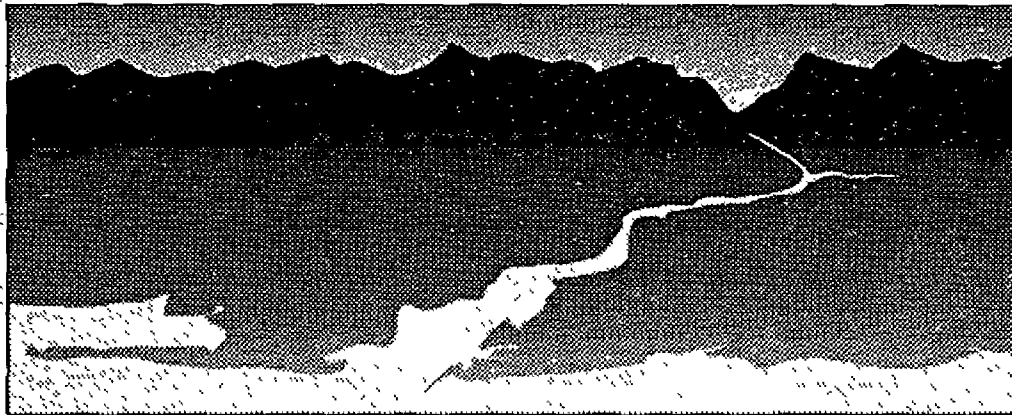

**FINAL REPORT
VOLUME 1: REPORT AND APPENDICES**

LOWER COLUMBIA RIVER



BI-STATE PROGRAM

**RECONNAISSANCE
SURVEY OF THE LOWER
COLUMBIA RIVER**

**TASK 5: BENEFICIAL USE DESCRIPTIONS
AND LOCATIONS**

APRIL 1992

Prepared By:

TETRA TECH

In Association With:

**DAVID EVANS & ASSOCIATES
EVS CONSULTANTS**

TETRA TECH

**TC 8526-05
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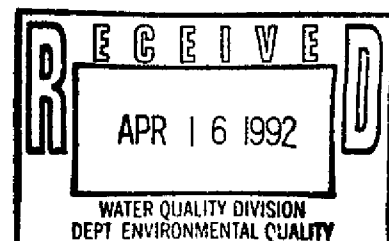
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VOLUME 1

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1.0 INTRODUCTION

1.1 THE BI-STATE PROGRAM

The Lower Columbia River Bi-State Water Quality Program (Bi-State Program) was established to assess the ecological health of the lower Columbia River from the mouth to Bonneville Dam [River Mile (RM) 146] (see Figure 1). The legislatures of Oregon and Washington developed an Interstate Agreement that directs a 4-year water quality characterization program. The goals of the Bi-State Program for managing the lower Columbia River are.

- To identify water quality problems;
- To determine if beneficial/characteristic uses are impaired,
- To develop solutions to problems; and
- To make recommendations on a long term Bi-State framework.

The objective of the first year studies is to establish the technical framework for determining the existing water quality and biological health of the lower Columbia River. This technical framework, designated as the Reconnaissance Survey of the Lower Columbia River, will serve as the basis for directing further study efforts.

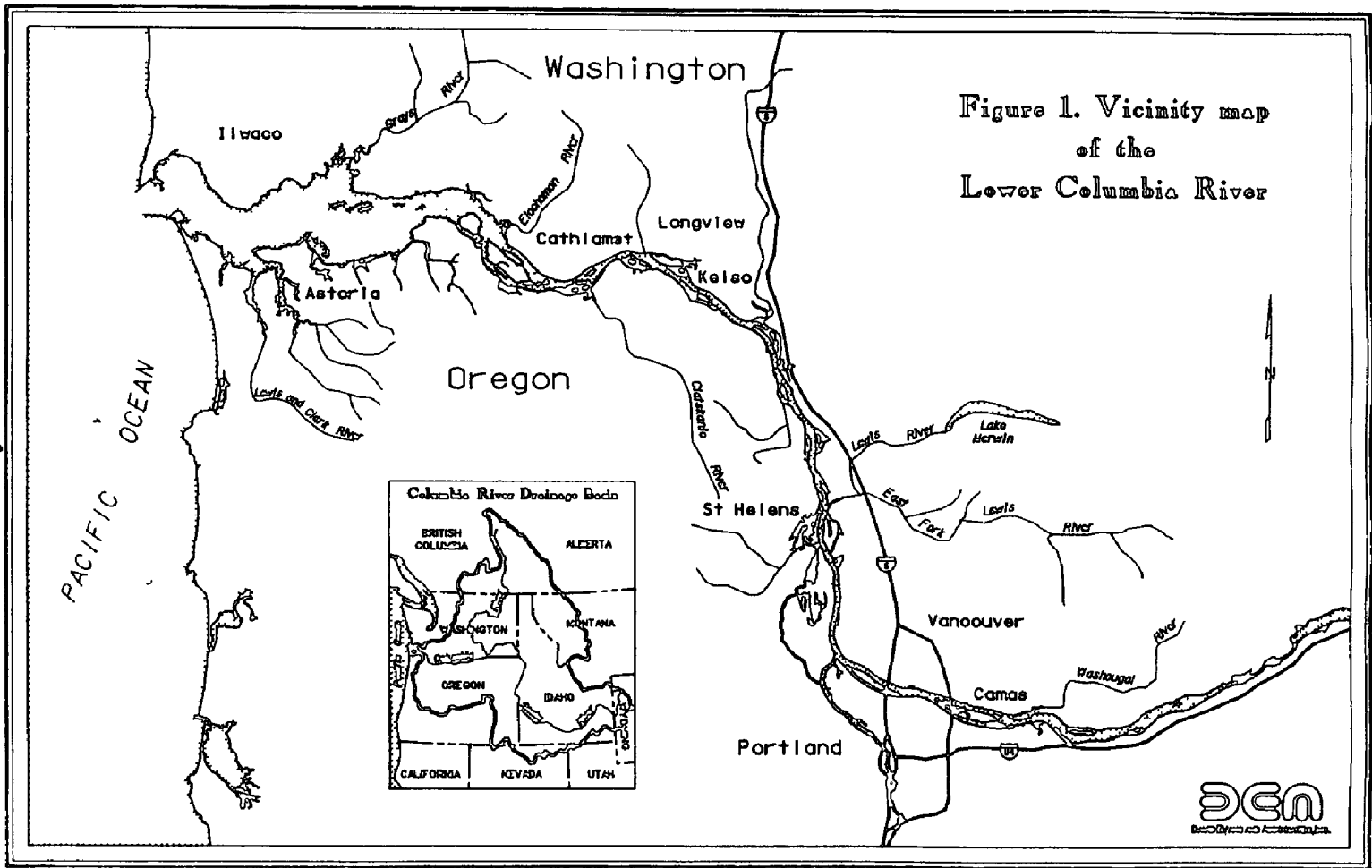
1.2 RELATIONSHIP OF TASKS

In order to complete the first year's work, the Reconnaissance Survey of the Lower Columbia River is divided into seven tasks:

- Task 1: Existing Data Review;
- Task 2: Pollution Sources;
- Task 3. Hydrologic and Physical Characterization;
- Task 4: Biological Characterization;
- Task 5: Beneficial Uses;
- Task 6: Screening Survey; and
- Task 7: Technical Framework and Recommendations.

Work on all tasks was concurrent and interdependent. Teams were established for each Task. In the initial stages all Task teams worked jointly to ensure the identification and collection of all relevant materials. Information was funneled into Task one, where the project database was developed. The Task one team then became the resource for data needed in the other Tasks. Tasks 2,3,4 and 5 required close coordination during GIS mapping. Correlations between beneficial uses and pollution loading areas were analyzed and used in the preparation of the sampling plan of Task 6. All Tasks will ultimately be compiled into Task 7.

Figure 1. Vicinity map
of the
Lower Columbia River



1.3 TASK 5 OBJECTIVES

The objective of Task 5 is to define, describe, and locate in consistent terms the beneficial and characteristic uses of the study area. The four subtasks associated with Task 5 include

1. Development of a work plan,
2. Definition of uses;
3. Use descriptions and locations; and
4. Final compilation report

Each of the subtasks result in work products. The Bi-State committee has approved the first two subtasks products, the work plan and the definition of uses. This report amplifies the definition of uses by presenting detailed use descriptions and locations. Information pertinent to understanding the use occurrence, extent, frequency or concentration, user group involvement, seasonality, and sensitivity to water quality changes are presented if the information was found in the literature. The conclusion of this report presents a discussion of data gaps, data quality, and recommendations for additional data collection and analysis.

2.0 PROCESS

The process used for accomplishing Task 5 required the following six steps to identify and map beneficial and characteristic uses:

1. Development of use definitions,
2. Literature search,
3. Agency and organization interviews,
4. Detailed description of uses;
5. Geographic Information System (GIS) mapping; and
6. Identify data gaps and make recommendations.

2.1 DEVELOPMENT OF USE DEFINITIONS

The identification of beneficial uses is critical to the development of a comprehensive understanding of the lower Columbia River system. The surface waters of the River are used for many purposes, all of which require a degree of quality appropriate to the use. Provisions have been established in both Washington and Oregon to ensure the conformance to water quality criteria for reasonable uses of surface waters.

Oregon Administrative Rules issued through the Department of Environmental Quality (DEQ) have established Water Quality Standards to manage and protect beneficial uses in the Lower Columbia River Basin for three separate reaches of the River.

The Washington Department of Ecology (WDOE) classifies surface waters based on water quality and characteristic uses. The lower Columbia River is classified as "Class A" (excellent). Water quality must meet or exceed the requirements for the specific characteristic uses associated with the Class A criteria.

Beneficial/characteristic uses from both states have been compiled and organized into the five main groupings for the Bi-State Program: 1) Water Supply, 2) Agricultural, 3) Fish/Wildlife Habitat, 4) Recreation, and 5) Commercial. Definitions are based on a synthesis of Oregon Administrative Rules (Chapter 340, Division 41, Sections 202, 424 and 482 including the proposed amendments) for the North Coast-Lower Columbia River Basin, and proposed Washington Administrative Code (Chapter 173-203) uses as established in Draft Surface Water Quality Standards. Categories of use overlap, for example fish and wildlife use often coincides with recreational uses and water supply. These areas may assume a greater importance in the overall system because of their multi-use characteristics. After mapping, the analysis of beneficial uses examines the relationships between the various use categories in the context of water quality standards, cumulative impacts, and limitations of the resource. A complete listing of Oregon and Washington uses, as well as the rationale for grouping of uses for the Bi-State Program are presented in the previous work product. The specific uses contained in each of these five groupings are listed in Table 1.

TABLE 1. BENEFICIAL USE DESCRIPTIONS FOR THE LOWER COLUMBIA RIVER

<p>1.</p>	<p>Water Supply:</p> <ul style="list-style-type: none"> <input type="checkbox"/> All domestic water supply systems including private wells, small private water systems, PUD and municipal public systems, Indian withdrawal rights, and other surface water extractions used for domestic supply, and <input type="checkbox"/> Industrial supply including direct withdrawals for manufacturing, processing, or other industrial activity
<p>2.</p>	<p>Agricultural:</p> <ul style="list-style-type: none"> <input type="checkbox"/> All private or public withdrawals for the purpose of irrigating agricultural crops, orchards, or public lands; <input type="checkbox"/> All withdrawals for the purpose of supplying water to commercial livestock operations; and <input type="checkbox"/> Areas of concentrated withdrawals by private landowners to supply livestock.
<p>3.</p>	<p>Fish/Wildlife:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Protection of Fish and Wildlife throughout the system <input type="checkbox"/> Areas supporting anadromous fish passage, salmonid fish rearing, salmonid fish spawning, resident fish, and aquatic wildlife use including national and state refuges, <input type="checkbox"/> Significant riparian habitats, such as backwater marshes and island nesting areas; and <input type="checkbox"/> Unique marine or freshwater habitats, and Natural Heritage Sites.
<p>4.</p>	<p>Recreation:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Hunting, fishing, and boating, <input type="checkbox"/> Primary contact recreation, in general where contact with the water submergence such as skin diving, swimming, water skiing, jet skiing, and wind surfing; <input type="checkbox"/> Secondary contact recreation, in general where water contact is limited, such as wading or fishing; and <input type="checkbox"/> Aesthetic quality where senses are involved (i.e., scenic overlooks, unique botanical areas, birdwatching areas)
<p>5.</p>	<p>Commercial:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Hydropower production; <input type="checkbox"/> Navigation and transportation, <input type="checkbox"/> Marinas and other commercial activities associated with the River; and <input type="checkbox"/> Commercial fisheries

2.2 LITERATURE SEARCH

A literature search was initiated based on the studies identified in the 1990 McConnell report as provided through Task 1. Additional materials were obtained from municipal, university and agency libraries. Documents were reviewed and used to pursue other primary sources of documentation. The Scientific Resource Panel and information provided by the Bi-State Steering Committee served as additional sources of information. All documents are listed in Section 5.0 - References and have been entered into the project computerized database.

Although bibliographic references are numerous on the Columbia River, there is no specific documentation of beneficial uses. Forty-one documents were reviewed and are cited in this report.

2.3 AGENCY AND ORGANIZATION INTERVIEWS

To supplement the literature review and to provide comprehensive identification and knowledge of beneficial uses, telephone and personal interviews were conducted with a variety of organizations, special districts, individuals and federal, state and local agencies. Much of the information is not documented in the literature, but is anecdotal from personal files and professional observations of the people interviewed. To ensure consistency and thorough data collection, questionnaires and/or survey forms were developed for use in interviews (Appendix A). The purpose of these forms is to gather comparative data and is not meant to be a statistical sampling.

Telephone interviews were conducted. Questions asked centered around knowledge of beneficial uses, the location of the use, frequency or seasonality, who or what is involved in the use, and sensitivity of the uses to changes in water quality. Contacts are listed in Appendix B.

2.4 DETAILED DESCRIPTION OF USES

Identified beneficial uses were compiled into narrative descriptions supported with tables, literature citations, and GIS maps. Each of the uses are described, based on available information, using the elements listed below:

- Where each use occurs or has the most concentrated activity;
- The frequency of the use;
- Who or what is involved in the uses,
- Seasons in which the use occurs,
- Sensitivity of the use to changes in water quality; and
- Past, present and projected use trends.

Beneficial and characteristic uses were found to be more qualitative than quantitative. Where specific, well-documented quantitative data are available, the actual use numbers are reported. However, where data are relative, undocumented and/or estimates, qualitative descriptions are used (e.g. low, moderate, high). Rationale for segregating data into descriptive ratings are described when applicable in each of the beneficial use sections.

Each identified beneficial use is reported by River Mile (RM) and is mapped using ARC/INFO GIS. Tabular information has been entered into ASCII files for integration into GIS.

2.5 GIS MAPPING

Collected and mapped beneficial use information is intended to be used to identify areas for the sampling plan of Task 6. Beneficial uses have been located on the lower Columbia River base map using GIS. Several layers of information were created to provide geographic analysis of other data layers. Where applicable, beneficial uses have been mapped as category groupings to provide a clear and concise report. The overlay method facilitates data analysis and assesses cumulative impacts of overlapping uses.

The methods used to digitize and enter data into GIS conform to published standards. The base map for the Columbia River, which is needed for all Tasks, was acquired from the DEQ and compiled according to Oregon State Map Advisory Council Digital Spatial Standards and Procedures (DSSP). Data entry and quality control procedures followed the standards described by the DSSP.

Beneficial use information will be compared with identified pollution sources (Task 2) to allow analysis of water quality sensitivity and adverse effects on each type of use. Five sets of overlay maps of beneficial uses and pollution sources are presented in the report. The study area is divided into four sections (A,B,C, and D), covering 146 miles. Map A covers RM 0 to RM 40, B covers RM 40 to RM 77; C covers RM 77 to RM 110; and D covers RM 110 to RM 146. GIS data file specifications are compatible with Oregon and Washington systems and are provided in printed and digital formats.

2.6 CONCLUSIONS AND RECOMMENDATIONS

The last section of this report provides an analysis of the information found during the process, identifies data gaps; makes recommendations for future studies; and suggests water quality sampling points for Task 6.

3.0 BENEFICIAL USE 1 - WATER SUPPLY

3.1 METHODOLOGY

Water is withdrawn from both surface sources and wells along the Columbia River for a variety of domestic and commercial/industrial uses. These withdrawals provide water supply for single domestic users, multiple domestic users, public utility districts, municipalities, and commercial/industrial users. In Oregon, those users of surface waters of the Columbia who use over 0 005 cubic feet per second (2.25 GPM) are required to have a permit from the state. The State of Washington has a permitting system for all withdrawals in the lower Columbia. Permit information was obtained from the Oregon Water Resources Department (1991) and the Washington Department of Ecology (1991). Information includes use type, withdrawal rate, total annual withdrawal amount, source type and location. Inconsistencies exist in individual permits and in available permit information of the two states. All information was reviewed, verified where possible, and converted into comparable units for use in this discussion (see Table 2). Some permits list annual withdrawal rates, others do not. All permits list instantaneous rates i.e., those allowable at any one time. For consistency, the instantaneous rates were used in Table 2. The permits show the allowable levels of extraction, but may not be the actual amounts withdrawn. This section presents the known extractions as permitted and results in a general pattern of water use, concentrations, and rates is established using the permit database.

Surface locations (indicated by permit numbers beginning S and S2) include withdrawal points located in or along the mainstem of the Columbia River, as well as other non-mainstem waters such as sloughs that may be hydrologically affected by upstream water passage and downstream tidal mixing. Surface locations in low-lying lakes in the study area are also included when it is likely that they are influenced by river water and associated groundwater during high water periods. Withdrawals from wells, or groundwater (indicated by permit numbers beginning G, GR, and G2), along the River were evaluated where the well location is in proximity to the River or topography suggests that the well is influenced by river water or associated groundwater. The permitted users listed on Table 2 are shown on Figures 2A through 2D (Volume 2). Information on the actual location of sources is imprecise. Some locations were reported simply by township section, consequently, withdrawal river mile locations are approximate.

A total of 564,921.5 gallons per minute (GPM) of water is withdrawn from surface sources and wells in the basin. Approximately fifty-five percent (311,438 GPM) is withdrawn from surface sources and the remaining forty-five percent (253,483.5 GPM) from wells.

3.2 DOMESTIC USES

Domestic uses include water extracted for private, public or municipal uses. Permit data received from state agencies were grouped into four categories:

- 1) Domestic General--an unspecified general use category
- 2) Domestic Single--generally a private well system withdrawing for a single residence

Table 2

Water Supply Use Along the Lower Columbia River

Start River Mile (RM)	End River Mile (RM)	Map ID#	Permit No.	State	User Name	Withdrawal Use*	Withdrawal Type	Withdrawal Rate** (Instantaneous GPM)
19	20	107	S-48258	OR		Dom/Ind	Surface	2 25
19	20	107	S-48225	OR		Dom/Ind	Surface	2 25
32	33	73	G2-24860C	WA	Wahkiakum Co	Dom Multiple	Well	18 00
32	33	74	G2-25927G	WA	Wahkiakum Co	Dom Multiple	Well	38 00
32	33	10	S2-19407C	WA	L Cook	Dom Single	Surface	4 50
32	33	10	S2-20836C	WA	Central Skamokawa	Dom/Com/Ind/Fire	Surface	324 00
32	33	11	S2-27195A	WA	Martha Boentgen	Dom Multiple/Fire	Surface	18 00
32	33	14	S2-27283A	WA	Eibert Fredncks	Dom Single	Surface	9 00
33	34	12	S2-18335C	WA	C.A Littleton	Dom Multiple	Surface	27 00
33	34	12	S2-2299C	WA	Anderson/Hayes	Dom Multiple	Surface	63 00
33	34	13	S2-21109CBL	WA	Maddens Water District	Dom Multiple	Surface	90 00
33	34	13	S2-22877C	WA	Carl Seaberg	Dom Single	Surface	9 00
41	42	13	GR-250	OR	Maddens Water District	Com/Ind	Well	400 00
42	43	108	S-30138	OR	Crown Zellerback	Com/Ind	Surface	70,200 00
54	55	106	S-41506	OR	Portland G.E	Fire	Surface	1,485 00
58	59	7	S2-23221C	WA	Neil Scott	Dom Multiple	Surface	9 00
58	59	8	S2-23249C	WA	Orvil Schweikhardt	Dom Single	Surface	9 00
58	59	9	S2-23201C	WA	Howard Rice	Dom Single	Surface	22 50
62	63	72	G2-08309C	WA	Reynolds Metal Co	Com/Ind	Well	2,500 00
62	63	72	G2-08367C	WA	Reynolds Metal Co	Com/Ind	Well	3,000 00
62	63	72	G2-09127C	WA	Reynolds Metal Co	Com/Ind	Well	2,150 00
63	64	70	G2-00185S	WA	Weyerhaeuser	Com/Ind	Well	700 00
63	64	70	G2-05006C	WA	Weyerhaeuser	Com/Ind	Well	200 00
63	64	70	G2-06343C	WA	Weyerhaeuser	Com/Ind	Well	2,000 00
63	64	71	G2-21657C	WA	Weyerhaeuser	Com/Ind	Well	1,000 00
63	64	71	G2-03517C	WA	Weyerhaeuser	Com/Ind	Well	450 00
63	64	5	S2-07062C	WA	Weyerhaeuser	Com/Ind	Surface	20,250 00
63	64	5	S2-25806C	WA	City of Longview	Municipal	Surface	999 00
63	64	5	S2-08656C	WA	Weyerhaeuser	Com/Ind	Surface	15,750 00
63	64	5	S2-15106C	WA	Weyerhaeuser	Com/Ind	Surface	33,750 00
63	64	6	S2-00269C	WA	Weyerhaeuser	Com/Ind	Surface	13,050 00
67	68	102	S-33386	OR	City of Rainier	Municipal	Surface	1,395 00
72	73	104	S-34940	OR	Portland G E.	Dom/Multi/Fire	Surface	360 00
72	73	109	G-11042	OR	Portland G E	Com/Ind	Well	675 00
81	82	101	S-30350	OR	Reichhold Chemical	Com/Ind	Surface	18,000 00
83	84	103	S-34529	OR	City of St. Helens	Municipal	Surface	1,575 00
102	103	60	G2-00180S	WA	Alcoa	Dom Multi/Heat Ex	Well	2,000 00
102	103	60	G2-00181S	WA	Alcoa	Fire	Well	850 00
102	103	60	G2-00182S	WA	Alcoa	Dom Multi/Heat Ex	Well	2,000 00
102	103	60	G2-00183S	WA	Alcoa	Dom Multi/Heat Ex	Well	2,000 00
102	103	60	G2-01093CAF	WA	Alcoa	Com/Ind	Well	500 00

Table 2

Water Supply Use Along the Lower Columbia River

Start River Mile (RM)	End River Mile (RM)	Map ID#	Permit No.	State	User Name	Withdrawal Use*	Withdrawal Type	Withdrawal Rate** (Instantaneous GPM)
102	103	60	G2-02313C	WA	Alcoa	Com/Ind	Well	2,000.00
102	103	60	G2-08839C	WA	Alcoa	Com/Ind	Well	450.00
102	103	60	G2-08840C	WA	Alcoa	Com/Ind	Well	700.00
103	104	61	G2-1093CBF	WA	Alcoa	Com/Ind	Well	1,500.00
103	104	61	G2-06486CBL	WA	Alcoa	Com/Ind	Well	4,700.00
103	104	61	G2-08825C	WA	Alcoa	Com/Ind	Well	500.00
103	104	61	G2-08832C	WA	Alcoa	Com/Ind	Well	1,500.00
103	104	62	G2-02934C	WA	Alcoa	Dom/Gen	Well	2,000.00
105	106	65	G2-00039S	WA	Great Western Malt	Com/Ind	Well	400.00
105	106	65	G2-00050C	WA	Great Western Malt	Com/Ind	Well	1,200.00
105	106	65	G2-07603A	WA	Vancouver Iron & Steel	Heat exchange	Well	75.00
105	106	65	G2-09016C	WA	Port of Vancouver	Com/Ind	Well	2,500.00
105	106	65	G2-01080C	WA	Port of Vancouver	Com/Ind	Well	2,500.00
105	106	65	G2-21495C	WA	Port of Vancouver	Com/Ind	Well	1,600.00
105	106	66	G2-26469C	WA	City of Vancouver	Dom/Gen	Well	1,350.00
105	106	110	G-1921	OR	Morrison Oil Co	Com/Ind	Well	99.00
105	106	111	G2731	OR	Crown Zellerback	Com/Ind	Well	2,648.00
105	106	112	G-5498	OR	City of Portland	Dom/Multi/Com/Ind	Well	2,002.50
106	107	63	G2-05451C	WA	Columbia River Paper	Com/Ind	Well	5,000.00
106	107	113	G2-22784C	WA	Boise Cascade Corp	Com/Ind	Well	10,000.00
106	107	2	S2-20937C	WA	Boise Cascade Corp	Com/Ind	Surface	225.00
106	107	114	G-5659	OR	City of Portland	Dom/Com/Ind	Well	2,002.50
107	108	67	G2-02392C	WA	Food Machinery & Chemical	Com/Ind	Well	8,000.00
107	108	67	G2-05623C	WA	Food Machinery & Chemical	Com/Ind/Heat Exchange	Well	8,000.00
108	109	68	G2-00452S	WA	City of Vancouver	Municipal	Well	2,500.00
108	109	68	G2-00454S	WA	City of Vancouver	Municipal	Well	2,400.00
108	109	68	G2-02303C	WA	City of Vancouver	Municipal	Well	1,000.00
108	109	68	G2-25359A	WA	City of Vancouver	Municipal	Well	2,000.00
108	109	68	G2-25365C	WA	City of Vancouver	Municipal	Well	800.00
108	109	68	G2-25366A	WA	City of Vancouver	Municipal	Well	2,000.00
108	109	68	G2-00455S	WA	USFHA	Municipal	Well	1,000.00
108	109	68	G2-00456S	WA	USFHA	Municipal	Well	1,000.00
108	109	68	G2-00457S	WA	USFHA	Municipal	Well	1,000.00
108	109	68	G2-00458S	WA	USFHA	Municipal	Well	1,000.00
108	109	68	G2-00453S	WA	USFHA	Municipal	Well	1,000.00
108	109	115	G-4884	OR	Columbia Edgewater C C	Municipal	Well	13.50
109	110	69	G2-20133C	WA	Protco Corp	Com/Ind	Well	75.00
109	110	69	G2-24567C	WA	Protco Corp	Com/Ind	Well	125.00
112	113	116	G-8755	OR	City of Portland	Municipal	Well	105,255.00
115	116	4	S2-06702C	WA	Smith Brothers	Com/Ind	Surface	900.00
118	119	117	G-8292	OR	City of Portland	Municipal	Well	202.50
118	119	118	G-10124	OR	City of Portland	Municipal	Well	29,997.00

