear Creek during the WDFW annual salmon spawning ground surveys from 1952 through 2000. These two adults were observed between RM 4.4 and 5.5 on November 6, 1976 (Appendix J). Based on the low number of observations of chum salmon in Little Bear Creek, these adults likely strayed from either the Cedar River or other Puget Sound watersheds.

4.3.5 Pink Salmon

Pink and chum salmon are similar in that they have a short residence time in freshwater as both adults and juveniles. Spawning occurs primarily between August and September (Wydoski and Whitney, 1979). Pink salmon were also considered extirpated from Lake Washington by the early 1930s (Goetz, proceedings from Conference, 2000). Only one adult pink salmon has been observed in Little Bear Creek (WDFW, 2001). The single adult was observed dead between RM 0.0 and 1.1 on November 1, 1977 (Appendix J). Based on the single observation of a pink salmon in Little Bear Creek, this adult was likely a strayed from a different Puget Sound watershed.

4.3.6 Cutthroat Trout

The life history of cutthroat trout is very diverse. Sea-run, adfluvial, and resident forms utilize the Lake Washington system. The resident form is likely the most abundant trout and the only resident salmonid in Little Bear Creek. During our electrofishing survey on August 24 and 31, 2001, cutthroat trout increased in abundance as we progressed upstream. They represented 8.6 percent of the catch in Reach 1 (n = 3), 50.8 percent in Reach 2 (n = 32), and 76.2 percent in Reach 3 (n = 64). Overall, cutthroat trout represented 54.4 percent of the total catch in Little Bear Creek. The largest specimen captured was in Reach 3 and was 21.6 centimeters (8.5 inches) long (Appendix K).

4.3.7 Western Brook Lamprey

Three species of lamprey have been documented in the State of Washington including the western brook lamprey (*Lampetra richardsoni*), Pacific lamprey (*Entosphenus tridentatus*), and river lamprey (*Lampetra ayresi*). Of these, only the western brook lamprey was documented in Little Bear Creek by DEA.

Adult western brook lampreys are the smallest of the lamprey family by being usually less than 17.8 centimeters (7 inches) in length (Wydoski and Whitney, 1979). They are slender, have dull/ nonfunctional teeth, may live for up to 6 years, and spend their entire life in freshwater. Unlike other species of lampreys, the brook lamprey does not attach themselves to other fish. Spawning occurs in small-excavated "nests" from April to July. Up to 12 adults may use a single nest and die soon after spawning. Juveniles are called ammocoetes and are non-parasitic filter feeders that consume primarily microscopic plant and animal matter such as diatoms, algae, and detritus.

Western brook lampreys were observed in Reaches 2 and 3, and in Tributary D as depicted on Figure 3 immediately downstream of 140th Place NE. Spawning behavior in the form of nest building and quivering was noted in the large pool immediately downstream of NE 205th Street and in a low-gradient riffle in Reach 2. In Reach 3 approximately 12 spawning lampreys were observed on June 15, 2001, at the NE 205th Street site. It is interesting to note that the same site along the edge (RB) of the pool near the tailout was later used by sockeye salmon for spawning. Numerous other sightings of lampreys occurred throughout Reaches 2 and 3 during the survey.

4.3.8 Coastrange Sculpin

The coastrange sculpin inhabits medium to large streams along the West Coast from California to Alaska. They grow to 7.6 to 10.2 centimeters (3 to 4 inches) long depending on geographic location, and spawn from mid-February to June (Wydoski and Whitney, 1979). They feed primarily on aquatic insects but will eat stray salmonid eggs when available. Large adult sculpins may feed on salmonid fry but are in-turn eaten by larger salmon and trout.

Sculpins are the most difficult fish in Washington to identify to species because of their morphological variations and small size (Wydoski and Whitney, 1979). At least 11 species occur in Washington State, some of which may hybridize and result in similar characteristics that further complicates species identification. Some of the characteristics that distinguish the coastrange sculpin from other species include its non-contiguous dorsal fin (separated to base), distinct tubular nostril, lack of palatine teeth, and absence of prickles and dark vertical bars (Wydoski and Whitney, 1979).

DEA documented coastrange sculpins throughout Little Bear Creek (Appendix K). Sculpins represented 82.9 percent of the catch in Reach 1 (n = 29), 46 percent in Reach 2 (n = 29), and 13.1 percent in Reach 3 (n = 23). The overall catch in Little Bear Creek was 37.9 percent. Although the majority of specimens captured were coastrange sculpins, some differed and may have been reticulated sculpins. The variation included the presence of a slightly contiguous dorsal fin on larger specimens.

4.3.9 Mollusks and Crawfish

Other aquatic species observed in Little Bear Creek include mollusks, crawfish, and macroinvertebrates. The western pearlshell (*Margaritifera falcata*) has been documented within

upper Little Bear Creek within Snohomish County. Several shells were observed in Little Bear Creek within King County, but no live specimens were documented during the DEA stream survey. These shells likely floated downstream during flood events. Another mollusk referred to as the Asian clam (*Coricula fluminea*) was observed in the Sammamish River near the mouth of Little Bear Creek during the DEA stream survey. The Asian clam is an introduced species known to be present in the Colombia River, but never previously documented in the Sammamish River. Crawfish are also present in the Sammamish River and Little Bear Creek. However, their presence in Little Bear Creek appears to be limited to the lowermost section of Reach 1.

4.4 STREAM HABITAT

DEA biologists surveyed the entire section of Little Bear Creek within the City of Woodinville between its mouth to NE 205th Street from June 25, through August 1, 2001. A total of 3,484.1 meters (2.2 miles) of stream was surveyed from the mouth of Little Bear Creek at the Sammamish River to the crossing under NE 205th Street along the City of Woodinville and Snohomish County line (Table 5). Little Bear Creek was segmented into three reaches. Reach 1 began at the mouth of Little Bear Creek and extended to the downstream end of the culverts under SR 202. Reach 2 started at the downstream side of the culverts under SR 202 and extended to the upstream side of the culverts under Highway 522. Reach 3 began at the upstream side of Highway 522 and ended at NE 205th Street, which follows the City of Woodinville and Snohomish County line.

Table 5:
Survey Summary for Reach 1, 2, and 3 of Little Bear Creek in Woodinville, Washington (WDFW Stream Number 08-0080)

	Reach 1	Reach 2	Reach 3
Date Surveyed	6/25/01	6/26/01 – 7/6/01	7/19/01 – 8/1/01
Total Length Surveyed	388.2 meters (0.24 mile)	1,725.7 meters (1.07 miles)	1,370.2 meters (0.85 mile)
Bank Full Width	4.5 – 6.6, x[1] = 5.8 meters	3.1 – 8.8, x = 6.2 meters	5.6 – 8.2, x = 6.9 meters
Total # of Habitat Units (NSOs)	14	105	94
Total Habitat Area	1,773.58 m^2	9,267.05 m^2	7,379.52 m^2
Percent Pool by Area	13.74%	34.01%	36.57%
Percent Glide by Area	15.04%	20.48%	21.34%
Percent Riffle by Area	71.22%	47.67%	42.09%
# Hardened Crossings	3	4	3
Percent Armoring	98.3%	13.7%	15.5%
Placed Structures	6 log weirs	0	5 rip/rap weirs
Gradient	0.25 – 1.25%	0.56 – 1.2%	0.31 - 0.87%
Sinuosity	1.01	1.15	1.08
Number Wolman Measurements	2	5	4
% Fines < 6 mm	19 – 40%, x = 29.5%	15 – 41%, x = 27%	13 – 31%, x = 21.5%
Wolman Pebble Count D-50	x = 20.6 mm	x = 21.9 mm	x = 29.6 mm
Dominant Substrate Type	Coarse gravel	Coarse gravel	Coarse gravel
Flow Measurement (8/24/01)	15.02 cfs	Not measured	13.77 cfs

Note #1: X = mean measurement.

4.4.1 Pool/Riffle Habitat

Pools and riffles are the basic components of stream habitat. The percentage and quality of these basic components help define the overall health of a stream. They are also key parameters that help

support both resident and anadromous populations of salmonids as well as other aquatic species that depend on a "healthy" stream.

Pool Habitat: Pools are used by adult salmonids for cover and resting, and pool tailouts are key spawning sites for many species. Juveniles depend on pools for cover, feeding, and refuge during extremes in stream flow. As the quantity and quality of pool habitat decreases, so does the abundance of aquatic life (salmonids, insects, mollusks, etc.). The importance of pool habitat and their associated tailouts can not be overstated. All spawning sockeye in Little Bear Creek observed during our studies were spawning in pool tailouts or the transition between the pool and their associated tailout. Although riffle habitat is also used in streams such as Little Bear Creek, riffles tend to be too shallow to be used consistently by most salmonids.

Pools are typically formed by stationary features such as large woody debris and boulders, abrupt changes in elevation, and changes in the direction of flow and substrate. The loss of large conifers within the riparian zone that contribute to in-stream woody debris and removal of in-stream wood has reduced the abundance and quality of pool habitat. Additional factors such as reduction in sinuosity, increased sedimentation, and changes in hydroperiod have further reduced habitat complexity.

In order to rate a stream within an urbanized environment, comparisons are made to more natural streams that have not been as heavily impacted by anthropogenic factors. Several researchers as well as state and federal agencies have suggested some basic standards upon which to rate a stream. Because of the wide variation in streams, bankfull width (BFW) and gradient are typically used as the parameters to which the standards are based. This is done so that comparisons are made to similar sized streams. Regardless of size, the overall area of pool habitat in a stream is typically expected to be about 40 percent to 60 percent to be considered optimum (Peterson et al., 1992).

Pool Frequency: The NMFS (1996) utilizes channel width (BFW) to develop a desired pool frequency (# pools/mile). Since the average BFW varied by reach, the desired pool frequency also varies. A stream is considered *properly functioning* if it meets the desired pool frequency and the large woody debris standards for properly functioning is also met (NMFS, 1996). A stream is considered *at risk* if it meets the desired pool frequency but large woody debris recruitment is inadequate to maintain pools overtime. A stream is considered to be *not properly functioning* if it does not meet the pool frequency standards. A comparison of the NMFS pool frequency standards and results of the DEA survey are presented below in Table 6.

Table 6:
Pool Frequency Data for Little Bear Creek, Woodinville

Reach	BFW	NMFS Match	NMFS Goal	Actual
Reach 1	19.0 ft.	20 ft.	56 pools/mile	21 pools/mile
Reach 2	20.3 ft.	20 ft.	56 pools/mile	43 pools/mile
Reach 3	22.6 ft.	25 ft.	47 pools/mile	41 pools/mile
Average	20.7 ft.	20 ft.	56 pools/mile	40 pools/mile

Based on the results presented in Table 6, pool frequency in Little Bear Creek is **not properly functioning**. This conclusion is strengthened by the fact that large woody debris recruitment is not sufficient to maintain existing pools over time due to the absence of large mature conifers within most of the riparian zone. Furthermore, the overall number of pools per kilometer in Little Bear Creek as it

flows through the City of Woodinville is 24.7 (40/mile), and the overall percentage of pool habitat is 33.1 percent. This further indicates that the frequency of pool habitat is below optimum levels.

Pool Quality: Although the number of pools is very important, another important factor is the residual depth, which is defined as the maximum depth minus tailout depth. The premise of residual depth is that deeper pools provide more cover, are more stable, and can be utilized by larger salmonids such as chinook. Shallow pools provide less cover, can be rapidly filled by sediment, and do not provide good refugia for salmonids.

The NMFS (1996) considers that pool quality is *properly functioning* when they contain pools >1 meter (3.3 feet) deep with good cover and cool water, and minor reduction of pool volume by fine sediment. Pool quality is *at risk* when few pools >1 meter (3.3 feet) are present or have inadequate cover/temperature, and only a moderate reduction in pool volume by fine sediment. Pool quality is *not properly functioning* when no pools are >1 meter (3.3 feet) deep and have inadequate cover/temperature, and there is a major reduction of pool volume by fine sediment. The NMFS Matrix of Pathways and Indicators does not mention "residual depth," therefore maximum depth will be used.

Within Reach 1, none of the five pools had a maximum depth >0.90 meter (2.9 feet). The maximum pool depth was 0.90 meter (2.9 feet), average pool depth was 0.60 meter (2 feet), average maximum depth was 0.85 meter (2.8 feet), average residual depth was 0.55 meter (1.8 feet), and maximum residual depth was 0.70 meter (2.3 feet). These pools also lacked "good" cover and "cool" water. Therefore, pool quality in Reach 1 is **not properly functioning**.

Reach 2 contained 46 pools, but only eight (17.4 percent) had a maximum depth equal to or >1 meter (3.3 feet). The maximum pool depth was 1.1 meter (3.6 feet), average pool depth was 0.43 meter (1.4 feet), average maximum depth was 0.73 meter (2.4 feet), average residual depth was 0.55 meter (1.8 feet), and maximum residual depth was 0.90 meter (2.9 feet). Although some of the pools contained good cover, most did not. Therefore, pool quality in Reach 2 is considered **at risk**.

Pool quality increased in Reach 3 due to the presence of deeper pools. Reach 3 contained 35 pools, nine (25.7 percent) of which had a maximum depth equal to or greater than 1 meter (3.3 feet). The maximum pool depth was 1.71 meter (5.6 feet), average pool depth was 0.39 meter (1.3 feet), average maximum depth was 0.75 meter (2.5 feet), average residual depth was 0.54 meter (1.8 feet), and maximum residual depth was 1.51 meter (4.9 feet). Compared to Reaches 1 and 2, the percentage of deeper pools increased and overall water temperature decreased, but few pools were considered to provide adequate cover. A reduction in pool volume due to fines was observed. Although conditions improved in Reach 3, pool quality is considered **at risk**. The overall pool quality in Little Bear Creek as it flows through the City of Woodinville is considered also **at risk** because few pools are greater than 1 meter (3.3 feet) deep.

Riffle Habitat: Riffles are also important spawning areas in many streams, and support a myriad of macroinvertebrates that provide the primary food source for juvenile salmonids as well as other species of fish. Gradient and water depth dictates the suitability for salmonid spawning while embeddedness and overall abundance of fines influence productivity. The NMFS (1996) states that gravel or cobble should be the dominant substrate, with embeddedness being less than 20 percent to be *properly functioning*. In other words, the interstitial spaces between the gravel or cobble should not be filled with more than 20 percent fines, and the gravel should not be compacted. Although

salmonids can and do spawn in gravel containing excess fines, the egg-to-fry ratio may be low. This could result in few, if any eggs surviving to the fry stage due to suffocation and entrapment.

Table 7 below summarizes the pool, riffle, and glide habitat parameters quantified by this survey. The raw data are provided in Appendix M. Table 7 is segmented by reach in order to capture trends as Little Bear Creek flows through the City of Woodinville. Overall, Reach 1 near the mouth of Little Bear Creek has been severely degraded while Reach 2 and 3 still contain "fair" habitat. Although pool habitat is **not properly functioning** based on NMFS standards, Reaches 2 and 3 of Little Bear Creek do contain a fair amount of suitable habitat (although somewhat degraded). The primary factors that have degraded pool habitat in Little Bear Creek are the lack of in-stream large woody debris, and relatively heavy sediment load.

Table 7:
Pool, Riffle, and Glide Habitat Summary for Reach 1, 2, and 3 of Little Bear Creek

	Reach 1	Reach 2	Reach 3
Total Habitat Area	1,773.58 m^2	9,267.05 m^2	7,379.52 m^2
Total Pool Area	243.66 m^2	3,151.51 m^2	2,698.64 m^2
Total Glide Area	266.81 m^2	1,898.24 m^2	1,574.86 m^2
Total Riffle Area	1,263.11 m^2	4,417.305 m^2	3,106.02 m^2
Percent Pool by Area	13.74%	34.01%	36.57%
Percent Glide by Area	15.04%	20.48%	21.34%
Percent Riffle by Area	71.22%	47.67%	42.09%
Number of Pools	5 (4 of 5 man made)	46	35
Pools per Kilometer	12.88	26.66	25.54
Total Length of Pool Habitat	74.8 meters	548.2 meters	421.9 meters
Dominant Pool Type	Plunge	Scour	Scour
Average Length of Pools	14.96 meters	11.92 meters	12.05 meters
Average Residual Pool Depth	0.55 meter	0.55 meter	0.54 meter
Maximum Residual Depth	0.70 meter	0.90 meter	1.51 meter
Maximum Pool Depth	0.90 meter	1.1 meter	1.71 meter
Average Maximum Pool Depth	0.85 meter	0.73 meter	0.75 meter
Average Pool Depth	0.60 meter	0.43 meter	0.39 meter
Average Pool Width	4.02 meters	6.10 meters	6.19 meters
Number of Riffles	4	43	40
Total Length of Riffle Habitat	246.80 meters	841.4 meters	634.28 meters
Average Length of Riffles	61.70 meters	19.57 meters	15.86 meters
Average Width of Riffles	5.35 meters	4.80 meters	4.81 meters
Average Depth of Riffles	0.34 meter	0.20 meter	0.16 meter
Number of Glides	5	16	19
Total Length of Glides	66.60 meters	336.1 meters	313.98 meters
Average Length of Glide Habitat	13.32 meters	19.57 meters	16.53 meters
Average Width of Glides	4.1 meters	4.75 meters	5.09 meters
Average Depth of Glides	0.43 meter	0.34 meter	0.25 meter

4.4.2 Large Woody Debris

Large woody debris (LWD) is a critical component of stream habitat because it creates pools, structure, and habitat diversity. Large pieces of coniferous trees provide the best habitat since they

are long-lived and will not decay as rapidly as deciduous trees. Large pieces will also stay stationary during high flows and scour out pool habitat as water velocity is redirected around them.

The USFS protocol for LWD west of the Cascades segments wood into three size categories based on length and diameter (USFS, 2001). Small LWD must have a diameter >30.5 centimeters (12 inches) at a length of 7.62 meter (25 feet) from the large end. Medium LWD must have a diameter >61 centimeters (24 inches) at a length of 15.24 meter (50 feet) from the large end. Large LWD must have a diameter >0.91 meter (36 inches) at a length of 15.24 meter (50 feet) from the large end. The NMFS recommends that streams should have a minimum of 80 pieces of LWD per 1.61 km (1 mile) that are at least 15.24 meter (50 feet) long with a diameter of at least 61 centimeters (24 inches) to be *properly functioning*.

Both the USFS and NMFS standards are larger than what is now typically found in Puget Sound lowland streams. Although present in some streams in low numbers, LWD of this size are more appropriately categorized as remnant key pieces. Because of their scarcity, the new standard of measuring and categorizing pieces >2 meters (6.6 feet) long and wider than 10 centimeters (3.9 inches) has been adopted by several jurisdictions. Although these smaller pieces are not as influential as the key pieces, they do provide some function. By measuring and categorizing their size, abundance, and species, a more accurate account of existing habitat conditions can be obtained. Appendix N contains all the specific details of each piece of wood >2 meters (6.6 feet) long and 10 centimeters (4 inches) wide encountered in Little Bear Creek as it flows through the City of Woodinville.

Only 5 pieces large enough to meet the NMFS standard were recorded throughout the 3.48 kilometers (2.2 miles) of stream surveyed within the City of Woodinville. Researchers have documented that the occurrence of smaller pieces of wood such as those inventoried during this survey in natural streams occur at a rate of 150 to 460 pieces per kilometer (0.62 mile) (Peterson et al., 1992). The total number of pieces of LWD greater than 2 meters (6.6 feet) long per kilometer (0.62 mile) in Little Bear Creek is 110.5. Based on the NMFS criteria, large woody debris is **not properly functioning** in Little Bear Creek. Table 8 below summarizes our findings by reach, and the raw data are presented in Appendix N.

Table 8:
Woody Debris Summary for Reach 1, 2, and 3 of Little Bear Creek

	Reach 1	Reach 2	Reach 3
Total Wood Inventoried	16 pieces	217 pieces	152 pieces
# NMFS Woody Debris	0	4	1
Pieces (> 2 m long) per Meter	0.04	0.13	0.11
Pieces (> 2 m long) per kilometer	47.31	125.75	110.93
Distance between Pieces	24.26 meters	7.95 meters	9.01 meters
% Coniferous Woody Debris	66.7% (weirs)	23.6%	34.5%
% Deciduous Woody Debris	33.3%	76.4%	65.5%
Dominant Conifer Species	Cedar	Cedar	Cedar
Dominant Deciduous Species	Alder	Alder	Alder
Average Length	3.66 meters	3.31 meters	3.74 meters
Average Diameter	32.5 cm	29.2 cm	27 cm
# Stumps	0	18	10
# Log Jams	0	4	3

Note: The results for Reach 1 were skewed due to the presence of log weirs.

4.4.3 Sediment and Substrate

Stream substrate varies significantly on all scales, and no survey method is perfect at documenting substrate composition on the reach scale. DEA utilized the Wolman (1954) pebble count due to its ease of use, comparability with existing data, and acceptance by both King County and the USFS. However, the Wolman pebble count method focuses on riffle habitat and hence does document substrate composition in pool tailouts. Pool tailouts are often extensively used for spawning.

Variation in substrate occurs by watershed, stream, reach, and habitat type. The substrate also varies on the site-specific scale when analyzing either lateral or longitudinal change. This variation in conjunction with the numerous methods of assessing substrate composition has created difficulties in adequately documenting and interpreting the results of sampling efforts. However, the variation in substrate composition on the watershed scale is one of the many factors that allows for a diverse benthic community to exist such as macroinvertebrates, mollusks, and numerous species of fish that reside within the substrate during their larval stage. A few of the factors that influence substrate composition include flow, gradient, sediment load, and location within the watershed.

Sediment: The focus of most stream substrate assessments is to determine the percentage of fines in potential salmonid spawning habitat. The percentage of fines is then used to infer the quality of spawning habitat because too many fines can degrade in-stream habitat and adversely impact salmonid spawning success. Streams in urbanized watersheds "tend" to have a larger percentage of smaller particles (May, 1996). The NMFS Matrix, as modified by the Mt. Baker/Snoqualmie National Forest, uses percent fines as an indicator of the quality of potential spawning and rearing habitat. Percent fines is used for assessing both spawning and incubation habitat. However, the size range depends on if the field data is collected from the stream surface (<6 millimeters [0.24 inch]) or from within the substrate (<0.85 millimeter [0.03 inch]). The Wolman pebble count collects stream substrate surface data. Therefore, based on NMFS Matrix values as modified by the Mt. Baker/Snoqualmie National Forest that includes surface fines: ≤20 percent fines (<6 millimeters [0.24 inch]) and low turbidity is considered *properly functioning* in most watersheds, 12 percent to 20 percent fines and moderate turbidity is considered *at risk*, and >20 percent fines and high turbidity is considered *not properly functioning* (Appendix L-2).

The results of the Wolman pebble count data collected in Little Bear Creek highlights the variability of fines (Table 9). Data was collected at 11 riffles, the percent fines <6 millimeter (0.24 inch) ranged from 13 percent to 41 percent, with an overall average of 25.45 percent. Based on these results, the sediment indicator at the local level ranges from **properly functioning** to **not properly functioning**, but averages in the **at risk** range. Assuming this data is representative and enough samples were collected to identify possible trends, an overall general trend of fewer fines per reach occurred as sampling progressed upstream. The average percent fines in Reach 1 was 29.5 percent, Reach 2 was 27 percent, and Reach 3 was 21.5 percent. These reach averages are all greater than 20 percent, and therefore indicates that the overall sediment indicator for Little Bear Creek is **not properly functioning**.

Table 9:
Substrate Composition Based on Wolman Pebble Counts in Little Bear Creek, Woodinville

#	Reach #	NSO	Location	Fines <6 mm	D35	D50	D84	D95
1.	1	1	R1: Station 18.4	40%	1.9 mm	16.0 mm	175.8 mm	299.3 mm
2.	1	14	R8: Imm. D. stream SR 202	19%	14.2 mm	25.1 mm	132.4 mm	203.4 mm
3.	2	2	Imm. U. stream SR 202	21%	19.2 mm	29.6 mm	64.9 mm	99.5 mm
4.	2	15	R9	41%	1.9 mm	10.1 mm	30.7 mm	44.0 mm
5.	2	27	Station 558.9, UW Bug site	26%	9.6 mm	16.5 mm	35.0 mm	50.7 mm
6.	2	56	R26: Station 1015	32%	8.0 mm	17.9 mm	30.9 mm	43.2 mm
7.	2	76	NSO 76	15%	27.0 mm	35.5 mm	67.5 mm	93.8 mm
8.	3	3	R2	13%	22.9 mm	30.6 mm	57.1 mm	78.1 mm
9.	3	38	R23	24%	20.1 mm	48.7 mm	48.7 mm	61.1 mm
10.	3	50	R30	18%	16.1 mm	22.7 mm	58.4 mm	87.5 mm
11.	3	81	R49	31%	7.4 mm	16.2 mm	41.9 mm	63.9 mm

Wolman pebble count data also documents larger particle size distribution (D35 – D95). The "D" represents distribution, while the adjoining number represents the percentile of interest. The D35 equates to the distribution of the 35 percentile of the particle size distribution. Whereas the D50 is the median particle size of a distribution that divides the distribution in two equal parts (mid-point/median). Another way of expressing this concept is that a percentile is a sediment size indicated by the cumulative distribution curve for a particle "percent finer" value. Therefore, D35 means 35 percent of the sample was smaller than the cumulative particle size (diameter in millimeters) documented at the riffle. In the case of the first sample site, 35 percent of the pebbles measured were smaller than 1.9 millimeter (0.075 inch) in diameter. The data in the form of a cumulative distribution curve from each of the sample sites is provided in Appendix O.

Substrate: The NMFS utilizes both embeddedness and substrate composition as the indicators for substrate quality. The percentage embeddedness is obtained visually and is extremely subjective. The NMFS criteria for *properly functioning* is a dominance of gravel or cobble (interstitial spaces clear) and embeddedness <20 percent, *at risk* is gravel and cobble subdominant or if dominant embeddedness is between 20 percent and 30 percent, and *not properly functioning* if bedrock, sand, silt or small gravel dominant or if gravel and cobble dominant embeddedness is >30 percent.

Based on the D50 results, the median gravel size in riffles throughout Little Bear Creek in the City of Woodinville ranged from medium to very coarse gravel. The D50 in Reach 1 ranged from 16 to 25.1 millimeters (0.63 to 0.99 inch) with the average being 20.55 millimeters (0.81 inch) (coarse gravel). The D50 in Reach 2 ranged from 10.1 to 35.5 millimeters (0.40 to 1.4 inches) with the average being 21.92 millimeters (0.86 inch) (coarse gravel). The D50 in Reach 3 ranged from 16.2 to 48.7 millimeters (0.64 to 1.92 inches) with the average being 29.55 millimeters (1.16 inches) (coarse gravel). Although more samples should be taken to increase confidence levels, there appears to be a trend of increasing D50 results as the upstream distance from Reach 1 increases. Although coarse gravel was dominant, interstitial spaces were not clear, and embeddedness averaged from 20 percent to 30 percent (sometimes >30 percent). Based on these results, the Habitat Element Pathway – Substrate Indicator is **at risk**.

4.4.4 Off-Channel Habitat/Refugia

The availability of "adequate" off-channel habitat and refugia are indicators of a stream's ability to provide a safe haven for primarily juvenile fish during high flow events. These are generally areas of lower stream velocity that can be accessed during flood events, but also includes low energy areas during normal stream flows such as backwater areas with cover, ponds, and oxbows.

Few side-channels, oxbows, or other types of potential off-channel habitat/refugia exist along Little Bear Creek. Although a few potential off-channel habitat and refugia sites were noted, they were not adequately abundant or distributed in Little Bear Creek. It appears that hydromodifications in the form of rip/rap armoring throughout Reach 1, and sections of Reaches 2 and 3 in conjunction with the loss of adjacent wetlands and tributaries that are culverted into Little Bear Creek, the indicator for off-channel habitat and refugia are **not properly functioning**.

4.4.5 Channel Condition and Dynamics

The channel condition and dynamics pathway includes three primary indicators assessed by the NMFS. These include: (1) width/depth ratio, (2) streambank condition, and (3) floodplain connectivity. Additional parameters not included in the Matrix of Pathways and Indicators developed by the NMFS (1996) that also provide insight into channel conditions and dynamics of a stream include: channel sinuosity and percent armoring. Although no specific percentages have been defined by the federal agencies for these last two indicators, they provide insight into the degree of anthropogenic influences that have been placed upon a stream. Both channel sinuosity and percent armoring are often closely associated with each other in that as the percentage of armoring increases the overall sinuosity decreases.

Width/Depth Ratio: The width/depth ratio concept relies on the premise that a stream channel will incise when banks are armored. This channel down cutting is created as high-flows that would normally spill-out into and over the adjacent stream banks are forced to stay within the defined channel by the presence of armoring (typically large rip/rap). The hydrologic impacts of urbanization typically widen and/or deepen a stream channel when the banks are not armored, but streamside development will often have the opposite effect (May et al., 1997).

The NMFS (1996) states that a *properly functioning* stream has a width/depth ratio of <10, an *at risk* stream has a ratio between 10 to 12, and the ratio for a *not properly functioning* stream is >12 (Appendix L-1). Based on the results of King County (2001b), the width/depth ratio for Reaches 1 through 3 is 5.8, 5.3, and 8.0, respectively. Based on their data, this indicator is **properly functioning** throughout Reaches 1 through 3. Although this could possibly be true for Reaches 2 and 3, it does not seem possible that Reach 1 could be properly functioning given that 98.3 percent is armored close to the bankfull line. Based on this, and that May et al., (1997) found varying results, this indicator as currently defined does not appear to be suited for urbanized streams in Puget Sound. Considering these issues, the width/depth ratio in Reach 1 is considered by DEA to be **not properly functioning**, and **at risk** in Reaches 2 and 3.

Streambank Condition: Streambank condition refers to the percentage of the bank that is stable and the percentage that is actively eroding. The NMFS (1996) defines a *properly functioning* streambank as being >90 percent stable with <10 percent actively eroding, 80 percent to 90 percent stable when *at risk*, and <80 percent stable when *not properly functioning*. This indicator also appears at least

partially flawed since a streambank that is completely armored would be considered stable using this approach and would be categorized as properly functioning. If the banks contain a predominance of gravels and not fines, the addition of new gravels to a stream channel can be beneficial. King County (2001b) reported that Reach 1 was 32 percent armored, 32 percent full scour, 33 percent low scour, and zero percent stable. Reach 2 was 9 percent armored, 18 percent full scour, 46 percent low scour, and 27 percent stable (King County, 2001b). Reach 3 was 6 percent armored, 16 percent full scour, 26 percent low scour, and 52 percent stable (King County, 2001b).

DEA biologists documented 98.3 percent armoring in Reach 1 distributed equally between the left and right banks. The percent armoring in Reach 2 varied depending upon bank (Table 10). The right bank (RB) was armored for a distance of 185.6 meters (608.9 feet) or 10.7 percent, while the left bank (LB) was armored for 288.4 meters (946.2 feet) or 16.7 percent. This discrepancy is due to the abundance of businesses along the left bank, and the relatively long distance between the right bank and Highway 522. Several sites along the left bank were experiencing localized sloughing as a result of streambank encroachment and absence of riparian vegetation (Appendix D – Reach 2 Photo 7). The percent armoring in Reach 3 also varied depending upon bank. The right bank was armored for a distance of 225.6 meters (740.2 feet) or 16.5 percent, while the left bank was armored for a distance of 198.5 meters (651.2 feet) or 14.5 percent. Based on these results, the streambank condition indicator is **not properly functioning**.

Table 10:
Bank Armoring Along Little Bear Creek in Woodinville

#	Reach	Bank	Downstream Station (m)	Upstream Station (m)	Length	Comment
1.	1	RB	6.6	388.2	381.6 meters	Rip/rap +
2.	1	LB	6.6	388.2	381.6 meters	Rip/rap +
3.	2	RB	0.0	39.7	39.7 meters	SR 202 culvert
4.	2	LB	0.0	39.7	39.7 meters	SR 202 culvert
5.	2	LB	128.6	138.2	9.6 meters	Rip/rap
6.	2	RB	196.0	226.5	30.5 meters	132nd Ave culvert
7.	2	LB	196.0	226.5	30.5 meters	132nd Ave culvert
8.	2	LB	254.5	274	19.5 meters	Rip/rap
9.	2	LB	311.4	315.2	3.8 meters	Rip/rap
10.	2	RB	487.1	498.6	11.5 meters	134th Ave culvert
11.	2	LB	487.1	498.6	11.5 meters	134th Ave culvert
12.	2	LB	778.4	786.0	7.6 meters	Gabion weir
13.	2	LB	839	846.1	7.1 meters	Rip/rap
14.	2	LB	870.9	898.5	27.6 meters	Rip/rap
15.	2	LB	1262.7	1274.2	11.5 meters	Rip/rap
16.	2	LB	1281.2	1286.3	5.1 meters	Rip/rap
17.	2	LB	1380.7	1390.2	9.5 meters	CMP discharge
18.	2	RB	1595.7	1637.1	41.4 meters	Old crossing +
19.	2	LB	1595.7	1615.6	19.9 meters	Old crossing +
20.	2	LB	1651.7	1666.7	15.0 meters	Rip/rap
21.	2	RB	1666.7	1725.7	62.5 meters	Hwy 522 culvert
22.	2	LB	1666.7	1725.7	62.5 meters	Hwy 522 culvert
23.	3	RB	0.0	17.1	17.1 meters	Rip/rap deflector
24.	3	LB	135.3	155.4	20.1 meters	Rip/rap - On-ramp

Table 10 continued

#	Reach	Bank	Downstream Station (m)	Upstream Station (m)	Length	Comment
25.	3	LB	267.6	273.1	5.5 meters	Rip/rap - On-ramp
26.	3	RB	277.7	313.6	35.9 meters	Rip/rap - House
27.	3	LB	271.3	313.6	42.3 meters	Rip/Rap - On-ramp
28.	3	RB	313.6	350.2	36.6 meters	NE 195th Street culvert
29.	3	LB	313.6	350.2	36.6 meters	NE 195th Street culvert
30.	3	RB	350.2	396.0	45.8 meters	Old business
31.	3	LB	350.2	396.0	45.8 meters	Old business
32.	3	LB	616.9	634.9	18.0 meters	Hwy 522 edge
33.	3	RB	915.3	1005.5	90.2 meters	Old Bridge + yards
34.	3	LB	915.3	934.5	19.2 meters	Old Bridge
35.	3	LB	1297.5	1308.5	11.0 meters	House

Floodplain Connectivity: The floodplain indicator as defined by the NMFS (1996) includes hydrologic linkage between adjacent off-channel areas, wetlands, and riparian vegetation and succession. This indicator does not specify quantifiable measurements, but relies on subjective inferences of frequently linked, reduced linkage, and severe reduction in linkage. Based on the lack of off-channel habitat, adjacent wetlands, and greater than 10 percent armoring along all three reaches, this indicator is **not properly functioning**.

4.4.6 Riparian Habitat

Riparian habitat is defined as the land adjoining the stream that influences stream habitat and its processes. The composition and quantity of riparian habitat directly influences temperature, sedimentation, productivity, habitat complexity, and the streams disturbance regime. An "intact" riparian zone buffers the stream from outside elements. One issue today is how large does a buffer have to be to protect a stream from anthropogenic influences. A buffer of 30.5 meters (100 feet) is often used for salmonid-bearing streams. However, many researchers have documented that a 30.5-meter (100-foot) buffer is not sufficient in protecting a stream and its processes from all anthropogenic influences, especially when the quality of the existing buffer is low. Some researchers have suggested that if the goal is to truly protect a valuable resource, than buffer width should be at least 100 meters (328 feet). However, this width can be adjusted downward depending on the maturity and overall percentage of the existing riparian habitat. Furthermore, it is also recognized that the composition of the entire watershed plays a vital role in a stream's overall health. On the watershed scale, the percent or fraction of total impervious area has been found to have a direct correlation with a stream's productivity (May et al., 1997).

This report will focus on a linear corridor adjacent to the stream, 61 meters (200 feet) from each bank or 122 meters (400 feet) total width. Site specific conditions within the City of Woodinville based on aerial photographs from 1999 indicate the width of the Little Bear Creek vegetated riparian buffer varies considerably by reach (Appendix G).

The width of the vegetated riparian buffer in Reach 1 averages about 7.6 meters (25 feet) wide and is abutted by development along both banks. The overall 121.9-meter (400-foot) wide corridor

within Reach 1 was composed of 64.36 percent impervious surface, 27.97 percent shrub/grass habitat, 5.11 percent forest habitat, and 2.59 percent gravel area.

The width of the vegetated buffer in Reach 2 varied between the left and right banks. The left bank ranges from 7.6 to 22.9 meters (25 to 75 feet) wide (average width about 7.6 meters [25 feet]) and is abutted by businesses. The right bank ranges from 15.2 to >61 meters (50 to >200 feet) wide (average width about 45.7 meters [150 feet]) and is abutted by Highway 522. The overall 122-meter (400-foot) wide corridor within Reach 2 was composed of 19.38 percent impervious surface, 46.46 percent shrub/grass habitat, 21.63 percent forest habitat, and 12.52 percent gravel area.

The width of the vegetated riparian buffer along both banks of Reach 3 varies from 15.2 to >61 meters (50 to >200 feet). The right bank is relatively unconstrained while the left bank is defined by Highway 522. The overall 122-meter (400-foot) corridor in Reach 3 was composed of 17.12 percent impervious surface, 1.55 percent gravel area, 45.76 percent forested habitat, and 35.56 percent shrub/grass habitat (Table 11).

Table 11:
Land Use Based on 1999 Aerial Photograph
Along Little Bear Creek, Woodinville

Land Use	Reach 1	Reach 2	Reach 3	Total
Developed Impervious	64.36%	19.38%	17.12%	24.05%
Gravel - cleared impervious	2.59%	12.52%	1.55%	6.56%
Forested Habitat	5.11%	21.63%	45.76%	29.94%
Shrub/Grass Habitat	27.97%	46.46%	35.56%	39.45%

Based on the photo interpretation of the 1999 aerial photographs (Appendix G), two trends are apparent. The percentage of developed impervious (developed and gravel [cleared impervious]) surface is significantly higher along the lower reaches while the percentage of forested habitat significantly decreases. The high percentage (12.52 percent) of cleared gravel area along Reach 2 may be an indicator that more development is planned and that the percentage of developed impervious surface will continue to increase within potential buffer habitat.

The remaining riparian buffer and upland forest habitat is of vital importance to the continued functionality of Little Bear Creek. However, the composition of the buffer along Little Bear Creek is varied, and typically dominated by deciduous trees and non-native species of grasses and shrubs. Red alder (*Alnus rubra*), Himalayan blackberry (*Rubus procerus*), bittersweet nightshade (*Solanum dulcamara*), and reed canarygrass (*Phalaris arundinacea*) are abundant throughout Reaches 1 and 2, and the lowermost section of Reach 3. Japanese knotweed (*Polyonum cuspidatum*), another introduced species is also present and locally abundant, but not as widespread as the other aforementioned invasive species.

A continuous 61-meter (200-foot) riparian buffer along each bank composed of mature coniferous forest with numerous adjoining wetlands should be the goal along the Little Bear Creek corridor. Based on our survey results, these target conditions are absent, but scattered sections along the left bank of Reach 3 do possess some of the desired traits.

The remaining buffer is composed of primarily deciduous trees, shrubs, and grasses. A detailed list of the species observed along Little Bear Creek is contained in Tables 12, 13, 14, and 15 below. As mentioned previously, red alder is the most abundant tree species along Little Bear Creek, followed by black cottonwood (*Populus balsamifera*), big-leaf maple (*Acer macrophyllum*), and willow (*Salix* spp). Other species such as Douglas fir and western red-cedar become more prevalent in Reach 3. Two Pacific yew (*Taxus brevifolia*) trees were observed along Reach 2. These are long-lived small conifer trees that were used extensively by native Americans and are a source of the cancer fighting drug taxol. The two observed along Little Bear Creek are remnants from pre-settlement. Once gone, Pacific yews will likely not become reestablished because of the absence of mature coniferous forest.

Table 12:
Tree Composition Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	2, 3.	Vine maple	*Acer circinatum*	Native.
2.	1, 2, 3.	Big-leaf maple	*Acer macrophyllum*	Native.
3.	1, 2, 3.	Red alder	*Alnus rubra*	Native.
4.	2, 3.	Black hawthorne	*Crataegus douglasii*	Native.
5.	1, 3.	Oregon ash	*Fraxinus latifolia*	Native.
6.	1, 2, 3.	Sitka spruce	*Picea sitchensis*	Native.
7.	1	Shore pine	*Pinus contorta*	Native.
8.	1, 2, 3.	Black cottonwood	*Populas balsamifera*	Native.
9.	1, 2, 3.	Bitter cherry	*Prunus emarginata*	Native.
10.	1, 2, 3.	Douglas fir	*Pseudotsuga menziesii*	Native.
11.	2, 3.	Cascara buckthorn	*Rhamnus purshiana*	Native.
12.	1, 2, 3.	Pacific willow	*Salix lasiandra*	Native.
13.	2, 3.	Scouler willow	*Salix scouleriana*	Native.
14.	1, 2, 3.	Sitka willow	*Salix sitchensis*	Native.
15.	2.	Pacific yew	*Taxus brevifolia*	Native.
16.	2, 3.	Western red cedar	*Thuja plicata*	Native.
17.	2, 3.	Western hemlock	*Tsuga heterophylla*	Native.

Shrubs and vines are abundant along Little Bear Creek. The most common along the stream bank include Himalayan blackberry, bittersweet nightshade, and Pacific ninebark (*Physocarpus capitatus*). Others such as Scotch broom (*Cytisus scoparius*) are also abundant, but typically occur beyond the riparian zone, especially within the disturbed areas between Little Bear Creek and Highway 522 along Reaches 2 and 3.

Table 13:
Shrub and Vine Composition Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	1, 2, 3.	Red-twig dogwood	*Cornus sericea*	Native.
2.	2	Beaked hazelnut	*Corylus cornuta*	Native.
3.	1, 2, 3.	Scotch broom	*Cytisus scoparius*	Introduced, invasive.
4.	2	Salal	*Gaultheria shallon*	Native.
5.	3.	Black twinberry	*Lonicera involucrata*	Native.
6.	2, 3.	Indian plum	*Oemieria cerasiformis*	Native.
7.	3.	Devil's club	*Oplopanax horridus*	Native.
8.	1, 2, 3.	Pacific ninebark	*Physocarpus capitatus*	Native.
9.	2, 3.	Sword fern	*Polysticum munitum*	Native.
10.	3.	Stink currant	*Ribes bracteosum*	Native.
11.	2	Wild rose	*Rosa* spp.	Native.
12.	1, 2, 3.	Evergreen blackberry	*Rubus laciniatus*	Introduced, invasive.
13.	2, 3.	Thimble berry	*Rubus parviflorus*	Native.
14.	1, 2, 3.	Himalayan blackberry	*Rubus procera*	Introduced, invasive.
15.	1, 2	Salmonberry	*Rubus spectabilis*	Native.
16.	2, 3.	Trailing blackberry	*Rubus ursinus*	Native.
17.	2	Red elderberry	*Sambucus racemosa*	Native.
18.	2, 3.	Douglas spirea	*Spiraea douglasii*	Native.
19.	3.	Highbush-cranberry	*Viburnum edule*	Native.

Herbs represent the most diverse subset of plants encountered along Little Bear Creek. The most common groups include the grasses and weeds. The herb category also contains the largest percentage of introduced species, many of which are invasive. They typically are the first group of species to colonize disturbed areas and once present are difficult to remove. Some of these species such as reed canarygrass and bittersweet nightshade can be extremely abundant, and have established extensive monocultures within the riparian zone. Others such as purple loosestrife and yellow flag iris are present but sparse.

Table 14:
Herb Composition Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	2	Creeping bentgrass	*Agrostis stolonifera*	Introduced.
2.	3.	Pearly everlasting	*Anaphalis margaritacea*	Native.
3.	1, 2, 3.	Lady fern	*Athyrium felix-femina*	Native.
4.	2, 3.	Canada thistle	*Cirsium arvense*	Introduced, invasive.
5.	3	Poison hemlock	*Conium maculatum*	Introduced.
6.	1, 2, 3.	Morning glory	*Convolvulus arvensis*	Introduced, invasive.
7.	2	Bristly hawksbeard	*Crepis setosa 'Haller'*	Introduced.
8.	2	Orchard grass	*Dactylis glomerata*	Introduced.
9.	2	Bleeding heart	*Dicentra formosa*	Native.
10.	1, 2	Fireweed	*Epilobium* sp.	Introduced.
11.	2	Field horsetail	*Equisetum arvense*	Native.
12.	1, 2	Giant horsetail	*Equisetum telmateia*	Native.

Table 14 continued

#	Reach #	Common Name	Scientific Name	Comment
13.	2	Tall fescue	*Festuca arundinacea*	Introduced.
14.	2, 3.	Bedstraw	*Galium aparine*	Native.
15.	2, 3.	Robert geranium	*Geranium robertianum*	Introduced, invasive.
16.	3.	Big-leaf avens	*Geum macrophyllum*	Native.
17.	1	St. John's-wort	*Hypericum perforatum*	Introduced, invasive, noxious.
18.	1, 2	Yellow touch-me-not	*Impatiens noli-tangere*	Introduced.
19.	1, 2	Yellow-flag iris	*Iris pseudacorus*	Introduced, invasive.
20.	1, 2,	Soft rush	*Juncus effusus*	Native.
21.	2	Daggerleaf rush	*Juncus ensifolius*	Native.
22.	3	Duck weed	*Lemna minor*	Native.
23.	2, 3.	Birdsfoot trefoil	*Lotus corniculatus*	Introduced, invasive.
24.	3	Skunk cabbage	*Lysichitum americanum*	Native.
25.	2, 3.	Purple loosestrife	*Lythrum salicaria*	Introduced, invasive.
26.	2	False lily-of-the-valley	*Maianthemum dilatatum*	Native.
27.	2, 3.	Small water forget-me-not	*Myosotis laxa*	Native.
28.	2	Common evening primrose	*Oenothera biennis*	Introduced – N.E. USA.
29.	1, 2, 3.	Reed canarygrass	*Phalaris arundinacea*	Introduced, invasive.
30.	1	English plantain	*Plantago major*	Introduced.
31.	1, 2, 3.	Japanese knotweed	*Polygonum cuspidatum*	Introduced, invasive.
32.	2, 3.	Bracken fern	*Pteridium aquilinum*	Native.
33.	2, 3.	Creeping buttercup	*Ranunculus repens*	Introduced, invasive.
34.	2	Water cress	*Rorippa nasturtium-aquaticum*	Introduced.
35.	2	Red sorrel	*Rumex acetosella*	Introduced.
36.	2, 3.	Curly dock	*Rumex crispus*	Introduced.
37.	2, 3.	Bitter dock	*Rumex obtusifolius*	Introduced.
38.	1, 2, 3.	Small-fruited bulrush	*Scirpus microcarpus*	Native.
39.	1, 2, 3.	Bittersweet nightshade	*Solanum dulcamara*	Introduced, invasive.
40.	2, 3.	Hedge nettle	*Stachys cooleyae*	Native.
41.	1	Tansy	*Tanacetum vulgare*	Introduced, invasive.
42.	1	Dandelion	*Taraxacum officinale*	Introduced, invasive.
43.	2, 3.	Piggy-back plant	*Tolmeia menziesii*	Native.
44.	2	White clover	*Trifolium repens*	Introduced.
45.	2, 3.	Stinging nettle	*Urtica dioica*	Introduced.

Ornamentals represent introduced species that were typically planted in private yards or businesses. They are usually not invasive, except for English ivy (*Hedera helix*), which can choke trees. Most do not represent a threat and are unable to naturally propagate. Others such as English holly (*Liex aquifolium*) are distributed by bird droppings, but are not problematic.

Table 15:
Ornamental Composition Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	3	Norway maple	*Acer platanoides*	Introduced.
2.	3	Red maple	*Acer rubrum*	Introduced.
3.	1	Butterfly bush	*Buddleia davidii*	Introduced.
4.	3	Parneyi cotoneaster	*Cotoneaster lacteus*	Introduced.
5.	3	Crocosmia	*Crocosmia* sp.	Introduced.
6.	1	Buning bush	*Euonymus alaalatus*	Introduced.
7.	1, 2	English ivy	*Hedera helix*	Introduced, invasive.
8.	3	Blue star juniper	*Juniperus squamata*	Introduced.
9.	2	English holly	*Liex aquifolium*	Introduced.
10.	1	Apple fruit tree	*Malus* sp.	Introduced.
11.	1	Scotch pine	*Pinus sylvestris*	Introduced.
12.	3	Thundercloud plum tree	*Prunus cerasifera*	Introduced.
13.	1	Otto-luyken laurel	*Prunus laurocerasus*	Introduced.
14.	1	Plum fruit tree	*Prunus* sp.	Introduced.
15.	3	Flowering cherry tree	*Prunus* sp.	Introduced.
16.	1	Rhododendron species	*Rhododendron* sp.	Introduced.
17.	1, 2, 3.	Locust tree	*Robinia* sp.	Introduced.
18.	1	Weeping willow	*Salix babylonica*	Introduced.
19.	2	European mountain ash	*Sorbus acuparia*	Introduced.

The NMFS (1996) indicator for riparian reserves includes several factors that must be assessed in order to determine its existing state. These factors include: adequate shade, large woody debris recruitment, habitat protection, connectivity, and percent similarity of riparian vegetation to the potential natural community/composition. The functionality of the riparian reserve decreases as loss and fragmentation increase, and as the percent similarity of the existing riparian vegetation to the potential natural community/composition drops from >50 percent (*properly functioning*), to 25 percent to 50 percent (*at risk*), and finally <25 percent (*not properly functioning*). The percent "intact" can also be quantified in that >80 percent is considered *properly functioning*, 70 percent to 80 percent is considered *at risk*, and <70 percent is considered *not properly functioning*. Based on the analysis of aerial photographs, ground truthing, and detailed stream survey, the results indicate the riparian reserves vary by reach.

The riparian reserve in Reach 1 is **not properly functioning** due to only 5.11 percent being forested habitat within the 122-meter (400-foot) wide corridor. Furthermore, the limited amount of riparian reserves along Reach 1 are dominated by deciduous trees and introduced invasive species.

The functionality of the riparian reserve in Reach 2 is not as clear as Reach 1. Although the percent forested increased to 21.63 percent, it is also composed of primarily deciduous trees, introduced invasive species are abundant, and shrubs and grasses (46.46 percent) dominate large tracts. The riparian reserve in this reach is also confined between Highway 522 to the west and commercial businesses to the east. Furthermore, the ability of the reserve to provide large woody debris and

adequate shading has been extremely compromised. Therefore, based on these facts, the riparian reserve in Reach 2 is also **not properly functioning**.

The functionality of the riparian reserve in Reach 3 increases as the percent forested habitat increased to 45.76 percent, and overall shading increased (except immediately upstream of NE 195th Street). Although the potential for future large woody debris recruitment is still unacceptably low, and much of the forest has a high deciduous component, conifers become much more prevalent. Because of these factors, the riparian reserve is considered **at risk** in Reach 3.

The overall rating for the riparian reserve in Little Bear Creek as it flows through the City of Woodinville is considered **not properly functioning**. Although conditions improve in the upper reaches, the overall dominance of deciduous trees, poor potential for future large woody debris recruitment and lack of shade in Reaches 1 and 2 indicate that overall the riparian reserve is **not properly functioning**.

4.4.7 Water Quality

The NMFS (1996) considers temperature, sediment, and chemical contamination/nutrients in their Matrix of Diagnostics/Pathways and Indicators criteria. Of these, sediment was previously discussed in Section 4.4.3, Substrate.

Temperature: Water temperature is a key factor controlling the ability of salmonids to survive in a stream. It will also influence species composition in that some species such as bull trout require exceptionally colder water to successfully reproduce. Water temperatures rising above a 7-day average maximum of 7.8°C (46°F) is reported to limit spawning and rearing success of bull trout.

The following temperatures are average 7-day maximums. The NMFS (1996) considers 10 to 13.9°C (50 to 57°F) or less to be *properly functioning*. At risk temperatures depend on time of year or life cycle (spawning or migration and rearing). Water temperature is considered *at risk* for spawning adults when between 13.9 to 15.6°C (57 to 60°F), and for migration and rearing when 13.9 to 17.8°C (57 to 64°F). Stream temperatures above 15.6°C (>60°F) for spawning and above 17.8°C (>64°F) for migration and rearing are considered *not properly functioning*. The Washington State Department of Ecology reported that temperatures from 21 to 22°C (69.8 to 71.6°F) are lethal to chinook salmon while temperatures from 20 to 21°C (68 to 69.8°F) create thermal barriers (Hicks, 2000 as reported by Kerwin, 2001).

DEA biologists monitored two Hobo temperature data loggers in Little Bear Creek between June 16 and October 17, 2001 (4 months). The lowermost data logger was installed near the mouth of Little Bear Creek while the uppermost was installed downstream of NE 205th Street crossing near the King/Snohomish County line. Each data logger was set to collect hourly readings. The City of Woodinville is continuing the monitoring effort beyond the period of analysis documented in this report (Monzaki, personal communication, 2001).

Table 16 below presents the consolidated stream temperature data in the NMFS 7-day average maximum temperature format for Little Bear Creek from June 16 through October 17, 2001. Juvenile

life cycle data is for chinook salmon as defined by Kerwin (2001) as adapted by Myers et al., 1998. The outmigration period lasts from early March through late July, peaking in June. Adult migration and spawning life cycle data was determined by reviewing the WDFW salmon spawning ground survey data from 1952 through 2000. The earliest observation of an adult chinook in Little Bear Creek occurred on September 29 while the latest live sighting occurred on November 5th, peaking in October. Although this analysis is focused on chinook salmon it is important to note that some species such as juvenile coho salmon, resident cutthroat trout, coastrange sculpins, and western brook lampreys are present in Little Bear Creek throughout the year.

Table 16:
7-day Average Maximum Stream Temperatures for Little Bear Creek, Woodinville

Week	Reach 1 Mouth	Reach 3 205th	Chinook Salmon Life Cycle	NMFS Indicator Status
6/16 – 6/22	15.3°C	14.9°C	Peak Juvenile Migration and Rearing	At Risk
6/23 – 6/29	14.8°C	14.5°C	Peak Juvenile Migration and Rearing	At Risk
6/30 – 7/6	16.4°C	16.1°C	Peak Juvenile Migration and Rearing	Not Properly Functioning
7/7 – 7/13	17.0°C	16.6°C	Juvenile Migration and Rearing	Not Properly Functioning
7/14 – 7/20	15.1°C	14.7°C	Juvenile Migration and Rearing – Adults in Lake Wa.	At Risk
7/21 – 7/27	16.1°C	15.6°C	Juvenile Migration and Rearing – Adults in Lake Wa.	Not Properly Functioning
7/28 – 8/3	15.0°C	14.7°C	Juvenile Migration and Rearing – Adults in Lake Wa.	At Risk
8/4 – 8/10	16.8°C	16.3°C	Juvenile Chinook now absent – Adults in Lake Wa.	Not Properly Functioning
8/11 – 8/17	17.2°C	16.5°C	Adults in Lake Washington	Not Properly Functioning
8/18 – 8/24	15.6°C	15.0°C	Adults in Lake Washington	Not Properly Functioning/At Risk
8/25 – 8/31	16.3°C	15.8°C	Adults in Lake Washington	Not Properly Functioning
9/1 – 9/7	14.8°C	14.4°C	Adults in Lake Washington	At Risk
9/8 – 9/14	14.7°C	14.2°C	Adults in Lake Washington	At Risk
9/15 – 9/21	13.7°C	13.3°C	Adults possibly present in Little Bear Creek	High-end of Properly Functioning
9/22 – 9/28	13.7°C	13.1°C	Adult Chinook likely present Little Bear Creek	High-end of Properly Functioning
9/29 – 10/5	12.0°C	11.6°C	Adult Chinook present – spawning in Little Bear Creek	Properly Functioning
10/6 – 10/12	11.1°C	10.6°C	Adult Chinook present – spawning in Little Bear Creek	Properly Functioning
10/13 – 10/17	11.0°C	10.6°C	Adult Chinook present – spawning in Little Bear Creek	Properly Functioning

Notes: *Properly Functioning* = 10 to 13.9° C.
At Risk = 13.9 to 15.6° C for migrating adults, and 13.9 to 17.8° C for migration and rearing.
Not Properly Functioning = >15.6° C for spawning, and >17.8° C for migration and rearing.

Based on the stream temperature data collected by DEA between June 16, through October 17, 2001, this parameter ranges from **at risk** to **not properly functioning** during juvenile migration and rearing, and **properly functioning** during adult migration and spawning. However, between September 15, 2001, through September 28, 2001, temperatures were at the upper end of **properly functioning** and will likely shift to **at risk** during warmer years.

The stream temperature data collected during this study is presented in Appendix P (Reach 1) and Appendix Q (Reach 3). It is interesting to note that daily stream temperatures fluctuated from 0.46 to 4.68 degrees and that on average, Reach 1 was approximately 0.4 degree warmer than Reach 3. The greatest daily fluctuations "typically" occurred on days when the maximum hourly temperature

was higher than average, and as stream temperature decreased so did the degree of fluctuation. Stream temperature was typically the coolest from 0700 to 0900 hours, and warmest from 1600 to 1800 hours. However, these "typical" time periods would shift substantially during cooling events. The highest hourly stream temperature reading occurred in Reach 1 measuring 18.16°C (64.69°F) for a 1-hour period between 1700 and 1800 hours on August 12, 2001.

Stream temperature data collected by Snohomish County Public Works – Surface Water Management (SWM) in the upper reaches of Little Bear Creek reported only one monthly measurement above 16°C (60.8°F) (SWM, 2000). However, these were spot checks during water quality sampling events utilizing hand held thermometers, and likely occurred prior to the daily peak. Snohomish County also reported that mean fecal coliform levels have violated Class AA standards, nitrate levels are some of the highest in the county, and dissolved oxygen levels violated standards about 8 percent of the time (SWM, 2000). Furthermore, the SWM reported that sediment samples collected near the mouth contained chromium, copper, lead, nickel, and zinc, although exact levels were not reported (SWM, 2000). Some of the peak water quality measurements during the year 2000 include 8,600 colonies/100 mL for fecal coliform, 0.00812 mg/L for copper, 0.000624 mg/L for lead, and 0.00691 mg/L for zinc collected on July 12, 2000 near the headwaters of Little Bear Creek (Thornburgh, personal communication, 2001).

Water quality data is collected by King County in Little Bear Creek at Station No. 0478 located in Reach 1 near the mouth. Stream temperature data collected by King County from 1990 through 1993 ranged from a low of 1.0°C (33.8°F) on February 16, 1993, to a high of 16.2°C (61.2°F) on July 20, 1992 (King County, 1994). Dissolved oxygen levels were generally good, with a low of 9.2 mg/L on August 19, 1991, when the stream temperature was 16.0°C (60.8°F), and a high of 14 mg/L on a couple of dates during the winter when stream temperatures were extremely low at 1.0 to 1.5°C (33.8 to 34.7°F). There is an inverse relationship of stream temperature and dissolved oxygen in that as stream temperature increases dissolved oxygen decreases.

Additional parameters analyzed by King County indicate turbidity fluctuates widely from 0.3 to 42 nephelometric turbidity units (NTU). The highest measurements recorded for various parameters were pH = 8.30, turbidity = 42.0 NTUs, suspended solids = 87.00 mg/L, fecal coliform = 1,700 organisms/100mL, nitrate + nitrite = 1.600 mg/L, ortho-phosphorus = 0.190 mg/L, and total phosphorus = 0.570 mg/L. Stormwater metal levels were below detection levels for cadmium, lead, and nickel, but averaged 0.006 mg/L copper, and 0.023 mg/L zinc (King County, 1994). Levels of copper and zinc in Little Bear Creek were higher than in Swamp, North, Bear-Evans, Issaquah, and Tibbetts creeks.

Chemical Contamination/Nutrients: The NMFS (1996) reports that for the chemical contamination/nutrients indicator, a *properly functioning* stream has low levels of chemical contamination from agricultural, industrial, and other sources, no excess nutrients, and no Clean Water Act (CWA) 303d designated reaches. An *at risk* stream has moderate levels of chemical contamination from agricultural, industrial, and other sources, some excess nutrients, and one CWA 303d designated reach. A *not properly functioning* stream contains high levels of chemical contamination, high levels of excess nutrients, and more than one Clean Water Act 303d designated reach. The Washington Department of Ecology has reported that Little Bear Creek does not support designated uses, and contains three 303(d) listed stream reaches due to elevated fecal

coliform levels (Kerwin, 2001). Furthermore, a recent King County small streams toxicity/pesticide study indicates a variety of pesticides are present in Little Bear Creek at levels high enough to be "toxic" to test species (Kerwin, 2001). Based on the data presented by Kerwin (2001), and reports by SWM (2000) and King County (1994), the water quality pathway and associated chemical contamination/nutrients are **not properly functioning** in Little Bear Creek.

Additional Water Quality Data: Water quality data was collected in the field with a Horiba U-10 water quality meter during this survey. The goal was to document change by reach, and compare Little Bear Creek with the Sammamish River utilizing data collected on the same day. Based on this effort, the following data in Table 17 is presented. On September 25, 2001, pH, turbidity, and dissolved oxygen levels were noticeably lower in the Sammamish River, while temperature was elevated (Table 17). Based on the results, water quality is generally better in Little Bear Creek than in the Sammamish River due to lower water temperature and higher dissolved oxygen levels in Little Bear Creek. Within Little Bear Creek, conductivity and turbidity increased, and temperature decreased from Reach 1 to 3. Dissolved oxygen and pH fluctuated little between reaches.

Table 17:
Water Quality Data on 9/25/01 for Little Bear Creek, Woodinville

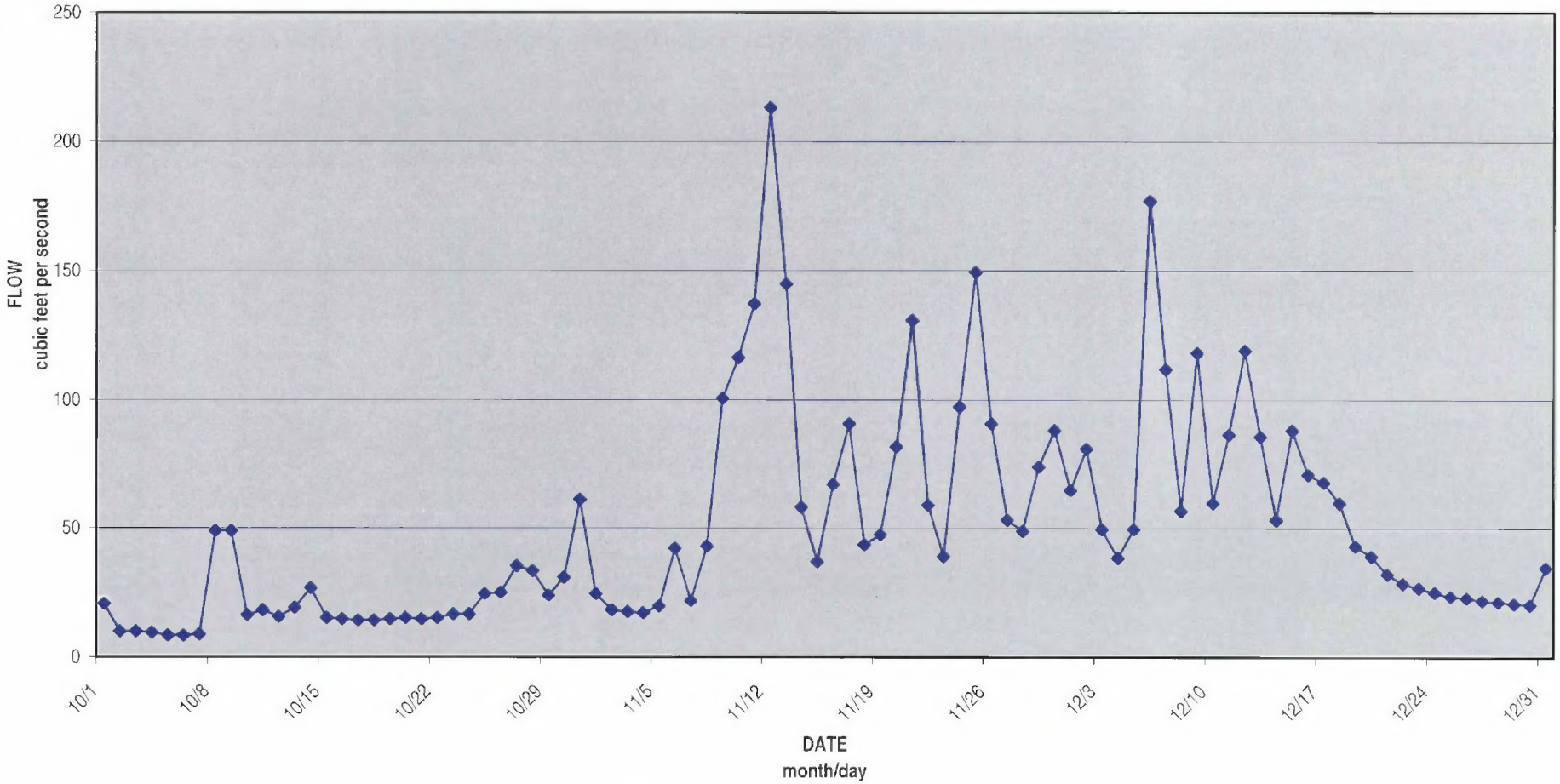
#	Parameter	Sammamish River	Reach 1 Mouth	Reach 2 134th	Reach 3 205th
1.	pH	6.85	7.70	7.89	7.72
2.	Conductivity (mS/cm)	0.145	0.144	0.147	0.148
3.	Temperature (C)	16.0	13.2	13.3	13.0
4.	Turbidity (NTU)	1	7	10	12
5.	Dissolved oxygen (mg/L)	6.90	9.40	8.65	8.95

4.4.8 Flow/Hydrology

The flow/hydrology pathway contains two indicators: change in peak/base flow and increase in drainage network. Increased urbanization results in increased flood frequency and streamflow variability (May et al., 1997). The result is that flow levels change frequently and extreme flow events occur more often. This condition is exasperated by an increase in the drainage network. Elements of the drainage network include ditches, road crossings, and stormwater outfalls. The overall result is that rainwater reaches the stream channel exponentially faster then what would occur naturally.

Peak/Base Flow: The NMFS (1996) Matrix of Diagnostics/Pathways and Indicators utilizes watershed hydrographs to document changes in peak/base flow. A *properly functioning* stream's hydrograph would indicate peak, base, and flow timing is comparable to a similar undisturbed watershed. An *at risk* stream shows some evidence of change. A *not properly functioning* stream's hydrograph indicates pronounced change in peak, base, and flow timing. Based on the following hydrographs (Figures 5a through 5c), the peak/base flow indicator is **at risk** due to evidence of change when compared with hydrographs from minimally disturbed watersheds.

Figure 5a: 1999 Hydrograph, October through December
Little Bear Creek



o:/project/w/wood0000-0010/0500 deliverables/Figure 5a 5b 5c.xls/5a, 1999

Figure 5b: 2000 Hydrograph, January through December
Little Bear Creek

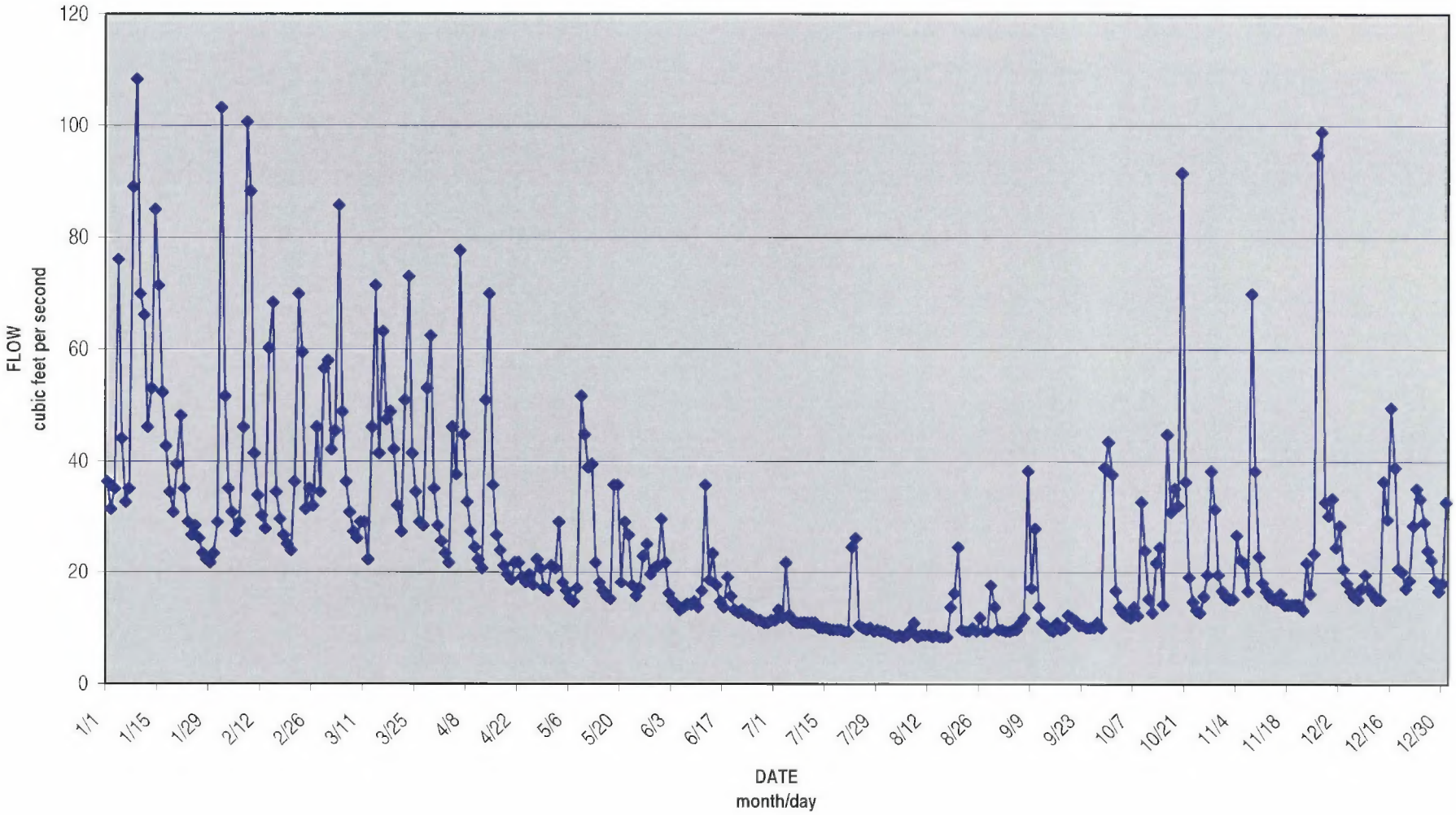
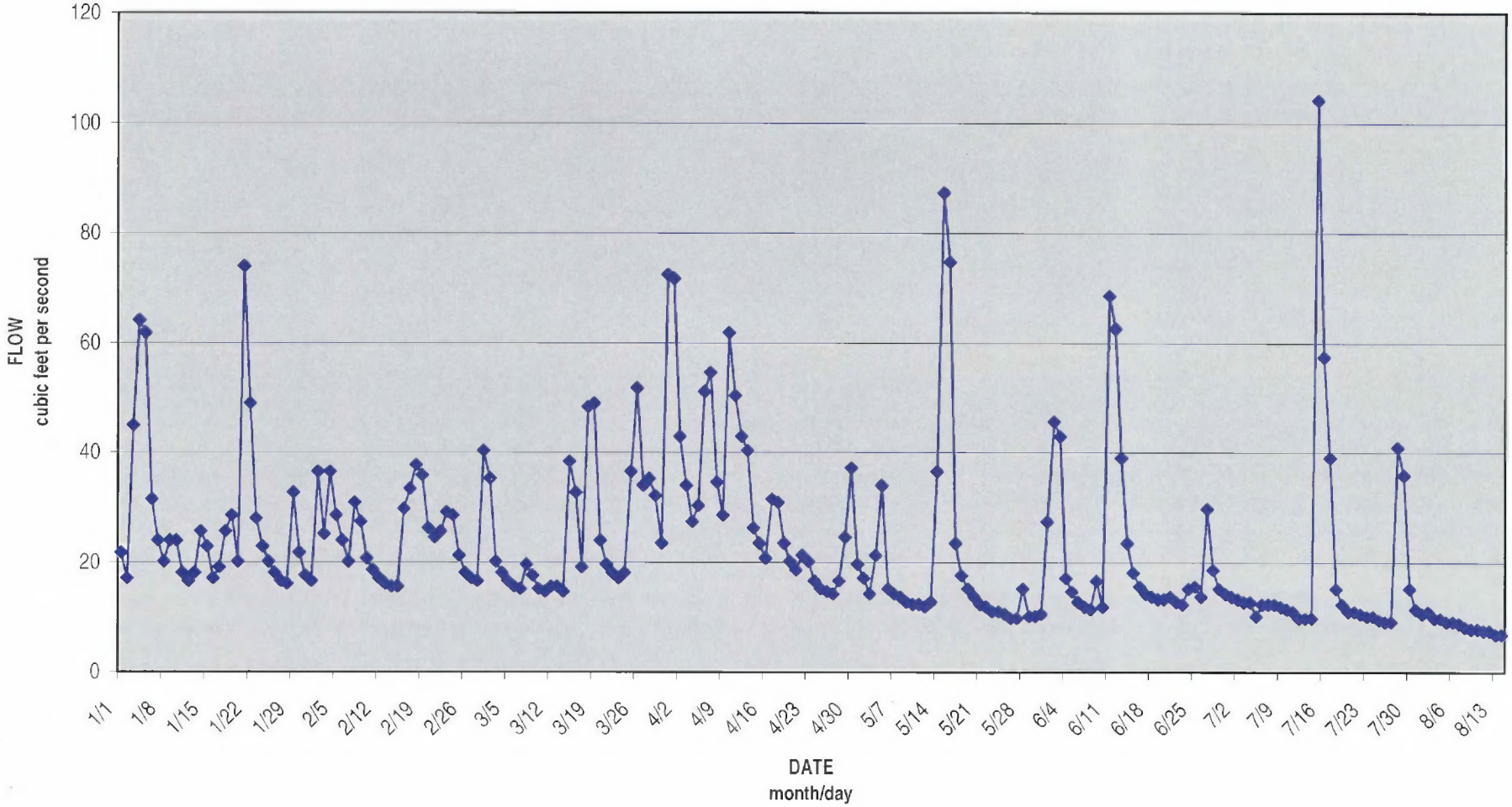


Figure 5c: 2001 Hydrograph, January through August
Little Bear Creek



Increase in Drainage Network: The NMFS (1996) Matrix of Diagnostics/Pathways and Indicators utilizes an increase in drainage network to document change. A *properly functioning* stream will have zero or minimum increases in drainage network due to roads. An *at risk* stream will have a moderate increase in drainage density due to roads (e.g., 5 percent). A *not properly functioning* stream will have a significant increase in the drainage network due to roads (e.g., 20 to 25 percent).

The percentage of total impervious surface has increased to about 37 percent and road density to 5.9 kilometers per square kilometer (km/km^2) (2.28 mi/mi^2) in the past 12 years (Purser and Simmonds, Snohomish County Surface Water Management, unpublished data as reported by Kerwin, 2001). Based on these changes, the increase in drainage network indicator is **not properly functioning**.

4.4.9 Watershed Conditions

The watershed conditions pathway is gauged by three indicators: road density and location, disturbance history, and riparian reserves. Riparian habitat was documented above in Section 4.4.6 – Riparian Habitat.

Road Density and Location: The NMFS (as modified by the Mt. Baker Snoqualmie National Forest) has quantified parameters to rank the degree of road density and location within their Matrix of Diagnostics/Pathways and Indicators (Appendix L-2). Based on their criteria, a *properly functioning* watershed contains less than 1.61 km/km^2 (<1 mi/mi^2) of roads and no valley bottom roads. An *at risk* watershed contains 1.61 to 3.86 km/km^2 (1 to 2.4 mi/mi^2) of roads with some valley bottom roads. A *not properly functioning* watershed contains >3.86 km/km^2 of roads (>2.4 mi/mi^2), and many valley bottom roads.

May et al. (1997) documented numerous watershed characteristics based on aerial photographs from 1989. At that time, the percent total impervious surface in the Little Bear Creek Basin was 13.8 percent and the road density was 4.9 km/km^2 (1.90 mi/mi^2). They reported that the basin was composed of 43 percent undeveloped forest, 12 percent undeveloped open land, 32 percent rural residential land, 6 percent suburban residential land, 2 percent urban residential land, and 7 percent commercial industrial land. This equates to a total of 57 percent of the land being developed to some degree at that time.

During the past 12 years, the percentage of total impervious surface has increased to about 37 percent and road density to 5.9 km/km^2 (2.28 mi/mi^2) (Purser and Simmonds, Snohomish County Surface Water Management, unpublished data – as reported by Kerwin, 2001). Based on these changes, the NMFS watershed condition indicators for road density is **not properly functioning**. During this period, the amount of undeveloped forest has only dropped to 40 percent. This indicates that the majority of new impervious surface since 1989 has been established in the previously undeveloped open land and rural residential land.

Disturbance History: The NMFS (1996) defines a *properly functioning* watershed as containing <15 percent equivalent clear-cut acres (ECA) within the entire watershed with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian areas. Additional parameters specific for the Northwest Forest Plan do not apply. An *at risk* watershed

also contains <15 percent ECA within the watershed, but disturbance is concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian areas. A *not properly functioning* watershed contains >15 percent ECA and disturbance is concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian areas.

This indicator is difficult to judge based on the NMFS (1996) criteria and may be more applicable to watersheds outside the Puget Sound lowlands due to the extensive amount of development within this region. The ECA concept appears to be applicable in watersheds where logging is the dominant land use. Instead, DEA proposes to utilize the Urban Stream Rehabilitation guideline presented by May (1996) that ranks a stream based on percent total impervious area (percent TIA). This system results in a ranking of natural (percent TIA < 5 percent), impacted (percent TIA 10 to 30 percent), degraded (percent TIA 30 percent to 40 percent), and non-supporting (percent TIA >45 percent). Therefore, DEA equated natural to *properly functioning*, impacted to *at risk*, and degraded and non-supporting to *not properly functioning*. The location of the disturbance can also be factored into the formula.

Since about 37 percent of the watershed is impervious, and much of the riparian zone in the lower reaches has been developed, this watershed appears to be degraded. Therefore, the disturbance history indicator is **not properly functioning**. This is especially apparent when reviewing the rate of increase in new impervious area from 1989 to present.

4.4.10 Habitat Access

The Habitat Access Pathway includes the Physical Barriers Indicator. The NMFS (1996) states that a *properly functioning* stream with man-made barriers allows upstream and downstream fish passage during all flows. An *at risk* stream with man-made barriers does not allow upstream and/or downstream passage at base/low flow. A *not properly functioning* stream with man-made barriers does not allow upstream and/or downstream fish passage during a wide range of flows.

The Adopt-A-Stream Foundation conducted a Washington State Department of Transportation (WSDOT) Level A assessment of 88 culverts that posed potential fish passage barriers throughout the Little Bear Creek watershed (Adopt-A-Stream, unpublished data as reported by Kerwin, 2001). They concluded that only 8 of these culverts were fully passable during winter and spring flow conditions. The remaining 80 culverts posed at least partial barriers during this high flow period. The 8 culverts that were fully passable during high flows could also pose fish passage barriers during lower flows. Although this may seem dire, adult salmon are not usually present during peak flow periods in the early winter and spring time period, and "most" juvenile salmonids are migrating downstream during the spring. Therefore, this condition may primarily impact resident trout and juvenile coho salmon. This conclusion does not negate the need to continue basin wide removal of restrictive culverts, or the conversion of round culverts to larger bottomless culverts and bridges.

Habitat Access is not a major limiting factor along the mainstem of Little Bear Creek as it flows through the City of Woodinville. Potentially restrictive road crossings containing culverts within the City of Woodinville include SR 202, 132nd Avenue NE, 134th Avenue NE, Highway 522, NE 195th Street, and NE 205th Street. The crossing at NE 178th Street is considered passable to all life stages regardless of flow. All crossings within the City of Woodinville are passable to adult salmonids during the late summer and early fall. All of these crossings are also passable to juveniles with the possible exception of NE 205th Street which likely restricts upstream movement

by juveniles. It is likely that during peak flows that occur during the winter and spring, juvenile upstream passage is further restricted by all the aforementioned culverts. The primary issue is shear velocity due to the funneling effect of the culverts along the mainstem, and loss of three tributaries as the result of extensive culverting at their interface with Little Bear Creek in Reach 2 (Figure 3). Based on these conclusions, the physical barrier indicator within the City of Woodinville is **at risk**, but could become **properly functioning** as existing culverts are replaced with bridges, removed, or retrofitted to improve upstream passage for juvenile salmonids.

4.5 WILDLIFE

Biologists recorded bird, mammal, reptile, and amphibian species along Little Bear Creek both during surveys and incidentally during other site visits. Additional species to those observed likely use the area but remain undocumented by this study, as field visits were limited to spring and summer of a single year. A list of additional wildlife species that could potentially be present along the Little Bear Creek corridor but were not documented during these surveys is included in Appendix S.

4.5.1 Bird Observations

Thirty-nine bird species were observed along Little Bear Creek during site visits and surveys (Table 18). The majority of these species likely breed in the area, as most males were observed singing during the breeding season. One species, willow flycatcher (*Empidonax traillii*), is a federally designated species-of-concern. Five singing males were identified on three survey plots. The WDFW Priority Habitat and Species (PHS) program classifies great blue heron rookeries as vulnerable aggregations (Criterion 2) and are protected. Although no rookeries are documented within 2 miles of the corridor (WDFW, 2001b), suitable foraging habitat exists within the creek and adjacent wetlands, and biologists observed one individual during stream surveys.

Table 18:
Bird Observations Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	S Rank	Comment
1.	2, 3	Mallard	*Anas platyrhynchos*	S5B	
2.	2, 3	Great blue heron	*Ardea herodias*	S4S5	
3.	1, 2, 3	Cedar waxwing	*Bombycilla cedrorum*	S4N	NMBS*
4.	1, 2	Canada goose	*Branta canadensis*	S5B	
5.	2, 3	Red-tailed hawk	*Buteo jamaicensis*	S5B	
6.	3	Pine siskin	*Carduelis pinus*	S5B	
7.	1, 2, 3	American goldfinch	*Carduelis tristis*	S5B	
8.	1, 2, 3	House finch	*Carpodacus mexicanus*	S5	
9.	3	Swainson's thrush	*Catharus ustulatus*	S5B	NMBS
10.	1, 2, 3	Belted kingfisher	*Ceryle alcyon*	S5	NMBS
11.	1, 2	Killdeer	*Charadrius vociferus*	S5B	
12.	2, 3	Northern flicker	*Colaptes auratus*	S5	
13.	1, 2, 3	American crow	*Corvus brachyrhynchos*	S5	
14.	2, 3	Steller's jay	*Cyanocitta stelleri*	S5	
15.	2, 3	Willow flycatcher	*Empidonax traillii*	S5B	NMBS; Federal Species of Concern.
16.	3	Brewer's blackbird	*Euphagus cyanocephalus*	S5	
17.	3	Dark-eyed junco	*Junco hyemalis oreganus*	S5B	
18.	1	California gull	*Larus californicus*	S4B	Flying over creek.
19.	1, 2, 3	Song sparrow	*Melospiza melodia*	S5B	

Table 18 continued

#	Reach #	Common Name	Scientific Name	S Rank	Comment
20.	1, 2, 3	Brown-headed cowbird	*Molothrus ater*	S4N	
21.	1	House sparrow	*Passer domesticus*	SE	
22.	2, 3	Black-headed grosbeak	*Pheucticus melanocephalus*	S5B	NMBS
23.	1, 3	Downy woodpecker	*Picoides pubescens*	S5	
24.	3	Hairy woodpecker	*Picoides villosus*	S4S5	
25.	2, 3	Spotted towhee	*Pipilo erythrophthalmus*	S5B	Nest observed in Reach 3.
26.	1, 2, 3	Black-capped chickadee	*Poecile atricapilla*	S5	Nest observed in Reach 2.
27.	2, 3	Chestnut-backed chickadee	*Poecile rufescens*	S5	
28.	1, 2, 3	Bushtit	*Psaltriparus minimus*	S5	Nest observed in Reach 3.
29.	3	Golden-crowned kinglet	*Regulus satrapa*	S5B	NMBS
30.	3	Red-breasted sapsucker	*Sphyrapicus ruber*	S4S5	
31.	1, 2, 3	European starling	*Sturnus vulgaris*	SE	Nest observed in Reach 2.
32.	1, 2, 3	Violet-green swallow	*Tachycineta thalassina*	S5B	NMBS
33.	1, 2, 3	Bewick's wren	*Thryomanes bewickii*	S5	
34.	1, 2, 3	American robin	*Turdus migratorius*	S5B	
35.	3	Warbling vireo	*Vireo gilvus*	S5B	NMBS
36.	3	Hutton's vireo	*Vireo huttoni*	S5	
37.	2, 3	Wilson's warbler	*Wilsonia pusilla*	S5B	NMBS
38.	1	Mourning dove	*Zenaidura macroura*	S5B	NMBS
39.	1, 2, 3	White-crowned sparrow	*Zonotrichia leucophrys*	S5B	NMBS

*NMBS = neotropical migrant bird species

The WDFW PHS program maintains a list of species for which it has occurrence and status information. A global rank (GRank) describes the species' relative rarity or endangerment worldwide, and a state rank (SRank) describes the status within Washington State. Most bird species observed in the study area have a GRank of G5, which signifies that they are demonstrably secure globally. Most species have an SRank of S5 or S4 (Table 18), defining them as "demonstrably secure in state" or "apparently secure, with many occurrences", respectively. SRanks may include the qualifiers "B" and "N", which indicate breeding and nonbreeding status, respectively, of migrant species. The breeding status of these species may differ greatly from their nonbreeding status in the state. SE indicates an established exotic species. Two codes for any one species indicates an intermediate rank.

Eleven of the species recorded along Little Bear Creek are neotropical migrant bird species. Neotropical migrants breed in North America and winter in Mexico, Central America, the Caribbean, and South America. The publication of results from long-term survey programs confirms that populations of many neotropical migrants are declining, in some cases precipitously. Habitat loss and related problems are key issues in the causes of the declines. Therefore, these species may be of interest, particularly if they are breeding in the area. The area could potentially provide breeding habitat for several of these species, including Swainson's thrush, black-headed grosbeak, willow flycatcher, warbling vireo, Wilson's warbler, mourning dove, and white-crowned sparrow (Table 18). In addition, neotropical migrant species not detected during surveys and field visits may use the corridor (Appendix S).

4.5.2 Mammal Observations

Biologists documented ten mammal species in the Little Bear Creek corridor (Table 19). None of the species observed have federal or state special status. Other mammal species that may utilize the corridor include mink (*Mustela vison*), striped skunk (*Mephitis mephitis*), and coyote (*Canis latrans*). Appendix S contains a complete list of mammals that could potentially be present based on habitat types and historic range.

Table 19:
Mammal Observations Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	2	Beaver	*Castor canadensis*	Chewed shrubs and trails.
2.	3	Opossum	*Didelphis marsupialis*	Introduced, dead in stream.
3.	3	River otter	*Lutra canadensis*	Tracks, scat, and eaten salmon.
4.	2	Longtail weasel	*Mustela frenata*	Crossing stream on log.
5.	1, 2, 3	Myotis bat	*Myotis* spp.	
6.	2, 3	Black-tailed deer	*Odocoileus heminonus columbianus*	Tracks along stream bank; pellets.
7.	2, 3	Raccoon	*Procyon lotor*	Tracks along stream bank.
8.	2	Norway rat	*Rattus norvegicus*	Introduced.
9.	2, 3	Eastern gray squirrel	*Sciurus carolinensis*	Introduced.
10.	1, 2	Eastern cottontail	*Sylvilagus floridanus*	Introduced, dead young in nest (Reach 2).

4.5.3 Reptile and Amphibian Observations

Four reptile and amphibian species were observed in and along Little Bear Creek during field visits and surveys (Table 20). None of the species have state or federal special status. Other reptiles and amphibians not documented during this survey that could potentially be present along the Little Bear Creek corridor include: northern alligator lizard (*Elgaria coerulea*), painted turtle (*Chrysemys picta*), red eared slider (*Trachemys scripta*), common garter snake (*Thamnophis sirtalis*), western terrestrial garter snake (*Thamnophis elegans*), long-toed salamander (*Ambystoma macrodactylum*), rough-skinned newt (*Taricha granulosa*), western red-backed salamander (*Plethodon vehiculum*), ensatina (*Ensatina eschscholtzii*), western toad (*Bufo boreas*), and red-legged frog (*Rana aurora*). Both species of turtles were included due to the close proximity of several lakes to the study area.

Table 20:
Amphibian and Reptile Observations Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	3	Pacific Tree frog	*Hyla regilla*	3 in wetland near reach end.
2.	2	Bull frog	*Rana catesbeiana*	Introduced species captured next to stream.
3.	Tributary D	Northwestern salamander	*Ambystoma gracile*	Larva in small tributary.
4.	3	Northwestern garter snake	*Thamnophis ordinoides*	Near barricades at NE 195th.

4.5.4 Wildlife Habitat

Habitat in the Little Bear Creek corridor consists of wetlands, uplands, and a riparian zone. Vegetative composition in the riparian zone is discussed in detail in Section 4.4.6, Riparian Habitat. Wetland habitats include mixed forest, young deciduous, and scrub/shrub wetlands. Upland

habitats include second- and third-growth mixed forest, young alder, shrub, and open grassy areas. Exotic and invasive plant species occur both as infestations and in small, scattered clusters.

Most of the corridor in Reach 1 is disturbed shrub, dominated by Himalayan blackberry, red alder saplings, and Scotch broom. Approximately 5.1 percent of the corridor along Reach 1 consists of forested riparian habitat. An area of non-native planted species occurs in the developed area between 130th Avenue NE and NE 178th Street. The corridor is relatively narrow along this reach and provides limited wildlife habitat, although the mouth of the creek adjoins more heavily vegetated habitat along the Sammamish River and may be utilized by birds and other wildlife using the Sammamish River corridor. Red alder saplings, red-osier dogwood, and Himalayan blackberry were dominant in Reach 1 sampling plots. No snags, logs, or suitable raptor nesting or perching trees fell within sampling plots. Invasive species are common in all habitat types in the reach. The wildlife community in this reach is most likely made up of species habituated to human disturbance and able to utilize highly fragmented habitat (see Tables 18, 19, and 20 for wildlife species occurrence by reach).

Approximately 22 percent of Reach 2 is composed of young and mature deciduous forest. The remaining area is largely scrub/shrub, much of it disturbed and dominated by invasive weeds. One small area at the southeast junction of Highway 522 and SR 202 that fell within a sampling plot consisted of mature riparian vegetation, including red cedar of 61 to 76 centimeters (24 to 30 inches) DBH and several black cottonwoods and Douglas firs each approximately 61 centimeters (24 inches) DBH. Dominant species in this plot were hazelnut, big leaf maple, and Indian plum. Red alder, black cottonwood, and big-leaf maple dominate the deciduous forest in Reach 2. Common species include Himalayan blackberry, salmonberry, willow, Douglas fir, and giant horsetail. Few mature trees occurred outside of the mature forested sampling plot, although 2 snags were present on another plot. Sampling plots in disturbed riparian habitat, including young forest and scrub/shrub, were dominated by red alder, with infestations of Himalayan blackberry, Scotch broom, reed canarygrass, and other invasive species. Common native species included salmonberry, willow, and bitter cherry. The most extensive tracts of undeveloped land in Reach 2 are highly disturbed, while less disturbed areas tend to be small and highly fragmented. These areas support scattered mature trees, some red cedar along the creek, that may provide limited perching/nesting opportunities for raptors. The reach contains little breeding habitat for neotropical migrant bird species, which generally breed in forest interiors.

Reach 3 contains the highest proportion of mature trees and native species-dominated areas, as well as the most extensive tract of habitat. Deciduous and mixed forest makes up approximately 46 percent of the habitat in this reach, with the remainder in shrub and grass habitats. The reach supports potential raptor and neotropical migrant bird habitat, particularly in the northern region, where habitat is most extensive and large conifers occur more frequently. Sampling plots in Reach 3 fell into three general vegetative communities translated here into habitat types. Douglas fir, western red-cedar, big-leaf maple, and red alder dominated forested sampling plots. Common species were western hemlock, red-osier dogwood, salmonberry, trailing blackberry, willow, vine maple, red elderberry, skunk cabbage, and lady fern. Less frequent species included red huckleberry, piggyback, and Indian plum. DBH averaged approximately 71 centimeters (28 inches) for Douglas fir and western red-cedar, 41 centimeters (16 inches) for big-leaf maple, and 23 centimeters (9 inches) for red alder. Snags, stumps, and logs were more common than in the other reaches, averaging one of each per sampling plot. Young deciduous forest in Reach 3 was dominated by red alder, and western red-cedar, black cottonwood, vine maple, and salmonberry

were common. Invasive species, mainly reed canarygrass and giant horsetail, were encroaching on one sampling plot. Red alders averaged 13 centimeters (5 inches) DBH, and a few larger cottonwoods ranging from 15 to 38 centimeters (6 to 15 inches) DBH were recorded. One stump and little downed wood occurred on two plots. Shrub wetland sampled in Reach 3 consisted of alder saplings, Himalayan blackberry, reed canarygrass, evergreen blackberry, and bracken fern.

5.0 RESTORATION POTENTIAL

The Little Bear Creek watershed has changed significantly since the arrival of European settlers in the late 1800s. Although the Little Bear Creek corridor is still utilized by numerous species of fish and wildlife the quality of instream and riparian habitat has been impacted by changes in land use. Throughout this report the existing status of numerous pathways and indicators as defined by the NMFS (1996) have been documented. The determination of *properly functioning*, *at risk*, and *not properly functioning* for each "indicator" was used as a basis for the prioritization of restoration efforts. Baseline conditions determined to be *not properly functioning* are likely the most limiting conditions for salmonids and are therefore considered the highest priority for restoration followed by the conditions determined to be *at risk*. Table 21 represents a summary of the baseline conditions in Little Bear Creek as they pertain to listed salmonids. Other important considerations in prioritizing possible restoration opportunities are cost, feasibility, and probability of success.

Table 21:
Little Bear Creek Environmental Baseline Condition Summary

PATHWAY	INDICATORS	BASELINE CONDITIONS
Water Quality	Temperature	Juvenile Migration and Rearing = Not Properly Functioning to At Risk Adult Migration and Spawning = Properly Functioning
	Sediment	Not Properly Functioning
	Chemical Contamination & Nutrients	Not Properly Functioning
Habitat Access	Physical Barriers	At Risk
Habitat Elements	Substrate	At Risk
	Large Woody Debris	Not Properly Functioning
	Pool Frequency	Not Properly Functioning
	Pool Quality/Depth	At Risk (not properly functioning in Reach 1)
	Off-Channel Habitat	Not Properly Functioning
	Refugia	Not Properly Functioning
Channel Conditions and Dynamics	Width/Depth Ratio	Reach 1: Not Properly Functioning Reach 2 and 3: At Risk
	Streambank Condition	Not Properly Functioning
	Floodplain Connectivity	Not Properly Functioning
Flow/Hydrology	Change in Peak/Base Flows	At Risk
	Increase in Drainage Network	Not Properly Functioning
Watershed Conditions	Road Density and Location	Not Properly Functioning
	Disturbance History	Not Properly Functioning
	Riparian Reserve/Conservation Areas	Not Properly Functioning (at risk in Reach 3)

The NMFS matrix of pathways and indicators is divided into six major pathways each having several indicators. The following discussion on stream and riparian habitat restoration possibilities and prioritization follows this habitat component approach. Many of these indicators are interwoven in that correcting one will also improve another. An example of this is that large woody debris, riparian reserve, refugia, pool frequency and quality, streambank conditions, and substrate are all related. Another important consideration is that no single action will fully restore Little Bear Creek, and that improving existing conditions will be the result of a multitude of efforts taken over an extended period of time.

The City of Woodinville has already begun undertaking numerous restoration measures along the Little Bear Creek corridor (Appendix R). This includes land acquisition, culvert removal, fish passage improvements, and non-native plant removal. These measures, in addition to those outlined below, will help improve fish and wildlife habitat along the Little Bear Creek corridor.

5.1 WATER QUALITY

Temperature: The temperature indicator ranges from **properly functioning** to **not properly functioning** depending on time of year and life cycle of the species under consideration (see Section 4.4.7 and Table 16). Stream temperature increases as Little Bear Creek flows towards the Sammamish River. Based on the results of data collected from two hobo temperature data loggers installed at the downstream and upstream extremes of Little Bear Creek within the City of Woodinville, stream temperature typically increases by 0.4 degree Celsius within the city.

Additional data documenting the contribution tributaries and ambient air temperature makes to the overall increase of stream temperature would be beneficial in analyzing potential mitigating measures. However, increasing shade by planting conifer trees along the mainstem and tributaries to Little Bear Creek is the primary action the City of Woodinville could undertake to address this issue. The simplistic step of drastically increasing the abundance of conifers along both banks of Little Bear Creek would help increase shade and thereby reduce the rate of increase in stream temperature. Furthermore, planting conifer trees along both banks would help increase bank stability, reduce the abundance of invasive species such as reed canarygrass, provide wildlife habitat, reduce sedimentation, and eventually provide LWD and habitat complexity.

Sediment: The sediment indicator is **not properly functioning** due to a high percentage of fines within the substrate. Primary sources of sediment include stormwater runoff from upland sources such as roads and disturbed areas that directly enter Little Bear Creek or its tributaries, eroding and sloughing banks, and upstream sources. Remedies to reduce the percent of fines within the substrate include best management practices (BMPs) associated with construction projects, bank stabilization efforts, stormwater impact reduction measures, and isolated sediment removal measures from potential spawning areas or introduction of quality spawning gravel (typically not practicable). The most practicable measures the City of Woodinville could undertake to address this issue include bank stabilization efforts utilizing native vegetation, increasing the enforcement and use of BMPs, and working with Snohomish County to address upstream sources.

Chemical Contamination and Nutrients: The chemical contamination and nutrients indicator is **not properly functioning** (Table 21). This determination was based primarily on high fecal

coliform levels (a 1998 303[d] listing), the presence of pesticides, and the presence of metals in sediment samples collected in Reach 1.

The presence of high fecal coliform levels in Little Bear Creek is likely the result of failing septic tanks and runoff from fields with livestock. Both of these potential sources appear to be restricted to the upper portions of Little Bear Creek in Snohomish County and therefore not within the jurisdiction of the City of Woodinville to correct. The source of pesticides in Little Bear Creek may also be the result of actions occurring in the upper watershed.

The presence of metals is likely the result of road runoff entering Little Bear Creek through stormwater runoff in tributaries and direct discharge of stormwater from retention/detention facilities throughout the watershed. However, no existing data on metal concentrations from various potential sources exists. Therefore, identification of priority sites that contribute the highest metal concentrations to Little Bear Creek would need to be initiated prior to the initiation of corrective actions. Junk and construction yards located in Reach 2 and 3, and immediately north of King County may also contribute to the high metal concentrations in Little Bear Creek. An alternative to investing money and time into additional data collection is to insert catch-basin filters in high capacity parking lots that have the highest probability of contributing pollutants. Existing stormwater catch basins can be fitted with filter systems designed to capture priority pollutants such as soluble metals. The overall cost of installing and maintaining catch basin filters depends on the quantity of systems installed. The installation of catch basins would not eliminate existing contamination, but would reduce the rate of future accumulation.

5.2 HABITAT ACCESS

Habitat Access is **at risk**, and therefore not an imminent concern (Table 21). Both the City of Woodinville and Snohomish County are currently addressing habitat access concerns at 132nd Avenue NE and NE 205th Street (Appendix R). The predominance of the culverts identified as potential barriers to fish passage by the Adopt-A-Stream foundation are in Snohomish County and therefore outside of the jurisdiction of the City of Woodinville to correct.

Although the 134th Avenue NE crossing is not currently a fish passage barrier to migrating adult salmonids, they do stack-up immediately downstream of the crossing. The City of Woodinville should investigate the feasibility of purchasing the wrecking yard on the west side of Little Bear Creek serviced by this crossing. If this lot could be purchased several stream enhancement opportunities could occur. The first goals would be to remove soil contaminants within the lot and remove all structures. The second goal would be to use this crossing for enhancement efforts between Little Bear Creek and Highway 522 within Reach 2. Once these actions were completed the crossing could be permanently removed.

5.3 HABITAT ELEMENTS

Four of six indicators of the Habitat Elements pathway are **not properly functioning** (Table 21). Indicators that are **not properly functioning** include LWD, pool frequency, off-channel habitat, and refugia. Although the substrate indicator is **at risk** versus **not properly functioning**, the status of this indicator is also a concern due to its impact on salmonid reproduction.

The lack of LWD plays a major role in decreasing pool frequency and the availability of refugia. The importance of LWD in creating and maintaining pool frequency and refugia is so vital that this may be the single most important habitat element requiring immediate attention in Little Bear Creek. Furthermore, because the riparian zone along Little Bear Creek does not contain adequate numbers of large conifers for LWD recruitment, this indicator will remain **not properly functioning**. The addition of LWD by mechanical means in itself is simplistic and only moderately expensive. However, streamside access and uncertainty in obtaining desired results can create problems. These facts limit the applicability of installing LWD or creating pool habitat. However, some areas with good access are present, and careful design and implementation can increase the probability of success. Sites where access is good include most of Reach 1, within Reach 2 near 132nd Avenue NE and 134th Avenue NE, and within Reach 3 immediately upstream of NE 195th Street. Additional sections of stream could be accessed along Highway 522.

Another important issue is the availability of future recruitment of LWD. Large conifer trees that could potentially add to the presence of instream LWD are lacking along the Little Bear Creek corridor. The only way to address this issue is to plant thousands of conifers along the riparian corridor. Although the time-delay between planting conifer saplings and achieving LWD recruitment would be many decades, this action is necessary for the long-term interest of Little Bear Creek. Because of this time-delay, the planting of conifers is of the highest priority. Additional actions associated with this effort include the removal of non-native and invasive species to facilitate conifer establishment, and long-term monitoring. Additional value is created by this action since planting conifers along the riparian zone will increase bank stability, shade, and wildlife habitat. The entire remaining vegetated corridor along Little Bear Creek is in need of immediate and intensive planting of conifer saplings.

Restoring or improving pool frequency above what would result from the placement of LWD in accessible locations is problematic and costly. Two sites where stream restoration efforts could be undertaken include the lowermost section of Reach 1 and within Reach 3 immediately upstream of NE 195th Street (Appendix G). Both of these sites are fully armored, linear, lack LWD, and consist of low-gradient riffle habitat. Because these sites are degraded, owned by the city, and accessible, they are deemed the best candidates for intensive site specific restoration efforts that could address a multitude of the indicators for the Habitat Elements pathway that are not properly functioning. Primary actions that could occur at these sites include removal of bank armoring, creation of refugia and off-channel habitat, creation of pool habitat, revegetation, and installation of LWD.

Off-channel habitat can also be used as refugia by juvenile salmonids. Off-channel habitat could be created as part of the site specific restoration plan that would be developed for the two stream restoration sites mentioned above. Another simplistic and relatively inexpensive measure that would create additional off-channel habitat and refugia would be to reduce the length of two or three culverts that currently extend into the active stream channel located in Reach 2 (Appendix D – Reach 2 Photos 10, 12, 17, 20, and 21). These culverts drain the unnamed tributaries within the City of Woodinville as shown on Figure 3. The idea here is to cut each culvert back as far as possible into the adjacent uplands for a distance of at least 6 meters (>20 feet) so that new off-channel habitat (and wetlands) is created where culverts and their associated fill material currently exists. The newly exposed area would need to be graded to the stream's

base-flow level and planted with native hydrophytic vegetation. LWD could also be installed at these sites to increase their overall functionality.

5.4 CHANNEL CONDITIONS AND DYNAMICS

Two indicators of the Channel Conditions and Dynamics pathway that are **not properly functioning** include streambank condition and floodplain connectivity. Streambank conditions can be improved by replacing non-native and invasive species with conifers as mentioned previously. Extensive sections of the streambank, especially between Little Bear Creek and Highway 522 could be greatly improved. The removal of armoring in conjunction with revegetation in the lower section of Reach 1 near the mouth and immediately upstream of NE 195th Street will also help to improve streambank conditions.

Floodplain connectivity relates to hydrologic linkage between Little Bear Creek and adjacent off-channel areas, wetlands, riparian vegetation, and succession. No connectivity occurs where stream armoring is present or the stream is abutted by development. No other areas were identified where floodplain connectivity could be increased except as where previously mentioned.

