

Capitol Lake
**COST ESTIMATE
REPORT**

1975



ASSOCIATES

COST ESTIMATE
For
REHABILITATION OF
CAPITOL LAKE
OLYMPIA, WASHINGTON
UPDATED TO FEBRUARY, 1975
CONTRACT NO. 74-499A

For:
Division of Engineering and Architecture
Department of General Administration
State of Washington

February 1975

Prepared by
PATRICK J. BYRNE AND ASSOCIATES
610 South Columbia
Olympia, Washington 98501

PATRICK J. BYRNE & ASSOCIATES
CONSULTING ENGINEERS
610 S. COLUMBIA
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TELEPHONE 357-6651

April 17, 1975

Mr. Richard L. Fankhauser
Landscape Architect
Department of General Administration
218 General Administration Building
Olympia, Washington

Re: Contract No. 74-499A
Capitol Lake Reclamation

Dear Mr. Fankhauser:

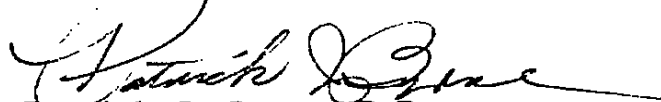
This is to transmit fifteen (15) copies of the report on Preliminary Construction Costs Estimates for sediment removal and disposal for Capitol Lake, Olympia, Washington, in accordance with the above referenced contract. An additional five (5) copies will temporarily be retained by this office to assist in answering questions that may be directed to us.

We wish to thank the Department for the opportunity to again provide engineering services on the Capitol Lake reclamation project, and to express our appreciation for the assistance of Mr. Jerry Bachmann, the coordinator of the project for his timely help.

Our office is available at your convenience to answer questions or clarify concepts presented in the report. Items which are available for your review which were considered too detailed for inclusion in the report were: 1) earth work estimating diagrams and computations, 2) preliminary computations and sketches of pollution control facilities, 3) manufacturers and contractors correspondence and literature.

Respectfully submitted,

PATRICK J. BYRNE & ASSOCIATES


Patrick J. Byrne, P.E.

PJB:sb
Enc.



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DEFINITIONS

- Upper Basin - That portion of Capitol Lake South of Interstate 5 Freeway.
- Middle Basin - That portion of Capitol Lake North of Interstate 5 and south of Burlington Northern Railroad bridge.
- Lower Basin - That portion of Capitol Lake north of Burlington Northern Railroad bridge and south of Capitol Lake dam.
- AD HOC Management Committee - A special committee of 22 individuals interested in the conservation of Capitol Lake from public and private life.
- Flashboards - Boards used to dam dredging disposal area for decanting.
- Decanting - To cause the dredging effluent to pour off gently without disturbing the sediment
- Monitoring - To check the effluent as to meeting requirements.

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- I. AUTHORIZATION
- II. PURPOSE
- III. SCOPE

I. AUTHORIZATION

On August 16, 1974 an agreement was executed between the State of Washington, Department of General Administration, Division of Engineering and Architecture and Patrick J. Byrne and Associates for work entitled "Consultant Services - Capitol Lake Study." Notice to proceed with the work was given on August 28, 1974.

Work was commenced in December 1974, after receiving and evaluating the R. L. Albrook Hydraulic Laboratory report with pertinent information obtained from their hydraulic model tests.

II. PURPOSE

The purpose of this report is to update the cost of rehabilitating Capitol Lake to approximately the 1949 condition and to update the annual cost of maintaining the lake thereafter.

III. SCOPE

The scope of work will include re-evaluation of the previous cost estimate in terms of the scope and quantity of work, the findings of the hydraulic study, the changed economic conditions and additional environmental factors as each relates to the initial dredging and the annual or biannual maintainance as required by the sediment load.

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IV. SUMMARY

IV. SUMMARY

Engineering for Capitol Lake Reclamation completed to date includes:

1. Hydrographic Survey (1970). ¹
2. "Engineering Investigation for Rehabilitation of Capitol Lake" Volume I and II. ²
3. Preliminary report on sediment removal, etc. for the Upper Basin of Capitol Lake, Olympia. ³

This work is the basis for the following construction cost estimates. These estimates were developed for project funding and budget purposes only and the concepts employed should not be construed as recommendations for final design configurations for dredging or spoil deposition.

The following estimates consider dredging the middle and lower basins to two (2) different depths, considered to be the minimum and maximum probable depths. They also consider two locations for the placement of the material dredged from the middle and lower basins. Treatment of the upper basin is essentially the same for the alternates estimated.

On the cost summary table below, alternate no. 1 estimates the cost (1975) of dredging Capitol Lake and placing the dredged material in the Port of Olympia Development Area.

