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1997 CAPITOL LAKE DRAWDOWN MONITORING RESULTS

Capitol Lake Adaptive Management Plan

November 1997

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OLYMPIA, WASHINGTON

Prepared for

Capitol Lake Adaptive Management Plan
Steering Committee

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INTRODUCTION

The purpose of this memoradum is to provide technical information concerning the environmental effects of partially draining the freshwater in Capitol Lake (drawdown) and allowing marine water to enter a portion of the lake for a short time (1 to 3 weeks). Occasional drawdown and refilling of the lake, as facilitated by operation of the dam on the north basin, has usually been conducted each year since 1968.

A multi-jurisdiction Steering Committee is overseeing the preparation of the Capitol Lake Adaptive Management Plan. This plan will guide the future management of Capitol Lake, including operation of the dam. In order to make decisions for the management plan, dam operations for lake drawdown have been modified and monitored in 1996 and 1997 to see if environmental effects could be made more compatible with wetland habitat mitigation proposed as part of Heritage Park.

This memorandum describes the results of the monitoring program for the 1997 Capitol Lake drawdown. The monitoring program was described in detail in a previous memorandum and agreed to by the members of the Technical Advisory Committee, a multi-jurisdictional body who provides technical advice to the Steering Committee. The monitoring program was separated into seven elements:

1. Salinity Monitoring in the North and Middle Basins
2. Fish Stranding Survey
3. Shoreline Vegetation and Large Woody Debris Assessment
4. Water Quality Sampling in Capitol Lake (one station in each of the three basins), Percival Creek, and Deschutes River
5. Aquatic Plant and Algal Mat Distribution and Density in Capitol Lake
6. Sedimentation
7. LOTT Coordination

HISTORY OF CAPITOL LAKE DRAWDOWN

Historically, Capitol Lake has been drained (drawn down) from its normal summer operating elevation of +6.4 feet mean sea level (MSL), to the tide gate sill elevation at -7.0 MSL, and then refilled with saltwater. The historic objectives for summer drawdown included:

1. Control of freshwater algae and aquatic plant growth (since 1968–1971) by saltwater toxicity.
2. Assist out-migration of juvenile salmonids (prior to 1985).

3. Facilitate construction and operation and maintenance activities associated with the lake, shoreline, and nearshore parks (includes drawdown for aerial photogrammetry).

Drawdown was performed up to 3 times a year (**CH2M Hill 1978**), with each episode spanning about 3 days. Under the right conditions, increased salinity levels extended up into the south basin and would typically last 3–5 weeks. It is estimated that up to 90 percent or more of the surface area of the lake would be impacted by high salinity. Prior to 1996, there was only one year, 1992, in which the lake was refilled with freshwater from the Deschutes River.

1996 DRAWDOWN PROCEDURE

In July of 1996, summer drawdown was modified to support the aquatic and wetland habitat mitigation plan for Heritage Park. Under the mitigation plan, it was necessary to maintain freshwater conditions (salinity less than 0.5 ppt) in the upper 5–6 feet (from +6.4 to +1.4 or +0.4 MSL) of the north basin, as well as most of the middle basin. To achieve this objective, the lake was drawn down to -3 feet MSL, refilled with saltwater to -1 foot MSL, and then allowed to refill the rest of the way with freshwater from the Deschutes River. This procedure resulted in discharging about 75 percent of the lake's freshwater volume into Budd Inlet compared to 100 percent in previous years. The intent of the drawdown plan was to limit saltwater influence from the lake bottom to elevation -1.0 foot MSL.

It was expected that the heavier saltwater would flow under the freshwater layer retained in the lake. It was also expected that some brackish water would be created during saltwater backfilling and that this brackish water layer would be sandwiched in between the heavier saltwater and the lighter freshwater. The plan to complete the filling with freshwater was intended to favor development of a freshwater layer above elevations -1.0 MSL. Freshwater, brackish, and saltwater salinity levels are given for reference below:

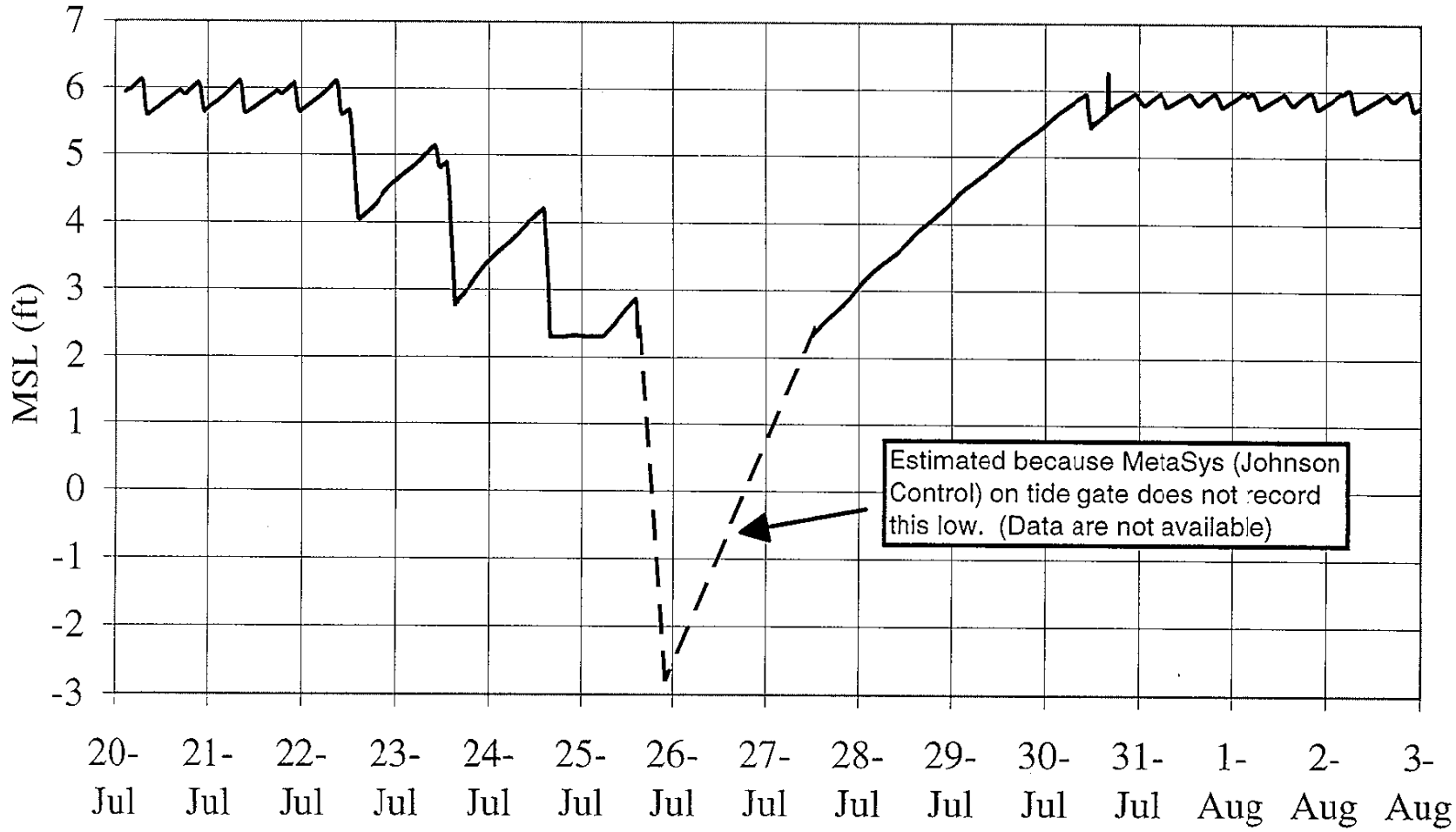
Freshwater: < 0.5 ppt
Brackish water: 0.5 to 8.3 ppt
Saltwater: > 8.3 ppt

Drawdown occurred over 18 days, between July 22 and August 8. It is unclear how the overall duration of drawdown for 1996 compared to drawdowns of previous years, but it may have taken longer due to the 5-day freshwater refill time.

1997 DRAWDOWN PROCEDURE

The 1997 drawdown procedure was performed to support the Heritage Park aquatic/wetland habitat mitigation plan. The procedures for the drawdown were similar to the 1996 drawdown procedure, except that the saltwater/freshwater refill operation was performed more slowly in accordance with recommendations by Herrera (**1996**). The lake level elevations are shown in **figure 1**. During drawdown, the flow rate in the Deschutes

Figure 1.
Capitol Lake Elevation During 1997 Drawdown



s:\env\97034-30\lakgraph.xls\chart2\jso

10/8/97

River was approximately 160 cubic feet per second (cfs) and was similar to the estimated flow rate of 150 cfs used to predict the time required to refill the lake. This compares to the average discharge of the Deschutes River of 114 cfs during July.

Drawdown occurred in steps over a four-day period starting July 22 at elevation +6.0 feet mean sea level (MSL) to elevation -3.0 feet MSL by the evening (estimated at 6 to 7:00 p.m.) of July 25, 1997. In the evening of July 25, saltwater was allowed to backfill the lake on the incoming tide. Once the lake reached -1.0 foot MSL (July 26), filling continued with freshwater from the Deschutes River and Percival Creek. No outflow occurred from this time until the lake returned to elevation +6.0 feet MSL on or about July 30, 1997.

MONITORING RESULTS

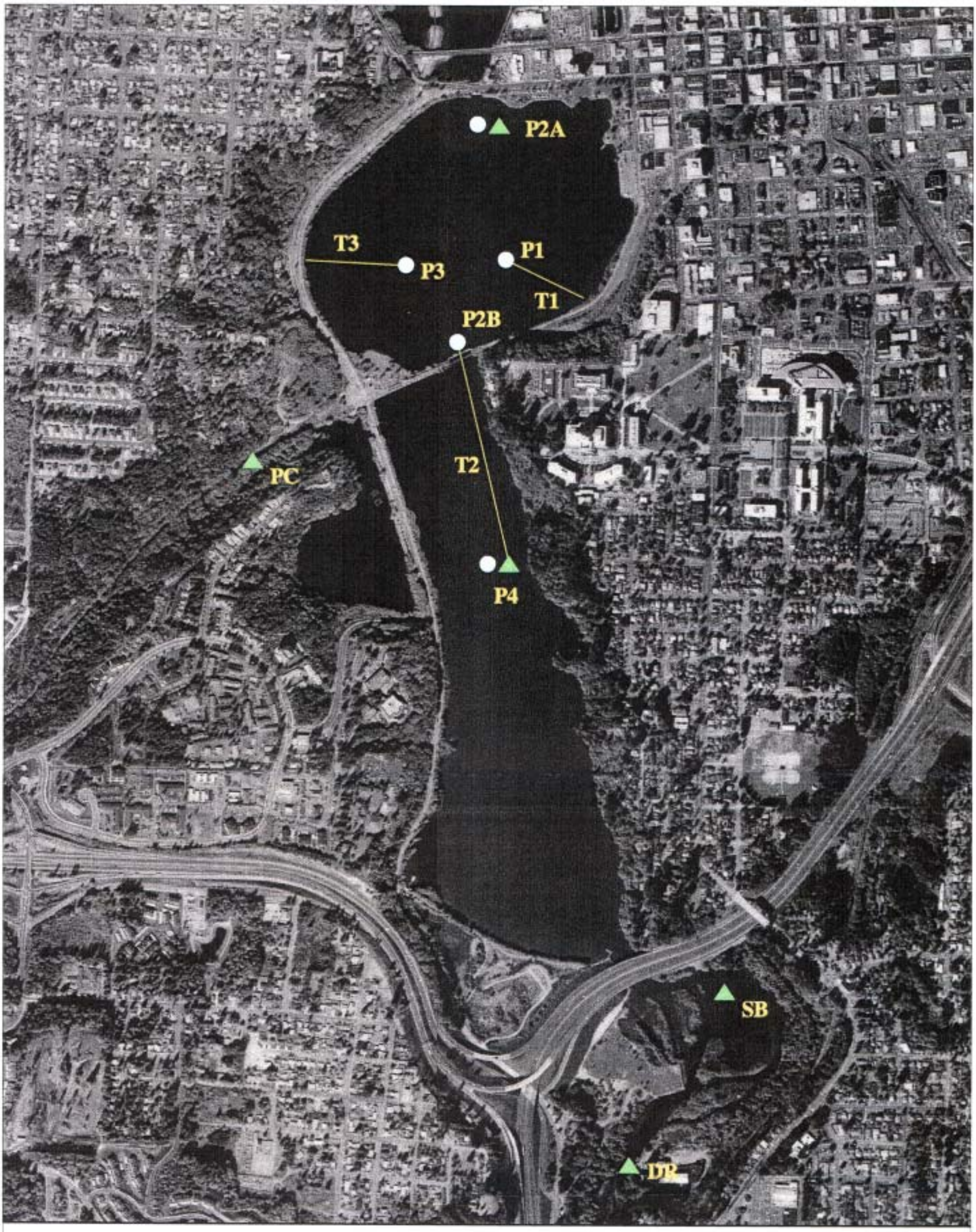
1. Salinity Monitoring in North and Middle Basins

The purpose of salinity monitoring was to document the extent of saltwater and brackish water in the North and Middle Basins of Capitol Lake before, during, and after the drawdown. The amount of saltwater affects the growth of nearshore aquatic plants, such as those recommended in the Heritage Park wetland mitigation plan. One goal of the 1997 drawdown was to maintain a freshwater layer in the nearshore area of the North Basin to support the proposed wetland mitigation for Heritage Park. The 1997 drawdown procedure represents a modification of normal operations procedure to retain freshwater in the northeast nearshore area.

Salinity monitoring was conducted five times between July 21 (predrawdown) and August 14, two weeks after backfilling. (Refer to **Appendix A** for the complete data set.) For comparison, the station locations were the same ones used in the 1996 drawdown monitoring (see **figure 2**). For the profile stations, salinity was measured at one-foot intervals. For the transect stations, salinity was measured at a distance of every 100 feet or every foot in depth, whichever occurs more frequently. The sampling dates of the salinity monitoring are listed in **table 1**.

Table 1
Salinity Monitoring Schedule

Date	Days Since Drawdown	Description	Measured Lake Level (MSL, feet)
July 21	Prior to	Before drawdown	5.8
July 26	5	One day after end of backfill with saltwater	0
July 30	9	End of refill with freshwater	5.6
August 6	17	One week after refilling	5.9
August 14	24	Two weeks after refilling	5.8



1997 DRAWDOWN -- WATER QUALITY STATIONS

Capitol Lake Adaptive Management Plan

Water Quality Stations

Salinity Monitoring Stations

Monitoring Transects

0 800 feet 1600 feet

Data Source: ENTRANCO 1997
Aerial Photos Taken August 1997
For copies of this map or for more information, please contact Thurston Regional Planning Council
(11/18/97, /trpc/projects/ga/ga97photomaps.aml)

Figure 2

In 1996, the drawdown procedure was modified in an attempt to achieve the nearshore freshwater conditions. Freshwater, brackish, and saltwater salinity levels were defined for the 1996 drawdown (**Herrera 1996**) and, for consistency, are used here as follows:

- Freshwater, less than 0.5 parts per thousand (ppt)
- Brackish water, 0.5 to 8.3 ppt
- Saltwater, greater than 8.3 ppt

On the day following backfilling (July 26), salinity levels indicated that the North Basin did retain freshwater in limited nearshore areas; however, the majority was brackish water and saltwater (**figure 3**). A one-foot freshwater layer occurred between +1 and 0 MSL, and brackish water occurred between 0 and -4 MSL. Saltwater was below -4 MSL, and it extended about 600 feet into the Middle Basin (**figure 3**).

The North Basin contained primarily freshwater (on a volumetric basis) by the time the lake returned to its normal operating elevation on July 30 (**figure 4**). The following salinity layers were measured in the North Basin on July 30:

- Freshwater: between +6 MSL and -3 MSL
- Brackish: between -3 MSL and -12 MSL
- Saltwater: below -12 MSL

In addition, there was very little saltwater intrusion into the Middle Basin.

The results from the 1997 drawdown are markedly different from those for the 1996 drawdown. For viewing purposes, **figures 4** and **5** are comparable. As shown in **figure 5**, there was no freshwater layer in the North Basin as a result of the drawdown procedure in 1996, even one week after refilling (August 7, 1996). In 1996, the North Basin contained primarily brackish water one week after refilling (**figure 5**). In contrast, an extensive freshwater layer was observed in the North Basin as a result of the modified drawdown procedure used in 1997.

It is apparent that the modified drawdown approach used for the 1997 drawdown met the goal of maintaining a freshwater zone to support the proposed wetland mitigation for Heritage Park.

1997 DRAWDOWN -- SALINITY ZONES AFTER 1 DAY *

Capitol Lake Adaptive Management Plan

Freshwater Zone: Located between +1 and 0 msl
(< 0.5 ppt salinity)

Brackish Zone: Located between 0 and -4 msl
(0.5 to 8.3 ppt salinity)

Saltwater Zone: Located below -4 msl
(> 8.3 ppt salinity)

0 800 feet 1600 feet

Data Source: ENTRANCO 1997
Aerial Photos Taken August 1993

For copies of this map or for more information, please contact Thurston Regional Planning Council (11/18/97, /trpc/projects/ga/ga97photomaps.aml)

Figure 3

*(July 26, 1997)

1997 DRAWDOWN -- SALINITY ZONES AFTER 5 DAYS*

Capitol Lake Adaptive Management Plan

Freshwater Zone: Located between +6 and -3 msl
(<0.5 ppt salinity)

Brackish Zone: Located between -3 and -12 msl
(0.5 to 8.3 ppt salinity)

Saltwater Zone: Located below -12 msl
(>8.3 ppt salinity)

0 800 feet 1600 feet

Data Source: ENTRANCO 1997
Aerial Photos Taken August 1993
For copies of this map or for more information, please contact Thurston Regional Planning Council (11/18/97, /trpc/projects/ga/ga97photomaps.aml)

Figure 4

*(July 30, 1997)

1996 DRAWDOWN -- SALINITY ZONES AFTER BACKFILLING

Capitol Lake Adaptive Management Plan

FRESHWATER ZONE: Located between +6 and +2 msl (Middle and South Basins only)
(<0.5 ppt salinity)

BRACKISH ZONE: Located between +2 and -3 msl
(0.5 to 8.3 ppt salinity)

SALTWATER ZONE: Located below -3 msl
(>8.3 ppt salinity)

0 800 feet 1600 feet

Aerial Photos Taken August 1993
For copies of this map or for more information, please contact Thurston Regional Planning Council (11/18/97, /trpc/projects/gaig97photomaps.aml)

Figure 5

Based on Herrera, 1996

2. Fish Stranding Survey

The annual "drawdown" at Capitol Lake has the side effect of potentially stranding fish in exposed shorelines, resulting in some mortality by environmental exposure and bird predation. Although conducting the drawdown in a sequential "bumping" (stepped process) manner reduces the degree of stranding, a survey of the shorelines during the drawdown to assess fish stranding is required as a general condition for approval of the Hydraulic Project Application (HPA) for the drawdown.

Fish stranding surveys were conducted in 1997 over approximately fifty percent of the lake to qualitatively assess the impact of the successive drawdown in water surface elevation of Capitol Lake on resident fish populations (see **Appendix B** for more details). Based on a qualitative visual survey, approximately 500 fish (such as three-spined sticklebacks, dace, and sculpins) were found dead due to stranding on the exposed shorelines and in isolated pools of the lake during the drawdown period. Only a few fish species of management interest (i.e., threatened/endangered salmonids) were detected or found in any of the stranded areas, namely juvenile coho salmon, sea run cutthroat trout, and Olympic mudminnow.

While up to 500 fish were found dead due to stranding exposure, active bird predation by numerous predatory birds was observed frequently, but could not be quantified by our surveys. Based on our observations, bird predation could easily represent the largest source of fish mortality due to stranding during the lake drawdown.

Three hundred and twenty fish (all less than four inches in length) were collected by electroshocking shoreline pools isolated during the drawdown. Fish of management interest—smallmouth bass (3), cutthroat trout (1), coho salmon (5), and Olympic Mudminnow (2)—were collected in isolated pools in Percival Cove. The Olympic Mudminnow is both a state and federal candidate for a rare, threatened or endangered species status because of its isolated geographic occurrence and vulnerability to habitat change. It is primarily found in the Chehalis River basin, the lower Deschutes River basin, and other smaller independent streams in Thurston County that drain into Puget Sound.

A similar fish stranding survey was conducted during the 1996 drawdown. The methods used in 1996 were similar to those used in 1997, including visual observation of fish stranded on exposed flats and electroshocking of fish found stranded in pools. The results were similar in the relative numbers of fish stranded, the species found stranded, and the high degree of predation by various birds and mammals. In both years, the total numbers of fish stranded were visually estimated in the hundreds or thousands (**J. Frasier, personal communication**). While the fish species captured in each year were similar, rainbow trout (*Oncorynchus mykiss*), carp (*Cyprinus carpio*), and the brackish water species starry founder (*Platichthys stellatus*) were observed in 1996 but not in 1997. Also, adult chinook salmon (*Onchorhynchus tshawytscha*) were stranded in Percival Cove in 1996 (**Herrara 1996**), but no chinook salmon (either adult or juvenile) were found in 1997. Conversely, several species were collected in 1997, that were not collected in 1996. These included speckled dace (*Rhinichthys osculus*), peamouth

(*Mylocheilus caurinus*), juvenile coho salmon (*Onchorhynchus kisutch*), smallmouth bass (*Micropterus dolomieui*), and unidentified frogs and crayfish.

3. Shoreline Habitat Assessment

The purpose of this monitoring element was to characterize the existing shoreline with respect to its functional habitat for fish and wildlife and with respect to erosion control.

A visual and photographic survey of lake shoreline conditions was performed on July 23 and 24, 1997 to assess shoreline habitat quality. This included a reconnaissance level survey of shoreline vegetation, erosion, and large woody debris. Both ground level and aerial photographs were used to characterize the shoreline as having high, medium, or low shoreline functional habitat (**figure 6**). Ground level photographs were taken when the lake was drawn down approximately 1–3 feet lower than normal (**figures 7** through **12**). Each habitat zone is defined below.

High Functional Shoreline Habitat

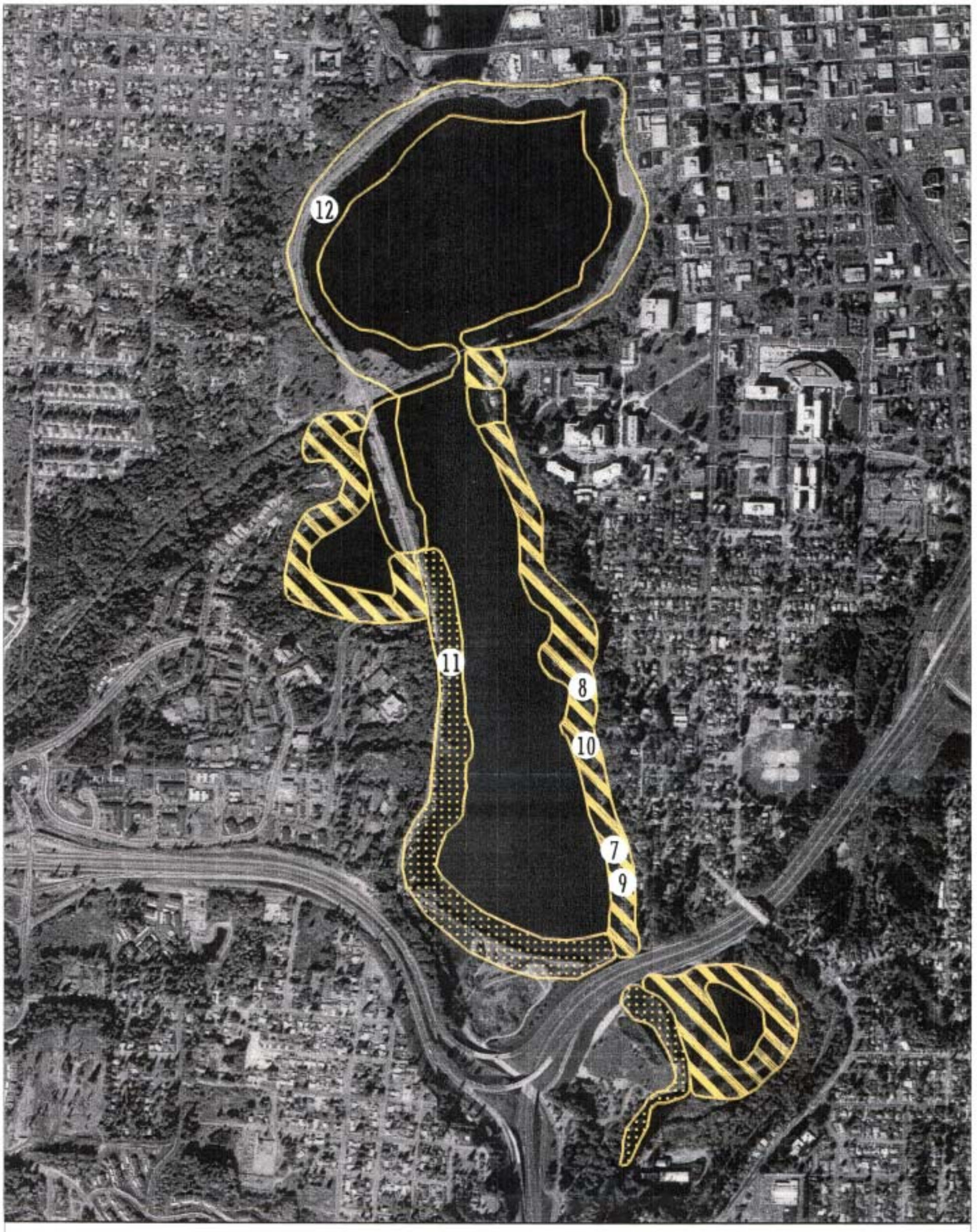
Shorelines of high functional habitat are those along the east shore of the south and middle basins and along the north, west, and south shores of Percival Cove (**figure 6**). These shorelines are dominated by dense stands of mature trees (red alder and big-leaf maple are the most common), and associated understory in a relatively broad buffer (up to 400 feet wide).