5.5 FLOW/HYDROLOGY

The Flow/Hydrology pathway includes two indicators that were identified as **not properly functioning**. The percent impervious surface within the watershed and abundance of man-made drainage networks are the primary factors influencing this pathway. The two actions that can improve this pathway include reducing the percent of impervious surface, and improving or creating retention/detention facilities within the watershed. The preservation and restoration of existing habitat are critical in protecting against the continued degradation of this pathway. These issues are watershed-wide problems that extend far beyond the Little Bear Creek corridor. Because of the scale of this issue, it is most appropriately dealt with through the implementation of the Growth Management Act (GMA), Shoreline regulations, and city and county codes throughout the Little Bear Creek watershed. However, retrofitting of stormwater retention/detention facilities and elimination of impervious surface should be undertaken whenever the opportunity arises. Actions that reduce the speed at which stormwater travels through existing ditch networks to Little Bear Creek will further reduce the flashy conditions of the existing hydrographs (Figures 5a through 5c).

5.6 WATERSHED CONDITIONS

All indicators for the Watershed Conditions pathway including road density and location, disturbance history, and riparian reserve/conservation areas are **not properly functioning**. With the exception of the riparian reserve/conservation areas indicator (previously addressed), the remaining indicators are influenced primarily by the total amount of impervious surface within the watershed. As was the case with the Flow/Hydrology pathway, this issue is most appropriately dealt with through the implementation of the GMA, Shoreline regulations, and city and county codes throughout the watershed.

Table 22 below summarizes the pathway, indicator, priority, and action for each baseline condition identified as *not properly functioning*. Included in Table 22 are indicators that may have been partially *properly functioning* or *at risk* in one reach or for a specific life history (adult

migration/spawning) but otherwise *not properly functioning*. The priority of each indicator was determined based on time required to achieve desired results, degree of additional benefit, potential for success, and feasibility. Several of the indicators will benefit from the same basic action (e.g. installation of LWD and planting conifers). Although prioritized, the actions required to address these conditions in Little Bear Creek should occur simultaneously.

Table 22:
Not Properly Functioning Baseline Conditions Summary

PATHWAY	INDICATORS	Priority	Basic Action
Water Quality	Temperature	Medium	Plant conifers in riparian zone to increase shading.
	Sediment	Medium	Stabilize problem areas (e.g. LB of Reach 2), stabilize banks, reduce/eliminate upland sources, clean substrate (not practicable).
	Chemical contamination and nutrients	Medium	Identify key sources and implement corrective actions at sources.
Habitat Elements	Large Woody Debris	High	Install LWD and plant conifers for future recruitment.
	Pool Frequency	Medium	Will increase through installation of LWD
	Off-Channel Habitat	High	Create through LWD and retracting culverts
	Refugia	High	Create through LWD and retracting culverts
Channel Conditions and Dynamics	Width/Depth Ratio	Low	Remove armoring and taper back, and address incision resulting from changes in hydrology.
	Streambank Condition	High	Remove non-natives & plant > 10,000 conifers
	Floodplain Connectivity	Medium	Protect and restore corridor
Flow/Hydrology	Increase in Drainage Network	Medium	Reduce ditching and impervious area.
Watershed Conditions	Road Density and Location	Medium	Limit new roads and remove unnecessary ones
	Disturbance History	Medium	Protect and restore corridor
	Riparian Reserve/Conservation Areas	High	Remove non-natives, plant > 10,000 conifers, preserve existing habitat, and acquire more.

In summary, several key actions could potentially improve existing habitat conditions in Little Bear Creek. These recommended actions include:

1. Obtain, preserve, and enhance land along Little Bear Creek to minimize further habitat degradation from continued development along the Little Bear Creek corridor. Undeveloped properties along the corridor with quality riparian habitat should be high priority acquisitions, such as, the properties to the north of the City's "Lumpkin" property (east of 134th Avenue NE crossing). Another area to consider would be the properties to the west of 134th Avenue NE as described in item 7.
2. Immediately initiate a program to reestablish conifers within the riparian zone throughout the Little Bear Creek corridor.
3. Restore hardened rip/rap banks along Little Bear Creek. Include creation of pool habitat, and addition of large woody debris as part of the restoration plan.
4. Retrofit potential pollution-generating sites such as large parking lots and roadways with pollution prevention and storm flow retention facilities where such facilities are presently absent.

5. Reforest upland areas dominated by introduced species such as reed canarygrass and Himalayan blackberry.
6. Create off-channel habitat at each culverted tributary confluence with Little Bear Creek. This can be accomplished by daylighting the maximum extent of culverted tributary possible at each confluence.
7. The City of Woodinville should investigate the feasibility of purchasing the wrecking yard on 134th Avenue NE along the west side of Little Bear Creek. If this lot could be purchased several stream enhancement opportunities could occur. The first goals would be to remove soil contaminants within the lot and remove all structures. The second goal would be to use this crossing for enhancement efforts between Little Bear Creek and Highway 522 within Reach 2. Once these actions were completed the 134th Avenue NE crossing could be permanently removed, or converted to a bridged crossing.
8. The newly purchased city property immediately upstream of NE 195th Street is an ideal site for intensive in-stream, riparian, and upland habitat restoration activities. Actions that would benefit Little Bear Creek at this site include removal of bank armoring, creation of pool habitat, removal of impervious surface (pavement) and non-native vegetation, and installation of large woody debris, riparian vegetation, and upland vegetation.
9. Maintain regular street sweeping, storm drainage system cleaning, and add sediment traps where feasible. This will reduce the amount of sediment entering Little Bear Creek.

5.7 WILDLIFE HABITAT

The Little Bear Creek corridor was originally dominated by large expanses of old-growth forest composed of primarily conifers. These forests were extensively logged throughout the late 1800s and early 1900s and subsequently converted to agricultural land. More recently, agricultural land has rapidly been replaced with an urban landscape. Wetlands adjacent to the Sammamish River were historically extensive but were later filled to reduce flooding and create more developable land. Habitat features such as snags, downed wood, large conifers with a multi-canopy understory, and large wetland complexes are now uncommon or absent along the Little Bear Creek corridor.

Because the existing landscape has been significantly degraded from native conditions, numerous wildlife habitat enhancement opportunities exist. Based on our survey results, five primary actions that would improve wildlife habitat have been identified including:

1. Replacement of existing reed canarygrass, Himalayan blackberry, and scotch broom expanses with native vegetation.
2. Addition of conifers and mast (food) producing shrubs within existing deciduous dominated forest habitat.
3. Addition of downed woody debris to the forest floor.
4. Wetland creation within the corridor.
5. Installation of bird boxes for cavity nesting species.

The first four actions would help create more natural conditions conducive to native wildlife species. These four actions would benefit wildlife by creating suitable habitat, and Little Bear Creek by improving buffer functions. The installation of bird boxes is presented as a temporary measure to provide habitat for cavity nesters until other restoration efforts are able to reestablish suitable cavity nesting sites.

Numerous opportunities for wildlife habitat enhancement exist along the Little Bear Creek corridor in the City of Woodinville. Non-native plant removal opportunities exist along all reaches of the creek. The south end of Reach 1 is highly disturbed and in need of restoration. Little cover exists and non-native plants, which generally provide poor wildlife habitat, are common. The creek in the remainder of Reach 1 is closely bordered by development and would also benefit from restoration, as the existing vegetation provides little cover for wildlife.

The south end of Reach 2 in the vicinity of 132nd Avenue NE also has habitat enhancement opportunities. Shrub habitat on the left bank between 132nd Avenue NE and 134th Avenue NE is heavily infested with Himalayan blackberry, reed canarygrass, and other invasive species and is in need of weed removal and enhancement. Large areas of Himalayan blackberry and Scotch broom exist on the right bank beyond the riparian strip. The area from 134th Avenue NE to the north end of Reach 2 would benefit from the removal of reed canarygrass and other exotics, followed by restoration and enhancement. Although it is highly disturbed, the corridor is relatively wide in the middle stretch of Reach 2 and could potentially provide habitat for birds and mammals. Access to the right bank is difficult because of thick blackberry. The riparian zone becomes very narrow and shade and cover decrease from south to north. The north end of Reach 2 in particular would benefit from habitat restoration, as there is currently only sparse tree cover.

The portion of Reach 3 below NE 195th Street is bordered by private property on the right bank and Highway 522 on the left bank, and accessibility is poor. The area along Highway 522 is densely vegetated with Himalayan blackberry, and intensive clearing would be necessary to access and enhance this area. Private ownership along the left bank (east side) could hinder restoration attempts along this segment.

A shrub area accessed by a gravel lot off of 136th Avenue NE immediately north of NE 195th Street has good access and potential to provide wildlife habitat. The area is adjacent to a stand of mixed forest, which supports scattered large conifers and could provide a corridor for wildlife using the shrub area. Restoration of the gravel lot and adjacent areas would likely provide additional habitat for wildlife using the corridor north of this point.

Wildlife habitat improves with the increase of forest in the northern portion of Reach 3. Abundance of potential nesting and perching trees increases northward, and the corridor increases in width. The middle of Reach 3 is accessible from 136th Avenue NE, and this area provides opportunities for habitat improvement. Weed removal and the addition of native trees and shrubs to upland clearings outside of the riparian zone would enhance habitat in this area. While much of the forested area is young deciduous trees, larger trees increase in number to the north. This area might benefit most from the preservation of large conifers and tracts of forest.

6.0 REFERENCES

Cooke, Sarah Spear. 1997. *A Field Guide to the Common Wetland Plants of Western Washington & Northwestern Oregon*. Seattle Audubon Society. Seattle, Washington.

Foley, S. 2001. *Personal Communication.* Washington Department of Fish and Wildlife. Mill Creek, Washington.

Fresh, K. 2000. *Personal Communication*. Washington Department of Fish and Wildlife. Mill Creek, Washington.

Goetz, F. 2000. *Introduction to the Hiram M. Chittenden Locks – History and Issues*. Proceedings from: Selected recent and ongoing chinook salmon in the greater Lake Washington watershed. Fred Goetz, U.S. Army Corps of Engineers, Seattle District, Seattle, Washington.

Hitchcock, C.L., and A. Cronquist, 1973. *Flora of the Pacific Northwest.* University of Washington Press, Seattle, Washington.

Kerwin, J. 2001. *Salmon and Steelhead Habitat Limiting Factors Report for the Cedar – Sammamish Basin (Water Resource Inventory Area 8).* Washington Conservation Commission. Olympia, Washington.

King County. 2001a. *Draft Inventory Methods for Wadable Streams in King County, Version 3.0.* King County Water and Land Resources Division – Modeling, Assessment, and Analysis Unit. Seattle, Washington.

King County. 2001b. *Habitat Inventory and Assessment of Three Sammamish River Tributaries: North, Swamp and Little Bear Creeks*. King County Department of Natural Resources - Water and Land Resources Division. Seattle, Washington.

King County. 2001c. Web page at http://dnr.metrokc.gov/hydrodat/index.htm.

King County. 2001d. Web page at http://www.kcls.org/wood/history.html.

King County. 2001e. *1998 and 1999 Volunteer Salmon Watcher Program in the Lake Washington Watershed.* King County Department of Natural Resources. Seattle, Washington.

King County. 2000a. *Historic and Current Status of Kokanee in the Lake Washington Basin – Discussion Draft.* King County – Water and Land Resource Division. Seattle, Washington.

King County. 2000b. *1997 Volunteer Salmon Watcher Program in the Lake Washington Watershed.* King County Department of Natural Resources. Seattle, Washington.

King County. 2000c. 1999 *Chinook Spawner Survey Data Technical Report for the Lake Washington Watershed.* Prepared in cooperation with: Washington Department of Fish and Wildlife, Seattle Public Utilities, and Muckleshoot Indian Tribal Fisheries Department.

King County. 1999. 1998 *Chinook Spawner Survey Data Technical Report for the Lake Washington Watershed.* Prepared in cooperation with: Washington Department of Fish and Wildlife, Seattle Public Utilities, and Muckleshoot Indian Tribal Fisheries Department.

King County. 1998. *1996 Salmon Spawning Surveys in the Lake Washington Watershed.* King County Department of Natural Resources. Seattle, Washington.

King County. 1994. *Water Quality of Small Lakes and Streams – Western King County 1990 – 1993.* Publication 946. King County Department of Metropolitan Services. Seattle, Washington.

King County. 1991. *Stream Survey Report Criteria.* King County Building and Land Development Division. Seattle, Washington.

May, C. W., E. B. Welsh, R. R. Horner, J. R. Karr, and B. W. Mar. 1997. *Quality Indices for Urbanization Effects in Puget Sound Lowland Streams.* Final Report for the Washington Department of Ecology. Water Resources Series Technical Report No. 154. Olympia, Washington.

May, C. 1996. *Assessment of Cumulative Effects of Urbanization on Small Streams in the Puget Sound Lowland Ecoregion: Implications for Salmonid Resource Management.* Dissertation, University of Washington, Seattle, Washington, USA.

McCain, M., D. Fuller, L. Decker, and K. Overton. 1990. *Stream Habitat Classification and Inventory Procedures for Northern California.* USDA Forest Service, Pacific Southwest Region. Arcata, California.

Monzaki, Y. 2001. *Personal Communication.* City of Woodinville, Surface Water Engineer. Woodinville, Washington.

NMFS. 1996. *Matrix of Diagnostics/Pathways and Indicators.* National Marine Fisheries Service, Portland, Oregon.

Peterson, N. P., A. Hendry, and T.P. Quinn. 1992. *Assessment of Cumulative Effects on Salmonid Habitat: Some Suggested Parameters and Target Conditions.* TFW-F3-92-001, Washington Timber, Fish, and Wildlife.

Pojar, J., and A. MacKinnon. 1994. *Plants of the Pacific Northwest Coast.* B.C. Ministry of Forests and Lone Pine Publishing. Redmond, Washington.

Purser, M. and R. Simmonds. *Unpublished data on Snohomish County sub-basins total impervious area and vegetation class land cover.* Snohomish County Surface Water Management, Everett, WA.

Repman, L. 2001. *Personal Communication*. Early resident of the City of Woodinville currently residing in Edmonds, Washington.

Reynolds, R.T., J.M. Scott, and R.A. Nussbaum. 1980. *A Variable Circular Plot Method for Establishing Bird Numbers*. Condor 82: pages 309 – 313.

Robbins, C. 1981. *Effect of Time of Day on Bird Activity*. In: Ralph, C. John; Scott J. Michael, editors. Estimating Numbers of Terrestrial Birds. Studies in Avian Biology 6: pages 275 – 286.

Rosgen, D. and L. Silvey. 1998. *Field Guide For Stream Classification*. Wildland Hydrology. Pagosa Springs, Colorado.

Seiler, D. 2001. *Evaluation of Downstream Migrant Chinook Production in Two Lake Washington Tributaries, Cedar River and Bear Creek*. Washington Department of Fish and Wildlife. Olympia, Washington.

Stickney, A. E., and L. McDonald. 1977. *Squak Slough: 1870 – 1920 Early Days on the Sammamish River Woodinville – Bothell – Kenmore*. Evergreen Printing Company, Seattle, Washington.

Snohomish County. 2000. *The State of the Waters: Water Quality in Snohomish County's Rivers, Streams and Lakes*. Snohomish County Public Works, Surface Water Management. Everett, Washington.

U.S. Fish and Wildlife Service. 1986. *Recovery Plan for the Pacific Bald Eagle*. USFWS, Portland, Oregon.

U.S. Forest Service. 2001. *Stream Inventory Handbook – Level 1 & 2*. Version 2.1. Pacific Northwest Region. Region 6.

Thornburgh, K. 2001. *Personal Communication*. Snohomish County Public Works, Surface Water Management. Everett, Washington.

Washington Department of Fish and Wildlife. 2001a. *Salmon Spawning Ground Survey Data*. Letter response to data request by David Evans and Associates, Inc. from Carol Turcotte (WDFW), June 26, 2001.

Washington Department of Fish and Wildlife. 2001b. *Priority Habitat and Species data for the City of Woodinville*. Washington Department of Fish and Wildlife. Olympia, Washington.

Washington Department of Fish and Wildlife. 1999. *Bull Trout in the Stillaguamish River System*. WDFW Mill Creek, Washington.

Williams, R.W., R.M. Laramie and J.J. Ames. 1975. *A Catalog of Washington Streams and Salmon Utilization – Volume I, Puget Sound Region*. Washington Department of Fisheries.

Wolman, M. 1954. *A Method of Sampling Coarse River-bed Material.* Transactions of the American Geophysical Union. 35(6): pages 951 – 956.

Wydoski, R.S. and R.R. Whitney. 1979. *Inland Fishes of Washington.* University of Washington Press. Seattle, Washington.

APPENDICES

Appendix A

APPENDIX A:
Existing Literature Status Update Letter to the City of Woodinville

DAVID EVANS AND ASSOCIATES, INC.

415-118th Avenue SE
Bellevue, Washington 98005
Tel: 425.519.6500
Fax: 425.519.5361

April 3, 2001

Yoshihiro Monzaki
City of Woodinville
13202 NE 175th Street
Woodinville, Washington 98072

SUBJECT: SUMMARY OF EXISTING LITERATURE TO BE USED IN THE LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT

Dear Mr. Monzaki:

David Evans and Associates, Inc. (DEA) has completed the initial task (Task A) of the Little Bear Creek Corridor Habitat Assessment. Task A consisted of obtaining and reviewing relevant existing information on Little Bear Creek that will be utilized in our assessment of the creek corridor. This information will be used to identify data gaps, eliminate unnecessary duplication, and enhance the final report.

Three major modes of data obtainment were used to ensure all pertinent resources were collected. City, county, and state staff were contacted and asked if they were aware of existing information on Little Bear Creek. The Internet was used to search numerous servers that may contain existing information on Little Bear Creek. The reference sections of numerous reports were scanned for potential sources of additional information on Little Bear Creek. Contacting city, county, and state staff produced the majority of relevant documents and often led to obtaining pertinent information on forthcoming reports that will greatly enhance the final report.

Existing data can be categorized into fisheries, instream habitat, water quality and quantity, wildlife, and multiple topic data. The following discussion briefly summarizes the findings of Task A. Additional reports and relevant data will be collected and analyzed as the project progresses.

FISHERIES DATA

Existing fisheries data is available, but selective and spotty. Larger species such as spawning salmonids that are easily observed from the stream bank have been surveyed for in Little Bear Creek. These surveys appear to be spotty in that easily accessed sections near road crossings tend to be the primary area of focus versus surveying the entire reach. Documentation of less prominent species such as three-spine stickleback (*Gasterosteus aculeatus*), speckled dace (*Rhichthys osulus*), sculpins (*Cottus* spp.), large-scale sucker (*Catostomas macrocheilus*) cutthroat trout (*Oncorhynchus clarki*), and lampreys (*Lampetra* spp.) have received little focus.

The Volunteer Salmon Watcher Program conducted by King County provides good information on the presence and distribution of salmonids in Little Bear Creek. It also provides some indication on the minimum number of salmonids that utilize Little Bear Creek. DEA has obtained copies of these reports dating from 1996 through 1999 (King County, 1998, 1999, and 2001). The results from the year 2000 are forthcoming.

Additional chinook (*Oncorhynchus tshawytscha)* spawner survey data was obtained from King County. This includes the results of surveys conducted by several agencies from 1998 and 1999 (King County, 1999 and 2000). Although this data is helpful in establishing presence, it has limited value in establishing abundance and distribution in Little Bear Creek.

Results from recent studies in Bear Creek will also be used to infer emigration timing, fecundity, and survival ratios of chinook fry in Little Bear Creek (Seiler, 2001). The validity of inferring similar trends is based on proximity, genetics, and stream temperature.

INSTREAM HABITAT DATA

Existing instream habitat data is available, but not fully compatible with current City of Woodinville goals. King County accomplished the most recent instream habitat survey conducted in Little Bear Creek during 1999. The final draft report will be available by mid-April. King County surveyed most, but not all of Little Bear Creek within the City of Woodinville. The protocol used was a hybrid of the Timber-Fish-Wildlife (TFW) and May (1996) methodologies. Although this hybrid protocol was suitable in addressing King County's needs, it is not comparable with on-going efforts in the upper watershed being conducted by Snohomish County or the draft protocol for WRIA 8. The results of recent macroinvertebrate studies will also be incorporated into the final report (Morley, 2000).

Additional outdated data is also available in *Reconnaissance Report No. 17 – Little Bear Creek* (King County, 1987). This report is very subjective, and does not provide references for the information contained within. Of particular interest will be checking if potential fish blockage and erosion concerns highlighted in 1987 have been addressed.

The upper watershed in Snohomish County has not been surveyed. However, sections of Little Bear Creek in Snohomish County will be surveyed by Snohomish County (Purser, personal communication, 2001). This data will hopefully be available for incorporation into the City of Woodinville Little Bear Creek Habitat Corridor study.

WATER QUALITY AND QUANTITY DATA

Water quality and quantity data is available for Little Bear Creek. King County has collected water quality and quantity data in Woodinville for several years (King County, 1994). This data will be consolidated and analyzed in the final report. Water quality data for the upper watershed within Snohomish County is also available and will be consolidated and analyzed in the final report (Snohomish County, 2000). Both counties have provided recent unpublished water quality data to DEA for inclusion into the final report. DEA still proposes to monitor temperature at the upstream and downstream city boundary to determine if temperature is a limiting factor and if temperature increases within the lower section of Little Bear Creek. This data will allow city planners and policy makers to determine if current land use activities and riparian coverage within the City of Woodinville are influencing stream temperature.

WILDLIFE DATA

Limited recent site-specific wildlife data is available for lands within the City of Woodinville. Four primary sources of existing literature to be utilized include the *Priority Habitat and Species data* (WDFW, 2001), *Washington State Gap Analysis* (Cassidy et al., 1997), *Birding in Seattle and King County* (Hunn, 1982), and *King County Wetland-Breeding Amphibian Monitoring Program* (Richter et. al., 1999). Additional data has

been requested from King County. Reports that will document historic use include *Mammals of Washington* (Dalquest, 1948). These sources, plus personal communications with local area habitat biologists and city staff will augment field surveys.

MULTIPLE TOPIC REPORTS

Several reports were located that addressed instream habitat, riparian habitat, water quality, fisheries, percent impervious surface, and anthropogenic factors in Little Bear Creek. Two reports by May (1996) and May et. al., (1997) provide a wide range of information on Little Bear Creek. The latter report titled *Quality Indices for Urbanization Effects in Puget Sound Lowland Streams* will be especially valuable as a source of additional information and in comparing Little Bear Creek to other similar streams within the Puget Sound basin. It also provides a framework to rank parameters that will be calculated during this forthcoming survey season.

Additional reports such as the *Tributary 087 – Biological Resources Inventory* (Adlofson Associates, 1998), *North Creek Flood Hazard Reduction Plan – Technical Information* (Watershed Dynamics, 1995), *North Creek Flood Hazard Reduction Plan – Resources Assessment Report* (Watershed Dynamics, 1995), and *ESA Overview and Strategy and Little Bear Creek Corridor Plan* (CH2M Hill, 1999).

DEA is looking forward to working with the City of Woodinville, and providing the city with a detailed Little Bear Creek Corridor Habitat Assessment. DEA is available to meet with you and other city staff to discuss our findings at your convenience. Please do not hesitate to contact me either by phone (425-519-6593) or e-mail (sasw@deainc.com) should you have any questions or comments regarding our findings, fisheries, wildlife, wetlands, permitting, or the endangered species act.

Sincerely,

DAVID EVANS AND ASSOCIATES, INC.

Scott Swarts

Scott Swarts
Fish and Wildlife Biologist

Enclosure: Attachment A, References

SASW(BCF)/sxm
o:\project\w\wood0000-0010\0500 deliverables\little bear summary ltr.doc
WOOD0000-0010.001

ATTACHMENT A
REFERENCES

Adolfson Associates. 1998. *Tributary 087 - Biological Resources Inventory.* Adolfson Associates, Inc. Seattle, Washington.

Cassidy, K. M., C. E. Grue, M. R. Smith, and K. M. Dvornich, eds. 1997. *Washington State Gap Analysis – Final Report.* Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle, Volumes 1-5.

CH2M HILL. 1999. *ESA Overview and Strategy and Little Bear Creek Corridor Plan.* Prepared for the City of Woodinville. Woodinville, Washington.

Dalquest, W. 1948. *Mammals of Washington.* University of Kansas Publications, Museum of Natural History. University of Kansas. Lawrence, Kansas. Volume 2, pp. 1-444.

Hunn, E. 1982. Birding in Seattle and King County. *Seattle Audubon Society – Trailside Series.* Seattle, Washington.

King County. 2001. *1998 and 1999 Volunteer Salmon Watcher Program in the Lake Washington Watershed.* King County Department of Natural Resources. Seattle, Washington.

King County. 2000. 1999 *Chinook Spawner Survey Data Technical Report for the Lake Washington Watershed.* Prepared in cooperation with: Washington Department of Fish and Wildlife, Seattle Public Utilities, and Muckleshoot Indian Tribal Fisheries Department.

King County. 2000. *1997 Volunteer Salmon Watcher Program in the Lake Washington Watershed.* King County Department of Natural Resources. Seattle, Washington.

King County. 1999. 1998 *Chinook Spawner Survey Data Technical Report for the Lake Washington Watershed.* Prepared in cooperation with: Washington Department of Fish and Wildlife, Seattle Public Utilities, and Muckleshoot Indian Tribal Fisheries Department.

King County. 1994. *Water Quality of Small Lakes and Streams – Western King County 1990 – 1993.* Publication 946. King County Department of Metropolitan Services. Seattle, Washington.

King County. 1998. *1996 Salmon Spawning Surveys in the Lake Washington Watershed.* King County Department of Natural Resources. Seattle, Washington.

King County. 1987. *Reconnaissance Report No. 17 – Little Bear Creek.* King County Department of Natural Resources. Seattle, Washington.

May, C. W., E. B. Welsh, R. R. Horner, J. R. Karr, and B. W. Mar. 1997. *Quality Indices for Urbanization Effects in Puget Sound Lowland Streams.* Final Report for the Washington Department of Ecology. Water Resources Series Technical Report No. 154. Olympia, Washington.

May, C. 1996. *Assessment of Cumulative Effects of Urbanization on Small Streams in the Puget Sound Lowland Ecoregion: Implications for Salmonid Resource Management.* Dissertation, University of Washington, Seattle, Washington, USA.

Morley, S. 2000. *Effects of Urbanization on the Biological Integrity of Puget Sound Lowland Streams: Restoration with a Biological Focus.* University of Washington Thesis Submittal. School of Fisheries. Seattle, Washington.

Purser, M. 2001. *Personal communication.* Principal Habitat Specialist. Snohomish County, Public Works, Surface Water Management. Everett, Washington.

Richter, K.O. and E.C. Ostergaard. 1999. *King County Wetland-Breeding Amphibian Monitoring Program: 1993-1997 Summary Report.* King County Department of Natural Resources, Water and Land Resources Division, Seattle, Washington, USA.

Seiler, D. 2001. *Evaluation of Downstream Migrant Chinook Production in Two Lake Washington Tributaries, Cedar River and Bear Creek.* Washington Department of Fish and Wildlife. Olympia, Washington.

Snohomish County. 2000. *The State of the Waters: Water Quality in Snohomish County's Rivers, Streams and Lakes.* Snohomish County Public Works, Surface Water Management. Everett, Washington.

WDFW, 2001. *Priority Habitat and Species data for the City of Woodinville.* Washington Department of Fish and Wildlife. Olympia, Washington.

Watershed Dynamics. 1995. *North Creek Flood Hazard Reduction Plan – Resource Assessment Report.* Prepared for CH2M Hill. Watershed Dynamics, Inc. Auburn, Washington.

Appendix B

APPENDIX B:
King County 1991 Protocol

King County
Building & Land Development Division
Parks, Planning and Resources Department
3600 - 136th Place Southeast
Bellevue, Washington 98006-1400

July 1, 1991

STREAM SURVEY REPORT CRITERIA

The purpose of these guidelines is to improve the validity, consistency, and usefulness of fisheries information. The guidelines address the appropriate scope and methods of stream and fisheries studies, and recommend three progressive levels of detail based on stream system classification and fish utilization. This document is subject to change as more information becomes available or new methods are developed. Future efforts should be devoted toward a better understanding and evaluation of the interrelationships among elements of the environment and on improving impact predictions.

A. General Site Survey

1. Natural drainage system configuration and stream classification
2. Riparian zone land uses
3. Riparian vegetation (structure, species composition & density)
4. Description of adjacent wetlands
5. Animal habitat and utilization
6. Riparian soils, channel morphology, and bank stability.
7. Substrate composition
8. Large woody debris & pool quality
9. Benthos (invertebrates)
10. Fish habitat and utilization
11. Photographs taken at 25 foot intervals

B. Stream Survey Data

Level I - Basic:

A habitat and and stream channel stability survey is required for all Class 1 and 2 streams that traverse the site. The stream survey must be adhere to the methodology developed by King County Surface Water Management (SWM), as modified from the USDA Forest Service Stream Habitat Classification and Inventory Procedures for Northern California (McCain et al, 1990; attached). The survey shall encompass stream reaches one quarter mile upstream and downstream of the site, or to the next higher order stream (Strahler 1957) for Master Drainage Plans and Subdivisions. Stream survey requirements for Building Permits, Short Subdivisions, and Grading and Clearing Permits shall encompass stream reaches 500 feet upstream and downstream of the site. The habitat survey form, attached, was modified by SWM (Fuerstenburg and Luchetti, 1990) from methods developed by the USDA Forest Service. Pool quality indexing should conform to criteria developed by Platts (Platts, 1987; attached).

Level II - Intermediate

In addition to a Level I stream habitat survey, an Intermediate Survey must be performed to list all fish species known to use the stream. Habitat requirements and season of use must be documented. Use of the "two-pass removal electrofishing method" is recommended for a distance of 300 feet of each stream, or 10% of the stream length on the site (whichever is greater). Three sites per stream may be required. Record standard lengths for all salmonids or provide a sub-sample if certain species are particularly numerous. Presence and relative abundance of non-salmonids should be recorded.

In streams with spawning habitat: depending on species presence, survey every two weeks during spawning for chinook, coho, sockeye, steelhead, or other anadromous species. Survey once per month for resident species. Document numbers of redds, live fish, and carcasses.

Spawning or juvenile salmonid survey requirements may be modified or waived if determined unnecessary by SWM and/or BALD.

References

Strahler, A.N. , 1957. Quantitative analysis of watershed geomorphology. American Geophysical Union Transactions 38:913-920.

Fuerstenburg, R.B. and Lucchetti, G.L. 1990. pers. comm. King County Surface Water Management Div. Seattle, WA.

Platts, W.S., G. Armour, G.D. boot, M. Bryant, et al. 1987. Methods for Evaluating Riparian Habitats With Applications to Management. USDA Forest Service General Tech Rept INT-221.

[illegible] FROM A PLATEAU [illegible] FOR ALL

Level III - Detailed:

In addition to Level I and II requirements, produce a habitat map of scale 1" = 100' (1:1,200) showing:

a) habitat types (as determined by Level I stream habitat survey)
b) spawning areas by species (salmonids only)
c) locations, estimated volumes, and species of large woody debris (any wood at least 10" in diameter and 10' long) within the channel or associated flood plain/riparian area.

Using SWM methodology, establish cross sections for each 300 feet of every Class 1 and 2 stream traversing the site and up to 1/4 mile downstream of the site. If the stream length is less than 300 feet, establish at least three equidistant cross sections. Number and location of transects may be modified by SWM depending on site conditions. For each section document the following:

a) bed cross section elevation at 1 foot intervals from the OHWM
b) substrate composition along the cross section utilizing a leadline methodology (Bain and Finnen, 1985)
c) representative macroinvertebrate species and numbers along the cross section
d) stream habitat types within 5 channel widths upstream and downstream of the cross section
e) position, species, and size of all trees at least 10" average diameter that lie within 10 feet upstream and downstream of the cross section and within a distance of 100 feet of the OHWMs.

Minimum standards of acceptability:

All studies shall include the following:

a) Map of habitat types and sampling locations
b) Inventory of observed and expected species
c) Detailed description of methodology used and identification of researchers and their qualifications
d) Attachment of copies of field data sheets, labeled with consultants name, date, location, and activity.

References

Strahler, A.N., 1957. Quantitative analysis of watershed geomorphology. American Geophysical Union Transactions 38:913-920.

Fuerstenberg, R.B. and Lucchetti, G.L. 1990. pers. comm. King County Surface Water Management Div. Seattle, WA.

Bain, M.B., J.T. Finn, L.J. Gerarde, Jr., M.R. Ross, and W.P. Saunders, Jr. 1982. An evaluation of methodologies for assessing the effects of flow fluctuations on stream fish. FWS/OBS-82/63. U.S. Fish and Wildlife Service, Newton Corner, Massachusetts, USA.

Management Briefs, 1985. Quantifying Stream Substrate For Habitat Studies. North American Journal of Fisheries Management. 5:499-506.

McCain, M., D. Fuller, L. Decker and K. Overton, 1990. Stream Habitat Classification Inventory Procedures For Northern California. USDA Forest Service FHR R-5's Fish Habitat Relationships Technical Bulletin No. 1. 15 pp.

Platts, W.S., G. Armour, G.D. Booth, M. Bryant, et al. 1987. Methods for Evaluating Riparian Habitats With Applications to Management. USDA Forest Service General Tech Rept INT-221.

Appendix C

APPENDIX C:
King County 2001 Protocol

TLH

Inventory Methods for Wadable Streams in King County

v 3.0 5/21/2001

DRAFT

Introduction

In the interest of consistency among stream surveys across the County, and in the interest of combining field data with information from other sources --aerial photographs, maps, GIS, and field data from Federal, state, and tribal agencies-- the following methods are being proposed as the standard to be used by King County employees when conducting instream surveys of fish habitat. Standard methods, while they will not accommodate all inquiries for all needs, will allow King County WLRD to combine data sets collected by different programs for different purposes. It will allow the County to collect data that are most useful to the broadest audience of scientists and policy makers. It makes use of data that are most easily collected and of the highest utility in assessment (Scholtz and Booth 2000). It will allow data storage, retrieval, use, and access by a wider spectrum of scientists and technicians than is currently possible. It will foster more efficient use of field data sets when they can be incorporated in widely-accessible databases and GIS layers. Finally, it will provide a set of standard data types for anticipated use in long-term monitoring and assessment.

No survey protocol can accommodate every foreseeable data need, thus the King County protocol must be flexible if it is to be used for studies with different objectives. Any standardization of stream data sets deserves a note of caution. Multiple studies of observer bias have found a direct positive correlation between the number of habitat types in a classification scheme and the observer disagreement between habitat types (Platts 1983, Ralph et al. 1991, Pleus 1995, Roper and Scarnecchia 1995, Wang et al. 1996). However, despite the questionable assumptions of classifying individual habitat units, with the proper classification system-- and ample training of field personnel-- habitat surveys may be dependably reduced to *reach level* variables such as pool-riffle ratios, average widths, and LWD loading (Frissel et al. 1986, Roper and Scarnecchia 1995, Montgomery et al. 1995).

Reach level variables should, with sufficient amounts of high-quality field data, yield general stream characteristics that can be averaged and applied on a watershed scale (Frissel et al. 1986). Reach-level average values should also provide a context for comparing each new stream survey to streams of similar type and character (Paustian et al. 1992, R2 Resource Consultants 2000). At the very least these assessments will create and use a dynamic library of on-the-ground environmental data. Such a library will by itself clarify what is known about King County streams, and where data is lacking.

No single habitat survey protocol can meet all of King County's modeling and assessment needs. Other protocols are or will be developed separately for discharge measurements, fish distribution, water temperatures, macroinvertebrate abundance, nearshore habitat, and geomorphological characteristics.

Office Preparation

Unless the particular study design requires otherwise, stream survey reaches should always be defined before setting out into the field. Property access, riparian continuity, and the streams' geomorphic context are all more manageable if approached beforehand using a combination of maps, databases, aerial photographs, and geographic information systems (GIS). The segment identification procedures outlined in the TFW Ambient Monitoring Methods manual (Schuett-Hames et al. 1994) are useful for delineating stream reaches for field investigation. Most streams in the county have already been typed (according to the TFW method) by gradient, confinement, and general habitat type. This typing is available in the database compiled by the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) and can be accessed from the MAA data server (\\wlrnt4\data\gis\shapes\SSH_NS4.shp). The SSHIAP maps, while not perfect, are consistent with both the TFW protocol and those used by state, tribal, and industry biologists conducting watershed analysis according to Washington State Department of Natural Resources methods (WFPB 1997). The SSHIAP points are revised frequently, so check the shapefile for updates before beginning a survey. The Washington Department of Wildlife has compiled a catalog of stream features (Williams et al. 1975) that, while outdated in many suburban districts, is still of immense value in determining fish access, species distribution, and habitat suitability. The Washington Department of Fish and Wildlife database of spawner survey observations can often supplement the stream catalog in terms of fish abundance. The SSHIAP and spawner databases are currently available on the MAA data directory (\\WLRNT4\data\…).

The entire length of a stream does not have to be sampled in the field. Property access problems often prevent extensive surveys, but even in the case of perfect access many researchers sub-sample streams to increase their efficiency. Montgomery et al. (1995) surveyed reaches from 8 to 24 bankfull channel widths, and their repeated surveys differed by no more than one pool per reach. McHenry et al. (1998) surveyed LWD over 100 meter stream reaches on the Olympic Peninsula and were able to calibrate results with surveys of the same reaches done in 1982 (Grette 1985). Hankin and Reeves (1988) measured one out of every 10 habitat units and visually estimated the dimensions of the other nine, achieving an r^2 of 0.93 between the measured and the estimated habitat areas. May et al. (1997) sampled a minimum of 25 percent of over 100 reaches in 22 Puget Sound Lowland streams, but results on the adequacy of the sample size have yet to be determined. The DNR standard methods for watershed analysis (WFPB 1997) suggest field measurements encompass 15-25 percent of the stream segments in each basin.

Field Methods

Establishing the reach location

Habitat unit surveys will begin at the downstream end of the reach and proceed upstream, even though labeling of the left-bank and right-bank features should be done as if the

observer were looking downstream. The downstream and upstream end points for the survey need to be described in a way that can be clearly interpreted by someone who has not visited the site. Taking GPS points is the preferred way of identifying the upstream and downstream end points. The habitat unit survey form has blanks in the top portion (the header) for GPS readings downstream (D/S) and upstream (U/S). All GPS readings should be recorded in State Plane North HPGN coordinates. When taking GPS coordinates in State Plane North the appropriate measurement units are feet, not meters. Under heavy forest canopies the GPS receiver may not be capable of making accurate readings. In such cases the preferred solution is to shoot offsets with a laser rangefinder.

If GPS readings are not practical or feasible begin the survey where the stream crosses a road, at a confluence, or at some other landmark identifiable on a map or aerial photograph. If the sampling needs to begin upstream of an identifiable landmark (e.g. you don't want to start at a road crossing) then measure the stream distance from the landmark to the point where the survey begins, or simply start the survey elsewhere. An identifiable point (GPS reading, stream confluence, or road crossing) for upstream extent is necessary for accurately locating the stream reach. A downstream point is critical.

If the stream survey can not be located on a map then the usefulness and validity of the data is compromised. There may not be any purpose in conducting a survey if it isn't located so that others can find the site or use the data.

Defining Pools, Riffles, and Glides

Definitions of pools, riffles, and glides vary among habitat survey protocols, and the characteristics of each vary with changing stream flow. Pools typically have slow water velocities, concave bed shapes, and depths greater than that found in riffles and runs. The water surface slope in a pool is essentially zero. If streamflow were to cease pools would continue to hold water (disregarding gravel permeability). Pools often contain eddies with widely varying directions of flow, compared to riffles and glides where the flow is more uni-directional downstream. Riffles are portions of the stream where water velocity is fast, depths are relatively shallow, and the gradient is relatively steep (compared to pools). Riffles typically have boulders and cobble protruding above the water surface, creating a turbulent flow. Channel profile is usually straight to convex. Glides-- which have been likened to shallow canals-- are too shallow to be pools and too slow to be riffles (Platts 1983). Likewise a run, which is typically used in older survey protocols, especially those used in the intermountain West, is too deep to be a riffle and too swift to be a pool. Runs are particularly difficult to distinguish from glides, and the two terms are sometimes used interchangeably. A riffle at high flow often turns into a glide or run, causing confusion and imprecision in delineation. Many glides, such as agricultural ditches and floodplain sloughs, are of such low gradient that they do not become riffles at low flow, yet do not have the concave streambed of pools. Many survey protocols record several habitat types, as discussed below, and then combine classifications in order to calculate pool-riffle ratios, pool spacing, and other summary indices (Platts et al. 1983, USDA Forest Service 1998, Schuett-Hames et al. 1994).

Bisson et al. (1982) was one of the first papers to associate fish preferences with specific habitat types, and most current survey protocols are based on this work. The Bisson et al. (1982) paper divided riffles into three habitat types – low gradient riffles, rapids, and cascades—and pools into six habitat types – secondary channel pools, backwater pools, trench pools, plunge pools, lateral scour pools, and dammed pools. They classified glides as intermediate between pools and riffles.

Hawkins et al. (1993) used a hierarchical approach to break two categories (fast water and slow water) into 18 different habitat types typically found in wadable streams. Definition of these 18 habitat types (7 riffle/cascades, 6 scour pools, and 5 dam pools) was left to literature that is not widely available (Helm et al. 1985). Nevertheless, the Hawkins paper clearly demonstrates the utility and practicality of nesting multiple habitat types into two or three summary units, such as pools and riffles. The authors in Hawkins et al. (1993) equated fast and slow water with riffles and pools, respectively, using the terms interchangeably. The 18 habitat types in Hawkins et al. (1993) are a subset of the 24 habitat units defined in what is commonly referred to as the "FHR" methodology (McCain et al 1997) and an expansion of the 14 habitat types in Bisson et al. (1982).

Hankin and Reeves (1988) developed a sophisticated and statistically defensible habitat and fish abundance estimation technique on four habitat types – pools, riffles, glides, and side channels—based on the habitat classification in Bisson et al. (1982). They emphasized, however, that accurate estimation of habitat areas was contingent on a single experienced observer making all of the visual estimates. Reeves et al. (1989) used data collected using the Hankin and Reeves (1988) method to develop a limiting factors model for coho in the western Cascades. That model enjoys a wide acceptance among fisheries biologists and is often cited as the most reliable method of assessing limiting factors to salmonids.

Beechie et al. (1994) shortened the procedures in the Reeves limiting factors model – while expanding the habitat types to pools, riffles, ponds, lakes, mainstem, and side channel sloughs—and estimated the factors limiting coho in the Skagit watershed. The Beechie model was voted the best paper to appear in the North American Journal of Fisheries Management for the year it was published.

The Northwest Indian Fisheries Commission developed stream survey methods to be used by all cooperators in the Timber-Fish-Wildlife (TFW) Ambient Monitoring program. These methods were consistent with the watershed analysis procedures for use by the state departments of Natural Resources (WADNR) and Fish and Wildlife (WDFW). The original TFW stream survey methods included pools, riffles, cascades, and pool tailouts, but emphasized that tailouts (the way they were defined in that document) usually only occur in large, low-gradient rivers (Schuett-Hames et al. 1994). An updated TFW habitat unit survey protocol reduces the fluvial habitat units to only pools and riffles (Pleus et al. 1999). Reasons for the abbreviated habitat list include 1) problems with habitat unit identification, 2) inconsistent habitat boundary identification, and 3) fluctuation in habitat types at various stream discharges (Pleus 1995). The TFW Ambient Monitoring manual (Schuett-Hames et al. 1994) and the succeeding manuals

(Schuett-Hames et al. 1999, Pleus et al. 1999) provide ample guidance in delineating stream reaches, habitat types, and LWD characteristics.

King County habitat types

Several systems have been developed to classify habitats (HabType), and can be referred to for guidance. The FHR system (McCain et al. 1990) has been adopted as the King County standard and is used by DDES for critical area surveys. Habitat units collected according to the FHR system will be stored in tables separate from current habitat survey data, therefore some habitat units in the database may not appear in the list below. Other nomenclature systems by Bisson et al. (1982), Helm et al. (1985), Hawkins et al. (1993), Rosgen (1994, 1996), and the NWIFC (Schuett-Hames et al. 1999) provide useful definitions, diagrams, and instructions for measuring various reach and habitat parameters. A sampling of sub-habitat types are listed below. Habitat type definitions are from Bisson et al. (1982) unless otherwise noted.

Riffles (aka low-gradient riffles) are defined as having slopes less than 0.04 (4 percent) and shallow depths (less than 20 cm). Current velocities range between 20 and 50 cm/sec, with moderate turbulence. Substrate is typically gravel and cobble from 2 to 256 mm.

Cascades are steeper than riffles and rapids, or, put another way, cascades are the steepest type of riffle (McCain et al. 1990). Unlike riffles and rapids, which have a generally even gradient, cascades alternate between short waterfalls and small pocket pools. Montgomery and Buffington (1993) classify this as a step-pool morphology. Typical substrate in cascades is bedrock or boulders. The TFW Ambient Monitoring manual distinguishes cascades as greater than 3.5 percent (gradient > 0.0350) and riffles as less than 3.5 percent.

Backwater pools usually occur in eddies on the margins of the main stream, typically behind obstructions of LWD, boulders, or rootwads of riparian trees. They are often quite shallow (less than 30 cm) and tend to have fine-grained substrates and low water velocities. Backwater pools are highly preferred summer and winter habitat for coho. McCain et al. (1990) further subdivide backwater pools into those formed by root wads, logs, and boulders.

Plunge pools occur where the stream passes over a channel-spanning obstruction (typically a log berm) and drops vertically into a pool scoured out below. These pools are often large and deep. A complex flow pattern in the pools radiates outward from the point of water entry. Substrates vary considerably from the center of the pool to the slackwater extremities. Plunge pool habitat can be highly complex, and often includes cover in the cavity under the log, behind the bubble curtain, and in the depths of the pool below.

Scour pools are the most common pools in wadable streams, and differ from plunge pools in that the flow is usually directed to one side of a stream by a partial channel obstruction. Often lateral scour pools are associated with undercut banks. Pools occurring on the outside of a meander bend (Montgomery and Buffington 1993, Montgomery et al.

1995) will be classified in King County surveys as lateral scour pools. McCain et al. (1990) specify that lateral scour pools are confined to less than 60 percent of the channel width, and should be sub-divided into those formed by logs, boulders, root wads, and bedrock. Habitats otherwise classified as lateral scour pools, trench pools, mid-channel pools, and convergence pools will be stored in the database as scour pools.

Dammed pools occur upstream of a complete or nearly complete channel obstruction. Typical obstructions include debris jams, landslides, and beaver dams. Water velocity is typically low and substrate sizes tend toward small gravels and sand.

Glides are wide, shallow "pools" flowing smoothly and gently, with low to moderate velocities and little or no surface turbulence. Substrates usually consist of cobble, gravel, and sand. The TFW protocols specify "tailouts" where many biologists would identify a glide (Schuett-Hames et al. 1994). Habitats formerly or otherwise classified as runs will be stored in the database as glides.

The following habitat types are usually not described in habitat survey protocols designed for forested watersheds. However these habitats are common in King County and will be included as available habitat types in the King County database.

Ditches are man-made channels (glides) created to carry runoff from fields and roadways. Some ditches may have once been small streams but have since been straightened, cleaned, or otherwise modified and are now artificially maintained. Ditches are typically straight, and are similar to glides in that they often have low velocities but do not have pool-like channel dimensions. They are typically found in agricultural zones and along road and railroads rights of way.

Debris complex habitat units are low-gradient stream segments with an overabundance of LWD, swirling flow, and indistinct pool or riffle morphology. The dominant feature is a conglomeration of woody debris. Flow is typically chaotic, with varying proportions of fast and slow water (% slow water should be noted). Number of LWD pieces should be counted and, depending on the purpose of the survey, measured.

Culverts are not favorable habitat for fish, but are encountered in many King County surveys and can not be ignored. Culvert survey protocols, which address passage problems, are considered separately from stream survey protocols. However, quantifying culvert length (and number) as a proportion of stream length may be an important factor in assessing habitat characteristics. Including pipes and culverts explicitly will avoid having to interrupt and re-start otherwise continuous habitat surveys.

Braids are a type of riffle that occur where the sediment load is exceeding the transport capacity of the stream under the current hydrologic regime (Leopold and Wolman 1957, Kellerhals et al. 1976). Braids result from an over abundance of sediment, which often originates from forest roads, washouts, or landsliding, and thus indicate a stream that has been impacted by watershed activities such as timber harvest. Either an increase in discharge or a decrease in sediment supply can return a braided channel to a single-thread

channel (Montgomery and Buffington 1993). Braids usually have very high width-to-depth ratios. Riffle habitats that consist of at least three channels separated by highly mobile cobble or sand bars (and bare of vegetation) should be considered braids .

Wetlands (jurisdictional wetlands) have a very specific definition codified in law and are delineated according to soil type, hydrologic regime, and plant community. For the purpose of stream surveys wetlands (in a non-jurisdictional context) are flat, marshy areas where the stream channel becomes indistinct, but where there is a channel entering and exiting the wetland (i.e. the stream being surveyed). For small wetlands the field measurements of length (as a pond centerline from outlet to inlet) and approximate width can be used to calculate habitat area, or for large marshes the area can be measured from aerial photographs back in the office.

Beaver dams provide excellent winter rearing habitat for salmonids, particularly coho, and are highly stable and productive habitats for macroinvertebrates and other organisms (Naiman et al. 1988). Beaver dams have significantly more coho in winter than other pools types (Nickelson et al. 1992) and so should be differentiated in habitat surveys. While dammed pools usually fill in with sediment over time, beavers maintain the depth of their ponds, and by doing so maintain the thermal refugia important to fish in the summer (Pollock et al. 1994). As with wetlands, beaver ponds should be measured in area rather than lineal meters. If field measurements of length and width are questionable it may be possible to measure habitat areas from maps or aerial photographs back in the office.

Habitat Unit Field Techniques

Habitat units will be measured one at a time working in an upstream direction. Left bank and right bank are denoted according to the Mormon method—looking down stream (LDS). The preferred method for measuring linear distance along the stream is a hip chain (also known as a string box) incremented in meters. A fiberglass tape measure may also be used if time permits and accuracy dictates, but a hip chain facilitates the upstream and downstream stationing required on the field form. Hip chain string should be removed from the stream whenever practicable. The suggested method for measuring stream width and depth is a surveyor's stadia rod, incremented in meters. Other instruments are acceptable if time and accuracy dictate.

Working upstream each habitat unit will be classified first as a pool, riffle, or side-channel and noted in the HabID column as P1, R1, P2, R2, S1…P*n*, R*n*, S*n* (see Form 1). Each habitat unit will get a new line on the habitat unit survey form. The cumulative distance (stationing) will be noted in two columns, STA D/S and STA U/S. The downstream distance (STA D/S) and upstream distance (STA U/S) will be used to calculate downstream and upstream measures for each habitat unit and plot them in GIS using routed hydrography layers when accurate hydrography becomes available. The separation of upstream and downstream measures also allows habitat units to exist, in tables, side-by-side where that reflects field conditions. This is especially relevant with side-channels, and also where pools and riffles do not extend across the entire channel.

The downstream and upstream end of each habitat unit will be noted in the STA columns of the survey form. In most cases the STA U/S of one habitat unit will be the same as the STA D/S of the next habitat unit. The habitat form will be clearer if both columns are filled in for each habitat unit (it doesn't take much time and avoids confusion). Habitat sub-unit categories (for example, those listed in Hawkins et al. 1993 or Bisson 1982) can be applied to each habitat in the HabType column of the survey form. This two-column method ensures a consistent accounting of pool-riffle ratios while allowing flexibility in deciding which habitat variables are most important for the survey and it's intended purpose. It also allows the concurrent delineation of side channels without interrupting the mainstem habitat survey. Each habitat unit should extend at least half way across the channel width to qualify as a new habitat unit (WFPB 1997, USDA Forest Service 1998). In cases where a pool occurs in part of a riffle but does not qualify as a new habitat unit, the column %POOL should be used to note the percentage of that riffle that is actually pool habitat (USDA Forest Service 1998). Using the %POOL column in combination with the HabID column allows an accurate and consistent tally of both pool-riffle ratios and the amount of pool habitat in a given reach. The %POOL column is also useful for eliminating observer doubt in steeper cascade reaches where pocket pools comprise a substantial amount of otherwise turbulent habitat.

Stream Width

Habitat width should be measured at least three times on longer habitats and noted in each of the width columns (W1, W2, W3), with an average width computed back in the office. Units of measurement on the field form will be in meters unless otherwise noted. For shorter or simpler habitats a single width measurement is sufficient. See Schuett-Hames et al. (1994) for useful diagrams of where to limit the width measurement on partially-inundated boulders and large cobbles.

Bankfull width should be measured only on habitat units where an accurate assessment of the bankfull flow is possible (Williams 1978, Dunne and Leopold 1978). Typically this occurs on long, straight riffles with a clearly-definable floodplain, distinct terraces, abrupt streambanks at the ordinary high water mark, or ample cobble bars topped with flattened areas of pea gravel or fine sediments (Leopold and Wolman 1957). A detailed discussion of various bankfull indicators can be found in Harrelson et al. (1994). A bankfull elevation that is consistent over several channel widths requires that the water surface slope be essentially the same as the floodplain slope (Leopold and Maddock 1953, Emmett 1975). The water surface slope at a pool is essentially zero. Bankfull *depth* is often irrelevant (or misleading) at pools and, according to some survey protocols, bankfull *width* should not be measured there (USDA Forest Service 1998).

Riffle and Pool Depth

Depth is measured differently in pools and riffles. Pools require two depth measurements, one at the deepest and one at the shallowest points. The pool maximum depth is self-explanatory. The pool crest measurement (or tailout depth) is taken at the deepest point

along the line dividing the pool from the riffle. This is the point at which the last trickle would flow out of the pool if stream flows were to cease. The difference between the maximum depth and the pool crest depth is the residual depth, and represents the pool depth at zero discharge. Pool maximum depth and tailout depth should be recorded on the field form. The residual depths will be calculated in the database. To qualify as a pool the habitat unit should comply with the criteria in Table __. Units of measurement on the field form will be in meters and centimeters unless otherwise noted.

Table__. Minimum residual depth criteria for pools (Schuett-Hames et al 1994).

Channel Bankfull Width (m)	Minimum Residual Depth (m)
0-2.5	0.10
2.5-5	0.20
5-10	0.25
10-15	0.30
15-20	0.35
>20	0.40

Depth in riffles is highly flow dependent so surveys that collect this characteristic should commence with a discharge measurement for the entire stream. (Methods for taking discharge measurements will be included in the next version of the survey protocol.) The average depth in riffles is taken in a representative section of the habitat unit. One way to think of average depth is to mentally note the depth at every point in the habitat, and then measure the depth at what would be an average over the entire habitat unit. If the average depth is in doubt the preferred method is to take measurements from three points along a transect perpendicular to the flow direction. Depths should be taken at one-fourth, one-half-, and three-fourths the distance across the stream, and then divided by 4, to account for the zero depths at the shore (USDA Forest Service 1998, Platts 1983).

Large Woody Debris (LWD)-

The effect of LWD on a stream generally depends on the size of the LWD relative to the width of the stream, the position of the LWD in the stream corridor, and the gradient of the stream reach (Beechie and Sibley 1997, Montgomery and Buffington 1993, Bilby and Ward 1991). Although many ecologists stress flexibility in interpretation, target conditions for LWD loading have nevertheless been set by various agencies and organizations, and in a variety of units. The National Marine Fisheries Service has set "properly functioning" LWD criteria for West Coast rivers at around 80 pieces per mile, greater than 24" diameter, and 50 ft in length (NMFS 1996). The Washington State Department of Fish and Wildlife (WDFW) set a minimum of two pieces of LWD per stream bankfull width on streams less than 20 meters wide, with a minimum of 0.3 key pieces for streams less than 10 meters wide and 0.5 key pieces for streams between 10 and 20 meters wide (WDFW 1996). The WDFW targets are identical to, and were adopted from, channel and fish habitat indicators defined in the Washington DNR watershed analysis methodology (WFPB 1997). Minimum LWD size thresholds in most Washington State standards are 10 cm diameter and 2 m length, and minimum key piece

diameters vary according to stream width, as in Table __ (Schuett-Hames et al. 1999, WFPB 1997).

Table __. Minimum size to qualify LWD as a key piece.

Bankfull Width		Diameter		Length	
meters	feet	meters	feet	meters	feet
0 – 5	0 – 15	0.40	1.3	8	26
6 – 10	15 – 30	0.55	1.8	10	33
11 – 15	30 – 45	0.65	2.1	18	60
16 – 20	45 – 60	0.70	2.3	24	79

Depending on the use of the survey some observers may need to measure each piece of LWD while for others a quick tally of LWD in different size classes may be sufficient. King County surveys will follow either a Level I or Level II assessment protocol depending on the needs of the party conducting the survey and the time and effort available for LWD counts.

For King County Level I surveys the size of LWD will be lumped into three size classes. Only LWD lying wholly or partially within the area inundated by bankfull flow (zone 2, Robison and Beschta 1990) will be counted. All LWD pieces on the division between two habitat units should be tallied on the same line as the habitat unit most affected, or by default with the downstream unit (since this unit will most likely be affected by any flow directed over or around the LWD). Minimum length of LWD will be two meters (6 feet). Root wads can be of any size that has an effect on stream morphology or habitat, but should generally not be less than about 25 centimetes in (bole) diameter. Units of measurement on the field form will be meters and centimeters unless otherwise noted. The LWD pieces for a Level I survey will be grouped into the three diameter classes in Table 1. These diameter classes coincide with those used in the King County and WADNR riparian analyses, but unfortunately do not coincide with either TFW or Mount Baker Snoqualmie National Forest protocols for LWD surveys (Schuett-Hames et al.. 1999, USDA Forest Service 1998, WFPB 1997).

Table1. LWD diameter classes.

Diameter Class	Diameter (inches)	Diameter (cm)
Small	4-12	10-30
Medium	12-20	30-50
Large	20+	Greater than 50

Each row on the habitat unit survey form will have four columns for tallying LWD. Hash marks ( ) will be entered for LWD pieces in each diameter class, with root wads in the fourth column. In many instances it may be useful to note the measured diameter of pool forming LWD pieces, particularly when those pieces are the smallest pieces forming pools in that reach (minimum pool-forming diameter for the reach). Minimum pool-forming diameter measurements can be entered in the column MIN in the LWD section (back) of the field form.

(WFPB 1997) for details on delineating RCUs from stereo photographs and verifying RCUs in the field.

Stream Gradient

Stream gradient is often used as a surrogate for stream energy, the dominant control on channel morphology (Richards 1982). An accurate gradient measurement that characterizes the entire reach is the most useful. Gradient measurements should be taken in a representative section if the reach is homogenous, or stretched over several bankfull widths if the reach is not. The most accurate method of determining stream gradient is to use an autolevel and stadia rod. This method, however, is relatively time consuming and requires more training than that normally given to stream survey personnel. In streams with gradients greater than about four percent it may be possible to achieve acceptable results with a clinometer, but clinometers and most other hand-held devices are not acceptable for flatter stream reaches (Isaak 1999, WFPB 1997, Harrelson 1994).

Laser rangefinders, although relatively expensive, are generally available to many King County personnel and give results nearly as accurate as an autolevel. Laser rangefinders are the preferred instrument for measuring stream gradient when an autolevel is unavailable or impractical. For best results the laser should be mounted on a staff and fired at a red reflector mounted on a second staff. Both the laser and the reflector must be the same height above the water surface (i.e. the staffs should be the same length). Gradient measurements should encompass a stream profile of at least 10 bankfull widths on all wadable streams and should be measured away from the influence of roads, bridges, berms, bank armoring, and other human impacts. Gradient measurements should be reported unitless and to at least three decimal places (i.e. not 0.2 percent but 0.002).

Substrate

The composition of streambed substrate is an crucial factor in how streams behave and can provide important information about how a channel will respond to changes in the watershed (Montgomery and Buffington 1993, Harrelson et al. 1994). Unfortunately, accurate and repeatable measurement of bed substrate can be both tedious and time consuming. Platts et al. (1983) visually classified substrate into six categories and listed a dominant and subdominant substrate in each habitat unit. Comparing these visual estimates to values acquired with sieves yielded disappointing results. Confidence intervals about the mean for the (visual) boulder category was ± 40.9 percent, for the rubble category ± 35.9 percent, and for the fines category was ± 27 percent (Platts et al. 1983). Year-to-year precision between observations was also low. A separate visual estimate of embeddedness fared better, with a 95 percent confidence interval of only ± 5.4 percent. In a similar study in Wisconsin, the accuracy and precision of substrate estimates was better, but still varied with the heterogeneity of the substrates. That is, the more homogenous the substrate mixture the narrower the variation in observer estimates (Wang et al. 1996). Visual estimates, preferred by fisheries biologists, may not be precise enough to serve the needs of fluvial geomorphologists and other river scientists.

Table 2. Riparian vegetation types for King County stream surveys

Type	Code	Description
Conifer dominated	C	Forested, more than 70% of trees are conifer
Hardwood dominated	H	Forested, more than 70% of the trees are hardwood
Mixed	M	Forested, no dominance greater than 70%
Shrub	S	Dominated by woody stemmed vegetation that does not reach > 40' at maturity, e.g., willows (salix), dogwood (cornus), and salmonberry (rubus).
Grass or Cleared	G	Pasture, row crops, maintained right-of-ways, orchards, parkland, landscaped areas, vacant fields, marshes and wetlands not in open water.
Urban	U	Greater than 70% of RCU is paved or built-up. Includes roads, levees, railroads, and bridges.

Table 3. Size classifications for riparian trees.

Type	Code	Description
Small	S	Dominant trees in the RCU: 3" ≤ DBH < 12"
Medium	M	Dominant trees in the RCU: 12" ≤ DBH < 20"
Large	L	Dominant trees in the RCU: 20" ≤ DBH
Not applicable	X	Value applied to the shrub, grass and urban classes

Table 4. Density classes for riparian trees.

Type	Code	Description
Dense	D	More than 1/3 of the RCU is covered by trees
Sparse	S	Less than 1/3 of the RCU is covered by trees
Not applicable	X	Value applied to the shrub, grass, and urban classes

Some studies may require a finer-scale approach to riparian condition than that available in the WADNR method, and some stream inventories may choose not to look at riparian composition at all. In the cases where riparian zone data *are* collected it will be most useful if the RCUs in Tables 2-4 are used to fill in the blanks for LBrip and RBrip on the habitat unit survey form.

The three categories in tables 2-4 are combined and listed in the appropriate columns on the field form. For example a riparian zone on the left bank with a typical stand of 20-year-old alder would get HMD (for hardwood, medium, dense) in the LBrip column. If the right bank was a mature, mixed-deciduous forest with at least 30% conifer understory beginning to accede to the canopy it would probably get MLD (for mixed large dense) in the RBrip column. Observers should interpret the riparian canopy as it would appear from an aerial photograph. Before going out in the field at least one observer should practice delineating riparian condition units using aerial photographs and a stereoscope. Before making riparian calls in the field each observer should also practice visually estimating the diameter classes of trees (at breast height, or 4.5 feet from the ground) and checking the visual estimates with a diameter tape. Refer to the watershed analysis methodology

Level II LWD surveys will use a separate form but will cross-reference to instream habitats by referencing the HabID column on both the habitat survey form and the LWD Level II form. The stationing for each piece may be recorded in the STA column, particularly if the LWD survey is conducted separately from the habitat unit survey. If conducted separately a Level II LWD survey should be located with upstream and downstream GPS points.

Each LWD piece above the minimum threshold (10 cm diameter and 2 m length) will be measured and entered on a separate line of the field form. The BANK column will record if the LWD piece is associated with the left bank (LB), right bank (RB), or mid stream (MS) portion of the channel. The diameter of each piece will be measured with calipers or a diameter tape. Laser rangefinders may be useful in measuring the length of large pieces of wood, but length is probably most easily measured with a stadia rod or fiberglass tape. Field measurements of LWD are acceptable in either metric or standard units, but must be converted to metric units for entry in the database. Each piece should be mentally broken into the four channel interaction zones (Figure __) as specified in Robison and Beschta (1990). Four columns (for zones 1 through 4) will record percentages for the volume of each LWD piece in the respective zones. If the LWD piece is responsible for forming a pool it will recieve an X in the POOL column. The ORIGIN column will record whether the LWD piece was placed during a restoration effort or was naturally recruited ("a" for artificial; "n" for natural). The field SRC_DST (for source distance) will record the distance from the formerly standing tree to the to the (bankfull) streambank, where it is obvious that the tree was recruited in place (laser rangefinders are particularly useful for this measurement). The species or composition (conifer or deciduous) may be recorded in the SP column, if known. A column for comments will also be provided.

Riparian Vegetation

Riparian vegetation has an enormous influence on the productivity and habitat characteristics of a stream reach, but without training and practice it is difficult to summarize from a single point on the ground. Accuracy and precision among different observers and over time are low for streamside cover and bank vegetation, but not for riparian trees (Wang et al. 1996, Platts et al. 1983, Lindsey et al. 1958). The Washington Department of Natural Resources (WADNR) has developed a standard methodology for assessing riparian vegetation along streams using aerial photographs combined with field verification (WFPB 1997). The WADNR method examines a riparian zone 100' on each side of the stream, and classifies the riparian condition units (RCUs) into categories depending on the trunk diameter, canopy density, and vegetational composition of the trees in the zone. King County has adopted a very similar method to classify RCUs in the Agricultural Production Districts and elsewhere, which uses the RCU categories listed in Tables 2-4.

Instead of visual estimates, many state, tribal, and Federal fisheries agencies in the Northwest use pebble counts to classify substrate (Wolman 1954, Booth et al. 1991, Ralph et al. 1991, Harrelson et al. 1994, WFPB 1997, USDA Forest Service 1998). Pebble counting consists of measuring the intermediate axis of 100 stones chosen from the river bed along a transect or from a grid (Wolman 1954). From the pebble sample a cumulative frequency distribution is plotted from which grain sizes may be read. The median diameter (D_{50}) and the diameter of the 84th percentile (D_{84}) are values used by many fluvial geomorphologists to characterize bedload transport in gravel bedded streams (Booth 1991, Kondolf and Li 1992).

Field techniques for the pebble count usually require an observer and a note taker. The reach in question may include both pools and riffles, pools only (usually tailouts, for spawning gravel surveys), or riffles only, depending on the needs of the survey. The reach location and character should be noted on the pebble count field form (Form 2). The observer paces across the bankfull channel width on a transect perpendicular to the flow. For multiple-habitat-unit pebble counts multiple transects are chosen, but typically the count is taken in a single "representative" riffle (USDA Forest Service 1998, Ralph et al. 1991). At each step the observer chooses a stone from under the tip of his or her boot. The tendency is to choose larger rocks, so the "first blind touch" technique is employed to minimize bias (Rosgen 1996). Observers should avoid looking down when choosing stones and try to select the first stone touched by the tip of a finger (Wolman 1954, USDA Forest Service 1998). Large boulders can be measured with a stadia rod. Each stone is measured on the intermediate axis, in millimeters, using a pocket ruler. The longest axis is the length, the shortest axis is the thickness, and the intermediate axis is the width. The intermediate axis determines whether or not a pebble would pass through a soil sieve. See Harrelson et al. (1994) for a good discussion of pebble count techniques that includes a useful diagram of the intermediate axis.

Each pebble is tallied according to a modified Wentworth scale (Form 2). The observer tells the note taker the measurement of each pebble, who tallies them in the appropriate category. If no note taker is available a voice activated pocket tape recorder is useful for recording the measurement (as long as the background noise of the stream isn't too loud). The recording can be played back as the 100 stones tallied on the field form. The note taker and observer can swap duties halfway through (or more often) to alleviate chilled hands. Cumulative frequencies can be totaled and plotted in the field, or saved for data entry in the office. The resulting frequency distribution represents the proportion of each gravel size class as it is found on the stream bed.

Data QA/QC

The most convenient, flexible, and widely-used data entry techniques usually involve spreadsheets. However, the flexibility afforded by spreadsheets often results in stream data that is inconsistent between streams, or even between habitat units in the same reaches of the same stream. To avoid inconsistency and streamline data interpretation, King County employees will enter habitat survey data into a database constructed for that purpose. The data entry screens will be arranged to mimic the field forms, and stream

summary parameters (average bankfull width, pool/riffle ratio, pool spacing, LWD counts, etc.) will be computed automatically. Output from the database will be used to construct GIS tables of stream inventory data.

Data should be entered into the database as soon as possible after the reach survey, preferably at the end of the day. Details of complex habitat configurations are quickly forgotten and can often make a difference in how data is entered or resolved in the database. Timely data entry is an important component of quality assurance.

After the data are entered they should be checked by at least one other person who was present when the data were collected. Both the data entry person and the QA/QC person should enter initials and dates in the appropriate boxes of the database entry forms. The third check of data quality (for character formatting, consistency, etc.) will be made by a database administrator, and the data will be posted for widespread access. Summary tables of survey data will be calculated and exported to standard report formats. The database itself will be posted on a read-only basis. Further manipulation of the survey data, for specific individual analyses and graphing, will occur on downloaded copies of the data, or by arrangement with the database administrators. ArcView event tables and shapefiles depicting the surveyed reaches will be set up by the database administrators and posted in freely-accessible ArcView projects. As with the data, the event tables and shapefiles will be available for copying and individual manipulation.

References

Beechie, T., E. Beamer, and L.Wasserman. 1994. Estimating coho salmon rearing habitat and smolt production losses in a large river basin, and implications for habitat restoration. North American Journal of Fisheries Management 14:797-811.

Beechie, T.J., and T.H. Sibley. 1997. Relationships between channel characteristics, woody debris, and fish habitat in northwestern Washington streams. Transactions of the American Fisheries Society **126**: 217-229.

Bilby, R.E., and J.W. Ward. 1991. Characteristics and function of large woody debris in streams draining old-growth, clear-cut, and second-growth forests in southwestern Washington. Canadian Journal of Fisheries and Aquatic Sciences 48: 2499-2508.

Bisson, P.A., J.L. Nielsen, R.A. Palmason, and L.E. Grove. 1982. A system of naming habitat types in small streams, with examples of habitat utilization by salmonids during low streamflow. *In* N.B. Armantrout [ed.] Acquisition and Utilization of Aquatic Habitat Inventory Information: Proceedings of the Symposium. [Portland, OR, October 1981].

Booth, D.B., K. Bell, and K.X. Whipple. 1991. Sediment transport along the South Fork and mainstem of the Snoqualmie River. King County Surface Water Management. Seattle, Washington.

Dunne, T. and L.B. Leopold. 1978. Water in environmental planning. W.H. Freeman and Co. New York.

Emmett, W.W. 1975. The channels and waters of the upper Salmon River area, Idaho. U.S. Geological Survey Professional Paper 870-A. Washington, D.C.

Frissel, C.A., W. J. Liss, C.E. Warren, M.D. Hurley. 1986. A hierarchical framework for stream habitat classification: viewing streams in a watershed context. Environmental Management 10(2): 199-214.

Grette, G.B. 1985. The role of large organic debris in juvenile salmonid rearing habitat in small streams. Masters thesis, University of Washington.

Hankin, D.G., and G.H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. *Can. J. Fish. Aquat. Sci.* 45: 834-844.

Harrelson, C.C., C.L. Rawlins, and J.P. Potyondy. 1994. Stream channel reference sites: an illustrated guide to field technique. Gen. Tech.Rep. RM-245. Fort Collins, CO: U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Hawkins, C.P., J.L. Kershner, P.A. Bisson, M.D. Bryant, L.M. Decker, S.V. Gregory, D.A. McCullough, C.K. Overton, G.H. Reeves, R.J. Steedman, and M.K. Young. 1993. A hierarchical approach to classifying stream habitat features. Fisheries **18**: 3-6.

Helm, W.T., P. Brouha, M. Aceituno, C. Armour, P. Bisson, J. Hall, G. Holton, and M. Shaw. 1985. Glossary of stream habitat terms. Habitat Inventory Committee, American Fisheries Society, Western Division.

Isaak, D.J., W.A. Hubert, and K.L. Krueger. 1999. Accuracy and precision of stream reach water surface slopes estimated in the field and from maps. North American Journal of Fisheries Management 19:141-148.

Kellerhalls, R., and M. Church, 1989. The morphology of large rivers: characterization and management. Pages 13-30 *in* Dodge, D.P. (ed) Proceedings of the International Large River Symposium (LARS). Can. Spec. Publ. Fish. Aquat. Sci. 106: 629 p.

Kondolf, G.M., and S. Li. 1992. The pebble count technique for quantifying surface bed material size in instream flow studies. Rivers 3(2): 80-87.

Leopold, L.B. and T. Maddock. 1953. The hydraulic geometry of stream channels and some physiographic implications. U. S. Geological Survey Professional Paper 252.

Leopold, L.B., and M.G. Wolman. 1957. River channel patterns: braided, meandering and straight. Geological Survey Professional Paper 282-B. U.S. Government Printing Office, Washington D.C.

Lindsey, A.A., J.D. Barton Jr., and S.R. Miles. 1958. Field efficiencies of forest sampling methods. Ecology 39(3): 428-444.

Lisle, T.E. and S. Hilton. 1992. The volume of fine sediment in pools: an index of sediment supply in gravel-bed streams. Water Resources Bulletin 28(2): 371-383

May, C.W., E.B. Welch, R.R. Horner, J.R. Karr, and B.W. Mar. 1997. Quality indices for urbanization effects in Puget Lowland streams. Report prepared for Washington Department of Ecology. Water Resources Series Technical Reprot No 154.

McCain, M. D. Fuller, L.Decker, and K. Overton. 1990. Stream habitat classification and inventory procedures for Northen California. USDA Forest Service, Pacific Southwest Region.

McHenry, M.L., E. Shott, R.H. Conrad, and G.B. Grette. 1998. Changes in the quantity and characteristics of large woody debris in streams of the Olympic Peninsula, Washington, USA. (1982-1993). Canadian Journal of Fisheries and Aquatic Sciences **55**: 1395-1407.

Montgomery, D.R., and J.M. Buffington. 1993. Channel classification, prediction of channel response, and assessment of channel condition. Report TFW-SH10-93-002. Washington Department of Ecology, Olympia WA.

Montgomery, D.R., J.M. Buffington, R.D. Smith, K.M. Schmidt, and G. Pess. 1995. Pool spacing in forest channels. Water Resources Research 31(4): 1097-1105.

Naiman, R.J., C.A. Johnston, and J.C. Kelley. 1988. Alteration of North American streams by beaver. BioScience 38(11): 753-762

Nickelson, T.E., J.D. Rodgers, S.L. Johnson, and M.F. Solazzi. 1992. Seasonal changes in habitat use by juvenile coho salmon (*Oncorhynchus kisutch*) in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences **49**: 783-789.

NMFS (National Marine Fisheries Service). 1996. Coastal salmon conservation: working guidance for comprehensive salmon restoration initiatives on the Pacific Coast. National Oceanic and Atmospheric Administration. September 15, 1996

Paustian, S.J. and thirteen coauthors. 1992. A channel type users guide for the Tongass National Forest, Southeast Alaska. USDA Forest Service, Alaska Region. R10 Technical Paper 26.

Platts, W.S., W.F. Megahan, and G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. USDA Forest Service General Technical Report INT-GTR-188.

Pleus A.E. 1995. Variability associated with salmon habitat identification and water surface area measurements. Masters thesis. Evergreen State College, Olympia, Washington.

Pleus, A.E., D. Schuett-Hames, and L. Bullchild. 1999. TFW Monitoring Program method manual for the habitat unit survey. Prepared for the Washington State Dept. of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-99-003. DNR #105.

Pollock, M.M., R.J. Naiman, H.E. Erickson, C.A. Johnston, J. Pastor, and G. Pinay. 1994. Beavers as engineers: influences on biotic and abiotic characteristics of drainage basins. pp. 117-126 *in* Linking Species to Ecosystems. C.G. Jones and J.H. Lawton eds. Chapman & Hall, New York.

R2 Resource Consultants. 2000. Tri-county urban issues ESA study. Prepared for the Tri-County Urban Issues Advisory Committee by R2 Resource Consultants in association with CH2MHill and Shapiro & Associates. Seattle, WA.

Ralph, S.C., T. Cardoso, G.C. Poole, L. L. Conquest, and R.J. Naiman. 1991. Ambient monitoring project biennial progress report; 1989-91 biennial period. Center for Streamside Studies, University of Washington, Seattle.

Reeves, G.H., F.H. Everest, and T.E. Nickelson. 1989. Identification of physical habitats limiting the production of coho salmon in western Oregon and Washington. USDA Forest Service General Technical Report PNW-GTR-245. 18p.

Richards, K. 1982. Rivers, form and process in alluvial channels. Methuen & Co. Ltd. London. 361pp.

Robison, G.E., and R.L. Beschta. 1990. Characteristics of coarse woody debris for several coastal streams of Southeast Alaska, USA. Canadian Journal of Fisheries and Aquatic Sciences 47: 1684-1693.

Roper, B.B. and D.L. Scarnecchia. 1995. Observer variability in classifying habitat types in stream surveys. North American Journal of Fisheries Management **15**: 49-53.

Rosgen, D.L. 1994. A classification of natural rivers. Catena 22: 169-199.

Rosgen, D.L. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO.

Scholtz, J. G., and D. B. Booth. 2000. Monitoring urban streams: strategies and protocols for humid-region lowland systems. Prepared for King Count WLRD. University of Washington Center for Urban Water Resources Management and University of Washington Center for Streamside Studies, Seattle.

Schuett-Hames, D. A. Pleus, L. Bullchild, and S. Hall. 1994. Timber-Fish-Wildlife Ambient Monitoring Program Manual. TFW-AM9-94-001 Northwest Indian Fisheries Commission. Olympia WA.

Schuett-Hames, D., A.E. Pleus, J. Ward, M. Fox, and J. Light. 1999. TFW Monitoring Program method manual for the large woody debris survey. Prepared for the Washington State Dept of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-004. DNR #106.

USDA Forest Service. 1998. Stream inventory handbook, version 9.8. Region VI, USDA Forest Service, Portland, Oregon.

Wang, L. T.D. Simonson, and J. Lyons. 1996. Accuracy and precision of selected stream habitat estimates. North American Journal of Fisheries Management 16:340-347

Washington Department of Fish and Wildlife. 1996. 21st Century Wild: Washington State's Fish and Habitat Policy for Salmonid Protection and Recovery. Internal WDFW Review Draft (Wild Salmonid Policy). August 15, 1996. Olympia WA.

Washington Forest Practices Board (WFPB). 1997. Standard Methodology for Conducting Watershed Analysis under Chapter 222-22 WAC. Version 4.0, November 1997. Washington Department of Natural Resources, Olympia, Washington.

Williams, G.P. 1978. Bank-full discharge of rivers. Water Resources Research 14(6): 1141-1154

Williams, R.W., R.M. Laramie and J.J. Ames. 1975. A catalog of Washington streams and salmon utilization. Vol. 1, Puget Sound Region; Washington Department of Fisheries. Olympia.

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transactions of the American Geophysical Union 35: 951-956

Wolman Pebble Count field data form

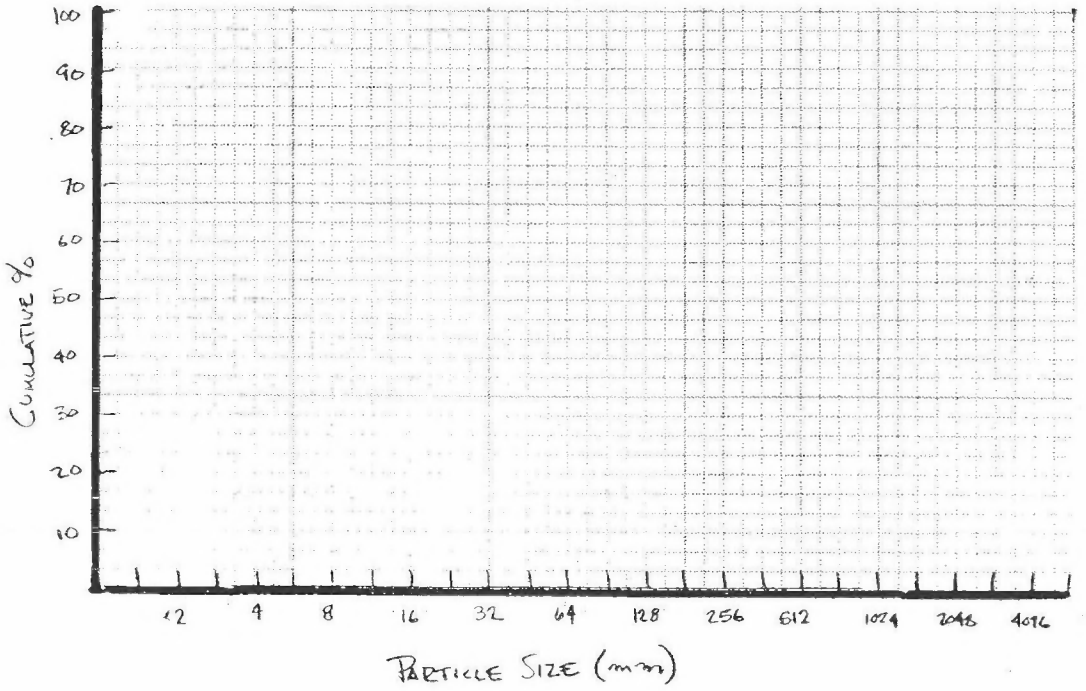
Date: _____ Observer: _____

Stream: _____ Recorder: _____

Habitat Unit: _____ Reach Description: _____

Particle	category	millimeters	count	total#	particle%	cumulative%
<= sand	fines	<2				
very fine	gravels	2-4				
fine	gravels	4-6				
fine	gravels	6-8				
medium	gravels	8-12				
medium	gravels	12-16				
coarse	gravels	16-24				
coarse	gravels	24-32				
very coarse	gravels	32-48				
very coarse	gravels	48-64				
small	cobbles	64-96				
small	cobbles	96-128				
large	cobbles	128-192				
large	cobbles	192-256				
small	boulders	256-384				
small	boulders	384-512				
medium	boulders	512-1024				
large	boulders	1024-2048				
very large	boulders	2048-4096				

BEDROCK



Stream Name	Date	Temp Air	Site Notes:
Reach Name/Num	Time In	Temp Water	
GPS D/S	Time Out	Weather	
GPS U/S	Crew		

						Width				Depth				Riparian		
Hab ID	STA D/S	STA U/S	Len	Hab Type	% pool	W1	W2	W3	BKF	Avg	Max	Tail	BKF	RB	LB	COMMENTS

LWD LEVEL II

Stream: _____

Date: _____

Crew: _____

HabID	STA	Bank	Length	Dia	Z1	Z2	Z3	Z4	Origin	Pool	MM	SP	Origin	SP	Comments

References

Beechie, T., E. Beamer, and L.Wasserman. 1994. Estimating coho salmon rearing habitat and smolt production losses in a large river basin, and implications for habitat restoration. North American Journal of Fisheries Management 14:797-811.

Beechie, T.J., and T.H. Sibley. 1997. Relationships between channel characteristics, woody debris, and fish habitat in northwestern Washington streams. Transactions of the American Fisheries Society 126: 217-229.

Bilby, R.E., and J.W. Ward. 1991. Characteristics and function of large woody debris in streams draining old-growth, clear-cut, and second-growth forests in southwestern Washington. Canadian Journal of Fisheries and Aquatic Sciences 48: 2499-2508.

Bisson, P.A., J.L. Nielsen, R.A. Palmason, and L.E. Grove. 1982. A system of naming habitat types in small streams, with examples of habitat utilization by salmonids during low streamflow. *In* N.B. Armantrout [ed.] Acquisition and Utilization of Aquatic Habitat Inventory Information: Proceedings of the Symposium. [Portland, OR, October 1981].

Booth, D.B., K. Bell, and K.X. Whipple. 1991. Sediment transport along the South Fork and mainstem of the Snoqualmie River. King County Surface Water Management. Seattle, Washington.

Dunne, T. and L.B. Leopold. 1978. Water in environmental planning. W.H. Freeman and Co. New York.

Emmett, W.W. 1975. The channels and waters of the upper Salmon River area, Idaho. U.S. Geological Survey Professional Paper 870-A. Washington, D.C.

Frissel, C.A., W. J. Liss, C.E. Warren, M.D. Hurley. 1986. A hierarchical framework for stream habitat classification: viewing streams in a watershed context. Environmental Management 10(2): 199-214.

Grette, G.B. 1985. The role of large organic debris in juvenile salmonid rearing habitat in small streams. Masters thesis, University of Washington.

Hankin, D.G., and G.H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. *Can. J. Fish. Aquat. Sci.* 45: 834-844.

Harrelson, C.C., C.L. Rawlins, and J.P. Potyondy. 1994. Stream channel reference sites: an illustrated guide to field technique. Gen. Tech.Rep. RM-245. Fort Collins, CO: U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Hawkins, C.P., J.L. Kershner, P.A. Bisson, M.D. Bryant, L.M. Decker, S.V. Gregory, D.A. McCullough, C.K. Overton, G.H. Reeves, R.J. Steedman, and M.K. Young. 1993. A hierarchical approach to classifying stream habitat features. Fisheries 18: 3-6.

Helm, W.T., P. Brouha, M. Aceituno, C. Armour, P. Bisson, J. Hall, G. Holton, and M. Shaw. 1985. Glossary of stream habitat terms. Habitat Inventory Committee, American Fisheries Society, Western Division.

Isaak, D.J., W.A. Hubert, and K.L. Krueger. 1999. Accuracy and precision of stream reach water surface slopes estimated in the field and from maps. North American Journal of Fisheries Management 19:141-148.

Kellerhalls, R., and M. Church, 1989. The morphology of large rivers: characterization and management. Pages 13-30 *in* Dodge, D.P. (ed) Proceedings of the International Large River Symposium (LARS). Can. Spec. Publ. Fish. Aquat. Sci. 106: 629 p.

Kondolf, G.M., and S. Li. 1992. The pebble count technique for quantifying surface bed material size in instream flow studies. Rivers 3(2): 80-87.

Leopold, L.B. and T. Maddock. 1953. The hydraulic geometry of stream channels and some physiographic implications. U. S. Geological Survey Professional Paper 252.

Leopold, L.B., and M.G. Wolman. 1957. River channel patterns: braided, meandering and straight. Geological Survey Professional Paper 282-B. U.S. Government Printing Office, Washington D.C.

Lindsey, A.A., J.D. Barton Jr., and S.R. Miles. 1958. Field efficiencies of forest sampling methods. Ecology 39(3): 428-444.

Lisle, T.E. and S. Hilton. 1992. The volume of fine sediment in pools: an index of sediment supply in gravel-bed streams. Water Resources Bulletin 28(2): 371-383

May, C.W., E.B. Welch, R.R. Horner, J.R. Karr, and B.W. Mar. 1997. Quality indices for urbanization effects in Puget Lowland streams. Report prepared for Washington Department of Ecology. Water Resources Series Technical Reprot No 154.

McCain, M. D. Fuller, L.Decker, and K. Overton. 1990. Stream habitat classification and inventory procedures for Northen California. USDA Forest Service, Pacific Southwest Region.

McHenry, M.L., E. Shott, R.H. Conrad, and G.B. Grette. 1998. Changes in the quantity and characteristics of large woody debris in streams of the Olympic Peninsula, Washington, USA. (1982-1993). Canadian Journal of Fisheries and Aquatic Sciences **55**: 1395-1407.

Montgomery, D.R., and J.M. Buffington. 1993. Channel classification, prediction of channel response, and assessment of channel condition. Report TFW-SH10-93-002. Washington Department of Ecology, Olympia WA.

Montgomery, D.R., J.M. Buffington, R.D. Smith, K.M. Schmidt, and G. Pess. 1995. Pool spacing in forest channels. Water Resources Research 31(4): 1097-1105.

Naiman, R.J., C.A. Johnston, and J.C. Kelley. 1988. Alteration of North American streams by beaver. BioScience 38(11): 753-762

Nickelson, T.E., J.D. Rodgers, S.L. Johnson, and M.F. Solazzi. 1992. Seasonal changes in habitat use by juvenile coho salmon (*Oncorhynchus kisutch*) in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences **49**: 783-789.

NMFS (National Marine Fisheries Service). 1996. Coastal salmon conservation: working guidance for comprehensive salmon restoration initiatives on the Pacific Coast. National Oceanic and Atmospheric Administration. September 15, 1996

Paustian, S.J. and thirteen coauthors. 1992. A channel type users guide for the Tongass National Forest, Southeast Alaska. USDA Forest Service, Alaska Region. R10 Technical Paper 26.

Platts, W.S., W.F. Megahan, and G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. USDA Forest Service General Technical Report INT-GTR-188.

Pleus A.E. 1995. Variability associated with salmon habitat identification and water surface area measurements. Masters thesis. Evergreen State College, Olympia, Washington.

Pleus, A.E., D. Schuett-Hames, and L. Bullchild. 1999. TFW Monitoring Program method manual for the habitat unit survey. Prepared for the Washington State Dept. of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-99-003. DNR #105.

Pollock, M.M., R.J. Naiman, H.E. Erickson, C.A. Johnston, J. Pastor, and G. Pinay. 1994. Beavers as engineers: influences on biotic and abiotic characteristics of drainage basins. pp. 117-126 *in* Linking Species to Ecosystems. C.G. Jones and J.H. Lawton eds. Chapman & Hall, New York.

R2 Resource Consultants. 2000. Tri-county urban issues ESA study. Prepared for the Tri-County Urban Issues Advisory Committee by R2 Resource Consultants in association with CH2MHill and Shapiro & Associates. Seattle, WA.

Ralph, S.C., T. Cardoso, G.C. Poole, L. L. Conquest, and R.J. Naiman. 1991. Ambient monitoring project biennial progress report; 1989-91 biennial period. Center for Streamside Studies, University of Washington, Seattle.

Reeves, G.H., F.H. Everest, and T.E. Nickelson. 1989. Identification of physical habitats limiting the production of coho salmon in western Oregon and Washington. USDA Forest Service General Technical Report PNW-GTR-245. 18p.

Richards, K. 1982. Rivers, form and process in alluvial channels. Methuen & Co. Ltd. London. 361pp.

Robison, G.E., and R.L. Beschta. 1990. Characteristics of coarse woody debris for several coastal streams of Southeast Alaska, USA. Canadian Journal of Fisheries and Aquatic Sciences 47: 1684-1693.

Roper, B.B. and D.L. Scarnecchia. 1995. Observer variability in classifying habitat types in stream surveys. North American Journal of Fisheries Management 15: 49-53.

Rosgen, D.L. 1994. A classification of natural rivers. Catena 22: 169-199.

Rosgen, D.L. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO.

Scholtz, J. G., and D. B. Booth. 2000. Monitoring urban streams: strategies and protocols for humid-region lowland systems. Prepared for King Count WLRD. University of Washington Center for Urban Water Resources Management and University of Washington Center for Streamside Studies, Seattle.

Schuett-Hames, D. A. Pleus, L. Bullchild, and S. Hall. 1994. Timber-Fish-Wildlife Ambient Monitoring Program Manual. TFW-AM9-94-001 Northwest Indian Fisheries Commission. Olympia WA.

Schuett-Hames, D., A.E. Pleus, J. Ward, M. Fox, and J. Light. 1999. TFW Monitoring Program method manual for the large woody debris survey. Prepared for the Washington State Dept of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-004. DNR #106.

USDA Forest Service. 1998. Stream inventory handbook, version 9.8. Region VI, USDA Forest Service, Portland, Oregon.

Wang, L. T.D. Simonson, and J. Lyons. 1996. Accuracy and precision of selected stream habitat estimates. North American Journal of Fisheries Management 16:340-347

Washington Department of Fish and Wildlife. 1996. 21st Century Wild: Washington State's Fish and Habitat Policy for Salmonid Protection and Recovery. Internal WDFW Review Draft (Wild Salmonid Policy). August 15, 1996. Olympia WA.

Washington Forest Practices Board (WFPB). 1997. Standard Methodology for Conducting Watershed Analysis under Chapter 222-22 WAC. Version 4.0, November 1997. Washington Department of Natural Resources, Olympia, Washington.

Williams, G.P. 1978. Bank-full discharge of rivers. Water Resources Research 14(6): 1141-1154

Williams, R.W., R.M. Laramie and J.J. Ames. 1975. A catalog of Washington streams and salmon utilization. Vol. 1, Puget Sound Region; Washington Department of Fisheries. Olympia.

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transactions of the American Geophysical Union 35: 951-956

Wolman Pebble Count field data form

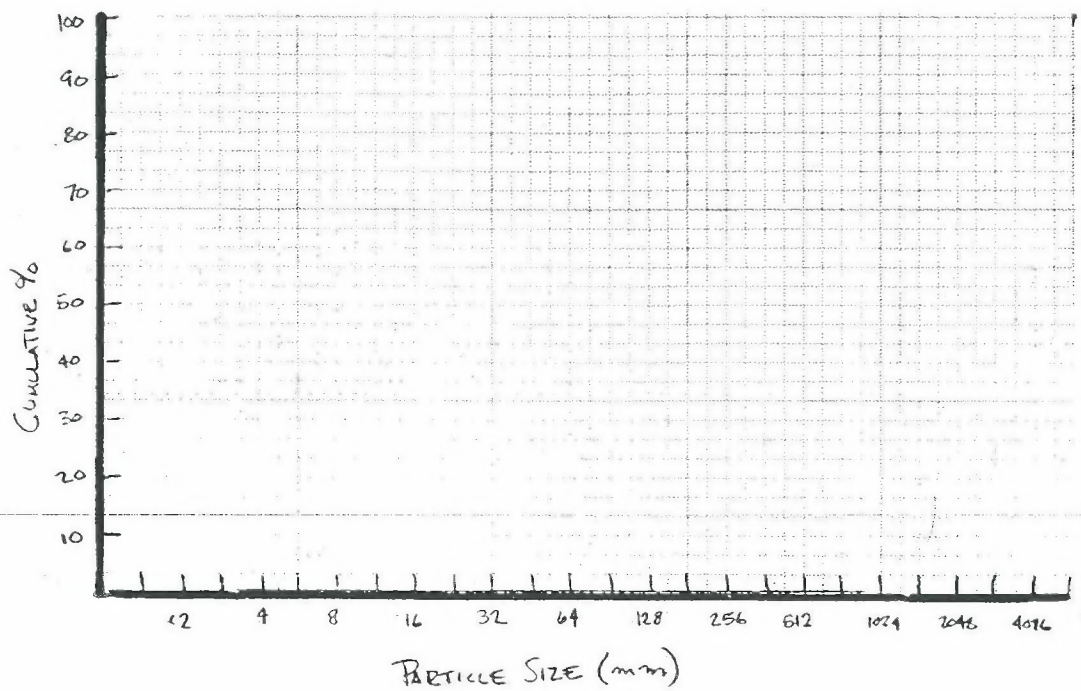
Date: _____ Observer: _____

Stream: _____ Recorder: _____

Habitat Unit: _____ Reach Description: _____

Particle	category	millimeters	count	total#	particle%	cumulative%
<= sand	fines	<2				
very fine	gravels	2-4				
fine	gravels	4-6				
fine	gravels	6-8				
medium	gravels	8-12				
medium	gravels	12-16				
coarse	gravels	16-24				
coarse	gravels	24-32				
very coarse	gravels	32-48				
very coarse	gravels	48-64				
small	cobbles	64-96				
small	cobbles	96-128				
large	cobbles	128-192				
large	cobbles	192-256				
small	boulders	256-384				
small	boulders	384-512				
medium	boulders	512-1024				
large	boulders	1024-2048				
very large	boulders	2048-4096				

BEDROCK



Appendix D

APPENDIX D:
Stream Photos;
Reach 1, Reach 2, and Reach 3

Reach 1

PHOTO 1

PHOTO 2

DAVID EVANS AND ASSOCIATES INC.	City of Woodinville	REACH 1 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	1 Start of Reach 1 at mouth of Little Bear Creek.
	September 2001	2 First riffle in Little Bear Creek.

GX0315

PHOTO 3

PHOTO 4

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 1 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	3 *View Looking downstream towards the Sammamish River Trail crossing over Little Bear Creek.*
September 2001	4 *View looking upstream from the downstream side old railroad crossing over Little Bear Creek.*

Gx0315

PHOTO 5

PHOTO 6

DAVID EVANS AND ASSOCIATES INC.

City of Woodinville

WOOD0000-0010

September 2001

REACH 1 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT

5 *View looking upstream at long linear riffle habitat downstream of the NE 178th street crossing.*

6 *View looking upstream at long linear riffle habitat downstream of the NE 178th street crossing*

Gx0315

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 1 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	7 View looking downstream at the NE 178th Street crossing over Little Bear Creek.
September 2001	8 View looking upstream immediately above the NE 178th Street crossing

Gx0315

PHOTO 9

PHOTO 10

DAVID EVANS AND ASSOCIATES INC.	City of Woodinville	REACH 1 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	9 View of series of weirs previously installed by King County.
	September 2001	10 View of Reach 1 endpoint at the Hwy 202 crossing over Little Bear Creek

GX0315

Reach 2

PHOTO 1

PHOTO 2

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	1 View of the Reach 2 start point at the Hwy 202 crossing over Little Bear Creek.
September 2001	2 View of riffle/pool habitat immediately upstream of the Hwy 202 crossing

GX0315

PHOTO 3

PHOTO 4

DAVID EVANS AND ASSOCIATES INC.

City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	3 View looking upstream at a water deflection device and scour pool.
September 2001	4 View of downstream side of culvert crossing under 132nd Ave. NE.

Gx0315

PHOTO 5

PHOTO 6

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	5 Close-up of failing deflector and erosion at 132nd Ave. NE culvert crossing.
September 2001	6 View of stream bank lacking shrub and/or tree cover.

Gx0315

PHOTO 7

PHOTO 8

DAVID EVANS AND ASSOCIATES INC	City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	7 *View of bank sluffing, and source of debris and sediment at Crane Company.*
	September 2001	8 *View of downstream side of culverts under the 134th Ave. NE crossing*

Gx0315

PHOTO 9

PHOTO 10

DAVID EVANS AND ASSOCIATES INC	City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	9 Typical riffle and riparian condition in Reach 2 upstream of 134th Ave. NE.
	September 2001	10 Mystery culvert that likely only flows during rain events

GX0315

PHOTO 11

PHOTO 12

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	11 Shrubby section of reach dominated by silt and sand
September 2001	12 Culverted outlet of unnamed tributary

GX0315

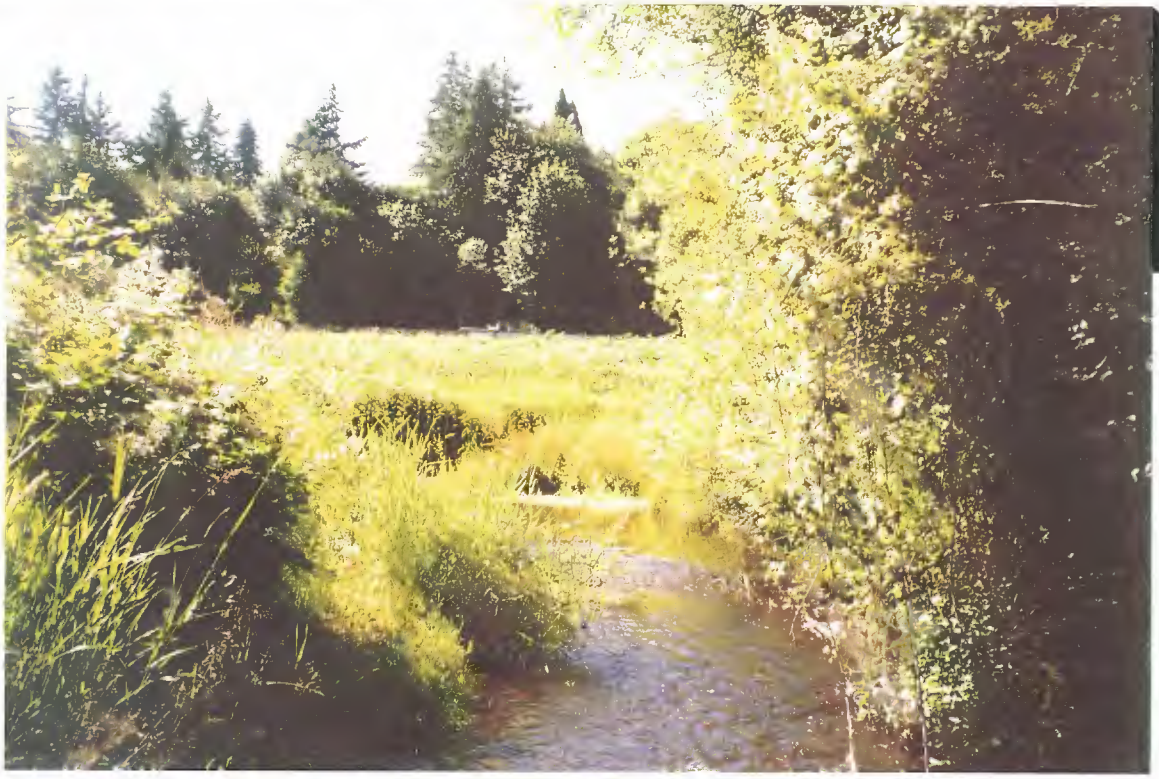


PHOTO 13

PHOTO 14

DAVID EVANS AND ASSOCIATES INC.

City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	**13** View looking upstream towards opening dominated by reed canary grass and Himalayan blackberry between stream and HWY 522.
September 2001	**14** Large pipe crossing over Little Bear creek.

Gx0315

PHOTO 15

PHOTO 16

DAVID EVANS AND ASSOCIATES INC.

City of Woodinville

WOOD0000-0010

September 2001

REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT

15 *Typical riffle habitat and dominant non-native species along left bank.*

16 *Additional view of riffle and riparian condition.*

GX0315

PHOTO 17

PHOTO 18

DAVID EVANS AND ASSOCIATES INC	City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	17 Stormwater/detention pond outlet.
	September 2001	18 Long and wide riffle potentially suitable for spawning.

GX0315

PHOTO 19

PHOTO 20

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	19 Right-bank (RB) unnamed tributary between creek and HWY 522.
September 2001	20 Downstream side of culvert under HWY 522. Note smaller culvert along right side of photo.

Gx0315

PHOTO 21

PHOTO 22

DAVID EVANS AND ASSOCIATES INC	City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	21 Close-up of culvert opening of unnamed tributary.
	September 2001	22 Inside of downstream side of culvert under HWY 522

Gx0315

PHOTO 23

PHOTO 24

DAVID EVANS AND ASSOCIATES INC.

City of Woodinville	REACH 2 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	23 Upstream side of culverts under HWY 522 at Reach 2 endpoint.
September 2001	24 Inside upstream side of culvert under HWY 522

GX0315

Reach 3

PHOTO 1

PHOTO 2

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	1 Upstream side of culverts under HWY 522 at Reach 3 starting point.
September 2001	2 Small unnamed tributary immediately upstream of HWY 522.

GX0315

PHOTO 3

PHOTO 4

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	3 Riffle habitat upstream of HWY 522.
September 2001	4 Cleared lawn along RB immediately downstream of 195th Street.

GX0315

PHOTO 5

PHOTO 6

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	5 Sluffing bank between creek and HWY 522 on-ramp from 195th Street southbound.
September 2001	6 View of stream bank armoring and rip/rap weirs near Reach 3 starting point.

GX0315

PHOTO 7

PHOTO 8

DAVID EVANS AND ASSOCIATES INC.	City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	7 Additional armoring and weirs immediately downstream of 195th Street.
	September 2001	8 Garter snakes at 195th Street.

Gx0315

PHOTO 9

PHOTO 10

DAVID EVANS AND ASSOCIATES INC.	City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	9 View looking upstream.
	September 2001	10 View looking downstream at 195th Street.

GX0315

PHOTO 11

PHOTO 12

DAVID EVANS AND ASSOCIATES INC.	City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	11 View looking upstream from 195th Street.
	September 2001	12 Riffle habitat near upstream end of long-linear-armored section.

Gx0315

PHOTO 13

PHOTO 14

DAVID EVANS AND ASSOCIATES INC.	City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	13 Raw bank around first large pool upstream of 195th Street
	September 2001	14 View of left bank of pool dominated by introduced species.

GX0315

PHOTO 15

PHOTO 16

DAVID EVANS AND ASSOCIATES INC.

City of Woodinville

WOOD0000-0010

September 2001

REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT

15 Debris with signs of beaver chew markings.

16 Beaver path into and out of Little Bear Creek

Gx0315

PHOTO 17

PHOTO 18

DAVID EVANS AND ASSOCIATES INC

City of Woodinville

WOOD0000-0010

September 2001

REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT

17 *View of increasing upstream canopy cover.*

18 *Armoring and introduced species as creek nears HWY 522.*

GX0315

PHOTO 19

PHOTO 20

DAVID EVANS AND ASSOCIATES INC.