Alternate no. 2 estimates the same dredging, with placement of the material along the periphery of Capitol Lake itself, mainly along the Deschutes Parkway, where this material can be utilized for constructing better access and recreational areas along the lake. The minimum and maximum figures shown reflect the cost for the two different depths estimated, namely to 12½ feet of normal water depth and to 16½ feet of water depth. For Alternate no. 1 a reduced total cost, is shown,

based on the assumption that the Port of Olympia would pay for the cost of diking in the Port area.

The estimated cost of annual or periodic removal of material from the settling basin is shown in Section X B-1. The costs increase from \$99,000 per year assuming a typical operation in 1975 to \$549,100 for the year 1996, assuming an inflation rate of 8.5% per year. It has not been determined, whether or not this concept of periodic or annual removal of material from the upper basin, is cost effective. Further study of the economics of this concept is necessary prior to incorporating it into the final design of the rehabilitation plan.

The following four (4) tables summarize the estimated construction costs for: Alternate no. 1 and no. 2, the annual dredging including site preparation and an overall summary of costs including contingencies, engineering and administration.

- (1) (2) By Patrick J. Byrne and Associates,
Consulting Engineers
- (3) By R. L. Albrook Hydraulic Laboratory,
Washington State University

CAPITOL LAKE COST ESTIMATE

ALTERNATE #1

DESCRIPTION	UPPER BASIN		MIDDLE BASIN		LOWER BASIN	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
Mobilization & Demobilization	\$ 15,000		\$ 39,000	\$ 39,000	\$ 6,000	\$ 6,000
Dredging & Pipe Laying	326,400		809,000	1,261,000	115,000	567,000
Dike Construction	77,000		636,000*	1,350,000*	97,000*	610,000*
Riprap & Training Groin	240,400					
Flashboards, Decanting & Monitoring	31,200		56,000	86,000	9,000	37,000
TOTAL	× \$690,000		\$1,540,000	\$2,736,000	\$227,000	\$1,220,000
*Less Dike Construction			× \$ 904,000	\$1,386,000	×\$130,000	\$ 610,000

NOTE:

Minimum cost is to the minimum depth of 12.5 feet and the maximum cost is dredging to 16.5 feet. Final design is expected to be within these two cost estimates. Mobilization to move dredge to site is \$60,000.

Handwritten calculations:

326,400
809,000
115,000
1,724,000

680,000
904,000
130,000
1,724,000

CAPITOL LAKE COST ESTIMATE

ALTERNATE #2

	UPPER BASIN		MIDDLE BASIN		LOWER BASIN	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
Mobilization & Demobilization	\$ 15,000		\$ 39,000	\$ 39,000	\$ 6,000	\$ 6,000
Dredging & Pipe Laying	326,400		794,000	1,243,500	116,000	567,000
Dike Construction	77,000		210,000	162,000	33,000	81,000
Riprap & Training Groin	240,400					
Flashboards, Decanting & Monitoring	31,200		53,100	87,500	10,000	39,000
TOTAL	\$690,000		\$1,097,000	\$1,532,000	\$165,000	\$693,000

NOTE: Minimum cost is to the minimum depth of 12.5 feet and the maximum cost is dredging to 16.5 feet. Final design is expected to be within these two cost estimates. Mobilization to move dredge to site is \$60,000.

ANNUAL DREDGING

SITE PREPARATION COST

Mobilization	\$ 19,000
Excavation & Dike Construction	35,000
Constructed Items & Equipment	227,000
Dredge (Purchase)	96,000
Railroad Spur Track	35,000

TOTAL \$412,000

ANNUAL REMOVAL COSTS

Mobilization & Equipment Maintenance	\$ 8,200
Dredging	16,000
Operating Site	4,800
Loading & Hauling	70,000

TOTAL \$ 99,000

SUMMARY OF COSTS

	ALTERNATE #1		ALTERNATE #2	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
UPPER BASIN	\$ 690,000	\$ 690,000	\$ 690,000	\$ 690,000
MIDDLE BASIN	1,540,000	2,736,000	1,097,000	1,532,000
LOWER BASIN	227,000	1,220,000	165,000	693,000
ANNUAL SITE	412,000	412,000	412,000	412,000
TOTAL	\$2,869,000	\$5,058,000	\$2,364,000	\$3,327,000
Contingencies 10%	287,000	506,000	236,000	333,000
Engineering 8%	229,000 -	405,000	189,000	266,000
Administration 3%	86,000	151,000	71,000	100,000
GRAND TOTAL	\$3,471,000*	\$6,120,000*	\$2,860,000	\$4,026,000
*Construction Cost Total Assuming Port of Olympia Constructs Dikes in Port Area	\$2,136,000	\$3,098,000		

Port

fake

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V. INTRODUCTION

V. INTRODUCTION

The report takes into consideration the various agencies or departments of the State and the Federal Government which utilize the lake or have jurisdiction thereof such as General Administration, Fisheries, Game, Corps of Engineers, Shoreline Management, Department of Ecology and so forth. Since the previous report costs have escalated at a rate unnatural to the normal annual increase, no attempt is made to predict a future escalation but average annual increases for recent years are used to project costs into the future.