Much of this shoreline is characterized by mature overhanging shoreline trees, which provide some shading of the water column and also provide habitat structure for insect life (**figures 7** and **8**). Leaf fall from shoreline trees and shrubs, which fall or are blown into the lake, also serves as a source of:

- nutrient supply to algae and aquatic plants
- food supply, directly or indirectly, to benthic invertebrates (midge larvae, ostracods, amphipods, etc.), in the shallow nearshore zone of the lake

Both terrestrial insects and benthic invertebrates also contribute to the food supply of resident and anadromous fish.

The tree/shrub habitat zone supports a variety of mammals and birds such as deer, raccoon, beaver, muskrat, river otter, skunk, mink, mice, moles, and various birds such as bald eagle, osprey, great blue heron, sparrows, Stellar's jays, Oregon juncos, woodpeckers, sapsuckers, flickers, and kingfishers. Bald eagles have been observed in the south basin of Capitol Lake near Tumwater Historical Park (**J. Michaels, personal communication**).



1997 DRAWDOWN -- SHORELINE HABITAT ZONES

Capitol Lake Adaptive Management Plan

LOW FUNCTIONAL HABITAT : Sparse shoreline vegetation, absence of large woody debris, and a riprap shoreline.

MEDIUM FUNCTIONAL HABITAT : Immature shoreline vegetation and absence of large woody debris.

HIGH FUNCTIONAL HABITAT : Mature overhanging trees and shrub vegetation and presence of large woody debris along shoreline.

(7) Photo Number - See Figures 7-12

0 800 feet 1600 feet

Data Source: ENTRANCO 1997
Aerial Photos Taken August 1993
For copies of this map or for more information, please contact Thurston Regional Planning Council
(11/18/97, /trpc/projects/lge/lge97photomaps.aml)

Figure 6

Figure 7 - High Functional Shoreline Habitat
Heavily vegetated east shoreline of the middle basin.
View to the south and I-5 Freeway.

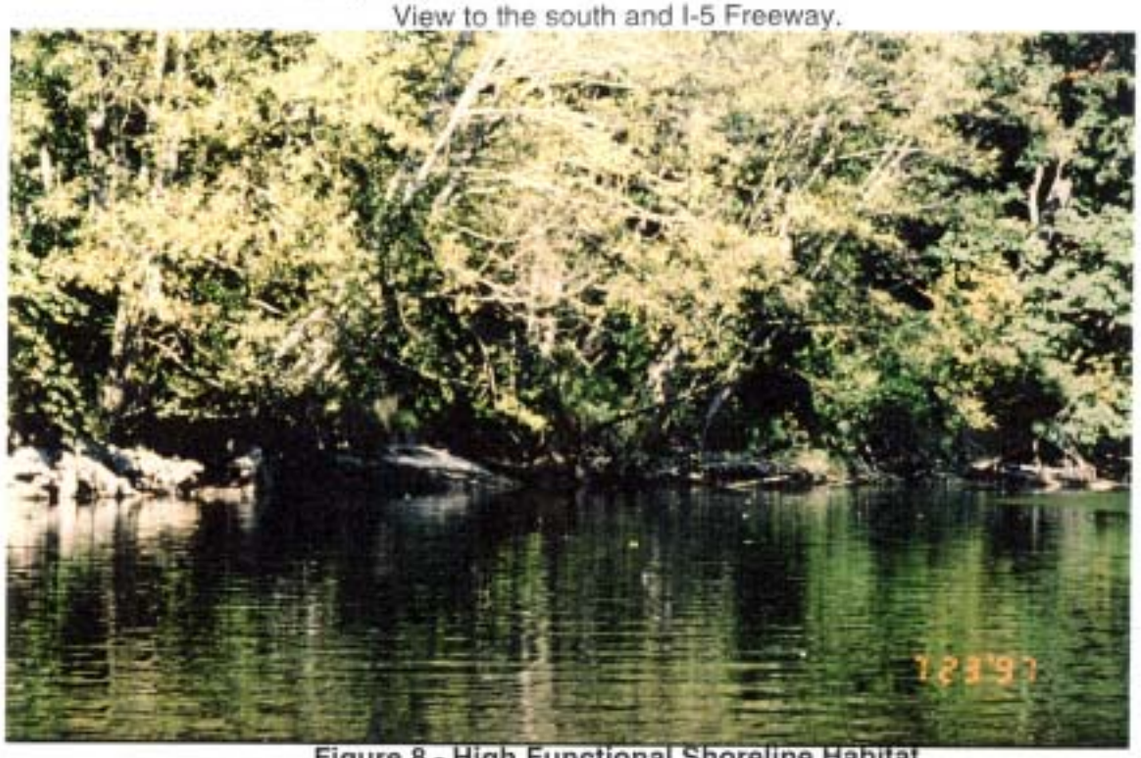


Figure 8 - High Functional Shoreline Habitat
Typical habitat along east shore of the middle basin. Mature deciduous trees overhanging water with large woody debris along shoreline edge.

Figure 9 - High Functional Shoreline Habitat
Another view of habitat along the east shore of the middle basin.
Cattails at shore's edge with mature shrubs and deciduous trees beyond.

Figure 10 - High Functional Shoreline Habitat
East shore of the middle basin showing nearshore wetland grasses
with mature shrubs and deciduous trees beyond.

Figure 11 - Medium Functional Shoreline Habitat
Shoreline habitat along western shore of the middle basin showing nearshore cattails. Off-shore aquatic plant beds and immature trees in the background.

Figure 12 - Low Functional Shoreline Habitat
Shoreline condition along the north basin showing riprap with upland grasses and sporadic immature deciduous trees.

The nearshore zone also supports a variety of waterfowl, including wood ducks, mergansers, goldeneyes, and mallards (**Entranco 1990**). A complete list of wildlife that inhabit the Capitol Lake area is presented in **Appendix C**. Many, if not most, of the wildlife listed in **Appendix C** make some use of the high functional habitat shoreline habitat for nesting, rearing, feeding, and cover.

Habitat diversity is exhibited in some high functional habitat shoreline zones where the tree/shrub canopy gives way to wetland grasses (primarily reed canarygrass) and cattail stands (**figures 9** and **10**). Other wildlife such as red-winged blackbirds and muskrats are more likely to occur in such areas.

Another important feature of the high functional habitat zone is the presence of large woody debris in the form of dead trees or branches which have accumulated along the shore. This is most evident in **figures 8** and **10**. This dead woody material provides several important functions:

- it provides haul-out/resting habitat for waterfowl and great blue herons
- it provides shade and cover for fish
- it provides shoreline erosion protection by absorbing wave energies before they reach the shoreline

Large patches of the aquatic plant *Elodea canadensis* (Common waterweed) are also prevalent in some nearshore areas of the high functional habitat zone. The floating leaves of this plant are faintly visible in **figures 7** and **10**. This plant contributes positively to lake ecology by providing:

- cover for small fish
- habitat and food supply for some aquatic insects
- food supply for some waterfowl
- enhanced dissolved oxygen production during daylight hours

Medium Functional Shoreline Habitat

Medium functional shoreline habitat occurs along the lower two thirds of the western shore of the middle basin and along the western shore of the south basin (**figure 6**). These shorelines are characterized by relatively young trees (estimated 5–20 years old) with limited over-water growth. Medium age trees (estimated 15–20 years old) are more common along the dike at the south end of the middle basin (Capitol Lake Interpretive Center) and occur in a relatively dense stand along the dike. Elsewhere, north of the dike, trees tend to be younger and more sparsely spaced along the shoreline (**figure 11**). Long stretches of this medium functional habitat have dense, but narrow, stands of

cattails along the waters edge and sparse-to-moderately-dense communities of *Elodea canadensis* in the shallow water adjacent to the shoreline (**figure 11**).

Finally, the medium functional habitat zone has very limited amounts of large woody debris along the shoreline. This is partly due to the absence of mature trees in this zone, and also partly due to the fact that wind and current patterns favor the accumulation of large woody debris on the eastern lake shore. Prevailing winds are west-to-east and the river channel, which carries large woody debris down from the upper watershed, flows close to the eastern shore of the lake.

Since the medium functional habitat is located in the narrow band of shore between Deschutes Parkway and the Capitol Lake Interpretive Center dike, it is deemed to have lower habitat functional than the broader high functional zone. This means there is less habitat space for birds and mammals to occupy and there is reduced cover and security. This is true even though the medium functional habitat zone is associated with densely forested uplands to the west of Deschutes Parkway. Wildlife in the medium functional zone is likely to be more frequently disturbed by human activities (automobiles and pedestrian traffic) along the Deschutes Parkway and the adjacent trail system.

Habitat value is also lower because there is less vegetation overhanging the water, so there is less opportunity for terrestrial insects to contribute to fish food supplies. There is also reduced nutrient input to the ecosystem from leaf fall and there is an obvious absence of large woody debris. Although the dense cattail stands serve to provide quite good shoreline erosion control, additional protection against erosion and additional habitat value for fish, waterfowl and other water birds, could be provided by large woody debris.

Low Functional Shoreline Habitat

As shown in **figure 6**, the entire north basin shoreline and the northern third of the west side of the middle basin is considered low habitat value. Vegetation along these shorelines is dominated by a combination of wetland and shoreline grasses and there are few trees (**figure 12**). In the vicinity of Marathon Park and the City of Olympia Park, natural grasses have been replaced by landscaped lawns and ornamental shrubs. Elsewhere, along limited shoreline reaches, the habitat is more similar to the medium value habitat zone—such as the narrow wetland edge along the southeast shore of the north basin (wetland S - **Washington State Department of General Administration 1997**).

The low value zones generally occupy a narrow band of land between the lake and existing roadways, parking areas, railroad tracks, and/or trails. Lack of good vegetative cover and the presence of considerable human activity (vehicular and pedestrian traffic) limits wildlife use of this zone. The one exception is the frequent and relatively heavy use of park lawns by Canadian geese.

Erosion control is provided by riprap along most of the shore (**figure 12**), which is functional, but provides little habitat for fish and wildlife compared to large woody debris.

The 1997 color aerial photo taken during drawdown indicates substantial growth of *Elodea canadensis* along the east-southeast shore and portions of the western shore of the north basin. The aquatic plant growth along the east-southeast shore can be considered part of the shoreline habitat zone and adds value for fish, waterfowl, and benthic invertebrate populations. Growth on the west side of the north basin seems to be primarily located in a deeper off-shore zone, but still contributes to improved fish and benthic habitat. The amount of *Elodea canadensis* in the north basin seems to be greater than in the recent past and may reflect an increase in plant colonization in response to reduced saltwater flushing during the past two summers.

4. Water Quality Monitoring in Capitol Lake

The purposes of water quality monitoring in Capitol Lake were to assess the:

- lake's current trophic status
- effectiveness of limited saltwater backfill as an algal control in the North Basin
- impact of saltwater backfill on the dissolved oxygen levels in the lake

Biweekly sampling of five stations began the day before drawdown and continued until late September, for a total of 6 trips (**table 2**). The station locations are shown in (**figure 2**). Surface (0.5 meter) discrete sample grabs were collected for algal nutrients (TP, NO_2+NO_3-N, SRP, NH_3), Chlorophyll *a* (chl *a*), and pH. Dissolved oxygen concentrations and temperature were measured at one-meter intervals. Secchi depths were also measured. Baseline data, (temperature, dissolved oxygen, pH, and nutrient parameters) were collected at Percival Creek and the Deschutes River. The Deschutes River station was located downstream of the brewery. (Refer to **Appendix A** for Water Quality Data.)

Trophic Status

The most common way lakes are classified is by their trophic state, which defines a lake in relation to the degree of biological productivity, nutrient productivity, nutrient levels, and water clarity (Secchi depth). High levels of algae, plant nutrients (such as phosphorus), and organic matter, and low water clarity characterize a lake that is eutrophic. Lakes with low levels of nutrients and algae and that have clear water are classified as oligotrophic. Eutrophication is a natural process that can be greatly accelerated by human activities in the watershed.

The data collected in this study indicate that Capitol Lake is eutrophic when compared to trophic criteria (**table 3**).

Table 2
Water Quality Monitoring Schedule

Monitoring Event	Date	Days since drawdown	Description
1	July 21	1 prior	Before drawdown
2	July 30	10	End of refill with freshwater
3	August 14	24	Two weeks after refilling
4	August 28	38	Four weeks after refilling
5	September 11	52	Six weeks after refilling
6	September 24	66	Eight weeks after refilling

Table 3
Trophic Data Summary for 1997 (July through September)

Trophic Parameter	Eutrophic Criteria[a]	North Basin Mean (Range)	Middle Basin Mean (Range)	South Basin Mean (Range)
Total phosphorus (µg/L)	>20	32 (21–47)	40 (21–58)	30 (27–40)
Chlorophyll *a* (µg/L)	>7	12 (4–24)	10 (4–21)	3 (2–8)
Secchi (m)	<2	2.1 (1.3–2.8)	1.4 (1.1–1.8)	[b]

Data Summary for six sampling dates, between July and September, 1997

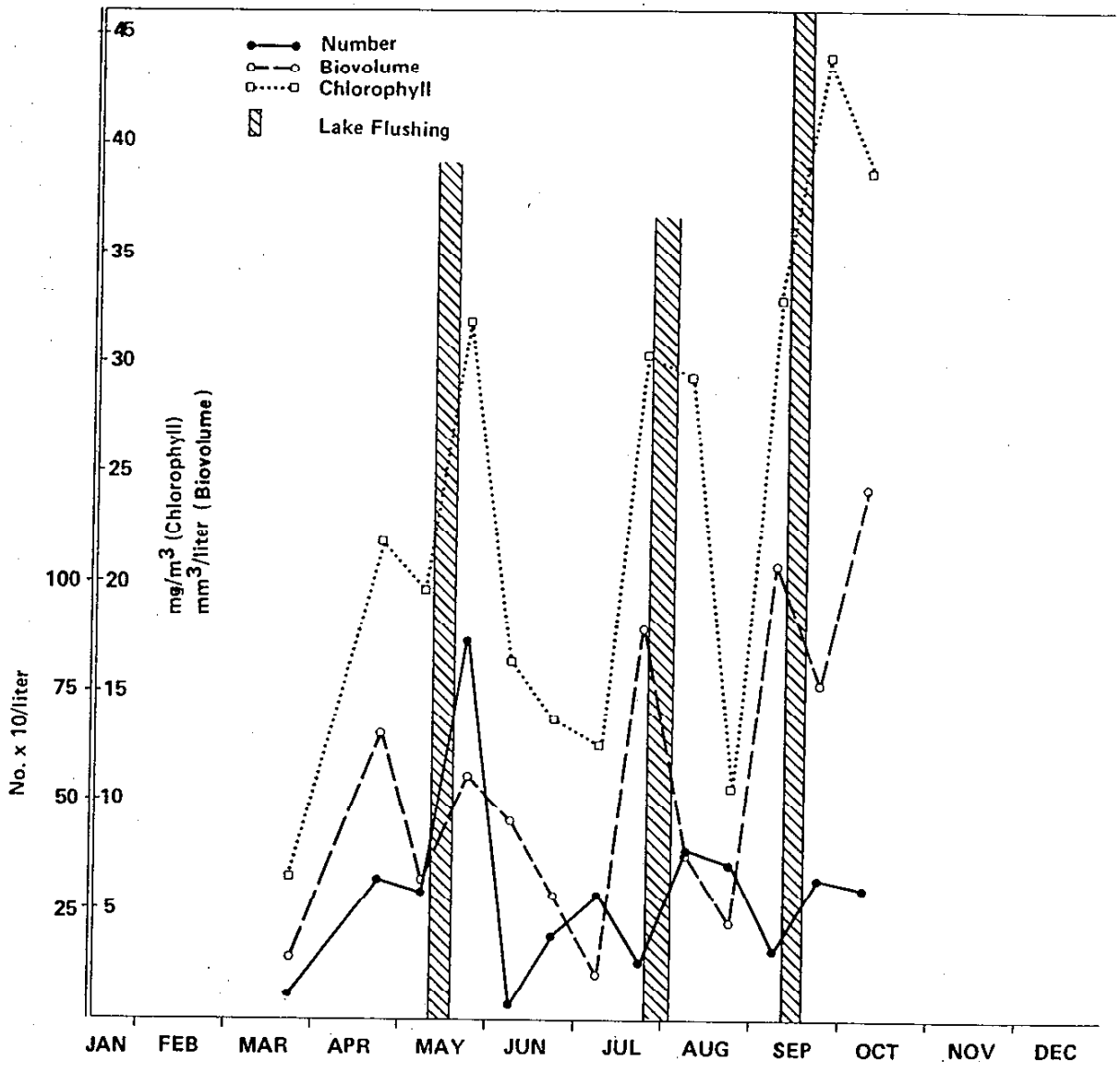
a. Source: EPA 1974
b. Secchi depths in the South Basin were generally greater than the water depth, varying between approximately 1 and 2 meters.
µg/L: micrograms per liter
m: meter

These 1997 data are generally similar to data collected between March and August 1983 (Entranco 1983). Mean (and range) 1983 values for TP in the north, middle, and south basins were 32 (16–90), 42 (21–82), and 43 (22–74) µg/L, respectively. Mean (and range) 1983 values for Chl *a* in the north, middle, and south basins were 18 (1–25), 13 (1–24), and 4 (1–5) µg/L, respectively.

Saltwater Backfilling Control of Algae

CH2M Hill (**1978**) provided data that indicated algal blooms in the lake were likely controlled by three saltwater flushing events in 1977. The saltwater backfill appeared to control algal levels for about three weeks (see **figure 13**).

Figure 13
Average Algal Indicators for all Stations



Source: CH2M Hill 1978

As shown in **figure 14**, the saltwater backfilling during the 1997 drawdown did not decrease surface algal levels in Capitol Lake. This is primarily due to the limited extent of saltwater and brackish water in the north and south basins during this year's drawdown (see **figures 3** and **4**). The 1997 drawdown and backfill procedure maintained a freshwater layer in the north basin, therefore, brackish water was relatively deep (below 9 feet) and would not restrict surface algae levels. Salinity measurements showed that saltwater did not extend far enough upstream to influence either the middle (P4) or south basin (SB) sampling stations (compare **figures 2** and **4**). In addition, elevated salinity levels within the north basin lasted for only a few days in comparison with previous drawdowns, which had elevated salinity levels for a few weeks.

Saltwater Backfilling Impacts on Dissolved Oxygen Levels

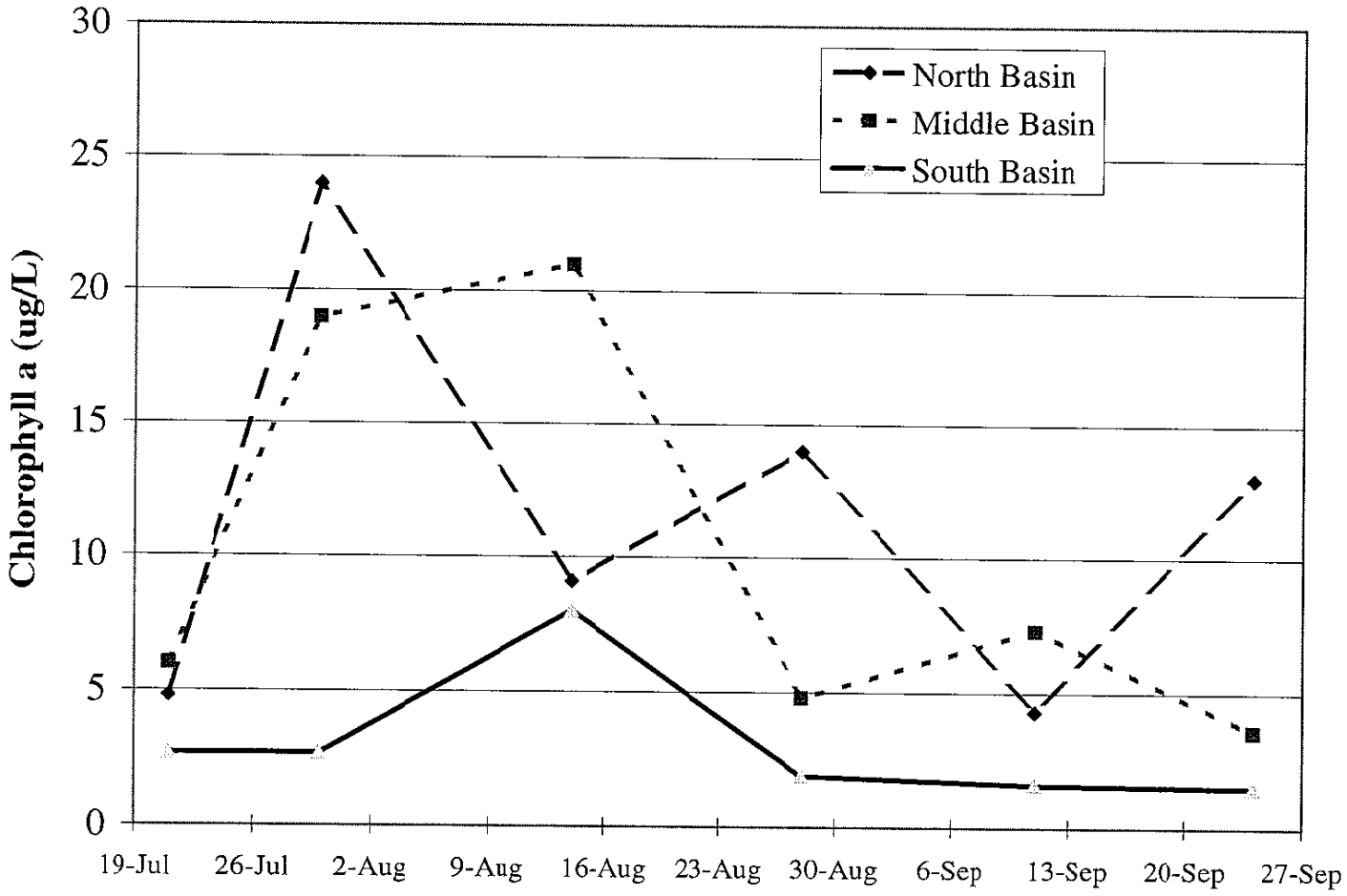
As with the other parameters, the 1997 saltwater backfill generally had a negligible effect on dissolved oxygen (DO) levels in the lake. The DO concentrations were essentially unchanged by the backfill procedures. Above a lake elevation of -4 MSL, (which represents about 95 percent of the volume of Capitol Lake), the minimum DO recorded in the North Basin was 9.3 mg/L following drawdown (**table 4**). The State DO standard (173-201A-030 WAC) for Lake class is to have "no measurable decrease from natural conditions". Therefore, the backfill procedure as performed was in compliance with state standards.

Table 4
Summary of Dissolved Oxygen Data Collected During 1997 Drawdown

	Before drawdown[1]	After drawdown[2]	
Basin	Minimum DO (mg/L)	Minimum DO (mg/L)	Mean DO (mg/L)
North			
Above an elevation of -4 MSL	12.2	9.3	11.8
Tide gate crater (-17 MSL)	8.3	0.5	2.6
Middle	9.7	7.2	10.9
South	11.4	10.7	11.0

1. 7/21/97
2. 7/26/97 through 9/24/97

Figure 14
Capitol Lake 1997 Drawdown
Chlorophyll a Concentrations



The one exception to no impact from the drawdown occurred within the tide gate crater. At -7 MSL (near the middle of the water column), DO concentrations decreased from 12 mg/L to approximately 8 mg/L. For the bottom three meters measured, (generally between -14 and -17 MSL), DO concentrations decreased from 10.1 mg/L before drawdown to 0.5 to 2 mg/L. Reduced DO concentrations at these lower depths lasted for approximately one month. An impact to Budd Inlet is not expected because the volume of water within the tide gate crater with low DO concentrations (below an elevation of -7 MSL) is a very small proportion of Capitol Lake (less than 1 percent).