City of Woodinville

WOOD0000-0010

September 2001

REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT

19 *View of dominant reed canary grass.*

20 *Close-up of small, unnamed right-bank tributary.*

GX0315

PHOTO 21

PHOTO 22

DAVID EVANS AND ASSOCIATES INC	City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	21 *View of old cedar stump near small, unnamed right-bank tributary.*
	September 2001	22 *Old, abandoned bridge over Little Bear Creek.*

GX0315

DAVID EVANS AND ASSOCIATES INC.

City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	23 Debris cuttings discarded into stream.
September 2001	24 One of few adjacent wetlands able to provide refuge during storm events

GX0315

PHOTO 25

PHOTO 26

DAVID EVANS AND ASSOCIATES INC	City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	**25** *Increasing abundance of conifers in upper section of Reach 3.*
	September 2001	**26** *Big-leaf maple providing in-stream structure.*

Gx0315

PHOTO 27

PHOTO 28

DAVID EVANS AND ASSOCIATES INC.

City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	27 Riffle habitat and hose crossing near Reach 3 endpoint
September 2001	28 View of last house along Reach 3.

Gx0315

PHOTO 29

PHOTO 30

DAVID EVANS AND ASSOCIATES INC

City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
WOOD0000-0010	29 View of Reach 3 endpoint at downstream side of 205th Street.
September 2001	30 View of last pool from endpoint at 205th Street.

Gx0315

PHOTO 31

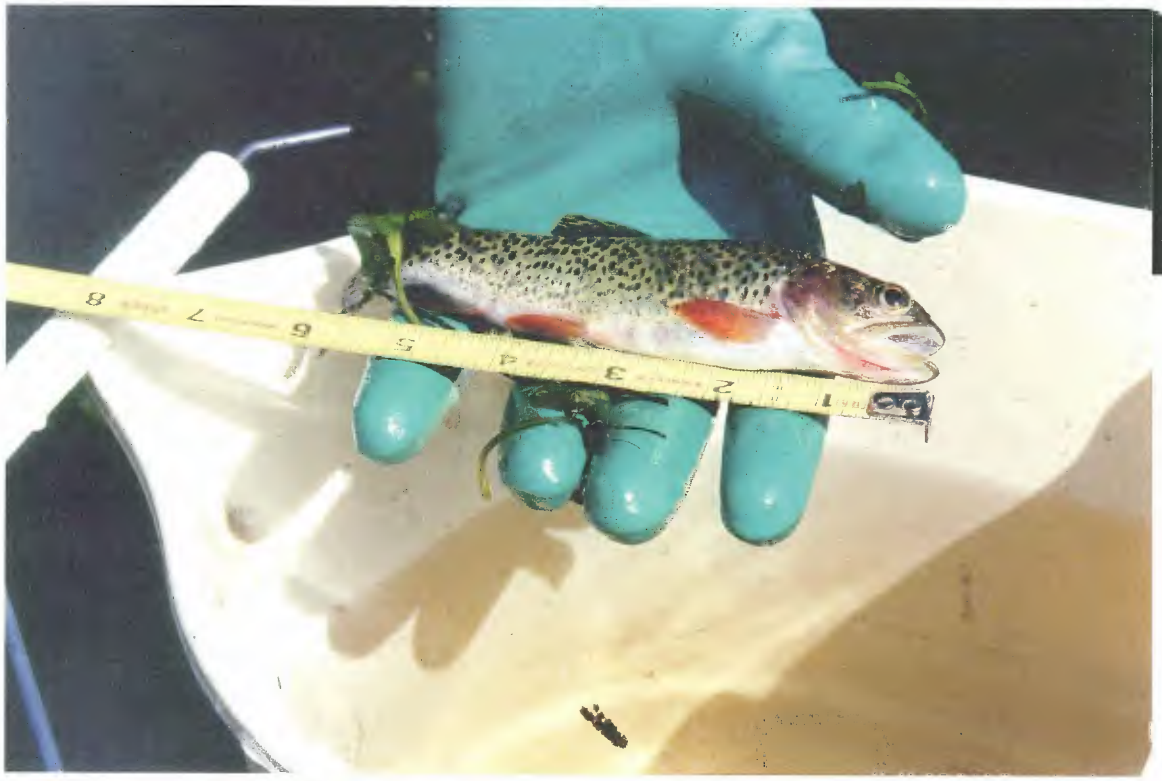


PHOTO 32

DAVID EVANS AND ASSOCIATES INC

City of Woodinville

WOOD0000-0010

September 2001

REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT

31 *Total fish sample captured near Reach 3 endpoint.*

32 *Close-up of cutthroat trout from Reach 3.*

Gx0315

PHOTO 33

PHOTO 34

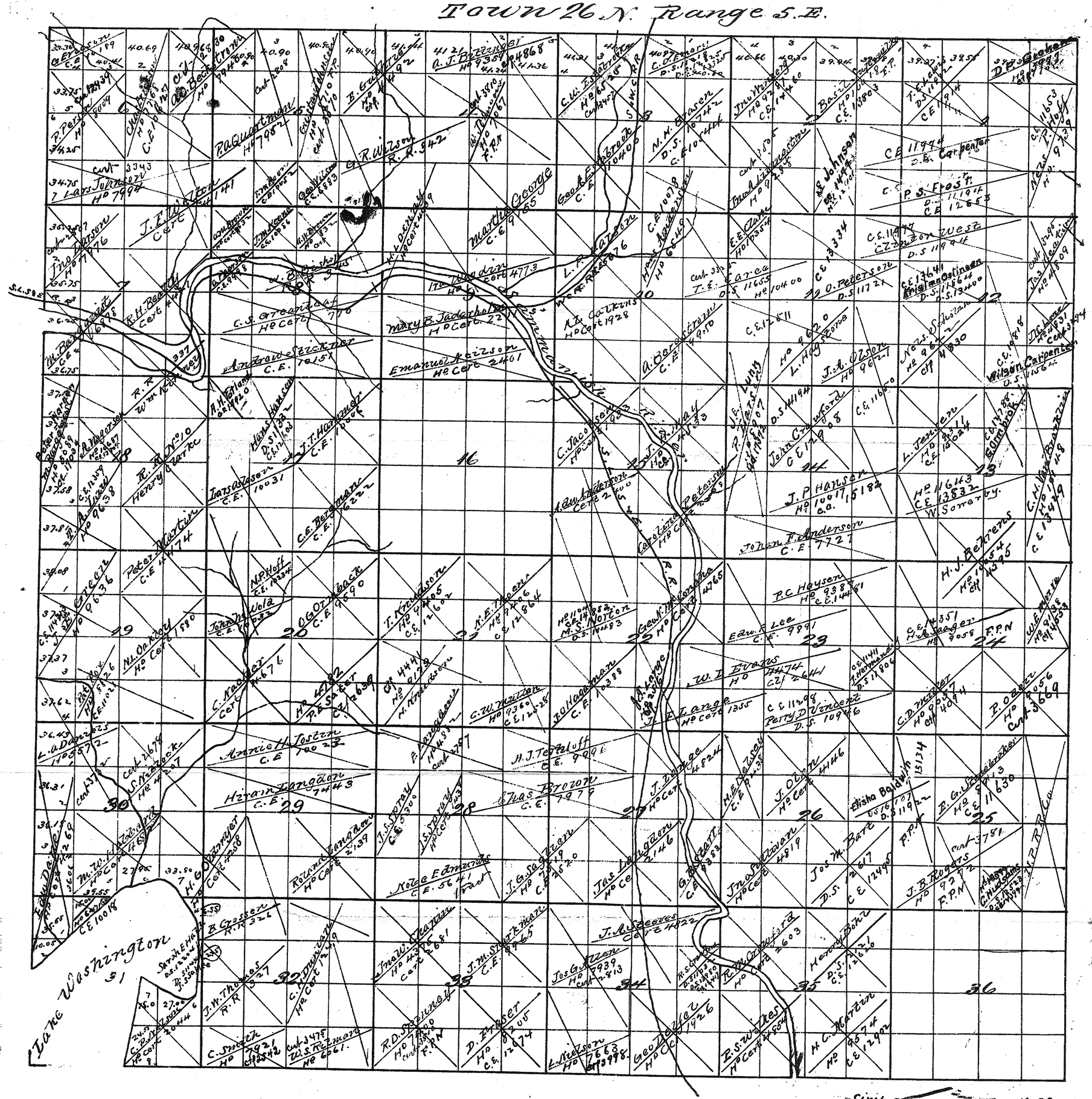
DAVID EVANS AND ASSOCIATES INC.	City of Woodinville	REACH 3 - LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT
	WOOD0000-0010	33 Spawning sockeye in pool tailout immediately downstream of 205th Street.
	September 2001	34 Spawning sockeye in pool tailout immediately downstream of 134th Avenue NE.

Gx0315

Appendix E

APPENDIX E:
Plat Map

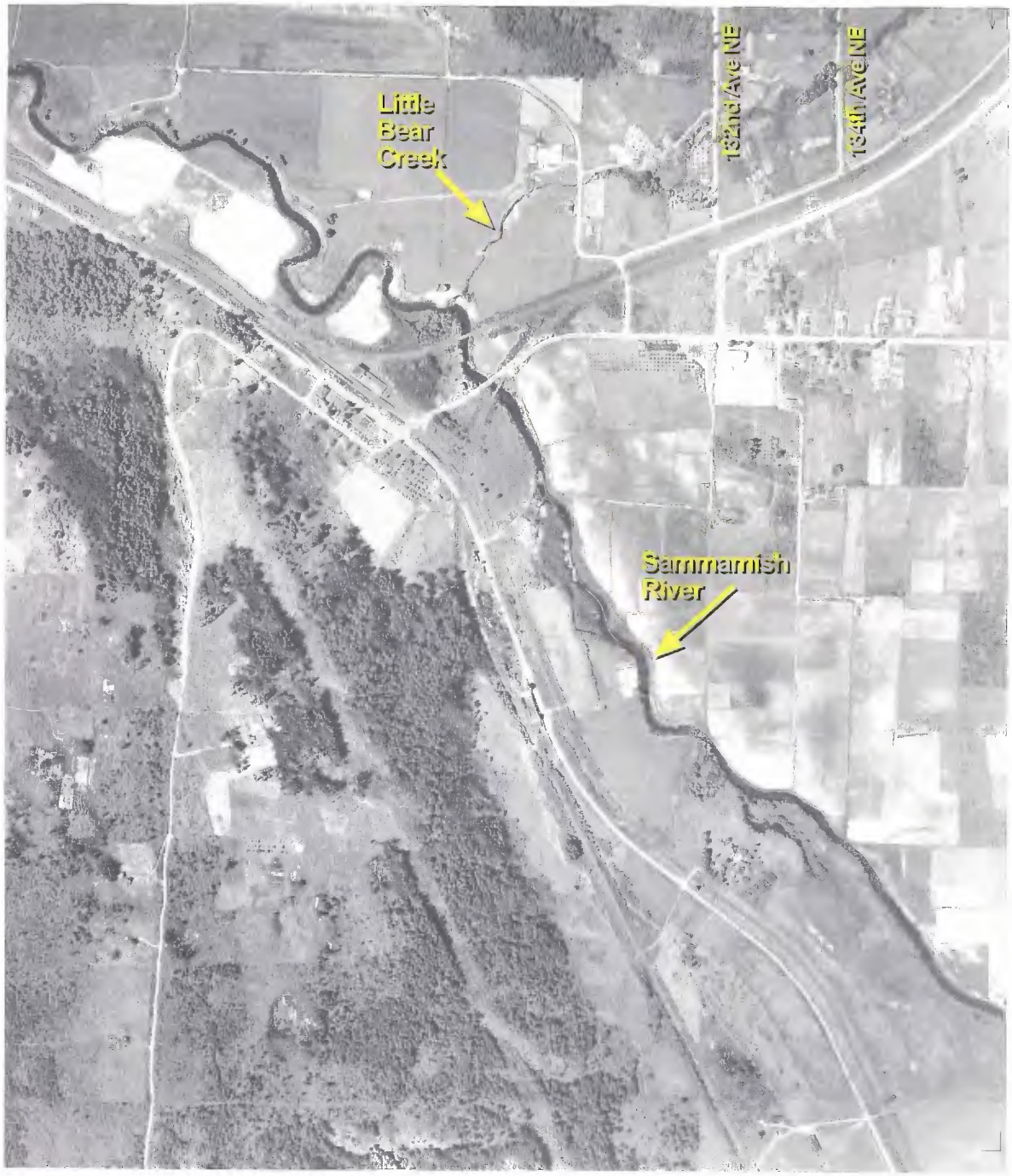
Town 26 N. Range 5 E.



Civil Engineers & Surveyors
Seattle Wash.

Appendix F

APPENDIX F:
1936 Aerial Photos



Approx Scale
1 inch = 800 feet

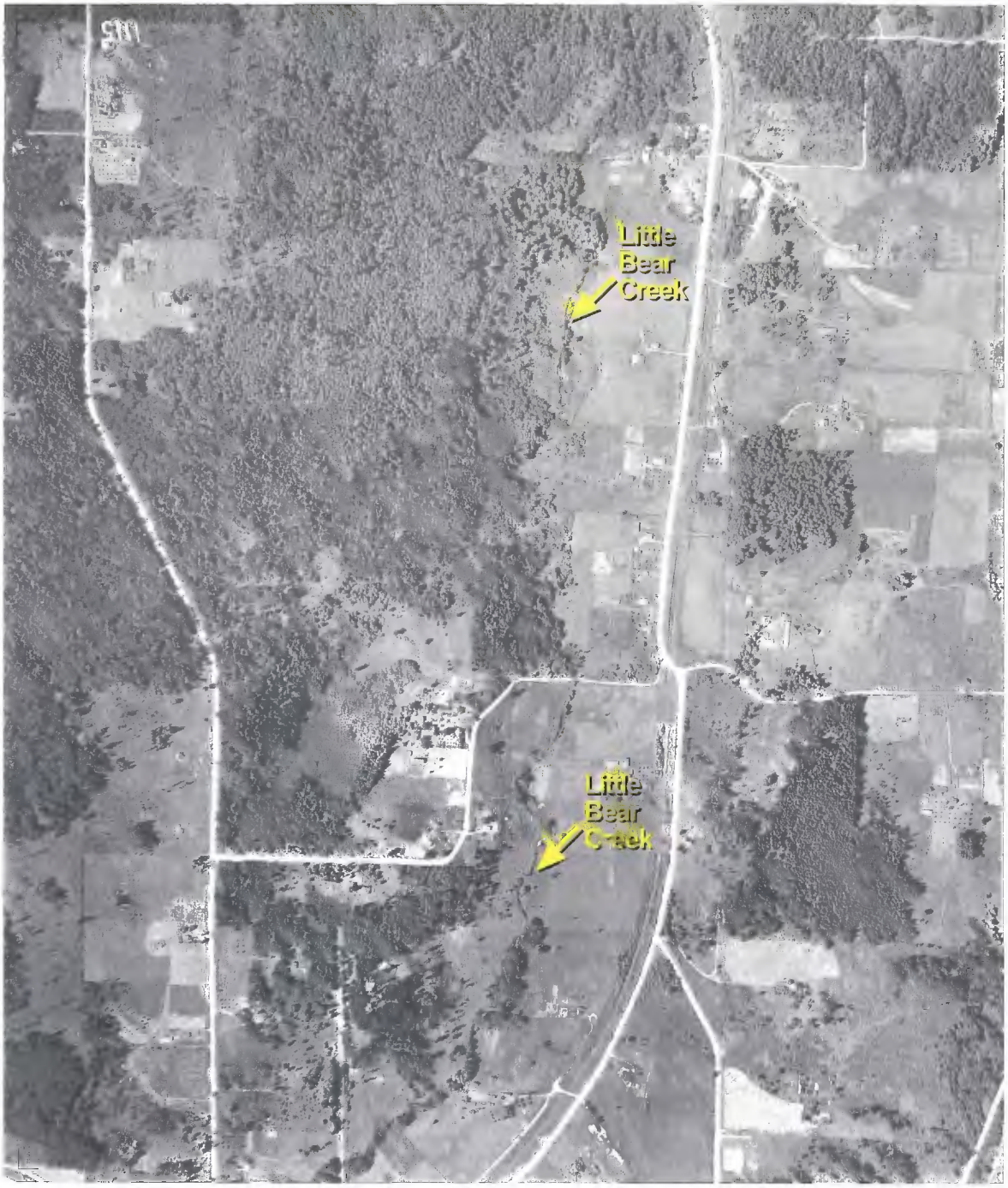
Gx:0321 Project # WOOD0000-0010.004

LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT	Appendix F Sheet 1 of 4	DAVID EVANS AND ASSOCIATES INC.
	City of Woodinville	
Aerial Photo: Year 1936 Source: Walker and Associates	Project Number: WOOD0000-0010.004	

Approx Scale
1 inch = 800 feet

Gx:0321 Project # WOOD0000-0010.004

LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT	Appendix F Sheet 2 of 4	DAVID EVANS AND ASSOCIATES INC.
	City of Woodinville	
Aerial Photo: Year 1936 Source: Walker and Associates	Project Number: WOOD0000-0010.004	



Approx Scale
1 inch = 800 feet

Gx:0321 Project # WOOD0000-0010.004

LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT	Appendix F Sheet 3 of 4	DAVID EVANS AND ASSOCIATES INC.
	City of Woodinville	
Aerial Photo: Year 1936 Source: Walker and Associates	Project Number: WOOD0000-0010.004	

Approx Scale
1 inch = 800 feet

Gx:0321 Project # WOOD0000-0010.004

LITTLE BEAR CREEK CORRIDOR HABITAT ASSESSMENT	Appendix F Sheet 4 of 4	DAVID EVANS AND ASSOCIATES INC.
	City of Woodinville	
Aerial Photo: Year 1936 Source: Walker and Associates	Project Number: WOOD0000-0010.004	

Appendix G

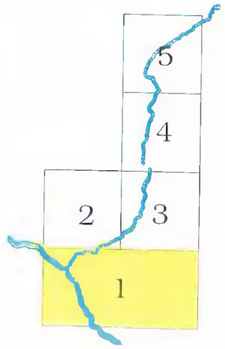
APPENDIX G:
1999 Aerial Photos

End Reach 1
Start Reach 2

Intensive Bank Restoration

Start Reach 1

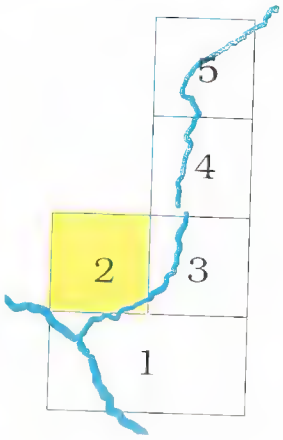
SAMMAMISH RIVER



61-meter Stream Buffer
Intensive Revegetation

100 0 100 200 Meters
250 0 250 500 750 Feet
N

Little Bear Creek
Reach 1
August, 1999



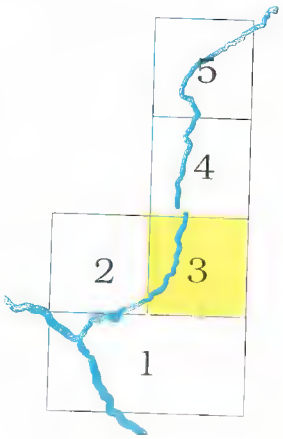
100 0 100 200 Meters

250 0 250 500 750 Feet

N

61-meter Stream Buffer
Intensive Revegetation

Little Bear Creek
Reach 2
August, 1999



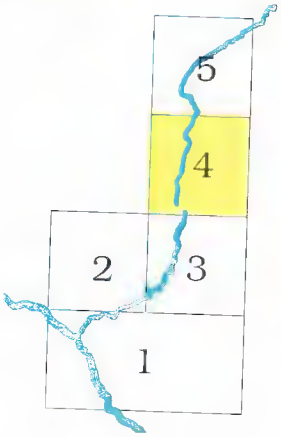
100 0 100 200 Meters

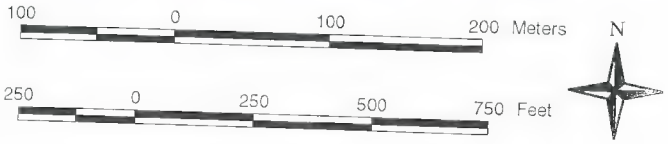
250 0 250 500 750 Feet

N

61-meter Stream Buffer
Intensive Revegetation

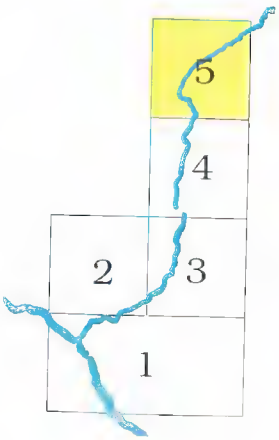
Little Bear Creek
Reach 2
August, 1999

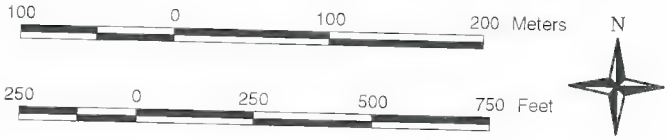




61-meter Stream Buffer
Intensive Revegetation

Little Bear Creek
Reach 3
August, 1999





61-meter Stream Buffer
Intensive Revegetation

Little Bear Creek
Reach 3
August, 1999

Appendix H

APPENDIX H:
Hatchery Plant Data for Little Bear Creek

LAKE WASHINGTON SYSTEM OFF-STATION COHO FINGERLING RELEASES

STREAM NAME	WRIA NO	NUMBER PLANTED	NO/LB	LBS PLNTD	DATE	STOCK	HATCHERY
LITTLE BEAR CR	08.0080	91098	482	189	4/24/97	ISSAQUAH	ISSAQUAH
		91728	504	182	4/10/96	ISSAQUAH	ISSAQUAH
		69625	557	125	4/13/95	ISSAQUAH	ISSAQUAH
		115900	666	174	4/06/94	ISSAQUAH	ISSAQUAH
		102300	598	171	5/03/93	ISSAQUAH	ISSAQUAH
		79000	1026	77	3/18/92	ISSAQUAH	ISSAQUAH
		54000	1400	39	3/13/91	ISSAQUAH	ISSAQUAH
		75000	798	94	4/12/89	ISSAQUAH	ISSAQUAH
		60600	830	73	3/11/88	ISSAQUAH	ISSAQUAH
		100000	1250	80	3/11/87	ISSAQUAH	ISSAQUAH
		55900	307	182	5/04/87	ISSAQUAH	ISSAQUAH
		130476	996	131	4/08/86	ISSAQUAH	ISSAQUAH
		75000	1250	60	3/19/84	ISSAQUAH	ISSAQUAH
UNNAMED Trib.	08.0083	7712	482	16	4/24/97	ISSAQUAH	ISSAQUAH
		7056	504	14	4/10/96	ISSAQUAH	ISSAQUAH
		5500	220	25	5/12/95	ISSAQUAH	ISSAQUAH
		10300	1026	10	3/18/92	ISSAQUAH	ISSAQUAH
UNNAMED Trib.	08.0084	7712	482	16	4/24/97	ISSAQUAH	ISSAQUAH
		7056	504	14	4/10/96	ISSAQUAH	ISSAQUAH
		5500	220	25	5/12/95	ISSAQUAH	ISSAQUAH
		10300	1026	10	3/18/92	ISSAQUAH	ISSAQUAH
UNNAMED	08.0102 ?	4500	447	10	4/15/92	ISSAQUAH	ISSAQUAH
UNNAMED	08.0104 ?	9620	481	20	4/25/97	ISSAQUAH	ISSAQUAH
		10665	395	27	4/16/96	ISSAQUAH	ISSAQUAH
		11697	557	21	4/12/95	ISSAQUAH	ISSAQUAH
		4900	405	12	4/26/94	ISSAQUAH	ISSAQUAH
		5400	598	9	5/03/93	ISSAQUAH	ISSAQUAH
		5700	710	8	3/24/92	ISSAQUAH	ISSAQUAH
		2500	248	10	5/20/91	ISSAQUAH	ISSAQUAH
		4800	798	6	4/13/89	ISSAQUAH	ISSAQUAH
		10000	770	13	3/14/88	ISSAQUAH	ISSAQUAH

Rel Site	Species/race name	Brood YR	Agency	DAT1	DAT2	Rel Stage	Rel Type	Tagged	AD Clipped	Unmarked	Total	Tag Loss Da	Weight (g)	Exp Survival	Hatchery
LTL BEAR CR 08.0080	COHO	1950	WDFW	19520306	19520306	Pre-smolt	H	0	0	15200	15200		11.9399996		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1951	WDFW	19530120	19530120	Fingerling	H	0	0	25200	25200		6.48000002		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1952	WDFW	19530319	19530319	Fed Fry	H	0	0	35435	35435		0.40000001		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1952	WDFW	19540315	19540315	Fingerling	H	0	0	5405	5405		9.64999962		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1953	WDFW	19550112	19550112	Fingerling	H	0	0	10416	10416		9.44999981		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1954	WDFW	19560308	19560308	Fingerling	H	0	0	9126	9126		8.39999962		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1955	WDFW	19570204	19570204	Fingerling	H	0	0	11520	11520		7.09000015		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1956	WDFW	19580205	19580205	Fingerling	H	0	0	19950	19950		7.96000004		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1957	WDFW	19590114	19590114	Fingerling	H	0	0	5040	5040		7.55999994		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1958	WDFW	19600113	19600113	Fingerling	H	0	0	19703	19703		7.44000006		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1959	WDFW	19610130	19610130	Fingerling	H	0	0	26961	26961		7.96000004		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1960	WDFW	19610330	19610330	Emergent	H	0	0	50600	50600		0.36000001		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1964	WDFW	19660119	19660119	Pre-smolt	H	0	0	4900	4900		16.2000008		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1967	WDFW	19680324	19680324	Fed Fry	H	0	0	161200	161200		0.37		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1968	WDFW	19700216	19700216	Smolt	H	0	0	4242	4242		21.6000004		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1981	COOP	19820312	19820312	Emergent	H	0	0	130000	130000		0.31		STEPS
LTL BEAR CR 08.0080	COHO	1982	COOP	19830308	19830308	Fed Fry	H	0	0	250000	250000		0.38		STEPS
LTL BEAR CR 08.0080	CHIN FALL	1983	WDFW	19840306	19840306	Fingerling	H	0	0	54000	54000		0.85000002		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	CHIN FALL	1983	WDFW	19840227	19840227	Fingerling	H	0	0	310000	310000		1.02999997		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1983	WDFW	19840319	19840319	Emergent	H	0	0	75000	75000		0.36000001		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1983	COOP	19840503	19840503	Fed Fry	H	0	0	470	470		0.47999999		BOTHELL HS FISH TEAM
LTL BEAR CR 08.0080	CHIN FALL	1983	WDFW	19840224	19840224	Fingerling	H	0	0	100000	100000		0.94		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1983	COOP	19840510	19840510	Fed Fry	H	0	0	470	470		0.47999999		BOTHELL HS FISH TEAM
LTL BEAR CR 08.0080	COHO	1984	COOP	19850404	19850404	Fed Fry	H	0	0	8523	8523		0.47999999		BOTHELL HS FISH TEAM
LTL BEAR CR 08.0080	CHIN FALL	1985	WDFW	19860327	19860327	Fed Fry	H	0	0	77800	77800		0.58999997		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1985	WDFW	19860408	19860408	Fed Fry	H	0	0	130500	130500		0.46000001		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1985	COOP	19860501	19860501	Fingerling	H	0	0	1500	1500		1.70000005		BOTHELL HS FISH TEAM
LTL BEAR CR 08.0080	CHIN FALL	1986	WDFW	19870304	19870304	Fingerling	H	0	0	27000	27000		0.97000003		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	CHIN FALL	1986	WDFW	19870304	19870304	Fingerling	H	0	0	111300	111300		1.02999997		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1986	WDFW	19870311	19870311	Emergent	H	0	0	100000	100000		0.36000001		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1986	WDFW	19870504	19870504	Fingerling	H	0	0	55900	55900		1.48000002		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1987	WDFW	19880311	19880311	Fed Fry	H	0	0	60600	60600		0.55000001		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	CHIN FALL	1987	WDFW	19880406	19880406	Fingerling	H	0	0	134700	134700		1		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1988	WDFW	19890412	19890412	Fed Fry	H	0	0	75000	75000		0.56999999		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	CHIN FALL	1988	WDFW	19890320	19890320	Fingerling	H	0	0	198800	198800		0.63		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1989	WDFW	19900312	19900312	Fingerling	H	0	0	128400	128400		1.13		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1990	COOP	19910115	19910115	Emergent	H	0	0	300000	300000		0.30000001		STEPS
LTL BEAR CR 08.0080	COHO	1990	COOP	19910315	19910315	Emergent	H	0	0	200000	200000		0.30000001		STEPS
LTL BEAR CR 08.0080	CHIN FALL	1991	WDFW	19920220	19920220	Fed Fry	H	0	0	69700	69700		0.47		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1991	WDFW	19920318	19920318	Fed Fry	H	0	0	78900	78900		0.44		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1991	COOP	19920228	19920228	Emergent	H	0	0	110000	110000		0.30000001		STEPS
LTL BEAR CR 08.0080	COHO	1992	COOP	19930115	19930115	Fed Fry	H	0	0	200000	200000		0.44999999		STEPS
LTL BEAR CR 08.0080	COHO	1992	WDFW	19930503	19930503	Fed Fry	H	0	0	102300	102300		0.75999999		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1993	WDFW	19940406	19940406	Fed Fry	H	0	0	115900	115900	0	0.68000001		ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1994	WDFW	19950413	19950413	Fed Fry	H	0	0	69625	69625		0.81	N	ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1995	WDFW	19960410	19960410	Fed Fry	H	0	0	91600	91600		0.89999998	N	ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1996	WDFW	19970424	19970424	Fed Fry	H	0	0	91098	91098		0.94	N	ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1997	WDFW	19980421	19980421	Fed Fry	H	0	0	44000	44000		0.82999998	N	ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1997	WDFW	19980421	19980421	Fed Fry	H	0	0	46410	46410		0.82999998	N	ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1997	WDFW	19980421	19980421	Fed Fry	H	0	0	30030	30030		0.82999998	N	ISSAQUAH HATCHERY
LTL BEAR CR 08.0080	COHO	1974	WDFW	197604	197605	Smolt	W	12575	0	0	12575		22.6800003	N	
LTL BEAR CR 08.0080	COHO	1975	WDFW	197705	197705	Pre-smolt	W	10660	0	0	10660		15.1199999	N	
LTL BEAR CR 08.0080	COHO	1976	WDFW	197806	197806	Pre-smolt	W	3013	30	305	3348	1	15.1199999	N	
											4011007				

Stock	COMMENTS	RepAGY	CWTmarkID	NonCWTmar	FishPerPoun	Pounds	MARKS	%CWT	TagLoss%	RelYear	RiverMile	Pond	AGE
ISSAQUAH CR 08.0178		WDFW		0000	38	400		0		1952			2
ISSAQUAH CR 08.0178		WDFW		0000	70	360		0		1953			2
ISSAQUAH CR 08.0178		WDFW		0000	1145	30.9475983		0		1953			1
ISSAQUAH CR 08.0178		WDFW		0000	47	115		0		1954			2
BIG SOOS CR 09.0072		WDFW		0000	48	217		0		1955			2
ISSAQUAH CR 08.0178		WDFW		0000	54	169		0		1956			2
SAMISH (FRIDAY CR)		WDFW		0000	64	180		0		1957			2
ISSAQUAH CR 08.0178		WDFW		0000	57	350		0		1958			2
ISSAQUAH CR 08.0178		WDFW		0000	60	84		0		1959			2
MAY CR 07.0943		WDFW		0000	61	323		0		1960			2
MAY CR 07.0943		WDFW		0000	57	473		0		1961			2
ISSAQUAH CR 08.0178		WDFW		0000	1265	40		0		1961			1
ISSAQUAH CR 08.0178		WDFW		0000	28	175		0		1966			2
ISSAQUAH CR 08.0178		WDFW		0000	1240	130		0		1968			1
ISSAQUAH CR 08.0178		WDFW		0000	21	202		0		1970			2
ISSAQUAH CR 08.0178		WDFW		0000	1445	89.9653979		0		1982			1
ISSAQUAH CR 08.0178		WDFW		0000	1200	208.333333		0		1983			1
ISSAQUAH CR 08.0178		WDFW		0000	533	101.313321		0		1984			1
ISSAQUAH CR 08.0178		WDFW		0000	440	704.545455		0		1984			1
ISSAQUAH CR 08.0178		WDFW		0000	1250	60		0		1984			1
ISSAQUAH CR 08.0178		WDFW		0000	940	0.5		0		1984			1
ISSAQUAH CR 08.0178		WDFW		0000	480	208.333333		0		1984			1
ISSAQUAH CR 08.0178		WDFW		0000	940	0.5		0		1984			1
ISSAQUAH CR 08.0178		WDFW		0000	947	9		0		1985			1
ISSAQUAH CR 08.0178		WDFW		0000	770	101.038961		0		1986			1
ISSAQUAH CR 08.0178		WDFW		0000	996	131.024096		0		1986			1
ISSAQUAH CR 08.0178		WDFW		0000	267	5.61797753		0		1986			1
ISSAQUAH CR 08.0178		WDFW		0000	466	57.9399142		0		1987			1
ISSAQUAH CR 08.0178		WDFW		0000	440	252.954545		0		1987			1
ISSAQUAH CR 08.0178		WDFW		0000	1250	80		0		1987			1
ISSAQUAH CR 08.0178		WDFW		0000	307	182.084691		0		1987			1
ISSAQUAH CR 08.0178		WDFW		0000	830	73.0120482		0		1988			1
BIG SOOS CR 09.0072		WDFW		0000	452	298.00885		0		1988			1
ISSAQUAH CR 08.0178		WDFW		0000	798	93.9849624		0		1989			1
ISSAQUAH CR 08.0178		WDFW		0000	723	274.965422		0		1989			1
ISSAQUAH CR 08.0178		WDFW		0000	400	321		0		1990			1
MINTER CR 15.0048		WDFW		0000	1500	200		0		1991			1
ISSAQUAH CR 08.0178		WDFW		0000	1500	133.333333		0		1991			1
ISSAQUAH CR 08.0178		WDFW		0000	968	72.0041322		0		1992			1
ISSAQUAH CR 08.0178		WDFW		0000	1026	76.9005848		0		1992			1
ISSAQUAH CR 08.0178		WDFW		0000	1500	73.3333333		0		1992			1
ISSAQUAH CR 08.0178		WDFW		0000	1000	200		0		1993			1
ISSAQUAH CR 08.0178		WDFW		0000	598	171.070234		0		1993			1
ISSAQUAH CR 08.0178	(RECORD FROM HHP DB)	WDFW		0000	666	174.024024		0		1994			1
ISSAQUAH CR 08.0178		WDFW		0000	557	125				1995		8	1
ISSAQUAH CR 08.0178		WDFW		0000	504	182				1996		9	1
ISSAQUAH CR 08.0178	NO SPECFIC R.M. LISTED-SCATTE	WDFW		0000	482	189				1997		2	1
ISSAQUAH CR 08.0178		WDFW		0000	546	29.3				1998	1	6	1
ISSAQUAH CR 08.0178		WDFW		0000	546	85				1998	4.3	6	1
ISSAQUAH CR 08.0178		WDFW		0000	546	55				1998	6.5	6	1
LTL BEAR CR 08.0080		WDFW	5000		20	628.75	AD+CWT	100	0	1976			2
LTL BEAR CR 08.0080		WDFW	5000		30	355.333333	AD+CWT	100	0	1977			2
LTL BEAR CR 08.0080		WDFW	5000	0000	30	111.6	AD+CWT	89.9940262	0.00986	1978			2

Appendix I

APPENDIX I:
Hatchery Plant Data for Issaquah Creek

ANTS REPORT

Washington Department of Fish and Wildlife
Hatcheries Program

AGENCY: WDFW--HATCHERIES
FACILITY: ISSAQUAH
MONTH / YEAR March 2001 /

	ID CODE (Appendix A) (Spc:Ru:Stk:BY:DO)	POND NO	START / END DAY	WATER NAME	WATER CODE	RIVER MILE	NUMBER	# PER POUND	POUNDS	MEAN LENGTH IN MM	CV OF LENGTH	Number Identified (grn sheet)	Total Rep. Pop. (at tagging)	Unidentifiable Marks (+CWT) (grn sheet)	AD&CWT (grn sheet)	AD Only (grn sheet)	CWT CODE	MARK CODE	?
1	CO:NA:ISSA:99:H	11	28/28	Issaquah Creek	8.0178	3	252,800	18	14,044		6.9					x			
2	CO:NA:ISSA:99:H	12	28/28	Issaquah Creek	8.0178	3	252800	18	14044		6.9					x			
3			/																
4			/																
5			/																
6			/																
7			/																
8			/																
9			/																
10			/																
11			/																
12			/																
13			/																
14			/																
15			/																
16			/																
17			/																
18			/																
19			/																
20			/																

NOTES:

For Lake Plants: County Section Township Range

Send to Olympia Monthly

PLANTS REPORT

Washington Department of Fish and Wildlife
Hatcheries Program

AGENCY: WDFW-HATCHERIES
FACILITY: ISSAQUAH
MONTH / YEAR March / 2001

	ID CODE (Appendix A) (Spc:Rc:Stk:BY:BO)	POND NO.	START / END DAY	WATER NAME	WATER CODE	RIVER MILE	NUMBER	# PER POUND	POUNDS	MEAN LENGTH IN MM	CV OF LENGTH	Number Identified (grn sheet)	Total Rep. Pop. (at tagging)	Unidentifiable Marks(+CWT) (grn sheet)	AD+CWT (grn sheet)	AD Only (grn sheet)	CWT CODE	MARK CODE	?
1	CO:NA:ISSA:00:H	hat.	01/01	Issaquah Creek	8.0178	3	450,000	1269	354.6										
2	CO:NA:ISSA:00:H	hat.	07/07	Issaquah Creek	8.0178	3	450,000	1411	318.92										
3	CO:NA:ISSA:00:H	hat.	07/07	Issaquah Creek	8.0178	3	225,000	1317	170.84										
4	CO:NA:ISSA:00:H	hat.	12/12	Issaquah Creek	8.0178	3	30,261	1441	21										
5	CO:NA:ISSA:00:H	hat.	12/12	Issaquah Creek	8.0178	3	262,026	1293	202.65										
6	CO:NA:ISSA:00:H	hat.	12/12	Issaquah Creek	8.0178	3	100,262	1492	67.2										
7	CO:NA:ISSA:00:H	hat.	12/12	Issaquah Creek	8.0178	3	227,400	1441	157.81										
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
										For Lake Plants:		County	Township	Section	Range			

NOTES:

Send to Olympia Monthly

PLANT REPORT

Washington Department of Fish and Wildlife
Hatcheries Program

AGENCY: WDFW
FACILITY: ISSAQUAH
MONTH / YEAR MAY / 2001

ID CODE (Appendix A) (Spc:Rc:Stk:BY:BO)	POND NO.	START / END DAY	WATER NAME	WATER CODE	RIVER MILE	NUMBER	# PER POUND	POUNDS	MEAN LENGTH IN MM	CV OF LENGTH	Number Identified (grn sheet)	Total Rep. Pop. (at tagging)	Unidentifiable Marks(+CWT) (grn sheet)	AD+CWT (grn sheet)	AD Only (grn sheet)	CWT CODE	MARK CODE	?
CK:FA:ISSA:00:H	11	15/15	Issaquah Creek	8.0178	3	339,212	69	4,916	83.6	7.16					AD			
CK:FA:ISSA:00:H	12	15/15	Issaquah Creek	8.0178	3	267,321	66	4,050	84.9	6.483					AD			
CK:FA:ISSA:00H	1	22/22	Issaquah Creek	8.0178	3	322,700	75.66	4,265	81.9	5.502					AD			
CK:FA:ISSA:00:H	2	22/22	Issaquah Creek	8.0178	3	344,900	75.66	4,559	81.9	5.502					AD			
CK:FA:ISSA:00:H	3	22/22	Issaquah Creek	8.0178	3	143,250	70.96	2,019	83.6	5.589					AD			
CK:FA:ISSA:00:H	4	22/22	Issaquah Creek	8.0178	3	125,000	70.96	1,762	83.6	5.589					AD			
CK:FA:ISSA:00:H	5	22/22	Issaquah Creek	8.0178	3	125,000	70.96	1,762	83.6	5.589					AD			
CK:FA:ISSA:00:H	6	22/22	Issaquah Creek	8.0178	3	125,000	70.96	1762	83.6	5.589					AD			
CK:FA:ISSA:00:H	8	22/22	Issaquah Creek	8.0178	3	139540	70.96	1966	83.6	5.589					AD			
CK:FA:ISSA:00:H	9	22/22	Issaquah Creek	8.0178	3	137,350	70.96	1936	83.6	5.589					AD			
CK:FA:ISSA:00:H	10	22/22	Issaquah Creek	8.0178	3	125500	70.96	1769	83.6	5.589					AD			
		/																
		/																
		/																
		/																
		/																
		/																
		/																
		/																
		/																

NOTES:

For Lake Plants: County Section Township Range

Send to Olympia Monthly

Appendix J

APPENDIX J:
WDFW Salmon Spawning Ground Survey Data

CODED COMMENTS FOR USE ON STREAM SURVEY CARDS

AREA SURVEYED

00 Partial index survey
01 Intertidal
02 Includes tributary in index
03 Holes not surveyed
04 Right bank side channel
05 Left bank side channel
06 Includes area above index
07 Includes area below index
08 Right bank survey
09 Left bank survey

SURVEY TIMING

10 Peak survey
11 Survey too early - before peak
12 Survey too late - after peak
13 Early run
14 Late run
15 Middle run
16 Redds observed - after peak
17
18
19

WATER CONDITIONS

20 Low - clear
21 Low - medium color
22 Low - muddy
23 Medium - clear
24 Medium - medium color
25 Medium - muddy
26 High - clear
27 High - medium color
28 High - muddy
29 Flooding

VIEWING CONDITIONS

30 Dark
31 Dark in pools
32 High glare
33 Some glare
34 Raining
35 Snowing
36 Frozen
37 Partly frozen
38 Water turbid
39

STREAM CONDITIONS

40 Needs SI work
41 Impassable log jam
42 Passable log jam
43 Man-made block
44 Damaging channel work
45 Damaging bank work
46 Damaging diversion
47 Passable beaver dam
48 Impassable beaver dam
49 Evidence of scouring

FACTORS AFFECTING FISH ABUNDANCE

50 Heavy Poaching
51 Light Poaching
52 Heavy predation
53 Light predation
54 Stream dry
55 Stream frozen
56 Fish kill
57 Stream too low
58 Illegal set netting
59 Recent habitat alteration

CARD INFORMATION

60 See card for additional comments
61 Count breakdown available on card
62 Summary card
63 Escapement estimate survey
64 Area surveyed unknown
65 Spot observation (F/M count not applicable)
66 Live tagged fish observed
67 Dead tagged fish observed
68 Tag recovered
69

MISCELLANEOUS

70 Most carcasses have been washed out
71 Heavy siltation
72 Count in holes estimated
73 Partial count
74 Exposed redds due to low flow
75 Actual dead count higher than show
76 Carcass count only
77 Tag recovery survey. Tails cut, these will be recounted on successive surveys.

Washington State Department of Fisheries Tue Sep 4 14:00:32 2001

Salmon Spawning Ground Survey Data

Species - All Species
Chinook Races - All Races
Stream Numbers - 080080
Date Range - 40/ 6/30 to 99/12/31
River Miles - All River Miles
Type Count - All Types of Counts
Type Survey - All Types of Surveys
Agency - All Agencies

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
Lake Washington Basin																	
LITTLE BEAR Creek																	
080080	52/12/12	0.0	4.4	4.4	COHO	161	36	197	44.8	4	0		SUPP	FOOT			0
080080	53/11/29	4.4	6.2	1.8	COHO	55	1	56	31.1	4	0		INDX	FOOT			0
080080	53/12/15	4.4	6.2	1.8	COHO	75	21	96	53.3	4	0		INDX	FOOT		61	0
080080	54/11/22	4.4	6.2	1.8	COHO	70	19	89	49.4	4	0		INDX	FOOT		20	0
080080	55/11/17	4.8	6.2	1.4	COHO	27	6	33	23.6	4	0		SUPP	FOOT		20 37	0
080080	55/12/02	4.4	6.2	1.8	COHO	45	7	52	28.9	4	0		INDX	FOOT		26	0
080080	56/11/30	4.4	6.2	1.8	COHO	20	2	22	12.2	4	0		INDX	FOOT			0
080080	56/12/13	4.4	6.2	1.8	COHO	75	8	83	46.1	4	0		INDX	FOOT		20	0
080080	57/12/09	4.4	6.2	1.8	COHO	124	26	150	83.3	4	0		INDX	FOOT		20	0
080080	58/12/03	4.4	6.2	1.8	COHO	235	56	291	161.7	4	0		INDX	FOOT		20	0
080080	58/12/22	4.4	6.2	1.8	COHO	118	68	186	103.3	4	0		INDX	FOOT		21	0
080080	59/12/02	4.4	6.2	1.8	COHO	114	20	134	74.4	4	0		INDX	FOOT		24	0
080080	59/12/18	4.4	6.2	1.8	COHO	84	20	104	57.8	4	0		INDX	FOOT		26	0
080080	60/11/28	4.4	6.2	1.8	COHO	107	19	126	70.0	4	0		INDX	FOOT		20 60	0
080080	60/12/20	4.4	6.2	1.8	COHO	27	34	61	33.9	4	0		INDX	FOOT		21	0
080080	61/12/11	4.4	6.2	1.8	COHO	145	136	281	156.1	4	0		INDX	FOOT		20	0
080080	63/12/30	4.8	6.2	1.4	COHO	27	75	102	72.9	4	0		SUPP	FOOT		21	0
080080	64/11/20	4.4	6.2	1.8	COHO	121	72	193	107.2	4	0		INDX	FOOT		20	0
080080	65/12/01	4.8	6.2	1.4	COHO	104	53	157	112.1	4	0	34	SUPP	FOOT		24	0
080080	66/11/29	4.4	6.2	1.8	COHO	364	52	416	231.1	4	0		INDX	FOOT		21	0
080080	67/11/29	4.4	5.4	1.0	COHO	52	27	79	79.0	4	0		INDX	FOOT		24	0
080080	68/12/11	4.4	5.4	1.0	COHO	74	49	123	123.0	4	0		INDX	FOOT		20	0
080080	70/11/06	4.4	4.6	0.2	COHO	0	2	2	10.0	4	0		SUPP	FOOT			0

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	70/11/06	4.4	4.6	0.2	SOCK	11	3	14	70.0	5	0		SUPP	FOOT	4		0
080080	70/11/17	4.4	5.4	1.0	COHO	266	17	283	283.0	4	75		INDX	FOOT		20	0
080080	70/12/04	4.4	4.8	0.4	COHO	140	65	205	512.5	4	80		SUPP	FOOT		25	0
080080	70/12/08	5.2	5.4	0.2	COHO	11	4	15	75.0	4	99		SUPP	FOOT		20	0
080080	71/11/23	4.4	5.4	1.0	FALL	0	1	1	1.0	1	85		SUPP	FOOT	4	20	0
080080	71/11/23	4.4	5.4	1.0	COHO	53	90	143	143.0	4	85		SUPP	FOOT	1	20	0
080080	71/12/21	4.4	5.4	1.0	COHO	95	105	200	200.0	4	85		INDX	FOOT		24	0
080080	72/09/28	0.0	0.0	0.0	COHO	0	0	0		4	99		SPOT	FOOT		20 65	0
080080	72/11/21	4.4	5.4	1.0	COHO	52	32	84	84.0	4	90		INDX	FOOT	1	20	0
080080	72/11/21	5.4	6.2	0.8	FALL	0	1	1	1.3	1	0		SUPP	FOOT	4	20	0
080080	72/12/14	4.4	5.4	1.0	COHO	22	15	37	37.0	4	90		INDX	FOOT		20	0
080080	73/10/29	0.0	0.0	0.0	COHO	2	0	2		4	80		SPOT	FOOT		20 65	0
080080	73/11/19	4.4	6.2	1.8	FALL	0	1	1	0.6	1	75		SUPP	FOOT	2		0
080080	73/11/19	4.4	4.8	0.4	COHO	68	11	79	197.5	4	75		SUPP	FOOT	1	20	0
080080	73/11/19	4.4	5.4	1.0	COHO	133	18	151	151.0	4	0		INDX	FOOT	1	20 62	0
080080	73/11/19	4.8	5.4	0.6	COHO	65	7	72	120.0	4	75		SUPP	FOOT	1	20	0
080080	73/12/06	4.4	4.8	0.4	COHO	18	57	75	187.5	4	0		SUPP	FOOT		20	0
080080	73/12/06	4.4	5.4	1.0	COHO	44	68	112	112.0	4	0		INDX	FOOT		20 62	0
080080	73/12/06	4.8	5.4	0.6	COHO	26	11	37	61.7	4	0		SUPP	FOOT		20	0
080080	74/10/24	4.4	4.7	0.3	COHO	0	0	0		4	99		INDX	FOOT		20 13	0
080080	74/10/31	3.2	4.4	1.2	FALL	3	1	4	3.3	1	0		SUPP	FOOT	4	21 31 60	0
080080	74/10/31	3.2	4.4	1.2	COHO	25	0	25	20.8	4	50	20	SUPP	FOOT	1	21 31 60	0
080080	74/10/31	4.4	6.2	1.8	FALL	0	2	2	1.1	1	60		SUPP	FOOT	4	21	0
080080	74/10/31	4.4	5.5	1.1	COHO	17	0	17	15.5	4	60		INDX	FOOT	1	21 61	0
080080	74/10/31	6.6	7.4	0.8	COHO	3	0	3	3.7	4	80		SUPP	FOOT		21 60	0
080080	74/11/14	4.4	5.5	1.1	COHO	83	9	92	83.6	4	60		INDX	FOOT	3		0
080080	74/11/26	4.4	5.5	1.1	COHO	97	22	119	108.2	4	85		INDX	FOOT		21 61	0
080080	74/12/09	4.4	5.5	1.1	COHO	36	58	94	85.5	4	85		INDX	FOOT		21 31 61	0
080080	74/12/26	4.4	5.5	1.1	COHO	9	46	55	50.0	4	80		INDX	FOOT		24 60 61	0
080080	75/11/03	4.4	5.5	1.1	FALL	2	0	2	1.8	1	75		SUPP	FOOT	45	23 34 60	0
080080	75/11/03	4.4	5.5	1.1	COHO	68	3	71	64.5	4	75		INDX	FOOT	15	23 34 61	0
080080	75/11/03	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	75		SUPP	FOOT	14	23 34 60	0
080080	75/11/05	3.2	4.0	0.8	FALL	2	1	3	3.8	1	65		SUPP	FOOT	4	67	0
080080	75/11/05	3.2	4.0	0.8	COHO	72	3	75	93.8	4	65		SUPP	FOOT	1	24 31 34	0
080080	75/11/05	5.5	5.8	0.3	COHO	24	1	25	83.3	4	65		SUPP	FOOT		24 60	0
080080	75/11/18	4.4	5.5	1.1	COHO	33	10	43	39.1	4	70		INDX	FOOT		24 31 68	0
080080	75/12/09	3.2	4.0	0.8	COHO	4	10	14	17.5	4	45		SUPP	FOOT		27 60	0
080080	75/12/09	4.4	5.5	1.1	COHO	15	17	32	29.1	4	60		INDX	FOOT		27 40 60	0
080080	75/12/15	4.4	0.0	0.0	COHO	0	0	0		4	60		SPOT	FOOT		24 60	0
080080	75/12/15	4.4	5.5	1.1	COHO	6	29	35	31.8	4	95		INDX	FOOT		20 60	0
080080	75/12/15	6.2	0.0	0.0	COHO	0	0	0		4	75		SPOT	FOOT		21 60	0
080080	75/12/15	6.5	0.0	0.0	COHO	0	0	0		4	75		SPOT	FOOT		21 60	0
080080	76/09/23	0.0	0.3	0.3	FALL	0	0	0		1	90		SUPP	FOOT	5	20 44	FW
080080	76/09/23	0.0	0.3	0.3	SOCK	0	0	0		5	90		SUPP	FOOT	1	20 44	FW
080080	76/09/29	2.2	3.2	1.0	FALL	0	0	0		1	60		SUPP	FOOT	5	25	FW

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code

LITTLE BEAR Creek

080080	76/09/29	2.2	3.2	1.0	SOCK	0	0	0		5	60	SUPP	FOOT	1	25		FW
080080	76/09/29	3.2	4.5	1.3	FALL	2	0	2	1.5	1	50	SUPP	FOOT	5	21 31		FW
080080	76/09/29	3.2	4.5	1.3	SOCK	3	0	3	2.3	5	50	SUPP	FOOT	1	21 31		FW
080080	76/10/05	2.0	4.0	2.0	FALL	0	0	0		1	90	SUPP	FOOT		20		FW
080080	76/10/13	1.9	3.2	1.3	FALL	0	1	1	0.8	1	50	SUPP	FOOT		15 24 65		0
080080	76/10/13	3.2	4.4	1.2	FALL	1	3	4	3.3	1	30	SUPP	FOOT	45	22 30		0
080080	76/10/13	3.2	4.4	1.2	COHO	5	0	5	4.2	4	25	SUPP	FOOT	15	22 30		0
080080	76/10/13	3.2	4.4	1.2	SOCK	2	1	3	2.5	5	30	SUPP	FOOT	14	22 30		0
080080	76/10/14	0.0	1.3	1.3	FALL	2	2	4	3.1	1	90	SUPP	FOOT		21 31 60		0
080080	76/10/14	1.3	2.6	1.3	FALL	1	0	1	0.8	1	25	SUPP	FOOT		22 30		0
080080	76/10/15	4.4	5.1	0.7	FALL	1	0	1	1.4	1	90	SUPP	FOOT		20 43 60		0
080080	76/10/15	5.1	5.5	0.4	COHO	0	0	0		4	70	SUPP	FOOT		20		0
080080	76/10/20	0.0	1.3	1.3	FALL	1	1	2	1.5	1	80	SUPP	FOOT		21 31		0
080080	76/10/20	1.3	2.1	0.8	FALL	2	0	2	2.5	1	60	SUPP	FOOT	4	21 31		0
080080	76/10/20	1.3	2.1	0.8	COHO	1	0	1	1.2	4	50	SUPP	FOOT	1	21 31		0
080080	76/10/21	2.1	3.2	1.1	FALL	0	0	0		1	70	SUPP	FOOT		20 31		0
080080	76/10/21	3.2	4.4	1.2	COHO	3	1	4	3.3	4	80	SUPP	FOOT	1	21 31		0
080080	76/10/21	3.3	4.4	1.1	FALL	2	1	3	2.7	1	80	SUPP	FOOT	4	21 31		0
080080	76/10/21	4.4	4.8	0.4	SOCK	0	1	1	2.5	5	85	SUPP	FOOT		20		0
080080	76/10/21	4.8	6.1	1.3	COHO	4	1	5	3.8	4	80	SUPP	FOOT		20 60		0
080080	76/10/27	0.0	1.3	1.3	FALL	0	1	1	0.8	1	45	SUPP	FOOT	4	20 30		0
080080	76/10/27	0.0	1.3	1.3	COHO	3	1	4	3.1	4	40	SUPP	FOOT	1	20 30		0
080080	76/10/27	1.3	2.1	0.8	FALL	1	0	1	1.2	1	60	SUPP	FOOT		24 31		0
080080	76/10/28	2.8	4.0	1.2	COHO	4	1	5	4.2	4	15	SUPP	FOOT		24 34		0
080080	76/10/28	4.0	4.4	0.4	FALL	0	0	0		1	40	SUPP	FOOT		25 34		0
080080	76/10/28	4.4	5.5	1.1	COHO	3	0	3	2.7	4	60	INDX	FOOT	5	24 34 60		0
080080	76/10/28	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	60	INDX	FOOT	4	24 34 60		0
080080	76/10/28	5.5	6.2	0.7	COHO	5	0	5	7.1	4	20	SUPP	FOOT		24 34		0
080080	76/11/04	0.0	1.3	1.3	FALL	0	0	0		1	75	SUPP	FOOT		23 31		0
080080	76/11/04	1.3	2.1	0.8	COHO	0	0	0		4	70	SUPP	FOOT		20 31		0
080080	76/11/04	2.1	3.2	1.1	COHO	3	1	4	3.6	4	80	SUPP	FOOT		23 31		0
080080	76/11/04	3.2	4.4	1.2	FALL	0	1	1	0.8	1	75	SUPP	FOOT	4	20 31		0
080080	76/11/04	3.2	4.4	1.2	COHO	45	0	45	37.5	4	75	SUPP	FOOT	1	20 31		0
080080	76/11/04	4.4	5.5	1.1	FALL	0	1	1	0.9	1	90	INDX	FOOT	4	23 31		0
080080	76/11/04	4.4	5.5	1.1	COHO	59	5	64	58.2	4	90	INDX	FOOT	1	23 31		0
080080	76/11/11	0.0	1.3	1.3	COHO	1	0	1	0.8	4	70	SUPP	FOOT		20 31		0
080080	76/11/11	1.3	2.1	0.8	COHO	0	1	1	1.2	4	70	SUPP	FOOT		20 31		0
080080	76/11/11	2.1	3.2	1.1	COHO	11	1	12	10.9	4	65	SUPP	FOOT		20 31		0
080080	76/11/11	3.2	4.4	1.2	COHO	33	5	38	31.7	4	65	SUPP	FOOT		20 31		0
080080	76/11/11	4.4	5.5	1.1	FALL	0	1	1	0.9	1	80	INDX	FOOT	4	20 31		0
080080	76/11/11	4.4	5.5	1.1	COHO	45	20	65	59.1	4	80	INDX	FOOT	1	20 31		0
080080	76/11/11	5.5	6.2	0.7	COHO	28	3	31	44.3	4	60	SUPP	FOOT		20 60		0
080080	76/11/11	6.2	6.5	0.3	COHO	4	0	4	13.3	4	60	SUPP	FOOT		20 60		0
080080	76/11/11	6.5	6.7	0.2	COHO	5	0	5	25.0	4	95	SUPP	FOOT		60		0
080080	76/11/11	6.7	7.3	0.6	COHO	12	2	14	23.3	4	80	SUPP	FOOT		60		0
080080	76/11/11	7.3	7.9	0.6	COHO	14	10	24	40.0	4	90	SUPP	FOOT				0
080080	76/11/17	4.4	5.5	1.1	COHO	37	12	49	44.5	4	75	INDX	FOOT		24 30		0
080080	76/11/19	2.1	3.2	1.1	COHO	10	4	14	12.7	4	0	SUPP	FOOT		20 30		0
080080	76/11/19	3.2	4.0	0.8	COHO	67	6	73	91.3	4	75	SUPP	FOOT		23 30		0
080080	76/11/22	6.2	6.5	0.3	COHO	7	6	13	43.3	4	65	SUPP	FOOT		60		0
080080	76/11/22	6.5	6.7	0.2	COHO	6	1	7	35.0	4	60	SUPP	FOOT		60		0

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	76/11/22	6.7	7.3	0.6	COHO	8	1	9	15.0	4	30		SUPP	FOOT		60	0
080080	76/11/22	7.3	7.9	0.6	COHO	19	13	32	53.3	4	80		SUPP	FOOT		60	0
080080	76/11/22	7.9	8.0	0.1	COHO	0	0	0		4	70		SUPP	FOOT		60	0
080080	76/11/24	2.1	3.2	1.1	COHO	2	3	5	4.5	4	50		SUPP	FOOT		21 30	0
080080	76/11/24	3.2	4.0	0.8	COHO	18	3	21	26.3	4	70		SUPP	FOOT		24 31	0

080080	76/11/24	4.4	5.5	1.1	COHO	55	15	70	63.6	4	85	INDX	FOOT		21 31	0
080080	76/11/29	0.0	1.3	1.3	COHO	0	0	0		4	40	SUPP	FOOT		24 31 60	0
080080	76/11/29	1.3	2.1	0.8	COHO	1	1	2	2.5	4	40	SUPP	FOOT		21 31	0
080080	76/11/29	2.1	3.2	1.1	COHO	1	1	2	1.8	4	55	SUPP	FOOT		24 30 31	0
080080	76/11/29	3.2	4.4	1.2	COHO	21	9	30	25.0	4	60	SUPP	FOOT		21 31	0
080080	76/11/29	4.4	5.5	1.1	COHO	16	3	19	17.3	4	80	INDX	FOOT		23 31	0
080080	76/11/29	5.5	6.2	0.7	COHO	19	5	24	34.3	4	85	SUPP	FOOT		20	0
080080	76/11/29	6.2	6.5	0.3	COHO	4	1	5	16.7	4	80	SUPP	FOOT		20 30	0
080080	76/11/29	6.5	7.7	1.2	COHO	17	9	26	21.7	4	60	SUPP	FOOT		21 31	0
080080	76/12/07	0.2	1.3	1.1	COHO	3	1	4	3.6	4	65	SUPP	FOOT		25 31	0
080080	76/12/07	1.3	2.1	0.8	COHO	0	1	1	1.2	4	20	SUPP	FOOT		24 34	0
080080	76/12/07	2.1	3.2	1.1	COHO	1	1	2	1.8	4	65	SUPP	FOOT		24 31	0
080080	76/12/07	3.2	4.0	0.8	COHO	15	4	19	23.8	4	60	SUPP	FOOT		24 30	0
080080	76/12/07	4.0	4.4	0.4	COHO	5	3	8	20.0	4	35	SUPP	FOOT		24 30	0
080080	76/12/07	5.5	6.5	1.0	COHO	33	8	41	41.0	4	70	SUPP	FOOT		24 31	0
080080	76/12/07	6.5	7.9	1.4	COHO	44	16	60	42.9	4	85	SUPP	FOOT		20 31	0
080080	76/12/08	4.4	5.5	1.1	COHO	81	27	108	98.2	4	75	INDX	FOOT		24 31 60	0
080080	76/12/14	0.2	1.3	1.1	COHO	1	2	3	2.7	4	60	SUPP	FOOT		24 31 60	0
080080	76/12/14	1.3	2.1	0.8	COHO	3	4	7	8.8	4	40	SUPP	FOOT		21 31	0
080080	76/12/14	2.1	3.2	1.1	COHO	3	7	10	9.1	4	45	SUPP	FOOT		21 31	0
080080	76/12/14	3.2	4.4	1.2	COHO	25	9	34	28.3	4	70	SUPP	FOOT		24 31	0
080080	76/12/14	4.4	5.5	1.1	COHO	66	37	103	93.6	4	75	INDX	FOOT		24 31 60	0
080080	76/12/14	5.5	6.5	1.0	COHO	43	11	54	54.0	4	65	SUPP	FOOT		24 31 60	0
080080	76/12/14	6.5	7.9	1.4	COHO	62	44	106	75.7	4	80	SUPP	FOOT		20	0
080080	76/12/21	3.2	4.4	1.2	COHO	26	10	36	30.0	4	70	SUPP	FOOT		24 31 60	0
080080	76/12/21	4.4	5.5	1.1	COHO	50	37	87	79.1	4	80	INDX	FOOT		20	0
080080	76/12/21	5.5	6.2	0.7	COHO	21	15	36	51.4	4	80	SUPP	FOOT		20	0
080080	76/12/21	6.2	6.5	0.3	COHO	3	9	12	40.0	4	80	SUPP	FOOT		20	0
080080	76/12/21	6.5	7.9	1.4	COHO	40	39	79	56.4	4	70	SUPP	FOOT		24 31 60	0
080080	76/12/27	4.4	5.5	1.1	COHO	70	58	128	116.4	4	75	INDX	FOOT		23	0
080080	76/12/27	5.5	6.2	0.7	COHO	57	16	73	104.3	4	75	SUPP	FOOT		23	0
080080	76/12/27	6.2	6.5	0.3	COHO	12	4	16	53.3	4	75	SUPP	FOOT		23	0
080080	76/12/27	6.5	7.9	1.4	COHO	95	41	136	97.1	4	80	SUPP	FOOT		21	0
080080	76/12/28	3.2	4.0	0.8	COHO	0	1	1	1.3	4	65	SUPP	FOOT		24 31	0
080080	76/12/28	4.0	4.4	0.4	COHO	7	2	9	22.5	4	50	SUPP	FOOT		24 31	0
080080	77/01/03	3.2	4.4	1.2	COHO	6	4	10	8.3	4	70	SUPP	FOOT		24 31 60	0
080080	77/01/03	4.4	5.5	1.1	COHO	27	43	70	63.6	4	80	INDX	FOOT		20	0
080080	77/01/03	5.5	6.2	0.7	COHO	16	9	25	35.7	4	80	SUPP	FOOT		20	0
080080	77/01/03	6.2	6.5	0.3	COHO	10	3	13	43.3	4	80	SUPP	FOOT		20	0
080080	77/01/03	6.5	7.9	1.4	COHO	33	34	67	47.9	4	70	SUPP	FOOT		24 31 60	0
080080	77/01/10	0.2	1.3	1.1	COHO	0	1	1	0.9	4	70	SUPP	FOOT		21 31	0
080080	77/01/10	1.3	2.1	0.8	COHO	0	0	0		4	60	SUPP	FOOT		21 31	0
080080	77/01/10	2.1	3.2	1.1	COHO	1	6	7	6.4	4	70	SUPP	FOOT		21 31	0
080080	77/01/10	3.2	4.4	1.2	COHO	11	2	13	10.8	4	70	SUPP	FOOT		21 31 60	0
080080	77/01/10	4.4	5.5	1.1	COHO	25	33	58	52.7	4	70	INDX	FOOT		21 31 60	0
080080	77/01/10	5.5	6.2	0.7	COHO	22	11	33	47.1	4	80	SUPP	FOOT		20	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	77/01/10	6.2	6.5	0.3	COHO	3	6	9	30.0	4	80		SUPP	FOOT		20	0
080080	77/01/10	6.5	7.9	1.4	COHO	22	42	64	45.7	4	70		SUPP	FOOT		21 31 60	0
080080	77/01/13	4.4	4.8	0.4	COHO	5	12	17	42.5	4	70		SUPP	FOOT		24 31 60	0
080080	77/01/17	3.2	4.4	1.2	COHO	2	2	4	3.3	4	65		SUPP	FOOT		38 60 31	0
080080	77/01/17	4.4	5.5	1.1	COHO	20	35	55	50.0	4	80		INDX	FOOT		20 31	0
080080	77/01/17	5.5	6.2	0.7	COHO	8	18	26	37.1	4	80		SUPP	FOOT		20	0
080080	77/01/17	6.2	6.5	0.3	COHO	0	5	5	16.7	4	80		SUPP	FOOT		20 31	0
080080	77/01/17	6.5	7.8	1.3	COHO	10	44	54	41.5	4	65		SUPP	FOOT		24 60	0
080080	77/01/24	2.1	3.2	1.1	COHO	1	1	2	1.8	4	65		SUPP	FOOT		20	0
080080	77/01/24	3.2	4.4	1.2	COHO	4	4	8	6.7	4	65		SUPP	FOOT		24 31 38	0
080080	77/01/24	4.4	5.5	1.1	COHO	11	33	44	40.0	4	70		INDX	FOOT		60	0

080080	77/01/24	5.5	6.2	0.7	COHO	2	6	8	11.4	4	80	SUPP	FOOT		20		0
080080	77/01/24	6.2	6.5	0.3	COHO	0	3	3	10.0	4	80	SUPP	FOOT		20		0
080080	77/01/24	6.5	7.9	1.4	COHO	6	37	43	30.7	4	65	SUPP	FOOT		60	24	0
080080	77/02/01	3.2	4.4	1.2	COHO	4	3	7	5.8	4	65	SUPP	FOOT		24	31 60	0
080080	77/02/01	4.4	5.5	1.1	COHO	2	26	28	25.5	4	70	INDX	FOOT		24	31 60	0
080080	77/02/01	5.5	6.2	0.7	COHO	1	2	3	4.3	4	80	SUPP	FOOT		20		0
080080	77/02/01	6.2	6.5	0.3	COHO	0	8	8	26.7	4	80	SUPP	FOOT		20		0
080080	77/02/01	6.5	7.9	1.4	COHO	4	15	19	13.6	4	70	SUPP	FOOT		24	31 60	0
080080	77/02/09	4.4	5.5	1.1	COHO	2	15	17	15.5	4	75	INDX	FOOT		23	60	0
080080	77/02/09	6.5	7.7	1.2	COHO	0	12	12	10.0	4	75	SUPP	FOOT		23	60	0
080080	77/10/27	4.4	5.5	1.1	COHO	4	2	6	5.5	4	75	INDX	FOOT	5	20	31 60	0
080080	77/10/27	4.4	5.5	1.1	SOCK	2	0	2	1.8	5	75	SUPP	FOOT	4	20	31 60	0
080080	77/10/27	5.5	6.0	0.5	COHO	1	0	1	2.0	4	75	SUPP	FOOT		6	20 60	0
080080	77/11/01	0.0	1.1	1.1	PINK	0	1	1	0.9	3	70	SUPP	FOOT		26	60	0
080080	77/11/01	0.0	1.1	1.1	COHO	0	0	0		4	50	SUPP	FOOT	3	26		0
080080	77/11/01	0.3	1.1	0.8	FALL	0	4	4	5.0	1	80	SUPP	FOOT		26	60	0
080080	77/11/01	1.1	3.2	2.1	FALL	2	4	6	2.9	1	50	SUPP	FOOT		26	60	0
080080	77/11/01	1.1	3.2	2.1	COHO	5	1	6	2.9	4	50	SUPP	FOOT	1	26	60	0
080080	77/11/01	3.2	4.4	1.2	COHO	2	0	2	1.7	4	60	SUPP	FOOT		26	31 60	0
080080	77/11/01	4.4	5.5	1.1	COHO	11	4	15	13.6	4	65	INDX	FOOT		24	30 60	0
080080	77/11/01	5.5	6.8	1.3	COHO	2	1	3	2.3	4	65	SUPP	FOOT		24	30 60	0
080080	77/11/07	0.2	1.3	1.1	FALL	0	1	1	0.9	1	60	SUPP	FOOT	4	27	30	0
080080	77/11/07	0.2	1.3	1.1	COHO	0	0	0		4	50	SUPP	FOOT	1	27	30	0
080080	77/11/07	1.3	2.1	0.8	FALL	0	4	4	5.0	1	60	SUPP	FOOT	4	27	60	0
080080	77/11/07	1.3	2.1	0.8	COHO	5	0	5	6.2	4	60	SUPP	FOOT	1	27	60	0
080080	77/11/07	3.2	4.4	1.2	COHO	11	1	12	10.0	4	70	SUPP	FOOT	6	24		0
080080	77/11/07	4.4	5.5	1.1	COHO	28	4	32	29.1	4	70	INDX	FOOT		23	60	0
080080	77/11/07	5.5	6.5	1.0	COHO	12	0	12	12.0	4	70	SUPP	FOOT		24		0
080080	77/11/07	6.5	7.3	0.8	COHO	6	0	6	7.5	4	90	SUPP	FOOT		20	60	0
080080	77/11/10	7.5	0.0	0.0	COHO	0	0	0		4	99	SPOT	FOOT		20	60	0
080080	77/11/14	4.4	5.5	1.1	COHO	12	8	20	18.2	4	70	INDX	FOOT		27	60 68	0
080080	77/11/14	5.5	6.5	1.0	COHO	12	0	12	12.0	4	70	SUPP	FOOT		26	60	0
080080	77/11/14	6.5	7.3	0.8	COHO	6	2	8	10.0	4	70	SUPP	FOOT		26	60	0
080080	77/11/14	7.3	7.9	0.6	COHO	2	0	2	3.3	4	85	SUPP	FOOT		21	60	0
080080	77/11/18	0.2	1.3	1.1	FALL	0	2	2	1.8	1	75	SUPP	FOOT	4	23	31	0
080080	77/11/18	0.2	1.3	1.1	COHO	0	0	0		4	75	SUPP	FOOT	1	23	31 60	0
080080	77/11/18	1.3	2.1	0.8	COHO	3	2	5	6.2	4	60	SUPP	FOOT		27	60	0
080080	77/11/18	2.1	2.9	0.8	COHO	2	1	3	3.8	4	80	SUPP	FOOT		23	33 60	0
080080	77/11/18	2.9	4.0	1.1	COHO	17	2	19	17.3	4	65	SUPP	FOOT		26	60	0

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	77/11/18	4.0	4.4	0.4	COHO	3	1	4	10.0	4	85		SUPP	FOOT		23 31 60	0
080080	77/11/21	0.2	1.3	1.1	COHO	1	1	2	1.8	4	70		SUPP	FOOT		24 60	0
080080	77/11/21	1.3	2.1	0.8	COHO	4	4	8	10.0	4	80		SUPP	FOOT		20 31 60	0
080080	77/11/21	2.1	3.2	1.1	COHO	0	1	1	0.9	4	80		SUPP	FOOT		23 60	0
080080	77/11/21	3.2	4.4	1.2	COHO	7	7	14	11.7	4	80		SUPP	FOOT		20 31 60	0
080080	77/11/21	4.4	5.5	1.1	COHO	5	5	10	9.1	4	80		INDX	FOOT		23 60	0
080080	77/11/21	5.5	6.5	1.0	COHO	5	0	5	5.0	4	90		SUPP	FOOT		20 60	0
080080	77/11/21	6.5	7.3	0.8	COHO	1	2	3	3.8	4	60		SUPP	FOOT		27 60	0
080080	77/11/22	7.3	7.9	0.6	COHO	2	3	5	8.3	4	95		SUPP	FOOT		20 60	0
080080	77/11/28	0.2	1.3	1.1	COHO	1	3	4	3.6	4	60		SUPP	FOOT		28 60	0
080080	77/11/28	1.3	2.1	0.8	COHO	3	0	3	3.8	4	70		SUPP	FOOT		24 34	0
080080	77/11/28	2.1	3.2	1.1	COHO	0	2	2	1.8	4	70		SUPP	FOOT		24 60	0
080080	77/11/28	3.2	4.4	1.2	COHO	29	5	34	28.3	4	70		SUPP	FOOT		24 34 68	0
080080	77/11/28	4.4	5.5	1.1	COHO	38	6	44	40.0	4	80		INDX	FOOT		24 34 60	0
080080	77/11/28	5.5	6.5	1.0	COHO	60	3	63	63.0	4	65		SUPP	FOOT		24 34 60	0
080080	77/11/28	6.5	7.3	0.8	COHO	5	5	10	12.5	4	70		SUPP	FOOT		28 34 60	0
080080	77/11/29	7.3	7.9	0.6	COHO	6	2	8	13.3	4	65		SUPP	FOOT		21 39 60	0

080080	77/12/05	0.2	1.3	1.1	FALL	0	1	1	0.9	1	75	SUPP	FOOT	4	23	0
080080	77/12/05	0.2	1.3	1.1	COHO	2	4	6	5.5	4	70	SUPP	FOOT	1	23 60	0
080080	77/12/05	1.3	2.1	0.8	COHO	0	3	3	3.8	4	80	SUPP	FOOT		23 31 60	0
080080	77/12/05	2.1	3.2	1.1	COHO	0	1	1	0.9	4	70	SUPP	FOOT		23 60	0
080080	77/12/05	3.2	4.4	1.2	COHO	32	15	47	39.2	4	80	SUPP	FOOT		23 33 60	0
080080	77/12/05	4.4	5.5	1.1	COHO	42	13	55	50.0	4	80	INDX	FOOT		23 60	0
080080	77/12/05	5.5	6.5	1.0	COHO	37	7	44	44.0	4	90	SUPP	FOOT		23 60	0
080080	77/12/05	6.5	7.3	0.8	COHO	8	1	9	11.3	4	60	SUPP	FOOT		25 60	0
080080	77/12/05	7.3	7.9	0.6	COHO	4	1	5	8.3	4	90	SUPP	FOOT		20 60	0
080080	77/12/19	1.3	2.1	0.8	COHO	0	3	3	3.8	4	60	SUPP	FOOT		27 60	0
080080	77/12/19	2.1	3.2	1.1	COHO	0	6	6	5.5	4	40	SUPP	FOOT		23 31 60	0
080080	77/12/19	3.2	4.4	1.2	COHO	4	2	6	5.0	4	65	SUPP	FOOT		27 60	0
080080	77/12/19	4.4	5.5	1.1	COHO	10	11	21	19.1	4	85	INDX	FOOT		23 33 60	0
080080	77/12/19	5.5	6.5	1.0	COHO	25	3	28	28.0	4	75	SUPP	FOOT		24 60	0
080080	77/12/19	6.5	7.3	0.8	COHO	8	7	15	18.8	4	90	SUPP	FOOT		20 60	0
080080	77/12/19	7.3	7.9	0.6	COHO	28	2	30	50.0	4	85	SUPP	FOOT		23 60	0
080080	77/12/27	0.2	1.3	1.1	COHO	0	1	1	0.9	4	80	SUPP	FOOT		23 60	0
080080	77/12/27	1.3	2.1	0.8	COHO	2	2	4	5.0	4	75	SUPP	FOOT		20 31 60	0
080080	77/12/27	2.1	3.2	1.1	COHO	0	4	4	3.6	4	80	SUPP	FOOT		23 60	0
080080	77/12/27	3.2	4.4	1.2	COHO	3	3	6	5.0	4	60	SUPP	FOOT		23 31 60	0
080080	77/12/27	4.4	5.5	1.1	COHO	0	12	12	10.9	4	85	INDX	FOOT		20 60	0
080080	77/12/27	5.5	6.5	1.0	COHO	0	6	6	6.0	4	80	SUPP	FOOT		23 60	0
080080	77/12/27	6.5	7.3	0.8	COHO	0	1	1	1.3	4	70	SUPP	FOOT		24 60	0
080080	77/12/27	7.3	7.9	0.6	COHO	1	12	13	21.7	4	95	SUPP	FOOT		20 50 60	0
080080	78/01/03	1.3	2.1	0.8	COHO	0	0	0		4	15	SUPP	FOOT		28 60	0
080080	78/01/03	2.1	2.9	0.8	COHO	0	1	1	1.3	4	20	SUPP	FOOT		24 31 60	0
080080	78/01/03	4.4	5.5	1.1	COHO	0	7	7	6.4	4	75	INDX	FOOT		23 34 60	0
080080	78/01/03	5.5	6.5	1.0	COHO	0	0	0		4	70	SUPP	FOOT		24 60	0
080080	78/01/03	6.5	7.3	0.8	COHO	0	8	8	10.0	4	80	SUPP	FOOT		23 34 60	0
080080	78/01/03	7.3	7.9	0.6	COHO	0	5	5	8.3	4	70	SUPP	FOOT		24 60	0
080080	78/01/11	4.4	5.5	1.1	COHO	0	0	0		4	85	INDX	FOOT		23 60	0
080080	78/01/11	5.5	6.5	1.0	COHO	4	5	9	9.0	4	75	SUPP	FOOT		23 60	0
080080	78/01/11	6.5	7.3	0.8	COHO	0	0	0		4	85	SUPP	FOOT		23 60	0
080080	78/01/11	7.3	7.9	0.6	COHO	0	0	0		4	85	SUPP	FOOT		23 60	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	78/10/27	0.0	1.0	1.0	FALL	2	4	6	6.0	1	45		SUPP	FOOT	45	21	0
080080	78/10/27	0.0	1.0	1.0	COHO	3	4	7	7.0	4	45		SUPP	FOOT	15	21	0
080080	78/10/27	0.0	1.0	1.0	SOCK	21	2	23	23.0	5	45		SUPP	FOOT	14	21	0
080080	78/10/27	1.0	1.3	0.3	FALL	0	3	3	10.0	1	80		SUPP	FOOT	4	20	0
080080	78/10/27	1.0	1.3	0.3	COHO	1	0	1	3.3	4	80		SUPP	FOOT	1	20	0
080080	78/10/27	1.3	1.9	0.6	FALL	2	3	5	8.3	1	65		SUPP	FOOT	45	20	0
080080	78/10/27	1.3	1.9	0.6	COHO	5	0	5	8.3	4	65		SUPP	FOOT	15	20	0
080080	78/10/27	1.3	1.9	0.6	SOCK	2	0	2	3.3	5	65		SUPP	FOOT	14	20	0
080080	78/10/27	1.9	2.9	1.0	COHO	1	0	1	1.0	4	60		SUPP	FOOT		20	0
080080	78/10/27	2.9	4.0	1.1	FALL	3	2	5	4.5	1	60		SUPP	FOOT	45	20	0
080080	78/10/27	2.9	4.0	1.1	COHO	18	1	19	17.3	4	60		SUPP	FOOT	15	20 66	0
080080	78/10/27	2.9	4.0	1.1	SOCK	0	1	1	0.9	5	60		SUPP	FOOT	14	20	0
080080	78/10/27	4.0	4.4	0.4	COHO	0	1	1	2.5	4	70		SUPP	FOOT		20	0
080080	78/10/27	4.4	5.5	1.1	FALL	0	4	4	3.6	1	80		SUPP	FOOT	4	20 60	0
080080	78/10/27	4.4	5.5	1.1	COHO	5	4	9	8.2	4	80		INDX	FOOT	1	20 61	0
080080	78/10/27	5.5	6.2	0.7	COHO	1	0	1	1.4	4	70		SUPP	FOOT		20	0
080080	78/10/27	6.2	7.9	1.7	COHO	0	0	0		4	80		SUPP	FOOT		20	0
080080	78/10/27	6.5	6.7	0.2	FALL	0	1	1	5.0	1	80		SUPP	FOOT		20	0
080080	78/10/30	1.0	1.9	0.9	FALL	2	10	12	13.3	1	0		SUPP	FOOT	4	20	0
080080	78/10/30	1.0	1.9	0.9	COHO	1	0	1	1.1	4	70		SUPP	FOOT	1	20	0
080080	78/10/30	1.9	4.0	2.1	COHO	6	2	8	3.8	4	70		SUPP	FOOT	5	20	0
080080	78/10/30	1.9	4.0	2.1	SOCK	1	0	1	0.5	5	0		SUPP	FOOT	4	20	0

080080	78/10/30	4.0	4.4	0.4	COHO	1	0	1	2.5	4	70	SUPP	FOOT		20	0
080080	78/10/30	4.4	5.5	1.1	COHO	2	0	2	1.8	4	70	INDX	FOOT		20	0
080080	78/10/30	5.5	7.9	2.4	FALL	0	1	1	0.4	1	70	SUPP	FOOT	4	20	0
080080	78/10/30	5.5	7.9	2.4	COHO	0	0	0		4	70	SUPP	FOOT	1	20	0
080080	78/11/01	4.4	4.8	0.4	COHO	1	2	3	7.5	4	90	INDX	FOOT	1	20	0
080080	78/11/02	2.1	2.9	0.8	COHO	6	0	6	7.5	4	60	SUPP	FOOT	5	20 31	0
080080	78/11/02	2.1	2.9	0.8	SOCK	0	1	1	1.3	5	60	SUPP	FOOT	4	20 31	0
080080	78/11/02	2.9	3.2	0.3	COHO	1	1	2	6.7	4	75	SUPP	FOOT	5	20	0
080080	78/11/02	2.9	3.2	0.3	SOCK	1	1	2	6.7	5	75	SUPP	FOOT	4	20	0
080080	78/11/02	3.2	4.0	0.8	FALL	1	4	5	6.3	1	70	SUPP	FOOT	45	20 34	0
080080	78/11/02	3.2	4.0	0.8	COHO	3	1	4	5.0	4	70	SUPP	FOOT	15	20 34	0
080080	78/11/02	3.2	4.0	0.8	SOCK	0	1	1	1.3	5	70	SUPP	FOOT	14	20 34	0
080080	78/11/02	4.0	4.4	0.4	COHO	0	2	2	5.0	4	50	SUPP	FOOT		21 34 68	0
080080	78/11/02	4.4	5.5	1.1	FALL	0	2	2	1.8	1	80	INDX	FOOT	4	20	0
080080	78/11/02	4.4	5.5	1.1	COHO	3	3	6	5.5	4	80	INDX	FOOT	1	20	0
080080	78/11/02	5.5	6.2	0.7	COHO	1	0	1	1.4	4	70	SUPP	FOOT	1	21 60	0
080080	78/11/02	6.2	6.7	0.5	COHO	0	0	0		4	50	SUPP	FOOT		21 34	0
080080	78/11/02	6.7	7.3	0.6	COHO	0	0	0		4	65	SUPP	FOOT		21	0
080080	78/11/03	3.2	4.0	0.8	FALL	1	2	3	3.8	1	30	SUPP	FOOT	45	21 34	0
080080	78/11/03	3.2	4.0	0.8	COHO	3	0	3	3.8	4	30	SUPP	FOOT	15	21 34	0
080080	78/11/03	3.2	4.0	0.8	SOCK	1	3	4	5.0	5	30	SUPP	FOOT	14	21 34	0
080080	78/11/03	4.0	4.4	0.4	COHO	1	0	1	2.5	4	25	SUPP	FOOT		22 34	0
080080	78/11/03	4.4	5.5	1.1	FALL	0	2	2	1.8	1	75	SUPP	FOOT	4	31 34	0
080080	78/11/03	4.4	5.5	1.1	COHO	12	2	14	12.7	4	75	INDX	FOOT	1	31 34	0
080080	78/11/03	5.5	6.2	0.7	COHO	0	0	0		4	25	SUPP	FOOT		22 34	0
080080	78/11/03	6.2	6.7	0.5	COHO	2	0	2	4.0	4	45	SUPP	FOOT		25 30 34	0
080080	78/11/03	6.7	7.3	0.6	COHO	0	0	0		4	25	SUPP	FOOT		22 34	0
080080	78/11/03	7.3	7.9	0.6	COHO	0	0	0		4	55	SUPP	FOOT		24 31 34	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	78/11/05	4.4	5.5	1.1	COHO	8	0	8	7.3	4	60		INDX	FOOT		25 34	0
080080	78/11/05	5.5	6.2	0.7	COHO	8	0	8	11.4	4	60		SUPP	FOOT		24	0
080080	78/11/05	6.2	6.7	0.5	COHO	3	0	3	6.0	4	60		SUPP	FOOT		24	0
080080	78/11/07	3.2	4.0	0.8	COHO	53	1	54	67.5	4	65		SUPP	FOOT		20 66	0
080080	78/11/07	4.0	4.4	0.4	COHO	8	0	8	20.0	4	70		SUPP	FOOT		20 66	0
080080	78/11/07	4.4	5.5	1.1	COHO	69	1	70	63.6	4	90		INDX	FOOT		20 66	0
080080	78/11/07	5.5	6.2	0.7	COHO	26	0	26	37.1	4	80		SUPP	FOOT		20 60	0
080080	78/11/07	6.2	6.5	0.3	COHO	8	0	8	26.7	4	70		SUPP	FOOT		20	0
080080	78/11/07	6.5	6.7	0.2	COHO	2	0	2	10.0	4	70		SUPP	FOOT		20 66	0
080080	78/11/07	6.7	7.3	0.6	COHO	6	0	6	10.0	4	65		SUPP	FOOT		20 66	0
080080	78/11/07	7.3	7.7	0.4	COHO	4	0	4	10.0	4	70		SUPP	FOOT		20	0
080080	78/11/08	3.2	4.4	1.2	COHO	37	1	38	31.7	4	75		SUPP	FOOT		23 34	0
080080	78/11/08	4.4	5.5	1.1	COHO	37	0	37	33.6	4	75		INDX	FOOT		23 34	0
080080	78/11/08	5.5	6.2	0.7	COHO	15	0	15	21.4	4	75		SUPP	FOOT		26 34	0
080080	78/11/08	6.2	6.7	0.5	COHO	3	0	3	6.0	4	80		SUPP	FOOT		27 31 60	0
080080	78/11/08	6.7	7.3	0.6	COHO	1	0	1	1.7	4	70		SUPP	FOOT		23	0
080080	78/11/08	7.3	7.9	0.6	COHO	0	0	0		4	60		SUPP	FOOT		23	0
080080	78/11/09	3.2	4.4	1.2	COHO	11	0	11	9.2	4	30		SUPP	FOOT		28	0
080080	78/11/09	4.4	5.5	1.1	COHO	38	0	38	34.5	4	65		INDX	FOOT		24 31 60	0
080080	78/11/09	5.5	6.2	0.7	COHO	13	0	13	18.6	4	70		SUPP	FOOT		24	0
080080	78/11/09	6.2	6.7	0.5	COHO	4	0	4	8.0	4	60		SUPP	FOOT		24	0
080080	78/11/09	6.7	7.9	1.2	COHO	7	0	7	5.8	4	70		SUPP	FOOT		21	0
080080	78/11/10	3.2	4.4	1.2	FALL	0	1	1	0.8	1	55		SUPP	FOOT	4	24 31 33	0
080080	78/11/10	3.2	4.4	1.2	COHO	17	2	19	15.8	4	55		SUPP	FOOT	1	24 31 33	0
080080	78/11/10	4.4	5.5	1.1	COHO	27	1	28	25.5	4	70		INDX	FOOT		24 33	0
080080	78/11/10	5.5	6.2	0.7	COHO	10	0	10	14.3	4	85		SUPP	FOOT		20 33	0
080080	78/11/10	6.2	6.7	0.5	COHO	10	0	10	20.0	4	80		SUPP	FOOT		23	0
080080	78/11/10	6.7	7.3	0.6	COHO	4	0	4	6.7	4	80		SUPP	FOOT		20	0
080080	78/11/10	7.3	7.7	0.4	COHO	1	0	1	2.5	4	75		SUPP	FOOT		20	0

080080	78/11/11	3.2	4.4	1.2	COHO	5	1	6	5.0	4	65	SUPP	FOOT		24 31		0
080080	78/11/11	4.4	5.5	1.1	COHO	31	2	33	30.0	4	90	INDX	FOOT		20 60		0
080080	78/11/11	5.5	6.2	0.7	COHO	5	0	5	7.1	4	70	SUPP	FOOT		23 33		0
080080	78/11/11	6.2	6.7	0.5	COHO	6	0	6	12.0	4	75	SUPP	FOOT		20 33		0
080080	78/11/11	6.7	7.9	1.2	COHO	3	0	3	2.5	4	75	SUPP	FOOT		20 33		0
080080	78/11/12	3.2	4.4	1.2	COHO	9	3	12	10.0	4	65	SUPP	FOOT		24 31	68	0
080080	78/11/12	4.4	5.5	1.1	COHO	18	2	20	18.2	4	75	INDX	FOOT		20 31		0
080080	78/11/12	5.5	6.2	0.7	COHO	3	0	3	4.3	4	85	SUPP	FOOT		20 33		0
080080	78/11/12	6.2	6.7	0.5	COHO	5	0	5	10.0	4	80	SUPP	FOOT		20 60		0
080080	78/11/12	6.7	7.3	0.6	COHO	0	0	0		4	85	SUPP	FOOT		20		0
080080	78/11/12	7.3	7.7	0.4	COHO	0	0	0		4	85	SUPP	FOOT		20 60		0
080080	78/11/13	5.5	7.5	2.0	COHO	2	0	2	1.0	4	90	SUPP	FOOT				0
080080	78/11/14	3.2	4.0	0.8	COHO	16	4	20	25.0	4	50	SUPP	FOOT		20 60		0
080080	78/11/14	4.0	4.4	0.4	COHO	4	2	6	15.0	4	40	SUPP	FOOT		20		0
080080	78/11/14	4.4	5.5	1.1	COHO	17	3	20	18.2	4	70	INDX	FOOT		20		0
080080	78/11/14	5.5	6.2	0.7	COHO	1	0	1	1.4	4	90	SUPP	FOOT		20		0
080080	78/11/14	6.2	6.5	0.3	COHO	1	0	1	3.3	4	90	SUPP	FOOT		20		0
080080	78/11/14	6.5	6.7	0.2	COHO	1	0	1	5.0	4	90	SUPP	FOOT		20		0
080080	78/11/14	6.7	7.3	0.6	COHO	0	0	0		4	80	SUPP	FOOT		20		0
080080	78/11/14	7.3	7.7	0.4	COHO	1	0	1	2.5	4	95	SUPP	FOOT		20		0
080080	78/11/15	1.0	1.9	0.9	COHO	15	0	15	16.7	4	60	SUPP	FOOT	1	66		0
080080	78/11/15	1.9	3.2	1.3	COHO	5	7	12	9.2	4	80	SUPP	FOOT				0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	78/11/15	3.2	4.4	1.2	FALL	0	1	1	0.8	1	90		SUPP	FOOT	4	20	0
080080	78/11/15	3.2	4.4	1.2	COHO	8	5	13	10.8	4	90		SUPP	FOOT	1	20	0
080080	78/11/15	4.4	5.5	1.1	COHO	7	2	9	8.2	4	90		INDX	FOOT		20	0
080080	78/11/15	5.5	6.2	0.7	COHO	2	1	3	4.3	4	85		SUPP	FOOT		20	0
080080	78/11/15	6.2	6.7	0.5	COHO	0	2	2	4.0	4	80		SUPP	FOOT		20	0
080080	78/11/15	6.7	7.7	1.0	COHO	0	0	0		4	80		SUPP	FOOT		20 60	0
080080	78/11/16	3.2	4.4	1.2	COHO	13	4	17	14.2	4	60		SUPP	FOOT		27 31 34	0
080080	78/11/16	4.4	5.5	1.1	COHO	19	4	23	20.9	4	75		INDX	FOOT		24 34	0
080080	78/11/16	5.5	6.2	0.7	COHO	6	1	7	10.0	4	85		SUPP	FOOT		21 33	0
080080	78/11/16	6.2	6.7	0.5	COHO	2	1	3	6.0	4	75		SUPP	FOOT		24 31	0
080080	78/11/16	6.7	7.3	0.6	COHO	1	0	1	1.7	4	80		SUPP	FOOT		23 31	0
080080	78/11/16	7.3	7.7	0.4	COHO	1	0	1	2.5	4	80		SUPP	FOOT		21 34	0
080080	78/11/17	3.2	4.4	1.2	COHO	17	3	20	16.7	4	60		SUPP	FOOT		27 31	0
080080	78/11/17	4.4	5.5	1.1	COHO	41	5	46	41.8	4	80		INDX	FOOT		27 31	0
080080	78/11/17	5.5	6.2	0.7	COHO	18	1	19	27.1	4	75		SUPP	FOOT		24 31	0
080080	78/11/17	6.2	6.7	0.5	COHO	5	1	6	12.0	4	75		SUPP	FOOT		24 31	0
080080	78/11/17	6.7	7.7	1.0	COHO	6	1	7	7.0	4	80		SUPP	FOOT		24	0
080080	78/11/19	3.2	4.0	0.8	COHO	23	4	27	33.8	4	50		SUPP	FOOT		24	0
080080	78/11/19	4.0	4.4	0.4	COHO	6	4	10	25.0	4	25		SUPP	FOOT		24	0
080080	78/11/19	4.4	5.5	1.1	COHO	56	5	61	55.5	4	70		INDX	FOOT		24 61	0
080080	78/11/19	5.5	6.2	0.7	COHO	30	0	30	42.9	4	70		SUPP	FOOT		30 24 33	0
080080	78/11/19	6.2	6.7	0.5	COHO	1	1	2	4.0	4	65		SUPP	FOOT		25 31 33	0
080080	78/11/19	6.7	7.3	0.6	COHO	4	2	6	10.0	4	70		SUPP	FOOT		25 31	0
080080	78/11/19	7.3	7.7	0.4	COHO	8	0	8	20.0	4	80		SUPP	FOOT		25 31	0
080080	78/11/20	3.2	4.0	0.8	COHO	23	4	27	33.8	4	65		SUPP	FOOT		23 32	0
080080	78/11/20	4.0	4.4	0.4	COHO	4	6	10	25.0	4	70		SUPP	FOOT		23	0
080080	78/11/20	4.4	5.5	1.1	COHO	48	5	53	48.2	4	80		INDX	FOOT		23	0
080080	78/11/20	5.5	6.2	0.7	COHO	10	0	10	14.3	4	70		SUPP	FOOT		23	0
080080	78/11/20	6.2	6.5	0.3	COHO	4	0	4	13.3	4	70		SUPP	FOOT		23	0
080080	78/11/20	6.5	6.7	0.2	COHO	5	0	5	25.0	4	70		SUPP	FOOT		23	0
080080	78/11/20	6.7	7.3	0.6	COHO	5	0	5	8.3	4	70		SUPP	FOOT		23	0
080080	78/11/20	7.3	7.5	0.2	COHO	2	0	2	10.0	4	70		SUPP	FOOT		23 60	0
080080	78/11/21	3.2	4.4	1.2	COHO	29	1	30	25.0	4	80		SUPP	FOOT			0
080080	78/11/21	4.4	5.5	1.1	COHO	27	0	27	24.5	4	80		INDX	FOOT			0
080080	78/11/22	1.0	1.9	0.9	COHO	5	1	6	6.7	4	85		SUPP	FOOT			0

080080	78/11/22	1.9	3.2	1.3	COHO	7	2	9	6.9	4	60	SUPP	FOOT			0
080080	78/11/22	3.2	4.4	1.2	COHO	11	3	14	11.7	4	70	SUPP	FOOT	24 31 33		0
080080	78/11/22	4.4	5.5	1.1	COHO	21	4	25	22.7	4	75	INDX	FOOT	24 33		0
080080	78/11/22	5.5	6.2	0.7	COHO	11	0	11	15.7	4	60	SUPP	FOOT	20 32		0
080080	78/11/22	6.2	6.7	0.5	COHO	5	1	6	12.0	4	70	SUPP	FOOT	20		0
080080	78/11/22	6.7	7.3	0.6	COHO	1	1	2	3.3	4	60	SUPP	FOOT	22		0
080080	78/11/22	7.3	7.7	0.4	COHO	1	0	1	2.5	4	60	SUPP	FOOT	21		0
080080	78/11/23	3.2	4.4	1.2	COHO	14	3	17	14.2	4	65	SUPP	FOOT	24		0
080080	78/11/23	4.4	5.5	1.1	COHO	22	4	26	23.6	4	80	INDX	FOOT	20 31		0
080080	78/11/23	5.5	6.2	0.7	COHO	13	2	15	21.4	4	75	SUPP	FOOT	21		0
080080	78/11/23	6.2	6.7	0.5	COHO	5	3	8	16.0	4	80	SUPP	FOOT	20		0
080080	78/11/23	6.7	7.7	1.0	COHO	4	1	5	5.0	4	75	SUPP	FOOT	20		0
080080	78/11/25	3.2	4.4	1.2	COHO	23	8	31	25.8	4	85	SUPP	FOOT	21 33		0
080080	78/11/25	4.4	5.5	1.1	COHO	15	5	20	18.2	4	75	INDX	FOOT	21 34 60		0
080080	78/11/25	5.5	6.2	0.7	COHO	2	1	3	4.3	4	75	SUPP	FOOT	20		0
080080	78/11/25	6.2	6.7	0.5	COHO	7	2	9	18.0	4	90	SUPP	FOOT	20		0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	78/11/25	6.7	7.3	0.6	COHO	0	1	1	1.7	4	70		SUPP	FOOT		20	0
080080	78/11/25	7.3	7.7	0.4	COHO	1	0	1	2.5	4	80		SUPP	FOOT		20	0
080080	78/11/26	3.2	4.4	1.2	COHO	33	6	39	32.5	4	85		SUPP	FOOT		21 31	0
080080	78/11/26	4.4	5.5	1.1	COHO	15	10	25	22.7	4	85		INDX	FOOT		20 31	0
080080	78/11/26	5.5	6.5	1.0	COHO	15	7	22	22.0	4	80		SUPP	FOOT		20	0
080080	78/11/26	6.5	7.7	1.2	COHO	2	2	4	3.3	4	75		SUPP	FOOT		20 60	0
080080	78/11/27	3.2	4.4	1.2	COHO	15	5	20	16.7	4	80		SUPP	FOOT		20	0
080080	78/11/27	4.4	5.5	1.1	COHO	13	9	22	20.0	4	85		INDX	FOOT		20	0
080080	78/11/27	5.5	7.3	1.8	COHO	8	7	15	8.3	4	50		SUPP	FOOT		22	0
080080	78/11/29	1.9	3.2	1.3	COHO	5	0	5	3.8	4	70		SUPP	FOOT			0
080080	78/11/29	3.2	4.0	0.8	COHO	36	12	48	60.0	4	85		SUPP	FOOT		20	0
080080	78/11/29	4.0	4.4	0.4	COHO	10	2	12	30.0	4	75		SUPP	FOOT		21	0
080080	78/11/29	4.4	5.5	1.1	COHO	30	19	49	44.5	4	75		INDX	FOOT		21	0
080080	78/11/29	5.5	6.2	0.7	COHO	8	3	11	15.7	4	60		SUPP	FOOT		21	0
080080	78/11/29	6.2	6.7	0.5	COHO	2	6	8	16.0	4	85		SUPP	FOOT		20	0
080080	78/11/29	6.7	7.3	0.6	COHO	2	0	2	3.3	4	75		SUPP	FOOT		20 31	0
080080	78/11/29	7.3	7.7	0.4	COHO	1	0	1	2.5	4	80		SUPP	FOOT		20	0
080080	78/12/02	3.2	4.4	1.2	COHO	24	2	26	21.7	4	55		SUPP	FOOT		28	0
080080	78/12/02	4.4	5.5	1.1	COHO	61	6	67	60.9	4	60		INDX	FOOT		27	0
080080	78/12/02	5.5	6.2	0.7	COHO	38	5	43	61.4	4	70		SUPP	FOOT		27	0
080080	78/12/02	6.2	6.7	0.5	COHO	18	4	22	44.0	4	75		SUPP	FOOT		24 68	0
080080	78/12/02	6.7	7.7	1.0	COHO	34	3	37	37.0	4	80		SUPP	FOOT		24	0
080080	78/12/03	3.2	4.4	1.2	COHO	77	11	88	73.3	4	75		SUPP	FOOT		27 68	0
080080	78/12/03	4.4	5.5	1.1	COHO	81	13	94	85.5	4	80		INDX	FOOT		24	0
080080	78/12/03	5.5	6.2	0.7	COHO	43	5	48	68.6	4	70		SUPP	FOOT		27 31	0
080080	78/12/03	6.2	6.7	0.5	COHO	25	1	26	52.0	4	75		SUPP	FOOT		24 31	0
080080	78/12/03	6.7	7.3	0.6	COHO	10	0	10	16.7	4	70		SUPP	FOOT		25	0
080080	78/12/03	7.3	7.7	0.4	COHO	15	1	16	40.0	4	75		SUPP	FOOT		23	0
080080	78/12/04	3.2	4.0	0.8	COHO	31	1	32	40.0	4	60		SUPP	FOOT		24	0
080080	78/12/04	4.0	4.4	0.4	COHO	10	0	10	25.0	4	35		SUPP	FOOT		24	0
080080	78/12/04	4.4	5.5	1.1	COHO	97	13	110	100.0	4	75		INDX	FOOT		23	0
080080	78/12/04	5.5	6.7	1.2	COHO	39	5	44	36.7	4	80		SUPP	FOOT		23	0
080080	78/12/04	6.7	7.5	0.8	COHO	21	1	22	27.5	4	75		SUPP	FOOT			0
080080	78/12/05	4.5	5.5	1.0	COHO	79	1	80	80.0	4	75		INDX	FOOT		23	0
080080	78/12/06	1.0	1.9	0.9	COHO	2	1	3	3.3	4	85		SUPP	FOOT		24	0
080080	78/12/06	1.9	3.2	1.3	COHO	3	0	3	2.3	4	60		SUPP	FOOT		24	0
080080	78/12/06	3.2	4.4	1.2	COHO	31	2	33	27.5	4	65		SUPP	FOOT		25 31 33	0
080080	78/12/06	4.4	5.5	1.1	COHO	62	6	68	61.8	4	80		INDX	FOOT		24 31	0
080080	78/12/06	5.5	6.2	0.7	COHO	26	6	32	45.7	4	80		SUPP	FOOT		24 33	0
080080	78/12/06	6.2	6.7	0.5	COHO	6	0	6	12.0	4	80		SUPP	FOOT		24	0
080080	78/12/06	6.7	7.7	1.0	COHO	23	3	26	26.0	4	80		SUPP	FOOT		24 60	0