Concepts and parameters have been developed with the aid of additional research and hydraulic modeling done by the Albrook Laboratory, Washington State University, so that a more comprehensive cost estimate can be achieved.

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VI. RESEARCH

VI. RESEARCH

Extensive use has been made of the Albrook Laboratory's research reports and their hydraulic modeling study. These reports were the Preliminary Report, Supplement number 1, Supplement number 2; and the Summary Report.

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VII. DESCRIPTION OF PHYSICAL FACILITIES
AND MANAGEMENT PROGRAMS

VII. DESCRIPTION OF PHYSICAL FACILITIES AND MANAGEMENT PROGRAMS

A. Considerations

The design and management for the reclamation of Capitol Lake must consider the following:

1. Quantity of material to be removed from the lake bottom in initial dredging.
2. The transport and wasting of dredged material.
3. The preparation of receiving sites for the dredged material.
4. The annual average quantity of material deposited in the lake by the Deschutes River and place of deposition.
5. Hydraulic design to control the place or places at which deposition will occur.
6. A program of periodic removal of deposited material.
7. Recreational and commercial use of the lake.
8. Water quality management during:
 - a. initial dredging
 - b. periodic dredging

B. Description

Dredging estimates for the upper basin were calculated to a water depth of 10 feet. Permanently designed into the upper basin will be training groins, islands and an additional 5 feet deep catchment basin capable of containing 60,000 cubic yards of sediment. (configuration based on Albrook hydraulic modeling)

The quantity of material to be removed from the middle and lower basins will be estimated at two depths, the first depth calculated is 12.5 feet and the second is 16.5 feet deep.

An undisturbed strip 150 feet wide will remain between the dredging area and the Deschutes Parkway as previously recommended in the report by Patrick J. Byrne and Associates entitled, Engineering Investigation for Rehabilitation of Capitol Lake.

Material dredged will be transported through pipes to areas designated to be reclaimed for park, recreation or port purposes.

The receiving sites will require very little preparation to receive the dredgings except in the Port of Olympia area where containment dikes will be required. However, the Port of Olympia is scheduling dike construction in the fall of 1976 and if Capitol Lake dredging is coordinated with this work the containment dikes will be constructed under the Port's program.

Following the initial dredging a program is required to maintain the rehabilitated condition of the lake. To accomplish this a site has been selected adjacent to the upper basin for annual or bi-annual maintenance operations. For estimate purposes a processing site has been designed to return clean water to the lake, which will meet required standards.

Water quality during the initial dredging will be handled in a normal manner for dredging operations with diking, flashboards, decanting weirs and monitoring as required.

- C. Management Goals As Approved By the AD HOC Management Committee, November 27, 1974
 - 1. Capitol Lake is a key part of the Capitol Campus and, as such, is of statewide sig-

nificance, as defined in Chapter 159,
Laws of Washington 1937.

2. Preserve the inherent resource values of Capitol Lake, including its visual quality, wildlife, active and passive recreational uses and other environmental characteristics.
3. Preserve and interpret the biological processes within the upper (south) basin, except in the area required for desilting operations.
4. Conserve the existing terrestrial vegetation within the entire visual basin of Capitol Lake.
5. Protect the key fish propagation areas of Capitol Lake, such as Percival Cove.
6. Encourage land uses within the Deschutes River Basin which will decrease sediment loading.

VIII. ESTIMATING

In addition to the dredging of the upper basin to a depth of ten (10) feet two depths have been selected for estimating purposes in the middle and lower basins. The first 12.5 feet deep and the second 16.5 feet deep. Estimates for the two depths were made to cover variations expected within final design parameters for dredging. Final design will be based on studies now in progress relating to light penetration, weed growth patterns and other factors that relate to the ecology of Capitol Lake. Albrook Hydraulic Laboratory recommended that 6" to 12" of bottom deposits should be dredged to remove nutrients in all areas of the lake.

Alternates have been selected to give a cost comparison for possible other solutions for the initial dredging.

Alternate #1

Utilize the Port of Olympia's facilities for depositing the dredgings in coordination with their First Stage expansion of constructing a marina, support facilities and cargo backup area. If the dredging were to go to a 12½ feet depth the port fill areas would comfortably contain all of the material from the middle and lower basins, with allowance for dredging from the port water ways.