Table 2

Water Supply Use Along the Lower Columbia River

Start River Mile (RM)	End River Mile (RM)	Map ID#	Permit No.	State	User Name	Withdrawal Use*	Withdrawal Type	Withdrawal Rate** (Instantaneous GPM)
118	119	119	G-10455	OR	City of Portland	Municipal	Well	7,515.00
118	119	120	G-1921	OR	West Interl. Water Corp	Municipal	Well	13.50
120	121	51	G2-00005C	WA	James River Corp	Com/Ind	Well	8,400.00
120	121	51	G2-00586S	WA	James River Corp	Com/Ind	Well	1,600.00
120	121	51	G2-00587S	WA	James River Corp	Com/Ind	Well	2,000.00
120	121	51	G2-00588S	WA	James River Corp	Com/Ind	Well	2,000.00
120	121	51	G2-02907PAL	WA	James River Corp	Com/Ind	Well	16,200.00
120	121	51	G2-04372C	WA	James River Corp	Com/Ind	Well	10,000.00
120	121	51	G2-06378C	WA	James River Corp	Com/Ind	Well	7,800.00
120	121	52	G2-00004C	WA	City of Camas	Municipal	Well	1,200.00
120	121	54	G2-05130C	WA	City of Camas	Municipal	Well	1,325.00
120	121	54	G2-09325C	WA	City of Camas	Municipal	Well	1,500.00
120	121	3	S2-00891C	WA	Crown Willamette Ind	Com/Ind/Fire	Surface	40,500.00
120	121	3	S2-03060C	WA	Willamette Paper	Com/Ind	Surface	22,500.00
120	121	3	S2-08040C	WA	James River Corp	Com/Ind	Surface	11,250.00
121	122	53	S2-02907PBL	WA	James River Corp	Municipal	Well	16,200.00
121	122	55	G2-00501C	WA	City of Camas	Municipal	Well	1,000.00
121	122	55	G2-24400C	WA	City of Camas	Municipal	Well	900.00
121	122	56	G2-25796C	WA	Burlington Northern	Municipal	Well	1,100.00
122	123	57	G2-11134C	WA	HB & HN Lackey	Dom Single	Infil Trench	12.00
122	123	57	G2-11437C	WA	J.C ET U Atchison	Dom Single	Well	35.00
123	124	58	G2-26638C	WA	Evergreen Forest Products	Com/Ind	Well	30.00
123	124	59	G27320A	WA	James River Corp	Com/Ind	Well	90.00
144	145	121	G-1231	OR	Corps of Engineers	Com/Ind	Well	500.00
144	145	122	G-3156	OR	Corps of Engineers	Municipal	Well	45.00
144	145	123	G3156	OR	Corps of Engineers	Com/Ind	Well	103.50

Total Instantaneous Withdrawals

564,921.50

- *Domestic Single = Dom Single
- Domestic Multiple = Dom Mutiple
- Domestic General = Dom General
- Commercial Industrial = Comm Ind
- Municipal = Municipal
- Fire = Fire
- Heat Exchange = Heat Ex

**Gallons per minute at any "instances" or "one-time" withdrawal

- 3) Domestic Multiple--surface or well water withdrawn for use by multiple residences
- 4) Domestic Municipal or municipal

However, there may be several additional domestic uses that are not reported in the existing permit system

A total of 13,446 GPM of water are withdrawn from private wells and systems for domestic single, domestic multiple, and domestic general uses. Approximately 97 percent is from wells and 3 percent from surface waters. Because these withdrawals are for residential use, it is likely that water is withdrawn daily and on a year-round basis. Since this water is used for human consumption, the sensitivity of this use to water quality changes of surface sources is assumed to be high, even though groundwater does not always exhibit the degraded characteristics of adjacent surface waters.

Approximately 185,936 GPM are withdrawn from surface sources and wells for domestic municipal water uses. Ninety-eight percent of this withdrawal is from wells. Permits for withdrawals from surface sources include the City of Rainier (1,395 GPM) and the City of St. Helens (1,575 GPM) between RM 67-68 and 83-84 respectively. The City of Rainier uses Columbia River water for domestic drinking water supply on a seasonal basis (summer and fall) and relies on water from tributaries the rest of the year (La Sollen 1991, personal communication). The City of St. Helens uses surface water as the primary potable source year round (Little 1991, personal communication). The City of Longview is permitted to withdraw 999 GPM annually from surface sources between RM 63 and 64. The City does not use Columbia River water for drinking water (Coplan 1991, personal communication).

The City of Vancouver, the largest Washington user, withdraws nearly 10,700 GPM from wells between river miles 108 and 109. The City of Portland is the largest user on the Oregon side, with permits to withdraw more than 100,000 GPM from wells between RM 110 and RM 120. Groundwater provides much of the City's drinking water (Anoushiravani 1991, personal communication). The second largest Washington user is the City of Camas, which withdraws approximately 5,925 GPM from wells between RM 120 and 122.

3.3 INDUSTRIAL USES

A significant amount of water from the lower Columbia River, approximately 362,169 GPM, withdrawn from wells and surface locations is used for industrial and commercial activities. Surface water supplies 246,375 GPM or 68 percent of the total and wells supply 115,794 GPM. Another 8,075 GPM is used by industry for heat exchange. No discharge information is available through the water use permit system. The effects of temperature change, water treatment, and volume of discharge are beyond the scope of this Task.

Crown Zellerbach is permitted to withdraw of 70,200 GPM from surface sources between RM 40 and RM 45. Two large industrial users withdraw at Longview between RM 62 and RM 65. Weyerhaeuser withdraws approximately 4,350 GPM from wells and 82,800 GPM from surface waters. The Reynolds Metals company withdraws 7,650 GPM from wells. Portland General Electric is permitted for withdrawal of 675 GPM from wells between RM 72 and RM 73.

Reichhold Chemical, Inc. withdraws approximately 18,000 GPM from surface sources between RM 81 and 82. ALCOA is a major withdrawer from wells (11,850 GPM) between RM 102 and 104. Numerous

other companies on the Washington side of the River near Vancouver, draw significantly from wells between RM 105 and RM 110, including Columbia River Paper, Boise Cascade Corporation, Great Western Malt, Portco Corporation, and Food Machinery and Chemical. The Port of Vancouver withdraws approximately 6,600 GPM from wells in this reach of the River for commercial and industrial use

Further upstream between RM 120-121, Willamette Industries withdraws 63,000 GPM and James River Corporation withdraws approximately 64,200 GPM. The U.S. Army Corps of Engineers is permitted to withdraw 604 GPM from wells near the Bonneville Dam for industrial use.

Withdrawals for commercial and industrial uses are assumed to occur daily and year-round. Because commercial/industrial uses requires water for non-consumptive purposes, their sensitivity to water quality is expected to be low to moderate. This is a subjective assumption since no investigation was made into the individual industry uses. Some manufacturing and commercial activities are very sensitive to changes in water quality depending on a number of variables. For example, Great Western Malt's sensitivity to water quality may be moderate if some water is used as a food product; however, their use of well water instead of river water, offers some water quality protection.

Several users including ALCOA (850 GPM), Crown Willamette Industries (202.5 GPM), and Portland General Electric Company (1,665 GPM) are permitted to withdraw water for emergency fire protection purposes. The James River is permitted to withdraw 400 GPM on an alternate permit basis. In most cases, water use for fire protection has not been reported on an annual basis, as this use is probably emergency use only. Water quality sensitivity for this use is presumed to be low.

3.4 OTHER EXTRACTIONS

There are undocumented extractions along the Oregon side of the River from non-adjudicated withdrawals. Such withdrawals include users with family histories of withdrawal preceding the present permitting and accounting system. Although the State of Oregon is in the process of completing the adjudication of water rights state-wide, the area bordering the Columbia River from the mouth to Bonneville Dam has not been completed. In addition, withdrawals of 0.005 cfs (2.25 GPM) or less can be made from wells for single residence use without needing permits (DeVyldere 1991, personal communication). No significant non-adjudicated water withdrawals are expected to occur on the Washington side of the River, since the present permit system already includes all long-standing withdrawals (Fox 1991, personal communication).

According to both the Oregon and Washington Water Rights Information Systems, no Native American Tribes currently withdraw water from the Columbia River. The Tribes believe they are not required to apply for withdrawal permits, although the issue is under consideration. The State of Oregon is currently negotiating with the Warm Springs and Umatilla Tribes regarding withdrawals from tributaries of the Columbia River. The outcome of this negotiation may affect the current situation of minimal accounting and regulation for Indian Nations (DeVyldere 1991, personal communication).

3.5 IMPLICATIONS

The water extraction permit systems for Washington and Oregon provides information on the allowable water use of both surface and well water in the lower Columbia River study area. The database informa-

tion is not consistent for all uses and provides limited detail, but can be used to indicate general patterns of use and potential sources of water quality problems. Table 3 lists the seventeen largest users in the region beginning at the upstream end of the study area. These users extract 92 percent (520,960 GPM) of total water supply used in this reach of the River. The three largest users, the City of Portland, Weyerhaeuser, and Crown Zellerbach all have associated potentially hazardous effluent discharges into the River. This does not imply that these users are in violation of NPDES permits. However, all seventeen users, and the three largest in particular, are upstream of both surface and well water potable water supplies. Changes in water quality could have significant adverse affects on downstream populations

TABLE 3. SIGNIFICANT WATER SUPPLY USERS

River Mile	User	Type of Supply	Volume (GPM)
RM 120-121	James River Corp	Surface	63,000
RM 120-121	Crown Willamette Ind	Surface	27,540
RM 120	City of Camas	Well (Municipal)	4,025
RM 120	James River	Well	26,200
RM 118	City of Portland	Well	37,715
RM 112	City of Portland	Well (Municipal)	105,255
RM 108	U.S.Fed. Housing Auth.	Well	5,000
RM 107	Food Machinery & Chemical	Well	16,000
RM 106	Boise Cascade	Well	10,225
RM 106	Columbia River Paper	Well	5,000
RM 105	Port of Vancouver	Well	6,600
RM 102	Alcoa	Well	20,700
RM 81	Reichhold Chemical	Surface	18,000
RM 63	Weyerhaeuser	Surface	87,150
RM 62	Reynolds Metals	Well	7,650
RM 42	Crown Zeilerbach	Surface	70,200
TOTALS			520,960
17 users	16% of total users	5 surface 12 wells	92% of total use

4.0 BENEFICIAL USE 2 - AGRICULTURE

4.1 METHODOLOGY

A report generated by the Oregon Department of Water Resources for this analysis identifies permitted irrigation points of withdrawal along the Columbia in the study area. The point locations, given by Section, Township, and Range, were plotted on 7.5 minute series U.S.G.S. topographic maps. The WDOE, Water Resources division supplied the same type of information for the Washington side of the River. Information included river mile, type of use, acreage, season, rate of withdrawal in cfs, and the user name or permit number. The information was tabulated into Table 4.

Agricultural lands are defined as those areas used for cropland, livestock, and general farming (both commercial and private). Agricultural uses along the lower Columbia are limited by access and topography. The agricultural immediately bordering the River area in the seven county region only occupies 7.7 percent the total land area. The estimated area of irrigated agricultural use in the study and is 4,051 acres. The general pattern of agricultural use is along the River's edge, on islands, and alluvial plains, often where tributary streams join the mainstem of the Columbia. Some orchards cover areas on steeper slopes above the River.

Two types of agricultural uses, irrigation and livestock, are permitted to draw surface water from the Columbia River. Based on state recorded water rights information there are 27 recorded diversion points along the Columbia River from the mouth to Bonneville Dam. Diversion points are summarized in Table 4 and shown on Figures 3A-3D (Volume 2). Diversion points only represent those agricultural uses that have permits to withdraw water and do not represent all agricultural uses.

4.2 IRRIGATION

The majority (94 percent) of the water diversion (17,730 GPM) is used to irrigate crops and orchards. Approximately 3,937 acres is irrigated. Sixteen irrigation diversion points are located on the Washington side of the River and seven on the Oregon side. The highest authorized instantaneous diversion rate on the Washington side is 2,668 GPM used to irrigate 750 acres at Bachelor Island Ranch between RM 87 and RM 88 in Clark County, south of confluence of the Columbia with the Lewis River (Oregon Water Resources Department 1991). The largest user on the Oregon side is Multnomah County Parks Service division between RM 117 and RM 118. The authorized rate of withdrawal is 15 cfs (6,750 GPM) to irrigate an estimated 1,200 acres. The maximum instantaneous rate of withdrawal at any one point in Oregon is 1/80th of one cfs (11 GPM) or an annual rate of 2.5 cfs per acre foot irrigated.

The Washington Water Rights Information System (WDOE 1991), and other secondary sources, provided no detailed information on the type of crops or the trend in water withdrawals for agricultural use within the study area. All of the irrigation users reported withdrawals during the annual growing season--approximately May 1 through September 30.

Table 4. Agricultural Uses

ID #	State	Start River Mi.	End River Mi.	Use	Acreage	Seasons in Use	Rate of Withdrawal		User/Permit No.
							(CFS)	(GPM)	
1951	WA	33	34	Irrigation	10	SpSu Wi Fa	0 18	81 0	Wahkiakum Co
1851	WA	40	41	Irrigation	365	Sp Su Wi Fa	2 00	900.0	Emrick, C.
1854	WA	40	41	Irrigation	100	Sp Su	2.00	900 0	Aegerter, J
1855	WA	40	41	Irrigation	0 5	Sp Su	0 01	4.5	Johnson, R M
1852	WA	41	42	Livestock	5 5	Sp Su Wi Fa	0 30	135 0	Phelan, M J
1853	WA	42	43	Irrigation	13 6	Sp Su	0 14	63 0	Tracy, H.
1752	WA	43	44	Irr/Livest.	*100	Sp Su Wi Fa	0.51	229 5	Kaste, W A
1753	WA	43	44	Irrigation	0 05	Su	0 01	4 5	Jacobsen, L J
1754	WA	43	44	Irrigation	1	Sp Su	0 02	9 0	Bowman, R J
1755	WA	43	44	Irrigation	0 6	Sp Su	0 01	4.5	Davis, J R & B A
1751	WA	44	45	Irrigation	17 5	Sp Su	0 35	157 5	Seaberg, C
1756	WA	44	45	Irrigation	0 5	Sp Su	0 03	13.5	Gabrielsen, G
1651	OR	55	56	Irrigation	*13	Sp Su	0 13	58 5	No. 23178
1551	WA	59	60	Irr/Livest	222 5	Sp Su Wi Fa	2 00	900 0	Youngquist, V A
1351	OR	72	73	Irrigation	*200	Sp Su	1.20	540 0	No 34940
1151	WA	83	84	Irrigation	50	Sp Su	0 50	225 0	Swett, E. E
1152	WA	83	84	Irrigation	35	Sp Su	0 67	301.5	Goeng, S L.
1051	WA	87	88	Irrigation	750	Sp Su Wi	5 93	2,668 5	Bachelor, Isl. Ranch
951	OR	98	99	Irrigation	*170	Sp Su	1 60	720.0	No. 41586
751	OR	114	115	Irrigation	*100	Sp Su	2 08	936 0	No. 50680
752	OR	114	115	Irrigation	*100	Sp Su Wi Fa	2.08	936 0	No 50680
652	OR	117	118	Irrigation	*1200	Sp Su	15 00	6,750 0	Multnomah Co Park
651	OR	118	119	Irrigation	*.5	Sp Su	0 05	22 5	No 50850
551	WA	121	122	Irrigation	0.5	Sp Su	0 04	18.0	Nevin, R
552	WA	127	128	Irrigation	220	Sp Su	2 50	1,125 0	Sampson, R R
151	WA	143	144	Irrigation	175	Sp Su	1 75	787 5	Foster, K G
152	WA	143	144	Irrigation	200	Sp Su	1 11	499.5	Pierce, L H
Totals					4050.75		42 20	18,990 0	

* = Estimate information not provided for Oregon

4.3 LIVESTOCK

Four water rights permits are issued for livestock watering. Three of the four also indicate crop irrigation withdrawal rights and are on Puget Island on the Washington side of the River, between RM 40 and RM 44 . The fourth is on an island at RM 60 adjacent to Coal Creek Slough. Only 1,260 GPM are designated for use by livestock on 114 acres of the lower Columbia River study area . Water withdrawals for livestock are year round

4.4 IMPLICATIONS

Degraded water quality of the Columbia River could potentially affect agricultural activities. Surface water used for crop irrigation and livestock watering should contain only trace levels of contaminants such as heavy metals, organic compounds, bacteria, or other substances that could potentially harm plants or animals through direct contact or bioaccumulation.

The three largest users of irrigation water supply, approximately 10,543 GPM, represent 55 percent of the total water used in this category. All three are downstream of Longview and Portland. There is no large concentration of users in the study area . The use of river water for agriculture is minimal in the study area, however, it has been estimated that 7 percent to 10 percent of the River's flow upstream is used for irrigation (Sherwood, et.al., 1990) and could affect downstream water quality. Typical problems associated with irrigation of agricultural lands in close proximity to waterbodies include soil erosion and excessive chemical applications entering the water from runoff or leaching into the water table. Some of the problems associated with livestock ranching include improper handling of animal waste, access to waterways by livestock, and poor pastures practices that cause erosion. Runoff from these areas can increase the nutrient levels or introduce contaminants into the waterway.

5.0 BENEFICIAL USE 3 - FISH AND WILDLIFE

5.1 METHODOLOGY

The diversity of fish and wildlife use of the Lower Columbia River system is well documented and has received more detailed study than any other use, however, many issues are left unanswered. Because of the vulnerability of species and habitats to degraded surface waters, fish and wildlife use is one of the most important uses related to water quality. The beneficial use is twofold, first the River provides important habitat for a wide variety of species, and second fish and wildlife habitat provide aesthetic, recreational, and commercial benefits to people. Documents, databases, research work, and interviews contributed the majority of information presented in this section.

Detailed scientific studies were initiated by the Columbia River Estuary Data Development Program (CREDDP) in 1990, and provide insight into many aspects of the estuary system. The database containing locations of fish use on the lower Columbia sponsored by CREDDP and published by Northwest Cartography (1984) was used to compile species use lists and habitat areas. Three major salinity zones are recognized in the literature: Plume and Ocean, Estuarine Mixing, and Tidal-Fluvial. A fourth zone, freshwater, exists upstream of the estuary and outside of the study area. The salinity zones (Figures 4A to 4D in Volume 2) also seem to be directly correlated to wildlife habitats and use. Wildlife users were mapped (Figures 5A to 5D in Volume 2) and concentrations analyzed.

Fish and wildlife species of special concern are categorized and protected by federal and state governments. There are three listing categories at the federal level: endangered (FE), threatened (FT), and candidate species (FC). Washington State has five listing categories: state endangered (SE), threatened (ST), sensitive (SS), candidate (SC), and monitor (SM). In addition, the Washington State Department of Wildlife (WDW) has compiled a list of "Priority Habitats and Species" (SP). The ODFW maintains a list of animal species of concern within its Natural Heritage Program database. These species are noted in the appropriate section.

5.2 FISHES

More than 92 fish species and 57 aquatic invertebrate species are known to inhabit the lower Columbia River during some part of their life cycle. The largest number of fish occur in the estuarine mixing zone, between RM 8 and RM 20 indicating the importance of this zone (Simendstad, et.al., 1990). Several scientific studies have shown that maximum production and consumption occurs in the estuarine mixing zone and have termed it "turbidity maximum". The lower Columbia is a physically energetic system of river discharge and tidal exchange that results in variations in conditions suited to a diversity of species populations. Fish populations fluctuate dynamically as a function of behavioral activities (feeding, resting, reproduction) and estuarine conditions (salinity, water clarity, temperature). Fish use is directly correlated to salinity gradient and prey distribution/abundance.

Several authors have defined habitat regions in the lower Columbia River. There is inconclusive evidence on the exact location of tidal influence, salinity changes, and sediment transport, and indeed, these locations change yearly or seasonally further complicating an exact definition and location of changes. (River miles are approximate and used for general reference) Four general salinity regions are discussed in most of the literature

Plume-Ocean (P) - (RM 0-6) This is the zone at the entrance to the River that has the highest proportion of ocean water and the highest salinities in the River. Suspended sediment is usually lower than in areas where turbid river water is more influential.

Estuarine Mixing (E) - (RM 6-20) This zone is a complex region where saltwater from the incoming tides interacts and mixes with freshwater from upriver. This region is the most productive, has the highest concentration of suspended sediments, and the greatest diversity of biological species. This is the area where the "turbidity maximum" or zone of maximum suspended particulate materials moves up and down river is a continual mixing of sediment, detritus matter, and organisms.

Tidal-Fluvial (T) - (RM 20-46) This is a freshwater zone subject to tidal currents and the resulting fluctuating water depths. The downstream boundary with the Estuarine Mixing zone changes with the seasons. The upstream boundary with totally Freshwater varies with the concentration of suspended river sediments.

Freshwater (F) - (RM 46-146) This zone is all freshwater from upriver and varies with the season and flows in the River.

Fish use within these regions has received significant study, but is by no means complete. Fish use in salinity zones is based on parameters such as the biological supply of specific food sources, depth of the water, temperature, vegetation, suspended solids, bottom conditions, and other factors. Fish species have been grouped into four general assemblages (Simenstad, 1990) associated with the duration of time spent in the estuary: marine, anadromous, estuarine, and freshwater.

Marine fishes survive in saltwater environments. Some marine species spend most of their life in the oceans and only use the estuary for a part of their life cycles. Others spend their entire life in the estuary and brackish water areas of the estuary mixing zone. The lower Columbia River estuary is less saline than many other estuaries, resulting in fewer exclusively marine species. Many of the marine species are more tolerant of freshwater and can relocate if freshwater intrusion becomes too great. Many species move in and out of the estuary with the tides.

Anadromous fish use the lower Columbia River system for seasonal access, spawning and/or rearing. Anadromous adult fish migrate from the ocean into the estuary and upstream into the freshwater tributaries to spawn. Hatched young fish remain in freshwater for a period of time (depending on species and race), then head downstream into the estuary, where they may pause to feed and adjust to the saltwater. The young then migrate to the ocean and as adults, return again to the River to spawn and die. Eleven known anadromous fish species, both salmonids and non-salmonids, inhabit the study area. Salmonids are further identified in the literature by runs, stocks, and races. These sub-categories are considered separate and identifiable populations, with characteristic physical or behavioral traits. Detailed information on selected populations are given in Appendix B. A salmon run is defined by the season when adults enter natal rivers to spawn (e.g., spring chinook).

Estuarine fish can be both marine and freshwater that spend the majority of their life in the estuary. These species are more tolerant of changes in salinity and fluctuating tidal influences.

Freshwater fish species live exclusively in freshwater habitats, but many may tolerate areas of more brackish water within the estuary, bays and tributaries affected by saltwater.

Table 5 lists the dominant fish species using the lower Columbia River estuary, the season of use, the distribution zone, and other information.

Eight fish are listed as threatened, endangered, priority, or monitored federal and state species

sandroller	SM
Dolly Varden trout	SP
rainbow/steelhead trout	SP
searun/coastal resident cutthroat trout	SP
Snake River sockeye	FE
Snake River fall chinook	FT
Snake River summer/spring chinook	FT

No fish are currently listed by Washington State as Endangered, Threatened, or Sensitive (Lea Knudson 1991, personal communication). Currently, the sandroller, a small trout perch, is the only state listed (SM) fish species within the lower Columbia River system (WDW 1991). This species is confined to the Columbia River system and its tributaries, and is usually found east of the Cowlitz River. One specimen was collected at Horseshoe Island Slough, near RM 25 (Wydoski 1975). The sandroller prefers quiet backwaters with adequate cover features such as undercut banks, submerged tree roots, and debris.