080080	78/12/07	3.2	4.0	0.8	COHO	23	8	31	38.8	4	65	SUPP	FOOT	24 31 33	0
080080	78/12/07	4.0	4.4	0.4	COHO	13	4	17	42.5	4	55	SUPP	FOOT	25 31 32	0
080080	78/12/07	4.4	5.5	1.1	COHO	55	15	70	63.6	4	75	INDX	FOOT	24 31 33	0
080080	78/12/07	5.5	6.2	0.7	COHO	18	4	22	31.4	4	65	SUPP	FOOT	20 32	0
080080	78/12/07	6.2	6.7	0.5	COHO	5	2	7	14.0	4	75	SUPP	FOOT	20 32	0
080080	78/12/07	6.7	7.3	0.6	COHO	8	0	8	13.3	4	70	SUPP	FOOT	21 31 32	0
080080	78/12/07	7.3	7.7	0.4	COHO	6	1	7	17.5	4	85	SUPP	FOOT	20 32	0
080080	78/12/08	3.2	4.4	1.2	COHO	34	7	41	34.2	4	80	SUPP	FOOT	20 31	0
080080	78/12/08	4.4	5.5	1.1	COHO	66	10	76	69.1	4	80	INDX	FOOT	20	0
080080	78/12/08	5.5	6.2	0.7	COHO	12	8	20	28.6	4	75	SUPP	FOOT	20	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	78/12/08	6.2	6.7	0.5	COHO	2	3	5	10.0	4	75		SUPP	FOOT		20	0
080080	78/12/08	6.7	7.7	1.0	COHO	9	8	17	17.0	4	75		SUPP	FOOT		20	0
080080	78/12/09	3.2	4.0	0.8	COHO	33	10	43	53.8	4	75		SUPP	FOOT		24 30 31	0
080080	78/12/09	4.0	4.4	0.4	COHO	10	4	14	35.0	4	65		SUPP	FOOT		24 31	0
080080	78/12/09	4.4	5.5	1.1	COHO	44	16	60	54.5	4	75		INDX	FOOT		24	0
080080	78/12/09	5.5	6.2	0.7	COHO	5	7	12	17.1	4	75		SUPP	FOOT		21	0
080080	78/12/09	6.2	6.7	0.5	COHO	0	4	4	8.0	4	80		SUPP	FOOT		20	0
080080	78/12/09	6.7	7.3	0.6	COHO	4	0	4	6.7	4	75		SUPP	FOOT		20	0
080080	78/12/09	7.3	7.7	0.4	COHO	6	1	7	17.5	4	85		SUPP	FOOT		20	0
080080	78/12/10	3.2	4.4	1.2	COHO	46	5	51	42.5	4	80		SUPP	FOOT		24 31	0
080080	78/12/10	4.4	5.5	1.1	COHO	41	12	53	48.2	4	85		INDX	FOOT		23	0
080080	78/12/10	5.5	6.2	0.7	COHO	12	6	18	25.7	4	35		SUPP	FOOT		21 30	0
080080	78/12/10	6.2	6.7	0.5	COHO	3	3	6	12.0	4	65		SUPP	FOOT		21 30	0
080080	78/12/10	6.7	7.7	1.0	COHO	14	4	18	18.0	4	70		SUPP	FOOT		21 31	0
080080	78/12/11	4.4	6.2	1.8	COHO	36	8	44	24.4	4	75		INDX	FOOT		6 20	0
080080	78/12/12	4.4	5.5	1.1	COHO	46	15	61	55.5	4	85		INDX	FOOT		20	0
080080	78/12/12	5.5	6.2	0.7	COHO	10	5	15	21.4	4	55		SUPP	FOOT		20	0
080080	78/12/12	6.5	7.9	1.4	COHO	14	5	19	13.6	4	75		SUPP	FOOT			0
080080	78/12/13	1.0	1.9	0.9	COHO	3	2	5	5.6	4	75		SUPP	FOOT		20	0
080080	78/12/13	1.9	3.2	1.3	COHO	1	11	12	9.2	4	80		SUPP	FOOT		20	0
080080	78/12/13	3.2	4.4	1.2	COHO	26	7	33	27.5	4	75		SUPP	FOOT		21 31	0
080080	78/12/13	4.4	5.5	1.1	COHO	37	18	55	50.0	4	80		INDX	FOOT		21 31	0
080080	78/12/13	5.5	6.2	0.7	COHO	9	5	14	20.0	4	75		SUPP	FOOT		20	0
080080	78/12/13	6.2	6.7	0.5	COHO	0	4	4	8.0	4	65		SUPP	FOOT		20	0
080080	78/12/13	6.7	7.3	0.6	COHO	10	2	12	20.0	4	80		SUPP	FOOT		20	0
080080	78/12/13	7.3	7.7	0.4	COHO	0	1	1	2.5	4	85		SUPP	FOOT		20	0
080080	78/12/14	3.2	4.4	1.2	COHO	24	2	26	21.7	4	55		SUPP	FOOT		28 34	0
080080	78/12/14	4.4	5.5	1.1	COHO	33	10	43	39.1	4	70		INDX	FOOT		27	0
080080	78/12/14	5.5	6.2	0.7	COHO	5	4	9	12.9	4	40		SUPP	FOOT		25 30 34	0
080080	78/12/14	6.2	6.7	0.5	COHO	2	4	6	12.0	4	50		SUPP	FOOT		25 34	0
080080	78/12/14	6.7	7.7	1.0	COHO	7	2	9	9.0	4	75		SUPP	FOOT		24	0
080080	78/12/15	3.2	4.0	0.8	COHO	16	6	22	27.5	4	70		SUPP	FOOT		27 31 33	0
080080	78/12/15	4.0	4.4	0.4	COHO	9	4	13	32.5	4	70		SUPP	FOOT		27 31	0
080080	78/12/15	4.4	5.5	1.1	COHO	51	12	63	57.3	4	80		INDX	FOOT		24	0
080080	78/12/15	5.5	6.2	0.7	COHO	15	3	18	25.7	4	70		SUPP	FOOT		24	0
080080	78/12/15	6.2	6.7	0.5	COHO	11	3	14	28.0	4	80		SUPP	FOOT		21	0
080080	78/12/15	6.7	7.3	0.6	COHO	8	1	9	15.0	4	85		SUPP	FOOT		20	0
080080	78/12/15	7.3	7.7	0.4	COHO	4	1	5	12.5	4	85		SUPP	FOOT		20	0
080080	78/12/16	3.2	4.4	1.2	COHO	28	7	35	29.2	4	65		SUPP	FOOT		25 33	0
080080	78/12/16	4.4	5.5	1.1	COHO	52	8	60	54.5	4	75		INDX	FOOT		24	0
080080	78/12/16	5.5	6.2	0.7	COHO	10	3	13	18.6	4	80		SUPP	FOOT		21 31	0
080080	78/12/16	6.2	6.7	0.5	COHO	3	4	7	14.0	4	80		SUPP	FOOT		21	0
080080	78/12/16	6.7	7.7	1.0	COHO	9	5	14	14.0	4	80		SUPP	FOOT		20	0
080080	78/12/17	3.2	4.0	0.8	COHO	30	10	40	50.0	4	75		SUPP	FOOT		24 31 34	0
080080	78/12/17	4.0	4.4	0.4	COHO	10	3	13	32.5	4	75		SUPP	FOOT		24 31 34	0
080080	78/12/17	4.4	5.5	1.1	COHO	52	13	65	59.1	4	80		INDX	FOOT		21 31 34	0
080080	78/12/17	5.5	6.2	0.7	COHO	17	2	19	27.1	4	80		SUPP	FOOT		20	0

080080	78/12/17	6.2	6.7	0.5	COHO	4	4	8	16.0	4	90	SUPP	FOOT		20	0
080080	78/12/17	6.7	7.3	0.6	COHO	7	1	8	13.3	4	85	SUPP	FOOT		20	0
080080	78/12/17	7.3	7.7	0.4	COHO	3	2	5	12.5	4	90	SUPP	FOOT		20	0
080080	78/12/18	3.2	4.4	1.2	COHO	35	5	40	33.3	4	80	SUPP	FOOT		20	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	78/12/18	4.4	5.5	1.1	COHO	36	9	45	40.9	4	80		INDX	FOOT		20	0
080080	78/12/18	5.5	7.9	2.4	COHO	14	1	15	6.2	4	80		SUPP	FOOT		20	0
080080	78/12/19	3.2	4.4	1.2	COHO	33	1	34	28.3	4	80		SUPP	FOOT		20	0
080080	78/12/19	4.4	5.5	1.1	COHO	29	13	42	38.2	4	85		INDX	FOOT		20 66 67	0
080080	78/12/19	5.5	7.9	2.4	COHO	24	15	39	16.2	4	90		SUPP	FOOT		20	0
080080	78/12/20	1.0	1.9	0.9	COHO	4	3	7	7.8	4	0		SUPP	FOOT		20	0
080080	78/12/20	1.9	3.2	1.3	COHO	3	1	4	3.1	4	75		SUPP	FOOT		20	0
080080	78/12/20	3.2	4.4	1.2	COHO	35	3	38	31.7	4	90		SUPP	FOOT		20	0
080080	78/12/20	4.4	5.5	1.1	COHO	17	18	35	31.8	4	90		INDX	FOOT		20	0
080080	78/12/20	5.5	6.2	0.7	COHO	10	6	16	22.9	4	75		SUPP	FOOT		21 31 33	0
080080	78/12/20	6.2	6.7	0.5	COHO	5	7	12	24.0	4	75		SUPP	FOOT		21 31	0
080080	78/12/20	6.7	7.7	1.0	COHO	8	5	13	13.0	4	80		SUPP	FOOT		20	0
080080	78/12/21	3.2	4.0	0.8	COHO	30	10	40	50.0	4	85		SUPP	FOOT		20 31 34	0
080080	78/12/21	4.0	4.4	0.4	COHO	6	3	9	22.5	4	75		SUPP	FOOT		21	0
080080	78/12/21	4.4	5.5	1.1	COHO	22	21	43	39.1	4	90		INDX	FOOT		20	0
080080	78/12/21	5.5	6.2	0.7	COHO	9	3	12	17.1	4	85		SUPP	FOOT		20 34	0
080080	78/12/21	6.2	6.7	0.5	COHO	5	3	8	16.0	4	85		SUPP	FOOT		20	0
080080	78/12/21	6.7	7.3	0.6	COHO	3	3	6	10.0	4	85		SUPP	FOOT		20	0
080080	78/12/21	7.3	7.7	0.4	COHO	5	1	6	15.0	4	90		SUPP	FOOT		26	0
080080	78/12/23	3.2	4.4	1.2	COHO	20	4	24	20.0	4	70		SUPP	FOOT		24	0
080080	78/12/23	4.4	5.5	1.1	COHO	21	12	23	20.9	4	80		INDX	FOOT		24	0
080080	78/12/23	5.5	6.2	0.7	COHO	7	7	14	20.0	4	70		SUPP	FOOT		24 30	0
080080	78/12/23	6.2	6.7	0.5	COHO	3	4	7	14.0	4	75		SUPP	FOOT		21 30	0
080080	78/12/23	6.7	7.7	1.0	COHO	3	4	7	7.0	4	80		SUPP	FOOT		20	0
080080	78/12/24	3.2	4.0	0.8	COHO	10	9	19	23.8	4	55		SUPP	FOOT		25	0
080080	78/12/24	4.0	4.4	0.4	COHO	3	1	4	10.0	4	55		SUPP	FOOT		25	0
080080	78/12/24	4.4	5.5	1.1	COHO	22	16	38	34.5	4	70		INDX	FOOT		24	0
080080	78/12/24	5.5	6.2	0.7	COHO	19	4	23	32.9	4	80		SUPP	FOOT		23	0
080080	78/12/24	6.2	6.7	0.5	COHO	0	3	3	6.0	4	85		SUPP	FOOT		23 32	0
080080	78/12/24	6.7	7.3	0.6	COHO	3	1	4	6.7	4	80		SUPP	FOOT		20 33	0
080080	78/12/24	7.3	7.7	0.4	COHO	0	0	0		4	90		SUPP	FOOT		20	0
080080	78/12/26	4.3	4.4	0.1	COHO	0	0	0		4	75		SUPP	FOOT			0
080080	78/12/26	4.4	5.5	1.1	COHO	5	11	16	14.5	4	75		INDX	FOOT			0
080080	78/12/27	1.9	3.2	1.3	COHO	0	2	2	1.5	4	70		SUPP	FOOT			0
080080	78/12/27	3.2	4.4	1.2	COHO	8	5	13	10.8	4	75		SUPP	FOOT		20	0
080080	78/12/27	4.4	5.5	1.1	COHO	2	11	13	11.8	4	80		INDX	FOOT		20 61	0
080080	78/12/27	5.5	6.2	0.7	COHO	7	7	14	20.0	4	75		SUPP	FOOT		20 33	0
080080	78/12/27	6.2	6.7	0.5	COHO	1	5	6	12.0	4	80		SUPP	FOOT		20 33	0
080080	78/12/27	6.7	7.7	1.0	COHO	3	5	8	8.0	4	80		SUPP	FOOT		20	0
080080	78/12/28	3.2	4.4	1.2	COHO	14	6	20	16.7	4	70		SUPP	FOOT		20	0
080080	78/12/28	4.4	5.5	1.1	COHO	3	8	11	10.0	4	75		INDX	FOOT		20	0
080080	78/12/28	5.5	6.2	0.7	COHO	1	6	7	10.0	4	75		SUPP	FOOT		20 32	0
080080	78/12/28	6.2	6.7	0.5	COHO	0	3	3	6.0	4	80		SUPP	FOOT		20 32	0
080080	78/12/28	6.7	7.7	1.0	COHO	4	5	9	9.0	4	80		SUPP	FOOT		20 32	0
080080	78/12/29	3.2	4.4	1.2	COHO	2	0	2	1.7	4	20		SUPP	FOOT		20 60 37	0
080080	78/12/29	4.4	5.5	1.1	COHO	2	1	3	2.7	4	30		INDX	FOOT		20 37 60	0
080080	78/12/29	5.5	6.2	0.7	COHO	2	3	5	7.1	4	75		SUPP	FOOT		20 60 37	0
080080	78/12/29	6.2	6.7	0.5	COHO	0	2	2	4.0	4	80		SUPP	FOOT		20 60	0
080080	78/12/29	6.7	7.3	0.6	COHO	4	3	7	11.7	4	85		SUPP	FOOT		20 60	0
080080	78/12/29	7.3	7.7	0.4	COHO	0	0	0		4	95		SUPP	FOOT		20 60	0
080080	79/09/28	4.6	0.0	0.0	SOCK	2	0	2		5	99		SPOT	FOOT		60	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	79/11/06	4.4	5.5	1.1	CHUM	2	0	2	1.8	2	75		SUPP	FOOT		21	0
080080	79/11/06	4.4	5.5	1.1	COHO	97	30	127	115.5	4	75		INDX	FOOT	5	21 60	0
080080	79/11/06	4.4	5.5	1.1	SOCK	39	19	58	52.7	5	75		SUPP	FOOT	2	21	0
080080	79/11/14	4.4	5.5	1.1	COHO	23	35	58	52.7	4	80		INDX	FOOT	5	20 61	0
080080	79/11/14	4.4	5.5	1.1	SOCK	8	13	21	19.1	5	80		SUPP	FOOT	4	20	0
080080	79/11/19	4.4	5.5	1.1	COHO	176	21	197	179.1	4	70		INDX	FOOT	5	23	0
080080	79/11/19	4.4	5.5	1.1	SOCK	0	7	7	6.4	5	70		SUPP	FOOT	4	23	0
080080	79/11/27	4.4	5.5	1.1	COHO	116	23	139	126.4	4	70		INDX	FOOT	5	20 31	0
080080	79/11/27	4.4	5.5	1.1	SOCK	0	3	3	2.7	5	70		SUPP	FOOT	4	20 31	0
080080	79/12/06	4.4	5.5	1.1	FALL	0	1	1	0.9	1	65		SUPP	FOOT	45	24 31	0
080080	79/12/06	4.4	5.5	1.1	COHO	126	48	174	158.2	4	65		INDX	FOOT	15	24 31	0
080080	79/12/06	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	65		SUPP	FOOT	14	24 31	0
080080	79/12/11	4.4	5.5	1.1	COHO	51	44	95	86.4	4	80		INDX	FOOT		60	0
080080	80/10/30	4.4	5.5	1.1	COHO	10	0	10	9.1	4	99		INDX	FOOT		20	0
080080	80/11/11	4.4	5.5	1.1	COHO	37	2	39	35.5	4	80		INDX	FOOT		20 31	0
080080	80/11/17	4.4	5.5	1.1	COHO	25	5	30	27.3	4	75		INDX	FOOT		20 31 60	0
080080	80/11/25	4.4	5.5	1.1	FALL	0	2	2	1.8	1	80		INDX	FOOT	4	24 31	0
080080	80/11/25	4.4	5.5	1.1	COHO	46	14	60	54.5	4	80		INDX	FOOT	1	24 31	0
080080	80/12/08	4.4	5.5	1.1	COHO	10	6	16	14.5	4	75		INDX	FOOT		21 31	0
080080	80/12/16	4.4	5.5	1.1	COHO	46	18	64	58.2	4	80		INDX	FOOT		21 31	0
080080	80/12/23	4.4	5.5	1.1	COHO	18	23	41	37.3	4	75		INDX	FOOT		24	0
080080	81/10/13	4.4	5.5	1.1	FALL	10	13	23	20.9	1	90		INDX	FOOT	45	51	0
080080	81/10/13	4.4	5.5	1.1	COHO	5	0	5	4.5	4	90		INDX	FOOT	15	20	0
080080	81/10/13	4.4	5.5	1.1	SOCK	10	7	17	15.5	5	90		INDX	FOOT	14	51	0
080080	81/10/15	0.0	4.4	4.4	FALL	8	3	11	2.5	1	70		SUPP	FOOT	45		0
080080	81/10/15	0.0	4.4	4.4	COHO	28	0	28	6.4	4	65		SUPP	FOOT	15		0
080080	81/10/15	0.0	4.4	4.4	SOCK	48	3	51	11.6	5	75		SUPP	FOOT	14		0
080080	81/10/21	4.4	5.5	1.1	FALL	1	13	14	12.7	1	85		SUPP	FOOT	45	21 31	0
080080	81/10/21	4.4	5.5	1.1	COHO	4	0	4	3.6	4	75		INDX	FOOT	15	21 31	0
080080	81/10/21	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	75		SUPP	FOOT	14	21 31	0
080080	81/10/27	4.4	5.5	1.1	FALL	0	10	10	9.1	1	65		SUPP	FOOT	4	24 31	0
080080	81/10/27	4.4	5.5	1.1	COHO	40	1	41	37.3	4	65		INDX	FOOT	1	24 31	0
080080	81/11/03	4.4	5.5	1.1	FALL	1	1	2	1.8	1	70		SUPP	FOOT	4	20 31 60	0
080080	81/11/03	4.4	5.5	1.1	COHO	34	2	36	32.7	4	70		INDX	FOOT	1	20 31 60	0
080080	81/11/10	4.4	5.5	1.1	FALL	0	1	1	0.9	1	80		SUPP	FOOT	4	20 31	0
080080	81/11/10	4.4	5.5	1.1	COHO	15	13	28	25.5	4	80		INDX	FOOT	1	20 31 33	0
080080	81/11/17	4.4	5.5	1.1	FALL	0	1	1	0.9	1	70		SUPP	FOOT	4	24 31	0
080080	81/11/17	4.4	5.5	1.1	COHO	49	4	53	48.2	4	70		INDX	FOOT	1	24 31	0
080080	81/11/24	4.4	5.5	1.1	COHO	57	4	61	55.5	4	65		INDX	FOOT		24 31 33	0
080080	81/12/01	4.4	5.5	1.1	COHO	20	16	36	32.7	4	75		INDX	FOOT		23 31	0
080080	81/12/08	4.4	5.5	1.1	COHO	15	9	24	21.8	4	60		INDX	FOOT		24 31 49	0
080080	81/12/17	4.4	5.5	1.1	COHO	4	3	7	6.4	4	70		INDX	FOOT		26 31 33	0
080080	82/11/01	4.4	5.5	1.1	FALL	0	2	2	1.8	1	90		INDX	FOOT	45	20 31	0
080080	82/11/01	4.4	5.5	1.1	COHO	67	3	70	63.6	4	90		INDX	FOOT	15	20 31	0
080080	82/11/01	4.4	5.5	1.1	SOCK	5	4	9	8.2	5	90		INDX	FOOT	14	20 31	0
080080	82/11/08	4.4	5.5	1.1	FALL	0	1	1	0.9	1	70		INDX	FOOT	45	20	0
080080	82/11/08	4.4	5.5	1.1	COHO	15	15	30	27.3	4	70		INDX	FOOT	15	20	0
080080	82/11/08	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	70		INDX	FOOT	14	20	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code

LITTLE BEAR Creek

080080	82/11/15	4.4	5.5	1.1	COHO	4	9	13	11.8	4	80	INDX	FOOT		20 31 61	0
080080	82/11/22	4.4	5.5	1.1	COHO	14	7	21	19.1	4	70	INDX	FOOT		20 30	0
080080	82/11/29	4.4	5.5	1.1	COHO	19	7	26	23.6	4	60	INDX	FOOT		24 30	0
080080	82/12/07	4.4	5.5	1.1	COHO	15	2	17	15.5	4	70	INDX	FOOT		23 30	0
080080	82/12/14	4.4	5.5	1.1	COHO	13	5	18	16.4	4	70	INDX	FOOT		23 30	0
080080	82/12/21	4.4	5.5	1.1	COHO	1	6	7	6.4	4	70	INDX	FOOT		24	0
080080	83/10/24	4.4	5.5	1.1	FALL	0	2	2	1.8	1	85	SUPP	FOOT	45	30 31 51	0
080080	83/10/24	4.4	5.5	1.1	COHO	31	0	31	28.2	4	85	INDX	FOOT	15	30 31 51	0
080080	83/10/24	4.4	5.5	1.1	SOCK	88	34	122	110.9	5	85	SUPP	FOOT	14	30 31 51	0
080080	83/10/27	3.0	3.7	0.7	COHO	4	0	4	5.7	4	70	SUPP	FOOT	5	23 31	0
080080	83/10/27	3.0	7.7	4.7	SOCK	296	278	574	122.1	5	80	SUPP	FOOT	4	20 60 61	0
080080	83/10/27	3.7	4.4	0.7	COHO	8	2	10	14.3	4	75	SUPP	FOOT	5	23 31	0
080080	83/10/27	4.4	5.5	1.1	COHO	22	1	23	20.9	4	80	INDX	FOOT	5	23 31	0
080080	83/10/27	5.5	7.7	2.2	COHO	39	2	41	18.6	4	80	SUPP	FOOT	5	20 61	0
080080	83/10/31	4.4	5.5	1.1	FALL	0	1	1	0.9	1	80	SUPP	FOOT	45	20 31	0
080080	83/10/31	4.4	5.5	1.1	COHO	29	5	34	30.9	4	80	INDX	FOOT	15	20 31	0
080080	83/10/31	4.4	5.5	1.1	SOCK	18	39	57	51.8	5	80	SUPP	FOOT	14	20 31	0
080080	83/11/07	4.4	5.5	1.1	SOCK	0	17	17	15.5	5	70	SUPP	FOOT	4	23 31	0
080080	83/11/08	4.4	5.5	1.1	COHO	26	9	35	31.8	4	70	INDX	FOOT	5	23	0
080080	83/11/15	4.4	5.5	1.1	COHO	23	3	26	23.6	4	30	INDX	FOOT		27 30 34	0
080080	83/11/23	4.4	5.5	1.1	COHO	34	11	45	40.9	4	60	INDX	FOOT		24 30 70	0
080080	83/12/02	4.4	5.5	1.1	COHO	5	20	25	22.7	4	85	INDX	FOOT		20	0
080080	83/12/09	4.4	5.5	1.1	COHO	2	9	11	10.0	4	60	INDX	FOOT		27	0
080080	83/12/16	4.4	5.5	1.1	COHO	4	8	12	10.9	4	80	INDX	FOOT		20	0
080080	83/12/23	4.4	0.0	0.0	COHO	0	0	0		4	25	SPOT	FOOT		36 60	0
080080	83/12/27	4.4	5.5	1.1	COHO	0	2	2	1.8	4	85	INDX	FOOT		20 37	0
080080	84/01/09	4.4	5.5	1.1	COHO	4	3	7	6.4	4	80	INDX	FOOT		20	0
080080	84/10/23	4.4	5.5	1.1	FALL	0	3	3	2.7	1	85	SUPP	FOOT	45	20 31	0
080080	84/10/23	4.4	5.5	1.1	COHO	2	1	3	2.7	4	85	INDX	FOOT	15	20 31	0
080080	84/10/23	4.4	5.5	1.1	SOCK	11	2	13	11.8	5	85	SUPP	FOOT	14	20 31	0
080080	84/10/30	4.4	5.5	1.1	FALL	0	1	1	0.9	1	75	SUPP	FOOT	45	20 31 33	0
080080	84/10/30	4.4	5.5	1.1	COHO	15	2	17	15.5	4	75	INDX	FOOT	15	20 31 33	0
080080	84/10/30	4.4	5.5	1.1	SOCK	6	1	7	6.4	5	75	SUPP	FOOT	14	20 31 33	0
080080	84/11/08	4.4	5.5	1.1	COHO	71	3	74	67.3	4	80	INDX	FOOT	5	20 31 33	0
080080	84/11/08	4.4	5.5	1.1	SOCK	5	0	5	4.5	5	80	INDX	FOOT	4	20 31 33	0
080080	84/11/16	4.4	5.5	1.1	COHO	86	9	95	86.4	4	90	INDX	FOOT		20 31 33	0
080080	84/11/16	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	90	SUPP	FOOT		20 31 33	0
080080	84/11/23	4.4	0.0	0.0	COHO	0	0	0		4	20	SPOT	FOOT		27 39	0
080080	84/11/29	4.4	5.5	1.1	COHO	31	21	52	47.3	4	60	INDX	FOOT		26 31 33	0
080080	84/12/03	4.4	5.5	1.1	COHO	18	8	26	23.6	4	85	INDX	FOOT		20 31 33	0
080080	84/12/10	4.4	5.5	1.1	COHO	11	19	30	27.3	4	80	INDX	FOOT		26 31	0
080080	84/12/19	4.4	5.5	1.1	COHO	2	14	16	14.5	4	80	INDX	FOOT		23 31 60	0
080080	84/12/28	4.4	5.5	1.1	COHO	2	11	13	11.8	4	85	INDX	FOOT		23 31	0
080080	85/10/18	4.4	5.5	1.1	FALL	10	1	11	10.0	1	85	SUPP	FOOT	45	20 31 33	0
080080	85/10/18	4.4	5.5	1.1	COHO	117	0	117	106.4	4	85	INDX	FOOT	15	20 31 33	0
080080	85/10/18	4.4	5.5	1.1	SOCK	119	30	149	135.5	5	85	SUPP	FOOT	14	20 31 33	0
080080	85/10/28	4.4	0.0	0.0	COHO	0	0	0		4	40	SPOT	FOOT		27 39	0
080080	85/10/31	4.4	5.5	1.1	FALL	1	1	2	1.8	1	75	SUPP	FOOT	45	23 30	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	85/10/31	4.4	5.5	1.1	COHO	58	11	69	62.7	4	75		INDX	FOOT	15	23 30	0
080080	85/10/31	4.4	5.5	1.1	SOCK	20	11	31	28.2	5	75		SUPP	FOOT	14	23 30	0
080080	85/11/08	4.4	5.5	1.1	FALL	0	2	2	1.8	1	60		SUPP	FOOT	45	23 30 33	0
080080	85/11/08	4.4	5.5	1.1	COHO	20	4	24	21.8	4	60		INDX	FOOT	15	23 30 33	0
080080	85/11/08	4.4	5.5	1.1	SOCK	6	12	18	16.4	5	60		SUPP	FOOT	14	23 30 33	0

080080	85/11/15	4.4	5.5	1.1	COHO	12	8	20	18.2	4	70	INDX	FOOT		23 31 33	0
080080	85/11/26	4.4	5.5	1.1	COHO	0	6	6	5.5	4	70	INDX	FOOT		20 37	0
080080	85/12/09	4.4	5.5	1.1	COHO	14	2	16	14.5	4	90	INDX	FOOT		23 33 60	0
080080	85/12/16	4.4	5.5	1.1	COHO	1	3	4	3.6	4	85	INDX	FOOT		20	0
080080	85/12/23	4.4	5.5	1.1	COHO	5	1	6	5.5	4	85	INDX	FOOT		20	0
080080	86/01/03	4.4	5.5	1.1	COHO	41	1	42	38.2	4	80	INDX	FOOT		23 30 60	0
080080	86/01/10	4.4	5.5	1.1	COHO	33	0	33	30.0	4	80	INDX	FOOT		23 31 33	0
080080	86/01/17	4.4	0.0	0.0	COHO	0	0	0		4	25	SPOT	FOOT		27 30 39	0
080080	86/01/24	4.4	5.5	1.1	COHO	6	1	7	6.4	4	75	INDX	FOOT		26 30 33	0
080080	86/10/15	1.2	1.9	0.7	FALL	0	0	0		1	0	SUPP	FOOT		21	0
080080	86/10/15	1.2	1.9	0.7	SOCK	7	6	13	18.6	5	0	SUPP	FOOT		21	0
080080	86/10/15	1.9	3.3	1.4	FALL	0	0	0		1	0	SUPP	FOOT		21	0
080080	86/10/15	1.9	3.3	1.4	SOCK	39	31	70	50.0	5	0	SUPP	FOOT		20	0
080080	86/10/15	3.3	4.4	1.1	FALL	0	0	0		1	0	SUPP	FOOT	5	21	0
080080	86/10/15	3.3	4.4	1.1	SOCK	82	44	126	114.5	5	0	SUPP	FOOT		21	0
080080	86/10/24	4.4	5.5	1.1	FALL	0	2	2	1.8	1	90	SUPP	FOOT	45	20	0
080080	86/10/24	4.4	5.5	1.1	COHO	1	1	2	1.8	4	90	INDX	FOOT	15	20	0
080080	86/10/24	4.4	5.5	1.1	SOCK	13	34	47	42.7	5	90	SUPP	FOOT	14	20	0
080080	86/11/03	4.4	5.5	1.1	COHO	12	0	12	10.9	4	85	INDX	FOOT	5	20	0
080080	86/11/03	4.4	5.5	1.1	SOCK	3	11	14	12.7	5	85	SUPP	FOOT	4	20	0
080080	86/11/10	4.4	5.5	1.1	FALL	0	3	3	2.7	1	85	SUPP	FOOT	45	20 31 33	0
080080	86/11/10	4.4	5.5	1.1	COHO	11	3	14	12.7	4	85	INDX	FOOT	15	20 31 33	0
080080	86/11/10	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	85	SUPP	FOOT	14	20 31 33	0
080080	86/11/18	4.4	0.0	0.0	COHO	0	0	0		4	25	SPOT	FOOT		28 39	0
080080	86/11/29	4.4	5.5	1.1	COHO	42	3	45	40.9	4	75	INDX	FOOT		23 30 33	0
080080	86/12/04	4.4	5.5	1.1	COHO	8	15	23	20.9	4	85	INDX	FOOT		20 31	0
080080	86/12/11	4.4	5.5	1.1	COHO	3	13	16	14.5	4	90	INDX	FOOT		20 31	0
080080	86/12/18	4.4	5.5	1.1	COHO	2	7	9	8.2	4	90	INDX	FOOT		20 31	0
080080	87/01/02	4.4	5.5	1.1	COHO	2	6	8	7.3	4	65	INDX	FOOT		26 30 33	0
080080	87/10/06	0.0	6.7	6.7	FALL	7	2	9	1.3	1	90	INDX	FOOT	5	20 57	0
080080	87/10/06	0.0	6.7	6.7	SOCK	1764	183	1947	290.6	5	90	SUPP	FOOT	1	20 57	0
080080	87/10/20	4.4	5.5	1.1	FALL	0	1	1	0.9	1	85	SUPP	FOOT	45	20 33	0
080080	87/10/20	4.4	5.5	1.1	COHO	4	1	5	4.5	4	85	INDX	FOOT	15	20 33	0
080080	87/10/20	4.4	5.5	1.1	SOCK	164	122	286	260.0	5	85	SUPP	FOOT	14	20 33 61	0
080080	87/10/27	4.4	5.5	1.1	FALL	0	0	0		1	90	SUPP	FOOT	45	20 33	0
080080	87/10/27	4.4	5.5	1.1	COHO	6	1	7	6.4	4	90	INDX	FOOT	5	20 33	0
080080	87/10/27	4.4	5.5	1.1	SOCK	101	158	259	235.5	5	90	SUPP	FOOT	4	20 33 61	0
080080	87/11/03	4.4	5.5	1.1	FALL	0	0	0		1	90	SUPP	FOOT	45	20 33	0
080080	87/11/03	4.4	5.5	1.1	COHO	52	2	54	49.1	4	90	INDX	FOOT	5	20 33	0
080080	87/11/03	4.4	5.5	1.1	SOCK	26	104	130	118.2	5	90	SUPP	FOOT	4	20 33	0
080080	87/11/10	4.4	5.5	1.1	COHO	36	2	38	34.5	4	80	INDX	FOOT	5	20 31 33	0
080080	87/11/10	4.4	5.5	1.1	SOCK	2	24	26	23.6	5	80	SUPP	FOOT	4	20 31 33	0
080080	87/11/17	4.4	5.5	1.1	COHO	184	7	191	173.6	4	75	INDX	FOOT	5	20 30 60	0
080080	87/11/17	4.4	5.5	1.1	SOCK	4	2	6	5.5	5	75	SUPP	FOOT	4	20 30 33	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	87/11/24	3.7	0.0	0.0	COHO	12	0	12		4	80		SPOT	FOOT		23 60	0
080080	87/11/24	4.1	0.0	0.0	COHO	10	0	10		4	75		SPOT	FOOT		23 30 60	0
080080	87/11/24	4.4	5.5	1.1	COHO	125	37	162	147.3	4	70		INDX	FOOT		23 30 61	0
080080	87/12/01	4.4	0.0	0.0	COHO	0	0	0		4	20		SPOT	FOOT		27 39	0
080080	87/12/05	4.4	5.5	1.1	COHO	39	31	70	63.6	4	55		INDX	FOOT		23 30	0
080080	87/12/08	4.4	5.5	1.1	COHO	28	16	44	40.0	4	80		INDX	FOOT		23 31 33	0
080080	87/12/15	4.4	5.5	1.1	COHO	14	21	35	31.8	4	80		INDX	FOOT		20 30	0
080080	87/12/22	4.4	0.0	0.0	COHO	0	0	0		4	40		SPOT	FOOT		27 30 39	0
080080	87/12/30	4.4	5.5	1.1	COHO	2	10	12	10.9	4	85		INDX	FOOT		20 31 33	0
080080	88/10/25	4.4	5.5	1.1	FALL	0	6	6	5.5	1	95		SUPP	FOOT	45	20	0

080080	88/10/25	4.4	5.5	1.1	COHO	21	19	40	36.4	4	95	INDX	FOOT	15		20 61	0
080080	88/10/25	4.4	5.5	1.1	SOCK	1	23	24	21.8	5	95	SUPP	FOOT	14		20	0
080080	88/11/01	4.4	5.5	1.1	COHO	41	9	50	45.5	4	85	INDX	FOOT		5	20 30 31	0
080080	88/11/01	4.4	5.5	1.1	SOCK	0	9	9	8.2	5	85	SUPP	FOOT	4		20 30 33	0
080080	88/11/08	4.4	5.5	1.1	COHO	24	0	24	21.8	4	70	INDX	FOOT			20 32 31	0
080080	88/11/15	4.4	5.5	1.1	COHO	32	8	40	36.4	4	85	INDX	FOOT			20 30	0
080080	88/11/22	4.9	0.0	0.0	COHO	0	0	0		4	0	SPOT	FOOT			28 39	0
080080	88/11/29	4.4	5.5	1.1	COHO	5	4	9	8.2	4	85	INDX	FOOT			20 31	0
080080	88/12/06	4.4	5.5	1.1	COHO	4	2	6	5.5	4	75	INDX	FOOT			21 30 31	0
080080	88/12/13	4.4	5.5	1.1	COHO	2	1	3	2.7	4	75	INDX	FOOT			21 30	0
080080	88/12/26	4.4	5.5	1.1	COHO	0	1	1	0.9	4	85	INDX	FOOT			20	0
080080	89/01/06	4.4	5.5	1.1	COHO	0	0	0		4	65	INDX	FOOT			24 33	0
080080	89/10/30	4.4	5.5	1.1	FALL	1	2	3	2.7	1	75	SUPP	FOOT	45		20 31	0
080080	89/10/30	4.4	5.5	1.1	COHO	6	1	7	6.4	4	75	INDX	FOOT	15		20 31	0
080080	89/10/30	4.4	5.5	1.1	SOCK	7	5	12	10.9	5	75	SUPP	FOOT	14		20 31	0
080080	89/11/06	4.4	5.5	1.1	COHO	32	1	33	30.0	4	85	INDX	FOOT	5		20 31 60	0
080080	89/11/06	4.4	5.5	1.1	SOCK	3	4	7	6.4	5	85	SUPP	FOOT	4		20 31 33	0
080080	89/11/15	4.4	5.5	1.1	FALL	0	1	1	0.9	1	80	SUPP	FOOT	45		20 31	0
080080	89/11/15	4.4	5.5	1.1	COHO	35	5	40	36.4	4	80	INDX	FOOT	15		20 31 60	0
080080	89/11/15	4.4	5.5	1.1	SOCK	1	0	1	0.9	5	80	SUPP	FOOT	14		20 31	0
080080	89/11/22	4.4	5.5	1.1	COHO	38	7	45	40.9	4	75	INDX	FOOT			20 31 60	0
080080	89/11/30	4.4	5.5	1.1	COHO	26	19	45	40.9	4	80	INDX	FOOT			20 31	0
080080	89/12/12	4.4	5.5	1.1	COHO	15	11	26	23.6	4	80	INDX	FOOT			20 31 60	0
080080	89/12/19	4.4	5.5	1.1	COHO	8	4	12	10.9	4	85	INDX	FOOT			20 33 60	0
080080	89/12/26	4.4	5.5	1.1	COHO	1	12	13	11.8	4	85	INDX	FOOT			20 60	0
080080	90/10/30	4.4	5.5	1.1	COHO	20	4	24	21.8	4	75	INDX	FOOT	5		20 31 60	0
080080	90/10/30	4.4	5.5	1.1	SOCK	17	47	64	58.2	5	75	SUPP	FOOT	4		20 31 60	0
080080	90/11/07	4.4	5.5	1.1	COHO	25	8	33	30.0	4	80	INDX	FOOT	5		20	0
080080	90/11/07	4.4	5.5	1.1	SOCK	2	0	0		5	80	SUPP	FOOT	4		20 60	0
080080	90/11/15	4.4	5.5	1.1	COHO	40	6	46	41.8	4	70	INDX	FOOT			20 31 60	0
080080	90/11/21	4.4	5.5	1.1	COHO	11	12	23	20.9	4	70	INDX	FOOT			23 30 60	0
080080	90/12/04	4.4	0.0	0.0	COHO	0	0	0		4	5	SPOT	FOOT			28 29 39	0
080080	90/12/10	4.4	0.0	0.0	COHO	0	0	0		4	30	SPOT	FOOT			27 29 39	0
080080	90/12/17	4.4	5.5	1.1	COHO	0	2	2	1.8	4	75	INDX	FOOT			23 31 60	0
080080	91/10/28	4.4	5.5	1.1	COHO	3	0	3	2.7	4	80	INDX	FOOT	5		20	0
080080	91/10/28	4.4	5.5	1.1	SOCK	72	49	121	110.0	5	80	SUPP	FOOT	4		20	0
080080	91/11/06	4.4	5.5	1.1	COHO	36	0	36	32.7	4	75	INDX	FOOT	5		20 30 61	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	91/11/06	4.4	5.5	1.1	SOCK	29	18	47	42.7	5	75		SUPP	FOOT	4	20 30	0
080080	91/11/13	4.4	5.5	1.1	COHO	5	0	5	4.5	4	75		INDX	FOOT	5	20	0
080080	91/11/21	4.4	5.5	1.1	COHO	5	2	7	6.4	4	60		INDX	FOOT		23 31 32	0
080080	91/12/03	4.4	5.5	1.1	COHO	0	4	4	3.6	4	80		INDX	FOOT		20 31 60	0
080080	91/12/03	4.4	5.5	1.1	SOCK	0	0	0		5	80		SUPP	FOOT	4	20 31	0
080080	91/12/11	4.4	5.5	1.1	COHO	1	0	1	0.9	4	80		INDX	FOOT		20 31	0
080080	91/12/26	4.4	5.5	1.1	COHO	0	0	0		4	80		INDX	FOOT		20 60	0
080080	92/10/29	4.4	5.5	1.1	COHO	0	0	0		4	85		INDX	FOOT	5	20	0
080080	92/10/29	4.4	5.5	1.1	SOCK	0	35	35	31.8	5	85		SUPP	FOOT		20 60	0
080080	92/11/09	4.4	5.5	1.1	COHO	8	0	8	7.3	4	70		INDX	FOOT		20 30 33	0
080080	92/11/16	4.4	5.5	1.1	COHO	1	0	1	0.9	4	70		INDX	FOOT		23 30 60	0
080080	92/11/24	4.4	5.5	1.1	COHO	3	2	5	4.5	4	80		INDX	FOOT		20 33 60	0
080080	92/12/03	4.4	5.5	1.1	COHO	3	2	5	4.5	4	80		INDX	FOOT		20 33 60	0
080080	92/12/14	4.4	5.5	1.1	COHO	3	0	3	2.7	4	70		INDX	FOOT		23 31 33	0
080080	92/12/22	4.4	5.5	1.1	COHO	3	1	4	3.6	4	75		INDX	FOOT		23 31 60	0
080080	92/12/28	4.4	5.5	1.1	COHO	4	5	9	8.2	4	85		INDX	FOOT		20 60	0

080080	93/01/05	4.4	5.5	1.1	COHO	0	2	2	1.8	4	75		INDX	FOOT		20 31 60	0
080080	93/11/03	4.4	5.5	1.1	COHO	14	5	19	17.3	4	75		INDX	FOOT	5	20 60	0
080080	93/11/03	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	75		SUPP	FOOT	4		0
080080	93/11/10	4.4	5.5	1.1	COHO	3	4	7	6.4	4	85		INDX	FOOT	5	20 31 60	0
080080	93/11/10	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	85		SUPP	FOOT	4	20 31 60	0
080080	93/11/18	4.4	5.5	1.1	COHO	6	2	8	7.3	4	80		INDX	FOOT		20 30 33	0
080080	93/11/29	4.4	0.0	0.0	COHO	0	0	0		4	40		SPOT	FOOT		24 30 39	0
080080	93/12/06	4.4	5.5	1.1	COHO	22	4	26	23.6	4	75		INDX	FOOT		20 31 60	0
080080	93/12/15	4.4	5.5	1.1	COHO	5	2	7	6.4	4	80	9	INDX	FOOT		20	0
080080	93/12/22	4.4	5.5	1.1	COHO	0	2	2	1.8	4	90		INDX	FOOT		20 60	0
080080	94/10/07	0.2	0.5	0.3	SOCK	31	14	45	150.0	5	0	17	SUPP	FOOT			KC
080080	94/10/07	1.3	1.8	0.5	SOCK	60	61	121	242.0	5	0	21	SUPP	FOOT			KC
080080	94/10/20	0.0	1.0	1.0	CHIN	0	1	1	1.0	1	0		SUPP	FOOT	5		KC
080080	94/10/20	0.0	1.0	1.0	SOCK	96	42	138	138.0	5	0		SUPP	FOOT	1		KC
080080	94/10/20	1.2	1.8	0.6	CHIN	0	1	1	1.7	1	0		SUPP	FOOT	5		KC
080080	94/10/20	1.2	1.8	0.6	SOCK	74	55	129	215.0	5	0		SUPP	FOOT	1		KC
080080	94/10/28	4.4	5.5	1.1	CHIN	0	5	5	4.5	1	75		SUPP	FOOT	45	21 31	0
080080	94/10/28	4.4	5.5	1.1	COHO	4	0	4	3.6	4	75		INDX	FOOT	15	21 31	0
080080	94/10/28	4.4	5.5	1.1	SOCK	89	99	188	170.9	5	75		SUPP	FOOT	14	21 31	0
080080	94/11/03	4.4	5.5	1.1	COHO	2	2	4	3.6	4	75		INDX	FOOT	5	20	0
080080	94/11/03	4.4	5.5	1.1	SOCK	36	77	113	102.7	5	75		SUPP	FOOT	4	20 31	0
080080	94/11/10	4.4	5.5	1.1	COHO	1	1	2	1.8	4	85		INDX	FOOT	5	20	0
080080	94/11/10	4.4	5.5	1.1	SOCK	7	63	70	63.6	5	85		INDX	FOOT	4	20	0
080080	94/11/17	4.4	5.5	1.1	COHO	4	0	4	3.6	4	75		INDX	FOOT		23 31	0
080080	94/11/25	4.4	5.5	1.1	COHO	1	0	1	0.9	4	85		INDX	FOOT		20	0
080080	94/12/07	4.4	5.5	1.1	COHO	2	1	3	2.7	4	90		INDX	FOOT		20	0
080080	94/12/14	4.4	5.5	1.1	COHO	0	2	2	1.8	4	90		INDX	FOOT		20	0
080080	95/10/18	4.4	5.5	1.1	COHO	16	0	16	14.5	4	75		INDX	FOOT	5	20	0
080080	95/10/18	4.4	5.5	1.1	SOCK	16	4	20	18.2	5	75		SUPP	FOOT	4	20	0
080080	95/10/26	4.4	5.5	1.1	COHO	4	1	5	4.5	4	60		INDX	FOOT	5	21 31 33	0
080080	95/10/26	4.4	5.5	1.1	SOCK	0	3	3	2.7	5	60		INDX	FOOT	4	21 31 33	0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	95/11/02	4.4	5.5	1.1	COHO	6	0	6	5.5	4	85		INDX	FOOT	5	20	0
080080	95/11/02	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	85		SUPP	FOOT	4	20	0
080080	95/11/13	4.4	5.5	1.1	COHO	48	0	48	43.6	4	80		INDX	FOOT		20 31	0
080080	95/11/21	4.4	5.5	1.1	COHO	38	3	41	37.3	4	85		INDX	FOOT		20 60	0
080080	95/12/01	4.4	0.0	0.0	COHO	0	0	0		4	0		SPOT	FOOT		27 39 60	0
080080	95/12/03	4.4	5.5	1.1	COHO	30	10	40	36.4	4	85		INDX	FOOT		20 60	0
080080	95/12/11	4.4	0.0	0.0	COHO	0	0	0		4	5		SPOT	FOOT		28 39	0
080080	95/12/19	4.4	5.5	1.1	COHO	1	7	8	7.3	4	85		INDX	FOOT		20 60	0
080080	95/12/27	4.4	5.5	1.1	COHO	1	3	4	3.6	4	90		INDX	FOOT		20 60	0
080080	96/10/09	0.0	4.4	4.4	SOCK	2782	1245	4027	915.2	5	85		SUPP	FOOT		60	11
080080	96/10/23	4.4	5.5	1.1	CHIN	0	1	1	0.9	1	75		SUPP	FOOT	45	20 30	0
080080	96/10/23	4.4	5.5	1.1	COHO	18	0	18	16.4	4	75		INDX	FOOT	15	20 30	0
080080	96/10/23	4.4	5.5	1.1	SOCK	68	108	176	160.0	5	75		SUPP	FOOT	14	20 30	0
080080	96/10/30	1.3	4.4	3.1	SOCK	93	316	409	131.9	5	70		SUPP	FOOT		60	11
080080	96/10/30	4.4	5.5	1.1	CHIN	1	1	2	1.8	1	75		SUPP	FOOT	45	20 30	0
080080	96/10/30	4.4	5.5	1.1	COHO	34	2	36	32.7	4	75		INDX	FOOT	15	20 30 60	0
080080	96/10/30	4.4	5.5	1.1	SOCK	29	66	95	86.4	5	75		SUPP	FOOT	14	20 30	0
080080	96/11/06	4.4	5.5	1.1	CHIN	0	2	2	1.8	1	85		SUPP	FOOT	45	20	0
080080	96/11/06	4.4	5.5	1.1	COHO	34	4	38	34.5	4	85		INDX	FOOT	15	20 60	0
080080	96/11/06	4.4	5.5	1.1	SOCK	1	7	8	7.3	5	85		SUPP	FOOT	14	20	0
080080	96/11/13	4.8	0.0	0.0	COHO	0	0	0		4	5		SPOT	FOOT		25 39	0
080080	96/11/20	4.4	5.5	1.1	COHO	11	3	14	12.7	4	75		INDX	FOOT		20 31 60	0

080080	96/11/20	4.4	5.5	1.1	SOCK	0	1	1	0.9	5	75	SUPP	FOOT	4	20 31		0
080080	96/11/27	4.4	0.0	0.0	COHO	0	0	0		4	20	SPOT	FOOT		25 39		0
080080	96/12/04	4.4	5.5	1.1	COHO	8	1	9	8.2	4	60	INDX	FOOT		24 31 60		0
080080	96/12/11	4.4	5.5	1.1	COHO	3	5	8	7.3	4	80	INDX	FOOT		23		0
080080	96/12/18	4.4	5.5	1.1	COHO	0	8	8	7.3	4	90	INDX	FOOT		20 60		0
080080	97/11/05	4.4	5.5	1.1	COHO	61	7	68	61.8	4	80	INDX	FOOT		23 30		0
080080	97/11/24	4.4	5.5	1.1	COHO	9	9	18	16.4	4	85	INDX	FOOT		20		0
080080	97/12/02	4.4	5.5	1.1	COHO	5	2	7	6.4	4	75	INDX	FOOT		20		0
080080	97/12/09	4.4	5.5	1.1	COHO	0	3	3	2.7	4	90	INDX	FOOT		20		0
080080	97/12/20	4.4	5.5	1.1	COHO	0	2	2	1.8	4	55	INDX	FOOT		25		0
080080	98/10/21	4.4	5.5	1.1	COHO	0	0	0		4	90	INDX	FOOT	5	21		0
080080	98/10/21	4.4	5.5	1.1	SOCK	3	31	34	30.9	5	90	INDX	FOOT	4	21		0
080080	98/10/29	4.4	5.5	1.1	COHO	3	0	3	2.7	4	80	INDX	FOOT	5	24 60		0
080080	98/10/29	4.4	5.5	1.1	SOCK	0	25	25	22.7	5	80	INDX	FOOT	4	24		0
080080	98/11/10	4.4	5.5	1.1	COHO	0	0	0		4	90	INDX	FOOT		20		0
080080	98/11/18	4.4	5.5	1.1	COHO	0	0	0		4	85	INDX	FOOT		24		0
080080	98/11/24	4.4	5.5	1.1	COHO	6	0	6	5.5	4	80	INDX	FOOT		24 60		0
080080	98/12/03	4.4	5.5	1.1	COHO	4	3	7	6.4	4	75	INDX	FOOT		24 60		0
080080	98/12/10	4.4	5.5	1.1	COHO	1	0	1	0.9	4	85	INDX	FOOT		24 60		0
080080	98/12/16	4.4	5.5	1.1	COHO	0	0	0		4	85	INDX	FOOT		24		0
080080	99/11/03	4.4	5.5	1.1	COHO	9	0	9	8.2	4	80	INDX	FOOT		23		0
080080	99/11/10	4.4	5.5	1.1	COHO	10	2	12	10.9	4	70	INDX	FOOT		24		0
080080	99/11/15	4.4	5.5	1.1	COHO	12	0	12	10.9	4	75	INDX	FOOT		24		0
080080	99/11/23	4.4	5.5	1.1	COHO	4	1	5	4.5	4	75	INDX	FOOT		24		0
080080	99/12/02	4.4	5.5	1.1	COHO	1	2	3	2.7	4	70	INDX	FOOT		24		0

1

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
LITTLE BEAR Creek																	
080080	99/12/09	4.4	5.5	1.1	COHO	0	0	0		4	70		INDX	FOOT		24	0
080080	99/12/22	4.4	5.5	1.1	COHO	0	0	0		4	80		INDX	FOOT		23	0

1

Washington State Department of Fisheries Tue Sep 4 14:02:15 2001

Salmon Spawning Ground Survey Data

Species - All Species
Chinook Races - All Races
Stream Numbers - 080080
Date Range - 0/ 1/ 1 to 1/ 6/30
River Miles - All River Miles
Type Count - All Types of Counts
Type Survey - All Types of Surveys
Agency - All Agencies

Wria-Stream Number	Date Yr Mo Dy	Start Mile	End Mile	Length	Spec	Live Count	Dead Count	Total	Fish/ Mile	Spec Code	Pct. Seen	Redd Count	Type Count	Type Survey	Other Spec	Comment Codes	Agency Code
Lake Washington Basin																	
LITTLE BEAR Creek																	
080080	0/10/27	4.4	5.5	1.1	COHO	1	0	1	0.9	4	75		INDX	FOOT	5	24	0
080080	0/10/27	4.4	5.5	1.1	SOCK	17	245	262	238.2	5	75		SUPP	FOOT	4	24	0
080080	0/11/06	4.4	5.5	1.1	COHO	33	3	36	32.7	4	75		INDX	FOOT	5	24	0
080080	0/11/06	4.4	5.5	1.1	SOCK	2	169	171	155.5	5	75		SUPP	FOOT	4	24	0
080080	0/11/16	4.4	5.5	1.1	COHO	4	1	5	4.5	4	85		INDX	FOOT		20	0
080080	0/11/22	4.4	5.5	1.1	COHO	0	2	2	1.8	4	90		INDX	FOOT		20	0

Appendix K

APPENDIX K:
Electrofish Data

Stream: Little Bear Creek					ELECTROFISH DATA		
Reach: 1					sculpin = coastrange		
Date: August 24, 2001					length = total length in inches		
Seconds: 110							
Setting: 60 Hz at 500 V							
number	species	length	note				
1	coho	3.5	wild				
2	coho	3.3	wild				
3	coho	4.2	hatchery				
1	cutthroat	3.25					
2	cutthroat	2.5					
3	cutthroat	2.5					
1	sculpin	5					
2	sculpin	4.75					
3	sculpin	4.3					
4	sculpin	4.25					
5	sculpin	3.75					
6	sculpin	3.5					
7	sculpin	3.5					
8	sculpin	3.1					
9	sculpin	3					
10	sculpin	3					
11	sculpin	2.8					
12	sculpin	2.75					
13	sculpin	2.7					
14	sculpin	2.6					
15	sculpin	2.5					
16	sculpin	2.4					
17	sculpin	2.25					
18	sculpin	2.2					
19	sculpin	2.2					
20	sculpin	2.2					
21	sculpin	2					
22	sculpin	2					
23	sculpin	2					
24	sculpin	2					
25	sculpin	2					
26	sculpin	1.9					
27	sculpin	1.9					
28	sculpin	1.75					
29	sculpin	1.5					

Stream: Little Bear Creek					ELECTROFISH DATA		
Reach: 2 #1					sculpin = coastrange		
Date: August 31, 2001					length = total length in inches		
Seconds: 107							
Setting: 60 Hz at 600 V							
Site: Upstream 132nd Ave. NE							
No.	species	length	note				
1	cutthroat	7.5					
2	cutthroat	6.5					
3	cutthroat	5.6					
4	cutthroat	5.5					
5	cutthroat	5.25					
6	cutthroat	5					
7	cutthroat	5					
8	cutthroat	3.3					
1	sculpin	4.5					
2	sculpin	4.1					
3	sculpin	3.8					
4	sculpin	3.7					
5	sculpin	3.6					
6	sculpin	3.3					
7	sculpin	3.3					
8	sculpin	2.7					

Stream: Little Bear Creek					ELECTROFISH DATA		
Reach: 2 #2					sculpin = coastrange		
Date: August 31, 2001					length = total length in inches		
Seconds: 74							
Setting: 90 Hz at 700 V							
Site: Downstream 134th Ave NE							
No.	species	length	note				
1	cutthroat	4.5					
2	cutthroat	5.5					
3	cutthroat	4.4					
4	cutthroat	5.5					
5	cutthroat	3.2					
6	cutthroat	5.7					
7	cutthroat	3.5					
1	sculpin	3.1					
2	sculpin	2.7					
3	sculpin	2.3					
4	sculpin	1.6					
5	sculpin	4.7					
6	sculpin	4.5					
7	sculpin	2.5					
8	sculpin	2.5					
9	sculpin	1.3					

Stream: Little Bear Creek					ELECTROFISH DATA		
Reach: 2 #3					sculpin = coastrange		
Date: August 31, 2001					length = total length in inches		
Seconds: 139							
Setting: 60 Hz at 600 V							
Site: Upstream 134th Ave NE							
No.	species	length	note				
1	coho	3.4	wild				
2	coho	3.2	wild				
1	cutthroat	8.2					
2	cutthroat	6.8					
3	cutthroat	6.7					
4	cutthroat	6					
5	cutthroat	5.7					
6	cutthroat	5.4					
7	cutthroat	5.4					
8	cutthroat	5.3					
9	cutthroat	5.3					
10	cutthroat	5.2					
11	cutthroat	4.8					
12	cutthroat	4.6					
13	cutthroat	4.3					
14	cutthroat	2.7					
15	cutthroat	2.7					
16	cutthroat	2.7					
17	cutthroat	2.3					
1	sculpin	4.4					
2	sculpin	5.2					
3	sculpin	3.7					
4	sculpin	3.6					
5	sculpin	3.2					
6	sculpin	2.8					
7	sculpin	2.5					
8	sculpin	2.6					
9	sculpin	1.5					
10	sculpin	2.3					
11	sculpin	2.7					
12	sculpin	2.4					

Stream: Little Bear Creek					ELECTROFISH DATA		
Reach: 3 #1					sculpin = coastrange		
Date: August 31, 2001					length = total length in inches		
Seconds: 112							
Setting: 60 Hz at 600 V							
Site: Upstream 195th Street							
No.	species	length	note				
1	cutthroat	8					
2	cutthroat	7.5					
3	cutthroat	7					
4	cutthroat	7					
5	cutthroat	6					
6	cutthroat	5.75					
7	cutthroat	5.75					
8	cutthroat	5.5					
9	cutthroat	5.25					
10	cutthroat	5.25					
11	cutthroat	5.1					
12	cutthroat	5					
13	cutthroat	4.9					
14	cutthroat	4.5					
15	cutthroat	4.5					
16	cutthroat	4.25					
17	cutthroat	4.25					
18	cutthroat	3.5					
19	cutthroat	3					
20	cutthroat	2.9					
21	cutthroat	2.75					
22	cutthroat	2.5					
23	cutthroat	2.5					
24	cutthroat	2.5					
25	cutthroat	2.5					
26	cutthroat	2.5					
27	cutthroat	2.5					
28	cutthroat	2.25					
29	cutthroat	2.25					
1	sculpin	3					
2	sculpin	2.75					
3	sculpin	2.5					
4	sculpin	2.5					
5	sculpin	1.5					
6	sculpin	1					

Stream: Little Bear Creek					ELECTROFISH DATA			
Reach: 3 #2					sculpin = coastrange			
Date: August 31, 2001					length = total length in inches			
Seconds: 141								
Setting: 60 Hz at 600 V								
Site: Downstream 205th Street								
No.	Species	Length	Note		No.	Species	Length	Note
1	coho	3.25	wild		27	cutthroat	3.5	
2	coho	3.25	wild		28	cutthroat	3.5	
3	coho	3.25	wild		29	cutthroat	3	
4	coho	3	wild		30	cutthroat	2.75	
5	coho	3	wild		31	cutthroat	2.5	
6	coho	3	wild		32	cutthroat	2.5	
7	coho	3	wild		33	cutthroat	2.5	
8	coho	3	wild		34	cutthroat	2.5	
9	coho	3	wild		35	cutthroat	2.25	
1	cutthroat	8.5			1	sculpin	2.75	
2	cutthroat	8			2	sculpin	2.25	
3	cutthroat	6.5			3	sculpin	2	
4	cutthroat	6			4	sculpin	2	
5	cutthroat	5.75			5	sculpin	1	
6	cutthroat	5.5						
7	cutthroat	5.25						
8	cutthroat	5						
9	cutthroat	5						
10	cutthroat	5						
11	cutthroat	5						
12	cutthroat	4.75						
13	cutthroat	4.75						
14	cutthroat	4.5						
15	cutthroat	4.5						
16	cutthroat	4.25						
17	cutthroat	4.25						
18	cutthroat	4						
19	cutthroat	4						
20	cutthroat	4						
21	cutthroat	4						
22	cutthroat	3.75						
23	cutthroat	3.5						
24	cutthroat	3.5						
25	cutthroat	3.5						
26	cutthroat	3.5						

Appendix L-1

Appendix L-1:
NMFS Matrix (1996)

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.

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/mi²[11], no valley bottom roads	2-3 mi/mi², some valley bottom roads	>3 mi/mi², 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 Calfornia (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 Vegatation as a base for Multiple Product Management. Abstaracts 42nd annual meeting, Society for Range Management, Billings MT, Denver CO: Society For Range Managem nt: p277.

Appendix L-2

Appendix L-2:
NMFS Matrix as modified by the Mt. Baker Snoqualmie National Forest

Recommended Revisions to the Matrix of Diagnostics / Pathways and Indicators for Salmonids
(J.E. Doyle 1/12/99)

The following recommendations to NMFS and F&WS's Matrix of Diagnostics / Pathways and Indicators for Chinook Salmon and Bull Trout is based on the Mt. Baker Snoqualmie National Forest aquatic staff's 18 years knowledge and experience gained from managing river and stream habitats within and adjacent to the national forest boundaries. These recommendations are consistent with the guidance and direction found within the Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions for Chinook Salmon and Bull Trout Watershed Scale documents.

The revisions or additions to the matrix are as follows:

(1) Pathway - Habitat, Indicator – Sediment

Of the seven major river basins found within the Mt. Baker Snoqualmie NF boundaries, three contain river sub-basins that are glacial (Nooksack, Skagit, White). This natural background sediment delivery and transport in these sub-basins needs to be acknowledged and accounted for in the baseline condition determinations for sediment. In these systems, snow and glacial melt usually enters the rivers in late spring/early summer (late May-June) and continues to late summer (late September-early October). During this time chinook salmon (spring) enter these systems to migrate to their native spawning areas. Bull trout also are in these systems, spawning in early fall.

Little or no known data/information exist describing the additional volume or degree of sediment generated by glacial melt over the ambient sediment levels in these sub-basins. Determinations of the sediment indicator will probably have to be based on professional judgement and experience for these systems.

When assessing the sediment indicator, consideration needs to be given to the preferred channel types used by spawning chinook and bull trout as well as knowledge of the preferred substrate size for each species.

(2) Pathway – Water Quality, Indicator – Chemical Contamination/Nutrients

When assessing this indicator include areas such as mine sites, Water Quality Restoration Plans, and fecal coliform sites.

(3) Pathway – Habitat Access

Consider all life stages for these two species

(4) Pathway - Habitat Elements, Indicator – Large Woody Debris

The value of LWD as a fish habitat element in channels is not only the number and size of this wood but the location and wood complexity. LWD size, frequency, location, and distribution requirements also varies with the size and type of channel. Adult chinook when in Puget Sound river systems holding and waiting to spawn require big, deep pools formed and maintained by large concentrations/complexes of large wood (log jams); the number of pieces per length of stream is of little or no value to spawning chinook. Frequency of LWD in a river or stream system is more meaningful habitat indicator for bull trout. Also the frequency and distribution of large woody debris is important component of the stream channel integrity and stability in the steep first and second order streams that connect to the lower gradient fish-bearing channels in all the Forest's watersheds. Consider these three situations when rating LWD.

In addition, the existing criteria separating the 3 functioning categories in the matrix will need to be changed based on collected Forest data/information. Over the past 10 years, stream inventories

have been conducted on managed and unmanaged Forest stream systems. This has not been completely analyzed and summarize, but will be in the near future. Once this is done, the Forest will advocate for changing the criteria for this indicator.

(5) **Pathway – Habitat Elements, Indicator – Pool Frequency and Quality**

This is another matrix indicator subject to change once the Forest completes the analysis and interpretation of its stream inventory data.

There is also a need to consider desired pool frequencies by channel type and channel gradients based on some published channel classification system (e.g. Rosgen, Montgomery & Buffington)

(6) **Pathway – Habitat Elements, Indicator – Large Pools**

Large pools should be the primary pools and the size of these types of pools will need to be tailored various sizes and types of channels. Also consider the needs of these two species and the freshwater life history stage when determining the size, frequency, and distribution of large (primary) pools (e.g. spawning chinook salmon).

(7) **Pathway – Channel Condition & Dynamics, Indicator – Average wetted width/max depth ratio and streambank condition**

These indicators and the associated criteria values need to be based on the geomorphic and hydrology features of a watershed. A simple watershed classification based on these three indicators needs to be developed and functioning criteria identified for watershed types. We suggest that average bankfull measurement be made and not wetted.

The numeric values for this baseline may require modification after Forest stream survey data is analyzed and evaluated for the different channel types found within the Forest boundaries.

(8) **Pathway – Flow/Hydrology, Indicator – Change in Peak and Base Flows**

This indicator needs to be linked to the disturbance history of the watershed. Flows can be dramatically altered by the management and natural disturbance within a fifth field watershed.

(9) **Pathway – Flow/Hydrology, Indicator – Increase in Drainage Network**

This indicator needs to be linked to the road density indicator. Increases in road density in many watersheds has been shown to increase the drainage network.

(10) **Pathway – Watershed Conditions, Indicator – Road Density, and Disturbance History, and Disturbance Regime**

The MBS NF developed and implemented a hydrologic cumulative effects assessment for all of the Forest's fifth field watersheds back in 1990 as a component of the old Forest Land Management Plan. Each watershed was assessed for upslope and in-channel conditions. Management induced disturbance (road building and timber harvesting) as well as natural disturbance events (floods) were used to generate these assessments. Based on this assessment, watersheds were rated into one of three conditions (acceptable, partially acceptable, and unacceptable). The recommendation is to use the road and other disturbance history indicators from this assessment supplemented by current watershed conditions to derive the current baseline condition for these three indicators (a copy of this hydrologic cumulative assessment and the ratings for each fifth field watershed is available from Jim Doyle).

(11) **Pathway – Integration of Species and Habitat Conditions**

This integration also needs to link to other fifth field watersheds in the river basin, if a similar environmental baseline has been done for that watershed which would help facilitate species and habitat integration at the 4th field level.

TABLE 1. MATRIX of DIAGNOSTICS / PATHWAYS AND INDICATORS

(Remember, the values of criteria presented here are NOT absolute, they may be adjusted for local watersheds given supportive documentation. See p. 7)

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
SPECIES:				
Subpopulation Characteristics within subpopulation watersheds	Subpopulation Size	Mean total subpopulation size or local habitat capacity more than several thousand individuals. All life stages evenly represented in the subpopulation.[1]	Adults in subpopulation are less than 500 but >50.[1]	Adults in subpopulation has less than 50.[1]
	Growth and Survival	Subpopulation has the resilience to recover from short term disturbances (e.g. catastrophic events, etc) or subpopulation declines within one to two generations (5 to 10 years).[1] The subpopulation is characterized as increasing or stable. At least 10+ years of data support this estimate.[2]	When disturbed, the subpopulation will not recover to predisturbance conditions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The subpopulation is reduced in size, but the reduction does not represent a long-term trend.[1]. At least 10+ years of data support this characterization.[2] If less data is available and a trend can not be confirmed, a subpopulation will be considered at risk until enough data is available to accurately determine its trend.	The subpopulation is characterized as in rapid decline or is maintaining at alarmingly low numbers. Under current management, the subpopulation condition will not improve within two generations (5 to 10 years).[1] This is supported by a minimum of 5+ years of data.
	Life History Diversity and Isolation	The migratory form is present and the subpopulation exists in close proximity to other spawning and rearing groups. Migratory corridors and rearing habitat (lake or larger river) are in good to excellent condition for the species. Neighboring subpopulations are large with high likelihood of producing surplus individuals or straying adults that will mix with other subpopulation groups.	The migratory form is present but the subpopulation is not close to other subpopulations or habitat disruption has produced a strong correlation among subpopulations that do exist in proximity to each other.[1]	The migratory form is absent and the subpopulation is isolated to the local stream or a small watershed not likely to support more than 2,000 fish.[1]

	Persistence and Genetic Integrity	Connectivity is high among multiple (5 or more) subpopulations with at least several thousand fish each. Each of the relevant subpopulations has a low risk of extinction. [1] The probability of hybridization or displacement by competitive species is low to nonexistent.	Connectivity among multiple subpopulations does occur, but habitats are more fragmented. Only one or two of the subpopulations represent most of the fish production. [1] The probability of hybridization or displacement by competitive species is imminent, although few documented cases have occurred.	Little or no connectivity remains for refounding subpopulations in low numbers, in decline, or nearing extinction. Only a single subpopulation or several local populations that are very small or that otherwise are at high risk remain.[1] Competitive species readily displace bull trout. The probability of hybridization is high and documented cases have occurred.
HABITAT:				
Water Quality:	Temperature	7 day average maximum temperature in a reach during the following life history stages: [1, 3] incubation 2 - 5?C rearing 4 - 12 ?C spawning 4 - 9?C also temperatures do not exceed 15?C **in areas used by adults during migration (no thermal barriers)**	7 day average maximum temperature in a reach during the following life history stages:[1, 3] incubation <2?C **or 6?C** rearing <4?C **or 13 - 15 ?C** spawning <4 ?C **or 10?C** also temperatures in areas used by adults during migration sometimes exceeds 15?C	7 day average maximum temperature in a reach during the following life history stages:[1, 3] incubation <1?C **or >6?C** rearing >15 ?C spawning <4 ?C or > **10?C** also temperatures in areas used by adults during migration regularly exceed 15?C **(thermal barriers present)**
	Sediment (in areas of spawning and incubation; rearing areas will be addressed under ''substrate embeddedness'')	Similar to chinook salmon [1]: for example (e.g.): < 12% fines (<0.85mm) in gravel[4]; e.g. ≤20% surface fines of ≤6mm[5, 6]	Similar to chinook salmon [1]: e.g. 12-17% fines (<0.85mm) in gravel[4]; e.g. 12-20% surface fines	Similar to chinook salmon [1]; e.g. >17% fines (<0.85mm) in gravel[4]; e.g. >20% fines at surface or depth in spawning habitat[7]
	Chemical Contamination/ Nutrients	low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients, no CWA 303d designated reaches[8]	moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients, one CWA 303d designated reach[8]	high levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients, more than one CWA 303d designated reach[8]
Habitat Access:	Physical Barriers (address subsurface flows impeding fish passage under the pathway ''flow/hydrology'')	man-made barriers present in watershed allow upstream and downstream fish passage at all flows	man-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows	man-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows
Habitat Elements:	Substrate Embeddedness in rearing areas (spawning anld incubation areas were addressed under the indicator ''sediment'')	reach embeddedness <20%[9, 10]	reach embeddedness 20-30%	reach embeddedness >30%[4, 10]

Large Woody Debris	current values are being maintained at greater than 80 pieces/mile that are >24"diameter and >50 ft length on the Coast', or >20 pieces/ mile >12"diameter >35 ft length on the Eastside[11] ; also adequate sources of woody debris are available for both long and short-term recruitment	current levels are being maintained at minimum levels desired for ''functioning appropriately'', but potential sources for long term woody debris recruitment are lacking to maintain these minimum values	current levels are not at those desired values for ''functioning appropriately'', and potential sources of woody debris for short and/or long term recruitment are lacking
Pool Frequency and Quality	pool frequency in a reach closely approximates [5]: Wetted width (ft) #pools/mile 0-5 39 5-10 60 10-15 48 15-20 39 20-30 23 30-35 18 35-40 10 40-65 9 65-100 4 (can use formula: pools/mi = 5,280/wetted channel width #channel widths per pool); also, pools have good cover and cool water', and only minor reduction of pool volume by fine sediment	pool frequency is similar to values in ''functioning appropriately'', but pools have inadequate cover/temperature', and/or there has been a moderate reduction of pool volume by fine sediment	pool frequency is considerably lower than values desired for ''functioning appropriately''; also cover/temperature is inadequate', and there has been a major reduction of pool volume by fine sediment
Large Pools (in adult holding, juvenile rearing, and overwintering reaches where streams are >3m in wetted width at baseflow)	each reach has many large pools >1 meter deep'	reaches have few large pools (>1 meter) present'	reaches have no deep pools (>1 meter)'
Off-channel Habitat (see reference 18 for identification of these characteristics)	watershed has many ponds, oxbows, backwaters, and other off-channel areas with cover; and side-channels are low energy areas'	watershed has some ponds, oxbows, backwaters, and other off-channel areas with cover; but side-channels are generally high energy areas'	watershed has few or no ponds, oxbows, backwaters, or other off-channel areas'
Refugia (see Checklist footnotes for definition of this indicator)	habitats capable of supporting strong and significant populations are protected and are well distributed and connected for all life stages and forms of the species [12, 13]	habitats capable of supporting strong and significant populations are insufficient in size, number and connectivity to maintain all life stages and forms of the species[12, 13]	adequate habitat refugia do not exist[12]

Channel Condition & Dynamics:	Average Wetted Width/ Maximum Depth Ratio in scour pools in a reach	≤10[7, 5]	11 - 20[5]	>20[5]
	Streambank Condition	>80% of any stream reach has ≥90% stability[5]	50 - 80% of any stream reach has ≥90% stability[5]	<50% of any stream reach has ≥90% stability[5]
	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 active channel length correlated with human caused disturbance	low to moderate increase in active channel length correlated with human caused disturbance	greater than moderate increase in active channel length correlated with human caused disturbance
Watershed Conditions:	Road Density & Location	<1mi/mi² [13]; no valley bottom roads	1 - 2.4 mi/mi² [13]; some valley bottom roads	>2.4 mi/mi² [13]; many valley bottom roads
	Disturbance History	<15% ECA of entire watershed with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area there is an additional criteria of ≥15% LSOG in watersheds[14]	<15% ECA of entire watershed but disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area there is an additional criteria of ≥15% LSOG in watersheds[14]	>15% ECA of 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
	Riparian Conservation Areas (RHCA - PACFISH and INFISH) (Riparian Reserves - Northwest Forest Plan)	the riparian conservation areas provide adequate shade, large woody debris recruitment, and habitat protection and connectivity in subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% intact), and adequately buffer impacts on rangelands: percent similarity of riparian vegetation to the potential natural community/ composition >50%[15]	moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian conservation areas, or incomplete protection of habitats and refugia for sensitive aquatic species (≈70-80% intact), and adequately buffer impacts on rangelands : percent similarity of riparian vegetation to the potential natural community/composition 25-50% or better[15]	riparian conservation areas are fragmented, poorly connected, or provides inadequate protection of habitats for sensitive aquatic species (<70% intact, refugia does not occur), and adequately buffer impacts on rangelands : percent similarity of riparian vegetation to the potential natural community/composition <25%[15]

Disturbance Regime	Environmental disturbance is short lived; predictable hydrograph, high quality habitat and watershed complexity providing refuge and rearing space for all life stages or multiple life-history forms. [1] Natural processes are stable.	Scour events, debris torrents, or catastrophic fire are localized events that occur in several minor parts of the watershed. Resiliency of habitat to recover from environmental disturbances is moderate.	Frequent flood or drought producing highly variable and unpredictable flows, scour events, debris torrents, or high probability of catastrophic fire exists throughout a major part of the watershed. The channel is simplified, providing little hydraulic complexity in the form of pools or side channels. [1] Natural processes are unstable.

SPECIES AND HABITAT:			
Integration of Species and Habitat Conditions	Habitat quality and connectivity among subpopulations is high. The migratory form is present. Disturbance has not altered channel equilibrium. Fine sediments and other habitat characteristics influencing survival or growth are consistent with pristine habitat. The subpopulation has the resilience to recover from short-term disturbance within one to two generations (5 to 10 years). The subpopulation is fluctuating around an equilibrium or is growing.[1]	Fine sediments, stream temperatures, or the availability of suitable habitats have been altered and will not recover to predisturbance conditions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The subpopulation is reduced in size, but the reduction does not represent a long-term trend. The subpopulation is stable or fluctuating in a downward trend. Connectivity among subpopulations occurs but habitats are more fragmented.[1]	Cumulative disruption of habitat has resulted in a clear declining trend in the subpopulation size. Under current management, habitat conditions will not improve within two generations (5 to 10 years). Little or no connectivity remains among subpopulations. The subpopulation survival and recruitment responds sharply to normal environmental events. [1]

[1] Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. U.S.D.A. Forest Service, Intermountain Research Station, Boise, ID.
[2] Rieman, B.E. and D.L. Meyers. 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus*) populations. Conservation Biology 11(4): 1015-1018.
[3] Buchanan, D.V. and S.V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. *In* W.C. Mackay, M.K. Brewin, and M. Monita, eds. Friends of the Bull Trout Conference Proceedings. P8.
[4] Washington Timber/Fish Wildlife Cooperative Monitoring Evaluation and Research Committee, 1993. Watershed Analysis Manual (Version 2.0). Washington Department of Natural Resources.
[5] Overton, C.K., J.D. McIntyre, R. Armstrong, S.L. Whitewell, and K.A. Duncan. 1995. User's guide to fish habitat: descriptions that represent natural conditions in the Salmon River Basin, Idaho. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Gen Tech. Rep. INT-GTR-322.
[6] Overton, C.K., S.P. Wollrab, B.C. Roberts, and M.A. Radko. 1997. R1/R4 (Northern/Intermoutain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Gen Tech. Rep. INT-GTR-346.
[7] 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.
[8] A Federal Agency Guide for Pilot Watershed Analysis (Version 1.2), 1994.

[9] Biological Opinion on Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of Calfornia (PACFISH). National Marine Fisheries Service, Northwest Region, January 23, 1995.
[10] Shepard, B.B., K.L. Pratt, and P.J. Graham. 1984. Life histories of westslope cutthroat and bull trout in the Upper Flathead River Basin, MT. Environmental Protection AgencyRep. Contract No. R008224-01-5.
[11] Interior Columbia Basin Ecosystem Management Project Draft Environmental Impact Statement and Appendices.
[12] 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.
[13] Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, J.E. Williams and others. 1997. Chapter 4: Broadscale Assessment of Aquatic Species and Habitats. *In* T.M. Quigley and S. J. Arbelbide eds ''An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III''. U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, Gen Tech Rep PNW-GTR-405.
[14] 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.
[15] 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.

Appendix M

APPENDIX M:
DEA Stream Habitat Survey Data

Stream Name: Little Bear Creek
Reach: 1 Habitat Survey
GPS D/S: Mouth
GPS U/S: Downstream Side SR 202

Date: 6/25/01
Time In: 10 am
Time out: 5:15 pm
Crew: Scott & Joe

Temp air: 21° C
Temp Water: 14° C
Weather: Overcast

								Width (meters)				Depth (meters)				
NSO	Hab ID	Sta D/S	Sta U/S	Length (m)	Hab Type	% Pool	Area m^2	W1	W2	W3	BKF	Avg	Max	Tail	Resid.	Comments
1	R1	0	192.7	192.7	Riffle		948.084	5.2	4.5	5.05	6.6	0.38				long-linear-rip/rap
2	R2	192.7	205.1	12.4	Glide		55.8	4.5	4.5	4.5		0.26				under first road
3	P1	205.1	218.8	13.7	RB Scour		57.54	4.2				0.60	0.90	0.28	0.62	
4	R3	218.8	225.8	7.0	Riffle		29.4	4.2			4.50	0.40				rip/rap in-stream
5	P2	225.8	245.7	19.9	Plunge Pool		83.58	4.2				0.55	0.90	0.38	0.52	walled in, created.
6	P3	245.7	260.5	14.8	Plunge Pool		50.32	3.4				0.70	0.90	0.28	0.62	walled in. V- weir
7	R4	260.5	277.1	16.6	Glide		44.82	2.7				0.50				
8	P4	277.1	288.3	11.2	Plunge Pool		45.92	4.1				0.55	0.67	0.40	0.27	walled in.
9	P5	288.3	303.5	15.2	Plunge Pool		63.84	4.2				0.60	0.90	0.20	0.70	walled in
10	R5	303.5	317.5	14.0	Glide		56	4.0				0.60	0.77			
11	R6	317.5	354.5	37.0	Riffle		222	6.0				0.30	0.60			sand still dominates
12	R7	354.5	370.8	16.3	Glide		76.61	4.7			5.80	0.45	0.60			
13	R8	370.8	380.9	10.1	Riffle		63.63	6.3				0.30	0.40			
14	R9	380.9	388.2	7.3	Glide		33.58	4.6				0.35	0.40			end reach
				388.2			1831.124									

Stream Name: Little Bear Creek
Reach: 2 Habitat
GPS D/S: Downstream side of Hwy 202
GPS U/S:

Temp air: 19° C
Temp Water: 13° C
Weather: Nice

								Width (Meter)			Depth (Meter)				
NSO	Hab ID	STA D/S	STA U/S	Length (meter)	Hab Type	Area (m^2)	% Pool	W1	W2	BKF	Avg	Max	Tail	Resid.	Comments
1	R1	0.0	39.7	39.7	Glide	123.07	0	3.1		3.1	0.41	0.5			Under Hwy 202
2	R2	39.7	54.7	15.0	Riffle	52.5	0	3.5		8.65	0.25	0.4			Pebble count site
3	P1	54.7	64.0	9.3	Scour	76.539		8.23			0.5	0.8	0.21	0.59	Sandy
4	R3	64.0	117.1	53.1	Riffle	288.067	10	4.75	6.1	5.6	0.27	0.4			Gravel nice, but sandy
5	P2	117.1	126.0	8.9	Scour	45.39		5.1			0.3	0.85	0.29	0.56	
6	R4	126.0	142.4	16.4	Riffle	73.8	0	4.5			0.2	0.3			LB armor 128.6-138.2.
7	P3	142.4	154.0	11.6	Scour	83.52		7.2			0.4	0.92	0.18	0.74	LB cleared, RB J. Knotweed.
8	R5	154.0	188.5	34.5	Riffle	144.9	0	4.2		7.3	0.3	0.4			
9	P4	188.5	196.1	7.6	Scour	60.8		8			0.6	1.0	0.25	0.75	Ended day at 132nd Ave.
				196.1		948.586									

Stream Name: Little Bear Creek
Reach: 2, day 2. Habitat
GPS D/S: 196.1 meters upstream of Hwy 202
GPS U/S: 132nd Ave NE

Temp air: 21 C
Temp Water: 14.5
Weather: Overcast, rained hard yesterday

								Width (Meter)			Depth (Meter)				
NSO	Hab ID	Sta D/S	Sta U/S	Length (Meter)	Hab Type	Area (m2)	% Pool	W1	W2	BKF	Avg	Max	Tail	Resid.	Comments
10	R6	196.1	231.0	34.9	riffle	171.01	5	4.9	-	5.8	0.4	0.7	-	-	Culvert (3) 26.5M long.
11	P5	231.0	242.2	11.2	l. scour	60.48	-	5.4	-	-	0.5	0.6	0.32	0.28	LB scour
12	R7	242.2	255.5	13.3	glide	53.2	30	4.0	-	-	0.6	0.8	0.2	0.6	deep trench/ riffle-turbulent
13	R8	255.5	301.1	45.6	riffle	241.68	-	5.3	-	-	0.3	0.4	-	-	
14	P6	301.1	313.3	12.2	l. scour	73.2	-	6.0	-	-	0.7	1.0	0.25	0.75	lateral scour & trench
15	R9	313.3	390.0	76.7	riffle	373.913	-	4.4	5.35	6.7	0.35	0.5	-		getting wider
16	P7	390.0	400.8	10.8	scour	113.4	-	10.5	-	-	0.4	0.7	0.22	0.48	most wood - lots of sand.
17	R10	400.8	408.8	8.0	riffle	22.4	-	2.8	-	-	0.15	0.3	-	-	
18	P8	408.8	419.8	11.0	scour	52.8	-	4.8	-	-	0.4	0.7	0.2	0.6	unstable LB 419.8-426.5.
19	R11	419.8	439.0	19.2	riffle	80.64	-	4.2	-	-	0.3	0.5	-	-	
20	P9	439.0	446.5	7.5	scour	51	-	6.8	-	-	0.4	0.6	0.3	0.3	
21	R12	446.5	469.4	22.9	riffle	87.02	-	3.8	-	-	0.35	0.5	-	-	first old growth cedar stump, LB
22	P10	469.4	478.1	8.7	scour	98.31	-	11.3	-	-	0.6	1.1	0.25	0.85	3 culverts 134th 11.5m long.
23	R13	478.1	503.0	24.9	riffle	119.52	-	4.8	-	-	0.3	0.6	-	-	starts downstream end culverts
24	P11	503.0	517.2	14.2	s. debris	110.76	-	7.8	-	-	0.5	0.8	0.15	0.65	part scour, part debris
25	R14	517.2	521.3	4.1	riffle	23.37	-	5.7	-	-	0.15	0.3	-	-	
26	P12	521.3	530.3	9.0	scour	51.3	-	5.7	-	-	0.4	0.8	0.15	0.65	several small fry; end day.
				334.2		1784.003									

Stream Name: Little Bear Creek
Reach 2. Habitat
GPS D/S: ~100 feet upstream of 134th Ave.
GPS U/S:

Temp air: 19° C
Temp Water:14° C
Weather: Sunny

								Width (Meter)			Depth (Meter)				
NSO	Hab ID	Sta D/S	Sta U/S	Length (Meter)	Hab Type	Area (m^2)	% Pool	W1	W2	BKF	Avg	Max	Tail	Resid.	Comments
27	R15	530.3	600.0	69.7	riffle	369.925	-	5.1	5.4	5.8	0.35	0.4			Small side channel (2nd)
28	P13	600.0	612.0	12.0	scour	55.2	-	4.6	-	-	0.4	0.6	0.23	0.37	
29	R16	612.0	625.3	13.3	riffle	49.21	-	3.7	-	5.5	0.2	0.3	-		
30	P14	625.3	642.0	16.7	scour	78.49	-	4.7	-	-	0.4	0.65	0.2	0.45	trench/scour
31	R17	642.0	662.0	20.0	glide	130	-	6.5	-	-	0.4	0.65	-		jungle dogwwod & ninebark
32	R18	662.0	685.9	23.9	riffle	109.94	20	4.6	-	-	0.2	0.5	-		photo 10
33	P15	685.9	694.0	8.1	plunge	48.6	-	~6	-	-	0.7	1	0.2	0.8	photo 11,12,13. Small fry.
34	P16	694.0	715.7	21.7	l. scour	104.16	-	4.8	-	-	0.3	0.65	0.23	0.42	scour-lateral, fallen fence LB,
35	R19	715.7	729.1	13.4	riffle	58.96	-	4.4	-	-	0.25	0.3	-		see discharge pipe LB
36	P17	729.1	742.0	12.9	scour	67.08	-	5.2	-	-	0.3	0.7	0.17	0.53	
37	P18	742.0	755.3	13.3	scour	62.51	-	4.7	-	-	0.35	0.63	0.2	0.43	
38	R20	755.3	759.3	4.0	riffle	20	-	5	-	-	0.1	0.2	-		
39	P19	759.3	771.6	12.3	scour	209.1	-	~17			0.3	1.1	0.2	0.9	wide area flooded
40	P20	771.6	786.0	14.4	l. scour	57.6	-	4			0.3	0.5	0.2	0.3	yellow iris
41	P21	786.0	808.7	22.7	b. water	86.26	-	3.8			0.45	0.8	0.24	0.56	backwater 70%, scour 70%
42	R21	808.7	826.9	18.2	glide	182	10	3.7			0.35	0.5	-		row of large cedars RB
43	R22	826.9	839.0	12.1	riffle	53.24	-	4.4		7.2	0.3	0.35	-		kingfisher, beaver sign
44	P22	839.0	852.0	13.0	l. scour	65	-	5		-	0.4	0.8	0.25	0.55	classic pool
45	R23	852.0	858.3	6.3	riffle	30.24	-	4.8			0.15	0.25	-		
46	R24	858.3	884.4	26.1	glide	122.67	-	4.7			0.3	0.45	-		
47	P23	884.4	892.4	8.0	scour	46.4	-	5.8			0.5	0.75	0.2	0.55	CMP- .47M dia.- LB, sta 890.2
48	R25	892.4	895.7	3.3	riffle	9.9	-	3		6.2	0.2	0.27	-		
49	P24	895.7	905.5	9.8	l. scour	43.12	-	4.4			0.45	0.6	0.2	0.4	
50	P25	905.5	913.2	7.7	l. scour	40.04	-	5.2			0.3	0.75	0.23	0.52	plunge 50%, scour 50%,
				382.9		2099.645									

Riparian: shrubs can be thick both sides. LB tends to have sections with a wall of Himalayen blackberry. Few if any conifers. When deciduous trees present, dominated by meduim and small alders. Some mature cottenwood, but usually set back. Large willows (pacific) present. Salmonberry co-dominates shrub later. Hazelnut also present. RCG present.

Stream Name: Little Bear Creek
Reach: 2. Habitat
GPS D/S:
GPS U/S:

Temp air: 22° C
Temp Water: 16° C
Weather: Sunny & Hot

								Width (m)		Depth (m)				
NSO	Hab ID	Sta D/S	Sta U/S	Length (meter)	Hab Type	Area (m2)	% Pool	W1	BKF	Avg	Max	Tail	Resid.	Comments
51	R26	913.2	936.9	23.7	riffle	111.39	-	4.7	6	0.23	0.3	-		Racoon tracks, clawfish claw. Clearing with new plants LB.
52	R27	936.9	955.4	18.5	glide	92.5	20	5	-	0.35	0.5	-		lots of salmonids 1-3 ", >12
53	P26	955.4	970.1	14.7	scour	108.78	-	7.4	-	0.45	0.79	0.4	0.39	
54	R28	970.1	978.2	8.1	riffle	36.45	-	4.5	-	0.15	0.25	-		
55	P27	978.2	1007.0	28.8	scour	210.24	-	7.3	5.9	0.5	1	0.2	0.8	shallow area LB-wide log-jam.
56	R29	1007.0	1028.6	21.6	riffle	118.8	-	5.5	-	0.1	0.3	-		narrow riparian
57	P28	1028.6	1046.7	18.1	scour	114.03	-	6.3	-	0.4	0.8	0.15	0.65	
58	P29	1046.7	1065.0	18.3	trench	78.69	-	4.3	-	0.6	0.8	0.2	0.6	ditch LB
59	R30	1065.0	1079.3	14.3	riffle	67.21	-	4.7	6.4	0.2	0.35	-		ditch LB
60	P30	1079.3	1091.7	12.4	scour	80.6	-	6.5	-	0.45	0.7	0.15	0.55	6" salmonid (trout?)
61	R31	1091.7	1103.0	11.3	riffle	58.76	-	5.2	-	0.15	0.2	-		SR522 close by RB
62	R32	1103.0	1116.8	13.8	glide	55.2	-	4	-	0.35	0.52	-		
63	R33	1116.8	1133.3	16.5	riffle	75.9	15	4.6	-	0.25	0.45	-		
64	P31	1133.3	1140.8	7.5	plunge	64.5	-	8.6	-	0.4	0.78	0.18	0.6	lamprey & juvenile salmonid
65	P32	1140.8	1158.5	17.7	b.water	56.64	-	3.2	-	0.4	0.7	0.15	0.55	backwater/trench
66	R34	1158.5	1161.3	2.8	riffle	14	-	5	-	0.1	0.2	-		
67	P33	1161.3	1168.0	6.7	scour	46.9	-	7	-	0.4	0.65	0.12	0.53	narrow band of trees
68	R35	1168.0	1169.9	1.9	glide	12.16	-	6.4	-	0.2	0.34	-		
69	P34	1169.9	1183	13.1	scour	52.4	-	4	-	0.35	0.64	0.25	0.39	
				269.8		1455.15								

Stream Name: Little Bear Creek
Reach 2. Habitat
GPS D/S:
GPS U/S: Upstream side of SR 522 crossing.

Temp air:16 C
Temp Water:14 C
Weather: Nice

								Width (m)		Depth (Meter)				
NSO	Hab ID	Sta D/S	Sta U/S	Length (Meter)	Hab Type	Area (m2)	% Pool	W1	BKF	Avg	Max	Tail	Resid.	Comments
70	R36	1183.0	1187.0	4.0	riffle	23.6	-	5.9	-	0.1	0.25	-		photo 1 & 2 of roll 3
71	R37	1187.0	1195.6	8.6	glide	51.6	-	6	-	0.25	0.45	-		
72	R38	1195.6	1204.9	9.3	riffle	93	10	5.3	-	0.15	0.3	-		
73	P35	1204.9	1218.7	13.8	l. scour	59.34	-	4.3	-	0.3	0.7	0.2	0.5	
74	R39	1218.7	1220.2	1.5	riffle	6.9	-	4.6	5.6	0.15	0.18	-		
75	R40	1220.2	1239.7	19.5	glide	62.4	-	3.2	-	0.3	0.5	0.15	0.35	glide like
76	R41	1239.7	1262.2	22.5	riffle	135	-	6	-	0.2	0.3	-		sloughing
77	P36	1262.2	1271.4	9.2	scour	35.88	-	3.9	-	0.35	0.7	0.3	0.4	LB rip/rap.
78	R42	1271.4	1275.7	4.3	riffle	22.36	-	5.2	-	0.1	0.2	-		LB unstable
79	P37	1275.7	1290.9	15.2	scour	69.92	-	4.6	-	0.45	0.98	0.2	0.78	LB rip/rap
80	R43	1290.9	1299.9	9.0	riffle	56.7	5	6.3	-	0.15	0.5	-		LB unstable
81	P38	1299.9	1309.2	9.3	scour	53.01	-	5.7	-	0.6	1	0.17	0.83	
82	P39	1309.2	1315.6	6.4	scour	46.08	-	7.2	-	0.5	0.85	0.2	0.65	RB unstable
83	P40	1315.6	1322.7	7.1	scour	36.21	-	5.1	-	0.3	0.5	0.15	0.35	
84	R44	1322.7	1337.3	14.6	riffle	87.6	-	6	-	0.2	0.4	-		
85	P41	1337.3	1346.1	8.8	scour	50.16	-	5.7	-	0.5	0.8	0.22	0.58	
86	R45	1346.1	1355.2	9.1	glide	47.32	-	5.2	-	0.3	0.55	-		
87	R46	1355.2	1360.0	4.8	riffle	28.8	-	6	8.8	0.1	0.2	-		
88	P42	1360.0	1370.8	10.8	scour	56.16	-	5.2	-	0.45	0.75	0.13	0.62	
89	P43	1370.8	1379.7	8.9	scour	50.73	-	5.7	-	0.4	0.7	0.3	0.4	
90	R47	1379.7	1391.2	11.5	riffle	47.15	-	4.1	-	0.25	0.5	-		Rip/rap 1380.7-1390.2
91	P44	1391.2	1403.3	12.1	scour	72.6	-	6	-	0.45	1.0	0.18	0.82	pipe LB sta. 1382
92	R48	1403.3	1408.7	5.4	riffle	24.84	-	4.6	-	0.15	0.22	-		
93	P45	1408.7	1416.2	7.5	scour	45	-	6	-	0.35	0.85	0.18	0.67	fish
94	R49	1416.2	1462.0	45.8	riffle	233.58	5	5.1	-	0.2	0.4	-		photo 17 & 18 of roll 3
95	R50	1462.0	1499.3	37.3	glide	208.88	-	5.6	-	0.3	0.5	-		banks ~ undercut good.
96	R51	1499.3	1514.1	14.8	riffle	76.96	-	5.2	-	0.2	0.25	-		

								Width (m)		Depth (Meter)				
NSO	Hab ID	Sta D/S	Sta U/S	Length (Meter)	Hab Type	Area (m2)	% Pool	W1	BKF	Avg	Max	Tail	Resid.	Comments
97	R52	1514.1	1554.8	40.7	glide	179.08	-	4.4	-	0.3	0.4			
98	R53	1554.8	1563.8	9.0	riffle	47.7	-	5.3	-	0.2	0.25			
99	R54	1563.8	1570.9	7.1	glide	32.66	-	4.6	-	0.3	0.45			
100	R55	1570.9	1583.2	12.3	riffle	70.11	-	5.7	-	0.2	0.3			
101	R56	1583.2	1630.0	46.8	glide	468	10	4.6	-	0.4	0.7			4 lampreys spawning
102	R57	1630.0	1640.5	10.5	riffle	57.75	-	5.5	-	0.2	0.25			pipe overhead.
103	R58	1640.5	1656.0	15.5	glide	77.5	-	5	-	0.4	0.6			
104	P46	1656.0	1663.2	7.2	pool	33.84	-	4.7	-	0.5	0.7	0.3		
105	R59	1663.2	1725.7	62.5	riffle	231.25		3.7		0.2				Within 2 CMP - SR-522
				542.7		2979.67								

Culvert 7.1m wide downstream side opening

Lots of deadly nightshade, Himalayan blackberry, and reed canarygrass.

Stream Name: Little Bear Creek
Reach: 3. Habitat
GPS D/S: Upstream side of SR 522.
GPS U/S: Downstream end of culverts under 195th Street

Temp air:21°C
Temp Water:16°C
Weather:cloudy
Date: 7/19/01

								Width (meter)			Depth (meter)				
NSO	Hab ID	Sta D/S	Sta U/S	Length (meter)	Hab Type	Area (m^2)	% Pool	W1	W2	BKF	Avg	Max	Tail	Resid.	Comments
1	R1	0.0	3.05	3.05	riffle	16.3462	-	5.36	-	-	.25	.3	-		Ditch/trib entering LB at culverts
2	P1	3.05	17.07	14.02	l. scour	60.8945	-	4.34	-	-	.3	.6	0.2	0.4	RB. Small alders
3	R2	17.07	45.4	28.33	riffle	130.247	0	3.531	5.664	7.82	.15	.2	-		Photo 5
4	R3	45.4	63.1	17.7	glide	114.643	5	6.477	-	-	.2	.45	-		Part pool, run/glide~shallow, flat
5	R4	63.1	84.1	21	riffle	128.549	-	6.121	-	-	.1	.15	-		Water/trib RB
6	R5	84.1	100.3	16.2	glide	98.755	0	6.096	-	-	.25	.4	-		Run/glide, like R3
7	R6	100.3	130.8	30.5	riffle	146.418	0	4.801	-	-	.12	.2	-		Blackberry thick RB
8	P2	130.8	149.7	18.9	l. scour	108.01	0	5.715	-	-	.25	.48	0.15	0.33	LB. Rip/rap LB, freeway close
9	R7	149.7	170.4	20.7	riffle	100.416		4.851	-	5.92	.15	.20	-		blackberry + Japanese knotweed
10	R8	170.4	177.7	7.3	glide	38.938	0	5.334	-	-	.2	.25	-		
11	P3	177.7	189.0	11.3	scour	46.928	0	4.547	3.759		.25	.5	0.2	0.3	%pool in glide.
12	R9	189.0	199.0	10	riffle	37.084	-	3.708	-	-	.15	.25	-		
13	P4	199.0	216.4	17.4	scour	90.602	-	5.207	-	-	.4	.71	0.19	0.52	Nice pool, old cedar stump
14	R10	216.4	236.8	20.4	riffle	97.414	-	4.775	-	-	.15	.3	-		Photo 6
15	P5	236.8	251.1	14.3	scour	67.559	-	4.724	-	-	.3	.70	0.15	0.55	Yards now present RB
16	R11	251.1	260.3	9.2	riffle	43.932	-	4.775	-	-	.15	.25	-		Photo 9 & 10
17	R12	260.3	271.2	10.9	glide	60.355	-	5.537	-	-	.3	.4	-		Run/glide
18	P10	271.2	277.7	6.5	plunge	39.624	-	6.096	-	-	.45	.70	0.25	0.45	Scour/plunge, rip/rap
19	P11	277.7	290.0	12.3	plunge	76.23	-	6.198	-	-	.45	.80	0.25	0.55	Foot Bridge 278.9
20	P12	290.0	296.6	6.6	plunge	22.128	-	3.353	-	-	.30	.65	0.25	0.4	
21	P13	296.6	303.9	7.3	plunge	35.601	-	4.877	-	-	.65	.80	0.2	0.6	Photo 11 & 12 = cascade
22	P14	303.9	313.6	9.7	plunge	59.427	-	6.126	-	-	.4	.7	0.4	0.3	Downstream end under 195th.
				313.6		1620.1									

*3 garter snakes on bank of stream, next to on ramp. 9 scales on 1/2 labia.

* Roll #1: P1 = both culverts; P2= LB culvert inside; P3= RB culvert inside; P4= LB trib.
*culverts round CMP 2M diameter each.
*LB trib is 1.4M wide-too small for adults, but could be used by juveniles.

Stream Name:Little Bear Creek
Reach: 3. Habitat.
GPS D/S: Upstream side of culverts under 195th St.
GPS U/S:

Temp air: 22°C
Temp Water: 15°C
Weather:partly coudy/sunny
Date: 7/20/01

								Width (meter)			Depth (meter)				
NSO	Hab ID	Sta. D/S	Sta. U/S	Length (meter)	Hab Type	Area (m^2)	% Pool	W1	W2	BKF	Avg	Max	Tail	Resid.	Comments
23	R13	313.9	330.7	53.38	glide	210.157		3.937			.28	.30			Shallow run/glide, plus 36.58 m in culvert
24	R14	330.7	338.0	7.3	riffle	33.93		4.648			.15	.20			~ at foot/old bridge
25	R15	338.0	345.3	7.3	glide	24.661		3.378			.25	.35			
26	R16	345.3	360.0	14.7	riffle	57.127		3.886			.17	.28			
27	R17	360.0	372.8	12.8	glide	55.921		4.369			.25	.4			
28	R18	372.8	375.5	2.7	riffle	14.813		5.486			.1	.2			
29	P15	375.5	380.7	5.2	s. pool	24.435		4.699			.35	.7	.15	0.55	Nice pool with cover
30	R19	380.7	385.6	4.9	riffle	21.656		4.42			.15	.26			
31	P16	385.6	402.3	16.7	d/s pool	180.701		10.82			.5	.9	.20	0.7	Two giant pools, debris/scour
32	P17	402.3	413.3	11	s. pool	109.525		9.957			.6	1.0	.22	0.78	Mink~brown, black tip on tail
33	R20	413.3	420.6	7.3	riffle	13.35		1.829			.2	.3			Red-tailed hawk. Photo 5-8
34	P18	420.6	424.2	3.6	plunge	16.276		4.521			.4	.65	.20	0.45	Photo 9
35	R21	424.4	450.5	26.1	glide	155.791		5.969			.3	.5	.20	0.3	Tough backwater/debris- glide
36	R22	450.5	455.7	5.2	riffle	26.152		5.029			.2	.3			Good cover, few large conifers
37	P19	455.7	473.0	17.3	scour	146.327		8.458			.65	1.1	.15	0.95	
38	R23	473.0	544.0	71	riffle	316.5		3.988	4.93	5.639	.16	.3			
39	P20	544.0	552.9	8.9	scour	37.3		4.191			.25	.6	.20	0.4	
40	R24	552.9	558.7	5.8	riffle	28.58		4.928			.15	.2			School of juvenile salmonids
41	R25	558.7	568.8	10.1	glide	55.669		5.512			.2	.35			School of juvenile salmonids
42	R26	568.8	593.8	25	riffle	112.395		4.496		6.17	.18	.3			
43	P21	593.8	603.1	9.3	scour	48.66		5.23			.35	.67	.10	0.57	Real close to SR 522
44	R27	603.1	615.4	12.3	riffle	67.636		7.264	3.73		.15	.2			
45	P22	615.4	634.9	19.5	l. scour	87.75		4.5			.30	1.1	.25	0.85	Invasives thick
				357.38		1845.312									

Stream Name:Little Bear Creek
Reach 3: Habitat
GPS D/S:
GPS U/S:

Temp air:18°C
Temp Water:14°C
Weather:cloudy
Date: 7/31/01

								Width		Depth				
NSO	Hab ID	Sta. D/S	Sta. U/S	Length (meter)	Hab Type	Area (m^2)	% Pool	W1	BKF	Avg	Max	Tail	Resid.	Comments
46	R28	634.9	664.8	29.9	riffle	146.576		4.902		0.15	0.3			Area near SR522-robin's nest
47	P23	664.8	679.7	14.9	l. scour	71.529		4.801		0.3	0.55	0.1	0.45	Lateral scour, nice cut bank
48	R29	679.7	690.7	11	riffle	43.586	5	3.962		0.2	0.4			
49	P24	690.7	705.3	14.6	s. pool	157.236		10.77		0.6	1.7	0.19	1.51	Scour pool, best so far
50	R30	705.3	714.4	9.1	riffle	47.615		5.23		0.1	0.2			
51	R31	714.4	734.6	20.2	run/glide	98.511		4.877		0.3	0.45	0.2	0.25	
52	R32	734.6	741.2	6.6	riffle	40.234		6.096		0.1	0.15			
53	P25	741.2	756.2	15	l. scour	72.39		4.826		0.3	0.6	0.19	0.41	RB trib (see photo) sta 750.
54	R33	756.2	783.3	27.1	riffle	128.03	20	4.724		0.15	0.16			
55	P26	783.3	792.4	9.1	l. scour	47.153		5.182		0.25	0.5	0.2	0.3	
56	R34	792.4	803.8	11.4	riffle	63.124		5.54		0.1	0.2			1998 UW B-IBI site
57	P27	803.8	809	5.2	scour	34.87		6.706		0.25	0.66	0.25	0.41	
58	R35	809	818.7	9.7	riffle	92.639		9.55		0.2	0.4			
59	R36	818.7	827.5	8.8	glide	50.963		5.79		0.25	0.4			
60	P28	827.5	847.6	20.1	scour	178.18		8.865		0.5	0.8	0.27	0.53	Clearing RB, big segment
61	R37	847.6	859.5	11.9	riffle	63.17		5.309		0.2	0.25			
62	R38	859.5	869.9	10.4	glide	47.55		4.572		0.27	0.4			
63	P29	869.9	876.6	6.7	pool	27.91		4.166		0.5	0.7	0.27	0.43	
64	R39	876.6	900.3	23.7	riffle	98.725		4.166		0.2	0.3			
65	R40	900.3	908.6	8.3	glide/run	39.845		4.801		0.25	0.35			
66	R41	908.6	934.5	25.9	riffle	169.728		6.55		0.15	0.18			
67	P30	915.3	934.5	19.2	s. pool	112.166		5.842		0.6	1.1	0.2	0.9	House RB-pool under old bridge.
				318.8		1831.73								

Stream Name: Little Bear Creek
Reach:3 Habitat
GPS D/S: Immediately upstream of old bridge, house RB.
GPS U/S: Immediately downstream of 205th Street.