5. Aquatic Plant and Algal Mat Survey

It is suspected that aquatic plant diversity and density is lower in Capitol Lake than is typical for western Washington lakes; this may be due to saltwater flushing and drawdown exposure. One objective of the annual saltwater backfill cited in the past was to reduce aquatic plant (macrophytes) growth in Capitol Lake. According to an earlier study of the lake,

> "Public complaints about the rooted macrophytes in 1969 led to a three-year program of macrophytes control. The principal noxious species were *Elodea canadensis* and *Potamogeton pectinatus*. The principal areas of infestation appeared to be along the east side of the middle basin, the ski launch area in the southwest section of the middle basin, the boat launch area in the southwest section of the middle basin, and the boat launch area of the upper basin. No quantitative data are given on the density of the macrophyte growths. A one-year growing season chemical treatment was tried and was largely unsuccessful. Saltwater flushing in the spring, used since 1970, has succeeded in controlling but not eliminating macrophyte growth (**WSU 1975**)."

The Capitol Lake Restoration and Recreation Plan Environmental Impact Statement (**DGA 1977**) indicated that saltwater flushing reduced the area colonized by aquatic plants (see **figure 15**). Due to the lack of recent quantitative data of aquatic plant distribution, however, the effectiveness of saltwater flushing in controlling aquatic plants cannot be confirmed. Plant density data were recently collected by Thurston County, however, there are no historic data on plant densities.

The purpose of this aquatic plant survey was to inventory the existing community and estimate plant biomass and nutrient loading to Budd Inlet that could be attributed to aquatic plants. This information can be used to compare future plant types and biomass (amount of plant material), if the lake operating strategy is changed.

ROOTED AQUATICS: 1971 & 1972

Capitol Lake Adaptive Management Plan

Rooted Aquatics (1971)

Rooted Aquatics After Saltwater Treatment (1972)

Figure 15

0 800 feet 1600 feet

Data Source: ENTRANCO 1972
Aerial Photos Taken August 1993
For copies of this map or for more information, please contact Thurston Regional Planning Council
(11/18/97, /trpc/projects/ga/ga97photomaps.aml)

The aquatic plant community in Capitol Lake was divided into the following categories:

- Algae. Free floating single-cell plants that live mostly in the water column
- Algal mats. Single-cell plants colonizing the lake's bottom.
- Aquatic plants. The large-rooted plants that exist primarily below the water surface. Aquatic plants provide valuable habitat for fish and aquatic insects (food for fish). However, excessive aquatic plant growth can degrade water quality, restrict habitat for fish, and impair recreational uses of the lake.
- Attached algae (periphyton). Single-cell algae that are primarily attached to the leaves and stems of aquatic plants.

The first category, algae, was discussed in the previous section (Water Quality Monitoring). This section addresses the remaining three aquatic plant categories. Attached algae were observed within the middle basin, however, it was not possible to quantify their density or and abundance. Aquatic plant and algal mat samples were collected from the three basins of Capitol Lake on July 23 and 24, 1997 during the lake drawdown. Eighteen samples were collected from the lake over the two-day sampling period. (Refer to **Appendix D** for more information on the methods used and the data collected.)

The results of the Aquatic Plant Survey are summarized in **table 5** and shown in **figure 16.**

Aquatic Plant and Algal Mat Distribution

The most significant characteristic of the aquatic plant community in Capitol Lake is that it is nearly made up entirely of one species. Common waterweed *(Elodea canadensis)* comprised almost 100% of the plant community in both the middle and north basins, with occasional sparse occurrences of a thin-leaved Pondweed. This may indicate that common waterweed is relatively tolerant of the higher salinity levels caused by the annual back flushing with saltwater.

The nearly complete dominance of common waterweed is supported by annual surveys of the lake done by Thurston County. The purpose of these surveys is to inventory plant species occurrence as a means of documenting invasion by Eurasian watermilfoil or other exotic aquatic plants (**M. Swartout, personal communication**). These surveys have identified a total of six aquatic plant species in Capitol Lake; four pondweeds, common waterweed, and duckweed (*Lemna* sp.) (**M. Swartout, personal communication**). (Duckweed, a small floating-leaved species was also observed during this survey in insignificant quantities along the lakes' edge.)

B100 97034-60 Capitol Lake (11/20/97) AGT

Figure 16
1997 Aquatic Plants

Table 5
Results of the Aquatic Plant Survey

Basin	Total Lake Area (acres)	Primary Species	Area with plants in acres (% of basin)	Total Biomass[1] (kg)	Phosphorus (kg)	Nitrogen (kg)
South	25	Algal mat (*Spirogyra* sp)	3 (12)	4,890	5	26
Middle	120	Aquatic Plant (Common waterweed)	82 (68)	17,232	92	690
North	100	Aquatic Plant (Common waterweed)	29 (29)	5,607	30	223
Total	245		114 (47)	27,729	127	939

1. Total biomass represents aquatic plants and algal mats. The amount of biomass for attached algae was not quantified.

The density of aquatic plants in Capitol Lake is low when compared to other lakes, which may be due to several factors, such as:

- the annual back flushing with saltwater,
- the presence of attached algae on the aquatic plants (which acts to shade the plants' leaves),
- unsuitable conditions on the bottom of the lake, or
- the velocity of the Deschutes River.

Comparing the areas colonized by aquatic plants measured in 1997 with the 1971 data (**figure 16**) indicates that the aquatic plants currently inhabit a greater area in the north and middle basins. This may be due to reduced saltwater flushing as compared to the early 1970s.

Reducing or eliminating saltwater backflushing may increase the extent and diversity of the aquatic plant community (assuming that common waterweed currently dominates the community because it can tolerate annual salinity increases), and create a more diverse plant community and therefore more diverse habitat for aquatic organisms.

Aquatic Plant Contribution to Budd Inlet

Based on the aquatic plant sampling conducted in this study, the aquatic plants in Capitol Lake represent a small proportion (in comparison to the contribution from the Deschutes River) of nutrient and biomass loading to Budd Inlet. The plant biomass represents an estimated 127 kg of phosphorus (P) and 939 kg of nitrogen (N). Assuming that decay of the plants and algae occurs over a 60-day period at the end of the growing season, and that 100 percent of the nitrogen and phosphorus contained in plant tissue is contributed to the water column at that time, the daily loading rate would be 2 kg P and 16 kg N. (This is a conservative estimate since some portion of these nutrients would be assimilated into the sediments.)

Using the average flow (712 cfs) and average P concentration (0.065 mg/L) measured in a 1992 study of the Deschutes River (**Davis et al., 1992**), the river contributes an average of 113 kg of phosphorus and at least ten times that much nitrogen each day. Consequently, even using worse case assumptions, the contribution of nutrients from the aquatic plants during the period when they are decaying represents only about 2 percent of the phosphorus contributed by the river.

Similar to last year's drawdown (**Herrera 1996**), some of the algae attached to the aquatic plants in the middle basin became detached and were released into the water where they formed large floating mats. The amount of plant material and nutrients that these algal mats contribute to Budd Inlet was not quantified. (Large amounts of plant material could lower oxygen concentrations in Budd Inlet.) However, it appears that the amount of nutrients and plant material contributed by the algal mats (which did not cover as large as an area as the aquatic plants) would be relatively low, in comparison with the loading from the Deshutes River.

6. Sedimentation

Visual comparisons were made of 1996 black and white (1"= 400' approximate scale) aerial photos and 1997 color (1"= 100' approximate scale) aerial photos, to assess whether any noteworthy changes in sediment deposition or stream/river meander patterns were evident. Only minor changes in stream meander at the mouth of Percival Creek and in the south basin of Capitol Lake were evident. There were also minor differences in sediment accumulation/loss patterns associated with the changes in the meander pattern. Apart from these relatively minor changes, no substantial differences in sediment accumulation or loss could be visually assessed by comparing the aerial photos.

7. LOTT Coordination

To understand how the lake drawdown affected water quality conditions within Budd Inlet, special measurements were performed as part of the Budd Inlet Scientific Study for LOTT. First, on the Monday prior to the drawdown, a complete survey of the inlet's water quality conditions was performed. Next, near the end of each day's drawdown, special

sampling of the conditions within the Inner Inlet (West Bay) occurred. Finally, measurements within the Inner Inlet and the entire inlet were performed approximately 5 and 10 days after completion of the drawdown.

Preliminary analysis of an incomplete set of the measurement results indicated that the thickness of the freshwater lens within the Inner Inlet essentially doubled immediately after each day's release of water, and that near-bottom dissolved oxygen conditions also dropped for several days. A more complete understanding of how the lake drawdown affects Budd Inlet is expected once additional laboratory results are obtained, in-situ measurements processed, and measurements from within the lake are examined in more detail. Entranco and Evans-Hamilton are coordinating the exchange of information and data necessary to complete this evaluation. Upon completion of this effort, a written description of the measurements and results will be available either as a section within a Budd Inlet study report, or as a separate document.

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APPENDIX A

Water Quality Monitoring Data

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
7/21/97	P2A	1110	0.1	5.6	na	0.1	0.12	20.9
7/21/97	P2A	1110	1	4.7	na	0.1	0.12	20.9
7/21/97	P2A	1110	2	3.7	na	0.1	0.12	20.9
7/21/97	P2A	1110	3	2.7	na	0.1	0.12	20.9
7/21/97	P2A	1110	4	1.7	na	0.1	0.12	20.9
7/21/97	P2A	1110	5	0.7	na	0.1	0.12	20.9
7/21/97	P2A	1110	6	-0.3	na	0.1	0.12	20.9
7/21/97	P2A	1110	7	-1.3	na	0.1	0.12	20.9
7/21/97	P2A	1110	8	-2.3	na	0.1	0.12	21.0
7/21/97	P2A	1110	9	-3.3	na	0.1	0.12	20.9
7/21/97	P2A	1110	10	-4.3	na	0.1	0.12	20.5
7/21/97	P2A	1110	11	-5.3	na	0.1	0.12	19.6
7/21/97	P2A	1110	12	-6.3	na	0.1	0.13	19.0
7/21/97	P2A	1110	13	-7.3	na	0.1	0.14	18.9
7/21/97	P2A	1110	14	-8.3	na	0.1	0.17	18.9
7/21/97	P2A	1110	15	-9.3	na	0.1	0.19	18.9
7/21/97	P2A	1110	16	-10.3	na	0.1	0.20	18.9
7/21/97	P2A	1110	17	-11.3	na	0.1	0.20	18.8
7/21/97	P2A	1110	18	-12.3	na	0.1	0.27	18.8
7/21/97	P2A	1110	19	-13.3	na	4.6	7.27	18.2
7/21/97	P2A	1110	20	-14.3	na	8.0	13.80	17.7
7/21/97	P2A	1110	21	-15.3	na	8.3	12.20	17.7
7/21/97	P2A	1110	22	-16.3	na	8.4	12.40	17.5
7/21/97	P2A	1110	23	-17.3	na	8.5	12.50	17.4
7/21/97	P2A	1110	24	-18.3	na	8.4	12.30	17.1
7/21/97	P2B	1150	0.1	5.6	0	0.1	0.11	21.6
7/21/97	P2B	1150	1	4.7	0	0.1	0.11	21.6
7/21/97	P2B	1150	2	3.7	0	0.1	0.11	21.5
7/21/97	P2B	1150	3	2.7	0	0.1	0.11	21.5
7/21/97	P2B	1150	4	1.7	0	0.1	0.11	21.4
7/21/97	P2B	1150	5	0.7	0	0.1	0.12	21.2
7/21/97	P2B	1150	6	-0.3	0	0.1	0.12	21.1
7/21/97	P2B	1150	7	-1.3	0	0.1	0.12	20.7
7/21/97	P2B	1150	8	-2.3	0	0.1	0.12	19.6
7/21/97	P2B	1150	9	-3.3	0	0.1	0.12	19.3
7/21/97	P2B	1150	10	-4.3	0	0.1	0.12	19.2
7/21/97	P2B	1150	11	-5.3	0	0.1	0.12	19.1
7/21/97	P2B	1150	12	-6.3	0	0.1	0.12	19.0
7/21/97	P2B	1150	13	-7.3	0	0.1	0.12	18.9
7/21/97	P2B	1150	14	-8.3	0	0.1	0.12	19.0
7/21/97	P2B	1150	15	-9.3	0	0.1	0.12	18.9
7/21/97	P2B	1150	16	-10.3	0	0.1	0.12	18.9

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
7/21/97	P1	1230	0.1	5.6	na	0.1	0.12	21.3
7/21/97	P1	1230	1	4.7	na	0.1	0.12	21.3
7/21/97	P1	1230	2	3.7	na	0.1	0.12	21.2
7/21/97	P1	1230	3	2.7	na	0.1	0.12	21.1
7/21/97	P1	1230	4	1.7	na	0.1	0.12	21.2
7/21/97	P1	1230	5	0.7	na	0.1	0.12	21.1
7/21/97	P1	1230	6	-0.3	na	0.1	0.12	21.1
7/21/97	P1	1230	7	-1.3	na	0.1	0.12	21.1
7/21/97	P1	1230	8	-2.3	na	0.1	0.12	20.9
7/21/97	P1	1230	9	-3.3	na	0.1	0.12	20.7
7/21/97	P1	1230	10	-4.3	na	0.1	0.13	19.3
7/21/97	T1	1230	0.1	5.6	0	0.1	0.12	21.4
7/21/97	T1	1230	0.1	5.6	100	0.1	0.12	21.3
7/21/97	T1	1230	0.1	5.6	200	0.1	0.12	21.3
7/21/97	T1	1230	0.1	5.6	300	0.1	0.12	21.3
7/21/97	T1	1230	0.1	5.6	400	0.1	0.12	21.3
7/21/97	P3	1230	0.1	5.6	500	0.1	0.12	21.3
7/21/97	P3	1230	1	4.7	500	0.1	0.12	21.2
7/21/97	P3	1230	2	3.7	500	0.1	0.12	21.3
7/21/97	P3	1230	3	2.7	500	0.1	0.12	21.3
7/21/97	P3	1230	4	1.7	500	0.1	0.12	21.3
7/21/97	P3	1230	5	0.7	500	0.1	0.12	21.1
7/21/97	P3	1230	6	-0.3	500	0.1	0.12	20.4
7/21/97	P3	1230	7	-1.3	500	0.1	0.12	20.3
7/21/97	P3	1230	8	-2.3	500	0.1	0.12	20.0
7/21/97	P3	1230	9	-3.3	500	0.1	0.12	19.7
7/21/97	T3	1230	0.1	5.6	0	0.1	0.12	21.0
7/21/97	T3	1230	0.1	5.6	100	0.1	0.12	21.0
7/21/97	T3	1230	0.1	5.6	200	0.1	0.12	21.2
7/21/97	T3	1230	0.1	5.6	300	0.1	0.12	21.2
7/21/97	T3	1230	0.1	5.6	400	0.1	0.12	21.3
7/21/97	T2	1230	0.1	5.6	900	0.1	0.11	21.5
7/21/97	T2	1230	0.1	5.6	700	0.1	0.12	21.4
7/21/97	T2	1230	0.1	5.6	500	0.1	0.12	21.4
7/21/97	P4	1330	0.1	5.6	na	0.1	0.12	21.3
7/21/97	P4	1330	1	4.7	na	0.1	0.12	21.3
7/21/97	P4	1330	2	3.7	na	0.1	0.12	21.2
7/21/97	P4	1330	3	2.7	na	0.1	0.12	21.2
7/21/97	P4	1330	4	1.7	na	0.1	0.12	21.2

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
7/21/97	P4	1330	5	0.7	na	0.1	0.12	21.2
7/21/97	P4	1330	6	-0.3	na	0.1	0.12	21.1
7/21/97	P4	1330	7	-1.3	na	0.1	0.12	21.0
7/21/97	P4	1330	8	-2.3	na	0.1	0.12	19.0
7/21/97	P4	1330	9	-3.3	na	0.1	0.12	18.6
7/21/97	P4	1330	10	-4.3	na	0.1	0.12	18.6
7/21/97	SB	1330	0.1	5.6	na	0.1	0.11	16.7
7/21/97	SB	1330	1	4.7	na	0.1	0.11	16.7
7/21/97	SB	1330	2	3.7	na	0.1	0.11	16.6
7/21/97	SB	1330	3	2.7	na	0.1	0.11	16.7
7/26/97	P2A	1315	0.1	-1.1	na	0.5	0.99	19.3
7/26/97	P2A	1315	1	-2	na	0.5	0.99	19.0
7/26/97	P2A	1315	2	-3	na	1.6	3.12	18.4
7/26/97	P2A	1315	3	-4	na	5.0	7.70	18.5
7/26/97	P2A	1315	4	-5	na	16.6	27.30	18.0
7/26/97	P2A	1315	5	-6	na	19.7	30.70	16.9
7/26/97	P2A	1315	6	-7	na	20.5	32.60	16.4
7/26/97	P2A	1315	7	-8	na	20.5	32.70	16.4
7/26/97	P2A	1315	8	-9	na	20.5	32.80	16.4
7/26/97	P2A	1315	9	-10	na	20.5	32.80	16.3
7/26/97	P2A	1315	10	-11	na	20.6	32.80	16.3
7/26/97	P2A	1315	11	-12	na	20.6	32.80	16.3
7/26/97	P2A	1315	12	-13	na	20.6	32.80	16.3
7/26/97	P2A	1315	13	-14	na	20.6	32.80	16.3
7/26/97	P2A	1315	14	-15	na	20.6	32.80	16.3
7/26/97	P2A	1315	15	-16	na	20.6	32.90	16.3
7/26/97	P2A	1315	16	-17	na	20.6	32.80	16.3
7/26/97	P2A	1315	17	-18	na	20.6	32.80	16.3
7/26/97	P2A	1315	18	-19	na	20.5	32.80	16.2
7/26/97	T3	1345	0.1	-1.1	50	0.4	0.73	23.8
7/26/97	T3	1345	0.1	-1.1	75	0.5	0.95	20.3
7/26/97	T3	1345	0.1	-1.1	100	0.5	0.94	20.2
7/26/97	T3	1345	0.1	-1.1	150	0.4	0.89	19.4
7/26/97	T3	1345	0.1	-1.1	200	0.4	0.87	19.7
7/26/97	T3	1345	0.1	-1.1	250	0.4	0.86	19.6
7/26/97	T3	1345	0.1	-1.1	300	0.4	0.89	19.5
7/26/97	T3	1345	0.1	-1.1	350	0.4	0.81	19.4
7/26/97	T3	1345	0.1	-1.1	400	0.4	0.78	19.4
7/26/97	T3	1345	0.1	-1.1	500	0.4	0.76	19.4

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
7/26/97	P3	1345	0.1	-1.1	600	0.4	0.70	19.4
7/26/97	P3	1345	1	-2	600	0.3	0.70	19.4
7/26/97	P3	1345	2	-3	600	0.4	0.73	19.3
7/26/97	P3	1345	3	-4	600	10.1	16.80	20.9
7/26/97	P3	1345	4	-5	600	9.4	16.40	20.7
7/26/97	P3	1345	5	-6	600	9.5	16.30	20.8
7/26/97	P3	1345	6	-7	600	9.6	16.30	20.8
7/26/97	T1	1440	0.1	-1.1	0.5	0.4	0.86	24.9
7/26/97	T1	1440	0.1	-1.1	50	0.5	0.96	22.2
7/26/97	T1	1440	0.1	-1.1	100	0.5	1.00	21.3
7/26/97	T1	1440	0.1	-1.1	200	0.5	1.03	20.7
7/26/97	T1	1440	0.1	-1.1	300	0.6	1.12	20.1
7/26/97	T1	1440	0.1	-1.1	400	0.5	1.10	19.9
7/26/97	P1	1440	0.5	-1.5	500	0.6	1.14	20.1
7/26/97	P1	1440	1	-2	500	0.6	1.13	20.1
7/26/97	P1	1440	2	-3	500	0.6	1.11	19.9
7/26/97	P1	1440	3	-4	500	5.7	9.40	18.9
7/26/97	P1	1440	4	-5	500	17.0	27.00	18.4
7/26/97	P1	1440	4.5	-5.5	500	16.6	26.70	18.6
7/26/97	P2B	1511	0	-1	0	0.1	0.29	19.1
7/26/97	P2B	1511	1	-2	0	0.1	0.27	19.0
7/26/97	P2B	1511	2	-3	0	0.1	0.31	18.8
7/26/97	P2B	1511	3	-4	0	0.4	0.81	17.9
7/26/97	P2B	1511	4	-5	0	15.2	24.90	17.5
7/26/97	P2B	1511	5	-6	0	17.7	28.60	17.6
7/26/97	P2B	1511	6	-7	0	18.0	29.00	17.5
7/26/97	P2B	1511	7	-8	0	18.0	29.10	17.4
7/26/97	P2B	1511	8	-9	0	17.8	29.20	17.7
7/26/97	T2	1511	0	-1	100	0.1	0.19	19.3
7/26/97	T2	1511	3	-4	100	0.3	0.60	18.1
7/26/97	T2	1511	4	-5	100	14.4	24.30	17.3
7/26/97	T2	1511	5	-6	100	17.7	28.70	17.5
7/26/97	T2	1511	0	-1	200	0.1	0.21	19.3
7/26/97	T2	1511	3	-4	200	0.2	0.45	18.7
7/26/97	T2	1511	4	-5	200	0.7	13.00	18.2
7/26/97	T2	1511	5	-6	200	16.8	27.50	17.8
7/26/97	T2	1511	0	-1	300	0.1	0.21	19.3
7/26/97	T2	1511	3	-4	300	0.1	0.30	19.0

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
7/26/97	T2	1511	4	-5	300	1.2	2.00	18.2
7/26/97	T2	1511	5	-6	300	16.8	27.90	17.7
7/26/97	T2	1511	0	-1	400	0.1	0.15	19.7
7/26/97	T2	1511	3	-4	400	0.1	0.23	19.3
7/26/97	T2	1511	4	-5	400	3.0	2.50	18.4
7/26/97	T2	1511	5	-6	400	16.3	27.00	18.2
7/26/97	T2	1511	0	-1	500	0.1	0.14	19.9
7/26/97	T2	1511	3	-4	500	0.1	0.19	19.4
7/26/97	T2	1511	4	-5	500	0.4	0.60	18.5
7/26/97	T2	1511	5	-6	500	16.8	27.20	17.8
7/26/97	T2	1511	0	-1	600	0.1	0.16	20.0
7/26/97	T2	1511	3	-4	600	0.1	0.20	19.8
7/26/97	T2	1511	4	-5	600	0.3	0.63	18.7
7/26/97	T2	1511	5	-6	600	16.5	27.20	17.6
7/26/97	T2	1511	0	-1	700	0.1	0.18	20.7
7/26/97	T2	1511	3	-4	700	0.1	0.24	19.5
7/26/97	T2	1511	5	-6	700	0.1	0.21	19.5
7/30/97	P2A	1330	0.1	5.4	na	0.3	0.53	22.0
7/30/97	P2A	1330	1	4.5	na	0.3	0.53	22.0
7/30/97	P2A	1330	2	3.5	na	0.3	0.55	21.6
7/30/97	P2A	1330	3	2.5	na	0.3	0.53	21.4
7/30/97	P2A	1330	4	1.5	na	0.3	0.53	20.7
7/30/97	P2A	1330	5	0.5	na	0.3	0.63	20.6
7/30/97	P2A	1330	6	-0.5	na	0.3	0.65	20.6
7/30/97	P2A	1330	7	-1.5	na	0.4	0.79	20.3
7/30/97	P2A	1330	8	-2.5	na	0.4	0.81	19.9
7/30/97	P2A	1330	9	-3.5	na	0.7	1.22	19.8
7/30/97	P2A	1330	10	-4.5	na	0.9	1.87	19.8
7/30/97	P2A	1330	11	-5.5	na	1.2	2.27	19.7
7/30/97	P2A	1330	12	-6.5	na	1.3	2.59	19.6
7/30/97	P2A	1330	13	-7.5	na	2.1	4.04	19.7
7/30/97	P2A	1330	14	-8.5	na	3.7	6.70	19.6
7/30/97	P2A	1330	15	-9.5	na	5.1	8.85	19.4
7/30/97	P2A	1330	16	-10.5	na	5.9	10.62	19.3
7/30/97	P2A	1330	17	-11.5	na	7.3	12.67	19.2
7/30/97	P2A	1330	18	-12.5	na	8.8	14.90	19.0
7/30/97	P2A	1330	19	-13.5	na	9.6	16.45	18.9
7/30/97	P2A	1330	20	-14.5	na	15.1	25.04	18.1
7/30/97	P2A	1330	21	-15.5	na	19.3	30.57	17.2