Dredging to a 16½ feet depth would develop more material than the port would utilize in their first stage plan. The additional material developed by dredging to 16½ feet could be placed on private property owned by Standard Oil Company, Reliable Welding and Hardell Mutual Plywood. These sites are shown on the accompanying map with the amount of the material that these sites would contain. Plate no. 6.

Alternate #2

Utilize the area within the Capitol Lake Basin for disposal. Shoreline disposal will require an average width of 150 feet along Deschutes Parkway for the 12.5 feet dredging depth, and an average width of 210 feet for the deeper dredging depth to 16.5 feet.

The accompanying plates 7 and 8 show both the widths to be utilized for this shoreline fill and the cross section shows the approximate fill slope of 12 to 1 which is a usable swimming beach slope.

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IX. COST FACTORS

IX. COST FACTORS

All costs in the following section are based upon current construction and material prices as of January 9, 1975. The Engineering News Record (E.N.R.) Construction Cost Index for this period is at 2103. The construction cost index this last year rose approximately 9.5% from January 1974 to January 1975. The projected increase for this report is 9.0% per year. If this trend continues, the index can be expected to reach 2395 by mid-1976.

It is expected that this increase will continue through 1976. This will make construction costs about 13.5 % higher in the summer of 1976 than at present. Rail transportation costs can be expected to increase by 12 to 20% in the next two years. See Plate no. 1.

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X. CONSTRUCTION COSTS

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A. Initial Dredging

1. Upper Basin

The initial dredging in the upper basin to an average of 10 feet deep is the same for Alternate #1 and Alternate #2. The plan for the upper basin dredging is shown on Plate number 2. The items of construction in this basin will be a training groin, island dredging processing site, placing riprap, general dredging, and a sediment catchment basin. (See plates 2, 3 and 4) The dredgings from this basin can be used to construct the annual processing site, a recreation area to the south owned by the city of Tumwater, an island and a recreation site north of Interstate 5. Developing these sites adjacent to the upper basin will allow for a balance of dredging and reclamation, and minimize pumping costs. The total dredging shown and estimated for the upper basin is approximately 304,000 cubic yards. The design for adjacent areas will contain approximately 360,000 cubic yards of embankment. Construction cost for the upper basin is:

UPPER BASIN	TOTAL \$690,000
-------------	-----------------

2. Middle Basin

The estimate for dredging of the middle basin will be considered in two parts. The first dredging estimate is to a 12½ foot depth with a 5 foot deep catchment basin with an approximate capacity of 60,000 cubic yards of sediment.

A strip 150 feet wide along the Deschutes Parkway will not be dredged and remain at its present depth and slope as recommended in the previous report by Patrick J. Byrne and Associates dated April, 1973. The dredging to a 12½ feet depth in the middle basin will result in approximately 682,000 cubic yards of material, and dredging to a 16½ feet depth, 1,170,000 cubic yards. The following estimate shows the cost to deposit this material in the port fill sites, Alternate #1:

	Water Depth	
MIDDLE BASIN ALTERNATE #1	12.5 ft.	16.5 ft.
	\$1,540,000	\$2,736,000

If work is coordinated with the Port of Olympia's dike construction, diking costs could be eliminated, or modified, reducing the cost to: \$904,000 and \$1,386,000. (See plates 5 and 6)

Alternate #2, depositing the dredged material along the shoreline of Capitol Lake is shown on Plates 7 and 8. The costs for this construction is shown below for both the 12.5 feet and 16.5 feet depths. Dike construction will be approximately the same but the width will vary along the shoreline of the lake from 150 feet for 12.5 feet depth (682,000 cubic yards) to 210 feet for the 16.5 feet depth (1,170,000 cubic yards).

	Water Depth	
MIDDLE BASIN ALTERNATE #2	12.5 feet	16.5 feet
	\$1,097,000	\$1,532,000

3. Lower Basin

Dredging the lower basin to a 12.5 feet depth would yield approximately 110,000 cubic yards, if the dredging is to a 16½ feet depth it would amount to 540,000 cubic yards. The following estimate shows the cost to deposit this material in port fill as Alternate #1:

	Water Depth	
LOWER BASIN ALTERNATE #1	12.5 ft.	16.5 ft.
	\$227,000	\$1,220,000

If work is coordinated with the Port of Olympia's dike construction, diking costs could be eliminated reducing the cost to: \$130,000 & \$610,000

Alternate #2, depositing dredged materials along the shoreline of the lake as shown on Plates 7 and 8. The cost for both depths of 12.5 feet and 16.5 feet are shown below. The width of the deposited material varies from 150 feet for the 110,000 cubic yards to 210 feet for the 540,000 cubic yards.