5.3 AQUATIC INVERTEBRATES

Aquatic invertebrates of the Columbia River estuary are fairly well documented. Simenstad et. al. (1984) identifies more than 28 species of epibenthic invertebrates, and more than 17 species of benthic infauna that use habitats within the estuary. Haertel and Osterberg (1967) sampled the estuary area for 21 months and identified over 71 species of invertebrates. Monaco et. al. (1990) lists spatial distribution, temporal distribution, and relative abundance for invertebrate and fish species of the estuary. The CREDDP studies quantified and mapped distributions of invertebrates in 1984.

The most important factor in the distribution of invertebrates is salinity. The average salinity in the estuary is less important than the extremes of high and low salinity (CREDDP, 1990). Species cannot live very long if their tolerance is exceeded. Invertebrates consume detrital materials and single-celled plants and organisms too small for consumption by vertebrates. Invertebrates can be carnivores, preying on smaller species, detritivores, and herbivores. The invertebrates provide the primary production and all of the particulate detritus in the estuary that would otherwise be useless to vertebrates. Invertebrates can be identified by three general habitats. Organisms living in the water column are called zooplankton. The invertebrates actually living within the sediment are known as benthic infauna. The zone at the surface of the sediment layer is a distinct region and supports the epibenthic organisms.

Dominant invertebrate species of the lower Columbia River are summarized in Table 6. Other known species of invertebrates, excluding zooplankton, are listed with references in Appendix B.

**Table 5
Dominant Fish Species**

Common Name	Assomblago	Threatened & Endangered	Seasonal Occurrence	Spawning	Rearing	Age (YR) Return	Wild or Hatchery	Distribution
Sandroller	F	yes	R	-	-	-		
Summer steelhead trout	A	yes	Sp Su Fa	WI SP	1-2 yrs	1-3	both	
Winter steelhead trout	A	yes	R	WI Sp	1 yr	2-3	both	
Searun cutthroat	A	yes	Sp Su Fa	-	-	-	wild	
Sockeye salmon	A	yes	Sp,Su	fall	> 1 yr	3-4	wild	P,E,T
Fall chinook salmon	A	yes	R	fall	< 1 yr	2-6	both	
Summer chinook salmon	A	yes	R	late fall	?	2-6	both	
Spring chinook salmon	A	yes	R	early fall	1 yr	2-6	both	
Coho salmon	A	no	W,Sp,Su	late fall	1 yr	1-3	90% H	P,E,T
Chum salmon	A	no	R	late fall	<6 months	3-5	both	
Pacific herring	M	no	R	summer	> 9 months	-	wild	P,E
Northern anchovy	M	no	R	none	none	-	wild	
Starry flounder	E	no	R	-	-	-	wild	P,E,T
English sole	E	no	R	none	< 6 months	-	wild	P,E
American shad	A	no	R	winter	< 6 months	-	wild	P,E,T
White sturgeon	E	no	R	spring	1 yr	> none	wild	E,T
Green sturgeon	E	no	Su	none	none	-	wild	
Big Skate	M		R				wild	P
Butter Sole	E		R				wild	P,E
Chum Salmon	A		W,Sp	late fall	1yr	2-6yrs	wild	P,E,T
Common Carp	F	no	R					P,E,T
Eulachon	A		W,Sp	late winter	<1yr	1-4yrs	wild	P,E,T
Largescale sucker	F		R	spring			wild	T
Lingcod	M		Sp,Su,Fa				wild	E
Longfin	A		R	winter/spring	<1yr	1-3yrs	wild	P,E,T
Northern squawfish	F	no	Su,Fa	summer			wild	T
Pacific Lamprey	A		W,Sp,Fa	summer	6 months	6-8yrs	wild	E,T
Pacific sand lance	M		R				wild	P,E
Pacific Stegorn sculpin	E	no	R	winter			wild	P,E,T
Pacific tomcod	E		R				wild	P,E
Peamouth	F	no	R	spring			wild	E,T
Prickly sculpin	F	no	R	spring			wild	E,T
Redtail surfperch			Sp, Su, Fa				wild	P,E
River lamprey	A	no	Sp,Su	spring			wild	P,E
Saddleback gunnel			R				wild	P,E
Sand Sole	E		R				wild	P,E
Shiner perch	E	no	R	summer			wild	P,E,T
Showy snailfish			R				wild	P,E
Snake prickleback	E		R				wild	P,E
Speckled sandab	E		R				wild	P,E
Spiny dogfish	M		Sp,Su,Fa				wild	P,E
Sportin surfperch	M		R				wild	P,E
Surf smelt	M		R				wild	P,E,T
Threespine stickleback	E	no	R	late fall			wild	P,E,T
Whitebat smelt	M	no	R	winter			wild	P,E
Brown bullhead	F	no	R	spring			wild	
White crappie	F	no	R	spring			wild	
Yellow perch	F	no	R	spring			wild	
Large mouth bass	F	no	R	spring			wild	
Small mouth bass	F	no	R	spring			wild	
Channel catfish	E,F	no	R	spring			wild	

Assemblage:

M = Marine
A = Anadranous
E = Estuarine
F = Freshwater

Seasonal:

Sp = Spring
Su = Summer
Fa = Fall
W = Winter
R = Resident

Distribution

P = Plume Ocean
E = Estuarine Mixing
T = Tidal -Flurial
F = Freshwater

TABLE 6. COMMON AQUATIC INVERTEBRATES OF THE LOWER COLUMBIA RIVER

Species	Salinity Zones
<i>Anisogammarus confervicolus</i>	PET
<i>Canuella canadensis</i>	PET
<i>Corbicula fluminea</i>	T
<i>Corbicula manilensis</i>	T
<i>Corophium salmonis</i>	ET
<i>Enchytraeus</i> sp	T
<i>Eohaustorius estuarius</i>	E
<i>Fluminicola virens</i>	ET
<i>Goniobasis plicifera</i>	ET
<i>Hobsonia florida</i>	E
<i>Hydrobia</i> sp.	T
<i>Macoma balthica</i>	PET
<i>Mesidotea entomon</i>	ET
<i>Mya arenaria</i> (eastern soft-shell clam)	E
<i>Mytilus edulis</i> (blue mussel)	P
<i>Neanthes limnicola</i>	PET
<i>Paraphoxus milleri</i>	PET
<i>Pseudopolydora kemp</i>	E
<i>Cancer magister</i> (Dungeness crab)	PET
<i>Crangon franciscorum</i> (sand shrimp)	PET
<i>Pacifastacus trowbridgi</i> (red crayfish)	TF

P=Plume and Ocean E=Estuarine Mixing T=Tidal Fluvial F=Freshwater

Several species of invertebrates are important to people as recreational and subsistence resources. These species (dungeness crab, clams, blue mussel, and shrimp) are generally limited to the lower end of the estuary, where salinity is the dominant factor controlling distribution. Some other species, like red crayfish, are found in freshwater environments as well as the Tidal-Fluvial estuary environments (Lilja, 1991, personal communication). Two invertebrate species, the giant Columbia River limpet and the Columbia River spire snail, are Washington SC Species. Oregon lists the limpet as a FC species.

5.4 WILDLIFE

More than 300 species of birds, amphibians, reptiles, marine mammals, and terrestrial mammals are known to occur in the lower Columbia River study area. The variety of food sources and habitats of the estuary and the River provide wildlife with the essentials of survival. Table 7 lists some of the most common wildlife and their sensitive status in the region.

5.4.1 Birds

The most abundant and diverse group of wildlife are birds. Birds are categorized into six general groups that depend on the estuary: shorebirds, gulls, waterfowl, diving birds, raptors, and wading birds. Other birds rely on the adjacent riparian and upland areas. Large numbers of birds are migratory, using the lower Columbia for resting, nesting, or feeding on their journeys to other areas. Factors that influence the abundance and distribution of birds include, seasons, availability of food, nesting patterns, and availability of habitat.

Riparian habitats are the major, and in some cases the only, breeding grounds for many of the avian species using the River. During the winter months riparian habitats, islands, and wetlands provide essential roosting and feeding grounds for a variety of birds. The region is in the Pacific Flyway and serves as resting and feeding grounds for a wide variety and great concentration (200,000) of migrating bird species (Tabor 1976). Where there are large concentrations of birds, or documented sightings of threatened and endangered species, the habitats are considered significant. The study area includes three national wildlife refuges, three state wildlife areas, nine state parks, and surrounding state forest lands. Critical breeding and nesting habitat for osprey, great blue heron, and bald eagles exist in the cottonwood/willow riparian areas. At least 12 great blue heron rookeries are within the study area. Mallards and Canada geese are the only known waterfowl to have brood sites along the lower Columbia River. A small breeding colony of Canada geese use Government Island (Tabor 1976).

5.4.2 Mammals

Three distinct classes of mammals inhabit the study area: marine, aquatic, and terrestrial. Each type has different habitat requirements for protective cover, breeding, and feeding. Three important marine mammals annually use the lower Columbia estuary: California Sea Lion, Northern Sea Lion, and harbor seals. The CREDDP study found four species of furbearing aquatic mammals are significant users of the estuary: nutria, muskrat, beaver, and river otter. Another furbearing terrestrial animal, the raccoon, is also common. Two species of deer are sited as significant: the rare and threatened Columbia White-tailed deer and the more common black-tailed deer.

TABLE 7 WILDLIFE SPECIES COMMON IN THE LOWER COLUMBIA RIVER

<p>Shorebirds snowy plover (SE) dunlin sanderling Western sandpiper sandhill crane (FS,SE) great blue heron (SM) black-crowned night heron</p>	<p>Upland birds turkey vulture (SM) Northern spotted owl (FE) marbled murrelet (FP) Lewis woodpecker tricolored blackbird Western yellow-billed cuckoo wildturkey purple martin (FS,SC) swallows chickadees sparrows kinglets wrens</p>
<p>Gulls glaucous-winged gull Western gull California gull</p>	<p>Marine Mammals Pacific harbor seals California sea lions Northern sea lions Northern elephant seal</p>
<p>Waterfowl mallard surf scoter common merganser tundra swan canada geese Western grebe double-crested cormorant common loon Barrow's goldeneye lesser scaup ring-necked duck Harlequin duck Brown Pelican (FE) cormorants</p>	<p>Terrestrial Mammals raccoon river otter nutria muskrat beaver white-footed vole gray-tailed vole fisher (SC) Townsend's big-eared bat Pacific fringe-tailed bat long-legger myotis (SM) big brown bat Columbia white-tailed deer (FE,SE) Black-tailed deer</p>
<p>Raptors bald eagle (FE,SE) osprey (SM) Peregrine falcon (FE,SE)</p>	<p>Amphibians painted turtle western pond turtle (ST) red-legger frog Cope's giant salamander spotted frog Oregon slender salamander Cascade frog Larch mountain salamander (FC,SC) Dunn's salamander (SC) Olympic salamander (SM) Leather back sea turtle (FE) Green sea turtle (FE) Loggerhead sea turtle (FE) Olive Ridley sea turtle (FE)</p>
<p>Insects Dun skipper (SM) Oregon silver spotted butterfly (FE)</p>	<p>Reptiles ring-necked snake (SM) California mountain kingsnake (SC)</p>

FE=federal endangered
ST=state threatened
FC=federal candidate

SE=state endangered
FP=federal proposed
SC=state candidate

FT=federal threatened
SM=state monitored

The lower Columbia provides necessary habitat for migrating marine mammals. Seals and Sea Lion migrate into the region to rest and feed on the abundant food. California Sea Lions and Northern Sea Lions use the South Jetty area for hauling out; this usually occurs in the spring with the heaviest concentrations in March. Few are observed in the fall or winter months. Harbour seals have been seen along the Columbia River up to Bonneville Dam, but are more typically observed in the Columbia River Estuary. The population fluctuates from about 500 in the summer to about 1500 in the winter (Fox, 1984). Seals forage primarily on eulachon, anchovy, and lamprey. Sculpin, tomcod, sole, flounder, prickleback, and herring appear to be year-round staples. In the past, seal and sea lion predation of gillnetted salmon have created problems.

Aquatic mammals inhabit the swamps and tidal marches surrounding the estuary. Marshes provide protective cover from other larger terrestrial predators, such as coyote. Tidal channels, that occur in nearly all tidal marshes and swamps, provide den sites, feeding sites, and transportation corridors for most of the key mammals of the estuary. Mink and river otter inhabit the shores of rivers, streams, lakes, ponds, and marshes, foraging primarily on cray fish, carp, and sculpin. These animals are found along the entire length of the study area, but are not particularly numerous in any one area.

Large terrestrial mammals are more numerous in upland areas than in the lower River estuary; however, deer frequent swampy areas. The White-tailed Deer prefer the Sitka spruce swamps on the Cathlamet Bay Islands, and on Welch, Puget, Hunting, Tenasillahe, and Price Islands upriver from Cathlamet Bay. Many other small terrestrial mammals (bats, mice, opossum, voles, moles) live throughout the lower Columbia study area, wherever suitable habitat exists.

5.5 SENSITIVE AND UNIQUE HABITATS

Several important sensitive and unique habitats have been preserved and protected as wildlife refuges and management areas. These include: the Lewis and Clark National Wildlife Refuge; the Julia Butler Hanson Wildlife Refuge for Columbia White-Tailed Deer; the Ridgefield National Wildlife Refuge; and the Sauvie Island Wildlife Management Area. More than a dozen state parks provide additional habitat for wildlife throughout the region. Table 8 lists information about these special areas.

Other unique and sensitive habitats exist along the River offering a diversity of environments for wildlife. Lakes, sloughs, shallow bays and the confluence of rivers and streams are particularly important to wildlife because they concentrate food and cover. Noteworthy among these are the Sandy River, Sturgeon Lake, Lower Columbia Slough, Bybee Lake, and Smith Lake.

5.6 IMPLICATIONS

A listing of the wildlife habitat users in the study area is shown on Table 9. The list is keyed by ID number to Figures 5A through 5D (Volume 2), and shows the variety of species, use by RM segment, season and frequency of use, and the habitat type preferred by the user. General categories of users are shown rather than individual species since the areas may be used by a number of individual species. Concentrations of species indicate the importance of the refuges in the region and the productivity of the estuary mixing zone in the distribution of wildlife.

TABLE 8. REFUGES AND MANAGEMENT AREAS

Area Name and Location	Characteristics	Value and Important Species
Lewis and Clark National Wildlife Refuge (RM 16-36) Oregon	35,000 acres, chain of estuary islands, mud flats, and tidal marsh	Habitat for migratory waterfowl and threatened and endangered species, Tundra Swans, osprey, great blue heron, harbor seal, sea lion, Columbia White-tailed deer, terrestrial mammals
Julia Butler Hanson Wildlife Refuge for the Columbia White-tailed Deer (RM 35-38) Washington	4,400 acres, combination of islands and shoreline covered in woodlands and grasslands, undisturbed natural environment	Established for the Columbia White-tailed deer, now habitat for other threatened and endangered species; great blue heron, bald eagle, osprey, terrestrial mammals
Ridgefield National Wildlife Refuge (RM 87-93) Washington	4,615 acres of marshes, grasslands, and woodlands, includes agricultural lands on Bachelor Island	Major habitat for migratory waterfowl and threatened and endangered species; 180 species of birds, great blue heron, Sandhill crane, painted turtle, terrestrial mammals
Sauvie Island Wildlife Management Area (RM 86-100) Oregon	12,000 acre island uplands, riparian areas, trees and shrubs, crops grown for wildlife	Major habitat for migratory waterfowl; Sandhill crane, great blue heron, ducks, geese, terrestrial mammals

Table 9
WILDLIFE HABITAT USERS

ID	START D	END RIV.M	RIV.M	WILDLIFE USER	HABITAT	USE OF HABITAT	USED IN SEASON	FREQUENCY OF USE	HABITAT DESCRIPTION
2899	2	3		WADING WATERFOWL	HF	HF	SP/FA/WI	SEASONAL	ROCKY CLIFFS W/ SHALLOW BAY
2899	2	3		DIVING BIRDS	B	B	ALL YEAR	ALL YEAR	ROCKY CLIFFS W/ SHALLOW BAY
2899	2	3		GULLS	BH	BH	SP/FA/WI	SEASONAL	ROCKY CLIFFS W/ SHALLOW BAY
2898	4	16		WADING WATERFOWL	BH	BH	SP/WI	SEASONAL	SHALLOW BAYS W/ TIDAL FLATS
2898	4	16		DIVING BIRDS	WF	WF	SU/FA/WI	SEASONAL	SHALLOW BAYS W/ TIDAL FLATS
2898	4	16		PEEPS	WF	WF	SP/FA/WI	SEASONAL	SHALLOW BAYS W/ TIDAL FLATS
2898	4	16		GULLS	B	B	SPRING	ANNUALLY	SHALLOW BAYS W/ TIDAL FLATS
2898	4	16		WADING BIRDS	B	B	SPRING	ANNUALLY	RIVER SHORE RIPARIAN AREAS
2898	4	16		TERRESTRIAL MAMMAL	BWFM	BWFM	ALL YEAR	ALL YEAR	RIVER SHORE RIPARIAN AREAS
2499	5	7		WADING WATERFOWL	BF	BF	SP/SU/FA	SEASONAL	SHALLOW BAYS W/ TIDAL FLATS
2499	5	7		DIVING BIRDS	BWF	BWF	ALL YEAR	ALL YEAR	SHALLOW BAYS W/ TIDAL FLATS
2499	5	7		PEEPS	F	F	FALL	ANNUALLY	SHALLOW BAYS W/ TIDAL FLATS
2499	5	7		TERRESTRIAL MAMMAL	BWFM	BWFM	SPRING	ALL YEAR	SHALLOW BAYS W/ TIDAL FLATS
2498	6	8		WADING WATERFOWL	F	F	WINTER	ANNUALLY	AQUATIC HABITATS
2498	6	8		MARINE MAMMALS	F	F	SUMMER	ANNUALLY	AQUATIC HABITATS
2494	8	9		WILD TURKEY	B	B	SPRING	ANNUALLY	MUD/TIDAL FLATS
2496	8	12		MARINE MAMMALS	B	B	ALL YEAR	ALL YEAR	MUD/TIDAL FLATS
2495	9	14		DIVING BIRDS	W	W	WINTER	ANNUALLY	SHALLOW BAYS W/ TIDAL FLATS
2495	9	14		PEEPS	F	F	SP/SU/FA	SEASONAL	SHALLOW BAYS W/ TIDAL FLATS
2495	9	14		GULLS	W	W	SP/FA/WI	SEASONAL	SHALLOW BAYS W/ TIDAL FLATS
2495	9	14		WADING BIRDS	F	F	SPRING	SEASONAL	RIVER SHORE RIPARIAN AREAS
2495	9	14		WADING BIRDS	B	B	SPRING	ANNUALLY	RIVER SHORE RIPARIAN AREAS
2495	9	14		BALD EAGLE/OSPREY/RAPTORS	F	F	ALL YEAR	ALL YEAR	SHALLOW BAYS W/ TIDAL FLATS
2495	9	14		TERRESTRIAL MAMMAL	BWFM	BWFM	ALL YEAR	ALL YEAR	RIVER SHORE RIPARIAN AREAS
2497	11	13		MARINE MAMMALS	F	F	ALL YEAR	ALL YEAR	AQUATIC HABITATS
2799	13	15		PEEPS	F	F	SP/FA/WI	SEASONAL	MUD/TIDAL FLATS
2799	13	15		GULLS	B	B	ALL YEAR	ALL YEAR	MUD/TIDAL FLATS
2799	13	15		WILD TURKEY	B	B	SPRING	ANNUALLY	MUD/TIDAL FLATS
2699	15	20		WADING WATERFOWL	F	F	SUMMER	SEASONAL	AQUATIC HABITATS
2699	15	20		DIVING BIRDS	BW	BW	SP/WI	SEASONAL	RIVER SHORE RIPARIAN AREAS
2699	15	20		BALD EAGLE/OSPREY/RAPTORS	BWF	BWF	ALL YEAR	ALL YEAR	RIVER SHORE RIPARIAN AREAS
2298	16	20		DIVING BIRDS	W	W	WINTER	ANNUALLY	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
2298	16	20		WADING BIRDS	W	W	WINTER	ANNUALLY	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
2298	16	20		BALD EAGLE/OSPREY/RAPTORS	BH	BH	SP/WI	SEASONAL	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
2299	16	36		WADING WATERFOWL	BWM	BWM	SP/FA/WI	SEASONAL	RIVER ISLANDS - MARSH/SWAMPS
2299	16	36		DIVING BIRDS	BWM	BWM	WINTER	SEASONAL	RIVER ISLANDS - MARSH/SWAMPS
2299	16	36		PEEPS	BF	BF	SPRING	SEASONAL	MUD/TIDAL FLATS
2299	16	36		GULLS	B	B	SPRING	SEASONAL	RIVER ISLANDS - MARSH/SWAMPS
2299	16	36		WADING BIRDS	B	B	SPRING	ANNUALLY	RIVER ISLANDS - MARSH/SWAMPS
2299	16	36		BALD EAGLE/OSPREY/RAPTORS	BW	BW	SP/WI	SEASONAL	RIVER ISLANDS - UPLAND
2299	16	36		MARINE MAMMALS	BW	BW	SU/WI	ANNUALLY	MUD/TIDAL FLATS

WILDLIFE HABITAT USERS

ID #	START RIV.M	END RIV.M	WILDLIFE HABITAT USER	USE OF HABITAT	USED IN SEASON	FREQUENCY OF USE	HABITAT DESCRIPTION
2299	16	36	TERRESTRIAL MAMMAL	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
2299	16	36	BAT	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
2299	16	36	OTHER BIRDS	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - UPLANDS W/ MARSH/SWAMP
2399	17	18	BALD EAGLE/OSPREY/RAPTORS	BW	ALL YEAR	SEASONAL	RIVER SHORE RIPARIAN AREAS
2399	17	18	MARINE MAMMALS	W	WINTER	ANNUALLY	MUD/TIDAL FLATS
2099	20	22	WADING WATERFOWL	BW	SP/FA/WI	SEASONAL	SHALLOW BAYS W/ TIDAL FLATS
2099	20	22	DIVING BIRDS	W	WINTER	ANNUALLY	SHALLOW BAYS W/ TIDAL FLATS
2099	20	22	PEEPS	W	WINTER	ANNUALLY	SHALLOW BAYS W/ TIDAL FLATS
2099	20	22	GULLS	W	FA/WI	SEASONAL	SHALLOW BAYS W/ TIDAL FLATS
2099	20	22	BALD EAGLE/OSPREY/RAPTORS	F	SP/SU/FA	SEASONAL	SHALLOW BAYS W/ TIDAL FLATS
2099	20	22	MARINE MAMMALS	B	SUMMER	SEASONAL	MUD/TIDAL FLATS
2099	20	22	TERRESTRIAL MAMMAL	BWFM	ALL YEAR	ALL YEAR	RIVER SHORE RIPARIAN AREAS
2098	23	24	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	ANNUALLY	RIVER SHORE RIPARIAN AREAS
2098	23	24	WILD TURKEY	B	SPRING	SEASONAL	RIVER SHORE RIPARIAN AREAS
2297	23	26	WADING BIRDS	B	SPRING	SEASONAL	RIVER SHORE RIPARIAN AREAS
2297	23	26	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	SEASONAL	RIVER SHORE RIPARIAN AREAS
1999	35	38	WADING WATERFOWL	BWFM	ALL YEAR	SEASONAL	RIVER ISLANDS - MARSH/SWAMPS
1999	35	38	DIVING BIRDS	WFM	SU/WI	SEASONAL	RIVER ISLANDS - MARSH/SWAMPS
1999	35	38	WADING BIRDS	BW	SP/WI	SEASONAL	RIVER ISLANDS - MARSH/SWAMPS
1999	35	38	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	SEASONAL	RIVER SHORE RIPARIAN AREAS
1999	35	38	MARINE MAMMALS	F	SPRING	ANNUALLY	AQUATIC HABITATS
1999	35	38	COLUMBIA WHITE TAIL DEER	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
1897	37	38	WADING WATERFOWL	M	FALL	ANNUALLY	RIVER SHORE RIPARIAN AREAS
1897	37	38	BALD EAGLE/OSPREY/RAPTORS	W	WINTER	ANNUALLY	RIVER SHORE RIPARIAN AREAS
1899	37	39	WADING BIRDS	B	SPRING	SEASONAL	RIVER ISLANDS - MARSH/SWAMPS
1899	37	39	COLUMBIA WHITE TAIL DEER	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
1899	37	39	WILD TURKEY	F	SPRING	SEASONAL	MUD/TIDAL FLATS
1898	39	42	WADING BIRDS	B	SPRING	SEASONAL	RIVER ISLANDS - MARSH/SWAMPS
1898	39	42	COLUMBIA WHITE TAIL DEER	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
1799	44	47	WADING WATERFOWL	W	WINTER	ANNUALLY	AQUATIC HABITATS
1799	44	47	DIVING BIRDS	W	FA/WI	SEASONAL	AQUATIC HABITATS
1799	44	47	PEEPS	W	WINTER	ANNUALLY	RIVER ISLANDS - MARSH/SWAMPS
1799	44	47	WADING BIRDS	B	SPRING	ANNUALLY	RIVER ISLANDS - MARSH/SWAMPS
1799	44	47	MARINE MAMMALS	W	WINTER	ANNUALLY	AQUATIC HABITATS
1799	44	47	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
1799	44	47	COLUMBIA WHITE TAIL DEER	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
1798	48	50	COLUMBIA WHITE TAIL DEER	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
1699	53	54	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	SEASONAL	LAKE ON ISLAND
1699	53	54	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	LAKE ON ISLAND
1599	61	64	WADING WATERFOWL	B	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS