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
7/30/97	P2A	1330	22	-16.5	na	20.0	32.03	16.8
7/30/97	P2A	1330	23	-17.5	na	20.1	32.03	16.8
7/30/97	P2A	1330	24	-18.5	na	20.1	32.10	16.8
7/30/97	P2B	1020	0.1	5.8	0	0.1	0.17	20.8
7/30/97	P2B	1020	1	4.9	0	0.1	0.17	20.8
7/30/97	P2B	1020	2	3.9	0	0.1	0.17	20.8
7/30/97	P2B	1020	3	2.9	0	0.1	0.17	20.8
7/30/97	P2B	1020	4	1.9	0	0.2	0.34	20.0
7/30/97	P2B	1020	5	0.9	0	0.2	0.49	21.2
7/30/97	P2B	1020	6	-0.1	0	0.3	0.62	20.7
7/30/97	P2B	1020	7	-1.1	0	0.1	0.26	19.5
7/30/97	P2B	1020	8	-2.1	0	0.1	0.14	18.2
7/30/97	P2B	1020	9	-3.1	0	0.1	0.29	18.2
7/30/97	P2B	1020	10	-4.1	0	2.8	5.36	18.8
7/30/97	P2B	1020	11	-5.1	0	16.3	26.60	18.5
7/30/97	P2B	1020	12	-6.1	0	15.1	24.00	18.0
7/30/97	T2	1020	0.1	5.8	100	0.1	0.17	20.9
7/30/97	T2	1020	1	4.9	100	0.1	0.17	20.9
7/30/97	T2	1020	2	3.9	100	0.1	0.17	20.9
7/30/97	T2	1020	3	2.9	100	0.1	0.17	20.9
7/30/97	T2	1020	4	1.9	100	0.1	0.18	20.8
7/30/97	T2	1020	5	0.9	100	0.1	0.20	20.7
7/30/97	T2	1020	6	-0.1	100	0.1	0.13	18.6
7/30/97	T2	1020	7	-1.1	100	0.1	0.13	18.5
7/30/97	T2	1020	8	-2.1	100	0.1	0.13	18.2
7/30/97	T2	1020	9	-3.1	100	0.1	0.18	18.1
7/30/97	T2	1020	10	-4.1	100	0.2	0.45	18.3
7/30/97	T2	1020	11	-5.1	100	13.2	22.50	18.2
7/30/97	T2	1020	12	-6.1	100	17.4	28.00	18.1
7/30/97	T2	1020	13	-7.1	100	17.4	28.30	18.0
7/30/97	T2	1020	14	-8.1	100	17.5	28.30	18.0
7/30/97	T2	1020	15	-9.1	100	17.5	28.30	18.0
7/30/97	T2	1020	0.1	5.8	200	0.1	0.18	20.9
7/30/97	T2	1020	1	4.9	200	0.1	0.18	20.9
7/30/97	T2	1020	2	3.9	200	0.1	0.18	20.9
7/30/97	T2	1020	3	2.9	200	0.1	0.17	20.8
7/30/97	T2	1020	4	1.9	200	0.1	0.21	20.8
7/30/97	T2	1020	5	0.9	200	0.1	0.22	20.2
7/30/97	T2	1020	6	-0.1	200	0.1	0.13	19.0
7/30/97	T2	1020	7	-1.1	200	0.1	0.13	18.5
7/30/97	T2	1020	8	-2.1	200	0.1	0.13	18.3

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
7/30/97	T2	1020	9	-3.1	200	0.1	0.15	18.1
7/30/97	T2	1020	10	-4.1	200	0.2	0.35	18.0
7/30/97	T2	1020	0.1	5.8	300	0.1	0.20	21.0
7/30/97	T2	1020	1	4.9	300	0.1	0.20	21.0
7/30/97	T2	1020	2	3.9	300	0.1	0.18	20.8
7/30/97	T2	1020	3	2.9	300	0.1	0.16	20.8
7/30/97	T2	1020	4	1.9	300	0.1	0.16	20.7
7/30/97	T2	1020	5	0.9	300	0.1	0.15	20.7
7/30/97	T2	1020	6	-0.1	300	0.1	0.15	19.8
7/30/97	T2	1020	7	1.1	300	0.1	0.13	18.7
7/30/97	T2	1020	8	-2.1	300	0.1	0.13	18.6
7/30/97	T2	1020	9	-3.1	300	0.1	0.14	18.4
7/30/97	T2	1020	10	-4.1	300	0.1	0.17	18.3
7/30/97	T2	1020	11	-5.1	300	0.7	1.25	18.1
7/30/97	T2	1100	0.1	5.8	400	0.1	0.22	21.2
7/30/97	T2	1100	1	4.9	400	0.1	0.23	21.0
7/30/97	T2	1100	2	3.9	400	0.1	0.22	20.9
7/30/97	T2	1100	3	2.9	400	0.1	0.22	20.8
7/30/97	T2	1100	4	1.9	400	0.1	0.16	20.7
7/30/97	T2	1100	5	0.9	400	0.1	0.25	20.6
7/30/97	T2	1100	6	-0.1	400	0.1	0.14	18.9
7/30/97	T2	1100	7	-1.1	400	0.1	0.14	18.8
7/30/97	T2	1100	8	-2.1	400	0.1	0.14	18.5
7/30/97	T2	1100	9	-3.1	400	0.1	0.15	18.5
7/30/97	T2	1100	10	-4.1	400	0.1	0.18	18.4
7/30/97	T2	1100	11	-5.1	400	0.2	2.20	18.2
7/30/97	T2	1100	0.1	5.8	500	0.1	0.21	20.9
7/30/97	T2	1100	8	-2.1	500	0.1	0.18	18.3
7/30/97	T2	1100	9	-3.1	500	0.2	0.76	18.1
7/30/97	T2	1100	0.1	5.8	600	0.1	0.25	21.1
7/30/97	T2	1100	8	-2.1	600	0.1	0.17	18.7
7/30/97	T3	1410	0.1	5.5	5	0.3	0.57	23.1
7/30/97	T3	1410	0.1	5.5	100	0.3	0.56	22.3
7/30/97	T3	1410	1	4.6	100	0.3	0.56	22.4
7/30/97	T3	1410	2	3.6	100	0.3	0.57	22.4
7/30/97	T3	1410	3	2.6	100	0.3	0.58	22.1
7/30/97	T3	1410	4	1.6	100	0.3	0.58	22.0
7/30/97	T3	1410	5	0.6	100	0.3	0.57	21.9

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
7/30/97	T3	1410	5.5	0.1	100	0.3	0.57	21.8
7/30/97	T3	1410	0.1	5.5	200	0.3	0.55	22.4
7/30/97	T3	1410	1	4.6	200	0.3	0.55	22.4
7/30/97	T3	1410	2	3.6	200	0.3	0.55	22.4
7/30/97	T3	1410	3	2.6	200	0.3	0.56	22.3
7/30/97	T3	1410	4	1.6	200	0.3	0.57	22.0
7/30/97	T3	1410	5	0.6	200	0.3	0.57	21.9
7/30/97	T3	1410	6	-0.4	200	0.3	0.59	21.8
7/30/97	T3	1410	7	-1.4	200	0.3	0.59	20.7
7/30/97	T3	1410	8	-2.4	200	0.4	0.73	20.5
7/30/97	T3	1410	0.1	5.5	300	0.3	0.55	22.5
7/30/97	T3	1410	1	4.6	300	0.3	0.55	22.5
7/30/97	T3	1410	2	3.6	300	0.3	0.55	22.4
7/30/97	T3	1410	3	2.6	300	0.3	0.56	22.2
7/30/97	T3	1410	4	1.6	300	0.3	0.57	21.9
7/30/97	T3	1410	5	0.6	300	0.3	0.58	21.9
7/30/97	T3	1410	6	-0.4	300	0.3	0.59	21.8
7/30/97	T3	1410	7	-1.4	300	0.3	0.60	21.6
7/30/97	T3	1410	8	-2.4	300	0.3	0.74	21.1
7/30/97	T3	1410	0.1	5.5	400	0.3	0.54	22.5
7/30/97	T3	1410	1	4.6	400	0.3	0.54	22.5
7/30/97	T3	1410	2	3.6	400	0.3	0.55	22.5
7/30/97	T3	1410	3	2.6	400	0.3	0.55	22.3
7/30/97	T3	1410	4	1.6	400	0.3	0.56	22.0
7/30/97	T3	1410	5	0.6	400	0.3	0.57	21.6
7/30/97	T3	1410	6	-0.4	400	0.3	0.60	21.7
7/30/97	T3	1410	7	-1.4	400	0.3	0.70	21.1
7/30/97	T3	1410	8	-2.4	400	0.4	0.82	20.6
7/30/97	T3	1410	0.1	5.5	500	0.3	0.53	22.6
7/30/97	T3	1410	1	4.6	500	0.3	0.63	21.3
7/30/97	T3	1410	6	-0.4	500	0.3	0.80	20.6
7/30/97	T3	1410	8	-2.4	500	0.4	0.60	21.6
7/30/97	T3	1410	0.1	5.5	600	0.3	0.53	22.6
7/30/97	T3	1410	1	4.6	600	0.3	0.53	22.6
7/30/97	T3	1410	7	-1.4	600	0.3	0.63	21.9
7/30/97	T3	1410	8	-2.4	600	0.4	0.81	20.6
7/30/97	T3	1410	9	-3.4	600	0.6	1.23	20.2
7/30/97	T1	1500	0.1	5.5	5	0.3	0.57	23.4

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
7/30/97	T1	1500	0.1	5.5	100	0.3	0.54	22.8
7/30/97	T1	1500	1	4.6	100	0.3	0.55	22.7
7/30/97	T1	1500	2	3.6	100	0.3	0.55	22.8
7/30/97	T1	1500	3	2.6	100	0.2	0.55	22.3
7/30/97	T1	1500	4	1.6	100	0.2	0.49	21.6
7/30/97	T1	1500	5	0.6	100	0.2	0.49	21.4
7/30/97	T1	1500	6	-0.4	100	0.2	0.50	21.5
7/30/97	T1	1500	7	-1.4	100	0.3	0.56	20.4
7/30/97	T1	1500	0.1	5.5	200	0.2	0.50	22.6
7/30/97	T1	1500	1	4.6	200	0.2	0.50	22.6
7/30/97	T1	1500	2	3.6	200	0.2	0.50	22.6
7/30/97	T1	1500	3	2.6	200	0.2	0.52	22.3
7/30/97	T1	1500	4	1.6	200	0.2	0.49	21.6
7/30/97	T1	1500	5	0.6	200	0.2	0.50	21.2
7/30/97	T1	1500	6	-0.4	200	0.3	0.60	20.9
7/30/97	T1	1500	7	-1.4	200	0.3	0.58	20.3
7/30/97	T1	1500	8	-2.4	200	0.3	0.57	20.3
7/30/97	T1	1500	0.1	5.5	300	0.3	0.52	22.7
7/30/97	T1	1500	1	4.6	300	0.3	0.52	22.7
7/30/97	T1	1500	2	3.6	300	0.3	0.52	22.6
7/30/97	T1	1500	3	2.6	300	0.2	0.52	22.3
7/30/97	T1	1500	4	1.6	300	0.2	0.49	21.3
7/30/97	T1	1500	5	0.6	300	0.2	0.51	21.1
7/30/97	T1	1500	6	-0.4	300	0.2	0.59	20.9
7/30/97	T1	1500	7	-1.4	300	0.3	0.61	20.2
7/30/97	T1	1500	8	-2.4	300	0.3	0.53	19.8
7/30/97	T1	1500	9	-3.4	300	0.4	0.86	19.9
7/30/97	T1	1500	0.1	5.5	400	0.3	0.53	22.8
7/30/97	T1	1500	1	4.6	400	0.3	0.53	22.8
7/30/97	T1	1500	4	1.6	400	0.2	0.46	21.7
7/30/97	T1	1500	8	-2.4	400	0.3	0.55	19.8
7/30/97	T1	1500	9	-3.4	400	0.4	0.74	19.6
8/6/97	P2A	0835	0.1	5.8	na	0.1	0.26	23.0
8/6/97	P2A	0835	1	4.9	na	0.1	0.26	23.0
8/6/97	P2A	0835	2	3.9	na	0.1	0.26	23.0
8/6/97	P2A	0835	3	2.9	na	0.1	0.26	23.0
8/6/97	P2A	0835	4	1.9	na	0.1	0.26	22.9
8/6/97	P2A	0835	5	0.9	na	0.1	0.21	21.9
8/6/97	P2A	0835	6	-0.1	na	0.1	0.19	21.0
8/6/97	P2A	0835	7	-1.1	na	0.1	0.20	20.3

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
8/6/97	P2A	0835	8	-2.1	na	0.1	0.20	19.9
8/6/97	P2A	0835	9	-3.1	na	0.1	0.20	19.8
8/6/97	P2A	0835	10	-4.1	na	0.1	0.27	19.7
8/6/97	P2A	0835	11	-5.1	na	0.1	0.28	19.5
8/6/97	P2A	0835	12	-6.1	na	0.5	0.61	19.4
8/6/97	P2A	0835	13	-7.1	na	3.1	6.38	20.1
8/6/97	P2A	0835	14	-8.1	na	4.8	8.69	20.3
8/6/97	P2A	0835	15	-9.1	na	5.8	10.19	20.4
8/6/97	P2A	0835	16	-10.1	na	6.1	10.65	20.4
8/6/97	P2A	0835	17	-11.1	na	6.3	11.20	20.4
8/6/97	P2A	0835	18	12.1	na	8.6	14.52	19.8
8/6/97	P2A	0835	19	-13.1	na	10.8	17.94	19.3
8/6/97	P2A	0835	20	-14.1	na	11.4	19.36	18.8
8/6/97	P2A	0835	21	-15.1	na	16.6	23.25	17.4
8/6/97	P2A	0835	22	-16.1	na	18.3	29.35	16.9
8/6/97	P2A	0835	23	-17.1	na	18.9	30.43	16.6
8/6/97	P2A	0835	24	-18.1	na	19.1	30.68	16.5
8/6/97	T3	0835	0.1	5.8	0	0.1	0.25	23.0
8/6/97	T3	0835	1	4.9	1	0.1	0.25	23.0
8/6/97	T3	0920	0.1	5.8	100	0.1	0.25	23.0
8/6/97	T3	0920	1	4.9	100	0.1	0.25	23.0
8/6/97	T3	0920	2	3.9	100	0.1	0.25	23.0
8/6/97	T3	0920	3	2.9	100	0.1	0.25	23.0
8/6/97	T3	0920	4	1.9	100	0.1	0.25	23.0
8/6/97	T3	0920	5	0.9	100	0.1	0.25	22.9
8/6/97	T3	0920	6	-0.1	100	0.1	0.25	21.8
8/6/97	T3	0920	0.1	5.8	200	0.1	0.24	23.0
8/6/97	T3	0920	1	4.9	200	0.1	0.24	23.0
8/6/97	T3	0920	2	3.9	200	0.1	0.23	23.0
8/6/97	T3	0920	3	2.9	200	0.1	0.24	23.0
8/6/97	T3	0920	4	1.9	200	0.1	0.24	23.0
8/6/97	T3	0920	5	0.9	200	0.1	0.25	23.0
8/6/97	T3	0920	6	-0.1	200	0.1	0.25	22.8
8/6/97	T3	0920	7	-1.1	200	0.1	0.27	21.7
8/6/97	T3	0920	8	-2.1	200	0.1	0.27	20.0
8/6/97	T3	0920	0.1	5.8	300	0.1	0.25	23.0
8/6/97	T3	0920	1	4.9	300	0.1	0.24	23.1
8/6/97	T3	0920	2	3.9	300	0.1	0.24	23.0
8/6/97	T3	0920	3	2.9	300	0.1	0.24	23.0
8/6/97	T3	0920	4	1.9	300	0.1	0.24	23.0

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
8/6/97	T3	0920	5	0.9	300	0.1	0.24	23.0
8/6/97	T3	0920	6	-0.1	300	0.1	0.22	22.1
8/6/97	T3	0920	7	-1.1	300	0.1	0.23	20.9
8/6/97	T3	0920	8	-2.1	300	0.1	0.26	20.2
8/6/97	T3	0920	9	-3.1	300	0.2	0.35	19.8
8/6/97	T3	0920	0.1	5.8	400	0.1	0.24	23.1
8/6/97	T3	0920	1	4.9	400	0.1	0.24	23.1
8/6/97	T3	0920	2	3.9	400	0.1	0.25	23.1
8/6/97	T3	0920	3	2.9	400	0.1	0.24	23.0
8/6/97	T3	0920	4	1.9	400	0.1	0.25	23.0
8/6/97	T3	0920	5	0.9	400	0.1	0.25	23.0
8/6/97	T3	0920	6	-0.1	400	0.1	0.21	21.5
8/6/97	T3	0920	7	-1.1	400	0.1	0.22	20.8
8/6/97	T3	0920	8	-2.1	400	0.1	0.29	20.0
8/6/97	T3	0920	9	-3.1	400	0.2	0.47	19.7
8/6/97	T3	0920	0.1	5.8	500	0.1	0.24	23.2
8/6/97	T3	0920	1	4.9	500	0.1	0.24	23.1
8/6/97	T3	0920	2	3.9	500	0.1	0.25	23.1
8/6/97	T3	0920	3	2.9	500	0.1	0.25	23.1
8/6/97	T3	0920	4	1.9	500	0.1	0.25	23.0
8/6/97	T3	0920	5	0.9	500	0.1	0.25	23.0
8/6/97	T3	0920	6	-0.1	500	0.1	0.23	22.1
8/6/97	T3	0920	7	-1.1	500	0.1	0.21	21.4
8/6/97	T3	0920	8	-2.1	500	0.1	0.24	20.4
8/6/97	T3	0920	9	-3.1	500	0.1	0.29	20.0
8/6/97	T3	0920	10	-4.1	500	0.2	0.35	19.7
8/6/97	T3	0920	0.1	5.8	600	0.1	0.24	23.1
8/6/97	T3	0920	1	4.9	600	0.1	0.24	23.1
8/6/97	T3	0920	2	3.9	600	0.1	0.25	23.1
8/6/97	T3	0920	3	2.9	600	0.1	0.25	23.1
8/6/97	T3	0920	4	1.9	600	0.1	0.25	23.1
8/6/97	T3	0920	5	0.9	600	0.1	0.25	23.0
8/6/97	T3	0920	6	-0.1	600	0.1	0.22	21.7
8/6/97	T3	0920	7	-1.1	600	0.1	0.20	21.0
8/6/97	T3	0920	8	-2.1	600	0.1	0.25	20.4
8/6/97	T3	0920	9	-3.1	600	0.2	0.35	19.8
8/6/97	T1	1035	0.1	5.8	5	0.1	0.26	23.2
8/6/97	T1	1035	1	4.9	5	0.1	0.26	23.2
8/6/97	T1	1035	2	3.9	5	0.1	0.26	23.2
8/6/97	T1	1035	3	2.9	5	0.1	0.26	23.2

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
8/6/97	T1	1035	0.1	5.8	100	0.1	0.25	23.2
8/6/97	T1	1035	3	2.9	100	0.1	0.25	23.2
8/6/97	T1	1035	5	0.9	100	0.1	0.25	23.2
8/6/97	T1	1035	7	-1.1	100	0.1	0.26	20.9
8/6/97	T1	1035	8	-2.1	100	0.1	0.27	20.3
8/6/97	T1	1035	0.1	5.8	200	0.1	0.25	23.1
8/6/97	T1	1035	3	2.9	200	0.1	0.25	23.1
8/6/97	T1	1035	5	0.9	200	0.1	0.26	22.7
8/6/97	T1	1035	7	-1.1	200	0.1	0.22	19.9
8/6/97	T1	1035	8	-2.1	200	0.1	0.26	20.4
8/6/97	T1	1035	0.1	5.8	300	0.1	0.25	23.2
8/6/97	T1	1035	3	2.9	300	0.1	0.25	23.1
8/6/97	T1	1035	5	0.9	300	0.1	0.25	23.0
8/6/97	T1	1035	7	-1.1	300	0.1	0.20	20.5
8/6/97	T1	1035	8	-2.1	300	0.1	0.25	20.1
8/6/97	T1	1035	9	-3.1	300	0.1	0.27	19.6
8/6/97	T1	1035	0.1	5.8	400	0.1	0.25	23.3
8/6/97	T1	1035	3	2.9	400	0.1	0.25	23.2
8/6/97	T1	1035	4	1.9	400	0.1	0.25	23.1
8/6/97	T1	1035	5	0.9	400	0.1	0.21	20.3
8/6/97	T1	1035	7	-1.1	400	0.1	0.25	19.8
8/6/97	T1	1035	8	-2.1	400	0.1	0.25	19.7
8/6/97	T1	1035	9	-3.1	400	0.1	0.28	19.4
8/6/97	T1	1035	0.1	5.8	500	0.1	0.26	23.2
8/6/97	T1	1035	3	2.9	500	0.1	0.26	23.2
8/6/97	T1	1035	5	0.9	500	0.1	0.25	22.7
8/6/97	T1	1035	7	-1.1	500	0.1	0.21	20.4
8/6/97	T1	1035	8	-2.1	500	0.1	0.23	20.1
8/6/97	T1	1035	9	-3.1	500	0.1	0.23	19.6
8/6/97	T1	1035	10	-4.1	500	0.1	0.27	19.4
8/6/97	T1	1035	0.1	5.8	600	0.1	0.26	23.4
8/6/97	T1	1035	3	2.9	600	0.1	0.26	23.2
8/6/97	T1	1035	5	0.9	600	0.1	0.26	21.9
8/6/97	T1	1035	7	-1.1	600	0.1	0.21	20.4
8/6/97	T1	1035	8	-2.1	600	0.1	0.21	20.0
8/6/97	T1	1035	9	-3.1	600	0.1	0.25	19.6
8/6/97	T1	1035	10	-4.1	600	0.1	0.23	19.3

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
8/6/97	T2	1130	0.1	5.8	0	0.1	0.16	23.3
8/6/97	T2	1130	3	2.9	0	0.1	0.16	23.0
8/6/97	T2	1130	5	0.9	0	0.1	0.20	22.6
8/6/97	T2	1130	7	-1.1	0	0.1	0.13	21.4
8/6/97	T2	1130	9	-3.1	0	0.1	0.14	20.5
8/6/97	T2	1130	11	-5.1	0	0.1	0.20	nr
8/6/97	T2	1130	12	-6.1	0	0.2	0.30	19.4
8/6/97	T2	1130	13	-7.1	0	1.4	2.80	19.5
8/6/97	T2	1130	14	-8.1	0	2.5	4.57	19.6
8/6/97	T2	1130	15	-9.1	0	2.7	5.00	19.6
8/6/97	T2	1130	15.5	-9.6	0	2.8	5.12	19.6
8/6/97	T2	1130	0.1	5.8	100	0.1	0.15	23.1
8/6/97	T2	1130	5	0.9	100	0.1	0.14	21.1
8/6/97	T2	1130	10	-4.1	100	0.1	0.13	19.4
8/6/97	T2	1130	12	-6.1	100	0.1	0.14	19.3
8/6/97	T2	1130	13	-7.1	100	0.1	0.16	19.3
8/6/97	T2	1130	14	-8.1	100	2.5	4.70	19.6
8/6/97	T2	1130	15	-9.1	100	2.6	5.19	19.6
8/6/97	T2	1130	16	-10.1	100	2.9	nr	nr
8/6/97	T2	1130	17	-11.1	100	3.0	nr	nr
8/6/97	T2	1130	10	-4.1	200	0.1	0.13	19.3
8/6/97	T2	1130	11	-5.1	200	0.1	0.13	nr
8/6/97	T2	1130	12	-6.1	200	0.1	0.14	nr
8/14/97	P2A	1110	0.1	5.8	na	0.1	0.17	24.1
8/14/97	P2A	1110	1	4.9	na	0.1	0.17	24.0
8/14/97	P2A	1110	2	3.9	na	0.1	0.17	23.9
8/14/97	P2A	1110	3	2.9	na	0.1	0.17	23.7
8/14/97	P2A	1110	4	1.9	na	0.1	0.17	23.7
8/14/97	P2A	1110	5	0.9	na	0.1	0.17	23.6
8/14/97	P2A	1110	6	-0.1	na	0.1	0.15	20.8
8/14/97	P2A	1110	7	-1.1	na	0.1	0.14	20.1
8/14/97	P2A	1110	8	-2.1	na	0.1	0.14	20.1
8/14/97	P2A	1110	9	-3.1	na	0.1	0.14	19.6
8/14/97	P2A	1110	10	-4.1	na	0.1	0.14	19.5
8/14/97	P2A	1110	11	-5.1	na	0.1	0.14	19.5
8/14/97	P2A	1110	12	-6.1	na	0.1	0.15	19.2
8/14/97	P2A	1110	13	-7.1	na	0.1	0.15	19.1
8/14/97	P2A	1110	14	-8.1	na	0.1	0.17	19.0
8/14/97	P2A	1110	15	-9.1	na	0.1	0.30	19.0
8/14/97	P2A	1110	16	-10.1	na	0.4	0.84	18.9
8/14/97	P2A	1110	17	-11.1	na	6.6	11.85	18.5

