FINAL

Lakepointe Technical Report on Natural Resources

Prepared for:
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P.O. Box 82298
Kenmore, Washington 98028-0298

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22140
30 May 1997

beak

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

Page

LIST OF TABLES (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

EXECUTIVE SUMMARY

The Lakepointe Mixed Use Community would be developed in the unincorporated area of King County known as Kenmore on a peninsula bounded by the Sammamish River on the south, Lake Washington on the west and an industrial inner harbor on the north. The property, commonly known as the Kenmore Pre-mix site, currently supports a variety of industrial uses including the production, storage and distribution of concrete. The Lakepointe project would redevelop approximately 50 acres with retail and commercial space, residential units and park facilities and establish additional habitat along the lake and river shoreline. A public access park with trails and viewpoints would also be established along the Sammamish River, which would be enhanced with a 100- to 130-foot-wide vegetated shoreline. A private moorage marina would replace the industrial use of the inner harbor.

The proposed Lakepointe development will have primarily beneficial impacts on the water quality, wetlands and wildlife habitat on the site, because of the existing degraded site condition. A summary of existing conditions; proposed project features and habitat improvements; and proposed measures for mitigating identified impacts on the natural resources is described below and in Table 1.

Water Quality

Stormwater Runoff

Best management practices developed on the Lakepointe project site to treat stormwater would be oil and water separators with wetponds for the high-use areas and sand filters with biofiltration for the low-use areas. This treatment would exceed King County Surface Water Design Manual (KCSWDM) (1990) and subsequent adopted revision requirements, and satisfy requirements of the draft KCSWDM (1996). Peak stormwater discharge is not expected to impair Lake Washington or lower Sammamish River water quality habitat value during construction or after development.

Table 1. Lakepointe Mixed Use Development Summary.

Description	Net Change Improvement/Mitigation
Vegetation	
Lake Washington Shoreline	Existing wetland and vegetated buffer will be enhanced. 11,861 sq. ft. nonvegetated wetland buffer will be vegetated. 7,470 sq. ft. of additional wetland buffer will be added and vegetated to compensate for project feature encroachment and to comply with SAO.
Sammamish River Shoreline	Buffer width will increase from 30 ft. - 60 ft. to 100 ft. - 130 ft. and exceed SAO requirements. Upland forest area will be increased by 3 acres and habitat condition improved. Wetland buffer condition will be improved.
Structures/Buildings	
Lake Washington Shoreline (within 50 ft. of shoreline)	12,450 sq. ft. industrial structures will be eliminated; a public access trail/firelane will be established within 40 feet of shoreline.
Sammamish River Shoreline (within 100 ft. of shoreline)	94,245 sq. ft. industrial structures will be removed; public access and interpretive trails (7,400 sq. ft) will be provided along 2,650 feet of shoreline currently closed to public access.
Fish Habitat Availability - Inner Harbor Shoreline	
Shallow Water (0-10')	
Habitat Creation	3,000 sq. ft. of shallow water habitat made available to salmonid species by bulkhead removal and substrate enhancement.
Surface Coverage	
- Overhang	An additional 12,954 sq. ft. of overhang would be created and it would be designed to allow passage of ambient light.
- Floating	Floating structures reduced by 4,421 sq. ft. from existing condition.
In-water Structure	
- Bulkheads (ft)	No change
- Pilings (count)	Increase in total number by 45; however this is offset by creation of prey refuge habitat .
Deep Water (>10')	
Surface Coverage	
- Overhang	An additional 12,252 sq. ft. of overhang would be created, and it would be designed to allow passage of ambient light through deck openings.
- Floating	Floating structures reduced by 1,842 sq. ft.
In-water Structure	
- Bulkheads (ft)	Bulkheads reduced by 115 ft.
- Pilings	Increase in total number by 57; however, this is offset by creation of prey refuge habitat.

Marina

Current industrial use of the inner harbor by deep draft tugs creates turbid conditions. While the proposed marina would increase boat traffic, the near-surface propellers of recreational vessels should not impact bottom sediments because of lower thrust and power, thus offering considerable improvement in turbid water conditions. Fecal coliforms would be controlled through providing on-shore restrooms for marina patrons and by prohibiting live-aboards. Boats are required by law to have on-board sewage collection systems and an adjacent off-site pump out station would facilitate sewage disposal.

Fisheries

Studies conducted along the Sammamish River, the Lake Washington shoreline and within the inner harbor established the presence of both salmonid and non-salmonid species. The most extensive littoral zones were identified along the Lake Washington shoreline. Shallow water habitat in the inner harbor is limited and restricted to portions of the south shore. Some 3,000 feet of shallow water that is currently not available to salmonid production was identified at the east end of the inner harbor. Surveys of the inner harbor noted the heavy industrialized nature of the harbor and identified an abundance of overhanging and/or floating structures and numerous fixed in-water structures. Brightly lighted conditions during evenings in the inner harbor from the Lonestar Cement Plant were noted. Along the Sammamish River north bank, bright lighting from the Kenmore Pre-mix property was also identified.

The proposed Lakepointe marina would impact habitat only within the inner harbor. Elements of the marina would include a fixed breakwater/wave attenuator, floating and fixed docks, an overhanging public viewpoint and an overhanging public access trail/firelane. While overhanging and floating surface area would increase relative to existing conditions, distance of the overhang from the water surface and passage of ambient light through the docks would reduce shade impacts. Shallow water habitat existing along the south shore would be enhanced with substrate materials to provide refuge and foraging habitat for salmonids. The east end of the harbor would be enhanced to support salmonid production by the removal of the bulkhead that currently precludes access to shallow water habitat. Increased opportunities for warmwater species to prey on juvenile salmonids will be reduced by increasing shallow water habitats and by adding habitat complexity by means of visual cover and hiding refuge.

Plants and Animals

The only plant communities on the Lakepointe site are found along the shorelines of the Sammamish River and Lake Washington. These communities are dominated by red alder, black cottonwood, and Douglas-fir in the overstory and Himalayan blackberry in the understory. A narrow band of wetland habitat lies along the Lake Washington shoreline and a portion of a second wetland lies at the extreme southeast section of the site under the Juanita Drive N.E. bridge.

Canadian geese nest along the Lake Washington and Sammamish River shoreline; and shorebirds, including great blue herons, and diving birds have been observed feeding along the Lake Washington shoreline and inner harbor. Bald eagles have been observed flying over the site and perched on the Sammamish River shoreline opposite the project site.

A soft-surfaced trail and three view points will be constructed in the 100-foot Sammamish River shoreline buffer to provide public access to the shoreline. The public access trail/firelane along the Lake Washington shoreline will lie within 0.17 acre of the wetland buffer, of which only 36 percent is currently vegetated. Native plant communities will be established on approximately 3.5 acres of non-vegetated areas along the Lake Washington and Sammamish River shorelines. In addition, the existing vegetated areas will be enhanced by suppressing non-native invasive species and interplanting with native woody species. Woody debris will also be placed throughout the shoreline native plant communities. Wetland "confluences" may also be constructed within the Sammamish River shoreline to add habitat complexity above ordinary high water; however, these optional features are not necessary as mitigation for any project action. The proposed project site will significantly increase available wildlife habitat on the project site.

1.0 INTRODUCTION

1.1 SCOPE AND PURPOSE

On 5 March 1996, a final scope of work was issued by King County for the Lakepointe Mixed Use Community (King County File Nos. A95P0105, A95P0218, A95P0219) Environmental Impact Statement, which identified key water quality, fisheries, wetlands, wildlife, and shoreline elements. The following report addresses existing water quality, fisheries, wetlands, and wildlife conditions and contains analyses of potential impacts to on-site and off-site natural resources as a result of the proposed Lakepointe project. In addition, proposed measures for mitigating identified significant adverse impacts to surface waters, fisheries, wildlife and wetlands are addressed. The shorelines permit application will be submitted as part of this project and is supported by information in the following technical report.

1.2 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

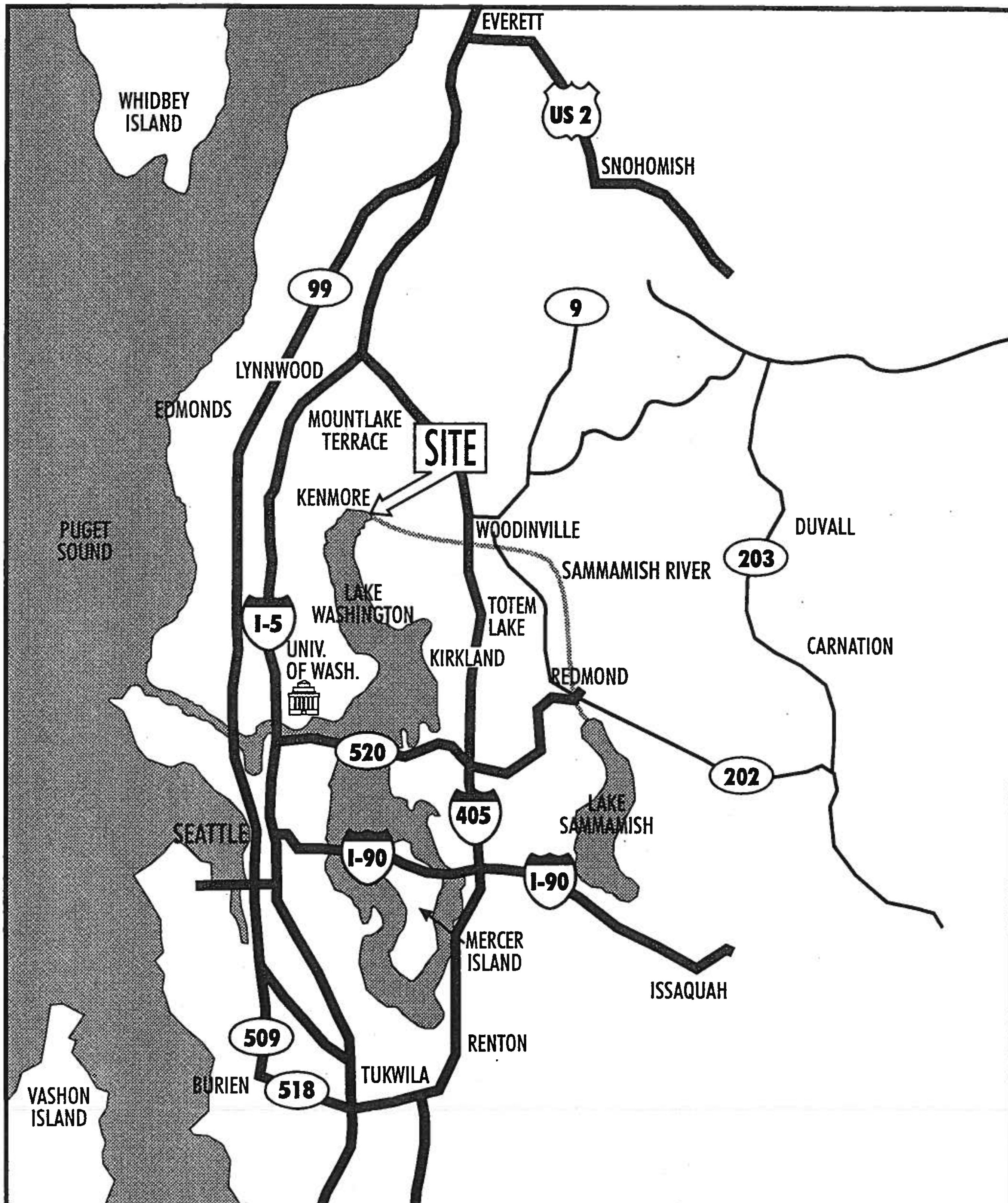
1.2.1 Property Location

The 45-acre Lakepointe project would be located in King County between the cities of Bothell and Lake Forest Park in the unincorporated area known as Kenmore, situated at the north end of Lake Washington north of the mouth of the Sammamish River (Figure 1.2-1). The property is located southwest of the intersection of State Route (SR) 522 and 68th Avenue. Currently, much of the property is used by Kenmore Pre-Mix for the production, storage and distribution of concrete.

1.2.2 Proposed Action

The proposed action has two options, labeled "preferred" and "baseline." The preferred option includes construction of a hotel. The baseline option would not include a hotel.

The Lakepointe project would be a mixed-use community featuring retail/commercial, entertainment and residential components, all designed to be pedestrian accessible (Figure 1.2-2). A pedestrian-only trail would be built parallel to the Sammamish River and a combined public access trail/firelane would be built along the Lake Washington shore. A marina, replacing the existing commercial channel, would feature a boardwalk with restaurants and retail businesses. The developed multiple land uses would include:

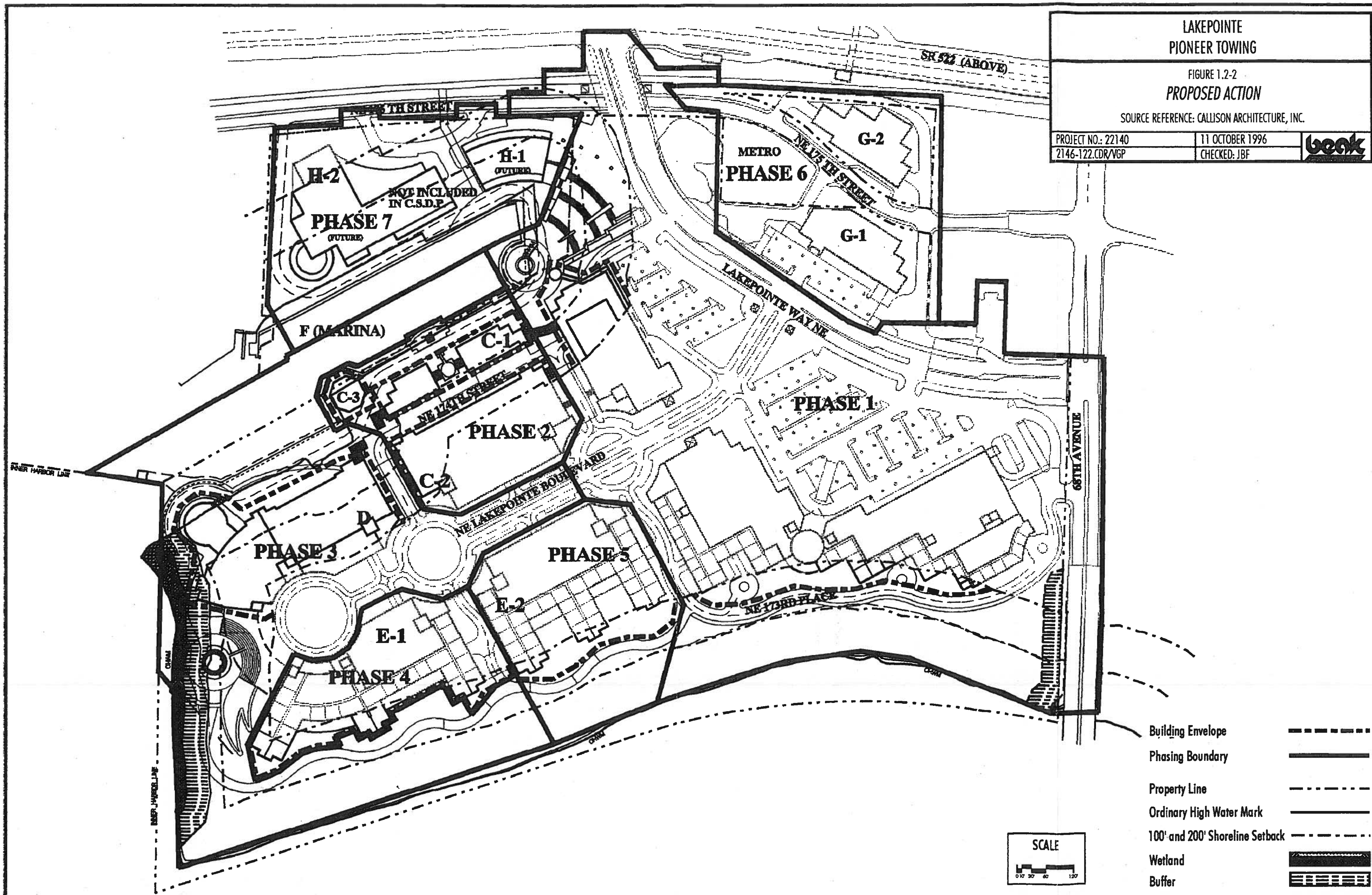


LAKEPOINTE
PIONEER TOWING COMPANY

FIGURE 1.2-1

LAKEPOINTE SITE MAP

PROJECT NO.: 22140	11 OCTOBER 1996
2140-121.CDR/VGP	CHECKED: JBF



LAKEPOINTE
PIONEER TOWING

FIGURE 1.2-2
PROPOSED ACTION

SOURCE REFERENCE: CALLISON ARCHITECTURE, INC.

- 1,200 residential units (apartments and condominiums)
- a private moorage marina with approximately 50 boat slips and short-term public moorage
- marina boardwalk
- retail and commercial space
- hotel
- cinema complex
- professional office space
- amphitheater
- restaurants
- landscaped park areas
- playground
- maintenance and fire access paths
- parking areas (surface and subsurface)
- shoreline trail system including viewpoints

The proposed action also includes expansion of the vegetated shoreline buffers, enhancement of the existing shoreline plant communities, and enhancement of fisheries habitat in the inner harbor channel.

Phase 7 of the development is not part of the current application proposal, but is discussed with regard to potential marina impacts and mitigation in this report. Phase 7 is a 5-acre parcel designated as Block H, which includes the northern half of the inner channel and property to the north of the inner channel (Figure 1.2-2). Development of Block H will require separate application and review. However, the inner channel and the marina proposed for the inner channel is a relatively small area, and through mitigation planning it became evident that mitigation for all marina development would need to be constructed during Phase 3 when the southern portion of the marina is built. Therefore, impacts and analysis of the entire marina, including Block H, are analyzed in this report and mitigation is proposed to compensate for impacts from the entire marina, including Block H.

1.2.3 Design Alternative

The design alternative would not change the proposed development footprint, marina plan nor shoreline treatment; therefore, no effect on the shoreline and water quality is anticipated other than that described in this report.

1.2.4 No-Action Alternative

Under the no-action alternative, the proposed Lakepointe mixed use development would not be constructed. The property would remain as a facility for the production and distribution of concrete operated by Kenmore Pre-Mix. Lease or rental of portions of the property to commercial or industrial tenants would continue.

1.2.5 Project Phasing

Table 1.2-1. Proposed Action Phases.

Phase	Land Use	Project Blocks
1	Retail (food, drug store, and other misc.) Rental apartments Senior residential units Parking decks Grand stairs Burke Gilman Trail access Elevated roadway (Lakepointe Way) Water treatment pond (wetpond)	A
1	Commercial/retail Public plaza at elevation 25 Entertainment/cinemas Portion of shoreline park adjacent to Block A Enhancement and expansion of vegetated shoreline buffer Enhancement of fisheries habitat in the channel Parking deck Bulkhead removal	B
2	Commercial/retail Residential Public promenade, public outlook and firelane Boathouse restaurant and public view point	C C-1, C-2, C-3
3	Retail Lakehouse restaurant Hotel Amphitheater Marina - south side Moorage facilities Enhancement of fisheries habitat in the inner harbor Enhancement and expansion of vegetated shoreline buffer Southwest shoreline park with biofiltration Public access trail/firelane Public outlook	D, F
4	Residential with adjacent shoreline park Enhancement and expansion of vegetated shoreline buffer	E-1
5	Residential	E-2
6	Commercial	G
7	Future Development North side of moorage facilities	H

1.3 REGULATIONS AND POLICIES GOVERNING WATER QUALITY, FISHERIES, WETLANDS AND WILDLIFE

1.3.1 Class AA and Lake Class Water Quality Standards (Ecology; Chapter 173-201A WAC)

Washington state water quality standards for Class AA or Lake Class waters must be maintained as designated by 173-201A WAC. Lake Washington is designated Lake Class and the Sammamish River has Class AA designation. Two wetlands are located on the Lakepointe project site. Currently, the state of Washington does not supply water quality standard criteria specific to wetlands, but considers them surface waters. In this case, because they are associated with Class AA waters, these wetlands would fall under Class AA criteria (Chapter 173-201A-120).

1.3.2 King County Surface Water Design Manual (January 1990)

The King County Surface Water Design Manual (KCSWDM) specifies hydrologic sizing, facility type and design requirements for stormwater quantity and quality control. The KCSWDM is in the process of being updated and revised to require "state-of-the-art" water quality treatment. The Lakepointe project would comply with all updated manual requirements and specifications.

From a water quality perspective, three water quality treatment provisions in the current manual (King County 1990) are applicable to the project:

1) Core Requirement #3 for runoff control and biofiltration requires that biofiltration swales be built for any project with more than 5,000 square feet of impervious surface that is subject to vehicular use.

2) Special Requirement #5 for special water quality controls requires that a wetpond be built in the case that the discharge point of a project with 1 acre of new impervious surface exists within the drainage and within 1 mile of a King County Class 1 wetland or a King County Class 1 or 2 stream.

3) Special Requirement #6 for oil/water separators requires coalescing plate oil/water separators for sites having high vehicular use. High use is defined as more than 2,500 average daily trips (ADT) on a site.

1.3.3 Draft King County Surface Water Design Manual (February 1996)

A draft of the updated KCSWDM, published in February 1996, is proposed to update requirements for water quality facilities and best management practices (BMPs) in King County. These new requirements would be applied to the Lakepointe project and would exceed the minimum 1990 KCSWDM requirements (KPFF 1996). The consideration of the technical analysis in this report uses the draft manual water quality requirements for wetpond sizing.

Five basic water quality "menus" are discussed in the draft KCSWDM (1996):

- Basic Water Quality
- Sensitive Lake Protection
- Resource Stream Protection
- Sphagnum Bog Protection
- High-Use

Each water quality menu provides a selection of water quality treatment(s) facilities that could be used under various situations. There are no protected lakes or streams in the project's drainage currently designated by the County that would trigger the Sensitive Lake Protection or Resource Stream Protection menus, nor are sphagnum bogs located on-site. At Lakepointe, some of the exposed commercial/retail parking and access roads would trigger the High-Use menu (under the 1996 draft) invoked by a special requirement (#5) provision for oil control.

The following requirements in the draft (1996) KCSWDM would be triggered by the Lakepointe proposed action.

Core Requirement #8: Water Quality

The Basic Water Quality menu requires that facilities remove 80 percent of the total suspended solids (TSS). Seven facilities listed as options meeting the removal criterion are: (1) biofiltration swale, (2) filter strip, (3) sand filter, (4) wetpond, (5) combined detention and wetpond facilities, (6) constructed wetland and (7) wet vault. The Lakepointe project would use either sand filter\biofiltration swales or a wetpond, depending upon the catchment (a wetpond will be used in high-use areas), using the draft 1996 KCSWDM design criteria to satisfy or exceed the Basic Water Quality menu functional requirement.

Draft 1996 KCSWDM: Special Requirement #4: Source Control

The development or redevelopment of a commercial, industrial or multifamily site requires use of water quality source controls (BMPs). Water quality BMPs are intended to help reduce the potential of contaminants entering surface waters by preventing rainfall and runoff from coming into contact with potential pollutants (e.g., dumpster area roofing).

Draft 1996 KCSWDM: Special Requirement #5: Oil Control

The High-Use menu applies to new and redeveloped sites that have high-use characteristics. A high-use site has at least 5,000 square feet of total impervious surface area and high traffic volumes, petroleum storage, or a diesel vehicle fleet. Lakepointe would be involved by the following specific criteria:

- impervious exposed parking subject to 100 vehicle ADTs per 1,000 square feet of gross building area served by the area. This criterion may be met by commercial parking in Phase 1 of the proposed action.

- more than 25,000 vehicle ADTs measured at a main intersection or more than 15,000 vehicles use on an intersecting roadway. This criterion would be met by Lakepointe Way N.E. proposed for Phase 1 of the proposed action.

High-use facilities for oil control are used to capture oil and related pollutants. Oil control facilities may include catch basin inserts, linear sand filters, and oil/water separators (gravity and coalescing plate). The goal of oil treatment facilities is to provide treatment so that facility discharge concentrations of oil/grease and total petroleum hydrocarbons (TPH) is 10 mg/l or less. At Lakepointe, coalescing plate filtration is proposed for treatment of high-use areas.

1.3.4 Stormwater Management Manual for the Puget Sound Basin (1992; Washington State Department of Ecology and the Puget Sound Water Quality Authority; Chapter 173-275-360 WAC); [*Regulatory Guidelines Only*]

The stormwater management manual provides Washington State Department of Ecology (Ecology) guidance on stormwater management for all areas draining to Puget Sound. The greatest difference between this and the KCSWDM manual (King County 1990) is that Ecology recommends sizing wetponds to 2/3 of the 2-year 24-hour design storm, rather than to 1/3 of the 2-year 24-hour design storm required in King County's 1990 manual. The Lakepointe project will meet or exceed the 2/3 of the 2-year 24-hour design storm Ecology sizing for its wetpond by use of the draft KCSWDM (1996) criterion for a volume of basin to volume of (mean annual storm) runoff ratio equal to 3.

1.3.5 Stormwater Runoff National Pollutant Discharge Elimination System (NPDES) Permit

For all new construction activity exceeding 5 acres in size, a Notice of Intent (NOI) must be filed for a National Pollutant Discharge Elimination System (NPDES) General Permit with Ecology. A public notice must be published at least once a week for two consecutive weeks in a newspaper that has general circulation in the county in which the site is located. The NOI must be received by Ecology prior to the publication of the public notices. Ecology will notify the applicant on coverage within 10 days of receiving a completed application; however, Ecology will not issue a permit until after the 30-day public comment period, which starts on the date of the last public notice publication. An NPDES permit would not be required for developed stormwater discharge at Lakepointe.

1.3.6 Hydraulic Project Approval (HPA)

An HPA is issued by the Washington Department of Fish and Wildlife for construction or other work that will use, divert, obstruct, or change the natural flow or bed of any fresh water or salt water of the state. The permit specifies time limitations and provisions for the qualifying project. All Lakepointe project work occurring within or overhanging the ordinary high water line of the Sammamish River, Lake Washington, and the inner harbor will be subject to an HPA. An HPA request would be filed by completing a Joint Aquatic Resource Permits Application (JARPA), which is also used to apply for Shoreline Management Permits, Water Quality Certification & Approval for Exceedance of Standards, and U.S. Army Corps of Engineers Section 404 and 10 Permits.

1.3.7 King County Environmentally Sensitive Areas (K.C.C 21A.24)

A sensitive areas review is conducted for a proposed development permit application if the project site includes a sensitive area or sensitive area buffer. The purpose of the review is to determine type of sensitive area on the site, determine if alteration of the sensitive area is necessary, and determine if mitigation, monitoring and bonding measures are sufficient.

According to K.C.C 21A.06.1415, two Class 2 wetlands occur on the Lakepointe project site. Class 2 wetlands are assigned a 50-foot buffer. The Sammamish River is considered a Class 1 stream requiring a minimum 100-foot buffer. Buildings and other structures are to be set back a distance of 15 feet from the edges of all sensitive areas.

Alterations to wetlands may be permitted if King County determines, based on special study review, that the proposed development will protect, restore or enhance the wildlife habitat, natural drainage or other valuable functions of the wetland and result in a net improvement to the functions of the wetland system. Alterations to streams and buffers may be allowed based on a special study. No wetland fill or stream relocations are proposed by the Lakepointe project.

Public and private trails may be allowed in wetland and stream buffers if the trail surface is made of pervious material located in the outer third of the buffer, and buffers are expanded equal to the width of the trail corridor. Road intrusion to the buffer is permitted if the buffer is expanded by the area of road within the buffer.

1.3.8 King County Shoreline Management Master Program

A shoreline permit is required if development is within 200 feet of the ordinary high water mark of a water body; or within 100-year floodplain of a water body for which the total cost or fair market value exceeds $2,500; or development materially interferes with normal public use of the water or shoreline.

1.3.9 Clean Water Act , Section 404 and Section 401

Dredge and fill activities within waters of the United States require Section 404 Permit as well as 401 Certification and Coastal Zone Management Act, Section 307 Consistency Determination from Washington State Department of Ecology. No dredge or fill activity is required for construction. However, the repair and replacement of existing bulkheads, the removal of 347 un-used and burnt pilings, and construction of 449 wooden, metal or concrete support pilings would require Section 404 review.

1.3.10 Rivers and Harbors Act of 1889, Section 10

33 CFR Part 322 prescribes policies to be followed by the Corps of Engineers to authorize structures or work affecting navigable water of the United States pursuant to section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403). The placement of piles in the inner harbor may require Section 10 review.

1.4 PROJECT HISTORY

In compliance with the state's Growth Management Act (GMA), a land use plan for the Northshore Community was updated and an EIS completed. The Northshore Community includes the Kenmore activity center, of which the Lakepointe project site is a part. The updated plan was completed in 1991, and is consistent with the King County Comprehensive Plan.

As well as addressing urban growth areas, urban areas, and environmental issues, the plan promotes developing an identity for the Kenmore activity center. This identity would emphasize its marine location and enhance pedestrian links between high-density housing and a commercial office core. The plan specifically identifies the Kenmore waterfront, the proposed location of the Lakepointe project, as a "major redevelopment opportunity." The Lakepointe project would redevelop approximately 50 acres of the waterfront; its land use would be consistent with the requirements of the Northshore Community Plan and the GMA.

1.5 BASIS OF EVALUATION

Construction and development of the proposed Lakepointe project is an integral part of a separate site remediation action for much of the site. The site remediation plan agreement and implementation will be developed by the land owner in consultation with Ecology as a separate action to this SEPA analysis. The analyses in these reports are based on impact assessments arising from project actions on a remediated site.

2.0 WATER QUALITY

2.1 AFFECTED ENVIRONMENT

Aquatic resources on or adjacent to the proposed project include two wetlands, Lake Washington, and the Sammamish River. These are described below, followed by a discussion of regulatory standards and Federal Clean Water Act evaluations of the Sammamish River and Lake Washington.

2.1.1 Surface Water Resources

Sammamish River

The Sammamish River is approximately 15.3 miles long. The river has been channelized by the Army Corps of Engineers for its entire length and runs generally north and west from Lake Sammamish to Lake Washington. The Sammamish River has been identified as "Water Quality Limited" (see section 2.1.3) for fecal coliform along 47 percent of its length (Ecology 1994). The entire river consists of five State of Washington Waterbody Segments, WA-08-1050, WA-08-1070, WA-08-1080, WA-08-1090 and WA-08-1100. The lowest, Waterbody Segment WA-08-1050, is adjacent to the proposed Lakepointe site. Numerous fecal coliform excursions have been recorded in all segments except WA-08-1090, based upon data reported by Metro and Ecology (ambient monitoring stations).

The Sammamish River is designated class AA water (extraordinary) along its length from the Marymoor Park Bridge to Kenmore by Ecology (WAC Chapter 173-201A-130). According to a Storage and Retrieval of Water Related Data (STORET) database search (United States Environmental Protection Agency [US EPA] 1996) on 11 September 1996, Metro began collecting water samples in 1963 (Station No. 0405), near the bridge on 68th Avenue NE in Kenmore. Water temperature and nutrient (phosphorus and nitrogen) samples were often collected weekly. Total coliforms and fecal coliforms were collected intermittently throughout the sampling record beginning in 1967 to present. The river at this location is high in fecal coliforms and high in nutrient concentrations. From 1976 through 1980, total cadmium, chromium, copper, iron, lead, nickel and zinc were collected quarterly. From 1981 through 1986, these metals (with the addition of iron) were collected monthly. During 1986 (the last year metals data are available) iron ranged from 428 to 878 μg/l; copper ranged from below detection to 4 μg/l; lead ranged from 2 to 9 μg/l; and zinc ranged from below detection to 9 μg/l. Hardness data were not listed in the STORET database search so comparison with state metals standards (WAC 173-201A), which vary with hardness, must be extrapolated from data from Lake Washington and Lake Sammamish. Metals compliance with state standards is probable, given known hardnesses for Lake Sammamish and Lake Washington at the origin and mouth of the Sammamish River.

Based on current sampling results, Metro (1994) has determined Sammamish River water quality is fair. Water quality is being compromised by fecal coliform bacteria, dissolved oxygen (DO) and temperature, which frequently violated Class AA standards during monitoring from 1990 to 1993. The majority of the water quality violations occurred during warmer summer months.

Lake Washington

Lake Washington, adjacent to the site, is the largest lake in King County, with a drainage area of 472 square miles and an area of 21,500 acres. The lake has a volume of 2.35 million acre-feet, a mean depth of 108 feet, and a maximum depth of 214 feet. The main inflows to the lake are the Cedar River in the south end (57 %) and the Sammamish River in the north end (27 %). The Sammamish River, forming the site's southern boundary at its mouth, contributes 41 percent of the annual phosphorus load (Metro 1989). The Lake Washington watershed is considered urban, with approximately 63 percent of its area developed (Metro 1989).

Between 1941 and 1963, Lake Washington received increasing amounts of secondary sewage, and water quality declined to the point that the lake became eutrophic. Welch (1992) describes eutrophication as "*the process by which water bodies become more productive through increased input of organic nutrients*." Sewage was diverted beginning in 1963, and sewage phosphorus input was eliminated by 1968 (Metro, 1989). Water quality improvements have been documented and the lake is currently classified as mesotrophic, with fairly good transparency, and low levels of phosphorus and chlorophyll except during the spring algal "bloom" (Metro 1991).

The Water Resources Section of the Water Pollution Control Department of Metro has established several Lake Washington water quality stations, including one near Kenmore at the north end of the lake near the Sammamish River mouth and the proposed project (Station No. 0804). A King County database search revealed water quality data at this station beginning in January 1990. Initially samples were collected weekly but newer data are collected at least monthly. Data on record include water temperature, turbidity, conductivity, dissolved oxygen, pH and nutrients. All data from this search are in Appendix B.

Water quality data for parameters used to determine the trophic state (lake nutrient and productivity condition) are available from 1981 to 1982 and 1984 to March 1996. Historic trophic data (1981, 1982 and 1984 to 1989) were compared to recent (1990 through 1995) data (Figure 2.1-1 and Table 2.1-1). Since 1990, chlorophyll-a has varied about the historic mean, being lower from 1990 through 1993 and higher from 1994 through 1995. Transparency and total phosphorus are slightly above the historic means. Fecal coliforms were above the recent historical average in 1991 and 1992, although the state Lake Class standard for fecal coliform was met during all monitoring. Although Lake Washington appears slightly more productive in 1996 relative to 1988, transparency was not affected and no significant change in trophic status has occurred (Figure 2.1-1).

On-Site Water Resources

During site visits in 1996 by Beak, on-site waters consisted of puddles during wet weather and a pond containing concrete wash-off. Puddles in areas of vehicle traffic were heavily silted and churned with mud during wet weather. Puddles in the areas of roofing debris piles were oily in appearance by sheen and color. The pond used for concrete wash-off was assumed to be very alkaline. No water quality monitoring occurred on-site. Since those visits, the large waste piles have been removed and industrial activity has been curtailed south of the inner harbor.

There are two wetlands on-site. Wetland A stretches linearly along the western Lake Washington shoreline and is hydrologically associated with the lake. Wetland B is located at the extreme southeastern corner of the property, and is largely off-site to the east. Wetland B is hydrologically associated with the Sammamish River. Neither wetland would receive any project runoff or be affected by development, so no specific water quality investigations were undertaken.

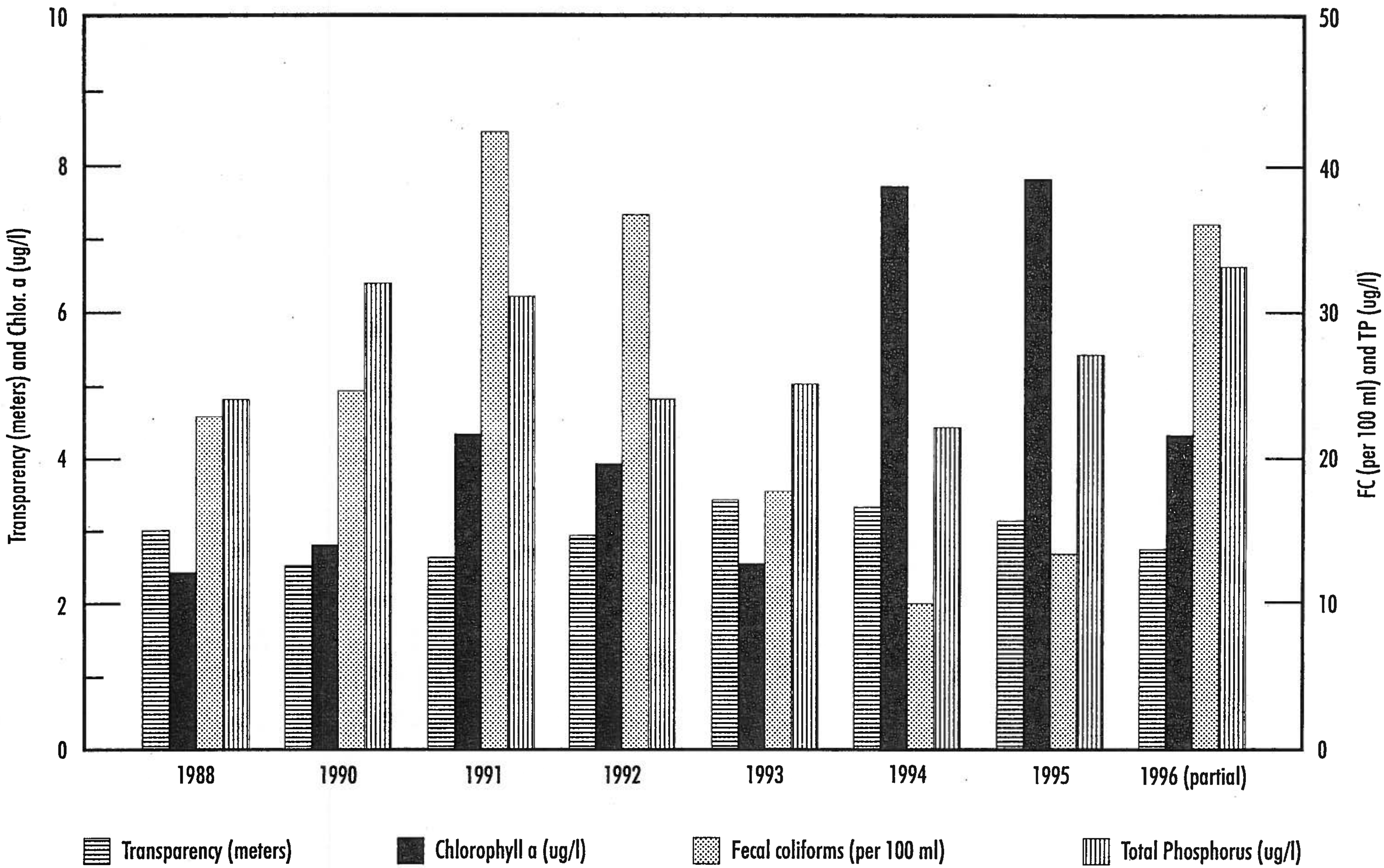


Figure. 2.1-1 Metro station 0804 Lake Washington near Kenmore average water quality data for each water year.

Table 2.1-1 Metro Station 0804 Trophic Water Quality Data by Water Year
Station located in Lake Washington near Kenmore at the Sammamish River Mouth

		Transparency (meters)	Total Phosphorus (ug/l)	Chlorophyll-a (ug/l)	Fecal Coliform #/100 ml
Water Year 87/88	Count	21.0	20	20.0	20.0
	Minimum	0.9	12	0.01	1.0
	Maximum	6.0	0	6.49	107.0
	Average	**3.0**	**24**	**2.41**	**22.9**
Water Year 89/90	Count	15.0	15	13.00	14.0
	Minimum	0.4	16	0.01	2.0
	Maximum	4.0	126	6.76	52.0
	Average	**2.5**	**32**	**2.78**	**24.6**
Water Year 90/91	Count	14.0	14	14.00	14.0
	Minimum	0.500	13	1.17	3.0
	Maximum	6.200	75	10.40	200.0
	Average	**2.621**	**31**	**4.32**	**42.2**
Water Year 91/92	Count	15.0	26	15.00	14.0
	Minimum	1.5	7	1.76	1.0
	Maximum	3.7	48	8.81	191.0
	Average	**2.9**	**24**	**3.93**	**36.6**
Water Year 92/93	Count	14.0	26	12.00	14.0
	Minimum	1.7	8	0.50	1.0
	Maximum	6.0	85	6.20	52.0
	Average	**3.4**	**25**	**2.53**	**17.6**
Water Year 93/94	Count	14.0	26	26.00	14.0
	Minimum	2.0	12	1.10	0.0
	Maximum	5.0	41	28.00	26.0
	Average	**3.3**	**22**	**7.68**	**9.8**
Water Year 94/95	Count	16.0	30	22.00	16.0
	Minimum	2.0	9	1.70	1.0
	Maximum	5.5	50	23.00	46.0
	Average	**3.1**	**27**	**7.79**	**13.2**
Water Year 95/96 (through 5 March 1996)	Count	6.0	15	6.00	7.0
	Minimum	1.5	9	1.30	3.0
	Maximum	4.2	84	12.00	70.0
	Average	**2.7**	**33**	**4.28**	**35.9**

(Complete Years from 1990 through 1995)				
Total count	73	122	89	72
Sum of Means	222.8	3090.0	520.8	1698.0
Average	3.1	25.3	5.9	23.6
Historic Data:				
81-82, 84-89	2.7	24	4.49	2
Difference	0.4	1.3	1.4	21.6

Historical Data Source: Quality of Local Lakes and Streams 1989-1990 Update, Table 3-13. Water Resources Section; Water Pollution Control Department, METRO 1991.
Recent Data Source: Data from 1990 through March of 1996 were courtesy of Metro (Brenn

2.1.2 Surface Water Quality Standards

Off-site surface waters within the vicinity of the proposed project have Class AA (extraordinary) or Lake Class water quality designations by Ecology, in accordance with Washington Administrative Code (WAC) 173-201A. Waters of this quality exceed the requirements for all or substantially all uses, including domestic, industrial or agricultural water supply, stock watering, fish rearing, spawning and harvesting, wildlife habitat, recreation, and aesthetic enjoyment.

Lakepointe site surface water resources include two wetlands. State surface water quality standards do apply to wetland waters; however, they were not established to specifically recognize water quality conditions naturally occurring in wetlands, bogs or fens, for example, low dissolved oxygen. Specific quality criteria for wetlands have not yet been established. Wetland waters are often stagnant, which may contribute to one or more of the following conditions: 1) low pH values; 2) low dissolved oxygen concentrations; and 3) warm water temperatures. These types of conditions may violate the standards established for surface water quality, but can be characteristic of high quality wetland waters.

Criteria for fresh water Class AA (extraordinary) are:

Parameter	
Fecal coliforms	Shall not exceed a geometric mean of 50 organisms per 100 ml, with not more than 10 percent of all samples exceeding 100 organisms per 100 ml.
Dissolved oxygen	Shall exceed 9.5 mg/L (total dissolved gas shall not exceed 110 percent).
Temperature	Shall not exceed 16.0 C due to human activities. When natural conditions exceed 16.0 C, no temperature increases will be allowed which will raise the receiving water temperature by more than 0.3 C.
pH	Shall be in the range of 6.5 to 8.5, with a human-caused variation of less than 0.2 units.

Turbidity	Shall not exceed 5 NTU over background when background is less than 50 NTU or less, or have more than a 10 percent increase when background is greater than 50 NTU.
Toxic, radioactive	Shall be below those levels adversely affecting water uses, cause acute deleterious material or chronic effects on aquatic biota, or adversely affect human health.
Aesthetic values	Shall not be impaired by the presence of materials or their effects.

Criteria for freshwater Lake Class are identical to Class AA standards with the exception that:

Parameter	
Dissolved Oxygen	No measurable decrease from natural conditions. Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.
Temperature	No measurable change from natural conditions.
pH	No measurable change from natural conditions.

2.1.3 Ecology 1994 and draft 1996 303(d) Water Quality Limited Lists

303(d) Water Quality Limited List

Section 303(d) of the 1972 Federal Clean Water Act (CWA) requires states identify and list threatened and impaired waterbodies. The CWA requires the list be updated and submitted to the Environmental Protection Agency (EPA) every two years. The purpose of the listing is to identify where, with technology-based pollution control measures, waterbodies are not expected to meet applicable standard(s), and indicate the non-compliant water quality parameter(s). The 1996 draft water quality limited list proposed by Ecology was scheduled for submittal to the EPA after the public comment review period that ended 1 March 1996. Because the 1996 version of the decision matrix has not been approved by the EPA, the 1994 303(d) list remains the official compilation of water-quality-limited bodies (Butkus, S., pers. comm., 9 September 1996).

The 1994 303(d) list recorded Sammamish River water quality parameters violating state standards in four sections of the river, from RM 0.0 to RM 0.6 (which includes the reach adjacent to Lakepointe), from RM 0.6 at the mouth of Swamp Creek to RM 4.4 at the mouth of North Creek, from the North Creek mouth to Little Bear Creek mouth at RM 5.5, and from Bear Creek at RM 13.6 to Lake Sammamish at RM 15.3. Fecal coliform exceeded state standards in all four reaches.

Section 305(b) of the 1972 CWA requires all states to prepare biennial reports assessing the impaired uses and causes of the water quality defined waterbodies within the state. The 1994 report prepared by Ecology addresses supported and impaired uses, and sources and causes of documented impairments of specific waterbodies. The Washington State Water Quality Assessment 305(b) Report listed the causes of Sammamish River water quality impairment as ammonia, pH, dissolved oxygen / organic enrichment, thermal modifications, and fecal coliform. The impaired uses were primary and secondary contact, rearing, harvesting, and salmonid spawning and other fish spawning.

The proposed 1996 draft listing for the water quality limited reaches includes most of the Sammamish River sections listed in 1994 as well as the reach between RM 5.5 and RM 13.6. It does not list the reach from the mouth to RM 0.6, which includes the portion adjacent to the Lakepointe site. The reach from RM 0.6 to RM 4.4 in the proposed 1996 list is unchanged from the 1994 status. The reach from RM 4.4 to RM 5.5, upstream of the proposed project, has been proposed for continued listing on the basis of excursions of fecal coliform and DO. There are some interpretations of the data record that would include listing of this reach due to temperature excursions, but listing was not recommended. The reach between RM 5.5 and RM 13.6 has been proposed for listing for temperature and fecal coliform excursions. The reach from RM 13.6 to RM 15.3 has been proposed for listing for excursions of fecal coliform. Numerous excursions from standard in this reach for temperature and DO were also documented, but were determined to be a result of natural conditions and were therefore not proposed for listing.

Lake Sammamish, from which the Sammamish River flows, was not listed in the 303(d) report in 1994. For 1996 it was considered for listing based on documented exceedances of biologically available phosphorus (Metro and King County 1995; Entranco 1989; Horner 1987). However, Lake

Sammamish has been proposed for exclusion from the 303(d) list in the 1996 draft based on Phase I lake restoration measures, including monitoring and source control, under federal regulation 40 CFR 130.7(b)(1)(iii).

Lake Washington has not been proposed for any change under the 1996 listing. It was listed in 1994 for sediment bioassays based on studies conducted near Renton in the southeastern portion of the lake, which occurred in 1984, 1991 and 1992 (Bennett and Cubbage 1992; Norton 1991, 1992). The 1996 proposed list includes bioassay data collected by Romberg (1984), Comiskey (1984) and Trial and Michaud (1985). The 305 (b) report listed the cause of impairment as unknown toxicity and wildlife habitat as an impaired use at the south end of the lake. Lakepointe is located at the extreme northern end of Lake Washington.

2.2 SIGNIFICANT IMPACT ANALYSES; WATER QUALITY

2.2.1 Construction Impact Analysis

For most construction, clearing and grading exposes erodible soils which increases the rate of surface water runoff from storms. For Lakepointe, soils are already exposed under the existing condition (see AGRA [1996] for a description of existing erosion conditions on the site). Therefore, surface flows from construction need to be controlled to minimize risk of sediment transport to on-site wetlands, the Sammamish River, or Lake Washington. However, the amount of sediment with potential for transport will not be significantly different from the existing condition during construction, provided soil stockpiling and non-compacted sediments are properly protected from erosion. The absence of steep slopes and lack of definitive channels on the project area reduce sediment transport risk. Construction of confluences in the immediate proximity of the Sammamish River will warrant careful temporary erosion and sediment control planning. See Fisheries (Chapter 3.0) for construction recommendations related to marine dredging.

Should uncontrolled surface runoff occur, potential construction impacts to water quality would primarily consist of the following:

- turbidity, suspended and settleable solids from runoff discharge,

- increased phosphorus and nitrogen contributions to adjacent waters from eroded soils, and

- potential release of petroleum hydrocarbons from construction equipment.

Temperature impact to Lake Washington and the lower Sammamish River from runoff during clearing and grading is not expected to be significant because of the small volume of controlled discharge relative to the adjacent Lake Washington volume and the Sammamish River mouth and because under the existing condition the site is open and soils are exposed.

Construction Sedimentation

Clearing, grading and construction would occur in phases over several seasons. All clearing and grading would be in accordance with King County requirements for prior installation and regular maintenance of sediment and erosion control facilities (King County 1990). Construction runoff would be conveyed to temporary settling ponds, with overflow directed to receiving waters by means of swales. These Temporary Erosion and Sediment Control Plan (TESCP) measures would be employed to prevent turbid water from causing turbidity water quality violations during upland construction. Work within or near the ordinary high water mark would require a short-term Water Quality Modification permit (WAC 173-201A-035) under conditions determined by Ecology, in addition to an hydraulics permit approval (HPA). A water quality certification (Section 401) would also be a prerequisite to obtaining an Army Corps of Engineers permit. Local and temporary increases in turbidity in Lake Washington under conditions of the Water Quality Modification permit would be expected from in-water work for the marina.

Mitigated sediment delivery rates for construction activities were calculated by AGRA (1996). The amount of sediment delivered to surface waters under mitigated construction conditions was calculated to total 0 tons per year for each phase, compared to 34.6 tons per year under the existing condition for all phases (Table 2.2-1). No sediment would be expected to pass through the buffers into Lake Washington or the Sammamish River because of existing site conditions (AGRA 1996).

Table 2.2-1. Lakepointe estimated sediment yields (tons/year) to off-site surface waters for existing conditions, construction and post-construction (Source: AGRA 1996).

I. Existing Site Conditions		
Phase	**Existing Sediment Yield Per Phase**	
Phase 1:	21.8 (tons/year)	
Phase 2:	0.6 (tons/year)	
Phase 3:	4.4 (tons/year)	
Phase 4:	2.4 (tons/year)	
Phase 5:	1.8 (tons/year)	
Phase 6:	2.4 (tons/year)	
Phase 7:	1.2 (tons/year)	
II. Construction		
Phase	**Construction Sediment Yield Per Phase**	**The Amount of Sediment Generated from the Remainder of the Site**
Phase 1:	0.0 (tons/year)	12.8 (tons/year)
Phase 2:	0.0 (tons/year)	12.2 (tons/year)
Phase 3:	0.0 (tons/year)	7.8 (tons/year)
Phase 4:	0.0 (tons/year)	5.4 (tons/year)
Phase 5:	0.0 (tons/year)	3.6 (tons/year)
Phase 6:	0.0 (tons/year)	1.2 (tons/year)
Phase 7:	0.0 (tons/year)	0.0 (tons/year)
III. Post Construction		
Phase	**Post-construction Sediment Yield Per Phase**	
Phase 1:	0.0 (tons/year)	
Phase 2:	0.0 (tons/year)	
Phase 3:	0.0 (tons/year)	
Phase 4:	0.0 (tons/year)	
Phase 5:	0.0 (tons/year)	
Phase 6:	0.0 (tons/year)	
Phase 7:	0.0 (tons/year)	

Construction mitigation measures would be detailed in the Lakepointe TESCP (to be completed by KPFF), which King County requires as a part of grading permit applications.

Phosphorus and Nitrogen

Phosphorus and nitrogen are natural components of soils which may increase in stormwater runoff as a function of sediment erosion, although the result is not very predictable. In clearcut areas, nitrate-nitrogen losses have been low when measured (Lynch and Corbett 1990). Lakepointe, with low slope and low potential for sediment delivery relative to the existing condition, would have a low risk of phosphorus or nitrogen release under TESCP measures recommended by the KCSWM (1990).

Petroleum Hydrocarbons

Release of petroleum hydrocarbons from heavy construction equipment poses a significant risk to surface waters, but can be prevented by mitigation measures such as catchment control of parking/staging areas for the equipment, strict prohibition of oil/fuel dumping by contractors, and contractual specification of accidental spill response procedures and notification requirements. In the construction of the Lakepointe project, no construction waste or soils affected by accidental spills would be left on site.

2.2.2 Post-Construction Impact Analysis

Unmitigated Stormwater Contaminants

Effects upon surface water quality from development were estimated by combining specific plans for surface water management with the proposed land use. The analysis in this report used water quality data measured in stormwater drainage from previously developed areas under unmitigated conditions (Beak 1995a; Barrett *et al.* 1993; King County 1993a; CH_2M-Hill 1992; City of Austin 1990; Pitt *et al.* 1983; URS Engineers 1983; US EPA 1983; Mar *et al.* 1982; Metro 1982; Chui *et al.* 1981; Farris *et al.* 1979; Farris *et al.* 1973; Galvin and Moore 1982; Meister and Kefer 1981). Contaminant-removal efficiencies taken from the literature for the various mitigation techniques were applied to the proposed stormwater management facilities to predict water quality at the catchment release point. Stormwater quality was estimated at entry to natural receiving waters. State standards apply to the receiving waters.

Urban runoff contaminants include the following:

- from vehicle traffic on roadways: mercury, copper, zinc, lead, chromium, cadmium, iron, total suspended solids and oil and grease;

- from motor oils and landscape fertilizers: phosphorus, ammonia, nitrate- and nitrite-nitrogen; and

- from diffuse sources associated with residential and urbanized runoff: biological oxygen demand, carbon oxygen demand, fecal coliforms, raised temperature, lowered DO and altered pH.

Metals

Roadways are a source of inorganic and organic materials in runoff from storms. Metro (1982) concluded that motor vehicles are primary contributors of both metals and organics in urban stormwater runoff. Roadways accumulate heavy metals, rubber, polycyclic aromatic hydrocarbons (PAH), petroleum products, and solid materials, which become mobilized in stormwater runoff. Types and amounts of contaminants vary, depending on such factors as storm intensity, time between storms, street surface pollutant accumulations, and traffic intensity (Reinertsen 1981).