WILDLIFE HABITAT USERS

ID	START # RIV.M	END RIV.M	WILDLIFE HABITAT USER	USE OF HABITAT	USED IN SEASON	FREQUENCY OF USE	HABITAT DESCRIPTION
1398	68	69	BAT	B	SPRING	ANNUALLY	RIVER SHORE RIPARIAN AREAS
1397	69	70	WADING BIRDS	B	SPRING	ANNUALLY	RIVER SHORE RIPARIAN AREAS
1399	70	72	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	ANNUALLY	RIVER ISLANDS - UPLAND
1396	72	73	WADING WATERFOWL	W	WINTER	ANNUALLY	LAKE ON ISLAND
1299	75	76	TERRESTRIAL MAMMAL	BWFM	ALL YEAR	ALL YEAR	RIVER SHORE RIPARIAN AREAS
1199	79	81	WADING WATERFOWL	BW	ALL YEAR	ALL YEAR	LAKE ON ISLAND
1199	79	81	WILD TURKEY	B	SPRING	ANNUALLY	MUD/TIDAL FLATS
1098	85	57	WADING BIRDS	B	SPRING	ANNUALLY	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
1098	85	87	BALD EAGLE/OSPREY/RAPTORS	BW	SP/WI	SEASONAL	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
999	86	100	WADING WATERFOWL	WM	WINTER	ANNUALLY	LAKE ON ISLAND
999	86	100	WADING WATERFOWL	WM	WINTER	ANNUALLY	LAKE ON ISLAND
999	86	100	DIVING BIRDS	WM	WINTER	ANNUALLY	LAKE ON ISLAND
999	86	100	WADING BIRDS	WM	WINTER	ANNUALLY	RIVER ISLANDS - MARSH/SWAMPS
999	86	100	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	SEASONAL	RIVER ISLANDS - UPLAND
999	86	100	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	MUD/TIDAL FLATS
999	86	100	OTHER BIRDS	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - UPLAND
999	86	100	WILD TURKEY	B	SPRING	ANNUALLY	MUD/TIDAL FLATS
30	1099	87	93 WADING WATERFOWL	BW	SP/WI	ALL YEAR	RIVER SHORE RIPARIAN AREAS
1099	87	93	DIVING BIRDS	W	WINTER	SEASONAL	RIVER SHORE RIPARIAN AREAS
1099	87	93	WADING BIRDS	BM	SP/WI	SEASONAL	RIVER SHORE RIPARIAN AREAS
1099	87	93	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	ANNUALLY	RIVER SHORE RIPARIAN AREAS
1099	87	93	TERRESTRIAL MAMMAL	BWFM	ALL YEAR	ALL YEAR	RIVER SHORE RIPARIAN AREAS
1099	87	93	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	LAKE ON ISLAND
1099	87	93	COLUMBIA WHITE TAIL DEER	BWFM	ALL YEAR	ALL YEAR	RIVER SHORE RIPARIAN AREAS
1099	87	93	BAT	B	SPRING	SEASONAL	RIVER SHORE RIPARIAN AREAS
1099	87	93	OTHER BIRDS	BWFM	ALL YEAR	SEASONAL	RIVER SHORE RIPARIAN AREAS
998	94	96	DIVING BIRDS	W	WINTER	ANNUALLY	LAKE ON ISLAND
998	94	96	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	ANNUALLY	RIVER SHORE RIPARIAN AREAS
997	97	98	WADING BIRDS	BWM	SP/WI	ANNUALLY	RIVER ISLANDS - MARSH/SWAMPS
995	99	100	PEEPS	B	SPRING	ANNUALLY	MUD/TIDAL FLATS
899	101	106	WADING BIRDS	B	SPRING	ANNUALLY	LAKE ON ISLAND
899	101	106	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	LAKE ON ISLAND
899	101	106	OTHER BIRDS	BP	SP/SU	ANNUALLY	LAKE ON ISLAND
996	101	102	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	MUD/TIDAL FLATS
898	107	108	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
897	108	109	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	RIVER SHORE RIPARIAN AREAS

WILDLIFE HABITAT USERS

ID #	START RIV.M	END RIV.M	WILDLIFE HABITAT USER	USE OF HABITAT	USED IN SEASON	FREQUENCY OF USE	HABITAT DESCRIPTION
799	110	111	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	ANNUALLY	RIVER SHORE RIPARIAN AREAS
799	110	111	WILD TURKEY	B	SPRING	ANNUALLY	MUD/TIDAL FLATS
797	114	115	WILD TURKEY	B	SPRING	ANNUALLY	MUD/TIDAL FLATS
798	115	116	WADING WATERFOWL	B	SPRING	SEASONAL	LAKE ON ISLAND
699	116	117	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	SEASONAL	RIVER SHORE RIPARIAN AREAS
699	116	117	WILD TURKEY	B	SPRING	SEASONAL	MUD/TIDAL FLATS
698	118	121	COLUMBIA WHITE TAIL DEER	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
697	120	122	BALD EAGLE/OSPREY/RAPTORS	BW	SP/WI	ALL YEAR	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
697	120	122	TERRESTRIAL MAMMAL	BWFM	ALL YEAR	ALL YEAR	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
697	120	122	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
697	120	122	OTHER BIRDS	BWFM	ALL YEAR	ALL YEAR	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
597	122	123	WILD TURKEY	F	SPRING	SEASONAL	MUD/TIDAL FLATS
598	123	125	WADING BIRDS	B	SPRING	ANNUALLY	RIVER SHORE RIPARIAN AREAS
598	123	125	BALD EAGLE/OSPREY/RAPTORS	BF	ALL YEAR	ALL YEAR	RIVER SHORE RIPARIAN AREAS
599	126	128	DIVING BIRDS	BW	SP/WI	SEASONAL	LAKE ON ISLAND
499	134	136	WILD TURKEY	B	SPRING	ANNUALLY	MUD/TIDAL FLATS
399	135	136	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
398	138	139	BALD EAGLE/OSPREY/RAPTORS	W	WINTER	ANNUALLY	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
398	138	139	SENSITIVE AMPHIBIAN	BWFM	ALL YEAR	ALL YEAR	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
397	140	141	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	SEASONAL	RIVER MOUTH W/ FORESTED RIPARIAN ZONES
397	140	141	WILD TURKEY	F	SPRING	SEASONAL	MUD/TIDAL FLATS
396	141	144	WADING WATERFOWL	B	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS
396	141	144	BALD EAGLE/OSPREY/RAPTORS	B	SPRING	ANNUALLY	RIVER ISLANDS - MARSH/SWAMPS
396	141	144	WILD TURKEY	BWFM	ALL YEAR	ALL YEAR	RIVER ISLANDS - MARSH/SWAMPS

USERS:

NON-DIVING WATERFOWL:

Mallard
Surf Scoter
Common Merganser
Tundra Swan
Canada Geese

PEEPS:

Snowy Plover
Dunlin
Sanderling
Western Sandpiper

WADING BIRDS:

Sandhill crane
Great blue heron

DIVING WATERFOWL:

Western Grebe
Double-crested Cormorant
Pelagic Cormorant
Common Loon
Barrow's Goldeneye
Lesser Scaup
Ring-necked Duck
Harlequin Duck

GULLS:

Glaucous-winged gull
Western gull
California gull

USE OF HABITAT:

B = Breeding grounds
W = Wintering grounds
F = Foraging grounds
M = Migratory grounds

Fish and wildlife habitat and use are the most sensitive beneficial use in the study area because of the relationship between water quality and the food chain. All species that live or use the area are dependent on the River for food, water and protective cover. The health of the swamps, marshes, wetlands, estuary, and riparian areas directly effects the survival or decline of various species. Protection of habitat and water quality are key elements in the maintaining diversity and continued success of wildlife in the region. The continuum of the foodweb in the lower Columbia is clearly the most dynamic feature of the ecosystem.

Measurements of the impacts of pollutants on the foodchain are limited, but their significance is well documented. Amphibians are important indicator species in assessing the health of wetlands and related ecosystems. Amphibians can absorb pollutants through their skin and are documented as particularly vulnerable to water quality degradation (Lukas 1983, Cooke et. al. 1989). Urban stormwater runoff constituents of heavy metals and phosphorus are suspected of decreasing amphibian populations in urban wetlands (Logan 1990).

Benthic invertebrates and toxin studies conducted to date have not shown the correlation between effects on the predator from digesting prey with known levels of toxins. The effects of pollutants on shorebird foraging has not been determined (Buchman 1987). However, elevated concentrations of DDE and PCBs have been found in bald eagles and their eggs from nests along the lower Columbia River. The eggs contained DDE concentrations that ranged from 4.0 to 24 ppm (Schuller 1991, personal communication) and showed eggshell thinning significant enough to impair successful productivity. The primary exposure route is dietary consumption of fish and migratory birds foraged from the Columbia River. Similar studies have shown the same elevated levels of these chemicals in mink and river otter. They share the same food source. No water quality impact studies on migrating waterfowl using the lower Columbia River has been done (Henney 1991, personal communication).

Great blue herons nest in cottonwood/willow riparian areas and feed in shallow emergent wetlands and open fields. Herons feed on both small fish and small mammals. There has been no determination on what levels of residues cause reproductive problems in great blue herons (Henney 1991, personal communication).

6.0 RECREATION

6.1 METHODOLOGY

Recreation uses described in this section include fishing, hunting, boating, water contact activities, and aesthetic quality. Each of the recreational uses were mapped from information on numerous maps from agencies and organizations, then verified in telephone interviews. Uses were assigned ID numbers, listed on Table 10, and mapped on Figures 6A through 6D (Volume 2). A detailed analysis that included user surveys and interviews was not possible at this reconnaissance level.

6.2 FISHING

Fishing is an individual activity that takes place along the entire length of the lower Columbia River study area. The largest concentrations of anglers is usually at the mouth of the Columbia and the confluence of tributary rivers that feed into the Columbia, such as the Sandy River, the Kalama River and the Cowlitz River. One of the most popular fishing sites is at the mouth of the Columbia River at Buoy 10 (RM 1-2) (Barnes 1991, personal communication; Sayce 1991, personal communication). This spot is accessed from the Ports of Ilwaco and Warrenton.

Fishing extends throughout the year. Most sport fishing activity occurs during spring and fall. During fish migration, the River is heavily used by anglers from the banks and from boats. The number of anglers at a given spot may range from as few as six to as many as one hundred. Many people living near the River fish for a variety of food fish such as bass, catfish, perch, and other common local species. People who routinely eat fish from the River are particularly susceptible to changes in the health of the fishery.

6.3 HUNTING

Hunting in the study area is predominately for migratory waterfowl that spend fall and winter in the grasses and wetlands of the fluvial plains adjacent to the River's banks. There is one location mapped where deer hunting occurs. Most hunters have hunting permits, and a few organizations or hunting clubs have exclusive rights to hunt in certain locations. Although a single point is mapped, it should be noted that hunting is permitted throughout Lewis and Clark National Wildlife Refuge (Hidy 1991, personal communication).

Hunting is a weekend and seasonal sport for most users, although some individuals hunt on a daily basis. In the wildlife refuges and on public lands the number of hunters and game harvests are carefully controlled.

Table 10

RECREATIONAL USES

ID.	START RIV.M	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
704	0	0	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2801	0	3	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2802	0	1	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
2801	0	3	Boating	ALL YEAR	DAILY		BOTH INDIVIDUAL AND ORGANIZATIONAL
2802	0	1	Boating	SUMMER	DAILY		INDIVIDUAL
501	0		Fishing	ALL YEAR	WEEKLY		INDIVIDUAL
2802	0	1	Fishing	ALL YEAR	DAILY		INDIVIDUAL
2803	0	3	Fishing	ALL YEAR	DAILY		INDIVIDUAL
2805	0	1	Fishing	ALL YEAR	DAILY		INDIVIDUAL
2804	0	1	Primary Contact Rec.	SUMMER	ALL YEAR	693872	INDIVIDUAL
2606	1	14	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
2806	1	2	Aesthetic Quality	SP/SU/FA	DAILY		INDIVIDUAL
2807	1	2	Fishing	ALL YEAR	DAILY	100	INDIVIDUAL
2408	4	6	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2501	4	5	Aesthetic Quality	ALL YEAR	DAILY	8	INDIVIDUAL
2501	4	5	Fishing	ALL YEAR	DAILY	8	INDIVIDUAL
2408	4	6	Primary Contact Rec.	ALL YEAR	DAILY	50	INDIVIDUAL
2703	5	6	Hunting	FA/WI	DAILY		INDIVIDUAL
2407	6	7	Hunting	ALL YEAR	DAILY	5	INDIVIDUAL
2702	6	7	Hunting	FA/WI	DAILY		INDIVIDUAL
2407	6	7	Primary Contact Rec.	ALL YEAR	DAILY	50	INDIVIDUAL
2406	7	8	Aesthetic Quality	ALL YEAR	ALL YEAR		INDIVIDUAL
2701	7	8	Boating	ALL YEAR	DAILY	300	INDIVIDUAL
2404	8	9	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
2405	8	9	Aesthetic Quality	ALL YEAR	DAILY	3	INDIVIDUAL
2404	8	9	Boating	SUMMER	DAILY		INDIVIDUAL
2404	8	9	Fishing	ALL YEAR	DAILY		INDIVIDUAL

RECREATIONAL USES

ID.	START # RIV.M	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
2402	9	10	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2403	9	10	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2704	9	10	Aesthetic Quality	ALL YEAR	ALL YEAR	167115	INDIVIDUAL
2401	11	12	Boating	ALL YEAR	DAILY		INDIVIDUAL
2309	11	13	Hunting	FA/WI		2	INDIVIDUAL
2308	11	12	Primary Contact Rec.	SP/SU/FA	DAILY	3	INDIVIDUAL
2311	12	13	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2313	12	13	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2307	12	13	Boating	ALL YEAR	DAILY		INDIVIDUAL
2305	13	14	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2306	13	14	Aesthetic Quality	ALL YEAR	DAILY	25	INDIVIDUAL
2312	13	15	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2310	13	14	Boating	SP/SU/FA	DAILY		INDIVIDUAL
2607	13	14	Boating	ALL YEAR	DAILY		INDIVIDUAL
2604	13	14	Fishing	ALL YEAR	DAILY		INDIVIDUAL
2605	13	14	Fishing	ALL YEAR	DAILY		INDIVIDUAL
2607	13	14	Fishing	ALL YEAR	DAILY		INDIVIDUAL
2304	14	15	Aesthetic Quality	ALL YEAR	ALL YEAR	92000	BOTH INDIVIDUAL AND ORGANIZATIONAL
2603	14	15	Fishing	ALL YEAR	DAILY		INDIVIDUAL
2303	15	16	Boating	ALL YEAR	ALL YEAR		INDIVIDUAL
2602	15	16	Boating	SP/SU/FA	DAILY	10	INDIVIDUAL
2602	15	16	Fishing	SP/SU/FA	DAILY	10	INDIVIDUAL
2601	15	18	Hunting	FA/WI	DAILY		INDIVIDUAL
2302	16	17	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
2301	17	18	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
2301	17	18	Fishing	ALL YEAR	DAILY		INDIVIDUAL
2206	18	19					UNKNOWN

RECREATIONAL USES

ID.	START #	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
2205	18	19	Boating	SP/SU/FA	DAILY		INDIVIDUAL
2204	18	19	Hunting	FA/WI	DAILY		INDIVIDUAL
2203	19	20	Aesthetic Quality	SP/SU	DAILY		INDIVIDUAL
2207	19	50	Aesthetic Quality	SP/SU/FA	DAILY		INDIVIDUAL
2207	19	50	Boating	SP/SU/FA	WEEKLY		INDIVIDUAL
2001	20	23	Aesthetic Quality	ALL YEAR	WEEKLY		INDIVIDUAL
2001	20	23	Hunting	FA/WI	WEEKLY		INDIVIDUAL
2202	21	23	Hunting	FA/WI	DAILY		INDIVIDUAL
2101	26	27	Aesthetic Quality	ALL YEAR	ALL YEAR		INDIVIDUAL
2102	26	27	Boating	SP/SU/FA	DAILY		INDIVIDUAL
2101	26	27	Fishing	ALL YEAR	ALL YEAR		INDIVIDUAL
2101	26	27	Hunting	ALL YEAR	ALL YEAR		INDIVIDUAL
1902	32	33	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
1904	32	33	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
1902	32	33	Boating	ALL YEAR	DAILY		INDIVIDUAL
1902	32	33	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1902	32	33	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1805	33	38	Aesthetic Quality	ALL YEAR	ALL YEAR		INDIVIDUAL
1903	33	34	Aesthetic Quality	ALL YEAR	ALL YEAR		INDIVIDUAL
1901	33	34	Boating	SP/SU/FA	DAILY		INDIVIDUAL
1805	33	34	Fishing	ALL YEAR	ALL YEAR		INDIVIDUAL
1903	33	34	Fishing	ALL YEAR	ALL YEAR		INDIVIDUAL
1903	33	34	Hunting	ALL YEAR	ALL YEAR		INDIVIDUAL
1803	34	35	Aesthetic Quality	ALL YEAR	ALL YEAR		INDIVIDUAL
1803	34	35	Fishing	ALL YEAR	ALL YEAR		INDIVIDUAL
1803	34	35	Hunting	ALL YEAR	ALL YEAR		INDIVIDUAL
1804	34	35	Hunting	FA/WI	ALL YEAR	65	INDIVIDUAL
1807	36	37	Aesthetic Quality	SP/SU/FA	WEEKLY		INDIVIDUAL
1801	37	38	Boating	ALL YEAR	DAILY		INDIVIDUAL
1806	37	38	Hunting	FA/WI	ALL YEAR		ORGANIZATIONAL

RECREATIONAL USES

ID.	START #	END RIV.M	TYPE OF RIV.M USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
1809	38	43	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
1809	38	43	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1802	39	40	Aesthetic Quality	ALL YEAR	ALL YEAR		INDIVIDUAL
1808	40	41	Aesthetic Quality	SP/SU/FA	DAILY		INDIVIDUAL
1808	40	41	Boating	SP/SU/FA	DAILY		INDIVIDUAL
1703	43	44	Aesthetic Quality	SP/SU	DAILY		INDIVIDUAL
1703	43	44	Fishing	ALL YEAR	DAILY	20	INDIVIDUAL
1704	45	46	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
1704	45	46	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1702	46	47	Fishing	SP/SU/FA	DAILY	5	INDIVIDUAL
1701	47	48	Primary Contact Rec.	SUMMER	WEEKLY	100	INDIVIDUAL
1601	51	52	Aesthetic Quality	SP/SU/FA	WEEKLY		INDIVIDUAL
1604	51	52	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
1601	51	52	Fishing	ALL YEAR	WEEKLY		INDIVIDUAL
37 1604	51	52	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1601	51	52	Primary Contact Rec.	SP/SU/FA	WEEKLY		INDIVIDUAL
1603	53	54	Fishing	ALL YEAR	DAILY	4	INDIVIDUAL
1602	54	55	Fishing	ALL YEAR	DAILY	5	INDIVIDUAL
1507	56	57	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
1512	56	57	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
1507	56	57	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1509	56	57	Fishing	ALL YEAR	DAILY	6	INDIVIDUAL
1506	57	58	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
1511	57	58	Aesthetic Quality	SUMMER	WEEKLY		INDIVIDUAL
1508	57	58	Boating	ALL YEAR	DAILY	8	INDIVIDUAL
1506	57	58	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1506	57	58	Primary Contact Rec.	SUMMER	DAILY	900	INDIVIDUAL
1503	59	61	Aesthetic Quality	SUMMER	WEEKLY		INDIVIDUAL
1504	59	60	Boating	SUMMER	DAILY	6	INDIVIDUAL

RECREATIONAL USES

ID.	START # RIV.M	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
1503	59	61	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1505	60	61	Boating	ALL YEAR	DAILY		INDIVIDUAL
1502	60	61	Fishing	ALL YEAR	DAILY	18	INDIVIDUAL
1501	61	62	Boating	SUMMER	DAILY		INDIVIDUAL
1510	61	62	Boating	SUMMER	DAILY		INDIVIDUAL
1510	61	62	Primary Contact Rec	SUMMER	DAILY		INDIVIDUAL
1401	63	64	Boating	SP/SU/FA	DAILY		INDIVIDUAL
1401	63	64	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1308	64	65	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1307	67	68	Aesthetic Quality	SP/SU/FA	DAILY		INDIVIDUAL
1307	67	68	Primary Contact Rec.	SP/SU/FA	DAILY		INDIVIDUAL
1303	68	69	Aesthetic Quality	SUMMER	WEEKLY	12	INDIVIDUAL
1304	68	69	Boating	ALL YEAR	DAILY		INDIVIDUAL
1304	68	69	Fishing	ALL YEAR	DAILY		INDIVIDUAL
38 1305	68	69	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1302	69	70	Aesthetic Quality	SUMMER	WEEKLY		INDIVIDUAL
1302	69	70	Boating	SUMMER	DAILY		INDIVIDUAL
1302	69	70	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1205	70	72	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
1301	70	71	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
1205	70	72	Boating	SUMMER	DAILY		INDIVIDUAL
1205	70	72	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1306	71	72	Primary Contact Rec.	SP/SU/FA	DAILY	6	INDIVIDUAL
1201	72	73	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1201	72	73	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1204	73	74	Boating	ALL YEAR	DAILY		INDIVIDUAL
1204	73	74	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1202	74	75	Boating	SP/SU/FA	DAILY		INDIVIDUAL
1202	74	75	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1106	75	76	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
1203	75	76	Aesthetic Quality	SU/FA/WI	DAILY		INDIVIDUAL

RECREATIONAL USES

ID.	START # RIV.M	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
1107	75	76	Boating	ALL YEAR	DAILY		INDIVIDUAL
1203	75	76	Boating	SU/FA/WI	DAILY		INDIVIDUAL
1106	75	76	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1107	75	76	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1106	75	76	Primary Contact Rec.	SP/SU/FA	DAILY		INDIVIDUAL
1105	76	77	Fishing	ALL YEAR	DAILY	10	INDIVIDUAL
1105	76	77	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1104	77	78	Aesthetic Quality	SUMMER	DAILY	10	INDIVIDUAL
1104	77	78	Primary Contact Rec.	SUMMER	DAILY	10	INDIVIDUAL
1112	78	79	Boating	SUMMER	WEEKLY		INDIVIDUAL
1112	78	79	Hunting	FA/WI	DAILY		INDIVIDUAL
1103	79	80	Boating	SUMMER	WEEKLY	50	INDIVIDUAL
1113	79	80	Boating	SUMMER	WEEKLY	12	INDIVIDUAL
39 1102	81	82	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1102	81	82	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1101	82	83	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1101	82	83	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1109	82	83	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1110	82	83	Primary Contact Rec.	SUMMER	DAILY	50	INDIVIDUAL
1108	83	84	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
1108	83	84	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1111	84	85	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
1111	84	85	Boating	SP/SU/FA	DAILY		INDIVIDUAL
1008	85	86	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
1003	85	86	Boating	SP/SU/FA	DAILY	75	INDIVIDUAL
1004	85	86	Boating	ALL YEAR	DAILY	120	INDIVIDUAL
1005	85	86	Boating	SP/SU/FA	DAILY	75	INDIVIDUAL
1003	85	86	Fishing	ALL YEAR	DAILY	75	INDIVIDUAL
1005	85	86	Fishing	ALL YEAR	DAILY	75	INDIVIDUAL
1008	85	86	Fishing	ALL YEAR	DAILY		INDIVIDUAL

RECREATIONAL USES

ID.	START # RIV.M	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
1005	85	86	Primary Contact Rec.	SUMMER	DAILY	75	INDIVIDUAL
1007	85	86	Secondary Contact Rec.	SUMMER	WEEKLY	350	BOTH INDIVIDUAL AND ORGANIZATIONAL
1002	86	87	Aesthetic Quality	SUMMER	DAILY	175	INDIVIDUAL
1006	86	87	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
1006	86	87	Boating	SP/SU/FA	DAILY		INDIVIDUAL
1002	86	87	Fishing	ALL YEAR	DAILY	175	INDIVIDUAL
1006	86	87	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1002	86	87	Primary Contact Rec.	SUMMER	DAILY	175	INDIVIDUAL
1006	86	87	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
1014	87	94	Aesthetic Quality	SU/FA/WI	ALL YEAR	5560	INDIVIDUAL
1014	87	94	Boating	SP/SU/FA	ALL YEAR		INDIVIDUAL
1014	87	94	Fishing	ALL YEAR	ALL YEAR	2600	BOTH INDIVIDUAL AND ORGANIZATIONAL
1014	87	94	Hunting	ALL YEAR	ALL YEAR	1103	INDIVIDUAL
1011	89	90	Aesthetic Quality	SP/SU/FA	DAILY		INDIVIDUAL
40 1013	89	90	Aesthetic Quality	FA/WI	DAILY		UNKNOWN
1001	89	90	Boating	SP/SU/FA	DAILY		INDIVIDUAL
1001	89	90	Fishing	ALL YEAR	DAILY		INDIVIDUAL
1012	91	95	Aesthetic Quality	FA/WI	DAILY		UNKNOWN
1015	91	94	Aesthetic Quality	SUMMER	DAILY	1000	INDIVIDUAL
1010	91	92	Boating	ALL YEAR	DAILY		INDIVIDUAL
1009	92	93	Boating	SP/SU/FA	WEEKLY		INDIVIDUAL
1009	92	93	Fishing	ALL YEAR	WEEKLY	100	INDIVIDUAL
1009	92	93	Primary Contact Rec.	SUMMER	WEEKLY		INDIVIDUAL
908	94	95	Boating	ALL YEAR	DAILY		INDIVIDUAL
902	95	96	Hunting	FA/WI			UNKNOWN
907	96	98	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
906	97	98	Boating	ALL YEAR	DAILY		INDIVIDUAL
903	97	98	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
901	98	102	Hunting	FA/WI	DAILY		INDIVIDUAL
905	99	100	Aesthetic Quality	SP/SU/FA	DAILY		INDIVIDUAL