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
8/14/97	P2A	1110	18	-12.1	na	9.6	16.35	18.7
8/14/97	P2A	1110	19	-13.1	na	10.2	17.17	18.6
8/14/97	P2A	1110	20	-14.1	na	10.9	18.95	18.3
8/14/97	P2A	1110	21	-15.1	na	14.9	24.85	17.2
8/14/97	P2A	1110	22	16.1	na	16.7	27.05	16.8
8/14/97	P2A	1110	23	-17.1	na	17.3	28.10	16.6
8/14/97	P2A	1110	24	-18.1	na	17.6	28.50	16.3
8/14/97	T3	1145	0.1	5.8	2	0.1	0.17	24.5
8/14/97	T3	1145	2	3.9	2	0.1	0.17	24.3
8/14/97	T3	1145	0.1	5.8	200	0.1	0.16	24.0
8/14/97	T3	1145	2	3.9	200	0.1	0.16	23.9
8/14/97	T3	1145	4	1.9	200	0.1	0.16	23.4
8/14/97	T3	1145	6	-0.1	200	0.1	0.17	21.0
8/14/97	T3	1145	7.5	-1.6	200	0.1	0.20	20.3
8/14/97	T3	1200	0.1	5.8	400	0.1	0.16	24.1
8/14/97	T3	1200	2	3.9	400	0.1	0.16	24.1
8/14/97	T3	1200	4	1.9	400	0.1	0.16	23.4
8/14/97	T3	1200	6	-0.1	400	0.1	0.15	23.3
8/14/97	T3	1200	8	-2.1	400	0.1	0.19	20.0
8/14/97	T3	1200	0.1	5.8	600	0.1	0.17	24.0
8/14/97	T3	1200	2	3.9	600	0.1	0.16	23.9
8/14/97	T3	1200	4	1.9	600	0.1	0.16	23.5
8/14/97	T3	1200	6	-0.1	600	0.1	0.15	21.6
8/14/97	T3	1200	8	-2.1	600	0.1	0.16	20.3
8/14/97	T3	1200	9	-3.1	600	0.1	0.20	19.8
8/14/97	T1	1220	0.1	5.8	5	0.1	0.18	24.8
8/14/97	T1	1220	2	3.9	5	0.1	0.17	24.8
8/14/97	T1	1220	0.1	5.8	200	0.1	0.17	24.4
8/14/97	T1	1220	2	3.9	200	0.1	0.17	24.4
8/14/97	T1	1220	4	1.9	200	0.1	0.17	23.6
8/14/97	T1	1220	6	-0.1	200	0.1	0.17	23.1
8/14/97	T1	1220	8	-2.1	200	0.1	0.17	20.6
8/14/97	T1	1220	0.1	5.8	400	0.1	0.17	24.3
8/14/97	T1	1220	2	3.9	400	0.1	0.17	24.3
8/14/97	T1	1220	4	1.9	400	0.1	0.17	24.2
8/14/97	T1	1220	6	-0.1	400	0.1	0.17	23.4
8/14/97	T1	1220	8	-2.1	400	0.1	0.15	21.0

Capitol Lake 1997 Drawdown Salinity Monitoring Data

Date	Station	Time	Water Depth (feet)	MSL (feet)	Distance Along Transect (feet)	Salinity (ppt)	S. Cond. (mS/cm)	Temp (C)
8/14/97	T1	1220	9.5	-3.6	400	0.1	0.17	20.3
8/14/97	P2B	1220	0.1	5.8	na	0.1	0.17	24.5
8/14/97	P2B	1220	1	4.9	na	0.1	0.17	24.5
8/14/97	P2B	1220	2	3.9	na	0.1	0.17	24.5
8/14/97	P2B	1220	3	2.9	na	0.1	0.17	24.5
8/14/97	P2B	1220	4	1.9	na	0.1	0.17	24.4
8/14/97	P2B	1220	5	0.9	na	0.1	0.16	24.5
8/14/97	P2B	1220	6	-0.1	na	0.1	0.16	23.9
8/14/97	P2B	1220	7	-1.1	na	0.1	0.15	21.8
8/14/97	P2B	1220	8	-2.1	na	0.1	0.14	21.1
8/14/97	P2B	1220	9	-3.1	na	0.1	0.13	20.8
8/14/97	P2B	1220	10	-4.1	na	0.1	0.13	20.2
8/14/97	P2B	1220	11	-5.1	na	0.1	0.14	19.7
8/14/97	P2B	1220	12	-6.1	na	0.1	0.14	19.2
8/14/97	P2B	1220	13	-7.1	na	0.1	0.14	19.2
8/14/97	T2	1220	0.1	5.8	100	0.1	0.16	24.6
8/14/97	T2	1220	2	3.9	100	0.1	0.16	24.3
8/14/97	T2	1220	4	1.9	100	0.1	0.15	24.2
8/14/97	T2	1220	6	-0.1	100	0.1	0.14	21.7
8/14/97	T2	1220	8	-2.1	100	0.1	0.13	21.1
8/14/97	T2	1220	10	-4.1	100	0.1	0.13	20.2
8/14/97	T2	1220	12	-6.1	100	0.1	0.13	19.4
8/14/97	T2	1220	13.5	-7.6	100	0.1	0.13	19.2
8/14/97	T2	1220	0.1	5.8	200	0.1	0.16	24.6
8/14/97	T2	1220	2	3.9	200	0.1	0.16	24.5
8/14/97	T2	1220	4	1.9	200	0.1	0.16	23.6
8/14/97	T2	1220	6	-0.1	200	0.1	0.13	21.8
8/14/97	T2	1220	8	-2.1	200	0.1	0.13	20.8
8/14/97	T2	1220	10	-4.1	200	0.1	0.14	19.2
8/14/97	T2	1220	11	-5.1	200	0.1	0.14	19.2
8/14/97	P4	1315	0	5.9	na	0.1	0.15	25.0
8/14/97	P4	1315	2	3.9	na	0.1	0.15	24.6
8/14/97	P4	1315	4	1.9	na	0.1	0.14	23.2
8/14/97	P4	1315	6	-0.1	na	0.1	0.13	21.4

Capitol Lake 1997 Drawdown				
Dissolved Oxygen Data				
Date	**Station**	**Water Depth**	**MSL**	**DO**
		m	**feet**	**mg/L**
7/21/97	P2A	0	6	13.0
7/21/97	P2A	1	2	12.7
7/21/97	P2A	2	-1	12.5
7/21/97	P2A	3	-4	12.2
7/21/97	P2A	4	-7	12.0
7/21/97	P2A	5	-11	11.7
7/21/97	P2A	6	-14	10.1
7/21/97	P2A	7	-17	8.3
7/26/97	P2A	0	-1	9.6
7/26/97	P2A	1	-4	9.3
7/26/97	P2A	2	-8	6.2
7/26/97	P2A	3	-11	6.2
7/26/97	P2A	4	-14	6.0
7/26/97	P2A	5	-17	6.0
7/26/97	P2A	5.5	-19	6.0
7/30/97	P2A	0	6	14.7
7/30/97	P2A	1	2	14.2
7/30/97	P2A	2	-1	12.9
7/30/97	P2A	3	-4	10.4
7/30/97	P2A	4	-8	10.1
7/30/97	P2A	5	-11	7.8
7/30/97	P2A	6	-14	4.5
7/30/97	P2A	7	-17	2.6
7/30/97	P2A	7.5	-19	0.3
8/6/97	P2A	0	6	13.3
8/6/97	P2A	1	3	12.4
8/6/97	P2A	2	-1	11.4
8/6/97	P2A	3	-4	10.5
8/6/97	P2A	4	-7	8.2
8/6/97	P2A	5	-11	8.5
8/6/97	P2A	6	-14	7.7
8/6/97	P2A	7	-17	1.2
8/6/97	P2A	7.5	-19	0.8
8/14/97	P2A	0	6	12.4
8/14/97	P2A	1	3	12.6
8/14/97	P2A	2	-1	12.3
8/14/97	P2A	3	-4	10.2
8/14/97	P2A	4	-7	8.1
8/14/97	P2A	5	-11	6.2

Capitol Lake 1997 Drawdown				
Dissolved Oxygen Data				
Date	**Station**	**Water Depth**	**MSL**	**DO**
		m	**feet**	**mg/L**
8/14/97	P2A	6	-14	4.0
8/14/97	P2A	7	-17	0.5
8/14/97	P2A	8	-20	0.5
8/28/97	P2A	0	6	11.3
8/28/97	P2A	1	3	11.3
8/28/97	P2A	2	-1	11.3
8/28/97	P2A	3	-4	11.0
8/28/97	P2A	4	-7	7.5
8/28/97	P2A	5	-11	4.7
8/28/97	P2A	6	-14	2.3
8/28/97	P2A	7	-17	1.7
9/11/97	P2A	0	6	11.2
9/11/97	P2A	1	3	11.4
9/11/97	P2A	2	-1	11.0
9/11/97	P2A	3	-4	11.2
9/11/97	P2A	4	-7	8.8
9/11/97	P2A	5	-11	7.4
9/11/97	P2A	6	-14	0.8
9/11/97	P2A	7	-17	0.5
9/24/97	P2A	0	6	13.7
9/24/97	P2A	1	3	13.1
9/24/97	P2A	2	-1	12.6
9/24/97	P2A	3	-4	12.4
9/24/97	P2A	4	-7	11.8
9/24/97	P2A	5	-11	5.6
9/24/97	P2A	6	-14	5.5
9/24/97	P2A	7	-17	5.9
7/21/97	P4	0	6	12.0
7/21/97	P4	1	2	11.9
7/21/97	P4	2	-1	10.5
7/21/97	P4	3	-4	9.7
7/21/97	P4	0	6	12.0
7/21/97	P4	1	2	11.9
7/21/97	P4	2	-1	10.5
7/21/97	P4	3	-4	9.7
7/30/97	P4	0	6	12.9
7/30/97	P4	1	2	11.6

Capitol Lake 1997 Drawdown				
Dissolved Oxygen Data				
Date	**Station**	**Water Depth**	**MSL**	**DO**
		m	**feet**	**mg/L**
7/30/97	P4	2	-1	11.4
8/14/97	P4	0	6	11.2
8/14/97	P4	1	3	11.3
8/14/97	P4	2	-1	9.9
8/28/97	P4	0	6	9.7
8/28/97	P4	1	3	9.2
8/28/97	P4	2	-1	8.9
8/28/97	P4	3	-4	8.8
8/28/97	P4	4	-7	7.2
9/11/97	P4	0	6	11.4
9/11/97	P4	1	3	11.0
9/11/97	P4	2	-1	10.7
9/11/97	P4	3	-4	10.2
9/24/97	P4	0	6	12.1
9/24/97	P4	1	3	14.4
9/24/97	P4	2	-1	12.6
9/24/97	P4	3	-4	12.0
7/21/97	SB1	0	6	11.9
7/26/97	SB1	0	nd	nd
7/30/97	SB1	0	6	11.8
8/14/97	SB1	0	6	10.9
8/14/97	SB1	1	3	10.6
8/14/97	SB1	2	-1	11.5
8/28/97	SB1	0	6	10.5
8/28/97	SB1	1	3	10.8
8/28/97	SB1	2	1	10.6
9/11/97	SB1	0	6	11.1
9/11/97	SB1	1	3	11.1
9/11/97	SB1	1.75	0	11.2
9/24/97	SB1	0	6	11.1
9/24/97	SB1	1	3	10.7
9/24/97	SB1	1.5	1	11.1

Capitol Lake
1997 Drawdown Data

DRAFT

Capitol Lake 1997 Drawdown Water Quality Monitirng Data															
Date	Station	Time	TP	SRP	NH3	NO2	NO3	NO2+NO3	Chl a	Pheo	pH	Secchi	DO	Temp	Cond
			ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L		m	mg/L	C	mS/cm
7/2./97	P2A	1110	35	4	94	8	262		4.8	6.2	8.65	1.75			
7/2./97	P4	1330	58	9	199	8	261		6.0	9.4	8.60	1.25			
7/2./97	SB1	NR	27	6	31	5	540		2.7	3.3	7.23	> 0.8			
7/2./97	PC1	1450	27	12	20	4	189				6.50		9.2	19.2	0.092
7/2./97	DR1	1545	30	14	101	5	694				7.70		11.1	17.8	0.109
7/30/97	P2A	1330	32	2	15	7	235		24.0	6.2	9.20	1.25			
7/30/97	P4	1200	34	3	< 10	7	266		19.0	5.1	8.75	1.1			
7/30/97	SB1	1250	29	14	14	5	765		2.7	1.6	8.10	1.4			
7/30/97	PC1	1630	26	17	< 10	3	204				7.74		9.2	20.5	0.100
7/30/97	DR1	1645	39	15	14	5	744				7.19		10.4	18.5	0.122
8/14/97	P2A	1110	28	2	39	8	45		9.1	4.8	9.20	2.8			
8/14/97	P4	1315	56	3	78	11	34		21.0	5.9	9.02	1.25			
8/14/97	SB1	NR	29	5	32	7	572		8.0	2.8	NR	> 2.1			
8/14/97	PC1	NR	27	16	< 10	3	214				7.68		9	21.8	0.104
8/14/97	DR1	NR	27	11	24	5	735				7.69		10	18.9	0.124
8/28/97	P2A	1245	47	9	65			272	14.0	7.5	7.45	2.25			
8/28/97	P4	NR	39	11	67			445	4.8	4.0	7.10	1.75			
8/28/97	SB1	NR	40	22	82			661	1.9	5.4	7.80	1.6			
8/28/97	PC1	NR	30	21	26			168			6.75		nd	18.8	0.109
8/28/97	DR1	NR	32	22	33			684			8.10		nd	16.2	0.125
9/11/97	P2A	1330	27	11	58	8	225		4.3	2.1	8.30	2.75			
9/11/97	P4	1450	31	17	64	8	333		7.3	2.9	8.18	1.75			
9/11/97	SB1	1430	27	7	35	5	665		1.6	1.9	7.70	> 2			
9/11/97	PC1	NR	26	18	13	3	175				7.53		9.4	18.9	0.103
9/11/97	DR1	NR	27	14	31	5	704				7.58		10.4	16.7	0.125
9/24/97	P2A	1230	21	4	64			308	13.0	2.7	7.80	1.75			
9/24/97	P4	1410	21	9	34			347	3.6	1.4	8.40	> 2.7			
9/24/97	SB1	1350	28	18	26			587	1.5	1.6	8.1	> 1.75			
9/24/97	PC1	1430	47	16	62			144			7.52		7.9	18.6	0.975
9/24/97	DR1	1450	25	18	27			602			7.90		9.5	16.0	0.113
NR: not recorded			nd: no data												

APPENDIX B
FISH STRANDING SURVEY

INTRODUCTION

This report documents the methods and results from the data collected and observations made during a four-day survey of fish strandings on Capitol Lake in Olympia, Washington, as a result of the bumping drawdown of the lake. The annual "drawdown" at Capitol Lake is conducted primarily to control aquatic plants, and has the beneficial effect of encouraging migratory and/or anadromous fish to exit the lake to saltwater. It nonetheless has the side effect of potentially stranding fish in exposed shorelines, resulting in some mortality by shear exposure and bird predation. While conducting the drawdown in a sequential "bumping" manner reduces the degree of stranding, a survey of the shorelines during the drawdown to assess fish stranding during the process is required as a general condition for approval of the Hydraulic Project Application (HPA) for the drawdown.

This report provides only a qualitative assessment of fish stranding and habitat observations during the four consecutive days coinciding with the Capitol Lake drawdown, and does not provide exact estimates of total mortality or percentages of the lake fish populations for each species that were affected. Data collection methods will be described, results will be explained and represented graphically on attached figures, and management recommendations will be provided based on professional judgment of the observations made during the field visits.

METHODS

The fish stranding surveys were performed on four successive days between July 22 and July 25, 1997. The stranding surveys were conducted in each of the four contiguous water bodies which comprise Capitol Lake. These areas are identified as the South Basin, the Middle Basin, the North Basin, and Percival Cove (**figure 1**). The surveys were initiated each day during or immediately after that day's sequential drawdown was completed, usually between the hours of 14:00 to 16:00. We attempted to survey exposed or isolated areas as rapidly as possible after drawdown to limit the number of stranded fish eaten by birds and other predators. Approximately fifty percent of the potential stranding areas were surveyed over the course of the drawdown.

The stranding surveys were conducted by a minimum of two to three surveyors each day. On the first day (Tuesday July 22) Jim Frasier, habitat biologist (WDFW), performed the survey with us to provide direction in the qualitative visual survey of fish mortality. A canoe was utilized during the surveys for accessing stranded areas in the South Basin, Middle Basin, and Percival Cove, while the North Basin was surveyed on foot due to the easy shoreline access in this basin. After accessing a shoreline area that had become exposed or dewatered, the survey crew would search the exposed mud flat areas for dead or dying stranded fish (this included fish which were found to be alive in isolated

pools on the mud flats). Locations where significant fish stranding occurred were marked on basin maps of Capitol Lake. Fish which were found were usually kept in buckets for later species identification. A rough visual estimate of dead fish numbers was determined over the course of the surveys.

In addition to searching for stranded fish on exposed mud flat areas, the survey crew also electroshocked wetted channels soon to be cut-off and isolated from the lake shoreline during the next day's drawdown. This was performed on three occasions and was done to get a representative sample of the species composition and relative numbers of fish that would become stranded, if the channel, in fact, were to become isolated. All fish captured during electroshocking were placed in buckets and were later identified as to species.

A final objective of the survey was to determine if the sequential drawdown schedule was increasing fish mortality by causing fish to become re-stranded in areas, which were being alternately isolated, rewatered, and then isolated again (i.e., a two-foot lake drawdown on Day 1, then an increase in lake elevation of 1-foot due to inflow from the Deschutes River, followed by a subsequent drawdown of 2 feet on Day 2). This was accomplished by completely removing all stranded fish from isolated areas, allowing the isolated areas to be rewatered by an increase in the lake elevation, and then resurveying those areas for stranded fish after they had become isolated again by the next sequential lake drawdown.

RESULTS

A variety of species were observed during the stranding surveys. Fish observed included the following: three-spined sticklebacks (*Gasterosteus aculeatus*), speckled dace (*Rhinichthys osculus*), largescale sucker (*Catostomus macrocheilus*), peamouth (*Mylocheilus caurinus*), carp (*Cyprinus carpio*), reticulate sculpin (*Cottus perplexus*), coastrange sculpin (*C. aleuticus*), riffle sculpin (*C. gulosus*), coho salmon (*Oncorhynchus kisutch*), cutthroat trout (*O. clarki*), Olympic mudminnow (*Novumbra hubbsi*), smallmouth bass (*Micropterus dolomieui*), and western brook lamprey (*Lampetra richardsoni*). In addition to these fish species, numerous invertebrate insect species and crayfish were observed.

Fish stranding surveys performed on the four successive days of the Capitol Lake drawdown showed that a variety of fish species were stranded in the lake (see **tables 1a, 1b,** and **2**). Based on a qualitative visual survey, approximately 500 common fish (such as three-spined sticklebacks, dace, and sculpins) were found dead due to stranding on the exposed shorelines and in isolated pools of the lake over the course of the survey during the drawdown. Only a few fish species of critical concern (i.e., threatened/endangered salmonids or other species) were detected or found in any of the stranded areas, namely coho salmon and Olympic mudminnow. However, bird predation should be considered as an extremely important source of fish mortality. Several predatory bird species were observed during our surveys. Some of these are: belted

Table 1a
Species, Size Classes, and Relative Number Caught During Electroshocking in the Lake Influenced Habitat of the South Basin on July 22, 1997

Lake Influenced Habitat	Size Class and Number Observed	
Species	**<1–2 inches**	**2–4 inches**
Speckled dace & Peamouth	74	28
Three-spined Sticklebacks	10	19
Sculpin (Cottus sp.)	58	16
Lamprey	0	2
Crayfish	12	2
Frogs	3	3

Table 1b
Species, Size Classes, and Relative Number Caught During Electroshocking in the Riverine Influenced Habitat of the South Basin on July 22, 1997

Riverine Influenced Habitat	Size Class and Number Observed	
Species	**<1–2 inches**	**2–4 inches**
Speckled dace & Peamouth	1	0
Three-spined Sticklebacks	0	2
Sculpin (Cottus sp.)	34	9
Lamprey	0	4
Crayfish	6	2
Frogs	0	3

kingfisher (*Megaceryle alcyon*), great blue heron (*Ardea herodias*), grebes (*Podiceps* sp.), ducks (*Anas* sp.), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), gulls (*Larus* sp.), even crows. All of these species were observed actively feeding on fish. Bird tracks were repeatedly observed by dried up pools and isolated channels in each of the four basins surveyed.

Table 2
Species, Size Classes, and Relative Number Caught During Electroshocking in Percival Cove on July 24, 1997

Percival Cove Pool Stranding	Size Class and Number Observed	
Species	**<1–2 inches**	**2–4 inches**
Smallmouth bass	0	3
Cutthroat trout	0	1
Coho salmon	0	5
Olympic Mudminnow	2	0
Speckled dace & Peamouth	0	6
Three-spined Sticklebacks	5	2
Sculpin (Cottus sp.)	6	2

Day 1 - July 22, 1997 (Lake Drawdown from 6.4 feet to 4.5 feet)

After the initial 2-foot drawdown, the only apparent habitat change occurred in the South Basin, the other Capitol Lake areas remained wetted (**figure 1**). Several areas in the South Basin became exposed, especially mud flats in between upland patches of cattails and sedges, and the farthest upstream shoreline areas (**figure 1a**). Several pools and soon to be isolated channels were observed as a result of the drawdown. Several cottids and sticklebacks were stranded along the shoreline margins and in isolated pool habitats. Almost exclusively, cottids were found in isolated and completely dried-up pools along the riverine section (section of the South Basin, influenced by Deschutes River flow) of the South Basin.

Electroshocking of the isolated channels and pool habitats indicated that the only fish present in these habitats in the South Basin were three-spined sticklebacks, peamouth, speckled dace, and sculpins. Several western brook lamprey, crayfish, and insects were also observed in the isolated/exposed areas (see photo plate at the back). Fish captured during electroshocking in the South Basin were separated into two categories: those caught in lake influenced pools or wetted channels with the potential for stranding fish and those caught in more riverine influenced side channels and pools. **Tables 1a** and **1b** show the species, size classes, and relative number of all fish captured during electroshocking on Day 1 for the different habitat areas (see photo plates at the back for fish identifications). No fish greater than 4 inches were captured during electroshocking.

Day 2 - July 23, 1997 (Lake Drawdown from 5.5 feet to 3.5 feet)

The North Basin remained unchanged as a result of the second sequential drawdown due to relatively steep gradient side slopes all the way around this basin. Percival Cove also remained relatively unchanged at this lake elevation drawdown.

Exposed mud flat areas began to emerge and strand a few fish in the Middle Basin and the wetted area in the South Basin continued to decrease (**figures 2** and **2a**). Sticklebacks, dace, and sculpins continued to be stranded in the South Basin. Few fish were found in the isolated areas, which had been isolated during Day 1, re-watered, and then isolated again on Day 2. It appears that fish are not significantly restranding themselves in those habitats that are isolated, re-watered, then isolated again.

Day 3 - July 24, 1997 (Lake Drawdown from 4.5 feet to 1.5 feet)

The lake drawdown to 1.5 feet revealed the continued wetted habitat isolation of the South Basin. Due to the 3-foot drop in water surface elevation, relatively few areas remained with a wetted surface. The areas remaining wetted became more riverine due to the influence of the Deschutes River. Very few fish were observed on the large amount of area that became exposed mainly due to the fact that the gently sloping lake margins provided few places for fish to become stranded in the South Basin.

The Middle Basin and Percival Cove showed the most significant wetted habitat loss during this lake level ramping period (**figure 3**). Both of these areas, particularly the Middle Basin, had large mud flat areas exposed due to the 3-foot drop in water surface elevation. Percival Cove experienced the most significant impact of any basin during Day 3 in terms of fishery resources. Several pools were left isolated from the main channel of Percival Creek during this drawdown. The pools were found to be cool and receiving some groundwater inflow, which most likely would be sufficient to keep salmonids and other sensitive species alive until the lake level rose again. However, several bird species were found in abundance near these pools and most likely would capture any of the isolated fish species. The electroshocker was used to determine which species were caught in these isolated pools (**table 2**). No fish greater than four inches were captured during electroshocking.

The only fish of interest were collected in isolated pools in Percival Cove and included smallmouth bass (3), cutthroat trout (1), coho salmon (5), and Olympic Mudminnow (2). The Olympic Mudminnow is both a state and federal candidate for a rare, threatened or endangered species status, and inhabits the Deschutes River basin, and other basins in western Washington.