Heavy metals such as lead, copper, zinc and cadmium are transported with roadway runoff both in solute (dissolved) and particulate form. Above certain concentrations, some of these metals are toxic to fish and other organisms. Heavy metals generally bind tightly to sediments, and it is this mechanism more than any other that accounts for their removal in wet detention ponds and swales. As an example, over an eight-year period, over 95 percent of the total metals loading from an Interstate freeway overpass (at an average daily volume of 55,000) was contained in detention pond sediments (Yousef *et al.* 1984), a metals loading situation greater than twice the severity that would occur for this project. Metals bind tightly to sediments and transport from detained sediments within a wetponds would not be significant. Metals diffusion in pond sediments was cited as less than 0.04 in^2 per year (Yousef *et al.* 1984). Studies by Mesuere and Fish (1989) of runoff derived metals showed much of the particulate copper settled within 20 meters (65.6 feet) measured axially from the main inlet to the detention pond system, which was approximately 40 meters in length.

Lead has been historically present in roadway runoff at higher concentrations than any other priority pollutant (Metro 1982). Since its removal as a gasoline fuel additive, lead has declined considerably in the environment. Recent data for developed runoff (CH2M-Hill 1992) has shown a dramatic decline in lead and other automotive pollutants as a result of automotive emission controls and catalytic converters.

The primary sources of roadway copper are the deposition from vehicle parts, such as brakes, alternators, and radiators. Low concentrations of the cupric ion of copper are extremely toxic to phytoplankton (Metro 1982), which in part accounts for copper's low state water quality standard value.

The source of cadmium on roadways is tire rubber. Once deposited on the road surface, cadmium is less affected by sorption than other trace metals (Metro 1982). In receiving waters, salmonids are extremely sensitive to waterborne cadmium ions (Metro 1982).

Zinc is an abundant trace mineral that occurs naturally in water. However, studies of lakes adjacent to roadways show increases in zinc concentrations in the lake sediment (Gjessing *et al.* 1984). Since zinc is not considered a carcinogenic metal, federal agencies have no specified health limits for zinc, but Washington state water quality standards for zinc do exist.

Street dust collects fuel combustion byproducts. Tire and mechanical wear are also concentrated in street dust and urban soils. Metro (1982) found all priority pollutant metals except selenium in street dust samples, and determined that the six metals found in highest concentration in street dust also appeared in highest concentration in stormwater runoff from the same areas.

The analysis in this report uses total metals, upon which state water quality standards are based. However, State standards for total metals assumes all metals are dissolved. Cadmium, copper, lead, nickel, silver and zinc water quality standards in Chapter 173-201A-040 WAC are based on toxicity test results for the acid-extracted dissolved fraction of the metal. The results were conservatively applied by Ecology in the standards as total recoverable (dissolved plus particulate, or "total metal") values. The effective result was a standard set as though all of the metals were dissolved, even though under natural conditions only a fraction of the total metals would be dissolved and potentially toxic in divalent ionic form. The standards make provision for directly switching to the dissolved concentrations to set permit limits, if the permit applicants can provide information on the dissolved fraction of their wastestreams actually contributing to toxicity. Therefore, the standards for metals discussed in this report are conservative in that they overestimate the amount of metal that will occur in the toxic form. In addition, these standards are applicable even under naturally acidic conditions because they are derived from acid-extractions of samples, and are applicable to varying fractions of dissolved to total metals since they assume far higher dissolved fractions than will occur in stormwater systems or receiving waters.

Acute standard concentrations, not chronic standards, are used in the following analysis for metals. Acute conditions are defined by WAC 173-201A-020 as "*changes in the physical, chemical or biologic environment which are expected or demonstrated to result in injury or death to an organism as a result of short-term exposure to the substance or detrimental environment condition*," which is applicable to other undetained stormwater releases that would be expected from Lakepointe. Metals toxicity concentrations are dependent on the hardness of the water and is determined by the water's calcium carbonate ($CaCO_3$) concentration.

Organics and Inorganics

Polycyclic aromatic hydrocarbons (PAHs) occur naturally in the environment and are produced by the combustion of fossil fuels (anthropogenic sources). Polycyclic aromatic hydrocarbons enter stormwater from the fallout or rain-out of airborne soot particles. Once in water, PAHs are hydrophobic (low solubility in water) and combine readily with organic particles and inorganic compounds.

Nutrients

Nitrogen and phosphorus occur in stormwater runoff from roadways and from fertilizers used in landscaping. Phosphorus can also be released from detergents used to wash cars or building exteriors. Phosphorus readily binds to sediments. Consequently, if a means of particulate settling or infiltration is provided, much of the phosphorus can be removed. Increases in phosphorus loading increase primary production; however, nitrogen is not limiting to production in Lake Washington.

Pesticides and Herbicides

Commercial pesticides and herbicides can be transported in stormwater runoff. The mobility and persistence of pesticides varies greatly. However, organic pesticides used in landscaping are not reported as a significant problem in surface runoff. When measured, their appearance tends to be sporadic and has not been associated with toxic effect. During its survey of residential and urban areas in the early 1980's, Metro reported tentative identification of seven pesticides in five of 21 samples collected. Of the seven pesticides found, all had concentrations in unmitigated runoff above chronic standards at least once; however, no violations of standards in receiving waters were noted and the report concluded "due to dilution, flushing, adsorption, and sediment deposition, no acute toxicity problems were discovered in the sites studied" (Metro 1982). At Lakepointe, minor space would be dedicated to urban landscaping, which alleviates concern about the landscape chemicals more typical of extensive lawns associated with suburban development.

Fecal Coliforms and Biological Oxygen Demand

Increased fecal coliforms and biological oxygen demand is a generalized result of development, and is often related to residential and land use density and to the amount of impervious surface area.

Temperature

Development can raise stormwater runoff temperature. In turn, this temperature increase lowers the physical gas saturation capacity of the water, lowering DO content. In the case of this proposal, which involves direct discharge to Lake Washington, while temperature increases could occur in immediate proximity to the discharges, cool temperatures during wet season runoff and the lake volume relative to discharge volume eliminate concerns for significant impairment of lake habitat value due to temperature.

Post-Construction Analysis Methods

Specific contaminants and estimates of their concentrations in discharge from Lakepointe were evaluated based on data in the literature on unmitigated contaminant concentrations for similar land uses.

The goal of the predictive analysis was to identify specific contaminants that present a potential for concern because of concentrations above state water quality guidelines or eutrophic or other impact thresholds of concern. Subsequent analysis determined whether reductions in their concentrations to acceptable levels (defined by state standards or other relevant criteria) would be made feasible by the stormwater control and treatment devices proposed for the project

The analysis of unmitigated peak concentrations was conservative for the following reasons:

- The developed areas discussed in the literature and used to generate the predictions were sampled at points at which there was no mitigation of surface water quality impacts, and thus represented a worst case (no contaminant removal) condition.

- The values utilized for each category of land use were from data collected during the first portion of larger storm events, when the first wash of water can contain higher than average concentrations of contaminants. Therefore, maximum concentrations are analyzed. Average surface water concentrations of the contaminants were expected to be lower over the complete duration of a storm.

- No dilution of stormwater output by base flows or receiving waters was assumed, and the undiluted stormwater runoff at the catchment release point was compared with water quality standards and guidelines. If warranted by the results, dilution within and the water quality of, the receiving water were assessed to predict the potential for water quality impact.

Annual average ranges of storm event contaminant concentration predicted from literature were reduced by the estimated contaminant-specific removal efficiencies for the proposed stormwater management system components (Ferrara and Witkowski 1983; Wigington *et al.* 1983; Harper *et al.* 1984; Hvitved-Jacobsen *et al.* 1984; Urbonas and Roesner 1986; Yousef *et al.* 1987; Horner 1988; Martin 1988; Nix *et al.* 1988; Holler 1989; Roesner *et al.* 1989; King County 1990; Ecology 1991; Metro 1992; Ecology 1992; USEPA 1993). Since rainfall, runoff, and contaminant concentrations all vary considerably over time and over short distances, it is impossible to predict short-term or localized water quality changes by calculation or measurement (Urbonas and Roesner 1986) and averaged estimates must be applied. If the average contaminant concentrations of untreated runoff were predicted to be near or over state criteria or a eutrophic threshold of concern, efficacy guidelines for removal by conventional basin retention measures were then applied, and the water quality after mitigation was then assessed. For contaminants not expected to exceed threshold criteria before mitigation treatment, ranges of contaminant removal efficiencies and discharge concentrations were calculated. Estimated contaminant concentrations after mitigation were then compared to state surface water standards.

Stormwater Facilities

Storm runoff from the Lakepointe project would be treated in one of three ways. From the high-use traffic areas, stormwater runoff would be routed through a coalescing plate oil/water separator to satisfy King County's High-Use Criteria as specified in the draft KCSWDM (1996). Then the stormwater would be directed to a two-celled wetpond meeting draft KCSWDM Core Requirement #8 requirements. Discharge from the wetpond would be conveyed by pipe to Lake Washington and would discharge at the north end of the marina channel to take advantage of the increased circulation in the marina area whenever stormwater runoff occurs. Stormwater from the lesser-used impervious roadways would be directed to one of two sand filtration/biofiltration swales for treatment. Treated discharge would be conveyed directly to the Sammamish River in a pipe with an energy dissipator. All stormwater outfalls would be protected from erosion by a combination of armoring and hydraulic energy dissipation devices as warranted. There would be no release of discharge onto unprotected soil banks. If the optional wetland confluences are constructed, discharge along the Sammamish River would be directed to the back ends of the confluences, with considerable dissipation of flow through the wetlands before reaching the river.

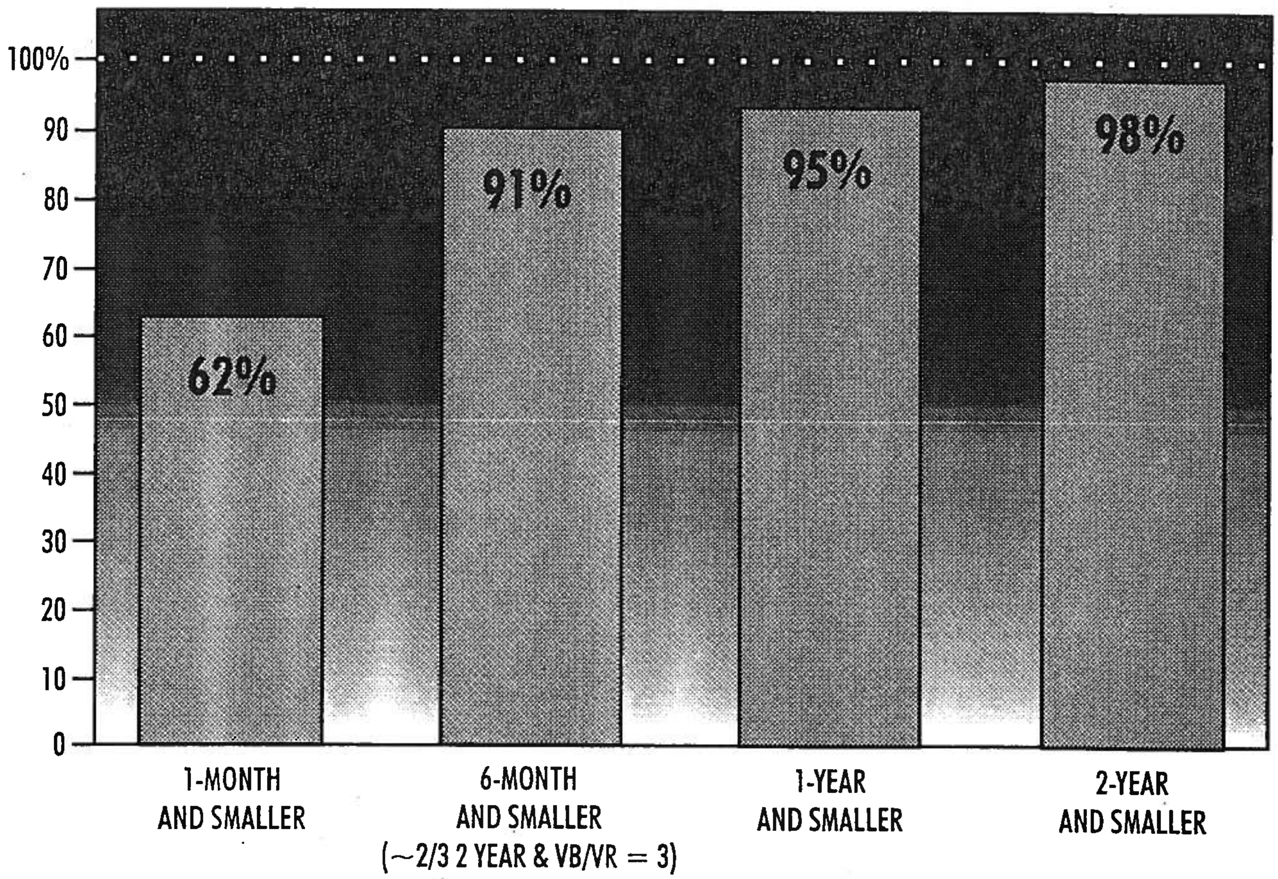
There is a white PVC pipe reported draining to the inner harbor. This pipe is not shown on existing site plans, which reportedly drains local runoff from the site. This pipe and its associated discharge would be eliminated when the site draining to it is developed. Post-construction drainage now conveyed in the pipe would be routed through the stormwater treatment system for the project.

Rooftop runoff would be directed in part to the Sammamish River and in part directly to Lake Washington. Flat rooftops as proposed for Lakepointe are not considered pollution generating surfaces by the draft KCSWM (1996); therefore, water quality treatment is not required. Excluding rooftop runoff from stormwater treatment facilities will enhance treatment capacity for runoff from streets and parking areas.

Stormwater Facility Sizing for Water Quality Treatment

Stormwater treatment facilities in King County are required by the 1990 KCSWDM to be sized to capture and treat the majority, but not 100 percent of the total stormwater that runs off of impervious surfaces. In King County, storm facilities accept and treat runoff discharge up to the point where the flow becomes greater than what is referred to as the facility's design storm flow. A one-third of the two-year storm design would treat approximately 60 percent of all runoff (Figure 2.2-1). The proposed Lakepointe wetpond would exceed the 1990 KCSWDM requirements for one-third of the two-year storm sizing by using King County's draft Surface Water Design Manual (King County 1996) requirements for wetponds sized to a volume of basin to annual average storm runoff volume ratio (VB/VR) of three. This facility size treats approximately 90 percent of all runoff. King County's mean annual storm isopluvial maps for the region were used to interpolate VR for the site from data for SeaTac and Landsburg determined by SYNOD. Sand filtration and biofiltration is proposed for remaining runoff from areas subject to vehicular traffic, which would be sized to treat 60 percent of the two-year storm, which also treats approximately 90 percent of all runoff. This is the larger sand filter size recommended in the 1996 draft KCSWDM. By virtue of being sized to treat the great majority of all rainfall, the proposed stormwater facilities will also treat the first flush of the rare summer or early fall storms, which can exhibit "first flush" contaminant concentrations. It is only the peak portions of these rare storm's runoff hydrographs that exceed the facility design storm flows and that will comprise the approximately 10 percent of runoff escaping untreated. Precipitation from two-year, 24-hour storms and all lesser intensity storms accounts for about 98 percent of all runoff (Stormwater Management Manual for the Puget Sound Basin, Ecology, 1992, page I-2-18). Ecology has applied this statistic to precipitation volumes (Figure 2.2-1) to establish sizing for stormwater treatment facilities in all Washington state basins draining to Puget Sound. The project site drains to Puget Sound. [Note: for reference, treatment capacities of stormwater facilities are generally discussed as fractions of the two-year 24-hour storm, for example, two-third the two-year 24-hour storm. Two-thirds of the two-year 24-hour storm is roughly equivalent to the six-month 24-hour storm at Sea Tac Airport].

PROPORTION OF TOTAL RAINFALL ACCOUNTED FOR BY VARIOUS STORM SIZES AND ALL SMALLER STORMS



STORM EVENT SIZE
(24-HOUR STORMS)

LAKEPOINTE
PIONEER TOWING COMPANY

FIGURE 2.2-1
PROPORTION OF TOTAL RAINFALL ACCOUNTED FOR BY VARIOUS STORM SIZES AND ALL SMALLER STORMS

SOURCE REFERENCE: DATA FROM WASHINGTON DEPT. OF ECOLOGY 1992 STORMWATER MANAGEMENT MANUAL FOR PUGET SOUND BASINS

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It is clear from Figure 2.2-1 why Ecology determined it was reasonable to select the six month 24-hour storm as the water quality design storm for water quality treatment because there is a rapidly diminishing benefit in volume of water treated above this sized storm relative to the cost of facility sizing. According to Ecology (1992), "*Sizing the facility for a 1-year, 24-hour storm instead of a 6-month storm requires an increase of about 33 percent [in facility size] for an increase of only 4 percent of volume treated from an already high value of approximately 90 percent. Further increasing the size to that required for the 2-year, 24-hour storm requires a further [facility size] increment of about 36 percent for a further gain of only 3 percent in the long-term runoff volume treated.*" The two-thirds the 2-year storm size is approximately the storm size treated by a VB/VR = 3 in King County.

The Lakepointe facilities will treat water to design storms as follows:

Facility	Design Storm	Percent of All Stormwater Volume
Sand filtration w/biofiltration	Treat 60% of the 2-year storm	Approximately 90 percent
Wetponds	VB/VR = 3	Approximately 90 percent

Approximately ten percent of the total runoff from the proposed project will occur in flows too great to be treated for water quality. The highest flows comprising this small percentage generally do not carry a volume-proportionate share of contaminants relative to the lower flows because they are the peak flows of the "gully-washer" storms. These rare large storms tend to scrub off most of the contaminant loads from impervious surfaces in the first portion of the runoff, which is treated up to the design storm flow limits specified above. As a result, the lowest contaminant load is carried by the greatest runoff volume for the portion of runoff that is untreated.

Detention facilities are not required for the Lakepointe project since all stormwater runoff would be directed to a major receiving water (as per the draft KCSWM [1996] Table 1.2.3.B and KPFF [1996]).

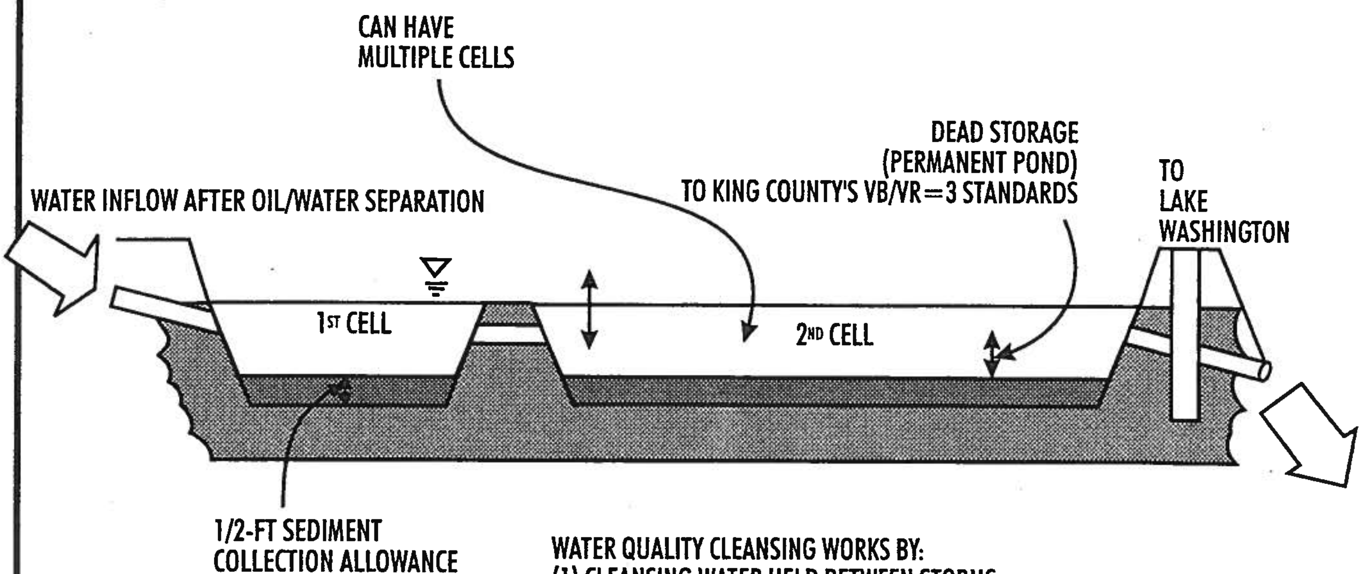
Oil and Water Separators

Oil and grease are common constituents in parking lot and roadway runoff from motor vehicles, occurring in direct proportion to the volume of traffic and inversely to the average length of time cars are parked. Longer term parking, as occurs with residences, carries a far lower contaminant burden in runoff than short term parking, such as in lots serving retail/commercial establishments, because most vehicles deposit brake dust, oil and other contaminants shortly after being parked while the engines are still warm. Residence-related parking results in one or two cars occupying a given parking space per day as opposed to a far higher number for retail/commercial establishments. Most parking for this project would not be exposed. Covered underground parking will enhance runoff water quality. Exposed short-term parking for the retail and commercial areas will exist in Phase I and along Lakepointe Boulevard. Oil and grease would be effectively removed from high-use area runoff by coalescing plate separators (CPS). The County's goal for high-use area treatment, and expectation of the CPS, is to treat runoff so that it has no visible oil sheen or has a TPH of less than 10 mg/l (KCSWDM 1996). The coalescing plates intercept oil as it moves through the separation vault chamber. As oil droplets come into contact with the plates, they coalesce with other droplets forming larger droplets (Romano 1989). Larger droplets are able to rise to the surface more quickly, where removal occurs. Oil collected on the surface of vault is removed with a skimming device. All high use areas would occur in Phase I of the Proposed Action.

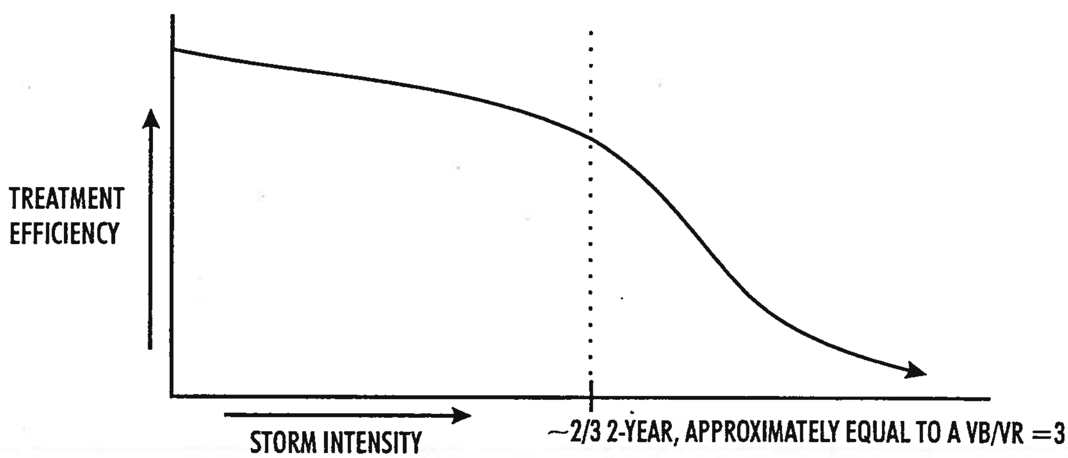
Wetponds

Wetponds (Figure 2.2-2) maintain a dead storage volume of water to remove dissolved phosphorus by sorption to and settling of fine particles. Nitrogen and phosphorus are removed to a lesser extent through uptake by algae and fringing vegetation (Nussbaum 1990), and denitrification may also remove some nitrogen. Microbial degradation of organics, sequestering of phosphorus and metals in the sediments, and dilution of the first flush input water from any storm by higher quality retained dead storage water residual from the last storm are also important wetpond functions to enhance water quality (Nussbaum 1990). Quiescent removal, or between-storm setting of particulates and attached contaminants, is very effective if time between storms lasts a period of days, in part because any sustained period with no hydraulic energy allows settling of very fine particles to which contaminants adhere. However, most runoff volume is treated under dynamic conditions during storms while pond inflow and outflow is occurring, which is the reason King County has increased

TYPICAL WETPOND SCHEMATIC



WATER QUALITY CLEANSING WORKS BY:
(1) CLEANSING WATER HELD BETWEEN STORMS
(2) SETTLING PARTICULATES TO WHICH CONTAMINATES ADHERE
(3) IMMOBILIZING TRAPPED CONTAMINANTS



LAKEPOINTE
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FIGURE 2.2-2

TYPICAL WETPOND SCHEMATIC

PROJECT NO.: 22140	27 NOVEMBER 1996
2140-222.CDR/VGP	CHECKED: JBF

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the dead storage volume it recommends to the size Lakepointe proposes to use. Wetponds have been listed as an approved Best Management Practice (BMP) in the Puget Sound Stormwater Manual (Ecology 1992) for treatment of stormwater.

Overall wetpond performance in removing particulates, and the dissolved constituents that they attract and bind, is a function of hydraulic residence time and dissipation of hydraulic energy, which relates to the amount of time slowly settling small particles have to settle below the dead water storage (i.e., water remaining in the pond below its outlet elevation) at the pond's bottom. The size, shape, two-celled structure, and dead water depth in wetponds are designed to prevent resuspension of fine sediments once they are settled on the bottom (Figure 2.2-2). In addition, the first portion of a storm's runoff will inflow to the wetpond and mix with the residual water in the wetpond left from the last storm, which will be cleaner because it has had time between storms to settle its fine particle load. Therefore, the first outflow from the wetpond will be mainly the well-cleaned residual water from the previous storm. As a result, efficiency for fine particle removal measured as the percentage of outflow over inflow concentrations is extremely variable from the start to finish of a given storm, as well as from storm to storm depending upon the runoff hydrographs and timing between storms. This is the reason that stormwater facility functions are presented in the literature as averaged percent removal efficiencies for individual contaminants. The following removal efficiencies have been cited for wet retention/detention ponds and for wetponds (US EPA 1993):

- 80 percent reduction in total suspended solids (TSS)
- 65 percent reduction in total phosphorus (a 35 to 45 percent removal range was used in this analysis)
- 55 percent reduction in total nitrogen
- 75 percent reduction in total lead
- 60 percent reduction in total zinc

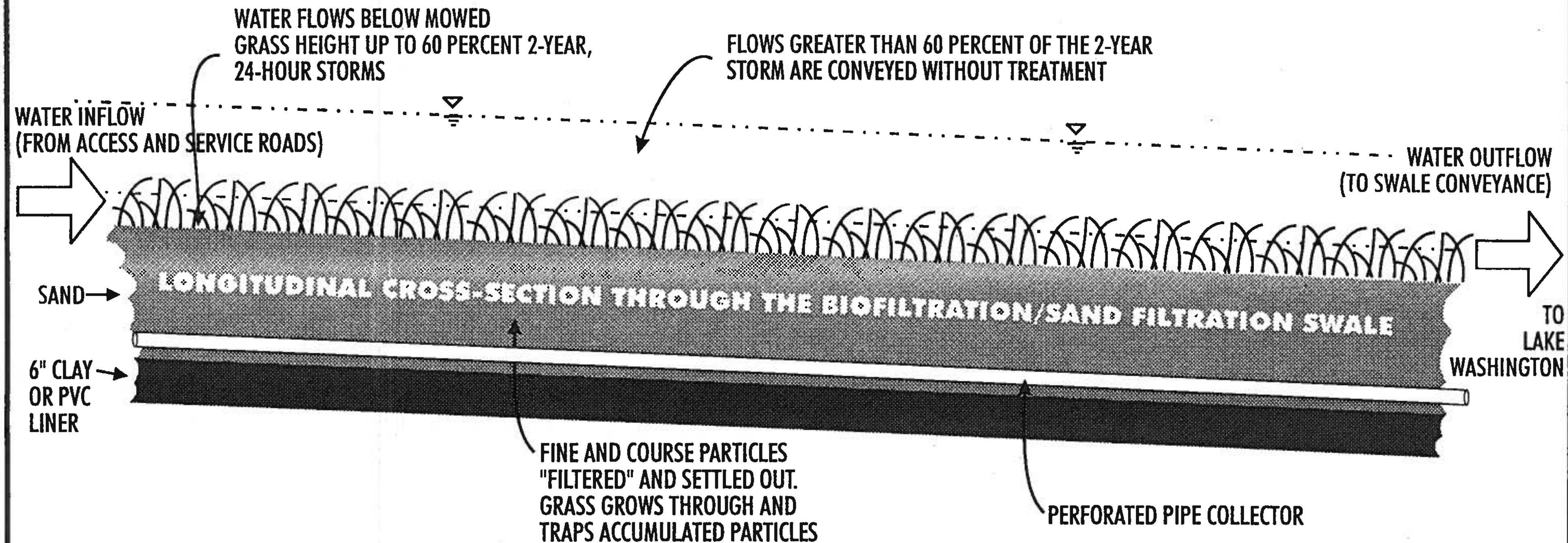
Sand Filters with Biofiltration

Sand filters would be provided in conjunction with on-site biofiltration treatment systems for water quality treatment of two lower-use impervious areas serving the Lakepointe project. These combined sand filter/biofiltration swales would be sized to treat 60 percent of the two-year runoff, which is the larger sand filter size in the draft 1996 KCSWDM (see KCSWM section 6.5.1) (Figure 2.2-3). The following average removals have been observed in sand filter systems (Sources: City of Austin 1990; US EPA 1993; King County 1993):

- 80 percent reduction in total suspended solids (TSS)
- 55 percent reduction in total phosphorus (TP)
- 51 percent reduction in ortho-phosphate (OP)
- 35 percent reduction in total nitrogen (TN)
- 80 percent reduction in lead (Pb)
- 80 percent reduction in zinc (Zn)

Water quality was analyzed for both sand filter treatment alone and biofiltration alone to establish a conservative range of contaminant removal expectations. Actual treatment will consist of some proportion of dual treatment by both systems, enhancing water quality over that predicted in this analysis. Assuming that all the stormwater routed through the sand filter/biofiltration swale would receive sand filtration treatment only is a conservative measure, since it is not known how much biofiltration treatment would initially be provided by the swale system before infiltrating into the sand. Biofiltration would provide preliminary sediment removal, but the first analysis does not take any biofiltration removal into account.

For the second case, it was conservatively assumed the sand filter was 100 percent clogged, leaving only biofiltration function through the overlying turf. Biofiltration swales function by physical filtration, settling of suspended particles and absorbed contaminants, and a degree of uptake and



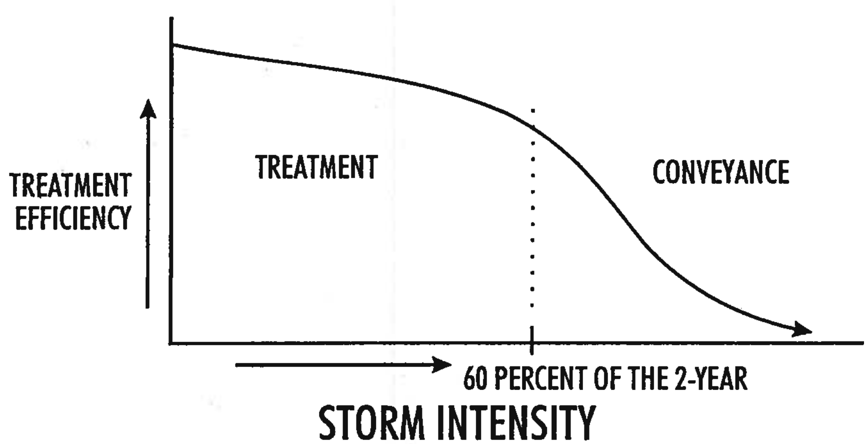


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FIGURE 2.2-3

GRASS-LINED BIOFILTRATION/SAND FILTRATION SCHEMATIC

PROJECT NO.: 22140	11 OCTOBER 1996
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sorption of nutrients and metals by the vegetation itself. Grass-lined swales can be very effective at removing sediments, particle-bound toxicants such as metals, and oil and greases from surface runoff. Over time, if the sand filters clog from the deposition of fine sediment material, the system would function as a biofiltration swale. Biofiltration swale performance for typical urban contaminants is quantified in Table 2.2-6 (see Section 2.2.4). With either sand filter treatment alone or swale treatment alone, essentially equivalent water quality treatment results (see Section 2.2.4).

Pre-treatment settling, normally provided in basins to remove larger particulates and slow clogging of the sand filters, will be provided in this case by the overlying turf sod. In part, this is justified because the runoff source to these systems is predominantly low-volume traffic roadways and pedestrian walkways, which do not carry a high suspended sediment load. More importantly, turf in sod over the sand filter is expected to allow filtration at a rate of approximately 21 inches per hour, because the grass roots control the rate of infiltration (AESI 1996; Beak 1996). Therefore, healthy grass growth sustains a high infiltration rate unless the grass becomes smothered by silts. However, this is an experimental situation, and we cannot conclusively know the maintenance interval difference between the proposed filter and the same filter without overlying sod but with pre-treatment in a settling basin. Therefore, the system was analyzed as well for the worst case with 100 percent clogging.

Facility Maintenance

Under KCSWDM Core Requirement #6 (1990 Manual: page 1.2.6-1 and 1996 Draft Manual page: 1-36), "*Maintenance and operation of all drainage facilities in compliance with King County maintenance standards is the responsibility of the applicant/property owner, except those facilities for which King County is granted an easement or covenant and assumes maintenance and operation...*"

Acceptance of maintenance by the county after two years is conditioned on inspection by the Surface Water Management Division to assure that the facilities have been properly maintained and that they are operating as designed.

To be effective, stormwater facilities need to be maintained on a regular basis. Maintenance specifics are defined by the county in both the 1990 and draft 1996 KCSWDM (Appendix A to both Manuals) for wetponds, sand filters, biofiltration swales, and oil/water separators.

For wetponds, King County (1996) requires maintenance when the following defects occur: abundant vegetation, excessive trash and debris, clogged inlet/outlet pipe, inspection/removal of bottom sediments when 6 inches has accrued, visible oil sheen on water, erosion of the pond side slopes, clogged rock window, settlement of more than 4 inches of the pond dikes or berms, and missing rocks from the ponds' overflow spillways.

The sand filter/biofiltration swales may require maintenance measures applicable to both a sand filter and biofiltration swale. Maintenance would be required when the following occurs: sediment exceeds the recommended depth; trash and debris accumulate; vegetation becomes excessively tall; sand filter media becomes clogged below the minimum design rate of infiltration; flow patterns become concentrated over the sand surface; inlet or outlet pipes become clogged or damaged; surface shows erosion/scouring damage or pipes or v-notch weirs become damaged.

Maintenance would be required for the oil/water separator when the following occurs: sediment accumulation over 6 inches; trash and debris accumulation; oil accumulation; damaged pipes; damaged access cover; vault structure damage; baffles and access ladder damage. Manufacturer recommendations for coalescing plate separators maintenance is twice a year or when the gap between plates is reduced by 40 percent (Romano 1990).

<u>Residential Sources of Stormwater Contaminants and Estimated Contaminant Concentrations at entry to Lake Washington or the Sammamish River</u>

The results of the analysis described above are summarized in Tables 2.2-2 through 2.2-5. The predicted unmitigated stormwater contaminant concentrations shown in Table 2.2-2 were reduced using the estimated total system efficiency shown in Tables 2.2-3 and 2.2-4 for each contaminant. The removal efficiencies of other parameters were taken from the literature as cited in Tables 2.2-3 and 2.2-5. Results of the mitigated stormwater quality analysis are summarized in Table 2.2-5, which highlights those parameters predicted to exceed state surface water quality standards (WAC 173-201A) in the immediate discharge to Lake Washington or the Sammamish River. Standards are summarized for the site in Table 2.2-5. For Lakepointe's high-use areas treated by a wetpond, the following parameters may exceed state water quality standards in the discharge prior to any dilution: fecal coliforms, lead, copper and cadmium. For the low-use areas draining to the sand filter/biofiltration swales combination, the following pollutants may exceed state standards in

Table 2.2-2 Projected peak unmitigated stormwater concentrations for the Proposed Action resulting from street and residence runoff at inflow to the stormwater treatment facilities. For context, these concentrations are compared to state water quality standards, although these standards are applicable only to receiving waters and not to discharge water.

Updated: 15 May 1997

Parameter	Units	Unmitigated Peak Concentrations	Discharge within Acute Standards?	Unmitigated Peak Concentrations	Discharge within Acute Standards?
		<u>Access Road and Turn Around</u>		<u>Urban Retail Commercial/ Roadway</u>	
Total Mercury	*mg/l*	0.0004	yes	0.0006	yes
Total Copper	*mg/l*	0.01	no	0.043	no
Total Zinc	*mg/l*	0.049	no	0.12	no
Total Lead	*mg/l*	0.01	yes	0.16	no
Total Chromium	*mg/l*	0.009	yes	0.053	yes
Total Cadmium	*mg/l*	0.004	no	0.007	no
Total Iron	*mg/l*	0.321	yes	1.04	no
Total NH3-N	*mg/l*	0.2	yes	0.15	yes
NO3-N+NO2-N	*mg/l*	0.36	n/a	0.436	n/a
Total Phosphorus	*mg/l*	0.18	n/a	0.255	n/a
SRP	*mg/l*	0.165	n/a	0.133	n/a
Turbidity	*NTU*	24	unlikely	22	unlikely
TSS	*mg/l*	105	n/a	140	n/a
Fecal coliforms	*CFU/100ml*	24581	*	13780	*
BOD-5 day	*mg/l*	9	n/a	11.6	n/a
Oil/Grease	*mg/l*	16	no	15.3	no

NOTES:

n/a = not applicable; no set standard but must support beneficial uses

Metals standards for a hardness of 40 mg/l; EPA and WAC 173-201A (AA and Lake Class)

All standards are Lake Class or Class AA waters under WAC 173-201A

Oil Grease standards do not exist; recommendation is to avoid any sheen.

* Fecal coliform standards apply to a geometric mean in the receiving water of 50 CFU/ 100 mls for Lake Class or Class AA not a peak discharge occurrence.

TSS = Total Suspended Solids

SRP = Soluble Reactive Phosphorus

BOD = Biochemical Oxygen Demand

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Table 2.2-3 Lakepointe estimated mitigated concentrations (after water quality treatment) for runoff from 4 acres of low-use impervious surface that would be routed through sand filter\biofiltration swales.

Updated: 15 May 1997

Parameter	Units	Unmitigated Concentration	Estimated Facility Removal Efficiencies	Estimated Mitigated Concentration
			Sand Filtration	
		Access Road and Turn Around	Percent	mg/l
Total Mercury	*mg/l*	0.0004	0.65	0.0001
Total Copper	*mg/l*	0.01	0.60	0.0040
Total Zinc	*mg/l*	0.049	0.80	0.0098
Total Lead	*mg/l*	0.01	0.80	0.0020
Total Chromium	*mg/l*	0.009	0.65	0.0032
Total Cadmium	*mg/l*	0.004	0.65	0.0014
Total Iron	*mg/l*	0.321	0.65	0.11
Total NH3-N	*mg/l*	0.2	0.76	0.05
NO3-N+NO2-N	*mg/l*	0.36	0	0.36
Total Phosphorus	*mg/l*	0.18	0.55	0.08
SRP	*mg/l*	0.165	0.51	0.08
Turbidity	*NTU*	24	0.80	4.8
TSS	*mg/l*	105	0.80	21.0
Fecal coliforms	*CFU/100ml*	24581	0.36	15732
BOD-5 day	*mg/l*	9	0.51	4.41
Oil/Grease	*mg/l*	16	--	16

Note: As a conservative measure, water quality removal credit is only given to the sand filtration function of the combined biofiltration/sand filtrations swales.

Sand Filter Removal Sources:

1. Sandfilter removals from EPA 1993, Cityof Austin: Jollyville Site: Table 10 (1990) and King County 1993.
2. Hg, Cr, Cd and Fe set equal to EPA (1993) removal for Zn and Pb.
3. City of Austin Jollyville site removals for Cu, Zn,Pb, Ammonia, Fecal Coliforms and 5-Day BOD were used.
4. TSS and Turbidity removal set equal to 80 percent. Facilities designed to meet draft King County SWM requirements are estimated to provide 80 percent removal.
5. King County Pine Lake Sand Filter Data removals used for total phosphorus and ortho-phosphate.

TSS = Total Suspended Solids

SRP = Soluble Reactive Phosphorus

BOD = Biochemical Oxygen Demand

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TABLE 2.2-4 Lakepointe estimated mitigated concentrations (after water quality treatment) for runoff from the high-use areas would be routed through an oil/water separator for oil control and a wetpond.

Updated: 15 May 1997

Parameter	Units	Unmitigated Concentration	Estimated Facility Removal Efficiencies (%)			Combined Removal Efficiency		Estimated Mitigated Concentration	
		Urban Retail Commercial/ Roadway	High Use Oil Control Percent	Wetpond Percent minimum	maximum	Percent minimum	maximum	mg/l minimum	maximum
Total Mercury	mg/l	0.0006	NA	0.6		0.6		0.0002	
Total Copper	mg/l	0.043	NA	0.6		0.6		0.0171	
Total Zinc	mg/l	0.12	NA	0.6		0.6		0.0480	
Total Lead	mg/l	0.16	NA	0.75		0.75		0.0400	
Total Chromium	mg/l	0.053	NA	0.6		0.6		0.0211	
Total Cadmium	mg/l	0.007	NA	0.6		0.6		0.0027	
Total Iron	mg/l	1.04	NA	0.6		0.6		0.42	
Total NH3-N	mg/l	0.15	NA	0.35		0.35		0.10	
NO3-N+NO2-N	mg/l	0.436	NA	0.35		0.35		0.28	
Total Phosphorus	mg/l	0.255	NA	0.35	0.45	0.35	0.45	0.14	0.17
SRP	mg/l	0.133	NA	0.35	0.45	0.35	0.45	0.07	0.09
Turbidity	NTU	22	NA	0.8		0.8		4.5	
TSS	mg/l	140	NA	0.8		0.8		28.1	
Fecal coliforms	CFU/100ml	13780	NA	0.2		0.2		11024	
BOD-5 day	mg/l	11.6	NA	0.4		0.4		6.94	
Oil/Grease	mg/l	15.3	75	--		0.75		3.83	

Sources:

Wetpond BOD and Heavy Metals (except Pb and Zn) from Ecology Draft 1991 Stormwater Management Manual for the Puget Sound Basin (lowest end of range used).

Wetpond Pb, Zn and nitrogen removal from EPA 1993.

Wetpond phosphorus removal from King County Assumption (35%) and U.S. EPA 1993 (45%).

Wetpond TSS and turbidity removal set at 80% per King County assumption and the lower range given by Ecology (1991).

TSS = Total Suspended Solids

SRP = Soluble Reactive Phosphorus

BOD = Biochemical Oxygen Demand

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Table 2.2-5 Water quality standards compared with peak predicted stormwater contaminant concentrations after mitigation.

Updated: 29 May 1997

Parameter	Units	Acute Standard WAC 173-201A	Peak Concentration of Discharge	Receiving Environment Concentration	Peak Concentration of Discharge	Receiving Environment Concentration
			Access Road and Turn Around	Sammamish River	Urban Retail Commercial/ Roadway	Lake Washington (g)
Total Mercury	*mg/l*	0.0024	0.0001	n/a	0.00024	n/a
Total Copper	*mg/l*	0.007	0.004	0.007 (f)	***0.017***	0.007
Total Zinc	*mg/l*	0.052	0.010	n/a	0.048	0.013
Total Lead	*mg/l*	0.0197	0.002	<0.02 (f)	***0.04***	<0.001
Total Chromium	*mg/l*	0.89	0.003	n/a	0.021	n/a
Total Cadmium	*mg/l*	0.0013	***0.0014***	0.006 (f)	***0.003***	<0.00002
Total Iron	*mg/l*	1	0.11	n/a	0.415	n/a
Total NH3-N	*mg/l*	24 (c)	0.05	n/a	0.10	0.03
NO3-N+NO2-N	*mg/l*	n/a	0.36	0.158 (f)	0.28	0.27
Total Phosphorus	*mg/l*	n/a (b)	0.08	0.021(f)	0.14 to 0.17	0.033
SRP	*mg/l*	n/a (b)	0.08	0.013 (f)	0.07 to 0.09	n/a
Turbidity	*NTU*	<5 or 110% bkgnd.	4.8	1(f)	4.5	1.7
TSS	*mg/l*	0.0013 (d)	21.0	n/a	28.1	n/a
Fecal coliforms	*CFU/100ml*	50(e)	***15732***	7 (f)	***11024***	33
BOD-5 day	*mg/l*	n/a (a)	4.41	n/a	6.94	n/a
Oil/Grease	*mg/l*	avoid sheen	16.0	n/a	3.83	n/a

Bold Italics Denotes concentrations exceeding the acute standards for Lake Washington or Sammamish River.

NOTES: n/a = not available

(a) Dissolved Oxygen (DO) must be >9.5 mg/l

(b) Ecology recommendeds to remain below 0.020 to 0.030 mg/l Total Phosphorus (TP)

(c) Based on a pH of 7.0 and a temperature of 15 deg C.

(d) Based on a hardness in Lake Washington of 44 mg/l of CaCO3 (Calcium Carbonate).

(e) The standard is based on a geometric mean in the receiving water not a peak discharge occurrence.

(f) Sammamish River concentrations were set equal to Lake Sammamish concentrations.
Lake Sammamish metals data collected by Beak (October 1994).
Other data from Metro Station 0621
Dissolved phosphorus listed as SRP

(g) Lake Washington water quality data collected at station 0804 by Metro and by Beak Consultants (metals).
Station 0804 data used from 1 October 1995 through March 1996 (average), the most recent water year available.

TSS = Total Suspended Solids
SRP = Soluble Reactive Phosphorus
BOD = Biochemical Oxygen Demand

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the discharge prior to any dilution or enhancement that may occur: fecal coliforms and cadmium (assuming sand filter treatment only). These standards and guidelines are applicable to the receiving surface water (waters of the state) and not to the mitigated (treated) discharge itself (Chapter 173-201A WAC). Therefore, the exceedence described do not directly imply a violation of water quality standards. Calculations of dilutions required to meet standards and assessment of the significance of the discharge quality to Lake Sammamish and Lake Washington are provided below.

Heavy Metals

Copper, lead, and cadmium peak discharge concentrations are predicted to be greater than state standards for the Sammamish River and Lake Washington (calculated at 44 mg/l of $CaCO_3$).

Copper

The peak storm water runoff from the wetpond is estimated to exceed the acute copper standard (0.007 mg/l). Because the copper concentration of Lake Washington is equal to the acute standard (0.007 mg/l), it is not possible to calculate a dilution required to bring the discharge into compliance. Since the state's acute standard for copper assumes total copper as all dissolved, the dissolved lake concentration (0.001 mg/l) was used to identify the required dilution. The dilution necessary for compliance with the acute copper standard would be 1.6:1. This dilution would be easily achieved in Lake Washington; therefore, no significant impacts are expected.

Cadmium

Estimated peak runoff cadmium concentrations from the high-use area, and low-use turnaround and access roads were estimated to exceed the state acute concentration of 0.0013 mg/l (at a hardness of 44 mg/l of $CaCO_3$). The peak cadmium concentration in the wetpond discharge is estimated to be 0.003 mg/l. In Lake Washington, this concentration is above receiving water concentration (below the detection limit of <0.00002 mg/l) and would require a 1.3:1 dilution to meet the acute standard. The lower use area peak discharge is also estimated to exceed the same acute standard. However, the estimated peak runoff concentration (0.0014 mg/l) is lower then the cadmium concentration of the Sammamish River to which it would discharge (0.006 mg/l). Therefore, dilution for compliance with the acute standard cannot be calculated because the cadmium concentration of the Sammamish

River is greater than the acute standard. Since Lake Washington is the receiving environment for the Sammamish River, the dilution necessary for compliance was calculated using the lake concentration's detection limit of <0.00002 mg/l. With a total cadmium concentration of 0.00002 mg/l, the dilution necessary would be 0.09:1. This slight dilution would be easily achieved in Lake Washington; therefore, no significant impacts are expected.

Lead

The estimated wetpond peak lead concentration (0.04 mg/l) exceeds the state acute standard of 0.02 mg/l (calculated at a hardness of 44 mg/l of $CaCO_3$). The total lead concentration in Lake Washington is below detection at <0.001 mg/l. The dilution necessary for the wetpond effluent to meet the acute standard would be 1.1:1, assuming lead was at the detection limit. This dilution would be easily achieved in Lake Washington; therefore, no significant impacts are expected.

Any sediment removed from the stormwater facilities as part of normal maintenance would also remove all trapped metals. Sediment disposal would occur in an approved off-site location. Street sweeping, if employed, would remove a significant fraction of metal particulates from road surfaces (See subsection 2.3, Mitigations).

Fecal Coliforms

During storms, fecal coliforms typically rise even under undeveloped conditions during storms, particularly during the first-flush portions of fall storms. Fecal coliforms originate from natural sources, including waterfowl and other birds and mammals utilizing wetlands and adjacent lands, and it is not unusual for elevated concentrations to occur in runoff. Based upon the sequential analysis presented in Tables 2.2-3 through 2.2-5, the peak mitigated fecal coliform concentration could range from 11,024 to 15,753 CFU/100 ml. The peak of this range could only be achieved by a large storm after an extended dry period, and is likely a considerable over-estimate given mitigation commitments to covered dumpsters and the fact that pet waste typical of suburban/urban development would not be as significant for Lakepointe due to the lack of private yards.

The state standard for fecal coliforms in Class AA surface waters is a geometric mean of 50 colonies/100ml, with not more than 10 percent of all samples obtained over time for calculating the geometric mean value exceeding 100 colonies/100 ml. The state allows the geometric mean to be calculated from a series of samples collected over a period of up to 30 days. Peak concentrations, and not sustained concentrations over repeated samplings, were estimated so that applicability of these peaks to the standard is conservative and not direct. Geometric means determined from samples collected over time are expected to conform to state standards in all receiving waters following water quality treatment because peak coliform discharges are episodic and expected to be far lower than other urbanized development for the reasons described above. Fecal coliforms have limited mobility and survival; they generally do live much longer than 24 to 96 hours in water. Long-term degradation to Lake Washington (including the inner harbor) or the Sammamish River from fecal coliforms is not expected to occur.

Nitrate-Nitrogen and Nitrite-Nitrogen

Nitrate- and nitrite-nitrogen occurs in urban stormwater runoff. Urban sources include fertilizer, eroded soil, organic debris, and atmospheric fallout (Canning 1988). The estimated peak unmitigated discharge for the site ranged from 0.28 mg/l (urban retail/commercial area) to 0.36 mg/l (access road and turn around), which is within the range of existing Lake Washington concentrations. The wetpond facility would remove nitrate-nitrogen to some degree (approximately 35 % removal). Sand filtration would not provide effective nitrate-nitrogen removal (analysis assumed zero nitrate-nitrogen removal). However, if discharge from the sand filter is directed to optional constructed wetland areas before discharge to Lake Washington, additional nitrate-nitrogen within the wetlands would be removed via plant uptake and denitrification (Watson *et al.* 1989). Discharge from the wetpond would be directed to Lake Washington in the upper marine channel where treated stormwater would mix with lake waters having a similar nitrate-nitrogen concentration. No significant adverse impacts are expected from nitrate- and nitrite-nitrogen loading from peak mitigated stormwater discharge, even without the optional wetland confluences, because nitrogen is not controlling primary production as a nutrient in Lake Washington.

Turbidity

Turbidity from a mature developed site is a short-lived phenomenon associated with higher runoff events. With the employment of proper mitigation protocols (wetponds, biofiltration swales or sand filters), adverse turbidity impacts are not expected. Turbidity is a regulated parameter in state surface water quality standards (Chapter 173-201A WAC). No turbidity impacts are expected since runoff from peak storm events would be directed to a wetpond or sand filter/biofiltration facility for removal prior to entry to Lake Washington. Facilities designed to draft KCSWDM (1996) criteria are expected to provide 80 percent total suspended solids (TSS) removal up to the design storm capacity.

Temperature

Temperature increases can occur from wetponds by release of storm runoff mixed with water detained since the previous event, which may have been warmed by solar insolation and air temperatures in the interim. However, climate in the Pacific Northwest usually eliminates this concern, since almost all rainfall that generates runoff occurs during the cooler seasons when temperature is not an environmental concern. Exceptions can occur when discharge from fall storms or late spring storms is made to coldwater streams or rivers supporting coldwater (salmonid) fisheries. However, if runoff from a storm occurs after an extended dry period, the water would be collected in the dead water storage volume of the wetpond previously drawn down by evaporation, where water could evaporate or be stored until the next storm event. Average seasonal temperatures can be high when these more rare storms with significant rainfall occur, but actual instantaneous temperatures during these storms are typically much cooler over an extended period.

Wetpond discharge would be released to Lake Washington in the area of the proposed marina. While temperature may rise locally at or near the discharge point, adverse temperature impacts above the existing condition are not likely to occur due to the rarity of summer storm discharges, the receiving volume relative to discharge, and the lack of functional habitat in the inner channel. Temperature impacts are not expected from stormwater routed through the filter/biofiltration facility because of the number of dispersed releases and cooling through the swale/sand filtration systems.

pH

pH is a measurement of the reciprocal of hydrogen ion (H^+) concentration. Changes in pH from the proposed development are difficult to quantitatively predict. Urbanization can influence stormwater runoff pH; however, the effect is primarily atmospheric from sulfuric and nitric acids produced by rainfall altered by automotive exhaust or industrial emissions (SO_2 and NO_x). Saturation of rainfall with carbon dioxide (CO_2) will naturally cause rainfall to be acidic even in undeveloped areas.

While reasonable correlations between high density urban/industrial areas are well established, lower density residential development does not have a significant correlation with acidic runoff beyond that which occurs on a regional basis (Randtke 1981). To some extent, acidity in rainfall is neutralized during overland flow by the buffering capacity afforded by weak organic salts in soils and dust, phosphates, ammonia and calcium, which will occur even on street pavements or through contact with concrete (Novotny and Kincaid 1981). The ability of surface waters to neutralize acidic inputs depends on alkalinity. If the optional wetland confluences were built and stormwater routed through them, naturally occurring organic decay in wetlands releases phosphates and ammonia, which would also buffer pH.

However, because the site would be converted from industrial to urban/expanded natural open space uses, no significant change or impairment of pH buffering of rainfall is predicted as a result of development. Consequently, no impacts to Lake Washington or Sammamish River resulting from changes in stormwater pH are reasonably anticipated after development of Lakepointe.