	Water Depth	
LOWER BASIN ALTERNATE #2	12.5 feet	16.5 feet
	\$165,000	\$693,000

B. Periodic Operational Costs

1. Removal

The annual dredging estimate is in two parts. The first part will be the preparation of the dredging processing site. In addition all equipment will be purchased and permanent facilities will be constructed which will include railroad spur, loading facilities, screen separator, aeration equipment, and purchasing of a small dredge.

The total cost of the processing site preparation is \$412,000. The annual cost of dredging is \$99,000 based on 40,000 cubic yards per year, at present 1975 prices.

The following estimates itemizes the above costs:

SITE PREPARATION

Mobilization	\$ 19,500
Excavation & Dike Const.	34,200
Constructed Items & Equip.	227,400
Dredge (purchase)	96,000
Railroad Spur Track	<u>34,900</u>
Total	\$412,000

ANNUAL REMOVAL COSTS

Mobilization & Equip. Main.	\$ 8,200
Dredging	16,000
Operating Site	4,800
Loading and Hauling	<u>70,000</u>
Total	\$ 99,000 per year

If the Washington State Highway Department can utilize the sanding gravel separated out of the dredgings and will pick up and haul the material at their own expense, a savings of \$70,000 can be realized. Other commercial use may possibly be found for this material.

REMOVAL COSTS FOR 20 YEAR PERIOD

BASED UPON 8.5% ESCALATION

1975	<u>\$99,000 Base year</u>
1977	116,500 first removal operation
1978	126,500

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1979	137,200
1980	148,900
1981	161,500
1982	175,200
1983	190,100
1984	206,300
1985	223,800
1986	242,900
1987	263,500
1988	285,900
1989	310,200
1990	336,600
1991	365,200
1992	396,200
1993	429,900
1994	466,400
1995	506,100
1996	549,100

Total removal cost over 20 year period =
\$5,638,000

20 year average, yearly cost = 281,900

20 year average cost per cubic yard removed
and transported = \$7.05

2. Disposal

This cost is almost indeterminate at this time, due to many factors.

If Olympia harbor sites are to be used, the cost of diking could vary from nothing to as much as equal the cost of material removal, depending upon whether fill sites have previously been diked by the Port or others prior to the sediment removal. A closely coordinated program between the Port of Olympia and the State of Washington could result in a considerable saving to the State in periodic disposal sites. If upland sites are to be used,

Plate number 9, the big variables to disposal costs are:

1. Cost for release or right to fill.
2. Or cost of outright acquisition of land.
3. Site preparation, i.e. clearing, drainage, track spurs, etc. vary considerably with each site.

Other possible solutions to disposal are:

1. Recycle the sands and gravel of commercial value and fine waste as topsoil.
2. Reclaim land which is of little value in its present condition, i.e. gravelly prairie ground 8 miles southeast of the dredging operation into usable crop growing land.

In the report entitled Engineering Investigation for Rehabilitation of Capitol Lake by Patrick J. Byrne & Associates dated April, 1973, Volume II, Section II - 500.42 Upland Sites show a possible 23 years of disposal area available. If Port of Olympia facilities are extended as planned the available disposal areas are greatly increased.

The possibility of utilizing 50% to 75% of this material as Highway sanding gravel or other uses would increase the available disposal sites. See Plate number 9.

C. Marine Disposal

Due to the strict guidelines issued by the Environmental Protection Agency for the disposal of spoil in water, the estimates of costs for deep water disposal have not been calculated. Material to be disposed must comply to seven basic pollution parameters and if one of the seven is exceeded, the material is considered unacceptable for marine disposal.

In 1971 the Corps of Engineers sampled Capitol Lake bottom and the chemical oxygen demand was exceeded by 400% to 600% throughout the three basins sampled.

If this method of disposal is to be considered in the design stage, further samples should be taken.

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XI. ENGINEERING

XI. ENGINEERING

Additional costs that will have to be budgeted before construction can commence is the design engineering and assembling construction plans.

The estimated costs for preparation of the design report and construction plans is \$150,000 and \$240,000 respectively at present rates.

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XII. ENVIRONMENTAL IMPACT STATEMENT

XII. ENVIRONMENTAL IMPACT STATEMENT

Costs vary to a great degree in the preparation of an environmental impact statement due to the complexity of the project and the time required for public hearings, formation of a citizens advisory group, and input from public and private sources, therefore, the cost is estimated to be between \$50,000 and \$100,000 for the Environmental Impact Statement on Capitol Lake Rehabilitation.

XIII. PERMITS

1. Corps of Engineers
2. Approvals from other agencies are as follows:

FEDERAL AGENCIES:

U.S. DEPARTMENT OF THE INTERIOR

ATTN: Mr. Grant A. Woolley

P.O. Box 3621

Portland, Oregon 97208, Tele: (503) 234-3361, #5254

ENVIRONMENTAL PROTECTION AGENCY

Permits Branch

ATTN: Mr. Ronald A. Lee

1200 Sixth Avenue

Seattle, Washington 98101

Tele: (206) 442-1352

NATIONAL OCEANIC & ATMOS. ADMIN.