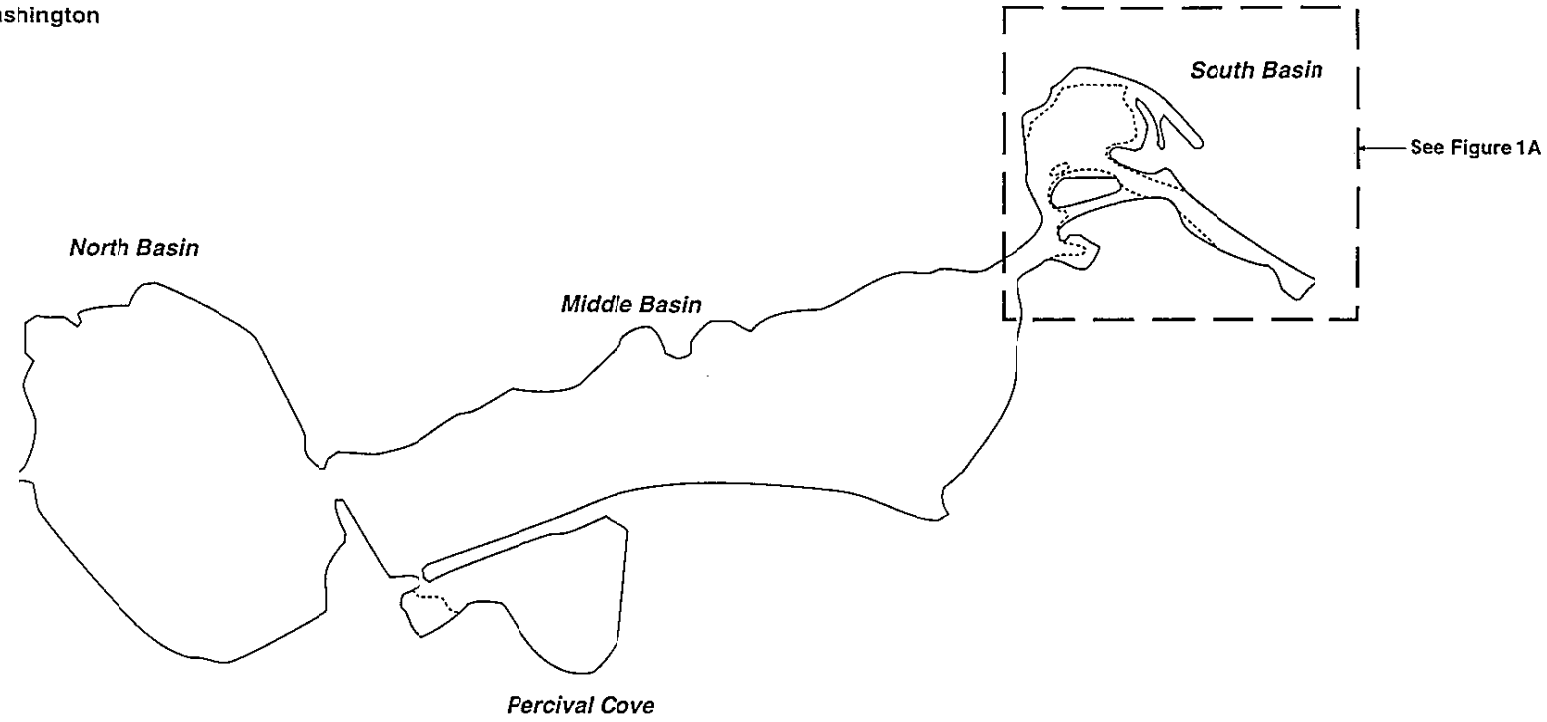
The North Basin was not impacted as a result of the lake drawdown for Day 3.

Day 4 - July 25, 1997 (Lake Drawdown From 2.5 feet to -3.0 feet)

The most significant impact of the fourth day of sequential lake drawdown occurred in the Middle and North Basins of Capitol Lake. Significant areas became exposed in the middle and along the lake margins of both of these basins (**figure 4**). The South Basin remained relatively unchanged as a result of the final lake drawdown, except that the remaining wetted areas became fast flowing riffle and glide habitats throughout the South Basin and into the Middle Basin.

As a result of the last 5-foot drawdown the exposed areas in the Middle and North Basins were found to have impacts on both three-spined sticklebacks and smallmouth bass. Both species, especially smallmouth bass, were stranded in great abundance in exposed areas of the Middle and North Basins that contained rooted aquatic macrophyte cover. Numerous bass were collected in these areas as the water receded during the drawdown. Several hundred 2- to 3-inch juvenile bass were observed and collected along the lake margin in the North Basin. These fish were apparently unable to navigate through the thick vegetation back to the lake margin or became entangled in the vegetation with their fin rays or spines.

Capitol Lake
Olympia, Washington



LEGEND

——— Full Lake Water Surface

····· Lake Water Surface after July 22 Drawdown

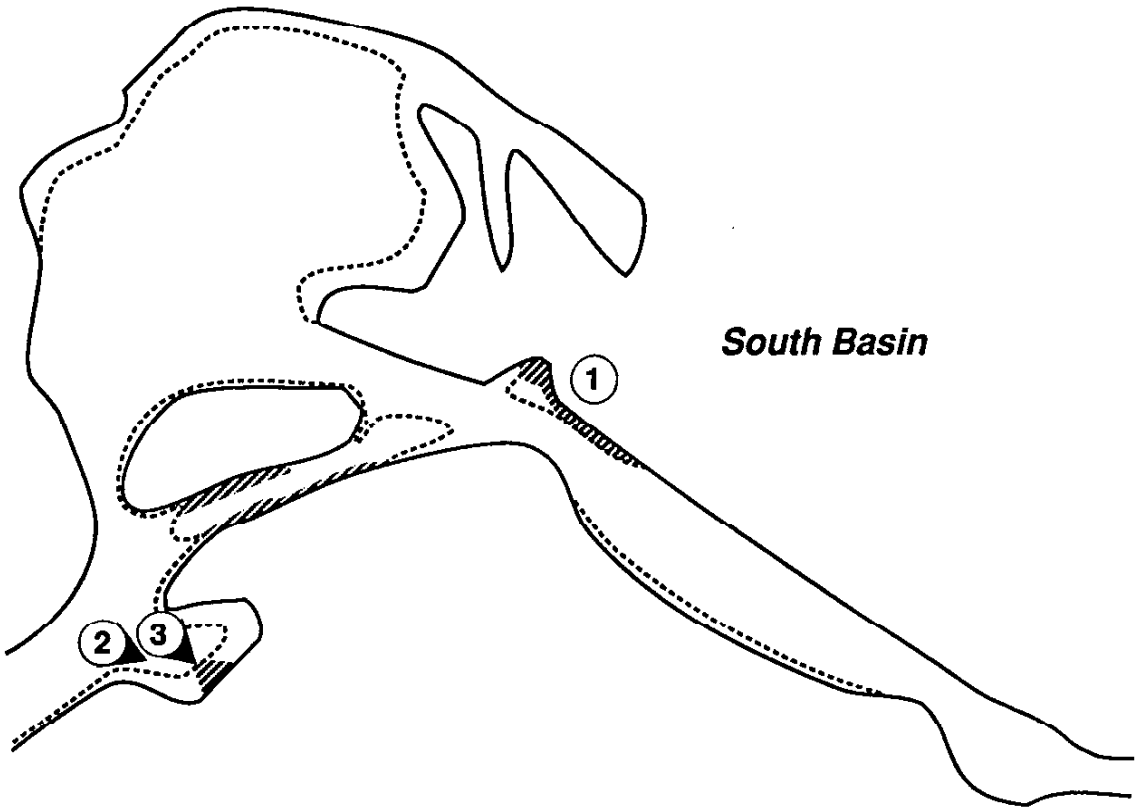
NOT TO SCALE

TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey
July 22 Drawdown

Figure 1 August 1997

Capitol Lake
Olympia, Washington



NOT TO SCALE

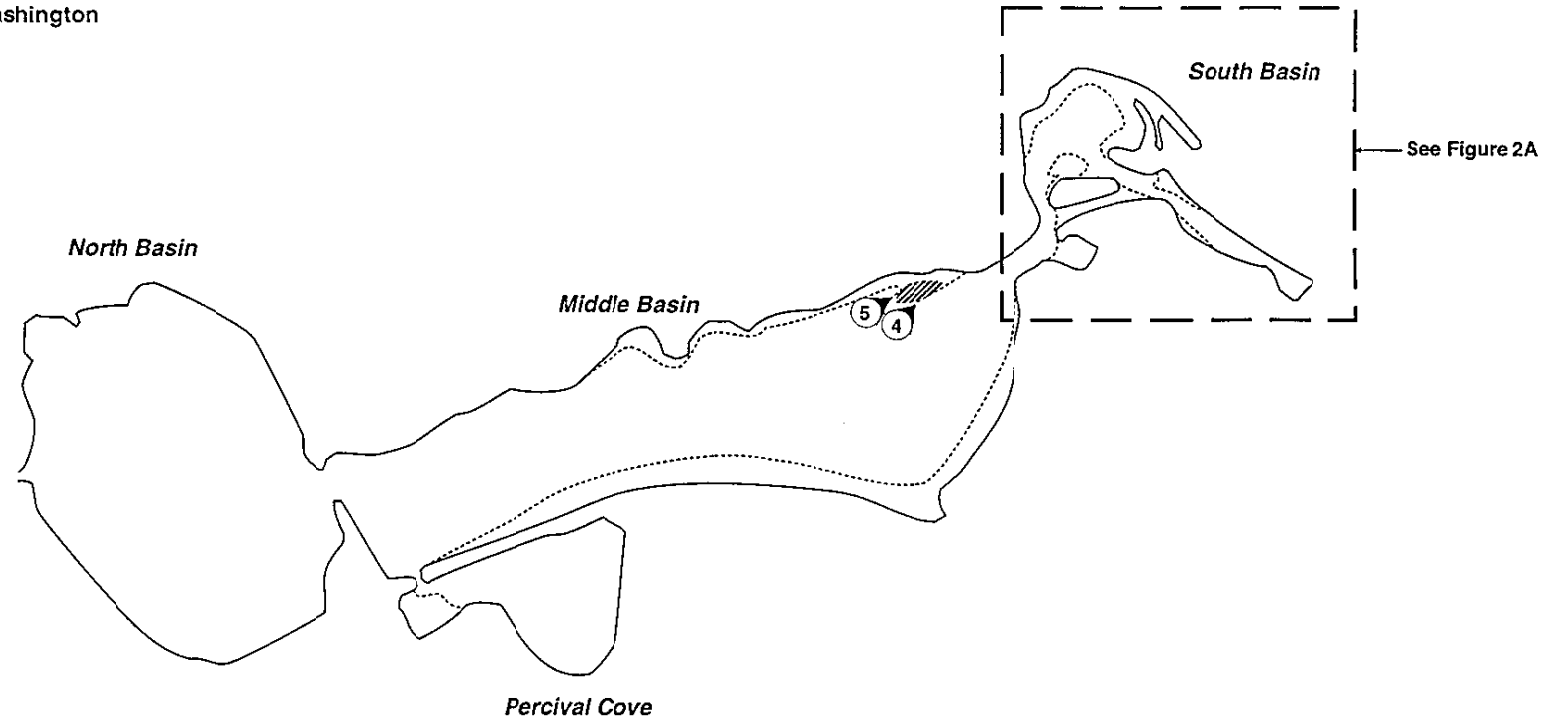
LEGEND

- 1 Photo Location and Direction
- Full Lake Water Surface
- Lake Water Surface after July 22 Drawdown
- Observed Fish Stranding Areas

TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey
South Basin - July 22 Drawdown
Figure 1A August 1997

Capitol Lake
Olympia, Washington



LEGEND

- 4 — Photo Location and Direction
- Full Lake Water Surface
- Lake Water Surface after July 23 Drawdown
- Observed Fish Stranding Areas

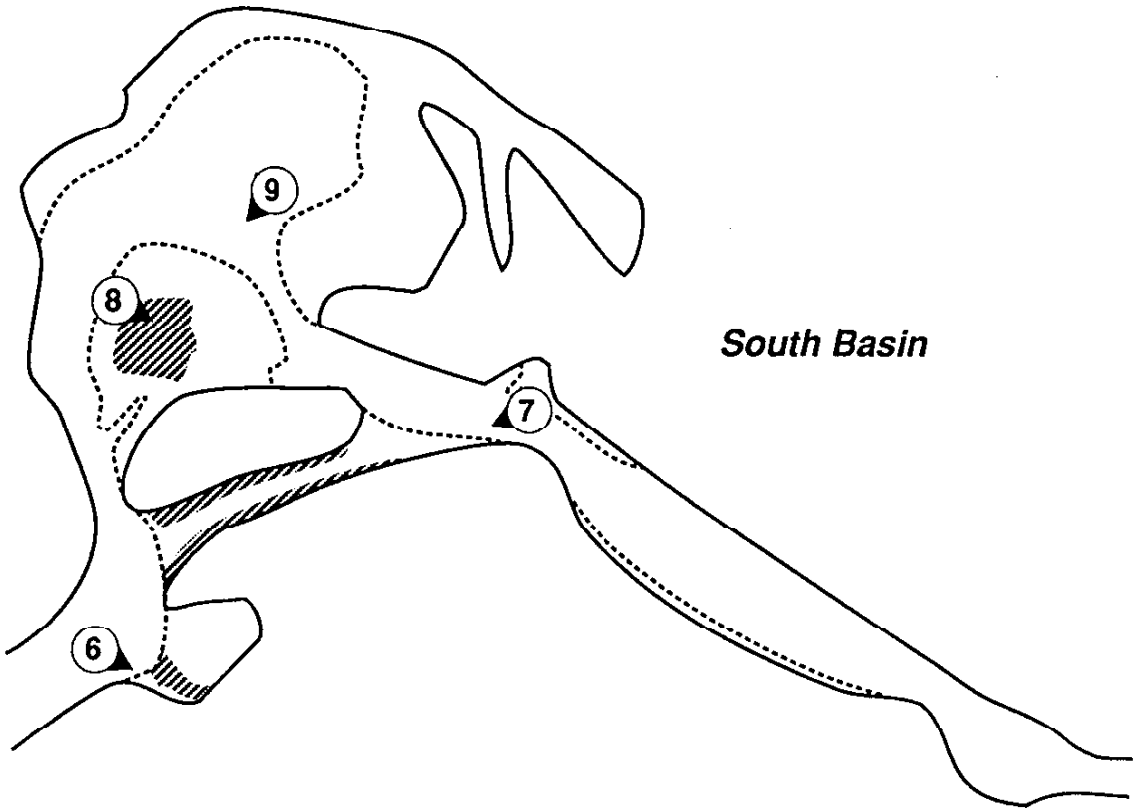
NOT TO SCALE

TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey
July 23 Drawdown

Figure 2 August 1997

Capitol Lake
Olympia, Washington



NOT TO SCALE

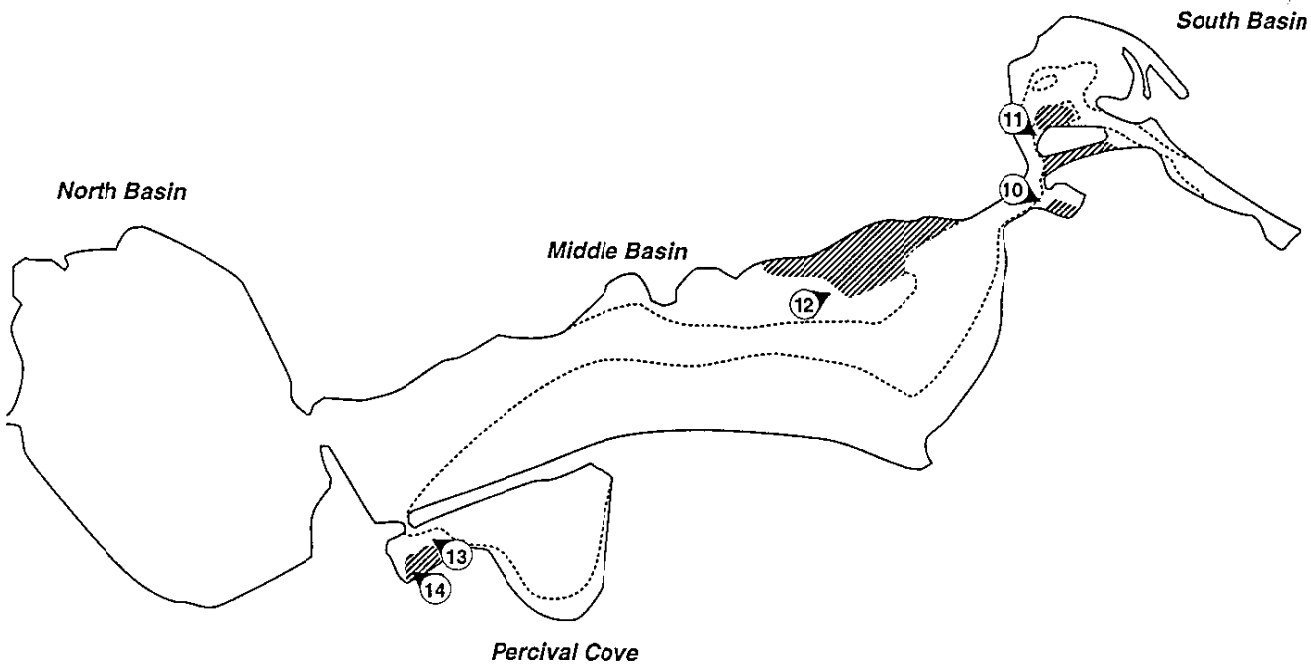
LEGEND

- 6 ▶ Photo Location and Direction
- ——— Full Lake Water Surface
- - - - - - - - - Lake Water Surface after July 23 Drawdown
- ////// Observed Fish Stranding Areas

TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey
South Basin - July 23 Drawdown
Figure 2A August 1997

Capitol Lake
Olympia, Washington



LEGEND

- 10 ▶ Photo Location and Direction
- Full Lake Water Surface
- Lake Water Surface after July 24 Drawdown
- Observed Fish Stranding Areas

NOT TO SCALE

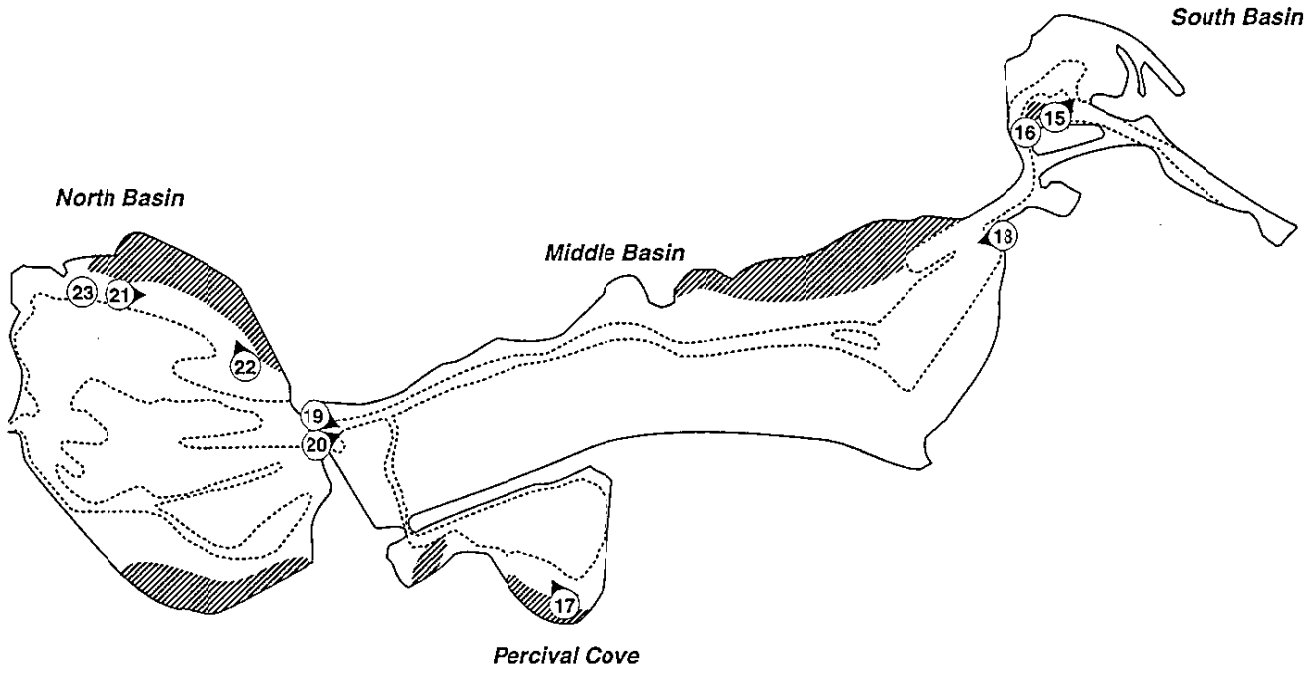
TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey
July 24 Drawdown

Figure 3 August 1997

Capitol Lake

Olympia, Washington



LEGEND

- 15 ▶ Photo Location and Direction
- ——— Full Lake Water Surface
- ····· Lake Water Surface after July 25 Drawdown
- ▨ Observed Fish Stranding Areas

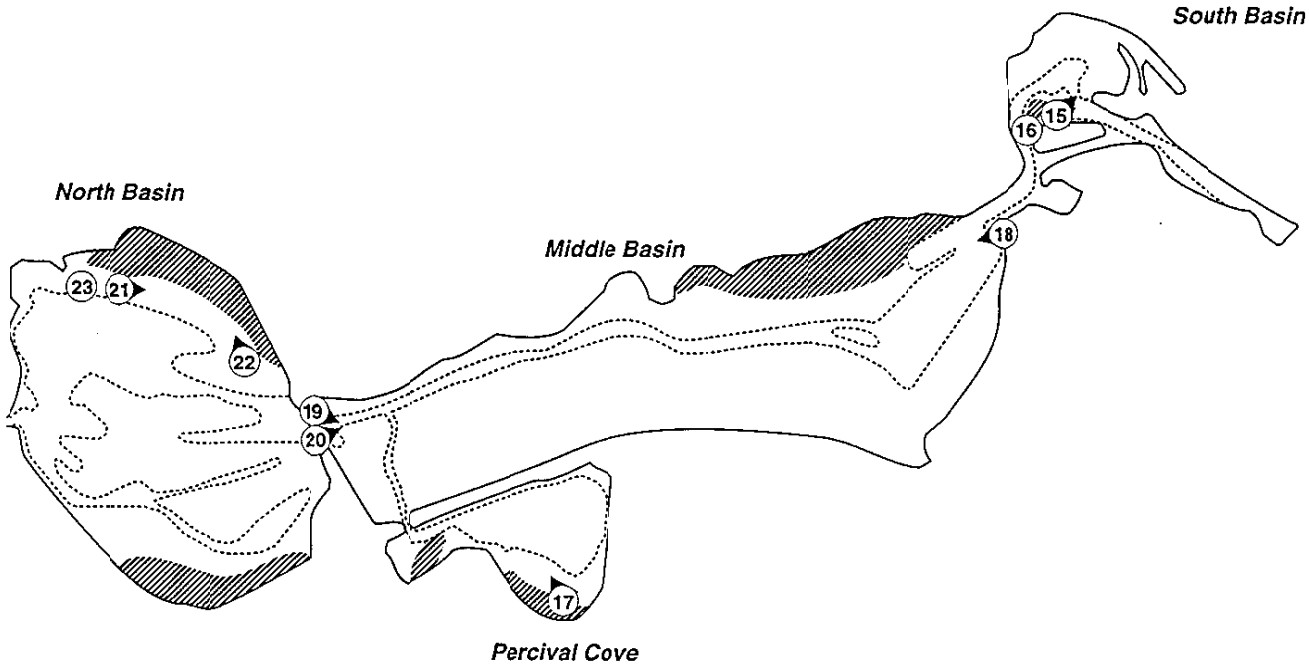
NOT TO SCALE

TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey
July 25 Drawdown

Figure 4 August 1997

Capitol Lake
Olympia, Washington



LEGEND

- 15 ▶ Photo Location and Direction
- ——— Full Lake Water Surface
- ····· Lake Water Surface after July 25 Drawdown
- ▨ Observed Fish Stranding Areas