Oil and Grease; Related Hydrocarbons

Urban stormwater runoff is a prime contributor of hydrocarbons to sediments, although sources such as organic detritus and wind-blown leaves contribute significant amounts of vegetative oils. Oil and grease, total petroleum hydrocarbons (TPH), and polycyclic aromatic hydrocarbons (PAH) are variable on roadways, with residential roads producing approximately one-third as much as arterial roads. Most of the potentially toxic organic pollutants in this category are strongly adsorbed to particulate matter (Gjessing *et al.* 1984) and, owing to their hydrophobic nature, will adhere and be filtered out reasonably well by swales during conveyance or passage through biofilter devices and during infiltration or interflow passage (horizontal water movement within the subsurface material). They are also removed to some extent by street sweeping. Oil and grease is a measure of many organic compounds including natural vegetative oils and similar to most petroleum hydrocarbon compounds, is biodegradable. The sand filter/biofiltration swales and the wetpond would provide some degree of biodegradative (decay) capability.

Some components of oil and grease are biodegradable by bacteria (Gavens *et al.* 1981); however, other components do have toxic properties. Bioassay tests on roadway runoff found no acute toxic effect on freshwater algae, salmon eggs or juvenile salmon (Gjessing *et al.* 1984). None of these studies considered potential bioaccumulation impacts. All studies considered unmitigated runoff from major highways, which would have oil and grease concentrations greater than the residential roadway network serving the proposed Lakepointe mixed-use community.

The development would use a coalescing plate oil/water separator to remove oils and greases and related compounds, which would be expected to increase as a result of roadway traffic and driveway parking. There is no expectation that runoff after mitigation would exceed the capacity of the receiving waters to microbially digest residual oils or show a sheen, or have toxic impact. It would be useful to discourage discharge of used motor oils or solvents in any storm drain through business and homeowner education and stenciling on storm drains (See subsection 2.3, Mitigations).

Phosphorus

Phosphate enrichment is generally the primary cause of eutrophication in most Pacific Northwest freshwater systems. Limiting averaged stormwater discharge phosphorus concentrations to below 0.020 to 0.030 mg/l is accepted as one preventive measure to eutrophication (Ecology 1992). Phosphorus is not a regulated parameter in Lake Washington or the Sammamish River (Chapter 173-201A).

The wetpond employed by Lakepointe would provide an estimated removal ranging between 35 percent (0.09 mgl) and 45 percent (0.11 mg/l) of the unmitigated concentration. The sand filter/biofiltration swales would remove approximately 55 percent (0.1 mg/l) of the unmitigated concentration of the total phosphorus (without accounting for any biofiltration removal). The mitigated total phosphorus concentrations for the project are estimated to range between 0.14 to 0.17 mg/l for wet detention pond treated runoff. These peak phosphorus concentrations would not pose a nutrient problem for Lake Washington. Since secondary sewage disposal was diverted from the lake in 1963, trophic conditions have improved and lake phosphorus concentrations have not posed a water quality problem.

Fertilizer

Portions of the project would be devoted to park areas, gardens, and pedestrian paths. Maintenance of such areas may require the use of fertilizers on grass and landscaped areas. The runoff from landscaped and grass areas would infiltrate and may travel within the subsurface interflow toward on-site wetlands, Lake Washington, or the Sammamish River or infiltrate to the ground water because no impervious barrier would exist under unpaved project areas. It is very improbable the stormwater would move as dispersed sheetflow through the buffers, since no evidence of such flow exists even with the existing narrow vegetated strips. No significant adverse impacts are expected from park land maintenance activities because subsurface transport would promote uptake of nitrogen and mineralization of phosphorus prior to entry into on-site wetlands or surface waters, and a 100-foot natural buffer area would be maintained along the shoreline areas (except for park grass areas and a portion of the amphitheater area), which is far wider than now exists. It is recommended as a mitigation precaution that slow release fertilizers low in phosphorus be utilized and that any herbicide or pesticide or fertilizer usage be on a minimal "as-needed" basis and selected because of minimal subsurface transport potential (King County 1993b).

Access Road and Turnaround Area Biofiltration Treatment Option

The above analysis assumes that the water quality mitigation for the access road and turnaround area is sand filter treatment only. However, the facility may provide some biofiltration treatment or complete biofiltration (with no sand filtration) if the facility clogs and all runoff travels on the surface without infiltrating. Assuming only biofiltration treatment, the water quality analysis estimates that cadmium and fecal coliforms may exceed state standards (Table 2.2-6). These results are similar to sand filter treatment, where the same constituents exceeded the state standards. The estimated peak cadmium concentration would be 0.0016 mg/l. It is not possible to comply with state water quality standards by mixing the mitigated runoff with the Sammamish River because the river concentration (0.006 mg/l) is already above the acute standard (0.0013 mg/l). Using the total cadmium concentration for Lake Washington (below the detection limit of <0.00002 mg/l; 0.00002 used to calculate dilutions), the dilution necessary would be 0.25:1. Biofiltration swales are less effective at removing fecal coliforms than are sand filters; however, the net conclusion of no impact would not be changed for reasons previously listed. If the swales function as biofilters instead of sand filters; water quality impacts to the Sammamish River or Lake Washington are not anticipated.

TABLE 2.2-6 Water quality standards compared with peak predicted stormwater contaminant concentrations for the low-use area assuming biofiltration treatment only (no sand filtration).

Updated: 15 May 1997

Parameter	Units	Acute Standard WAC 173-201A	Peak Concentration of Discharge	Receiving Environment Concentration
			(biofiltration swale) Access Road and Turn Around	Sammamish River
Total Mercury	*mg/l*	0.0024	0.0002	n/a
Total Copper	*mg/l*	0.007 (d)	0.005	0.007 (f)
Total Zinc	*mg/l*	0.052 (d)	0.018	n/a
Total Lead	*mg/l*	0.0197 (d)	0.003	<0.02 (f)
Total Chromium	*mg/l*	0.89 (d)	0.004	n/a
Total Cadmium	*mg/l*	0.0013 (d)	***0.0016***	0.006 (f)
Total Iron	*mg/l*	1	0.09	n/a
Total NH3-N	*mg/l*	24 (c)	0.16	n/a
NO3-N+NO2-N	*mg/l*	n/a	0.36	0.158 (f)
Total Phosphorus	*mg/l*	n/a (b)	0.18	0.021(f)
SRP	*mg/l*	n/a (b)	0.17	0.013 (f)
Turbidity	*NTU*	<5 or 110% bkgnd.	8.4	1(f)
TSS	*mg/l*	n/a	17.9	n/a
Fecal coliforms	*CFU/100ml*	50(e)	***24581***	7 (e)
BOD-5 day	*mg/l*	n/a (a)	5.40	n/a
Oil/Grease	*mg/l*	avoid sheen	4.0	n/a

Bold Italics Denotes concentrations exceeding the acute standards for the Sammamish River.

NOTES: n/a = not available.

(a) Dissolved Oxygen (DO) must be >9.5 mg/l.
(b) Ecology recommendeds to remain below 0.020 to 0.030 mg/l Total Phosphorus (TP).
(c) Based on a pH of 7.0 and a temperature of 15 deg C.
(d) Based on a hardness in Lake Washington of 44 mg/l of CaCO3 (Calcium Carbonate).
(e) The standard is based on a geometric mean in the receiving water not a peak discharge occurrence.
(f) Sammamish River concentrations were set equal to Lake Sammamish concentrations.
Lake Sammamish metals data collected by Beak (October 1994).
Other data from Metro Station 0621
Dissolved phosphorus listed as SRP

TSS = Total Suspended Solids
SRP = Soluble Reactive Phosphorus
BOD = Biochemical Oxygen Demand

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<u>Marina Water Quality</u>

See Chapter 3.0; Fisheries, subsection 3.2.3, Structures.

Oil and Grease

Oil and grease would have the potential to enter lake waters from boat use and moorage. No dredging would be required for construction of the marina. The greater number of boat motors associated with the proposed marina, though smaller and generally less prone to leakage than large commercial craft now using the channel, may increase hydrocarbons (this would be perceived as silvery sheen even at a monomolecular level). This may be partially offset during the wet season by flushing of the inner harbor with treated storm water discharge.

The estimated annual volume of stormwater entering the marina channel would be approximately 1.7 million cubic feet (Eliason, J., pers. comm., 16 October 1996). This is approximately 85 percent of the calculated volume of the channel. Volatile components of oil or gas sheen evaporate rapidly and degrade in the atmosphere (U.S. Department of Health and Human Services 1993). Natural biodegradation would also remove hydrocarbons once introduced into the marina waters. Significant impacts from hydrocarbons from the marina are not expected.

On-board Sewage Disposal

Boats are required by law to have on-board sewage collection systems. A sewage pumping station is located at a marina adjacent to the proposed Lakepointe marina, eliminating concern for accidental spills or leakage, and live-aboards would be prohibited. On-shore restrooms would be provided at Lakepointe for marina patrons.

<u>Water Quality Summary</u>

Upland Development

Some localized increase in turbidity along the Lake Washington and lower Sammamish River may occur during construction if failure of Temporary Erosion and Sediment Control Plan (TESCP) provisions were to occur. However, this risk is expected to be very low because of the flat site and phased construction. Smothering of any portion of the lake shore or river bank habitats is not expected to occur, nor is turbidity expected to be sufficient to lower productivity even locally.

After construction, stormwater runoff from high-use roadways and high-use exposed parking areas would be routed to a coalescing plate oil/water separator and two-celled wetpond for treatment. After treatment, it is estimated that mitigated discharge from the high-use areas may exceed state water quality standards on a temporary basis for copper, cadmium, lead and fecal coliforms prior to any dilution or mixing; however, compliance with standards would occur at very low dilution ratios in the area of immediate discharge. All other parameters analyzed were estimated to meet applicable standards. High-use area runoff metals would be in compliance with state acute standards at dilutions ranging from 1.1:1 to 1.6:1 (lake water:discharge). Runoff from the low-use areas would be routed to combined sand filter/biofiltration swales for water quality treatment, which are expected to discharge water within state water quality standards except for cadmium and fecal coliforms, again prior to any dilution or mixing. For the low-use areas, dilution between 0.09:1 to 0.25:1 (Sammamish River:discharge) would be necessary for cadmium to meet state standards after discharge. Because all required metals dilutions to meet standards are less than 2:1, peak stormwater discharge is not expected to impair Lake Washington or lower Sammamish River water quality habitat values after development, even immediately adjacent to the stormwater discharge locations. All high-use areas will discharge after treatment to the back end of the marina channel, where habitat values are currently very slight. Discharge to this location would have the incidental benefit of promoting circulation in the inner harbor. Compliance with state water quality standards will be maintained. Even with the use of all reasonable and current BMPs, fecal coliforms may temporarily exceed state standards at discharge points to Lake Washington and the Sammamish River. If the optional wetland confluences are constructed along Lake Sammamish, further reduction of fecal coliforms would occur by discharging treated stormwater to the back ends of these areas of emergent vegetation above the OHWM. Because fecal coliforms have limited mobility and survival in water, long-term fecal coliform degradation to Lake Washington or the Sammamish River, even on a localized basis, is not expected to occur.

Under the No Action Alternative, industrial use of the site with diffuse and uncontrolled runoff to Lake Washington and the Sammamish River would continue as it presently occurs.

Marina

Short-term turbidity is expected to increase as a result of construction activity during marina construction, which may also resuspend PAHs likely to occur in bottom sediments of the inner channel due to its historic use. However, bioassay of sediments to be dredged by the Army Corps in the Kenmore Channel did not prove restrictive to open water disposal. No dredging would occur because of marina construction. Turbidity during bulkhead construction or pile driving would be temporary and similar to sediment resuspension now occurring from tug boat prop wash in the commercial/industrial channel. Therefore, no change in current conditions with respect to water quality and its affect on habitat value is anticipated. Please refer to Section 3,2.3 for analysis of fisheries impacts from the marina.

Long-term operational impacts of the marina on water quality would be mitigated by prohibition of live-aboard tenants, known to increase fecal coliform levels when allowed, lack of pump-out or fueling facilities which eliminates most of the risk for accidental discharges of waste or fuels, and prohibition of underwater clearing of boats in the inner harbor. The greater number of private boat motors, through smaller and generally less prone to leakage than large commercial craft now using the channel, may increase hydrocarbons which would be perceived as silvery sheen even at the mono-molecular thickness level. This may be partially or completely offset during the wet season by enhancing circulation in the marina with treated stormwater discharge at it's back end. Prop wash from private craft would not be expected to significantly resuspend sediment because of the channel depth, their washer engines, and slow boat speeds in the marina. Please refer to Section 3.2.3 for analysis of fisheries impacts from the marina.

Under the No Action Alternative, commercial activity without flushing enhancement would continue to occur, including resuspension of sediments through prop wash.

<u>Water Quality Impact Analysis: No Action Alternative</u>

Under the no action alternative, water quality impacts to Lake Washington from the site would remain at their existing level, because the land use would remain as a concrete production, storage and distribution site, with some space leased or rented to industrial or commercial tenants. The Lake Washington water channel, located west of the site, would continue to support industrial activities in the area.

2.3 WATER QUALITY MITIGATION MEASURES

Beak recommends mitigation be proposed in the following categories.

2.3.1 Required Mitigation Measures During Construction

King County requires specific mitigation measures and protocols be followed during the construction phase(s) of development.

- Required mitigation measures would be outlined in the TESCP that would be submitted to King County DDES with the site Engineering Plans completed by KPFF.

- Provisions for accidental spill response cleanup and notification procedures could be included in contractor agreements.

2.3.2 Other Proposed Mitigating Measures During Construction

The following mitigation measures would be implemented, in addition to provisions in KCSWDM required sediment and erosion control plan:

- Construction runoff (e.g., concrete wastes, equipment oils) would be collected in sumps (catchment areas with no outlets used for containment) and disposed of in approved off-site locations.

- Inclusion of a water quality/TESCP inspector in the TESCP.

- Use of sediment ponds during construction to retain runoff (KPFF 1996). Swales (with silt fencing or straw bale barriers) would be used to convey overflow to surface waters (KPFF 1996).

2.3.3 Other Possible Mitigating Measures During Construction

None.

2.3.4 Required Mitigating Measures Following Construction

- Maintenance of all stormwater facilities for two years, after which King County may assume maintenance and operations responsibility after inspection by SWM.

- Use of water quality treatment facilities meeting requirements of the 1990 KCSWDM and adopted subsequent revisions.

2.3.5 Other Proposed Mitigating Measures Following Construction

- Use of the draft KCSWDM (1996) design manual criteria for water quality facilities, which exceed the 1990 KCSWDM criteria, including:

  1) Use of a wetpond sized in accordance with draft methodology VB/VR = 3 meeting draft KCSWDM (1996) for treatment of the high use vehicular areas,

  2) Use of a biofiltration swale meeting draft King County Core Requirement #8 (King County 1996) that would be enhanced with biofiltration prior to sand filtration,

  3) Use of BMPs as required by King County Special Requirement #4 (King County 1996), water quality source controls. Source controls identified in the Stormwater Pollution Control Manual (King County 1995) would be employed such as roofing of dumpster areas.

- Installation and maintenance of a coalescing plate oil/water separator for runoff meeting draft King County manual definition of High Use (King County 1996).

- Runoff from rooftops may bypass water quality facilities, which would increase facility treatment capacity for runoff from roadways and parking lots.

- Boat moorage would be restricted to recreational users. No live-aboards would be allowed in the marina; however, cable television and other amenities would be offered for use of the boat owners.

- The marina would not include a fuel dock or waste holding tank pump station.

- The marina management would develop a fuel spill response plan.

- Underwater cleaning of the craft in the inner harbor would be prohibited.

2.3.6 Other Possible Mitigating Measures Following Construction

The following measures are recommended for consideration, although none are required to avoid impacts:

- Educational materials for habitat/resource protection could be provided to businesses and residences.

- Inclusion of native or adaptive species in landscaped areas to reduce the need for irrigation and chemical intervention.

- Wet street sweeping of exposed parking areas.

- Stenciling storm drains to read "Dump No Waste Drains To Lake."

- Post, promote and educate boat owners about regulations concerning illegal discharges of waste holding tanks.

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3.0 FISHERIES

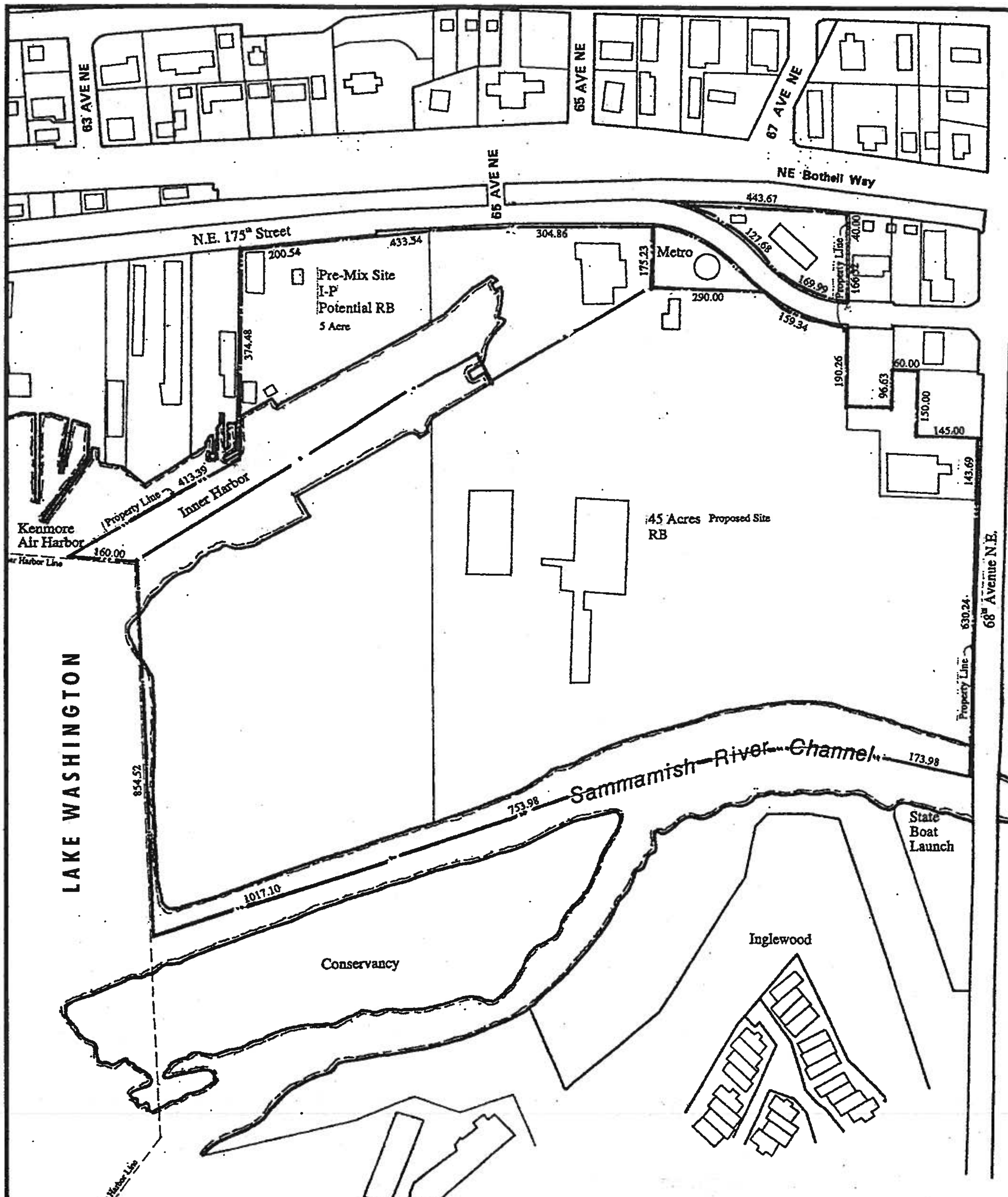
3.1 AFFECTED ENVIRONMENT

The proposed Lakepointe development is a mixed-use community that combines professional office, retail and commercial space, residential units, park facilities and a private moorage marina. The project would be developed at the northeast end of Lake Washington on the property commonly known as the Kenmore Pre-mix site (Figure 3-1). The Kenmore Pre-mix site is a peninsula with water on its south, west and north sides. The south edge of the property forms the north bank of the Sammamish River where it enters Lake Washington. The west edge contains shallow, sloping Lake Washington beach habitat. On the northern portion, a heavy industrial harbor (the "inner harbor") is currently located.

The Kenmore Pre-mix property is currently used by various industries. Barges frequently enter and exit the inner harbor to unload sand and gravel at Kenmore Pre-mix located on the north shore of the inner harbor. The middle of the harbor is dredged to provide barge access. Small boat traffic is associated with the operations of Waterfront Construction, a business located along the south shore of the inner harbor. Fishing boats are also moored on the south shore. The vast majority of the property located south of the inner harbor contained large amounts of industrial solid waste that had been dumped on the site by businesses occupying the site..

Large-scale development of the site may affect fisheries resources, including salmonid rearing and migration. A particular concern is the potential expansion of habitat for ambush predators, such as largemouth (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieui*), which may prey on juvenile salmonids. If ambient light conditions are increased by project lighting, that may also extend feeding periods for these predators. This evaluation compares existing and proposed conditions and evaluates effects of the project on salmonid fish resources and habitat in the area.

The Sammamish River basin supports a variety of anadromous salmonids, including chinook (*Onchorhynchus tshawytscha*), coho (*O. kisutch*), and sockeye salmon (*O. nerka*) and steelhead (*O. mykiss*) and cutthroat trout (*O. clarki*). The Sammamish River system also supports runs of non-anadromous kokanee (*O. nerka*) salmon and ad-fluvial cutthroat trout (King County 1993). The mouth of the Sammamish River provides rearing habitat for salmonids and is a migration corridor for adult and juvenile salmon.



LAKEPOINTE

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FIGURE 3-1

THE PROPOSED LAKEPOINTE PROPERTY

PROJECT NO.: 22140	11 OCTOBER 1996
2140-31.CDR/VGP	CHECKED: JBF

Salmon production occurs in tributaries to the Sammamish River (notably Big Bear Creek), and tributaries to Lake Sammamish (notably natural and artificial production in Issaquah Creek). Anadromous juveniles produced in this system emigrate through the Sammamish River, passing by the Kenmore Pre-mix property, before reaching Lake Washington. Washington Department of Fish and Wildlife (WDFW) personnel suspect that outmigrating juvenile salmonids may temporarily hold in the shallow beach area at the western edge of the Lakepointe Property before migrating through Lake Washington (L. Fisher, WDFW letter to King County dated 1/5/96).

The State Salmon and Steelhead Stock Inventory (SASSI) identifies the run size status of Sammamish River spawning stocks of coho sockeye and winter steelhead as depressed; meaning escapement, run size or survival levels for these stocks are below normal ranges. Of these depressed stocks, only the wild winter steelhead are of native origin to the Lake Washington basin. None of the Lake Washington stocks are candidates for threatened or endangered status under the Endangered Species Act (ESA).

Lake Washington also contains a wide variety of non-salmonid fish species, some of which are considered "warm water" species. Easy access to the Sammamish River from Lake Washington makes it likely that many of these lake species make at least temporary journeys into the river. Non-salmonid fish inhabiting Lake Washington and the Sammamish River are both native and non-native in origin, and include Pacific and western brook lamprey; speckled dace; three-spine stickleback; northern squawfish; yellow perch; black crappie; pumpkinseed; peamouth; brown bullhead; largemouth and smallmouth bass; largescale sucker; tench; and prickly sculpin (Wydoski and Whitney 1979; Pfeifer and Weinheimer 1992; King County 1993).

To evaluate potential effects of the Lakepointe development on fisheries resources, physical and biological surveys of the site were completed using the EIS scope of work agreement as a guideline (King County 1996). Surveys of the physical characteristics of the site were conducted in January 1996. Biological surveys were completed in the spring and early summer of 1996 and in the spring of 1997. A description of the physical and biological methods and results is provided below.

3.1.1 Study Methods

Surveys of the physical and biological characteristics of shoreline areas along the Kenmore Pre-mix property were designed to establish baseline conditions. These data would aid in the assessment of potential project impacts, and allow project proponents, resource agencies and tribes to minimize impacts to fisheries resources.

Physical Sampling Program

The objective of the physical surveys was to characterize existing shoreline habitats. This characterization described industrial shoreline treatments, substrate and vegetation types, the number and location of artificial in-water structures that may serve as salmonid-predator habitat, and the area of open water that is covered by an artificial structure ("shaded" open water). Survey design was modified from criteria for King County Level III stream surveys (King County 1995).

Physical survey transects were established approximately every 150 feet (50 meters) along the north bank of the Sammamish River from the Juanita Drive NE/68th Avenue Bridge to the Lake Washington confluence [a distance of ≈ 2000 feet (600 m)] and along the Lake Washington shoreline on the western property boundary shoreline [distance ≈ 525 feet (160 m)]. On 3 January 1996, data were collected at each transect characterizing substrates, riparian vegetation, nearshore topography, water depths, nearshore fish habitat, and the location and number of significant in-water structures. Between transects, riparian vegetation, nearshore fish habitat, and the location and number of significant in-water structures were described.

On 12 January and 21 August 1996 shoreline surveys of the inner harbor were made, describing substrate and riparian vegetation types, total linear feet of bulkhead, number and location of significant in-water structures, area of temporary floating structure, and area of shoreline overhang. Snorkeling was performed on 26 May 1996 to inventory underwater structures in the inner harbor, the Lake Washington shoreline, and the Sammamish River.

Biological Sampling Program

Spring 1996

Electrofishing

The biological surveys were designed to describe fish use in littoral areas (0-50 ft. [0-15 m] from shoreline, depending on water depth) along the Kenmore Pre-mix site. The degree of salmonid fry use of nearshore areas surrounding the proposed Lakepointe development was determined by nighttime electrofishing using a backpack-mounted Smith-Root model 15B programmable electrofisher. Stunned fish were collected using 0.4 m x 0.6 m dip nets with 3 mm mesh. All collected fish were identified to species; lengths to the nearest 5 mm and any external abnormalities were recorded. Data were primarily collected by nighttime electrofishing but were supplemented by ancillary surveys, including: nighttime seining, daytime electrofishing, and daytime snorkeling. Nighttime electrofishing was the primary method of fish sampling because salmonid fry are more likely to migrate downstream and use nearshore areas under the cover of darkness (Foerster 1968; Burgner 1991; Healey 1991). Sampling during a full moon was avoided because bright moonlight has been shown to influence the downstream migration of salmonids (Pritchard 1944; Kobayashi 1960; Reimers 1971).

Nighttime electrofishing began one hour after sunset and was performed approximately every two weeks from late March through mid-June. This period coincided with the peak outmigration of naturally spawned salmonids in the Sammamish River system and the releases of hatchery-spawned coho and chinook salmon from the Issaquah Salmon Hatchery (Table 3-1a).

Water temperature, Secchi depth, and observations of avian predators were recorded at sunset prior to each evening survey. While taking physical measurements, shoreline areas were visually checked for schooling salmonids. Electrofishing was performed only when water transparency permitted the successful collection of stunned fish.

Table 3-1a. Issaquah Salmon Hatchery releases of young chinook and coho salmon into Issaquah Creek in 1996.

Date Released	Age and species	Number released	Fork Length (mm)
02/08/96*	yearling coho	100,000	125
03/06/96	subyearling coho	169,000	32
03/20/96	subyearling coho	163,000	38
03/20/96	subyearling chinook	158,000	42
04/15/96	yearling coho	436,000	135
05/06/96	subyearling coho	202,000	88
05/24/96	subyearling chinook	1,000,000	80
06/03/96 and 06/05/96	subyearling chinook	1,033,000	80

*Fish released as a result of heavy February rainfall that flooded holding pond.
Source: Issaquah Salmon Hatchery, pers. comm., 15 August 1996.

Table 3-1b. Issaquah Salmon Hatchery releases of young coho salmon into the Lake Washington Basin in 1997.

Date Released	Age and species	Number released	Fork Length (mm)
2/18/97	subyearling coho	370,900	32
2/24/97	subyearling coho	349,920	32
3/10/97	subyearling coho	49,900	32
4/07/97 thru 4/14/97	yearling coho	505,216	124
4/23/97 thru 4/28/97	subyearling coho	1,297,544	45-50

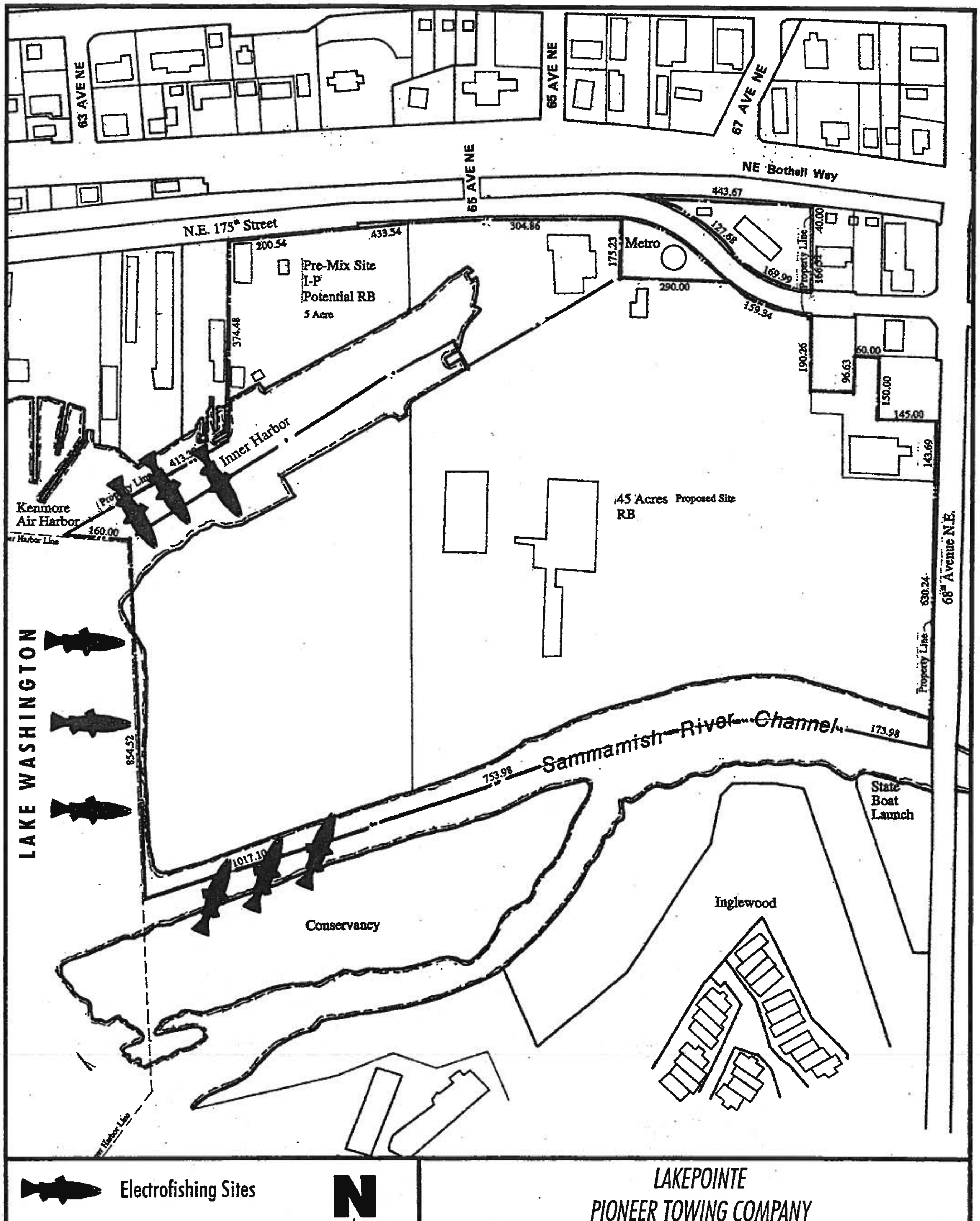
Source: Issaquah Salmon Hatchery, pers. comm., 23 May 1997.

Electrofishing was conducted in three general areas: 1) on the north bank of the Sammamish River to a point approximately 980 feet (300 meters) upstream from its confluence with Lake Washington; 2) on the shoreline of Lake Washington; and 3) along the south shore of the inner harbor, west of the westernmost bulkhead. Three sites in the inner harbor, three sites along the Lake Washington shoreline, and three sites along the north shore of the Sammamish River were sampled (Figure 3-2a).

Electrofishing was performed parallel to the shoreline and covered areas within four meters of the shoreline in the Sammamish River and the inner harbor, depending on water depth. Areas electrofished along Lake Washington extended from the shoreline to a distance of up to 50 feet (15 meters) from shore due to the shallow character of the beach. Nearshore habitat sampled along the lakeshore and Sammamish River included areas with overhanging vegetation, undercut banks, and submerged and emergent wooden pilings. Nearshore habitat sampled in the inner harbor included areas underneath floating structures and under shoreline overhangs. Each of the nine sites was electroshocked for approximately 4 minutes.

Beach Seining

Concurrent with the evening electrofishing surveys, beach seining was conducted using a 21 m x 1.2 m net with 3 mm Ace mesh. Seining was restricted to sites that contained relatively few pieces of underwater debris. In Lake Washington, seining was conducted at the north end of the shoreline, where the seine was set with two people approximately 100 feet (30m) from shore and then pulled perpendicular to shore. In the Sammamish River, seining was performed approximately 900 feet (275 m) west of the Juanita Drive NE bridge where the seine was set with two people approximately 20 feet (6 m) from the bank and then pulled at a 45° angle to the bank. No locations in the inner harbor were accessible to beach seines. All fish collected from the Lake Washington shoreline and the Sammamish River were identified to species; lengths and any external abnormalities were recorded.



Electrofishing Sites

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FIGURE 3-2A

THE PROPOSED LAKEPOINTE PROPERTY, SHOWING ELECTROFISHING SITES IN THE INNER HARBOR, THE SAMMAMISH RIVER & LAKE WASHINGTON-1996

PROJECT NO.: 22140	11 OCTOBER 1996
2140-32A.CDR/VGP	CHECKED: JBF

Snorkeling

Daytime snorkeling of the inner harbor, the Lake Washington shoreline and the north bank of the Sammamish River was performed when water transparency was sufficient for accurate fish observation and species identification. Snorkeling supplemented the daytime electrofishing surveys and documented daytime fish use of nearshore areas, as well as completing the inventory of any underwater structures that were not observed during the physical stream surveys in the winter.

Spring 1997

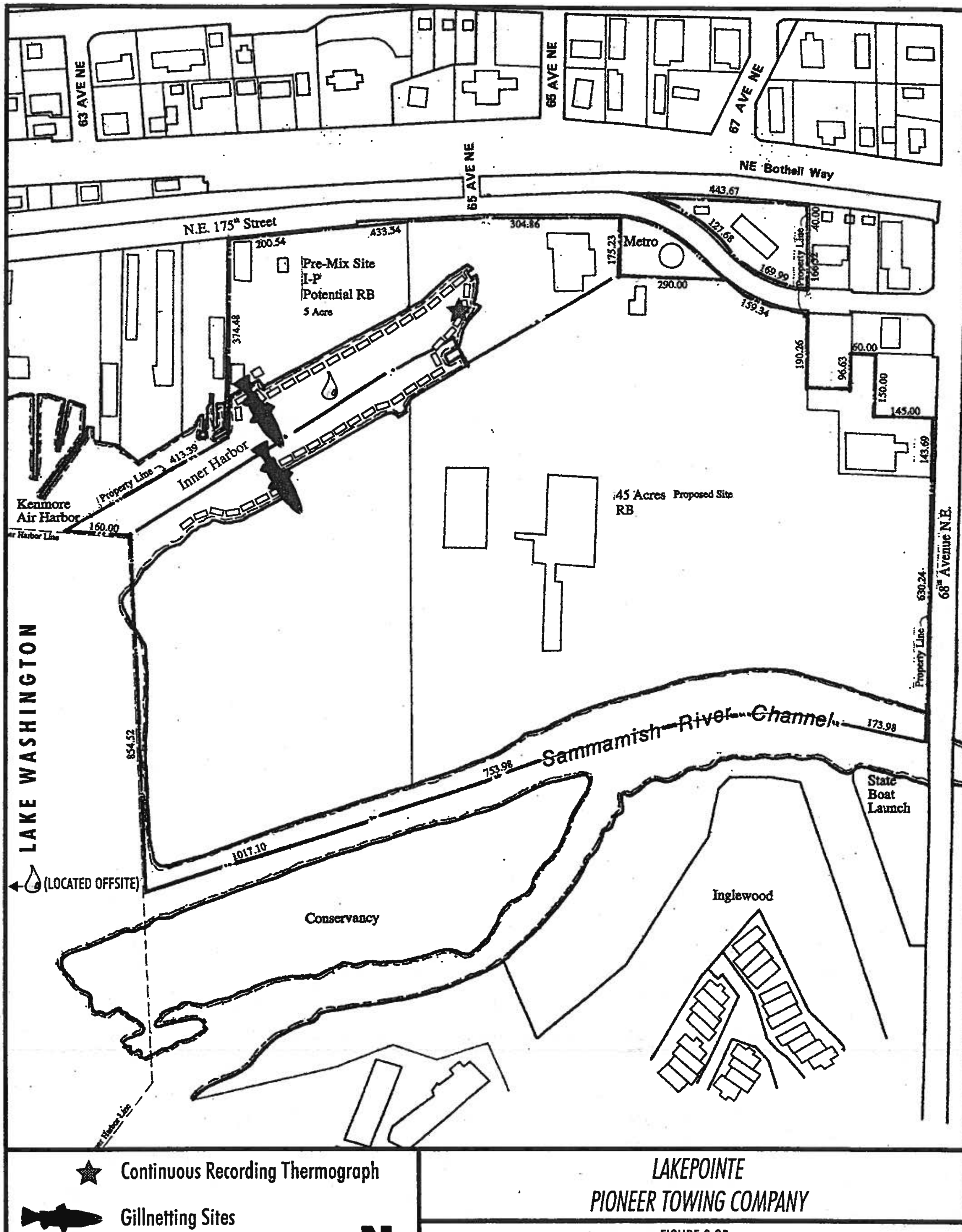
Additional physical and biological sampling was performed on a limited basis during the 1997 spring outmigration period to improve the understanding of fish utilization of deep water habitats in the inner harbor and to further identify the period of possible temporal and spatial overlap between juvenile salmonids and large predators such as squawfish and bass. Water quality and temperature measurements and various fish sampling methods were employed as described below:

Water Quality and Temperature Monitoring

Continuous temperature monitoring was designed to increase understanding of the range of temperatures in the inner harbor during a period of potential temporal overlap (mid-April through mid-May) between outmigrating juvenile salmonids and possible predators.

Two continuous thermographs, one located just under the waters surface and one located near the bottom, were installed in the eastern corner of the inner harbor (Figure 3.2b). The thermographs were submersed on 29 April 1997 at 2040 hours and were removed from the water on 20 May 1997 at 1030 hours. The thermographs were programmed to record instantaneous water temperatures every 30 minutes from 29 April through 20 May.

Prior to installation of the thermographs, temperature and dissolved oxygen profiles were taken in the inner harbor on 16 and 25 April 1997 with a YSI meter and a Hydrolab Scout, respectively. Profiles were monitored from bulkheads or other floating structures along the south shoreline at three different points (easternmost, center and westernmost points of the south shoreline). Similarly, in



LAKEPOINTE

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FIGURE 3.2B

THE PROPOSED LAKEPOINTE PROPERTY, SHOWING LOCATION OF WATER QUALITY & FISHERIES SAMPLING STATIONS IN THE INNER HARBOR - 1997

PROJECT NO.: 22140	28 MAY 1997
2140-32B.CDR/VGP	CHECKED: EBK

beak

association with biological surveys performed on 29 April, 12 May and 19 May 1997, temperature, dissolved oxygen, pH, and conductivity profiles (top to bottom) were measured at 1 foot intervals with a Hydrolab Scout in the inner harbor and in Lake Washington near Metro monitoring station 0804. Water transparency was also measured with a secchi disk at the same locations prior to each electrofishing survey.

Electrofishing

Salmonids and predators were sampled in the inner harbor using a boat electrofisher. Electrofishing occurred parallel to and as close to the shoreline as possible (Figure 3.2b). The entire perimeter of the harbor was surveyed to the extent possible. Surveys were limited by floating and submerged structures and the location of various vessels. Areas adjacent to existing bulkheads, floating structure and emergent piling structure were specifically targeted for sampling. Electrofishing occurred on 29 April, 12 May, and 19 May 1997. This period coincided with releases of hatchery-spawned coho salmon from the Issaquah Salmon Hatchery. Sampling occurred at night, starting at approximately one hour after sunset.

Electrofishing was conducted at sub-lethal levels. Stunned fish were collected, identified, measured and their condition examined. Stomach contents of known predators were analyzed to assess prey item frequency.

Gillnetting

Floating and sinking variable mesh gill nets were used as an ancillary method to sample predator populations. Mesh size ranged from 1.5 to 5-inch stretch mesh. The placement of gillnets was largely dictated by boat and barge traffic. Gillnets were deployed perpendicular to the shoreline in two locations where the nets would not (or only temporarily) extend into shipping lanes.

The floating gillnet was set immediately west of the burned wooden platform located along the north shore of the inner harbor (Figure 3-2b). After deployment, the floating gillnet extended into the direct path of barges and tugs entering and exiting the inner harbor. Because of barge and tug activity scheduled after dark in the inner harbor, the floating gillnet was not left overnight on any of the sampling dates. The floating gillnet was set at sunset and retrieved after the night's electrofishing was completed. The floating gillnet fished from two to four hours before retrieval.

The sinking gillnet was set immediately west of the timber bulkhead located along the south shore of the inner harbor. The sinking gillnet was set just before sunset, left overnight (since it was not in the direct path of barge or boat traffic), and retrieved the following morning.

The sinking gillnet was set in relatively deeper water than the floating gillnet to ensure deep waters of the inner harbor were sampled. Both gillnets were set so panels with the largest mesh were in the deepest water. This orientation increased chances of capturing adult predators known to inhabit deep waters. All fish caught in the gillnets were enumerated and measured. Known salmonid predators were kept for stomach content analyses.

Stomach Content Analyses

Salmonid predators kept following electrofishing and gillnetting were examined as soon as possible after collection (usually the afternoon following collection). Fish were eviscerated and stomach and anterior gut segments were removed by dissection and placed into a dissection pan. Stomachs and anterior gut segments were cut open lengthwise and their contents removed. Gut analysis specifically looked for the presence of salmonids in stomach contents. No other food items were enumerated.

Biological surveys were supplemented with a review of published literature covering fisheries data collected in the lower Sammamish River and/or the northeast end of Lake Washington. The review also included literature discussing the interactions between bass, squawfish, other piscivorous fish and salmonid fry, and the seasonal distribution of fish species at piers and bulkheads in Lake Washington.

3.1.2 Results - 1996

Electrofishing was the most effective method of fish sampling because nearshore habitats posed a number of constraints to other sampling methods, including: 1) underwater debris and steep, blackberry-laden banks, which made beach seining impractical in the Lake Washington beach area and the Sammamish River; 2) above water and underwater structures that limited the use of a seine net and a boat-mounted electroshocker along nearshore areas of the inner harbor; and 3) turbid water which made accurate fish observation by snorkeling ineffective from late March through mid-May. A summary of the Lakepointe biological sampling effort is presented in Table 3-2. Backpack electrofishing was the only sampling technique that could be used effectively in the nearshore habitats of all three areas. Therefore, this type of electrofishing was selected as the primary method of biological surveys.

The Muckleshoot Indian Tribe used a boat shocker to sample salmonid predators in the Sammamish River and along the Lake Washington shoreline at the western edge of the Kenmore Pre-mix property on the evening of 10/11 June 1996 (Malcom 1996). The boat was operated within two to four meters from shore. Because the survey targeted salmonid predators rather than salmonids, collection of all stunned salmonids was not attempted. Therefore, species identification of all salmonids was not possible. A subsample of collected salmonids indicated that the majority of observed juveniles were chinook and the majority of observed fry were coho. Nonetheless, the single survey found that compared to seven other sites located in the Sammamish River, the Lake Washington shoreline contained the highest density of salmonid fry and juveniles. The Tribe concluded that significant numbers of juvenile salmon use the beach area along the shoreline of Lake Washington (Malcom 1996).

Inner Harbor Characterization

Physical Conditions

The middle of the inner harbor is dredged to allow access for barges. As a result, water depth drops sharply from the shoreline towards the center of the harbor. Water depth at the edge of existing bulkheads ranges from 15 to 17 feet at ordinary high water. Depth contours of the inner harbor are portrayed in Figure 3-3a. Representative cross section profiles of the southwest shore (west of bulkhead) of the inner harbor are displayed in Figure 3-4. The southwest shore is the area of the inner harbor that has the most extensive littoral zone.

Table 3-2. Summary of Lakepointe fisheries surveys including sampling dates; sampling methods; and Secchi transparency and water temperature measured in the inner harbor, Lake Washington and Sammamish River during the surveys.

		Secchi depth (feet)			Surface water temperature (°C)*	
Date (time)	**Sampling method**	**Inner harbor**	**Lake Washington**	**Sammamish River**	**Inner harbor**	**Sammamish River**
3/29/96 (Evening)	Electrofishing, seining	3.0	4.5	NM	NM	11
4/12/96 (Evening)	Electrofishing	3.5	3.4	4.4	NM	13
4/29/96 (Evening)	Electrofishing	3.8	3.5	4.3	17	15
5/06/96 (Evening)	Electrofishing, seining	5.0	4.5	5.2	17	15
5/26/96 (Day)	Snorkeling	9.0	>6.5	5.5	8.5	NM
5/27/96 (Evening)	Electrofishing	7.5	NM	>6.0	14	14
5/30/96 (Day)	Electrofishing	6.0	6.0	>4.5	16.5	16
6/14/96 (Day)	Electrofishing	8.0	NM	>4.5	18	19
6/24/96 (Evening)	Electrofishing	6.4	6.2	>4.5	21	19.5
4/29/97 (Evening)	Electrofishing, gillnetting	1.7	3.0	2.5	15	14
5/12/97 (Evening)	Electrofishing, gillnetting	8.0	7.5	NM	19	NM
5/19/97 (Evening)	Electrofishing, gillnetting	6.0	NM	NM	18.5	NM

NM = Not measured
* = Measured with hand-held thermometer

▦="unlikely" result, possible equipment malfunction

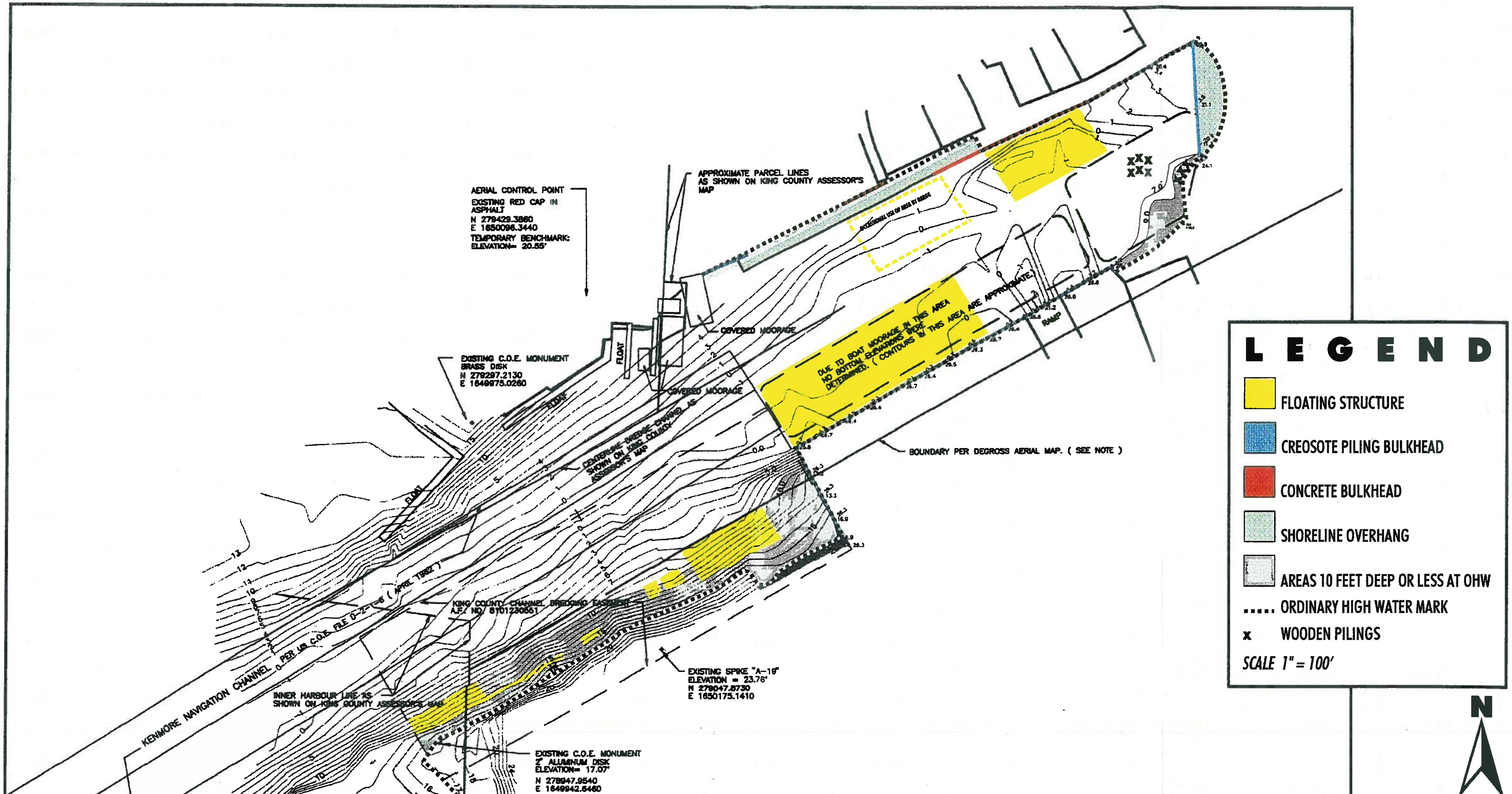

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FIGURE 3.3A

EXISTING BATHYMETRIC CONTOURS & ARTIFICIAL STRUCTURE IN THE INNER HARBOR

SOURCE REFERENCE: REID MIDDLETON

PROJECT NO.: 22140	18 NOVEMBER 1996	beak
2140-33A.CDR/VGP	CHECKED: EBK	

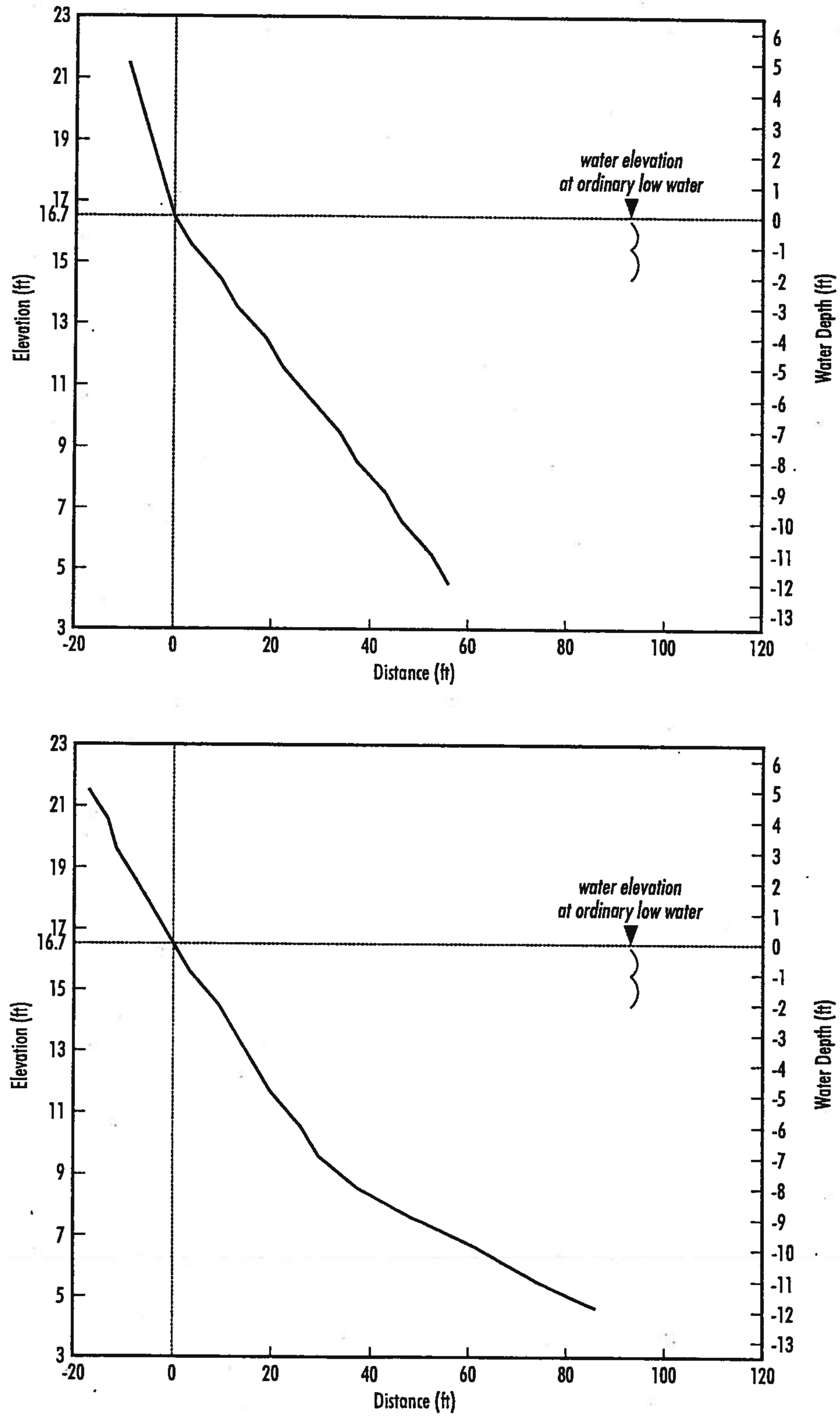


Figure 3-4. Cross-section profiles at two representative transects along the southwest shore of the inner harbor. Distances are relative to the waterline at ordinary low water (+16.7 ft. project datum; +20 ft. Mean Low Low Water USCOE datum). Elevations are relative to water surface at ordinary low water.

The substrate along the shoreline is characterized by soft to hard mud, with patches of cobble and gravel. The cobble and gravel are fill or material that likely fell off the barges during unloading operations at Kenmore Pre-mix. Blackberry bushes and reed canary grass dominate the riparian vegetation. The majority of the riparian zone of the inner harbor has been altered by shoreline treatments. The majority (64%) of shoreline treatments along the inner harbor is bulkhead. Bulkhead is a vertical wall of concrete or wooden pilings that effectively creates an artificial shoreline.