National Marine Fisheries Service

ATTN: Mr. George O. Black

P.O. Box 4332

Portland, Oregon 97208

Tele: (503) 236-3361, #4311

U.S. BUREAU OF SPORT FISHERIES & WILDLIFE

Div. of River Basin Studies

Portland Area Office

Omark Building

809 NE - 6th Avenue

Portland, Oregon 97232

STATE AGENCIES:

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ATTN: Mr. Dale Ferrier

Operations Div. - Auth. Section

Olympia, Washington 98504

Tele: (206) 753-6193

WASHINGTON STATE GAME DEPARTMENT

600 N. Capitol Way
Olympia, Washington
Tele: (206) 753-5700

WASHINGTON STATE DEPARTMENT OF FISHERIES

General Administration Building
Olympia, Washington
Tele: (206) 753-6600

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

Public Lands - Social Security Building
Olympia, Washington
Tele: (206) 753-5327

LOCAL AGENCIES:

City of Olympia
Thurston County Regional Planning Council
Thurston County Courthouse Annex
Olympia, Washington

A Shoreline Management Permit would be filed
with Olympia, Tumwater and Thurston County.

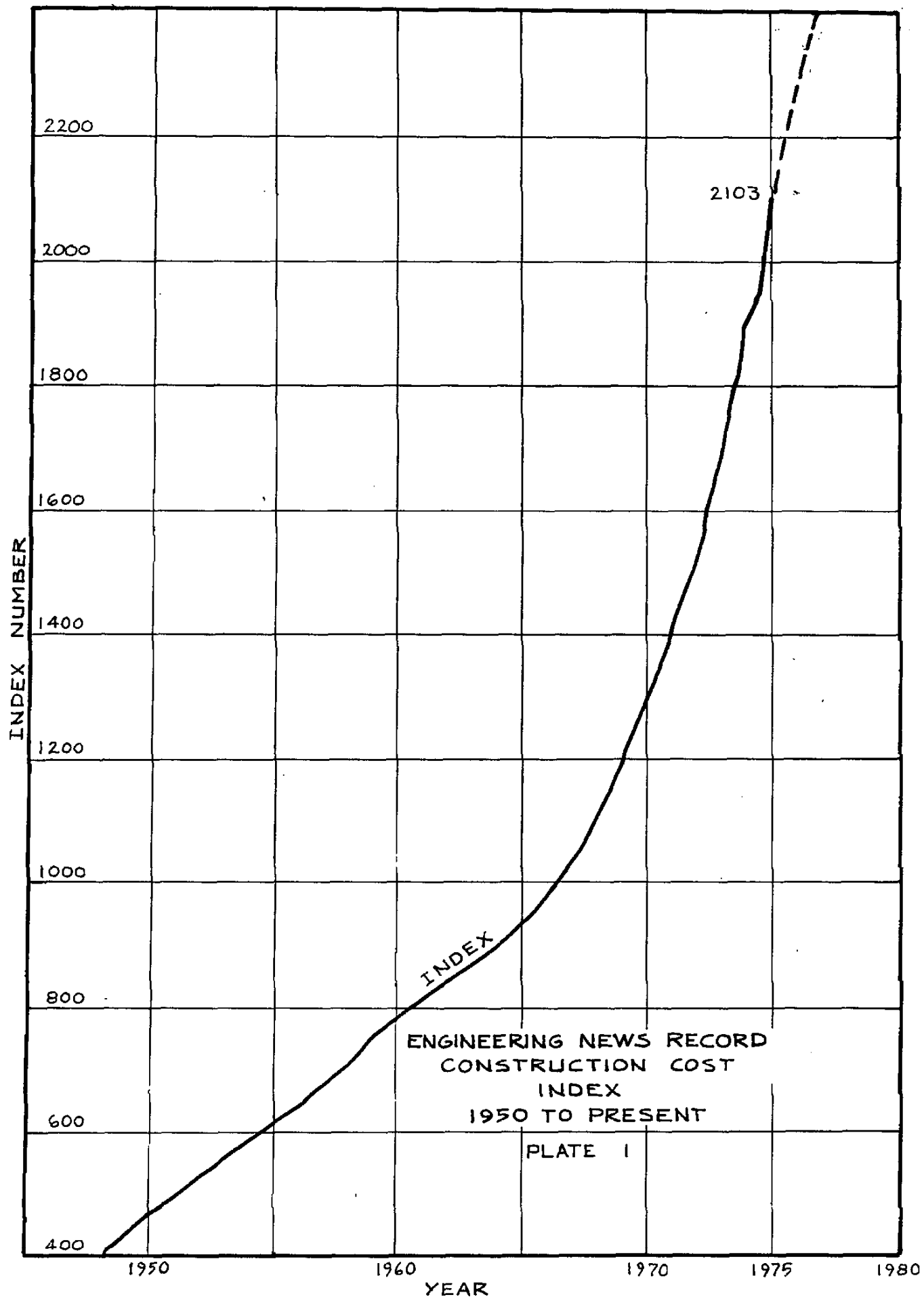