Temp air:17°C
Temp Water:14°C
Weather:overcast
Date: 8/01/01

								Width (meter)		Depth (meter)				
NSO	Hab. ID	Sta. D/S	Sta. U/S	Length (meter)	Hab. Type	Area (m^2)	% Pool	W1	BKF	Avg	Max	Tail	Resid.	Comments
68	R42	934.5	954.6	20.1	riffle	108.745		5.41		0.15	0.25			Large riffle. LB trib, sta 948.2
69	R43	954.6	973.2	18.6	glide	87.874		4.72		0.25	0.55	0.2	0.35	Sta. 973.2, large cobble placed across stream by landowner.
70	P31	973.2	979.6	6.4	l. scour	29.7485		4.648		0.35	0.6	0.2	0.4	Yard RB. 1/2 width functioning
71	R44	979.6	1013.2	33.6	riffle	172.395		5.131		0.2	0.28			Not much spawning gravel.
72	P32	1013.2	1020.1	6.9	l/s pool	28.042		4.064		0.3	0.5	0.25	0.25	Freeway noise, raccoon tracks.
73	R45	1020.1	1029.3	9.2	riffle	28.976		3.15		0.15	0.25			Clay substrate prevalent.
74	R46	1029.3	1039	9.7	glide	53.711		5.537		0.35	0.45	0.24	0.21	Large doug firs and cedar LB.
75	P33	1039	1054	15	p. pool	135.636		9.04		0.6	1.4	0.25	1.15	Big simple plunge pool, less clay.
76	P34	1054	1060.7	6.7	l. scour	40.843		6.096		0.3	0.6	0.25	0.35	
77	R47	1060.7	1075	14.3	riffle	83.177		5.817		0.1	0.2			
78	P35	1075	1089.7	14.7	s. pool	91.85		6.248		0.4	0.5	0.2	0.3	Nice Wetland RB
79	R48	1089.7	1098.1	8.4	riffle	35.204		4.19		0.1	0.2			
80	P36	1098.1	1111.9	13.8	scour	76.413		5.537		0.25	0.5	0.2	0.3	Not much of a pool.
81	R49	1111.9	1116.5	4.6	riffle	25.588		5.563	8.2	0.05	1			
82	P37	1116.5	1138.1	21.6	s. pool	121.249		5.613		0.3	0.6	0.15	0.45	
83	R50	1138.1	1151.5	13.4	riffle	64.668		4.826		0.2	0.3			Some large cobble, clay gone
84	R51	1151.5	1180.8	29.3	glide	150.33	20	5.1308	7.39	0.2	0.5	0.2	0.3	
85	R52	1180.8	1186.9	6.1	riffle	35.791		5.867		0.1	0.15			
86	P38	1186.9	1199.7	12.8	scour	61.448		4.801		0.25	0.4	0.15	0.25	Not much of a pool.
87	R53	1199.7	1237.1	37.4	riffle	172.893	5	4.623		0.2	0.4			Steep, sandy, bedrock, black clay gravel. House RB
88	R54	1237.1	1258.8	21.7	glide	109.134		5.029		0.2	0.4			Run - Flat. 85% hard clay bottom.
89	R55	1258.8	1267.4	8.6	riffle	44.125		5.131		0.2	0.3			Steep. Sandy gravel
90	R56	1267.4	1279.2	11.8	glide	48.854		4.14		0.2	0.35			Flat, run.
91	R57	1279.2	1284.1	4.9	riffle	22.901		4.674		0.2	0.3			Steep.
92	R58	1284.1	1297.5	13.4	glide	73.177		5.461		0.25	0.3			Flat. LB rip/rap length of unit.
93	R59	1297.5	1305.5	8	riffle	25.6		3.2		0.2	0.3			and 10 feet into this unit
94	P39	1305.5	1314.9	9.4	plunge	154		16.38		0.5	1.2	0.25	0.95	End, 0.6 M vertical jump distant
				380.4		2082.373								Added 36.58 meters for 195th Street in NSO 23 not reflected in station #s.

Appendix N

APPENDIX N:
DEA Large Woody Debris Survey Data

Stream: Little Bear Creek **Reach: 1 WOOD**
Date: 6/25/01
Crew: Scott & Joe

						Zone %								Decay	
NSO	Hab ID	STA	Bank	Length (M)	Dia (CM)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Class	Comments
1	R1	9.1	LB	3.2	22	90	10	-	-	N	N	N	Decid.	4	Under walk bridge
1	R1	11.1	LB	2.6	21	5	95	-	-	A	N	Y	Doug Fir	4	Fractured beam?
1	R1	100.8	LB	3	13	5	95	-	-	N	N	N	Decid.	3	
1	R1	102	RB	5.9	20	0	100	-	-	N	N	N	Decid.	3	Beaver chewed
6	P3	245.7	Cross	4.3 +	48	100	0	-	-	A	Y	Y	Doug Fir	3	Placed-created plunge pool
6	P3	245.7	RB	5.5	13	70	30	-	-	N	N	N	?	3	
7	R4	260.5	RB	3.5	50	100	-	-	-	A	Y	Y	Conif.	3	V-weir connected to next
7	R4	260.5	LB	3.5	50	100	-	-	-	A	Y	Y	Conif.	3	V-weir connected to previous
8	P4	288.3	Cross	4.9	50	100	-	-	-	A	Y	Y	Conif.	3	Weir
9	P5	303.5	RB	4.3	47	100	-	-	-	A	Y	Y	Conif.	3	V-weir
9	P5	303.5	LB	3.7	50	100	-	-	-	A	Y	Y	Conif.	3	V-weir
11	R6	331.4	LB	1.7	40	100	-	-	-	A	N	Y	Conif.	3	Embedded V-weir
11	R6	331.4	RB	1.7	38	100	-	-	-	A	N	Y	Conif.	3	Embedded V-weir
11	R6	354.5	Cross	5	30	100	-	-	-	A	N	Y	Conif.	3	
12	R7	370.8	RB	5	15	20	80	-	-	N	N	N	Alder	1	Recently fell into stream
12	R7	370.8	RB	5	13	20	80	-	-	N	N	N	Alder	1	Recently fell into stream
				58.5	520										

Stream: Little Bear Creek **Reach: 2. Wood**
Date: 6/26/01
Crew: Scott & Joe

				Length	Dia.	Zone %									
NSO	Hab ID	STA	Bank	(m)	(cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
3	P1	57.5	Cross	12.5	46	5	80	15	0	N	N	N	BLM	4	Crosses center of pool
3	P1	57.5	LB	2.6	22	5	95	0	0	A	N	Y		NA	Railroad Tie- on top of other LWD
4	R3	94.3	RB	6	15	3	87	10	0	N	N	N	Decid.	3	Tips in water
4	R3	94.3	RB	5.5	12	4	86	10	0	N	N	N	Decid.	3	Tips in water
4	R3	105.6	RB	5.7	15	30	70	0	0	N	N	N	Decid.	3	
5	P2	122.4	LB	13	35	5	15	40	40	N	N	N	BLM	3	Fallen Tree Cluster
5	P2	122.5	LB	13	30	5	15	40	40	N	N	N	BLM	3	Roots 1/2 in water
5	P2	122.6	LB	13	30	5	15	40	40	N	N	N	BLM	2	BLM = big-leaf maple
5	P2	122.7	LB	20	55	5	15	40	40	N	N	N	BLM	2	
7	P3	150.7	RB	15	90	30	40	30	0	N	Y	N	Cedar	2	Stump-nice-pool ~70yrs old.
9	P4	194.2	RB	3.6	37	10	20	20	50	N	N	N	Decid.	4	
				109.9	387										

Stream: Little Bear Creek
Date: 6/28/01
Crew: Scott & Joe

Reach: 2, day 2 Habitat.

				Length	Dia	Zone %									
NSO	Hab. ID	Sta.	Bank	(meter)	(cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
10	R6	231	RB	2.0	23	60	40	0	0	N	Y	N	?	3	partly visible, formed 5% Pool
11	P5	243	RB	4.0	30	100	0	0	0	N	Y+/-	N	?	4	
12	R7	248.2	LB	1.2	22	0	100	0	0	A	N	Y	?	NA	~ 1/2 length exposed railroad tie
13	R7	250.5	cross	5.5	32	90	10	0	0	N	N	N	Decid.	4	
14	R8	277	LB	1.3	22	40	60	0	0	A	N	Y	-	-	Railroad Tie fallen-part of fence.
15	P6	309.9	cross	5.5	30	95	5	0	0	N	Y	N	Decid.	4	
15	P6	315.4	middle	4	30	50	50	0	0	N	N	N	Alder	2	
15	R9	350.5	LB	4	33	5	20	50	25	N	N	N	Alder	4	Part of fallen snag
15	R9	358.9	RB	2.4	30	30	70	0	0	N	N	N	Conifer	4	Slice of stump
15	R9	377.7	LB	4	20	2	68	30	0	N	N	N	Alder	3	
16	R9	383.7	LB	4	25	5	90	5	0	N	N	N	Alder	3	
16	R9	393.9	LB	4.5	27	10	10	60	20	N	N	N	Alder	2	Fry ~ 1inch
16	P7	393.9	LB	~10	28	5	10	75	10	N	N	N	Willow	1	Still alive but fallen into pool
16	P7	395.4	LB	~10	15	10	80	10	0	N	N	N	Decid.	2	3 small stumps also
16	P7	395.4	LB	2	13	5	95	0	0	N	N	N	Decid.	3	
16	P7	395.4	LB	2	15	50	50	0	0	N	N	N	Decid.	4	
16	P7	398.7	LB	5	30	10	85	5	0	N	N	N	Decid.	3	
16	P7	398.7	LB	4	35	30	70	0	0	N	N	N	Decid.	3	
16	P7	399.6	LB	3.6	13	90	10	0	0	N	N	N	Decid.	3	
16	P7	399.6	middle	~9.5	35	40	60	0	0	N	N	N	Decid.	3	
16	P7	399.6	LB	3.5	25	10	20	70	0	N	N	N	Decid.	2	
19	R11	419.5	LB	2.1	35	5	20	75	0	A	N	Y	Decid.	-	Part of beam
21	R12	466	RB	4.5	16	20	20	60	0	N	N	N	Decid.	3	
24	P11	505.8	center	~10	17	30	70	0	0	N	N	N	Decid.	2	Rootwad persist
24	P11	505.8	center	3	12	50	50	0	0	N	N	N	Decid.	2	
24	P11	508.4	center	2+	43	50	50	0	0	N	N	N	Cedar	5	Cedar slab
24	P11	510.4	LB	6.8	15	10	80	10	0	N	N	N	Willow	1	Log-jam this station/area
24	P11	510.4	LB	6.5	12	5	75	20	0	N	N	N	Willow	1	Cluster

				Length	Dia	Zone %									
NSO	Hab. ID	Sta.	Bank	(meter)	(cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
24	P11	510.4	LB	6.8	15	5	65	30	0	N	N	N	Willow	1	Cluster
24	P11	510.4	LB	~5	11	5	95	0	0	N	N	N	Willow	1	Cluster
24	P11	510.4	LB	4	13	0	5	95	0	N	N	N	Willow	1	Cluster
24	P11	510.4	LB	~7	13	0	50	50	0	N	N	N	Willow	1	Cluster
24	P11	510.5	LB	2.5	70	30	60	10	0	N	N	N	Cedar	5	Old part of stump
24	P11	511.5	cross	~4	20	50	50	0	0	N	N	N	Conifer	5	
24	P11	511.5	cross	2.5	60	80	20	0	0	N	N	N	Conifer	4	Stump
24	P11	511.5	cross	~4.5	14	10	5	85	0	N	N	N	Willow	1	
25	R14	518	LB	~3	30	0	80	20	0	N	N	N	-		Plank 6 x 12"
25	R14	518	LB	2.6	40	20	80	0	0	N	N	N	Decid.	5	
25	R14	519	LB	2.5	35	5	10	85	0	N	N	N	Decid.	5	
26	P12	518	cross	~3	~25	10	60	30	0	N	N	N	?	4	cluster upstream of channel
26	P12	525.9	cross	6+	14	5	90	5	0	N	N	N	Decid.	3	buried one end
26	P12	525.9	cross	5.5	13	0	95	5	0	N	N	N	Alder	3	
26	P12	525.9	cross	3	13	20	70	10	0	N	N	N	Alder	3	
26	P12	525.9	cross	2+	12	100	0	0	0	N	N	N	Decid.	3	
26	P12	525.9	LB	~6	18	40	5	55	0	N	N	N	Alder	3	
26	P12	525.9	LB	2.5	25	0	40	60	0	N	N	N	Decid.	4	
26	P12	525.9	LB	~3	14	0	25	75	0	N	N	N	Alder	3	
26	P12	525.9	LB	~6	23	0	40	60	0	N	N	N	Alder	3	
26	P12	526	LB	~4	26	20	5	75	0	N	N	N	?	5	End Day.
				117.3	1162										

Stream: Little Bear Creek **Reach: 2 Wood**
Date: 06/29/01
Crew: Scott & Joe

						Zone %									
NSO	**Hab ID**	**STA**	**Bank**	**Length**	**Dia**	**Z1**	**Z2**	**Z3**	**Z4**	**Origin**	**Pool**	**MM**	**Species**	**Decay Class**	**Comments**
27	R15	543	LB	3+	35	80	20	0	0	N	N	N	?	5	Embedded
27	R15	547.4	LB	4.4	32	5	90	5	0	N	N	N	?	5	
27	R15	556.5	LB	2.3	30	70	30	0	0	N	N	N	Conifer	5	
27	R15	556.5	LB	3.8	18	5	30	65	0	N	N	N	Alder	3	
27	R15	568	LB	2.3	14	50	50	0	0	N	N	N	?	4	
27	R15	572.3	LB	2.4	10	10	90	0	0	N	N	N	?	3	
27	R15	575.1	LB	2.4	70	5	45	50	0	N	N	N	Cedar	5	Stump
27	R15	594.8	cross	15.5	39	2	18	80	0	N	N	N	Alder	4	
27	R15	594.8	cross	4.5	12	0	100	0	0	N	N	N	Alder	2	
28	P13	608	cross	9.3	19	30	40	30	0	N	N	N	Alder	3	Rootwad attatched
28	P13	608.5	RB	2	75	20	60	20	0	N	N	N	Decid.	5	Stump
30	P14	631.4	LB	2.3	100	95	5	0	0	N	N	N	Conifer	5	Stump
30	P14	634.2	in strm	1	20	80	20	0	0	N	N	N	?	5	Stump
30	P14	634.2	in strm	0.8	40	90	10	0	0	N	N	N	?	5	Stump
30	P14	636.4	in strm	3+	15	100	0	0	0	N	N	N	?	5	
30	P14	636.4	LB	1.3	100	30	40	30	0	N	N	N	?	5	Stump
31	R17	661.8	LB	3.6	35	60	40	0	0	N	N	N	?	5	
31	R17	671	RB	4.2	13	5	45	50	0	N	N	N	Alder	2	Beaver dropped-in past
31	R17	671	RB	3.8	18	40	60	0	0	N	N	N	Alder	4	
31	R17	662	RB	4.5	24	5	95	0	0	N	N	N	Alder	2	
32	R18	663	RB	2	19	5	90	5	0	N	N	N	Alder	2	
32	P15	663	RB	4.8	41	0	60	40	0	N	N	N	Decid.	5	
33	P15	686.1	2/3cross	~20	38	40	30	30	0	N	N	N	Cedar	1	
33	P15	686.1	LB	~25	70	5	20	70	5	N	N	N	Cedar	1	
33	P15	688.4	middle	4.3	20	50	50	0	0	N	N	N	?	4	
33	P15	688.4	middle	2+	15	100	0	0	0	N	N	N	?	3	
33	P15	690.9	middle	1.5+	110	30	60	10	0	N	N	N		5	Stump- cedar
33	P15	692.6	cross	~25	80	20	60	20	0	N	N	N	Cedar	1	fell same time last year?

						Zone %									
NSO	Hab ID	STA	Bank	Length	Dia	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
33	P15	692.6	middle	2	15	100	0	0	0	N	N	N	?	4	
33	P15	693	middle	2+	20	75	25	0	0	N	N	N	?	4	
33	P15	693	middle	2+	20	80	20	0	0	N	N	N	?	4	
33	P15	694	cross	~20	60	95	5	0	0	N	Y	N	Cedar	3	Created plunge
34	P16	710	middle	2.5	25	100	0	0	0	N	N	N	dogwood	4	Pacific Dogwood
36	P17	736.7	RB	2	12	60	40	0	0	N	N	N	?	2	Recent beaver activity
36	P17	738.1	RB	7.3	28	50	30	20	0	N	Y	N	Alder	3	Burned
39	P19	768.2	cross	~20	55	10	60	30	0	N	Y	N	Cedar	2	
39	P19	769	cross	5	130	10	90	0	0	N	Y	N	Cedar	5	
40	P20	770	RB	3.5	13	15	85	0	0	N	N	N	Alder	2	
39	P19	767	RB	~3	11	50	50	0	0	N	N	N	Decid.	4	
41	P21	788.7	LB	~15	80	20	40	40	0	N	Y	N	BLM	3	BLM = Big-leaf Maple
41	P21	788.7	LB	~10	26	10	10	80	0	N	Y	N	Alder	4	
41	P21	794	center	1.7+	50	30	70	0	0	N	N	N	?	4	Beaver using Japanese Knotweed
44	P22	845.1	cross	10	44	0	30	50	20	N	N	N	Cotton	1	
44	P2	846	LB	1.9+	30	100	0	0	0	N	N	N	?	4	
46	R24	872	RB	6.1	15	10	50	40	0	N	N	N	Alder	2	
46	R24	873	LB	2.9	29	95	5	0	0	N	N	N	?	5	
46	R24	875.6	LB	5.1	12	5	90	5	0	N	N	N	Alder	2	
46	R24	878.1	RB	2.7	17	5	95	0	0	N	N	N	Alder	3	
47	P23	889.1	LB	6	45	0	30	70	0	N	N	N	Conifer	4	On top of CMP
47	P23	890.2	LB	3.8	24	70	30	0	0	N	N	N	Conifer	5	
49	P24	897.5	LB	4.6	15	90	10	0	0	N	N	N	Decid.	4	
49	P24	898.2	LB	3.5	21	0	100	0	0	N	N	N	Decid.	4	
49	P24	898.5	RB	8	24	50	50	0	0	N	N	N	Decid.	4	
49	P24	898.5	RB	7.6	21	5	90	5	0	N	N	N	Alder	3	
49	P24	905.3	RB	3.8	23	20	70	10	0	N	N	N	DEC	4	
49	P24	905.3	RB	~6.5	14	5	30	40	25	N	N	N	ALD	3	
49	P24	910.1	CROSS	9.3	70	60	40	0	0	N	Y	N	CON	5	
49	P24	913.2	1/2 CROSS	4	30	70	30	0	0	N	Y	N	conifer	5	
49	P24	913.2	RB	3.3	20	90	10	0	0	N	N	N	conifer	5	
				184.5	2111										

Stream: Little Bear Creek
Date: 7/02/01
Crew: Scott and Joe

Reach: 2. Wood

				Length	Dia.	Zone %									
NSO	Hab ID	STA	Bank	(m)	(cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
51	R26	915	RB	3.8	18	60	40	0	0	N	N	N	?	5	
51	R26	929.2	RB	1.4	60	10	40	50	0	N	N	N	Conifer	3	Stump
53	P26	964.8	cross	4.7	80	30	60	10	0	N	N	N	Cedar	5	Burned
53	P26	965	middle	2	20	100	0	0	0	N	N	N	?	4	
55	P27	978	RB	12.7	70	5	15	80	0	N	N	N	?	5	Log-jam
55	P27	979	RB	~7	28	5	15	30	40	N	N	N	Alder	2	"
55	P27	978	RB	2.5	20	15	85	0	0	N	N	N	?	4	"
55	P27	979	RB	3.5	13	0	20	80	0	N	N	N	Alder	3	"
55	P27	979.5	RB	3	15	10	30	60	0	N	N	N	Alder	3	"
55	P27	986	LB	2.4	14	10	90	0	0	N	N	N	Decid.	4	Spread out - shallow area
55	P27	986	LB	~7	18	60	40	0	0	N	N	N	Decid.	4	"
55	P27	986	LB	3	26	30	70	0	0	N	N	N	Cedar	5	Stump
55	P27	986	LB	4.5	22	40	60	0	0	N	N	N	Decid.	3	"
55	P27	986	LB	3	11	10	90	0	0	N	N	N	Decid.	3	"
55	P27	988.9	cross	~25	70	10	10	40	40	N	Y	N	Cedar	1	At bend in stream
55	P27	988.9	RB	~4	50	10	40	50	0	N	N	N	Conifer	4	In previous log-jam
55	P27	989	RB	~7.5	20	5	10	85	0	N	N	N	Alder	3	In previous log-jam
56	R29	1007	RB	6.1	60	40	55	5	0	N	N	N	Decid.	5	burn marks
56	R29	1013.9	RB	~5	13	10	30	30	30	N	N	N	Alder	3	
57	P28	1042.6	LB	2+	16	0	95	5	0	N	N	N	Willow	3	Embedded
57	P28	1045.2	LB	2.9	24	40	40	20	0	N	N	N	Conifer	5	Burned
57	P28	1045.2	LB+	6.5	60	60	40	0	0	N	N	N	Conifer	5	Burned
57	P28	1046.7	CROSS	6.3	50	100	0	0	0	N	~Y	N	Conifer	5	
57	P28	1050.8	MID	3.5	24	100	0	0	0	N	N	N	Conifer	5	
58	P29	1057.2	MID	2.4	15	20	70	10	0	N	N	N	?	4	
58	P29	1064	MID	3	20	100	0	0	0	N	N	N	?	5	
59	R30	1068.2	LB	4.5+	20	20	80	0	0	N	N	N	?	4	
59	R30	1069	LB	2.4	20	90	10	0	0	N	N	N	?	4	

				Length	Dia.	Zone %									
NSO	Hab ID	STA	Bank	(m)	(cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
59	R30	1071	LB	4.5	29	95	5	0	0	N	N	N	?	5	
60	R30	1079.3	LB	3.8	30	20	80	0	0	N	N	N	?	4	
60	P30	1087.4	RB	2.7+	60	100	0	0	0	N	N	N	?	5	
62	R32	1111.2	RB	3.5	13	40	60	0	0	N	N	N	Alder	3	Lots reed canary grass
62	R32	1111.2	RB	3+	25	100	0	0	0	N	N	N	?	5	RB
63	R33	1117	LB	9.1	37	5	95	0	0	N	N	N	Alder	3	
63	R33	1120	LB	7+	17	5	90	5	0	N	N	N	?	4	Beaver Chew
63	R33	1125	LB	7.5	12	5	10	85	0	N	N	N	Alder	3	
63	R33	1125	LB	8	17	10	80	10	0	N	N	N	Alder	2	
63	R33	1125	LB	2+	25	0	10	90	0	N	N	N	Decid.	4	
63	R33	1125	RB	2.3	10	100	0	0	0	N	N	N	Conifer	5	
63	R33	1125	LB	2.2	20	0	50	50	0	N	N	N	Decid.	3	
63	R33	1126.4	LB	1.6+	40	95	5	0	0	N	Y	N	Conifer	5	Pocket pool
63	R33	1127	cross	4.5+	13	40	40	20	0	N	N	N	Decid.	4	
64	P31	1133.3	LB	2+	40	95	5	0	0	N	N	N	Conifer	5	Buried stump next to this
64	P31	1138.5	middle	4	15	90	5	5	0	N	N	N	Decid.	4	Nice pool
64	P31	1140.8	cross	12.5+	70	100	0	0	0	N	Y	N	Conifer	5	Embedded
65	P32	1148	LB	3.5+	27	65	25	10	0	N	N?	N	Conifer	5	Embedded
65	P32	1157	cross	5.8	16	50	45	5	0	N	N	N	Alder	3	
65	P32	1157	RB	2	35	10	85	5	0	N	N	N	Conifer	5	Raccoon tracks
65	P32	1158.5	cross	7.6	14	5	30	65	0	N	N	N	Alder	1	
67	P33	1165.5	cross	~30	70	5	10	30	55	N	N	N	Conifer	1	Cluster.
				139.9											

Stream: Little Bear Creek **Reach: 2 WOOD**
Date: 7/06/01
Crew: Scott & Joe

						Zone %								Decay	
NSO	Hab ID	STA	Bank	Length	Dia	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Class	Comments
70	R36	1184	LB	2	21	5	95	0	0	N	N	N		5	
71	R37	1187	RB	2.9	210	5	10	75	10	N	N	N	Conifer	4	Giant Stump
71	R37	1187	RB	2.4+	18	30	70	0	0	N	N	N		5	
71	R37	1189.3	LB	5.2	25	5	80	15	0	N	N	N	Decid.	4	
71	R37	1191.8	LB	3.1	19	0	95	5	0	N	N	N	Decid.	4	
71	R37	1191.8	cross	7	12	5	5	80	10	N	N	N	Alder	1	
71	R37	1191.8	LB	4.1	17	0	5	10	85	N	N	N	Alder	3	
75	P37	1235.6	LB	5.4	19	5	95	0	0	N	N	N	Alder	3	Photo 4, Roll 3
80	R43	1294.3	LB	3.5	33+	50	50	0	0	N	Y	N		4	Photo 3, Roll 3
80	R43	1296.8	LB	6.2	23	5	10	85	0	N	N	N	Alder	3	
81	P39	1302.7	cross	11.5	30	10	80	10	0	N	N	N	Alder	1	
81	P39	1303	LB	7.1	26	15	85	0	0	N	N	N	Alder	3	
81	P39	1302.7	RB	5.2+	13	0	20	80	0	N	N	N	Alder		
82	P40	1315.9	cross	3+	65+	100	0	0	0	N	N	N	Conifer	5	
84	R44	1322.7	LB	2.7	40	20	80	0	0	N	N	N	Conifer	5	
84	R44	1325.5	LB	4.7+	15+	5	45	50	0	N	N	N	Alder	3	Little salmonids
84	R44	1328.9	RB	6.5	20	90	10	0	0	N	N	N	Alder	3	
84	R44	1328.9	RB	3.2+	~40	10	90	0	0	N	N	N	Decid.	5	Embedded
85	P42	1346.1	cross	2.8	39	95	5	0	0	N	N	N	Decid.	4	Embedded
86	R45	1349	RB	6+	16	20	60	20	0	N	N	N	Alder	3	
88	P43	1361.3	cross	7.9	21	5	95	0	0	N	N	N	Alder	3	Lots of little fish~ 1.25"
88	P43	1362.3	RB	2.7	13	0	60	40	0	N	N	N	Alder	3	
88	P43	1363.6	center	2.5+	~26	90	10	0	0	N	N	N	Alder	3	
88	P43	1366.9	center	7.5	18	5	75	20	0	N	N	N	Alder	1	Beaver chew
88	P43	1370.6	RB	7.8	23	0	100	0	0	N	N	N	Alder	3	
88	P43	1370.6	RB	4.3	15	0	100	0	0	N	N	N	Alder	3	
89	P44	1373.2	LB	2+	45	100	0	0	0	N	N	N	Conifer	5	
89	P44	1373.2	LB	2+	~45	40	60	0	0	N	N	N	Conifer	5	Embedded

						Zone %								Decay	
NSO	Hab ID	STA	Bank	Length	Dia	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Class	Comments
89	P44	1373.2	LB	6.5	20	10	10	10	70	N	N	N	Alder	3	
89	P44	1373.2	LB	5	11	5	85	10	0	N	N	N	Alder	3	
91	P45	1391.2	LB	3	22	100	0	0	0	N	N	N	Alder	3	
91	P45	1395.2	cross	~12+	31	40	60	0	0	N	N	N	Alder	3	End in blackberries
91	P45	1398.1	cross	~10	33	10	70	20	0	N	N	N	Willow	1	Pacific willow
91	P45	1403.3	LB	6.4	16	5	80	15	0	N	N	N	Alder	3	
93	P46	1411.6	RB	2+	35	5	10	85	0	N	N	N	Alder	3	
93	P46	1413.3	CROSS	5.7	18	5	90	5	0	N	N	N	Alder	3	
93	P46	1413.3	RB	2+	18	30	40	30	0	N	N	N	Alder	3	
93	P46	1414	RB	3+	12	20	70	10	0	N	N	N	Alder	3	
94	P49	1417	center	5.2	60	0	100	0	0	N	N	N	Alder	3	Part of jam
94	P49	1417	LB	7	~25	80	20	0	0	N	Y	N	?	4	"
94	P49	1419.4	center	5.8	25	0	100	0	0	N	N	N	Alder	3	"
94	P49	1421	center	~4	32	40	50	10	0	N	N	N	Alder	4	"
94	R49	1421.9	cross	~5	14	95	5	0	0	N	N	N	Alder	3	"
95	R50	1470.8	center	2.6	16	0	100	0	0	N	N	N	Decid.	4	
95	R50	1771.1	center	7	20	40	60	0	0	N	N	N	Decid.	4	
95	R50	1488.2	LB	~7	25	10	10	80	0	N	N	N	Decid.	3	
96	R51	1507.9	LB	4+	13	40	60	0	0	N	N	N	Alder	3	
97	R52	1542.6	center	2.4	15	60	40	0	0	N	N	N	Decid.	4	
100	R55	1580.1	LB	5.1	22	50	50	0	0	N	N	N	Alder	3	4 spawning Lampreys digging a nest
103	R58	1642	RB	4.4	18	10	70	20	0	N	N	N	Alder	3	LB rip/rap 1651.7 - 1666.7
				166.3	1159										

Stream: Little Bear Creek **Reach: 3. Wood.**
Date: 7/19/01
Crew: Scott & Amy

						Zone %									
NSO	Hab ID	Station	Bank	Length (m)	Dia (cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
1	R1	0	middle	3.38	12	2	48	50	0	N	N	N	Alder	2	Jammed up against culvert
1	R1	0	middle	3.45	16	50	50	0	0	N	N	N	Alder	2	Jammed up against culvert
2	P1	5.5	RB	8.48	22	5	30	65	0	N	N	N	Alder	2	
2	P1	6.1	center	2.84	17	100	0	0	0	N	N	N	Alder	2	Embedded
2	P1	7.6	LB	9.3	17	0	15	20	65	N	N	N	Alder	2	Attached rootwad
2	P1	7.6	LB	13.64	26	2	38	20	40	N	N	N	Alder	2	Attached rootwad
2	P1	8.5	LB	2.92	19	100	0	0	0	N	N	N	Alder	3	Attached rootwad
3	R2	21.3	LB	1.9	17	0	100	0	0	N	N	N	Decid.	5	
3	R2	22.3	LB	2.2	16	80	20	0	0	N	N	N	Alder	3	
3	R2	23.8	RB	7.6	21	40	60	0	0	N	N	N	Alder	3	
3	R2	27.4	RB	4	20	10	80	10	0	N	N	N	Alder	1	Recently fell into stream
3	R2	34.4	LB	1.8	18	5	95	0	0	N	N	N	Alder	4	
3	R2	36.3	LB	6.1	19	0	100	0	0	N	N	N	Alder	2	
4	R3	53	RB	4.5	13	5	92	0	0	N	N	N	Alder	3	
4	R3	61.6	LB	3.8	18	80	20	0	0	N	N	N	Alder	3	
5	R4	67.7	middle	2.8	13	20	80	0	0	N	N	N	Decid.	4	Embedded
6	R5	85.5	center	5	20	90	10	0	0	N	N	N	Alder	3	Rootwad
6	R5	89.6	center	3.5	17	10	90	0	0	N	N	N	Alder	3	Rootwad
6	R5	95.4	LB	~3.7	13	5	20	75	0	N	N	N	Alder	2	
7	R6	100.3	RB	~15.2	~25	5	15	30	50	N	N	N	Alder	3	
7	R6	104.5	RB	7.6	26	50	50	0	0	N	N	N	Alder	3	
7	R6	121	LB	~5.2	16	5	20	50	25	N	N	N	Alder	2	
12	R9	194.4	cross	~6.1	28	0	5	65	30	N	N	N	Decid.	5	
12	R9	194.4	RB	4.5	30	0	100	0	0	N	N	N	Alder	3	
13	P4	210.3	RB	6.1	27	20	75	5	0	N	N	N	Decid.	4	
16	R11	252.1	LB	1.8	~75	75	25	0	0	N	N	N	Cedar	5	chunk of cedar stump
				107.21	461										

Stream:Little Bear Creek
Date:7/20/01

Reach: 3. Wood.
Crew:Scott & Amy

					Zone %										
NSO	Hab ID	STA	Bank	Length (m)	Dia. (cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
26	R16	349.3	cross	4.1	18	50	50	0	0	N	N	N	Alder	2	
26	R16	357.5	LB	4.7	20	40	60	0	0	N	N	N	Alder	2	
30	R19	383.4	RB	10.1	38	30	70	0	0	N	Y	N	Alder	3	Giant rootwad
30	R19	383.4	RB	9.0	32	0	20	70	10	N	Y	N	Alder	3	
31	P16	388.9	LB	7.6	33	20	60	20	0	N	Y	N	Alder	2	Giant rootwad
31	P16	390.8	LB	4.1	14	100	0	0	0	N	N	N	Alder	3	
31	P16	400.5	LB	8.3	25	20	80	0	0	N	Y	N	Alder	3	
31	P16	400.5	center	2.1	150	10	70	20	0	N	Y	N	Cedar	3	Giant cedar stump
32	P17	400.5	LB	3.6	33	80	20	0	0	N	Y	N	Alder	2	
32	P17	400.5	LB	4.8	24	10	90	0	0	N	Y	N	Alder	2	
32	P17	400.5	LB	7.2	22	0	100	0	0	N	N	N	Alder	3	
32	P17	400.5	LB	2.4	15	10	60	30	0	N	N	N	Decid.	4	
32	P17	400.5	LB	3.7	16	70	30	0	0	N	N	N	Decid.	4	
32	P17	400.5	RB	1.8	24	90	10	0	0	N	Y	N	Decid.	4	
32	P17	400.5	RB	4.6	14	5	75	20	0	N	N	N	Alder	3	
32	P17	400.5	RB	2.4	16	20	70	10	0	N	N	N	Alder	3	
32	P17	407.8	center	4.4	22	95	5	0	0	N	N	N	?	4	
32	P17	411.5	LB	4.5	14	100	0	0	0	N	N	N	Alder	3	
33	R20	413.3	RB	3.0	33	60	40	0	0	N	Y	N	Alder	4	
33	R20	413.3	RB	1.8	50	95	5	0	0	N	Y	N	Alder	5	
34	P18	424.3	cross	6.7	29	50	40	10	0	N	Y	N	Alder	1	
34	P18	424.3	cross	7.6	26	15	35	50	0	N	Y	N	Alder	2	
35	R21	429.8	LB	1.8	19	20	20	60	0	N	N	N	Alder	2	
35	R21	429.8	LB	2.1	24	10	30	60	0	N	N	N	Alder	2	
37	P19	459.6	LB	3.4	22	40	60	0	0	N	N	N	Decid.	4	
37	P19	459.6	LB	3.0	26	50	50	0	0	N	N	N	Decid.	4	
37	P19	463.9	center	4.7	16	100	10	0	0	N	N	N	Decid.	4	
37	P19	463.9	RB	5.5	25	20	30	50	0	N	N	N	Alder	3	
37	P19	463.9	RB	~3.7	~20	100	0	0	0	N	N	N	?	4	

					Zone %										
NSO	Hab ID	STA	Bank	Length (m)	Dia. (cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
37	P19	466	RB	~4.2	130	20	40	40	0	N	N	N	Conifer	4	Giant stump.
38	R23	500.8	LB	~4.6	19	40	60	0	0	N	N	N	Decid.	5	
38	R23	502.9	LB	2.6	15	5	25	70	0	N	N	N	Decid.	4	
38	R23	504.4	LB	2.8	45	40	60	0	0	N	N	N	Conifer	5	
38	R23	527.9	RB	2.4	29	50	50	0	0	N	N	N	Alder	3	
38	R23	542.8	LB	2.6	27	5	95	0	0	N	N	N	Alder	4	
38	R23	544.1	LB	3.0	17	60	40	0	0	N	N	N	Alder	3	
39	P20	545	LB	3.0	20	50	50	0	0	N	N	N	Decid.	3	
39	P20	546.5	LB	2.0	14	70	30	0	0	N	N	N	Decid.	2	
39	P20	549.6	RB	~4.6	12	5	95	0	0	N	N	N	Decid.	3	
39	P20	551.7	LB	~3.0	25	5	70	25	0	N	N	N	Decid.	4	
42	R26	584.6	LB	1.8	~80	40	60	0	0	N	N	N	Cedar	5	
42	R26	591	LB	3.1	31	70	30	0	0	N	N	N	Alder	2	
43	P21	598.6	RL	4.6	15	60	40	0	0	N	y	N	Willow	3	Rootwad attached plus
44	R27	604.4	LB	2.8	22	40	50	10	0	N	N	N	Decid.	4	
45	P22	604.4	center	3.0	25	20	40	40	0	N	N	N	Alder	2	
45	P22	625.1	center	~7.6	25	50	20	20	0	N	Y	N	Conifer	4	Jam, LWD from here down.
45	P22	630.6	center	~4.6	15	80	20	0	0	N	Y	N	Alder	2	
45	P22	630.6	center	~6.1	22	30	30	40	0	N	Y	N	Alder	3	
45	P22	630.6	center	~6.1	18	25	75	0	0	N	Y	N	Alder	2	
45	P22	630.6	center	~4.6	22	20	40	40	0	N	Y	N	Alder	2	Snags
45	P22	630.6	center	~4.6	17	20	40	40	0	N	Y	N	Alder	3	Snags
45	P22	630.6	center	~9.1	20	20	30	25	25	N	Y	N	Alder	3	Snags
45	P22	630.6	center	~6.1	15	25	25	25	25	N	Y	N	Alder	3	Snags
45	P22	630.6	center	~10.7	32	40	60	0	0	N	Y	N	Alder	2	
45	P23	630.6	center	~7.6	16	20	10	10	0	N	Y	N	Alder	2	
45	P24	630.6	center	~6.1	21	0	10	90	0	N	Y	N	Alder	2	
45	P25	630.6	center	~6.1	26	0	100	0	0	N	Y	N	Alder	3	
				162.7	1495										

Stream: Little Bear Creek
Date: 7/31/01

Reach: 3. Wood.
Crew:

					Zone %										
NSO	Hab ID	STA	Bank	Length (m)	Dia (cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
49	P24	694.3	LB	2.9	21	50	50	0	0	N	N	N	Alder	3	
49	P24	694.3	RB	6.3	15	5	30	65	0	N	N	N	Decid.	1	
49	P24	694.3	RB	5.8	28	50	25	25	0	N	N	N	Alder	2	
49	P24	694.3	cross	15.5	100	30	40	10	20	N	Y	N	FIR	2	Doug-fir
49	P24	694.3	RB	3.4	~30	50	40	10	0	N	N	N	?	2	
49	P24	694.3	RB	4.6	32	50	50	0	0	N	N	N	Cedar	2	
51	R31	706.8	RB	5.2	16	75	25	0	0	N	N	N	Alder	2	
54	R33	766.6	cross	~10.7	37	5	70	20	5	N	N	N	Cedar	1	
54	R33	768.1	cross	~6.1	20	5	70	20	5	N	N	N	Cedar	1	
54	R33	768.4	cross	~12.2	42	5	70	20	5	N	N	N	Cedar	1	
54	R33	780.3	LB	2.3	35	100	0	0	0	N	N	N	Cedar	4	
57	P27	806.8	center	7.3	40	20	80	0	0	N	Y	N	Alder	3	
57	P27	806.8	RB	4.0	30	30	70	0	0	N	N	N	Alder	3	
58	R35	811.1	LB	4.7	27	10	80	10	0	N	N	N	Alder	3	
58	R35	811.1	LB	1.7	24	40	60	0	0	N	N	N	Cherry?	3	
58	R35	811.1	LB	2.4	120	90	10	0	0	N	N	N	Cedar	5	Chunk of stump
59	R36	816.9	LB	10.9	35	0	100	0	0	N	N	N	Alder	2	
60	P28	827.5	LB	3.8	26	95	5	0	0	N	N	N	Alder	3	
60	P28	839.4	center	1.8+	34	99	1	0	0	N	N	N	Decid.	4	Embedded, raccoon tracks.
60	P28	839.4	center	1.8+	26	99	1	0	0	N	N	N	Decid.	4	Embedded, pileated woodpecker
60	P28	847.6	cross	5.8	25	60	40	0	0	N	Y	N	Alder?	4	
60	P28	847.6	cross	5.1	36	75	25	0	0	N	Y	N	Alder?	4	
64	R39	877.5	RB	6.4	21	80	20	0	0	N	N	N	Alder	2	
64	R39	892.8	RB	3.6	35	0	40	60	0	N	N	N	Alder	4	
64	R39	891.5	RB	4.8	17	5	95	0	0	N	N	N	Alder	2	
65	R40	905	RB	4.7	29	10	80	10	0	N	N	N	Alder	2	
65	R40	909.5	LB	4.7	28	10	90	0	0	N	N	N	Alder	3	
67	P30	915.9	LB	4.6	90	20	80	0	0	N	N	N	Cedar	5	
67	P30	919.6	cross	6.1	22	0	60	20	20	N	N	N	Cherry	1	House LB
67	P30	920.5	cross	6.1	28	0	60	20	20	N	N	N	Cherry	1	
67	P30	922.3	cross	6.1	22	5	20	75	0	N	N	N	Cherry	1	
				138.7											

Stream: Little Bear Creek
Date: 8/01/01

Reach: 3. Wood.
Crew: Scott & Dan

					Zone %										
NSO	Hab ID	STA	Bank	Length (m)	Dia (cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
71	R44	1008	RB	3.4	30	40	60	0	0	N	N	N	Alder	3	
72	P32	1015	LB	6.8	28	50	50	0	0	N	N	N	Alder	4	
75	P34	1054	cross	12.2	37	30	20	25	25	N	Y	N	Cedar	3	
75	P34	1055	cross	4.8	19	90	10	0	0	N	Y	N	Decid.	4	
75	P34	1054	cross	10.7+	32	25	25	25	25	N	Y	N	Cedar	3	
75	P34	1053	LB	2.4	40	10	90	0	0	N	N	N	Cedar	3	Broken, large alive cedar, not counted.
75	P34	1054	LB	2.4	30	5	95	0	0	N	N	N	Alder	3	Broken, see photo 8
76	P35	1059	center	6.6	20	5	80	15	0	N	N	N	Cedar	2	
76	P35	1142	LB	5.5	25	10	90	0	0	N	N	N	Cedar	3	
77	R47	1061	LB	5.5	42	15	85	0	0	N	N	N	Alder	2	
77	R47	1061	LB	4.7	15	40	60	0	0	N	N	N	Cedar	3	
78	P35	1076	cross	12.2+	50	10	30	30	30	N	Y	N	BLM	1	Giant big-leaf maple
80	P36	1109	RB	6.8	30	15	85	0	0	N	?Y	N	Cedar	3	
80	P36	1109	RB	7.0	25	10	90	0	0	N	?Y	N	Cedar	3	
82	P37	1125	cross	7.0	60	5	45	50	0	N	N	N	Alder	2	Old, big, rotten.
83	R50	1140	cross	7.6	29	5	55	40	0	N	N	N	Alder	3	
84	R51	1167	cross	6.1	20	10	90	0	0	N	N	N	Cedar	3	
84	R51	1167	LB+	4.6+	20	100	0	0	0	N	N	N	Cedar	3	
84	R51	1170	cross	5.5	19	5	95	0	0	N	N	N	Cedar	4	
84	R51	1170	LB+	1.8+	21	60	40	0	0	N	N	N	Cedar	4	
84	R51	1170	LB+	2.9	24	15	85	0	0	N	N	N	Cedar	4	
84	R51	1170	RB	3.7	30	5	95	0	0	N	N	N	Cedar	4	
84	R52	1181	RB	2.1	60	10	90	0	0	N	N	N	Cedar	5	
85	R52	1185	RB	4.9	18	40	60	0	0	N	N	N	Cedar	4	
86	P38	1187	LB	9.0	25	5	95	0	0	N	N	N	Cedar	1	
86	P38	1199	LB	2.1+	19	25	75	0	0	N	N	N	Decid.	4	
87	R53	1202	RB	6.7	20	5	45	30	20	N	N	N	Cedar	4	
87	R53	1202	RB	10.7+	40	0	5	45	50	N	N	N	Cedar	3	
87	R53	1204	LB	4.0	32	5	90	5	0	N	N	N	Fir	3	Doug-fir, broken.

					Zone %										
NSO	Hab ID	STA	Bank	Length (m)	Dia (cm)	Z1	Z2	Z3	Z4	Origin	Pool	MM	Species	Decay Class	Comments
87	R53	1205	LB	3.4	22	0	100	0	0	N	N	N	Decid.	4	
87	R54	1216	cross	12.2+	22	5	25	25	45	N	Y	N	Spruce	1	Pocket pool.
87	R54	1223	cross	6.1	29	50	50	0	0	N	Y	N	Cedar	4	
87	R54	1223	RB	3.0	35	0	100	0	0	N	N	N	Fir		
91	R57	1279	LB	5.2	22	10	90	0	0	N	N	N	Cedar	4	
92	R58	1288	center	4.2	32	0	95	5	0	N	N	N	BLM	4	
92	R58	1291	RB	4.9	35	10	65	10	15	N	N	N	Alder	1	
93	R59	1306	RB	2.1	35	40	60	0	0	N	N	N	Conifer	5	
94	P39	1310	RB	3.7	25	0	100	0	0	N	N	N	Alder	2	
				160.3	1117										

Appendix O

APPENDIX O:
DEA Wolman Pebble Count Data

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

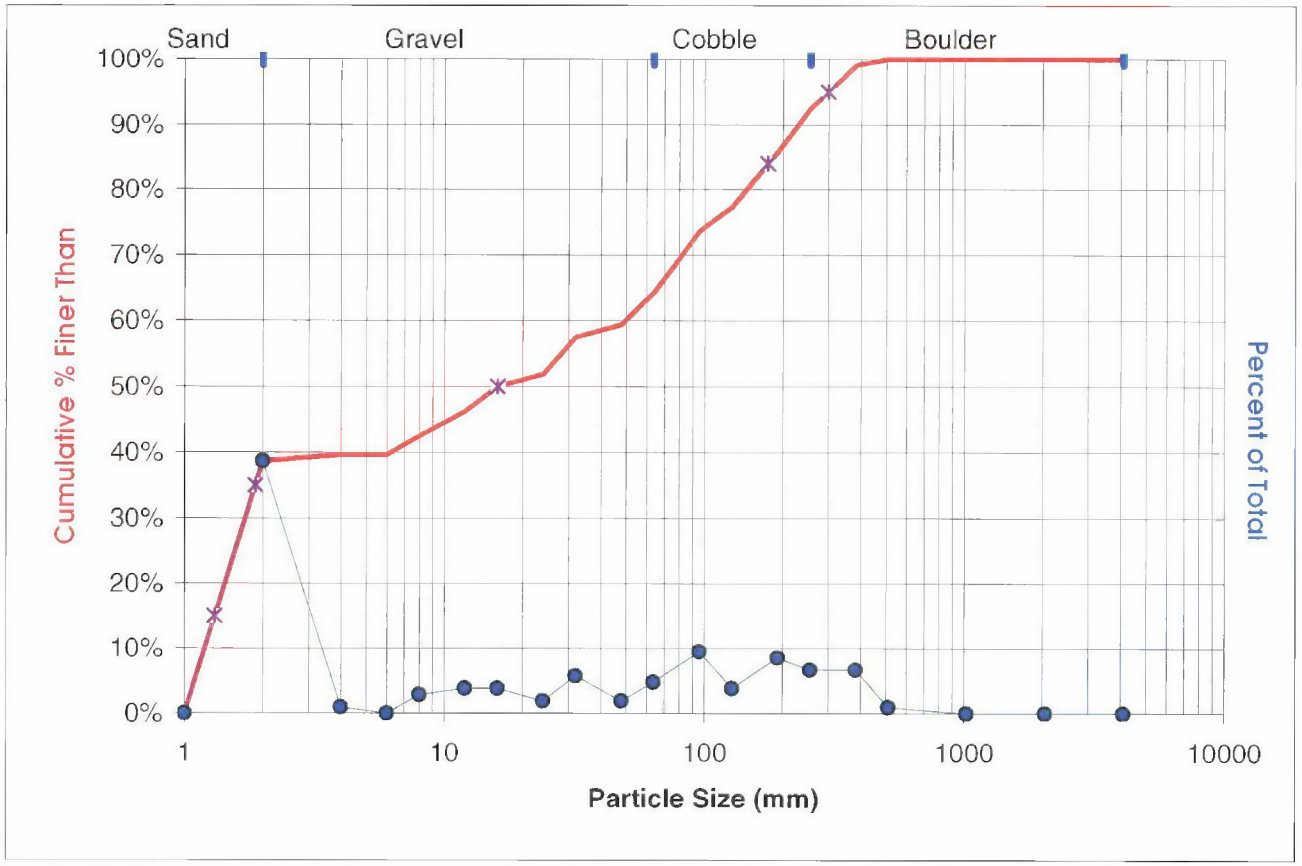
Pebble Count Worksheet

Comment: +/- 18.4M upstream of mouth (started immediately upstream of walk bridge)

Particle Size (mm)	% finer than	Total Count
< 2	39%	41
2 - 4	40%	1
4 - 6	40%	0
6 - 8	42%	3
8 - 12	46%	4
12 - 16	50%	4
16 - 24	52%	2
24 - 32	58%	6
32 - 48	59%	2
48 - 64	64%	5
64 - 96	74%	10
96 - 128	77%	4
128 - 192	86%	9
192 - 256	92%	7
256 - 384	99%	7
384 - 512	100%	1
512 - 1024	100%	0
1024-2048	100%	0
2048-4096	100%	0
	Total #	106

STREAM NAME: Little Bear Creek
ID NUMBER:
DATE: 6/25/01
CREW: Scott & Joe

Particle Size Distribution (mm)	Fines <6 mm	D35	D50	D84	D95
	40%	1.9	16.0	175.8	299.3



FILENAME: PebbleReach1_6-25-01a.xls ENTERED: 7/10/02

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

Pebble Count Worksheet

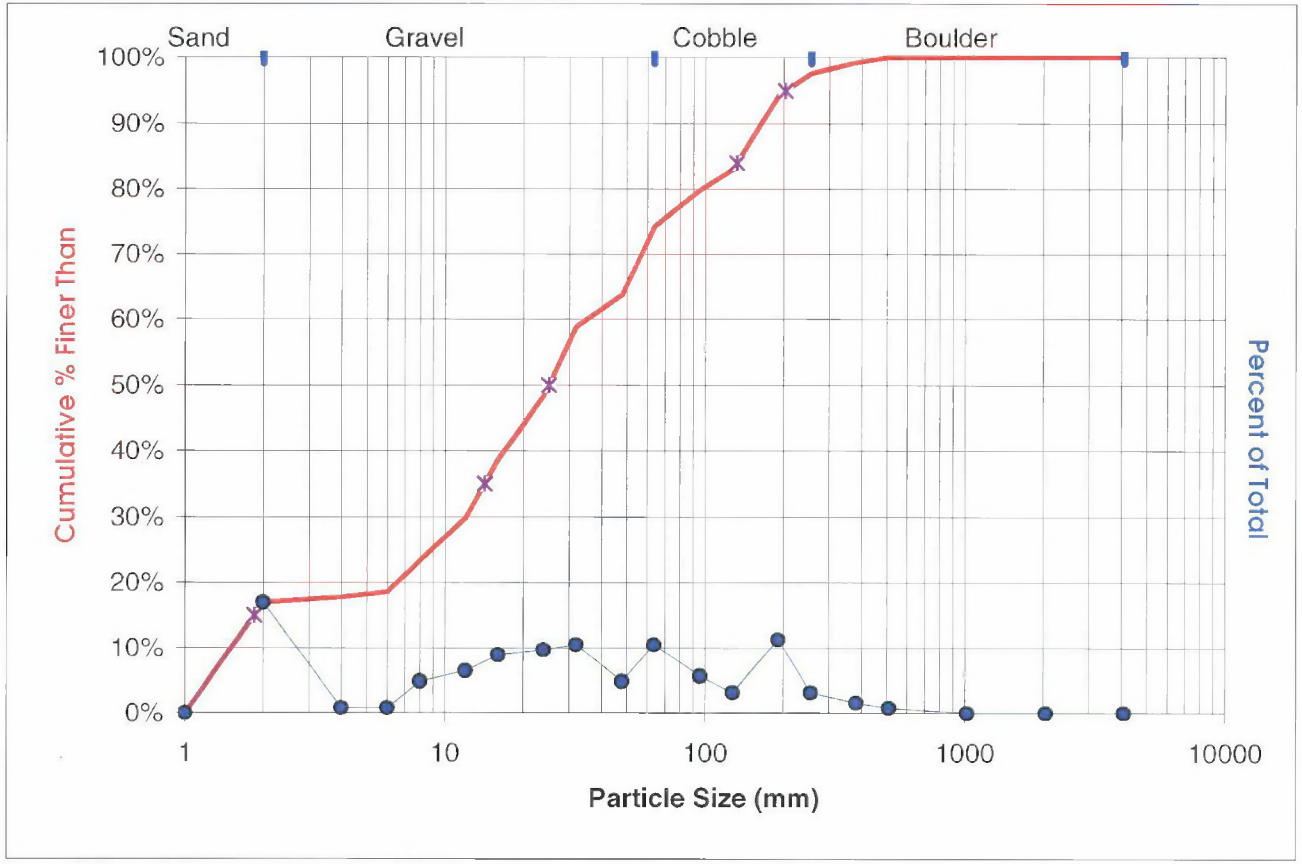
COMMENTS: immediately downstream of SR 202: very embedded

# of transects= 7

STREAM NAME: Little Bear Creek
ID NUMBER: NSO 14
DATE: 6/25/01
CREW: Scott &

Particle Size (mm)	% finer than	Total Count
< 2	17%	21
2 - 4	18%	1
4 - 6	19%	1
6 - 8	23%	6
8 - 12	30%	8
12 - 16	39%	11
16 - 24	48%	12
24 - 32	59%	13
32 - 48	64%	6
48 - 64	74%	13
64 - 96	80%	7
96 - 128	83%	4
128 - 192	94%	14
192 - 256	98%	4
256 - 384	99%	2
384 - 512	100%	1
512 - 1024	100%	0
1024-2048	100%	0
2048-4096	100%	0
	Total #	124

Particle Size Distribution (mm)	Fines <6 mm	D35	D50	D84	D95
	19%	14.2	25.1	132.4	203.4



FILENAME: PebbleReach1_06-25-01b.xls ENTERED: 7/10/02

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

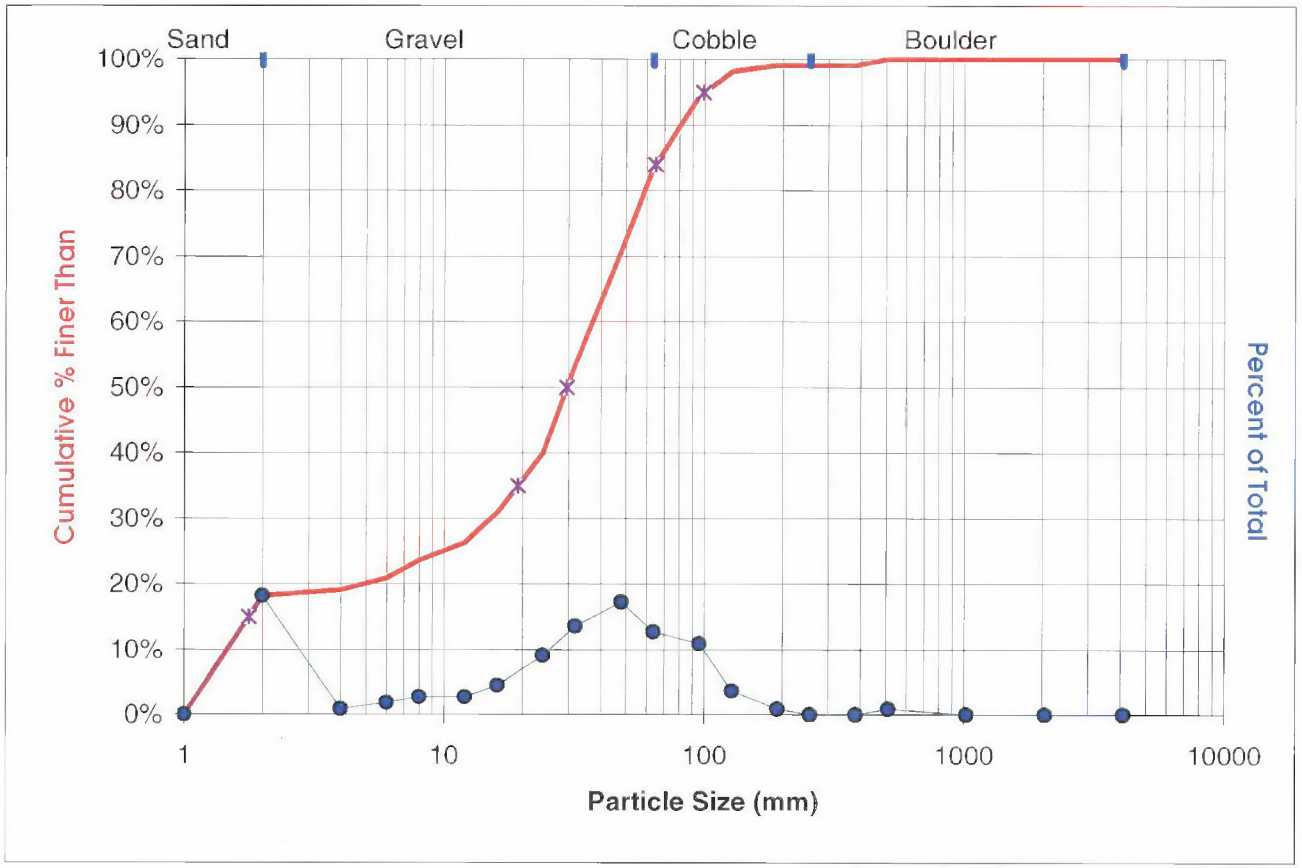
Pebble Count Worksheet

COMMENTS: Site: riffle immediately upstream of SR202 culvert

Particle Size (mm)	% finer than	Total Count
< 2	18%	20
2 - 4	19%	1
4 - 6	21%	2
6 - 8	24%	3
8 - 12	26%	3
12 - 16	31%	5
16 - 24	40%	10
24 - 32	54%	15
32 - 48	71%	19
48 - 64	84%	14
64 - 96	95%	12
96 - 128	98%	4
128 - 192	99%	1
192 - 256	99%	0
256 - 384	99%	0
384 - 512	100%	1
512 - 1024	100%	0
1024-2048	100%	0
2048-4096	100%	0
	Total #	110

STREAM NAME: Little Bear Creek
ID NUMBER: NSO 2
DATE: 6/25/01
CREW: Scott & Joe

Particle Size Distribution (mm)	Fines <6 mm	D35	D50	D84	D95
	21%	19.2	29.6	64.9	99.5



FILENAME: PebbleReach2_6-26-01.xls ENTERED: 7/10/02

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

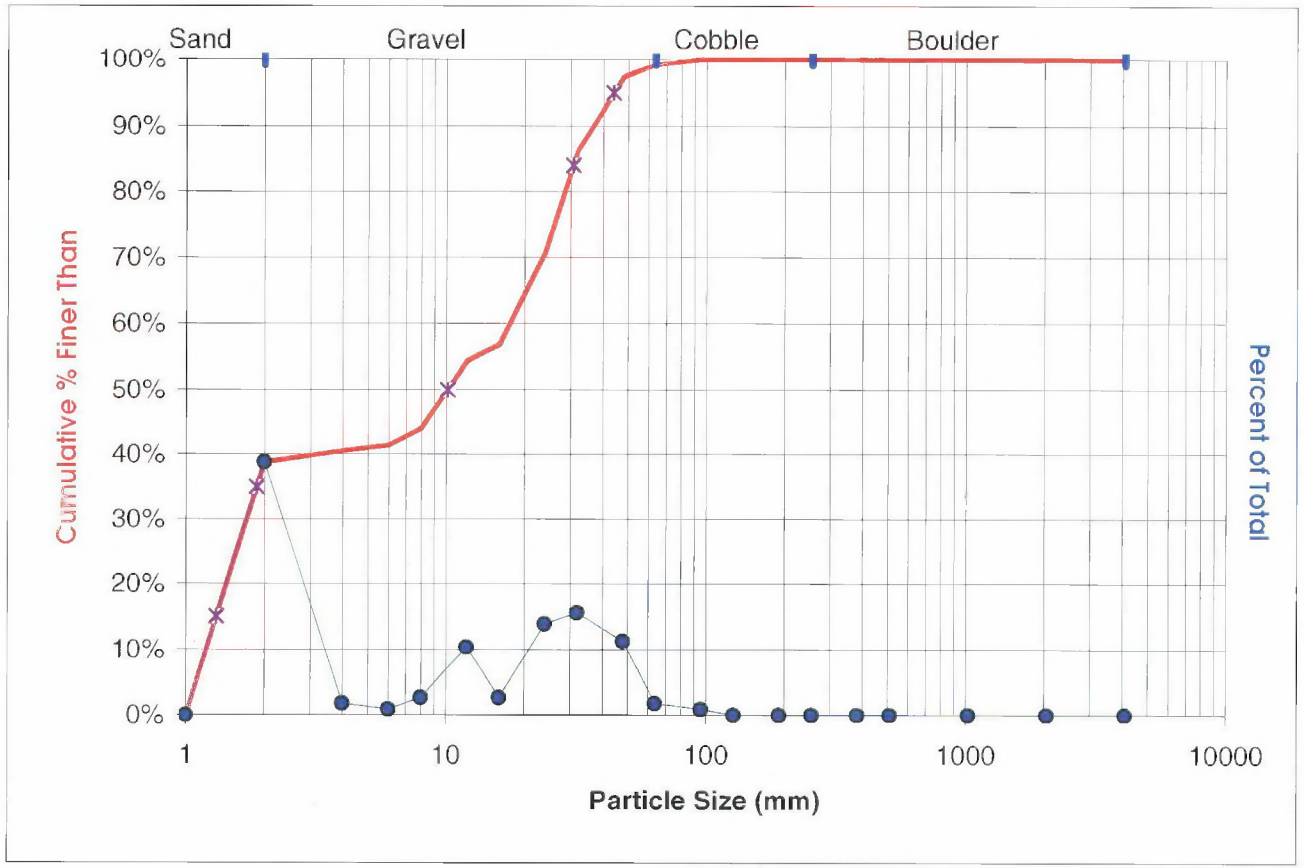
Pebble Count Worksheet

COMMENTS:# of transects 5

Particle Size (mm)	% finer than	Total Count
< 2	39%	45
2 - 4	41%	2
4 - 6	41%	1
6 - 8	44%	3
8 - 12	54%	12
12 - 16	57%	3
16 - 24	71%	16
24 - 32	86%	18
32 - 48	97%	13
48 - 64	99%	2
64 - 96	100%	1
96 - 128	100%	0
128 - 192	100%	0
192 - 256	100%	0
256 - 384	100%	0
384 - 512	100%	0
512 - 1024	100%	0
1024-2048	100%	0
2048-4096	100%	0
Total #		116

STREAM NAME: Little Bear Creek
ID NUMBER: NSO 15, R9
DATE: 6/28/01
CREW: Scott & Joe

Particle Size Distribution (mm)	Fines <6 mm	D35	D50	D84	D95
	41%	1.9	10.1	30.7	44.0



FILENAME: PebbleRreach2_6-28-01.xls1 ENTERED: 7/10/02

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

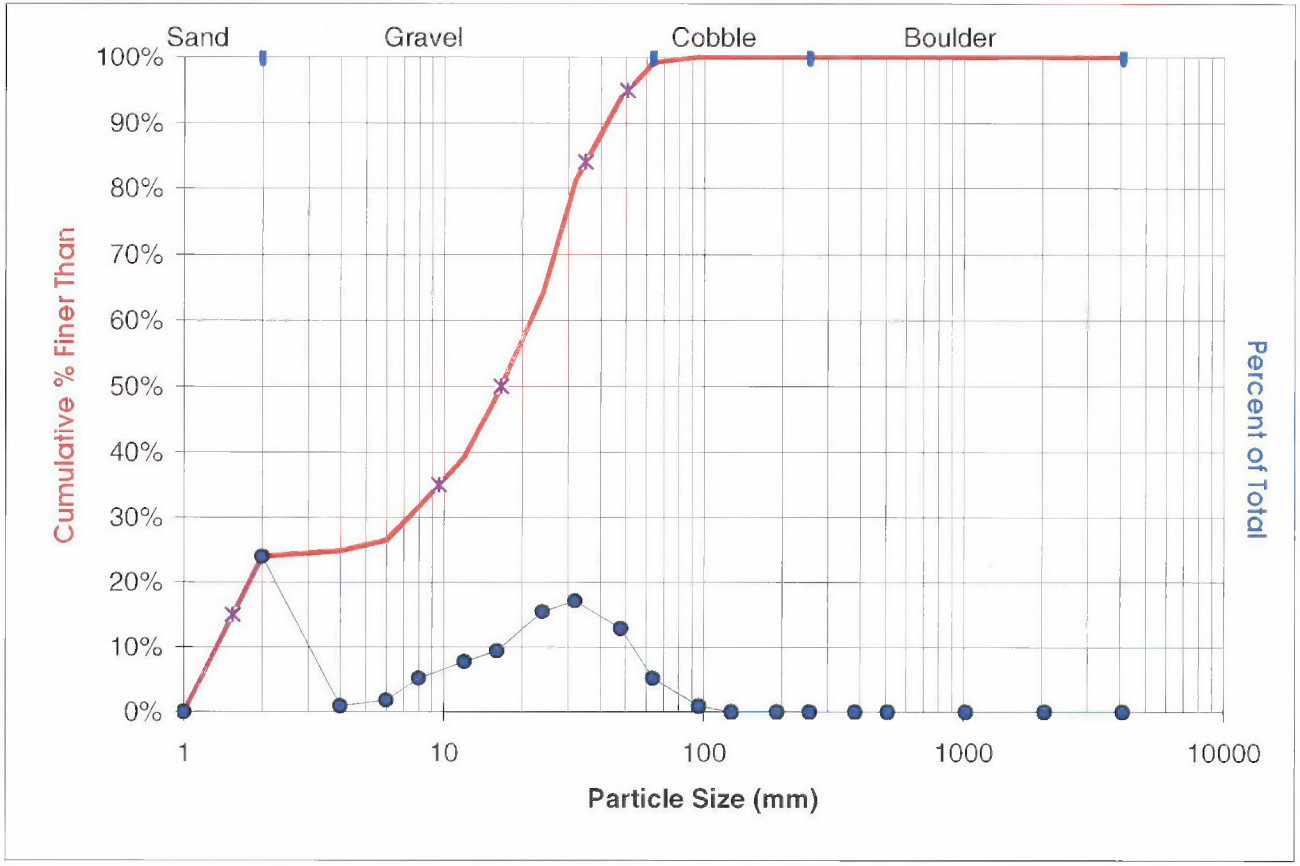
Pebble Count Worksheet

COMMENTS:sta. 558.9 at orange flag saying 1998 UW BJBI.

Particle Size (mm)	% finer than	Total Count
< 2	24%	28
2 - 4	25%	1
4 - 6	26%	2
6 - 8	32%	6
8 - 12	39%	9
12 - 16	49%	11
16 - 24	64%	18
24 - 32	81%	20
32 - 48	94%	15
48 - 64	99%	6
64 - 96	100%	1
96 - 128	100%	0
128 - 192	100%	0
192 - 256	100%	0
256 - 384	100%	0
384 - 512	100%	0
512 - 1024	100%	0
1024-2048	100%	0
2048-4096	100%	0
	Total #	117

STREAM NAME: Little Bear Creek
ID NUMBER:
DATE: 6/29/01
CREW: Scott & Joe

Particle Size Distribution (mm)	Fines <6 mm	D35	D50	D84	D95
	26%	9.6	16.5	35.0	50.7



FILENAME: PebbleReach2_6-29-01.xls1 ENTERED: 7/10/02

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

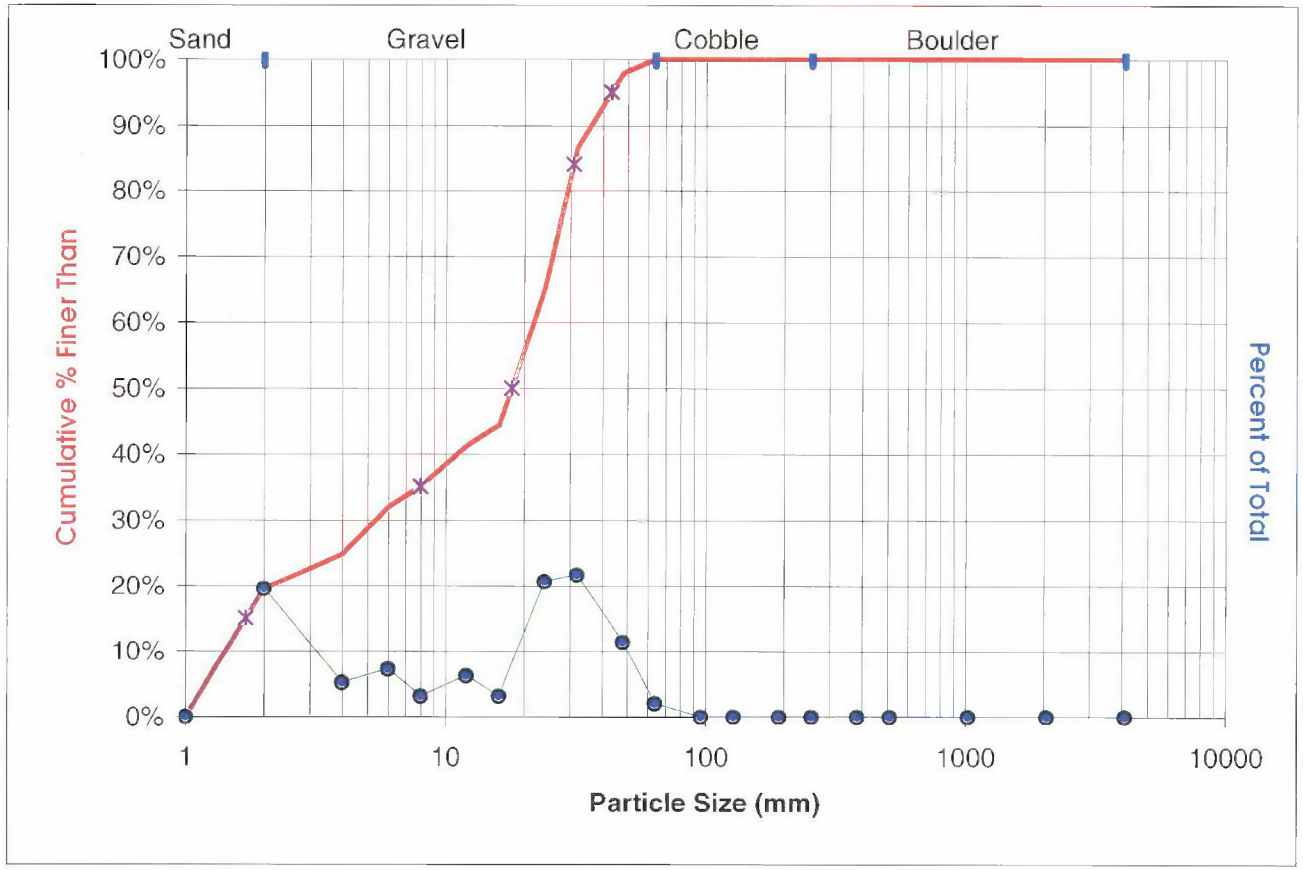
Pebble Count Worksheet

COMMENTS:just upstream of reach 27, sta. 1015, # of transects= 4

Particle Size (mm)	% finer than	Total Count
< 2	20%	19
2 - 4	25%	5
4 - 6	32%	7
6 - 8	35%	3
8 - 12	41%	6
12 - 16	44%	3
16 - 24	65%	20
24 - 32	87%	21
32 - 48	98%	11
48 - 64	100%	2
64 - 96	100%	0
96 - 128	100%	0
128 - 192	100%	0
192 - 256	100%	0
256 - 384	100%	0
384 - 512	100%	0
512 - 1024	100%	0
1024-2048	100%	0
2048-4096	100%	0
	Total #	97

STREAM NAME: Little Bear Creek
ID NUMBER: NSO 56, R29
DATE: 7/2/01
CREW: Scott & Joe

Particle Size Distribution (mm)	Fines <6 mm	D35	D50	D84	D95
	32%	8.0	17.9	30.9	43.2



FILENAME: PebbleReach2_7-2-011 ENTERED: 7/10/02

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

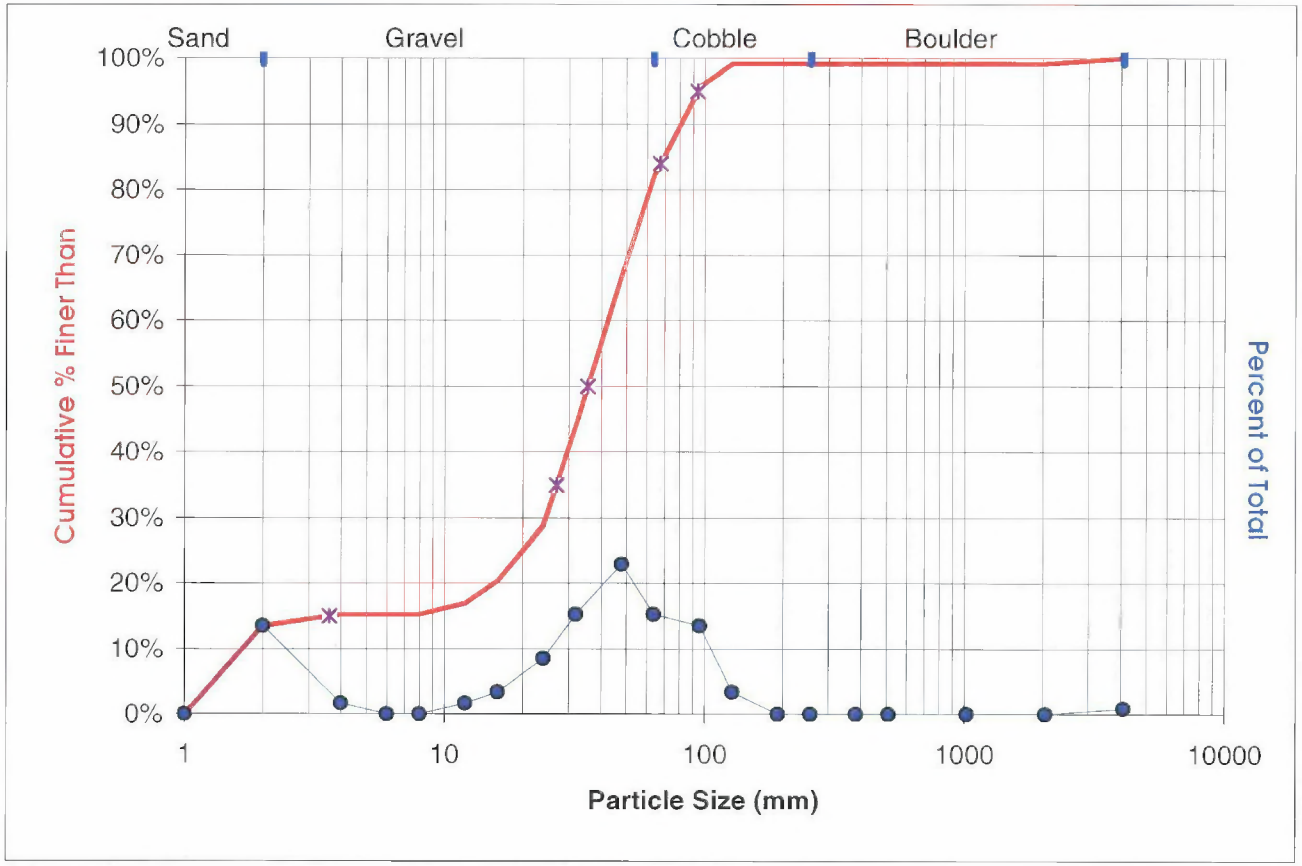
Pebble Count Worksheet

COMMENTS:# of transects=6, NSO= 76

Particle Size (mm)	% finer than	Total Count
< 2	14%	16
2 - 4	15%	2
4 - 6	15%	0
6 - 8	15%	0
8 - 12	17%	2
12 - 16	20%	4
16 - 24	29%	10
24 - 32	44%	18
32 - 48	67%	27
48 - 64	82%	18
64 - 96	96%	16
96 - 128	99%	4
128 - 192	99%	0
192 - 256	99%	0
256 - 384	99%	0
384 - 512	99%	0
512 - 1024	99%	0
1024-2048	99%	0
2048-4096	100%	1
Total #		118

STREAM NAME: Litle Bear Creek
ID NUMBER:
DATE: 7/6/01
CREW: Scott & Joe

Particle Size Distribution (mm)	Fines <6 mm	D35	D50	D84	D95
	15%	27.0	35.5	67.5	93.8



FILENAME: PebbleReach2_7-6-011 ENTERED: 7/10/02

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

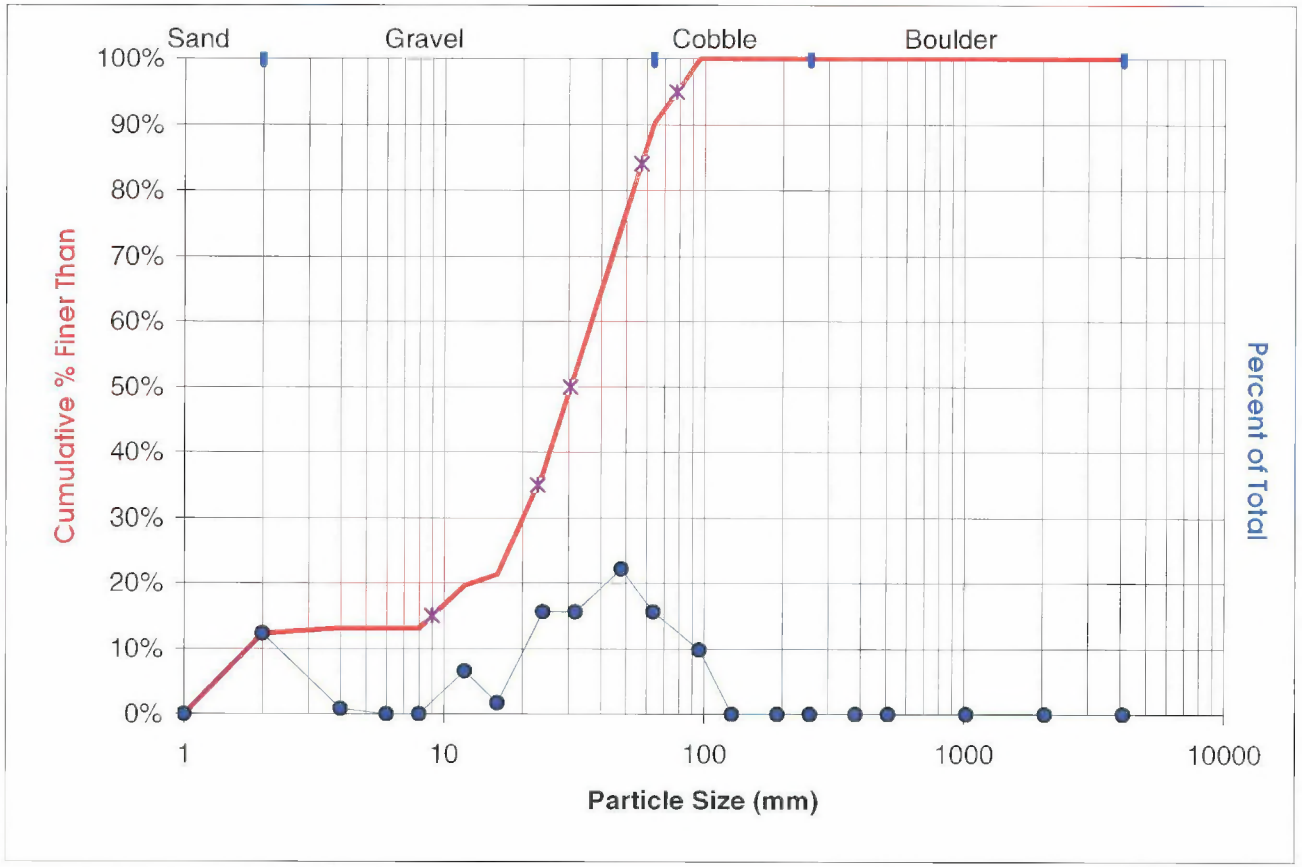
Pebble Count Worksheet

Particle Size (mm)	% finer than	Total Count
< 2	12%	15
2 - 4	13%	1
4 - 6	13%	0
6 - 8	13%	0
8 - 12	20%	8
12 - 16	21%	2
16 - 24	37%	19
24 - 32	52%	19
32 - 48	75%	27
48 - 64	90%	19
64 - 96	100%	12
96 - 128	100%	0
128 - 192	100%	0
192 - 256	100%	0
256 - 384	100%	0
384 - 512	100%	0
512 - 1024	100%	0
1024-2048	100%	0
2048-4096	100%	0
	Total #	122

COMMENTS:

STREAM NAME: Little Bear Creek
ID NUMBER: R2
DATE: 7/19/01
CREW: Scott & Amy

Particle Size Distribution (mm)	**Fines <6 mm**	**D35**	**D50**	**D84**	**D95**
	13%	**22.9**	**30.6**	**57.1**	**78.1**



FILENAME: PebbleReach3_7-19-01.xls ENTERED: 7/10/02

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

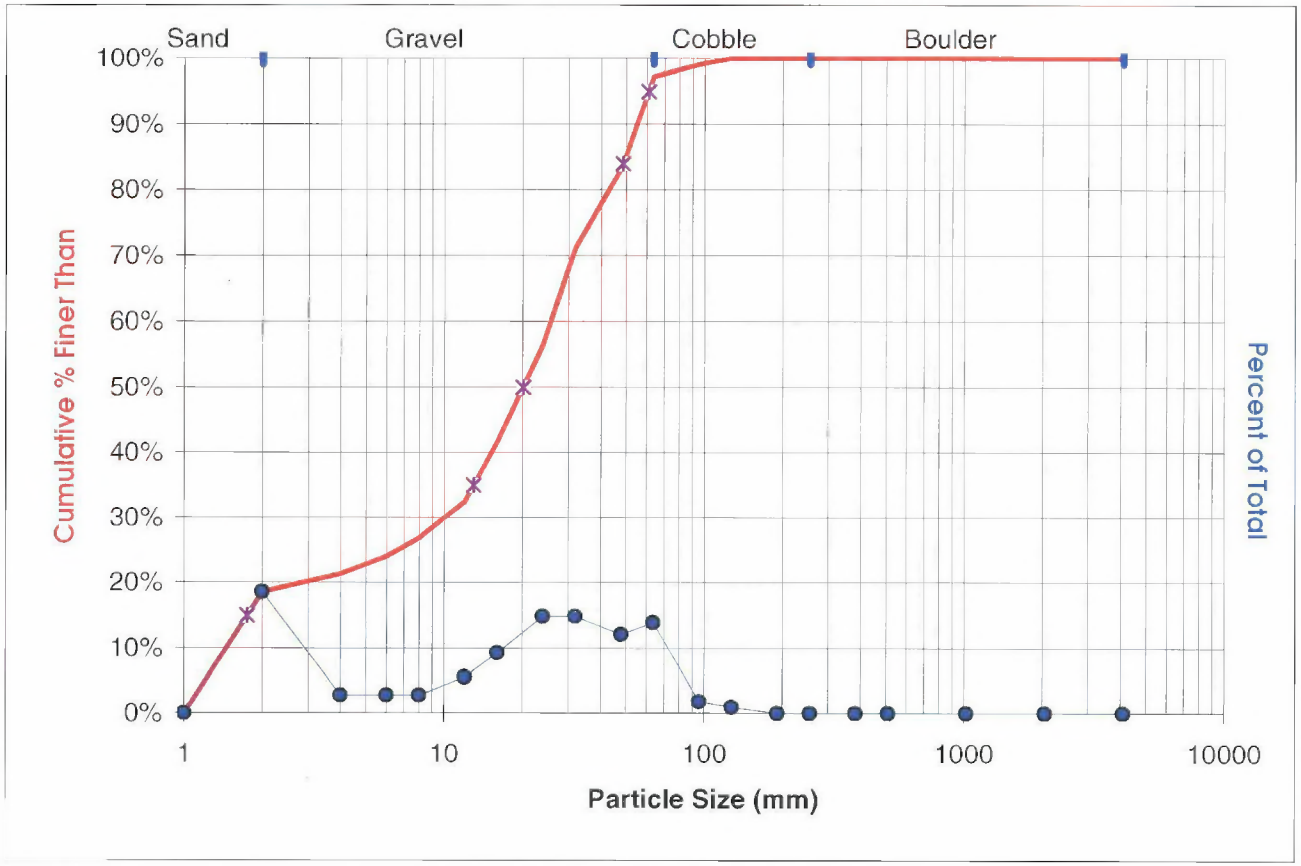
Pebble Count Worksheet

Particle Size (mm)	% finer than	Total Count
< 2	19%	20
2 - 4	21%	3
4 - 6	24%	3
6 - 8	27%	3
8 - 12	32%	6
12 - 16	42%	10
16 - 24	56%	16
24 - 32	71%	16
32 - 48	83%	13
48 - 64	97%	15
64 - 96	99%	2
96 - 128	100%	1
128 - 192	100%	0
192 - 256	100%	0
256 - 384	100%	0
384 - 512	100%	0
512 - 1024	100%	0
1024-2048	100%	0
2048-4096	100%	0
	Total #	108

COMMENTS:

STREAM NAME: Little Bear Creek
ID NUMBER: R23
DATE: 7/20/01
CREW: Scott & Amy

Particle Size Distribution (mm)	**Fines <6 mm**	**D35**	**D50**	**D84**	**D95**
	24%	**13.0**	**20.1**	**48.7**	**61.1**



FILENAME: PebbleReach3_7-20-01.xls ENTERED: 7/10/02

Check Cell Notes (See online help to access cell notes) for specific information. If spreadsheet is slow on data entry you may want to use man

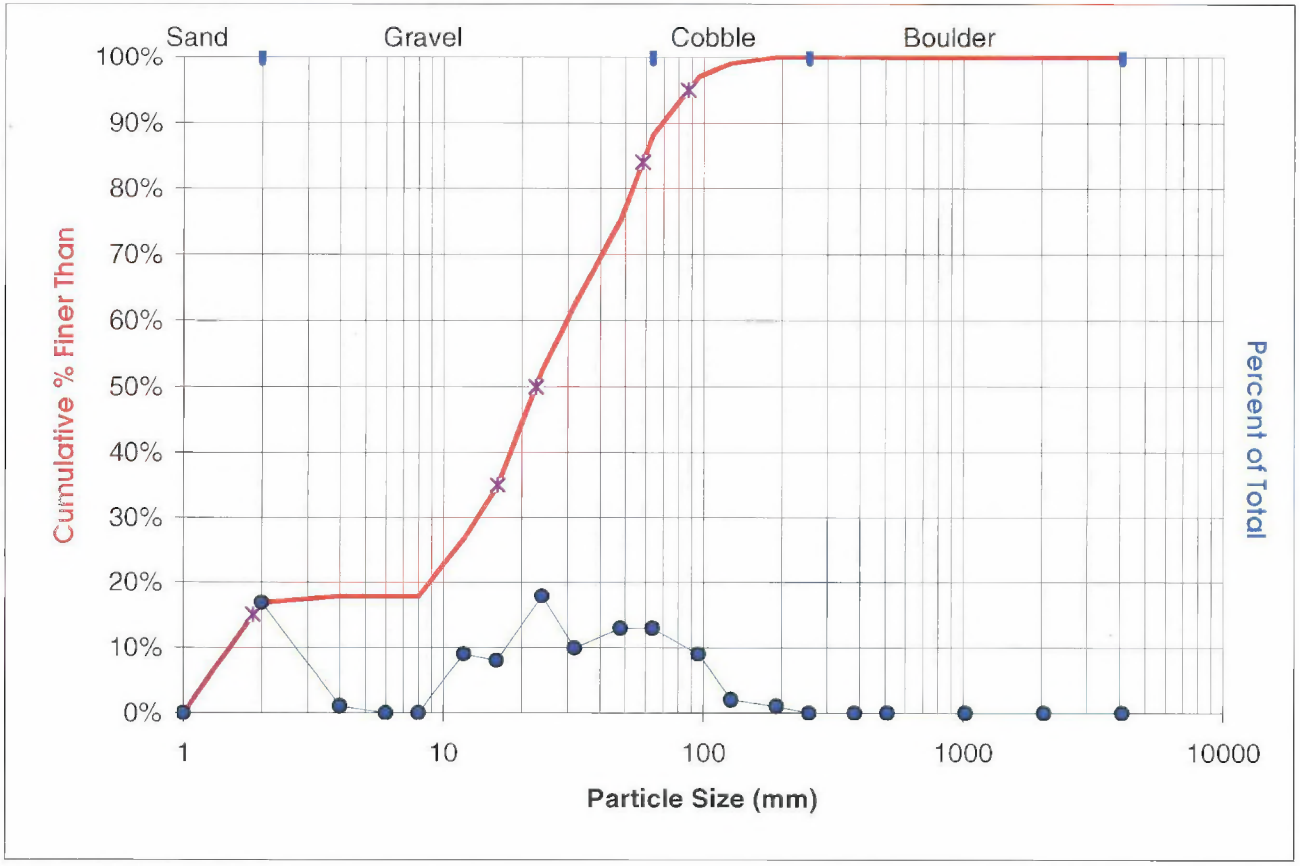
Pebble Count Worksheet

Particle Size (mm)	% finer than	Total Count
< 2	17%	17
2 - 4	18%	1
4 - 6	18%	0
6 - 8	18%	0
8 - 12	27%	9
12 - 16	35%	8
16 - 24	52%	18
24 - 32	62%	10
32 - 48	75%	13
48 - 64	88%	13
64 - 96	97%	9
96 - 128	99%	2
128 - 192	100%	1
192 - 256	100%	0
256 - 384	100%	0
384 - 512	100%	0
512 - 1024	100%	0
1024-2048	100%	0
2048-4096	100%	0
	Total #	101

COMMENTS:

STREAM NAME: Little Bear Creek
ID NUMBER: R30
DATE: 7/31/01
CREW: Scott & amy

Particle Size Distribution (mm)	Fines <6 mm	D35	D50	D84	D95
	18%	16.1	22.7	58.4	87.5



FILENAME: PebbleReach3_7-31-01.xls ENTERED: 7/10/02

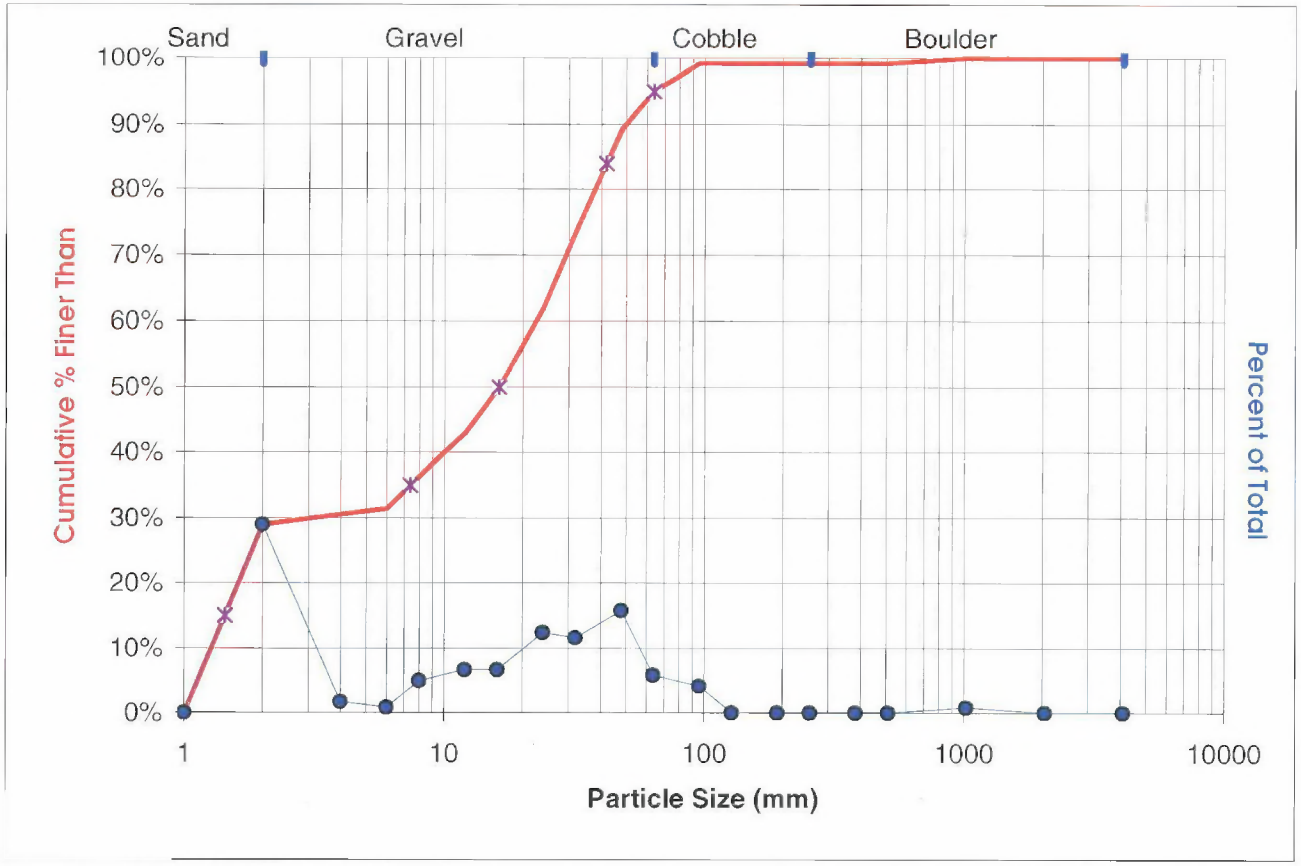
Pebble Count Worksheet

Particle Size (mm)	% finer than	Total Count
< 2	29%	35
2 - 4	31%	2
4 - 6	31%	1
6 - 8	36%	6
8 - 12	43%	8
12 - 16	50%	8
16 - 24	62%	15
24 - 32	74%	14
32 - 48	89%	19
48 - 64	95%	7
64 - 96	99%	5
96 - 128	99%	
128 - 192	99%	
192 - 256	99%	
256 - 384	99%	
384 - 512	99%	
512 - 1024	100%	1
1024-2048	100%	
2048-4096	100%	
	Total #	121

COMMENTS:

STREAM NAME: Little Bear Creek
ID NUMBER: Reach 3, NSO 81
DATE: 9/25/01
CREW: Matt and Scott

Particle Size Distribution (mm)	Fines <6 mm	D35	D50	D84	D95
	31%	7.4	16.2	41.9	63.9



FILENAME: PebbleReach3__9-25-01.xls ENTERED: 7/10/02

Appendix P

APPENDIX P:
2001 Reach 1
Data Logger Stream Temperature Results

```
Date,Time,Temperature    (*C)
06/15/01,18:00,13.42
06/15/01,19:00,13.27
06/15/01,20:00,13.27
06/15/01,21:00,13.12
06/15/01,22:00,12.81
06/15/01,23:00,12.49
06/16/01,00:00,12.34
06/16/01,01:00,12.03
06/16/01,02:00,11.72
06/16/01,03:00,11.56
06/16/01,04:00,11.41
06/16/01,05:00,11.25
06/16/01,06:00,11.25
06/16/01,07:00,11.1
06/16/01,08:00,11.1
06/16/01,09:00,11.25
06/16/01,10:00,11.25
06/16/01,11:00,11.41
06/16/01,12:00,11.56
06/16/01,13:00,11.87
06/16/01,14:00,12.34
06/16/01,15:00,12.81
06/16/01,16:00,12.81
06/16/01,17:00,13.27
06/16/01,18:00,13.27
06/16/01,19:00,13.12
06/16/01,20:00,13.12
06/16/01,21:00,12.81
06/16/01,22:00,12.49
06/16/01,23:00,12.34
06/17/01,00:00,12.03
06/17/01,01:00,11.87
06/17/01,02:00,11.56
06/17/01,03:00,11.41
06/17/01,04:00,11.25
06/17/01,05:00,10.94
06/17/01,06:00,10.79
06/17/01,07:00,10.79
06/17/01,08:00,10.79
06/17/01,09:00,10.79
06/17/01,10:00,10.94
06/17/01,11:00,11.25
06/17/01,12:00,11.56
06/17/01,13:00,12.18
06/17/01,14:00,12.34
06/17/01,15:00,12.81
06/17/01,16:00,13.27
```

```
06/17/01,17:00,13.58
06/17/01,18:00,13.88
06/17/01,19:00,13.73
06/17/01,20:00,13.58
06/17/01,21:00,13.27
06/17/01,22:00,12.96
06/17/01,23:00,12.81
06/18/01,00:00,12.65
06/18/01,01:00,12.49
06/18/01,02:00,12.34
06/18/01,03:00,12.18
06/18/01,04:00,12.03
06/18/01,05:00,11.72
06/18/01,06:00,11.72
06/18/01,07:00,11.56
06/18/01,08:00,11.56
06/18/01,09:00,11.56
06/18/01,10:00,11.72
06/18/01,11:00,11.72
06/18/01,12:00,12.03
06/18/01,13:00,12.65
06/18/01,14:00,13.27
06/18/01,15:00,14.04
06/18/01,16:00,14.51
06/18/01,17:00,14.66
06/18/01,18:00,14.66
06/18/01,19:00,14.51
06/18/01,20:00,14.35
06/18/01,21:00,14.04
06/18/01,22:00,13.73
06/18/01,23:00,13.58
06/19/01,00:00,13.27
06/19/01,01:00,12.96
06/19/01,02:00,12.65
06/19/01,03:00,12.34
06/19/01,04:00,12.03
06/19/01,05:00,11.72
06/19/01,06:00,11.56
06/19/01,07:00,11.41
06/19/01,08:00,11.41
06/19/01,09:00,11.56
06/19/01,10:00,11.87
06/19/01,11:00,12.34
06/19/01,12:00,12.96
06/19/01,13:00,13.73
06/19/01,14:00,14.35
06/19/01,15:00,15.13
06/19/01,16:00,15.61
```

```
06/19/01,17:00,15.92
06/19/01,18:00,15.92
06/19/01,19:00,15.77
06/19/01,20:00,15.45
06/19/01,21:00,15.29
06/19/01,22:00,14.98
06/19/01,23:00,14.66
06/20/01,00:00,14.35
06/20/01,01:00,14.04
06/20/01,02:00,13.88
06/20/01,03:00,13.58
06/20/01,04:00,13.27
06/20/01,05:00,12.96
06/20/01,06:00,12.65
06/20/01,07:00,12.49
06/20/01,08:00,12.49
06/20/01,09:00,12.65
06/20/01,10:00,12.81
06/20/01,11:00,13.27
06/20/01,12:00,14.04
06/20/01,13:00,14.66
06/20/01,14:00,15.29
06/20/01,15:00,16.08
06/20/01,16:00,16.56
06/20/01,17:00,16.72
06/20/01,18:00,16.72
06/20/01,19:00,16.56
06/20/01,20:00,16.24
06/20/01,21:00,15.92
06/20/01,22:00,15.61
06/20/01,23:00,15.29
06/21/01,00:00,14.98
06/21/01,01:00,14.66
06/21/01,02:00,14.35
06/21/01,03:00,14.04
06/21/01,04:00,13.73
06/21/01,05:00,13.42
06/21/01,06:00,13.12
06/21/01,07:00,12.96
06/21/01,08:00,12.96
06/21/01,09:00,13.12
06/21/01,10:00,13.42
06/21/01,11:00,13.88
06/21/01,12:00,14.51
06/21/01,13:00,15.13
06/21/01,14:00,15.77
06/21/01,15:00,16.4
06/21/01,16:00,17.04
```

```
06/21/01,17:00,17.36
06/21/01,18:00,17.36
06/21/01,19:00,17.04
06/21/01,20:00,16.72
06/21/01,21:00,16.4
06/21/01,22:00,15.92
06/21/01,23:00,15.61
06/22/01,00:00,15.29
06/22/01,01:00,15.13
06/22/01,02:00,14.98
06/22/01,03:00,14.66
06/22/01,04:00,14.51
06/22/01,05:00,14.19
06/22/01,06:00,14.04
06/22/01,07:00,13.88
06/22/01,08:00,13.73
06/22/01,09:00,13.58
06/22/01,10:00,13.58
06/22/01,11:00,13.58
06/22/01,12:00,13.58
06/22/01,13:00,13.73
06/22/01,14:00,14.04
06/22/01,15:00,14.51
06/22/01,16:00,14.66
06/22/01,17:00,14.82
06/22/01,18:00,14.82
06/22/01,19:00,14.82
06/22/01,20:00,14.66
06/22/01,21:00,14.51
06/22/01,22:00,14.19
06/22/01,23:00,14.04
06/23/01,00:00,13.73
06/23/01,01:00,13.58
06/23/01,02:00,13.42
06/23/01,03:00,13.27
06/23/01,04:00,13.12
06/23/01,05:00,12.96
06/23/01,06:00,12.81
06/23/01,07:00,12.81
06/23/01,08:00,12.81
06/23/01,09:00,12.81
06/23/01,10:00,12.96
06/23/01,11:00,13.12
06/23/01,12:00,13.58
06/23/01,13:00,14.04
06/23/01,14:00,14.35
06/23/01,15:00,14.51
06/23/01,16:00,14.66
```

```
06/23/01,17:00,14.66
06/23/01,18:00,14.82
06/23/01,19:00,14.82
06/23/01,20:00,14.66
06/23/01,21:00,14.35
06/23/01,22:00,14.19
06/23/01,23:00,13.88
06/24/01,00:00,13.73
06/24/01,01:00,13.42
06/24/01,02:00,13.27
06/24/01,03:00,13.12
06/24/01,04:00,12.96
06/24/01,05:00,12.65
06/24/01,06:00,12.49
06/24/01,07:00,12.34
06/24/01,08:00,12.34
06/24/01,09:00,12.34
06/24/01,10:00,12.49
06/24/01,11:00,12.65
06/24/01,12:00,12.81
06/24/01,13:00,12.96
06/24/01,14:00,12.96
06/24/01,15:00,13.12
06/24/01,16:00,13.12
06/24/01,17:00,13.12
06/24/01,18:00,13.12
06/24/01,19:00,13.12
06/24/01,20:00,13.12
06/24/01,21:00,13.12
06/24/01,22:00,12.81
06/24/01,23:00,12.65
06/25/01,00:00,12.65
06/25/01,01:00,12.49
06/25/01,02:00,12.34
06/25/01,03:00,12.34
06/25/01,04:00,12.18
06/25/01,05:00,12.03
06/25/01,06:00,12.03
06/25/01,07:00,11.87
06/25/01,08:00,12.03
06/25/01,09:00,12.03
06/25/01,10:00,12.18
06/25/01,11:00,12.49
06/25/01,12:00,12.81
06/25/01,13:00,13.27
06/25/01,14:00,13.88
06/25/01,15:00,14.19
06/25/01,16:00,14.51
```

```
06/25/01,17:00,14.82
06/25/01,18:00,14.82
06/25/01,19:00,14.82
06/25/01,20:00,14.66
06/25/01,21:00,14.51
06/25/01,22:00,14.19
06/25/01,23:00,13.88
06/26/01,00:00,13.58
06/26/01,01:00,13.27
06/26/01,02:00,13.12
06/26/01,03:00,12.96
06/26/01,04:00,12.65
06/26/01,05:00,12.49
06/26/01,06:00,12.34
06/26/01,07:00,12.34
06/26/01,08:00,12.34
06/26/01,09:00,12.34
06/26/01,10:00,12.49
06/26/01,11:00,12.65
06/26/01,12:00,12.96
06/26/01,13:00,13.58
06/26/01,14:00,14.19
06/26/01,15:00,14.82
06/26/01,16:00,14.98
06/26/01,17:00,15.13
06/26/01,18:00,15.13
06/26/01,19:00,14.98
06/26/01,20:00,14.82
06/26/01,21:00,14.82
06/26/01,22:00,14.66
06/26/01,23:00,14.51
06/27/01,00:00,14.35
06/27/01,01:00,14.19
06/27/01,02:00,14.04
06/27/01,03:00,14.04
06/27/01,04:00,13.88
06/27/01,05:00,13.73
06/27/01,06:00,13.58
06/27/01,07:00,13.58
06/27/01,08:00,13.58
06/27/01,09:00,13.58
06/27/01,10:00,13.73
06/27/01,11:00,13.73
06/27/01,12:00,14.04
06/27/01,13:00,13.88
06/27/01,14:00,14.98
06/27/01,15:00,14.82
06/27/01,16:00,14.66
```