Bulkhead extends along portions of both shores of the inner harbor (Figure 3-3a). The majority (59%) of bulkhead is located on the southeast shore (Table 3-3). The total length of bulkhead along the inner harbor is 1,041 feet (317 m). In some locations, water intrudes behind the bulkhead for an unknown distance. The material on the inside of the bulkhead is fill.

In addition to bulkhead, artificial overhangs also line the inner harbor. Shoreline overhang shades the water, making such habitat less biologically productive than unshaded areas of the inner harbor. The shoreline is covered by artificial structures in three areas (Figure 3-3a). One shaded area occurs in the eastern corner, where a cement platform is fixed 1.5 feet above the water's surface at ordinary high water (Table 3-4). The cement overhang is supported by a row of vertical wooden pilings (1 foot in diameter) 0.5 feet apart. The estimated area of the inner harbor covered by this cement platform is 3,080 square feet.

Another source of shoreline overhang is an unused wooden platform along the northwest shore of the inner harbor. The area of this shoreline overhang is 3,426 square feet. Less prominent shoreline overhangs are located along the southwest shore of the inner harbor (Table 3-4).

Offshore in the inner harbor there are numerous in-water structures that are fixed and that provide ambush habitat for salmonid predators. A total of 347 in-water vertical wooden pilings or pier supports are present (Figure 3-3a). Of these, 258 emergent wooden pilings support the burned and unused wooden platform running parallel to the northshore of the inner harbor. The diameter of the pier supports is from 1 to 1.5 feet. The majority of the pilings are burned and in various stages of decay. Underneath the unused platform are 63 decayed bulkhead stumps. A total of 26 vertical wooden pilings are located in the southeast corner of the inner harbor. The pilings in the southeast corner do not support any structure.

Table 3-3. Summary of measurements characterizing bulkhead in the inner harbor.

Bulkhead Description	Inner Harbor Location	Length (ft)
Creosote Timber (1-foot diameter)	Southeast Shore and East Corner	627 (191 m)
Creosote Timber (1-1.5-foot diameter)	Northeast Shore	250 (76 m)
Concrete (9.5x2x5-foot blocks)	Northeast Shore	200 (61m)
Rotted Timber (1-foot diameter)	Northwest Shore	54 (16m)

Table 3-4. Summary of measurements characterizing artificial overhangs in the inner harbor.

Overhang Description	Inner Harbor Location	Height (ft) Above Ordinary High Water	Shaded Water Area (ft^2)
Cement Platform	East Corner	1.5	3,080 ($286m^2$)
Wooden Platform	Northwest Shore	7.5	3,426 ($318m^2$)
Steel Girders	Southwest Shore	1.5 to 2.0	345 ($32m^2$)
Wooden Ramp	Southwest Shore	1.0 to 1.5	140 ($13m^2$)
Wooden Platform	Southwest Shore	1.5 to 2.0	651 ($60m^2$)

Table 3-5. Summary of measurement characterizing floating material in the inner harbor.

Description	Inner Harbor Location	Area (ft^2)
Barges	Northeast Shore	6,600 ($613m^2$)*
Fishing Boats	Southeast Shore	19,200 ($1,784m^2$)*
Wooden Decking/Platform	Southwest Shore	5,740 ($533m^2$)
Hollow Metal Tubes	Southwest Shore	1,355 ($126m^2$)
Cabled Logs	Southwest Shore	400 ($37m^2$)
Unused Barge	Southwest Shore	300 ($28m^2$)

*See text for calculation of area

In addition to the fixed structures, unfixed structures such as boats and other floating material are also present in the inner harbor (Table 3-5). Two barges, regularly used to transport gravel to Kenmore Pre-mix, are temporarily moored in the inner harbor, covering a 13,200 square foot area (Gleason, M., pers. comm., 26 August 1996). The barges are alternatively unloaded and moored in the inner harbor every two to four days. Because the barges are not always present, their operations are estimated to result in a 13,200 ft^2 area being occupied 50 percent of the year (annual shading equivalent of 6,600 ft^2). Likewise, large fishing boats moored in the inner harbor are estimated to occupy a 32,000 ft^2 area 60 percent of the year (Gleason, M., pers. comm., 26 August 1996) for an annual shading equivalent of 19,200 ft^2. More permanent floating structure is located along the southwest shore of the inner harbor (Table 3-5). The total area of floating material along the southwest shore is approximately 7,795 square feet. However, the size of this floating island of material fluctuates depending on the operations of the inner harbor industries. The location of these floating structures is displayed in Figure 3-3a.

The existing level of nighttime lighting along the industrial waterfront and along the river bank is high at the Lonestar Cement Plant. There are five light standards, 30 feet high, supporting high pressure sodium lamps, which are likely 250 watts each (Sparling and Candela 1996). The lights include "cutoff" type fixtures with flat, clear lenses. The cement plant has numerous other site lights and building safety lighting, including flood lights mounted to the sides of many buildings. Therefore, large surfaced areas of the cement plant incorporate flood lighting. Many of these lights are adjacent to the proposed marina and illuminate the inner harbor.

Due to infrequent spacing of lights, the measured light intensity at ground level varied considerably. The general area had an average light level of 2.5-foot candles with high spots exceeding 5.0-foot candles one night in November 1996 (Sparling and Candela 1996). During the spring of 1996 and 1997, existing lighting in the inner harbor and along the Sammamish River at night was sufficient for field personnel to perform sampling functions and prepare notes without the use of headlamps.

Light and dark cycles are important factors in the diel movements of aquatic biota (Fox 1925, Emery 1973; Elliott 1976; Dobble and Eggers 1978; Eggers 1978; Levy 1987, Helfman 1981). Most biological response to light is deeper positions in the water column during daylight and shallower positions during darkness.

Fish have specific habits of diurnal, twilight and nocturnal activity in freshwater lakes (Emery 1973). During periods of twilight, diurnally active and nocturnally active fish species engage in a characteristic transitional behavior as they "change over" between modes of foraging and resting. At dusk, diurnally active lake fishes progressively increase swimming until one hour before dark, cease feeding, disband schooling behavior, slow swimming and finally stop approximately one hour after dark to rest for the evening (Emery 1973; Helfman 1981). By day, nocturnally active fishes rest, and increase their movements as light begins to fade. Predators are usually most active and successful during twilight periods (Woodhead 1966; Hobson 1972).

In Lake Washington, the salmonids, yellow perch and smallmouth bass are considered diurnal species, while the largemouth bass (>200 mm), black crappie and bullheads are considered nocturnal. Largemouth bass are considered both diurnal and nocturnal feeders (Heidinger 1975).

Sockeye in Lake Washington school during daylight and disperse at night due to lost visual acuity (Eggers 1978). Salmonids terminate schooling behavior at 10^{-4} foot candles which is between starlight and full moon light (Whitney 1969). Without schooling behavior to avoid predators, fish disperse and seek shallow nearshore areas to minimize predation. Levy (1987) also postulated that these diel vertical migration of juvenile sockeye in relation to light were related to predator avoidance. Juvenile sockeye feeding does not occur at any time in hours of darkness in Lake Washington (Dobble and Eggers, 1978).

Since salmonids use the cover of darkness to rest along the nearshore areas of the river and along the waterfront at night, artificial lighting could expose them to avian predators in the shallow water or fish predators if they move into deep water to avoid the light. Fish exhibit a period of increasing "wakefulness" under the influence of artificial night light and they move away from the light (Emery 1973). Tabor and Chan (1996) conclude that artificial lighting may increase predation of sockeye fry in the Cedar River.

Given the high level of existing night lighting in the inner harbor, its value as resting and nightime refuge habitat for juvenile salmonid fishes is presently diminished compared to unlit sections of the lake.

Biological Conditions

Nighttime electrofishing surveys revealed that the inner harbor primarily supports warmwater fish species. Among the warmwater species, three-spine stickleback, prickly sculpin, juvenile northern squawfish, and juvenile pumpkinseed were found in greatest abundance nearshore with a backpack electrofisher (Table 3-6a). Daytime electrofishing and snorkeling survey data confirm that the inner harbor is more frequently used by warmwater species. Prickly sculpin, three-spine stickleback, northern squawfish and pumpkinseed were collected during daytime electrofishing surveys in the inner harbor. No salmonids were collected from the inner harbor during daytime electrofishing.

Three-spine stickleback were the most frequently observed species during snorkel surveys. A school of approximately 60 (1+ age) juvenile salmonid smolts (≈150-200mm) was observed in the northeast end of the inner harbor. However, it was impossible to swim close enough to the school during snorkeling for positive species identification. The juveniles were believed to be sockeye salmon. Two largemouth bass (≈100-150 mm) were observed during snorkel surveys near the vertical wooden pilings in the southeast corner of the inner harbor. Three yellow perch (≈125mm) were also seen in the east corner of the inner harbor. Of the three areas studied, the inner harbor is the only location where largemouth bass were observed. Only juvenile bass were encountered nearshore. They were not common.

The inner harbor is typical of preferred spawning and nursery areas for largemouth bass. Bass move from offshore areas in the lake to spawning sites in calm coves and wave-protected beaches when temperatures exceed 13°C. Spawning is initiated when temperatures are between 13 and 16°C. Spawning was noted to occur in Lake Powell when water temperatures at nesting depths were 14.4 to 15°C and continued continuously from late April through mid-June (Miller and Kramer 1970). Spawning begins earliest in coves and shallow littoral areas where temperatures are generally 1 to 3°C warmer than the main lake (Wydoski and Whitney, 1979).

Bottom temperatures rose and stayed above 13°C generally in mid-May in the inner harbor. It is assumed the backwater cove offers spawning and fry rearing opportunities for largemouth bass in May and June annually.

Three-spine stickleback may have been more common in the inner harbor because the soft organic substrate along the shoreline provided spawning habitat for the adults. Many, if not all, of the stickleback collected by electrofishing and observed by snorkeling were pregnant females or males in spawning colors.

All of the northern squawfish collected nearshore in 1996 were juveniles (the largest fish was 80 mm). Young squawfish are known to inhabit the shallow waters of lakes until they mature and move offshore (Scott and Crossman 1973). In Lake Washington, young squawfish inhabit shallow waters over sand and mud bottoms (Wydoski and Whitney 1979), which is typical of nearshore areas sampled along the inner harbor. Northern squawfish are considered abundant in Lake Washington. Adult squawfish move from deep-portions of the lake in fall and winter to lake shorelines in spring to embayments in summer (Bartoo 1972). Squawfish are present in bays generally only during the summer as temperatures reach 22°C. Squawfish prefer waters up to or warmer than the maximum available in Lake Washington (Bartoo 1972). Shoreline movements may be spawning behavior (White 1975; Taylor nd; Martz et al 1996). Jeppson (1957) notes squawfish spawn in shallow waters over rock and rubble during the summer. Presumably squawfish move inshore in Lake Washington near the project site during summer to spawn.

Coho salmon fry and juvenile/adult rainbow and cutthroat trout were collected in the inner harbor, but based on electrofishing data, they were not as abundant as they were along the Lake Washington shoreline or the Sammamish River (Table 3-6a). Sockeye salmon were not collected by electroshocking, but a school of approximately 40 fry was observed during late afternoon on 29 April 1996 while conducting ancillary surveys in the inner harbor. Twenty individuals from a school of approximately 40 were collected with a dip net and positively identified. Similarly, a school of yearling salmonid smolts was observed while snorkeling, as noted above.

Summary of Physical and Biological Conditions

The majority of shoreline treatments, in-water structure and floating structure located along the Kenmore Pre-mix property was found in the inner harbor. Warmwater fishes were found to use shoreline areas of the inner harbor more frequently than the other two areas. Salmonids were found to use the shoreline of the inner harbor during their spring outmigration period. However, they were not as common as they were along the Lake Washington shoreline or in the Sammamish River.

Table 3-6a. Results of night electrofishing, night seining, day electrofishing, and day snorkeling efforts associated with Lakepointe fisheries studies occurring March through June 1996.

	Night electrofishing			Night seining[1]		Day electrofishing			Day snorkeling		
Species	**Inner Harbor**	**Lakeshore**	**Sammamish River**	**Lakeshore**	**Sammamish River**	**Inner Harbor**	**Lakeshore**	**Sammamish River**	**Inner Harbor**	**Lakeshore**	**Sammamish River**
Chinook salmon	0	10	3								
Coho salmon	3	12	7	1							
Sockeye salmon	0	6	3						60[2]		
Cutthroat trout*	2	9	9							1	2
Rainbow trout*	5	4	6						2		
Total salmonids	**10**	**41**	**28**	**1**	**0**	**0**	**0**	**0**	**62**	**1**	**2**
Northern squawfish*	53	8	1	3		6	0	0			
Largemouth bass*	4	0	0						2		
Pumpkinseed*	32	1	0			7	0	0			1
Prickly sculpin*	136	115	134	5	X	55	45	15			6
Three-spine stickleback	181	67	43	3	X	17	8	7	X	X	17
Pacific lamprey	7	0	0			2	0	0			
W. brook lamprey	0	0	1								
Brown bullhead*	5	0	0								
Yellow perch*	0	5	1						3	14	
Largescale sucker	0	0	1								
Total non-salmonids	**419**	**196**	**180**	**8**	**X**	**97**	**53**	**22**	**X**	**X**	**24**

[1] Seining was not practical in the inner harbor area.
[2] School of approximately 60 salmonids, believed to be sockeye.
X - Species present, but not enumerated.
* - Known salmonid predators

Fish habitat in the inner harbor is not functioning properly for the production of salmonid fishes. It is currently a heavy industrialized site with the following habitat conditions:

1) No natural habitat conditions remain in the inner harbor. All shoreline materials are either fill (including solid wastes) or bulkheads,

2) Shallow water habitat, extensively used by juvenile salmonids, is limited. Only 36 percent of the existing shoreline offers beach conditions. The remainder has various degrees of shoreline treatment in the form of bulkheads, creating deep-water habitats. On an area basis, shallow water habitat totals 24,936 square feet or approximately 0.5 acres (12% of the inner harbor area).

3) The inner harbor includes a dredged navigation channel, and all nearshore banks have been altered. Shallow water habitat has been cut back at 4:1 side slopes and surfaced with large non-native materials to above OHWM.

4) The bottom sediments contain hydrocarbons, and petroleum odors are present. Hydrocarbons are likely present in harbor sediments as a result of the historic use of the site as a lumber mill.

5) There are no shoreline trees in the inner harbor, so an effective riparian zone does not exist. Small amounts of blackberry bushes and weed canary grass occur adjacent to some of the beach areas. These species comprise the only riparian vegetation.

6) Water conditions are highly turbid following tug deployment to transport barges and as a result of stormwater runoff from adjacent industrial land uses (including truck washing facilities).

7) The artificial shading level is currently high, 41,237 square feet, representing approximately 24 percent of the inner harbor.

8) In-water structures including free-standing wooden pilings and decaying submerged piles are prevalent. Total inner harbor count includes 347 pilings.

9) The inner harbor is a warm, backwater area. Surface water temperatures are generally the same or slightly higher (≈1.0°C) than river temperatures. Summer temperatures would frequently exceed the upper range of metabolic optima for salmonid fishes (18.5°C). Project fish studies measured surface water temperatures in the inner harbor at 21°C in late June 1996. Bottom water temperatures were generally the same or slightly cooler (1.4°C) than at the surface. Salmonid fishes have shown a general level of avoidance for water temperatures exceeding approximately 19°C - 21°C depending upon the species size and season (Brett 1971, Coutant 1977, McMichael and Kaya 1991). Late-June is assumed to be the end of salmonid residence in the inner harbor.

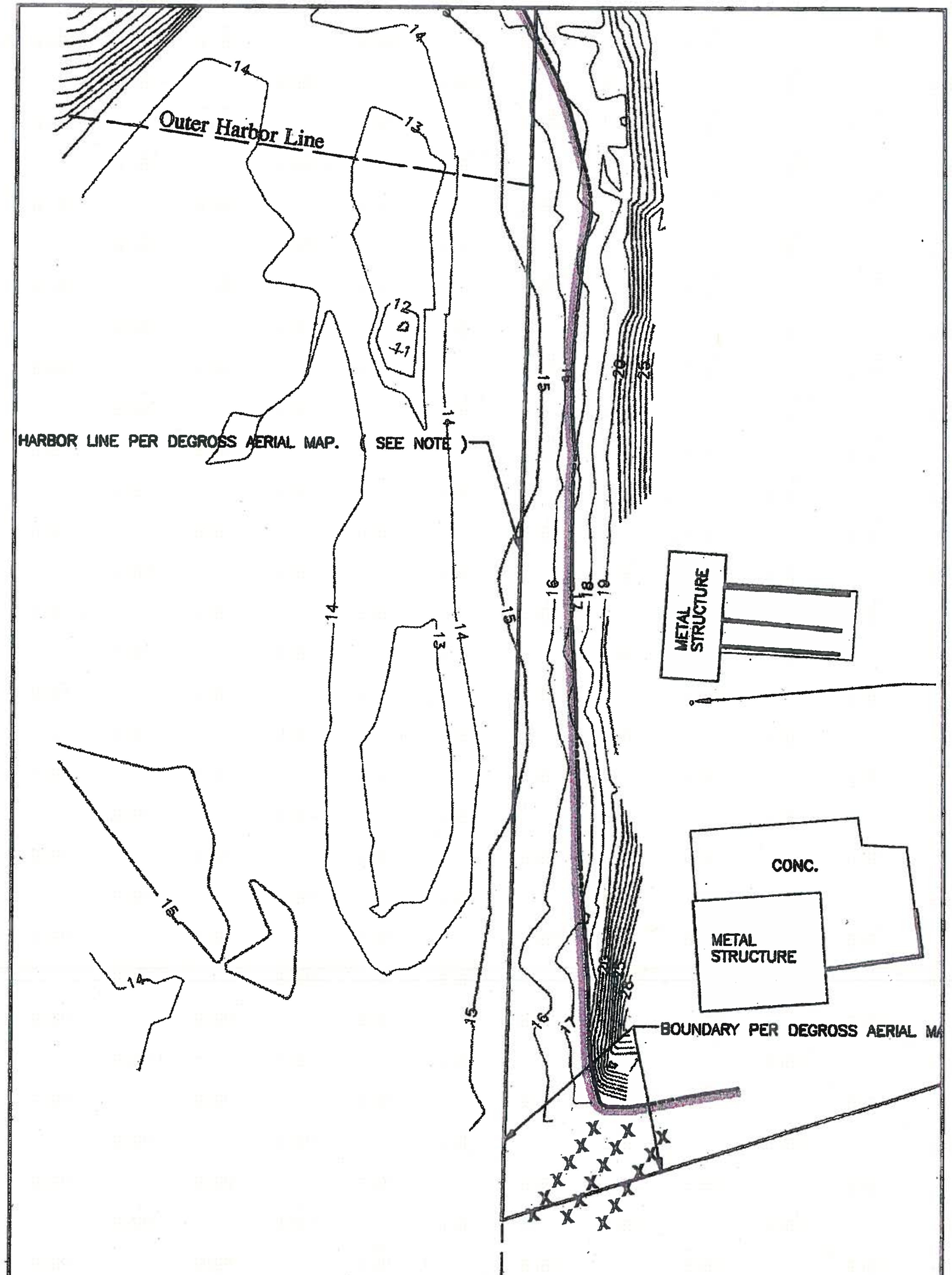
10) There is a high degree of artificial lighting from the concrete plant operations adjacent to the inner harbor. Added light can extend predation periods of visual sight feeders (diurnal feeders) throughout the evening.

As such, the inner harbor does not currently offer quality rearing habitat conditions for salmonid fishes. It is likely used seasonally (March-June) by juvenile salmonids as a transit zone to other littoral areas in northeastern Lake Washington. Secondarily, it may offer limited seasonal rearing opportunities.

Lake Washington Shoreline Characterization

Physical Conditions

Approximately 500 (152 m) feet of Lake Washington shoreline borders the western edge of the Kenmore Pre-mix property. The Lake Washington shoreline gradually increases in depth from the shore westward towards the center of the lake. Depth contours along the Lake Washington shoreline are displayed in Figure 3-3b. Representative cross section profiles of the shoreline are presented in Figure 3-5. The Lake Washington shoreline has a considerable area of littoral zone relative to the other two areas bordering the property (Figure 3-6).



LEGEND

- ORDINARY HIGH WATER MARK
- x WOODEN PILINGS

N

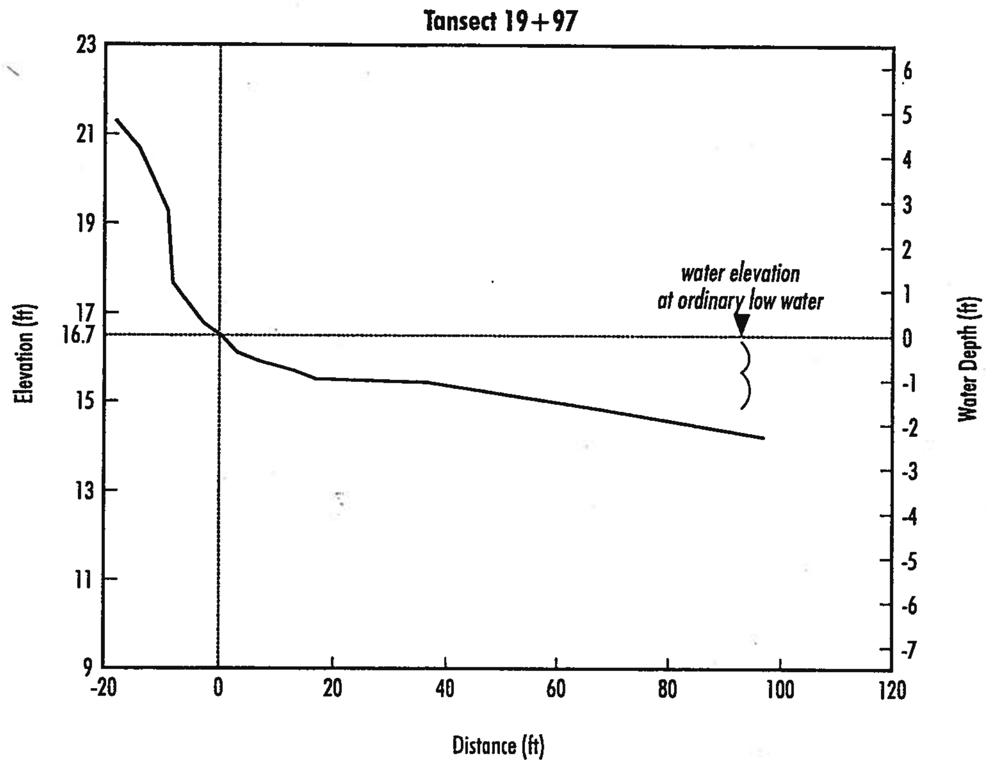
LAKEPOINTE
PIONEERING TOWING COMPANY

FIGURE 3.3B

EXISTING BATHYMETRIC CONTOURS & ARTIFICIAL STRUCTURE ALONG LAKE WASHINGTON SHORELINE

SOURCE REFERENCE: REID MIDDLETON

PROJECT NO.: 22140	22 OCTOBER 1996	beak
2140-33B.CDR/VGP	CHECKED: EBK	



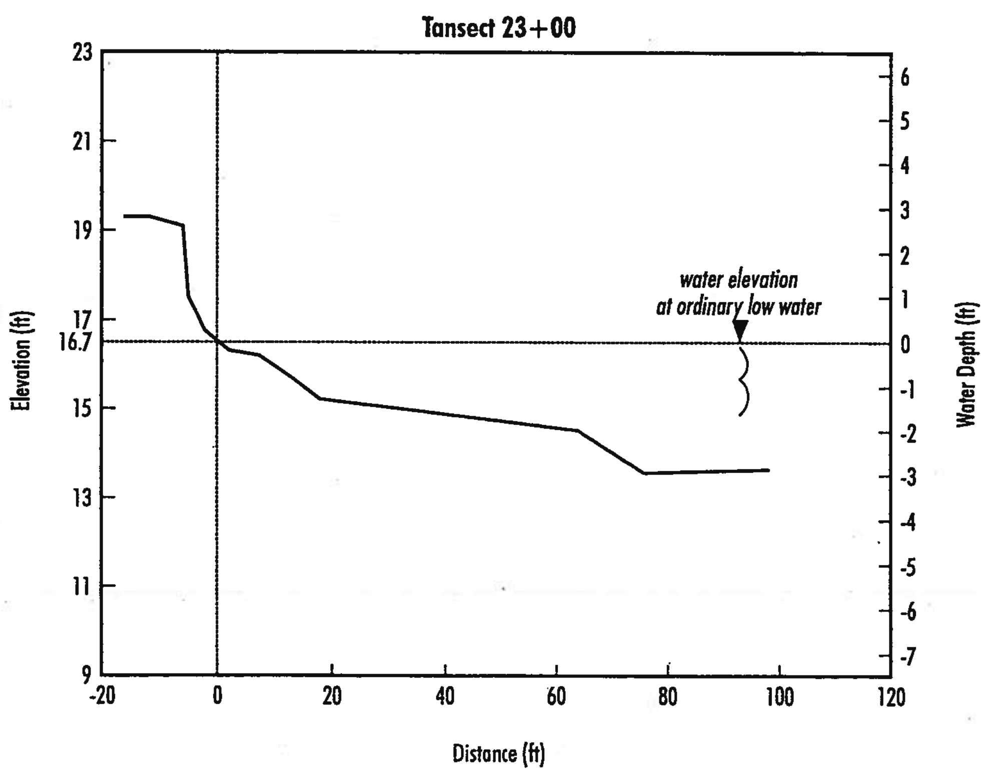
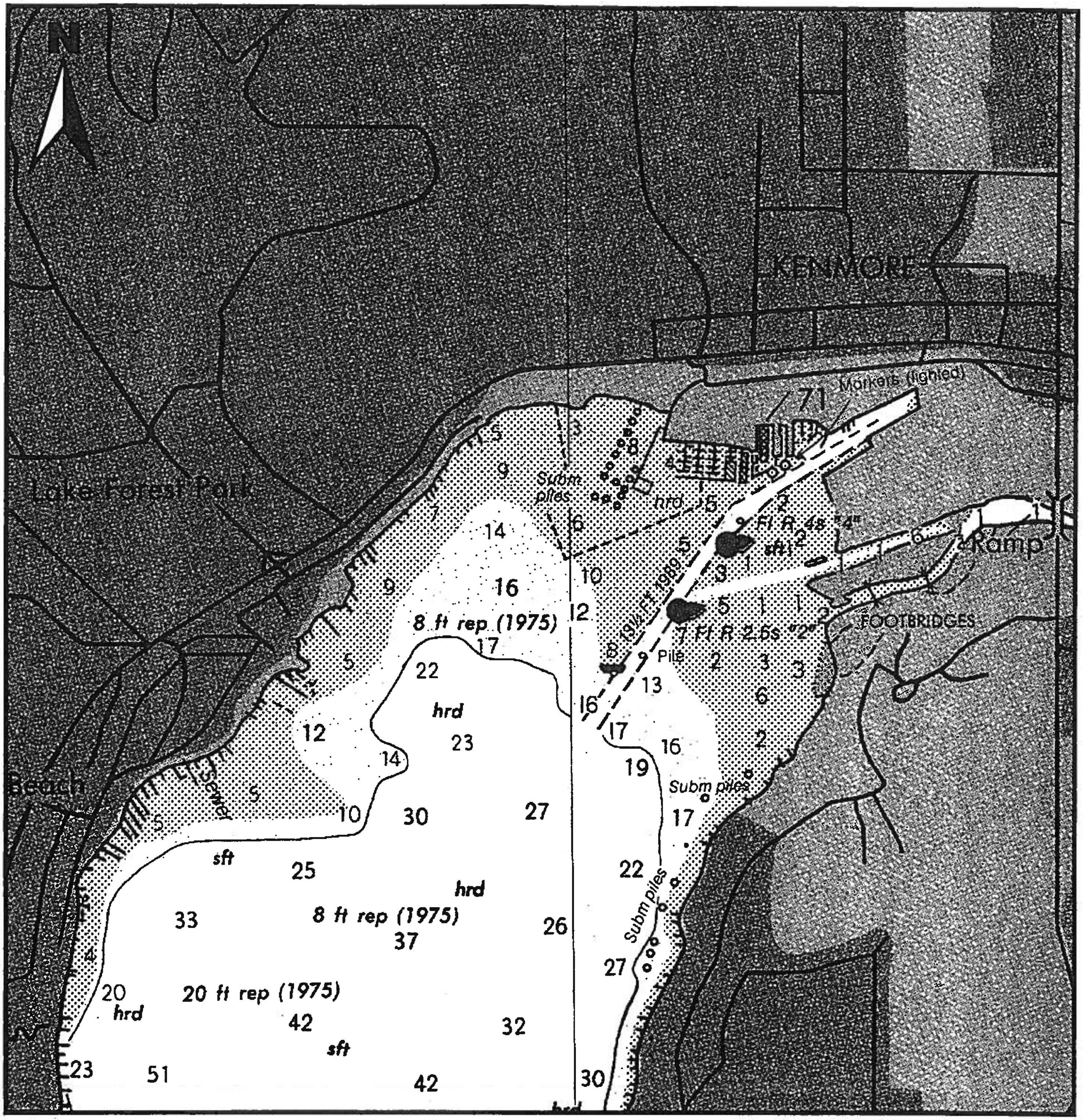


Figure 3-5. Cross-section profiles at two representative transects along the Lake Washington side of the proposed Lakepointe property. Distances are relative to the waterline at ordinary low water (+16.7 ft. Project Datum; +20 ft. Mean Low Low Water US COE Datum). Elevations are relative to water surface at ordinary low water.



SHALLOW LITTORAL AREA

LAKEPOINTE PIONEER TOWING	
FIGURE 3-6 *SHALLOW (0-10FT.) LITTORAL AREA ALONG NORTH LAKE WASHINGTON IN THE VICINITY OF THE SAMMAMISH RIVER AND KENMORE HARBOR*	
PROJECT NO.: 22140	4 DECEMBER 1996
2140-36.CDR/VGP	CHECKED: JBF

The substrate is small gravel and sand at the wave-swept shoreline. However, it is predominately sand and mud farther from shore. Several large logs lie parallel to the shore along the waterline. A band of Eurasian milfoil (*Myriophyllum spicatum*) extending from the shoreline to at least 50 feet (15 m) from shore was observed in May and June.

The riparian buffer between industrial areas and the lakeshore is approximately 45 feet (14 m) wide and is dominated by reed canary grass and blackberry and also includes mature Douglas fir, red alder, black locust and cattails. The Douglas fir grow in a single row parallel to the lakeshore and are approximately 45 feet (14 m) from shore. The reed canary grass and blackberry grow right to the shoreline and overhang the water.

Unlike the inner harbor, the Lake Washington shoreline contains no bulkhead, no area of artificial shoreline overhang, and no floating structures. Submerged car tires, cement blocks, and other industrial debris are present along the entire length of the shoreline. There are 18 emergent and submerged wooden pilings located offshore near the confluence with the Sammamish River. The pilings at the Sammamish River mouth do not support any structure.

Biological Conditions

Nighttime electrofishing surveys found prickly sculpin and three-spine stickleback were the most common species along the Lake Washington shoreline (Table 3-6a). Prickly sculpin were nearly as abundant along the lakeshore as they were in the inner harbor. Northern squawfish were collected infrequently, but not in the vicinity of the wooden pilings located near the mouth of the Sammamish River. Yellow perch were collected in May and June along the lakeshore in areas of fresh milfoil (*M. spicatum*) growth. Yellow perch move into shallow water in the spring to spawn and use vegetation or submerged brush as egg attachment sites (Wydoski and Whitney 1979). The yellow perch were likely spawning on or amongst the milfoil.

Anadromous salmonids, including juvenile/adult rainbow and cutthroat trout, sockeye fry, coho fry, chinook fry and coho juveniles were collected at the Lake Washington sites (Table 3-6a). More juvenile anadromous salmonids were collected along the Lake Washington shoreline than in the inner harbor or the Sammamish River. Resident cutthroat and rainbow trout were nearly as abundant along the lakeshore as in the Sammamish River.

Evening seining survey data were similar to the evening electrofishing survey results. Two seine hauls were attempted along the north end of the shoreline, but the net snagged numerous times on underwater debris and had to be lifted to be freed. Lifting the seine allowed fish to escape the net. Five prickly sculpin, three northern squawfish, and two three-spine stickleback were collected on the evening of 29 March. One yearling coho and one three-spine stickleback were collected on the evening of 6 May.

Daytime electrofishing surveys detected only prickly sculpin and three-spine stickleback. Yellow perch were the most common fish species observed while snorkeling. The perch were scattered along the bottom among fresh milfoil growth. One juvenile/adult rainbow trout was observed during snorkeling. No largemouth bass, pumpkinseed or northern squawfish were observed along the Lake Washington shoreline during daytime snorkeling or daytime electrofishing.

Summary of Physical and Biological Conditions

The lakeshore contains no shoreline treatments, no floating structure and the only significant in-water structure is near the Sammamish River mouth where 18 wooden pilings are located. The lakeshore has an extensive littoral zone. Of the three study areas, salmonids were found in greatest abundance along the Lake Washington shoreline. This finding supports results from the Tribe's study (Malcom 1996). The primary value of the shallow shoreline habitat is for salmonid rearing and possibly staging prior to further migration offshore into the lake.

<u>Sammamish River Characterization</u>

Physical Conditions

Approximately 2,000 feet (610 m) of the north bank of the Sammamish River border the Kenmore Pre-mix property. Lights atop poles as high as the tallest trees shine brightly for the entire length of the Kenmore Pre-mix property that lies along the north bank. The north bank has a narrow band of shallow beach habitat until the point where the channel is influenced by dredging activity; then the depth abruptly increases (Figure 3-7). The nearshore substrate is influenced by wave action from Lake Washington, and consists of small gravel and sand. Outside the zone of wave influence, the substrate is dominated by sand. It progressively includes a higher proportion of soft or hard silt as the water deepens.

The riparian buffer between developed areas and the Sammamish River is approximately 25 feet (8 m) wide. Riparian vegetation includes a single line of mature Douglas fir and black cottonwood, but it is dominated by reed canary grass and dense blackberry bushes that overhang the bank. Due to the width of the Sammamish River at the confluence with Lake Washington and the aspect of the river to the sun, the thin band of Douglas fir and black cottonwood provides minimal shading of the river from solar radiation. Such riparian habitat conditions are not exclusive to the Sammamish River mouth, as fish habitat along the entire length of the Sammamish River is limited by warm water temperatures in the summer and a lack of bank cover (King County 1993).

The Sammamish River along the Kenmore Pre-mix property contains no bulkhead, no area of artificial shoreline overhang, and no floating structures. Root masses and single wooden timbers are present at various points along the north bank and they provide the only in-channel cover in nearshore areas.

Biological Conditions

Nighttime electrofishing surveys indicated that prickly sculpin were the most common species, followed in abundance by three-spine stickleback (Table 3-6a). Yellow perch were collected in the Sammamish River in May and June. Warmwater species were nearly as abundant in the river as they were along the lakeshore.

Five species of salmonids were collected (Table 3-6a). Resident juvenile/adult cutthroat and rainbow trout were collected more frequently in the Sammamish River than in the inner harbor or along the Lake Washington shoreline. Anadromous species of salmonids were more abundant in the Sammamish River than in the inner harbor, but were not as common as along the lakeshore.

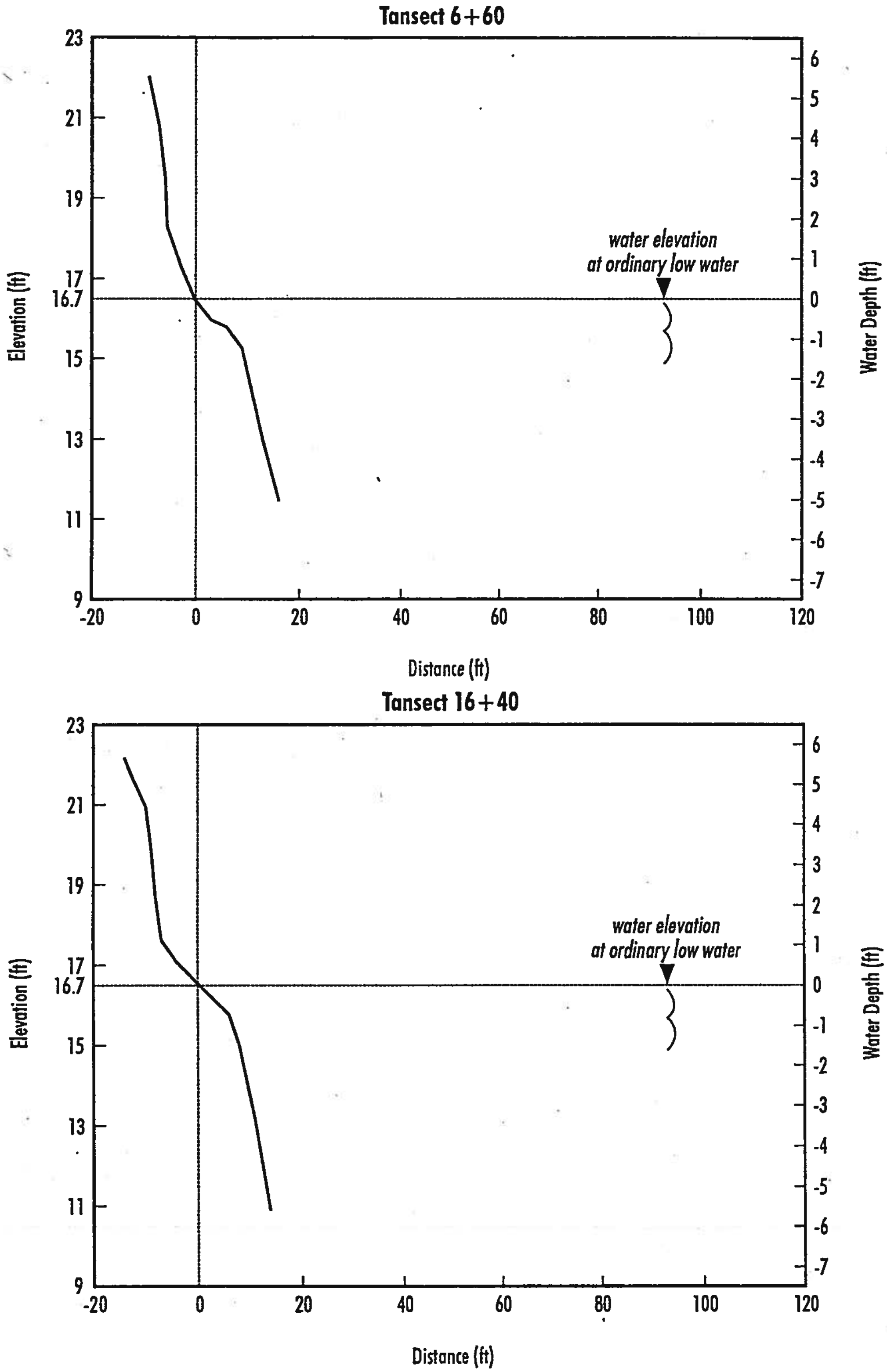


Figure 3-7. Cross-section profiles at two representative transects along the Sammamish River side of the proposed Lakepointe property. Distances are relative to the waterline at ordinary low water (+16.7 ft. Project Datum; +20 ft. Mean Low Low Water US COE Datum). Elevations are relative to water surface at ordinary low water.

On 29 March, one seine haul was completed perpendicular to the bank, but the net snagged numerous times on underwater debris. The net had to be lifted to be freed, allowing fish in the net to escape. Prickly sculpin and three-spine stickleback were collected, but were not enumerated.

Daytime electrofishing surveys collected only prickly sculpin and three-spine stickleback. Three-spine stickleback were the most frequently observed fish species during snorkeling surveys. One adult pumpkinseed was observed in a small floating patch of vegetation. Snorkel surveys detected two juvenile/adult salmonids. No largemouth bass or northern squawfish were observed in the Sammamish River.

Summary of Physical and Biological Conditions

There are no shoreline treatments, no floating structure or no significant in-water structures along the north bank of the Sammamish River. Salmonids were 32 percent less abundant along the north bank of the Sammamish River as they were along the Lake Washington shoreline. The primary utility of the river is an unimpeded migration corridor for adult and juvenile salmonids. The secondary value is for salmonid rearing, but habitat is limited by warm water temperatures in the summer and a lack of instream or bank cover.

3.1.3 Results - 1997

Additional physical and biological sampling occurred in the Inner Harbor on a limited basis during the spring of 1997, to gather further information on deep water habitats in the backwater bay.

Water Quality and Temperature Monitoring

Continuous recording thermographs deployed from 30 April through 19 May 1997, recorded mean daily water temperatures at the surface of the inner harbor between 12°C and 17.6°C. The instantaneous maximum during this period was 20.6°C. Temperatures near the bottom of the Harbor averaged approximately 1.4°C cooler than the surface temperatures (Figure 3-8). Temperature profiles at spot locations in the inner harbor prior to deployment of continuous thermographs, were relatively uniform between surface and bottom (Figure 3-9). A layer of slightly warmer surface water was apparent in mid-May, as confirmed by the continuous thermographs.

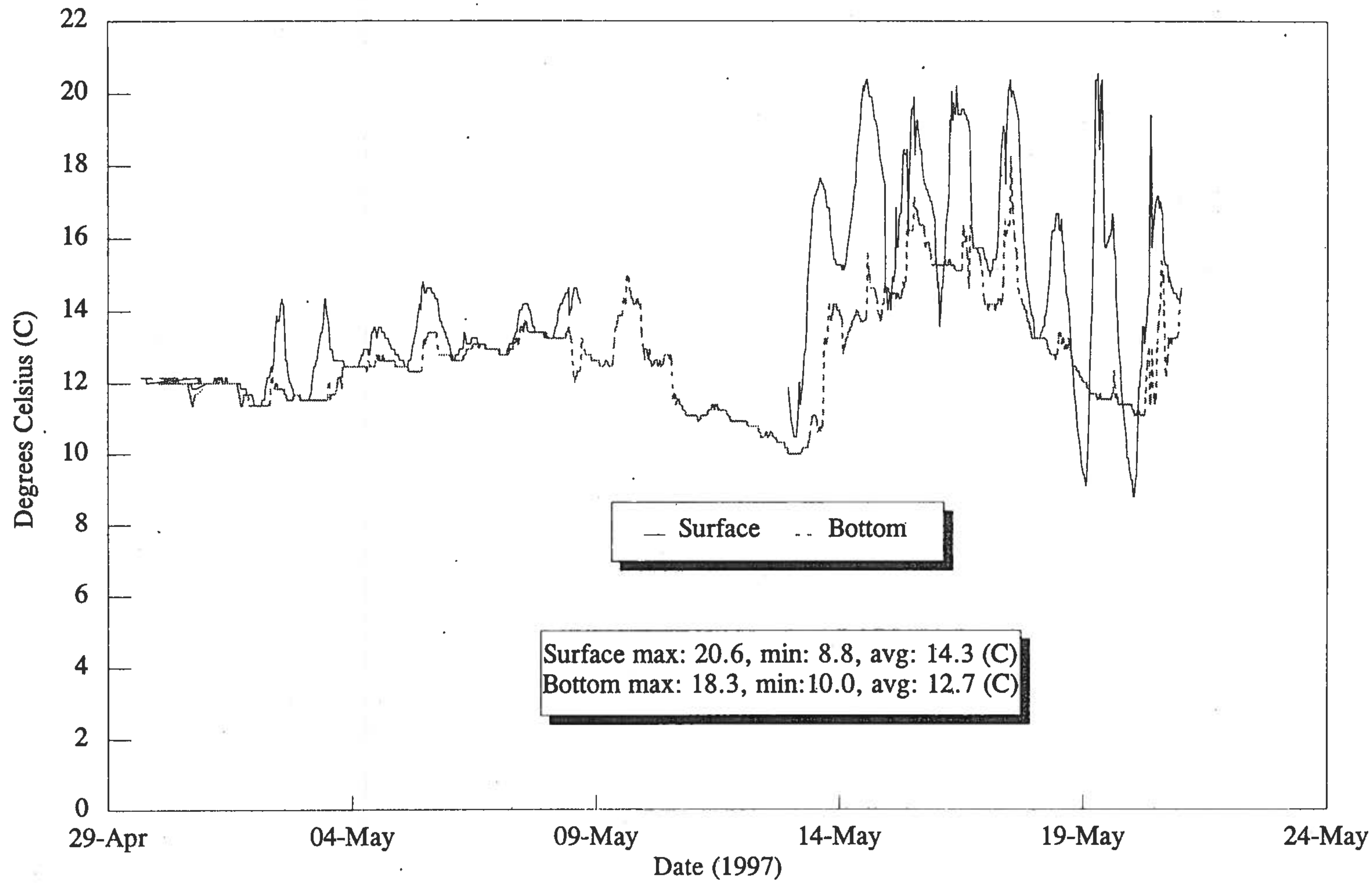


Figure 3-8. Spring Water Temperature in the Kenmore Inner Harbor near Lakepointe
Missing surface temperature data due to equipment malfunction

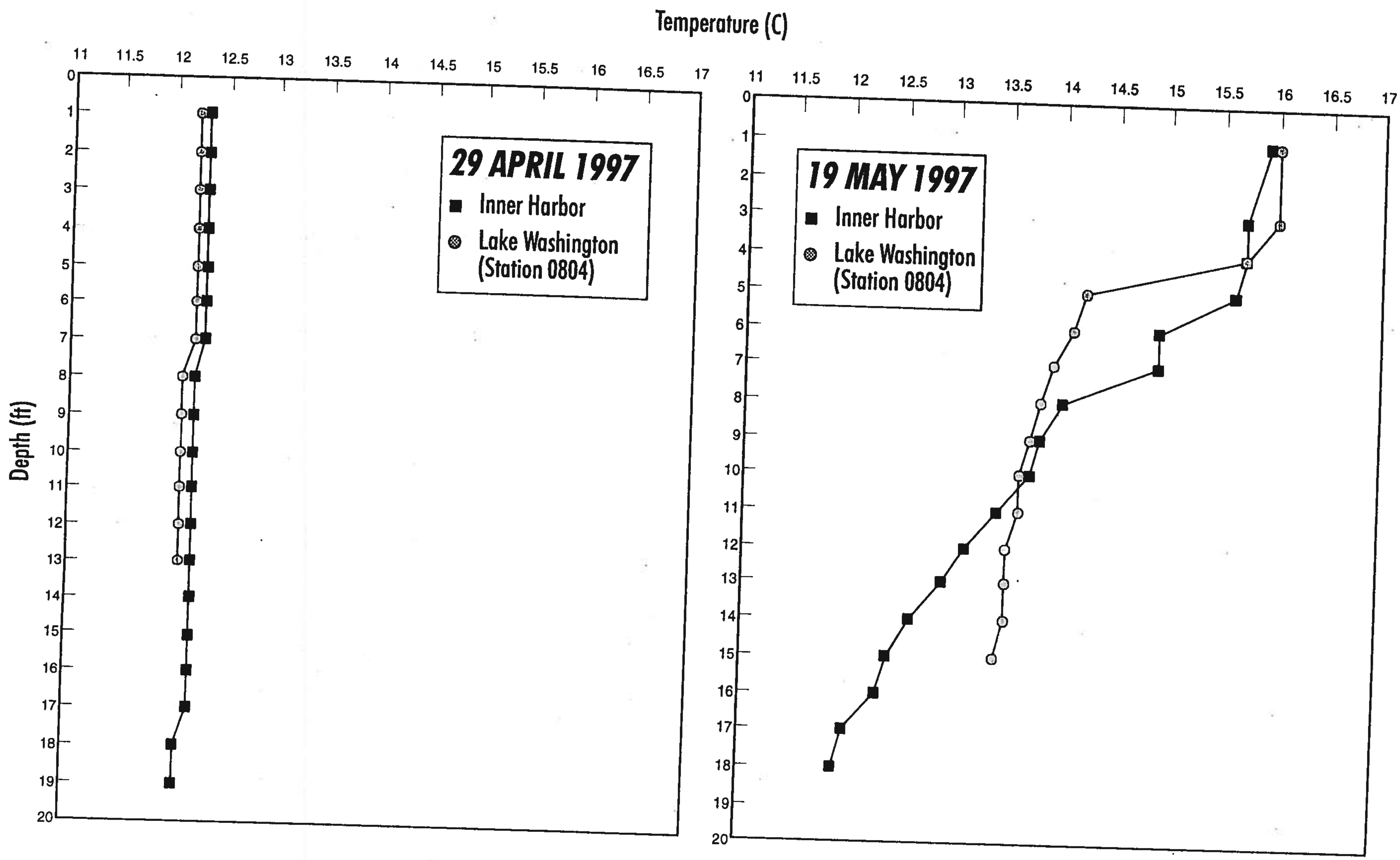


Figure 3-9. Spring 1997 water temperature profiles in the inner harbor and at Lake Washington metro monitoring station #0804 near Kenmore, WA.

In situ water quality data collected concurrently in the Inner Harbor and at Lake Washington (Metro monitoring station 0804) suggest that the entire water column in spring is well oxygenated (>9.3 mg/L), with moderate conductivity (107 to 131 µmhos/cm) and near neutral pH (5.7 to 8.2) (Appendix B).

Biological Sampling Program

Gillnetting and Electrofishing:

Fish sampling surveys revealed the presence of various warmwater and cold water species in the inner harbor during April and May. The cold water species were all salmonid fishes including juvenile chinook, coho, sockeye and resident adult rainbow and cutthroat trout. The juveniles were collected along the perimeter of the inner harbor, usually within 30 ft of the shore via electrofishing, whereas the resident adults were captured by gillnets in deeper more offshore positions than the juveniles. Coho salmon smolts (110-160 mm) were found in the greatest abundance (Table 3-6b). The dominance of coho smolts in the catch on 12 May 1997 was most likely the capture of yearling coho salmon released from the Issaquah Salmon Hatchery into tributaries of Lake Sammamish, the Sammamish River and north Lake Washington from 7 through 14 April 1997 (Table 3-1b). The sockeye collected were young-of-the-year fry ranging in size from 45 to 70 mm.

Among the warmwater species, three-spied sticklebacks, and large scale suckers were collected most frequently. Tench, brown bullhead and northern squawfish were also observed in moderate densities. Sticklebacks were only captured by electrofishing techniques and tench were only collected via gillnetting. The other noted warmwater species were collected by both methods.

Stomach Content Analysis

The only potential predators large enough to prey on juvenile salmonids were the resident cutthroat and rainbow trout, brown bullhead, northern squawfish, black crappie, and pumpkinseed. The stomachs of one rainbow, three squawfish and one bullhead were dissected. None of the stomachs contained any salmonid fishes. The squawfish and bullhead were ripe with females possessing well developed eggs and the males supported extended gonadal development. Many warmwater species curtail or reduce feeding activities during spawning periods (Stein 1970, Helfman 1981).

Table 3-6b. Results of night electrofishing and night gillnetting in the inner harbor, April through May, 1997.

	April 29		May 12		May 19	
	Night Electrofishing	**Night Gillnetting**	**Night Electrofishing**	**Night Gillnetting**	**Night Electrofishing**	**Night Gillnetting**
Chinook salmon	0	0	0	0	1	0
Coho salmon	2	0	85	0	6	0
Sockeye salmon	5	0	0	0	2	0
Cutthroat trout*	0	0	0	1	0	0
Rainbow trout*	0	1	0	0	0	0
Total salmonids	**7**	**1**	**85**	**1**	**9**	**0**
Northern squawfish*	0	0	0	3	1	0
Largemouth bass*	0	0	0	0	0	0
Pumpkinseed*	0	0	0	0	0	1
Prickly sculpin*	0	0	0	0	1	0
Three-spine stickleback	2	0	6	0	1	0
Pacific lamprey	0	0	0	0	0	0
W. brook lamprey	0	0	0	0	0	0
Brown bullhead*	0	0	0	1	3	0
Yellow perch*	0	0	0	0	1	0
Largescale sucker	1	0	3	2	0	3
Black crappie*	1	0	1	0	0	0
Tench	0	1	0	2	0	1
Peamouth	0	0	0	0	2	0
Total non-salmonids	**4**	**1**	**10**	**8**	**9**	**5**

* - Salmonid predators

3.2 SIGNIFICANT FISHERIES IMPACTS

The proposed Lakepointe development specific to shoreline areas surrounding the Kenmore Pre-mix property includes: 1) a public shoreline park along the north bank of the Sammamish River; 2) a fixed moorage pier, public promenade, and ADA access ramp adjacent to the lakehouse and public lookout in the inner harbor; 3) public plazas and view points along the south eastern and eastern shores of the inner harbor; and 4) floating moorage slips in the eastern half of the inner harbor. The effects of these development features upon salmonid fish habitat are addressed below.

3.2.1 Lake and Stream Function

The proposed development would not include structures below OHWM along either the Sammamish River or the Lakeshore. Therefore, physical and biological functions of the lake and the river would not be altered from current conditions. The shoreline park is not expected to modify the riparian zone to a great degree. However, removal of a few Douglas fir and cottonwoods would be required during park construction. Similarly, Douglas fir along the north end of the Lake Washington shoreline may be removed during construction of the public access trail and firelane. Such removal is not expected to affect the function of the riparian zones in these areas for fish species since the trees currently provide little, if any, thermal protection for the river or bankside cover for fish.

The inner harbor would be cleaned up (removal of wood debris, unused pilings and piers) and built out including structures below OHWM as delineated in Fish Impact Section 3.2.3 below. The inner harbor is a backwater area of the lake that primarily functions as a warmwater species spawning and rearing area. It also offers protection from storm waves along the high energy, open areas of the lake. Its value to salmonid fishes is related to a seasonal juvenile rearing and nighttime resting area as well as migratory transit area, but compared to the river and lakeshore it offers moderate to low habitat value for salmonid fishes. The biological function of the embankment to provide backwater rearing habitat for salmonid fishes is presently limited due to the industrial built out nature of the harbor. A severely reduced littoral zone and lack of a riparian zone in the inner harbor, due to prior shoreline modifications and dredging, decreases the aquatic productive capacity compared to an undeveloped backwater area.

The proposed development would increase the amount of overhanging docks and the number of piles in comparison to existing conditions further reducing the value of the inner harbor for salmonid fishes as described below. It would likely increase its value to warmwater species, primarily bass, that prefer backwater conditions and piling/pier habitat.

3.2.2 Dredging

Maintenance dredging of the Kenmore navigation channel occurs irregularly and is currently approved and scheduled for dredging to -17 feet (below OHWM of 18.7 ft. Project Datum) during the dredging season of 1997 (SAIC 1996). To assess the potential impacts of this dredging, the US Army Corp of Engineers undertook sediment sampling along the navigation channel. Sediments from cores in the inner harbor were characterized as sandy-silt with abundant organics and wood fiber/chips with a wet brown to olive color. Petroleum odor was noted to increase with sediment depth in the core samples (SAIC 1996).