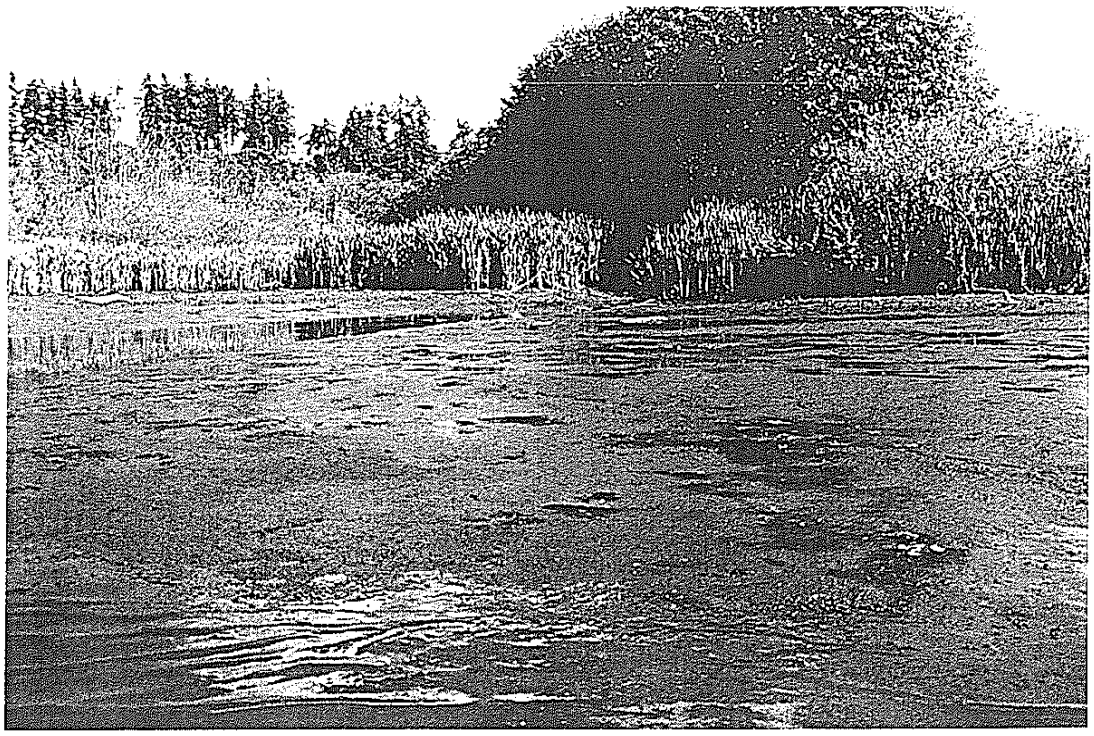
NOT TO SCALE

TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey
July 25 Drawdown

Figure 4 August 1997

1



2

TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey Photos

August 1997

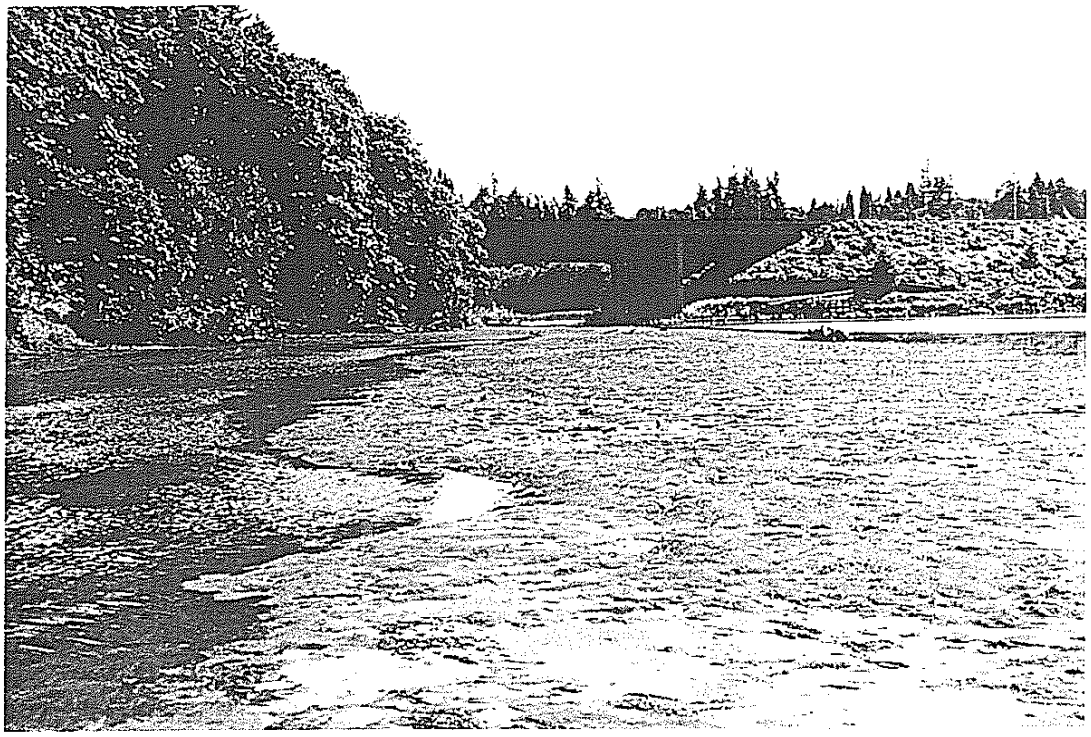
3

4

TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey Photos

August 1997



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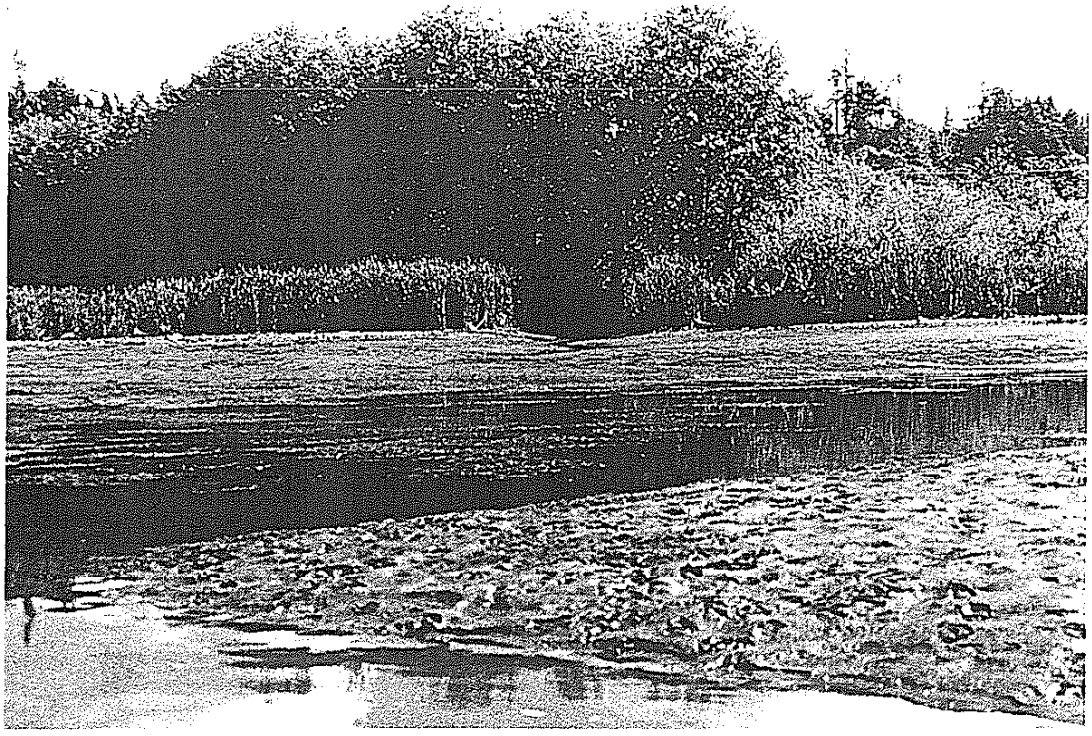
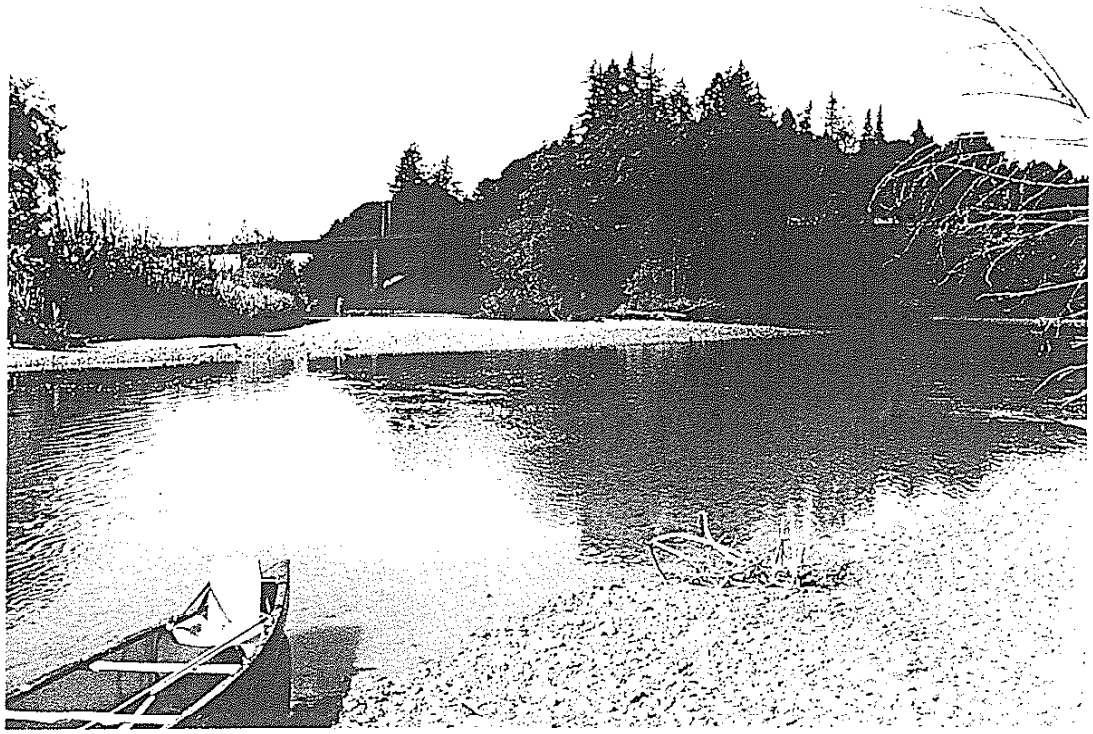


6

TAYLOR ASSOCIATES

Capitol Lake Fish Stranding Survey Photos

August 1997



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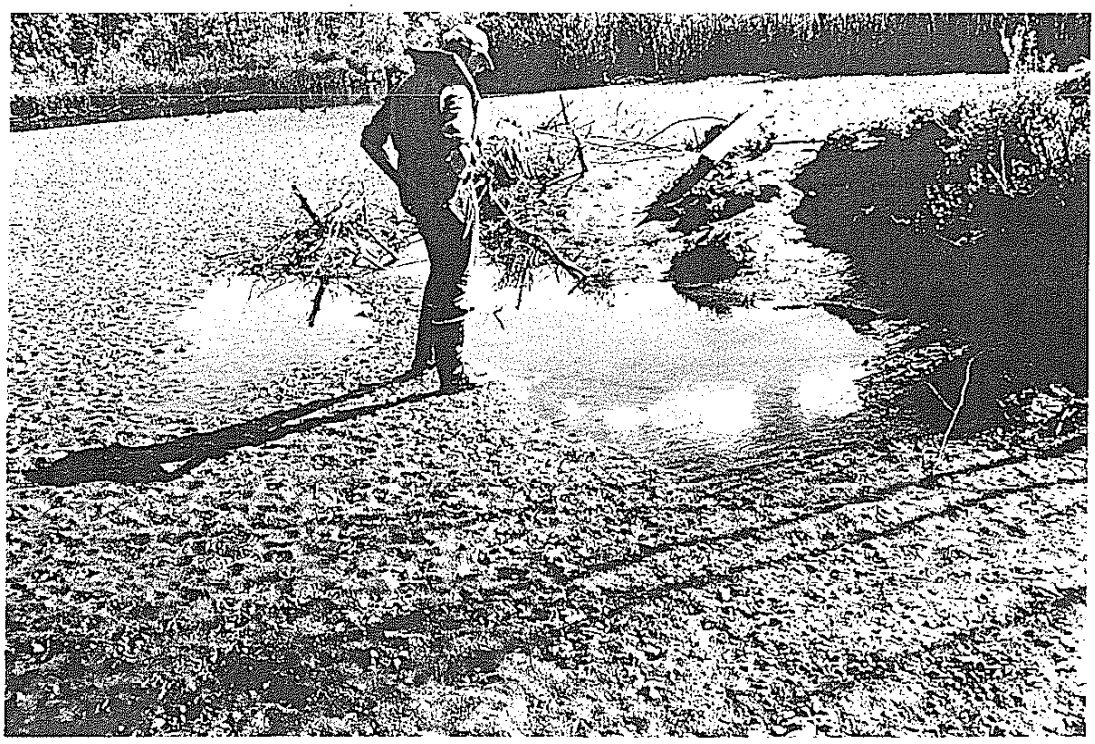

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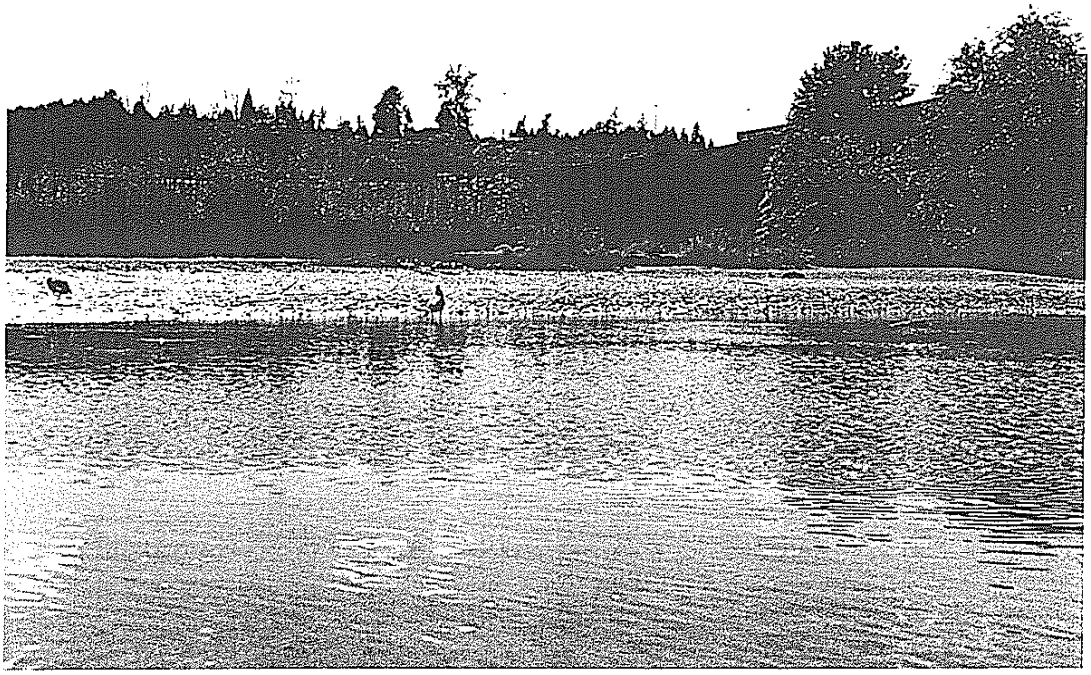

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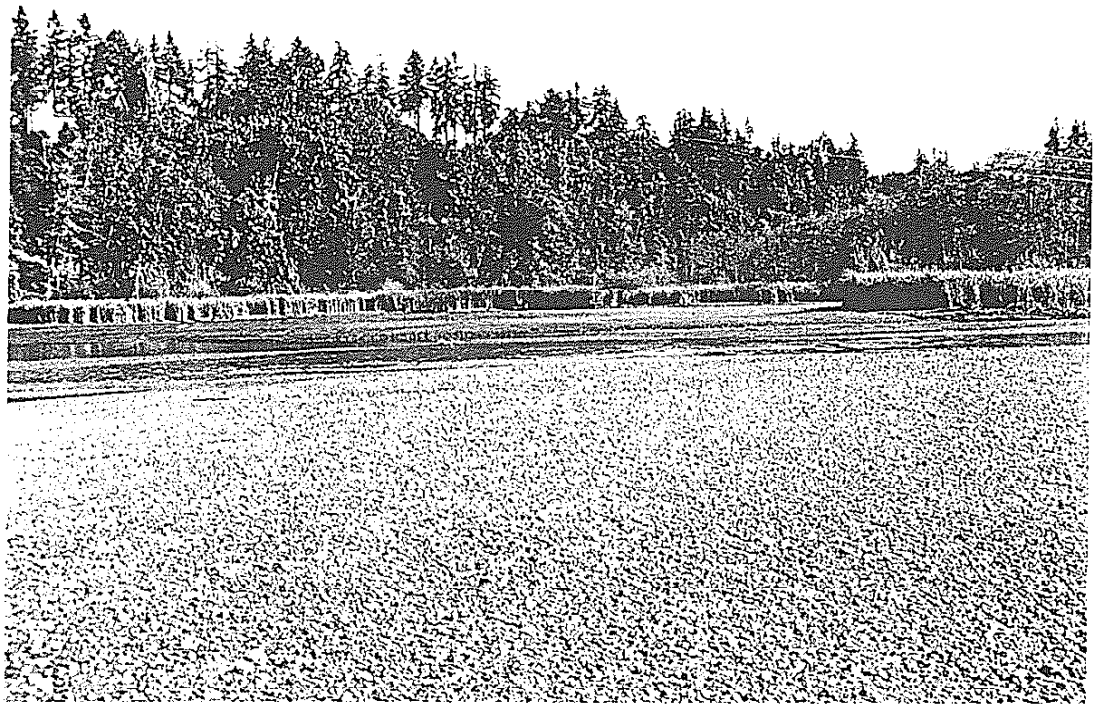

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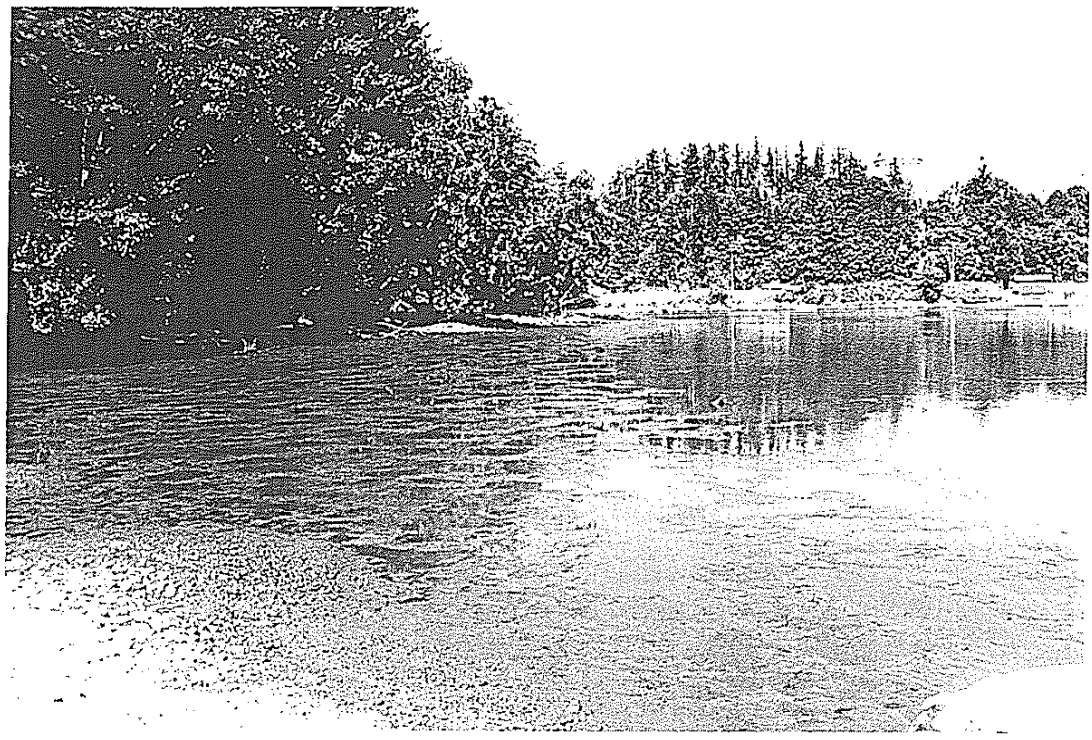

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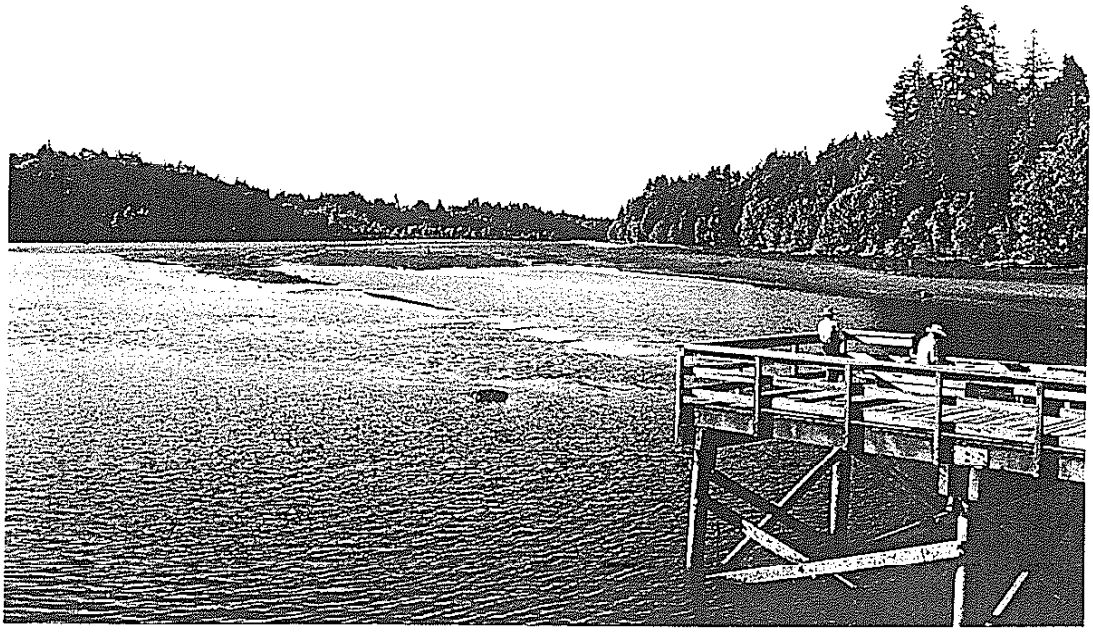

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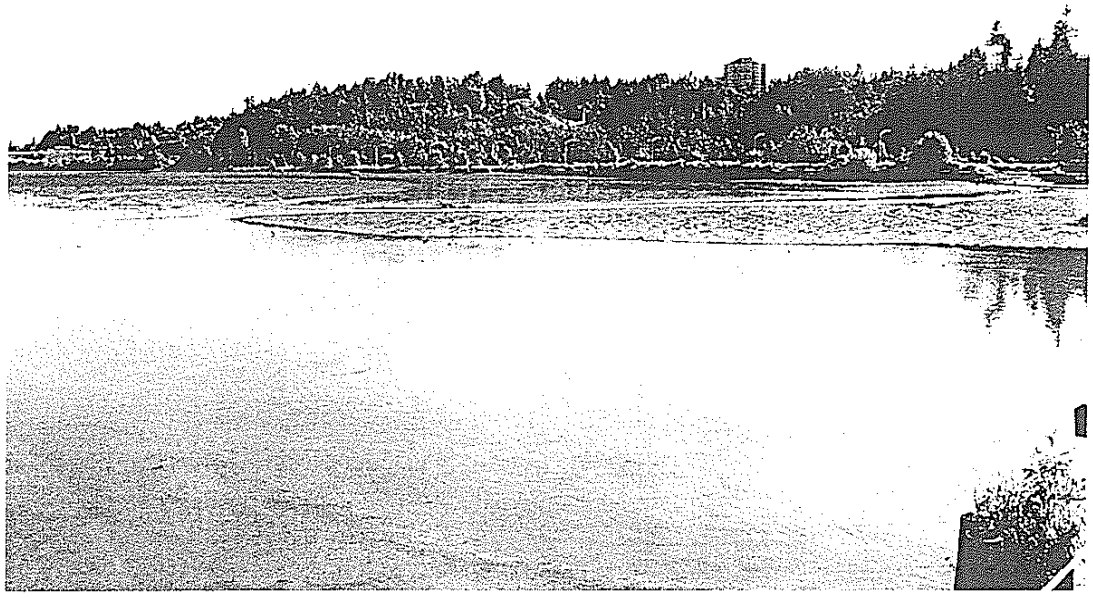

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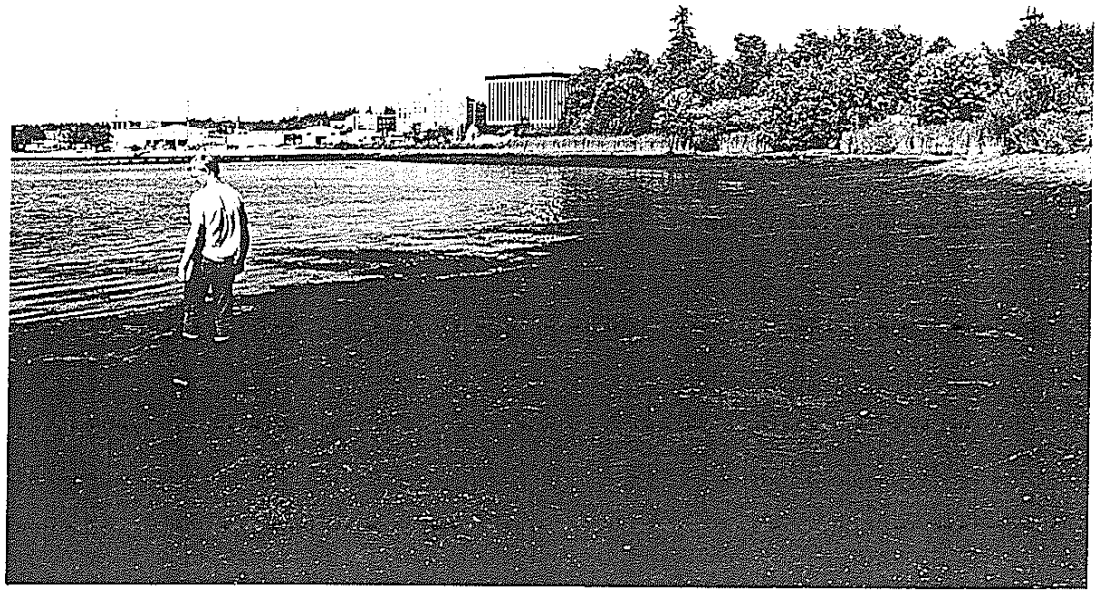

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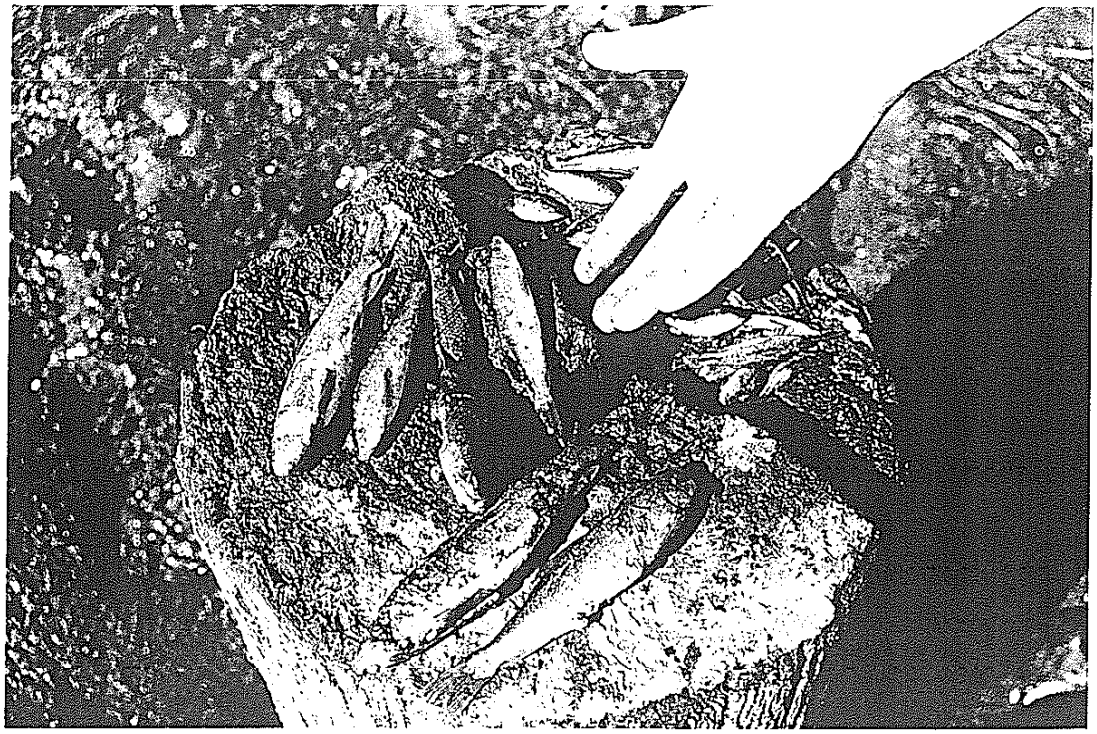

APPENDIX C

Wildlife Observed at Capitol Lake

APPENDIX C
WILDLIFE OBSERVED AT CAPITAL LAKE

The following animals. or recent signs of their presence, were observed in the Capitol Lake area on a field trip conducted 29 October 1975 by Charles Lindberg and Christopher Dlugokenski.