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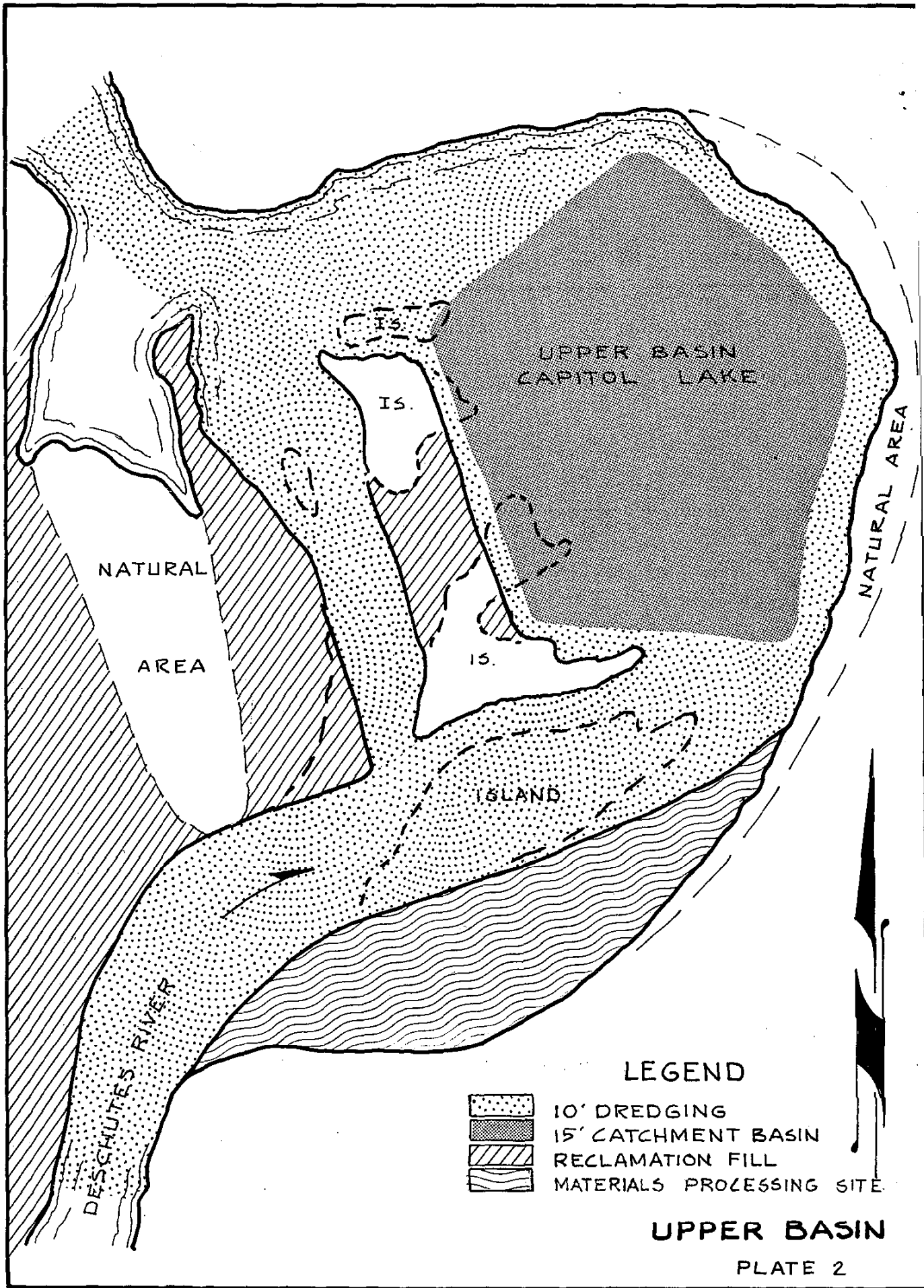
XIV. PLATES

XIV. PLATES

DESCRIPTIONS

Plate	Description
1. Cost Index	Engineering News Record Index based on 100 for the year of 1913
2. Upper Basin	Dredging depths and spoil sites
3. Riprap	Placement of riprap to stabilize river channel and islands
4. Processing Site	Plan of the functions of the annual processing site
5. Dredging Plan	Dredging areas and depths for the 3 lake basins
6. Port Disposal Sites	Port of Olympia's tentative disposal sites with available quantities & diking
7. Shoreline Disposal	Disposal areas within the lake basin
8. Cross Sections	Typical cross sections of dredging of each lake basin where indicated on Plate 7, also riprap section
9. Fill Sites	Sites for disposal of annual dredging waste
10. Rail Routes	Railroad transportation of annual dredging to Port area by Burlington Northern and Union Pacific Railroads.
11. Hydraulic Routes	Hydraulic transport of dredging effluent to the Port Area, inflow and discharge.
12. Lake Activities	Chart of Fish activities in the Lake by annual cycles.