Sediment testing for open water disposal at the PSDDA site in Elliott Bay, revealed slightly elevated concentrations of poly-aromatic hydrocarbons (PAHs) above PSDDA screening levels in the inner harbor. However, the sediments passed biological testing and were approved for open water disposal. PAHs are likely present in the harbor sediments due to the historic use of the site as a lumber mill. No other priority pollutants were found above PSDDA screening levels.

No dredging of the inner harbor for marina development is anticipated. It is unknown whether maintenance dredging for the marina would be required in the future. Should it become necessary, the sediments to be removed would require analysis for disposal options and impact assessment. Given the results of the recent ACOE study for sediments in the inner harbor, it is assumed any future maintenance dredging would be approved for open water disposal and the sediments would not pose a risk to aquatic organisms. Temporary increases in turbidity would occur during any future maintenance dredging operations for the marina. Increases in turbidity and re-suspension of sediments should be similar in effect to the current operation of re-suspending sediments via the prop wash of tug boats during barge movements in the harbor (Figure 3-10). As a result, re-suspension of sediments during potential maintenance dredging, should not have an adverse effect on biota of the inner harbor.

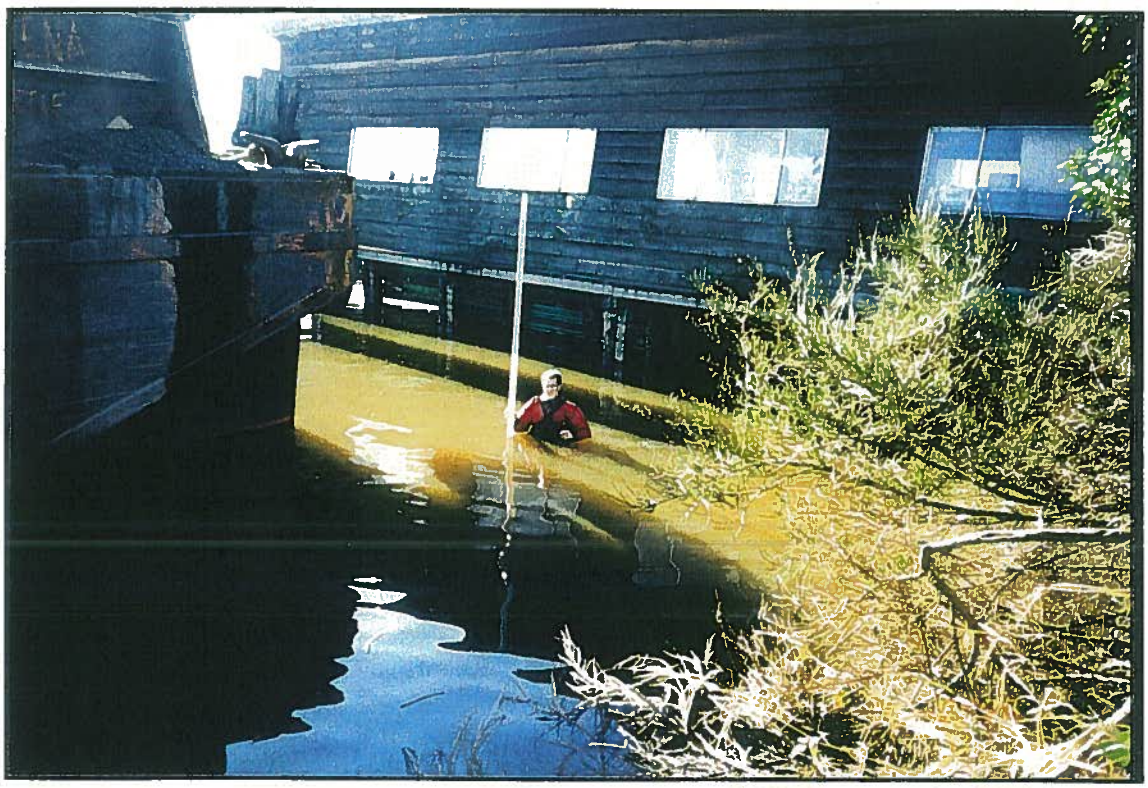


Figure 3-10. Turbid water conditions following tug deployment in the Inner Harbor.

3.2.3 Structures

As previously stated, no in-water or over-water structures are planned for the north shore of the Sammamish River or along the Lake Washington shoreline area west of the property. Anticipated structures in the inner harbor include:

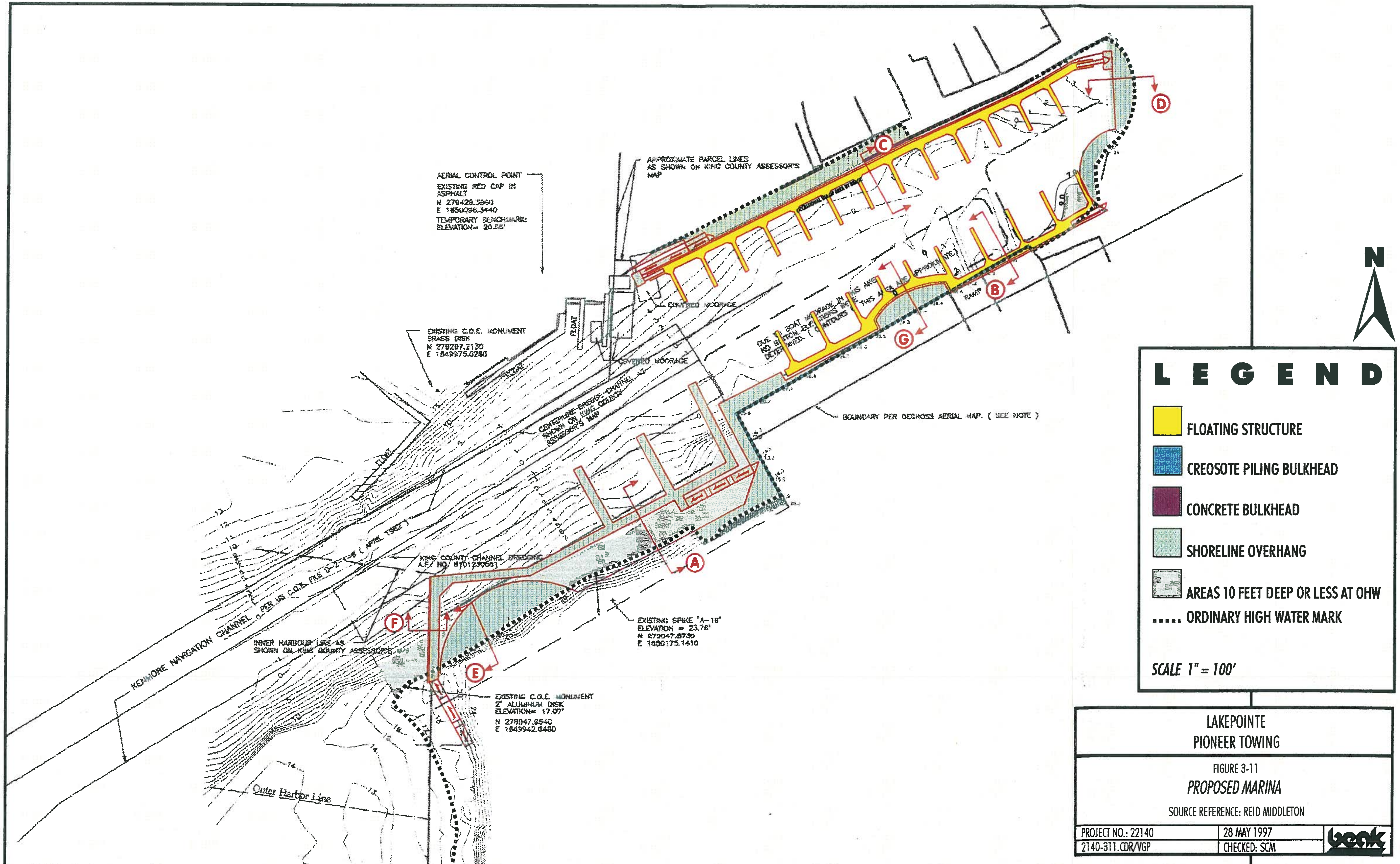
- Overhanging public lookout adjacent to the lakehouse
- Overhanging public view point around boathouse restaurant
- South east overhanging public outlook
- North reconstructed wharf
- Marina fixed piers, and public promenade with ADA access ramps
- Marina floating piers
- East end overhanging public plaza

<u>Bulkheads</u>

Existing bulkheads in the inner harbor would be used in conjunction with the proposed floating moorage and fixed wharf structures. No new bulkheads or fill are proposed with this action. Therefore, no further loss of shallow water, habitat for fish rearing and refuge because of bulkhead construction would occur as a result of this development. As discussed in Section 3.3; Fish Habitat Mitigation, 115 lineal feet of existing bulkhead along the eastern shore would be removed to create approximately 3,000 square feet of shallow water habitat for juvenile salmonids.

<u>Over-water Structures</u>

Approximately 32,488 square feet of fixed surface area and 12,700 square feet of floating surface area are planned to be constructed over the surface waters of the lake in the inner harbor as shown in Figure 3-11 and listed in Table 3-7. An additional annual equivalent of 14,632 square feet of transient floating surfaces from boats moored in the marina are estimated with project development. The proposed over-water structures would cast nearly 45 percent more shade than the existing structures in the harbor.



LAKEPOINTE
PIONEER TOWING

FIGURE 3-11
PROPOSED MARINA

SOURCE REFERENCE: REID MIDDLETON

PROJECT NO.: 22140	28 MAY 1997
2140-311.CDR/VGP	CHECKED: SCM

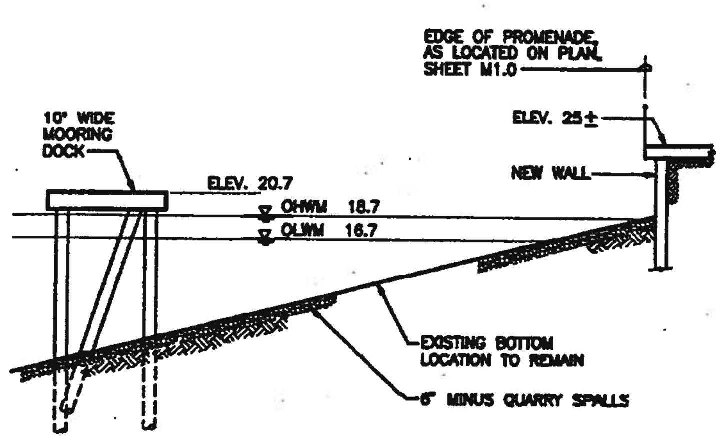
Table 3-7. Summary of existing conditions and predicted post-development shoreline treatments and water structures associated with the Lakepointe Property.

	Existing	Post development
Area of shoreline overhang (ft^2)	7,642	32,488
Area of floating material (ft^2)		
Floats	7,795	12,700
Boats	25,800	14,632
Total shaded area	41,237	59,820
Linear feet of bulkhead	1,131	1,016
Number of in-water pilings	365	449

Fixed Structures (Overhang)

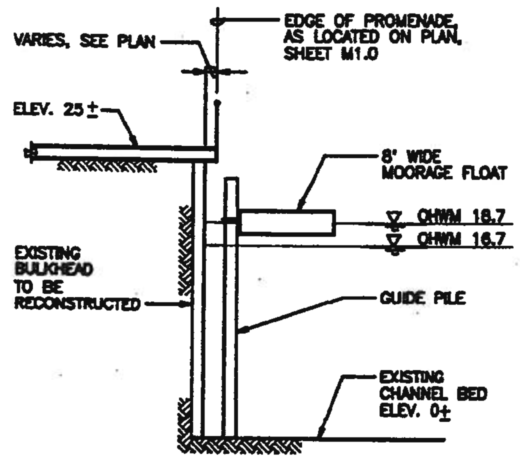
The fixed wharf structures would be built approximately 5 feet above OHWM and shoreline overhang would vary from 1 foot to 50 feet in width (Figure 3-12). The height of the structures would allow more light to penetrate the water compared to near surface structures, especially along the north shore of the inner harbor where the aspect of the sun would provide substantial underwater illumination. To preclude adverse effects of shading, all overhanging structures would be designed to pass ambient light by means of openings, gratings, or clearstory in the decking or they would include artificial lighting beneath the wharf. The fixed moorage pier and public promenade has been designed approximately 35 feet offshore to allow unhindered light penetration to a majority of the shallow water littoral zone located on the southwest shore (Figure 3-11).

High amounts of shading can reduce aquatic growth in the littoral zone with an ultimate reduction in fish production compared to open water shorelines of the lake. Areas where light rarely penetrates to the bottom can become relatively sterile. Additionally, salmonid fish are thought to avoid dark areas without a light source to guide them past the darkness. A direct estimate of lost productivity potential from current shaded conditions is not feasible due to the high prevalence of turbid water conditions resulting from barge offloading and tug activities in the harbor. High levels of turbidity also reduce the available light for aquatic productivity narrowing the littoral zone and reducing fish production.



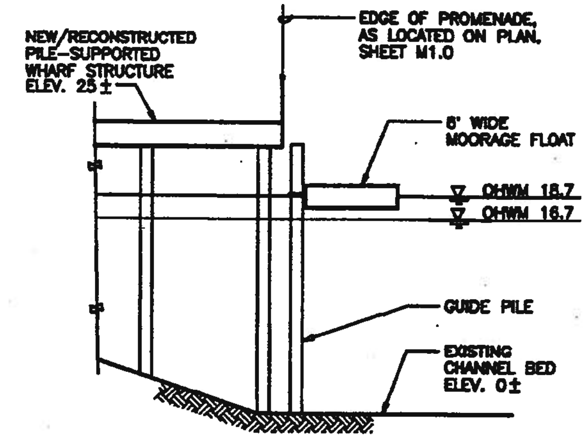
SECTION A (SOUTH SHORE)

SCALE IN FEET 5 0 5 10



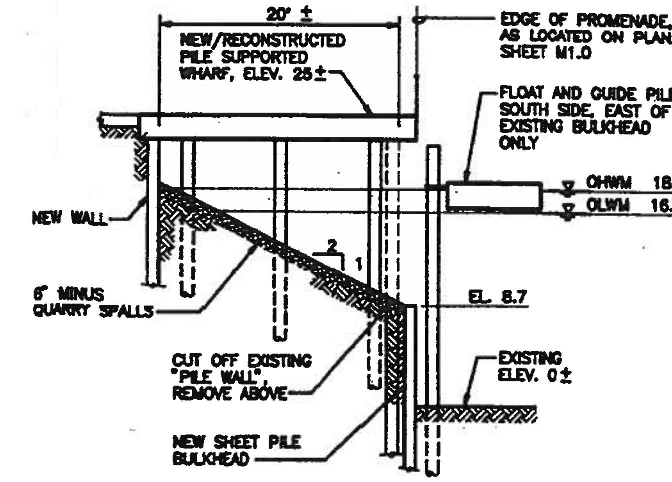
SECTION B (EXISTING BULKHEAD)

SCALE IN FEET 5 0 5 10



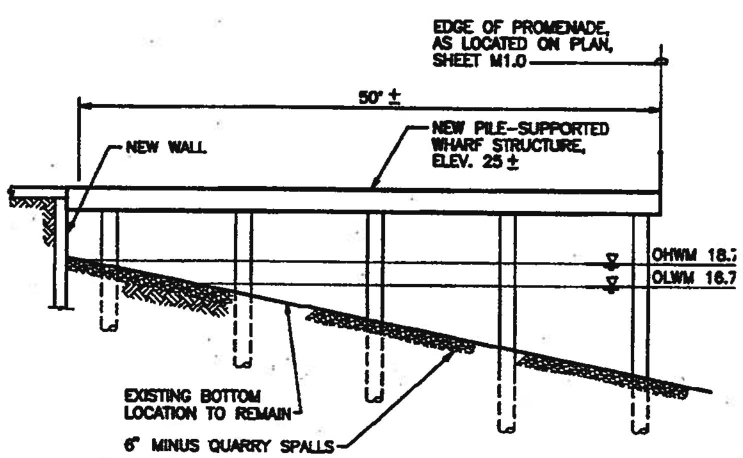
SECTION C (EXISTING TRESTLE)

SCALE IN FEET 5 0 5 10



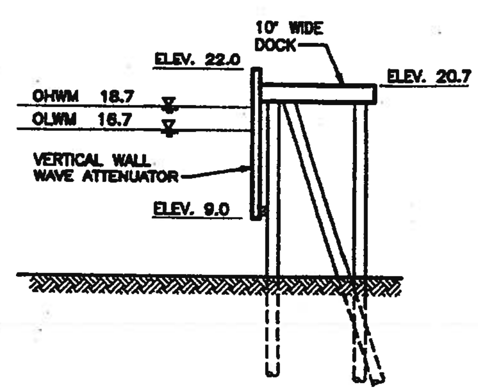
SECTION D (EAST END)

SCALE IN FEET 5 0 5 10



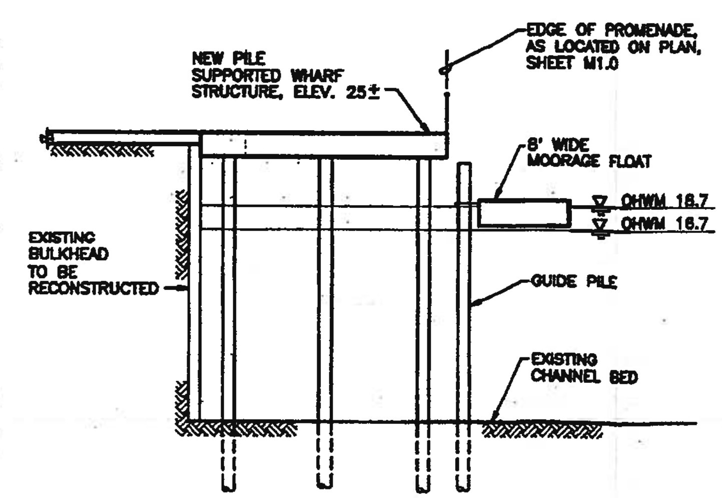
SECTION E (PUBLIC LOOKOUT)

SCALE IN FEET 5 0 5 10



SECTION F (WAVE ATTENUATOR)

SCALE IN FEET 5 0 5 10



SECTION G (PUBLIC OUTLOOK)

SCALE IN FEET 5 0 5 10

LAKEPOINTE
PIONEER TOWING

FIGURE 3-12
MARINA SECTIONS

SOURCE REFERENCE: REID MIDDLETON

PROJECT NUMBER: 22140	28 MAY 1997
2140-312.CDR/VGP	CHECKED: SCM

beak

The greatest amount of shading impacts to salmonid fishes in the inner harbor would occur along the southern harbor shoreline where usable littoral habitat exists. Although salmonid fish were found in this location, the shoreline has been previously dredged and offers only limited habitat value. Approximately 16,000 square feet of shallow-water (<10 ft) rearing habitat would likely have some degree of shading from overhangs with the Proposed Action. Given the minimization in the amount of developed structures overhanging the OHWM and the level of deck openings incorporated into the overhangs to allow passage of ambient light, the amount of shading beneath the overhangs is not anticipated to adversely affect either salmonid use or aquatic productivity of the shallow water littoral zones in the inner harbor. Overall aquatic productivity may be improved with the anticipated reduction of turbid water conditions in the inner harbor as a result of a cessation of deep draft prop wash from tugs and elimination of sediment-laden stormwater runoff from surrounding land uses. Some overhanging shade conditions may be a benefit to nearshore salmonid use given the lack of any riparian zone and associated shading in the inner harbor. Eggers et al. (1978) offer that low light intensity of shallow littoral habitats provide effective refuge for juvenile sockeye from predators.

Floating Structures

Marina finger piers, access floats and moored boats would also cast shade. The annual shade equivalent post-project development from floating surfaces is estimated to be 27,332 square feet or approximately 0.6 acres (16% of the inner harbor). Both predator and prey species should be attracted to the cover provided by floating structures. However, the available scientific literature suggests these structures may be a benefit to small fishes (<100mm). Prey fish species are particularly attracted to floats to obtain protection from predators (Helfman 1979). This study strongly implicated shade, provided by the floating objects, was the attractive factor with predator avoidance as the ultimate cause. Shade with surface water cover, offers visual cover decreasing prey visibility while increasing approaching predator visibility. Helfman surmised prey fishes hovering in the shadow of a float are not only more difficult to see, they should also be able to see an approaching predator before the predator sees them. This research supports the understanding that marina floats and piers in the Pacific Northwest have long been known to attract juvenile salmonids (Heiser and Finn 1970, Ratte and Salo 1985, Hotchkiss 1996, Taylor 1997). It is also consistent with DeVore and White (1978) findings that trout preferred overhead cover 4 inches, rather than 6 or 8 inches, above the water, as well as cover with tactual features. This finding may explain salmonid preference for floats versus overhanging piers.

Based on the review of literature, we conclude small fish would be closer to the tactile surfaces and in smaller spaces than the large predators. Floating structures would improve survival compared to areas without cover even though both predator and prey are in the same area. Increasing floating surfaces in the inner harbor would not differentially increase predation rates on juvenile salmonids.

<u>In-water Structures</u>

The fixed over-water structures would be supported by pilings at an average rate of one pile per 100 square feet. Pilings would also be used to anchor floating moorage structures. A 23 percent increase in the number of pilings over the current level of pilings is anticipated with project development (Table 3-7). If cement piling structures are used, only cured cement would come into contact with surface waters, precluding any influence in pH from the cement.

Pilings would support a food base for fish and would add structure and cover for various species. Artificial structure is often added to enhance fish habitat. According to Crowder and Cooper (1979), fish maximize their feeding efficiency and growth at intermediate levels of structural complexity. Pilings and overhangs are thought to be preferred by warmwater species over salmonids and have been shown to increase bass spawning potential by adding protection to nest sites (Hoff 1991). There is a general perception that piling structures provide ambush cover for salmonid predators and would lower the value of the inner harbor for salmonid use. However, there is little scientific literature to support this contention. Beauchamp et al. (1994) found that piers had no significant effect on densities of littoral fishes. Daytime densities and species composition of fishes associated with piling-supported piers did not differ significantly from adjacent no-pier areas (Beauchamp et al. 1994). In addition, White (1975) found no greater predation on salmonids in areas built out with docks and pilings compared to open water areas in Lake Washington. The author states there was: .."evidence that ... fish were neither avoiding the piers nor preferentially selecting open areas. If a section of shoreline fulfills the requirements regarding substrate type, it appears these fish would utilize the area regardless of whether or not a pier or other structure is in the immediate vicinity." In estuarine waters at the Port of Tacoma, Ratte and Salo (1985) found that predator species did not aggregate under piers and they were not targeting extensively on juvenile salmonids. Similarly, Tabor and Chan (1996) found that largemouth and smallmouth bass rarely preyed on sockeye juveniles emanating from the Cedar River. The authors believe the low predation rate is because habitat utilization by bass/squawfish and salmonid fry rarely overlap during the time of peak outmigration by salmonid fry spawned in the Cedar River. There were no studies located or data provided in the literature search or interview process suggesting in-water structures increase predation on salmonids. Although unproven, the hypothesis remains plausible.

Project studies collected various fish species regarded as potential salmonid predators (Tables 3.6a,b). The literature concerning salmonid predation in the lake suggest the northern squawfish, largemouth bass, and resident trout have the capacity to take significant quantities of juvenile salmonids. Squawfish and resident trout are considered abundant in Lake Washington, largemouth bass are not (Bartoo, 1972).

Northern Squawfish: Project studies collected juvenile squawfish (40-80 mm) in the shallow nearshore areas of the inner harbor during spring. Adult squawfish (120-470 mm) were first collected in the inner harbor in mid-May at a surface water temperature of 16°C. They were located slightly deeper in the harbor than the juveniles. The timing of squawfish in the inner harbor was similar to the noted presence of squawfish in nearshore areas of southern Lake Washington (Martz et al. 1996).

Squaw fish are voracious predators on small fishes, but are primarily pelagic feeders targeting longfin smelt and juvenile sockeye salmon in offshore areas of the lake during fall, winter and spring. According to life history studies of northern squawfish in Lake Washington, squawfish overwinter in deep portions of Lake Washington and do not move into shoreline littoral zones until May or June each year (Bartoo 1972; Olney 1975). Sockeye predation may be seasonal (Levy 1987). As they move inshore in late spring and summer their diet changes to alternate more profitable benthic species and insects in the littoral zone (Ricker 1941; Bartoo 1972; Olney 1975; Eggers 1978; Levy 1987). They especially exploit the abundant prickly sculpin in Lake Washington (Eggers 1978; Eggers et al. 1978).

Movement to inshore areas appears to be primarily related to spawning (Jeppson 1957; Bartoo 1972; White 1975; Martz et al. 1996). Many freshwater species are known to reduce or cease feeding during the spawning season (Stein 1970, Helfman 1981; Martz et al. 1996). Project studies showed no evidence of salmonids in stomachs collected from the inner harbor and all squawfish were noted to be in spawning condition. No literature or information was found indicating squawfish use in water structures as ambush cover.

Thus, salmonid predation in the inner harbor is currently minimized by:

1) The spatial timing of habitat use between squawfish and salmonids overlap for only a brief period at the end of the juvenile outmigration (mid-May to mid-June).

2) Squawfish presence in the inner harbor during this overlap period is primarily related to spawning. It is assumed feeding during this period is reduced.

3) Squawfish shift their diets during the seasonal inshore phase to focus on benthic littoral fish, primarily prickly sculpin, and insect species.

It is concluded the late spring movement of squawfish to the inner harbor is primarily spawning related. Summer residence is assumed in this warm backwater area, since squawfish seek preferred water temperatures > 22°C (Bartoo 1972). However, target food sources during this period are non-salmonid. It is concluded an increase in in-water structures with project development is unlikely to alter the existing predator-prey relationship between northern squawfish and juvenile salmonids.

Largemouth Bass: Project studies collected or observed yearling largemouth bass (90-150 mm) in the shallow regions of the inner harbor during spring. No young-of-the-year fry or adult bass were observed by any of the sampling methods conducted either year. Lack of detection of adult largemouth bass is not surprising since they are generally unavailable to electrofishing and netting techniques and may be sufficiently wary of snorklers to avoid detection. As such, it is assumed adult largemouth bass would utilize the inner harbor at least during certain times of the year.

Bass are generally found in the lake, at the lower portions of the littoral zone near slope breaks and near the lower line of vegetation (12-20 ft. deep). There is a general permanence of station within a small (80-100 mm) home range (Mesing and Wicker 1986).

During winter, largemouth are usually dormant and are generally inactive <10°C. They enter deep water in the lake and feeding is limited (Wydoski and Whitney 1979). As waters warm in the spring they move to the shoreline areas of the lake and begin feeding. Martz et al. (1996) collected low numbers of largemouth at night in the littoral zone of south Lake Washington shorelines beginning late-May and June.

Spawning migrations are initiated as water temperatures exceed 13°C and they migrate to calm, wave protected beaches and covers that warm slightly sooner than the main portion of the lake. Spawning typically occurs when water temperatures at the nest site reach 14.4 to 15.0°C (Miller and Kramer 1970) or as reported for Lake Washington when surface temperature lie between 15.5 and 18.3°C (Wydoski and Whitney 1979). These temperatures are met in the inner harbor in mid-May through June.

Nest are frequently constructed in depths > 5 feet to protect against wave action. Nests are built under large broken boulders, and rubble at the base of ledges to take advantage of protection offered by slopes, boulders, ledges, overhangs and submerged vegetation (Miller and Kramer 1970; Wydoski and Whitney 1979). The inner harbor offers suitable characteristics for largemouth bass spawning. It is assumed bass will be present mid-May through June for spawning.

Logs and dead heads provide excellent cover for bass (Stein 1970). Nyberg (1971) states largemouth bass are most successful in warm, quiet water where they locate preferentially near shelter. Such preference for cover is why piling structures are thought to offer increased ambush feeding opportunities for largemouth bass.

Juvenile salmonids use the Lake Washington lakeshore and the inner harbor during outmigration from the Sammamish River in late winter and spring when shoreline water temperatures are in their preferred temperature range. Bass prefer warmer water temperatures and occupy shoreline habitats when temperatures increase in late spring and early summer, after the majority of outmigrating salmonids have vacated the shallow water areas for cooler and deeper waters offshore (Tabor and Chan 1996). Quiescent backwater areas with piling structure are known spawning areas for bass. The use and timing of abundance of these fish in the inner harbor may be more directly related to spawning, nest protection and juvenile rearing than to adult foraging. Foraging markedly decreases during spawning and nest guarding periods (Stein 1970; Helfman 1981).

Largemouth bass are primarily benthic carnivores feeding on both fish and invertebrates. Largemouth bass are known to consume juvenile salmonids, but not in large numbers. In Lake Washington, Stein (1970) found bass, greater than 100 mm in size, consumed mostly fish. They comprised 85 percent of the total diet volume of large bass. Sculpins were the dominant species fed upon, appearing in 28 percent of the stomact analysed. Crayfish were the next most important food item, occuring in 11 percent of the stomachs. Bass fry were the second most frequently found fish occuring in 7 percent of the stomachs. Only 2 percent of the bass stomachs contained coho and one 1 percent, each had rainbow or sockeye juveniles. Thus, a total of 4 percent of the bass stomachs sampled had evidence of salmonid fishes. Stein (1970) states the value of salmonids as forage for largemouth bass in Lake Washington is thought to be quite limited.

Bass are known to be actively feeding during twilight periods and into the evening. The behavior of salmonids seeking shallow nesting spots nearshore at night where large predators cannot maneuver, may reduce the probability of enacting with bass.

Thus, salmonid predation is the inner harbor is currently minimized by:

1) Largemouth bass are not abundant in Lake Washington.

2) The timing of habitat use between bass and salmonids likely overlap for only a brief period at the end of the juvenile outmigration (mid-May to mid-June).

3) The inner harbor offers suitable characteristics and water temperatures for bass spawning beginning in mid-May annually. It is assumed bass use this area more for spawning than for foraging. Bass feeding is reduced during the spawning season.

4) Lake Washington largemouth bass are not specifically targeting juvenile salmonids.

5) Salmonid nighttime and predator avoidance behaviors may reduce interaction with bass.

Therefore, it is concluded an increase in in-water structures with project development is unlikely to alter the existing predator-prey relationship between largemouth bass and juvenile salmonids.

Resident Trout: Both yearling and adult resident rainbow (130-355 mm) and cutthroat trout (120-420 mm) were collected in small numbers during spring sampling in the inner harbor. These fish have been reported to consume large numbers of juvenile salmonids in Lake Washington. However, in-water structure has not been reported to increase their advantage as a predator. As such, it is concluded an increase in in-water structures with project development is unlikely to alter the existing predator-prey relationship between resident trout and juvenile salmonids.

Given the current abundance of potential predators in this location, salmonid fishes are likely exposed to a greater incidence of predation in the inner harbor than elsewhere in the vicinity of the proposed project. This is especially true since prey have little access to shallow shoreline areas for cover. The abundance of proposed in-water structures in the inner harbor would likely enhance spawning opportunities for bass in the inner harbor and potentially add additional ambush cover. However, given the existing habitat in the inner harbor, the anticipated increase should not change the character of the present adverse environment for salmonid fishes. While the effects of salmonid predation in the inner harbor cannot be downplayed, the available information suggests predation due to an increase in piling structures may be less of an incremental concern to salmonid fishes than anticipated.

Marina

The proposed marina would add narrow fixed piers along the south end of the harbor and floating piers around the perimeter as shown in Figure 3-12. Slips for approximately 50 recreational boats between 30 and 50 feet in length would be provided. Transit moorage for boats 75 to 100 feet in length is available at the fixed moorage pier adjacent to the lakehouse and public lookout. There would be no live-aboard residents. Similarly, no pump out, fueling or haulout facilities would be incorporated into this plan, since they exist nearby at marina facilities to the west of Kenmore Air Harbor. Issues related to salmonid fish production and migration include surface water shading and predation, and water quality.

Shading/Predation

The effects of fixed and floating piers from the marina have been included in the previous discussion in this section (Over Water and In-water Structures). All of these structures are narrow longitudinal features. The fixed piers are 10 feet wide to accommodate public and ADA access as well as to support larger craft than the floating portion of the marina. The floating finger piers are 8 feet wide. Although some shading of the surface waters would occur with these features, the shading would alternate with lighted portions of the harbor and should not extend to the bottom. Salmonids of all size classes are known to frequent and use the floating structures of marinas for feeding opportunities and for cover. Predators may also use these structures, but an increase in predation over current levels is not anticipated (White 1975). Floats have been shown to be a benefit to small fish with respect to predator avoidance (Helfman 1979). Heiser and Finn (1970) concluded that predation upon salmon fry within marinas in the marine waters of Puget Sound region was much less than formerly thought and may have been less than in comparable adjacent beach areas. It is reasonable to assume salmonid fry of similar sizes would use the cover provided by floats to avoid predators in both the marine and freshwater environments.

Marina structures have also been hypothesized to add perching surfaces for avian predators, but an extensive study to monitor avian abundance and feeding behavior at the Port of Seattle's Bell Street Marina showed no concentration of avian predators or increase in feeding behavior at the marina facility during the 1996 juvenile salmonid migration period between April - July (Hotchkiss, D., pers. comm., 20 June 1996; Taylor 1997). An increase in salmonid predation as a result of the proposed marina features is not anticipated.

Water Quality

The water quality issues of the marina related to fish include turbidity, water temperature, dissolved oxygen, fecal coliforms, petrochemical byproducts, and anti-fouling bottom paints. Anticipated changes to each water quality issue with the proposed marina are discussed below.

Turbidity

The present industrial use of the harbor and deployment of deep draft tugs creates turbid conditions in the inner harbor. Turbid water scatters light, reducing the depth of light penetration and could decrease aquatic productivity substantially compared to clear lake conditions. The proposed marina would increase boat traffic, but the recreational vessels at slow speed would have near-surface propellers that should not scour and re-suspend bottom sediments given the depth of the inner harbor. The proposed use should offer considerable improvement in the frequency of turbid water conditions in the inner harbor.

Water Temperature

Existing late-summer water temperatures are presently warm in Lake Washington in the vicinity of the inner harbor and may seasonally exceed thermal optima for coldwater species (see Fish Impact Section 3.2.5). Marina activities are not anticipated to increase water temperatures of the inner harbor. If anything, the small amount of surface shading from the marina structures should decrease temperatures. Regardless, the overall effect of this shading is likely not measurable.

Dissolved Oxygen

Seasonally low dissolved oxygen (DO) concentrations are also present in the vicinity of the inner harbor from July through September. DO levels in water are inversely related to water temperature, since warm water is unable to hold as much dissolved oxygen as cool water. The relative amounts of photosynthetic activity and organic decomposition are also factors influencing overall DO levels. Since the marina would not increase water temperatures and should not add organic materials increasing biochemical oxygen demand, it is unlikely to affect dissolved oxygen concentrations in the harbor.

Fecal Coliforms

Bacterial levels from warm blooded animals including humans are high in the Sammamish River near the mouth at Lake Washington. It is assumed the sources generally occur upstream in the Sammamish River basin. Water quality data available from Metro indicate that overall levels of fecal coliform have declined noticeably over the last ten years. There are no known fecal coliform sources entering the inner harbor. The marina would include onshore restroom facilities as well as boats with waste water holding tanks, both potential sources of fecal coliforms. Both sources should be contained and should not have waste water entering the harbor. The restrooms are sewered, and attached to Metro's Northshore system. The discharge of boat holding tanks is regulated by the US Coast Guard and Ecology and open water disposal is prohibited (US Coast Guard 1995). Holding tank pump out facilities are not incorporated into the marina plan, so spillage is not an issue. Existing pump out facilities are available at the marina immediately west of the inner harbor making disposal handy.

Marinas with live aboard residents often support higher bacterial levels in the water than marinas without onboard residents. The proposed marina operations would preclude onboard residents. As a consequence, the planned marina and associated operations should not have a measurable increase in existing fecal coliform levels in the inner harbor or in Lake Washington.

Petrochemical Byproducts

No data currently exist on the level of oil and grease, gas or related hydrocarbons in the water column of the inner harbor. Elevated levels of PAHs occur in the bottom sediments and petroleum odors were noted in deep sediment cores related to historic use of the site (SAIC 1996). Given the current industrial use and boat moorage occurring in the inner harbor it is safe to assume a high background of hydrocarbons occur in the water. The marina would increase the numbers of boats using the inner harbor and could be expected to periodically release oil or gas products to the water surface. No fuel dock is proposed with the plan, so accidental spillage of oil products would be vastly reduced compared to marinas with fuel facilities. Similarly, the size of the boats anticipated for the marina would likely by predominated by inboard gas powered or diesel powered engines. Inboard engines discharge far less oil residues to surface waters than outboard engines. The change from industrial uses to light recreational craft would likely not have a measurable change in existing hydrocarbon levels and should not alter the current conditions for salmonid fishes.

Anti-fouling bottom paints

Boats kept in the water year-round often have bottom paints laden with anti-fouling compounds to limit the growth of fouling organisms. Often these paints are comprised as soft materials that are easily eroded and toxic compounds (active ingredients) leach into the water column. Anti-fouling compounds have been a typical contaminant at marinas, especially if a boat yard occurred in conjunction with the marina. Runoff from boat yards contains concentrated levels of metals and other toxic compounds.

Use of anti-fouling bottom paints is not as intense in freshwater environments as in marine waters. Nevertheless, tributyltin, a common ingredient in bottom paints until restricted by Congress in the Organotin Antifouling Paint Control Act in 1988 (U.S. Code Title 33), was found in elevated levels in the Kenmore Navigation Channel, immediately south of the existing marinas.

The proposed Lakepointe development would not include a boat yard or haulout facility. In addition, the current strength and availability of anti-fouling compounds are substantially restricted compared to recent history. No measurable effect of leaching of anti-fouling compounds from bottom paints upon salmonid fishes in the inner harbor is anticipated.

3.2.4 Lighting

The existing level of nighttime lighting along the industrial waterfront is high at the Lonstar Cement Plant with average ground light levels of 2.5-foot candles and high spots exceeding 5.0-foot candles one night in November 1996 (Sparling and Candela 1996).

This existing illumination is hypotherized to extend feeding periods of visual sight feeders including both salmonids and salmonid predators into the evening. Extended feeding periods may result in increased consumption of salmon fry known to use the shallow nearshore areas in the evening.

Post-development lighting associated with the buildings as well as safety lighting for the marina, walkways and trails have the potential to illuminate of the surface waters somewhat in the project vicinity. There has not been a study of forecasted lighting from future buildings with project development. Given the existing high level of artificial lighting, this analysis assumes project-associated lighting would not increase illumination in the inner harbor. Existing industrial lighting would be removed when the cement plant is phased out.

Safety lighting associated with the trails is not expected to increase illumination of the river given the current level of illumination provided by on-site lights. Nighttime illumination of the river may decrease if existing lights are removed and trailside lighting is beneath and amongst trail side trees and if shading devices are used on the water side of the lamps to deflect glare from the water. Overwater lighting could be minimized by installing tinted windows in the buildings, lampshades that cover the water side of the walkway lamps and thus, shade the adjacent water, and by keeping pedestrian lighting low on the moorage docks.

3.2.5 Water Temperature

The highest annual water temperatures for the Sammamish River are typically recorded in July or August and generally range from 18.4° to 22.0°C (King County 1993). High seasonal temperatures are due primarily to the warm surface water of Lake Sammamish flowing into the river and also to the scarcity of riparian trees and shrubs along the banks of the river to provide shade. These high temperatures exceed the thermal optima for most coldwater salmonid species and may impede migration of adult sockeye and chinook salmon in the late summer and early fall. They may also reduce the feeding and growth potential of rearing juvenile salmonids. These temperature recordings do not exceed lethal temperatures reported in the literature to occur around 24°C for the most sensitive salmonid species (USEPA 1986; Bell 1990).

Surface water temperatures in the backwater area of the inner harbor are anticipated to be similar to or slightly warmer (~ 1°C) than temperatures in the river. Measurements taken during fishery studies recorded temperatures up to 21°C in June 1996. Deep waters in the inner harbor averaged approximately 1.4°C cooler during Spring 1997, and may offer some thermal relief. But since coldwater salmonids show a general avoidance of 19°C and higher, it is assumed the backwater area of the inner harbor is not conducive to juvenile salmonids during the summer months.

Project development is not anticipated to increase water temperatures in the inner harbor. Removal of a few Douglas fir, black locust and black cottonwoods may be required during trail construction and during construction of the lighthouse pier and amphitheater along the lakefront. Such removal is not expected to affect water temperatures in these areas since the trees presently provide little, if any, thermal protection for the river. Given the aspect of the sun to these shorelines, the wide surface area of the river and the extensive flat shallow area adjacent to the lakeshore, measurable water temperature changes in these areas are not anticipated.

3.2.6 Boat Traffic

Boat traffic in the Kenmore Navigation Channel would change from industrial use (barge and tug) to light recreational (private craft 30 to 50 ft. in length) with the proposed development of a moorage facility in the inner harbor. The number of craft would increase, but use would change from deep draft to shallow draft boats. Anticipated harbor speeds would likely be between 2 and 5 knots and traffic would be concentrated in the middle of the harbor. No data are available indicating vessel traffic has an adverse effect upon fish species. There are no anticipated impacts to fish from boat traffic in the inner harbor.

A WDFW public boat launch is located on the south bank of the Sammamish River immediately downstream of the 68th Ave. NE bridge. The boat launch is frequently used by sport anglers and by recreational boaters and jet ski enthusiasts bound for Lake Washington. As a result, boat traffic in the lower reaches of the Sammamish River can be heavy during periods of suitable weather. There is no anticipated change to salmonid behavior in the river from current conditions related to increased boat traffic from the proposed marina.

3.2.7 Shoreline Recreational Use

Promenade

Use of the fixed pier promenades in the inner harbor would increase the level of human disturbance over the waterway. The primary disturbance would be noise and vibration as discussed in Fish Impact Section 3.2.8, below.

Public Access Trail/Firelane

The public access trail/firelane along the north shore of the Sammamish River and the Lake Washington shoreline is more than 100 feet and 45 feet, respectively inshore of the OHWM. Salmonid use of the nearshore areas occurs primarily during the night, when these species move inshore for resting purposes. Little, if any, human disturbance to salmonid use of the Sammamish

River is anticipated since the peak period of disturbance would not overlap with nearshore salmonid use.

Fishing Pressure

There is no commercial or active tribal fishery in the Sammamish River. Although the Muckleshoot Tribe has an historic treaty fishery at the mouth of the Sammamish River, they have voluntarily ended the harvest until resource levels increase in the future. As such, there is no commercial or active tribal fishery in the Sammamish River area. Public access to any future fishery would be subject to fisheries resource agency and tribal evaluation. Boat traffic from the marina would be concentrated in the defined navigational channel and should not affect any future tribal net fishery.

Sport fishing remains a popular activity on the Sammamish River. The Kenmore area near the mouth of the Sammamish River was noted in a WDW gamefish guide as a good area in Lake Washington to catch largemouth bass and cutthroat trout. The Lakepointe development would not affect public access to Lake Washington from the WDFW boat launch and would not restrict fishing opportunities in the Kenmore area.

Shoreline recreational use would increase with the anticipated development. Increased public access would likely add to fishing pressure. Increased fishing access along the north shore of the Sammamish River is not regarded as an adverse effect upon salmonid populations. If spawning recruitment levels are not met, the fisheries resource agencies and Tribes would evaluate sport fishing closures on a species by species basis.

3.2.8 Noise

Fish detect and respond to sounds in their environment. Salmonids hear with a primitive version of an inner-ear and with the lateral line systems that runs the length of each side of the fish. The lateral-line is extremely sensitive to close-range pressure changes. Nevertheless, salmonids have relatively poor hearing on the basis of perceivable frequency range and sensitivity to sound pressure. The hearing ability of salmonids is limited in bandwidth and intensity thresholds compared to other fish.

Atlantic salmon juveniles cannot hear sound frequencies > 380 Hz (Hawkins & Johnston 1978), whereas most other fish species can hear frequencies up to 1,000 Hz and some to 7,000 Hz. Salmonids are capable of hearing infrasound levels down to 1 Hz and actively avoid less than 10 Hz frequencies (Enger et al. 1993).

The classic fright response of salmonids to sound is not dramatic. Salmonids typically elicit a "startle" or "start" behavior involving a sudden burst of swimming that is short in duration and distance traveled (<2 ft) (Feist 1991). Without a conditioned response to the stimuli, they would rapidly habituate to the sound. Fish have shown a more pronounced reaction to pulses, similar to pile driving, rather than continuous pure sounds.

An increase in the level of noise and shallow water vibration will occur with human activity associated with the overhanging promenades and the moorage facility in the inner harbor and during project construction, especially related to diving pilings that support the development. Marina activities occur primarily during daytime hours and salmonid use of marinas has not been shown to be curtailed. No effect of noise from marina operations on salmonid use of the inner harbor is projected.

Use of the promenades will likely occur during both daytime and nighttime hours. Outdoor activities could include alfresco dining, bars and live outdoor music. Fish have highly developed sensory capabilities and are sensitive to vibrations in the water. They readily react to sharp vibrations or movement, which may increase their exposure to predation. There is no literature available regarding the response of resting salmonids to such nighttime noise disturbances. Thus, any anticipated effect is unquantifiable. Given the low use and value of the current habitat in the inner harbor for salmonids, and the likely avoidance of this warm backwater area during warmest months of the year (July - September), this unquantifiable impact is deemed not to be a significant project impact.

Pile driving has been hypothesized to adversely affect juvenile salmonids by startling them toward deeper water. Such departure from the protective confines of the nearshore area could place them at a disadvantage by prohibiting optimal foraging opportunities and by exposing them to increased predation. Habituation to the sound could mask sounds of approaching predators, reducing survivability.

The impact of pile driving on the distribution and behavior of juvenile salmonids was studied during construction of the US Navy Home Port in Port Gardener, Everett (Feist 1991). Salmonids have trouble detecting sound pressure levels < 100 dBs at frequencies between 20-40 Hz (Hawkins & Johnston 1978) and sound shocks need to be 20-30 dBs higher than ambient to induce a behavioral response (Feist 1991). Sound levels from pile driving hollow and solid concrete piles at the Home Port site were in excess of 20 dBs above ambient and within the range of salmonid hearing. The author concluded it was conceivable the sound field generated by pile driving in marine water could be detected by salmonids within 300 m (1000 ft) radius from the source. The sounds may be audible, but the relevance of the pulsed signal to fish could not be determined. According to Fiest (1991), the effects of pile driving appear to be subtle and include changes in general behavior noted by short-burst responses laterally along the shoreline, reduction in sizes of schools and reduced presence in the near-field construction zone. However, the prevalence of fish schools near the site did not change significantly with and without pile driving. Schools of juvenile salmonids were observed during operations about the pile driving rigs themselves. There were no significant differences observed in fish distance from shore or changes in water depth as a function of pile driving. Without an observed startle response to deeper water, the anticipated increase in predation is judged to be unlikely.

3.2.9 Exotic Plants

Milfoil (*M. spicatum*) currently grows along the Lake Washington shoreline. This shallow stretch of shoreline is predominately a leeward beach on Lake Washington. It receives an accumulation of debris during southerly winds that serves as a constant source for milfoil recruitment. Although considered a noxious weed, the milfoil in this location is used by yellow perch as spawning substrate as noted during our surveys and could also offer limited amount of cover for salmonid fishes rearing in this area. No organized efforts are underway to remove the milfoil.

Improving water clarity and opening new shallow water beach areas along the north edge of the inner harbor may offer a limited amount of habitat for milfoil to colonize. The amount of shallow water habitat in the inner harbor is quite restricted, such minor habitat modification is not considered a significant project effect.

3.3 FISH HABITAT MITIGATION MEASURES

Fish mitigation for the Lakepointe Development would incorporate adverse impact avoidance, minimization and mitigation as well as habitat enhancement as described below. Significant impacts would be avoided where possible and efforts would be made to minimize impacts that cannot be avoided. A summary of impacts deemed significant is provided in this section. On-site mitigation for significant unavoidable adverse impacts are recommended through mitigative and enhancement measures within the inner harbor.

3.3.1 Significant Impacts and Associated Mitigation

<u>Structures</u>

Over-water structures

Fixed piers and public lookouts built over the OHWM would increase shading and could potentially reduce aquatic productivity in the littoral zone. The increase in shaded area compared to existing conditions could decrease salmonid production to some unquantifiable extent over 12,594 square feet (0.3 acre) of the shallow water littoral zone, primarily along the southern side of the inner harbor.

<u>Proposed Mitigation</u> The following are recommended for inclusion as proposed mitigation:

1) Provide large openings in the decking above to allow light to penetrate to the littoral zone. Such mitigative action has been successful at other marinas to improve fish passage and utilization of habitat below pier structures. This effort would increase aquatic productivity and would provide sufficient light for salmonids to enter and use this area.

2) Remove the bulkhead along the eastern shoreline where it is not functionally required for the proposed project and return the beach area to a gradual slope. This effort would create approximately 3,000 square feet (a 13% increase) of additional littoral area that does not currently exist at this location. Openings to the deckwork above

should be included to enhance light penetration to the new littoral area below.

In-water Structures

The number of pilings in the inner harbor would increase approximately 29 percent with the proposed action. Although no supporting data are available, in-water structure has been hypothesized to increase the abundance of predator fish habitat and potentially increase incidents of predation on juvenile salmonid fishes. The following four approaches are prevalent in the scientific literature to reduce potential predation on salmonid fishes:

1) Offer shallow water refuge habitat.

2) Offer greater habitat complexity nearshore in shallow water to increase visual cover and add interstitial spaces by means of rock surfacing or boulder clusters, or by the addition of emergent/submergent vegetation.

3) Offer floating surfaces.

4) Promote the production of three-spine sticklebacks. Salmonid aggregation with similar sized (60-80 mm) sticklebacks reduces the risk of predation.

<u>Shallow Water Refugia</u>

The presence of shallow water and cover significantly decreases predation rates on juvenile fishes. Vulnerable fish with no place to hide must make a trade off between feeding and avoiding predators (Eggers 1980). In open water, fish have no place to hide. Tabor and Chan (1996) conclude the highest predation risk for sockeye from predatory fish occurs in deep water. Selection of inshore shallow water for cover is believed to be primarily a response to greater predation risk in deep water (Tabor and Wurtsbaugh 1991).

<u>Habitat Complexity</u>

Fish species and sizes most vulnerable to predation tend to associate more closely with structure (Crossman 1959; Charnov et al. 1976; Stein 1979; Van Dolah 1978; Crowder and

Cooper 1979). Daily predator capture rates decrease with increasing habitat complexity since interstitial spaces with large particle substrates provide effective refugia for fish (Crowder and Cooper 1979). The authors also noted reduced largemouth bass capture rates with increased quantities of aquatic plants.

To avoid predation, fish often move to structurally complex habitats where predators cannot forage effectively (Glass 1971; Savino and Stein 1982; Tabor and Wurtsbaugh 1991; Beauchamp et al. 1994). Increased structural complexity reduces both attack rate and capture rate of largemouth bass (Glass 1971). In most of these studies, fish larger than 100 mm were not as vulnerable to predatory fishes and foraged at would, whereas small fish (<100 mm) were more vulnerable and remained in or near shallow nearshore water with complex habitat structure (Beauchamp et al. 1994).

Floating Structures

Prey fish species are particularly attracted to floating structures to obtain predator protection (Helfman 1979). His research showed that shade provided by floats was the attractive factor to avoid predators. For a more detailed discussion of the refuge benefits of floating structures to small prey see Section 3.2.3.

Three-spine Sticklebacks

Ruggerone (1992) observed a considerable reduction (45%) in predation rates on juvenile sockeye in the presence of three-spine sticklebacks. Sockeye and sticklebacks are frequently sympatric in Pacific Northwest lakes. Many predatory fish appear to avoid three-spine sticklebacks primarily due to their dorsal spines. Sockeye aggregated with sticklebacks of the same size are offered similar protection.

Proposed Mitigation The following are recommended for inclusion as proposed mitigation:

1) Increase the amount of shallow water habitat available for refuge from predators. Mitigation item #2) above for over-water structures increases shallow water habitat by approximately 3,000 square feet (+13%).

2) Add large rock (> 1 ft), boulder/cobble, mounds (2-3 ft high) adjacent to the piers and in the shallow water habitat to increase habitat complexity and to increase interstitial spaces for salmonid hiding/refuge habitat.

3) Surface shallow water beach slopes with appropriate substrate to increase refuge habitat for salmonids.

4) Encourage dock-side fishing and support bass (or other warmwater fish) fishing tournaments focused on the inner harbor to reduce the potential predator base.

Marina

Marina issues related to floating and fixed structures have been incorporated in mitigation options above for over-water and in-water structures. Water quality and fish passage mitigation options are discussed below:

Proposed Mitigation The following are recommended for inclusion as propoed mitigation:

1) Preclude live-aboard residents.

2) Do not provide boat haul-out areas, boat yards and the like.

3) Do not provide fueling facilities.

4) Post, promote and educate boat owners about regulations concerning illegal discharges of waste holding tanks.

5) Prohibit underwater cleaning of the craft in the inner harbor.

6) Ensure any consideration of a breakwater or wave board arrangement includes shoreline openings for unimpeded fish passage.

Lighting

Increased illumination could extend feeding periods of both salmonids and salmonid predators into the evening. This extended feeding period could result in increased consumption of salmon juveniles known to use the nearshore areas along the Sammamish River and in the inner harbor in the evening. Options to minimize this effect include:

Proposed Mitigation The following are recommended for inclusion as proposed mitigation:

1) Remove existing lighting along the northshore of the Sammamish River and along the inner harbor as industrial uses of the site are phased out.

2) Design safety lighting along trails and the marina piers low to the ground.

3) Install lampshades that cover the water side of the lamps to deflect glare from the water.

It is recommended future lighting from all buildings and project features not exceed existing levels along the waterfront and shoreline areas surrounding the Lakepointe property.

Noise

The scientific literature concerning pile driving effects on juvenile salmonids is limited to a study in estuarine waters of Puget Sound (Navy Homeport). This study concludes salmonid fishes can hear and may briefly react to the noise and vibration of pile driving. However, no potential significant adverse impacts of the operation were noted. Juvenile salmonids were not driven into deeper water and an increase in predation was not anticipated. As such, noise from pile driving was not considered a significant adverse impact at the Navy Homeport Project in Everett.

This study was limited in its application to estuarine waters with only chum and pink salmon. It is prudent to assume juvenile salmonids would exhibit short-term disturbance behaviors during pile driving operations, but pile-driving is unlikely to have an adverse effect on the populations. An HPA would be required for all in-water construction and would likely preclude pile-driving during the juvenile outmigration period. Such impact avoidance is sufficient and further mitigation is not recommended.