Mammals

Deer	*Odocoileus* sp.
Muskrat	*Ondatra zibethica*
Striped skunk	*Mephitis mephitis*
Raccoon	*Procyon lotor*
Voles	*Microtus sp., Clethrionomys sp.*
Mink	*Mustela vison*
Mountain beaver	*Aplodontia rufa*
River otter	*Lutra canadensis*
Deer mouse	*Peromyscus maniculatus*
Bushytail woodrat	*Neotoma cinerea*
Pacific mole	*Scapanus orarius*
Bat	*Myotis Sp.*

Amphibians

Frogs
Turtles
Lizards

Benthic Animals

Crayfish
Snails

Fish

Salmon
Steelhead
Cutthroat trout

These populations were compiled from the lists of the Black Hills Audubon Society, and are concerned with the area of the lake between the 1-5 bridge and Tumwater Falls.

Winter Residents	Permanent Residents
Common loon***	Great blue heron***
Horned grebe*	Green heron***
Eared grebe*	Mallard*
Western grebe*	Sharp-shinned hawk**
Pied-billed grebe*	Cooper's hawk***
Double-crested cormorant	Red-tailed hawk

Appendix C Wildlife Observed at Capitol Lake

Spring and Summer Residents

Turkey vulture
Band-tailed pigeon**
Common nighthawk
Rufous hummingbird***
Violet-green swallow***
Tree swallow
Rough-winged swallow
Barn swallow***
Cliff swallow***
Solitary vireo***
Red-eyed vireo
Warbling vireo
Swainson's thrush
Orange crowned warbler***
Yellow warbler
Black-throated gray warbler
Yellowthroat***
Wilson's warbler

Brown-headed cowbird
Western tanager
Black-headed grosbeak
Savanah sparrow
White-crowned sparrow***

Breeding Birds and Potential Breeders

Green heron
Blue grouse**
Ruffed grouse**
California quail
American coot
Kilideer
Screech owl
Great horned owl
Saw-whet owl**
Rufous hummingbird
Belted kingfisher
Common flicker
Pileated woodpecker
Yellow-belled sapsucker
Hairy woodpecker
Downy woodpecker
American robin
Varied thrush
Swainson's thrush
Golden-crowned kinglet
Ruby-crowned kinglet
Cedar waxwing
Starling
Hutton's vireo
Solitary vireo
Red-eyed vireo
Warbling vireo
Orange-crowned warbler
Yellow warbler
Yellow-rumped warbler
Yellowthroat
Wilson's warbler
Violet-green swallow
Tree swallow
Rough-winged swallow
Barn swallow
Cliff swallow
Steller's jay
Common crow
Chestnut-backed chickadee
White-breasted nuthatch
Red-breasted nuthatch
Brown creeper
Dipper**
House wren
Winter wren
Bewick's wren
Long-billed marsh wren
House sparrow
Red-winged blackbird
Brewer's blackbird
Western tanager
Black-headed grosbeak
Evening grosbeak
Purple finch
House finch
Pine siskin
Rufous-sided towhee
Dark-eyed junco
Savannah sparrow
White-crowned sparrow
Song sparrow

Appendix C - Wildlife Observed at Capitol Lake

Winter Residents

American bittern
Gadwair
Pintair
Green-winged teal*
American widgeon*
Northern shoveler
Ring-necked duck*
Canvasback**
Greater scaup***
Lesser scaup*
Common goldeneye***
Barrows goideneye***
Bufflhead*
Ruddy duck*
Hooded merganser*
Common merganser***
Red-breasted merganser*
American coot*
Common snipe*
Spotted sandpiper
Least sandpiper
Dunlin***
Western sandpiper
California gull
Ring-billed gull*
Mew gull
Bonaparte's gull*
Winter wren***
Varied thrush***
Golden = -crowned kinglet
Ruby-crowned kinglet***
Northern shrike
Evening grosbeak***
Golden-crowned sparrow***
Fox sparrow***

Permanent Residents

California quail
Ring-necked pheasant*
Killdeer***
Glaucous-winged guir*
Belted kingfisher*
Common flicker**
Pileated woodpecker***
Yelow-bellied sapsucker
Hairy woodpecker*
Downy woodpecker
Steeler's jay***
Common crow*
Black-capped chickadee
Chestnut-backed chickadee*
Common bushtit***
Red-breasted nuthatch***
Brown creeper
Dipper***
Bewick's wren*
Long-billed marsh wren*
American robin***
Cedar waxwing
Starling***
Hutton's vireo***
Yellow-rumped warbler*
House sparrow***
Red-winged blackbird***
Brewers blackbird***
Purple finch***
House finch*
Pine siskin*
American goldfinch
Rufous-sided towhee***
Dark-eyed junco*
Song sparrow*

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* Indicates birds observed 29 October 1975. Charles Lindberg, Christopher Dlugokenski, and Douglas Canning, researchers.

** Indicates species that are unusual for the area.

*** Indicates species seen since 20 October 1975.
NOTE: Bald eagle observed 21 April 1976.

APPENDIX D

Aquatic Plant Collection Methods and Results

METHODS

Field Methods

Aquatic plant and algal mat samples were collected on July 23 and 24,1997, during the lake drawdown. Based on characteristics of the lake plant community, the three lake basins (north, middle, and south) were treated separately in the monitoring plan. The basins are depicted on **figure D-1**. Of the three basins, the south basin is the most riverine in nature and has the least plant growth. This basin was considered to be a one-plant community zone, therefore, three samples were collected from within this zone. Because there were few aquatic macrophytes (those seen were Elodea) in the south basin, the major plant group was represented by algae mats on the sediment surface. Therefore, a modified bucket sampler was used to collect all three samples. This bucket sampler represented a surface area of approximately 0.022 square meters (m^2).

The middle lake basin was divided into four zones (A through D). Three samples were collected from each zone. Samples were collected using either the standard aquatic macrophyte sampler (standard 0.26 m^2 half barrel sampler) or the modified bucket sampler, depending upon the type of vegetation observed. **Table 1** summarizes field and laboratory data and indicates the type of sampler used at each sampling location.

The north basin was considered to be a one-plant community zone, and therefore only three samples were collected from this basin. The half barrel sampler was used for each sample.

A total of 18 samples were collected from the lake over the two-day sampling period. All samples were placed in labeled plastic bags and stored in a cooler on ice until delivery to the laboratory the following day.

Laboratory Methods

Plant samples were washed and weighed at the laboratory to obtain wet weight biomass. (Algae mat samples could not be washed and were weighed directly.) After drying at 105° C, samples were reweighed to obtain dry weights. Subsamples were collected from seven of the plant samples and were used to analyze percent solids, total phosphorus, and total kjeildahl nitrogen. Laboratory wet and dry weight results were then converted to the standard unit of grams per square meter (g/m^2).

Evaluation Methods

Aerial photographs were used to estimate the total area of plant coverage in each of the basins. All of the areas that contained plants were first outlined on the aerial photographs, and then a planimeter was used to estimate the outlined areas. Review of the aerial photographs (at 1:100 scale) indicated that in the north and middle basin plant densities could be divided into at least two density levels; high and low density plants. These density levels did not necessarily

correspond with the zones or the specific locations where samples were collected for biomass estimates. The assumptions made in assigning biomass estimates to each plant growth region are described below:

The south basin appeared to have similar plant (algal) densities, and the average of the three biomass samples (461.4 g/m2) was used to estimate total plant biomass in this basin.

Eight different plant regions were marked on aerial photographs of the middle basin. These could generally be separated into high and low density areas. According to the laboratory data, three of the four zones in the middle basin (Zones A, B, and C) had similar average plant densities. Since these samples were collected from within what appeared to be a lower plant density zone, the average density (33.7 g/m2) from these zones was used to represent the lower density regions. The fourth zone (Zone D) had a much higher average density, therefore, this density (60.7 g/m2) was used to represent the higher density regions marked on the aerial photographs.

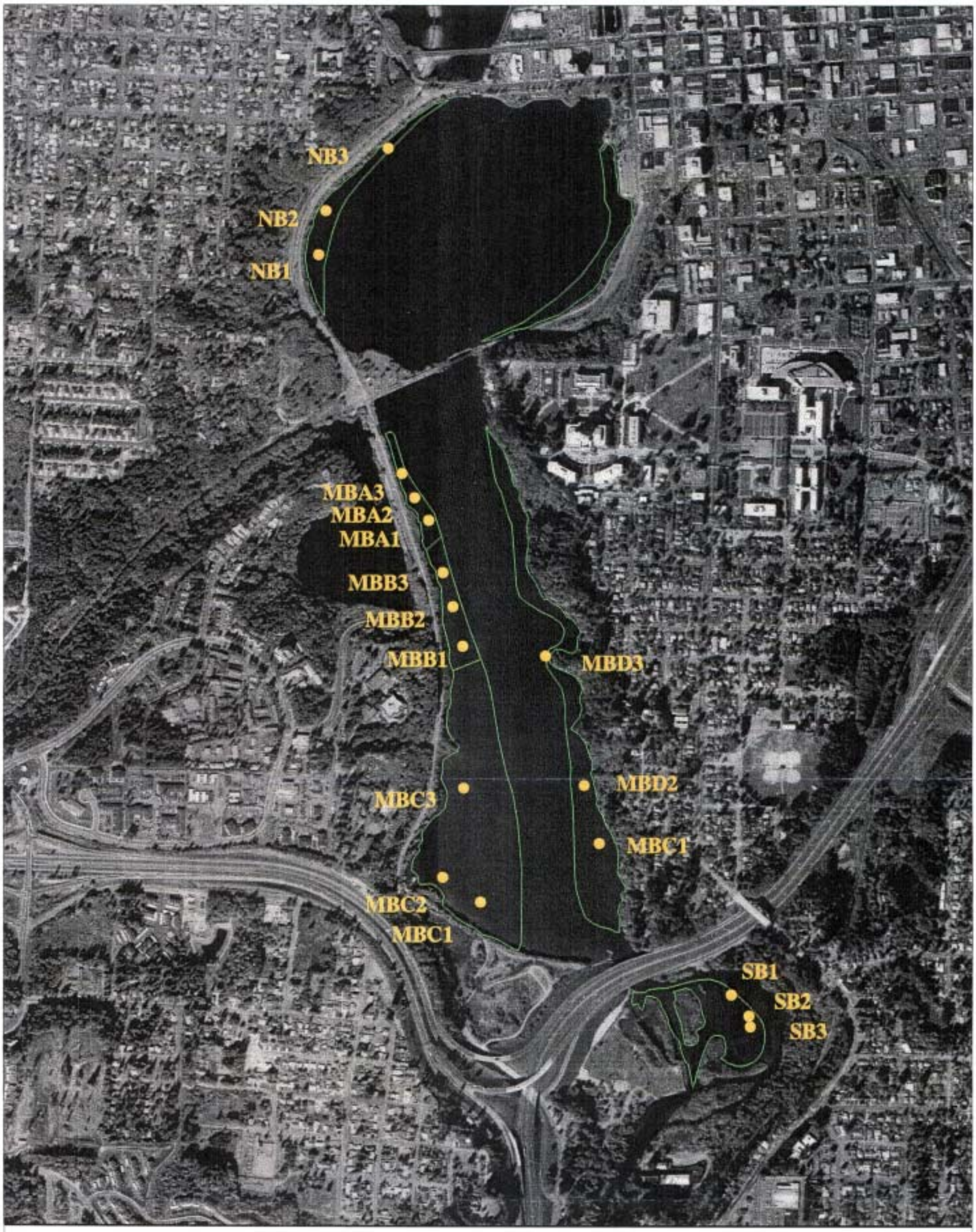
In the north basin, three plant growth regions were marked and measured, and these too fell within two density levels. The average density of the two lowest biomass estimates (28.1 g/m2) from this basin was used to represent the lower plant density area, while the maximum biomass estimate (66.6 g/m2) was used to represent the higher density area.

Total plant biomass estimates for each basin were then calculated as the sum of the totals from each separately marked region. This information, in combination with phosphorus and nitrogen data, was used to estimate the potential plant related nutrient load from the three basins.

RESULTS

The primary plants observed in the south basin were somewhat sparse algal mats located in shallower nearshore areas. It is interesting to note that the designation of "sparse" comes from field observations. If aerial photographs alone had been used, it would have been assumed that this basin had dense plant growth. The algae were identified as Spirogyra (*Spirogyra* sp.). Few aquatic macrophytes were observed in the south basin. Those that could be seen from the boat were common waterweed (*Elodea canadensis*). No macrophytes were observed at the sampling locations, therefore, algal mat samples were collected. By weight the biomass of algal mat samples was much greater than the biomass measured in aquatic macrophyte samples collected elsewhere (461 g/m^2 versus a maximum of 85 g/m^2 measured in macrophyte stands). However, nutrient content was significantly lower in the algae cells, resulting in overall lower nutrient loading estimates. The total biomass estimate for the south basin is 4,890 kilograms (Kg), which equated to 5 Kg of phosphorus and 26 Kg of nitrogen. Biomass and nutrient estimates are shown in **table 2**.

Although the middle basin was divided into four zones to characterize the four different sections of the basin, there was little difference in the aquatic plant community between the zones. Common waterweed was the dominant plant, representing 95 to 100 percent of the plant community in all samples. On the west side of the basin, in the zone located furthest to the north (zone A), thin-leaved pondweed (*Potamogeton* sp.) was present in two of the three



1997 AQUATIC PLANT AND ALGAL MAT SAMPLING LOCATIONS

Capitol Lake Management Plan

0 800 feet 1600 feet

Aerial Photos Taken August 1993
For copies of this map or for more information,
please contact Thurston Regional Planning Council

Figure D-1

samples. This potamogeton was also observed in deeper waters in the middle basin, but was quite sparse. Many of the plants in the middle basin were covered with periphyton.

Review of the aerial photographs indicates that the nearshore area had lower plant densities than areas further from shore. This was also true for the north basin. This may be a characteristic of common waterweed, (e.g., a preference for greater water depths), or may be associated with impacts from water level changes that result from operation of the tide gate. Aerial photographs also clearly depict the affect of the river on plant growth. In the main channel of the middle basin and into the north basin, bare sediments are exposed along the channel. The plant biomass in the middle basin was estimated at 17,232 Kg, which was estimated to represent 92 Kg phosphorous and 690 Kg nitrogen (**table 2**).

The north basin was entirely dominated by common waterweed. These plants did not have the periphyton growth observed on plants in the middle basin. Again, plant growth appears to be denser in the deeper water further from shore. The total biomass estimate from the north basin was 5,607 Kg; 30 Kg of which was phosphorus and 223 Kg of which was nitrogen.

Table 1
Capitol Lake Plant Community Assessment Field and Laboratory Results (1997)

Sample Location	Sample I.D.	Sampler Type	Plant Composition	Wet Weight (g)	Wet Weight (g/m^2)	Dry Weight (g)	Dry Weight (g/m^2)	Vol Solids	Phosphorus (mg/Kg)	Nitrogen (mg/Kg)
North Basin	#1	Half barrel	Elodea (100%)	298	1147.3	17.3	66.6	74.56	5265	39823
	#2	Half barrel	Elodea (100%)	148	569.8	10.3	39.7			
	#3	Half barrel	Elodea (100%)	69.8	268.7	4.3	16.4			
Middle Basin Zone A	#1	Bucket	Elodea w/ periphyton	20.1	914.6	1.3	61.0			
	#2	Half barrel	Elodea (99%) Potamogeton (1%)	103	396.6	6.1	23.6			
	#3	Half barrel	Elodea (95%) Potamogeton (5%)	90.7	349.2	6.5	25.1			
Zone B	#1	Half barrel	Elodea (100%)	88.5	340.7	6.1	23.5	53.66	5786	47143
	#2	Half barrel	Elodea (100%)	77.5		5.7		66.79	5735	40686
	#3	Bucket	Elodea (100%) covered w/algae	12.9	587.0	0.6	25.9			
Zone C	#1	Half barrel	Elodea	122	469.7	7.9	30.4	77.7	6298	39183
	#2	Half barrel	Elodea (100%)	103	396.6	6.6	25.3			
	#3	Half barrel	Elodea (100%)	271	1043.4	16.5	63.5			
Zone D	#1	Bucket	Elodea w/periphyton	25.5	1160.3	1.9	84.6			
	#2	Half barrel	Elodea	212	816.2	12.9	49.7			
	#3	Half barrel	Elodea	164	631.4	12.4	47.7	76.2	3619	33095
South Basin	#1	Bucket	Algal mat	39.2	1783.6	8.4	383.1	11.3	1237	7166
	#2	Bucket	Algal mat	96.0	4368.0	7.8	354.9			
	#3	Bucket	Algal mat	52.0	2366.0	14.2	646.1	10.7	703	3468

Table 2
Biomass and Nutrient Estimates for Capitol Lake Basins (1997)

Region Identified		Area (sq. Meters)	Areal Biomass (g/ m^2 dry wt.)	Total Biomass (Kg)	Phosphorus (Kg)	TK Nitrogen (Kg)
North Basin	N1	31072.0	66.6	2069.4	10.9	82.4
	N2	61010.9	40.9	2495.3	13.1	99.4
	N3	25483.6	40.9	1042.3	5.5	41.5
Total		117566.4		5607.0	29.5	223.3
Mid Basin	M1	33315.2	33.7	1122.7	6.0	44.9
	M2	17719.6	33.7	597.1	3.2	23.9
	M3	5427.0	60.7	329.4	1.8	13.2
	M4	159146.0	60.7	9660.2	51.8	386.7
	M5	52344.5	60.7	3177.3	17.0	127.2
	M6	7264.2	33.7	244.8	1.3	9.8
	M7	9534.0	60.7	578.7	3.1	23.2
	M8	45147.3	33.7	1521.5	8.2	60.9
Total		329897.8		17231.7	92.4	689.7
South Basin	S1	6112.7	461	2818.0	2.7	15.0
	S2	2806.3	461	1293.7	1.3	6.9
	S3	1689.0	461	778.6	0.8	4.1
Total		10608.1		4890.3	4.7	26.0

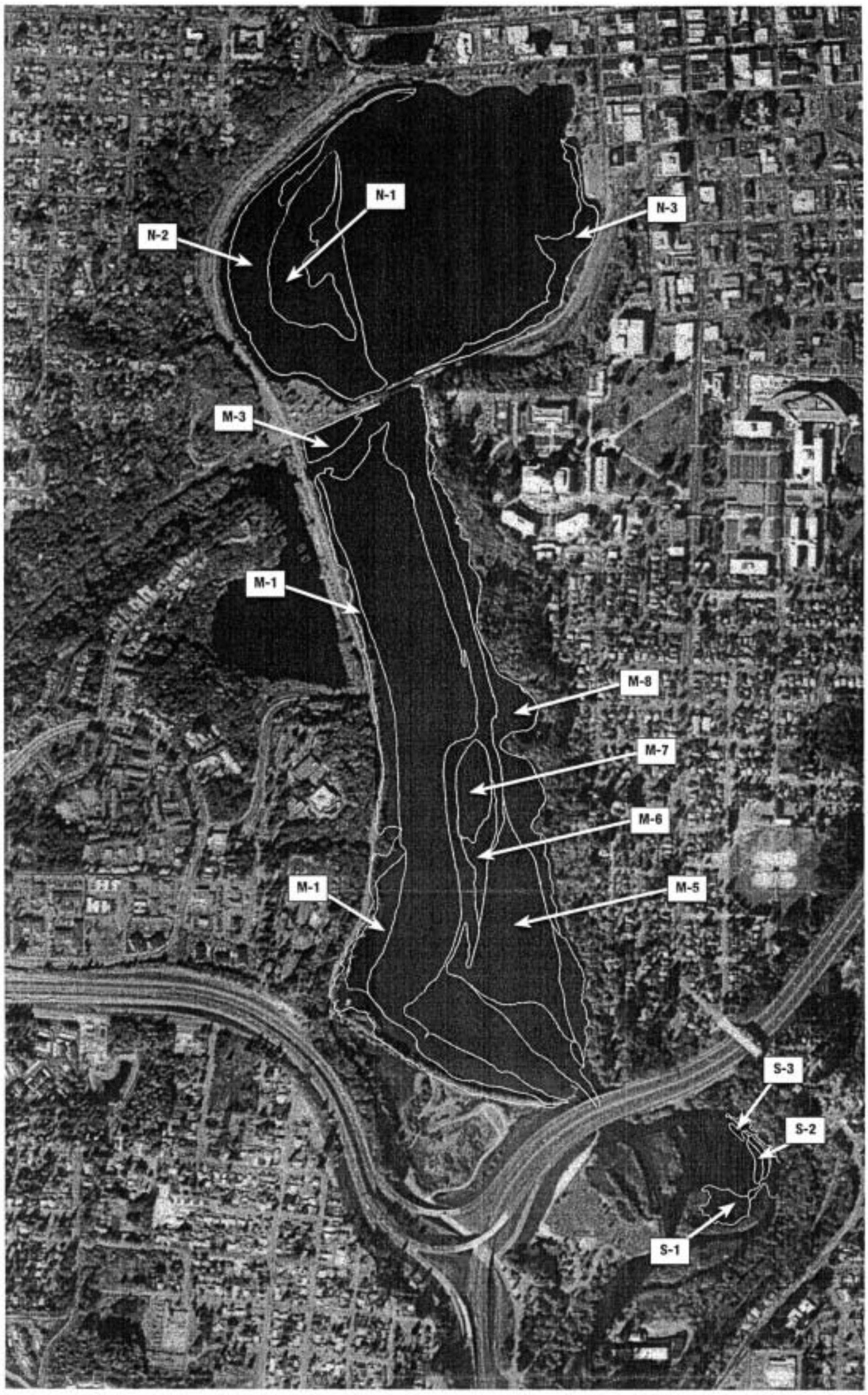


Figure D-2
1997 Aquatic Plant Regions

Capitol Lake Management Plan