RECREATIONAL USES

ID. #	START RIV.M	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
905	99	100	Fishing	ALL YEAR	DAILY		INDIVIDUAL
904	101	102	Boating	SUMMER	DAILY		INDIVIDUAL
904	101	102	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
803	107	108	Aesthetic Quality				UNKNOWN
802	107	108	Boating	ALL YEAR	DAILY		INDIVIDUAL
804	107	108	Boating	ALL YEAR	DAILY		INDIVIDUAL
711	108	109	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
801	108	109	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
807	108	109	Aesthetic Quality	SUMMER	WEEKLY		INDIVIDUAL
808	108	109	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
809	108	109	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
711	108	109	Boating	SUMMER	DAILY		INDIVIDUAL
801	108	109	Boating	ALL YEAR	DAILY		INDIVIDUAL
805	108	109	Boating	ALL YEAR	DAILY		INDIVIDUAL
809	108	109	Fishing	ALL YEAR	DAILY		INDIVIDUAL
708	109	110	Aesthetic Quality	SUMMER	DAILY		INDIVIDUAL
709	109	110	Boating	SUMMER	DAILY		INDIVIDUAL
709	109	110	Fishing	ALL YEAR	DAILY		INDIVIDUAL
708	109	110	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
709	109	110	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
710	110	111	Boating	ALL YEAR	DAILY		INDIVIDUAL
710	110	111	Fishing	ALL YEAR	DAILY		INDIVIDUAL
710	110	111	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
705	111	112	Aesthetic Quality	SUMMER	WEEKLY		INDIVIDUAL
705	111	112	Boating	SUMMER	WEEKLY	250	INDIVIDUAL
707	111	113	Boating	ALL YEAR	DAILY		INDIVIDUAL
705	111	112	Primary Contact Rec.	SUMMER	WEEKLY		INDIVIDUAL
706	112	113	Boating	SUMMER	WEEKLY		INDIVIDUAL
701	113	116	Aesthetic Quality	SUMMER	WEEKLY		INDIVIDUAL

RECREATIONAL USES

ID.	START # RIV.M	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
701	113	116	Boating	SUMMER	WEEKLY		INDIVIDUAL
701	113	116	Primary Contact Rec.	SUMMER	WEEKLY		INDIVIDUAL
611	115	116	Aesthetic Quality	SP/SU/FA	DAILY		INDIVIDUAL
611	115	116	Fishing	ALL YEAR	DAILY		INDIVIDUAL
609	116	117	Aesthetic Quality	SUMMER	WEEKLY	200	INDIVIDUAL
609	116	117	Boating	SUMMER	WEEKLY		INDIVIDUAL
610	116	117	Boating	SUMMER	DAILY		INDIVIDUAL
609	116	117	Primary Contact Rec.	SUMMER	WEEKLY		INDIVIDUAL
605	117	118	Boating	ALL YEAR	DAILY		INDIVIDUAL
606	117	118	Boating	ALL YEAR	DAILY	70	INDIVIDUAL
607	117	118	Boating	SUMMER	DAILY		INDIVIDUAL
608	117	118	Boating	SUMMER	WEEKLY	200	INDIVIDUAL
607	117	118	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
608	117	118	Primary Contact Rec.	SUMMER	WEEKLY	200	INDIVIDUAL
42	603	118	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
603	118	119	Boating	ALL YEAR	DAILY		INDIVIDUAL
604	118	119	Boating	ALL YEAR	DAILY		INDIVIDUAL
603	118	119	Primary Contact Rec.	SP/SU/FA	DAILY		INDIVIDUAL
601	120	121	Boating	SUMMER	WEEKLY		INDIVIDUAL
601	120	121	Fishing	SUMMER	WEEKLY		INDIVIDUAL
601	120	121	Primary Contact Rec.	SUMMER	WEEKLY		INDIVIDUAL
602	121	122	Aesthetic Quality	ALL YEAR	DAILY		INDIVIDUAL
602	121	122	Boating	SP/SU/FA	DAILY		INDIVIDUAL
602	121	122	Fishing	ALL YEAR	DAILY		INDIVIDUAL
602	121	122	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
501	123		Aesthetic Quality	SU/FA/WI	DAILY		INDIVIDUAL
501	123	124	Boating	SUMMER	DAILY	140	INDIVIDUAL
503	123	125	Boating	SUMMER	WEEKLY		INDIVIDUAL
501	123	124	Primary Contact Rec.	SUMMER	DAILY	140	INDIVIDUAL
503	123	125	Primary Contact Rec.	SUMMER	WEEKLY		INDIVIDUAL
504	124	128	Aesthetic Quality	ALL YEAR	ALL YEAR		INDIVIDUAL
504	124	128	Boating	SP/SU/FA	ALL YEAR		INDIVIDUAL

RECREATIONAL USES

ID.	START #	RIV.M	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
504	124	128	Fishing		ALL YEAR	ALL YEAR		INDIVIDUAL
504	124	128	Primary Contact Rec.		SUMMER	ALL YEAR		INDIVIDUAL
505	125	126	Aesthetic Quality		ALL YEAR	ALL YEAR		INDIVIDUAL
502	126	127	Aesthetic Quality		ALL YEAR	DAILY		INDIVIDUAL
502	126	127	Boating		SUMMER	WEEKLY		INDIVIDUAL
502	126	127	Fishing		SUMMER	WEEKLY		INDIVIDUAL
403	128	129	Aesthetic Quality		ALL YEAR	ALL YEAR		INDIVIDUAL
403	128	129	Boating		SP/SU/FA	ALL YEAR		INDIVIDUAL
403	128	129	Fishing		ALL YEAR	ALL YEAR		INDIVIDUAL
403	128	129	Primary Contact Rec.		SUMMER	ALL YEAR		INDIVIDUAL
406	129	130	Aesthetic Quality		SP/SU/FA	ALL YEAR	310888	INDIVIDUAL
407	129	130	Aesthetic Quality		SP/SU/FA	ALL YEAR	818378	INDIVIDUAL
404	131	132	Aesthetic Quality		SP/SU/FA	ALL YEAR		INDIVIDUAL
405	131	132	Aesthetic Quality		SP/SU/FA	ALL YEAR		INDIVIDUAL
401	132	133	Aesthetic Quality		ALL YEAR	DAILY		INDIVIDUAL
402	133	134	Boating		SP/SU/FA	DAILY		INDIVIDUAL
402	133	134	Fishing		ALL YEAR	DAILY		INDIVIDUAL
303	135	136	Aesthetic Quality		SUMMER	ALL YEAR		INDIVIDUAL
303	135	136	Boating		SUMMER	ALL YEAR		INDIVIDUAL
303	135	136	Fishing		SUMMER	ALL YEAR		INDIVIDUAL
305	136	137	Aesthetic Quality		ALL YEAR	ALL YEAR		BOTH INDIVIDUAL AND ORGANIZATIONAL
306	138	139	Aesthetic Quality		ALL YEAR	DAILY		INDIVIDUAL
304	139	140	Aesthetic Quality		SUMMER	DAILY		INDIVIDUAL
302	140	141	Boating		ALL YEAR	DAILY		INDIVIDUAL
302	140	141	Fishing		ALL YEAR	DAILY	100	INDIVIDUAL
301	141	142	Aesthetic Quality		SP/SU/FA	DAILY		INDIVIDUAL
301	141	142	Boating		SP/SU/FA	DAILY		INDIVIDUAL
108	143	144	Aesthetic Quality		ALL YEAR	DAILY		INDIVIDUAL
201	143	144	Aesthetic Quality		SP/SU/FA	DAILY		INDIVIDUAL
107	144	145	Boating		SP/SU/FA	DAILY		INDIVIDUAL
110	144	145	Fishing		ALL YEAR	DAILY		INDIVIDUAL
109	145	146	Fishing		ALL YEAR	DAILY		INDIVIDUAL

RECREATIONAL USES

ID.	START #	RIV.M	END RIV.M	TYPE OF USE	SEASONS OF USE	FREQUENCY OF USE	NUMBER OF VISITS	USER TYPE
504	124	128	Fishing		ALL YEAR	ALL YEAR		INDIVIDUAL
504	124	128	Primary Contact Rec.		SUMMER	ALL YEAR		INDIVIDUAL
505	125	126	Aesthetic Quality		ALL YEAR	ALL YEAR		INDIVIDUAL
502	126	127	Aesthetic Quality		ALL YEAR	DAILY		INDIVIDUAL
502	126	127	Boating		SUMMER	WEEKLY		INDIVIDUAL
502	126	127	Fishing		SUMMER	WEEKLY		INDIVIDUAL
403	128	129	Aesthetic Quality		ALL YEAR	ALL YEAR		INDIVIDUAL
403	128	129	Boating		SP/SU/FA	ALL YEAR		INDIVIDUAL
403	128	129	Fishing		ALL YEAR	ALL YEAR		INDIVIDUAL
403	128	129	Primary Contact Rec.		SUMMER	ALL YEAR		INDIVIDUAL
406	129	130	Aesthetic Quality		SP/SU/FA	ALL YEAR	310888	INDIVIDUAL
407	129	130	Aesthetic Quality		SP/SU/FA	ALL YEAR	818378	INDIVIDUAL
404	131	132	Aesthetic Quality		SP/SU/FA	ALL YEAR		INDIVIDUAL
405	131	132	Aesthetic Quality		SP/SU/FA	ALL YEAR		INDIVIDUAL
401	132	133	Aesthetic Quality		ALL YEAR	DAILY		INDIVIDUAL
402	133	134	Boating		SP/SU/FA	DAILY		INDIVIDUAL
402	133	134	Fishing		ALL YEAR	DAILY		INDIVIDUAL
303	135	136	Aesthetic Quality		SUMMER	ALL YEAR		INDIVIDUAL
303	135	136	Boating		SUMMER	ALL YEAR		INDIVIDUAL
303	135	136	Fishing		SUMMER	ALL YEAR		INDIVIDUAL
305	136	137	Aesthetic Quality		ALL YEAR	ALL YEAR		BOTH INDIVIDUAL AND ORGANIZATIONAL
306	138	139	Aesthetic Quality		ALL YEAR	DAILY		INDIVIDUAL
304	139	140	Aesthetic Quality		SUMMER	DAILY		INDIVIDUAL
302	140	141	Boating		ALL YEAR	DAILY		INDIVIDUAL
302	140	141	Fishing		ALL YEAR	DAILY	100	INDIVIDUAL
301	141	142	Aesthetic Quality		SP/SU/FA	DAILY		INDIVIDUAL
301	141	142	Boating		SP/SU/FA	DAILY		INDIVIDUAL
108	143	144	Aesthetic Quality		ALL YEAR	DAILY		INDIVIDUAL
201	143	144	Aesthetic Quality		SP/SU/FA	DAILY		INDIVIDUAL
107	144	145	Boating		SP/SU/FA	DAILY		INDIVIDUAL
110	144	145	Fishing		ALL YEAR	DAILY		INDIVIDUAL
109	145	146	Fishing		ALL YEAR	DAILY		INDIVIDUAL

RECREATIONAL USES

ID.	START	END	TYPE OF	SEASONS	FREQUENCY	NUMBER	USER
#	RIV.M	RIV.M	USE	OF USE	OF USE	OF VISITS	TYPE
106	147	148	Fishing	ALL YEAR	DAILY		INDIVIDUAL
105	149	150	Aesthetic Quality	SP/SU/FA	DAILY		INDIVIDUAL
105	149	150	Fishing	ALL YEAR	DAILY		INDIVIDUAL
105	149	150	Primary Contact Rec.	SP/SU/FA	DAILY		INDIVIDUAL
103	150	151	Aesthetic Quality	SP/FA	DAILY		INDIVIDUAL
102	150	151	Boating	SP/SU/FA	DAILY		INDIVIDUAL
103	150	151	Primary Contact Rec.	SUMMER	DAILY		INDIVIDUAL
101	150	151	Primary Contact Rec.	SP/SU/FA	DAILY		INDIVIDUAL
104	150	151	Primary Contact Rec.	SP/SU/FA	DAILY		INDIVIDUAL

6.4 BOATING

Boating related to fishing and other types of recreation occurs all along the lower Columbia River. Recreational boating activity is often concentrated at specific sites, with the heaviest use in summer and early fall. Those sites are usually along the shores of the many natural and dredge-built islands on the River. Many boaters will moor in the protected lagoons of these islands. Most boating is done by individual small boat, but there are a few commercial companies that provide river tours (Obern 1991, personal communication).

The Oregon Historical Society recently designated a Lower Columbia River Heritage Canoe Trail beginning at Clatskanie, Oregon and ending at the John Day River. The trail approximates the route taken by Lewis and Clark during their exploration of the region. Along the way, significant wildlife areas and historic sites are marked and called out for tourists (McKinney 1991, personal communication).

6.5 WATER CONTACT ACTIVITIES

Windsurfers and water skiers are the primary users in water contact activities. Because of perceived dangers associated with strong currents and whirlpools, swimming in the Columbia River is not a popular activity. Swimming and wading only occur in a few locations along the River. Because of perceived dangers associated with strong currents and whirlpools, swimming in the Columbia River is not a popular activity. Water skiing is concentrated toward the middle and upper end of the study area (Figure 6D in Volume 2). Popular sites for the sport are usually adjacent to islands where protection from the wind creates calmer water. In contrast, wind surfing is located in open areas of the River where geography causes an increase in the winds. One such site is on the lower Columbia River at Jones Beach, approximately RM 45, where the wind increases at a bend in the River around a steep mountain side.

Water skiing, swimming and wading take place during the warmer summer months. Wind surfing has a longer season, beginning in March or April and extending well into late October and early November. All the water contact activities take place on a daily basis especially during the weekends and on hotter days.

6.6 AESTHETICS

Aesthetic value is subjective and difficult to quantify, but is an important beneficial use of most waterways. The Columbia River has historically been appreciated for its beauty and scenic values. People take year-round advantage of the scenic opportunities of the Columbia River, although the summer receives the heaviest use.

During the interviews for recreation information, respondents identified areas they considered possessing aesthetic qualities, such as and beautiful, a panoramic viewscape, natural abundance of wildlife, pleasing habitats, etc. The responses were mapped with the other recreational findings, and should be used as a guide in considering aesthetic values.

Numerous scenic viewpoints exist along the length of the lower Columbia River from the roadside and along hiking trails. Most of the scenic viewpoints are located above the study area in the Columbia Gorge National Scenic Area. Areas of designated roadway viewpoints and places for viewing the sunset on both sides of the River were included in the mapping.

Many state parks and historic sites in the study area provide camping, picnicking, hiking and other related activities. Sandy beaches are used heavily in the summer months for sunbathing and beachcombing. Wildlife refuges offer people opportunities to view wildlife and birds, and provide hiking and interpretive walking trails. Wildlife refuges experience increased numbers of visitors when waterfowl are in abundance. At these times schools organize field trips and the nature clubs plan related tours and activities.

The historical and cultural aspects of the lower Columbia River contribute to the aesthetic enjoyment of many visitors. For this reason, historic sites and resources located along the River have been included as aesthetic sites. However, historic and cultural resources are not recognized as a separate and distinct beneficial use in the water quality codes of either state, and have not been separately (or completely) investigated in this reconnaissance study.

6.7 IMPLICATIONS

Recreation uses along the Columbia River include hunting, fishing, boating, water contact activities, and scenic opportunities. All recreational beneficial uses are affected to some degree by changes in water quality. Degraded water quality will have the greatest impact on those recreational uses where high water quality is closely linked to the success and continuation of a particular recreation use.

Poor water quality could reduce wildlife and fish populations thus limiting or eliminating sport hunting and fishing opportunities. Moreover, sport fishing for food fish such as bass, catfish, and perch, is particularly sensitive to changes in water quality that adversely affect the health of fish and in turn those who eat fish.

Excessive algae growths, bacteria or toxic chemical contamination, and unpleasant odors could decrease water contact activities and impair the aesthetic qualities of the River. Water contact activities such as water skiing, swimming, wind surfing, and skin diving, are more sensitive to degraded water quality than are those activities with limited water contact such as wading. Polluted water can negatively impact aesthetic qualities related to the senses. For example, excessive algae and unpleasant or noxious odors would destroy the ambiance of a scenic overlook, panoramic vista, picnic site and so on.

7.0 COMMERCIAL

7.1 METHODOLOGY

Commercial uses along the lower Columbia River can be seasonal or year-round and include: power production, navigation and transportation, commercial fisheries, marinas and other commercial activities; port facilities; and tourism. These uses typically provide individual or public economic benefits. Most of the data for this section were obtained from telephone interviews of users, agencies, and individuals with knowledge of commercial activities.

Since most of these uses occur near cities or along several miles of the River they were not mapped on a separate set of figures. Only the commercial fisheries are mapped along with the fish use on Figures 4A through 4D (Volume 2).

7.2 POWER PRODUCTION

The beneficial uses associated with Columbia River hydropower facilities include: production of electricity to consumers in the Western U S ; regulation of water on the Columbia River in order to control floods and allocate ample flow for power generation and fish passage systems, and facilitation of navigation on the River. Hydropower production facilities in the study area are: Bonneville Dam (RM 146), Trojan Nuclear Power Plant (Trojan) (RM 723) and the Beaver stream generating plant (RM 54).

Bonneville Dam was constructed between 1933 and 1937 by the U.S. Army Corps of Engineers (Corps). It was the first of eight federal lock and dam projects on the Columbia-Snake River system. The project consists of a dam and spillway, a navigation lock, fish ladders, juvenile by-pass systems, administration building, and visitor facilities (US Army Corps of Engineers 1987). A second powerhouse was added on the Washington shore and began producing electricity in 1981. The second powerhouse produces 558,000 kilowatts (kw), doubling Bonneville's capability. Based on a long term average, 140,000 cfs flows daily through Bonneville Dam, generating approximately 600,000 kw hours. The minimum outflow that must be passed through the dam is of 70,000 cfs.

Fish ladders and fishways allow migratory fish to continue their accustomed paths from the sea to tributaries of the Columbia and Snake Rivers. Chinook, coho (silver) and sockeye salmon, steelhead trout, shad and other anadromous fish use the ladders in their upstream migration. These economically viable species are fished commercially and for recreation throughout the Columbia River system. Between 700,000 and 1,000,000 adult salmon and steelhead migrate upstream through Bonneville Dam in an average year. From thirty- to fifty- million juvenile and fingerling salmon and steelhead pass downstream on their way to the ocean in an average year (US Army Corps 1987). On a daily average, 8,800 cfs is used for fish passage systems. Too much water over the dam discourages fish migration. The maximum allowable spill during adult migration is 75,000 cfs per day (Hunt 1991, personal communication).

The Corps also manages over 200 acres of on-site lands as mitigation for waterfowl and non-game species habitat lost to construction of the second powerhouse and the new navigation lock. In addition, 682 acres of land at Steigerwald Lake near Camas, Washington were purchased to replace wildlife habitat lost during construction of the second powerhouse

Trojan occupies 34 acres of a 634-acre site on the Columbia River near Rainier, Oregon (RM 73), and is owned by Portland General Electric (PGE), Eugene Water and Electric Board, and Pacific Power and Light (PG&E). It began producing electricity commercially in May 1976. In its first full year of production (1977), Trojan produced 6.5 billion kw hours of electricity (PGEa). Major structures include reactor, containment building, reactor auxiliary building, turbine-generator, control building, fuel, intake structure, and cooling tower. Seventy-five acres have been developed by PGE as a public day-use recreation area. Recreation Lake, Reflection Lake, Swan Lake, wetlands and undeveloped open space cover the remainder of the site and provide both recreation opportunities (picnicking, hiking, windsurfing, fishing) and wildlife habitat (PGEb).

Columbia River water is used for temperature control in the operation of Trojan. Approximately 93 cfs (41,738 gpm) is withdrawn from a combination of two wells and two surface sources. Purified River water within a closed-loop system passes through condensers located in the plant. As steam from the plant's turbine generators passes over the cool tubes, some of the heat transfers to the river water. The water is then pumped part way up the tower, spraying down over many acres of cement cooling fins. By the time it is returned to the condensers, the water temperature has dropped about 30° F. River temperature monitoring shows there is only a fraction of a degree difference between the plant discharge and the receiving River water (PGEb).

Possible discharges from Trojan to the Columbia River include cooling water, treated wastewater, settling basin effluent, boiler blowdown, neutralizing tank effluent and oil/water separator. Salts and other impurities tend to build-up in the cooling water as a result of evaporation. Many safety, containment, and security features are incorporated into the operation of Trojan. These systems are designed to prevent the release of radioactive materials into the environment. Trojan was temporarily closed for maintenance from March 1991 through February 1992. It should be operational again in February 1992 (Sauther 1991, personal communication). This means Trojan was closed during the Fall 1991 Columbia River sample survey, so no water quality data on its operation was obtained at that time.

Beaver Generating Plant is located in Clatskanie, Oregon along Bradbury Slough in the Columbia River at RM 54. This small fuel/steam facility has been in operation since 1972 and is owned by PGE. Power production is limited most years to late summer and winter.

The Beaver facility produces an average of 450,000 kw daily and is linked to the Bonneville power grid. Six combustion turbines are used to produce the majority of the power. The heat generated by their operation is recovered and used to operate one steam generator turbine. Approximately two MGD (1,389 gpm) of water is withdrawn from the Columbia River (Bradbury Slough) for process control and drinking water. Most of this water is injected into the combustion process to reduce particulate emissions from the stacks. About 0.5 MGD (347 gpm) is treated for drinking water and fire protection and is stored on-site until needed. A water treatment plant is operated to improve the quality of the river water for use by the facility. This system is designed to remove solids, salts and minerals that may cause corrosion and interfere with the operation of the plant. Chlorine is also added to minimize bacterial contamination so there is no human health risk involved with consumption.

About 1.5 MGD (1,042 gpm) of the 2 MGD totally withdrawn is discharged back to Bradbury Slough. The effluent is routed through an oil/grease separator and then into two cement-lined settling ponds with a two day detention time before being discharged into the River. This discharge is monitored weekly for total suspended solids, oil and grease, iron, copper, chlorine and daily for pH and temperature. Their effluent is always within the limits defined by their NPDES discharge permit (Simpson 1992, personal communication).

7.3 NAVIGATION AND TRANSPORTATION

Authorized federal navigation projects on the lower Columbia River create and maintain dredged channels for navigation (Table 11). Major projects are:

- The "Columbia River at the Mouth, Oregon and Washington" (a 6 mile long north channel, 55 feet deep by 2,000 feet wide, a 6 mile long south channel, 48 feet deep by 640 feet wide, and a 0.3 mile long spur jetty),
- The "Columbia and lower Willamette Rivers below Vancouver, Washington, and Portland, Oregon" (40 foot deep channel from RM 3 to RM 105.5 on the Columbia River and up the Willamette River 11.6 miles), and
- The "Columbia River between Vancouver, Washington, and The Dalles, Oregon" (an 84.5 foot long channel, 27 feet deep by 300 feet wide, an alternate barge channel, 15 feet deep by 300 feet long, several small channels, and a turning basin adjacent to the Port of Camas-Washougal) U.S. Army Corps of Engineers 1991a).

The maintenance of channels and basins adjacent to the Columbia River is also authorized, separately or under the "Columbia and lower Willamette Rivers" project (U.S. Army Corps of Engineers 1991b).

Foreign import and export make up the bulk of shipping traffic in the lower Columbia River (Table 12). Exports comprised 87 percent of the 33 million short tons in 1990 from five deep-water ports: Astoria and Portland, Oregon; and Kalama, Longview, and Vancouver, Washington. Approximately 2,000 foreign ships from 45 different countries were piloted into the lower Columbia River during both 1989 and 1990 (Merchants Exchange 1990b). During 1990, the primary cargo exports were wheat, corn, logs, and soda ash.

Domestic shipping is primarily by barge. Barges carry grain from as far upstream as Lewiston, Idaho, to elevators at the Ports of Portland, Kalama and Longview. Grain is reloaded to ships for export (Sellers 1991, personal communication). Barges also carry paper and chips to downstream ports between Portland and Astoria. Fuel barges travel upstream from Portland to Pasco, Washington. In 1990, 4.5 million tons of grain, 1.8 million tons of forest products, and 1.4 million tons of petroleum products were shipped by barge within the Columbia-Snake River system (American Waterways Operators undated). In addition, Hawaiian Marine Lines carries 140,000-150,000 short tons of cargo from Portland to Hawaii each year (Gallagher 1991, personal communication).