3.3.2 Summary of Mitigation

Fish mitigation items are summarized below with respect to project avoidance, minimization, mitigation and enhancement. A tally of anticipated habitat changes following project development and incorporation of improvements is summarized in Table 3-8.

Table 3-8. Summary of Anticipated Fish Habitat Features with the Lakepointe Development.

	Net Change Following Project Improvements			
Features	**Inner Harbor**	**Lakeshore**	**Sammamish River**	**Total**
Habitat Creation				
Shallow water (ft²)	+3,000	0	0	+3,000
Deep water (ft²)	0	0	0	0
Structures Overhanging OHWM				
Fixed	+24,846	0	0	+24,846
Floating	-6,263	0	0	-6,263
Total shaded area	+18,583	0	0	+18,583
In-water structures				
Bulkheads (ft)	-115	0	0	-115
Pilings (counts)	+102	-18	-18	+84

Avoidance

- Project structures within or overhanging the OHWM along the Sammamish River and the Lake Washington shoreline, the two most sensitive fish habitat areas along the property, would be avoided.

- Boat haul-out areas, boat yards and the like associated with marina development would be avoided.

- Fueling facilities at the marina would be avoided.
- Live-aboard marina residents would be precluded.
- Any consideration of a breakwater or wave board arrangement would include shoreline openings for unimpeded fish passage.
- In-water construction within the OHWM would be precluded during the juvenile salmonid outmigration period in accordance with future HPA conditions.
- Post-project light levels will avoid increasing ambient light above current conditions along the project shorelines.

Minimization

- The overwater coverage of available shallow water habitat by floats within the inner harbor would be minimized.
- A net increase in structure and overhang in available shallow water habitat (0 - 10ft.) within the inner harbor would be minimized approximately 40 percent from prior proposals.
- The level of incident light reaching the shoreline and inner harbor areas, would be minimized through directional lighting and shading. Safety lighting along trails and the marina piers would be designed low to the ground and lampshades that cover the water side of the lamps to deflect glare from the water would be installed. Existing lighting along the northshore of the Sammamish River and along the inner harbor would be removed as industrial uses of the site are phased out.
- Illegal discharges of waste holding tanks from watercraft would be minimized by posting, promoting and educating boat owners about the appropriate regulations.

- The effects of leaching anti-fouling paints would be minimized by prohibition of underwater cleaning of watercraft in the inner harbor through moorage leasehold covenants.

Mitigation

- The adverse effects of increased shading of shallow water habitat would be mitigated with large openings, grating, clearstory and/or glass structures in overwater decking. Where surface openings are not practical, under-wharf lighting would be used (Table 3-9).

- The adverse effects of potentially increasing salmonid predator habitat would be mitigated by 1) increasing the amount of shallow water habitat available for refuge, 2) increasing habitat complexity by adding large rock, boulder/cobble, substrate adjacent to the pilings to increase spaces for salmonid hiding/refuge habitat; 3) surfacing shallow beach areas with appropriate substrate to increase refuge habitat for salmonids (Table 3-9); and 4) encouraging dock-side fishing and supporting bass (or other warmwater fish) fishing tournaments focused on the inner harbor to reduce the potential predator base.

Enhancement

- The amount of shallow water habitat in the inner harbor would be increased by (+3,000 sq.ft.) by removing 115 ft. of bulkhead along the eastern portion and returning the beach area to a gradual slope. The deck work in this area would be opened to allow light penetration below or artificial lighting would be installed beneath the overhang to make this habitat productive for salmonids. This effort would create additional shallow water (<10ft.) littoral area that does not currently exist (Table 3-9).

- The debris and unusable in-water structures including pilings and decaying bulkhead stumps in the river, lakefront and inner harbor areas would be removed (Table 3-9).

- Uncontrolled and untreated stormwater runoff entering the inner harbor with occasional high levels of fine sediment would be eliminated and adjacent industrial land uses including the need for harbor tugs and barges would be phased out. Such action would enhance the aquatic productivity potential in the harbor by decreasing turbid water conditions.

Table 3-9. Lakepointe Mixed Use Development Summary.

Inner Harbor Shoreline Conditions South Shore Phase 1 (east end), 2 (central), 3 (west end)	Existing Conditions	Proposed Project Features and Habitat Improvements	Net Change Improvement/Mitigation
Fish Habitat Availability Shallow Water (0-10') (sq. ft.)	23,436 sq. ft. of dredged shoreline cut at 4:1 slope and surfaced with non-native materials.	26,436 sq. ft of shallow habitat including improved substrate materials and creation of new habitat.	+3,000 sq. ft. of new available shallow-water habitat with substrate improvements.
Surface Coverage - Overhang	1,906 sq. ft. of overhang including wooden ramps, old log cabled bench and steel girders, with limited light penetration	14,500 sq. ft. of overhanging deck work and fixed piers including through deck openings to pass ambient light.	+12,594 sq. ft. now lighted rather than shaded.
- Floating	5,067 sq. ft. of floating structures including wooden docks with limited light penetration.	646 sq. ft. of marina floats and moored boats.	-4,421 sq. ft. adding more light to shallow waters.
In-water Structure - Bulkheads (ft)	86 ft. of creosote piling bulkhead limiting beach access.	86 ft. of unchanged creosote pilings.	0 sq. ft. No change.
- Pilings (count)	3 unused emergent pilings.	177 wooden, metal or concrete support pilings with substrate improvements to create refuge habitat.	+174 support pilings with refuge habitat created.
Deep Water (>10') (sq. ft.)	77,590 sq. ft. of deep water, a majority has been dredged; bottom substrate consists of soft silty sediment.	77,590 sq. ft. of unchanged deep water area.	0 sq. ft. No change.
Surface Coverage - Overhang	770 sq. ft. of concrete decking overhang with no light penetration.	12,800sq ft of overhanging deck work and fixed piers including through deck openings to pass ambient light.	+12,030 sq. ft. now lighted rather than shaded.
- Floating	21,928 sq. ft. of floating structures including large fishing boats and commercial craft with limited light penetration.	12,766 sq. ft. of marina floats and moored boats.	-9,162 sq. ft. adding more light to deep waters.
In-water Structure - Bulkheads (ft)	486 lineal ft. of creosote piling bulkhead.	428 lineal ft. (includes reduction in number of creosote pilings).	-58 ft. removal of creosote bulkhead.
- Pilings (count)	23 unused emergent pilings and dolphins.	202 wooden, metal or concrete support pilings with substrate improvements to create refuge habitat.	+179 support pilings with refuge habitat created.

Table 3.9. Continued.

Inner Harbor Shoreline Conditions South Shore Phase 1 (east end), 2 (central), 3 (west end)	Existing Conditions	Proposed Project Features and Habitat Improvements	Net Change Improvement/Mitigation
Fish Habitat Availability Shallow Water (0-10') (sq. ft.)	1,500 sq. ft. of shallow water behind burned out bulkhead and trestle supports.	1,500 sq. ft. of unchanged shallow water.	No change.
Surface Coverage - Overhang	2,270 sq. ft. of decking overhang with limited light penetrations.	2,270 sq. ft. of unchanged overhang deck work.	No change.
- Floating	0 sq. ft. of floating structures in shallow water.	0 sq. ft. of unchanged floating structures.	No change.
In-water Structure - Bulkheads (ft)	103 ft. of concrete and creosote bulkheads limiting beach access.	103 ft. of unchanged concrete and creosote bulkheads.	No change.
- Pilings (count)	144 emergent and submergent un-used pilings.	15 wooden, metal or concrete support pilings with substrate improvements to create refuge habitat.	-129 pilings.
Deep Water (>10') (sq. ft.)	77,590 sq. ft. of deep water, a majority has been dredged; bottom substrate consists of soft silty sediment.	77,590 sq. ft. of unchanged deep water area.	No change.
Surface Coverage - Overhang	2,696 sq. ft. of decking overhang with limited light penetration.	2,918 sq. ft. of overhanging deck work and ramps including through deck openings to pass ambient light.	+222 sq. ft. now lighted rather than shaded.
- Floating	6,600 sq. ft. of floating structures including barge moorage with limited light penetration.	13,920 sq. ft. of marina floats and moored boats.	+7,320 sq. ft. of floating structures offering refuge habitat to small fish from predators (avian and fish).
In-water Structure - Bulkheads (ft)	365 lineal ft. of concrete and creosote bulkheads limiting beach access.	308 lineal ft. (including reduction in number of creosote pilings).	-57 ft. removal of creosote bulkhead.
- Pilings (count)	177 emergent and submergent un-used pilings.	55 wooden, metal or concrete support pilings with substrate improvements to create refuge habitat.	-122 pilings.

Table 3-9. Continued.

Lake Washington Shoreline Conditions **Phase <u>3</u>**	**Existing Conditions**	**Proposed Project Features and Habitat Improvements**	**Net Change Improvement/Mitigation**
Fish Habitat Availability			
Shallow Water (0-10')	382,500 sq. ft.	382,500 sq. ft.	0
Deep Water (> 10')	0 sq. ft.	0 sq. ft.	0

Sammamish River Shoreline Conditions **Phase <u>1 (east end), 3 (west end), 4 (central)</u>**	**Existing Conditions**	**Proposed Project Features and Habitat Improvements**	**Net Change Improvement/Mitigation**
Fish Habitat Availability			
Shallow Water (0-10')	40,500 sq. ft.	40, 500 sq. ft.	0
- Piling Count	18 unused emergent wooden pilings.	0	-18 wooden pilings removed.
Deep Water (> 10')	84,375 sq. ft.	84,375 sq. ft.	0

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4.0 PLANTS AND ANIMALS

The subject site has been extensively filled in the past and has a history of use for a variety of industrial purposes. As a result of the placement of fill material, including construction debris, and chronic disturbance, very little of the site supports vegetation.

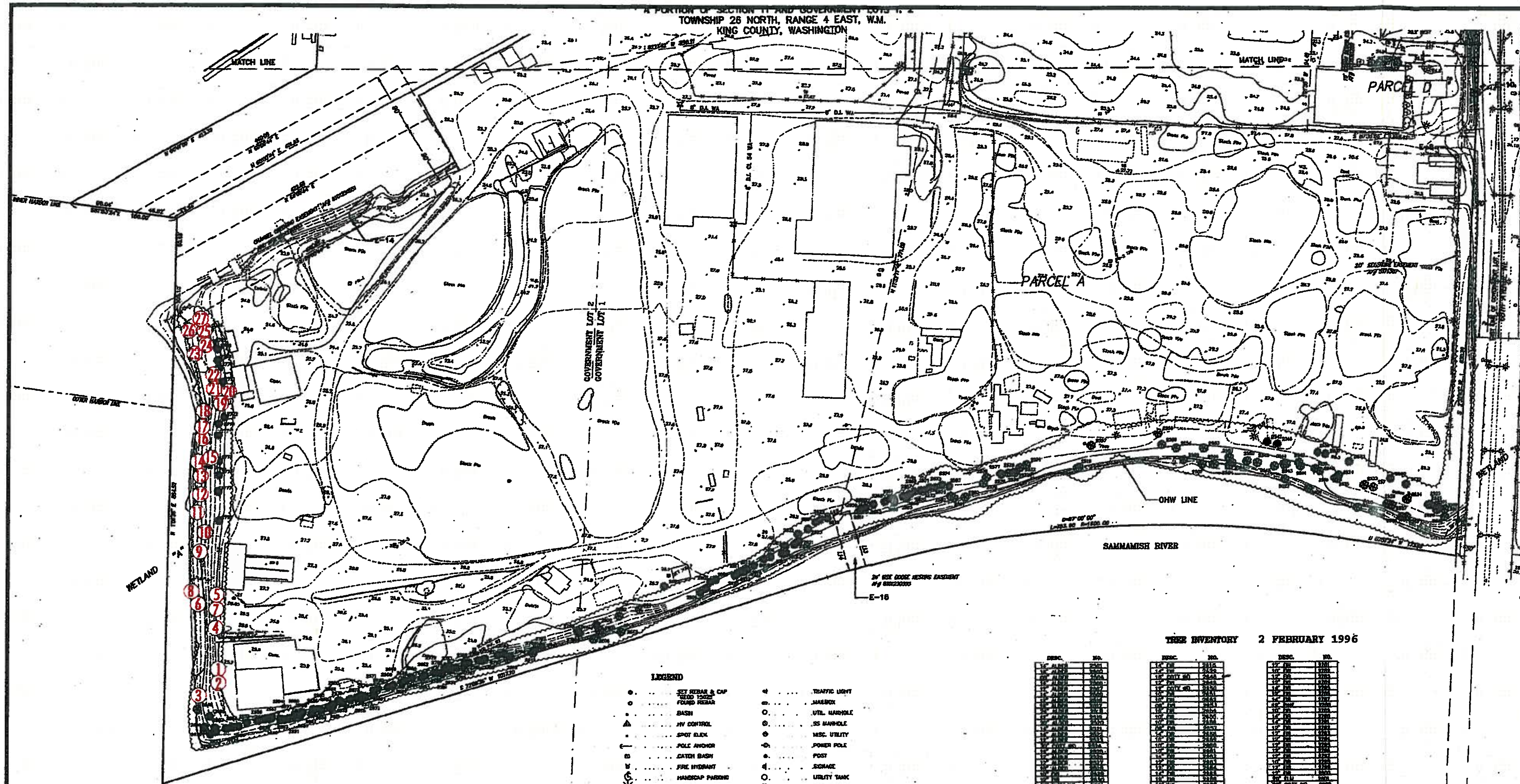
The Lakepointe project site lies within the Sammamish River Corridor Habitat area, which requires applicants to identify Great Blue Heron nesting, roosting or feeding areas that may be on the project site identified in the Northshore Community Plan Natural Resource Protection Area P-suffix condition. All significant trees as defined in the Northshore Plan P-4 suffix condition were flagged and surveyed. Regulated trees per King County Chapter 21A-24 were also identified along the Lake Washington shoreline (Figure 4-1). A wetland delineation was performed on the project site in March 1995 (see Appendix).

4.1 AFFECTED ENVIRONMENT

4.1.1 Shoreline and Wetlands Habitat

With minor exceptions, the only plant communities on the Lakepointe site lie along the shorelines of the Sammamish River and Lake Washington. Typical plant communities lying along the Sammamish River shoreline include upland forest and shrub communities dominated primarily by black cottonwood (*Populus trichocarpa*), red alder (*Alnus rubra*), Douglas-fir (*Pseudotsuga menziesii*) and Himalayan blackberry (*Rubus discolor*). A similar upland plant community occurs along much of the Lake Washington shoreline within the buffer of a long, narrow wetland, identified as Wetland A, located at the northwest corner of the site (Figure 4-2).

Wetland A lies between fill material to the east and Lake Washington to the west (Figure 4-2). It supports both palustrine forested and palustrine scrub-shrub habitat. Wetland A supports a native plant community comprised of red alder, black cottonwood, black locust (*Robinia pseudoacacia*), Pacific willow (*Salix lasiandra*), Sitka willow (*Salix sitchensis*), Douglas' spiraea (*Spiraea douglassii*), cattail (*Typha latifolia*) and soft rush (*Juncus effusus*), as well as invasive, non-native plants such as Himalayan blackberry, reed canarygrass (*Phalaris arundinaceae*), purple loosestrife (*Lythrum salicaria),* bittersweet nightshade (*Solanum dulcamara*) and yellow iris (*Iris pseudacorus)*.



LEGEND

NOTES

REFERENCES

TREE INVENTORY 2 FEBRUARY 1996

SURVEY LOCATIONS

REGULATED TREES ① **22 NOVEMBER 1996**

Tree	dbh	Species	Tree	dbh	Species
1	multi stem	Black locust	15	7"	Bigleaf maple
2	9"	Black locust	16	multi stem	Willow
3	multi stem	Pacific willow	17	11"	Red alder
4	15"	Black cottonwood	18	12"	Red alder
5	multi stem	Black locust	19	7"	Lodgepole pine
6	9"	Red alder	20	9"	Lodgepole pine
7	6"	Bitter cherry	21	multi stem	Black hawthorn
8	multi stem	Black locust	22	8"	Oregon crabapple
9	multi stem	Red alder	23	7"	Red alder
10	multi stem	Red alder	24	11"	Red alder
11	6"	Red alder	25	7"	Red alder
12	multi stem	Red alder	26	multi stem	Red alder
13	12"	Red alder	27	7"	Lodgepole pine
14	multi stem	Willow			

① *APPROXIMATE LOCATION*

N

LAKEPOINTE
PIONEER TOWING

FIGURE 4-1
EXISTING CONDITIONS AND TREE INVENTORY
SOURCE REFERENCE: CALLISON ARCHITECTURE, INC.

PROJECT NO.: 22140 | 5 DECEMBER 1996
2146-41.CDR/VGP | CHECKED: JBF

beak

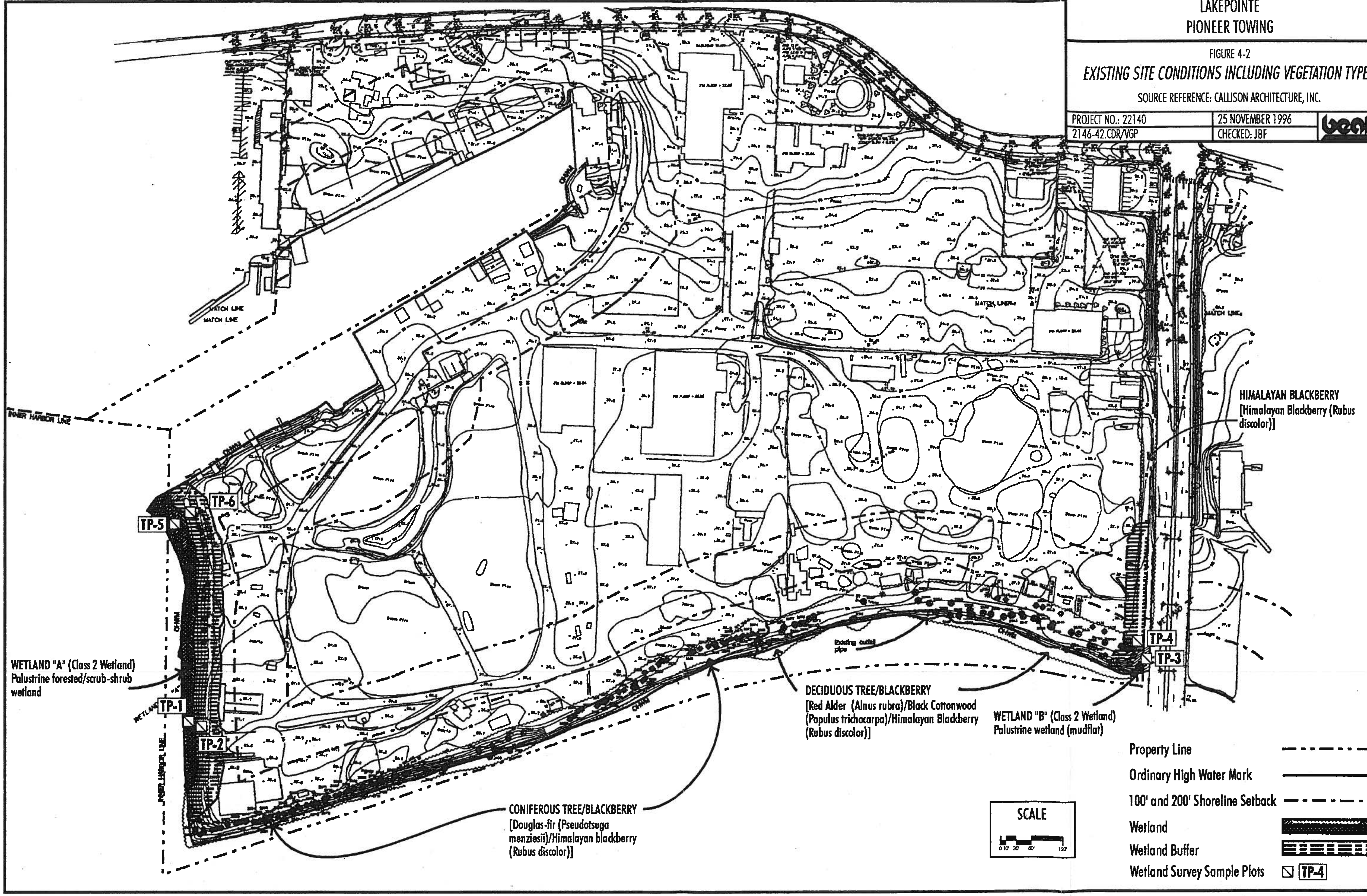
LAKEPOINTE
PIONEER TOWING

FIGURE 4-2

EXISTING SITE CONDITIONS INCLUDING VEGETATION TYPES

SOURCE REFERENCE: CALLISON ARCHITECTURE, INC.

PROJECT NO.: 22140	25 NOVEMBER 1996
2146-42.CDR/VGP	CHECKED: JBF



A second wetland, identified as Wetland B, is located at the southeast corner of the Lakepointe site near the 68th Avenue NE bridge (Figure 4-2). The entire wetland is approximately 1.5 acres of which 0.006 areas are located on the site. The off-site portion of this wetland is predominantly reed canarygrass, but also supports some willow, cattail, Himalayan blackberry, bittersweet nightshade, and yellow iris. The on-site portion of Wetland B, which is shaded by the Kenmore bridge, is a periodically inundated mudflat that supports minimal vegetation.

Under King County's Sensitive Areas Ordinance, both Wetlands A and B would be classified as Class 2, requiring a 50-foot buffer and a 15-foot building setback. Approximately one-third to one-half of Wetland A buffer is vegetated with an overstory of Douglas-fir and understory of Himalayan blackberry. The remainder of the buffer is non-vegetated with some portions occupied by industrial activity. Wetland B buffer is comprised of Himalayan blackberry and red alder.

4.1.2 Shoreline and Wetlands Function and Value

Due to the narrow linear nature of the upland plant communities along the shorelines of the Sammamish River and Lake Washington, existing wildlife habitat value is low. However, the dense blackberry cover does provide seasonal foraging and year round cover for a wide variety of passerine birds and small mammals. The trees along the shoreline provide perch sites and limited shade. Wildlife observed in the Lakepointe project vicinity during fisheries and wetland surveys conducted on the site are listed in Table 4.1-1.

Wetlands A and B are small areas with little habitat diversity and limited biological support. However, due to its direct interconnection with Lake Washington, Wetland A offers breeding habitat for waterfowl and passerine birds, foraging habitat for shorebirds, and breeding and foraging habitat for amphibians. Wetlands A and B provide some shoreline protection; very limited water quality improvement due to the small amount of runoff flowing into these areas; no groundwater support due to their small size and narrow configuration; no cultural or socioeconomic functions; and little to no flood/storm water control. The hydrology of these wetlands is controlled by the river and lake levels, and neither provide any base flow support.

Table 4-1. Wildlife observations in the Lakepointe Project vicinity made during surveys conducted on the Lakepointe Project site.

Species observed	Date(s)
American coot	3/01/95
Mallard & mallard/domestic cross breeds	3/01/95, 4/29/96
Common merganser	3/01/95, 1/03/96
Greater scaup	3/01/95
Gadwall	3/01/95
Western grebe	3/01/95, 1/03/96, 4/12/96, 4/24/96, 4/29/96, 5/06/96, 4/16/97, 4/25/97
Canada goose	3/01/95, 3/29/96, all 4/97 and 5/97 fish survey dates
Snipe	3/01/95
Great blue heron	3/01/96, 5/26/96, 9/06/96
Cormorant	3/01/95, 3/29/96, 5/06/96
Belted king fisher	3/01/95
Bald eagle	1/03/96
Western gull	3/01/95
Rock dove	3/01/95
Bewicks wren	3/01/95
American crow	9/06/96
Black-capped chickadee	3/01/95
Song sparrow	3/01/95
Bush tits	3/01/95
Swallows' nest (under bridge)	3/01/95
Beaver (inner harbor)	4/12/96
Muskrat (inner harbor)	5/12/97

A great blue heron rookery occurs approximately one mile northeast of the Lakepointe project area (14 November 1996 WDFW PHS database review). A second great blue colony has been documented approximately three miles northeast of the Lakepointe project area, and a third six miles north of the project site. No roosting or nesting of the herons has been reported along the Lakepointe shoreline. Great blue herons have been noted feeding in the project vicinity in the shallow water habitat along the Lake Washington shoreline and in the inner harbor.

The most common waterfowl species observed feeding in the barge channel and the Lake Washington shoreline is the western grebe. Canadian geese nest on the project site along the Sammamish River shoreline and the southern end of the Lake Washington shoreline in the area of Wetland A. A 24-foot wide goose nesting easement demarcated by a chain link fence lies along the Sammamish River shoreline (Figure 4-1). No geese were observed using this area during the fisheries and wetland surveys. A cormorant was observed perching in a black cottonwood tree along the Sammamish River shoreline immediately upstream of the goose easement on March 29, 1996.

No threatened or endangered plant or animal species are known or expected to occur on the Lakepointe project site due to the disturbed nature of the existing habitat (14 November 1996 WDFW PHS database review and 17 March 1995 DNR Natural Heritage database review). However, bald eagles have been reported flying over the project site by an employee working at one of the inner harbor businesses, and two bald eagles were observed perched along the Lake Washington shoreline south of the Sammamish River confluence during the January 3, 1996 fisheries surveys. Several bald eagle nests are reported south (1.5 miles and 3 miles) of the project site (22 October 1996 WDFW PHS database review). Another bald eagle nest is located 5.5 miles northwest of the project site, approximately 0.5 mile from Puget Sound (14 November 1996 WDFW PHS database review).

4.2 SIGNIFICANT IMPACTS

Buffer areas around the wetlands and the Sammamish River shoreline do not currently satisfy the minimum width required by the King County Sensitive Areas Ordinance (SAO). Consequently, to improve habitat conditions along the Lake Washington and Sammamish River shoreline and to comply with the SAO buffer width requirement, a vegetated buffer ranging from 100 feet to 130 feet wide would be established along the entire length of the Sammamish River that borders the

Lakepointe site and within the adjusted wetland buffer along Lake Washington (Figure 4-3). In addition to converting 3.3 acres of non-vegetated areas to native plant communities, the existing plant communities, including the wetland and wetland buffer areas, would be enhanced along the Sammamish River and the Lake Washington shorelines to suppress non-native, invasive species (e.g., Himalayan blackberry), and support native species with greater habitat value (Figure 4-3). Additional habitat features such as woody debris would also be placed within these areas. These actions would significantly increase the amount of available wildlife habitat on the project site and increase value of existing habitat (Table 4-2).

Blackberry control would be achieved through a combination of manual, mechanical and chemical controls. Blackberry removal would be conducted through mechanical and manual efforts. Spot application of an approved herbicide would be used along with manual efforts to control blackberry growth after the initial removal efforts. Without continued control, the blackberries would likely re-establish at a density greater than currently exists. Complete removal of the blackberry roots through mechanical means would result in root damage of the existing trees and disturbance of soil directly adjacent to the Sammamish River. Although the restoration of the shoreline vegetation would be phased (Phases 1, 3, and 4), mechanical disturbance of the entire area of each phase could result in undesirable water quality impacts and thus would be avoided in favor of control of regrowth via manual and chemical means. Only herbicides registered for streamside use in the State of Washington and those for which transport of non-target toxicity risks are minimal would be used. Any herbicide would be selectively applied by hand.

The public access trail/firelane would impact approximately 7,470 square feet (0.17 acre) of Wetland A buffer. Only 36 percent of the impacted area currently supports vegetation, comprised of a few scattered Douglas-fir trees over a dense understory of Himalayan blackberry. Three Douglas fir trees with an average diameter at breast height (dbh) of 12 to 16 inches, meeting the "significant tree" criteria as defined in the Northshore Plan P-4 suffix condition, would be removed to accommodate the public access trail/firelane. A big-leaf maple (7-inch dbh) would also be removed for public access trail/firelane construction through the wetland buffer.

LAKEPOINTE
PIONEER TOWING

FIGURE 4-3
SHORELINE PARK LANDSCAPE PLAN
SOURCE REFERENCE: SHINBO

PROJECT NO.: 22140	6 DECEMBER 1996
2146-43.CDR/VGP	CHECKED: JBF

SHORELINE PARK

The shoreline park strings together a series of interconnected outdoor spaces and wildlife habitat. It provides recreational space for residents and visitors, new and improved habitat for shore edge creatures, and a pleasant stroll and natural systems interpretative tour along the Sammamish River and Lake Washington shorelines.

Stormwater from paved areas is filtered through two swales outside of the shoreline buffer zone. A third source, from relatively clean roof runoff is located between these two, along the river edge. This middle source and the western swale are combined to form a narrow, elevated swale to the river. This accomplishes several important purposes. It creates a sizeable (.5 acre) environment of riparian vegetation, including western red cedar, willow, dogwood, sedges, and reeds. The elevated swale and resultant island also serve to further buffer human activity and disturbance from the lake and river at the confluence of these two important waterbodies. Most of the large existing Douglas fir are preserved and remain to overhang the view and provide shade. The elevated swale is contoured to no lower than 21 feet msl - to preclude warm water fish habitat.

The swales and roof runoff source drop six to ten feet. Each enters the lower ledge through as series of small cascades and pools. These ephemeral features should enliven the park and provide a dynamic element.

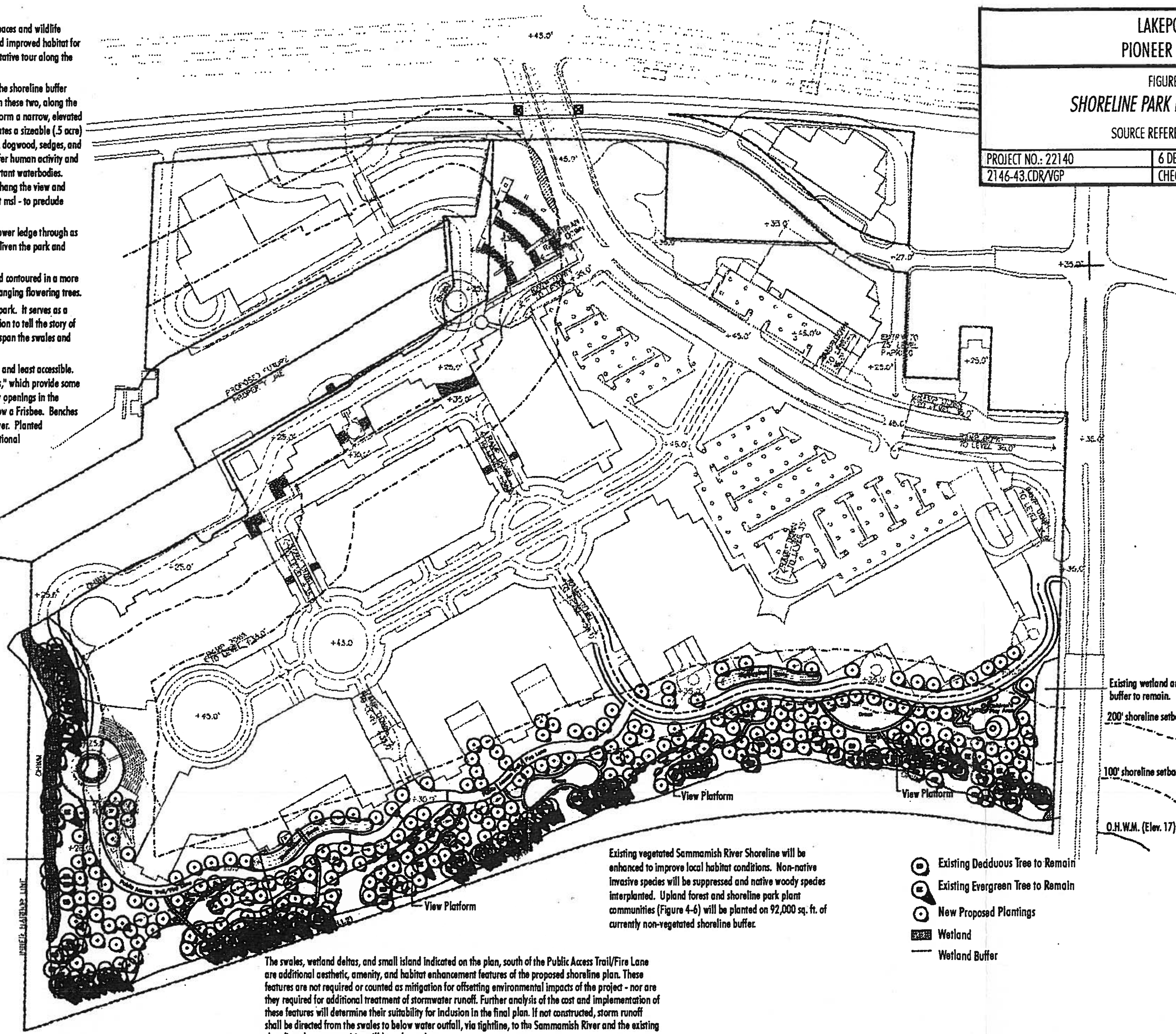
The swales themselves are not typical storm runoff facilities. Shaped and contoured in a more natural form, the swales are edged by river rock and bordered by overhanging flowering trees.

A public access trail/firelane parallels the entire length of the shoreline park. It serves as a stroll path along the river, incorporating interpretive signs and information to tell the story of the natural and cultural history of this unique site. Two narrow bridges span the swales and provide emergency access from the lane to the buildings across the way.

In general, the western portion of the shoreline park is the most natural and least accessible. The eastern portion of the park is punctuated with small outdoor "rooms," which provide some diversity of space, and access a view of the river. These spaces are grassy openings in the wooded canopy - a perfect place to read a book, play badminton, or throw a Frisbee. Benches along the southern edge of these spaces provide a visual access to the river. Planted mostly in native riparian plant species, these spaces can also afford additional natural education opportunities.

A children's play area is contoured and built into the landform at the eastern edge of the park. Rather than a typical "off-the-shelf" solution, the playground is formed mostly of grass, pebbles, and kinetic sculpture, scaled for the little (and perhaps big) people who might venture here.

The northwestern corner of the shoreline park, paralleling the Lake Washington shoreline, maintains the wetland and most of the adjacent buffer and creates a natural edge for this space which links the marina to the river.



Existing wetland and buffer to remain outside of Public Access Trail/Firelane. Enhancement plantings will occur to diversity habitat. Non-native, invasive species will be suppressed and native woody species interplanted.

Upland forest communities will be planted on 5,400 sq. ft. of currently non-vegetated buffer. (Plant community description in Figure 4-6). Woody debris, minimum 15 ft. long and 18 inches diameter at the small end, will be placed at an average density of 20 pieces per acre for both shoreline areas.

Existing vegetated Sammamish River Shoreline will be enhanced to improve local habitat conditions. Non-native invasive species will be suppressed and native woody species interplanted. Upland forest and shoreline park plant communities (Figure 4-6) will be planted on 92,000 sq. ft. of currently non-vegetated shoreline buffer.

The swales, wetland deltas, and small island indicated on the plan, south of the Public Access Trail/Fire Lane are additional aesthetic, amenity, and habitat enhancement features of the proposed shoreline plan. These features are not required or counted as mitigation for offsetting environmental impacts of the project - nor are they required for additional treatment of stormwater runoff. Further analysis of the cost and implementation of these features will determine their suitability for inclusion in the final plan. If not constructed, storm runoff shall be directed from the swales to below water outfall, via tightline, to the Sammamish River and the existing shoreline plant communities will be enhanced.

Table 4-2. Lakepointe Mixed Use Development Summary.

Lake Washington Shoreline Conditions Phase___3___	**Existing**	**Proposed Project Features and Habitat Improvements**	**Net Change Improvement/Mitigation**
Vegetated shoreline is comprised of wetland and wetland buffer.			
Wetland (King County Type 2)	11,203 sq. ft. of palustrine forested and scrub-shrub wetland (red alder, willow and Himalayan blackberry).	11,203 sq. ft. The southern half of the wetland will be enhanced by removing blackberries and interplanting native woody species and placement of woody debris.	No change in total area. Habitat is improved by removal of invasive, non-native species and addition of native woody species and woody debris.
50-foot Wetland Buffer Vegetated	24,543 sq. ft. (red alder, Douglas-fir and Himalayan blackberry).	Trail/firelane will be constructed in 2,725 sq. ft., remaining vegetated buffer will be enhanced per treatment described above for wetland.	36,404 sq. ft. of vegetated buffer. In addition to the 11,861 sq. ft. increase in vegetated buffer; the existing habitat is improved.
Non-Vegetated	11,861 sq. ft., buffer not in compliance with King County SAO.	Trail/firelane and a portion of amphitheater steps will be constructed in 4,744 sq. ft. of non-vegetated buffer; remaining non-vegetated area (7,117 sq. ft.) and an additional 7,470 sq. ft. adjacent to the southern portion of the buffer will be planted with native tree, scrub and ground cover species and woody debris added (Figure 4-4).	The only non-vegetated portion of the buffer will be 7,470 sq. ft. comprised of project features built to provide public access. An additional 7,470 sq. ft. is added to the buffer and vegetated to compensate for features constructed in the buffer (buffer averaging). Buffer complies with SAO.
Structures/buildings Within 50' of shoreline	12,450 sq. ft. industrial structures; no public access.	Existing structures removed. Public access trail/firelane only project features within 40 feet of shoreline.	Industrial activities eliminated; public access provided.
In-water Pilings (count)	18	Existing pilings to be removed.	Removal of potential salmonid predator habitat.

Table 4-2. Lakepointe Mixed Use Development Summary - Continued.

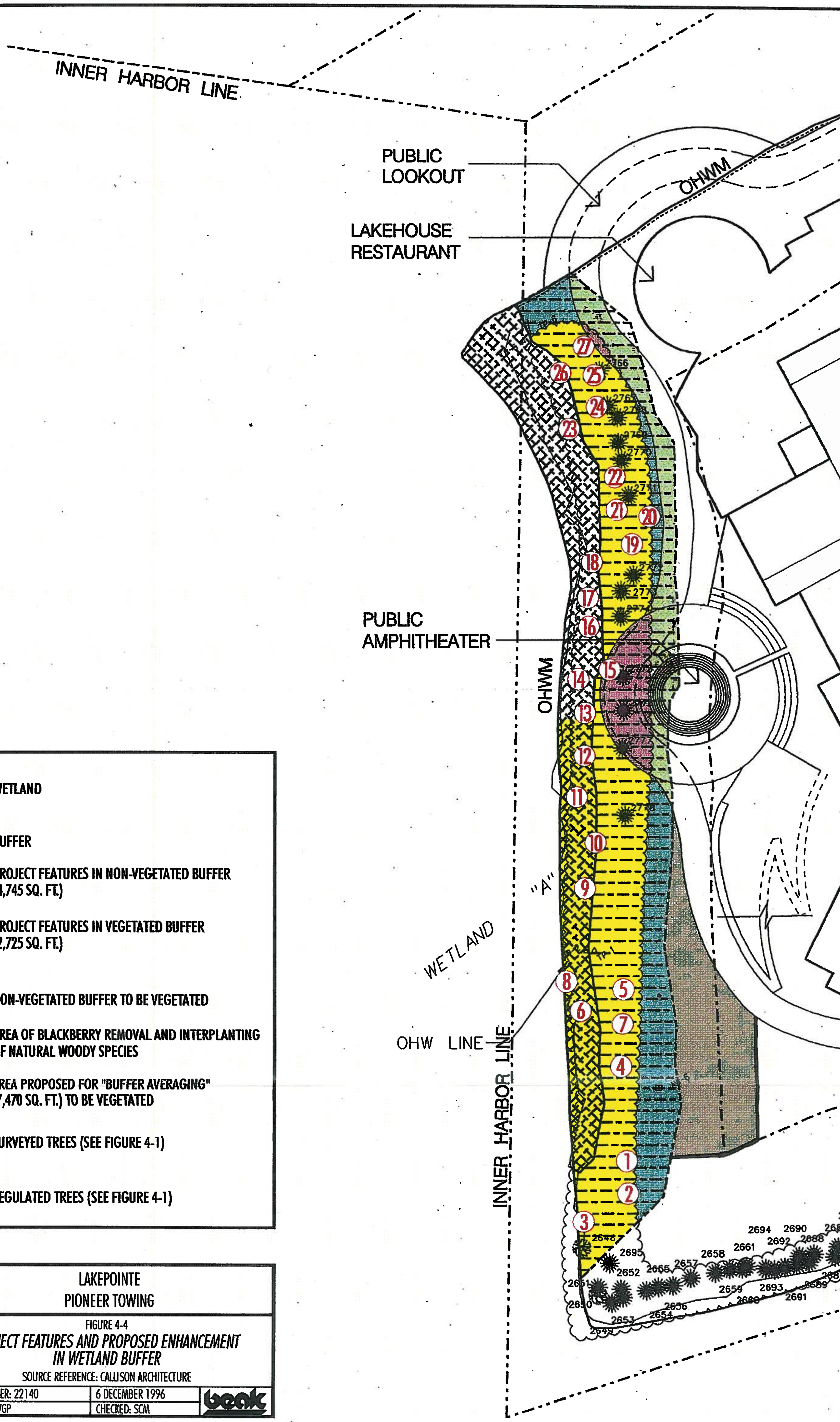
Sammamish River Shoreline Conditions **Phase 1 (east end), 3 (west end), 4 (central)**	**Existing**	**Proposed Project Features and Habitat Improvementss**	**Net Change Improvement/Mitigation**
Vegetation Width	30 ft. - 60 ft. Buffer not in compliance with King County SAO.	100 ft. - 130 ft.	Increased shoreline buffer width ranges from 70 ft. - 100 ft. Shoreline buffer exceeds SAO requirements.
Vegetation Type/Area	2 acres of upland forest. Overstory dominated by red alder, black cottonwood or Douglas-fir, all with a Himalayan blackberry-dominated understory.	5 acres native forest and scrub plant communities. Existing communities (2 acres) will be enhanced by controlling blackberry growth and interplanting native woody species and placement of woody debris. Three acres of currently non-vegetated area will be planted with native tree, shrub and ground cover species. Sixteen trees would be removed if the optional wetland deltas and elevated channel were constructed.	Increase of 3 acres of vegetative habitat. Improved habitat conditions. Wetland deltas and elevated swale also add habitat diversity, if constructed.
Wetland (King County Type 2)	277 sq. ft.	277 sq. ft.	
50-foot Wetland Buffer	11,964 sq. ft.	11,964 sq. ft. - Blackberry control and interplanting of native woody species and placement of woody debris.	Improved habitat conditions.
Structures/buildings Within 100 feet of shoreline	94,245 sq. ft. industrial structures	3 public viewpoints - 1,900 sq. ft. Public access and interpretive trail system 6,500 sq. ft.	Industrial structures removed. Public access and educational opportunities provided along 2,650 ft. of shoreline currently closed to public access. The 3 additional acres of vegetated buffer more than compensate for the 8,400 sq. ft. of trail and view structures established in shoreline buffer.

Although a short segment of the firelane would be located within several feet of the wetland boundary (Figure 4-4), the functions of the wetland system would not be compromised. The hydrology of Wetland A is controlled by the lake level; surface runoff from the project site does not significantly influence Wetland A hydrology. No vegetation would be removed from the wetland; therefore, shoreline protection/erosion, stormwater control, and biological support functions would not be compromised. The habitat enhancement actions proposed for the wetland and wetland buffer will increase overall biological support of this wetland system. The public access trail/firelane would provide an opportunity for interpretive/educational signage on the trail system (Figure 4-5). This would improve the cultural function of this wetland system.

Optional design features are also being evaluated, which would create a more natural and diversified shoreline along the Sammamish River. The shoreline may be broken by wetland "confluences" and an elevated swale, which would support native wetland plant communities (Figure 4-6). These features would be established above elevation 21 feet and consequently would not be flooded during high water periods. The elevated swale would create a small "island" that would be separated from the main shoreline area by wetland vegetation (Figure 4-6). Treated stormwater and roof runoff would discharge into the deltas and elevated swale, if constructed, instead of being piped directly to the river from the biofilter swales.

"Significant trees" would be removed with the implementation of the optional design features (wetland deltas and elevated swale), along the Sammamish River shoreline (Figures 4-3 and 4-6). If the wetland deltas and elevated swale are constructed, 22 percent of the "significant trees" within the shoreline zone would be removed (approximately 40 trees based on the 9 December 1996 drawings). The three public view points would require removal of no "significant trees."

Removal of these few trees (4 for the trail/firelane for the public view points and 19 for the optional Sammamish River shoreline improvements) would not significantly impact wildlife habitat on the project site as the existing majority of the trees along the shoreline would be retained and would still be available for perching and shading. Although approximately 0.06 acre of vegetated shoreline area would be impacted by the project (public access trail/firelane), the area of vegetated shoreline along Lake Washington and Sammamish River would be increased by approximately 0.17 acre and 3.25 acres, respectively, with the proposed shoreline habitat improvements.



WETLAND

BUFFER

PROJECT FEATURES IN NON-VEGETATED BUFFER (4,745 SQ. FT.)

PROJECT FEATURES IN VEGETATED BUFFER (2,725 SQ. FT.)

NON-VEGETATED BUFFER TO BE VEGETATED

AREA OF BLACKBERRY REMOVAL AND INTERPLANTING OF NATURAL WOODY SPECIES

AREA PROPOSED FOR "BUFFER AVERAGING" (7,470 SQ. FT.) TO BE VEGETATED

SURVEYED TREES (SEE FIGURE 4-1)

① REGULATED TREES (SEE FIGURE 4-1)

LAKEPOINTE
PIONEER TOWING

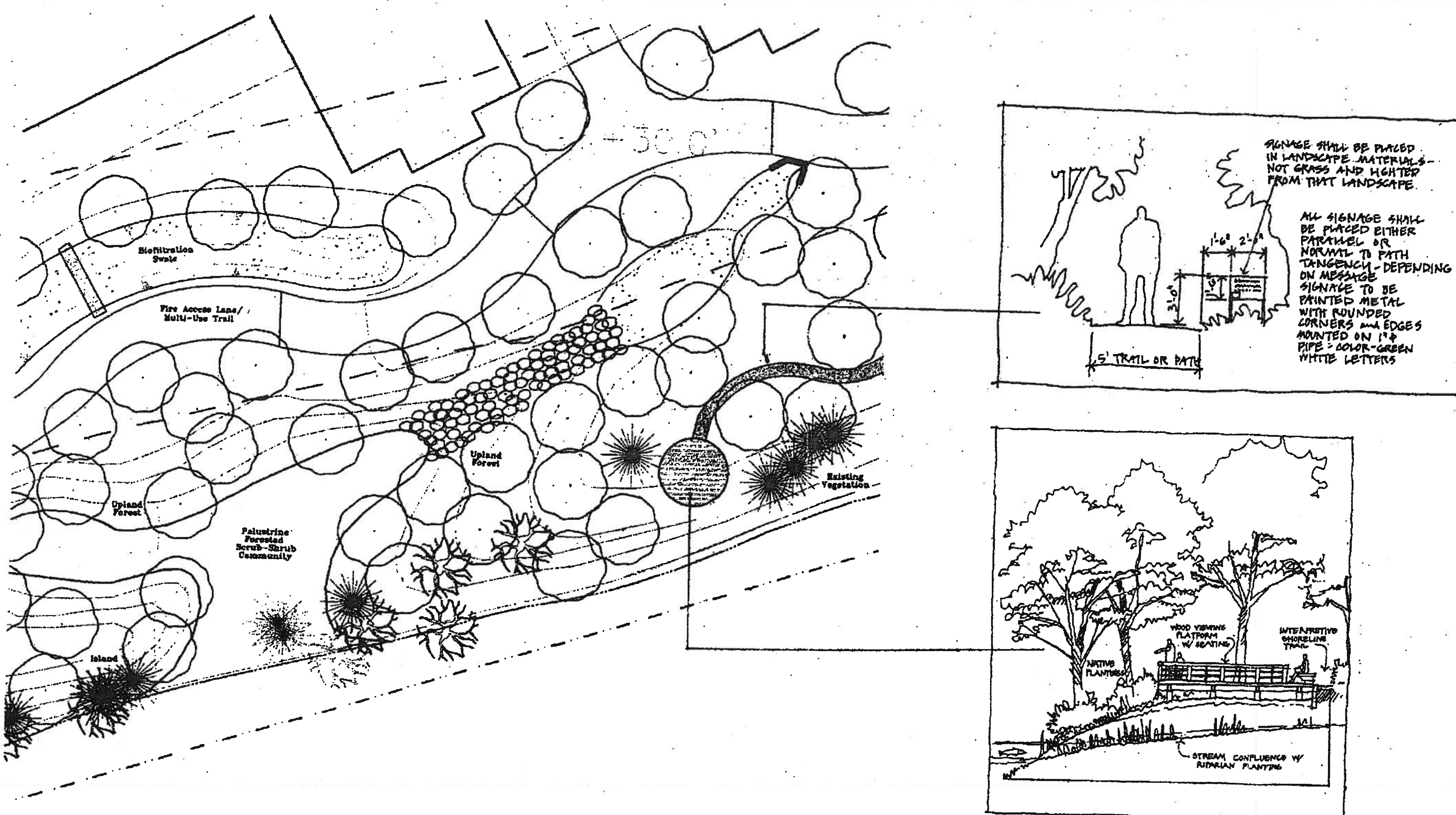
FIGURE 4-4

PROJECT FEATURES AND PROPOSED ENHANCEMENT IN WETLAND BUFFER

SOURCE REFERENCE: CALLISON ARCHITECTURE

PROJECT NUMBER: 22140	6 DECEMBER 1996
2140-44.CDR/VGP	CHECKED: SCM

beak



LAKEPOINTE
PIONEER TOWING

FIGURE 4-5

DETAIL PLAN - SHORELINE PARK & PALUSTRINE COMMUNITY

SOURCE REFERENCE: CALLISON ARCHITECTURE, INC.

PROJECT NO.: 22140	6 DECEMBER 1996
2146-45.CDR/VGP	CHECKED: JBF

beak

LAKEPOINTE
PIONEER TOWING

FIGURE 4-6

SECTION THROUGH SHORELINE PARK AND PALUSTRINE WETLAND COMMUNITY TO BE ESTABLISHED IN THE WETLAND DELTAS OR ELEVATED SWALE

SOURCE REFERENCE: CALLISON ARCHITECTURE, INC.

PROJECT NO.: 22140	6 DECEMBER 1996
2146-45.CDR/VGP	CHECKED: JBF

SHORELINE PARK

TREES	
Bigleaf Maple	*Acer macrophyllum*
Vine Maple	*Acer circinatum*
Quaking Aspen	*Populus tremuloides*
Douglas Fir	*Pseudotsuga menziesii*
Western Hemlock	*Tsuga heterophylla*
SHRUBS	
Oregon Grape	*Mahonia aquifolium*
Snowberry	*Symphoricarpos albus*
Red Twig Dogwood	*Cornus stolonifera*
GROUNDCOVER	
Salal	*Gaultheria shallon*

UPLAND FOREST

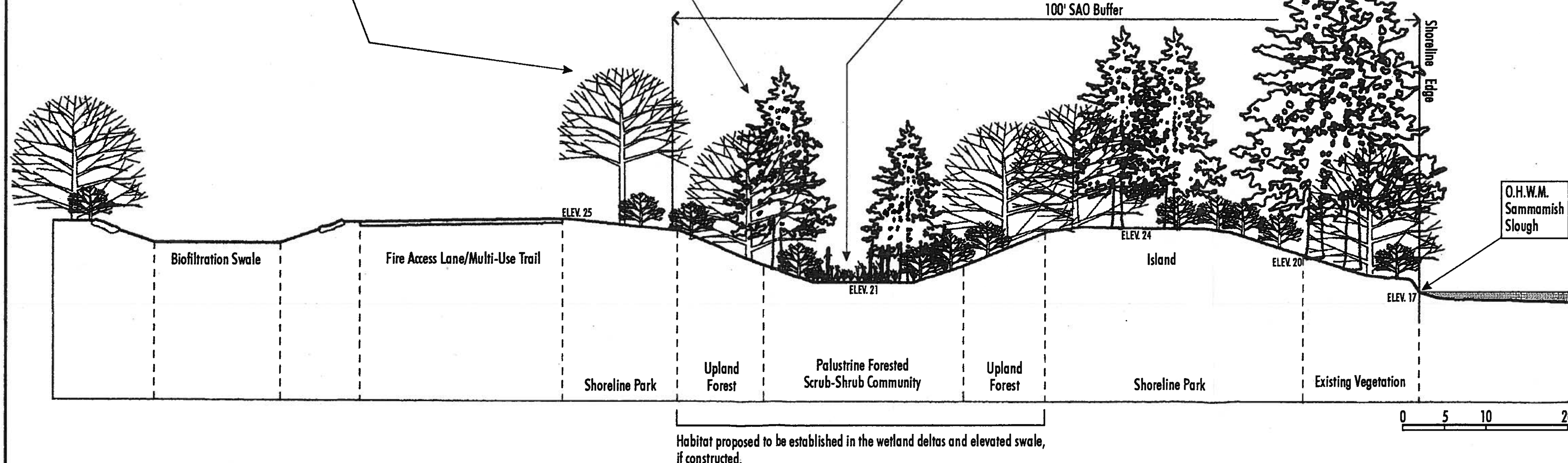
TREES	
Bigleaf Maple	*Acer macrophyllum*
Red Alder	*Alnus rubra*
Black Cottonwood	*Populus trichocarpa*
Vine Maple	*Acer circinatum*
Pacific Dogwood	*Cornus nuttallii*
Western Hemlock	*Tsuga heterophylla*
Western Redcedar	*Thuja plicata*
Douglad Fir	*Pseudotsuga menziesii*
SHRUBS	
Oregon Grape	*Mahonia aquifolium*
Snowberry	*Symphoricarpos albus*
Red Twig Dogwood	*Cornus stolonifera*
Red Elderberry	*Sambucus racemosa*
Salmonberry	*Rubus spectabilis*
GROUNDCOVER	
Salal	*Gaultheria shallon*
Deer Fern	*Blechnum spicant*

PALUSTRINE COMMUNITY

TREES	
Red Alder	*Alnus rubra*
Western Redcedar	*Thuja plicata*
Sitka Spruce	*Picea sitchensis*
SHRUBS	
Red Twig Dogwood	*Cornus stolonifera*
Salmonberry	*Rubus spectabilis*
Sitka Willow	*Salix sitchensis*
Scouler Willow	*Salix scouleriana*
GROUNDCOVER	
Lady-Fern	*Athyrium filix-femina*
Native Iris	*Iris tenax or I. tenuis*
Skunk Cabbage	*Lysichitum americanum*
Slough Sedge	*Carex abnupta*
Water Parsley	*Oenanthe sarmentosa*

EXISTING VEGETATION

Remove invasive blackberries and infill with native plant material.