06/27/01,17:00,14.98
06/27/01,18:00,15.13
06/27/01,19:00,14.98
06/27/01,20:00,14.51
06/27/01,21:00,14.35
06/27/01,22:00,14.19
06/27/01,23:00,14.04
06/28/01,00:00,13.88
06/28/01,01:00,13.88
06/28/01,02:00,13.73
06/28/01,03:00,13.58
06/28/01,04:00,13.42
06/28/01,05:00,13.27
06/28/01,06:00,13.27
06/28/01,07:00,13.12
06/28/01,08:00,13.12
06/28/01,09:00,13.12
06/28/01,10:00,13.12
06/28/01,11:00,13.27
06/28/01,12:00,13.73
06/28/01,13:00,14.04
06/28/01,14:00,14.19
06/28/01,15:00,14.35
06/28/01,16:00,14.51
06/28/01,17:00,14.51
06/28/01,18:00,14.51
06/28/01,19:00,14.51
06/28/01,20:00,14.35
06/28/01,21:00,14.04
06/28/01,22:00,13.73
06/28/01,23:00,13.58
06/29/01,00:00,13.27
06/29/01,01:00,12.96
06/29/01,02:00,12.81
06/29/01,03:00,12.49
06/29/01,04:00,12.18
06/29/01,05:00,12.03
06/29/01,06:00,11.72
06/29/01,07:00,11.56
06/29/01,08:00,11.56
06/29/01,09:00,11.72
06/29/01,10:00,12.03
06/29/01,11:00,12.49
06/29/01,12:00,13.12
06/29/01,13:00,13.58
06/29/01,14:00,14.19
06/29/01,15:00,14.82
06/29/01,16:00,15.29

```
06/29/01,17:00,15.61
06/29/01,18:00,15.61
06/29/01,19:00,15.29
06/29/01,20:00,15.13
06/29/01,21:00,14.82
06/29/01,22:00,14.51
06/29/01,23:00,14.19
06/30/01,00:00,14.04
06/30/01,01:00,13.73
06/30/01,02:00,13.42
06/30/01,03:00,13.12
06/30/01,04:00,12.81
06/30/01,05:00,12.49
06/30/01,06:00,12.18
06/30/01,07:00,12.03
06/30/01,08:00,12.03
06/30/01,09:00,12.18
06/30/01,10:00,12.49
06/30/01,11:00,12.96
06/30/01,12:00,13.42
06/30/01,13:00,14.04
06/30/01,14:00,14.66
06/30/01,15:00,15.13
06/30/01,16:00,15.45
06/30/01,17:00,15.61
06/30/01,18:00,15.61
06/30/01,19:00,15.45
06/30/01,20:00,15.29
06/30/01,21:00,14.98
06/30/01,22:00,14.66
06/30/01,23:00,14.35
07/01/01,00:00,14.19
07/01/01,01:00,13.88
07/01/01,02:00,13.73
07/01/01,03:00,13.42
07/01/01,04:00,13.12
07/01/01,05:00,12.96
07/01/01,06:00,12.81
07/01/01,07:00,12.81
07/01/01,08:00,12.65
07/01/01,09:00,12.81
07/01/01,10:00,12.81
07/01/01,11:00,13.12
07/01/01,12:00,13.58
07/01/01,13:00,14.35
07/01/01,14:00,14.82
07/01/01,15:00,15.13
07/01/01,16:00,15.61
```

```
07/01/01,17:00,15.77
07/01/01,18:00,15.92
07/01/01,19:00,15.77
07/01/01,20:00,15.45
07/01/01,21:00,15.13
07/01/01,22:00,14.82
07/01/01,23:00,14.51
07/02/01,00:00,14.19
07/02/01,01:00,13.88
07/02/01,02:00,13.58
07/02/01,03:00,13.27
07/02/01,04:00,12.96
07/02/01,05:00,12.65
07/02/01,06:00,12.34
07/02/01,07:00,12.18
07/02/01,08:00,12.18
07/02/01,09:00,12.34
07/02/01,10:00,12.65
07/02/01,11:00,13.12
07/02/01,12:00,13.73
07/02/01,13:00,14.35
07/02/01,14:00,15.13
07/02/01,15:00,15.77
07/02/01,16:00,16.24
07/02/01,17:00,16.4
07/02/01,18:00,16.4
07/02/01,19:00,16.4
07/02/01,20:00,16.08
07/02/01,21:00,15.77
07/02/01,22:00,15.29
07/02/01,23:00,15.13
07/03/01,00:00,14.82
07/03/01,01:00,14.51
07/03/01,02:00,14.19
07/03/01,03:00,13.88
07/03/01,04:00,13.58
07/03/01,05:00,13.27
07/03/01,06:00,13.12
07/03/01,07:00,12.81
07/03/01,08:00,12.81
07/03/01,09:00,12.96
07/03/01,10:00,13.27
07/03/01,11:00,13.73
07/03/01,12:00,14.35
07/03/01,13:00,14.98
07/03/01,14:00,15.61
07/03/01,15:00,16.24
07/03/01,16:00,16.56
```

```
07/03/01,17:00,16.88
07/03/01,18:00,16.88
07/03/01,19:00,16.88
07/03/01,20:00,16.56
07/03/01,21:00,16.24
07/03/01,22:00,15.92
07/03/01,23:00,15.61
07/04/01,00:00,15.29
07/04/01,01:00,15.13
07/04/01,02:00,14.82
07/04/01,03:00,14.51
07/04/01,04:00,14.19
07/04/01,05:00,13.88
07/04/01,06:00,13.58
07/04/01,07:00,13.42
07/04/01,08:00,13.42
07/04/01,09:00,13.58
07/04/01,10:00,13.88
07/04/01,11:00,14.35
07/04/01,12:00,14.98
07/04/01,13:00,15.77
07/04/01,14:00,16.4
07/04/01,15:00,17.04
07/04/01,16:00,17.36
07/04/01,17:00,17.67
07/04/01,18:00,17.67
07/04/01,19:00,17.36
07/04/01,20:00,17.04
07/04/01,21:00,16.4
07/04/01,22:00,15.92
07/04/01,23:00,15.61
07/05/01,00:00,15.29
07/05/01,01:00,14.98
07/05/01,02:00,14.82
07/05/01,03:00,14.51
07/05/01,04:00,14.35
07/05/01,05:00,14.19
07/05/01,06:00,14.04
07/05/01,07:00,13.88
07/05/01,08:00,13.73
07/05/01,09:00,13.73
07/05/01,10:00,13.73
07/05/01,11:00,13.88
07/05/01,12:00,14.19
07/05/01,13:00,14.66
07/05/01,14:00,14.98
07/05/01,15:00,15.61
07/05/01,16:00,16.08
```

```
07/05/01,17:00,16.24
07/05/01,18:00,16.24
07/05/01,19:00,16.08
07/05/01,20:00,15.77
07/05/01,21:00,15.45
07/05/01,22:00,15.13
07/05/01,23:00,14.82
07/06/01,00:00,14.51
07/06/01,01:00,14.19
07/06/01,02:00,13.88
07/06/01,03:00,13.58
07/06/01,04:00,13.27
07/06/01,05:00,13.12
07/06/01,06:00,12.81
07/06/01,07:00,12.65
07/06/01,08:00,12.65
07/06/01,09:00,12.65
07/06/01,10:00,12.96
07/06/01,11:00,13.42
07/06/01,12:00,13.88
07/06/01,13:00,14.51
07/06/01,14:00,15.13
07/06/01,15:00,15.77
07/06/01,16:00,16.24
07/06/01,17:00,16.4
07/06/01,18:00,16.4
07/06/01,19:00,16.24
07/06/01,20:00,15.92
07/06/01,21:00,15.61
07/06/01,22:00,15.13
07/06/01,23:00,14.82
07/07/01,00:00,14.66
07/07/01,01:00,14.19
07/07/01,02:00,14.04
07/07/01,03:00,13.58
07/07/01,04:00,13.27
07/07/01,05:00,13.12
07/07/01,06:00,12.81
07/07/01,07:00,12.65
07/07/01,08:00,12.65
07/07/01,09:00,12.65
07/07/01,10:00,12.96
07/07/01,11:00,13.42
07/07/01,12:00,14.04
07/07/01,13:00,14.66
07/07/01,14:00,15.29
07/07/01,15:00,15.92
07/07/01,16:00,16.4
```

```
07/07/01,17:00,16.56
07/07/01,18:00,16.72
07/07/01,19:00,16.56
07/07/01,20:00,16.08
07/07/01,21:00,15.77
07/07/01,22:00,15.45
07/07/01,23:00,15.13
07/08/01,00:00,14.82
07/08/01,01:00,14.66
07/08/01,02:00,14.35
07/08/01,03:00,14.04
07/08/01,04:00,13.88
07/08/01,05:00,13.58
07/08/01,06:00,13.27
07/08/01,07:00,13.12
07/08/01,08:00,13.12
07/08/01,09:00,13.27
07/08/01,10:00,13.58
07/08/01,11:00,14.04
07/08/01,12:00,14.66
07/08/01,13:00,15.29
07/08/01,14:00,15.92
07/08/01,15:00,16.56
07/08/01,16:00,17.04
07/08/01,17:00,17.36
07/08/01,18:00,17.36
07/08/01,19:00,17.19
07/08/01,20:00,16.88
07/08/01,21:00,16.56
07/08/01,22:00,16.08
07/08/01,23:00,15.77
07/09/01,00:00,15.61
07/09/01,01:00,15.29
07/09/01,02:00,14.98
07/09/01,03:00,14.66
07/09/01,04:00,14.51
07/09/01,05:00,14.19
07/09/01,06:00,14.04
07/09/01,07:00,13.73
07/09/01,08:00,13.73
07/09/01,09:00,13.88
07/09/01,10:00,14.04
07/09/01,11:00,14.66
07/09/01,12:00,15.29
07/09/01,13:00,15.92
07/09/01,14:00,16.56
07/09/01,15:00,17.19
07/09/01,16:00,17.67
```

```
07/09/01,17:00,17.83
07/09/01,18:00,17.83
07/09/01,19:00,17.83
07/09/01,20:00,17.51
07/09/01,21:00,17.04
07/09/01,22:00,16.72
07/09/01,23:00,16.4
07/10/01,00:00,16.08
07/10/01,01:00,15.77
07/10/01,02:00,15.61
07/10/01,03:00,15.29
07/10/01,04:00,14.98
07/10/01,05:00,14.66
07/10/01,06:00,14.51
07/10/01,07:00,14.19
07/10/01,08:00,14.19
07/10/01,09:00,14.35
07/10/01,10:00,14.66
07/10/01,11:00,14.82
07/10/01,12:00,15.29
07/10/01,13:00,15.92
07/10/01,14:00,16.72
07/10/01,15:00,17.36
07/10/01,16:00,17.83
07/10/01,17:00,17.99
07/10/01,18:00,17.99
07/10/01,19:00,17.67
07/10/01,20:00,17.36
07/10/01,21:00,17.04
07/10/01,22:00,16.72
07/10/01,23:00,16.4
07/11/01,00:00,15.92
07/11/01,01:00,15.77
07/11/01,02:00,15.29
07/11/01,03:00,14.98
07/11/01,04:00,14.82
07/11/01,05:00,14.51
07/11/01,06:00,14.19
07/11/01,07:00,14.04
07/11/01,08:00,13.88
07/11/01,09:00,13.88
07/11/01,10:00,14.19
07/11/01,11:00,14.66
07/11/01,12:00,15.29
07/11/01,13:00,15.92
07/11/01,14:00,16.4
07/11/01,15:00,17.04
07/11/01,16:00,17.51
```

```
07/11/01,17:00,17.83
07/11/01,18:00,17.83
07/11/01,19:00,17.67
07/11/01,20:00,17.36
07/11/01,21:00,17.04
07/11/01,22:00,16.56
07/11/01,23:00,16.24
07/12/01,00:00,15.92
07/12/01,01:00,15.61
07/12/01,02:00,15.29
07/12/01,03:00,15.13
07/12/01,04:00,14.82
07/12/01,05:00,14.51
07/12/01,06:00,14.19
07/12/01,07:00,14.04
07/12/01,08:00,13.88
07/12/01,09:00,13.88
07/12/01,10:00,14.04
07/12/01,11:00,14.51
07/12/01,12:00,14.66
07/12/01,13:00,14.98
07/12/01,14:00,15.13
07/12/01,15:00,15.45
07/12/01,16:00,15.61
07/12/01,17:00,15.92
07/12/01,18:00,16.08
07/12/01,19:00,16.08
07/12/01,20:00,15.92
07/12/01,21:00,15.61
07/12/01,22:00,15.29
07/12/01,23:00,15.13
07/13/01,00:00,14.98
07/13/01,01:00,14.66
07/13/01,02:00,14.51
07/13/01,03:00,14.35
07/13/01,04:00,14.04
07/13/01,05:00,13.73
07/13/01,06:00,13.58
07/13/01,07:00,13.42
07/13/01,08:00,13.27
07/13/01,09:00,13.42
07/13/01,10:00,13.42
07/13/01,11:00,13.58
07/13/01,12:00,13.88
07/13/01,13:00,14.04
07/13/01,14:00,14.19
07/13/01,15:00,14.66
07/13/01,16:00,15.13
```

```
07/13/01,17:00,15.45
07/13/01,18:00,15.45
07/13/01,19:00,15.45
07/13/01,20:00,15.13
07/13/01,21:00,14.98
07/13/01,22:00,14.66
07/13/01,23:00,14.51
07/14/01,00:00,14.35
07/14/01,01:00,14.19
07/14/01,02:00,13.88
07/14/01,03:00,13.58
07/14/01,04:00,13.42
07/14/01,05:00,13.12
07/14/01,06:00,12.96
07/14/01,07:00,12.81
07/14/01,08:00,12.65
07/14/01,09:00,12.81
07/14/01,10:00,13.12
07/14/01,11:00,13.58
07/14/01,12:00,14.04
07/14/01,13:00,14.51
07/14/01,14:00,15.13
07/14/01,15:00,15.61
07/14/01,16:00,15.92
07/14/01,17:00,16.08
07/14/01,18:00,16.4
07/14/01,19:00,16.4
07/14/01,20:00,16.08
07/14/01,21:00,15.61
07/14/01,22:00,15.13
07/14/01,23:00,14.82
07/15/01,00:00,14.51
07/15/01,01:00,14.35
07/15/01,02:00,14.19
07/15/01,03:00,13.88
07/15/01,04:00,13.73
07/15/01,05:00,13.58
07/15/01,06:00,13.58
07/15/01,07:00,13.42
07/15/01,08:00,13.27
07/15/01,09:00,13.27
07/15/01,10:00,13.27
07/15/01,11:00,13.27
07/15/01,12:00,13.27
07/15/01,13:00,13.27
07/15/01,14:00,13.27
07/15/01,15:00,13.27
07/15/01,16:00,13.12
```

```
07/15/01,17:00,13.12
07/15/01,18:00,13.12
07/15/01,19:00,13.12
07/15/01,20:00,13.12
07/15/01,21:00,13.42
07/15/01,22:00,13.88
07/15/01,23:00,14.19
07/16/01,00:00,14.04
07/16/01,01:00,13.88
07/16/01,02:00,13.58
07/16/01,03:00,13.27
07/16/01,04:00,13.12
07/16/01,05:00,13.12
07/16/01,06:00,12.96
07/16/01,07:00,12.81
07/16/01,08:00,12.96
07/16/01,09:00,13.42
07/16/01,10:00,13.27
07/16/01,11:00,13.42
07/16/01,12:00,13.58
07/16/01,13:00,13.73
07/16/01,14:00,13.88
07/16/01,15:00,13.88
07/16/01,16:00,13.88
07/16/01,17:00,14.04
07/16/01,18:00,14.51
07/16/01,19:00,14.19
07/16/01,20:00,14.04
07/16/01,21:00,14.04
07/16/01,22:00,13.88
07/16/01,23:00,13.73
07/17/01,00:00,13.58
07/17/01,01:00,13.27
07/17/01,02:00,13.27
07/17/01,03:00,13.12
07/17/01,04:00,13.27
07/17/01,05:00,13.27
07/17/01,06:00,13.12
07/17/01,07:00,13.12
07/17/01,08:00,13.12
07/17/01,09:00,12.96
07/17/01,10:00,12.96
07/17/01,11:00,13.12
07/17/01,12:00,13.27
07/17/01,13:00,13.58
07/17/01,14:00,13.88
07/17/01,15:00,14.04
07/17/01,16:00,14.04
```

```
07/17/01,17:00,14.19
07/17/01,18:00,14.35
07/17/01,19:00,14.35
07/17/01,20:00,14.19
07/17/01,21:00,14.19
07/17/01,22:00,14.04
07/17/01,23:00,14.04
07/18/01,00:00,13.88
07/18/01,01:00,13.73
07/18/01,02:00,13.73
07/18/01,03:00,13.58
07/18/01,04:00,13.42
07/18/01,05:00,13.27
07/18/01,06:00,13.12
07/18/01,07:00,13.12
07/18/01,08:00,13.12
07/18/01,09:00,13.12
07/18/01,10:00,13.27
07/18/01,11:00,13.42
07/18/01,12:00,13.58
07/18/01,13:00,14.04
07/18/01,14:00,14.35
07/18/01,15:00,14.35
07/18/01,16:00,14.51
07/18/01,17:00,14.51
07/18/01,18:00,14.51
07/18/01,19:00,14.51
07/18/01,20:00,14.51
07/18/01,21:00,14.35
07/18/01,22:00,14.19
07/18/01,23:00,14.19
07/19/01,00:00,14.04
07/19/01,01:00,13.88
07/19/01,02:00,13.73
07/19/01,03:00,13.58
07/19/01,04:00,13.42
07/19/01,05:00,13.42
07/19/01,06:00,13.27
07/19/01,07:00,13.27
07/19/01,08:00,13.27
07/19/01,09:00,13.42
07/19/01,10:00,13.58
07/19/01,11:00,13.88
07/19/01,12:00,14.04
07/19/01,13:00,14.51
07/19/01,14:00,14.98
07/19/01,15:00,15.13
07/19/01,16:00,15.61
```

```
07/19/01,17:00,15.92
07/19/01,18:00,15.77
07/19/01,19:00,15.61
07/19/01,20:00,15.45
07/19/01,21:00,15.13
07/19/01,22:00,14.98
07/19/01,23:00,14.66
07/20/01,00:00,14.51
07/20/01,01:00,14.19
07/20/01,02:00,14.04
07/20/01,03:00,13.73
07/20/01,04:00,13.58
07/20/01,05:00,13.27
07/20/01,06:00,13.12
07/20/01,07:00,13.12
07/20/01,08:00,12.96
07/20/01,09:00,13.12
07/20/01,10:00,13.27
07/20/01,11:00,13.58
07/20/01,12:00,14.19
07/20/01,13:00,14.35
07/20/01,14:00,14.66
07/20/01,15:00,14.82
07/20/01,16:00,14.82
07/20/01,17:00,14.98
07/20/01,18:00,15.13
07/20/01,19:00,15.29
07/20/01,20:00,15.29
07/20/01,21:00,15.13
07/20/01,22:00,14.82
07/20/01,23:00,14.66
07/21/01,00:00,14.51
07/21/01,01:00,14.35
07/21/01,02:00,14.19
07/21/01,03:00,14.04
07/21/01,04:00,13.88
07/21/01,05:00,13.88
07/21/01,06:00,13.73
07/21/01,07:00,13.73
07/21/01,08:00,13.58
07/21/01,09:00,13.58
07/21/01,10:00,13.58
07/21/01,11:00,13.73
07/21/01,12:00,13.73
07/21/01,13:00,13.88
07/21/01,14:00,14.04
07/21/01,15:00,14.19
07/21/01,16:00,14.51
```

```
07/21/01,17:00,14.51
07/21/01,18:00,14.51
07/21/01,19:00,14.51
07/21/01,20:00,14.35
07/21/01,21:00,14.35
07/21/01,22:00,14.19
07/21/01,23:00,14.04
07/22/01,00:00,14.04
07/22/01,01:00,13.88
07/22/01,02:00,13.88
07/22/01,03:00,13.88
07/22/01,04:00,13.73
07/22/01,05:00,13.73
07/22/01,06:00,13.58
07/22/01,07:00,13.58
07/22/01,08:00,13.58
07/22/01,09:00,13.58
07/22/01,10:00,13.58
07/22/01,11:00,13.73
07/22/01,12:00,13.88
07/22/01,13:00,14.19
07/22/01,14:00,14.35
07/22/01,15:00,14.66
07/22/01,16:00,14.98
07/22/01,17:00,15.29
07/22/01,18:00,15.29
07/22/01,19:00,15.29
07/22/01,20:00,15.13
07/22/01,21:00,14.98
07/22/01,22:00,14.66
07/22/01,23:00,14.51
07/23/01,00:00,14.35
07/23/01,01:00,14.19
07/23/01,02:00,14.04
07/23/01,03:00,13.73
07/23/01,04:00,13.58
07/23/01,05:00,13.42
07/23/01,06:00,13.42
07/23/01,07:00,13.42
07/23/01,08:00,13.27
07/23/01,09:00,13.42
07/23/01,10:00,13.58
07/23/01,11:00,13.88
07/23/01,12:00,14.51
07/23/01,13:00,15.13
07/23/01,14:00,15.77
07/23/01,15:00,16.24
07/23/01,16:00,16.56
```

```
07/23/01,17:00,16.72
07/23/01,18:00,16.72
07/23/01,19:00,16.88
07/23/01,20:00,16.56
07/23/01,21:00,16.24
07/23/01,22:00,16.08
07/23/01,23:00,15.77
07/24/01,00:00,15.77
07/24/01,01:00,15.61
07/24/01,02:00,15.45
07/24/01,03:00,15.29
07/24/01,04:00,15.13
07/24/01,05:00,14.98
07/24/01,06:00,14.82
07/24/01,07:00,14.66
07/24/01,08:00,14.66
07/24/01,09:00,14.66
07/24/01,10:00,14.66
07/24/01,11:00,14.82
07/24/01,12:00,14.98
07/24/01,13:00,15.29
07/24/01,14:00,15.61
07/24/01,15:00,16.24
07/24/01,16:00,16.4
07/24/01,17:00,16.4
07/24/01,18:00,16.4
07/24/01,19:00,16.4
07/24/01,20:00,16.24
07/24/01,21:00,15.92
07/24/01,22:00,15.61
07/24/01,23:00,15.45
07/25/01,00:00,15.13
07/25/01,01:00,14.98
07/25/01,02:00,14.66
07/25/01,03:00,14.51
07/25/01,04:00,14.19
07/25/01,05:00,14.04
07/25/01,06:00,13.73
07/25/01,07:00,13.58
07/25/01,08:00,13.58
07/25/01,09:00,13.58
07/25/01,10:00,13.73
07/25/01,11:00,14.19
07/25/01,12:00,14.82
07/25/01,13:00,15.29
07/25/01,14:00,15.92
07/25/01,15:00,16.56
07/25/01,16:00,16.88
```

```
07/25/01,17:00,17.19
07/25/01,18:00,17.19
07/25/01,19:00,17.04
07/25/01,20:00,16.72
07/25/01,21:00,16.4
07/25/01,22:00,16.08
07/25/01,23:00,15.77
07/26/01,00:00,15.61
07/26/01,01:00,15.29
07/26/01,02:00,15.13
07/26/01,03:00,14.82
07/26/01,04:00,14.51
07/26/01,05:00,14.19
07/26/01,06:00,14.04
07/26/01,07:00,13.73
07/26/01,08:00,13.73
07/26/01,09:00,13.73
07/26/01,10:00,13.88
07/26/01,11:00,14.19
07/26/01,12:00,14.66
07/26/01,13:00,15.29
07/26/01,14:00,15.77
07/26/01,15:00,16.4
07/26/01,16:00,16.72
07/26/01,17:00,17.04
07/26/01,18:00,17.04
07/26/01,19:00,16.88
07/26/01,20:00,16.72
07/26/01,21:00,16.4
07/26/01,22:00,15.92
07/26/01,23:00,15.77
07/27/01,00:00,15.45
07/27/01,01:00,15.29
07/27/01,02:00,14.98
07/27/01,03:00,14.82
07/27/01,04:00,14.51
07/27/01,05:00,14.35
07/27/01,06:00,14.19
07/27/01,07:00,14.04
07/27/01,08:00,13.88
07/27/01,09:00,13.88
07/27/01,10:00,13.88
07/27/01,11:00,13.88
07/27/01,12:00,13.88
07/27/01,13:00,14.04
07/27/01,14:00,14.04
07/27/01,15:00,14.19
07/27/01,16:00,14.35
```

```
07/27/01,17:00,14.66
07/27/01,18:00,14.66
07/27/01,19:00,14.66
07/27/01,20:00,14.66
07/27/01,21:00,14.51
07/27/01,22:00,14.51
07/27/01,23:00,14.35
07/28/01,00:00,14.35
07/28/01,01:00,14.19
07/28/01,02:00,14.19
07/28/01,03:00,14.19
07/28/01,04:00,14.19
07/28/01,05:00,14.66
07/28/01,06:00,14.82
07/28/01,07:00,14.82
07/28/01,08:00,14.66
07/28/01,09:00,14.66
07/28/01,10:00,14.51
07/28/01,11:00,14.66
07/28/01,12:00,14.66
07/28/01,13:00,14.35
07/28/01,14:00,14.35
07/28/01,15:00,14.35
07/28/01,16:00,14.19
07/28/01,17:00,14.19
07/28/01,18:00,13.88
07/28/01,19:00,13.88
07/28/01,20:00,13.73
07/28/01,21:00,13.58
07/28/01,22:00,13.42
07/28/01,23:00,13.27
07/29/01,00:00,13.27
07/29/01,01:00,13.12
07/29/01,02:00,13.12
07/29/01,03:00,12.96
07/29/01,04:00,12.96
07/29/01,05:00,12.96
07/29/01,06:00,12.81
07/29/01,07:00,12.81
07/29/01,08:00,12.81
07/29/01,09:00,12.81
07/29/01,10:00,12.96
07/29/01,11:00,13.12
07/29/01,12:00,13.58
07/29/01,13:00,14.04
07/29/01,14:00,14.04
07/29/01,15:00,14.35
07/29/01,16:00,14.51
```

```
07/29/01,17:00,14.66
07/29/01,18:00,14.82
07/29/01,19:00,14.66
07/29/01,20:00,14.51
07/29/01,21:00,14.35
07/29/01,22:00,14.04
07/29/01,23:00,13.88
07/30/01,00:00,13.73
07/30/01,01:00,13.42
07/30/01,02:00,13.27
07/30/01,03:00,12.96
07/30/01,04:00,12.81
07/30/01,05:00,12.65
07/30/01,06:00,12.49
07/30/01,07:00,12.34
07/30/01,08:00,12.18
07/30/01,09:00,12.34
07/30/01,10:00,12.65
07/30/01,11:00,12.96
07/30/01,12:00,13.42
07/30/01,13:00,13.88
07/30/01,14:00,14.04
07/30/01,15:00,14.35
07/30/01,16:00,14.82
07/30/01,17:00,14.98
07/30/01,18:00,14.98
07/30/01,19:00,14.98
07/30/01,20:00,14.82
07/30/01,21:00,14.82
07/30/01,22:00,14.66
07/30/01,23:00,14.51
07/31/01,00:00,14.35
07/31/01,01:00,14.19
07/31/01,02:00,14.04
07/31/01,03:00,13.88
07/31/01,04:00,13.58
07/31/01,05:00,13.42
07/31/01,06:00,13.27
07/31/01,07:00,13.12
07/31/01,08:00,12.96
07/31/01,09:00,13.12
07/31/01,10:00,13.12
07/31/01,11:00,13.27
07/31/01,12:00,13.58
07/31/01,13:00,14.04
07/31/01,14:00,14.19
07/31/01,15:00,14.35
07/31/01,16:00,14.51
```

```
07/31/01,17:00,14.66
07/31/01,18:00,14.82
07/31/01,19:00,14.82
07/31/01,20:00,14.82
07/31/01,21:00,14.51
07/31/01,22:00,14.35
07/31/01,23:00,14.04
08/01/01,00:00,13.88
08/01/01,01:00,13.73
08/01/01,02:00,13.42
08/01/01,03:00,13.27
08/01/01,04:00,12.96
08/01/01,05:00,12.81
08/01/01,06:00,12.65
08/01/01,07:00,12.49
08/01/01,08:00,12.49
08/01/01,09:00,12.65
08/01/01,10:00,12.81
08/01/01,11:00,13.12
08/01/01,12:00,13.42
08/01/01,13:00,13.73
08/01/01,14:00,13.88
08/01/01,15:00,14.04
08/01/01,16:00,14.19
08/01/01,17:00,14.35
08/01/01,18:00,14.35
08/01/01,19:00,14.35
08/01/01,20:00,14.35
08/01/01,21:00,14.19
08/01/01,22:00,14.19
08/01/01,23:00,14.04
08/02/01,00:00,14.04
08/02/01,01:00,14.04
08/02/01,02:00,13.88
08/02/01,03:00,13.88
08/02/01,04:00,13.88
08/02/01,05:00,13.73
08/02/01,06:00,13.73
08/02/01,07:00,13.73
08/02/01,08:00,13.73
08/02/01,09:00,13.73
08/02/01,10:00,13.88
08/02/01,11:00,14.04
08/02/01,12:00,14.51
08/02/01,13:00,14.82
08/02/01,14:00,15.45
08/02/01,15:00,15.92
08/02/01,16:00,16.08
```

```
08/02/01,17:00,16.24
08/02/01,18:00,16.24
08/02/01,19:00,16.08
08/02/01,20:00,15.92
08/02/01,21:00,15.77
08/02/01,22:00,15.61
08/02/01,23:00,15.45
08/03/01,00:00,15.29
08/03/01,01:00,15.13
08/03/01,02:00,14.98
08/03/01,03:00,14.98
08/03/01,04:00,14.82
08/03/01,05:00,14.66
08/03/01,06:00,14.51
08/03/01,07:00,14.51
08/03/01,08:00,14.51
08/03/01,09:00,14.51
08/03/01,10:00,14.51
08/03/01,11:00,14.51
08/03/01,12:00,14.51
08/03/01,13:00,14.66
08/03/01,14:00,14.66
08/03/01,15:00,14.82
08/03/01,16:00,14.98
08/03/01,17:00,14.98
08/03/01,18:00,15.13
08/03/01,19:00,15.29
08/03/01,20:00,15.13
08/03/01,21:00,14.98
08/03/01,22:00,14.82
08/03/01,23:00,14.82
08/04/01,00:00,14.66
08/04/01,01:00,14.66
08/04/01,02:00,14.51
08/04/01,03:00,14.35
08/04/01,04:00,14.19
08/04/01,05:00,14.19
08/04/01,06:00,14.04
08/04/01,07:00,13.88
08/04/01,08:00,13.88
08/04/01,09:00,14.04
08/04/01,10:00,14.19
08/04/01,11:00,14.35
08/04/01,12:00,14.51
08/04/01,13:00,14.66
08/04/01,14:00,14.98
08/04/01,15:00,15.29
08/04/01,16:00,15.61
```

```
08/04/01,17:00,15.77
08/04/01,18:00,15.77
08/04/01,19:00,15.77
08/04/01,20:00,15.61
08/04/01,21:00,15.45
08/04/01,22:00,15.29
08/04/01,23:00,15.13
08/05/01,00:00,14.98
08/05/01,01:00,14.82
08/05/01,02:00,14.51
08/05/01,03:00,14.35
08/05/01,04:00,14.19
08/05/01,05:00,14.04
08/05/01,06:00,13.88
08/05/01,07:00,13.73
08/05/01,08:00,13.73
08/05/01,09:00,13.73
08/05/01,10:00,14.04
08/05/01,11:00,14.35
08/05/01,12:00,14.51
08/05/01,13:00,14.66
08/05/01,14:00,14.82
08/05/01,15:00,14.98
08/05/01,16:00,15.13
08/05/01,17:00,15.29
08/05/01,18:00,15.13
08/05/01,19:00,15.13
08/05/01,20:00,15.13
08/05/01,21:00,14.98
08/05/01,22:00,14.98
08/05/01,23:00,14.82
08/06/01,00:00,14.82
08/06/01,01:00,14.66
08/06/01,02:00,14.66
08/06/01,03:00,14.51
08/06/01,04:00,14.51
08/06/01,05:00,14.35
08/06/01,06:00,14.35
08/06/01,07:00,14.35
08/06/01,08:00,14.35
08/06/01,09:00,14.35
08/06/01,10:00,14.51
08/06/01,11:00,14.66
08/06/01,12:00,14.98
08/06/01,13:00,15.29
08/06/01,14:00,15.61
08/06/01,15:00,16.08
08/06/01,16:00,16.4
```

08/06/01,17:00,16.56
08/06/01,18:00,16.56
08/06/01,19:00,16.4
08/06/01,20:00,16.08
08/06/01,21:00,15.92
08/06/01,22:00,15.77
08/06/01,23:00,15.45
08/07/01,00:00,15.29
08/07/01,01:00,15.13
08/07/01,02:00,14.98
08/07/01,03:00,14.82
08/07/01,04:00,14.82
08/07/01,05:00,14.66
08/07/01,06:00,14.51
08/07/01,07:00,14.35
08/07/01,08:00,14.35
08/07/01,09:00,14.19
08/07/01,10:00,14.35
08/07/01,11:00,14.66
08/07/01,12:00,15.29
08/07/01,13:00,15.77
08/07/01,14:00,16.24
08/07/01,15:00,16.72
08/07/01,16:00,17.04
08/07/01,17:00,17.19
08/07/01,18:00,17.19
08/07/01,19:00,17.04
08/07/01,20:00,16.72
08/07/01,21:00,16.24
08/07/01,22:00,15.92
08/07/01,23:00,15.61
08/08/01,00:00,15.29
08/08/01,01:00,14.98
08/08/01,02:00,14.66
08/08/01,03:00,14.51
08/08/01,04:00,14.19
08/08/01,05:00,13.88
08/08/01,06:00,13.73
08/08/01,07:00,13.42
08/08/01,08:00,13.27
08/08/01,09:00,13.42
08/08/01,10:00,13.73
08/08/01,11:00,14.04
08/08/01,12:00,14.66
08/08/01,13:00,15.29
08/08/01,14:00,15.92
08/08/01,15:00,16.4
08/08/01,16:00,16.88

```
08/08/01,17:00,17.04
08/08/01,18:00,17.04
08/08/01,19:00,16.88
08/08/01,20:00,16.72
08/08/01,21:00,16.24
08/08/01,22:00,15.92
08/08/01,23:00,15.77
08/09/01,00:00,15.45
08/09/01,01:00,15.13
08/09/01,02:00,14.82
08/09/01,03:00,14.66
08/09/01,04:00,14.35
08/09/01,05:00,14.19
08/09/01,06:00,13.88
08/09/01,07:00,13.73
08/09/01,08:00,13.73
08/09/01,09:00,13.73
08/09/01,10:00,14.04
08/09/01,11:00,14.51
08/09/01,12:00,15.13
08/09/01,13:00,15.77
08/09/01,14:00,16.4
08/09/01,15:00,16.88
08/09/01,16:00,17.36
08/09/01,17:00,17.67
08/09/01,18:00,17.67
08/09/01,19:00,17.67
08/09/01,20:00,17.36
08/09/01,21:00,17.04
08/09/01,22:00,16.56
08/09/01,23:00,16.4
08/10/01,00:00,16.08
08/10/01,01:00,15.77
08/10/01,02:00,15.45
08/10/01,03:00,15.29
08/10/01,04:00,14.98
08/10/01,05:00,14.66
08/10/01,06:00,14.51
08/10/01,07:00,14.19
08/10/01,08:00,14.19
08/10/01,09:00,14.19
08/10/01,10:00,14.51
08/10/01,11:00,14.98
08/10/01,12:00,15.61
08/10/01,13:00,16.08
08/10/01,14:00,16.72
08/10/01,15:00,17.36
08/10/01,16:00,17.67
```

```
08/10/01,17:00,17.99
08/10/01,18:00,17.99
08/10/01,19:00,17.83
08/10/01,20:00,17.67
08/10/01,21:00,17.19
08/10/01,22:00,16.88
08/10/01,23:00,16.56
08/11/01,00:00,16.4
08/11/01,01:00,16.08
08/11/01,02:00,15.77
08/11/01,03:00,15.61
08/11/01,04:00,15.29
08/11/01,05:00,15.13
08/11/01,06:00,14.82
08/11/01,07:00,14.66
08/11/01,08:00,14.51
08/11/01,09:00,14.66
08/11/01,10:00,14.82
08/11/01,11:00,15.13
08/11/01,12:00,15.77
08/11/01,13:00,16.24
08/11/01,14:00,16.88
08/11/01,15:00,17.36
08/11/01,16:00,17.67
08/11/01,17:00,17.99
08/11/01,18:00,17.99
08/11/01,19:00,17.83
08/11/01,20:00,17.51
08/11/01,21:00,17.19
08/11/01,22:00,16.88
08/11/01,23:00,16.56
08/12/01,00:00,16.24
08/12/01,01:00,16.08
08/12/01,02:00,15.77
08/12/01,03:00,15.45
08/12/01,04:00,15.29
08/12/01,05:00,15.13
08/12/01,06:00,14.82
08/12/01,07:00,14.66
08/12/01,08:00,14.51
08/12/01,09:00,14.66
08/12/01,10:00,14.82
08/12/01,11:00,15.29
08/12/01,12:00,15.92
08/12/01,13:00,16.4
08/12/01,14:00,17.04
08/12/01,15:00,17.51
08/12/01,16:00,17.99
```

```
08/12/01,17:00,18.16
08/12/01,18:00,18.16
08/12/01,19:00,17.99
08/12/01,20:00,17.67
08/12/01,21:00,17.36
08/12/01,22:00,17.04
08/12/01,23:00,16.72
08/13/01,00:00,16.56
08/13/01,01:00,16.4
08/13/01,02:00,16.08
08/13/01,03:00,15.92
08/13/01,04:00,15.61
08/13/01,05:00,15.45
08/13/01,06:00,15.29
08/13/01,07:00,15.13
08/13/01,08:00,14.98
08/13/01,09:00,14.98
08/13/01,10:00,15.13
08/13/01,11:00,15.29
08/13/01,12:00,15.77
08/13/01,13:00,16.24
08/13/01,14:00,16.88
08/13/01,15:00,17.36
08/13/01,16:00,17.67
08/13/01,17:00,17.83
08/13/01,18:00,17.83
08/13/01,19:00,17.67
08/13/01,20:00,17.51
08/13/01,21:00,17.04
08/13/01,22:00,16.72
08/13/01,23:00,16.4
08/14/01,00:00,16.24
08/14/01,01:00,15.92
08/14/01,02:00,15.61
08/14/01,03:00,15.29
08/14/01,04:00,15.13
08/14/01,05:00,14.82
08/14/01,06:00,14.66
08/14/01,07:00,14.35
08/14/01,08:00,14.19
08/14/01,09:00,14.19
08/14/01,10:00,14.35
08/14/01,11:00,14.82
08/14/01,12:00,15.29
08/14/01,13:00,15.77
08/14/01,14:00,16.4
08/14/01,15:00,16.88
08/14/01,16:00,17.36
```

```
08/14/01,17:00,17.51
08/14/01,18:00,17.51
08/14/01,19:00,17.36
08/14/01,20:00,17.19
08/14/01,21:00,16.88
08/14/01,22:00,16.56
08/14/01,23:00,16.24
08/15/01,00:00,16.08
08/15/01,01:00,15.77
08/15/01,02:00,15.61
08/15/01,03:00,15.29
08/15/01,04:00,15.13
08/15/01,05:00,14.82
08/15/01,06:00,14.66
08/15/01,07:00,14.51
08/15/01,08:00,14.35
08/15/01,09:00,14.51
08/15/01,10:00,14.51
08/15/01,11:00,14.82
08/15/01,12:00,15.29
08/15/01,13:00,15.77
08/15/01,14:00,16.4
08/15/01,15:00,16.88
08/15/01,16:00,17.19
08/15/01,17:00,17.36
08/15/01,18:00,17.36
08/15/01,19:00,17.19
08/15/01,20:00,17.04
08/15/01,21:00,16.72
08/15/01,22:00,16.4
08/15/01,23:00,16.24
08/16/01,00:00,16.08
08/16/01,01:00,15.77
08/16/01,02:00,15.61
08/16/01,03:00,15.45
08/16/01,04:00,15.29
08/16/01,05:00,15.13
08/16/01,06:00,14.98
08/16/01,07:00,14.98
08/16/01,08:00,14.82
08/16/01,09:00,14.82
08/16/01,10:00,14.66
08/16/01,11:00,14.66
08/16/01,12:00,14.82
08/16/01,13:00,14.82
08/16/01,14:00,14.98
08/16/01,15:00,14.98
08/16/01,16:00,15.29
```

```
08/16/01,17:00,15.29
08/16/01,18:00,15.45
08/16/01,19:00,15.45
08/16/01,20:00,15.29
08/16/01,21:00,14.98
08/16/01,22:00,14.82
08/16/01,23:00,14.66
08/17/01,00:00,14.51
08/17/01,01:00,14.35
08/17/01,02:00,14.35
08/17/01,03:00,14.19
08/17/01,04:00,14.19
08/17/01,05:00,14.19
08/17/01,06:00,14.04
08/17/01,07:00,14.04
08/17/01,08:00,14.04
08/17/01,09:00,14.04
08/17/01,10:00,14.04
08/17/01,11:00,14.19
08/17/01,12:00,14.35
08/17/01,13:00,14.66
08/17/01,14:00,14.98
08/17/01,15:00,15.29
08/17/01,16:00,15.45
08/17/01,17:00,15.45
08/17/01,18:00,15.45
08/17/01,19:00,15.29
08/17/01,20:00,15.29
08/17/01,21:00,15.13
08/17/01,22:00,14.98
08/17/01,23:00,14.66
08/18/01,00:00,14.51
08/18/01,01:00,14.51
08/18/01,02:00,14.35
08/18/01,03:00,14.35
08/18/01,04:00,14.19
08/18/01,05:00,14.19
08/18/01,06:00,14.04
08/18/01,07:00,14.04
08/18/01,08:00,14.04
08/18/01,09:00,14.04
08/18/01,10:00,14.04
08/18/01,11:00,14.04
08/18/01,12:00,14.19
08/18/01,13:00,14.51
08/18/01,14:00,14.82
08/18/01,15:00,15.13
08/18/01,16:00,15.29
```

```
08/18/01,17:00,15.13
08/18/01,18:00,15.13
08/18/01,19:00,15.13
08/18/01,20:00,15.13
08/18/01,21:00,14.98
08/18/01,22:00,14.66
08/18/01,23:00,14.66
08/19/01,00:00,14.51
08/19/01,01:00,14.35
08/19/01,02:00,14.35
08/19/01,03:00,14.19
08/19/01,04:00,14.04
08/19/01,05:00,14.04
08/19/01,06:00,13.88
08/19/01,07:00,13.88
08/19/01,08:00,13.88
08/19/01,09:00,13.88
08/19/01,10:00,14.04
08/19/01,11:00,14.19
08/19/01,12:00,14.51
08/19/01,13:00,14.98
08/19/01,14:00,15.45
08/19/01,15:00,15.77
08/19/01,16:00,15.92
08/19/01,17:00,16.08
08/19/01,18:00,16.08
08/19/01,19:00,15.92
08/19/01,20:00,15.61
08/19/01,21:00,15.29
08/19/01,22:00,14.98
08/19/01,23:00,14.66
08/20/01,00:00,14.51
08/20/01,01:00,14.19
08/20/01,02:00,13.88
08/20/01,03:00,13.58
08/20/01,04:00,13.42
08/20/01,05:00,13.12
08/20/01,06:00,12.96
08/20/01,07:00,12.81
08/20/01,08:00,12.65
08/20/01,09:00,12.81
08/20/01,10:00,12.96
08/20/01,11:00,13.27
08/20/01,12:00,13.73
08/20/01,13:00,14.04
08/20/01,14:00,14.66
08/20/01,15:00,14.82
08/20/01,16:00,15.29
```

```
08/20/01,17:00,15.45
08/20/01,18:00,15.45
08/20/01,19:00,15.45
08/20/01,20:00,15.13
08/20/01,21:00,14.98
08/20/01,22:00,14.66
08/20/01,23:00,14.51
08/21/01,00:00,14.19
08/21/01,01:00,14.04
08/21/01,02:00,14.04
08/21/01,03:00,13.88
08/21/01,04:00,13.73
08/21/01,05:00,13.58
08/21/01,06:00,13.58
08/21/01,07:00,13.42
08/21/01,08:00,13.42
08/21/01,09:00,13.58
08/21/01,10:00,13.58
08/21/01,11:00,13.73
08/21/01,12:00,13.88
08/21/01,13:00,14.04
08/21/01,14:00,14.35
08/21/01,15:00,14.51
08/21/01,16:00,14.51
08/21/01,17:00,14.35
08/21/01,18:00,14.35
08/21/01,19:00,14.35
08/21/01,20:00,14.35
08/21/01,21:00,14.51
08/21/01,22:00,14.98
08/21/01,23:00,15.13
08/22/01,00:00,14.98
08/22/01,01:00,14.98
08/22/01,02:00,15.13
08/22/01,03:00,15.13
08/22/01,04:00,14.98
08/22/01,05:00,14.98
08/22/01,06:00,15.13
08/22/01,07:00,14.98
08/22/01,08:00,14.98
08/22/01,09:00,14.98
08/22/01,10:00,15.13
08/22/01,11:00,14.98
08/22/01,12:00,15.13
08/22/01,13:00,15.29
08/22/01,14:00,15.29
08/22/01,15:00,15.45
08/22/01,16:00,15.45
```

```
08/22/01,17:00,15.77
08/22/01,18:00,16.56
08/22/01,19:00,16.08
08/22/01,20:00,16.24
08/22/01,21:00,16.08
08/22/01,22:00,15.77
08/22/01,23:00,15.45
08/23/01,00:00,15.29
08/23/01,01:00,15.13
08/23/01,02:00,14.82
08/23/01,03:00,14.51
08/23/01,04:00,14.35
08/23/01,05:00,14.19
08/23/01,06:00,14.04
08/23/01,07:00,14.04
08/23/01,08:00,14.04
08/23/01,09:00,14.04
08/23/01,10:00,13.88
08/23/01,11:00,14.04
08/23/01,12:00,14.04
08/23/01,13:00,14.19
08/23/01,14:00,14.19
08/23/01,15:00,14.35
08/23/01,16:00,14.51
08/23/01,17:00,14.66
08/23/01,18:00,14.66
08/23/01,19:00,14.66
08/23/01,20:00,14.51
08/23/01,21:00,14.35
08/23/01,22:00,14.19
08/23/01,23:00,14.19
08/24/01,00:00,14.04
08/24/01,01:00,13.88
08/24/01,02:00,13.88
08/24/01,03:00,13.73
08/24/01,04:00,13.58
08/24/01,05:00,13.42
08/24/01,06:00,13.27
08/24/01,07:00,13.12
08/24/01,08:00,12.96
08/24/01,09:00,13.12
08/24/01,10:00,13.27
08/24/01,11:00,13.58
```

Date,Time,Temperature (*C)
08/24/01,11:10,~~18.31~~
08/24/01,12:10,13.88
08/24/01,13:10,14.19
08/24/01,14:10,14.66
08/24/01,15:10,14.98
08/24/01,16:10,15.29
08/24/01,17:10,15.45
08/24/01,18:10,15.29
08/24/01,19:10,15.13
08/24/01,20:10,14.98
08/24/01,21:10,14.66
08/24/01,22:10,14.51
08/24/01,23:10,14.35
08/25/01,00:10,14.04
08/25/01,01:10,13.88
08/25/01,02:10,13.73
08/25/01,03:10,13.42
08/25/01,04:10,13.27
08/25/01,05:10,12.96
08/25/01,06:10,12.81
08/25/01,07:10,12.65
08/25/01,08:10,12.49
08/25/01,09:10,12.49
08/25/01,10:10,12.81
08/25/01,11:10,13.12
08/25/01,12:10,13.58
08/25/01,13:10,14.19
08/25/01,14:10,14.66
08/25/01,15:10,15.13
08/25/01,16:10,15.45
08/25/01,17:10,15.61
08/25/01,18:10,15.61
08/25/01,19:10,15.45
08/25/01,20:10,15.29
08/25/01,21:10,14.98
08/25/01,22:10,14.82
08/25/01,23:10,14.66
08/26/01,00:10,14.35
08/26/01,01:10,14.19
08/26/01,02:10,14.04
08/26/01,03:10,13.73
08/26/01,04:10,13.58
08/26/01,05:10,13.27
08/26/01,06:10,13.12
08/26/01,07:10,12.96
08/26/01,08:10,12.96
08/26/01,09:10,12.96

```
08/26/01,10:10,13.12
08/26/01,11:10,13.58
08/26/01,12:10,14.04
08/26/01,13:10,14.51
08/26/01,14:10,15.13
08/26/01,15:10,15.61
08/26/01,16:10,15.92
08/26/01,17:10,16.08
08/26/01,18:10,15.92
08/26/01,19:10,15.77
08/26/01,20:10,15.61
08/26/01,21:10,15.29
08/26/01,22:10,15.13
08/26/01,23:10,14.98
08/27/01,00:10,14.66
08/27/01,01:10,14.51
08/27/01,02:10,14.35
08/27/01,03:10,14.04
08/27/01,04:10,13.88
08/27/01,05:10,13.58
08/27/01,06:10,13.42
08/27/01,07:10,13.27
08/27/01,08:10,13.12
08/27/01,09:10,13.12
08/27/01,10:10,13.42
08/27/01,11:10,13.73
08/27/01,12:10,14.19
08/27/01,13:10,14.66
08/27/01,14:10,15.13
08/27/01,15:10,15.45
08/27/01,16:10,15.61
08/27/01,17:10,15.77
08/27/01,18:10,15.77
08/27/01,19:10,15.61
08/27/01,20:10,15.29
08/27/01,21:10,15.13
08/27/01,22:10,14.98
08/27/01,23:10,14.98
08/28/01,00:10,14.82
08/28/01,01:10,14.82
08/28/01,02:10,14.66
08/28/01,03:10,14.51
08/28/01,04:10,14.35
08/28/01,05:10,14.19
08/28/01,06:10,14.04
08/28/01,07:10,14.04
08/28/01,08:10,13.88
08/28/01,09:10,14.04
```

```
08/28/01,10:10,14.19
08/28/01,11:10,14.51
08/28/01,12:10,14.98
08/28/01,13:10,15.45
08/28/01,14:10,15.92
08/28/01,15:10,16.4
08/28/01,16:10,16.72
08/28/01,17:10,16.72
08/28/01,18:10,16.72
08/28/01,19:10,16.56
08/28/01,20:10,16.24
08/28/01,21:10,15.92
08/28/01,22:10,15.77
08/28/01,23:10,15.61
08/29/01,00:10,15.45
08/29/01,01:10,15.13
08/29/01,02:10,14.98
08/29/01,03:10,14.82
08/29/01,04:10,14.51
08/29/01,05:10,14.35
08/29/01,06:10,14.19
08/29/01,07:10,14.04
08/29/01,08:10,14.04
08/29/01,09:10,14.04
08/29/01,10:10,14.19
08/29/01,11:10,14.51
08/29/01,12:10,14.98
08/29/01,13:10,15.45
08/29/01,14:10,16.08
08/29/01,15:10,16.4
08/29/01,16:10,16.72
08/29/01,17:10,16.72
08/29/01,18:10,16.72
08/29/01,19:10,16.56
08/29/01,20:10,16.4
08/29/01,21:10,16.08
08/29/01,22:10,15.92
08/29/01,23:10,15.77
08/30/01,00:10,15.45
08/30/01,01:10,15.29
08/30/01,02:10,15.13
08/30/01,03:10,14.82
08/30/01,04:10,14.66
08/30/01,05:10,14.35
08/30/01,06:10,14.19
08/30/01,07:10,14.04
08/30/01,08:10,13.88
08/30/01,09:10,13.88
```

```
08/30/01,10:10,14.04
08/30/01,11:10,14.51
08/30/01,12:10,14.98
08/30/01,13:10,15.45
08/30/01,14:10,15.92
08/30/01,15:10,16.4
08/30/01,16:10,16.56
08/30/01,17:10,16.72
08/30/01,18:10,16.56
08/30/01,19:10,16.4
08/30/01,20:10,16.24
08/30/01,21:10,15.92
08/30/01,22:10,15.77
08/30/01,23:10,15.61
08/31/01,00:10,15.45
08/31/01,01:10,15.45
08/31/01,02:10,15.29
08/31/01,03:10,15.29
08/31/01,04:10,15.13
08/31/01,05:10,14.98
08/31/01,06:10,14.98
08/31/01,07:10,14.82
08/31/01,08:10,14.82
08/31/01,09:10,14.82
08/31/01,10:10,14.82
08/31/01,11:10,15.13
08/31/01,12:10,15.45
08/31/01,13:10,15.77
08/31/01,14:10,16.08
08/31/01,15:10,16.24
08/31/01,16:10,16.4
08/31/01,17:10,16.4
08/31/01,18:10,16.4
08/31/01,19:10,16.24
08/31/01,20:10,16.08
08/31/01,21:10,15.92
08/31/01,22:10,15.77
08/31/01,23:10,15.77
09/01/01,00:10,15.61
09/01/01,01:10,15.45
09/01/01,02:10,15.29
09/01/01,03:10,15.13
09/01/01,04:10,15.13
09/01/01,05:10,14.98
09/01/01,06:10,14.98
09/01/01,07:10,14.82
09/01/01,08:10,14.82
09/01/01,09:10,14.82
```

```
09/01/01,10:10,14.98
09/01/01,11:10,15.13
09/01/01,12:10,15.29
09/01/01,13:10,15.29
09/01/01,14:10,15.29
09/01/01,15:10,15.45
09/01/01,16:10,15.29
09/01/01,17:10,15.29
09/01/01,18:10,15.29
09/01/01,19:10,15.13
09/01/01,20:10,14.98
09/01/01,21:10,14.82
09/01/01,22:10,14.66
09/01/01,23:10,14.51
09/02/01,00:10,14.35
09/02/01,01:10,14.19
09/02/01,02:10,14.04
09/02/01,03:10,13.88
09/02/01,04:10,13.73
09/02/01,05:10,13.58
09/02/01,06:10,13.58
09/02/01,07:10,13.42
09/02/01,08:10,13.27
09/02/01,09:10,13.42
09/02/01,10:10,13.58
09/02/01,11:10,13.88
09/02/01,12:10,14.19
09/02/01,13:10,14.66
09/02/01,14:10,15.29
09/02/01,15:10,15.61
09/02/01,16:10,15.77
09/02/01,17:10,15.77
09/02/01,18:10,15.77
09/02/01,19:10,15.61
09/02/01,20:10,15.45
09/02/01,21:10,15.29
09/02/01,22:10,15.13
09/02/01,23:10,14.98
09/03/01,00:10,14.82
09/03/01,01:10,14.66
09/03/01,02:10,14.51
09/03/01,03:10,14.35
09/03/01,04:10,14.35
09/03/01,05:10,14.19
09/03/01,06:10,14.19
09/03/01,07:10,14.04
09/03/01,08:10,14.04
09/03/01,09:10,13.88
```

```
09/03/01,10:10,14.04
09/03/01,11:10,14.04
09/03/01,12:10,14.04
09/03/01,13:10,14.04
09/03/01,14:10,14.19
09/03/01,15:10,14.35
09/03/01,16:10,14.66
09/03/01,17:10,14.98
09/03/01,18:10,14.98
09/03/01,19:10,14.82
09/03/01,20:10,14.51
09/03/01,21:10,14.35
09/03/01,22:10,14.19
09/03/01,23:10,14.04
09/04/01,00:10,13.88
09/04/01,01:10,13.73
09/04/01,02:10,13.58
09/04/01,03:10,13.58
09/04/01,04:10,13.42
09/04/01,05:10,13.27
09/04/01,06:10,13.12
09/04/01,07:10,13.12
09/04/01,08:10,12.96
09/04/01,09:10,12.96
09/04/01,10:10,13.27
09/04/01,11:10,13.42
09/04/01,12:10,13.88
09/04/01,13:10,14.04
09/04/01,14:10,14.04
09/04/01,15:10,14.19
09/04/01,16:10,14.35
09/04/01,17:10,14.35
09/04/01,18:10,14.51
09/04/01,19:10,14.35
09/04/01,20:10,14.19
09/04/01,21:10,14.04
09/04/01,22:10,13.88
09/04/01,23:10,13.73
09/05/01,00:10,13.73
09/05/01,01:10,13.58
09/05/01,02:10,13.42
09/05/01,03:10,13.27
09/05/01,04:10,13.27
09/05/01,05:10,13.12
09/05/01,06:10,13.12
09/05/01,07:10,12.96
09/05/01,08:10,12.81
09/05/01,09:10,12.81
```

```
09/05/01,10:10,12.81
09/05/01,11:10,12.96
09/05/01,12:10,13.12
09/05/01,13:10,13.42
09/05/01,14:10,13.58
09/05/01,15:10,13.73
09/05/01,16:10,13.88
09/05/01,17:10,13.88
09/05/01,18:10,13.88
09/05/01,19:10,13.88
09/05/01,20:10,13.73
09/05/01,21:10,13.58
09/05/01,22:10,13.42
09/05/01,23:10,13.27
09/06/01,00:10,13.12
09/06/01,01:10,12.96
09/06/01,02:10,12.81
09/06/01,03:10,12.65
09/06/01,04:10,12.49
09/06/01,05:10,12.49
09/06/01,06:10,12.49
09/06/01,07:10,12.34
09/06/01,08:10,12.34
09/06/01,09:10,12.34
09/06/01,10:10,12.49
09/06/01,11:10,12.49
09/06/01,12:10,12.65
09/06/01,13:10,12.96
09/06/01,14:10,13.12
09/06/01,15:10,13.58
09/06/01,16:10,13.73
09/06/01,17:10,13.88
09/06/01,18:10,13.88
09/06/01,19:10,13.73
09/06/01,20:10,13.58
09/06/01,21:10,13.42
09/06/01,22:10,13.42
09/06/01,23:10,13.27
09/07/01,00:10,13.27
09/07/01,01:10,13.12
09/07/01,02:10,12.96
09/07/01,03:10,12.81
09/07/01,04:10,12.81
09/07/01,05:10,12.81
09/07/01,06:10,12.65
09/07/01,07:10,12.65
09/07/01,08:10,12.65
09/07/01,09:10,12.65
```

```
09/07/01,10:10,12.81
09/07/01,11:10,13.12
09/07/01,12:10,13.42
09/07/01,13:10,13.73
09/07/01,14:10,14.04
09/07/01,15:10,14.35
09/07/01,16:10,14.51
09/07/01,17:10,14.66
09/07/01,18:10,14.51
09/07/01,19:10,14.35
09/07/01,20:10,14.19
09/07/01,21:10,13.88
09/07/01,22:10,13.73
09/07/01,23:10,13.58
09/08/01,00:10,13.27
09/08/01,01:10,13.12
09/08/01,02:10,12.81
09/08/01,03:10,12.65
09/08/01,04:10,12.34
09/08/01,05:10,12.18
09/08/01,06:10,12.03
09/08/01,07:10,11.72
09/08/01,08:10,11.56
09/08/01,09:10,11.72
09/08/01,10:10,11.87
09/08/01,11:10,12.34
09/08/01,12:10,12.81
09/08/01,13:10,13.27
09/08/01,14:10,13.73
09/08/01,15:10,14.19
09/08/01,16:10,14.51
09/08/01,17:10,14.51
09/08/01,18:10,14.51
09/08/01,19:10,14.35
09/08/01,20:10,14.04
09/08/01,21:10,13.88
09/08/01,22:10,13.73
09/08/01,23:10,13.42
09/09/01,00:10,13.27
09/09/01,01:10,12.96
09/09/01,02:10,12.81
09/09/01,03:10,12.65
09/09/01,04:10,12.34
09/09/01,05:10,12.03
09/09/01,06:10,11.87
09/09/01,07:10,11.72
09/09/01,08:10,11.56
09/09/01,09:10,11.56
```

```
09/09/01,10:10,11.72
09/09/01,11:10,12.18
09/09/01,12:10,12.65
09/09/01,13:10,13.27
09/09/01,14:10,13.73
09/09/01,15:10,14.19
09/09/01,16:10,14.35
09/09/01,17:10,14.35
09/09/01,18:10,14.35
09/09/01,19:10,14.19
09/09/01,20:10,13.88
09/09/01,21:10,13.73
09/09/01,22:10,13.42
09/09/01,23:10,13.27
09/10/01,00:10,12.96
09/10/01,01:10,12.81
09/10/01,02:10,12.65
09/10/01,03:10,12.34
09/10/01,04:10,12.18
09/10/01,05:10,11.87
09/10/01,06:10,11.72
09/10/01,07:10,11.56
09/10/01,08:10,11.41
09/10/01,09:10,11.41
09/10/01,10:10,11.56
09/10/01,11:10,12.03
09/10/01,12:10,12.49
09/10/01,13:10,12.96
09/10/01,14:10,13.58
09/10/01,15:10,14.04
09/10/01,16:10,14.19
09/10/01,17:10,14.35
09/10/01,18:10,14.19
09/10/01,19:10,14.04
09/10/01,20:10,13.88
09/10/01,21:10,13.58
09/10/01,22:10,13.42
09/10/01,23:10,13.27
09/11/01,00:10,13.12
09/11/01,01:10,12.96
09/11/01,02:10,12.65
09/11/01,03:10,12.49
09/11/01,04:10,12.34
09/11/01,05:10,12.18
09/11/01,06:10,11.87
09/11/01,07:10,11.72
09/11/01,08:10,11.72
09/11/01,09:10,11.72
```

```
09/11/01,10:10,11.87
09/11/01,11:10,12.34
09/11/01,12:10,12.81
09/11/01,13:10,13.27
09/11/01,14:10,13.88
09/11/01,15:10,14.19
09/11/01,16:10,14.51
09/11/01,17:10,14.51
09/11/01,18:10,14.51
09/11/01,19:10,14.35
09/11/01,20:10,14.04
09/11/01,21:10,13.88
09/11/01,22:10,13.73
09/11/01,23:10,13.58
09/12/01,00:10,13.42
09/12/01,01:10,13.12
09/12/01,02:10,12.96
09/12/01,03:10,12.81
09/12/01,04:10,12.49
09/12/01,05:10,12.34
09/12/01,06:10,12.18
09/12/01,07:10,12.03
09/12/01,08:10,11.87
09/12/01,09:10,11.87
09/12/01,10:10,12.03
09/12/01,11:10,12.49
09/12/01,12:10,12.96
09/12/01,13:10,13.58
09/12/01,14:10,14.04
09/12/01,15:10,14.51
09/12/01,16:10,14.82
09/12/01,17:10,14.82
09/12/01,18:10,14.82
09/12/01,19:10,14.66
09/12/01,20:10,14.35
09/12/01,21:10,14.19
09/12/01,22:10,13.88
09/12/01,23:10,13.73
09/13/01,00:10,13.58
09/13/01,01:10,13.42
09/13/01,02:10,13.27
09/13/01,03:10,12.96
09/13/01,04:10,12.81
09/13/01,05:10,12.65
09/13/01,06:10,12.49
09/13/01,07:10,12.34
09/13/01,08:10,12.18
09/13/01,09:10,12.18
```

```
09/13/01,10:10,12.49
09/13/01,11:10,12.81
09/13/01,12:10,13.12
09/13/01,13:10,13.73
09/13/01,14:10,14.19
09/13/01,15:10,14.66
09/13/01,16:10,14.98
09/13/01,17:10,14.98
09/13/01,18:10,14.82
09/13/01,19:10,14.66
09/13/01,20:10,14.51
09/13/01,21:10,14.35
09/13/01,22:10,14.19
09/13/01,23:10,14.04
09/14/01,00:10,13.88
09/14/01,01:10,13.58
09/14/01,02:10,13.42
09/14/01,03:10,13.27
09/14/01,04:10,13.12
09/14/01,05:10,12.96
09/14/01,06:10,12.81
09/14/01,07:10,12.65
09/14/01,08:10,12.49
09/14/01,09:10,12.49
09/14/01,10:10,12.65
09/14/01,11:10,13.12
09/14/01,12:10,13.58
09/14/01,13:10,14.04
09/14/01,14:10,14.51
09/14/01,15:10,14.98
09/14/01,16:10,15.29
09/14/01,17:10,15.29
09/14/01,18:10,15.29
09/14/01,19:10,15.13
09/14/01,20:10,14.82
09/14/01,21:10,14.51
09/14/01,22:10,14.35
09/14/01,23:10,14.19
09/15/01,00:10,14.04
09/15/01,01:10,13.88
09/15/01,02:10,13.58
09/15/01,03:10,13.42
09/15/01,04:10,13.27
09/15/01,05:10,13.12
09/15/01,06:10,12.96
09/15/01,07:10,12.65
09/15/01,08:10,12.65
09/15/01,09:10,12.65
```

```
09/15/01,10:10,12.81
09/15/01,11:10,13.12
09/15/01,12:10,13.58
09/15/01,13:10,14.04
09/15/01,14:10,14.51
09/15/01,15:10,14.98
09/15/01,16:10,15.13
09/15/01,17:10,15.13
09/15/01,18:10,15.13
09/15/01,19:10,14.82
09/15/01,20:10,14.66
09/15/01,21:10,14.51
09/15/01,22:10,14.35
09/15/01,23:10,14.19
09/16/01,00:10,14.04
09/16/01,01:10,13.88
09/16/01,02:10,13.73
09/16/01,03:10,13.42
09/16/01,04:10,13.27
09/16/01,05:10,13.12
09/16/01,06:10,12.96
09/16/01,07:10,12.96
09/16/01,08:10,12.96
09/16/01,09:10,12.96
09/16/01,10:10,12.96
09/16/01,11:10,12.96
09/16/01,12:10,12.96
09/16/01,13:10,13.12
09/16/01,14:10,13.27
09/16/01,15:10,13.42
09/16/01,16:10,13.42
09/16/01,17:10,13.58
09/16/01,18:10,13.42
09/16/01,19:10,13.42
09/16/01,20:10,13.27
09/16/01,21:10,13.12
09/16/01,22:10,12.96
09/16/01,23:10,12.96
09/17/01,00:10,12.96
09/17/01,01:10,12.96
09/17/01,02:10,12.81
09/17/01,03:10,12.81
09/17/01,04:10,12.81
09/17/01,05:10,12.81
09/17/01,06:10,12.81
09/17/01,07:10,12.81
09/17/01,08:10,12.81
09/17/01,09:10,12.81
```

```
09/17/01,10:10,12.81
09/17/01,11:10,12.81
09/17/01,12:10,12.81
09/17/01,13:10,12.96
09/17/01,14:10,12.96
09/17/01,15:10,13.12
09/17/01,16:10,13.27
09/17/01,17:10,13.27
09/17/01,18:10,13.27
09/17/01,19:10,13.12
09/17/01,20:10,13.12
09/17/01,21:10,12.96
09/17/01,22:10,12.96
09/17/01,23:10,12.96
09/18/01,00:10,12.81
09/18/01,01:10,12.81
09/18/01,02:10,12.81
09/18/01,03:10,12.81
09/18/01,04:10,12.65
09/18/01,05:10,12.65
09/18/01,06:10,12.65
09/18/01,07:10,12.65
09/18/01,08:10,12.65
09/18/01,09:10,12.65
09/18/01,10:10,12.65
09/18/01,11:10,12.65
09/18/01,12:10,12.81
09/18/01,13:10,12.96
09/18/01,14:10,13.12
09/18/01,15:10,13.12
09/18/01,16:10,13.27
09/18/01,17:10,13.27
09/18/01,18:10,13.27
09/18/01,19:10,13.27
09/18/01,20:10,13.27
09/18/01,21:10,13.12
09/18/01,22:10,13.12
09/18/01,23:10,12.96
09/19/01,00:10,12.96
09/19/01,01:10,12.96
09/19/01,02:10,12.81
09/19/01,03:10,12.81
09/19/01,04:10,12.65
09/19/01,05:10,12.65
09/19/01,06:10,12.49
09/19/01,07:10,12.34
09/19/01,08:10,12.18
09/19/01,09:10,12.18
```

```
09/19/01,10:10,12.34
09/19/01,11:10,12.49
09/19/01,12:10,12.65
09/19/01,13:10,13.12
09/19/01,14:10,13.27
09/19/01,15:10,13.58
09/19/01,16:10,13.73
09/19/01,17:10,13.73
09/19/01,18:10,13.73
09/19/01,19:10,13.42
09/19/01,20:10,13.27
09/19/01,21:10,12.96
09/19/01,22:10,12.81
09/19/01,23:10,12.65
09/20/01,00:10,12.34
09/20/01,01:10,12.18
09/20/01,02:10,11.87
09/20/01,03:10,11.72
09/20/01,04:10,11.56
09/20/01,05:10,11.41
09/20/01,06:10,11.1
09/20/01,07:10,10.94
09/20/01,08:10,10.79
09/20/01,09:10,10.79
09/20/01,10:10,10.94
09/20/01,11:10,11.41
09/20/01,12:10,11.87
09/20/01,13:10,12.34
09/20/01,14:10,12.65
09/20/01,15:10,12.96
09/20/01,16:10,13.12
09/20/01,17:10,13.27
09/20/01,18:10,13.27
09/20/01,19:10,13.12
09/20/01,20:10,12.96
09/20/01,21:10,12.81
09/20/01,22:10,12.81
09/20/01,23:10,12.65
09/21/01,00:10,12.49
09/21/01,01:10,12.49
09/21/01,02:10,12.34
09/21/01,03:10,12.34
09/21/01,04:10,12.18
09/21/01,05:10,12.18
09/21/01,06:10,12.18
09/21/01,07:10,12.18
09/21/01,08:10,12.18
09/21/01,09:10,12.18
```

```
09/21/01,10:10,12.18
09/21/01,11:10,12.18
09/21/01,12:10,12.34
09/21/01,13:10,12.49
09/21/01,14:10,12.81
09/21/01,15:10,12.96
09/21/01,16:10,13.12
09/21/01,17:10,13.12
09/21/01,18:10,13.27
09/21/01,19:10,13.12
09/21/01,20:10,13.12
09/21/01,21:10,13.12
09/21/01,22:10,12.96
09/21/01,23:10,12.96
09/22/01,00:10,12.81
09/22/01,01:10,12.81
09/22/01,02:10,12.65
09/22/01,03:10,12.65
09/22/01,04:10,12.49
09/22/01,05:10,12.34
09/22/01,06:10,12.18
09/22/01,07:10,12.03
09/22/01,08:10,12.03
09/22/01,09:10,12.03
09/22/01,10:10,12.18
09/22/01,11:10,12.49
09/22/01,12:10,12.96
09/22/01,13:10,13.42
09/22/01,14:10,13.88
09/22/01,15:10,14.19
09/22/01,16:10,14.51
09/22/01,17:10,14.51
09/22/01,18:10,14.51
09/22/01,19:10,14.35
09/22/01,20:10,14.19
09/22/01,21:10,14.04
09/22/01,22:10,13.88
09/22/01,23:10,13.73
09/23/01,00:10,13.58
09/23/01,01:10,13.42
09/23/01,02:10,13.27
09/23/01,03:10,13.12
09/23/01,04:10,12.96
09/23/01,05:10,12.65
09/23/01,06:10,12.49
09/23/01,07:10,12.34
09/23/01,08:10,12.18
09/23/01,09:10,12.18
```

```
09/23/01,10:10,12.34
09/23/01,11:10,12.81
09/23/01,12:10,13.27
09/23/01,13:10,13.58
09/23/01,14:10,14.04
09/23/01,15:10,14.51
09/23/01,16:10,14.66
09/23/01,17:10,14.82
09/23/01,18:10,14.66
09/23/01,19:10,14.51
09/23/01,20:10,14.19
09/23/01,21:10,14.04
09/23/01,22:10,14.04
09/23/01,23:10,13.88
09/24/01,00:10,13.73
09/24/01,01:10,13.58
09/24/01,02:10,13.27
09/24/01,03:10,13.27
09/24/01,04:10,13.12
09/24/01,05:10,12.96
09/24/01,06:10,12.81
09/24/01,07:10,12.65
09/24/01,08:10,12.65
09/24/01,09:10,12.65
09/24/01,10:10,12.81
09/24/01,11:10,12.96
09/24/01,12:10,12.96
09/24/01,13:10,13.12
09/24/01,14:10,13.27
09/24/01,15:10,13.42
09/24/01,16:10,13.73
09/24/01,17:10,13.73
09/24/01,18:10,13.73
09/24/01,19:10,13.58
09/24/01,20:10,13.42
09/24/01,21:10,13.27
09/24/01,22:10,13.27
09/24/01,23:10,13.27
09/25/01,00:10,13.27
09/25/01,01:10,13.12
09/25/01,02:10,13.12
09/25/01,03:10,13.12
09/25/01,04:10,13.12
09/25/01,05:10,13.12
09/25/01,06:10,13.12
09/25/01,07:10,13.12
09/25/01,08:10,13.12
09/25/01,09:10,13.12
```

```
09/25/01,10:10,13.27
09/25/01,11:10,13.27
09/25/01,12:10,13.27
09/25/01,13:10,13.42
09/25/01,14:10,13.58
09/25/01,15:10,13.58
09/25/01,16:10,13.58
09/25/01,17:10,13.58
09/25/01,18:10,13.58
09/25/01,19:10,13.58
09/25/01,20:10,13.42
09/25/01,21:10,13.42
09/25/01,22:10,13.42
09/25/01,23:10,13.42
09/26/01,00:10,13.42
09/26/01,01:10,13.42
09/26/01,02:10,13.58
09/26/01,03:10,13.58
09/26/01,04:10,13.42
09/26/01,05:10,13.27
09/26/01,06:10,13.27
09/26/01,07:10,13.27
09/26/01,08:10,13.12
09/26/01,09:10,13.12
09/26/01,10:10,13.27
09/26/01,11:10,13.27
09/26/01,12:10,13.42
09/26/01,13:10,13.88
09/26/01,14:10,13.88
09/26/01,15:10,14.19
09/26/01,16:10,13.88
09/26/01,17:10,14.35
09/26/01,18:10,14.04
09/26/01,19:10,13.73
09/26/01,20:10,13.73
09/26/01,21:10,13.42
09/26/01,22:10,13.27
09/26/01,23:10,12.96
09/27/01,00:10,12.81
09/27/01,01:10,12.65
09/27/01,02:10,12.34
09/27/01,03:10,12.18
09/27/01,04:10,11.87
09/27/01,05:10,11.72
09/27/01,06:10,11.41
09/27/01,07:10,11.25
09/27/01,08:10,11.1
09/27/01,09:10,10.94
```

```
09/27/01,10:10,10.94
09/27/01,11:10,11.1
09/27/01,12:10,11.25
09/27/01,13:10,11.41
09/27/01,14:10,11.87
09/27/01,15:10,12.03
09/27/01,16:10,12.03
09/27/01,17:10,12.18
09/27/01,18:10,12.03
09/27/01,19:10,12.03
09/27/01,20:10,11.87
09/27/01,21:10,11.72
09/27/01,22:10,11.56
09/27/01,23:10,11.25
09/28/01,00:10,11.1
09/28/01,01:10,10.94
09/28/01,02:10,10.79
09/28/01,03:10,10.64
09/28/01,04:10,10.48
09/28/01,05:10,10.33
09/28/01,06:10,10.17
09/28/01,07:10,10.02
09/28/01,08:10,9.86
09/28/01,09:10,9.86
09/28/01,10:10,10.02
09/28/01,11:10,10.33
09/28/01,12:10,10.64
09/28/01,13:10,11.1
09/28/01,14:10,11.41
09/28/01,15:10,11.72
09/28/01,16:10,12.03
09/28/01,17:10,12.03
09/28/01,18:10,11.87
09/28/01,19:10,11.72
09/28/01,20:10,11.72
09/28/01,21:10,11.56
09/28/01,22:10,11.41
09/28/01,23:10,11.41
09/29/01,00:10,11.25
09/29/01,01:10,11.1
09/29/01,02:10,10.94
09/29/01,03:10,10.79
09/29/01,04:10,10.64
09/29/01,05:10,10.48
09/29/01,06:10,10.48
09/29/01,07:10,10.33
09/29/01,08:10,10.33
09/29/01,09:10,10.48
```

```
09/29/01,10:10,10.64
09/29/01,11:10,10.94
09/29/01,12:10,11.25
09/29/01,13:10,11.72
09/29/01,14:10,12.18
09/29/01,15:10,12.34
09/29/01,16:10,12.65
09/29/01,17:10,12.65
09/29/01,18:10,12.65
09/29/01,19:10,12.65
09/29/01,20:10,12.49
09/29/01,21:10,12.34
09/29/01,22:10,12.18
09/29/01,23:10,12.03
09/30/01,00:10,11.87
09/30/01,01:10,11.72
09/30/01,02:10,11.56
09/30/01,03:10,11.41
09/30/01,04:10,11.25
09/30/01,05:10,11.1
09/30/01,06:10,11.1
09/30/01,07:10,11.1
09/30/01,08:10,11.25
09/30/01,09:10,11.25
09/30/01,10:10,11.41
09/30/01,11:10,11.41
09/30/01,12:10,11.56
09/30/01,13:10,11.87
09/30/01,14:10,12.03
09/30/01,15:10,12.34
09/30/01,16:10,12.65
09/30/01,17:10,12.81
09/30/01,18:10,12.65
09/30/01,19:10,12.49
09/30/01,20:10,12.34
09/30/01,21:10,12.18
09/30/01,22:10,12.03
09/30/01,23:10,11.87
10/01/01,00:10,11.72
10/01/01,01:10,11.56
10/01/01,02:10,11.41
10/01/01,03:10,11.25
10/01/01,04:10,11.1
10/01/01,05:10,10.94
10/01/01,06:10,10.79
10/01/01,07:10,10.64
10/01/01,08:10,10.64
10/01/01,09:10,10.79
```

```
10/01/01,10:10,10.79
10/01/01,11:10,11.1
10/01/01,12:10,11.25
10/01/01,13:10,11.72
10/01/01,14:10,12.18
10/01/01,15:10,12.49
10/01/01,16:10,12.65
10/01/01,17:10,12.65
10/01/01,18:10,12.49
10/01/01,19:10,12.34
10/01/01,20:10,12.03
10/01/01,21:10,11.87
10/01/01,22:10,11.72
10/01/01,23:10,11.41
10/02/01,00:10,11.25
10/02/01,01:10,10.94
10/02/01,02:10,10.79
10/02/01,03:10,10.48
10/02/01,04:10,10.33
10/02/01,05:10,10.17
10/02/01,06:10,10.02
10/02/01,07:10,9.86
10/02/01,08:10,9.71
10/02/01,09:10,9.71
10/02/01,10:10,9.71
10/02/01,11:10,10.02
10/02/01,12:10,10.48
10/02/01,13:10,10.94
10/02/01,14:10,11.41
10/02/01,15:10,11.72
10/02/01,16:10,11.87
10/02/01,17:10,12.03
10/02/01,18:10,11.87
10/02/01,19:10,11.72
10/02/01,20:10,11.56
10/02/01,21:10,11.41
10/02/01,22:10,11.25
10/02/01,23:10,11.1
10/03/01,00:10,10.94
10/03/01,01:10,10.79
10/03/01,02:10,10.48
10/03/01,03:10,10.33
10/03/01,04:10,10.17
10/03/01,05:10,10.02
10/03/01,06:10,9.71
10/03/01,07:10,9.55
10/03/01,08:10,9.55
10/03/01,09:10,9.55
```

```
10/03/01,10:10,9.71
10/03/01,11:10,10.02
10/03/01,12:10,10.33
10/03/01,13:10,10.48
10/03/01,14:10,10.94
10/03/01,15:10,11.25
10/03/01,16:10,11.41
10/03/01,17:10,11.56
10/03/01,18:10,11.41
10/03/01,19:10,11.25
10/03/01,20:10,11.1
10/03/01,21:10,10.94
10/03/01,22:10,10.79
10/03/01,23:10,10.64
10/04/01,00:10,10.48
10/04/01,01:10,10.33
10/04/01,02:10,10.17
10/04/01,03:10,10.02
10/04/01,04:10,9.71
10/04/01,05:10,9.55
10/04/01,06:10,9.39
10/04/01,07:10,9.39
10/04/01,08:10,9.24
10/04/01,09:10,9.24
10/04/01,10:10,9.24
10/04/01,11:10,9.55
10/04/01,12:10,10.02
10/04/01,13:10,10.48
10/04/01,14:10,10.94
10/04/01,15:10,11.25
10/04/01,16:10,11.56
10/04/01,17:10,11.56
10/04/01,18:10,11.41
10/04/01,19:10,11.25
10/04/01,20:10,11.1
10/04/01,21:10,10.79
10/04/01,22:10,10.64
10/04/01,23:10,10.48
10/05/01,00:10,10.33
10/05/01,01:10,10.02
10/05/01,02:10,9.71
10/05/01,03:10,9.55
10/05/01,04:10,9.24
10/05/01,05:10,9.09
10/05/01,06:10,8.93
10/05/01,07:10,8.63
10/05/01,08:10,8.47
10/05/01,09:10,8.47
```

```
10/05/01,10:10,8.63
10/05/01,11:10,9.09
10/05/01,12:10,9.55
10/05/01,13:10,10.02
10/05/01,14:10,10.48
10/05/01,15:10,10.79
10/05/01,16:10,10.94
10/05/01,17:10,11.1
10/05/01,18:10,10.94
10/05/01,19:10,10.79
10/05/01,20:10,10.64
10/05/01,21:10,10.48
10/05/01,22:10,10.33
10/05/01,23:10,10.17
10/06/01,00:10,10.02
10/06/01,01:10,9.71
10/06/01,02:10,9.71
10/06/01,03:10,9.71
10/06/01,04:10,9.71
10/06/01,05:10,9.71
10/06/01,06:10,9.71
10/06/01,07:10,9.71
10/06/01,08:10,9.71
10/06/01,09:10,9.86
10/06/01,10:10,10.02
10/06/01,11:10,10.33
10/06/01,12:10,10.48
10/06/01,13:10,10.94
10/06/01,14:10,11.1
10/06/01,15:10,11.41
10/06/01,16:10,11.56
10/06/01,17:10,11.56
10/06/01,18:10,11.41
10/06/01,19:10,11.1
10/06/01,20:10,10.94
10/06/01,21:10,10.79
10/06/01,22:10,10.48
10/06/01,23:10,10.33
10/07/01,00:10,10.17
10/07/01,01:10,10.02
10/07/01,02:10,9.86
10/07/01,03:10,9.71
10/07/01,04:10,9.71
10/07/01,05:10,9.55
10/07/01,06:10,9.55
10/07/01,07:10,9.55
10/07/01,08:10,9.39
10/07/01,09:10,9.55
```

```
10/07/01,10:10,9.55
10/07/01,11:10,9.55
10/07/01,12:10,9.71
10/07/01,13:10,9.86
10/07/01,14:10,9.86
10/07/01,15:10,10.17
10/07/01,16:10,10.33
10/07/01,17:10,10.48
10/07/01,18:10,10.48
10/07/01,19:10,10.48
10/07/01,20:10,10.33
10/07/01,21:10,10.33
10/07/01,22:10,10.33
10/07/01,23:10,10.33
10/08/01,00:10,10.33
10/08/01,01:10,10.33
10/08/01,02:10,10.33
10/08/01,03:10,10.33
10/08/01,04:10,10.33
10/08/01,05:10,10.48
10/08/01,06:10,10.48
10/08/01,07:10,10.48
10/08/01,08:10,10.64
10/08/01,09:10,10.79
10/08/01,10:10,10.79
10/08/01,11:10,10.79
10/08/01,12:10,10.94
10/08/01,13:10,11.25
10/08/01,14:10,11.56
10/08/01,15:10,11.56
10/08/01,16:10,11.72
10/08/01,17:10,11.56
10/08/01,18:10,11.56
10/08/01,19:10,11.41
10/08/01,20:10,11.41
10/08/01,21:10,11.25
10/08/01,22:10,11.1
10/08/01,23:10,11.1
10/09/01,00:10,10.94
10/09/01,01:10,10.94
10/09/01,02:10,10.94
10/09/01,03:10,10.79
10/09/01,04:10,10.64
10/09/01,05:10,10.64
10/09/01,06:10,10.48
10/09/01,07:10,10.48
10/09/01,08:10,10.33
10/09/01,09:10,10.33
```

```
10/09/01,10:10,10.33
10/09/01,11:10,10.48
10/09/01,12:10,10.79
10/09/01,13:10,10.94
10/09/01,14:10,11.41
10/09/01,15:10,11.56
10/09/01,16:10,11.72
10/09/01,17:10,11.72
10/09/01,18:10,11.56
10/09/01,19:10,11.41
10/09/01,20:10,11.1
10/09/01,21:10,10.94
10/09/01,22:10,10.79
10/09/01,23:10,10.64
10/10/01,00:10,10.33
10/10/01,01:10,10.17
10/10/01,02:10,10.02
10/10/01,03:10,9.71
10/10/01,04:10,9.55
10/10/01,05:10,9.55
10/10/01,06:10,9.39
10/10/01,07:10,9.24
10/10/01,08:10,9.24
10/10/01,09:10,9.24
10/10/01,10:10,9.24
10/10/01,11:10,9.39
10/10/01,12:10,9.39
10/10/01,13:10,9.55
10/10/01,14:10,9.86
10/10/01,15:10,9.86
10/10/01,16:10,9.86
10/10/01,17:10,9.86
10/10/01,18:10,9.86
10/10/01,19:10,9.86
10/10/01,20:10,9.86
10/10/01,21:10,9.86
10/10/01,22:10,10.02
10/10/01,23:10,10.17
10/11/01,00:10,10.02
10/11/01,01:10,9.55
10/11/01,02:10,8.93
10/11/01,03:10,9.55
10/11/01,04:10,9.55
10/11/01,05:10,9.55
10/11/01,06:10,9.55
10/11/01,07:10,9.71
10/11/01,08:10,9.71
10/11/01,09:10,9.71
```

```
10/11/01,10:10,9.71
10/11/01,11:10,10.02
10/11/01,12:10,10.17
10/11/01,13:10,10.33
10/11/01,14:10,10.48
10/11/01,15:10,10.79
10/11/01,16:10,10.64
10/11/01,17:10,10.64
10/11/01,18:10,10.64
10/11/01,19:10,10.48
10/11/01,20:10,10.33
10/11/01,21:10,10.33
10/11/01,22:10,10.17
10/11/01,23:10,10.17
10/12/01,00:10,10.02
10/12/01,01:10,10.02
10/12/01,02:10,10.02
10/12/01,03:10,9.86
10/12/01,04:10,9.86
10/12/01,05:10,9.86
10/12/01,06:10,9.86
10/12/01,07:10,9.86
10/12/01,08:10,9.86
10/12/01,09:10,9.86
10/12/01,10:10,9.86
10/12/01,11:10,10.02
10/12/01,12:10,10.17
10/12/01,13:10,10.17
10/12/01,14:10,10.17
10/12/01,15:10,10.33
10/12/01,16:10,10.33
10/12/01,17:10,10.33
10/12/01,18:10,10.64
10/12/01,19:10,10.48
10/12/01,20:10,10.64
10/12/01,21:10,10.94
10/12/01,22:10,10.79
10/12/01,23:10,10.64
10/13/01,00:10,10.64
10/13/01,01:10,10.64
10/13/01,02:10,10.64
10/13/01,03:10,10.64
10/13/01,04:10,10.48
10/13/01,05:10,10.48
10/13/01,06:10,10.48
10/13/01,07:10,10.33
10/13/01,08:10,10.33
10/13/01,09:10,10.33
```

```
10/13/01,10:10,10.33
10/13/01,11:10,10.33
10/13/01,12:10,10.48
10/13/01,13:10,10.48
10/13/01,14:10,10.64
10/13/01,15:10,10.64
10/13/01,16:10,10.79
10/13/01,17:10,10.79
10/13/01,18:10,10.79
10/13/01,19:10,10.64
10/13/01,20:10,10.64
10/13/01,21:10,10.64
10/13/01,22:10,10.48
10/13/01,23:10,10.48
10/14/01,00:10,10.48
10/14/01,01:10,10.48
10/14/01,02:10,10.48
10/14/01,03:10,10.64
10/14/01,04:10,10.64
10/14/01,05:10,10.64
10/14/01,06:10,10.64
10/14/01,07:10,10.64
10/14/01,08:10,10.64
10/14/01,09:10,10.64
10/14/01,10:10,10.79
10/14/01,11:10,10.79
10/14/01,12:10,11.1
10/14/01,13:10,11.25
10/14/01,14:10,11.41
10/14/01,15:10,11.56
10/14/01,16:10,11.72
10/14/01,17:10,11.56
10/14/01,18:10,11.56
10/14/01,19:10,11.41
10/14/01,20:10,11.1
10/14/01,21:10,10.94
10/14/01,22:10,10.79
10/14/01,23:10,10.64
10/15/01,00:10,10.48
10/15/01,01:10,10.33
10/15/01,02:10,10.33
10/15/01,03:10,10.33
10/15/01,04:10,10.33
10/15/01,05:10,10.33
10/15/01,06:10,10.17
10/15/01,07:10,10.17
10/15/01,08:10,10.17
10/15/01,09:10,10.02
```

```
10/15/01,10:10,10.02
10/15/01,11:10,10.17
10/15/01,12:10,10.48
10/15/01,13:10,10.79
10/15/01,14:10,11.1
10/15/01,15:10,11.25
10/15/01,16:10,11.41
10/15/01,17:10,11.41
10/15/01,18:10,11.41
10/15/01,19:10,11.25
10/15/01,20:10,11.1
10/15/01,21:10,11.1
10/15/01,22:10,10.94
10/15/01,23:10,10.79
10/16/01,00:10,10.79
10/16/01,01:10,10.79
10/16/01,02:10,10.64
10/16/01,03:10,10.48
10/16/01,04:10,10.48
10/16/01,05:10,10.33
10/16/01,06:10,10.33
10/16/01,07:10,10.17
10/16/01,08:10,10.17
10/16/01,09:10,10.17
10/16/01,10:10,10.33
10/16/01,11:10,10.48
10/16/01,12:10,10.48
10/16/01,13:10,10.48
10/16/01,14:10,11.1
10/16/01,15:10,10.79
10/16/01,16:10,10.79
10/16/01,17:10,10.79
10/16/01,18:10,10.79
10/16/01,19:10,10.64
10/16/01,20:10,10.64
10/16/01,21:10,10.33
10/16/01,22:10,10.17
10/16/01,23:10,10.02
10/17/01,00:10,9.86
10/17/01,01:10,9.71
10/17/01,02:10,9.39
10/17/01,03:10,9.24
10/17/01,04:10,9.09
10/17/01,05:10,8.93
10/17/01,06:10,8.78
10/17/01,07:10,8.63
10/17/01,08:10,8.47
10/17/01,09:10,8.47
```

```
10/17/01,10:10,8.47
10/17/01,11:10,8.63
10/17/01,12:10,8.93
10/17/01,13:10,9.24
10/17/01,14:10,9.39
10/17/01,15:10,9.55
10/17/01,16:10,9.71
10/17/01,17:10,9.71
10/17/01,18:10,9.71
10/17/01,19:10,9.55
10/17/01,20:10,9.39
10/17/01,21:10,9.24
10/17/01,22:10,9.24
10/17/01,23:10,9.09
10/18/01,00:10,9.09
10/18/01,01:10,8.93
10/18/01,02:10,8.78
10/18/01,03:10,8.78
10/18/01,04:10,8.63
10/18/01,05:10,8.63
10/18/01,06:10,8.47
10/18/01,07:10,8.47
10/18/01,08:10,8.47
10/18/01,09:10,8.47
10/18/01,10:10,8.63
10/18/01,11:10,8.78
10/18/01,12:10,8.93
10/18/01,13:10,9.09
```