TABLE 11. DREDGING PROJECTS ON THE COLUMBIA RIVER

RM	Features	Major Projects on Main Stem
0-3	Columbia River at the Mouth, Oregon and Washington	channels and jetties
3-106	40-foot channel, below Vancouver, WA	channels, turning basins, small boat basins, and breakwaters
106-146	Vancouver, Washington to The Dalles, Oregon	channels, turning basins, small boat basins, and breakwaters
RM	Features	Smaller Projects on Side Channels
3	Baker Bay, Washington	channels, mooring basin, spur dike
5	between Chinook, Washington and The Head of Sand Island	channel, turning and mooring basin, breakwater
10	Skipanon Channel, Oregon	channel, turning and mooring basin
20	Deep River, Washington	channels
21	Grays River, Washington	removal of snags from channel and overhanging trees from banks
33	Skamokawa Creek, Washington	channel
34	Skamokawa (Steamboat) Slough, Washington	channel
41	Elochoman Slough, Washington	channel, turning basin, breakwater
43	Westport Slough, Oregon	channel
50	Clatskanie River, Oregon	channel
68	Cowlitz River, Washington	channels
86	Multnomah Channel, Oregon	channels, removal of sunken logs
87	Lewis River, Washington	channels
88	Lake River, Washington	channel
102	Oregon Slough (North Portland Harbor), Oregon	channels, turning basin

TABLE 12. 1988 to 1990

Year	Astoria	Kalama	Longview	Vancouver	Portland
Foreign Exports - Total Short Tons (10,000)					
1990	376	8,716	3,878	4,516	11,277
1989	576	9,111	4,581	3,561	11,608
1988	523	7,877	5,046	5,297	12,653
Foreign Imports - Total Short Tons (10,000)					
Year	Astoria	Kalama	Longview	Vancouver	Portland
1990	28	55	907	726	2,694
1989	7	57	1,048	641	2,844
1988	9	68	971	824	2,584

Source: Merchants Exchange 1990a and 1990b

The Corps routinely dredges channels to maintain access to each of the five deep-water ports (Astoria and Portland, Oregon, and Kalama, Longview, and Vancouver, Washington) and several smaller ports. Degradation of sediment quality would increase the economic and environmental costs of dredging activities and dredged material disposal because additional safeguards would need to be employed to protect aquatic life and the public.

7.4 COMMERCIAL FISHERIES

Commercial fishing is regulated and limited in the Columbia River upstream to McNary Dam. None is allowed in special closed areas at dams, at the mouths of certain tributaries, and adjacent to hatcheries. There are two distinct commercial fisheries, treaty and non-treaty. They are separated geographically by Bonneville Dam. Non-treaty (all citizens' fishery) is allowed below the Dam. Members of four Columbia River treaty Indian Tribes are allowed to fish above the Dam (WDF 1990). The length of the commercial season and the allowable catch may be influenced by upstream treaty and recreational fishing. The number of licensed non-treaty commercial gillnetters below Bonneville Dam has ranged from a low of 597 in 1969 to a high of 1,524 in 1979. Since then the number has declined to 874 in 1990; 354 in Oregon and 520 in Washington (ODFW 1991).

Since 1988 all management of Columbia River fish runs and fisheries have been directly based on the Columbia River Fish Management Plan (CRFMP) (WDF 1990). Guidelines are established for treaty and non-treaty catch allocation requirements and escapement goals of upper Columbia River fish stocks destined for tribal fishing areas. Both states attempt to reach agreement on regulations that consider biological, social and economic aspects brought out in testimony and are consistent with court mandates of the Fish Management Plan (WDF 1990).

A total of 56 fishing days were allowed for the commercial main-stem fishery below Bonneville Dam in 1990 (ODFW 1991) (Table 13). The number of allowable fishing days varies annually. The schedule of fishing dates for specific fish species depends on the numbers of fish counted at various points throughout the system. The number of fishing days, allowable catch of certain species, and number of boats permitted to be in a specific location is also regulated by the Columbia River Compact (Compact) (Burgeron 1991, personal communication). Existing agreements between the states do not prevent either state from limiting commercial privileges of its own citizens.

Most of the commercial fishery activity takes place on the lower 40 miles of river, particularly between RM 25-35. Areas of particular importance are Tongue Point, Youngs Bay, the mouth of the Cowlitz River, and at several islands in this vicinity (Barnes 1991, personal communication). Fishing locations vary from year to year and are established and enforced by the agencies (Burgeron 1991, personal communication).

The Columbia River supports the largest anadromous fish stocks remaining in the lower 48 states (Beach 1985). Salmon, steelhead, sturgeon, smelt, and shad are the principal species harvested from the Columbia River. Since 1960 the minimum number of salmon and steelhead, including jacks, entering the Columbia River has ranged from a high of 3.1 million fish in 1986 to a low of 1.0 million fish in 1983. A total of 1.2 million fish entered the Columbia River in 1990, the smallest run since 1983. The minimum number of adult salmon and steelhead entering the Columbia River since 1970 has ranged from a high of 2.9 million adults in 1986 to a low of 0.9 million adults in 1983. A total of 1.1 million adults

TABLE 13. COMMERCIAL FISHERIES IN THE LOWER COLUMBIA RIVER - 1990

Start RM	End RM	Species	Season	Number of Days Fished	Opening Date	Closing Date	Harvest
0	19	Chinook	Spring	20	Feb.11	Mar 9	18,301
--	--	Chinook	Summer	0	--	--	0
112	142	Chinook	Fall	10	Aug.12	Aug.24	6,769
--	--	Chinook	Fall	17	Sep 18	Oct.31	35,607
0	12	Chinook	Fall	--	--	--	3,224
--	--	Sockeye	Fall	--	--	--	0
--	--	Coho	Fall	--	Aug.1	Aug.31	21
--	--	Coho	Fall	19	Late Sep	Oct.31	47,376
0	12	Coho	Fall	--	--	--	27,563
--	--	Chum	Fall	--	Late Oct	--	890
--	--	Steelhead	Winter	--	Feb.	Mar.	0
--	--	Steelhead	Summer	--	--	--	0
65	76	Smelt	Winter	--	Mid Jan.	Mid Mar.	2,784,223(lbs)
123	145	Shad	Spring	--	Late May	June	167,835
--	--	White Sturgeon	Winter	--	--	--	6
--	--	White Sturgeon	Fall	--	Aug.1	Aug.31	1,485
--	--	White Sturgeon	Fall	--	Sep	Oct.	3,046
0	12	White Sturgeon	--	--	--	--	8
0	45	Green Sturgeon	Winter	--	--	--	3
0	45	Green Sturgeon	Fall	--	Aug.1	Aug.31	7
0	45	Green Sturgeon	Fall	--	Sep.	Oct	2,207
0	12	Green Sturgeon	--	--	--	--	4
--	--	Starry Flounder	variable	--	--	--	4,166(lbs)
123	145	Walleye	variable	--	Late May	Mid June	150
0	45	Dungeness crab	variable	--	Dec.1	Aug.31	small
0	45	Crayfish	variable	--	--	--	small

Source: Oregon Department of Fish and Wildlife 1991.

entered the Columbia in 1990, the smallest run since 1983 (ODFW 1991). The 1990 commercial fishery produced the lowest landings since 1983 at 1.8 million pounds (139,800 fish), or 46 percent of the total Columbia River commercial catch.

7.5 OTHER COMMERCIAL ACTIVITIES

7.5.1 Port Districts

Ten port districts with property adjacent to the lower Columbia River provide a variety of commercial facilities and services. Commercial facilities and services provided by port districts along the lower Columbia River are described below

Port of Ilwaco. The Port of Ilwaco (RM 3) operates a 22-acre RV park and a 1,000-slip marina. The marina is used by recreational and commercial fishing boats up to 150 feet long. Two large canneries operate year-round and three smaller canneries operate seasonally on Port land. Approximately 30 charter boats operate from the Port of Ilwaco, a destination for sight-seeing boats out of Portland (Hendrikson 1991, personal communication)

Port of Astoria. The Port (RM 12) operates five deep-draft berths, one million square feet of open dock space, a 50-ton capacity barge ramp, handling equipment, and ship repair and oil bunkering services. In addition, the Port operates a commercial marina with 82 slips for vessels up to 100 feet and a mixed-use marina with 364 slips for 50 foot long vessels (Cook 1991, personal communication and Port of Astoria No Date.).

Port of Wahkiakum #1. The Port (RM 34) operates a year-round marina at Elochoman Slough used by recreational and commercial fishing boats. Commercial fishing boats up to 100 feet in length operate from the Port. Barges tow out logs and bring in crushed rock from St. Helens. The rock is off-loaded by hopper barge, stored, and transferred to trucks for further shipment (Mast 1991, personal communication).

Port of Wahkiakum #2. The Port (RM 34) currently provides recreational facilities only, although the Port plans to develop property for commercial use. The economy of the Town of Skamokawa is tied to use of the Port's Skamokawa Park. In addition to recreational use, the boat launch at the park is used by commercial fishing boats up to 26 feet in length. A 1/4-mile long stretch of river-front property, created from the disposal of dredged materials, is used for picnicking and swimming (McClain 1991, personal communication).

Port of Longview. The Port (RM 64) provides cargo handling facilities in the form of 19 warehouses, transit sheds, and gear lockers, truck-loading ramps, and railroad loading facilities. The Port operates seven deep-draft berths for receiving, storage, and shipping of grain, calcined petroleum coke, dry bulk minerals and chemicals, and the transport of general cargo, logs, and containers (McChesney 1991, personal communication).

Port of St. Helens. The Port (RM 87) operates an 802-acre rural industrial site at Port Westward that includes a deep-water berth on the 40-foot wide channel and two berths plus moorage for barges on Bradbury Slough. The 258 acres zoned heavy industrial at Rainier, Oregon, include almost two miles of frontage on the 40-foot maintained channel. Another 93 acres, zoned heavy industrial, at Columbia

City includes 5,000 ft of moorage on the 40-foot channel. The 116 acre McNulty Industrial Park (heavy industrial) receives barges via the Multnomah Channel (Port of St. Helens. No Date.).

Port of Kalama The Port of Kalama (RM 75) operates a 222-slip recreational marina with a public boat launch and a fuel dock. The Port also operates a 22-space RV park. Industrial park property is leased to 16 businesses. The Port operates two berths for deep-draft vessels, currently used by Harvest States Cooperative, to export grain from eastern Oregon and Washington, and by Peavy Co., to export feed-corn brought to the River by train from the Midwest. The Port of Kalama is the third largest exporter of bulk cargo on the West Coast (Pickett 1991, personal communication).

Port of Portland The Port (RM 103) operates three deep-draft berths for container vessels and a barge loading ramp at Terminal 6 in North Portland Harbor. Businesses at the Port's Rivergate Industrial District support activities at the shipping terminals. In addition, the port leases two marinas to private operators and a third to the Sea Scouts (Korvola 1991, personal communication).

Port of Vancouver The Port (RM 105) operates cargo docks that receive vessels up to 1,000 feet in length. Most of the cargo (approximately 220 ships per year) is grain. The rest (approximately 65 ships per year each) is divided between break-bulk (pelletized items such as lumber, steel, machinery, and plywood and other manufactured wood products) and bulk (e.g., fertilizer and mineral concentrates) cargo. Some container cargo is handled at the Port. In addition, the Port of Vancouver leases land to a hotel and restaurant (Red Lion on the Key) (Hill 1991, personal communication).

Port of Camas-Washougal. The Port (RM 123) operates a marina with 235 slips. Two commercial fishing boats dock at the marina. The Port's public boat launch is used by a commercial marine preparation and repair facility (Erwin Marine). A privately owned restaurant, Parker House, is located on Port property (Tyler 1991, personal communication).

7.5.2 Tourism

Three companies operate stern wheel vessels from Portland and run cruises (less than 20/year) on the lower Columbia River. The stern wheelers pick up passengers at the hotels at Jantzen Beach and tour upstream along Hayden Island to the Portland Airport. They carry 130 to 150 people per cruise, (Higgins 1991, personal communication, and Simrin 1991, personal communication). Tours run during the summer tourist season although special charters are booked year-round to specific destinations.

7.6 IMPLICATIONS

Commercial uses exist throughout the entire study area. The wide variety of uses benefit many diverse groups and organizations. All depend on the abundance and quality of the water. No specific data were identified that address impacts of water quality on commercial activities. However, some common sense observations can be made based on knowledge of the activities themselves. For example, commercial activities that result in a consumptive product such as fish are dependent on the abundance and health of the fishery. Since fish and other commercial aquatic life require a habitable environment, the health of the River is essential to commercial fishery. The same holds true for recreation providers. The health of the River is essential to people enjoying the resource, and directly effects the commercial success of commercial recreation on the River. On the other hand, power production, navigation, transportation, and Port operations depend more on volume than quality.

The most important water quality issues related to commercial activities is the impact of the use on water quality. Dams, nuclear reactors, and generators create temperature changes and may introduce chemicals into the River that must be carefully monitored and regulated to prevent distribution of the River's ecosystems. High spills from dams also create high total dissolved gas which can be lethal to fish. Dredging of channels and basins increase turbidity to unbearable levels for many fish and aquatic invertebrates. The release of chemicals and waste from boats, ships, and barges can potentially accumulate or contaminate sections of the River. Ports and commercial boating facilities can increase pollutants in areas of heavy use.

The analysis of impacts associated with commercial activities is very complex because of the economic interdependence of all of the users. No definitive work has been done to show the various interrelationships between the commercial users.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The goal of Task 5 was to identify and describe the beneficial uses along the Lower Columbia River in relation to where the use occurs, the frequency and season of the use; who or what is involved in the use, and how sensitive the use is to water quality changes. The beneficial uses of the Lower Columbia River are sensitive to water quality changes in different ways and in varying degrees. In order to document the current health of the Columbia River within the study area, the water, fish, sediment, and benthic invertebrates were sampled in designated locations. Each beneficial use was reviewed to determine the major users (wildlife and human) of the River and/or the primary use areas that would be most affected by changes in water quality. These areas were marked on the maps along with the other factors (i.e., point and nonpoint sources) being considered to determine where appropriate sampling points should be located.

Under water supply the major users of the Columbia River for municipal, industrial, and domestic purposes were identified. The Cities of Vancouver (RM 108-109) and Camas (RM 120-122) use wells along the River for domestic municipal uses. The City of Longview (RM 63-64) uses surface water from the Cowlitz River for domestic municipal uses. Alcoa (RM 108-109) is the largest private user of wells for domestic purposes. Whenever water sources are used for drinking water and other municipal domestic uses there is concern for human health. Well water has less chance of being contaminated, as opposed to surface water, because it passes through the soil and has a chance to be filtered before being withdrawn for use. Two of the largest industrial users are Weyerhaeuser (RM 62-65) and Reynolds (RM 62-65). The major concerns for drinking water are contamination by fecal coliform and other pathogens, nitrates, and toxic levels of metals and/or organic chemicals.

There is a limited amount of agricultural lands along the lower Columbia River. The largest agriculture user of the River is the Bachelor Island Ranch (RM 87-88). Approximately 6 cfs are withdrawn to irrigate this 750-acre ranch. Depending on the use of the water (for irrigation or livestock) diminished water quality could affect crop production rates and quality, soil chemistry, and potentially the health of livestock. Conversely, a large agricultural area has the potential to alter the quality of the River water by adding excess amounts of fertilizer, pesticide and herbicide residues, sediment, and fecal coliform.

Fish use occurs along the entire length of the lower Columbia River. Some fish species are year-round residents while others only use the River for migration. The largest number of fish occur in the estuarine mixing zone, where the "turbidity maximum" moves up and down the River in a continual mixing of sediment, detritus matter and organisms. Several areas of the River provide prime habitat for fish and shellfish and are known as popular fishing and crabbing locations. The mouth of the Columbia River (Buoy 10) contains large concentrations of fish and Dungeness crabs (RM 0-6). The Cowlitz River (RM 68), Kalama River (RM 73) and Sandy River (RM 120-122) are also popular places for recreational fishing. As human and wildlife consumption of fish increases at these areas, water quality and bottom sediment becomes a concern. Toxic substances are known to accumulate in sediment and fatty tissue. Fish contain a large percentage of fatty tissue per body weight and have the ability to bioaccumulate any excess toxins. These pollutants can cause disease and cancerous lesions in the fish and, in turn, diseased fish can contaminate whoever consumes them. Pollutants of major concern are metals and organic chemicals.

Wildlife use is prevalent throughout the River but particular locations (refuges and river mouths) support large concentrations of a wide range of species. Areas that were focused on for sampling purposes are known for bald eagle, osprey, raptor and sensitive amphibian use. Because their main food staple comes from the River, these species are susceptible to changes in water and sediment quality. Bald eagles and other raptors primarily feed on fish from the River. The U.S. Fish and Wildlife Service has indicated that peamouth chub are a common prey species of the bald eagle. Bald eagle are particularly sensitive to high levels of pesticides that weaken their eggshells. If the prey that bald eagles consume are contaminated with toxic substances then their reproductive capabilities are more likely to become impaired. Several sensitive amphibians (i.e., red-legged frog and Olympic salamander) reside at the mouth of the Sandy River (RM 120-122). Because they absorb water quality constituents through their skin, these amphibians are vulnerable to water quality and sediment degradation, especially high levels of metals and phosphorus. Not only are substances potentially fatal to the amphibian but they also cause potential problems to the predators who consume them. Amphibians, like fish, can store excess toxins in their fatty tissue that can lead to bioaccumulation of toxins in the food chain which would ultimately affect many creatures.

Many recreational uses occur in and along the lower Columbia River. Primary contact sports are of particular concern because humans come in direct contact with the water. Swimming, wind surfing, water skiing, and fishing areas were monitored for water quality problems. A few popular areas that receive high usage are Jones Beach (RM 45) for wind surfing, Youngs Bay (RM 12) for primary contact activities, and Skamokawa (RM 33) for primary contact activities and fishing. Degradation of water quality could potentially affect waterfowl and fish populations which would directly affect hunting and fishing activities. Excess nutrients can produce algae blooms that hamper boating and contact activities. Pathogens and toxic chemicals that come in contact with the skin or are ingested by humans can cause skin irritations or illness. Accumulations of oil and grease on the surface of the water, unpleasant odors due to anaerobic conditions, and discoloration of the water due to excess sedimentation, a spill or a discharge plume can detract from the visual appearance of the River and diminish the aesthetic qualities normally associated with a healthy riparian system.

Of all the commercial uses along the Lower Columbia River, commercial fishing is by far the most sensitive to water quality changes. The open season for commercial fishing is regulated by the number of days, season, location and species caught. Most of the commercial fishing takes place from the mouth to RM 40 and especially between RM 25-35. Tongue Point, Youngs Bay and the Cowlitz River are also regularly fished for certain species. Fish species that are of economical importance are salmon, steelhead, sturgeon, smelt and shad. If water quality is altered to unacceptable levels for fish to tolerate then mortality and disease increase and fish runs are reduced. Fewer fish directly affects the commercial fishing industry because fishing seasons are shortened and the allowable catch is reduced. Fish are highly sensitive to changes in water temperature, dissolved oxygen, dissolved gas saturation, sediment loading, and high concentrations of metals and organic compounds.

All these beneficial use activities and water quality concerns were taken into account in establishing the proposed sampling stations for the Reconnaissance Survey Sampling Plan. Most of the significant user locations are covered by a water or sediment monitoring station and should be able to indicate if the water or sediment and ultimately the beneficial use is being adversely affected.

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APPENDIX A

**LIST OF AGENCY AND ORGANIZATIONS
CONTACTED AND INTERVIEWED**

OREGON RESOURCES

Agriculture Stabilization & Conservation Program 648-3174

Audubon Society
5151 N.W. Cornell Road
Portland, OR 97201
292-6855

Mike Houck-Urban Naturalist
hm. 245-1880
slough canoe trips

Astoria Chamber of Commerce
P.O. Box 276
Astoria, OR 97103
503/325-6311 - Lynn Wallace

Clatsop County
749 Commercial, P.O. Box 179
Astoria, OR 97103
325-6452
Extension office 842-7672
Planning & Development - Sharon McConnell 325-8611
District Conservationist - Ken Hyde 325-4571

Columbia County
Land Development Services
Courthouse
St. Helens, OR 97051
397-1501
Economic Development Director - George Cross 397-1035
Extension office -Chip Bubl 397-3462
US Dept. Agriculture-SCS
William Eagle District Conservation 397-4555

Columbia River Estuary Study Taskforce (CREST)
750 Commercial St. Rm. 214
Astoria, OR 97103-4513
Director - Mark Barnes 325-0435

Columbia River Gorge National Scenic Area
U.S. Forest Service
Waucoma Building
Hood River, OR 97031
503/386-2333
Dale Cummings
Stan Hinatsu

D.L.C.D.
Bob Courtwright
Coastal Policy Specialist
503/373-0084

Metropolitan Service District (METRO)
2000 S.W. 1st
Portland, OR 97201
Planning and Development 503/221-1646
Patrick Lee - Regional Planning Supervisor

Multnomah County
Dept. of Environmental Services
2115 S.E. Morrison
Portland, OR 97214
Extension office 655-3144
Peggy Olds - District Conservationist
Planning & Development Div. Bob Hall 248-3043

Multnomah County
1620 S.E. 190th
Portland, OR 97233
Parks & Recreation
Guy Swartz-Park Maintenance Supervisor 665-6918

Northwest Power Planning Council
Rich Applegate 222-5161

Northwest Sailboard/
Gargo Publications
P.O. Box 918
Hood River, OR 97031
Carol York 386-7440

Oregon Dept. of Environmental Quality
811 S.W. 6th
Portland, OR 97205
Water Quality and Subsurface Sewage Systems Info 229-6474
Krysztyna Wolniakowski
Cornelia Shea - nonpoint

Oregon Dept. of Parks and Recreation
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WASHINGTON RESOURCES

Camas-Washougal Port District
24 A Street
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Port Manager - Sheldon Tyler 206/835-2196

Clark County
1408 Franklin
P.O. Box 5000
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Planning & Development - Michael Grant 206/699-2375
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Cowlitz County
207 N. 4th Avenue
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County Assessor office Dean Takko 206/577-3010
Planning Linda Peterson 206/577-3052
Public Works - Jim Fletcher 206/577-3030
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1351 Officer's Row
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7272 Cleanwater Lane, MS LU-11
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APPENDIX B BIOLOGICAL INFORMATION

- B-1. PARTIAL LIST OF FISHES OF THE LOWER COLUMBIA RIVER
- B-2. PARTIAL LIST OF AQUATIC INVERTEBRATES OF THE LOWER COLUMBIA RIVER
- B-3. COMMON WILDLIFE SPECIES OF LOWER COLUMBIA RIVER
- B-4. WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM OF PLANT SPECIES OF CONCERN IN LOWER COLUMBIA RIVER
- B-5. WASHINGTON NATURAL HERITAGE DATA SYSTEM OF NONGAME SPECIES OF CONCERN WITHIN THE STUDY AREA
- B-6. USFWS LISTING OF ENDANGERED, THREATENED AND CANDIDATE SPECIES WITHIN STUDY AREA

**B-1. PARTIAL LIST OF FISHES OF
THE LOWER COLUMBIA RIVER**

B-1. Partial List of Fishes of the Lower Columbia River

Common name	Scientific name	References
Petromyzonidae		
Pacific lamprey	<i>Lampetra tridentatus</i>	1,2,4
river lamprey	<i>L. ayresi</i>	1
Squalidae		
spiny dogfish	<i>Squalus acanthius</i>	1,2
Rajidae		
big skate	<i>Raja binoculata</i>	1
longnose skate	<i>R. rhina</i>	2
Acipenseridae		
green sturgeon	<i>Acipenser medirostris</i>	1,3
white sturgeon	<i>A. transmontanus</i>	1,2,3,4
Clupeidae		
American shad	<i>Alosa sapidissima</i>	1,2,3,5
Pacific herring	<i>Clupea harengus</i>	1,3,5
Engraulidae		
northern anchovy	<i>Engraulis mordax</i>	1,2,3,5
Salmonidae		
chum salmon	<i>Oncorhynchus keta</i>	1,3,4
coho salmon	<i>O. kisutch</i>	1,3,4,5
sockeye salmon	<i>O. nerka</i>	1,3,4
chinook salmon	<i>O. tshawytscha</i>	1,2,4,3,5
coastal cutthroat/searun trout	<i>O. clarka</i>	1,5
steelhead/rainbow trout	<i>O. mykiss</i>	1,3,5
mountain whitefish	<i>Prosopium williamsoni</i>	1,
Dolly Varden trout	<i>Salvelinus malma</i>	
bull trout	<i>S.</i>	

B-1. Fishes of the Lower Columbia River (Continued)