The most productive shoreline area in the project area for fish, and hence feeding area for shore birds and diving birds, is the Lake Washington shoreline along Wetland A. No in-water or nearshore impacts would occur in this area. Shoreline vegetation would not be disturbed, with only 2,725 square feet of vegetated wetland buffer 40 feet from the OHWM being removed to construct the public access trail/firelane along the Lake Washington shoreline. The removal of vegetation in this area may increase the potential for human activity to disrupt shore bird feeding activities along the Lake Washington shoreline. However, the expansion of the vegetated buffer and interplantings within the existing vegetated areas of the remaining shoreline areas would increase the buffer between the shoreline and activities on the project site.

Impacts to nesting birds along the shoreline would be insignificant. The only birds observed nesting along the shoreline are Canadian geese. The goose nests observed on the project site occurred along the Lake Washington shoreline in Wetland A and along the Sammamish River shoreline. Industrial activity on the areas immediately adjacent to the Lake Washington shoreline has not deterred geese from nesting along the shoreline. Geese are expected to continue nesting in the area during and after construction of the Lakepointe project.

Surface runoff from the construction areas could increase sediment input into the wetland and adjacent waterways, which could effect shore bird and diving bird feeding. Construction noise could also reduce diving and shorebird feeding activities.

Project construction activities should not disturb observed bald eagle activities in the general vicinity, as the current industrial use of the site has not curtailed such activities. These activities and noise levels of construction are not anticipated to be significantly different than the current industrial uses. Nesting bald eagles will not be affected as the nearest documented nest is 1.2 miles from the project site.

The features constructed in the shoreline buffer would provide public access to the Lake Washington and Sammamish River shorelines, currently not available to the public (Table 4-2). Human traffic along the shoreline would significantly increase as a result of the Lakepointe project, and therefore, could potentially increase disturbance of wildlife along the shoreline.

4.3 MITIGATION MEASURES

Measures to enhance and re-establish native vegetation communities along the project shoreline are included as part of the project proposal and are not proposed as mitigation. However, some of these measures would also offset the loss of 2,725 square feet of vegetated wetland buffer and are incorporated to minimize impacts of increased human use of the shoreline area. An additional 0.17 acre adjacent to the southern portion of the Wetland A buffer would be designated as part of the Wetland A buffer to compensate for public access trail/firelane construction through this buffer (Figure 4-4). This expansion of the vegetated wetland buffer and enhancement of the existing vegetated wetland and wetland buffer, including blackberry removal and control, would provide improved wildlife habitat along the Lake Washington shoreline (Table 4-2).

Public access in the shoreline area would be limited to a trail system, view platforms and grassy openings that would provide viewpoints along the Sammamish River and the public access trail/firelane along the Lake Washington shoreline. Plantings would also be used to control movement through the shoreline and wetland buffer areas (e.g. dense plantings, addition of native thorny species).

The expanded buffer along the Sammamish River would be approximately 0.8 acre greater than the required 100-foot buffer. This is 0.65 acre more than required to compensate for the 6,500 square feet of trail and 1,900 square feet of public view platforms established in the Sammamish River buffer (Table 4-2).

The construction of the wetland swales and elevated swale, if constructed, would require over-excavation of approximately 18 inches to allow for the import of topsoils to be placed as the final grade to support the nursery plantings. All construction work would be conducted during the dry season within the criteria established in the site remediation plan. Erosion control measures, such as silt fencing, as defined in the Erosion Sediment Control Plan developed for the project would be implemented prior to the initiation of any clearing or grading. All disturbed soils would be hydroseeded after final grade is achieved, and native nursery stock planted in the fall. A temporary irrigation system would be installed to assure successful plant establishment.

The constructed features and plantings would be monitored for a five-year period to determine success of the nursery plantings and stability of the constructed deltas and elevated side channel.

Appropriate contingency measures would be implemented to correct any failure of plant establishment or erosion of the constructed features (i.e., replanting with appropriate species if survivorship or percent cover criteria is not met, or modification of surface materials or slope if erosion occurs).

5.0 NORTHSHORE COMMUNITY PLAN

Redevelopment Conditions

The Lakepointe Mixed Use Development complies with the Northshore Community Plan as described below:

Redevelopment of the shoreline should include restoration of shoreline areas damaged by industrial activities and conform to the 1990 Sensitive Areas Ordinance.

The proposed Lakepointe project includes expansion of the vegetated shoreline along the Sammamish River and Lake Washington within the project area, and enhancement of the existing plant communities by removal of invasive, non-native plant species and replacement with native shrub and ground cover species. Small wetland confluences may also be developed along the Sammamish River shoreline to diversify the shoreline habitat. A portion of the public access/firelane system would lie within 7,470 square feet of the wetland buffer adjacent to the Lake Washington shoreline, of which only 36 percent is currently vegetated. This wetland buffer impact would be mitigated by the expansion of the vegetated shoreline habitat adjacent to the existing buffer by 7,470 square feet and enhancement of the existing vegetated upland and wetland areas which will include interplantings of native species to diversify the plant communities and placement of woody debris in these areas.

Redevelopment of the shoreline must include public access, viewpoints and open space.

Public access along the Sammamish River shoreline would be controlled by a trail system, view platforms and grassy openings that would provide viewpoints along the Sammamish River. Access to the Lake Washington shoreline and views across the lake would be provided by the promenade along the marina and a continuation of the Sammamish River shoreline trail connecting to the marina promenade.

Conditions to be met prior to redevelopment as related to the shoreline and natural resources:

D. Provide substantial public access to the Lake Washington and Sammamish River waterfront.

Public access would be provided by a trail system, view platforms and grassy openings that would provide viewpoints along the Sammamish River. Access to the Lake Washington shoreline and views across the lake would be provided by the promenade along the marina and a continuation of the Sammamish River shoreline trail connecting to the marina promenade. Private and public moorage would be provided at the marina.

H. Provide for fish and wildlife enhancement.

Expansion and enhancement of the Sammamish River shoreline and buffer would provide increased vegetated area, diversified plant communities and diversified habitat features (e.g., woody debris). These improvements would increase and improve available wildlife habitat on the project site.

Fish impacts would be restricted to the inner harbor where increased over-water and in-water structure would occur with project development. Industrial uses of the inner harbor would be phased out. Water clarity would be enhanced by: 1) terminating tug and barge activity that currently stirs up bottom sediments, and 2) eliminating untreated stormwater discharge from the harbor. Such action would enhance the aquatic productivity potential in the harbor by decreasing turbid water conditions. Industrial debris and unusable in-water structures, including burned-out pilings and decaying bulkhead stumps in the river, lakefront and inner harbor areas, would be removed, enhancing natural conditions. Shallow water nearshore habitat is important for juvenile salmonid migration, feeding, refuge from predatory fish, and for nighttime resting purposes. The amount of shallow water habitat is currently limited in the inner harbor (0.5 acre). Project development would create approximately 3,000 square feet of additional shallow water (<10 ft) littoral habitat that is not currently available to fish.

I. Mitigate for impacts to the shoreline edge through riparian vegetation enhancement.

The wetland buffer impacts, resulting from construction of public access/firelane system for public access, would be mitigated by the expansion of the vegetated shoreline habitat and enhancement of the existing vegetated upland and wetland areas which would include interplantings of native species to diversify the plant communities and placement of woody debris in these areas.

J. Provide for easily accessible public viewpoints and project view corridors.

Public access would be provided by a trail system, view platforms and grassy openings that would provide viewpoints along the Sammamish River. Access to the Lake Washington shoreline and views across the lake would be provided by the promenade along the marina and a continuation of the Sammamish River shoreline trail connecting to the marina promenade.

Area-Wide P-Suffix Development Conditions

P2. Seasonal Clearing Restrictions

All clearing and grading would be conducted between 31 March and 1 October except for approved activities allowed under exemptions of this timing restriction (i.e., exemptions B.4, B.5, B.9 and B.10). All bare ground would be fully covered or revegetated between October 1 and March 31.

P3. Natural Resource Protection Area

The Lakepointe project lies within the Sammamish River Corridor Habitat. Special wildlife studies are to be conducted to identify great blue heron nesting, roosting and feeding areas on the site. No suitable nesting or roosting habitat has been identified on the project site. A great blue heron was noted near the mouth of the Sammamish River along the Lake Washington shoreline during the wetland surveys and a great blue heron was noted in the barge channel during the fisheries surveys. The most productive fisheries area along the project shoreline is considered to be the shallow, sandy Lake Washington shoreline along Wetland A. Therefore, this area could likely be used as a foraging area by great blue herons who reportedly have nesting areas approximately one mile northeast, three miles northeast and six miles north of the Lakepointe project site (14 November 1996 WDFW PHS Database review).

Wetland A is a Class 2 wetland requiring a 50-foot buffer. The proposed design of the public access trail/firelane would occur in a portion of this 50-foot buffer. The plant communities in the southern portion of Wetland A and associated 50-foot buffer would be enhanced and expanded. Plantings in this wetland and wetland buffer area would increase plant density and include some thorny species, both of which would discourage human entry into this wetland area. Woody debris would also be placed in the wetland and buffer area (Figure 4-3).

Site densities calculated for the Lakepointe project are consistent with the Sensitive Areas Ordinance.

P4. Significant Vegetation Retention

All trees meeting the significant tree definition, as defined in P4.F, have been surveyed. The survey identified the location, size and species of all significant trees (see Figure 4-1). A maximum of 22 percent of the "significant trees" would be removed if the optional wetland deltas and elevated channel are constructed, over-exceeding all significant tree retention requirements of the P4 suffix condition.

E. Mixed -Use Pedestrian-Oriented Areas - special conditions attached to the Kenmore Pre-Mix site:

P-suffix conditions for the Kenmore Pre-Mix site applicable to the shoreline and natural resources:

8. Public viewpoints:

> Public access along the Sammamish River shoreline would be controlled by a trail system, view platforms and grassy openings that would provide viewpoints along the Sammamish River. Access to the Lake Washington shoreline and views across the lake would be provided by the promenade along the marina and a continuation of the Sammamish River shoreline trail connecting to the marina promenade. Public seating would be provided on the view platforms, and historical and natural habitat interpretive signage would be strategically placed along the pedestrian trail through the shoreline park and along the Lake Washington shoreline.

9. Shoreline Enhancement:

The proposed Lakepointe project includes expansion of the vegetated shoreline along the Sammamish River and Lake Washington, and enhancement of the existing plant communities by removal of invasive, non-native plant species and replacement with native shrub and ground cover species. The vegetated Sammamish River shoreline buffer would respect the 100-foot shoreline buffer distance, and in some areas extend beyond that distance. Small wetland deltas and an elevated side channel may also be developed along the Sammamish River shoreline to diversify the shoreline habitat. The encroachment of the public access trail/firelane into the wetland buffer would be offset by the expansion of the Lake Washington and Sammamish River vegetated shoreline habitat and enhancement of the existing vegetated upland and wetland areas which would include the placement of woody debris and interplantings of native species to diversify the plant communities. The development team included a Certified Wetland Scientist.

Public access along the Sammamish River shoreline would be controlled by a trail system and three view platforms that would provide viewpoints along the river.

The Lakepointe development includes a marina that would provide private moorage and temporary guest moorage. Potential marine/air conflicts have been mitigated by an agreement between Kenmore Air Harbor and the owner.

A fisheries study was conducted along the Sammamish River and Lake Washington shoreline adjacent to the project site and in the barge channel where the marina is proposed. A second study more specific to the channel was completed in May 1997. All project features extending beyond the OHWM have been restricted to the inner harbor. As such, no negative impact upon adult salmon migration or feeding areas at the mouth of the river are anticipated. None of the project features in the inner harbor would pose a hinderance to salmonid migrations. Boat traffic would increase along the Kenmore navigation channel, but would not substantially alter the boat traffic in the Sammamish River, which currently is high because of the boat launch on the eastshore of the river downstream of the 68th Ave. N.E. bridge.

15. Mixed Use Master Plan Submittal Requirements

b. Adequate review of the cumulative impacts of all mixed use development in Kenmore. There are currently no mixed use developments in Kenmore on which to base a cumulative impacts study.

c. Environmental review considered the phasing of the proposed development.

d. A proposed wetland enhancement and shoreline enhancement plan have been developed. Marina design minimized fisheries impacts and incorporated enhancement of shallow (≤10 ft) nearshore habitat.

16. Required Elements for Master Plan and Final Development Applications

a. Assessment of project level impacts are provided in this document for fish, wildlife, wetland and water quality impacts.

i. Proposed mitigation for wetland buffers meet the SAO requirements, and meet the requirements of the Northshore Plan to mitigate for shoreline edge impacts through riparian vegetation enhancement.

The public access trail/firelane disturbs the wetland buffer to provide public safety and provide public access to the Lake Washington shoreline. This public access is not solely for the purposes of wildlife viewing as identified in Condition 9. However, the trail system meets the mitigation requirements of Condition 14 c.(3)(e) and (f) - development of a lakeside viewpoint at the southern end of the site and public gathering place adjacent to the lakeside viewpoint.

Mitigation elements of the project include: 1) wetland buffer averaging and enhancement; 2) avoidance of in-water and over-water project structures along the Sammamish River and the lakeshore portions of the property by restricting project features to the inner harbor; 3) creation of shallow (≤10 ft) nearshore habitat; 4) providing openings in over-water deck surfaces to allow ambient light to penetrate to nearshore habitats; 5) removal of a portion of existing bulkhead shoreline treatment; 6) adding habitat complexity and interstitial spaces in the nearshore substrate to create hiding/refuge habitat for potential prey species; 7) precluding live-aboard residents in the marina; 8) avoiding boat haul-out, boat yards and cleaning facilities associated with the marinas in the inner harbor; 9) avoiding fueling or sewage pump-out facilities in the inner harbor; 10) removing existing high levels of industrial lighting as these land uses are phased out; 11) designing safety lighting along trails and marina piers close to the ground; and 12) incorporating lampshades that cover the water side of the lamp to deflect glare from the water.

APPENDIX A

Lakepointe Development Wetland Delineation Report

APPENDIX A

LAKEPOINTE DEVELOPMENT
WETLAND DELINEATION REPORT

1.0 INTRODUCTION

The Lakepointe project is a mixed-use development proposed on approximately 50 acres at the north end of Lake Washington (Figure 1). Beak Consultants, Incorporated was retained by the project owner to assess the biological conditions of the site, including verification of the wetland delineation conducted by Talasaea Consultants.

The mouth of the Sammamish River forms the southern shoreline of the site, and Lake Washington forms the west shoreline. A dredged navigation channel bordered by bulkheads angles across the northwest corner of the site (Figure 2). The site is relatively flat, lying between elevation 25 and 30. The static ground water table beneath the filled southern portion of the site is relatively level at approximate elevations of 17.5 to 18.5 msl, corresponding to the adjacent surface water level in Lake Washington and the Sammamish River (Agra 1996). The subject site has been extensively filled in the past and has a history of use for a variety of industrial purposes. The majority of the site is presently in use for concrete and asphalt manufacturing, as an aggregate stockyard, as a parking area and as a staging area for commercial fishing activities.

As a result of the placement of fill material, including construction debris, and chronic disturbance, the few vegetated areas found on the site support invasive non-native species. The only substantive plant communities that support woody vegetation on the subject site lie along the shorelines of the Sammamish River and Lake Washington.

Two areas of jurisdictional wetland habitat were identified on the project site. A narrow wetland identified as Wetland A is located at the northwest corner of the site, lying between fill material to the east and Lake Washington to the west (Figure 2). A second wetland area is located on the southeast corner of the Lakepointe site along the Sammamish River near the Juanita Drive Northeast bridge crossing. Under King County's Sensitive Areas Ordinance, both of these wetland areas would be classified as Class 2 Wetlands requiring a 50-foot buffer setback.

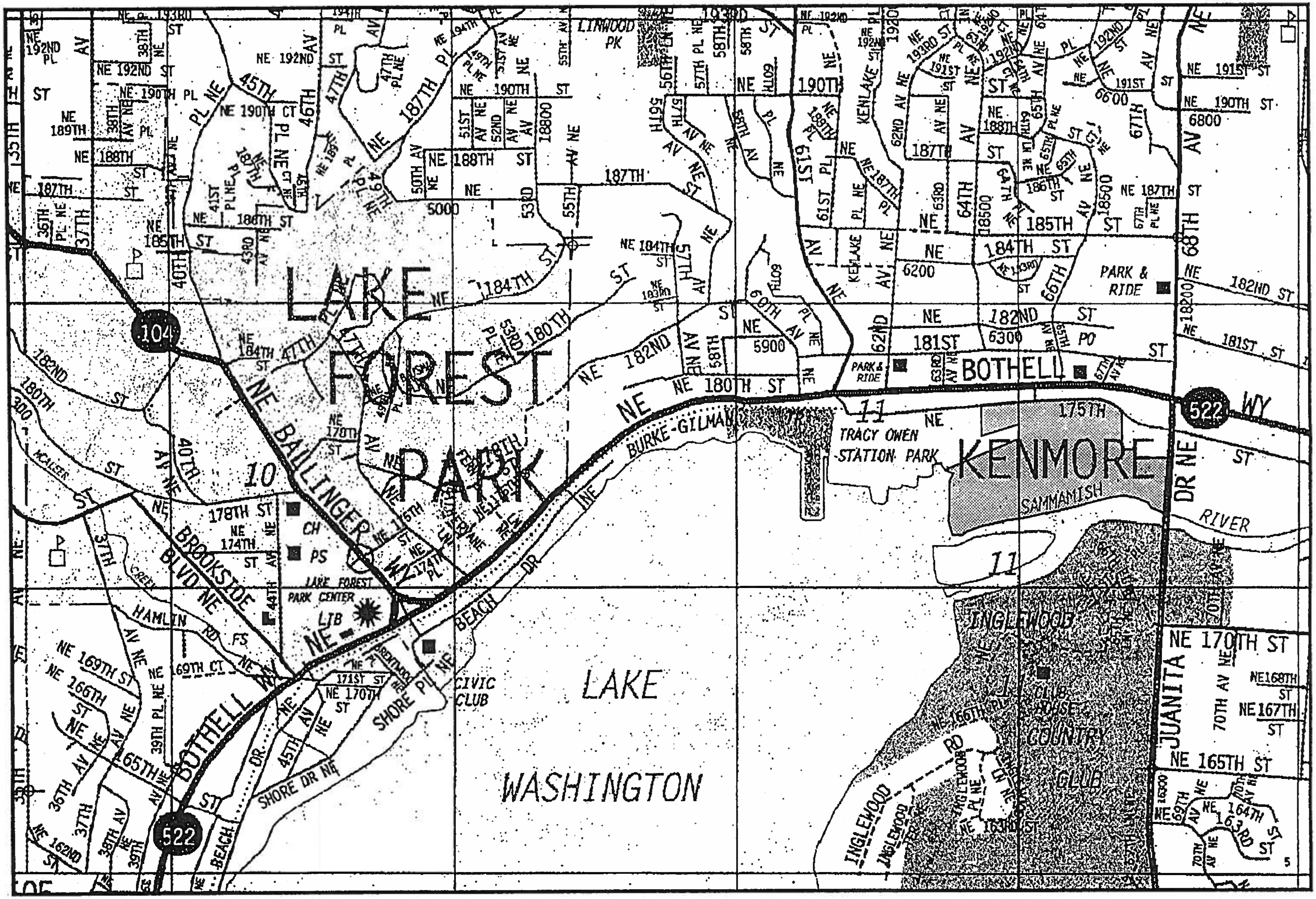


Figure 1. Lakepointe project area vicinity map.

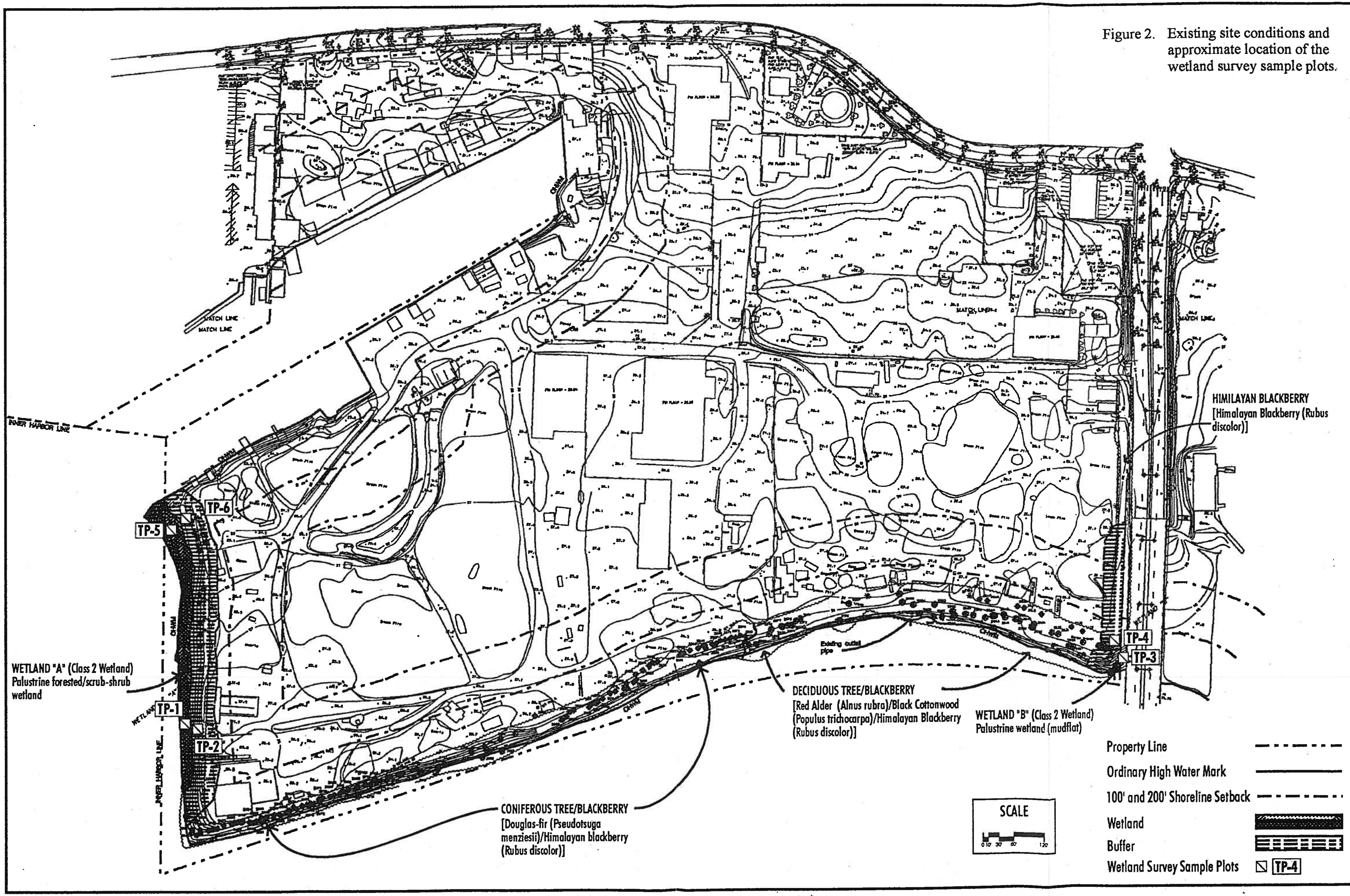


Figure 2. Existing site conditions and approximate location of the wetland survey sample plots.

2.0 WETLAND DELINEATION METHODOLOGY

The on-site wetland delineation was conducted in March 1995 by Talasaea Consultants utilizing the routine on-site wetland determination methodology as defined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1989). Although the U.S. Army Corps of Engineers recognized the methodology defined in the U.S. Army Corps of Engineers Wetlands Delineation Manual (1987) at the time of the wetland delineation survey, the 1989 federal wetland delineation methodology was recognized by King County. Since King County has subsequently adopted the 1987 federal wetland delineation methodology, the boundaries of on-site habitat delineated in 1995 were reviewed during a September 1996 reconnaissance using the 1987 methodology. Those boundaries delineated using the 1989 federal wetland delineation methodology were found to be consistent with those that would be delineated using the 1987 federal methodology.

During the 1995 wetland delineation survey, plant species were identified and percent coverage per species was estimated in five percent increments for overstory, understory and herbaceous layers within each established sample plot. Soils were inspected at each sample plot and along the delineated wetland boundaries in hand-dug soil pits 15 to 20 inches deep. Soil texture, matrix color, presence of mottles or gleying, and saturation levels were recorded at each sample plot. Soil and mottle colors were determined through the use of the Munsell Soil Color Chart (Kollmorgen 1990). Hydrologic indicators, including drainage patterns, presence of surface water, depth of ground water and evidence of inundation (i.e., drift lines, water marks, oxidized root zones, etc.) were also noted at each sample plot. Standard wetland delineation forms used to record collected information are attached to this report (Appendix A).

Sample plot locations and delineated wetland boundaries were flagged in the field and each marker was identified with the survey date and point reference. Flagged wetland boundaries were professionally surveyed. The delineated wetland boundaries and approximate sample plot locations are shown on Figure 2.

Plant species identified in the sample plots were classified according to moisture tolerance and placed in one of the following categories; obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU) or obligate upland (UPL). The U.S. Fish and Wildlife Service (USFWS) wetland plant list (Reed 1988) and Supplement (Reed 1993) were referenced to determine plant species indicator categories. If greater than 50 percent of the dominant plant species were OBL, FACW or FAC, the vegetation was considered to be hydrophytic.

The U.S. Soil Conservation Service (SCS) King County Area Soil Survey (Snyder et al. 1973) classifies the northernmost portion of the site as "Urban Land". According to the 1973 soil survey, the "Urban Land" designation is given to those areas in which soils have been modified by disturbance of the natural layers through the addition of fill material up to several feet in depth. The 1973 soil survey further identifies Norma soils as occurring in the central portion of the site and identifies the southern and southwestern portions of the property as "marsh" (Figure 3). Soils in the Norma series are considered to be hydric (wetland) soils and the "marsh" designation denotes the type of habitat originally occurring in the southern and southwestern portions of the property. However, due to the placement of fill material since the 1973 soil survey, and chronic disturbances associated with use of the site for a variety of industrial purposes, the information provided in the 1973 soil survey is no longer applicable for surficial soil conditions. Except for a narrow corridor of habitat along the shoreline of Lake Washington at the west end of the site, and a small area at the southeastern corner of the site, all of the on-site soils could likely be classified as "Urban Land".

Although the U.S. Fish and Wildlife Service National Wetlands Inventory (NWI) map for the area does identify on-site palustrine scrub-shrub seasonally inundated wetland habitat as occurring along the shoreline of Lake Washington (Figure 4), the King County Sensitive Areas Map Folio (SAMF) does not identify any on-site wetland habitat. However, the SAMF does identify areas of jurisdictional wetland habitat as occurring directly south of the subject site.

3.0 WETLAND DELINEATION RESULTS

As described above, most of the subject site supports little, if any, vegetation. Those areas that do support vegetation are primarily dominated by invasive non-native species. With minor exceptions, the only plant communities that support woody vegetation on the subject site lie along the shorelines of the Sammamish River and Lake Washington.

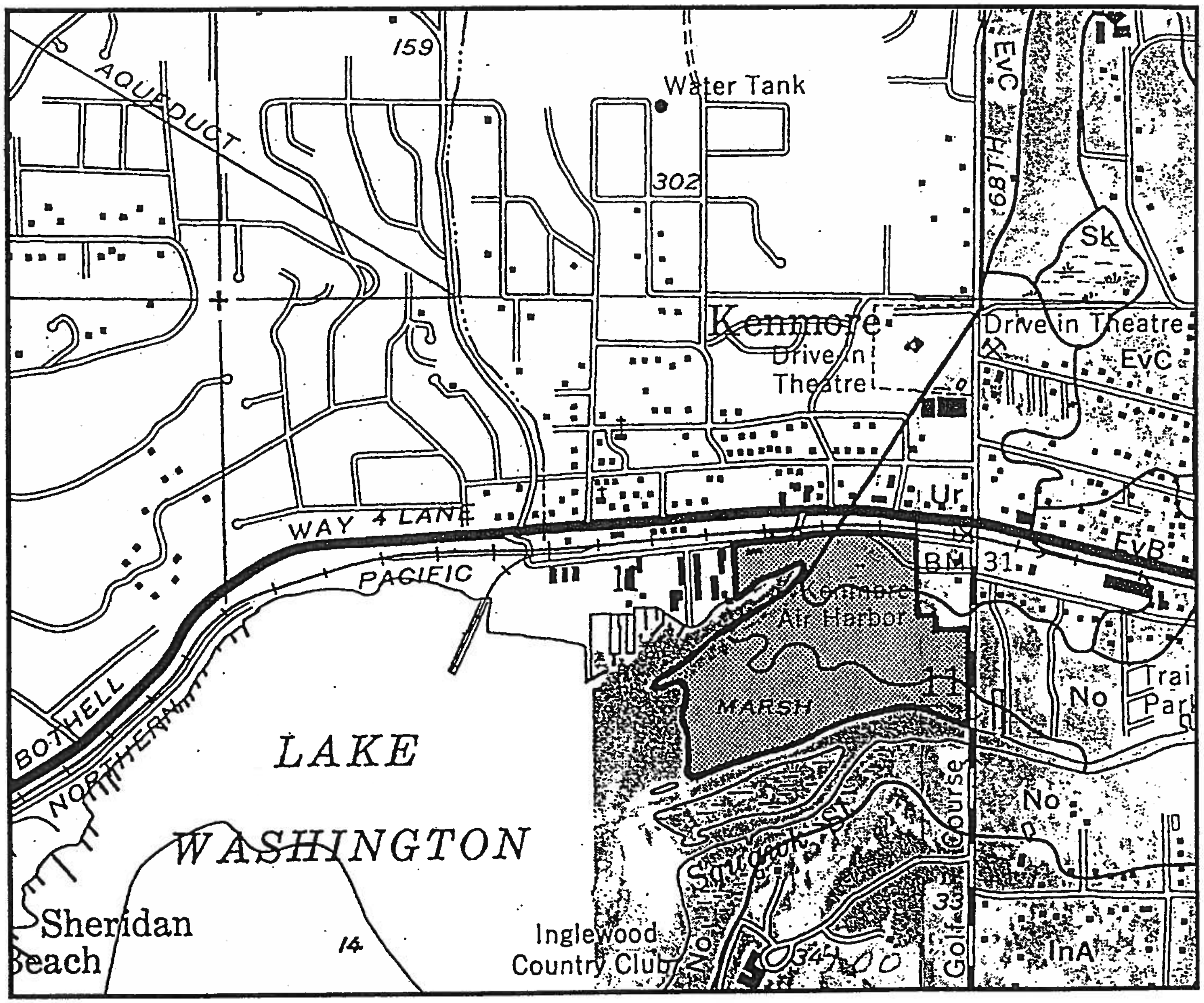


Figure 3. Mapped soils in the Lakepointe project area [from U.S. Soil Conservation Service King County Area Soil Survey (Snyder et. al. 1973)]

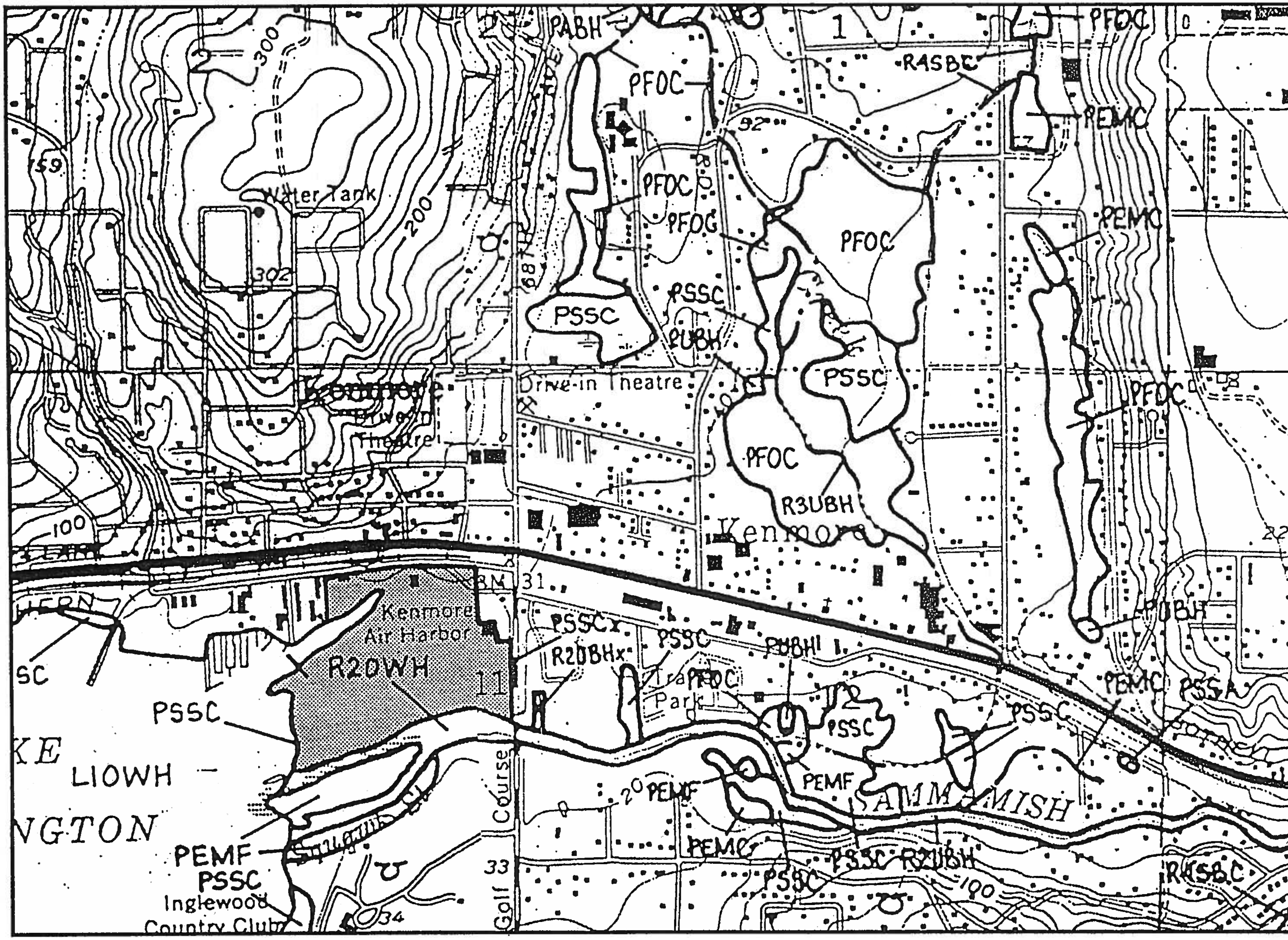


Figure 4. National Wetland Inventory in the Lakepointe project vicinity.

3.1 UPLAND HABITAT

Common upland plant species occurring in the less disturbed portions of on-site upland habitat near Lake Washington and along the Sammamish River include black cottonwood (*Populus trichocarpa*), red alder (*Alnus rubra*), Douglas-fir (*Pseudotsuga menziesii*), black locust (*Robinia pseudoacacia*) and Himalayan blackberry (*Rubus discolor*). On-site upland soils consist of fill materials of various origin. Past material used for on-site filling includes soil, construction debris and broken concrete.

3.2 WETLAND HABITAT

Wetland A

Wetland A occupies a narrow corridor of habitat lying between the edge of fill material and the Ordinary High Water Mark (OHWM) of the lake (Figure 2). This wetland supports both palustrine forested and palustrine scrub-shrub wetland habitat. Common plant species within this wetland include red alder, black cottonwood, black locust, Pacific willow (*Salix lasiandra*), Sitka willow (*Salix sitchensis*), Himalayan blackberry, Douglas' spiraea (*Spiraea douglassii*), reed canarygrass (*Phalaris arundinaceae*), bittersweet nightshade (*Solanum dulcamara*), purple loosestrife (*Lythrum salicaria*), cattail (*Typha latifolia*), yellow iris (*Iris pseudacorus*), and soft rush (*Juncus effusus*).

Soils observed in this wetland during the 1995 wetland delineation survey ranged from black (10YR 2/1 on the Munsell Soil Color Chart) to grayish brown (10YR 5/2). Soil mottles observed in these soils were gray (10YR 5/1). Hydrologic indicators observed within Wetland A during the March 1995 survey consisted of saturated surface soils. Additional indicators of wetland hydrology observed during the September 1996 reconnaissance include wetland drainage patterns.

Wetland B

The area of jurisdictional wetland habitat designated as Wetland B lies directly beneath Juanita Drive Northeast at the southeast corner of the subject site (Figure 2). Due to overhead shading associated with the roadway, this area of jurisdictional wetland habitat consists of periodically inundated mudflat habitat that supports little vegetation. However, contiguous wetland habitat located east of Juanita Drive Northeast supports willow, reed canarygrass, cattail, Himalayan blackberry, bittersweet nightshade and yellow iris.

Soils observed in this wetland during the 1995 wetland delineation survey ranged were generally black (10YR 2/1) with no apparent soil mottles. Hydrologic indicators observed within this wetland during the March 1995 survey consisted of saturated surface soils. Additional indicators of wetland hydrology observed during the September 1996 reconnaissance include wetland drainage patterns and the presence of drift lines.

4.0 WETLAND FUNCTION AND VALUE

Based strictly on size and the dense cover of blackberries, the wildlife habitat value of Wetland A is low. However, due to its direct interconnection with Lake Washington, this area offers breeding habitat for waterfowl and passerine birds, foraging habitat for shorebirds and breeding and foraging habitat for amphibians. Due to its narrow width and orientation with the shoreline, the biofiltration and groundwater recharge functions of this wetland are essentially non-existent. However, the dense vegetation does protect the shoreline from wave erosion.

Due to overhead shading associated with Juanita Drive Northeast, the portion of Wetland B directly adjacent to the project site consists of periodically inundated mudflat habitat that does not support significant vegetative cover. Consequently, this portion of the wetland has essentially no wildlife habitat value. However, this area may offer limited micro- and macro-invertebrate production capabilities. The wildlife habitat value of adjacent areas of wetland habitat to the east of Juanita Drive Northeast is similar to that listed above for Wetland A. Wetland B provides limited water quality improvement due to the small amount of runoff flowing into the area and low vegetative cover; no groundwater support due to the small size and narrow configuration along the shoreline; and little to no flood water functions. Neither wetland provides cultural or socioeconomic functions. Wetland and Buffer Functions and Semi-quantitative Performance Assessment forms (Cooke 1996) are attached in the appendix.

5.0 REFERENCES

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Wetland Delineation Data Forms & Wetland Function Assessment Forms

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): ALTMANN Date: 3-3-95
Project/Site: LAKEPOINTE State: WA County: KING
Applicant/Owner: PIONEER TOWING Plant Community #/Name: TP #1
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes X No ___ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ___ No X (If yes, explain on back)

VEGETATION

STRATUM COVERAGE	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
* 60	1. Rubus discolor	FACU	SHRUB	11.		
* 60	2. Phalaris arundinacea	FACW	HERB	12.		
* 20	3. Athyrium filix-femina	FAC	HERB	13.		
10	4. Robinia pseudoacacia	FACU-	TREE	14.		
	5.			15.		
	6.			16.		
	7.			17.		
	8.			18.		
	9.			19.		
	10.			20.		

* Percent of dominant species that are OBL, FACW, and/or FAC 66%
Is the hydrophytic vegetation criterion met? Yes X No ___
Rationale: > 50% FAC OR WETTER

SOILS

Series/phase: ___ Subgroup:[2] ___
Is the soil on the hydric soils list? Yes ___ No ___ Undetermined ___
Is the soil a Histosol? Yes ___ No X Histic epipedon present? Yes ___ No ___
Is the soil: Mottled? Yes X No ___ Gleyed? Yes ___ No X
Matrix Color: 10YR 5/2 Mottle Colors: 10YR 5/1
Other hydric soil indicators: ___
Is the hydric soil criterion met? Yes X No ___
Rationale: CHROMA OF 2 WITH MOTTLES

HYDROLOGY

Is the ground surface inundated? Yes ___ No X Surface water depth: ___
Is the soil saturated? Yes X No ___
Depth to free-standing water in pit/soil probe hole: 14"
List other field evidence of surface inundation or soil saturation. ___

Is the wetland hydrology criterion met? Yes X No ___
Rationale: ASSUMED DUE TO INCREASE IN WATER LEVEL

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes X No ___
Rationale for jurisdictional decision:
ALL 3 PARAMETERS MET

1 This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
2 Classification according to "Soil Taxonomy."

DATA FORM

ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): ALTMANN Date: 3-3-95

Project/Site: LAKEPOINTE State: WA County: KING

Applicant/Owner: PIONEER TOWING Plant Community #/Name: TP #2

Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?

Yes X No ____ (If no, explain on back)

Has the vegetation, soils, and/or hydrology been significantly disturbed?

Yes X No ____ (If yes, explain on back) FILLED + BERMED

VEGETATION

STRATUM COVERAGE		Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Species	Indicator Status	Stratum
100	1.	Rubus discolor	FACU	SHRUB	11.			
2	2.	Acer macrophyllum	FACU	"	12.			
	3.				13.			
	4.				14.			
	5.				15.			
	6.				16.			
	7.				17.			
	8.				18.			
	9.				19.			
	10.				20.			

Percent of dominant species that are OBL, FACW, and/or FAC ____

Is the hydrophytic vegetation criterion met? Yes ____ No X

Rationale: < 50% FAC OR WETTER

SOILS

Series/phase: ____ Subgroup:[2] ____

Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ____

Is the soil a Histosol? Yes ____ No X Histic epipedon present? Yes ____ No X

Is the soil: Mottled? Yes ____ No X Gleyed? Yes ____ No X

Matrix Color: 10YR 3/2 Mottle Colors: ____

Other hydric soil indicators: ____

Is the hydric soil criterion met? Yes ____ No X

Rationale: NO MOTTLES IN CHROMA OF 2

HYDROLOGY

Is the ground surface inundated? Yes ____ No X Surface water depth: ____

Is the soil saturated? Yes ____ No X

Depth to free-standing water in pit/soil probe hole: ____

List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes ____ No X

Rationale: NO EVIDENCE OF INUNDATION OR SATURATION

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No X

Rationale for jurisdictional decision: NO CRITERIA MET

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.

[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): ALTMANN Date: 3-3-95
Project/Site: LAKEPOINTE State: WA County: KING
Applicant/Owner: PIONEER TOWING Plant Community #/Name: TP#3
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes X No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No X (If yes, explain on back)

VEGETATION

STRATUM COVERAGE		Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Species	Indicator Status	Stratum
* 50	1.	Typha latifolia	OBL	HERB	11.			
* 50	2.	Phalaris arundinacea	FACW	"	12.			
5	3.	Rubus discolor	FACU	SHRUB	13.			
	4.				14.			
	5.				15.			
	6.				16.			
	7.				17.			
	8.				18.			
	9.				19.			
	10.				20.			

* Percent of dominant species that are OBL, FACW, and/or FAC 100
Is the hydrophytic vegetation criterion met? Yes X No ____
Rationale: > 50% FAC OR WETTER

SOILS

Series/phase: ____ Subgroup:[2] ____
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ____
Is the soil a Histosol? Yes X No ____ Histic epipedon present? Yes ____ No ____
Is the soil: Mottled? Yes ____ No X Gleyed? Yes ____ No ____
Matrix Color: 10YR 2/1 Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes X No ____
Rationale: CHROMA OF 1

HYDROLOGY

Is the ground surface inundated? Yes ____ No X Surface water depth: ____
Is the soil saturated? Yes X No ____
Depth to free-standing water in pit/soil probe hole: SURFACE
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes X No ____
Rationale: SATURATED TO SURFACE

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes X No ____
Rationale for jurisdictional decision: ALL 3 CRITERIA MET

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): ALTMANN Date: 3-3-95
Project/Site: LAKEPOINTE State: WA County: KING
Applicant/Owner: PIONEER TOWING Plant Community #/Name: TP 4
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes X No ___ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes X No ___ (If yes, explain on back) FILLED + BERMED

VEGETATION

STRATUM %AGE		Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Species	Indicator Status	Stratum
*95	1.	Rubus discolor	FACU	SHRUB	11.			
5	2.	Polygonum cuspidatum	NI	"	12.			
	3.				13.			
	4.				14.			
	5.				15.			
	6.				16.			
	7.				17.			
	8.				18.			
	9.				19.			
	10.				20.			

* Percent of dominant species that are OBL, FACW, and/or FAC 0
Is the hydrophytic vegetation criterion met? Yes ___ No X
Rationale:
< 50% FAC OR WETTER

SOILS

Series/phase: ___ Subgroup:[2] ___
Is the soil on the hydric soils list? Yes ___ No ___ Undetermined ___
Is the soil a Histosol? Yes ___ No X Histic epipedon present? Yes ___ No X
Is the soil: Mottled? Yes ___ No X Gleyed? Yes ___ No X
Matrix Color: 10YR 3/2 Mottle Colors: ___
Other hydric soil indicators: ___
Is the hydric soil criterion met? Yes ___ No X
Rationale:
CHROMA OF 2 WITHOUT MOTTLES

HYDROLOGY

Is the ground surface inundated? Yes ___ No X Surface water depth: ___
Is the soil saturated? Yes ___ No X
Depth to free-standing water in pit/soil probe hole: ___
List other field evidence of surface inundation or soil saturation.
___
Is the wetland hydrology criterion met? Yes ___ No X
Rationale:
NO EVIDENCE OF SATURATION OR INUNDATION

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ___ No X
Rationale for jurisdictional decision:
NO CRITERIA MET

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): ALTMANN. Date: 3-3-95
Project/Site: LAKEPOINTE State: WA County: KING
Applicant/Owner: PIONEER TOWING Plant Community #/Name: TP #5
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes X No ___ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ___ No X (If yes, explain on back)

VEGETATION

STRATUM COVERAGE	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
* 50	1. Typha latifolia	OBL	HERB	11.		
* 30	2. Phalaris arundinacea	FACW	"	12.		
* 20	3. Lythrum salicaria	OBL	"	13.		
* 10	4. Rubus discolor	FACU	SHRUB	14.		
	5.			15.		
	6.			16.		
	7.			17.		
	8.			18.		
	9.			19.		
	10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 75%
Is the hydrophytic vegetation criterion met? Yes X No ___
Rationale: > 50% FAC OR WETTER

SOILS

Series/phase: ___ Subgroup:[2] ___
Is the soil on the hydric soils list? Yes ___ No ___ Undetermined ___
Is the soil a Histosol? Yes X No ___ Histic epipedon present? Yes ___ No ___
Is the soil: Mottled? Yes ___ No X Gleyed? Yes ___ No X
Matrix Color: 10YR 2/1 Mottle Colors: ___
Other hydric soil indicators: ___
Is the hydric soil criterion met? Yes X No ___
Rationale: HISTOSOL

HYDROLOGY

Is the ground surface inundated? Yes ___ No X Surface water depth: ___
Is the soil saturated? Yes X No ___
Depth to free-standing water in pit/soil probe hole: SURFACE
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes X No ___
Rationale: SATURATED TO SURFACE

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes X No ___
Rationale for jurisdictional decision: ALL 3 CRITERIA MET

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): ALTMANN. Date: 3-3-95
Project/Site: LAKEPOINTE State: WA County: KING
Applicant/Owner: PIONEER TOWING Plant Community #/Name: TP #6
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes X No ___ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes X No ___ (If yes, explain on back) FILLED

VEGETATION

%COVER / ... ATUM / AGE		Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Species	Indicator Status	Stratum
* 90	1.	Rubus discolor	FACU	SHRUB	11.			
20	2.	Phalaris arundinacea	FACW	HERB	12.			
	3.				13.			
	4.				14.			
	5.				15.			
	6.				16.			
	7.				17.			
	8.				18.			
	9.				19.			
	10.				20.			