Appendix Q

APPENDIX Q:
2001 Reach 3
Data Logger Stream Temperature Results

```
Date,Time,Temperature    (*C)
06/15/01,18:00,13
06/15/01,19:00,13
06/15/01,20:00,12.84
06/15/01,21:00,12.69
06/15/01,22:00,12.38
06/15/01,23:00,12.22
06/16/01,00:00,11.91
06/16/01,01:00,11.6
06/16/01,02:00,11.44
06/16/01,03:00,11.13
06/16/01,04:00,10.98
06/16/01,05:00,10.98
06/16/01,06:00,10.82
06/16/01,07:00,10.82
06/16/01,08:00,10.82
06/16/01,09:00,10.98
06/16/01,10:00,10.98
06/16/01,11:00,11.13
06/16/01,12:00,11.29
06/16/01,13:00,11.6
06/16/01,14:00,12.22
06/16/01,15:00,12.38
06/16/01,16:00,12.69
06/16/01,17:00,12.69
06/16/01,18:00,12.69
06/16/01,19:00,12.69
06/16/01,20:00,12.53
06/16/01,21:00,12.38
06/16/01,22:00,12.07
06/16/01,23:00,11.91
06/17/01,00:00,11.6
06/17/01,01:00,11.44
06/17/01,02:00,11.29
06/17/01,03:00,11.13
06/17/01,04:00,10.98
06/17/01,05:00,10.67
06/17/01,06:00,10.36
06/17/01,07:00,10.36
06/17/01,08:00,10.36
06/17/01,09:00,10.51
06/17/01,10:00,10.67
06/17/01,11:00,10.98
06/17/01,12:00,11.6
06/17/01,13:00,11.76
06/17/01,14:00,12.22
06/17/01,15:00,12.84
06/17/01,16:00,13.47
```

```
06/17/01,17:00,13.31
06/17/01,18:00,13.47
06/17/01,19:00,13.16
06/17/01,20:00,13.16
06/17/01,21:00,12.84
06/17/01,22:00,12.69
06/17/01,23:00,12.53
06/18/01,00:00,12.22
06/18/01,01:00,12.07
06/18/01,02:00,11.91
06/18/01,03:00,11.76
06/18/01,04:00,11.6
06/18/01,05:00,11.44
06/18/01,06:00,11.29
06/18/01,07:00,11.13
06/18/01,08:00,11.13
06/18/01,09:00,11.29
06/18/01,10:00,11.29
06/18/01,11:00,11.29
06/18/01,12:00,11.76
06/18/01,13:00,12.53
06/18/01,14:00,13.31
06/18/01,15:00,13.93
06/18/01,16:00,14.24
06/18/01,17:00,14.39
06/18/01,18:00,14.55
06/18/01,19:00,14.39
06/18/01,20:00,14.08
06/18/01,21:00,13.77
06/18/01,22:00,13.47
06/18/01,23:00,13.16
06/19/01,00:00,12.84
06/19/01,01:00,12.53
06/19/01,02:00,12.22
06/19/01,03:00,11.91
06/19/01,04:00,11.6
06/19/01,05:00,11.29
06/19/01,06:00,11.13
06/19/01,07:00,10.98
06/19/01,08:00,10.98
06/19/01,09:00,11.13
06/19/01,10:00,11.44
06/19/01,11:00,12.07
06/19/01,12:00,12.84
06/19/01,13:00,13.62
06/19/01,14:00,14.39
06/19/01,15:00,14.87
06/19/01,16:00,15.18
```

```
06/19/01,17:00,15.51
06/19/01,18:00,15.66
06/19/01,19:00,15.34
06/19/01,20:00,15.18
06/19/01,21:00,14.87
06/19/01,22:00,14.55
06/19/01,23:00,14.24
06/20/01,00:00,13.77
06/20/01,01:00,13.47
06/20/01,02:00,13.16
06/20/01,03:00,13
06/20/01,04:00,12.69
06/20/01,05:00,12.38
06/20/01,06:00,12.07
06/20/01,07:00,11.91
06/20/01,08:00,11.91
06/20/01,09:00,12.07
06/20/01,10:00,12.38
06/20/01,11:00,12.84
06/20/01,12:00,13.77
06/20/01,13:00,14.55
06/20/01,14:00,15.34
06/20/01,15:00,15.82
06/20/01,16:00,16.14
06/20/01,17:00,16.3
06/20/01,18:00,16.3
06/20/01,19:00,16.14
06/20/01,20:00,15.82
06/20/01,21:00,15.51
06/20/01,22:00,15.18
06/20/01,23:00,14.71
06/21/01,00:00,14.39
06/21/01,01:00,14.08
06/21/01,02:00,13.77
06/21/01,03:00,13.47
06/21/01,04:00,13.16
06/21/01,05:00,12.84
06/21/01,06:00,12.69
06/21/01,07:00,12.53
06/21/01,08:00,12.38
06/21/01,09:00,12.53
06/21/01,10:00,13
06/21/01,11:00,13.47
06/21/01,12:00,14.39
06/21/01,13:00,15.18
06/21/01,14:00,15.82
06/21/01,15:00,16.3
06/21/01,16:00,16.62
```

```
06/21/01,17:00,16.78
06/21/01,18:00,16.78
06/21/01,19:00,16.46
06/21/01,20:00,16.3
06/21/01,21:00,15.98
06/21/01,22:00,15.66
06/21/01,23:00,15.18
06/22/01,00:00,14.87
06/22/01,01:00,14.55
06/22/01,02:00,14.39
06/22/01,03:00,14.08
06/22/01,04:00,13.93
06/22/01,05:00,13.77
06/22/01,06:00,13.62
06/22/01,07:00,13.47
06/22/01,08:00,13.16
06/22/01,09:00,13.16
06/22/01,10:00,13.16
06/22/01,11:00,13.16
06/22/01,12:00,13.16
06/22/01,13:00,13.31
06/22/01,14:00,13.47
06/22/01,15:00,13.77
06/22/01,16:00,14.24
06/22/01,17:00,14.55
06/22/01,18:00,14.55
06/22/01,19:00,14.39
06/22/01,20:00,14.24
06/22/01,21:00,14.08
06/22/01,22:00,13.77
06/22/01,23:00,13.47
06/23/01,00:00,13.31
06/23/01,01:00,13.16
06/23/01,02:00,13
06/23/01,03:00,12.84
06/23/01,04:00,12.69
06/23/01,05:00,12.69
06/23/01,06:00,12.53
06/23/01,07:00,12.38
06/23/01,08:00,12.38
06/23/01,09:00,12.38
06/23/01,10:00,12.53
06/23/01,11:00,12.84
06/23/01,12:00,13.31
06/23/01,13:00,13.77
06/23/01,14:00,13.93
06/23/01,15:00,14.08
06/23/01,16:00,14.39
```

```
06/23/01,17:00,14.55
06/23/01,18:00,14.55
06/23/01,19:00,14.55
06/23/01,20:00,14.39
06/23/01,21:00,14.08
06/23/01,22:00,13.77
06/23/01,23:00,13.47
06/24/01,00:00,13.16
06/24/01,01:00,13
06/24/01,02:00,12.84
06/24/01,03:00,12.69
06/24/01,04:00,12.53
06/24/01,05:00,12.22
06/24/01,06:00,12.07
06/24/01,07:00,11.91
06/24/01,08:00,11.91
06/24/01,09:00,12.07
06/24/01,10:00,12.22
06/24/01,11:00,12.22
06/24/01,12:00,12.38
06/24/01,13:00,12.53
06/24/01,14:00,12.69
06/24/01,15:00,12.69
06/24/01,16:00,12.84
06/24/01,17:00,12.84
06/24/01,18:00,12.69
06/24/01,19:00,12.69
06/24/01,20:00,12.69
06/24/01,21:00,12.53
06/24/01,22:00,12.38
06/24/01,23:00,12.38
06/25/01,00:00,12.38
06/25/01,01:00,12.22
06/25/01,02:00,12.07
06/25/01,03:00,11.91
06/25/01,04:00,11.91
06/25/01,05:00,11.76
06/25/01,06:00,11.6
06/25/01,07:00,11.6
06/25/01,08:00,11.6
06/25/01,09:00,11.6
06/25/01,10:00,11.76
06/25/01,11:00,12.22
06/25/01,12:00,12.53
06/25/01,13:00,13.16
06/25/01,14:00,13.77
06/25/01,15:00,14.39
06/25/01,16:00,14.71
```

```
06/25/01,17:00,14.71
06/25/01,18:00,14.71
06/25/01,19:00,14.39
06/25/01,20:00,14.24
06/25/01,21:00,13.93
06/25/01,22:00,13.62
06/25/01,23:00,13.47
06/26/01,00:00,13.16
06/26/01,01:00,12.84
06/26/01,02:00,12.69
06/26/01,03:00,12.53
06/26/01,04:00,12.38
06/26/01,05:00,12.07
06/26/01,06:00,11.91
06/26/01,07:00,11.91
06/26/01,08:00,11.91
06/26/01,09:00,11.91
06/26/01,10:00,12.07
06/26/01,11:00,12.07
06/26/01,12:00,12.38
06/26/01,13:00,13.16
06/26/01,14:00,14.08
06/26/01,15:00,14.55
06/26/01,16:00,14.87
06/26/01,17:00,15.03
06/26/01,18:00,14.71
06/26/01,19:00,14.71
06/26/01,20:00,14.55
06/26/01,21:00,14.39
06/26/01,22:00,14.24
06/26/01,23:00,14.08
06/27/01,00:00,13.93
06/27/01,01:00,13.77
06/27/01,02:00,13.62
06/27/01,03:00,13.47
06/27/01,04:00,13.31
06/27/01,05:00,13.31
06/27/01,06:00,13.16
06/27/01,07:00,13
06/27/01,08:00,13
06/27/01,09:00,13.16
06/27/01,10:00,13.16
06/27/01,11:00,13.16
06/27/01,12:00,13.16
06/27/01,13:00,13.31
06/27/01,14:00,14.24
06/27/01,15:00,14.71
06/27/01,16:00,14.39
```

```
06/27/01,17:00,14.24
06/27/01,18:00,13.93
06/27/01,19:00,13.93
06/27/01,20:00,13.77
06/27/01,21:00,13.77
06/27/01,22:00,13.62
06/27/01,23:00,13.47
06/28/01,00:00,13.31
06/28/01,01:00,13.31
06/28/01,02:00,13.16
06/28/01,03:00,13.16
06/28/01,04:00,13
06/28/01,05:00,13
06/28/01,06:00,12.84
06/28/01,07:00,12.84
06/28/01,08:00,12.69
06/28/01,09:00,12.69
06/28/01,10:00,12.84
06/28/01,11:00,13.16
06/28/01,12:00,13.47
06/28/01,13:00,13.62
06/28/01,14:00,13.62
06/28/01,15:00,13.77
06/28/01,16:00,13.77
06/28/01,17:00,13.93
06/28/01,18:00,13.93
06/28/01,19:00,13.93
06/28/01,20:00,13.93
06/28/01,21:00,13.62
06/28/01,22:00,13.47
06/28/01,23:00,13.16
06/29/01,00:00,12.84
06/29/01,01:00,12.69
06/29/01,02:00,12.38
06/29/01,03:00,12.07
06/29/01,04:00,11.91
06/29/01,05:00,11.6
06/29/01,06:00,11.29
06/29/01,07:00,11.13
06/29/01,08:00,11.13
06/29/01,09:00,11.29
06/29/01,10:00,11.6
06/29/01,11:00,12.07
06/29/01,12:00,12.84
06/29/01,13:00,13.47
06/29/01,14:00,14.08
06/29/01,15:00,14.55
06/29/01,16:00,15.03
```

```
06/29/01,17:00,15.18
06/29/01,18:00,15.18
06/29/01,19:00,15.03
06/29/01,20:00,14.71
06/29/01,21:00,14.55
06/29/01,22:00,14.24
06/29/01,23:00,13.93
06/30/01,00:00,13.62
06/30/01,01:00,13.31
06/30/01,02:00,13
06/30/01,03:00,12.69
06/30/01,04:00,12.38
06/30/01,05:00,12.07
06/30/01,06:00,11.76
06/30/01,07:00,11.6
06/30/01,08:00,11.6
06/30/01,09:00,11.6
06/30/01,10:00,11.91
06/30/01,11:00,12.38
06/30/01,12:00,13.16
06/30/01,13:00,13.77
06/30/01,14:00,14.55
06/30/01,15:00,15.03
06/30/01,16:00,15.18
06/30/01,17:00,15.18
06/30/01,18:00,15.18
06/30/01,19:00,15.03
06/30/01,20:00,14.87
06/30/01,21:00,14.71
06/30/01,22:00,14.39
06/30/01,23:00,14.08
07/01/01,00:00,13.77
07/01/01,01:00,13.47
07/01/01,02:00,13.31
07/01/01,03:00,13
07/01/01,04:00,12.69
07/01/01,05:00,12.53
07/01/01,06:00,12.38
07/01/01,07:00,12.22
07/01/01,08:00,12.22
07/01/01,09:00,12.22
07/01/01,10:00,12.38
07/01/01,11:00,12.53
07/01/01,12:00,13.31
07/01/01,13:00,13.93
07/01/01,14:00,14.39
07/01/01,15:00,15.03
07/01/01,16:00,15.51
```

```
07/01/01,17:00,15.66
07/01/01,18:00,15.66
07/01/01,19:00,15.51
07/01/01,20:00,15.18
07/01/01,21:00,14.87
07/01/01,22:00,14.55
07/01/01,23:00,14.24
07/02/01,00:00,13.93
07/02/01,01:00,13.47
07/02/01,02:00,13.16
07/02/01,03:00,12.84
07/02/01,04:00,12.53
07/02/01,05:00,12.22
07/02/01,06:00,11.91
07/02/01,07:00,11.76
07/02/01,08:00,11.6
07/02/01,09:00,11.76
07/02/01,10:00,12.07
07/02/01,11:00,12.53
07/02/01,12:00,13.31
07/02/01,13:00,14.24
07/02/01,14:00,14.87
07/02/01,15:00,15.51
07/02/01,16:00,15.66
07/02/01,17:00,15.98
07/02/01,18:00,15.98
07/02/01,19:00,15.82
07/02/01,20:00,15.66
07/02/01,21:00,15.34
07/02/01,22:00,15.03
07/02/01,23:00,14.71
07/03/01,00:00,14.39
07/03/01,01:00,14.08
07/03/01,02:00,13.77
07/03/01,03:00,13.47
07/03/01,04:00,13.16
07/03/01,05:00,12.84
07/03/01,06:00,12.53
07/03/01,07:00,12.38
07/03/01,08:00,12.38
07/03/01,09:00,12.38
07/03/01,10:00,12.69
07/03/01,11:00,13.16
07/03/01,12:00,13.93
07/03/01,13:00,14.71
07/03/01,14:00,15.34
07/03/01,15:00,15.82
07/03/01,16:00,16.14
```

```
07/03/01,17:00,16.3
07/03/01,18:00,16.46
07/03/01,19:00,16.3
07/03/01,20:00,16.14
07/03/01,21:00,15.98
07/03/01,22:00,15.66
07/03/01,23:00,15.34
07/04/01,00:00,15.03
07/04/01,01:00,14.71
07/04/01,02:00,14.39
07/04/01,03:00,14.08
07/04/01,04:00,13.77
07/04/01,05:00,13.47
07/04/01,06:00,13.16
07/04/01,07:00,13
07/04/01,08:00,13
07/04/01,09:00,13
07/04/01,10:00,13.31
07/04/01,11:00,13.77
07/04/01,12:00,14.71
07/04/01,13:00,15.51
07/04/01,14:00,16.14
07/04/01,15:00,16.78
07/04/01,16:00,16.93
07/04/01,17:00,17.09
07/04/01,18:00,17.09
07/04/01,19:00,16.93
07/04/01,20:00,16.46
07/04/01,21:00,16.14
07/04/01,22:00,15.82
07/04/01,23:00,15.51
07/05/01,00:00,15.03
07/05/01,01:00,14.71
07/05/01,02:00,14.39
07/05/01,03:00,14.24
07/05/01,04:00,14.08
07/05/01,05:00,13.77
07/05/01,06:00,13.62
07/05/01,07:00,13.47
07/05/01,08:00,13.47
07/05/01,09:00,13.31
07/05/01,10:00,13.47
07/05/01,11:00,13.62
07/05/01,12:00,14.08
07/05/01,13:00,14.39
07/05/01,14:00,15.03
07/05/01,15:00,15.51
07/05/01,16:00,15.82
```

```
07/05/01,17:00,15.98
07/05/01,18:00,16.14
07/05/01,19:00,15.82
07/05/01,20:00,15.51
07/05/01,21:00,15.18
07/05/01,22:00,14.87
07/05/01,23:00,14.55
07/06/01,00:00,14.24
07/06/01,01:00,13.93
07/06/01,02:00,13.62
07/06/01,03:00,13.31
07/06/01,04:00,13
07/06/01,05:00,12.69
07/06/01,06:00,12.38
07/06/01,07:00,12.22
07/06/01,08:00,12.22
07/06/01,09:00,12.22
07/06/01,10:00,12.38
07/06/01,11:00,12.84
07/06/01,12:00,13.47
07/06/01,13:00,14.24
07/06/01,14:00,14.87
07/06/01,15:00,15.34
07/06/01,16:00,15.66
07/06/01,17:00,15.82
07/06/01,18:00,15.98
07/06/01,19:00,15.82
07/06/01,20:00,15.51
07/06/01,21:00,15.18
07/06/01,22:00,14.87
07/06/01,23:00,14.55
07/07/01,00:00,14.24
07/07/01,01:00,13.93
07/07/01,02:00,13.62
07/07/01,03:00,13.31
07/07/01,04:00,13
07/07/01,05:00,12.69
07/07/01,06:00,12.38
07/07/01,07:00,12.22
07/07/01,08:00,12.22
07/07/01,09:00,12.22
07/07/01,10:00,12.53
07/07/01,11:00,12.84
07/07/01,12:00,13.62
07/07/01,13:00,14.39
07/07/01,14:00,15.03
07/07/01,15:00,15.51
07/07/01,16:00,15.82
```

```
07/07/01,17:00,16.14
07/07/01,18:00,16.14
07/07/01,19:00,15.98
07/07/01,20:00,15.66
07/07/01,21:00,15.51
07/07/01,22:00,15.18
07/07/01,23:00,14.87
07/08/01,00:00,14.55
07/08/01,01:00,14.24
07/08/01,02:00,13.93
07/08/01,03:00,13.62
07/08/01,04:00,13.47
07/08/01,05:00,13.16
07/08/01,06:00,12.84
07/08/01,07:00,12.69
07/08/01,08:00,12.69
07/08/01,09:00,12.69
07/08/01,10:00,13
07/08/01,11:00,13.47
07/08/01,12:00,14.24
07/08/01,13:00,15.03
07/08/01,14:00,15.66
07/08/01,15:00,16.3
07/08/01,16:00,16.46
07/08/01,17:00,16.78
07/08/01,18:00,16.78
07/08/01,19:00,16.62
07/08/01,20:00,16.3
07/08/01,21:00,16.14
07/08/01,22:00,15.82
07/08/01,23:00,15.51
07/09/01,00:00,15.18
07/09/01,01:00,14.87
07/09/01,02:00,14.55
07/09/01,03:00,14.24
07/09/01,04:00,14.08
07/09/01,05:00,13.77
07/09/01,06:00,13.47
07/09/01,07:00,13.31
07/09/01,08:00,13.16
07/09/01,09:00,13.31
07/09/01,10:00,13.47
07/09/01,11:00,13.93
07/09/01,12:00,14.71
07/09/01,13:00,15.51
07/09/01,14:00,16.3
07/09/01,15:00,16.78
07/09/01,16:00,17.09
```

```
07/09/01,17:00,17.26
07/09/01,18:00,17.42
07/09/01,19:00,17.26
07/09/01,20:00,16.93
07/09/01,21:00,16.62
07/09/01,22:00,16.3
07/09/01,23:00,15.98
07/10/01,00:00,15.82
07/10/01,01:00,15.51
07/10/01,02:00,15.03
07/10/01,03:00,14.71
07/10/01,04:00,14.55
07/10/01,05:00,14.24
07/10/01,06:00,13.93
07/10/01,07:00,13.77
07/10/01,08:00,13.62
07/10/01,09:00,13.77
07/10/01,10:00,13.93
07/10/01,11:00,14.08
07/10/01,12:00,14.55
07/10/01,13:00,15.51
07/10/01,14:00,16.3
07/10/01,15:00,16.78
07/10/01,16:00,17.09
07/10/01,17:00,17.42
07/10/01,18:00,17.42
07/10/01,19:00,17.09
07/10/01,20:00,16.78
07/10/01,21:00,16.46
07/10/01,22:00,16.3
07/10/01,23:00,15.98
07/11/01,00:00,15.66
07/11/01,01:00,15.34
07/11/01,02:00,15.03
07/11/01,03:00,14.71
07/11/01,04:00,14.39
07/11/01,05:00,14.08
07/11/01,06:00,13.77
07/11/01,07:00,13.62
07/11/01,08:00,13.47
07/11/01,09:00,13.47
07/11/01,10:00,13.77
07/11/01,11:00,14.24
07/11/01,12:00,15.03
07/11/01,13:00,15.66
07/11/01,14:00,16.3
07/11/01,15:00,16.78
07/11/01,16:00,16.93
```

```
07/11/01,17:00,17.26
07/11/01,18:00,17.26
07/11/01,19:00,17.09
07/11/01,20:00,16.78
07/11/01,21:00,16.46
07/11/01,22:00,16.14
07/11/01,23:00,15.98
07/12/01,00:00,15.66
07/12/01,01:00,15.34
07/12/01,02:00,14.87
07/12/01,03:00,14.71
07/12/01,04:00,14.39
07/12/01,05:00,14.08
07/12/01,06:00,13.77
07/12/01,07:00,13.47
07/12/01,08:00,13.47
07/12/01,09:00,13.47
07/12/01,10:00,13.47
07/12/01,11:00,13.93
07/12/01,12:00,14.08
07/12/01,13:00,14.39
07/12/01,14:00,14.55
07/12/01,15:00,14.87
07/12/01,16:00,15.18
07/12/01,17:00,15.34
07/12/01,18:00,15.66
07/12/01,19:00,15.82
07/12/01,20:00,15.66
07/12/01,21:00,15.51
07/12/01,22:00,15.34
07/12/01,23:00,15.18
07/13/01,00:00,14.71
07/13/01,01:00,14.39
07/13/01,02:00,14.08
07/13/01,03:00,13.77
07/13/01,04:00,13.47
07/13/01,05:00,13.31
07/13/01,06:00,13
07/13/01,07:00,12.84
07/13/01,08:00,12.84
07/13/01,09:00,12.84
07/13/01,10:00,13
07/13/01,11:00,13.16
07/13/01,12:00,13.31
07/13/01,13:00,13.47
07/13/01,14:00,13.62
07/13/01,15:00,14.24
07/13/01,16:00,14.55
```

```
07/13/01,17:00,15.03
07/13/01,18:00,15.18
07/13/01,19:00,15.03
07/13/01,20:00,14.87
07/13/01,21:00,14.71
07/13/01,22:00,14.39
07/13/01,23:00,14.24
07/14/01,00:00,14.08
07/14/01,01:00,13.77
07/14/01,02:00,13.47
07/14/01,03:00,13.16
07/14/01,04:00,13
07/14/01,05:00,12.69
07/14/01,06:00,12.53
07/14/01,07:00,12.38
07/14/01,08:00,12.22
07/14/01,09:00,12.38
07/14/01,10:00,12.53
07/14/01,11:00,13
07/14/01,12:00,13.77
07/14/01,13:00,14.55
07/14/01,14:00,15.18
07/14/01,15:00,15.66
07/14/01,16:00,15.66
07/14/01,17:00,15.51
07/14/01,18:00,15.34
07/14/01,19:00,15.34
07/14/01,20:00,15.03
07/14/01,21:00,14.87
07/14/01,22:00,14.71
07/14/01,23:00,14.39
07/15/01,00:00,14.24
07/15/01,01:00,13.93
07/15/01,02:00,13.77
07/15/01,03:00,13.62
07/15/01,04:00,13.47
07/15/01,05:00,13.31
07/15/01,06:00,13.16
07/15/01,07:00,13
07/15/01,08:00,13
07/15/01,09:00,12.84
07/15/01,10:00,12.84
07/15/01,11:00,12.84
07/15/01,12:00,12.69
07/15/01,13:00,12.69
07/15/01,14:00,12.69
07/15/01,15:00,12.69
07/15/01,16:00,12.69
```

```
07/15/01,17:00,12.69
07/15/01,18:00,12.69
07/15/01,19:00,12.69
07/15/01,20:00,12.69
07/15/01,21:00,13.47
07/15/01,22:00,14.08
07/15/01,23:00,13.77
07/16/01,00:00,13.31
07/16/01,01:00,13
07/16/01,02:00,12.84
07/16/01,03:00,12.69
07/16/01,04:00,12.69
07/16/01,05:00,12.53
07/16/01,06:00,12.53
07/16/01,07:00,12.38
07/16/01,08:00,12.38
07/16/01,09:00,12.84
07/16/01,10:00,13.16
07/16/01,11:00,13.16
07/16/01,12:00,13.16
07/16/01,13:00,13.16
07/16/01,14:00,13.47
07/16/01,15:00,13.47
07/16/01,16:00,13.47
07/16/01,17:00,13.62
07/16/01,18:00,13.93
07/16/01,19:00,13.93
07/16/01,20:00,13.47
07/16/01,21:00,13.77
07/16/01,22:00,13.47
07/16/01,23:00,13.16
07/17/01,00:00,13.16
07/17/01,01:00,13
07/17/01,02:00,13
07/17/01,03:00,12.84
07/17/01,04:00,13
07/17/01,05:00,13
07/17/01,06:00,12.84
07/17/01,07:00,12.84
07/17/01,08:00,12.69
07/17/01,09:00,12.69
07/17/01,10:00,12.69
07/17/01,11:00,12.84
07/17/01,12:00,13
07/17/01,13:00,13.31
07/17/01,14:00,13.62
07/17/01,15:00,13.93
07/17/01,16:00,13.77
```

```
07/17/01,17:00,13.93
07/17/01,18:00,14.08
07/17/01,19:00,14.24
07/17/01,20:00,14.08
07/17/01,21:00,13.93
07/17/01,22:00,13.77
07/17/01,23:00,13.62
07/18/01,00:00,13.47
07/18/01,01:00,13.47
07/18/01,02:00,13.31
07/18/01,03:00,13.16
07/18/01,04:00,13
07/18/01,05:00,12.84
07/18/01,06:00,12.69
07/18/01,07:00,12.69
07/18/01,08:00,12.69
07/18/01,09:00,12.69
07/18/01,10:00,13
07/18/01,11:00,13.16
07/18/01,12:00,13.31
07/18/01,13:00,13.62
07/18/01,14:00,13.77
07/18/01,15:00,13.93
07/18/01,16:00,14.24
07/18/01,17:00,14.24
07/18/01,18:00,14.24
07/18/01,19:00,14.24
07/18/01,20:00,14.08
07/18/01,21:00,14.08
07/18/01,22:00,13.93
07/18/01,23:00,13.77
07/19/01,00:00,13.62
07/19/01,01:00,13.47
07/19/01,02:00,13.31
07/19/01,03:00,13.16
07/19/01,04:00,13.16
07/19/01,05:00,13
07/19/01,06:00,13
07/19/01,07:00,12.84
07/19/01,08:00,12.84
07/19/01,09:00,13
07/19/01,10:00,13.31
07/19/01,11:00,13.62
07/19/01,12:00,13.77
07/19/01,13:00,14.24
07/19/01,14:00,14.55
07/19/01,15:00,14.87
07/19/01,16:00,15.03
```

```
07/19/01,17:00,15.34
07/19/01,18:00,15.34
07/19/01,19:00,15.18
07/19/01,20:00,15.18
07/19/01,21:00,14.87
07/19/01,22:00,14.71
07/19/01,23:00,14.39
07/20/01,00:00,14.08
07/20/01,01:00,13.77
07/20/01,02:00,13.47
07/20/01,03:00,13.31
07/20/01,04:00,13.16
07/20/01,05:00,12.84
07/20/01,06:00,12.69
07/20/01,07:00,12.69
07/20/01,08:00,12.69
07/20/01,09:00,12.69
07/20/01,10:00,12.84
07/20/01,11:00,13.16
07/20/01,12:00,13.77
07/20/01,13:00,13.93
07/20/01,14:00,14.24
07/20/01,15:00,14.71
07/20/01,16:00,14.71
07/20/01,17:00,14.71
07/20/01,18:00,14.87
07/20/01,19:00,15.03
07/20/01,20:00,14.87
07/20/01,21:00,14.87
07/20/01,22:00,14.71
07/20/01,23:00,14.39
07/21/01,00:00,14.24
07/21/01,01:00,14.08
07/21/01,02:00,13.93
07/21/01,03:00,13.77
07/21/01,04:00,13.62
07/21/01,05:00,13.47
07/21/01,06:00,13.47
07/21/01,07:00,13.31
07/21/01,08:00,13.16
07/21/01,09:00,13.31
07/21/01,10:00,13.31
07/21/01,11:00,13.47
07/21/01,12:00,13.47
07/21/01,13:00,13.62
07/21/01,14:00,13.77
07/21/01,15:00,13.77
07/21/01,16:00,13.93
```

```
07/21/01,17:00,14.08
07/21/01,18:00,14.08
07/21/01,19:00,13.93
07/21/01,20:00,13.93
07/21/01,21:00,13.93
07/21/01,22:00,13.77
07/21/01,23:00,13.77
07/22/01,00:00,13.62
07/22/01,01:00,13.62
07/22/01,02:00,13.47
07/22/01,03:00,13.47
07/22/01,04:00,13.31
07/22/01,05:00,13.31
07/22/01,06:00,13.16
07/22/01,07:00,13.16
07/22/01,08:00,13.16
07/22/01,09:00,13.16
07/22/01,10:00,13.16
07/22/01,11:00,13.31
07/22/01,12:00,13.62
07/22/01,13:00,13.77
07/22/01,14:00,14.08
07/22/01,15:00,14.39
07/22/01,16:00,14.55
07/22/01,17:00,14.71
07/22/01,18:00,14.71
07/22/01,19:00,14.71
07/22/01,20:00,14.55
07/22/01,21:00,14.39
07/22/01,22:00,14.24
07/22/01,23:00,14.24
07/23/01,00:00,14.08
07/23/01,01:00,13.93
07/23/01,02:00,13.62
07/23/01,03:00,13.47
07/23/01,04:00,13.16
07/23/01,05:00,13
07/23/01,06:00,13
07/23/01,07:00,12.84
07/23/01,08:00,12.84
07/23/01,09:00,12.84
07/23/01,10:00,13.16
07/23/01,11:00,13.47
07/23/01,12:00,14.08
07/23/01,13:00,14.71
07/23/01,14:00,15.18
07/23/01,15:00,15.66
07/23/01,16:00,15.98
```

```
07/23/01,17:00,16.14
07/23/01,18:00,16.3
07/23/01,19:00,16.14
07/23/01,20:00,15.98
07/23/01,21:00,15.82
07/23/01,22:00,15.66
07/23/01,23:00,15.51
07/24/01,00:00,15.34
07/24/01,01:00,15.18
07/24/01,02:00,15.03
07/24/01,03:00,14.87
07/24/01,04:00,14.71
07/24/01,05:00,14.55
07/24/01,06:00,14.39
07/24/01,07:00,14.24
07/24/01,08:00,14.24
07/24/01,09:00,14.24
07/24/01,10:00,14.24
07/24/01,11:00,14.24
07/24/01,12:00,14.55
07/24/01,13:00,14.71
07/24/01,14:00,15.18
07/24/01,15:00,15.51
07/24/01,16:00,15.66
07/24/01,17:00,15.66
07/24/01,18:00,15.98
07/24/01,19:00,15.98
07/24/01,20:00,15.66
07/24/01,21:00,15.51
07/24/01,22:00,15.34
07/24/01,23:00,15.03
07/25/01,00:00,14.71
07/25/01,01:00,14.55
07/25/01,02:00,14.24
07/25/01,03:00,14.08
07/25/01,04:00,13.77
07/25/01,05:00,13.47
07/25/01,06:00,13.31
07/25/01,07:00,13.16
07/25/01,08:00,13
07/25/01,09:00,13.16
07/25/01,10:00,13.31
07/25/01,11:00,13.62
07/25/01,12:00,14.39
07/25/01,13:00,15.03
07/25/01,14:00,15.66
07/25/01,15:00,16.3
07/25/01,16:00,16.46
```

```
07/25/01,17:00,16.62
07/25/01,18:00,16.62
07/25/01,19:00,16.46
07/25/01,20:00,16.3
07/25/01,21:00,15.98
07/25/01,22:00,15.82
07/25/01,23:00,15.51
07/26/01,00:00,15.18
07/26/01,01:00,14.87
07/26/01,02:00,14.55
07/26/01,03:00,14.39
07/26/01,04:00,14.08
07/26/01,05:00,13.77
07/26/01,06:00,13.47
07/26/01,07:00,13.31
07/26/01,08:00,13.16
07/26/01,09:00,13.31
07/26/01,10:00,13.47
07/26/01,11:00,13.77
07/26/01,12:00,14.55
07/26/01,13:00,15.03
07/26/01,14:00,15.66
07/26/01,15:00,16.14
07/26/01,16:00,16.46
07/26/01,17:00,16.46
07/26/01,18:00,16.62
07/26/01,19:00,16.46
07/26/01,20:00,16.14
07/26/01,21:00,15.82
07/26/01,22:00,15.66
07/26/01,23:00,15.34
07/27/01,00:00,15.03
07/27/01,01:00,14.87
07/27/01,02:00,14.55
07/27/01,03:00,14.24
07/27/01,04:00,13.93
07/27/01,05:00,13.77
07/27/01,06:00,13.62
07/27/01,07:00,13.47
07/27/01,08:00,13.47
07/27/01,09:00,13.31
07/27/01,10:00,13.31
07/27/01,11:00,13.31
07/27/01,12:00,13.31
07/27/01,13:00,13.47
07/27/01,14:00,13.47
07/27/01,15:00,13.62
07/27/01,16:00,13.93
```

```
07/27/01,17:00,14.08
07/27/01,18:00,14.24
07/27/01,19:00,14.24
07/27/01,20:00,14.24
07/27/01,21:00,14.08
07/27/01,22:00,14.08
07/27/01,23:00,13.93
07/28/01,00:00,13.93
07/28/01,01:00,13.93
07/28/01,02:00,13.77
07/28/01,03:00,13.77
07/28/01,04:00,13.77
07/28/01,05:00,13.93
07/28/01,06:00,14.08
07/28/01,07:00,14.24
07/28/01,08:00,14.08
07/28/01,09:00,13.93
07/28/01,10:00,13.77
07/28/01,11:00,13.93
07/28/01,12:00,13.93
07/28/01,13:00,13.93
07/28/01,14:00,13.77
07/28/01,15:00,13.47
07/28/01,16:00,13.47
07/28/01,17:00,13.47
07/28/01,18:00,13.47
07/28/01,19:00,13.47
07/28/01,20:00,13.16
07/28/01,21:00,13.16
07/28/01,22:00,13.16
07/28/01,23:00,13
07/29/01,00:00,13
07/29/01,01:00,12.84
07/29/01,02:00,12.84
07/29/01,03:00,12.84
07/29/01,04:00,12.69
07/29/01,05:00,12.69
07/29/01,06:00,12.53
07/29/01,07:00,12.53
07/29/01,08:00,12.53
07/29/01,09:00,12.53
07/29/01,10:00,12.69
07/29/01,11:00,12.84
07/29/01,12:00,13.47
07/29/01,13:00,13.77
07/29/01,14:00,13.93
07/29/01,15:00,14.08
07/29/01,16:00,14.08
```

```
07/29/01,17:00,14.24
07/29/01,18:00,14.39
07/29/01,19:00,14.24
07/29/01,20:00,14.08
07/29/01,21:00,13.93
07/29/01,22:00,13.77
07/29/01,23:00,13.47
07/30/01,00:00,13.31
07/30/01,01:00,13.16
07/30/01,02:00,13
07/30/01,03:00,12.69
07/30/01,04:00,12.53
07/30/01,05:00,12.38
07/30/01,06:00,12.22
07/30/01,07:00,12.07
07/30/01,08:00,11.91
07/30/01,09:00,12.07
07/30/01,10:00,12.38
07/30/01,11:00,12.69
07/30/01,12:00,13
07/30/01,13:00,13.47
07/30/01,14:00,13.77
07/30/01,15:00,14.24
07/30/01,16:00,14.71
07/30/01,17:00,14.87
07/30/01,18:00,14.87
07/30/01,19:00,14.87
07/30/01,20:00,14.71
07/30/01,21:00,14.55
07/30/01,22:00,14.39
07/30/01,23:00,14.24
07/31/01,00:00,14.08
07/31/01,01:00,13.77
07/31/01,02:00,13.62
07/31/01,03:00,13.47
07/31/01,04:00,13.31
07/31/01,05:00,13.16
07/31/01,06:00,12.84
07/31/01,07:00,12.69
07/31/01,08:00,12.69
07/31/01,09:00,12.69
07/31/01,10:00,12.84
07/31/01,11:00,13
07/31/01,12:00,13.31
07/31/01,13:00,13.62
07/31/01,14:00,13.93
07/31/01,15:00,14.24
07/31/01,16:00,14.24
```

```
07/31/01,17:00,14.39
07/31/01,18:00,14.39
07/31/01,19:00,14.55
07/31/01,20:00,14.39
07/31/01,21:00,14.39
07/31/01,22:00,14.08
07/31/01,23:00,13.77
08/01/01,00:00,13.62
08/01/01,01:00,13.31
08/01/01,02:00,13.16
08/01/01,03:00,12.84
08/01/01,04:00,12.69
08/01/01,05:00,12.38
08/01/01,06:00,12.22
08/01/01,07:00,12.07
08/01/01,08:00,12.07
08/01/01,09:00,12.22
08/01/01,10:00,12.38
08/01/01,11:00,12.69
08/01/01,12:00,13
08/01/01,13:00,13.31
08/01/01,14:00,13.47
08/01/01,15:00,13.62
08/01/01,16:00,13.77
08/01/01,17:00,13.93
08/01/01,18:00,13.93
08/01/01,19:00,14.08
08/01/01,20:00,14.08
08/01/01,21:00,13.93
08/01/01,22:00,13.77
08/01/01,23:00,13.77
08/02/01,00:00,13.62
08/02/01,01:00,13.62
08/02/01,02:00,13.47
08/02/01,03:00,13.47
08/02/01,04:00,13.47
08/02/01,05:00,13.31
08/02/01,06:00,13.31
08/02/01,07:00,13.31
08/02/01,08:00,13.16
08/02/01,09:00,13.31
08/02/01,10:00,13.47
08/02/01,11:00,13.62
08/02/01,12:00,13.93
08/02/01,13:00,14.55
08/02/01,14:00,15.18
08/02/01,15:00,15.51
08/02/01,16:00,15.66
```

```
08/02/01,17:00,15.82
08/02/01,18:00,15.82
08/02/01,19:00,15.66
08/02/01,20:00,15.66
08/02/01,21:00,15.51
08/02/01,22:00,15.18
08/02/01,23:00,15.03
08/03/01,00:00,14.87
08/03/01,01:00,14.71
08/03/01,02:00,14.55
08/03/01,03:00,14.39
08/03/01,04:00,14.24
08/03/01,05:00,14.24
08/03/01,06:00,14.08
08/03/01,07:00,14.08
08/03/01,08:00,13.93
08/03/01,09:00,13.93
08/03/01,10:00,13.93
08/03/01,11:00,13.93
08/03/01,12:00,13.93
08/03/01,13:00,14.08
08/03/01,14:00,14.24
08/03/01,15:00,14.39
08/03/01,16:00,14.39
08/03/01,17:00,14.55
08/03/01,18:00,14.71
08/03/01,19:00,14.71
08/03/01,20:00,14.71
08/03/01,21:00,14.55
08/03/01,22:00,14.55
08/03/01,23:00,14.39
08/04/01,00:00,14.39
08/04/01,01:00,14.24
08/04/01,02:00,14.08
08/04/01,03:00,13.93
08/04/01,04:00,13.93
08/04/01,05:00,13.77
08/04/01,06:00,13.62
08/04/01,07:00,13.62
08/04/01,08:00,13.47
08/04/01,09:00,13.62
08/04/01,10:00,13.77
08/04/01,11:00,13.93
08/04/01,12:00,14.08
08/04/01,13:00,14.39
08/04/01,14:00,14.71
08/04/01,15:00,15.03
08/04/01,16:00,15.51
```

```
08/04/01,17:00,15.66
08/04/01,18:00,15.66
08/04/01,19:00,15.51
08/04/01,20:00,15.34
08/04/01,21:00,15.18
08/04/01,22:00,15.03
08/04/01,23:00,14.87
08/05/01,00:00,14.55
08/05/01,01:00,14.39
08/05/01,02:00,14.24
08/05/01,03:00,14.08
08/05/01,04:00,13.77
08/05/01,05:00,13.62
08/05/01,06:00,13.47
08/05/01,07:00,13.47
08/05/01,08:00,13.31
08/05/01,09:00,13.47
08/05/01,10:00,13.47
08/05/01,11:00,13.77
08/05/01,12:00,14.08
08/05/01,13:00,14.24
08/05/01,14:00,14.24
08/05/01,15:00,14.55
08/05/01,16:00,14.71
08/05/01,17:00,14.71
08/05/01,18:00,14.71
08/05/01,19:00,14.71
08/05/01,20:00,14.55
08/05/01,21:00,14.55
08/05/01,22:00,14.39
08/05/01,23:00,14.39
08/06/01,00:00,14.24
08/06/01,01:00,14.24
08/06/01,02:00,14.24
08/06/01,03:00,14.08
08/06/01,04:00,14.08
08/06/01,05:00,13.93
08/06/01,06:00,13.93
08/06/01,07:00,13.77
08/06/01,08:00,13.77
08/06/01,09:00,13.93
08/06/01,10:00,14.08
08/06/01,11:00,14.24
08/06/01,12:00,14.55
08/06/01,13:00,14.87
08/06/01,14:00,15.18
08/06/01,15:00,15.66
08/06/01,16:00,15.98
```

```
08/06/01,17:00,15.98
08/06/01,18:00,15.98
08/06/01,19:00,15.98
08/06/01,20:00,15.66
08/06/01,21:00,15.51
08/06/01,22:00,15.34
08/06/01,23:00,15.03
08/07/01,00:00,14.87
08/07/01,01:00,14.71
08/07/01,02:00,14.71
08/07/01,03:00,14.39
08/07/01,04:00,14.39
08/07/01,05:00,14.24
08/07/01,06:00,14.08
08/07/01,07:00,13.93
08/07/01,08:00,13.93
08/07/01,09:00,13.93
08/07/01,10:00,13.93
08/07/01,11:00,14.24
08/07/01,12:00,15.03
08/07/01,13:00,15.51
08/07/01,14:00,15.98
08/07/01,15:00,16.46
08/07/01,16:00,16.62
08/07/01,17:00,16.78
08/07/01,18:00,16.62
08/07/01,19:00,16.46
08/07/01,20:00,16.14
08/07/01,21:00,15.98
08/07/01,22:00,15.66
08/07/01,23:00,15.34
08/08/01,00:00,15.03
08/08/01,01:00,14.71
08/08/01,02:00,14.39
08/08/01,03:00,14.08
08/08/01,04:00,13.77
08/08/01,05:00,13.47
08/08/01,06:00,13.31
08/08/01,07:00,13
08/08/01,08:00,13
08/08/01,09:00,13
08/08/01,10:00,13.16
08/08/01,11:00,13.47
08/08/01,12:00,14.24
08/08/01,13:00,14.87
08/08/01,14:00,15.51
08/08/01,15:00,15.98
08/08/01,16:00,16.14
```

```
08/08/01,17:00,16.3
08/08/01,18:00,16.46
08/08/01,19:00,16.3
08/08/01,20:00,15.98
08/08/01,21:00,15.82
08/08/01,22:00,15.51
08/08/01,23:00,15.34
08/09/01,00:00,15.03
08/09/01,01:00,14.71
08/09/01,02:00,14.39
08/09/01,03:00,14.24
08/09/01,04:00,13.93
08/09/01,05:00,13.77
08/09/01,06:00,13.62
08/09/01,07:00,13.47
08/09/01,08:00,13.31
08/09/01,09:00,13.31
08/09/01,10:00,13.62
08/09/01,11:00,13.93
08/09/01,12:00,14.71
08/09/01,13:00,15.34
08/09/01,14:00,15.98
08/09/01,15:00,16.46
08/09/01,16:00,16.78
08/09/01,17:00,16.93
08/09/01,18:00,16.93
08/09/01,19:00,16.78
08/09/01,20:00,16.62
08/09/01,21:00,16.46
08/09/01,22:00,16.14
08/09/01,23:00,15.98
08/10/01,00:00,15.66
08/10/01,01:00,15.34
08/10/01,02:00,15.03
08/10/01,03:00,14.71
08/10/01,04:00,14.55
08/10/01,05:00,14.24
08/10/01,06:00,14.08
08/10/01,07:00,13.77
08/10/01,08:00,13.77
08/10/01,09:00,13.77
08/10/01,10:00,13.93
08/10/01,11:00,14.24
08/10/01,12:00,15.03
08/10/01,13:00,15.66
08/10/01,14:00,16.3
08/10/01,15:00,16.78
08/10/01,16:00,17.09
```

```
08/10/01,17:00,17.26
08/10/01,18:00,17.26
08/10/01,19:00,17.09
08/10/01,20:00,16.93
08/10/01,21:00,16.78
08/10/01,22:00,16.46
08/10/01,23:00,16.3
08/11/01,00:00,15.98
08/11/01,01:00,15.66
08/11/01,02:00,15.34
08/11/01,03:00,15.18
08/11/01,04:00,14.87
08/11/01,05:00,14.55
08/11/01,06:00,14.39
08/11/01,07:00,14.24
08/11/01,08:00,14.08
08/11/01,09:00,14.08
08/11/01,10:00,14.24
08/11/01,11:00,14.55
08/11/01,12:00,15.18
08/11/01,13:00,15.82
08/11/01,14:00,16.46
08/11/01,15:00,16.93
08/11/01,16:00,17.09
08/11/01,17:00,17.26
08/11/01,18:00,17.26
08/11/01,19:00,17.09
08/11/01,20:00,16.93
08/11/01,21:00,16.62
08/11/01,22:00,16.3
08/11/01,23:00,16.14
08/12/01,00:00,15.82
08/12/01,01:00,15.66
08/12/01,02:00,15.34
08/12/01,03:00,15.03
08/12/01,04:00,14.87
08/12/01,05:00,14.55
08/12/01,06:00,14.39
08/12/01,07:00,14.08
08/12/01,08:00,14.08
08/12/01,09:00,14.08
08/12/01,10:00,14.24
08/12/01,11:00,14.55
08/12/01,12:00,15.34
08/12/01,13:00,15.98
08/12/01,14:00,16.62
08/12/01,15:00,17.09
08/12/01,16:00,17.26
```

```
08/12/01,17:00,17.42
08/12/01,18:00,17.42
08/12/01,19:00,17.26
08/12/01,20:00,16.93
08/12/01,21:00,16.78
08/12/01,22:00,16.62
08/12/01,23:00,16.3
08/13/01,00:00,16.14
08/13/01,01:00,15.98
08/13/01,02:00,15.66
08/13/01,03:00,15.34
08/13/01,04:00,15.18
08/13/01,05:00,14.87
08/13/01,06:00,14.71
08/13/01,07:00,14.55
08/13/01,08:00,14.39
08/13/01,09:00,14.55
08/13/01,10:00,14.55
08/13/01,11:00,14.71
08/13/01,12:00,15.18
08/13/01,13:00,15.82
08/13/01,14:00,16.3
08/13/01,15:00,16.93
08/13/01,16:00,17.09
08/13/01,17:00,17.09
08/13/01,18:00,17.09
08/13/01,19:00,16.93
08/13/01,20:00,16.78
08/13/01,21:00,16.46
08/13/01,22:00,16.3
08/13/01,23:00,15.98
08/14/01,00:00,15.82
08/14/01,01:00,15.51
08/14/01,02:00,15.18
08/14/01,03:00,14.87
08/14/01,04:00,14.55
08/14/01,05:00,14.39
08/14/01,06:00,14.08
08/14/01,07:00,13.93
08/14/01,08:00,13.77
08/14/01,09:00,13.77
08/14/01,10:00,13.93
08/14/01,11:00,14.24
08/14/01,12:00,14.87
08/14/01,13:00,15.51
08/14/01,14:00,15.98
08/14/01,15:00,16.46
08/14/01,16:00,16.62
```

```
08/14/01,17:00,16.78
08/14/01,18:00,16.78
08/14/01,19:00,16.62
08/14/01,20:00,16.46
08/14/01,21:00,16.14
08/14/01,22:00,15.98
08/14/01,23:00,15.82
08/15/01,00:00,15.51
08/15/01,01:00,15.34
08/15/01,02:00,15.03
08/15/01,03:00,14.87
08/15/01,04:00,14.55
08/15/01,05:00,14.39
08/15/01,06:00,14.24
08/15/01,07:00,14.08
08/15/01,08:00,13.93
08/15/01,09:00,13.93
08/15/01,10:00,14.08
08/15/01,11:00,14.24
08/15/01,12:00,14.71
08/15/01,13:00,15.34
08/15/01,14:00,15.98
08/15/01,15:00,16.46
08/15/01,16:00,16.62
08/15/01,17:00,16.62
08/15/01,18:00,16.78
08/15/01,19:00,16.46
08/15/01,20:00,16.3
08/15/01,21:00,16.14
08/15/01,22:00,15.98
08/15/01,23:00,15.82
08/16/01,00:00,15.66
08/16/01,01:00,15.34
08/16/01,02:00,15.18
08/16/01,03:00,15.03
08/16/01,04:00,14.87
08/16/01,05:00,14.71
08/16/01,06:00,14.55
08/16/01,07:00,14.55
08/16/01,08:00,14.39
08/16/01,09:00,14.39
08/16/01,10:00,14.24
08/16/01,11:00,14.24
08/16/01,12:00,14.24
08/16/01,13:00,14.24
08/16/01,14:00,14.39
08/16/01,15:00,14.55
08/16/01,16:00,14.71
```

```
08/16/01,17:00,14.87
08/16/01,18:00,15.03
08/16/01,19:00,14.87
08/16/01,20:00,14.71
08/16/01,21:00,14.55
08/16/01,22:00,14.39
08/16/01,23:00,14.24
08/17/01,00:00,14.08
08/17/01,01:00,14.08
08/17/01,02:00,14.08
08/17/01,03:00,13.93
08/17/01,04:00,13.77
08/17/01,05:00,13.77
08/17/01,06:00,13.62
08/17/01,07:00,13.62
08/17/01,08:00,13.47
08/17/01,09:00,13.62
08/17/01,10:00,13.62
08/17/01,11:00,13.77
08/17/01,12:00,13.93
08/17/01,13:00,14.24
08/17/01,14:00,14.55
08/17/01,15:00,14.87
08/17/01,16:00,14.71
08/17/01,17:00,14.71
08/17/01,18:00,14.71
08/17/01,19:00,14.71
08/17/01,20:00,14.71
08/17/01,21:00,14.55
08/17/01,22:00,14.39
08/17/01,23:00,14.39
08/18/01,00:00,14.24
08/18/01,01:00,14.24
08/18/01,02:00,14.08
08/18/01,03:00,13.93
08/18/01,04:00,13.93
08/18/01,05:00,13.77
08/18/01,06:00,13.62
08/18/01,07:00,13.62
08/18/01,08:00,13.62
08/18/01,09:00,13.62
08/18/01,10:00,13.62
08/18/01,11:00,13.62
08/18/01,12:00,13.62
08/18/01,13:00,14.08
08/18/01,14:00,14.39
08/18/01,15:00,14.87
08/18/01,16:00,14.71
```

```
08/18/01,17:00,14.71
08/18/01,18:00,14.71
08/18/01,19:00,14.71
08/18/01,20:00,14.55
08/18/01,21:00,14.39
08/18/01,22:00,14.39
08/18/01,23:00,14.24
08/19/01,00:00,14.24
08/19/01,01:00,14.08
08/19/01,02:00,14.08
08/19/01,03:00,13.93
08/19/01,04:00,13.77
08/19/01,05:00,13.62
08/19/01,06:00,13.62
08/19/01,07:00,13.47
08/19/01,08:00,13.47
08/19/01,09:00,13.47
08/19/01,10:00,13.62
08/19/01,11:00,13.77
08/19/01,12:00,14.08
08/19/01,13:00,14.55
08/19/01,14:00,14.71
08/19/01,15:00,15.18
08/19/01,16:00,15.51
08/19/01,17:00,15.66
08/19/01,18:00,15.51
08/19/01,19:00,15.34
08/19/01,20:00,15.03
08/19/01,21:00,14.71
08/19/01,22:00,14.55
08/19/01,23:00,14.24
08/20/01,00:00,14.08
08/20/01,01:00,13.93
08/20/01,02:00,13.62
08/20/01,03:00,13.31
08/20/01,04:00,13.16
08/20/01,05:00,12.84
08/20/01,06:00,12.69
08/20/01,07:00,12.38
08/20/01,08:00,12.22
08/20/01,09:00,12.38
08/20/01,10:00,12.53
08/20/01,11:00,12.69
08/20/01,12:00,13.31
08/20/01,13:00,13.93
08/20/01,14:00,14.24
08/20/01,15:00,14.39
08/20/01,16:00,14.55
```

```
08/20/01,17:00,14.55
08/20/01,18:00,14.71
08/20/01,19:00,14.71
08/20/01,20:00,14.55
08/20/01,21:00,14.55
08/20/01,22:00,14.39
08/20/01,23:00,14.24
08/21/01,00:00,13.93
08/21/01,01:00,13.77
08/21/01,02:00,13.62
08/21/01,03:00,13.47
08/21/01,04:00,13.31
08/21/01,05:00,13.31
08/21/01,06:00,13.16
08/21/01,07:00,13.16
08/21/01,08:00,13.16
08/21/01,09:00,13.16
08/21/01,10:00,13.16
08/21/01,11:00,13.16
08/21/01,12:00,13.16
08/21/01,13:00,13.47
08/21/01,14:00,13.47
08/21/01,15:00,13.62
08/21/01,16:00,13.77
08/21/01,17:00,13.62
08/21/01,18:00,13.62
08/21/01,19:00,13.62
08/21/01,20:00,13.62
08/21/01,21:00,13.77
08/21/01,22:00,14.08
08/21/01,23:00,14.24
08/22/01,00:00,14.24
08/22/01,01:00,14.24
08/22/01,02:00,14.24
08/22/01,03:00,14.24
08/22/01,04:00,14.08
08/22/01,05:00,14.08
08/22/01,06:00,14.08
08/22/01,07:00,14.24
08/22/01,08:00,14.24
08/22/01,09:00,14.24
08/22/01,10:00,14.24
08/22/01,11:00,14.24
08/22/01,12:00,14.24
08/22/01,13:00,14.39
08/22/01,14:00,14.55
08/22/01,15:00,14.71
08/22/01,16:00,14.71
```

```
08/22/01,17:00,14.71
08/22/01,18:00,15.66
08/22/01,19:00,15.98
08/22/01,20:00,15.18
08/22/01,21:00,14.87
08/22/01,22:00,15.03
08/22/01,23:00,15.03
08/23/01,00:00,14.71
08/23/01,01:00,14.55
08/23/01,02:00,14.39
08/23/01,03:00,14.08
08/23/01,04:00,14.08
08/23/01,05:00,13.93
08/23/01,06:00,13.77
08/23/01,07:00,13.62
08/23/01,08:00,13.62
08/23/01,09:00,13.62
08/23/01,10:00,13.62
08/23/01,11:00,13.62
08/23/01,12:00,13.77
08/23/01,13:00,13.77
08/23/01,14:00,13.93
08/23/01,15:00,14.08
08/23/01,16:00,14.24
08/23/01,17:00,14.24
08/23/01,18:00,14.24
08/23/01,19:00,14.24
08/23/01,20:00,14.24
08/23/01,21:00,14.08
08/23/01,22:00,13.93
08/23/01,23:00,13.77
08/24/01,00:00,13.77
08/24/01,01:00,13.62
08/24/01,02:00,13.47
08/24/01,03:00,13.31
08/24/01,04:00,13.16
08/24/01,05:00,13
08/24/01,06:00,12.84
08/24/01,07:00,12.69
08/24/01,08:00,12.69
08/24/01,09:00,12.84
```

Date,Time,Temperature (*C)
08/24/01,09:52,~~15.03~~
08/24/01,10:52,13.16
08/24/01,11:52,13.62
08/24/01,12:52,13.77
08/24/01,13:52,14.08
08/24/01,14:52,14.55
08/24/01,15:52,14.87
08/24/01,16:52,15.03
08/24/01,17:52,15.03
08/24/01,18:52,14.87
08/24/01,19:52,14.71
08/24/01,20:52,14.55
08/24/01,21:52,14.24
08/24/01,22:52,14.08
08/24/01,23:52,13.77
08/25/01,00:52,13.62
08/25/01,01:52,13.47
08/25/01,02:52,13.16
08/25/01,03:52,13
08/25/01,04:52,12.69
08/25/01,05:52,12.53
08/25/01,06:52,12.22
08/25/01,07:52,12.07
08/25/01,08:52,12.07
08/25/01,09:52,12.22
08/25/01,10:52,12.53
08/25/01,11:52,13.16
08/25/01,12:52,13.77
08/25/01,13:52,14.24
08/25/01,14:52,14.71
08/25/01,15:52,15.03
08/25/01,16:52,15.18
08/25/01,17:52,15.18
08/25/01,18:52,15.03
08/25/01,19:52,14.87
08/25/01,20:52,14.71
08/25/01,21:52,14.55
08/25/01,22:52,14.24
08/25/01,23:52,14.08
08/26/01,00:52,13.77
08/26/01,01:52,13.62
08/26/01,02:52,13.47
08/26/01,03:52,13.16
08/26/01,04:52,13
08/26/01,05:52,12.84
08/26/01,06:52,12.69
08/26/01,07:52,12.53

Appendix R

APPENDIX R:
On-Going
City of Woodinville Restoration Projects

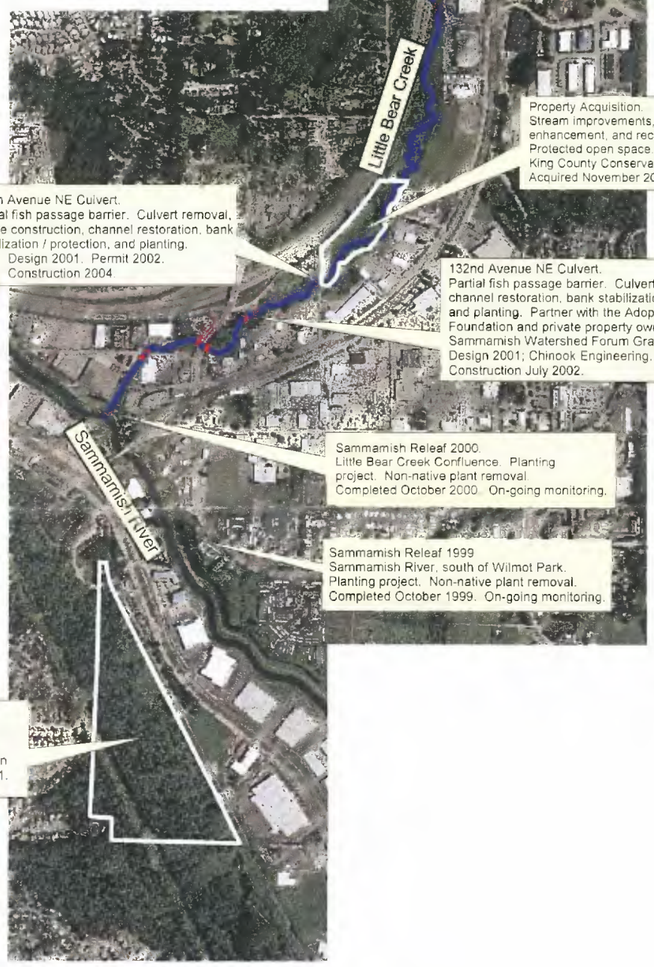
NE 205th Street Culvert. Baffle installed at outlet.
Partnered with Snohomish County.
Trans-Aid Grant Fund.
Completed September 2000.

NE 205th Street Reach.
Fish passage improvement. Weir installation, bank stabilization / protection, pool enhancement, and planting. Partner with Snohomish County and private property owner.
Design 2001. Permit 2001. Construction July 2002.

Property Acquisition.
Good habitat. Restoration, enhancement, and recreation opportunities. Protected open space.
Acquired June 2001.

Property Acquisition.
Restoration, enhancement, and recreation opportunities. Protected open space.
Acquired June 2001.

NE 195th Street Reach.
Fish passage improvement.
Weir repairs, and plantings. Partner with Snohomish County and Adopt-A-Stream Foundation.
Trans-Aid Grant Fund.
Design 2001. Permit 2002. Construction July 2004.



Property Acquisition.
Stream improvements, good habitat, enhancement, and recreation opportunities.
Protected open space.
King County Conservation Grant.
Acquired November 2000.

134th Avenue NE Culvert.
Partial fish passage barrier. Culvert removal, bridge construction, channel restoration, bank stabilization / protection, and planting.
Design 2001. Permit 2002.
Construction 2004

132nd Avenue NE Culvert.
Partial fish passage barrier. Culvert removal, channel restoration, bank stabilization / protection, and planting. Partner with the Adopt-A-Stream Foundation and private property owners.
Sammamish Watershed Forum Grant.
Design 2001; Chinook Engineering. Permit 2001.
Construction July 2002.

Sammamish Releaf 2000.
Little Bear Creek Confluence. Planting project. Non-native plant removal.
Completed October 2000. On-going monitoring.

Sammamish Releaf 1999
Sammamish River, south of Wilmot Park.
Planting project. Non-native plant removal.
Completed October 1999. On-going monitoring.

Property donated by
Lakeside Industries, Inc.
Good habitat and recreation opportunities. Protected open space. Donated August 2001.

Little Bear Creek Habitat Assessment Study. Field investigation. Begun June 2001.
Study completion March 2002.
David Evans and Associates, Inc.

Sammamish Releaf 2001
Planting project. Non-native plant removal.
Planting October 2001.

N

City of Woodinville
Habitat Enhancement Projects
July 2001

NTS

DRAFT

The city of WOODINVILLE

Drawn by Sean Baker July 5, 2001

Appendix S

APPENDIX S:
Potential Wildlife Species List

Common Name	Scientific Name	Habitat									
		Herbaceous	Shrub	Deciduous	Coniferous	Mixed C/D	Riparian	Wetland (Fo)	Wetland (S-S)	Wetland (Em)	Wetland (OW)
BIRDS											
Great blue heron	*Ardea herodias*	X					X			X	X
Green-backed heron	*Butorides striatus*						X			X	X
Canada goose	*Branta canadensis*	X								X	X
Green-winged teal	*Anas crecca*									X	X
Cinnamon teal	*Anas cyanoptera*									X	X
Blue-winged teal	*Anas discors*									X	X
Mallard	*Anas platyrhynchos*						X			X	X
Northern pintail	*Anas acuta*									X	X
Northern shoveler	*Anas clypeata*									X	X
American wigeon	*Anas americana*									X	X
Gadwall	*Anas strepera*									X	X
Wood duck	*Aix sponsa*						X			X	X
Hooded merganser	*Lophodytes cucullatus*						X			X	X
Red-tailed hawk	*Buteo jamaicensis*	X		X	X	X					
Sharp-shinned hawk	*Accipiter striatus*			X	X	X					
Cooper's hawk	*Accipiter cooperii*			X	X	X					
Bald eagle	*Haliaeetus leucocephalus*			X	X	X	X				X
American kestrel	*Falco sparverius*	X		X		X					
Ruffed grouse	*Bonasa umbellus*			X	X	X	X				
California quail	*Callipepla californica*	X	X								
Ring-necked pheasant	*Phasianus colchicus*	X	X								
Virginia rail	*Rallus limicola*								X	X	X
Sora	*Porzana carolina*								X	X	X
Killdeer	*Charadrius vociferus*	X									
Common snipe	*Gallinago gallinago*	X	X								
Spotted sandpiper	*Actitis macularia*						X				
California gull	*Larus californicus*	X									
Band-tailed pigeon	*Columba fasciata*			X	X	X					
Rock dove	*Columba livia*	X									
Mourning dove	*Zenaida macroura*		X	X	X	X	X				
Western screech owl	*Otus kennicottii*			X	X	X	X				
Great horned owl	*Bubo virginianus*			X	X	X	X				
Short-eared owl	*Asio flammeus*	X	X							X	
Northern pygmy owl	*Glaucidium gnoma*				X	X					
Barred owl	*Strix varia*			X	X	X					
Barn owl	*Tyto alba*	X		X		X					
Rufous hummingbird	*Selasphorus rufus*		X				X				
Anna's hummingbird	*Calypte anna*			X		X					
Belted kingfisher	*Ceryle alcyon*						X				X
Northern flicker	*Colaptes auratus*		X	X	X	X	X				
Pileated woodpecker	*Dryocopus pileatus*			X	X	X					
Red-breasted sapsucker	*Sphyrapicus ruber*		X	X	X	X					
Downy woodpecker	*Picoides pubescens*			X	X	X	X				
Hairy woodpecker	*Picoides villosus*			X	X	X	X				
Olive-sided flycatcher	*Contopus borealis*			X	X	X	X				
Western wood-pewee	*Contopus sordidulus*			X	X	X	X				

Common Name	Scientific Name	Habitat									
		Herbaceous	Shrub	Deciduous	Coniferous	Mixed C/D	Riparian	Wetland (Fo)	Wetland (S-S)	Wetland (Em)	Wetland (OW)
Willow flycatcher	*Empidonax traillii*		X	X			X				
Pacific-slope flycatcher	*Empidonax difficilis*			X	X	X	X				
Tree swallow	*Tachycineta bicolor*	X	X		X	X	X	X	X	X	X
Violet-green swallow	*Tachycineta thalassina*	X	X	X	X	X	X	X	X	X	X
Barn swallow	*Hirundo rustica*	X	X						X	X	X
Steller's jay	*Cyanocitta stelleri*		X	X	X	X					
American crow	*Corvus brachyrhynchos*	X	X	X	X	X	X	X	X	X	
Black-capped chickadee	*Parus atricapillus*		X	X	X	X	X	X	X		
Chestnut-backed chickadee	*Parus rufescens*		X	X	X	X	X	X	X		
Common bushtit	*Psaltriparus minimus*		X	X		X	X	X	X		
Red-breasted nuthatch	*Sitta canadensis*			X	X	X	X				
Brown creeper	*Certhia americana*			X	X	X	X				
American dipper	*Cinclus mexicanus*						X				
Bewick's wren	*Thryomanes bewickii*		X	X	X	X	X		X		
Winter wren	*Troglodytes troglodytes*		X	X	X	X	X	X			
Marsh wren	*Cistothorus palustris*								X	X	
American robin	*Turdus migratorius*	X	X	X	X	X	X	X	X	X	
Varied thrush	*Ixoreus naevius*		X	X	X	X	X	X	X		
Swainson's thrush	*Catharus ustulatus*		X	X	X	X	X	X	X		
Northern shrike	*Lanius excubitor*	X	X						X	X	
Golden-crowned kinglet	*Regulus satrapa*			X	X	X	X	X			
Ruby-crowned kinglet	*Regulus calendula*			X	X	X	X	X			
Cedar waxwing	*Bombycilla cedrorum*		X	X	X	X	X	X	X		
European starling	*Sturnus vulgaris*	X	X	X	X	X	X	X	X	X	
Solitary vireo	*Vireo solitarius*		X	X	X	X	X	X	X		
Hutton's vireo	*Vireo huttoni*		X	X	X	X	X	X	X		
Warbling vireo	*Vireo gilvus*		X	X	X	X	X	X	X		
Red-eyed vireo	*Vireo olivaceus*			X			X				
MacGillivray's warbler	*Oporonis tolmiei*		X	X		X	X	X	X		
Orange-crowned warbler	*Vermivora celata*		X	X			X	X	X		
Yellow-rumped warbler	*Dendroica coronata*		X	X	X	X	X	X	X		
Yellow warbler	*Dendroica petechia*		X	X		X	X	X	X		
Townsend's warbler	*Dendroica townsendi*				X	X	X	X			
Black-throated gray warbler	*Dendroica nigrescens*			X	X	X	X	X			
Common yellowthroat	*Geothlypis trichas*	X	X				X		X	X	
Wilson's warbler	*Wilsonia pusilla*		X	X		X	X	X	X		
House sparrow	*Passser domesticus*	X	X								
Red-winged blackbird	*Agelaius phoeniceus*		X						X	X	X
Brewer's blackbird	*Euphagus cyanocephalus*	X							X	X	X
Bullock's oriole	*Icterus galbula bullockii*		X	X		X	X	X	X		
Brown-headed cowbird	*Molothrus ater*	X	X	X	X	X	X	X	X	X	
Western tanager	*Piranga ludoviciana*		X	X	X	X	X	X	X		
Black-headed grosbeak	*Pheucticus melanocephalus*			X	X	X	X	X			
Evening grosbeak	*Hesperiphona vespertina*		X	X	X	X	X				
Purple finch	*Carpodacus purpureus*			X	X	X	X				
House finch	*Carpodacus mexicanus*		X						X		
Pine siskin	*Carduelis pinus*			X	X	X	X	X			

Common Name	Scientific Name	Habitat									
		Herbaceous	Shrub	Deciduous	Coniferous	Mixed C/D	Riparian	Wetland (Fo)	Wetland (S-S)	Wetland (Em)	Wetland (OW)
American goldfinch	*Carduelis tristis*	X	X								
Red crossbill	*Loxia curvirostra*				X	X	X				
Rufous-sided towhee	*Pipilo erythrophthalmus*		X	X	X	X	X	X	X		
Dark-eyed junco	*Junco hyemalis*	X	X	X	X	X	X	X	X		
White-crowned sparrow	*Zonotrichia leucophrys*	X	X						X		
Golden-crowned sparrow	*Zonotrichia atricapilla*						X				
Chipping sparrow	*Spizella passerina*	X	X	X					X		
Savannah sparrow	*Passerculus sandwichensis*	X								X	
Fox sparrow	*Passerella iliaca*		X	X	X	X	X	X	X		
Song sparrow	*Melospiza melodia*		X	X	X	X	X	X	X		
MAMMALS											
Opossum	*Didelphis marsupialis*	X	X	X	X	X	X	X	X	X	
Vagrant shrew	*Sorex vagrans*	X	X				X		X	X	
Marsh shrew	*Sorex bendirii*						X		X	X	
Shrew-mole	*Neurotrichus gibbsii*			X	X	X	X	X			
Coast mole	*Scapanus orarius*	X	X	X		X					
Townsend's mole	*Scapanus townsendi*	X	X								
Little brown bat	*Myotis lucifugus*			X	X	X	X	X	X	X	X
California myotis	*Myotis californicus*			X	X	X	X	X	X	X	X
Yuma myotis	*Myotis yumanensis*		X	X	X	X	X	X	X	X	X
Silvery-haired bat	*Lasionycteris noctivagans*			X	X	X	X	X	X	X	X
Big brown bat	*Eptesicus fuscus*			X	X	X	X	X	X	X	X
Porcupine	*Erethizon dorsatum*		X	X	X	X					
Deer mouse	*Peromyscus maniculatus*	X	X	X	X	X	X	X	X	X	
Townsend's meadow mouse	*Microtus townsendii*	X	X							X	
Norway rat	*Rattus norvegicus*	X	X				X		X		
Black rat	*Rattus rattus*	X	X				X		X		
House mouse	*Mus musculus*	X	X								
Mountain beaver	*Aplodontia rufa*			X	X	X	X	X			
Muskrat	*Ondatra zibethicus*		X				X		X	X	X
Beaver	*Castor canadensis*						X	X	X	X	X
Townsend's chipmunk	*Eutamias townsendi*			X	X	X					
Douglas' squirrel	*Tamiasciurus douglasii*				X	X					
Eastern gray squirrel	*Sciurus carolinensis*			X	X	X					
Eastern cottontail	*Sylvilagus floridanus*	X	X								
Mink	*Mustela vison*						X	X	X	X	
Long-tailed weasel	*Mustela frenata*		X	X	X	X	X	X			
River otter	*Lutra canadensis*						X				X
Striped skunk	*Mephitis mephitis*		X	X		X	X		X		
Spotted skunk	*Spilogale putoris*			X	X	X	X	X			
Raccoon	*Procyon lotor*			X	X	X	X	X	X	X	
Bobcat	*Felis rufus*			X	X	X					
Mountain lion	*Felis concolor*			X	X	X					
Coyote	*Canis latrans*	X	X	X	X	X	X				
Black bear	*Ursus americanus*		X	X	X	X	X				
Black-tailed deer	*Odocoileus hemionus columbianus*		X	X	X	X	X				
AMPHIBIANS											

Common Name	Scientific Name	Habitat									
		Herbaceous	Shrub	Deciduous	Coniferous	Mixed C/D	Riparian	Wetland (Fo)	Wetland (S-S)	Wetland (Em)	Wetland (OW)
Rough-skinned newt	*Taricha granulosa*			X	X	X	X	X	X		X
W. red-backed salamander	*Plethodon vehiculum*				X	X	X				
Northwestern salamander	*Ambystoma gracile*				X	X	X	X			X
Long-toed salamander	*Ambystoma macrodactylum*			X	X	X	X	X			
Ensatina	*Ensatina eschscholtzi*			X	X	X	X	X			
Pacific treefrog	*Hyla regilla*		X	X	X	X	X	X	X	X	X
Red-legged frog	*Rana aurora*			X	X	X	X	X			X
Bullfrog	*Rana catesbeiana*										X
Western toad	*Bufo boreas*			X	X	X	X	X	X	X	X
REPTILES											
N. alligator lizard	*Elgaria coerulea*		X		X						
Common garter snake	*Thamnophis sirtalis*	X	X	X	X	X	X	X			
N.W. garter snake	*Thamnophis ordinoides*	X	X	X	X	X					
Source: Brown 1985, Guenther and Kucera 1978, Hunn 1982, Ingles 1965, Nussbaum et al. 1983, and Wahl and Paulson 1977.											

APPENDIX B

VEGETATION, FISH & WILDLIFE INVENTORY

4.4.6 Riparian Habitat

Riparian habitat is defined as the land adjoining the stream that influences stream habitat and its processes. The composition and quantity of riparian habitat directly influences temperature, sedimentation, productivity, habitat complexity, and the streams disturbance regime. An "intact" riparian zone buffers the stream from outside elements. One issue today is how large does a buffer have to be to protect a stream from anthropogenic influences. A buffer of 30.5 meters (100 feet) is often used for salmonid-bearing streams. However, many researchers have documented that a 30.5-meter (100-foot) buffer is not sufficient in protecting a stream and its processes from all anthropogenic influences, especially when the quality of the existing buffer is low. Some researchers have suggested that if the goal is to truly protect a valuable resource, than buffer width should be at least 100 meters (328 feet). However, this width can be adjusted downward depending on the maturity and overall percentage of the existing riparian habitat. Furthermore, it is also recognized that the composition of the entire watershed plays a vital role in a stream's overall health. On the watershed scale, the percent or fraction of total impervious area has been found to have a direct correlation with a stream's productivity (May et al., 1997).

This report will focus on a linear corridor adjacent to the stream, 61 meters (200 feet) from each bank or 122 meters (400 feet) total width. Site specific conditions within the City of Woodinville based on aerial photographs from 1999 indicate the width of the Little Bear Creek vegetated riparian buffer varies considerably by reach (Appendix G).

The width of the vegetated riparian buffer in Reach 1 averages about 7.6 meters (25 feet) wide and is abutted by development along both banks. The overall 121.9-meter (400-foot) wide corridor

within Reach 1 was composed of 64.36 percent impervious surface, 27.97 percent shrub/grass habitat, 5.11 percent forest habitat, and 2.59 percent gravel area.

The width of the vegetated buffer in Reach 2 varied between the left and right banks. The left bank ranges from 7.6 to 22.9 meters (25 to 75 feet) wide (average width about 7.6 meters [25 feet]) and is abutted by businesses. The right bank ranges from 15.2 to >61 meters (50 to >200 feet) wide (average width about 45.7 meters [150 feet]) and is abutted by Highway 522. The overall 122-meter (400-foot) wide corridor within Reach 2 was composed of 19.38 percent impervious surface, 46.46 percent shrub/grass habitat, 21.63 percent forest habitat, and 12.52 percent gravel area.

The width of the vegetated riparian buffer along both banks of Reach 3 varies from 15.2 to >61 meters (50 to >200 feet). The right bank is relatively unconstrained while the left bank is defined by Highway 522. The overall 122-meter (400-foot) corridor in Reach 3 was composed of 17.12 percent impervious surface, 1.55 percent gravel area, 45.76 percent forested habitat, and 35.56 percent shrub/grass habitat (Table 11).

Table 11:
Land Use Based on 1999 Aerial Photograph
Along Little Bear Creek, Woodinville

Land Use	Reach 1	Reach 2	Reach 3	Total
Developed Impervious	64.36%	19.38%	17.12%	24.05%
Gravel - cleared impervious	2.59%	12.52%	1.55%	6.56%
Forested Habitat	5.11%	21.63%	45.76%	29.94%
Shrub/Grass Habitat	27.97%	46.46%	35.56%	39.45%

Based on the photo interpretation of the 1999 aerial photographs (Appendix G), two trends are apparent. The percentage of developed impervious (developed and gravel [cleared impervious]) surface is significantly higher along the lower reaches while the percentage of forested habitat significantly decreases. The high percentage (12.52 percent) of cleared gravel area along Reach 2 may be an indicator that more development is planned and that the percentage of developed impervious surface will continue to increase within potential buffer habitat.

The remaining riparian buffer and upland forest habitat is of vital importance to the continued functionality of Little Bear Creek. However, the composition of the buffer along Little Bear Creek is varied, and typically dominated by deciduous trees and non-native species of grasses and shrubs. Red alder (*Alnus rubra*), Himalayan blackberry (*Rubus procerus*), bittersweet nightshade (*Solanum dulcamara*), and reed canarygrass (*Phalaris arundinacea*) are abundant throughout Reaches 1 and 2, and the lowermost section of Reach 3. Japanese knotweed (*Polyonum cuspidatum*), another introduced species is also present and locally abundant, but not as widespread as the other aforementioned invasive species.

A continuous 61-meter (200-foot) riparian buffer along each bank composed of mature coniferous forest with numerous adjoining wetlands should be the goal along the Little Bear Creek corridor. Based on our survey results, these target conditions are absent, but scattered sections along the left bank of Reach 3 do possess some of the desired traits.

The remaining buffer is composed of primarily deciduous trees, shrubs, and grasses. A detailed list of the species observed along Little Bear Creek is contained in Tables 12, 13, 14, and 15 below. As mentioned previously, red alder is the most abundant tree species along Little Bear Creek, followed by black cottonwood (*Populus balsamifera*), big-leaf maple (*Acer macrophyllum*), and willow (*Salix* spp). Other species such as Douglas fir and western red-cedar become more prevalent in Reach 3. Two Pacific yew (*Taxus brevifolia*) trees were observed along Reach 2. These are long-lived small conifer trees that were used extensively by native Americans and are a source of the cancer fighting drug taxol. The two observed along Little Bear Creek are remnants from pre-settlement. Once gone, Pacific yews will likely not become reestablished because of the absence of mature coniferous forest.

Table 12:
Tree Composition Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	2, 3.	Vine maple	*Acer circinatum*	Native.
2.	1, 2, 3.	Big-leaf maple	*Acer macrophyllum*	Native.
3.	1, 2, 3.	Red alder	*Alnus rubra*	Native.
4.	2, 3.	Black hawthorne	*Crataegus douglasii*	Native.
5.	1, 3.	Oregon ash	*Fraxinus latifolia*	Native.
6.	1, 2, 3.	Sitka spruce	*Picea sitchensis*	Native.
7.	1	Shore pine	*Pinus contorta*	Native.
8.	1, 2, 3.	Black cottonwood	*Populas balsamifera*	Native.
9.	1, 2, 3.	Bitter cherry	*Prunus emarginata*	Native.
10.	1, 2, 3.	Douglas fir	*Pseudotsuga menziesii*	Native.
11.	2, 3.	Cascara buckthorn	*Rhamnus purshiana*	Native.
12.	1, 2, 3.	Pacific willow	*Salix lasiandra*	Native.
13.	2, 3.	Scouler willow	*Salix scouleriana*	Native.
14.	1, 2, 3.	Sitka willow	*Salix sitchensis*	Native.
15.	2.	Pacific yew	*Taxus brevifolia*	Native.
16.	2, 3.	Western red cedar	*Thuja plicata*	Native.
17.	2, 3.	Western hemlock	*Tsuga heterophylla*	Native.

Shrubs and vines are abundant along Little Bear Creek. The most common along the stream bank include Himalayan blackberry, bittersweet nightshade, and Pacific ninebark (*Physocarpus capitatus*). Others such as Scotch broom (*Cytisus scoparius*) are also abundant, but typically occur beyond the riparian zone, especially within the disturbed areas between Little Bear Creek and Highway 522 along Reaches 2 and 3.

Table 13:
Shrub and Vine Composition Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	1, 2, 3.	Red-twig dogwood	*Cornus sericea*	Native.
2.	2	Beaked hazelnut	*Corylus cornuta*	Native.
3.	1, 2, 3.	Scotch broom	*Cytisus scoparius*	Introduced, invasive.
4.	2	Salal	*Gaultheria shallon*	Native.
5.	3.	Black twinberry	*Lonicera involucrata*	Native.
6.	2, 3.	Indian plum	*Oemieria cerasiformis*	Native.
7.	3.	Devil's club	*Oplopanax horridus*	Native.
8.	1, 2, 3.	Pacific ninebark	*Physocarpus capitatus*	Native.
9.	2, 3.	Sword fern	*Polysticum munitum*	Native.
10.	3.	Stink currant	*Ribes bracteosum*	Native.
11.	2	Wild rose	*Rosa* spp.	Native.
12.	1, 2, 3.	Evergreen blackberry	*Rubus laciniatus*	Introduced, invasive.
13.	2, 3.	Thimble berry	*Rubus parviflorus*	Native.
14.	1, 2, 3.	Himalayan blackberry	*Rubus procera*	Introduced, invasive.
15.	1, 2	Salmonberry	*Rubus spectabilis*	Native.
16.	2, 3.	Trailing blackberry	*Rubus ursinus*	Native.
17.	2	Red elderberry	*Sambucus racemosa*	Native.
18.	2, 3.	Douglas spirea	*Spiraea douglasii*	Native.
19.	3.	Highbush-cranberry	*Viburnum edule*	Native.

Herbs represent the most diverse subset of plants encountered along Little Bear Creek. The most common groups include the grasses and weeds. The herb category also contains the largest percentage of introduced species, many of which are invasive. They typically are the first group of species to colonize disturbed areas and once present are difficult to remove. Some of these species such as reed canarygrass and bittersweet nightshade can be extremely abundant, and have established extensive monocultures within the riparian zone. Others such as purple loosestrife and yellow flag iris are present but sparse.

Table 14:
Herb Composition Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	2	Creeping bentgrass	*Agrostis stolonifera*	Introduced.
2.	3.	Pearly everlasting	*Anaphalis margaritacea*	Native.
3.	1, 2, 3.	Lady fern	*Athyrium felix-femina*	Native.
4.	2, 3.	Canada thistle	*Cirsium arvense*	Introduced, invasive.
5.	3	Poison hemlock	*Conium maculatum*	Introduced.
6.	1, 2, 3.	Morning glory	*Convolvulus arvensis*	Introduced, invasive.
7.	2	Bristly hawksbeard	*Crepis setosa 'Haller'*	Introduced.
8.	2	Orchard grass	*Dactylis glomerata*	Introduced.
9.	2	Bleeding heart	*Dicentra formosa*	Native.
10.	1, 2	Fireweed	*Epilobium* sp.	Introduced.
11.	2	Field horsetail	*Equisetum arvense*	Native.
12.	1, 2	Giant horsetail	*Equisetum telmateia*	Native.

Table 14 continued

#	Reach #	Common Name	Scientific Name	Comments
13.	2	Tall fescue	*Festuca arundinacea*	Introduced.
14.	2, 3.	Bedstraw	*Galium aparine*	Native.
15.	2, 3.	Robert geranium	*Geranium robertianum*	Introduced, invasive.
16.	3.	Big-leaf avens	*Geum macrophyllum*	Native.
17.	1	St. John's-wort	*Hypericum perforatum*	Introduced, invasive, noxious.
18.	1, 2	Yellow touch-me-not	*Impatiens noli-tangere*	Introduced.
19.	1, 2	Yellow-flag iris	*Iris pseudacorus*	Introduced, invasive.
20.	1, 2,	Soft rush	*Juncus effusus*	Native.
21.	2	Daggerleaf rush	*Juncus ensifolius*	Native.
22.	3	Duck weed	*Lemna minor*	Native.
23.	2, 3.	Birdsfoot trefoil	*Lotus corniculatus*	Introduced, invasive.
24.	3	Skunk cabbage	*Lysichitum americanum*	Native.
25.	2, 3.	Purple loosestrife	*Lythrum salicaria*	Introduced, invasive.
26.	2	False lily-of-the-valley	*Maianthemum dilatatum*	Native.
27.	2, 3.	Small water forget-me-not	*Myosotis laxa*	Native.
28.	2	Common evening primrose	*Oenothera biennis*	Introduced – N.E. USA.
29.	1, 2, 3.	Reed canarygrass	*Phalaris arundinacea*	Introduced, invasive.
30.	1	English plantain	*Plantago major*	Introduced.
31.	1, 2, 3.	Japanese knotweed	*Polygonum cuspidatum*	Introduced, invasive.
32.	2, 3.	Bracken fern	*Pteridium aquilinum*	Native.
33.	2, 3.	Creeping buttercup	*Ranunculus repens*	Introduced, invasive.
34.	2	Water cress	*Rorippa nasturtium-aquaticum*	Introduced.
35.	2	Red sorrel	*Rumex acetosella*	Introduced.
36.	2, 3.	Curly dock	*Rumex crispus*	Introduced.
37.	2, 3.	Bitter dock	*Rumex obtusifolius*	Introduced.
38.	1, 2, 3.	Small-fruited bulrush	*Scirpus microcarpus*	Native.
39.	1, 2, 3.	Bittersweet nightshade	*Solanum dulcamara*	Introduced, invasive.
40.	2, 3.	Hedge nettle	*Stachys cooleyae*	Native.
41.	1	Tansy	*Tanacetum vulgare*	Introduced, invasive.
42.	1	Dandelion	*Taraxacum officinale*	Introduced, invasive.
43.	2, 3.	Piggy-back plant	*Tolmeia menziesii*	Native.
44.	2	White clover	*Trifolium repens*	Introduced.
45.	2, 3.	Stinging nettle	*Urtica dioica*	Introduced.

Ornamentals represent introduced species that were typically planted in private yards or businesses. They are usually not invasive, except for English ivy (*Hedera helix*), which can choke trees. Most do not represent a threat and are unable to naturally propagate. Others such as English holly (*Liex aquifolium*) are distributed by bird droppings, but are not problematic.

Table 15:
Ornamental Composition Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	3	Norway maple	*Acer platanoides*	Introduced.
2.	3	Red maple	*Acer rubrum*	Introduced.
3.	1	Butterfly bush	*Buddleia davidii*	Introduced.
4.	3	Parneyi cotoneaster	*Cotoneaster lacteus*	Introduced.
5.	3	Crocosmia	*Crocosmia* sp.	Introduced.
6.	1	Buning bush	*Euonymus alaalatus*	Introduced.
7.	1, 2	English ivy	*Hedera helix*	Introduced, invasive.
8.	3	Blue star juniper	*Juniperus squamata*	Introduced.
9.	2	English holly	*Liex aquifolium*	Introduced.
10.	1	Apple fruit tree	*Malus* sp.	Introduced.
11.	1	Scotch pine	*Pinus sylvestris*	Introduced.
12.	3	Thundercloud plum tree	*Prunus cerasifera*	Introduced.
13.	1	Otto-luyken laurel	*Prunus laurocerasus*	Introduced.
14.	1	Plum fruit tree	*Prunus* sp.	Introduced.
15.	3	Flowering cherry tree	*Prunus* sp.	Introduced.
16.	1	Rhododendron species	*Rhododendron* sp.	Introduced.
17.	1, 2, 3.	Locust tree	*Robinia* sp.	Introduced.
18.	1	Weeping willow	*Salix babylonica*	Introduced.
19.	2	European mountain ash	*Sorbus acuparia*	Introduced.

Table 2:
Fish Species Documented in Little Bear Creek

#	Common Name	Scientific Name	Source
1.	Coast Range Sculpin	*Cottus aleuticus*	DEA
2.	Western Brook Lamprey	*Lampretra richardsoni*	DEA
3.	Cutthroat Trout	*Oncorhynchus clarki*	DEA
4.	Pink Salmon	*Oncorhynchus gorbuscha*	WDFW
5.	Chum Salmon	*Oncorhynchus keta*	WDFW
6.	Coho Salmon	*Oncorhynchus kisutch*	WDFW, King County, & DEA.
7.	Sockeye Salmon	*Oncorhynchus nerka*	WDFW & King County, & DEA
8.	Kokanee	*Oncorhynchus nerka*	WDFW & King County, & DEA
9.	Chinook Salmon	*Oncorhynchus tshawytscha*	WDFW, NMFS, & King County.

At least 40 different non-native species of fish have been introduced into the Lake Washington watershed since the arrival of the first European settlers. However, many of these introduced species did not survive and today approximately 24 species remain (Kerwin, 2001). A listing of 21 species of native and non-native fish that have been documented within the greater Lake Washington watershed are included in Table 3 below. Introduced species have become prevalent in both Lake Washington and Lake Sammamish, and continue to adversely impact native salmonids. Although the list presented in Table 3 below is not all-inclusive, it provides evidence of the shear abundance of non-native species of fish that still inhabit the Lake Washington watershed. Some of these species listed in Table 3 likely utilize the Sammamish River and therefore potentially the lowermost reach of Little Bear Creek. The likelihood of any of these additional undocumented species being present in Little Bear Creek varies by species.

Table 3:
Additional Fish Species Documented in the Greater Lake Washington Watershed

#	Common Name	Scientific Name	Native or Introduced	Resident or Anadromous	Status
1.	White sturgeon	*Acipenser transmontanus*	Locks created access	Anadromous	Rare visitor
2.	Largescale sucker	*Catostomus macrocheilus*	Native	Resident	Unknown
3.	Lake whitefish	*Coregonus clupeaformis*	Introduced in 1899	Resident	No longer present
4.	Prickly sculpin	*Cottus asper*	Native	Resident	Abundant
5.	Shorthead sculpin	*Cottus confusus*	Native	Resident	Abundant
6.	Carp	*Cyprinus carpio*	Introduced	Resident	Locally abundant
7.	Three-spine stickleback	*Gasterosteus aculeatus*	Native	Both	Unknown
8.	Brown bullhead	*Ictalurus nebulosus*	Introduced	Resident	Unknown
9.	Pumpkinseed	*Lepomis gibbosus*	Introduced	Resident	Sparse
10.	Pacific staghorn sculpin	*Leptocottus armatus*	Native	Both	Sparse
11.	Smallmouth bass	*Micropterus dolomieui*	Introduced	Resident	Abundant
12.	Largemouth bass	*Micropterus salmoides*	Introduced	Resident	Abundant
13.	Peamouth	*Mylocheilus caurinus*	Native	Resident	Unknown
14.	Olympic mudminnow	*Novumbra hubbsi*	Unknown	Resident	Rare: one siting
15.	Steelhead trout	*Oncorhynchus mykiss*	Native	Both	Stock depressed
16.	Yellow perch	*Perca flavescens*	Introduced	Resident	Abundant
17.	Black crappie	*Pomoxis nigromaculatus*	Introduced	Resident	Sparse
18.	Northern Squawfish	*Ptychocheilus oregonensis*	Native	Resident	Unknown
19.	Bull trout	*Salvelinus confluentus*	Native	Both	Rare
20.	Longfin smelt	*Spirinchus thaleichthys*	Native	Resident	Unknown
21.	Tench	*Tinca tinca*	Introduced	Resident	Unknown

4.5 WILDLIFE

Biologists recorded bird, mammal, reptile, and amphibian species along Little Bear Creek both during surveys and incidentally during other site visits. Additional species to those observed likely use the area but remain undocumented by this study, as field visits were limited to spring and summer of a single year. A list of additional wildlife species that could potentially be present along the Little Bear Creek corridor but were not documented during these surveys is included in Appendix S.

4.5.1 Bird Observations

Thirty-nine bird species were observed along Little Bear Creek during site visits and surveys (Table 18). The majority of these species likely breed in the area, as most males were observed singing during the breeding season. One species, willow flycatcher (*Empidonax traillii*), is a federally designated species-of-concern. Five singing males were identified on three survey plots. The WDFW Priority Habitat and Species (PHS) program classifies great blue heron rookeries as vulnerable aggregations (Criterion 2) and are protected. Although no rookeries are documented within 2 miles of the corridor (WDFW, 2001b), suitable foraging habitat exists within the creek and adjacent wetlands, and biologists observed one individual during stream surveys.

Table 18:
Bird Observations Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	S Rank	Comment
1.	2, 3	Mallard	*Anas platyrhynchos*	S5B	
2.	2, 3	Great blue heron	*Ardea herodias*	S4S5	
3.	1, 2, 3	Cedar waxwing	*Bombycilla cedrorum*	S4N	NMBS*
4.	1, 2	Canada goose	*Branta canadensis*	S5B	
5.	2, 3	Red-tailed hawk	*Buteo jamaicensis*	S5B	
6.	3	Pine siskin	*Carduelis pinus*	S5B	
7.	1, 2, 3	American goldfinch	*Carduelis tristis*	S5B	
8.	1, 2, 3	House finch	*Carpodacus mexicanus*	S5	
9.	3	Swainson's thrush	*Catharus ustulatus*	S5B	NMBS
10.	1, 2, 3	Belted kingfisher	*Ceryle alcyon*	S5	NMBS
11.	1, 2	Killdeer	*Charadrius vociferus*	S5B	
12.	2, 3	Northern flicker	*Colaptes auratus*	S5	
13.	1, 2, 3	American crow	*Corvus brachyrhynchos*	S5	
14.	2, 3	Steller's jay	*Cyanocitta stelleri*	S5	
15.	2, 3	Willow flycatcher	*Empidonax traillii*	S5B	NMBS; Federal Species of Concern.
16.	3	Brewer's blackbird	*Euphagus cyanocephalus*	S5	
17.	3	Dark-eyed junco	*Junco hyemalis oreganus*	S5B	
18.	1	California gull	*Larus californicus*	S4B	Flying over creek.
19.	1, 2, 3	Song sparrow	*Melospiza melodia*	S5B	

Table 18 continued

#	Reach #	Common Name	Scientific Name	S Rank	Comment
20.	1, 2, 3	Brown-headed cowbird	*Molothrus ater*	S4N	
21.	1	House sparrow	*Passer domesticus*	SE	
22.	2, 3	Black-headed grosbeak	*Pheucticus melanocephalus*	S5B	NMBS
23.	1, 3	Downy woodpecker	*Picoides pubescens*	S5	
24.	3	Hairy woodpecker	*Picoides villosus*	S4S5	
25.	2, 3	Spotted towhee	*Pipilo erythrophthalmus*	S5B	Nest observed in Reach 3.
26.	1, 2, 3	Black-capped chickadee	*Poecile atricapilla*	S5	Nest observed in Reach 2.
27.	2, 3	Chestnut-backed chickadee	*Poecile rufescens*	S5	
28.	1, 2, 3	Bushtit	*Psaltriparus minimus*	S5	Nest observed in Reach 3.
29.	3	Golden-crowned kinglet	*Regulus satrapa*	S5B	NMBS
30.	3	Red-breasted sapsucker	*Sphyrapicus ruber*	S4S5	
31.	1, 2, 3	European starling	*Sturnus vulgaris*	SE	Nest observed in Reach 2.
32.	1, 2, 3	Violet-green swallow	*Tachycineta thalassina*	S5B	NMBS
33.	1, 2, 3	Bewick's wren	*Thryomanes bewickii*	S5	
34.	1, 2, 3	American robin	*Turdus migratorius*	S5B	
35.	3	Warbling vireo	*Vireo gilvus*	S5B	NMBS
36.	3	Hutton's vireo	*Vireo huttoni*	S5	
37.	2, 3	Wilson's warbler	*Wilsonia pusilla*	S5B	NMBS
38.	1	Mourning dove	*Zenaidura macroura*	S5B	NMBS
39.	1, 2, 3	White-crowned sparrow	*Zonotrichia leucophrys*	S5B	NMBS

*NMBS = neotropical migrant bird species

The WDFW PHS program maintains a list of species for which it has occurrence and status information. A global rank (GRank) describes the species' relative rarity or endangerment worldwide, and a state rank (SRank) describes the status within Washington State. Most bird species observed in the study area have a GRank of G5, which signifies that they are demonstrably secure globally. Most species have an SRank of S5 or S4 (Table 18), defining them as "demonstrably secure in state" or "apparently secure, with many occurrences", respectively. SRanks may include the qualifiers "B" and "N", which indicate breeding and nonbreeding status, respectively, of migrant species. The breeding status of these species may differ greatly from their nonbreeding status in the state. SE indicates an established exotic species. Two codes for any one species indicates an intermediate rank.

Eleven of the species recorded along Little Bear Creek are neotropical migrant bird species. Neotropical migrants breed in North America and winter in Mexico, Central America, the Caribbean, and South America. The publication of results from long-term survey programs confirms that populations of many neotropical migrants are declining, in some cases precipitously. Habitat loss and related problems are key issues in the causes of the declines. Therefore, these species may be of interest, particularly if they are breeding in the area. The area could potentially provide breeding habitat for several of these species, including Swainson's thrush, black-headed grosbeak, willow flycatcher, warbling vireo, Wilson's warbler, mourning dove, and white-crowned sparrow (Table 18). In addition, neotropical migrant species not detected during surveys and field visits may use the corridor (Appendix S).

4.5.2 Mammal Observations

Biologists documented ten mammal species in the Little Bear Creek corridor (Table 19). None of the species observed have federal or state special status. Other mammal species that may utilize the corridor include mink (*Mustela vison*), striped skunk (*Mephitis mephitis*), and coyote (*Canis latrans*). Appendix S contains a complete list of mammals that could potentially be present based on habitat types and historic range.

Table 19:
Mammal Observations Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	2	Beaver	*Castor canadensis*	Chewed shrubs and trails.
2.	3	Opossum	*Didelphis marsupialis*	Introduced, dead in stream.
3.	3	River otter	*Lutra canadensis*	Tracks, scat, and eaten salmon.
4.	2	Longtail weasel	*Mustela frenata*	Crossing stream on log.
5.	1, 2, 3	Myotis bat	*Myotis* spp.	
6.	2, 3	Black-tailed deer	*Odocoileus heminonus columbianus*	Tracks along stream bank; pellets.
7.	2, 3	Raccoon	*Procyon lotor*	Tracks along stream bank.
8.	2	Norway rat	*Rattus norvegicus*	Introduced.
9.	2, 3	Eastern gray squirrel	*Sciurus carolinensis*	Introduced.
10.	1, 2	Eastern cottontail	*Sylvilagus floridanus*	Introduced, dead young in nest (Reach 2).

4.5.3 Reptile and Amphibian Observations

Four reptile and amphibian species were observed in and along Little Bear Creek during field visits and surveys (Table 20). None of the species have state or federal special status. Other reptiles and amphibians not documented during this survey that could potentially be present along the Little Bear Creek corridor include: northern alligator lizard (*Elgaria coerulea*), painted turtle (*Chrysemys picta*), red eared slider (*Trachemys scripta*), common garter snake (*Thamnophis sirtalis*), western terrestrial garter snake (*Thamnophis elegans*), long-toed salamander (*Ambystoma macrodactylum*), rough-skinned newt (*Taricha granulosa*), western red-backed salamander (*Plethodon vehiculum*), ensatina (*Ensatina eschscholtzii*), western toad (*Bufo boreas*), and red-legged frog (*Rana aurora*). Both species of turtles were included due to the close proximity of several lakes to the study area.

Table 20:
Amphibian and Reptile Observations Along Little Bear Creek, Woodinville

#	Reach #	Common Name	Scientific Name	Comment
1.	3	Pacific Tree frog	*Hyla regilla*	3 in wetland near reach end.
2.	2	Bull frog	*Rana catesbeiana*	Introduced species captured next to stream.
3.	Tributary D	Northwestern salamander	*Ambystoma gracile*	Larva in small tributary.
4.	3	Northwestern garter snake	*Thamnophis ordinoides*	Near barricades at NE 195th.

APPENDIX C

ZONING CLASSIFICATIONS

Zoning

The existing zoning along the corridor comprises of five different zones. The General Business (GB) zone runs the length of Little Bear Creek Parkway (177th Street) and abuts to the west side of Woodinville-Snohomish Hwy. The Central Business District and Industrial zones are located at the southerly end of the corridor and 131st Street. Little Bear Creek crosses Hwy 522, and runs along the east side of the Woodinville High School (Public/Institutional) and Residential development that is the north westerly section of the corridor. Listed below include the various zones and descriptions located in the Little Bear Creek corridor.

**General Business: The purpose of the general business zone (GB) is to provide auto-oriented retail services for local and regional service areas that exceed the daily convenience needs of residential neighborhoods but that cannot be served conveniently by the central business district, and to provide retail and business services in locations within the city that are appropriate for extensive outdoor storage and auto related and commercial uses. These purposes are accomplished by: providing a wide range of the retail, recreation, and business services that are found in neighborhood business areas; allowing for commercial uses with extensive outdoor storage or auto related and industrial use; and limiting residential, institutional, personal services and office to those necessary to directly support commercial activity. Use of this zone is appropriate in commercial areas that are designated by the Comprehensive Plan and are served at the time of development by adequate public sewers, water supply, roads and other needed public facilities and services.*
*Note that all General Business zone permitted uses are also allowed in at least one other zone of the City.

Central Business District: The purpose of the central business district (CBD) is to provide for the broadest mix of comparison retail, higher density residential (R-12 through R-48), wholesale, service and recreation/cultural uses with compatible storage and fabrication uses, serving regional market areas and offering significant employment and housing opportunities. These purposes are accomplished by: encouraging compact development that is supportive of transit and pedestrian travel, through higher nonresidential building heights and floor area ratios that those found in other business areas; allowing for outdoor sales and storage, regional shopping areas and limited fabrication use; and concentrating large scale commercial and office uses to facilitate the efficient provision of public facilities and services. Use of this zone is appropriate in the urban center as designated by the Comprehensive Plan that is served at the time of development by adequate public sewers, water supply, roads and other needed public facilities and services.

Industrial: The purpose of the industrial zone (I) is to provide for the location and grouping of industrial enterprises and activities involving manufacturing, assembly, fabrication, processing, bulk handling and storage, research facilities, warehousing and heavy trucking. It is also a purpose of this zone to protect the industrial land base for industrial economic development and employment opportunities. These purposes are accomplished by: allowing for a wide range of industrial and manufacturing uses; establishing appropriate development standards and public review procedures for industrial activities with the greatest potential for adverse impacts; and limiting residential, institutional, service, office and other non-industrial uses to those necessary

to directly support industrial activities. Use of this zone is appropriate in industrial areas designated by the Comprehensive Plan which are served at the time of development by adequate public sewers, water supply, roads and other needed public facilities and services.

Public/Institutional: The purpose of the public/institutional zone (P/I) is to provide and protect properties devoted to public and semi-public uses and uses providing social and physical services to the Woodinville Community. This purpose is accomplished by: providing a zone in which uses serving public needs may be located; limiting residential and privately owned operations; and protecting adjacent properties from potential impacts of public uses. Use of this zone is appropriate on properties designated by the Comprehensive Plan to be public and/or institutional, such as schools, government facilities, social services, hospitals, libraries, utilities, etc.

R-6 (residential): The purpose of the urban residential zones (R) is to implement Comprehensive Plan Goals and Policies for housing quality, diversity and affordability, and to effectively use residential land, public services and energy. These purposes are accomplished by: providing in the moderate density zones (R-5 to R-8), for a mix of predominantly single-family attached and detached dwelling units. Other development types, such as apartments, duplexes, and townhomes would be allowed so long as they contribute to Woodinville's small town atmosphere as articulated in the vision statement found in the City's Comprehensive Plan and conform to all applicable regulations.

APPENDIX D

TRANSPORTATION ANALYSIS
&
STREET & TRAIL DESIGN CONCEPTS

earth tech
engineering and technology for the planet

Final Report

Little Bear Creek Corridor Redevelopment Alternatives Traffic Impact Analysis

Prepared for:
City of Woodinville, Washington

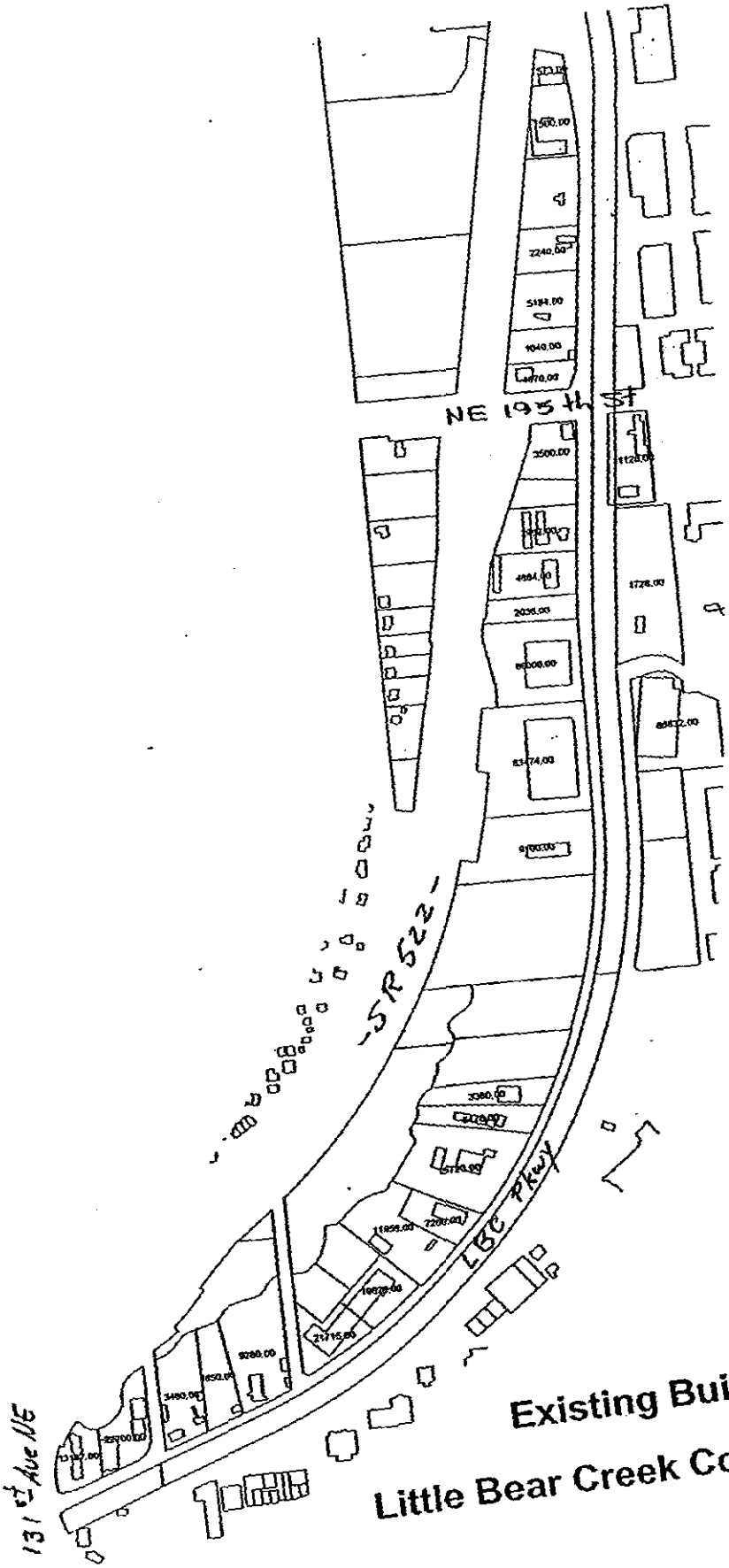
Prepared by:
Earth Tech
10800 NE 8th Street
Bellevue, WA 98004

April 22, 2002

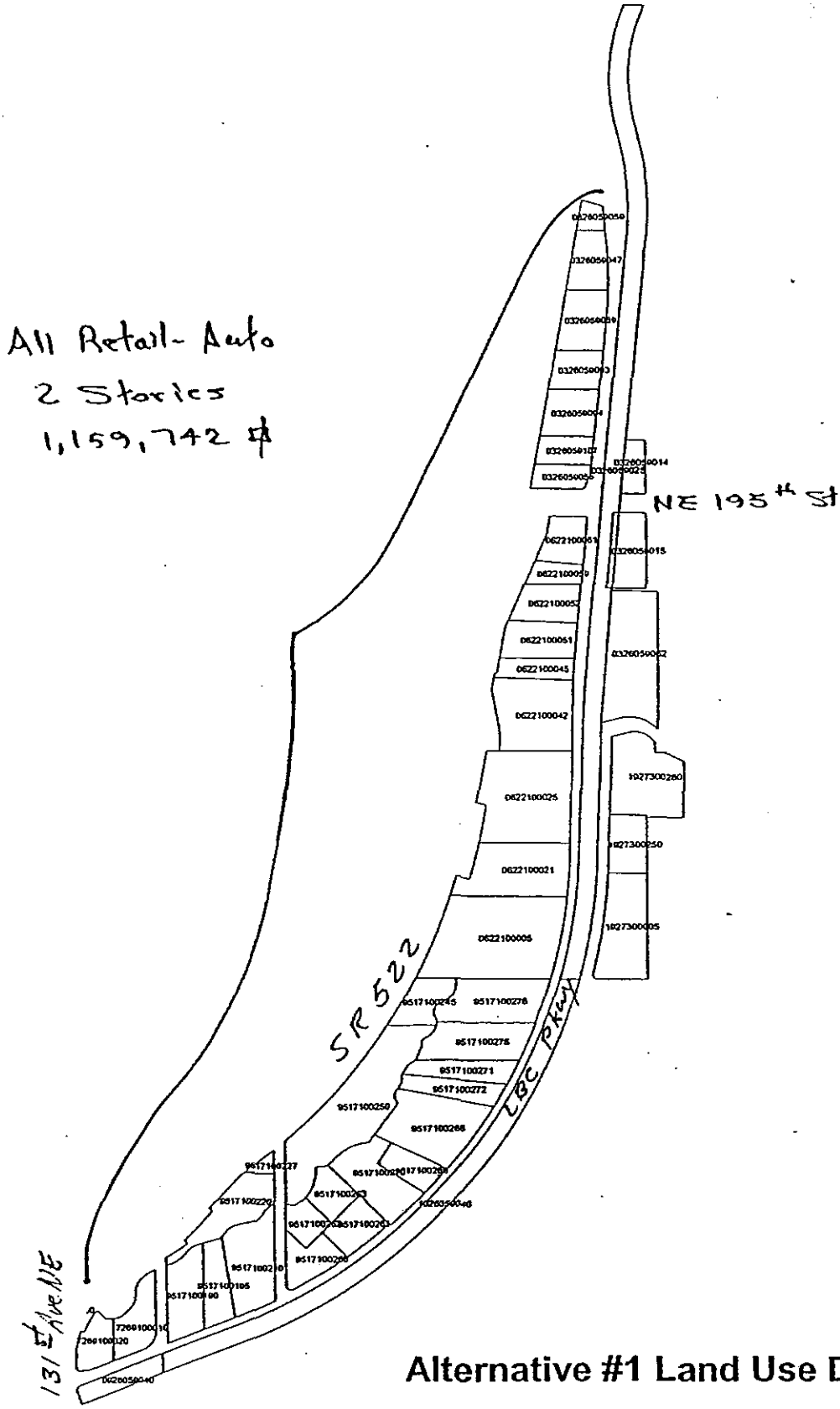
Table of Contents

Summary *1*
Study Area *2*
Land Use Alternatives *3*
Trip Generation *7*
Traffic Forecasts *9*
Level of Service *12*

Appendices

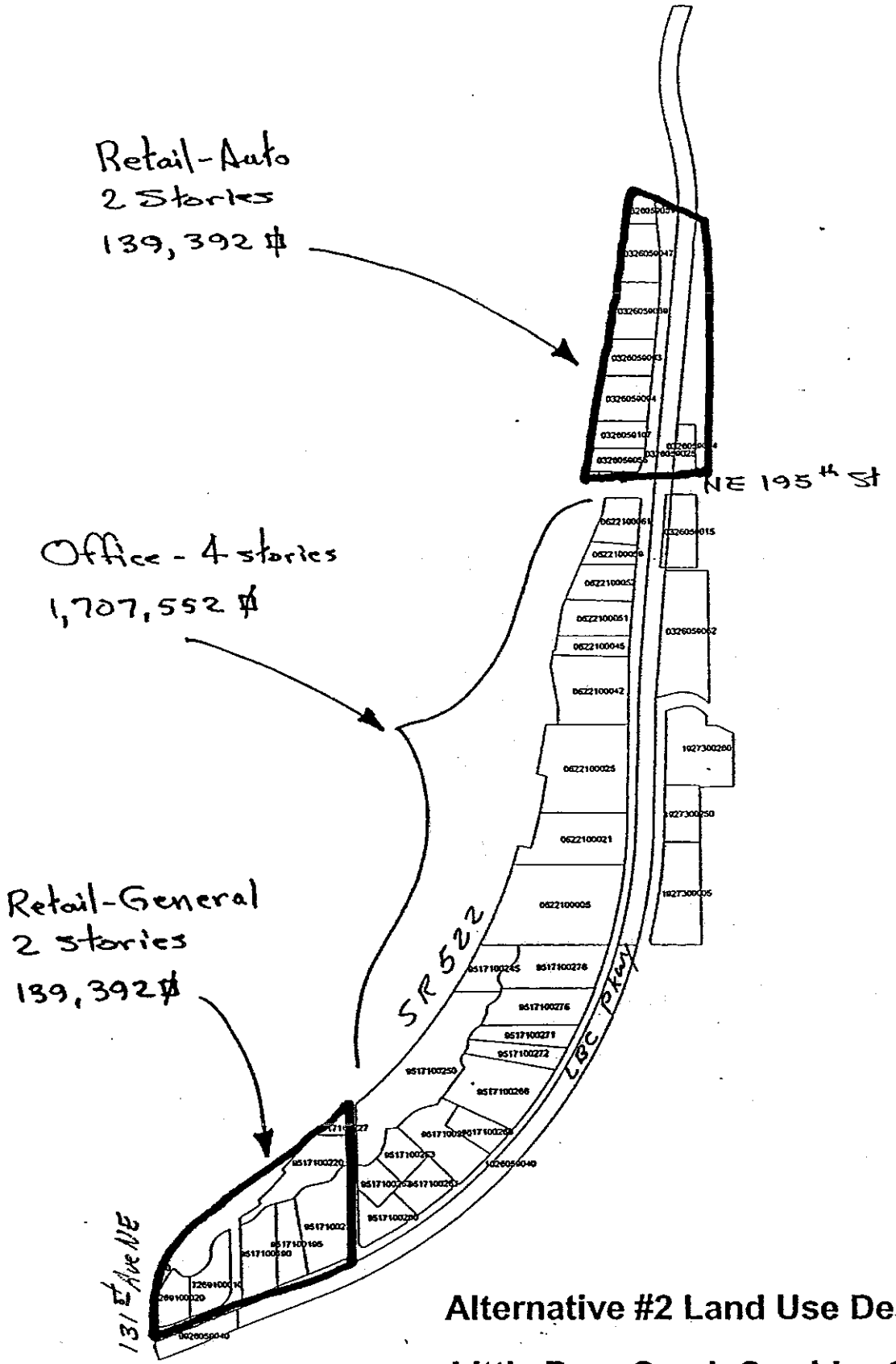


Existing Building Sizes in the Little Bear Creek Corridor Study Area



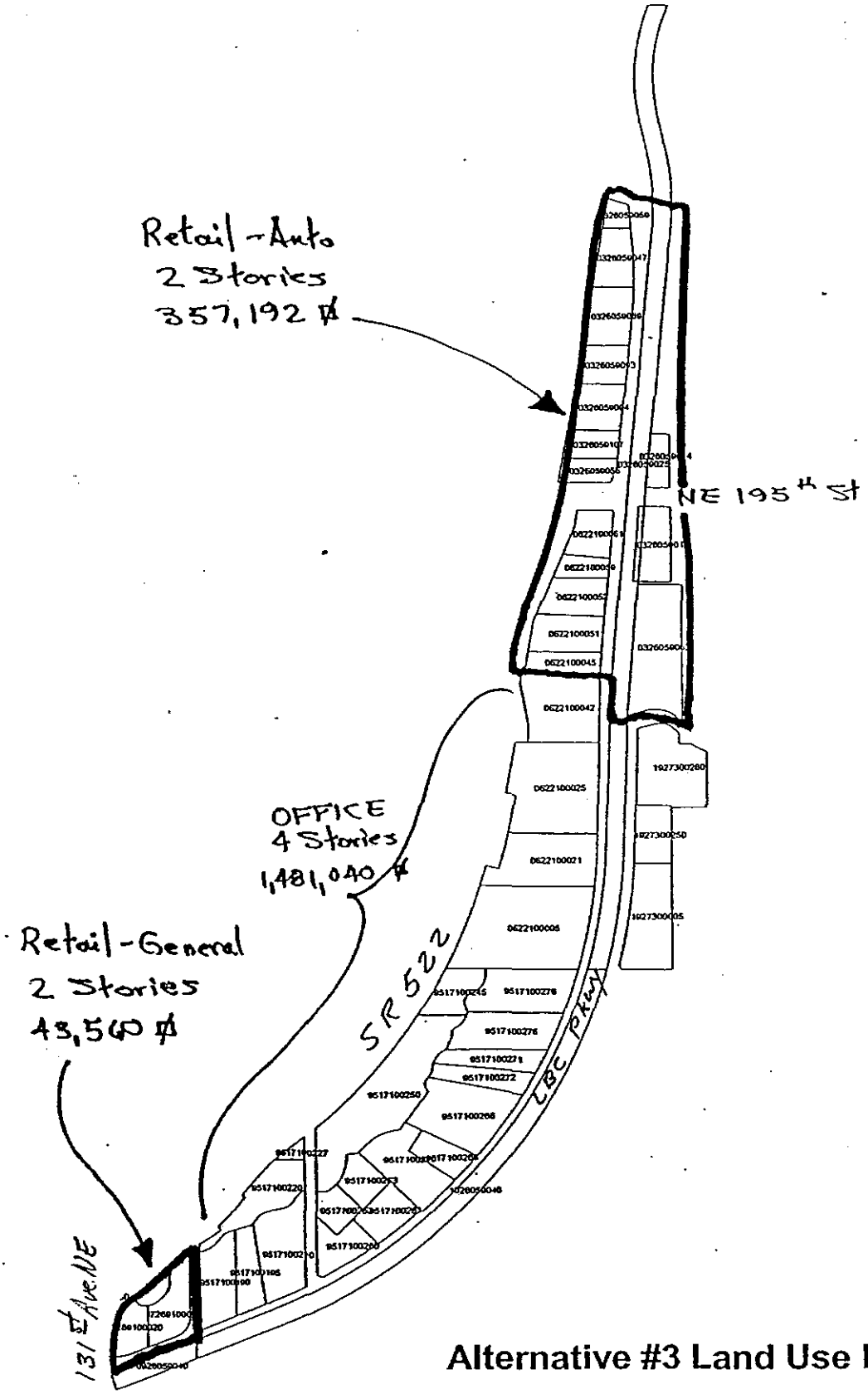
Alternative #1 Land Use Designations

Little Bear Creek Corridor Study Area



Alternative #2 Land Use Designations

Little Bear Creek Corridor Study Area



Alternative #3 Land Use Designations

Little Bear Creek Corridor Study Area

Trip Generation

Trip generation for existing and future conditions in the study area was calculated from land use data using trip rates found in Trip Generation, 6th edition (1998) published by the Institute of Transportation Engineers. The afternoon peak hour was evaluated, because that time period generally has the most congested traffic conditions.