Common name	Scientific name	References
Osmeridae		
whitebait smelt	<i>Allosmerus elongatus</i>	1,2,5
surf smelt	<i>Hypomesus pretiosus</i>	1,2,3,5
night smelt	<i>Spirinchus starksi</i>	1
longfin smelt	<i>S. thaleichthys</i>	1,2,3,5
eulachon	<i>S. pacificus</i>	1,2,3,5
rainbow smelt	<i>Osmerus (mordax) dentex</i>	2
Cyprinidae		
carp	<i>Cyprinus carpio</i>	1,4
peamouth	<i>Mylocheilus caurinus</i>	1,2,4,5
northern squawfish	<i>Ptychocheilus oregonensis</i>	1
speckled dace	<i>Rhinichthys osculus</i>	4
chiselmouth	<i>Acrocheilus alutaceus</i>	
goldfish	<i>Carassius auratus</i>	6
Catostomidae		
longnose sucker	<i>Catostomus catostomus</i>	4
largescale sucker	<i>C. macrocheilus</i>	1,2
bridgelip sucker	<i>C. columbianus</i>	6
Ictaluridae		
channel catfish	<i>Ictalurus punctatus</i>	6
yellow bullhead	<i>I. natalis</i>	1
brown bullhead	<i>I. nebulosis</i>	1
Gadidae		
Pacific hake	<i>Merluccius productus</i>	1,2
Pacific tomcod	<i>Microgadus proximus</i>	1,2,3,5
walleye pollock	<i>Theragra chalcogramma</i>	1
Gasterosteidae		
three-spine stickleback	<i>Gasterosteus aculeatus</i>	1,2,3,5
Percopsidae		
sandroller	<i>Percopsis transmontana</i>	6
Percichthyidae		
striped bass	<i>Morone saxatilis</i>	6
Syngnathidae		
bay pipefish	<i>Syngnathus griseolineatus</i>	1

B-1. Fishes of the Lower Columbia River (Continued)

Common name	Scientific name	References
Centrarchidae		
warmouth	<i>Lepomis gulosus</i>	1
pumpkinseed	<i>L. gibbosus</i>	1
bluegill	<i>L. macrochirus</i>	1
largemouth bass	<i>Micropterus salmoides</i>	1
smallmouth bass	<i>M. dolomieu</i>	6
white crappie	<i>Pomoxis annularis</i>	1
black crappie	<i>P. nigromaculatus</i>	1
Percidae		
yellow perch	<i>Perca flavescens</i>	1
walleye	<i>Stizostedion vitreum</i>	6
Embiotocidae		
redtail surfperch	<i>Amphistichus rhodoterus</i>	1
shiner perch	<i>Cymatogaster aggregata</i>	1,2,3,5
striped seaperch	<i>Embiotoca lateralis</i>	1
silver surfperch	<i>Hyperprosopon ellipticum</i>	1
spotfin surfperch	<i>H. anale</i>	1
walleye surfperch	<i>H. argenteum</i>	1
white surfperch	<i>Phanerodon furcatus</i>	1
pile surfperch	<i>Rhacochilus vacca</i>	1
Trichodontidae		
Pacific sandfish	<i>Trichodon trichodon</i>	1,2
Stichaeidae		
snake prickleback	<i>Lumpenus sagitta</i>	1,2,5
Pholidae		
saddleback gunnel	<i>Pholis ornata</i>	1
Ammodytidae		
Pacific sand lance	<i>Ammodytes hexapterus</i>	1,2,3
Gobiidae		
bay goby	<i>Lepidogobius lepidus</i>	1
Scorpaenidae		
black rockfish	<i>Sebastes melonops</i>	1
darkblotched rockfish	<i>S. crameri</i>	2

B-1. Fishes of the Lower Columbia River (Continued)

Common name	Scientific name	References
Hexagrammidae		
kelp greenling	<i>Hexagrammos decagrammus</i>	1
lingcod	<i>Ophiodon elongatus</i>	1
Cottidae		
padded sculpin	<i>Artedius fenestralis</i>	1
prickly sculpin	<i>Cottus asper</i>	1,2
coastrange sculpin	<i>C. aleuticus</i>	1
riffle sculpin	<i>C. gulosus</i>	2,
buffalo sculpin	<i>Enophrys bison</i>	1,2
red Irish lord	<i>Hemilepidotus hemilepidotus</i>	1
Pacific staghorn sculpin	<i>Leptocottus armatus</i>	1,2,3
cabezón	<i>Scorpaenichthys marmoratus</i>	1
Agonidae		
warty poacher	<i>Ocella verrucosa</i>	1
tubenose poacher	<i>Pallasina barbata</i>	1
pricklebreast poacher	<i>Stellarina xyosterna</i>	1
blacktip poacher	<i>Xeneretmus latifrons</i>	2
Cycloptenidae		
slipskin snailfish	<i>Liparis fucensis</i>	1
showy snailfish	<i>L. pulchellus</i>	1,2
ringtail snailfish	<i>L. rutteri</i>	1
Bothidae		
Pacific sanddab	<i>Citharichthys sordidus</i>	1
speckled sanddab	<i>C. stigmaeus</i>	1
Pleuronectidae		
butter sole	<i>Isopsetta isolepis</i>	1,5
English sole	<i>Parophrys vetulus</i>	1,2,3,5
starry flounder	<i>Platichthys stellatus</i>	1,2,3,5
c-o sole	<i>Pleuronichthys coenosus</i>	1
sand sole	<i>Psettichthys melanostictus</i>	1,2,5

References:

- 1) Simenstad, C., D. Jay, C.D. McIntire, W. Nehlsen, C. Sherwood, and L. Small. 1984. The dynamics of the Columbia River estuarine ecosystem, Volume II Columbia River Estuary Taskforce, Astoria, Oregon. 354pp.
- 2) Haertel, L., and C. Osterberg. 1967. Ecology of zooplankton, benthos and fishes in the Columbia River estuary. Ecology 48(3). 459-472.

- 3) Monaco, M.E., D.M. Nelson, R.L. Emmett, and S.A. Hinton. 1990. Distribution and abundance of fishes and invertebrates in westcoast estuaries, Volume I: data summaries. Strategic Assessment Branch, National Ocean Service; NOAA/ 240 pp
- 4) Blahm, T.H., J.T. Durkin, G.R. Snyder, T.C. Coley, and R.L. Emmett. 1990. Columbia River oil spill study June-July 1978. EPA-78-D-X-0390, National Marine Fisheries Center, Seattle, WA. 41 pp.
- 5) Fox, D.S. and P. Benoit. No date. The physical and biological characteristics of the Columbia River Estuary - summarized by sub-region. Columbia River Estuary Study Taskforce, Astoria, Oregon. 247 pp. + app
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- 7) McPhail, J.D. 1967. Distribution of Freshwater Fishes in Western Washington. Northwest Science, Vol. 41:1, pp 1-11.

Nomenclature follows these sources.

Hart, J. 1973. Pacific Fishes of Canada. Fisheries Research Board of Canada, Ottawa, Canada. 740 pp.

Muller, D. and R. Lea. 1972. Guide to the Coastal Marine Fishes of California. California Department of Fish and Game, Marine Resources Division. 249 pp

Wydoski, R. and R. Whitney. 1979. Inland Fishes of Washington. University of Washington Press, USA. 220 pp

B-2. PARTIAL LIST OF AQUATIC INVERTEBRATES
OF THE LOWER COLUMBIA RIVER

B-2. Partial List of Aquatic Invertebrates of the Lower Columbia River

Common name	Scientific name	References
Benthic Infauna		
<u>Deposit Feeders</u>		
amphipod	<i>unid Chironmidae</i>	1
	<i>Corophium salmonis</i>	1,2
oligochaete	<i>Eohaustorius estuarius</i>	1
	<i>Enchytraeus</i> sp.	2
	<i>Fluminicola virens</i>	1
	<i>Goniobasis plicifera</i>	1
	<i>Hobsonia florida</i>	1
polychaete	<i>Macoma balthica</i>	1,2
	<i>Neanthes limnicola</i>	1,2
	<i>unid Oligochaeta</i>	1
	<i>Paraonella platybranchia</i>	1
	<i>Paraphoxus milleri</i>	1,2
	<i>Pseudopolydora kemp</i>	1
	<i>Spio.</i> spp.	1
<u>Suspension Feeders</u>		
freshwater clam	<i>Corbicula manilensis</i>	1
freshwater clam	<i>C. fluminea</i>	2
soft-shell clam	<i>Mya arenaria</i>	1
<u>Predators</u>		
	<i>Eogammarus confervicolus</i>	1
	<i>Etonne</i> spp.	1,2
	<i>unid Heleidae</i>	1
	<i>Nephtys californiensis</i>	1
	<i>unid. Rhynchocoela</i>	1
	<i>Saduria entomon</i>	1
	<i>unid. Turbellaria</i>	1
Epibenthic Invertebrates		
<u>Deposit Feeders</u>		
amphipod	<i>Alonella</i> sp.	1
	<i>Anisogammarus confervicolus</i>	2
	<i>Attheyella</i> sp.	1
	<i>Bryocamptus</i> spp.	1
harpacticoid copepod	<i>Candona</i> sp	1
	<i>Canuella canadensis</i>	2
	<i>unid. Chironomidae</i>	1

B-2. Partial List of Aquatic Invertebrates of the Lower Columbia River (Continued)

Common name	Scientific name	References
amphipod	<i>Corophium</i> spp.	1
	unid. <i>Ectinosomatidae</i>	1
	<i>Eogammarus confervicolus</i>	1
isopod	<i>Gnorimosphaeroma oregonensis</i>	2
snail	<i>Huntemania jadenis</i>	1
	<i>Hydrobia</i> sp.	2
	unid. <i>Laophontidae</i>	1
	<i>Leucon</i> sp.	1
	<i>Limnocythere</i> sp.	1
isopod	<i>Microarthridion littorale</i>	1
	<i>Mesidotea entomon</i>	2
	unid. <i>Nematomorpha</i>	1
	<i>Paraleptastacus</i> sp.	1
	unid. <i>Podocopa</i>	1
	<i>Scottllana canadensis</i>	1
	<i>Tachidius discipes</i>	1
<i>T. triangularis</i>	1	
<u>Suspension Feeders</u>	<i>Alona</i> sp.	1,2
	unid. <i>Balanomorpha</i>	1
hydroid	<i>Cordylophora lacustris</i>	2
<u>Predators</u>		
Dungeness crab	<i>Cancer magister</i>	1,2
sand shrimp	<i>Crangon franciscorum</i>	1,2
	<i>Neomysis mercedis</i>	1,2
red crayfish	<i>Pacifastacus trowbridgii</i>	2
	<i>Halicyclops</i> sp.	1
	<i>Paracyclops fimbriatus</i>	1

Sources:

Haertel, L., and C Osterberg. 1967 Ecology of zooplankton, benthos and fishes in the Columbia River estuary. *Ecology* 48(3): 459-472.

Simenstad, C., D. Jay, C.D. McIntire, W Nehlsen, C. Sherwood, and L. Small. 1984. The dynamics of the Columbia River estuarine ecosystem, Volume II. Columbia River Estuary Taskforce, Astoria, Oregon. 354pp.

**B-3 COMMON WILDLIFE SPECIES OF
LOWER COLUMBIA RIVER**

B-3. Wildlife Species Addressed in Study of the lower Columbia River

Species Key

Common Name	Scientific Name
NON-DIVING WATERFOWL.	
mallard	<i>Anas platyrhynchos</i>
surf scoter	<i>Melanitta perspicillata</i>
common merganser*	<i>Mergus merganser</i>
tundra swan	<i>Olor columbianus</i>
canada geese	<i>Branta canadensis</i>
DIVING WATERFOWL:	
Western grebe*	<i>Aechmophorus occidentalis</i>
double-crested cormorant	<i>Phalacrocorax auritus</i>
pelegic cormorant	<i>Phalacrocorax pelagicus</i>
common loon*	<i>Gavia immer</i>
Barrow's goldeneye*	<i>Bucephala islandica</i>
lesser scaup*	<i>Aythya marila</i>
ring-necked duck*	<i>Aythya collaris</i>
Harlequin duck*	<i>Histrionicus histrionicus</i>
PEEPS:	
snowy plover*	<i>Charadrius alexandrinus</i>
dunlin	<i>Calidris alpina</i>
sanderling	<i>Calidris alba</i>
Western sandpiper	<i>Calidris mauri</i>
GULLS.	
glaucous-winged gull	<i>Larus glaucesens</i>
Western gull	<i>Larus occidentalis</i>
California gull	<i>Larus californicus</i>
WADING BIRDS:	
sandhill crane*	<i>Grus canadensis</i>
great blue heron	<i>Ardea herodias</i>
black-crowned night heron	<i>Nycticorax nycticorax</i>
BALD EAGLES/OSPREY:	
bald eagle*	<i>Haliaeetus leucocephalus</i>
osprey	<i>Pandion haliaetus</i>
MARINE MAMMALS:	
harbor seal	<i>Phoca vitulina</i>
Northern sea lion	<i>Eumetopias jubatus</i>
California sea lion	<i>Zalophus californianus</i>
Northern elephant seal	<i>Mirounga angustirostris</i>

B-3. Wildlife Species Addressed in Study of the lower Columbia River

Species Key

Common Name	Scientific Name
TERRESTRIAL MAMMALS:	
raccoon	<i>Procyon lotor</i>
river otter	<i>Lutra canadensis</i>
nutria	<i>Myocastor coypus</i>
muskrat	<i>Ondatra zibethica</i>
beaver	<i>Castor canadensis</i>
white-footed vole*	<i>Myotis thysanodes</i>
SENSITIVE AMPHIBIANS:	
painted turtle	<i>Chrysemys picta</i>
western pond turtle	<i>Clemmys marmorata</i>
red-legged frog	<i>Rana aurora</i>
Cope's giant salamander	<i>Dicamptodon copei</i>
spotted frog	<i>Rana pretiosa</i>
Oregon slender salamander	<i>Batrachoseps wrighti</i>
Cascade frog	<i>Rana casadae</i>
Larch mountain salamander	<i>Plethodon larselli</i>
Dunn's salamander	<i>Plethodon dunni</i>
COLUMBIA WHITE-TAILED DEER*	<i>Odocoileus virginianus leucurus</i>
BATS:	
Townsend's big-eared bat*	<i>Plecotus townsendii</i>
Pacific fringe-tailed bat*	<i>Myotis thysanodes</i>
long-legged myotis	<i>Myotis volans</i>
big brown bat	<i>Eptesicus fuscus</i>
OTHER BIRDS OF INTEREST:	
Lewis woodpecker*	<i>Melanerpes lewis</i>
tricolored blackbird*	<i>Agelaius tricolor</i>
Western yellow-billed cuckoo*	<i>Coccyzus americanus occidentalis</i>
WILD TURKEY	<i>Meleagris gallopavo</i>
PURPLE MARTIN*	<i>Progne subis</i>

* Federally or state (WA/OR) listed endangered, threatened, or sensitive species.

**B-4 WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
OF PLANT SPECIES OF CONCERN IN LOWER COLUMBIA RIVER**



WASHINGTON STATE DEPARTMENT OF
Natural Resources

BRIAN BOYLE
Commissioner of Public Lands

August 2, 1991

OLYMPIA, WA 98504

Jeff Tupen
David Evans and Associates Inc.
301 116th Avenue SE - Suite 170
Bellevue WA 98004-6477

RECEIVED
AUG 1 1991

AUG 1 1991



SUBJECT: Lower Columbia River Bi-State Water Quality Program Data Search

We've searched the Natural Heritage Information System for information on significant natural features in your study area. I have enclosed a list of rare plants, high quality native wetlands and high quality native plant communities occurring in the vicinity of your project.

The Natural Heritage Information System is a cooperative effort between the Department of Natural Resources' Washington Natural Heritage Program and the Department of Wildlife's Nongame Program. The Washington Natural Heritage Program is responsible for information on the state's endangered, threatened, and sensitive plants as well as high quality native plant communities and wetlands. The Nongame Program manages and interprets data on wildlife species of concern in the state. For information on animals of concern in the state, please contact the Nongame Program, Washington Department of Wildlife, Mail Stop: EX-12, Olympia, WA 98504.

The Natural Heritage Information System is not a complete inventory of Washington's natural features. Many areas of the state have never been thoroughly surveyed. There may be significant natural features in your study area that we don't yet know about. This response should not be regarded as a final statement on the natural features of the areas being considered and doesn't eliminate the need or responsibility for detailed on-site surveys.

I hope you'll find this information helpful.

Sincerely,

Sandy Norwood

Sandy Norwood, Environmental Review Coordinator
Washington Natural Heritage Program
Division of Land & Water Conservation
Mail Stop: EX-13
Olympia, WA 98504
(206) 753-2449

SN:ds



WASHINGTON STATE DEPARTMENT OF
Natural Resources

BRIAN BOYLE
 Commissioner of Public Lands

OLYMPIA, WA 98504

Washington Natural Heritage Program

INFORMATION REQUEST ACCOUNT

Date: August 5, 1991

Account Name:

David Evans and Associates Inc
 301 116th Avenue SE - Suite 170
 Bellevue WA 98004-6477

Description	Quantity	Unit Cost	Amount
Previous Account Balance			\$ 65.00
Cost of Information Retrieval for Lower Columbia River Bi-state Water Quality Project	2 hr	\$30/hr	60.00
TOTAL REMAINING IN ACCOUNT			\$ 5.00

PLEASE NOTE ACCOUNT BALANCE !!

Washington Natural Heritage Program
 Division of Land and Water Conservation
 Mail Stop: EX-13
 Olympia, WA 98504

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
 ENDANGERED, THREATENED AND SENSITIVE PLANTS
 HIGH QUALITY NATIVE WETLANDS
 HIGH QUALITY NATIVE PLANT COMMUNITIES
 IN LOWER COLUMBIA RIVER GORGE

DATA CURRENT AS OF FEBRUARY 1991

TOWNSHIP, RANGE AND SECTION	NATURAL FEATURE	STATUS STATE	FED	HISTORIC RECORD*
T01N R03E S11	BOLANDRA OREGANA BOLANDRA	S		H
T01N R04E S24 NW	LINDERNIA ANAGALLIDEA FALSE-PIMPERNEL	S		H
T01N R04E S24 NW	LINDERNIA ANAGALLIDEA FALSE-PIMPERNEL	S		
T01N R04E S24 NW	TILLAEA AQUATICA PYGMY-WEED	S		
T01N R04E S24 NE0FNE	BOLANDRA OREGANA BOLANDRA	S		H
T01N R05E S02 E20FSE	BOLANDRA OREGANA BOLANDRA	S		
T01N R05E S02 E20FSE	ERIGERON OREGANUS GORGE DAISY	S		
T01N R05E S10 NE0FSE	BOLANDRA OREGANA BOLANDRA	S		
T01N R05E S11	CIMICIFUGA ELATA TALL BUGBANE	S		
T01N R05E S11 NW0FSW	BOLANDRA OREGANA BOLANDRA	S		
T01N R05E S16 SE0FNW	BOLANDRA OREGANA BOLANDRA	S		
T01N R05E S16 SE0FNW	CIMICIFUGA ELATA TALL BUGBANE	S		
T01N R05E S16 SW0FNE	ERIGERON OREGANUS GORGE DAISY	S		
T01N R05E S16 SW0FNE	POA GRACILLIMA VAR MULTNOMAE PACIFIC BLUEGRASS	S		
T01N R05E S19 NW0FNW	BOLANDRA OREGANA BOLANDRA	S		H
T02N R06E S24 NE0FSW	BOLANDRA OREGANA BOLANDRA	S		

TOWNSHIP, RANGE AND SECTION	NATURAL FEATURE	STATUS		HISTORIC RECORD*
		STATE	FED	
T02N R06E S25 NW0FSW	ERIGERON OREGANUS GORGE DAISY		S	
T02N R06E S25 S20FS2	RORIPPA COLUMBIAE PERSISTENTSEPAL YELLOWCRESS	E	C	
T02N R06E S26 E20FNE	CIMICIFUGA ELATA TALL BUGBANE		S	
T02N R06E S36 NW	POTR 2-FRLA 2 BLACK COTTONWOOD-OREGON ASH COMMUNITY			
T02N R06E S36 N2	RORIPPA COLUMBIAE PERSISTENTSEPAL YELLOWCRESS	E	C	
T02N R07E S02 NE0FSW	LOW ELEVATION SPHAGNUM BOG			
T02N R07E S02 SE0FSW	LOW ELEVATION SPHAGNUM BOG			
T02N R07E S02 SE0FSW	LYCOPODIUM INUNDATUM BOG CLUBMOSS		S	
T02N R07E S11 NW	TILLAEA AQUATICA PYGMY-WEED		S	
T02N R07E S30 SW	RORIPPA COLUMBIAE PERSISTENTSEPAL YELLOWCRESS	E	C	
T02N R07E S31	RORIPPA COLUMBIAE PERSISTENTSEPAL YELLOWCRESS	E	C	
T03N R08E S29	BOLANDRA OREGANA BOLANDRA		S	H
T04N R01W S11 SE	HOHELLIA AQUATILIS HOHELLIA		E C	
T06N R01W S06 SE0FNE	POA NERVOSA VAR NERVOSA WHEELER'S BLUEGRASS		S	
T06N R01W S33 SW0FNE	POA NERVOSA VAR NERVOSA WHEELER'S BLUEGRASS		S	
T07N R01W S30 SW	POA NERVOSA VAR NERVOSA WHEELER'S BLUEGRASS		S	
T07N R01W S31 NW0FNE	ISOETES NUTTALLII NUTTALL'S QUILLWORT		S	
T07N R01W S31 NW0FNE	POA NERVOSA VAR NERVOSA WHEELER'S BLUEGRASS		S	
T07N R01W S31 NW0FSW	POA NERVOSA VAR NERVOSA WHEELER'S BLUEGRASS		S	

TOWNSHIP, RANGE AND SECTION	NATURAL FEATURE	STATUS		HISTORIC RECORD*
		STATE	FED	
T08N R04W S09	CIMICIFUGA ELATA TALL BUGBANE	S		H
T08N R05W S30	POTR 2 BLACK COTTONWOOD FOREST			
T08N R05W S30	POTR 2-SALIX BLACK COTTONWOOD-WILLOW COMMUNITY			
T09N R06W S16 SWOFSW	EPIPACTIS GIGANTEA GIANT HELLEBORINE	S		
T09N R06W S17 SE	EPIPACTIS GIGANTEA GIANT HELLEBORINE	S		
T09N R06W S17 SEOFNW	EPIPACTIS GIGANTEA GIANT HELLEBORINE	S		
T09N R06W S20 NE	EPIPACTIS GIGANTEA GIANT HELLEBORINE	S		
T09N R06W S21	EPIPACTIS GIGANTEA GIANT HELLEBORINE	S		
T09N R06W S27 NW	EPIPACTIS GIGANTEA GIANT HELLEBORINE	S		
T09N R06W S28 SWOFSW	CAREX Densa DENSE SEDGE	S		
T09N R06W S34 NW	LIMOSELLA ACAULIS SOUTHERN MUDWORT	S		
T09N R07W S16 S20FNW	EPIPACTIS GIGANTEA GIANT HELLEBORINE	S		
T09N R07W S17 NE	PISI-TSHE/POMU SITKA SPRUCE-WESTERN HEMLOCK/SWORDFERN COMMUNITY			
T09N R07W S17 NE	PSME-TSHE/POMU DOUGLAS FIR-WESTERN HEMLOCK/SWORDFERN COMMUNITY			
T09N R07W S17 NE	TSHE/OXOR WESTERN HEMLOCK/OREGON OXALIS COMMUNITY			
T09N R07W S17 SE	LIMOSELLA ACAULIS SOUTHERN MUDWORT	S		
T09N R07W S17 SE	SAMOLUS PARVIFLORUS WATER-PIMPERNEL.	S		
T09N R08W S04 NW	EPIPACTIS GIGANTEA GIANT HELLEBORINE	S		

TOWNSHIP, RANGE AND SECTION		NATURAL FEATURE	STATUS STATE FED	HISTORIC RECORD*
T09N R10W S06		HIGH INTERTIDAL, LOW SAL. MARSH		
T09N R10W S06		LOW INTERTIDAL, LOW SAL., SANDY MARSH		
T09N R10W S07	NE	HIGH INTERTIDAL, LOW SAL. MARSH		
T09N R10W S07	NE	LOW INTERTIDAL, LOW SAL., SANDY MARSH		
T09N R11W S04	W2	LOW INTERTIDAL, LOW SAL., SANDY MARSH		
T09N R11W S04	W2	PISI/GASH SITKA SPRUCE/SALAL COMMUNITY		
T09N R11W S05	E2	PISI/GASH SITKA SPRUCE/SALAL COMMUNITY		
T09N R11W S05	NW	POA UNILATERALIS SAN FRANCISCO BLUEGRASS	T	C
T09N R11W S08	NE	POA UNILATERALIS SAN FRANCISCO BLUEGRASS	T	C
T09N R11W S09	N2	LOW INTERTIDAL, LOW SAL., SANDY MARSH		
T09N R11W S09	NWOFSH	POA UNILATERALIS SAN FRANCISCO BLUEGRASS	T	C
T10N R08W S28	SE	SURGE PLAIN WETLAND SEDGE GRASSLAND		
T10N R08W S33	NE	SURGE PLAIN WETLAND SEDGE GRASSLAND		
T10N R10W S31	SH	HIGH INTERTIDAL, LOW SAL. MARSH		
T10N R10W S31	SH	LOW INTERTIDAL, LOW SAL., SANDY MARSH		
T10N R11W S32	SH	POA UNILATERALIS SAN FRANCISCO BLUEGRASS	T	C
T10N R11W S32	SHOFNE	POA UNILATERALIS SAN FRANCISCO BLUEGRASS	T	C
T10N R11W S34	NE	HIGH INTERTIDAL, LOW SAL. MARSH		
T10N R11W S34	NE	LOW INTERTIDAL, LOW SAL., SANDY MARSH		
T10N R11W S35	N2	HIGH INTERTIDAL, LOW SAL. MARSH		
T10N R11W S35	N2	LOW INTERTIDAL, LOW SAL., SANDY MARSH		
T10N R11W S36		HIGH INTERTIDAL, LOW SAL. MARSH		
T10N R11W S36		LOW INTERTIDAL, LOW SAL., SANDY MARSH		

*C = CANDIDATE FOR LISTING ON THE 1985 FEDERAL REGISTER, NOTICE OF REVIEW

*H = KNOWN ONLY FROM RECORDS PRIOR TO 1980

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
ENDANGERED, THREATENED, & SENSITIVE VASCULAR PLANTS OF WASHINGTON

* STATE STATUS:

- E =** *Endangered* This status is assigned to each vascular plant taxon in danger of becoming extinct or extirpated in Washington within the near future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.
- T =** *Threatened* A threatened vascular plant taxon is one likely to become endangered within the near future in Washington if factors contributing to its population decline or habitat degradation or loss continue.
- S =** *Sensitive* A vascular plant taxon is labelled sensitive when it is vulnerable or declining, and could become endangered or threatened in the state without active management or removal of threats.
- X =** *Possibly Extinct
 or Extirpated
 in Washington* Based on recent field searches a number of plant taxa are considered to be possibly extinct or extirpated in Washington (status of out-of-state populations were not considered). Taxa in this group are all high priorities for field investigation. If found, they will be assigned one of the above status categories.