* Percent of dominant species that are OBL, FACW, and/or FAC 0%
Is the hydrophytic vegetation criterion met? Yes ___ No X
Rationale: < 50% FAC OR WETTER

SOILS

Series/phase: ___ Subgroup:[2] ___
Is the soil on the hydric soils list? Yes ___ No ___ Undetermined ___
Is the soil a Histosol? Yes ___ No X Histic epipedon present? Yes ___ No X
Is the soil: Mottled? Yes ___ No X Gleyed? Yes ___ No X
Matrix Color: FILL Mottle Colors: ___
Other hydric soil indicators: ___
Is the hydric soil criterion met? Yes ___ No X
Rationale: FILL

HYDROLOGY

Is the ground surface inundated? Yes ___ No X Surface water depth: ___
Is the soil saturated? Yes ___ No X
Depth to free-standing water in pit/soil probe hole: ___
List other field evidence of surface inundation or soil saturation. ___

Is the wetland hydrology criterion met? Yes ___ No X
Rationale: NO EVIDENCE OF SATURATION OR INUNDATION

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ___ No X
Rationale for jurisdictional decision: NO CRITERIA MET.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

Wetland and Buffer Functions and Semi-quantitative Performance Assessment

Wetland # LAKEPOINTE Wetland A Staff PLH, JBL Date 2/18/97

Location S T R

Function	Criteria Group 1 — 1 pt	Group 2 — 2 pts	Group 3 — 3 pts
Flood/ Storm Water Control N/A points 5 (max 15)	✓ size < 5 acres – riverine or lakeshore wetland ✓ < 10 % forested cover ✓ unconstrained outlet ✓ located in lower 1/3 of the drainage	__ size 5-10 acres __ mid-sloped wetland __ 10 - 30 % forested cover __ semi-constrained outlet __ located in middle 1/3 of the drainage	__ size > 10 acres __ depressions, headwaters, bogs, flats __ > 30 % forested cover __ culvert/bermed outlet __ located in upper 1/3 of the drainage
Base Flow/ Ground Water Support N/A points 5 (max 15)	✓ size < 5 acres ✓ riverine or lakeshore wetland ✓ located in lower 1/3 of the drainage __ temporally flooded or saturated N/A no flow-sensitive fish populations on-site or downstream	__ size 5-10 acres __ mid-sloped wetland __ located in middle 1/3 of the drainage ✓ seasonally or semi-permanently flooded or saturated __ low flow-sensitive fish populations on-site or downstream	__ size > 10 acres __ depressions, headwaters, bogs, flats __ located in upper 1/3 of the drainage __ permanently flooded or saturated, or intermittently exposed __ high flow-sensitive populations contiguous with site in highly permeable strata
Erosion/ Shoreline Protection points 5 (max 9)	__ sparse grass/herbs or no veg along OHWM ✓ wetland extends < 30 m from OHWM ✓ highly developed shoreline or subcatchment	__ sparse wood or veg along OHWM __ wetland extends 30 - 60 m from OHWM __ moderately developed shoreline or subcatchment	✓ dense wood or veg along OHWM __ wetland extends > 200 m from OHWM __ undeveloped shoreline or subcatchment
Water Quality Improvement points 6 (max 12)	N/A rapid flow through site __ < 50 % veg cover __ upstream in basin from wetland is undeveloped ✓ holds < 25 % overland runoff	__ moderate flow through site ✓ 50 - 80 % cover __ ≤ 50% of basin upstream from wetland is developed __ holds 25 - 50 % overland runoff	__ slow flow through site __ > 80 % veg cover ✓ > 50% of basin upstream from wetland is developed __ holds > 50 % overland runoff

N/A = Not Applicable, N/I = No information available

Dominant Vegetation: reed canary grass, blackberry, willow

Wildlife: Canada goose nests, great blue heron foraging in the littoral zone

Wetland and Buffer Functions and Semi-quantitative Performance Assessment

Vetland # Lakepointe Wetland B Staff PLH/JSi Date 3/18/97

ocation S T R

Function	Criteria		
	Group 1 — 1 pt	Group 2 — 2 pts	Group 3 — 3 pts
Flood/ Storm Water Control points 4 (max 15)	✓ size < 5 acres ✓ riverine or lakeshore wetland N/A < 10 % forested cover ✓ unconstrained outlet ✓ located in lower 1/3 of the drainage	__ size 5-10 acres __ mid-sloped wetland __ 10 - 30 % forested cover __ semi-constrained outlet __ located in middle 1/3 of the drainage	__ size > 10 acres __ depressions, headwaters, bogs,flats __ > 30 % forested cover __ culvert/bermed outlet __ located in upper 1/3 of the drainage
Base Flow/ Ground Water Support N/A points 5 (max 15)	✓ size < 5 acres ✓ riverine or lakeshore wetland ✓ located in lower 1/3 of the drainage __ temporally flooded or saturated N/A no flow-sensitive fish populations on-site or downstream	__ size 5-10 acres __ mid-sloped wetland __ located in middle 1/3 of the drainage ✓ seasonally or semi-permanently flooded or saturated __ low flow-sensitive fish populations on-site or downstream	__ size > 10 acres __ depressions, headwaters, bogs,flats __ located in upper 1/3 of the drainage __ permanently flooded or saturated, or intermittently exposed __ high flow-sensitive populations contiguous with site in highly permeable strata
Erosion/ Shoreline Protection points 4 (max 9)	__ sparse grass/herbs or no veg along OHWM ✓ wetland extends < 30 m from OHWM ✓ highly developed shoreline or subcatchment	✓ sparse wood or veg along OHWM __ wetland extends 30 - 60 m from OHWM __ moderately developed shoreline or subcatchment	__ dense wood or veg along OHWM __ wetland extends > 200 m from OHWM __ undeveloped shoreline or subcatchment
Water Quality Improvement points 7 (max 12)	✓ rapid flow through site __ < 50 % veg cover __ upstream in basin from wetland is undeveloped ✓ holds < 25 % overland runoff	__ moderate flow through site ✓ 50 - 80 % cover __ ≤ 50% of basin upstream from wetland is developed __ holds 25 - 50 % overland runoff	__ slow flow through site __ > 80 % veg cover ✓ > 50% of basin upstream from wetland is developed __ holds > 50 % overland runoff

A = Not Applicable, N/I = No information available

ominant Vegetation: reed canary grass

Wildlife:

Wetland and Buffer Functions and Semi-quantitative Performance Assessment

Lakepointe Wetland B

Natural Biological Support points 14 (max 36)	✓ size < 5 acres ✓ ag land, low veg structure ✓ seasonal surface water ✓ one habitat type PAB POW PEM PSS PFO EST ✓ low plant diversity (< 6 species) ✓ > 50 % invasive species __ low primary productivity ✓ low organic accumulation ✓ low organic export ✓ few habitat features ✓ buffers very disturbed __ isolated from upland habitats	__ size 5 - 10 acres __ 2 level veg __ permanent surface water __ two habitat types PAB POW PEM PSS PFO EST __ moderate plant diversity (7-15 species) __ 10 to 50 % invasive species ✓ moderate primary productivity __ moderate organic accumulation __ low organic export __ some habitat features __ buffers slightly disturbed ✓ partially connected to upland habitats	__ size > 10 acres __ high veg structure __ open water pools through summer __ ≥ 3 habitat types PAB POW PEM PSS PFO EST __ high plant diversity (> 15 species) __ < 10% invasive species __ high primary productivity __ high organic accumulation __ high organic export __ many habitat features __ buffers not disturbed __ well connected to upland habitats
Overall Habitat Functions points 3 (max 9)	✓ size < 5 acres ✓ low habitat diversity ✓ low sanctuary or refuge	__ size 5-10 acres __ moderate habitat diversity __ moderate sanctuary or refuge	__ size > 10 acres __ high habitat diversity __ high sanctuary or refuge
Specific Habitat Functions points 6 (max 15)	__ low invertebrate habitat ✓ low amphibian habitat ✓ low fish habitat ✓ low mammal habitat ✓ low bird habitat	✓ moderate invertebrate habitat __ moderate amphibian habitat __ moderate fish habitat __ moderate mammal habitat __ moderate bird habitat	__ high invertebrate habitat __ high amphibian habitat __ high fish habitat __ high mammal habitat __ high bird habitat
Cultural/ Socioeco-nomic points 7 (max 21)	✓ low educational opportunities ✓ low aesthetic value ✓ lacks commercial fisheries, agriculture, renewable resources ✓ lacks historical or archeological resources ✓ lacks passive and active recreational opportunities ✓ privately owned ✓ not near open space	__ moderate educational opportunities __ moderate /aesthetic value __ moderate commercial fisheries, agriculture, renewable resources __ historical or archeological site __ some passive and active recreational opportunities __ privately owned, some public access __ some connection to open space	__ high educational opportunities __ high aesthetic value __ high commercial fisheries, agriculture, renewable resources __ important historical or archeological site __ many passive and active recreational opportunities __ unrestricted public access __ directly connected to open space

Notes:

Wetland and Buffer Functions and Semi-quantitative Performance Assessment

Lakepointe Wetland A

Natural Biological Support points 18 (max 36)	✓ size < 5 acres __ ag land, low veg structure ✓ seasonal surface water __ one habitat type PAB POW PEM PSS PFO EST __ low plant diversity (< 6 species) __ > 50 % invasive species __ low primary productivity ✓ low organic accumulation ✓ low organic export ✓ few habitat features ✓ buffers very disturbed __ isolated from upland habitats	__ size 5 - 10 acres ✓ 2 level veg __ permanent surface water ✓ two habitat types PAB POW PEM PSS PFO EST ✓ moderate plant diversity (7-15 species) ✓ 10 to 50 % invasive species (at least) ✓ moderate primary productivity __ moderate organic accumulation __ low organic export __ some habitat features __ buffers slightly disturbed ✓ partially connected to upland habitats	__ size > 10 acres __ high veg structure __ open water pools through summer __ ≥ 3 habitat types PAB POW PEM PSS PFO EST __ high plant diversity (> 15 species) __ < 10% invasive species __ high primary productivity __ high organic accumulation __ high organic export __ many habitat features __ buffers not disturbed __ well connected to upland habitats
Overall Habitat Functions points 3 (max 9)	✓ size < 5 acres ✓ low habitat diversity ✓ low sanctuary or refuge	__ size 5-10 acres __ moderate habitat diversity __ moderate sanctuary or refuge	__ size > 10 acres __ high habitat diversity __ high sanctuary or refuge
Specific Habitat Functions points 6 (max 15)	✓ low invertebrate habitat ✓ low amphibian habitat ✓ low fish habitat ✓ low mammal habitat __ low bird habitat	__ moderate invertebrate habitat __ moderate amphibian habitat __ moderate fish habitat __ moderate mammal habitat ✓ moderate bird habitat	__ high invertebrate habitat __ high amphibian habitat __ high fish habitat __ high mammal habitat __ high bird habitat
Cultural/ Socioeconomic points 7 (max 21)	✓ low educational opportunities ✓ low aesthetic value ✓ lacks commercial fisheries, agriculture, renewable resources ✓ lacks historical or archeological resources ✓ lacks passive and active recreational opportunities ✓ privately owned ✓ not near open space	__ moderate educational opportunities __ moderate /aesthetic value __ moderate commercial fisheries, agriculture, renewable resources __ historical or archeological site __ some passive and active recreational opportunities __ privately owned, some public access. __ some connection to open space	__ high educational opportunities __ high aesthetic value __ high commercial fisheries, agriculture, renewable resources __ important historical or archeological site __ many passive and active recreational opportunities __ unrestricted public access __ directly connected to open space

Notes:

APPENDIX B

Fisheries & Water Quality Data Collected During Spring 1996 & Spring 1997 for Lakepointe Development

LAKEPOINTE FISHERIES STUDIES - MARCH THROUGH JUNE 1996

29 March 1996 (Evening Backpack Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	1	155
rainbow trout	0	
northern squawfish	10	60,40,55,50,35,40,40,78,65,55
largemouth bass	1	95
pumpkinseed	7	50,50,55,55,50,55,50
prickly sculpin	14	70,70,55,85,80,60,75,50,35,55,50,45,40, one individual escaped
three-spine stickleback	13	80,75,70,80,75,65,60,70,65,70,75,75,75
Pacific lamprey	2	NM
w. brook lamprey	0	
brown bullhead	1	62
yellow perch	0	
largescale sucker	0	
Lakeshore		
chinook salmon	0	
coho salmon	0	
sockeye salmon	1	33
cutthroat trout	1	140
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	X	
three-spine stickleback	X	
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Sammamish River		
chinook salmon	1	61
coho salmon	4	48,45,44,45
sockeye salmon	2	32,30
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	X	
three-spine stickleback	X	
Pacific lamprey	0	
w. brook lamprey	1	70
brown bullhead	0	
yellow perch	0	
largescale sucker	0	

X - Species was collected, but not enumerated.
NM - Not measured

LAKEPOINTE FISHERIES STUDIES - MARCH THROUGH JUNE 1996

12 April 1996 (Evening Backpack Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	2	48,48
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	1	140
northern squawfish	7	54,61,65,53,65,70,45
largemouth bass	0	
pumpkinseed	2	118,45
prickly sculpin	20	65,58,60,71,60,53,45,30,68,70,81,71,28,30,85,60,109,93,59,76
three-spine stickleback	37	75,68,70,65,70,63,65,70,75,60,69,69,74,70,68,71,73,66,70,75,68,69,69,71 70,55,66,70,75,66,64,63,65,62,66,69,74
Pacific lamprey	2	NM
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Lakeshore		
chinook salmon	0	
coho salmon	2	50,93
sockeye salmon	2	45,30
cutthroat trout	2	125,135
rainbow trout	1	140
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	24	97,93,66,90,55,85,55,63,63,60,81,58,57,83,80,88,78,70,93,85,90,95,45,35
three-spine stickleback	17	62,64,75,69,75,65,69,67,63,70,65,69,67,75,66,70,70
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Sammamish River		
chinook salmon	0	
coho salmon	1	45
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	27	60,50,50,60,85,85,66,55,75,74,52,78,60,54,85,73,80,55,55,80,74,51,48,76 81,42,109,48,63,47,69,75,65,42
three-spine stickleback	6	70,73,60,65,63,76
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	

NM - Not measured

12 April 1996 (Evening Seining)

	Number	Lengths (mm)
Lakeshore		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	3	72,55,60
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	5	NM
three-spine stickleback	2	55,70
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Sammamish River		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	X	
three-spine stickleback	X	
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	

X - Species was collected, but not enumerated.
NM - Not measured

29 April 1996 (Evening Backpack Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	1	160
northern squawfish	13	60,55,50,60,53,51,45,46,45,45,52,62,52
largemouth bass	1	90
pumpkinseed	11	106,89,97,90,99,110,45,50,45,118,80,58,46,81,102,78,61,50,55,45
prickly sculpin	31	130,60,91,56,55,95,90,71,59,70,59,71,84,89,118,80,58,46,81,102,78,61,50,55 45,101,72,65,85,95,40
three-spine stickleback	40	71,71,73,70,65,73,69,68,71,66,70,71,67,70,70,70,70,71,66,67,68,71,71,70 70,70,65,70,70,70,70,71,70,70,71,70,75,68,71,73
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Lakeshore		
chinook salmon	0	
coho salmon	1	65
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	17	88,100,65,58,34,34,66,95,80,90,76,75,88,75,68,78,75
three-spine stickleback	7	66,70,63,72,62,63,68
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Sammamish River		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	2	150,128
rainbow trout	1	215
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	37	70,126,53,100,65,64,78,34,65,38,68,95,80,55,55,48,58,60,89,74,65,73,70,50,35 56,50,56,79,77,35,65,83,50,80,41,39
three-spine stickleback	14	76,73,70,67,70,70,70,74,67,70,68,71,78,66
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	1	78

6 May 1996 (Evening Backpack Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	1	64
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	16	46,43,52,36,36,35,39,55,37,47,47,70,46,47,57,41
largemouth bass	0	
pumpkinseed	3	91,55,41
prickly sculpin	38	60,100,94,51,62,73,66,51,48,70,50,44,59,30,49,94,91,65,56,109,55,105,90,59 53,53,59,55,73,85,95,64,48,46,70,55,55,43
three-spine stickleback	54	75,70,71,66,68,76,71,75,72,66,67,74,71,71,73,69,76,61,72,72,72,69,72,70,69,69 70,69,66,65,69,71,72,68,69,70,69,69,69,50,71,70,67,70,64,74,69,70,76,70,69,66
Pacific lamprey	1	NM
w. brook lamprey	0	
brown bullhead	2	61,143
yellow perch	0	
largescale sucker	0	
Lakeshore		
chinook salmon	0	
coho salmon	4	110,110,110,100
sockeye salmon	2	53,55
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	37	100,96,64,55,67,79,75,45,52,35,78,35,63,35,35,80,78,90,73,66,65,90,99,121 65,80,75,79,44,81,84,50,55,42,71,54,59
three-spine stickleback	14	70,62,70,69,72,78,70,71,70,67,70,77,73,73
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Sammamish River		
chinook salmon	0	
coho salmon	2	120,100
sockeye salmon	1	61
cutthroat trout	2	148,150
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	45	97,77,54,71,72,89,68,74,45,60,83,121,60,55,82,80,66,55,58,59,75,43,45,65,38,8 70,66,67,51,50,71,46,83,70,67,34,87,53,56,80,53,75,68
three-spine stickleback	16	70,77,73,73,74,71,69,71,72,76,70,72,65,61,64,68,69,68,66,67
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	

NM - Not measured

LAKEPOINTE FISHERIES STUDIES - MARCH THROUGH JUNE 1996

6 May 1996 (Evening Seining)

	Number	Lengths (mm)
Lakeshore		
chinook salmon	0	
coho salmon	1	126
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	0	
three-spine stickleback	1	77
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	

26 May 1996 (Daytime Snorkeling)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	60	152-203
cutthroat trout	0	
rainbow trout	2	355,355
northern squawfish	0	
largemouth bass	2	152,102
pumpkinseed	0	
prickly sculpin	0	
three-spine stickleback	TNC	NM
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	3	127,127,127
largescale sucker	0	
Lakeshore		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	1	140
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	0	
three-spine stickleback	TNC	NM
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	14	80-150
largescale sucker	0	
Sammamish River		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	2	127-178
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	1	178
prickly sculpin	6	NM
three-spine stickleback	17	NM
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	

TNC - Too numerous to count
NM - Not measured

27 May 1996 (Evening Backpack Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	1	145
rainbow trout	2	140,130
northern squawfish	5	50,50,60,60,50
largemouth bass	1	100
pumpkinseed	6	65,65,42,64,50,50
prickly sculpin	9	35,75,50,45,50,30,55,50,55
three-spine stickleback	26	78,65,80,70,75,75,70,70,75,75,80,70,75,75,75,70,70,80,85,80,75,70,65,70 70,75
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Lakeshore		
chinook salmon	7	85,90,80,85,90,90,80
coho salmon	5	115,110,135,90,120
sockeye salmon	1	50
cutthroat trout	2	165,155
rainbow trout	1	130
northern squawfish	1	80
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	11	110,60,90,90,40,35,90,80,60,60,60
three-spine stickleback	22	60,75,75,80,75,75,80,80,75,80,80,75,85,70,70,80,75,80,80,75,70,65
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	4	85,80,95,80
largescale sucker	0	
Sammamish River		
chinook salmon	1	100
coho salmon	0	
sockeye salmon	0	
cutthroat trout	5	150,135,160,135,130
rainbow trout	4	130,140,145,130
northern squawfish	1	45
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	10	70,60,90,70,60,41,135,90,45,120
three-spine stickleback	2	70,75
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	1	220
largescale sucker	0	

30 May 1996 (Daytime Backpack Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	6	50,41,40,43,30,40
largemouth bass	0	
pumpkinseed	4	54,52,52,49
prickly sculpin	29	57,122,60,60,62,70,70,62,53,53,67,53,56,43,85,76,44,66,76,40,48,35,98,73 59,65,55,42,44
three-spine stickleback	9	71,75,76,56,77,63,76,64,74
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Lakeshore		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	9	47,60,70,98,101,71,67,33,44
three-spine stickleback	3	72,80,61
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Sammamish River		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	7	34,45,34,97,79,72,46
three-spine stickleback	3	72,68,71
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	

14 June 1996 (Daytime Backpack Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	10	63,73,56,51,65,42,65,71,52,44
largemouth bass	0	
pumpkinseed	3	55,50,60
prickly sculpin	26	80,97,70,87,75,63,62,41,27,59,65,76,47,48,55,63,43,31,72,73,73,110,57,35 90,86
three-spine stickleback	8	80,68,23,23,23,23,23,25
Pacific lamprey	2	NM
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Lakeshore		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	24	44,31,23,25,53,73,25,25,27,49,27,28,27,30,80,53,51,47,24,48,28,26,24,16
three-spine stickleback	5	71,75,74,68,20
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
Sammamish River		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	8	49,59,46,48,39,43,24,27
three-spine stickleback	3	66,76,68
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	

NM - Not measured

LAKEPOINTE FISHERIES STUDIES - MARCH THROUGH JUNE 1996

24 June 1996 (Evening Backpack Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	1	120
rainbow trout	1	140
northern squawfish	2	49,65
largemouth bass	1	120
pumpkinseed	4	73,44,60,91
prickly sculpin	24	30,53,59,90,72,73,62,42,70,78,68,63,55,50,59,52,55,44,71,90,57,76,82,80
three-spine stickleback	11	65,70,67,70,69,75,68,80,78,71,20
Pacific lamprey	2	NM
w. brook lamprey	0	
brown bullhead	1	70
yellow perch	0	
largescale sucker	0	
Lakeshore		
chinook salmon	3	79,115,115
coho salmon	0	
sockeye salmon	0	
cutthroat trout	4	67,67,64,60
rainbow trout	0	
northern squawfish	7	62,65,76,77,76,83,66
largemouth bass	0	
pumpkinseed	1	98
prickly sculpin	26	70,85,115,110,80,90,97,58,50,58,22,120,79,100,110,76,80,68,55,80,99,108,87,1 85,43
three-spine stickleback	7	64,73,79,70,80,72,70
Pacific lamprey	1	NM
w. brook lamprey	0	
brown bullhead	0	
yellow perch	1	80
largescale sucker	0	
Sammamish River		
chinook salmon	1	110
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	1	130
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	15	90,64,48,85,68,97,95,85,75,95,62,79,99,93,58
three-spine stickleback	4	73,71,76,80
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	

NM - Not measured

LAKEPOINTE FISHERIES STUDIES - APRIL THROUGH MAY 1997

29 April 1997 (Evening Boat Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	2	120,130
sockeye salmon	5	45,45,50,45,50
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	0	
three-spine stickleback	2	70,60
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	1	125
black crappie	1	235

29 April 1997 (Evening Gillnetting)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	1	350
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	0	
three-spine stickleback	0	
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	0	
tench	1	350

12 May 1997 (Evening Boat Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	85	125,115,110,115,140,110,130,125,165,120,135,130,110,105,130, 130
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	0	
three-spine stickleback	6	NM
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	3	200,250,170
black crappie	1	170

12 May 1997 (Evening Gillnetting)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	1	420
rainbow trout	0	
northern squawfish	3	420,430,470
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	0	
three-spine stickleback	0	
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	1	255
yellow perch	0	
largescale sucker	2	480,480
tench	2	270,330

NM - Not measured

19 May 1997 (Evening Boat Electrofishing)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	1	90
coho salmon	6	70,50,100,65,65,60
sockeye salmon	2	45,70
cutthroat trout	0	
rainbow trout	0	
northern squawfish	1	120
largemouth bass	0	
pumpkinseed	0	
prickly sculpin	1	85
three-spine stickleback	1	70
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	3	175,160,140
yellow perch	1	75
largescale sucker	0	
black crappie	0	
peamouth	2	200,150
cyprinidae	1	40

19 May 1997 (Evening Gillnetting)

	Number	Lengths (mm)
Inner Harbor		
chinook salmon	0	
coho salmon	0	
sockeye salmon	0	
cutthroat trout	0	
rainbow trout	0	
northern squawfish	0	
largemouth bass	0	
pumpkinseed	1	160
prickly sculpin	0	
three-spine stickleback	0	
Pacific lamprey	0	
w. brook lamprey	0	
brown bullhead	0	
yellow perch	0	
largescale sucker	3	500,340,530
tench	1	500

LAKEPOINTE WATER QUALITY DATA - APRIL THROUGH MAY 1997

16 April 1997 (1230 hours)

Location: Easternmost corner of inner harbor at overhanging cement deck (water depth 13 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	14.2	9.9	NM	NM
7	12.9	9	NM	NM
12	12.5	9.2	NM	NM

16 April 1997 (1315 hours)

Location: Center of inner harbor at northwest corner of bulkhead along south shoreline (water depth 15 ft)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	15.1	8.5	NM	NM
7	12.5	9.5	NM	NM
13	12.5	9.3	NM	NM

16 April 1997 (1345 hours)

Location: Westernmost corner of inner harbor at floating barge (water depth 8 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	13.8	9.6	NM	NM
7	12.5	9.8	NM	NM

25 April 1997 (1400 hours)

Location: Easternmost corner of inner harbor at overhanging cement deck (water depth 14 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	13.6	9	NM	NM
7	12.9	8.8	NM	NM
13	12.6	8.1	NM	NM

25 April 1997 (1420 hours)

Location: Center of inner harbor at northwest corner of bulkhead along south shoreline (water depth 16 ft)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	13.2	7.9	NM	NM
7	13	7.4	NM	NM
15	12.8	7.2	NM	NM

25 April 1997 (1430 hours)

Location: Westernmost corner of inner harbor at floating barge (water depth 8 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	13.3	8.6	NM	NM
7	12.9	7.7	NM	NM

NM - Not measured

LAKEPOINTE WATER QUALITY DATA - APRIL THROUGH MAY 1997

29 April 1997 (2140 hours)

Location: North Lake Washington near Metro monitoring station 0804 (water depth 13.5 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	12.2	10.4	7.5	110.8
2	12.2	10.2	7.3	108.9
3	12.2	10.1	7.3	109.6
4	12.2	10.1	7.2	110.4
5	12.2	10.1	7.2	110.3
6	12.2	10.1	7.2	110.4
7	12.2	10	7.2	109.9
8	12.1	9.8	7.2	108
9	12.1	10	7.2	107.7
10	12.1	10	7.2	107.2
11	12.1	9.8	7.2	107.2
12	12.1	9.9	7.2	107.2
13	12.1	9.8	7.2	107.2
13.5	12.1	9.8	7.2	108.8

29 April 1997 (2155 hours)

Location: Inner Harbor at mid-span of bulkhead along south shoreline (water depth 19 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	12.3	9.6	7.2	114.8
2	12.3	9.6	7.2	114.8
3	12.3	9.5	7.2	114.5
4	12.3	9.3	7.2	114.3
5	12.3	9.5	7.2	114.1
6	12.3	9.5	7.2	114
7	12.3	9.5	7.2	114
8	12.2	9.4	7.2	113.9
9	12.2	9.5	7.2	113.9
10	12.2	9.6	7.2	113.9
11	12.2	9.6	7.2	113.9
12	12.2	9.7	7.2	113.8
13	12.2	9.5	7.2	114.3
14	12.2	9.6	7.2	114.5
15	12.2	9.3	7.2	115.4
16	12.2	9.5	7.2	114.5
17	12.2	9.3	7.2	114.8
18	12.1	9.4	7.2	114.7
19	12.1	9.5	7.2	115.6

NM - Not measured

LAKEPOINTE WATER QUALITY DATA - APRIL THROUGH MAY 1997

12 May 1997 (2105 hours)

Location: North Lake Washington near Metro monitoring station 0804 (water depth 13.5 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	16.3	11.4	5.7	NM
2	15.8	11.6	6.2	NM
3	NM	NM	NM	NM
4	NM	NM	NM	NM
5	NM	NM	NM	NM
6	NM	NM	NM	NM
7	NM	NM	NM	NM
8	NM	NM	NM	NM
9	13.3	12.2	7.2	NM
10	13.3	10	7.4	NM
11	13.1	9.8	7.5	NM
12	13	9.9	7.7	NM
13	13	9.8	7.9	NM
13.5	12.9	9.8	8	NM

12 May 1997 (2210 hours)

Location: Inner Harbor at mid-span of bulkhead along south shoreline (water depth 18.5 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	16.3	11.1	7.7	NM
2	16.2	11.1	7.7	NM
3	15.9	11.2	7.7	NM
4	15.7	11.2	7.7	NM
5	15.6	11.3	7.7	NM
6	15.2	11.5	7.8	NM
7	14.9	11.4	7.8	NM
8	14.4	11.2	7.8	NM
9	14	11.4	7.8	NM
10	13.8	11.6	7.8	NM
11	13.1	11.4	7.8	NM
12	12.8	11.5	7.8	NM
13	12.3	11.3	7.9	NM
14	11.9	11.4	7.9	NM
15	10.8	11.5	8	NM
16	10.2	11.6	8	NM
17	10.2	11.4	8	NM
18	10.1	11.5	8.1	NM
18.5	10.1	11.5	8.1	NM

NM - Not measured

LAKEPOINTE WATER QUALITY DATA - APRIL THROUGH MAY 1997

19 May 1997 (2150 hours)

Location: North Lake Washington near Metro monitoring station 0804 (water depth 15.5 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	16	11.4	7.4	130.9
2	NM	NM	NM	NM
3	16	11.4	7.4	130.8
4	15.7	11	7.6	119.9
5	14.2	11.7	8.1	118.3
6	14.1	11.6	8.1	113.8
7	13.9	11.8	8.2	113.7
8	13.8	11.4	8.2	113.3
9	13.7	11.7	8.2	113.2
10	13.6	11.6	8.2	113.4
11	13.6	11.8	8.2	113.1
12	13.5	11.6	8.2	113.1
13	13.5	11.8	8.2	113
14	13.5	11.7	8.2	113.2
15	13.4	11.5	8.2	112.9
15.5	13.3	11.6	8.2	112.9

19 May 1997 (2100 hours)

Location: Inner Harbor at mid-span of bulkhead along south shoreline (water depth 18 feet)

Depth (ft)	Temperature (C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µmhos/cm)
1	15.9	10.9	6.5	126.4
2	NM	NM	NM	NM
3	15.7	11.1	6.8	126.5
4	15.7	11.2	7	127
5	15.6	10.9	7.2	125.7
6	14.9	11	7.2	123.1
7	14.9	10.9	7.3	125.5
8	14	11	7.5	118.6
9	13.8	11.6	7.6	120.2
10	13.7	11.2	7.6	117.9
11	13.4	11.3	7.7	117
12	13.1	11.2	7.8	115.6
13	12.9	11.5	7.8	115.6
14	12.6	11.3	7.8	113.6
15	12.4	11.2	7.9	113
16	12.3	11.1	7.9	111.4
17	12	11.2	7.9	111.3
18	11.9	11.2	7.9	111.2

NM - Not measured

SEATTLE WA MAR 22'96

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STATION 0804 - NORTH LAKE WASHINGTON WATER QUALITY

RECEIVED
MAR 25 1996
BEAK

County Department of Metropolitan Services
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e, WA 98104-1598

er Pollution Control Department
MS-81

Mr. Shugrue
Beak Consultants
12931
126th Pl.
Kirkland WA
98034

collectdate	Depth m	Temperature (Sample) deg C	Dissolved Oxygen mg/L	Ph-Field	Conductivity usiemens	Secchi m	Turbidity ntu	Alkalinity mg/L	Qual	NO2+NO3 mg/L	Qual	NH3 mg/L
2-Jan-90	1	7.7	10.4	7.6	89	3.3	1.1	39		0.284	<MDL	
13-Feb-90	1	6.2	11.7	7.5	90	2.7	2			0.34		0.014
5-Mar-90	1	8.2	12.2	6.7	82	1.8	2.5	40		0.65	<MDL	
21-Mar-90	1	9.7	11.7	7	82	1.6	2.5			0.46	<MDL	
2-Apr-90	1	10.4	13	7.9	101	2.8	1.7			0.37	<MDL	
16-Apr-90	1	12.7	12	7	85	2.6	1.9			0.22		0.024
7-May-90	1	12.5	11.6	7.1	94	2.1	1.4			0.14		0.013
21-May-90	1	15.4	10.6	6.4	85	1.9	1.5			0.13		0.013
4-Jun-90	1	15	10	8.1	78	3	1.2			0.042		0.039
10-Jul-90	1	24.1	10	7.7	100	3	1	35	<MDL			0.028
7-Aug-90	1	22.4	9.4	7.8	101	2	1.5		<MDL			0.013
4-Sep-90	1	20.1	9.1	7.4	110	2.5	1.5		<MDL		<MDL	
9-Oct-90	1	16.3	9.6	7.2	96	3.5	1.5	42	<MDL		<MDL	
6-Nov-90	1	12	9.8	6.7	105	4.3	0.5			0.094		0.016
8-Jan-91	1	6.1	11.4	7.2	83	3.6	1.1	35		0.28		0.012
6-Feb-91	1	5.7	10.6	6.8	98	0.5	6.7			0.89		0.031
4-Mar-91	1	7	10.5		74	0.5	8.6			1.1		0.032
18-Mar-91	1	8.2	11.6	7.5	98	1.8	3			0.61		0.011
1-Apr-91	1	10.2	12	7.3	112	2.2	2	44		0.53		0.012
15-Apr-91	1	10.2	11.2	6.9	102	1.5	3.4			0.52	<MDL	
14-May-91	1	13.5	11.4	8.3	103	2	1.4			0.21	<MDL	
28-May-91	1	14.5	11	8.6	112	2.1	1.7			0.21		0.01
11-Jun-91	1	14.3	10.2	7.5	101	2.6	1.5			0.19		0.015
1-Jul-91	1	19.2	9.7	7.5	110	6.2	1.2	41		0.17		0.026
6-Aug-91	1	20.5	9.6	8.2	125	2.5	1.5		<MDL			0.02
24-Sep-91	1	12	9.5	8	99	3.4	1.2		<MDL		<MDL	
7-Oct-91	1	16.2	9.3	8	93	3.7	1	38	<MDL			0.031
4-Nov-91	1	10.8	9.9	7.2	101	3.6	0.4			0.07	<MDL	
2-Dec-91	1	8.6	9.5	7.6	99	3.2	1.1			0.17	<MDL	
7-Jan-92	3	7.2	10	7.4	97		1.7	36				
23-Mar-92	5	8.4	9.8	7.3	96							
7-Jan-92	1	7.6	9.9	7.4	97	3.6	1.7	36		0.23		0.015
4-Feb-92	1	7.9	10.3	7.1	105	1.5	3			0.88		0.032
4-Feb-92	3	7.9	10.2	7.1	106		3.3			0.99		0.033
2-Mar-92	1	9.8	10.4	7.1	112	2	2			0.52		0.015
2-Mar-92	3	9.7	10.4	7.1	112		1.8			0.58		0.014
23-Mar-92	1	10.1	10.7	7.2	119	3	1.5			0.4		0.022
23-Mar-92	3	9.9	10.7	7.3	116		1.5			0.39		0.015
6-Apr-92	1	10.9	11	8	99	2.4	1	38		0.13		0.012
6-Apr-92	3	10.8	10.9	8	105		1.1	37		0.13		0.012
20-Apr-92	1	13.7	10.8	7.9	104	1.5	2.3			0.15		0.012

20-Apr-92	3	13.3	10.9	8.2	104		2.3			0.15		0.016
4-May-92	1	15	10	7.3	106	3.2	0.8			0.16		0.013
4-May-92	3	12.1	9.8	7.5	94		0.5			0.097		0.034
18-May-92	1	16.1	11.1	8	100	1.7	1.2			0.07		0.017
18-May-92	3	16.1	11	8	100		1.2			0.068		0.011
1-Jun-92	1	18.4	9.9	7.7	96	2.8	5.4		<MDL			0.021
1-Jun-92	3	15.7	9.1	7.4	89		4			0.082		0.042
6-Jul-92	1	20.5	9	8.2	105	3.6	0.4	36	<MDL			0.038
6-Jul-92	3	20.5	9	8.2	105		0.3	38	<MDL			0.027
3-Aug-92	1	22.1	9	7.9	106	3.5	0.5		<MDL		<MDL	
3-Aug-92	3	22	9.1	8.2	104		0.4		<MDL		<MDL	
8-Sep-92	1	19.2	8.9	8.2	101	3.5	0.7		<MDL			0.01
8-Sep-92	3	19.2	9.3	8.7	102		0.6		<MDL		<MDL	
5-Oct-92	1	16.8	8.5	7.7	97	4.1	0.5	41		0.095		0.019
5-Oct-92	3	16.8	8.5	7.7	96		0.3	39		0.073		0.015
2-Nov-92	1	13.6	9.4	7.5	97	4.5	0.3			0.12		0.024
2-Nov-92	3	13.5	9.3	7.5	97		0.3			0.12		0.024
3-May-93	1	12.35	9.76	7.2	107	2.9	1.8			0.38		0.051
3-May-93	8	11.48	9.19	7.88	98		1.1			0.16		0.033
25-May-93	1	15.37	9.95	8.13	101	3	0.5			0.12	<MDL	
25-May-93	8	14.82	9.94	8.02	100					0.32	<MDL	
7-Jun-93	1	18.32	9.61	8.01	101	2.1	0.7			0.06	<RDL	0.01
7-Jun-93	8	18.25	9.18	7.66	108		0.9			0.062	<MDL	
6-Jul-93	1	19.14	9.53	8.18	100	2	0.9	41		0.032	<MDL	
6-Jul-93	8	18.77	8.88	7.56	104		2.2	44		0.082	<RDL	0.01
2-Aug-93	1	19.4	8.83	7.57	107	1.7	2.6			0.092		1.6
2-Aug-93	8	17.58	7.8	7.38	97		0.8			0.053		0.046
7-Sep-93	1	20.16	8.89	8.14	108	3	0.8			0.014	<MDL	
7-Sep-93	8	19.48	6.72	7.2	110		1.1			0.035		0.028
4-Oct-93	1	18.2	9.42	7.84	105	3	1.3	22	<MDL		<MDL	
4-Oct-93	8	17.91	9.09	7.59	113		1.5	46		0.024	<MDL	
1-Nov-93	1	14.63	9.74	7.59	106	5.2				0.026	<RDL	0.007
1-Nov-93	8	14.59	9.71	7.59	106					0.025	<MDL	
7-Dec-93	1	9.01	9.69	7.18	102	6				0.15	<MDL	
7-Dec-93	8	8.49	9.56	7.16	102		0.8			0.19	<MDL	
5-Jan-94	1	7.99	9.83	7.45	99	4.2		38		0.18	<MDL	
5-Jan-94	4	7.98	9.8	7.44	101							
5-Jan-94	8	7.95	9.84	7.43	102			38		0.27	<MDL	
4-Jan-93	1	6.3	11.3	7.21	104	2.8	0.6	37		0.31	<MDL	
4-Jan-93	3	6.27	11.21	7.19	103		0.8	36		0.25	<MDL	
15-Feb-94	1	7.01	11.16	7.45	98.9	2.8	0.7			0.22	<MDL	
15-Feb-94	4	7	11.1	7.46	100.2							
15-Feb-94	8	7	11.11	7.47	101.4		0.7			0.25	<MDL	
7-Mar-94	1	7.58	10.48	7.21	108.6	2	2.2			0.57	<MDL	

7-Mar-94	8	7.3	10.31	7.1	117.3		3			[illegible]	<MDL	
21-Mar-94	1	7.81	11.6	7.65	103.2	2	1.2			0.22	<MDL	
21-Mar-94												
21-Mar-94	8	7.78	11.63	7.66	105.1		1.7			0.22	<MDL	
4-Apr-94	1	9.96	13	8.62	104.4	2	0.9			0.134	<MDL	
4-Apr-94												
4-Apr-94	8	9.89	13.06	8.67	104.3		0.8			0.124	<MDL	
18-Apr-94	1	12.68	12.41	8.4	112.2	2	1.3			0.27	<MDL	
18-Apr-94												
18-Apr-94	8	9.55	10.85	7.75	102		0.9			0.153	<MDL	
2-May-94	1	13.66	11.68	8.74	116.7	2.7	0.9	43	<RDL	0.085	<MDL	
2-May-94												
2-May-94	4	13.56	11.56	8.76	116.8							
2-May-94	8	13.38	11.56	8.86	113.7		0.7	41	<RDL	0.061	<MDL	
23-May-94	1	16.46	10.4	8.12	124	2.8	1			0.105	<MDL	
23-May-94												
23-May-94	4	15.6	10.49	8.74	111.6							
23-May-94	8	14.14	10.25	8.46	109.1		0.7		<MDL		<MDL	
6-Jun-94	1	16.88	10.18	8.46	105.4	3.2	0.7		<MDL		<MDL	
6-Jun-94												
6-Jun-94	4	16.79	10.19	8.52	104.8							
6-Jun-94	8	16.84	10.16	8.48	105.7		0.6		<MDL		<MDL	
5-Jul-94	1	18.31	9.45	7.88	115.8	3	1	44	<MDL		<MDL	
5-Jul-94												
5-Jul-94	4	17.47	9.17	8.03	108							
5-Jul-94	8	16.37	8.56	7.58	107.4			40	<MDL		<MDL	
3-Aug-94	1	22.08	9.36	8.3	110.1	3	0.7		<MDL		<MDL	
3-Aug-94												
3-Aug-94	4	21.96	9.37	8.31	110.2							
3-Aug-94	8	21.04	8.64	8.04	105.8		0.8		<MDL		<MDL	
1-Feb-93	1	6.82	10.72	7.04	105	3.7				0.26	<MDL	
1-Feb-93	8	6.46	10.01	6.96	112					0.35	<MDL	
6-Sep-94	1	20.71	8.8	8.01	100.3	5			<MDL		<MDL	
6-Sep-94												
6-Sep-94	4	20.33	8.88	8.08	101.4							
6-Sep-94	8	20.12	8.33	7.73	106.3		0.6		<MDL		<MDL	
3-Oct-94	1	18.4	9	7.75	109	5		43	<MDL		<RDL	0.02
3-Oct-94												
3-Oct-94	4	18.37	8.91	7.75	110							
3-Oct-94	8	18.07	8.9	7.73	110.8		0.5	44	<MDL		<MDL	
2-Nov-94	1	13.65	9.4	7.53	103.4	4.5	0.5		<MDL		<MDL	
2-Nov-94												
2-Nov-94	4	13.65	9.34	7.52	103.9							
2-Nov-94	8	13.56	9.32	7.51	104.2				<MDL		<MDL	

5-Dec-94	1	8.5	10.01	7.33	106.2	5				0.141	<MDL
5-Dec-94											
5-Dec-94	5	8.44	9.92	7.31	106.5						
5-Dec-94	8	8.1	9.99	7.29	107.4					0.145	<MDL
18-Jan-95	1	7.14	10.72	7.83	91	4	0.9	39		0.279	<MDL
18-Jan-95											
18-Jan-95	4	7.13	10.72	7.77	92.4						
18-Jan-95	8	7.02	10.7	7.66	95.1		1.1	40		0.37	<MDL
6-Feb-95	8	7.62	10.45	7.15	113.7		2.1			0.558	<MDL
6-Feb-95											
6-Feb-95	1	7.99	10.71	7.15	118.7	2	2.5			0.65	<MDL
6-Feb-95	4	7.94	10.62	7.13	118.9						
6-Mar-95							1.5				
6-Mar-95	8	6.7	11.2	7.33	108.3					0.356	<MDL
6-Mar-95											
6-Mar-95							1.1				
6-Mar-95	1	6.89	11.53	7.45	99.7	3.5				0.276	<MDL
6-Mar-95	4	6.81	11.24	7.4	102.7						
20-Mar-95	1	8.97	11.67	7.45	104.4	2	1.7			0.36	<MDL
20-Mar-95	4	9.04	11.45	7.42	106.1						
20-Mar-95	8	9	11.38	7.4	106.2		1.5			0.337	<MDL
20-Mar-95											
1-Mar-93	1	6.41	11.27	7.54	103	3.8				0.23	<MDL
1-Mar-93	8	6.39	11.17	7.55	101					0.25	<MDL
3-Apr-95	1	10.66	13.57	8.24	106.3	2	1.2	42		0.244	<MDL
3-Apr-95	4	10.15	12.44	8.12	103.2						
3-Apr-95	8	9.6	12.45	8.16	99.3		1.2	39	<RDL	0.094	<MDL
3-Apr-95											
3-Apr-95	3	10.27	12.58	8.19	103.4						
17-Apr-95	1	10.29	11.71	7.99	104.3	2.5	1.3			0.139	<MDL
17-Apr-95	4	10.29	11.66	7.93	105.3						
17-Apr-95	8	10.24	11.58	7.84	106.1		1.2			0.143	<MDL
17-Apr-95											
1-May-95	1	13.67	13.47	9.02	105.2	2	1.5		<MDL		<MDL
1-May-95	4	12.74	13.31	9	101.5						
1-May-95	8	11.19	11.66	8.39	100.9		1		<MDL		<MDL
1-May-95											
15-May-95	1	15.96	10.65	8.53	108.7	3	0.9		<RDL	0.079	<MDL
15-May-95	4	14.2	10.91	8.93	102.9						
15-May-95	8	13.56	10.9	8.72	103.4		0.8		<MDL		<MDL
15-May-95											
6-Jun-95	1	18.47	10.4	8.8	101.5	4	0.8		<MDL		<MDL
6-Jun-95	4	18.45	10.31	8.78	102.1						
6-Jun-95	8	18.45	10.24	8.72	103		0.9		<MDL		<MDL

6-Jun-95												
11-Jul-95	1	20.7	9.55	8.15	108.6	3.5	0.8	40	<MDL		<MDL,E,IP	
11-Jul-95	4	20.39	9.58	8.22	107.9							
11-Jul-95	8	19.45	8.17	7.38	117.8		1.4	43	<RDL	0.076	E,IP	0.0418
11-Jul-95												
20-Jul-95	9											
20-Jul-95	10,9											
16-Mar-93	1	8.12	11.63	7.4	110	2	1.1			0.25	<RDL	0.01
16-Mar-93	8	7.66	11.54	7.53	103		1.2			0.19	<MDL	
2-Aug-95	1	19.77	9.72	8.07	101.7	2.5	0.9		<MDL		<MDL	
2-Aug-95	4	19.28	9.2	7.86	97.4							
2-Aug-95	8	18.85	8.85	7.72	96.7		0.5		<MDL		<MDL	
2-Aug-95												
11-Sep-95	1	20.43	9.55	7.96	116.3	3.5	0.9		<MDL		<MDL	
11-Sep-95	4	20.2	9.28	7.79	116.1							
11-Sep-95	8	19.52	7.84	7.36	123.5		1.3		<MDL		<RDL	0.039
11-Sep-95												
4-Oct-95	1	17.8	8.86	7.57	156	4.3	0.6	39.9	<MDL		<MDL	
4-Oct-95	4	17.74	8.87	7.57	153							
4-Oct-95	8	17.57	8.78	7.52	150		0.6	40	<MDL		<MDL	
4-Oct-95												
6-Nov-95	1	12.09	8.11	7.31	100.7	5.5			<RDL	0.052	<MDL	
6-Nov-95	4	12.08	8.07	7.3	104.1							
6-Nov-95	8	11.46	8.26	7.31	107.3		0.5		<RDL	0.065	<MDL	
6-Nov-95												
4-Dec-95	1	10.08	9.94	7.15	103.4	3	1.4			0.203	<RDL	0.029
4-Dec-95	4	10.02	9.85	7.15	104.1							
4-Dec-95	8	9.26	9.71	7.03	106.5		2.6			0.361	<RDL	0.036
4-Dec-95												
2-Jan-96	8	8.42	10.18	6.97	107.2		1.2	38.4		0.344	<MDL	
2-Jan-96												
2-Jan-96	1	8.44	10.33	6.98	105.9	3.5	1.2	38.2		0.343	<MDL	
2-Jan-96	4	8.42	10.21	6.98	106.8							
5-Apr-93	1	10.17	12.07	7.92	112	2.1	1.8	40		0.22	<MDL	
5-Apr-93	8	9.15	12.37	8.56	102		1.4	39		0.12	<MDL	
6-Feb-96	8	5.63	11.09	6.9	101.6		5.9			0.518	<RDL	0.034
6-Feb-96												
6-Feb-96	1	6.71	10.9	7.04	100.9	1.5	3			0.355	<RDL	0.02
6-Feb-96	4	6.6	10.84	7.02	101.9							
5-Mar-96							1			0.335	<MDL	
5-Mar-96							1.2			0.331	<MDL	
19-Apr-93	1	11.43	9.87	7.3	112	2	1.6			0.44		0.034
19-Apr-93	8	10.58	11.15	8.46	101		1.2			0.11	<RDL	0.02
1-Dec-92	1	9.62	9.8	7.26	103	4.2	0.8			0.14		0.028

1-Dec-92	3	9.24	10.09	7.35	102	0.5	0.14	0.029

collectdate	Depth m	Qual	TN mg/L	Qual	Orthop	Qual	Total P	Qual	Chlorophyll-A	Qual	Phaeo	Qual	Fecal	Qual	Enterococcus
2-Jan-90	1				0.015		0.018		0.59		2.29		45	E	8
13-Feb-90	1				0.014		0.024		0.88		0.15		40		41
5-Mar-90	1				0.01		0.034		1.53		1.25	E	17	E	6
21-Mar-90	1				0.01		0.035		2.16		3.68		35	E	9
2-Apr-90	1			<MDL			0.03						52	E	13
16-Apr-90	1				0.006		0.031						43	E	14
7-May-90	1			<MDL			0.018		4.57		8.68	E	13	E	2
21-May-90	1			<MDL			0.027		6.76		1.88		30	E	9
4-Jun-90	1			<MDL			0.016		3.38		3.72	E	7	E	2
10-Jul-90	1			<MDL			0.017		5.97		0.78	E	4	<MDL	
7-Aug-90	1				0.006		0.024		3.56		2.25	E	11	E	1
4-Sep-90	1				0.006		0.036		2.92		2.04	E	18	E	2
9-Oct-90	1			<MDL			0.013		4.15		1.87	E	8	<MDL	
6-Nov-90	1				0.008		0.021		2.94		3.23	E	3	E	12
8-Jan-91	1				0.009		0.025		1.38		0.55	E	15	E	8
6-Feb-91	1				0.008		0.058		1.17		1.09	>	60	>	80
4-Mar-91	1				0.019		0.075		1.34		0.53	>	200	>	267
18-Mar-91	1			<MDL			0.034		4.77		1.14		25	E	8
1-Apr-91	1				0.01		0.036		4.77		1.65	E	20	E	7
15-Apr-91	1				0.008		0.037		6.85		3.08	E	122		49
14-May-91	1				0.005		0.024		10.4		1.43		30	E	1
28-May-91	1				0.009		0.024		7.64		3.88		27	E	1
11-Jun-91	1			<MDL			0.031		4.41		3.3	E	59	E	14
1-Jul-91	1			<MDL			0.022		2.61		1.5	E	8	<MDL	
6-Aug-91	1			<MDL			0.024		5.14		1.54	E	6	E	1
24-Sep-91	1			<MDL			0.015		2.94		2	E	8	<MDL	
7-Oct-91	1			<MDL			0.016		2.88		1.96	E	2	E	1
4-Nov-91	1			<MDL			0.007		4.2		1.09	E	3	E	1
2-Dec-91	1				0.006		0.019		2.26		2.88	E	12	E	8
7-Jan-92	3														
23-Mar-92	5														
7-Jan-92	1				0.015		0.017		1.76		0.7		25	E	5
4-Feb-92	1				0.018		0.042		2.35		0.32	E	191		52
4-Feb-92	3				0.019		0.048								
2-Mar-92	1				0.012		0.031		6.17		2.06		38		24
2-Mar-92	3				0.013		0.03								
23-Mar-92	1				0.011		0.047		3.82		0.29		28	E	11
23-Mar-92	3				0.009		0.034								
6-Apr-92	1			<MDL			0.022		8.81		4.76	E	17	E	4
6-Apr-92	3			<MDL			0.023								
20-Apr-92	1			<MDL			0.034		8.22		5.76	E	100	E	21

20-Apr-92	3	<MDL		0.034				
4-May-92	1	<MDL		0.026	1.76	3.58	49 E	4
4-May-92	3	<MDL		0.014				
18-May-92	1	<MDL		0.023	7.64	1.2 E	4 E	1
18-May-92	3	<MDL		0.028				
1-Jun-92	1	<MDL		0.012	1.76	3.17	21 E	4
1-Jun-92	3	<MDL		0.016				
6-Jul-92	1		0.008	0.011	2.57	1.28 E	21 E	3
6-Jul-92	3	<MDL		0.011				
3-Aug-92	1	<MDL		0.012	1.76	1.32 E	1 <MDL	
3-Aug-92	3	<MDL		0.011				
8-Sep-92	1		0.007	0.019	2.94	3.82 <MDL	E	2
8-Sep-92	3		0.012	0.041				
5-Oct-92	1	<MDL		0.017	2.1	0.84 E	8 E	11
5-Oct-92	3	<MDL		0.035				
2-Nov-92	1	<MDL		0.016	3.23	0.06 E	3 E	3
2-Nov-92	3	<MDL		0.014				
3-May-93	1	0.58	0.017	0.033	2.1	0.9	51	20
3-May-93	8	0.34	0.011	0.015				
25-May-93	1	0.33	0.007	0.015	3.6	0.61	10	1
25-May-93	8	0.31	0.007	0.015				
7-Jun-93	1	0.33	0.007	0.022	4.8	5.9	8	9
7-Jun-93	8	0.36	0.007	0.025				
6-Jul-93	1	0.36 <MDL		0.034			3	1
6-Jul-93	8	0.42 <RDL	0.004	0.048				
2-Aug-93	1	0.34	0.005	0.085	0.55	5.8	52	12
2-Aug-93	8	0.25 <RDL	0.004	0.05				
7-Sep-93	1	0.28	0.005	0.014	1.5	9.1	5	22
7-Sep-93	8	0.28	0.01	0.022				
4-Oct-93	1	0.23 <MDL		0.012	2	2.6	2	0
4-Oct-93	8	0.26 <RDL	0.002	0.014				
1-Nov-93	1	0.23 <RDL	0.003 <RDL	0.008	1.6	4.3	7	1
1-Nov-93	8	0.24 <RDL	0.003	0.01				
7-Dec-93	1	0.24	0.007 <MDL		0.5	3	1	3
7-Dec-93	8	0.27	0.01 <MDL					
5-Jan-94	1	0.29	0.015	0.02 <MDL		6.1	36	4
5-Jan-94	4							
5-Jan-94	8	0.4	0.017	0.021				
4-Jan-93	1		0.017	0.035	6.2	1.5	17	6
4-Jan-93	3		0.016	0.033				
15-Feb-94	1	0.37	0.016	0.021	2.2	0.39	44	23
15-Feb-94	4							
15-Feb-94	8	0.37	0.016	0.02				
7-Mar-94	1	0.72	0.015	0.036	5.2	0.56	18	12

7-Mar-94	8	1		0.019		0.041				
21-Mar-94	1	0.42		0.0081		0.026	10	2.7	14	18
21-Mar-94							11	2.5		
21-Mar-94	8	0.44		0.011		0.029				
4-Apr-94	1	0.37	<MDL			0.021	28	2.4	26	8
4-Apr-94							17	2.4		
4-Apr-94	8	0.33	<RDL	0.0024		0.025				
18-Apr-94	1	0.59	<RDL	0.0032		0.028	19	2.5	6	4
18-Apr-94							22	2		
18-Apr-94	8	0.38	<RDL	0.0032		0.016				
2-May-94	1	0.34	<MDL			0.027	13	2.3	17	2
2-May-94							13	2.5		
2-May-94	4									
2-May-94	8	0.31	<MDL			0.022				
23-May-94	1	0.53	<RDL	0.0044		0.029	6.1	1.1	12	5
23-May-94							6.4	1.8		
23-May-94	4									
23-May-94	8	0.59	<MDL			0.018				
6-Jun-94	1	0.17	<MDL			0.012	5.8	1.2	0	0
6-Jun-94							4.6	1.5		
6-Jun-94	4									
6-Jun-94	8	0.18	<MDL			0.013				
5-Jul-94	1	0.32	<MDL			0.024	5.8	1.4	7	0
5-Jul-94							4.7	2		
5-Jul-94	4									
5-Jul-94	8	0.23	<MDL			0.014				
3-Aug-94	1	0.22		0.0334		0.026	2.2	0.72	1	0
3-Aug-94							2.1	0.7		
3-Aug-94	4									
3-Aug-94	8	0.2	<RDL	0.0033		0.02				
1-Feb-93	1			0.015		0.017	1.1	1.7	17	2
1-Feb-93	8			0.013	<MDL					
6-Sep-94	1	0.21	<RDL	0.0042		0.029	1.9	0.38	3	3
6-Sep-94							2.2	0.27		
6-Sep-94	4									
6-Sep-94	8	0.23	<RDL	0.0037		0.021				
3-Oct-94	1	0.25		0.0057		0.018	2.3	0.35	5	0
3-Oct-94							2.4	0.65		
3-Oct-94	4									
3-Oct-94	8	0.2		0.00602		0.018				
2-Nov-94	1	0.23	<MDL			0.017	3.4	1.5	3	4
2-Nov-94							3.6	0.81		
2-Nov-94	4									
2-Nov-94	8	0.23	<MDL			0.012				

5-Dec-94	1	0.35		0.00938	0.022		3.7		1.2	[illegible]	[illegible]
5-Dec-94							3.1		0.61		
5-Dec-94	5										
5-Dec-94	8	0.33		0.0109	0.02						
18-Jan-95	1	0.5		0.0166	0.026		3.6		0.83	12	6
18-Jan-95							3.9		0.68		
18-Jan-95	4										
18-Jan-95	8	0.66		0.0173	0.03						
6-Feb-95	8	0.78		0.0202	0.05						
6-Feb-95							2		1.2		
6-Feb-95	1	0.9		0.0203	0.048		1.7		1.3	46	40
6-Feb-95	4										
6-Mar-95											
6-Mar-95	8	0.61		0.0124	0.048						
6-Mar-95							3.3		1.1		
6-Mar-95										9	0
6-Mar-95	1	0.42		0.0127	0.036		3.2		1.2		
6-Mar-95	4										
20-Mar-95	1	0.76		0.00705	0.036		7.7		0.89	28	10
20-Mar-95	4										
20-Mar-95	8	0.69		0.00866	0.038						
20-Mar-95							9.4		1.2		
1-Mar-93	1		<RDL	0.005	0.046		4.1	<MDL		2	0
1-Mar-93	8		<MDL		0.03						
3-Apr-95	1	0.62	<MDL		0.029		17		2.5	10	5
3-Apr-95	4										
3-Apr-95	8	0.39	<MDL		0.023						
3-Apr-95							19		1.9		
3-Apr-95	3										
17-Apr-95	1	0.47	<MDL		0.026					16	2
17-Apr-95	4										
17-Apr-95	8	0.45	<MDL		0.029						
17-Apr-95							17		3.4		
1-May-95	1	0.33	<MDL		0.0209		23		3.8	12	6
1-May-95	4										
1-May-95	8	0.29	<RDL	0.0021	0.0163						
1-May-95							23		2.7		
15-May-95	1	0.35	<MDL		0.0175					15	2
15-May-95	4										
15-May-95	8	0.21	<MDL		0.015						
15-May-95							2.9		1.1		
6-Jun-95	1	0.3	<MDL		0.0259	R		R		2	0
6-Jun-95	4										
6-Jun-95	8	0.28	<RDL	0.0025	0.0157						

-Jun-95								
11-Jul-95	1	0.26 <MDL	<RDL	0.0092	3.6	0.34	8	1
11-Jul-95	4							
11-Jul-95	8	0.33 <RDL	0.0041	0.025				
11-Jul-95					3.9	0.48		
20-Jul-95	9							
20-Jul-95	10,9			436				
16-Mar-93	1		0.015	0.029	9.1 <MDL		15	2
16-Mar-93	8		0.013	0.031				
2-Aug-95	1	0.25 <RDL	0.0029	0.027	3.3	0.74	6	2
2-Aug-95	4							
2-Aug-95	8	0.17 <MDL		0.011				
2-Aug-95					4.3	1.1		
11-Sep-95	1	0.29 <RDL	0.0026				1	1
11-Sep-95	4							
11-Sep-95	8	0.23	0.00514					
11-Sep-95					4.4	0.83		
4-Oct-95	1	0.24 <MDL		0.015			16	25
4-Oct-95	4							
4-Oct-95	8	0.18 <RDL	0.0025	0.021				
4-Oct-95					2	0.36		
6-Nov-95	1	0.23 <RDL	0.0026	0.0105			13	0
6-Nov-95	4							
6-Nov-95	8	0.21 <RDL	0.0044 <RDL	0.0087				
6-Nov-95								
4-Dec-95	1	0.4	0.011	0.015			44	19
4-Dec-95	4							
4-Dec-95	8	0.61	0.015	0.032				
4-Dec-95					1.4	0.68		
2-Jan-96	8	0.59	0.026	0.023				
2-Jan-96					1.8	0.49		
2-Jan-96	1	0.57	0.013	0.032			53	22
2-Jan-96	4							
5-Apr-93	1	0.5 <RDL	0.007	0.039	12	2.8	35	18
5-Apr-93	8	0.38 <MDL		0.023				
6-Feb-96	8	0.79	0.014	0.084				
6-Feb-96					1.3	0.52		
6-Feb-96	1	0.54	0.017	0.052			70	110
6-Feb-96	4							
5-Mar-96		0.54	0.012	0.025				
5-Mar-96		0.52	0.012	0.024			3	2
19-Apr-93	1	0.9	0.019	0.061	4.1 <MDL		41	3
19-Apr-93	8	0.39	0.009	0.027				
1-Dec-92	1		0.013	0.026	5.1	0.39	5	2

1-Dec-92	3	0.013	0.027