The future land uses permitted under the City's proposed zoning classifications correspond to a wide range of example land use categories documented in the ITE reference. Since the future developments are not now known, an average trip rate was calculated for each zoning classification as follows, and the average rate was used uniformly throughout the study area.

Land Use Class	PM Peak Hour Trip Rate	Outbound Directional Split
General Retail :	4.5 trips / 1,000 sq. ft.	54% outbound
Auto Retail :	3.5 trips / 1,000 sq. ft.	54% outbound
Office :	1.4 trips / 1,000 sq. ft.	84% outbound
Warehouse, Utilities, and Industrial :	0.6 trips / 1,000 sq. ft.	66% outbound

The last category was used to represent existing developments in the baseline scenario, and is not part of the forecasting scenarios for the City's land use alternatives.

A table of the various ITE trip rates used to develop these average rates is in the appendix.

The study area includes 43 land parcels, for which the existing development is known, and the proposed future land use under each alternative is estimated on the assumption that all land parcels would eventually be developed or redeveloped to the maximum density provided for each land use zoning alternative. Full conversion and redevelopment may or may not occur on some existing parcels with substantial buildings of recent construction. Therefore, this planning analysis represents a "worst case" scenario that exceeds the amount of development likely to occur in the corridor in any short-range future time period. A brief description of the trip generation for each alternative follows.

Existing Conditions (Baseline)

Solely for purposes of establishing a baseline of reference and for calibrating the traffic model, the existing as-built condition of the corridor in 2001/2002 was documented from the City of Woodinville GIS inventory, and trip generation was modeled from that data, as detailed in tables found in the appendix. A summary description follows:

Total Land Use :	444,100 sq. ft.
Total Trip Generation :	688 trips (PM Peak Hour)

Alternative 1- Auto Retail

This alternative considers most land in the study corridor to be redeveloped as auto-oriented retail activity. The average development potential per acre of this type of activity was estimated from ITE source data to be approximately 15,000 square feet of building area per acre, or 33% land coverage on average. Trip generation was modeled from those assumptions, as detailed in tables found in the appendix. A summary description follows:

Total Land Use :	1,159,000 sq. ft.
Total Trip Generation :	4,089 trips (PM Peak Hour)

Alternative 2- Office and Less Retail

This alternative classifies the majority of the land in the study corridor as office buildings, with a small amount of general retail activity at each end of the corridor. The average development potential per acre of the office land use was prescribed by the City to be approximately 27,000 square feet of building area per acre, all as two-story buildings, with 30% land coverage on average. Trip generation was modeled from those assumptions, as detailed in tables found in the appendix. A summary description follows:

Total Land Use :	1,986,000 sq. ft.
Total Trip Generation :	3,504 trips (PM Peak Hour)

Alternative 3- Office and More Retail

This alternative classifies the majority of the land in the study corridor as office buildings, with a moderate amount of general retail activity at each end of the corridor. There is less office development and more retail development, compared to Alternative 2. The average development potential per acre of the office land use was prescribed by the City to be approximately 27,000 square feet of building area per acre, all as two-story buildings, with 30% land coverage on average. Trip generation was modeled from those assumptions, as detailed in tables found in the appendix. A summary description follows:

Total Land Use :	1,882,000 sq. ft.
Total Trip Generation :	3,520 trips (PM Peak Hour)

Traffic Forecasts

The Woodinville Traffic Model consists of a road network model and a trip table derived from land use, for a base year of 1998 and a forecast year of 2020. The current version of the model uses Tmodel2 software; however, this is a translation to Tmodel2 of an earlier model created using emme2 software, which was itself based on the PSRC four-county regional traffic forecasting system. The conversion to Tmodel2 included a major simplification of the model from the regional zone structure of 1220 Traffic Analysis Zones to the current structure of 243 zones, and a corresponding simplification of the road network from 19,000 links to just 4,000 links.

The emme2 trip tables were derived from trip tables of the PSRC regional traffic model, and only indirectly account for local land use details. There is no independent capability in Woodinville at this time to recalculate trip generation and trip distribution directly from local land use. Adjusting the future 2020 trip table for the proposed study area land use changes was accomplished indirectly and awkwardly rather than straightforwardly and simply.

Traffic Network Revisions

The existing Tmodel network represents the study corridor with just three Traffic Analysis Zones (TAZ's). To accurately simulate all of the 43 land parcels in the study, and account for all the variations of existing and proposed land uses, a total of nine TAZ's were created for this study. The existing and future road networks were correspondingly updated to account for those TAZ's and their access locations along Little Bear Creek Parkway (nee 177th Avenue NE).

To better match the traffic model's simulation of existing counts in the study area, revisions were made to improve the accuracy of trip loading on the road network for three TAZ's physically located outside the study area but routing considerable traffic through the study area.

First, to represent the significant flow of retail traffic through the south end of the LBC Parkway corridor between the downtown's new retail centers and the SR 202 interchange, the access points for TAZ 44 were rebalanced to emphasize that path rather than the path via 175th Street to/from SR 202. Also, the trip volumes at TAZ 41 (Target Store) were tripled to reflect current reality. It is not known how those volumes were previously estimated in the 1998 calibration effort, but a large increase was appropriate for present needs. The same TAZ's future volumes were doubled in the future scenarios for consistency. In addition, the running speed of Little Bear Creek Parkway was increased in the model while the speed of 175th Street was reduced. These changes greatly increased the accuracy of the modeled turns at the 131st / LBC Pkwy intersection, and also improved the accuracy of modeled volumes on 175th Street.

Next, the loading point of industrial park TAZ 9 was shifted fromWoodinville – Duvall Way (195th) to 200th Street / 244th Avenue NE. This greatly improved the simulation of turns to/from the north leg of the 195th / LBC Pkwy intersection.

Future Network Assumptions

The future road network includes the improvements currently planned or proposed by the City of Woodinville. This includes in particular the completion of the downtown area street grid, completion of the 195th Street Interchange as a four-legged diamond, and the addition of an overpass across SR 522 effectively extending SR 202 northward to 120th Avenue NE in Bothell across the freeway. The latter proposed overcrossing diverts a significant volume of traffic away from the congested SR 202 interchange with SR 522. It reduces future volumes on 131st Avenue NE below the existing volumes, through the intersection with LBC Parkway.

The proposed overcrossing is a very significant assumption for the analysis of future conditions for the study corridor. Similarly, the addition of the north legs of the 195th Street interchange significantly affects the routing of traffic to, from, and through the study corridor.

Trip Generation/Distribution

Due to the fact that an independent trip generation model does not exist for Woodinville, the trip distribution for each study area TAZ was estimated by analogy to the nearest TAZ with traffic patterns representing the assumed land use type. The applicable row and column of the origin-destination matrix for the "pattern" TAZ was copied to the study area TAZ, then scaled to match the expected trip generation of that TAZ. For general retail and auto retail land use alternatives, the pattern zone was a TAZ in the existing retail core area of Woodinville. For office and industrial land uses, the distribution pattern was patterned after a TAZ representing the existing industrial park area near the north end of the study corridor. A similar pattern methodology was used in the recent Traffic Impact Fee Study, to estimate the travel patterns for all development land use types in each part of the city.

Traffic Forecasts

The traffic forecasting model was run once for each of four scenarios: the existing baseline case and three future alternatives. The baseline model was run solely to determine that the representation of existing conditions was consistent with actual traffic counts. The traffic model refinements described previously were identified and executed in order to improve that consistency. Based on that calibration effort, the future model volumes were deemed suitable for analysis without further adjustment or post-processing in the study corridor. No analysis of other areas has been made.

Following pages depict the results of the traffic forecasting effort. Depicted are three types of information, in three series of plots for the four model runs. All data represents PM peak hour conditions.

- Total traffic volumes on the road network (numeric data, by direction)
- LBC Study Subarea-generated traffic volumes (numeric data, by direction)
- LBC Study Subarea-generated traffic volumes (bandwidth data, by direction)

The bandwidth data provides a good visual representation of the total impact of development in the study corridor. The width of the dark bands corresponds to the directional traffic volumes in the numeric plots. It is apparent that the major impact is that of growth in the corridor, from present to future. The differences between the three alternatives are relatively minor in comparison to the fact of growth from the present.

The numeric data is useful to identify directional flow volumes in absolute terms, and to calculate proportional shares of the total volumes at any location that are attributable to the study area.

Traffic Impacts of Land Use Alternatives

Based on the attached maps of total volumes and subarea volumes, the contributions of study area developments are directly stated below for the north and south ends of the corridor. For simplicity, only the two-way total volume on LBC Parkway is tabulated here. For a more detailed consideration of traffic impacts by direction, see the next section on Level of Service.

The existing conditions for land use and traffic modeling represent 1998, while the comparison traffic counts were from 2000. It is therefore not surprising that the "existing" traffic model volumes are lower than the "existing" counts, even after the relatively adjustments described previously. The future traffic model is nominally associated with the year 2020 for regional background growth, and assumes full development of the land parcels within the study area. For the most basic description of relative impacts between land use policy alternatives, only net changes need to be considered, based on the data below.

Volumes on LBC Parkway north of 131st Avenue NE

Land Use Alternative	Total Volumes	Study Area Trips
Actual Traffic Counts (2000):	745	unknown
Traffic Model Results:		
Existing Land Use (1998):	603	227
Future Alternative #1:	1902	1267
Future Alternative #2:	1899	1316
Future Alternative #3:	1698	1095

Volumes on LBC Parkway south of NE 195th Street

Land Use Alternative	Total Volumes	Study Area Trips
Actual Traffic Counts (2000):	1803	unknown
Traffic Model Results:		
Existing Land Use (1998):	1404	171
Future Alternative #1:	2528	974
Future Alternative #2:	2423	789
Future Alternative #3:	2440	808

Level of Service

For a more detailed analysis of the traffic impacts of the land use policy alternatives, the operating conditions of the two anchor intersections at each end of the corridor were examined, again using the traffic model outputs for data. For intersection analysis, the individual turning movements were used, which add up to the directional and two-way total volumes previously tabulated and mapped. Intersection worksheets are in the appendix.

Letter grades from "A" to "F" are used to describe level of service, by analogy to the common meaning of school grades. LOS "A" represents free flowing conditions with near-zero delay, while LOS "E" represents considerable delays, and full use of available capacity but without breakdown of traffic flow. LOS "F" is reserved for breakdown conditions where the traffic demand exceeds the available capacity, and stop-and-go operations result.

The American Association of State Highway and Transportation Officials (AASHTO) in its authoritative publication, A Policy on Design of Highways and Streets, 2001 ed., states that LOS "C" is the most desirable design goal. Woodinville, like many jurisdictions, regards LOS "D" as an acceptable design goal, in a compromise between traffic performance and other adverse costs to society of building larger transportation facilities to achieve a higher level of service. Some highly urbanized jurisdictions regard LOS "E" as acceptable.

Two methods of calculating intersection level of service are presented in parallel. The two methods differ in absolute ratings, but tend to show similar trends when comparing the net changes between alternatives.

The first definition of Level of Service is based on the Highway Capacity Manual ("HCM") - National Academy of Sciences, Transportation Research Board, Special Report #209, 1998 Update. HCM bases LOS on delay, and calculates the average of all delays for all vehicles using the location at hand under the given circumstances of traffic volumes, physical lane configuration, and traffic signal operational controls.

Future delay at signalized intersections is highly sensitive to signal control settings, which are presently unknown and must be estimated. The future settings were therefore set to represent a mid-range of the cycle lengths and other control settings likely to occur if the corridor to/from SR 522 has interconnected signals and saturated flow conditions. This assumption allowed the analysis of each intersection to be completed without further reference to the remainder of each corridor. This is sufficient for the purposes of comparing the land use plan alternatives.

The second method presented is Intersection Capacity Utilization ("ICU"), which utilizes most of the same assumptions as the HCM method except that signal control details are entirely omitted. The emphasis is on the capacity provided by the available lanes, at an "average" level of signal control settings and efficiencies. The LOS scale for ICU is measured by percentage consumption of capacity. This has some appeal when evaluating growth impacts and relating impact mitigation to development size in quantitative terms.

The following LOS results are all based on the counted or modeled total volumes that use the intersections at hand. Cycle lengths of 130 seconds (131st Ave intersection) and 100 seconds (195th St intersection) match the present cycle lengths at those intersections as obtained from King County traffic operations personnel. The Synchro analysis of each case was set to optimize the phase splits within the given cycle length without changing the cycle length. Longer cycle lengths would reduce the delays in the future cases, but the difference would not be enough to change any LOS ratings, nor change the relative comparisons between the alternatives.

The future results indicate clearly that the existing intersections cannot accommodate the projected travel increases without substantial expansion for more lanes through the intersections, in all directions.

Level of Service on LBC Parkway north of 131st Avenue NE

	Existing Lanes		With Added Lanes	
Land Use Alternative	HCM	ICU	HCM	ICU
Actual Traffic Counts (2000):	C 35s	F 108%	na	na
Traffic Model Results:				
Existing Land Use (1998):	C 31s	F 100%	na	na
Future Alternative #1:	F 176s	H 177%	C 30s	E 92%
Future Alternative #2:	F 192s	H 183%	C 36s	E 98%
Future Alternative #3:	F 185s	H 172%	C 33s	E 97%

Hypothetical improvements considered for the intersection of LBC Parkway at 131st Avenue NE are the addition of one lane eastbound and two lanes westbound on the east leg (only) of LBC Parkway, and the addition of two lanes southbound on 131st Avenue NE (north leg only), to support high turn volumes in most directions.

Level of Service on LBC Parkway south of NE 195th Street

	Existing Lanes		With Added Lanes	
Land Use Alternative	HCM	ICU	HCM	ICU
Actual Traffic Counts (2000):	C 31s	D 88%	na	na
Traffic Model Results:				
Existing Land Use (1998):	D 36s	E 92%	na	na
Future Alternative #1:	F 146s	H 146%	E 56s	G 113%
Future Alternative #2:	F 149s	H 145%	E 67s	G 116%
Future Alternative #3:	F 147s	H 144%	E 62s	G 113%

Hypothetical improvements considered for the intersection of LBC Parkway at NE 195th Street are the addition of one lane eastbound and westbound on the west leg (only) of 195th Street, and the addition of one lane northbound and southbound on LBC Parkway (Woodinville-Snohomish Road), to support high turn volumes to/from the west (SR522 interchange).

Discussion of Results

The primary finding is that all three land use alternatives will produce approximately the same future level of service, with rather minor distinctions between the three cases. This outcome is true whether the assumed road conditions are only the existing built network, or the assumptions include substantial future improvements to accommodate future growth. Alternative 2 has slightly higher loadings, higher delay, and more congestion, than the other two alternatives, but the differences are not great enough to change any level of service ratings.

The analysis of future conditions with "existing lanes" represents the case of adding the forecast traffic volumes, with no improvements to the existing intersections. The result is a predictable extreme level of overloading in all future cases, indicating that the assumed level of future growth cannot be served by existing facilities.

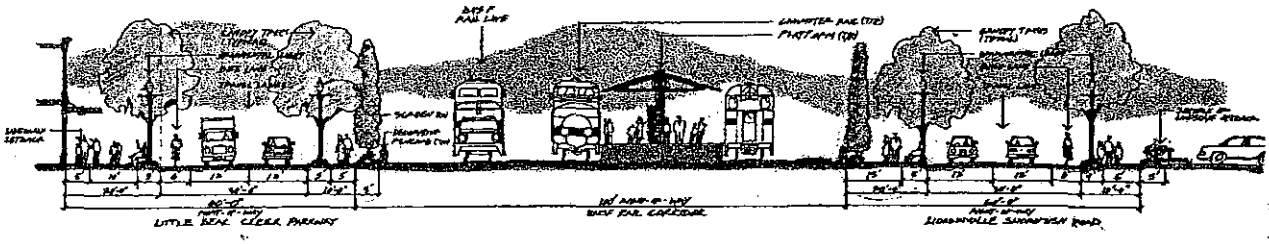
The alternative set of analyses "With Added Lanes" documents the results for a hypothetical set of improvements to each intersection to overcome the deficiencies observed with the existing lanes. The hypothetical improvements described are not the only solution available, and serve only to represent the degree of capacity improvements necessary to meet the forecast travel demand at a minimally acceptable level of service. The cases calculated with the hypothetical improvements are in some particulars still not a fully satisfactory solution, but adding still more lanes to achieve a mathematically better result does not appear to be a practical option in reality.

The relatively low future travel demand on 131st Avenue NE is dependent on the existence of the proposed overpass above SR 522 connecting SR 202 to 120th Avenue NE. Without that overpass, much more demand would occur on 131st Avenue NE, and still more lanes would be needed in that corridor.

Without the completion of the 195th Street interchange's north ramps, the volumes on 195th Street would be less, but the users of those ramps would need to be accommodated somewhere else. Volumes on LBC Parkway would be affected both positively and negatively. The situation has not been modeled that combines future travel demand with the existing half-diamond interchange.

3.3 Little Bear Creek Corridor Motorized Circulation Plan

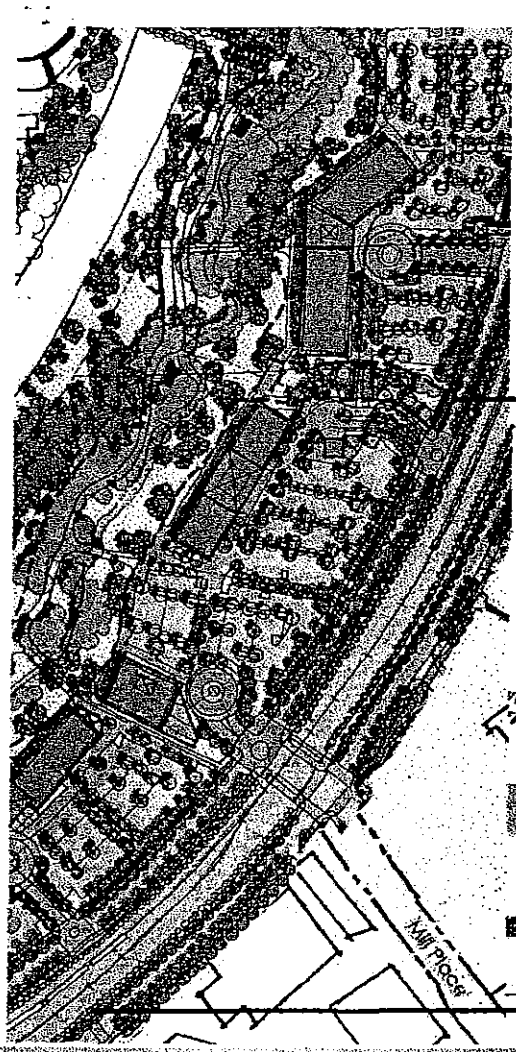
3.3.1 CORRIDOR STREET DESIGN CONCEPTS

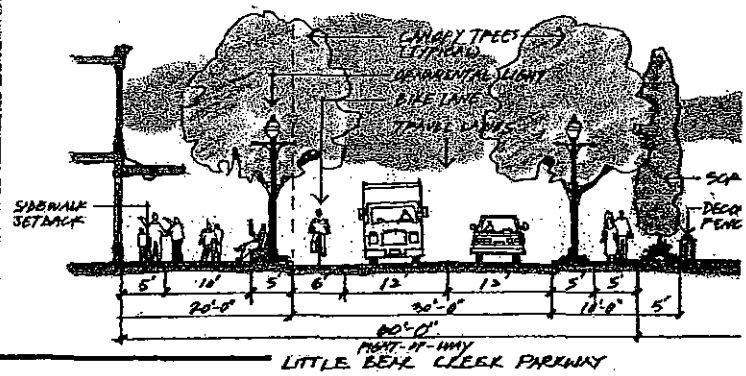


3.3.1. Little Bear Creek Parkway

Features:

- Significant landscaping and tree canopy
- 5-foot minimum sidewalks
- 60-foot street section width
- Pedestrian amenities
- Bicycle lanes

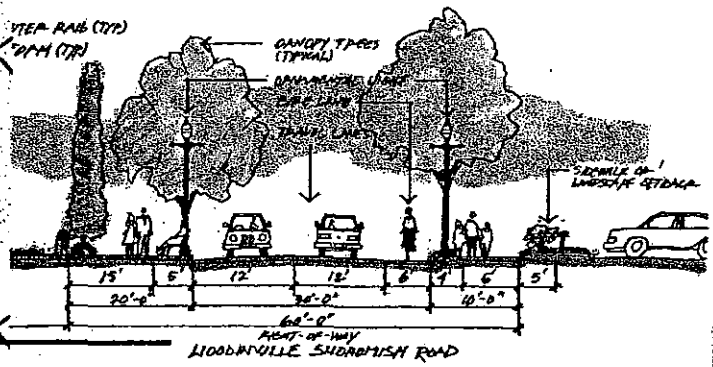




3.3.1. Woodinville-Snohomish Road

Features:

- Landscape screening for parking lots
- 5-foot minimum sidewalks
- 60-foot street section width
- Pedestrian amenities
- Bicycle lanes



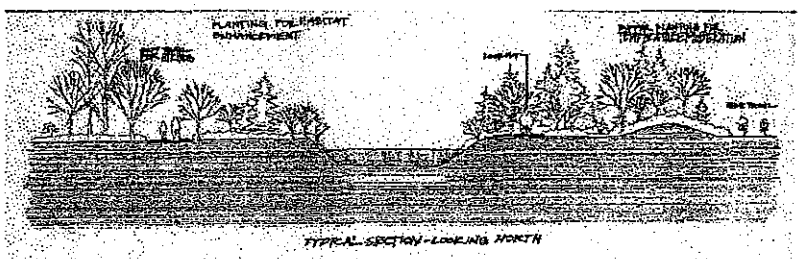
4.2 Little Bear Creek Corridor Parks, Open Space, and and Trail Plan

4.2.1 Linear Park

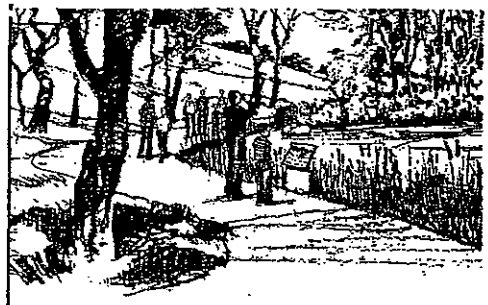
The City owns four parcels within the corridor study area. The three parcels located west of SR522 and north of NE 195th are planned under a separate master plan to be developed as a skate park and a resource conservation park. The parcel situated adjacent to the north side of 134th Ave. NE between SR 522 and Little Bear Creek will also serve as both active and passive recreation to help address the overall recreational needs of the City.

Access to the linear park will be via the lineal trail system along the creek, 134th Ave. NE, and additional points obtained over private property along Little Bear Creek Parkway.

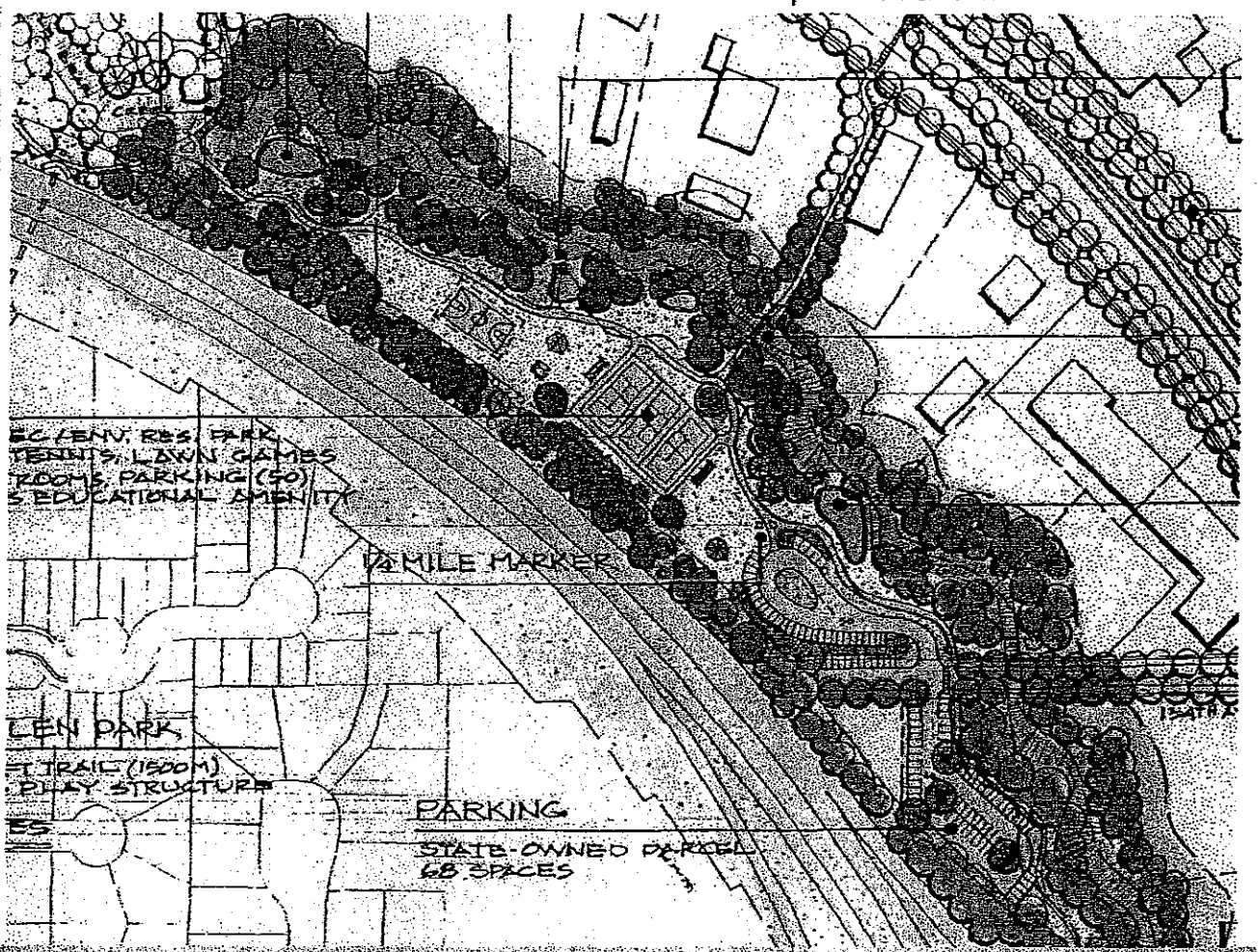
Active recreation will be situated outside the 100-foot required stream buffer and consist of tennis courts, basketball court, area for lawn games, and picnic amenities with associated parking. Passive recreation will focus on educational opportunities including sensitive area interpretive signage and look-out points to highlight wildlife and vegetation.



LINEAR PARK
LITTLE BEAR CREEK CORRIDOR



LINEAR PARK
LITTLE BEAR CREEK CORRIDOR



APPENDIX E

RECORD OF PUBLIC MEETINGS
&
PUBLIC WORKSHOP RESULTS

0 Planning Process

2.1 Record of Public Meetings

April 2001	
4/18/01 Identified Corridor issues, items, and concepts to be addressed in the visioning process	⇒ Planning Commission
May 2001	
5/15/01 Public Open House Kick – off meeting for road improvements project and corridor study concept	⇒ Public ⇒ Corridor Property Owners
June 2001	
6/15/01 Identified possibility of land use changes including allowed uses and development regulations within the GB Zone. PC requested tour of corridor and building height examples.	⇒ Planning Commission
August 2001	
8/02/01 Reviewed Work Program for Park Department	⇒ Parks & Recreation Commission
8/15/01 Tour of Corridor Area and building height examples	⇒ Planning Commission
September 2001	
9/05/01 Developed Draft Corridor Master Plan Goals and reviewed Master Plan Work Program	⇒ Planning Commission
9/06/01 Developed Draft Corridor Master Plan Goals and reviewed Study Area boundaries	⇒ Parks & Recreation Commission
9/19/01 Reviewed revised Draft Corridor Master Plan Goals and Study Area boundaries	⇒ Planning Commission
October 2001	
10/4/01 Reviewed Corridor Natural Systems Data presented by staff	⇒ Parks & Recreation Commission
10/17/01 Reviewed Corridor Natural Systems Data presented by staff	⇒ Planning Commission
November 2001	
11/01/01 Reviewed Social Systems Data presented by staff	⇒ Parks & Recreation Commission
11/11/01 Joint meeting between the City Council, Planning Commission, and Parks Commission to discuss the vision for the Downtown Master Plan	⇒ Council and Commissions
11/28/01 Reviewed Social Systems Data presented by staff	⇒ Planning Commission
December 2001	
12/06/01 Reviewed presentation by University of Washington Students on corridor concepts.	⇒ Parks & Recreation Commission
12/12/01 Identified specific key features to be in the Corridor Master Plan	⇒ **JOINT COMMISSION MEETING**
January 2002	
1/29/02 First Downtown Master Plan Meeting. Questions asked: What improvements would you like to see in Dwtn Woodinville? What are your top two improvements	⇒ Public ⇒ Commissions ⇒ City Council
March 2002	
3/28/02 Second Downtown Master Plan Meeting. Evaluate and comment on alternative development concepts.	⇒ Public ⇒ Commissions ⇒ City Council
April 2002	
4/11/02 Itemized Corridor feature priorities	⇒ **JOINT COMMISSION MEETING**
May 2002	
5/23/02 Third Downtown Master Plan Meeting (First integrated DT and LBCC mtg). Evaluate and comment on refined concepts.	⇒ Public ⇒ Commissions ⇒ City Council

APPENDIX

June 2002	
6/10/02 Received update on Master Plan progress and approved integration with Downtown Master Plan	⇒ City Council
6/25/02 Presentation of land use concepts	⇒ Corridor Property Owners
6/25/02 Introduction of Plan integration with Downtown Plan and draft concepts of Corridor	⇒ Public ⇒ Commissions ⇒ City Council
July 2002	
7/11/02 Fourth Downtown Master Plan Meeting (2nd ST and LBCC mtg). Evaluate and comment on refined concepts	⇒ Public ⇒ Commissions ⇒ City Council
7/25/02 Final workshop to identify preferred concepts of circulation, land use, and parks/open space	⇒ Public ⇒ Commissions ⇒ City Council
August 2002	
8/01/02 Parks and Recreation Commission. Purpose: To discuss features of the plan and mailer	⇒ Staff ⇒ Parks & Recreation Commission
8/07/02 Planning Commission meeting. Purpose: To discuss features of the plan and mailer	⇒ Staff ⇒ Planning Commission
September 2002	
9/04/02 Planning Commission meeting. Purpose:	⇒ Staff ⇒ Planning Commission
9/05/02 Parks and Recreation meeting. Purpose:	⇒ Staff ⇒ Parks & Rec Commission
October 2002	
10/02/04 (proposed) Draft Plan Distribution to Planning Commission 10/03/02 (proposed) Draft Plan Distribution to Parks & Recreation Commission	⇒ Staff ⇒ Parks & Rec Commission ⇒ Planning Commission
10/18/02 (proposed) *Open House 5-7* Joint Commission Meeting – Plan Presentation	⇒ Public ⇒ Staff ⇒ Planning Commission
November 2002	
11/06/002 (proposed) Planning Commission Public Hearing	⇒ Public ⇒ Planning Commission ⇒ Staff
11/18/02 (proposed) City Council Study Session	⇒ City Council ⇒ Staff
December 2002	
12/2/02 (proposed) City Council first reading of adopting ordinance	⇒ City Council ⇒ Staff
12/9/02 (proposed) City Council second reading of adopting ordinance	⇒ City Council ⇒ Staff

2.5 Downtown/Little Bear Creek Integrated Workshop 4

Summary

Approximately 50 people interested in contributing to the design and future development of Downtown Woodinville met for Work Session #4 of the Downtown Master Plan Study. Work Session 4 took place on the evening of July 11, 2002 at City Hall. The purpose of the meeting was to present the Draft Land Use & Circulation Plan, and to evaluate and comment on project phasing, essential street designations, and building heights. In addition, a financial strategy for implementing the plan was presented. The preferences indicated by citizens on the Response Sheet 4 ballot are summarized below.

RESPONSE SHEET 4

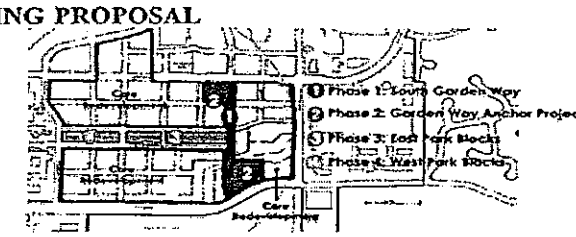
Woodinville Downtown Master Plan **July 11, 2002**

40 Response Sheets were submitted. In addition, 6 sheets responding to 1 of the 4 questions were submitted and are included in the tallies below. In some cases, respondents did not indicate a response to all 4 questions. The figure for percentage of "Yes" votes reflects the total number of respondents to that specific question.

CATALYST PROJECT PHASING PROPOSAL

Do you support the proposal?

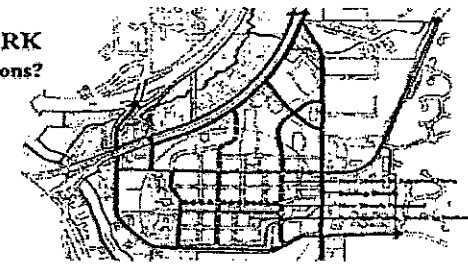
% "Yes"	Yes	No	Other
70	28	6	6



ESSENTIAL STREET FRAMEWORK

Do you support the essential street designations?

% "Yes"	Yes	No	Other
76	29	3	6

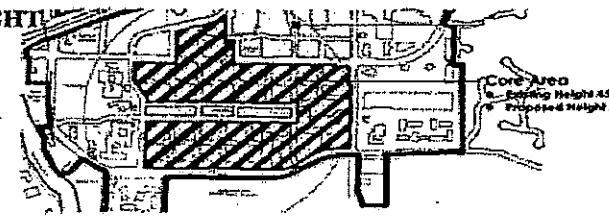


CORE AREA BUILDING HEIGHT

Do you support the 55' proposal?

% supporting height increase*	Yes	No	Other
78	25	12	8

*3 of the "No" and 7 of the "Other" votes commented that height should be greater than 55'. allow for architectural projections, and/or expand to area north of 175th.

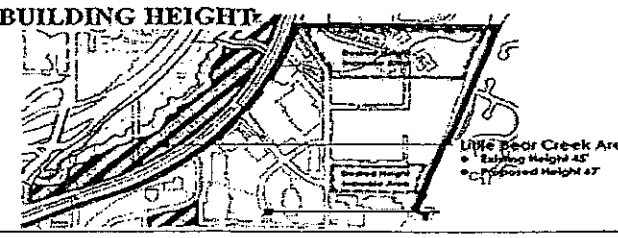


LITTLE BEAR CREEK AREA BUILDING HEIGHT

Do you support the 67' proposal?

% supporting height increase*	Yes	No	Other
68	22	6	9

*3 of the "Other" votes commented that height should be greater than 67'.



Summary

Participants worked in groups of two to six people at 8 discussion tables to determine their preferences for Plan Concepts. Their responses and observations are summarized below:

Table 1

- Yes for the soft and hard trails.
- Not yet clear about City Park.
- Concerned about security on the passage proposal.
- We support 522 crossing.
- We support land use and phasing.
- Concerned for displaced office workers.

Table 2

- The height of buildings will be exceeded over time by tall trees.
- Water table and expense are concerns for parking structure.
- When planning trail locations, think about avoiding dissection of properties.
- Trails are good for both office workers and the public.
- Property Owner - We own 12 acres in the area. We can't develop on the west side. On the east side, height may be necessary. We try to work with people and understand the facts of the circumstances. Over the time we have owned the property, the 25' setback from Little Bear Creek was expanded to 50'. Recent discussion has talked about expanding to as far as 300'.

Table 3

- Not informed enough to comment on trails.
- Not informed enough to comment regarding the passage.
- 522 crossing, yes.
- For land use, office seems OK.
- Not informed enough to comment on phasing.

Table 4

- I like the proposal.
- Prefer to direct growth.
- As a business, you have to invest. Each time I invest, it has come back.. This proposal generates an income.

Table 5

- Generally agreed with parks proposal.
- Definitely passive use for City Park, especially with salmon.
- Overpass is good and goes well with the park.
- Concerned with buildings. Water table and underground parking an issue.
- Concerned with congestion from office development – especially around the High School. Improving roads around High School is a major issue.
- Where is mitigation for new streets from new housing? This is not addressed in proposal.

Table 6

- Office development may have to precede development in downtown core.
- I live here because I like to live close to work and do not have to use the freeway.
- Parks are important in a city
- Many businesses may have to move from the core. They can go to (proposed office area?)

Table 7

- I represent perhaps the largest property owner in the Little Bear Creek Corridor area. I'm pleased with the number of people here.
- I like a lot of the plans.
- A big concern is the High School. Look at it – it's part of our city.
- Regarding the creek, we need to acknowledge legal setbacks. My property legally has not addressed this.
- There are some really good ideas here and it needs to be sold to the public who will actually do this.

Table 8

- Trails, yes.

- City Park – no concensus.
- Passage – cost concerns.
- SR-522 crossing – need input from the wedge area. Would it be used?
- Office land use, yes.
- Height – pretty adamant about 55'.
- Office use should probably extend up into GB.
- Provide a little entry park at the north.

Written Responses

The following written comments were included on the 21 Response Sheets submitted.

Respondent 4.
City Park Preference **Respondent indicated "Passive" and "Active" with comments:** ***Each use.***

Respondent 5.
General Comments: ***I would like to see the plan reworked more closely to the CBD Plan and the Parks & Recreation Commission Plan for Little Bear Corridor.***

Respondent 6.
City Park Preference **Respondent indicated "Passive" with comments:** ***Need to have picnic and open space but no "organized" recreation area.***
Passage Proposal **Respondent indicated "Yes" with comments:** ***Great idea.***
Encouraging Office Uses **Respondent indicated "No" and "Other" with comments:** ***Should be more mixed use – housing, office. Leave general business with 45' height.***
Increasing Height for Office Uses **Respondent indicated "No" with comments:** ***No No No No.***
Implementation **Respondent indicated "Yes" with comments:** ***Has to be.***

Respondent 7.
General Comments: ***Go higher in "O". Underground, 2 stories may not work. May require more open parking.***

Respondent 8.
Passage Proposal **Respondent indicated "No" with comments:** ***? Don't understand the passage proposal.***
SR-522 Crossing **Respondent indicated "Other" with comments:** ***With ADA lift.***
General Comments: ***Not related question: Where is the Woodinville Senior Center that we voted on? Why not use the full 45' – what are the costs and why was it not presented? Why was the flyer not put in Woodinville Weekly. Make a tryfold, prestamped, return flyer for lot more response. Why not do underpass to cross rivers? All trails should be able to provide firm ground for***

all wheelchairs, etc.!!! Most definitely tennis courts and lots of basketball! The river does not show up very well, which is hard to follow what's what. Is there going to be extra parking in the business lots for people that want to go to the park during the day? How wide are the roads going to be that are goin in? Will all the streets have a two-way center lane? If need more parking, put it in the center of the building with offices around, so parking is hid. Why can't a parking lot be put along the edge of the west area park to ease school parking and add parking for the park. Why do the land owners have to continue to pay land taxes when the city takes the land? (Please call or write answer).

Respondent 9.

SR-522 Crossing **Respondent indicated "No" with comments:** ***Combine with a road crossing makes more sense.***

Increasing Height for Office Use **Respondent indicated "Yes" with comments:** ***But only with enough supporting road development.***

Implementation **Respondent gave no indication with comments:** ***Development of Little Bear Creek Corridor should precede any park development.***

General Comments: ***The Park Block planned for the center of Woodinville S/B located and planned for development with the future sale of Canterbury Mobile Home Park. Displacing 30+ businesses does not make sense and would be much more costly than locating the park block along the northern boundary of the mobile home park Perhaps the stream that runs along the southern boundary of the mobile home park could be relocated to the south side of the south bypass to give more land room for the future development of the mobile home park.***

Respondent 8.

Trail Options **Respondent indicated "Yes" with comments:** ***Why do we have to have 2 trails though. Paved trail would be fine.***

Passage Proposal **Respondent made no indication with comments:** ***Need a passage somewhere. 131st may or may not be best place.***

SR-522 Crossing **Respondent indicated "Yes" with comments:** ***Actually, really should have an actual road overpass.***

Increasing Height for Office Use **Respondent indicated "Yes" with comments:** ***Not really but guess we have to.***

General Comments: ***Agree that "Office" should extend up to "GB" area also. Want to connect this green space with trails – Burke-Gilman on up to Snohomish. Need to develop railroad right-of-way into a linear park. Need access to water somewhere in Woodinville. (We need a beach somewhere.) Also need to have street front requirements: nice sidewalks with landscaping between street and sidewalk.***

Respondent 8.

Trail Options Respondent indicated "Other" with comments: Soft trail on both

City Park Preference **Respondent indicated "Other" with comments:** ***No City Park..***

Passage Proposal **Respondent indicated "Yes" with comments:** ***In 50 years.***

General Comments: ***Needs to be extended out for a longer period of time. In***

fact, you could have soft trails directly adjacent to the buffer area without having to purchase that much land adjacent to business.

Respondent 14.

Passage Proposal **Respondent indicated "No" with comments:** *No tunnels.*
Implementation **Respondent indicated "Other" with comments:** *See General Comments*
General Comments: 1) The north porders of Little Bear Creek Study Area should be clarified to extend up to the City Limits to keep the city design continuous and cohesive. 2) The zoning of the land in Little Bear Creek Corridor should be "O" in its entirety. The design currently shows very northern tip of the Little Bear Creek Study Area as being "GB". This should be changed to "O". 3) Little Bear Creek development should be phased first for development. A) It is largely vacant or has temporary or interim users and is ready for immediate development. B) It is Woodinville's "northern gateway" and should be improved.

Respondent 15.

Passage Proposal **Respondent indicated "No" with comments:** *Security issue.*
Implementation **Respondent indicated "Other" with comments:** *Little Bear Creek development should be done first. That way displaced office workers from downtown would have a place to go.*

Respondent 16.

Passage Proposal **Respondent indicated "Other" with comments:** *Over. No tunnel. Safety issue.*
Implementation **Respondent indicated "Other" with comments:** *Move ahead of some of CBD development.*

Respondent 17.

Trail Options **Respondent indicated "Yes" with comments:** *Paved or groomed trail..*
Passage Proposal **Respondent indicated "No" with comments:** *Security issues. Only do it if you have no other option*
Implementation: **Respondent indicated "Other" with comments:** *Yes, if we are talking about phasing "within" Little Bear Creek..*

Respondent 18.

Trail Options/Park Character **Respondent gave no indication for the 3 questions with comments:** *Park should be passive use only. Woodinville has other sites for active use recreation. A business locale is more conducive to passive recreation.*
Increasing Height for Office Use **Respondent indicated "Yes" with comments:** *Absolutely necessary for both recreation and commercial uses.*
General Comments: To have recreation and open space at LBC, you need to do commercial must build vertically (especially at north end of town) – not enough parking even with 1.5 dpsvrd; probably additional parking should be considered with a 5-story garage. Business needs to trust government in order to implement this or any other enhanced park/business plan. Perhaps government should begin any new program by starting with business considerations first before recreation, when and where feasible. It is

imperative that the business community come on board first – the rec land will always be there. People first!!!

Respondent 19.
No Comments.

Respondent 20.
General Comments: **Continue the "O" zoning north through the "GB" zoning to the northern city limits.**

Respondent 21.
General Comments: ***1) Need to understand what the cost is and how it will be funded. 2) Conditional cost crossing on NE 70 and ? seldom used as is one NE 12th in Bellevue. 3) Also retail uses; food services.. 4) Max should be 55'. 5) "GB" on land Use Framework (Draft) should be "O". Max should be 55'. 5) parcel west of letter "GB" should be "park".***

Respondent 22.
Passage Proposal **Respondent indicated "Yes" with comments:** ***Cost?***
City Park Preference **Respondent indicated "Passive" with comments:** ***No (active)! The tennis courts on the Sammamish Trail not used now.***
SR-522 Crossing **Respondent indicated "Yes" with comments:** ***Would like to know what people living in the 'wedge' think.***
Encouraging Office Uses **Respondent indicated "Yes" with comments:** ***Possibly should include retail uses. Also printing/deli, Starbucks, etc.***
Increasing Height for Office Uses **Respondent indicated "No" with comments:** ***4 floors, 55' – 56'.***
General Comment: ***All office and other buildings in Little Bear Creek Corridor must have 2 faces – one facing freeway and other facing Little Bear Creek Parkway and/or Woodinville-Snohomish Road. GB (Woodinville Auto Auction) and north etc. should be rezoned "O" – as rest of Little Bear Creek Area is. Note: Northeast corner of 195th (small parcel) should be acquired by Parks. Signage, passive park, landscpaed "GATEWAY".***

Respondent 23.
General Comment: ***I am coming into the process late so I may have missed a lot. I would like to know what you have planned for all of the new kids that will be in the schools after all of this growth. What is going to happen to all of the people living in the downtown area. Wouldn't it be prudent to fix all of the problems created by the city and all of the developers to this point before embarking on more growth?***

Respondent 24.
General Comment: ***Phasing agreement is qualified: Need to put revegetation/reforestation of parkland and riparian zone on front burner. Trail system later is fine. But need salmon habitat restoration to begin soonest. Trees, shrubs to provide shade to water temperature in creek and food web for juvenile/pairing fish need years to grow before providing benefit as intended. Salmon programs in rest of watershed depend in part on successful transit of this reach of Little Bear for trip upstream to spawn, and downstream for early life cycle rearing and lake time Needed. This must take salmon (Chinook –***

ESA endangered specie) viability/safety into account. This is the "gateway" into the rest of our salmon rearing watershen upstream for 17 square miles of stream habitat.

Respondent 25.

Trail Options/Park Character **Respondent indicated "No" with comments:** ***One is enough.***

Encouraging Office Uses **Respondent indicated "Other" with comments:** ***Some fine businessess exist in concrete tilt-ups. Leave attractive business buildings alone.***

General Comments: ***Don not consider using 132 Avenue NE for trail access. Do use 134 Avenue NE for trail access. Here's why: 132nd Avenue NE: Public benefit – 5 parking spaces. That's it! Private Benefit – None. Entirely adverse. 134the Avenue NE: Public Benefit: Unlimited parking, rest rooms, water, garbage, lights, unlimited future expansion, located in the open flat park; "a signature park entry"; "an active park" is possible using this street access; It can be made into a freeway crossing. Private benefit – no businesses are disturbed. Problems at 132 Avenue NE: Will eliminate street parking for business traffic congestion; no place to turn around 40' trucks use the street; cars often have to be moved; conflict with businesses and the public; no bathrooms; no parking; it is fenced on both sides of the street; the street ends at a 20' bank (culvert will be removed); street vacation will be sought by abutting owners.***

Respondent 26.

Increasing Height for Office Uses **Respondent indicated "Yes" with comments:** ***With underground parking with low impact development, permeable paving.***

Implementation **Respondent indicated "Other" with comments:** ***Vegetation should be done at outset in buffer area.***

General Comments: ***Preserving habitat in and along Little Bear Creek is critical. Adequate shade, undisturbed stream flow, and avoidance of all pollution must be observed to protect this habitat which is key to our fish stocks.***

2.6 Little Bear Creek Planning Process Summary

2.7 Downtown/Little Bear Creek Integrated Workshop 5

Summary

Approximately 40 people interested in contributing to the design and future development of the Little Bear Creek Corridor Area met for the Final Work Session. The Work Session took place on the evening of July 25, 2002 at City Hall. The purpose of the meeting was to evaluate and comment on refined circulation, open space, land use and phasing concepts. The preferences indicated by citizens on the Response Sheet ballot are summarized below.

RESPONSE SHEET

Little Bear Creek Corridor Master Plan — July 25, 2002

21 Response Sheets were submitted. In some cases, respondents may not have indicated a response to all questions, or may have indicated 2 responses to a single question.

TRAIL OPTIONS/PARK CHARACTER

	Yes	No	Other
Do you agree with a natural "soft trail" on the west, and a groomed "paved trail" on the east sides of Little Bear Creek?	18	2	1
	Passive	Active	Other
Indicate your preference for City Park:*	15	4	3
	Yes	No	Other
Do you support the 131st Avenue Little Bear Creek trail passage proposal?	9	6	4

*Active - Tennis and basketball courts and lawn games.
Passive - Picnic, interpretive and natural areas

SR-522 CROSSING

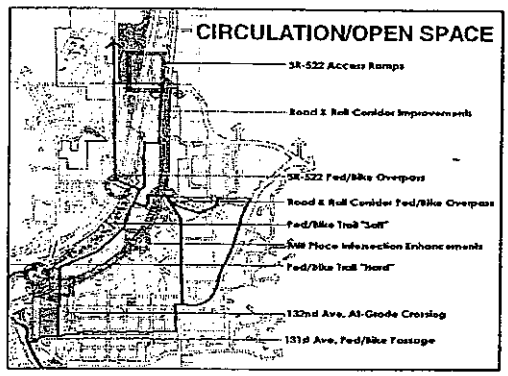
	Yes	No	Other
Do you support the pedestrian and bicycle overpass connection?	16	3	2

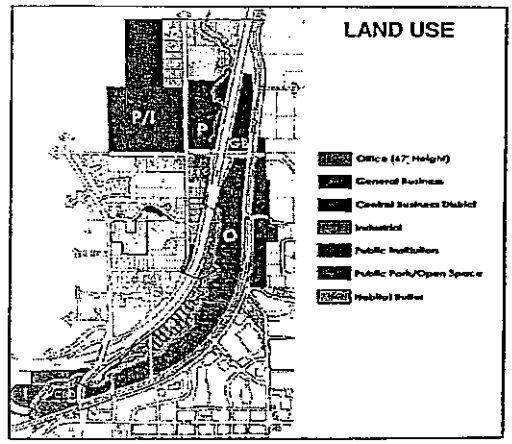
LAND USE

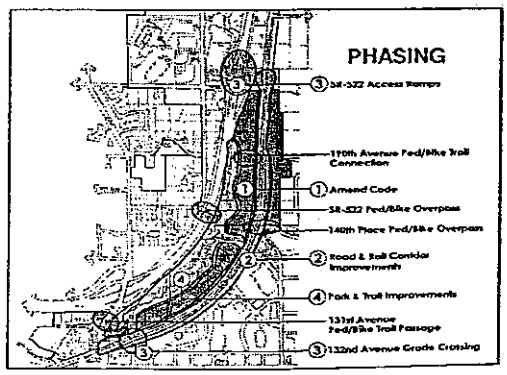
	Yes	No	Other
Do you agree with the policy of encouraging office uses (amend codes)?	17	3	2
	Yes	No	Other
Do you agree with increasing the allowable building height from 45' to 67' (3 floors to 5 floors) for office uses only?	13	7	1

IMPLEMENTATION

	Yes	No	Other
Do you agree with the project phasing proposal?	9	3	6







Small Group Presentations

Participants worked in groups of two to six people at 8 discussion tables to determine their preferences for Plan Concepts. Their responses and observations are summarized below:

Table 1

- Yes for the soft and hard trails.
- Not yet clear about City Park.
- Concerned about security on the passage proposal.
- We support 522 crossing.
- We support land use and phasing.
- Concerned for displaced office workers.

Table 2

- The height of buildings will be exceeded over time by tall trees.
- Water table and expense are concerns for parking structure.
- When planning trail locations, think about avoiding dissection of properties.
- Trails are good for both office workers and the public.
- Property Owner - We own 12 acres in the area. We can't develop on the west side. On the east side, height may be necessary. We try to work with people and understand the facts of the circumstances. Over the time we have owned the property, the 25' setback from Little Bear Creek was expanded to 50'. Recent discussion has talked about expanding to as far as 300'.

Table 3

- Not informed enough to comment on trails.
- Not informed enough to comment regarding the passage.
- 522 crossing, yes.
- For land use, office seems OK.
- Not informed enough to comment on phasing.

Table 4

- I like the proposal.
- Prefer to direct growth.
- As a business, you have to invest.
  Each time I invest, it has come back..
  This proposal generates an income.

Table 5

- Generally agreed with parks proposal.
- Definitely passive use for City Park, especially with salmon.
- Overpass is good and goes well with the park.
- Concerned with buildings. Water table and underground parking an issue.
- Concerned with congestion from office development – especially around the High School. Improving roads around High School is a major issue.
- Where is mitigation for new streets from new housing? This is not addressed in proposal.

Table 6

- Office development may have to precede development in downtown core.
- I live here because I like to live close to work and do not have to use the freeway.
- Parks are important in a city
- Many businesses may have to move from the core. They can go to (proposed office area?)

Table 7

- I represent perhaps the largest property owner in the Little Bear Creek Corridor area. I'm pleased with the number of people here.
- I like a lot of the plans.
- A big concern is the High School. Look at it – it's part of our city.
- Regarding the creek, we need to acknowledge legal setbacks. My property legally has not addressed this.
- There are some really good ideas here and it needs to be sold to the public who will actually do this.

Table 8

- Trails, yes.
- City Park – no concensus.

- Passage – cost concerns.
- SR-522 crossing – need input from the wedge area. Would it be used?
- Office land use, yes.
- Height – pretty adamant about 55'.
- Office use should probably extend up into GB.
- Provide a little entry park at the north.

Written Responses

The following written comments were included on the 21 Response Sheets submitted.

Respondent 10.

City Park Preference Respondent indicated "Passive" and "Active" with comments: *Each use.*

Respondent 11.

General Comments: *I would like to see the plan reworked more closely to the CBD Plan and the Parks & Recreation Commission Plan for Little Bear Corridor.*

Respondent 12.

City Park Preference Respondent indicated "Passive" with comments: *Need to have picnic and open space but no "organized" recreation area.*
Passage Proposal Respondent indicated "Yes" with comments: *Great idea.*
Encouraging Office Uses Respondent indicated "No" and "Other" with comments: *Should be more mixed use – housing, office. Leave general business with 45' height.*
Increasing Height for Office Uses Respondent indicated "No" with comments: *No No No No.*
Implementation Respondent indicated "Yes" with comments: *Has to be.*

Respondent 13.

General Comments: *Go higher in "O". Underground, 2 stories may not work. May require more open parking.*

Respondent 14.

Passage Proposal Respondent indicated "No" with comments: *? Don't understand the passage proposal.*
SR-522 Crossing Respondent indicated "Other" with comments: *With ADA lift.*
General Comments: *Not related question: Where is the Woodinville Senior Center that we voted on? Why not use the full 45' – what are the costs and why was it not presented? Why was the flyer not put in Woodinville Weekly. Make a tryfold, prestamped, return flyer for lot more response. Why not do underpass to cross rivers? All trails should be able to provide firm ground for all wheelchairs, etc.!!! Most definitely tennis courts and lots of basketball! The river does not show up very well, which is hard to follow what's what. Is there going to be extra parking in the business lots for people that want to go to the park during the day? How wide are the roads going to be that are goin in? Will all the streets have a two-way center lane? If need more parking, put it in the center of the building with offices around, so parking is hid. Why can't a parking lot be put along the edge of the west area park to ease school parking and add parking for the park. Why do the land owners have to continue to pay land taxes when the city takes the land? (Please call or write answer).*

Respondent 15.

SR-522 Crossing Respondent indicated "No" with comments: *Combine with a road crossing makes more sense.*
Increasing Height for Office Use Respondent indicated "Yes" with comments: *But only with enough supporting road development.*

Implementation **Respondent gave no indication with comments:** *Development of Little Bear Creek Corridor should precede any park development.*
General Comments: *The Park Block planned for the center of Woodinville S/B located and planned for development with the future sale of Canterbury Mobile Home Park. Displacing 30+ businesses does not make sense and would be much more costly than locating the park block along the northern boundary of the mobile home park Perhaps the stream that runs along the southern boundary of the mobile home park could be relocated to the south side of the south bypass to give more land room for the future development of the mobile home park.*

Respondent 9.
Trail Options **Respondent indicated "Yes" with comments:** *Why do we have to have 2 trails though. Paved trail would be fine.*
Passage Proposal **Respondent made no indication with comments:** *Need a passage somewhere. 131st may or may not be best place.*
SR-522 Crossing **Respondent indicated "Yes" with comments:** *Actually, really should have an actual road overpass.*
Increasing Height for Office Use **Respondent indicated "Yes" with comments:** *Not really but guess we have to.*
General Comments: *Agree that "Office" should extend up to "GB" area also. Want to connect this green space with trails – Burke-Gilman on up to Snohomish. Need to develop railroad right-of-way into a linear park. Need access to water somewhere in Woodinville. (We need a beach somewhere.) Also need to have street front requirements: nice sidewalks with landscaping between street and sidewalk.*

Respondent 9.
Trail Options Respondent indicated "Other" with comments: Soft trail on both
City Park Preference **Respondent indicated "Other" with comments:** *No City Park..*
Passage Proposal **Respondent indicated "Yes" with comments:** *In 50 years.*
General Comments: *Needs to be extended out for a longer period of time. In fact, you could have soft trails directly adjacent to the buffer area without having to purchase that much land adjacent to business.*

Respondent 27.
Passage Proposal **Respondent indicated "No" with comments:** *No tunnels.*
Implementation **Respondent indicated "Other" with comments:** *See General Comments*
General Comments: 1) The north porders of Little Bear Creek Study Area should be clarified to extend up to the City Limits to keep the city design continuous and cohesive. 2) The zoning of the land in Little Bear Creek Corridor should be "O" in its entirety. The design currently shows very northern tip of the Little Bear Creek Study Area as being "GB". This should be changed to "O". 3) Little Bear Creek development should be phased first for development. A) It is largely vacant or has temporary or interim users and is ready for immediate development. B) It is Woodinville's "northern gateway" and should be improved.

Respondent 28.
Passage Proposal **Respondent indicated "No" with comments:** *Security issue.*
Implementation **Respondent indicated "Other" with comments:** *Little Bear Creek development should be done first. That way displaced office workers from downtown would have a place to go.*

Respondent 29.

Passage Proposal **Respondent indicated "Other" with comments:** *Over. No tunnel. Safety issue.*

Implementation **Respondent indicated "Other" with comments:** *Move ahead of some of CBD development.*

Respondent 30.

Trail Options **Respondent indicated "Yes" with comments:** *Paved or groomed trail..*

Passage Proposal **Respondent indicated "No" with comments:** *Security issues. Only do it if you have no other option*

Implementation: **Respondent indicated "Other" with comments:** *Yes, if we are talking about phasing "within" Little Bear Creek..*

Respondent 31.

Trail Options/Park Character **Respondent gave no indication for the 3 questions with comments:** *Park should be passive use only. Woodinville has other sites for active use recreation. A business locale is more conducive to passive recreation.*

Increasing Height for Office Use **Respondent indicated "Yes" with comments:** *Absolutely necessary for both recreation and commercial uses.*

General Comments: To have recreation and open space at LBC, you need to do commercial must build vertically (especially at north end of town) – not enough parking even with 1.5 dpsvrd; probably additional parking should be considered with a 5-story garage. Business needs to trust government in order to implement this or any other enhanced park/business plan. Perhaps government should begin any new program by starting with business considerations first before recreation, when and where feasible. It is imperative that the business community come on board first – the rec land will always be there. People first!!!

Respondent 32.

No Comments.

Respondent 33.

General Comments: **Continue the "O" zoning north through the "GB" zoning to the northern city limits.**

Respondent 34.

General Comments: *1) Need to understand what the cost is and how it will be funded. 2) Conditional cost crossing on NE 70 and ? seldom used as is one NE 12th in Bellevue. 3) Also retail uses; food services.. 4) Max should be 55'. 5) "GB" on land Use Framework (Draft) should be "O". Max should be 55'. 5) parcel west of letter "GB" should be "park".*

Respondent 35.

Passage Proposal **Respondent indicated "Yes" with comments:** *Cost?*

City Park Preference **Respondent indicated "Passive" with comments:** *No (active)! The tennis courts on the Sammamish Trail not used now.*

SR-522 Crossing **Respondent indicated "Yes" with comments:** *Would like to know what people living in the 'wedge' think.*

Encouraging Office Uses **Respondent indicated "Yes" with comments:** *Possibly should include retail uses. Also printing/deli, Starbucks, etc.*

Increasing Height for Office Uses **Respondent indicated "No" with comments:** *4 floors, 55' – 56'.*

General Comment: *All office and other buildings in Little Bear Creek Corridor must have 2 faces – one facing freeway and other facing Little Bear Creek Parkway and/or Woodinville-Snohomish Road. GB (Woodinville Auto Auction) and north etc. should be rezoned "O" – as rest of Little Bear Creek Area is. Note: Northeast corner of 195th (small parcel) should be acquired by Parks. Signage, passive park, landscpaed "GATEWAY".*

Respondent 36.

General Comment: *I am coming into the process late so I may have missed a lot. I would like to know what you have planned for all of the new kids that will be in the schools after all of this growth. What is going to happen to all of the people living in the downtown area. Wouldn't it be prudent to fix all of the problems created by the city and all of the developers to this point before embarking on more growth?*

Respondent 37.

General Comment: *Phasing agreement is qualified: Need to put revegetation/reforestation of parkland and riparian zone on front burner. Trail system later is fine. But need salmon habitat restoration to begin soonest. Trees, shrubs to provide shade to water temperature in creek and food web for juvenile/pairing fish need years to grow before providing benefit as intended. Salmon programs in rest of watershed depend in part on successful transit of this reach of Little Bear for trip upstream to spawn, and downstream for early life cycle rearing and lake time Needed. This must take salmon (Chinook – ESA endangered specie) viability/safety into account. This is the "gateway" into the rest of our salmon rearing watershen upstream for 17 square miles of stream habitat.*

Respondent 38.

Trail Options/Park Character **Respondent indicated "No" with comments:** *One is enough.*

Encouraging Office Uses **Respondent indicated "Other" with comments:** *Some fine businessess exist in concrete tilt-ups. Leave attractive business buildings alone.*

General Comments: *Don not consider using 132 Avenue NE for trail access. Do use 134 Avenue NE for trail access. Here's why: 132nd Avenue NE: Public benefit – 5 parking spaces. That's it! Private Benefit – None. Entirely adverse. 134the Avenue NE: Public Benefit: Unlimited parking, rest rooms, water, garbage, lights, unlimited future expansion, located in the open flat park; "a signature park entry"; "an active park" is possible using this street access; It can be made into a freeway crossing. Private benefit – no businesses are disturbed. Problems at 132 Avenue NE: Will eliminate street parking for business traffic congestion; no place to turn around 40' trucks use the street; cars often have to be moved; conflict with businesses and the public; no bathrooms; no parking; it is fenced on both sides of the street; the street ends at a 20' bank (culvert will be removed); street vacation will be sought by abutting owners.*

Respondent 39.

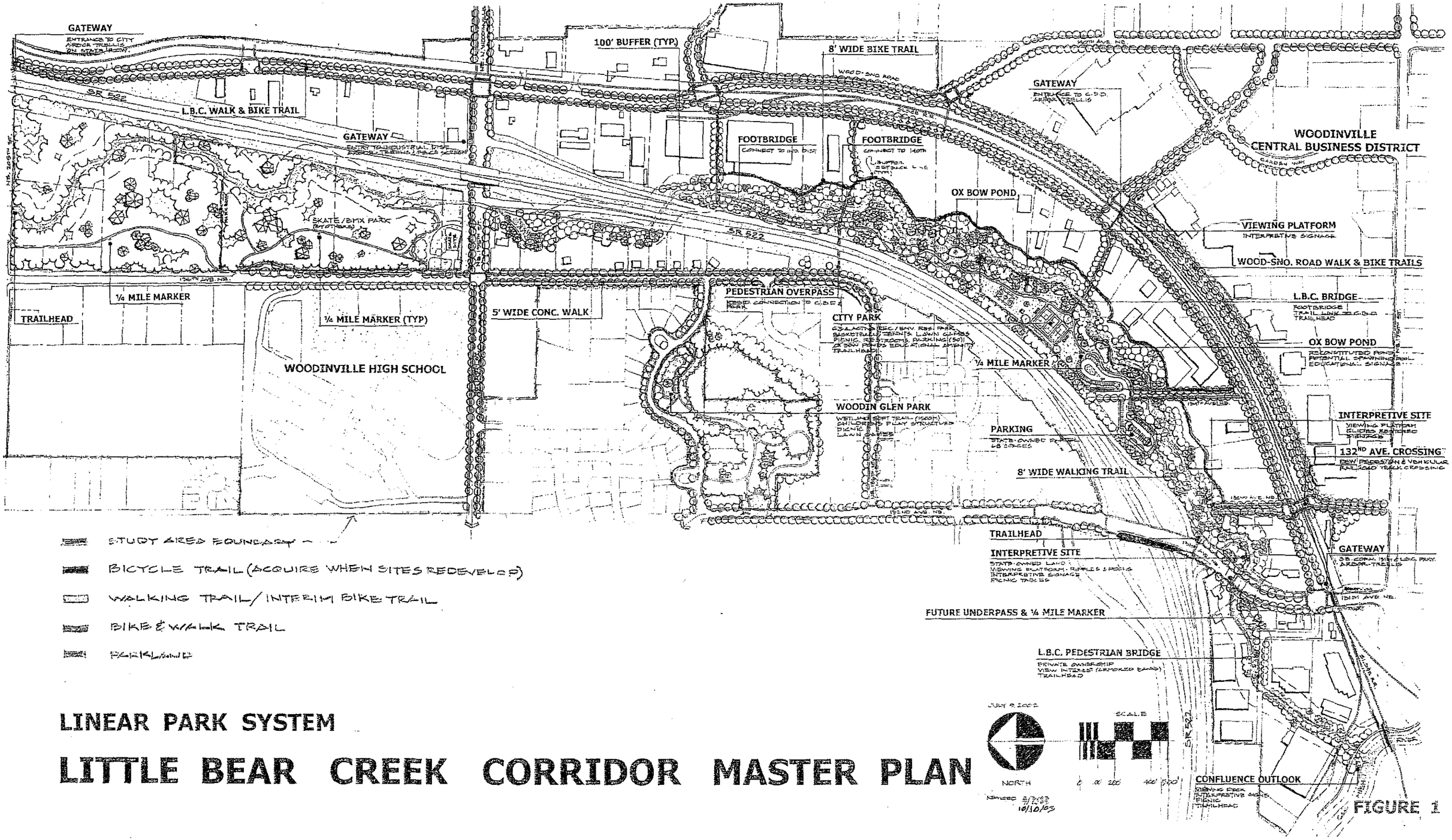
Increasing Height for Office Uses **Respondent indicated "Yes" with comments:** *With underground parking with low impact development, permeable paving.*

Implementation **Respondent indicated "Other" with comments:** *Vegetation should be done at outset in buffer area.*

General Comments: *Preserving habitat in and along Little Bear Creek is critical. Adequate shade, undisturbed stream flow, and avoidance of all pollution must be observed to protect this habitat which is key to our fish stocks.*

LIST OF ILLUSTRATIONS

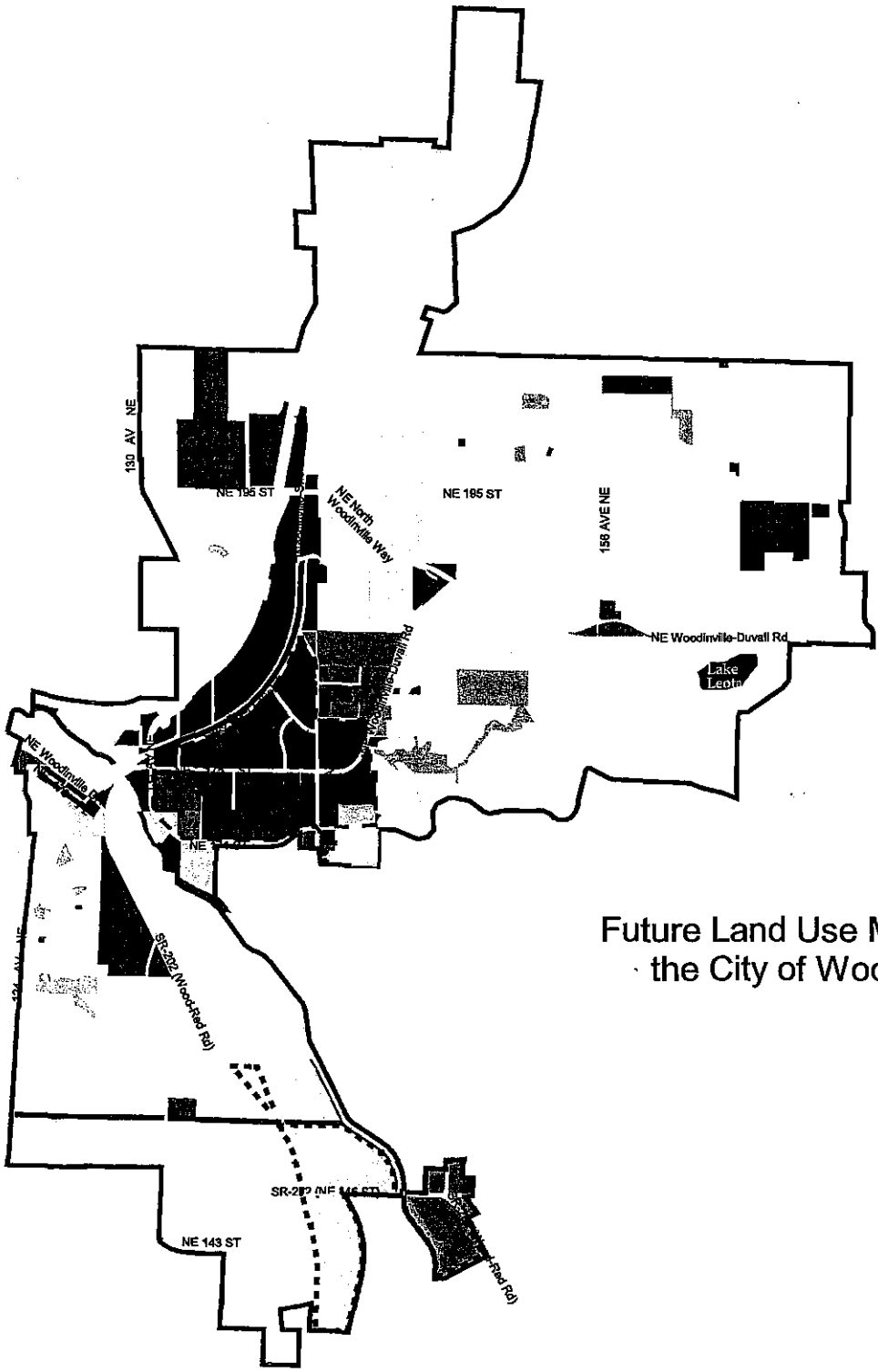
Figure 1	Master Plan - Little Bear Creek Linear Park
Figure 2	City of Woodinville - Comprehensive Plan Map
Figure 3	Habitat Improvements – Little Bear Creek Linear Park
Figure 4	Existing land use map
Figure 5	Land Value Map
Figure 6	Land Use Plan changes for Little Bear Creek corridor
Figure 7	Railroad right of way proposals
Figure 8	SR 522 overpass sketch



LINEAR PARK SYSTEM

LITTLE BEAR CREEK CORRIDOR MASTER PLAN

FIGURE 1



Future Land Use Map for the City of Woodinville

Low Density Residential
Moderate Density Residential
Medium Density Residential
High Density Residential
High Density Residential/Office

Neighborhood Business
Tourist Business
Office
Central Business
Auto/General Commercial
Industrial

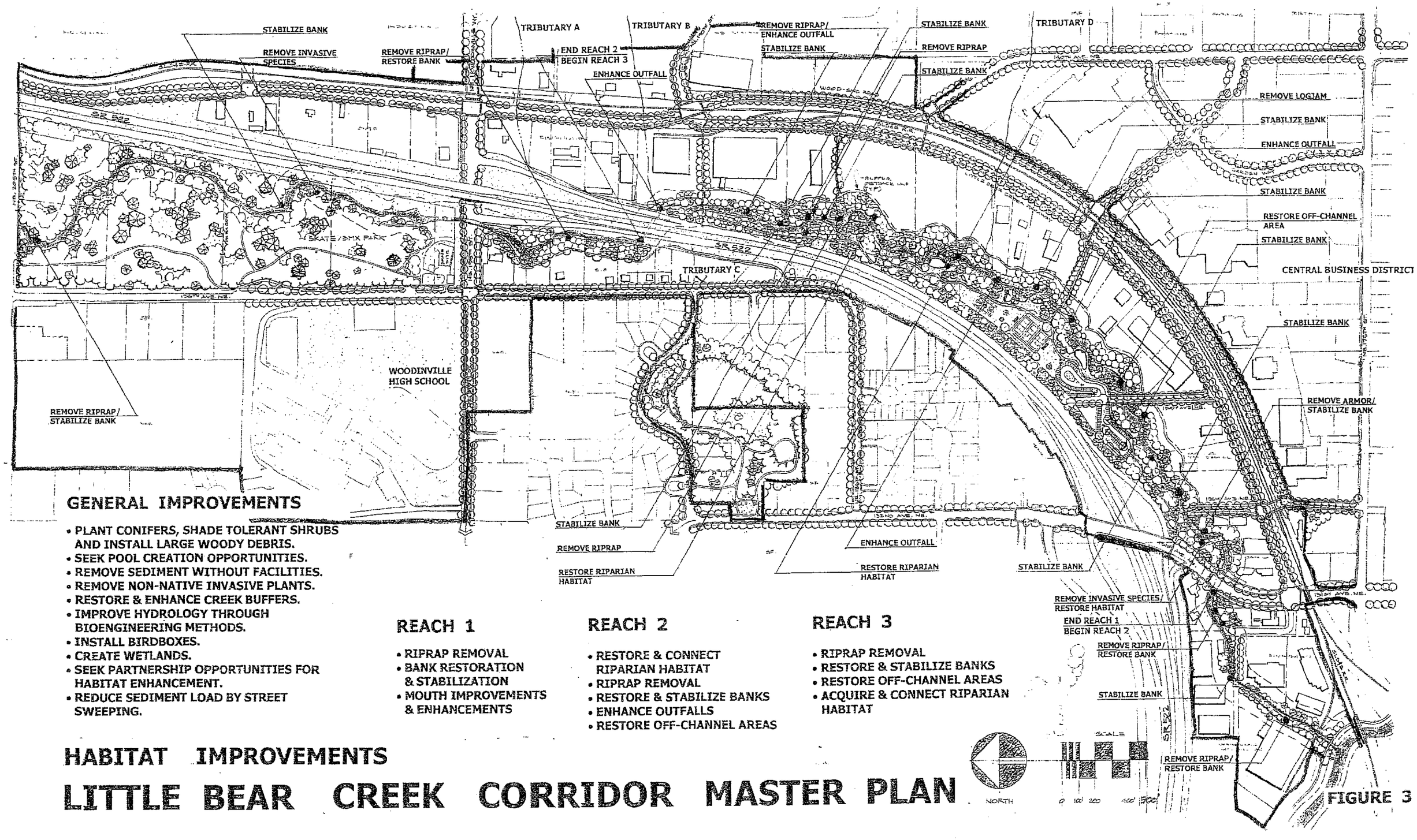
Public/Institutional
Public Parks
Openspace
Mixed-Use Area
Tourist District
Urban Growth Boundary

0 0.3 0.6 0.9 Miles

N

NOTE: This comp plan map is a pictorial representation and the City does not warrant its accurate depiction. dc 3/17/04

Figure 2



GENERAL IMPROVEMENTS

- PLANT CONIFERS, SHADE TOLERANT SHRUBS AND INSTALL LARGE WOODY DEBRIS.
- SEEK POOL CREATION OPPORTUNITIES.
- REMOVE SEDIMENT WITHOUT FACILITIES.
- REMOVE NON-NATIVE INVASIVE PLANTS.
- RESTORE & ENHANCE CREEK BUFFERS.
- IMPROVE HYDROLOGY THROUGH BIOENGINEERING METHODS.
- INSTALL BIRDBOXES.
- CREATE WETLANDS.
- SEEK PARTNERSHIP OPPORTUNITIES FOR HABITAT ENHANCEMENT.
- REDUCE SEDIMENT LOAD BY STREET SWEEPING.

REACH 1

- RIPRAP REMOVAL
- BANK RESTORATION & STABILIZATION
- MOUTH IMPROVEMENTS & ENHANCEMENTS

REACH 2

- RESTORE & CONNECT RIPARIAN HABITAT
- RIPRAP REMOVAL
- RESTORE & STABILIZE BANKS
- ENHANCE OUTFALLS
- RESTORE OFF-CHANNEL AREAS

REACH 3

- RIPRAP REMOVAL
- RESTORE & STABILIZE BANKS
- RESTORE OFF-CHANNEL AREAS
- ACQUIRE & CONNECT RIPARIAN HABITAT

HABITAT IMPROVEMENTS

LITTLE BEAR CREEK CORRIDOR MASTER PLAN

FIGURE 3

CITY OF WOODINVILLE
GENERAL BUSINESS ZONE
2000 LAND USE SURVEY

Parcel #	TaxpayerName	Acres	Land Value ($)	Zone	Land Use	Land Use Category	
0326059015	EGGE RICHARD C	1.4873	$ 471,798.96	GB	Construction / Auto Body	Business	
0326059059	KELLY WILLIAM RAY	0.4646	$ 953,406.71	GB	One Way Plumbing	Business	
0326059062	JARVIS TERRY J	4.2947	$ 261,205.09	GB	Steel Craft	Business	
0326059094	SUZUKI FAMILY PARTNERSHIP	1.6395	$ 559,258.49	GB	Del's Truck Rental(Multi-purpose vehicular rental)	Business	
0622100021	CONSOLIDATED FREIGHTWAYS	3.694	$ 392,286.15	GB	Consolidated Freightways	Business	
0622100025	GREENBAUM ASSOCIATES PART	5.446	$ 917,247.89	GB	Greenbaum/Sasco	Business	
0622100042	MONEY SAVER WOODINVILL ASSC	3.6675	$ 985,007.41	GB	Moneysaver Mini Storage	Business	
0622100051	HOWDY PARTNERS III LP	1.8019	$ 552,517.73	GB	BIC, Inc.	Business	
0622100061	STUART ANDERSON PROPERTIES	1.3048	$ 559,254.40	GB	Super Rents/Coast Crane (Small machinery rental).	Business	
9517100190	KALMBACH JOHN G+DONNA J+	2.0536	$ 289,692.83	GB	Anchor Fencing	Business	
9517100195	WHITESCARVER BILL P	1.4537	$ 310,115.45	GB	Coral Construction	Business	
9517100210	GONZALES DONALD W	2.9233	$ 275,507.60	GB	Boring service	Business	
9517100227	SHANNON PAUL M + JEAN	0.2465	$ 135,875.47	GB	Mac's Towing	Business	
9517100268	LAKEPOINTE INC	1.1387	$ 350,310.98	GB	Ryder Truck Rental	Business	
9517100270	DEYOUNG LOWELL	2.5867	$ 325,467.92	GB	Lowell DeYoung Co.	Business	
9517100271	BDM-LLC	1.3496	$ 249,706.22	GB	Familion	Business	
9517100272	BDM-LLC	1.2651	$ 294,199.44	GB	Familion	Business	
0326059093	SUZUKI FAMILY PARTNERSHIP	1.266	$ 577,870.33	GB	Lees Auto Rebuild (Mechanic)	General	
9517100266	SMICO DEVELOPMENTAL CO	3.6165	$ 329,375.25	GB	Checkride driving	General-Education	
7269100010	COGAN JOHN P	1.6201	$ 863,257.85	GB	The Bindery	Manufacturing	
0326059047	HIGHWAY 9 LLC	1.4587	$ 563,586.35	GB	Prime Power Sales/Service Generators	Retail	
0326059056	MERCER SCOTT+COLLEEN M	0.9212	$ 561,684.58	GB	Woodinville Public Auto Auction	Retail	
0326059089	JARVIS TERRY ET AL	1.8098	$ 563,717.08	GB	Park 'n' Sell (Auto dealer)	Retail	
0326059107	MERCER SCOTT+COLLEEN M	1.051	$ 574,873.52	GB	Woodinville Public Auto Auction	Retail	
0622100052	BURLEY JEROME	1.61	$ 567,462.89	GB	Woodinville Truss	Retail	
0622100059	ANDERSON MALCOLM D&MARY JO	0.7844	$ 568,054.37	GB	Woodinville Truss	Retail	
1927300250	CLEARWATER RONALD D	1.4437	$ 219,568.92	GB	Clearwater Spa's	Retail	
1927300280	CLEARWATER RONALD D	3.4377	$ 895,392.88	GB	Clearwater Spa's	Retail	
7269100020	ASIAN-AMERICAN ENTERPRISES	1.1587	$ 942,690.47	GB	China Cottage, Silver Shears, Boiling Kitchen, US Marine Corps.	Retail	
9517100260	WOODINVILLE BUSINESS CTR 1	1.4044	$ 1,182,969.56	GB	vacant/retail/Art Works/Symmetry Elect. Woodinville Concrete Tools/National Credit Services	Retail	

Figure 4

CITY OF WOODINVILLE
GENERAL BUSINESS ZONE
2000 LAND USE SURVEY

Parcel #	TaxpayerName	Acres	Land Value ($)	Zone	Land Use	Land Use Category
9517100261	WOODINVILLE BUSINESS CTR 1	1.3674	$ 918,249.91	GB	retail/restraunt/electronics/vacant/office/Pool Tables & Games/Symetry Elect./The Patchworks/TPA/Krazan Eng./Western Tool Supply/Cabot Staizs/Jet City Pizza Office	Retail
0326059014	MACKINNON KINNON O+BRENDA K	0.7697	$ 195,525.79	GB	Vacant	Vacant
0326059126	KING COUNTY	0.0203	$ -	GB	Vacant	Vacant
0622100005	PLYWOOD SUPPLY INC	7.0026	$ 307,356.96	GB	Vacant	Vacant
0622100045	WOLF RICHARD M	1.0446	$ 546,215.14	GB	Vacant	Vacant
1927300005	BINCKLEY WILLIAM/FIRST WOOD	3.1938	$ 176,875.48	GB	Vacant	Vacant
9517100220	STATE OF WASHINGTON	2.2795	$ -	GB	Vacant	Vacant
9517100245	SWANSON RALPH L JR	1.3488	$ 31,287.74	GB	Vacant	Vacant
9517100250	WOODINVILLE CITY OF	6.4195	$ 37,619.53	GB	Vacant	Vacant
9517100262	WOODINVILLE BUSINESS CTR 1	0.9156	$ 139,148.21	GB	Vacant	Vacant
9517100263	WOODINVILLE BUSINESS CTR 1	1.127	$ 131,593.87	GB	Vacant	Vacant
9517100275	PLYWOOD SUPPLY INC	2.5627	$ 199,050.41	GB	Vacant	Vacant
9517100276	PLYWOOD SUPPLY INC	2.8715	$ 189,794.30	GB	Vacant	Vacant
TOTALS		89.3227	$ 19,166,080.15			

USE CATEGORY	ACRES	VALUE	PARCELS
Business Services	36.8175	$ 7,882,858.76	17
General Services	4.8825	$ 907,245.58	2
Retail	16.447	$ 7,558,250.53	11
Manufacturing	1.6201	$863,257.85	1
Vacant	29.5556	$ 1,954,467.44	12
	89.3227	$ 19,166,080.16	43

The city of WOODINVILLE

Little Bear Creek Study Area

Taxpayer, Business Name and Total Assessed Valuation

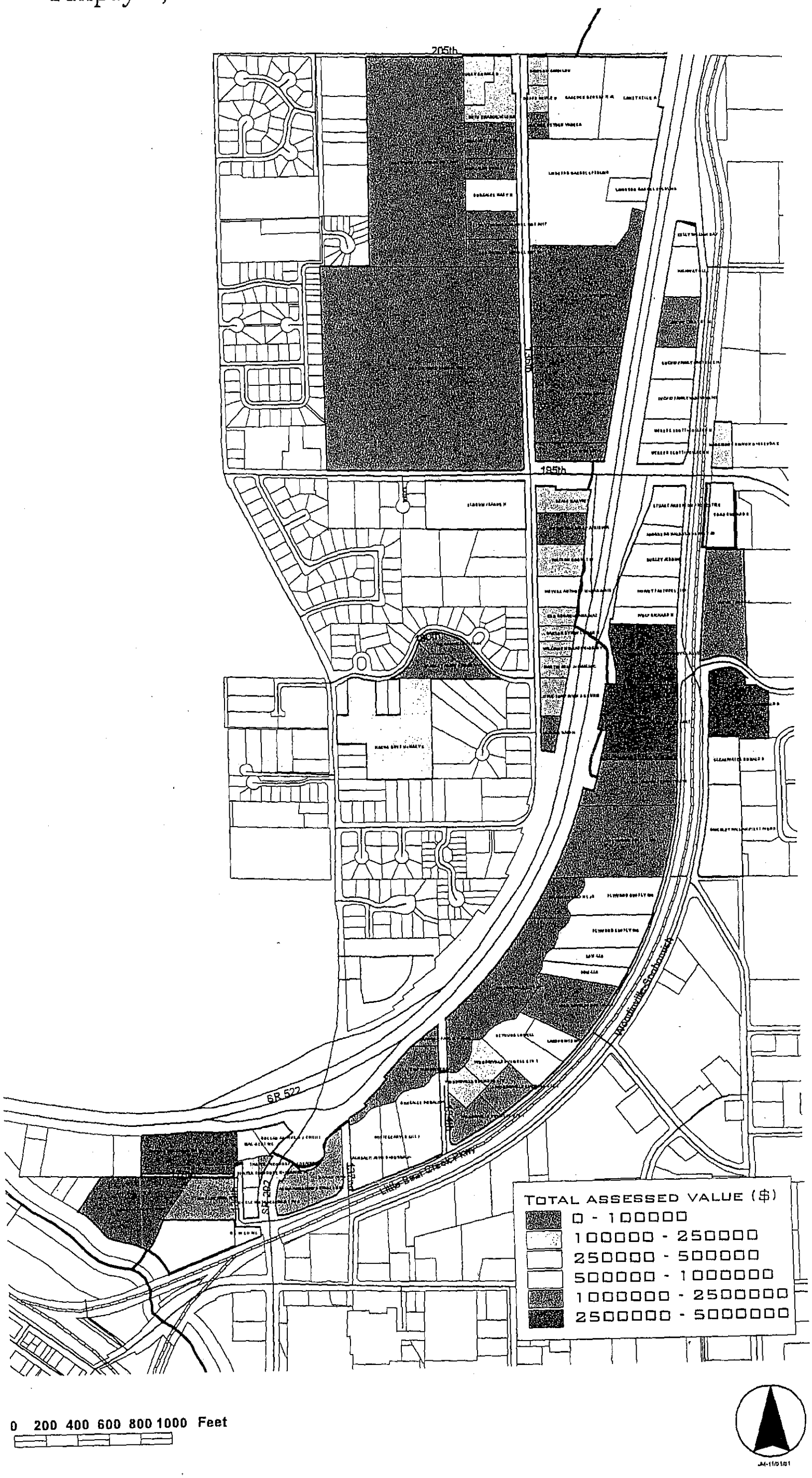


Figure 5

City of Woodinville
Downtown - Little Bear Creek Corridor Master Plan

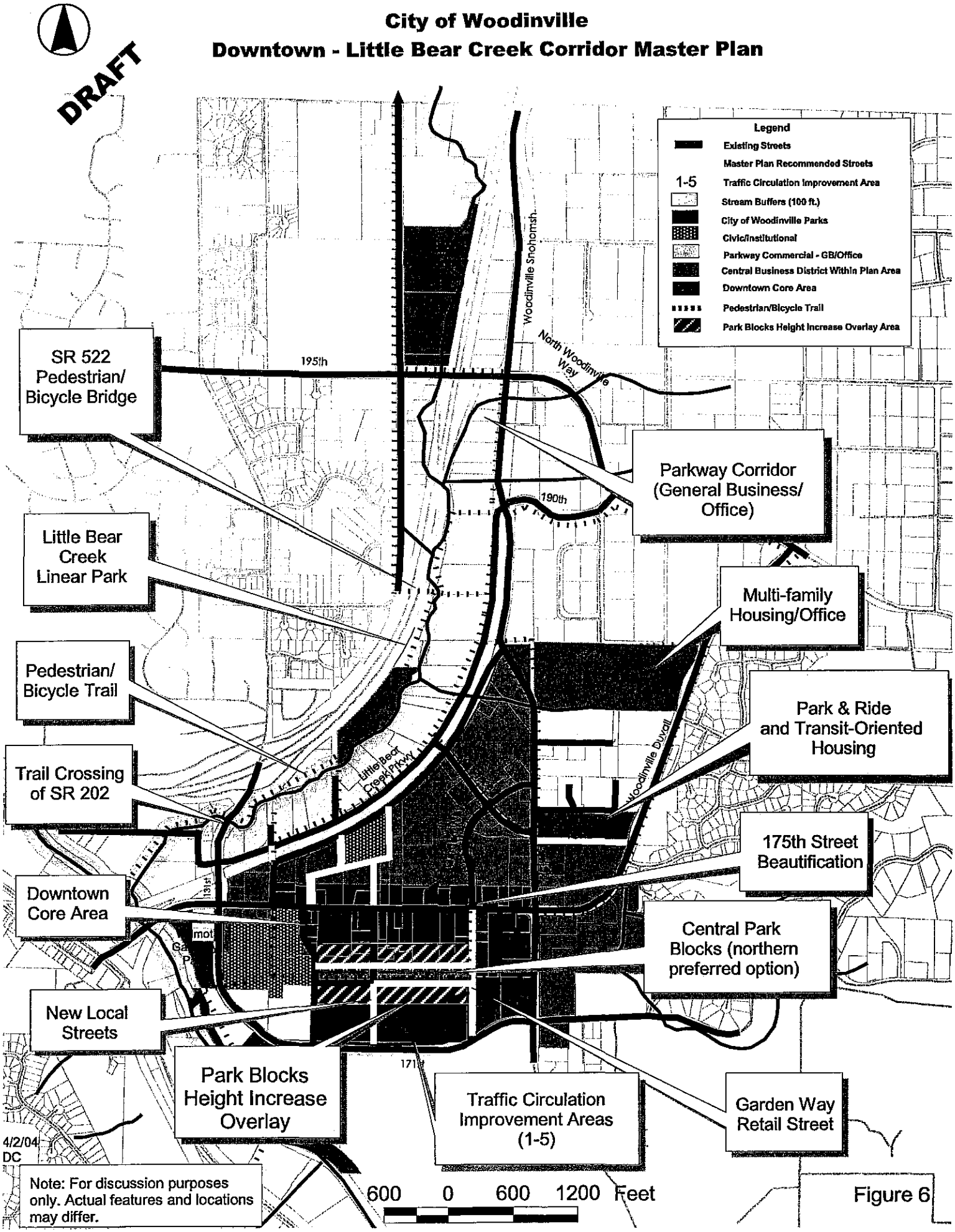
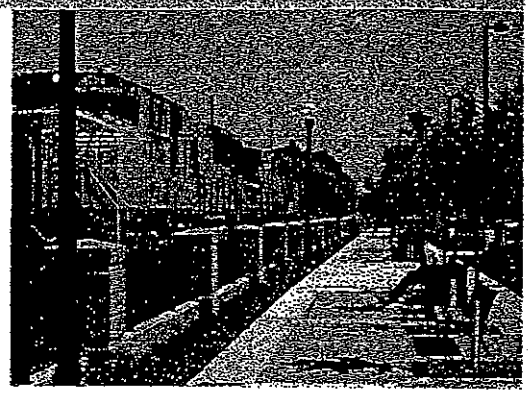


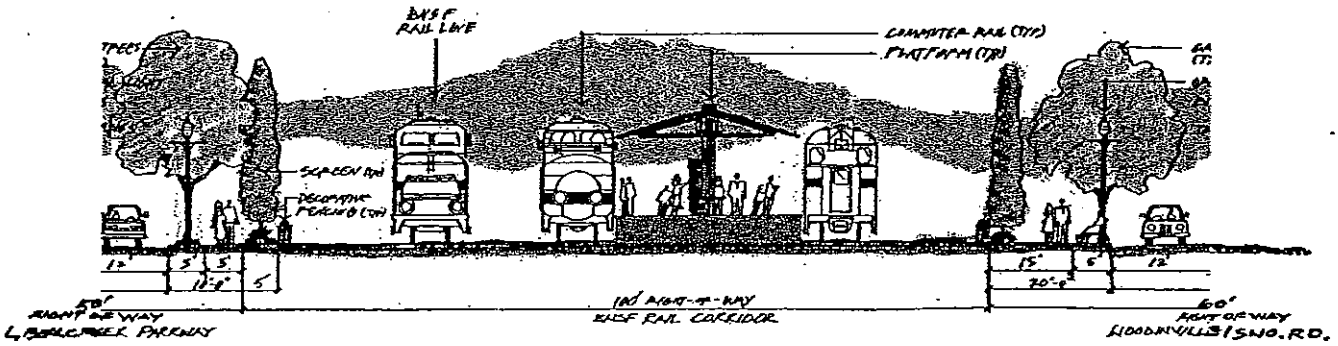
Figure 6

Rail Line Improvements

Features:

- Decorative safety fencing
- Landscape screening
- Pedestrian amenities
- Rail line platform
- Separation of rail line and commuter rail
- Weather canopy





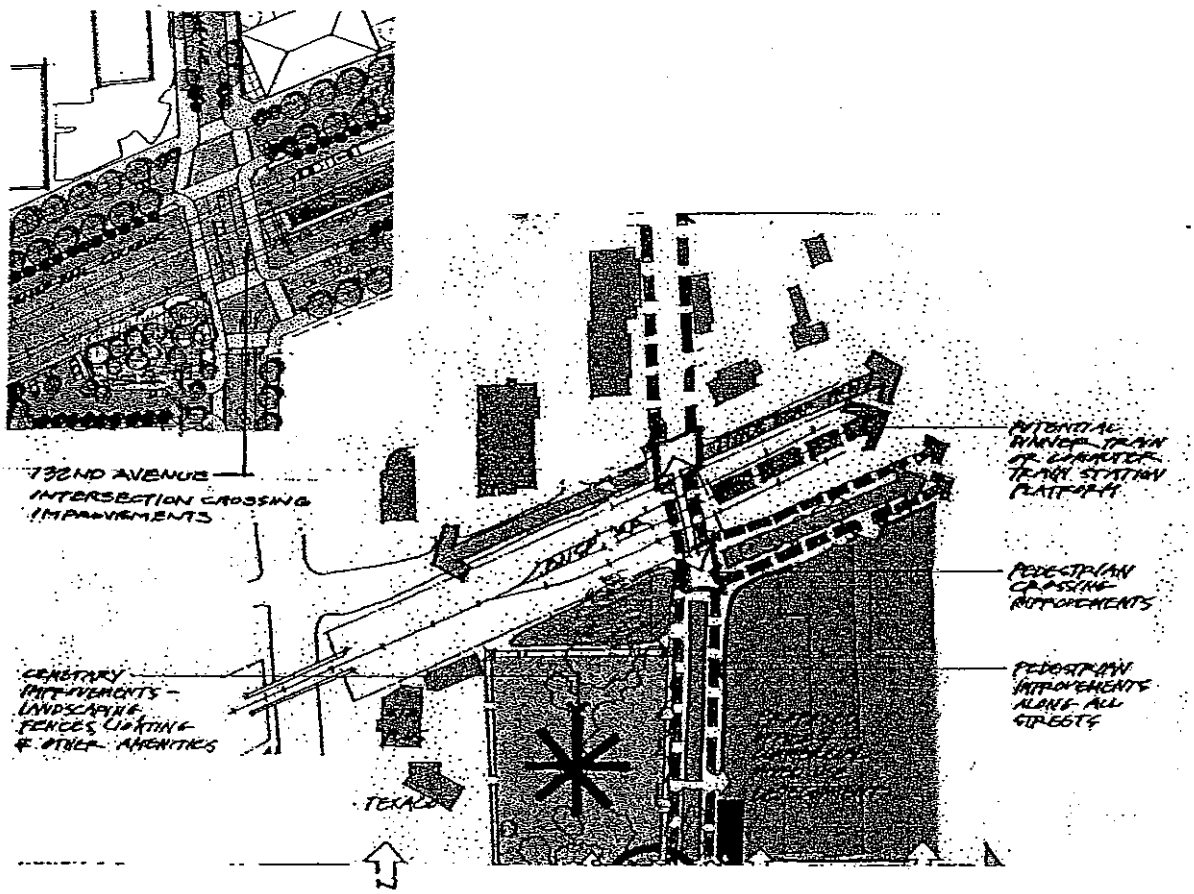
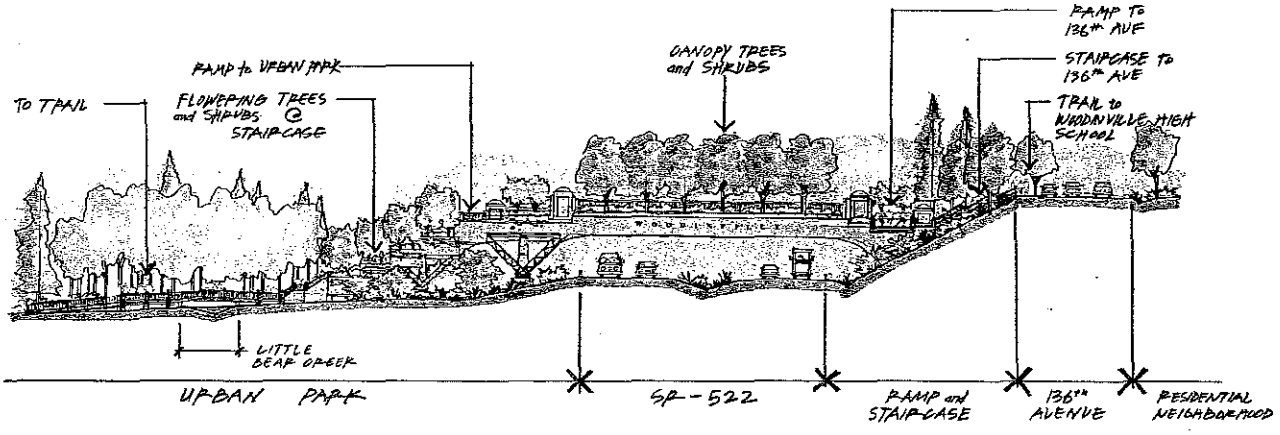


FIGURE 7

5.3 SR-522 Pedestrian/Bike Gateway Overpass

The SR-522 Pedestrian/Bicycle overpass will provide an important link in the trail system by providing an alternative route for people in the Wedge Neighborhood, regional trail system, downtown and employment centers. It will also provide a safe, non-motorized connection between downtown and other residential neighborhoods to the Rotary Community Park and Woodinville High School.

Looking South



The pedestrian/bicycle overpass will connect to the area of 186th street and 136th Avenue NE in the Wedge Neighborhood and span SR-522 to a connection on the east side of SR-522 and west side of Little Bear Creek at approximately the 141st block. From this point, users may access Little Bear Creek Linear Park and Little Bear Creek Parkway. The overpass can be designed to provide a pleasant pedestrian experience with planters, landscaping and other architectural features. From the perspective of a motorist on SR-522, this bridge can be an important "gateway" symbol of the City. The design of the bridge can take advantage of this opportunity with attractive features and signage. Conceptual views of the overpass are shown on page 54.

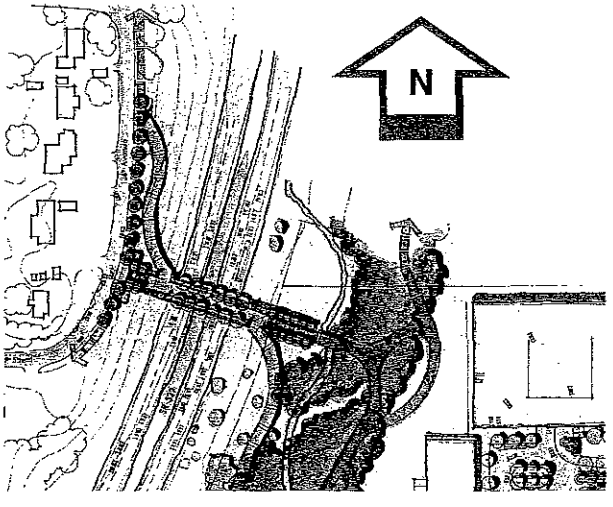


FIGURE 8