* FEDERAL STATUS:

- C =** *CANDIDATE* This taxa is a candidate for listing as an Endangered or Threatened Species on the 1990 Federal Register, Notice of Review

**B-5. WASHINGTON NATURAL HERITAGE DATA SYSTEM OF
NONGAME SPECIES OF CONCERN WITHIN THE STUDY AREA**

CURT SMITCH
Director



STATE OF WASHINGTON
DEPARTMENT OF WILDLIFE

600 Capitol Way North • Olympia, Washington 98501-1091 • (206) 753-5700

July 25, 1991

JEFF TUPEN AQUATIC BIOLOGIST
DAVID EVANS & ASSOCIATES INC
301 116TH AVENUE SE SUITE 170
BELLEVUE WA 98004-6477

SUBJECT: DATA SEARCH FROM BONNEVILLE DAM TO MOUTH OF COLUMBIA RIVER

Dear Mr. Tupen:

We have completed a review of our files for information on significant natural features in the study area. The result of this review is presented in the enclosed material, which summarizes the occurrence of special animals reported within or adjacent to the study area. The Washington Natural Heritage program will mail, under separate cover, project area information concerning special plants and plant communities.

We hope this presentation will be useful to you. This response is provided for your information only and is not to be construed as an official Department of Wildlife environmental review of your project. For official Department review and comment, mail environmental impact documents to: Washington Department of Wildlife, Tara Zimmerman, Regional Habitat Program Manager, 5405 NE Hazel Dell, Vancouver, WA 98663.

If your office should publish or distribute general information from the enclosed material, please provide the Nongame Wildlife Program with a draft of any document in which information from the Natural Heritage Data System is incorporated or referenced, and cite the System as follows:

Natural Heritage Data System
Washington Department of Natural Resources and
Department of Wildlife - Nongame Program
c/o Mail Stop EX-12
Olympia, Washington 98504

The information provided is not to be taken as a complete inventory of the project area and does not eliminate the need or responsibility to conduct more thorough research. If you have further questions or concerns, please feel free to contact us at (206) 586-1449.

Sincerely,

A handwritten signature in black ink, appearing to read "Richard H. Taylor".

Richard H. Taylor, Biologist
Nongame Data Systems

Enclosure

cc: David Anderson
Tara Zimmerman
Bob Bicknell

ELEMENT OCCURRENCE SUMMARY**INTRODUCTION**

The Natural Heritage Data System was established by the State of Washington and the Washington Natural Heritage Program of the Nature Conservancy. It is currently maintained by the Heritage Program of the Washington Department of Natural Resources and by the Nongame Wildlife Program of the Washington Department of Wildlife.

The database is comprised of "element occurrences." An "element" is a natural feature of particular interest because it is exemplary, unique, or endangered on a statewide or national basis. An element can be a plant community, special plant, or special animal species. An "element occurrence" is a reported or confirmed locality of a native vegetation community, or of significant habitat for a plant or animal species of concern. Information on element occurrences in the state is collected from herbarium and museum specimens, scientific literature, knowledgeable individuals, and field investigations. This information is compiled in the Natural Heritage Data System for use in land-use planning and evaluating the status of Washington's natural features.

This enclosure summarizes the special animal occurrences reported within or adjacent to the study area and catalogued in the Natural Heritage Data System. The Washington Natural Heritage Program manages similar information concerning special plants and plant communities.

FORMAT

The Element Occurrence Summary table lists those special animals that have been reported to occur in or adjacent to the area specified in your information request.

- The first column lists the U.S. Geological Service (USGS) topographic quadrangle.
- The second column lists the township, range, and section.
- The third column, entitled "conf." (confirmation), lists a code indicating the specificity of the locations recorded for each element occurrence.

CONFIRMATION CODES

- C = The location of the element occurrence is known to within a 1/4-mile radius. In addition, the locality has been confirmed.
- U = The location of the element occurrence is known to within a 1/4-mile radius, but at this time has not been confirmed.
- W = The location of the element occurrence is known to within a 1-mile radius. This information usually is derived from secondary sources.
- G = The element occurrence is known only to a general area, usually denoted by a geographic name. This information was derived from secondary sources.

CODE

EXPLANATION

SC

STATE CANDIDATE - Wildlife species that are under review by the Department for possible listing as endangered, threatened, or sensitive. A species will be considered for State Candidate designation if sufficient scientific evidence suggests that its status may meet criteria defined for endangered, threatened, or sensitive in WAC 232-12-297. Currently listed State Threatened or State Sensitive Species may also be designated as a State Candidate Species if their status is in question. State Candidate Species will be managed by the Department, as needed, to ensure the long-term survival of populations in Washington. They are listed in WDW Policy 4802.

SM

STATE MONITOR - Wildlife species native to the State of Washington that:

- 1) were at one time classified as endangered, threatened, or sensitive;
- 2) require habitat that has limited availability during some portion of its life cycle;
- 3) are indicators of environmental quality;
- 4) require further field investigations to determine population status;
- 5) have unresolved taxonomy which may bear upon their status classification;
- 6) may be competing with and impacting other species of concern;
or
- 7) have significant popular appeal.

State monitor species will be managed by the department, as needed, to prevent them from becoming endangered, threatened, or sensitive.

Species already classified in a category that provides adequate management emphasis, survey work, and data maintenance (e.g., game animals, game birds, furbearers, etc.) will not be designated as State Monitor Species. Monitor species are designated in Wildlife Policy 403.

If code column is blank this species is currently under consideration for classification as either endangered, threatened, sensitive or monitor.

- In the fourth column the animal species is named.

RE: SPECIES OF CONCERN - FROM BONNEVILLE DAM TO MOUTH OF COLUMBIA RIVER

Quad Name	T	R	S	---Status---			Element Name	Crit.	Occ.
				Conf.	Fed.	State			
MOUNT TABOR 7.5	01N	02E	41	C	FS	SC	Progne subis	B	46 -1
							Purple martin		
CAMAS 7.5	01N	03E	08	C		SM	Pandion haliaetus	B	632-1
							Osprey		
CAMAS 7.5	01N	03E	08	C	FS	SC	Progne subis	B	48 -1
							Purple martin		
CAMAS 7.5	01N	03E	15	N	FE	SE	Odocoileus virginianus leucurus	IO	9 -1
							Columbian white-tailed deer		
CAMAS 7.5	01N	03E	47	G		SM	Diadophis punctatus	IO	2 -1
							Ring-necked snake		
WASHOUGAL 7.5	01N	04E	20	C		SM	Pandion haliaetus	B	633-1
							Osprey		
WASHOUGAL 7.5	01N	04E	21	C		SM	Ardea herodias	B	139-1
							Great blue heron		
WASHOUGAL 7.5	01N	04E	53	C	FS	SC	Progne subis	B	47 -1
							Purple martin		
BRIDAL VEIL 7.5	01N	05E	02	U	FC2	SC	Plethodon larselli	IO	5 -1
							Larch mountain salamander		
BRIDAL VEIL 7.5	01N	05E	11	N		SM	Diadophis punctatus	IO	22 -1
							Ring-necked snake		
BRIDAL VEIL 7.5	01N	05E	12	C	FS	SC	Progne subis	B	49 -1
							Purple martin		
BRIDAL VEIL 7.5	01N	05E	16	C	FC2	SC	Plethodon larselli	IO	10 -1
							Larch mountain salamander		
MULTNOMAH FALLS 7.5	01N	06E	07	N	FE	SE	Odocoileus virginianus leucurus	IO	7 -1
							Columbian white-tailed deer		
MOUNT TABOR 7.5	02N	02E	62	C	FS	SC	Progne subis	BOX	45 -1
							Purple martin		
MOUNT TABOR 7.5	02N	02E	72	C		SM	Pandion haliaetus	B	631-1
							Osprey		
BEACON ROCK 7.5	02N	06E	25	C	FE	SE	Falco peregrinus	H	19 -1
							Peregrine falcon		

RE: SPECIES OF CONCERN - FROM BONNEVILLE DAM TO MOUTH OF COLUMBIA RIVER

Quad Name	T	R	S	---Status---		Element Name	Crit.	Occ.
				Conf.	Fed. State			
BEACON ROCK 7.5	02N	06E	26	C	FC2 SC	Plethodon larselli Larch mountain salamander	IO	3 -1
MULTNOMAH FALLS 7.5	02N	06E	31	N	SM	Rhyacotriton olympicus Olympic salamander	IO	2 -1
MULTNOMAH FALLS 7.5	02N	06E	34	C	SM	Pandion haliaetus Osprey	B	64 -1
MULTNOMAH FALLS 7.5	02N	06E	34	C	SM	Pandion haliaetus Osprey	B	499-1
MULTNOMAH FALLS 7.5	02N	06E	34	C	SM	Pandion haliaetus Osprey	B	64 -2
MULTNOMAH FALLS 7.5	02N	06E	35	C	FS SC	Progne subis Purple martin	B	24 -1
MULTNOMAH FALLS 7.5	02N	06E	36	C	SM	Ardea herodias Great blue heron	B	119-1
MULTNOMAH FALLS 7.5	02N	06E	36	C	SM	Pandion haliaetus Osprey	B	634-1
BEACON ROCK 7.5	02N	06E	37	G	SC	Lampropeltis zonata California mountain kingsnake	IO	10 -1
BONNEVILLE DAM 7.5	02N	07E	03	C	SM	Pandion haliaetus Osprey	B	643-1
BONNEVILLE DAM 7.5	02N	07E	09	C	SM	Pandion haliaetus Osprey	B	640-1
BONNEVILLE DAM 7.5	02N	07E	10	C	SM	Pandion haliaetus Osprey	B	332-1
BONNEVILLE DAM 7.5	02N	07E	10	U	SM	Euphyes vestris vestris Dun skipper	IO	3 -1
BONNEVILLE DAM 7.5	02N	07E	10	C	SM	Pandion haliaetus Osprey	B	408-1
BONNEVILLE DAM 7.5	02N	07E	10	C	SM	Pandion haliaetus Osprey	B	641-1
BONNEVILLE DAM 7.5	02N	07E	10	C	SM	Pandion haliaetus Osprey	B	642-1

RE: SPECIES OF CONCERN - FROM BONNEVILLE DAM TO MOUTH OF COLUMBIA RIVER

Quad Name	T	R	S	---Status---		Element Name	Crit.	Occ.
				Ocnf.	Fed. State			
BONNEVILLE DAM 7.5	02N	07E	11	C	SM	Pandion haliaetus Osprey	B	412-1
BONNEVILLE DAM 7.5	02N	07E	14	C	SM	Pandion haliaetus Osprey	B	333-1
BONNEVILLE DAM 7.5	02N	07E	15	C	SM	Pandion haliaetus Osprey	B	413-1
BONNEVILLE DAM 7.5	02N	07E	15	C	SM	Pandion haliaetus Osprey	B	365-1
BONNEVILLE DAM 7.5	02N	07E	15	C	SM	Pandion haliaetus Osprey	B	635-1
BONNEVILLE DAM 7.5	02N	07E	16	C	SM	Pandion haliaetus Osprey	B	498-1
BONNEVILLE DAM 7.5	02N	07E	29	C	SM	Pandion haliaetus Osprey	B	334-1
BONNEVILLE DAM 7.5	02N	07E	29	C	SM	Pandion haliaetus Osprey	B	335-1
BONNEVILLE DAM 7.5	02N	07E	29	C	SM	Pandion haliaetus Osprey	B	636-1
BONNEVILLE DAM 7.5	02N	07E	29	C	SM	Pandion haliaetus Osprey	B	638-1
CARSON 7.5	02N	07E	31	G	SM	Rhyacotriton olympicus Olympic salamander	IO	3 -1
BONNEVILLE DAM 7.5	02N	07E	37	C	SM	Pandion haliaetus Osprey	B	429-1
BONNEVILLE DAM 7.5	02N	07E	37	C	SM	Pandion haliaetus Osprey	B	430-1
BONNEVILLE DAM 7.5	02N	07E	37	C	SM	Pandion haliaetus Osprey	B	563-1
BONNEVILLE DAM 7.5	02N	07E	37	C	SM	Pandion haliaetus Osprey	B	637-1
BONNEVILLE DAM 7.5	02N	07E	37	C	SM	Pandion haliaetus Osprey	B	639-1

RE: SPECIES OF CONCERN - FROM BONNEVILLE DAM TO MOUTH OF COLUMBIA RIVER

Quad Name	T	R	S	---Status---			Element Name	Crit.	Occ.
				Conf.	Fed.	State			
BONNEVILLE DAM 7.5	02N	07E	37	C		SM	Pandion haliaetus	B	645-1
							Osprey		
BONNEVILLE DAM 7.5	02N	07E	44	N		SM	Euphyes vestris vestris	IO	4 -1
							Dun skipper		
ST HELENS 7.5	03N	01W	42	C	FT	ST	Haliaeetus leucocephalus	B	341-1
							Bald eagle		
SAUVIE ISLAND 7.5	03N	01W	45	C		SM	Ardea herodias	B	25 -1
							Great blue heron		
SAUVIE ISLAND 7.5	03N	01W	45	C	FS	SE	Grus canadensis	B,RLC	4 -1
							Sandhill crane		
ST HELENS 7.5	04N	01W	02	N		SM	Ardea herodias	B	93 -1
							Great blue heron		
ST HELENS 7.5	04N	01W	02	C	FT	ST	Haliaeetus leucocephalus	B	784-1
							Bald eagle		
ST HELENS 7.5	04N	01W	14	N		SM	Ardea herodias	B	10 -1
							Great blue heron		
ST HELENS 7.5	04N	01W	15	C		SM	Ardea herodias	B	29 -1
							Great blue heron		
ST HELENS 7.5	04N	01W	36	C	FS	SE	Grus canadensis	RLC	16 -1
							Sandhill crane		
ST HELENS 7.5	04N	01W	39	G		SM	Microtus canicaudus	IO	1 -1
							Gray-tailed vole		
ST HELENS 7.5	04N	01W	39	N	FE	SE	Odocoileus virginianus leucurus	IO	10 -1
							Columbian white-tailed deer		
ST HELENS 7.5	04N	01W	45	C	FT	ST	Haliaeetus leucocephalus	B	271-1
							Bald eagle		
ST HELENS 7.5	05N	01W	35	C	FT	ST	Haliaeetus leucocephalus	B	339-1
							Bald eagle		
KALAMA 7.5	06N	01W	17	G		SM	Diadophis punctatus	IO	1 -1
							Ring-necked snake		
RAINIER 7.5	07N	02W	13	C		SM	Ardea herodias	B	146-1
							Great blue heron		

RE: SPECIES OF CONCERN - FROM BONNEVILLE DAM TO MOUTH OF COLUMBIA RIVER

Quad Name	T	R	S	Status			Element Name	Crit.	Occ.
				Conf.	Fed.	State			
RAINIER 7.5	07N	02W	25	C		SM	Pandion haliaetus Osprey	B	504-1
RAINIER 7.5	07N	02W	25	C		SM	Pandion haliaetus Osprey	B	504-2
CLATSKANIE 15	08N	03W	07	N		SC	Plethodon dunni Dunn's salamander	IO	6 -1
CLATSKANIE 15	08N	03W	21	C		SM	Ardea herodias Great blue heron	B	28 -1
OAK POINT 7.5	08N	04W	09	C		SC	Plethodon dunni Dunn's salamander	IO	7 -1
OAK POINT 7.5	08N	04W	10	N		SM	Rhyacotriton olympicus Olympic salamander	IO	5 -1
OAK POINT 7.5	08N	04W	10	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	656-1
OAK POINT 7.5	08N	04W	10	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	656-2
NASSA POINT 7.5	08N	05W	18	C		SC	Plethodon dunni Dunn's salamander	IO	9 -1
OAK POINT 7.5	08N	05W	24	U		SM	Rhyacotriton olympicus Olympic salamander	IO	6 -1
NASSA POINT 7.5	08N	05W	29	C		SM	Ardea herodias Great blue heron	B	16 -1
NASSA POINT 7.5	08N	05W	31	C	FE	SE	Odocoileus virginianus leucurus Columbian white-tailed deer	IO	12 -1
CATHLAMET 7.5	08N	06W	02	C	FS	SC	Progne subis Purple martin	B	43 -1
CATHLAMET 7.5	08N	06W	02	N	FE	SE	Odocoileus virginianus leucurus Columbian white-tailed deer	IO	2 -1
CATHLAMET 7.5	08N	06W	03	C		SM	Ardea herodias Great blue heron	B	15 -1
CATHLAMET 7.5	08N	06W	11	G	FE	SE	Odocoileus virginianus leucurus Columbian white-tailed deer	IO	6 -1

RE: SPECIES OF CONCERN - FROM BONNEVILLE DAM TO MOUTH OF COLUMBIA RIVER

Quad Name	T	R	S	---Status---			Element Name	Crit.	Occ.
				Conf.	Fed.	State			
CATHLAMET 7.5	08N	06W	14	N	FE	SE	Odocoileus virginianus leucurus Columbian white-tailed deer	IO	3 -1
SKAMOKAWA 7.5	09N	06W	16	U		SM	Myotis volans Long-legged myotis	B,CR	4 -1
SKAMOKAWA 7.5	09N	06W	17	C		SM	Ardea herodias Great blue heron	B	140-1
CATHLAMET 7.5	09N	06W	21	G	FE	SE	Odocoileus virginianus leucurus Columbian white-tailed deer	IO	4 -1
SKAMOKAWA 7.5	09N	06W	21	C		SM	Pandion haliaetus Osprey	B	674-1
SKAMOKAWA 7.5	09N	06W	22	G		SM	Cathartes aura Turkey vulture	B,CR	9 -1
CATHLAMET 7.5	09N	06W	34	N	FE	SE	Odocoileus virginianus leucurus Columbian white-tailed deer	IO	5 -1
CATHLAMET 7.5	09N	06W	34	C		SM	Ardea herodias Great blue heron	B	231-1
CATHLAMET 7.5	09N	06W	35	C		SM	Pandion haliaetus Osprey	B	585-1
GRAYS RIVER 7.5	09N	07W	09	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	248-2
GRAYS RIVER 7.5	09N	07W	09	U		SC	Martes pennanti Fisher	IO	43 -1
GRAYS RIVER 7.5	09N	07W	09	G		SC	Plethodon dunni Dunn's salamander	IO	17 -1
GRAYS RIVER 7.5	09N	07W	16	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	248-1
GRAYS RIVER 7.5	09N	07W	16	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	248-3
GRAYS RIVER 7.5	09N	07W	16	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	248-4
ROSBURG 7.5	09N	08W	06	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	896-1

RE: SPECIES OF CONCERN - FROM BONNEVILLE DAM TO MOUTH OF COLUMBIA RIVER

Quad Name	T	R	S	---Status---			Element Name	Crit.	Occ.
				Conf.	Fed.	State			
GRAYS RIVER 7.5	09N	08W	13	C	FT	ST	Haliaeetus leucocephalus Bald eagle	CR	961-1
ROSEBURG 7.5	09N	08W	14	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	249-2
ROSEBURG 7.5	09N	08W	14	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	249-3
ROSEBURG 7.5	09N	08W	15	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	249-4
ROSEBURG 7.5	09N	08W	15	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	249-1
ROSEBURG 7.5	09N	08W	15	N	FS	SC	Progne subis Purple martin	B	44 -1
ROSEBURG 7.5	09N	08W	16	N	FE	SE	Odocoileus virginianus leucurus Columbian white-tailed deer	IO	1 -1
ROSEBURG 7.5	10N	08W	31	N	FE	SE	Odocoileus virginianus leucurus Columbian white-tailed deer	IO	13 -1
ROSEBURG 7.5	10N	08W	32	C	FT	ST	Haliaeetus leucocephalus Bald eagle	RSC	813-1
ROSEBURG 7.5	10N	08W	32	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	897-1
ROSEBURG 7.5	10N	09W	36	C	FT	ST	Haliaeetus leucocephalus Bald eagle	B	896-2

Washington Department of Wildlife
Management Guidelines for
Species of Concern

Fisherolanuttalli

Giant Columbia River Limpet

RANGE: White-water sections of the Snake River from below Upper Salmon Falls Reservoir to possibly Clover Creek; Hanford Reach of the Columbia River (Taylor 1982).

WASHINGTON DISTRIBUTION. Hanford Reach of the Columbia River (Benton County).

HABITAT REQUIREMENTS: Fossils of the giant Columbia River limpet are known from one million years ago. The species occurs only on cobbles or boulders in swiftly flowing water. The snails presumably occur at any depth as long as oxygenated water current, protection from siltation, and rocks too large for movement by the river are available (Taylor 1982, Coutant and Becker 1970).

Giant Columbia River limpet eggs are laid in a jelly-like mass, which is attached to the lower surfaces of rocks. Individuals disperse by crawling from rock to rock. The snails probably feed on organic growth that coats the lower surfaces of stones. They are not found on rough algae-coated or silt-coated upper surfaces of rocks, where feeding and maintaining a tight grip are difficult (Taylor 1982).

LIMITING FACTORS: Availability of rivers with rapidly flowing current.

MANAGEMENT RECOMMENDATIONS: All activities which could jeopardize the swift flowing current in portions of Hanford Reach should be prohibited. Impoundment of this section of the Columbia River and other activities such as dredging, inundation, or diverting water should not occur.

Water pollution may seriously impact giant Columbia River limpets (Taylor 1982). Therefore, activities which could pollute the water should not occur near the Hanford Reach. These include eliminating discharge of effluent from agriculture or fish hatcheries into this portion of the Columbia River, and eliminating application of biocides if contact with the water is likely.

REFERENCES: Coutant, C.C. and C.D. Becker. 1970. Growth of the Columbia River limpet, *Fisherola nuttalli* (Haldeman), in normal and reactor-warmed water. Battelle Northwest Laboratories publication #1537, UC-48.

Taylor, D.W. 1982. Status report on seven snails from the Snake River area. USDI Fish and Wildlife Service, Portland, Oregon.2

Washington Department of Wildlife
 Management Guidelines for
 Species of Concern

*Lithoglyphus
 columbianus*

Great Columbia River Spire Snail

- RANGE:** Historically occurred in the middle and lower Columbia River, the Payette River in Idaho, and possibly in the Snake River near Weiser, Idaho.
- WASHINGTON DISTRIBUTION:** Currently known only in the Hanford Reach of the Columbia River (Benton County).
- HABITAT REQUIREMENTS:** Although it is one of the more ancient species surviving in the modern fauna, little is known about the biology of the great Columbia River spire snail. The species is restricted to large rivers where it is found among boulders in moderate current along the river's edge (Taylor 1982). Construction of impoundments has eliminated most of the free-flowing river habitat that this species requires.
- LIMITING FACTORS:** Availability of large, free-flowing rivers.
- MANAGEMENT RECOMMENDATIONS:** All activities which could alter the character of the Hanford Reach should be prohibited. Water flowing in this portion of the Columbia River should not be diverted for irrigation or other uses. Damming, dredging, and inundation should not occur.
- Water pollution may be one factor responsible for the extirpation of the great Columbia River spire snail from the Snake River (Taylor 1982). Therefore, activities which could pollute the water should not occur near the Hanford Reach. Effluent from agriculture or fish hatcheries should not be introduced into Hanford Reach waters. Spraying or land application of biocides should be avoided in the area, if contact with the water is likely.
- REFERENCES:** Taylor, D W. 1982. Status report on seven snails from the Snake River area. USDI Fish and Wildlife Service, Portland, Oregon.