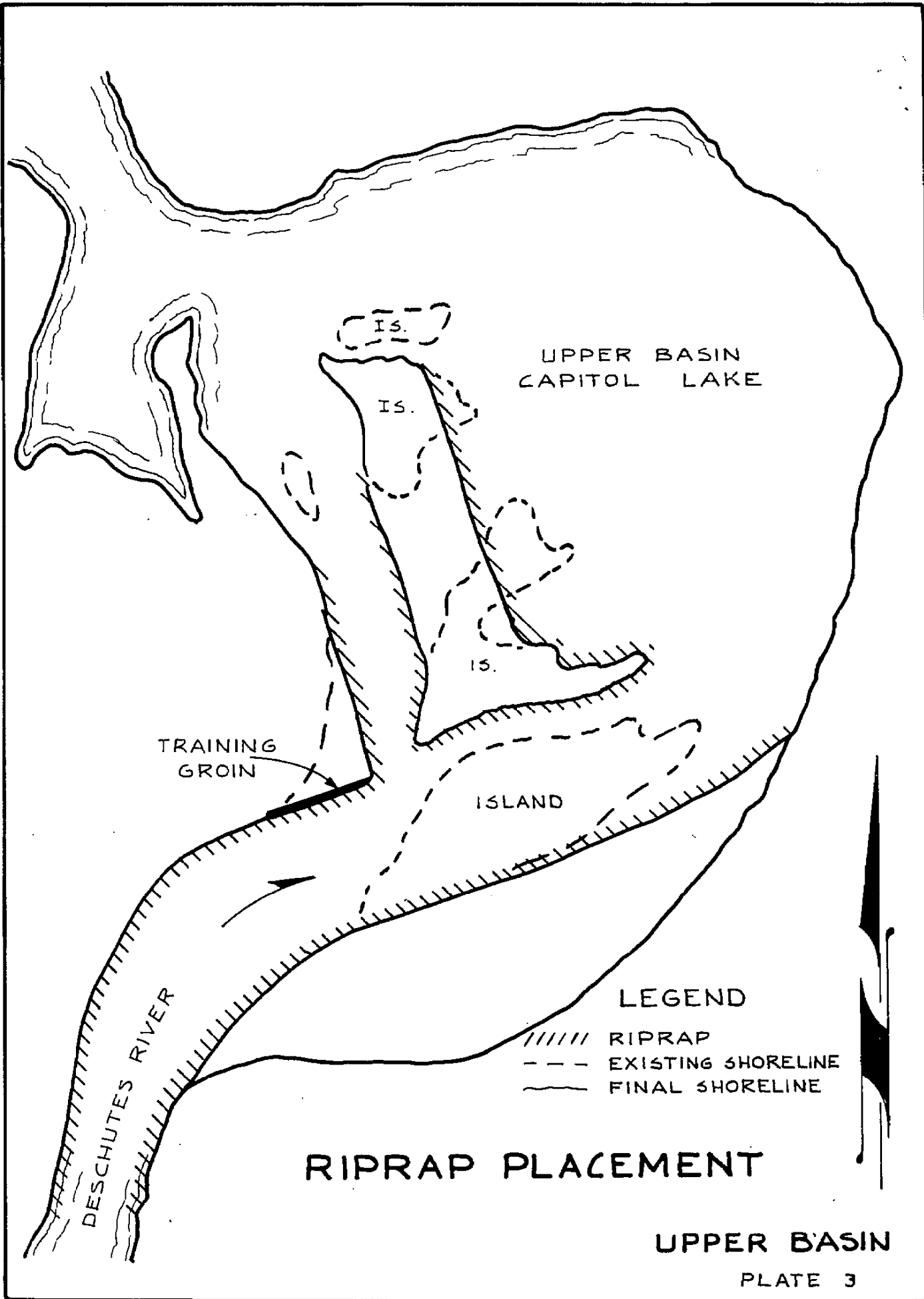


PLATE IV DESCRIPTION

Functions of the Annual Processing Site

The approximate 40,000 cubic yards of material dredged annually from the catchment basin will be processed as shown on Plate 4.

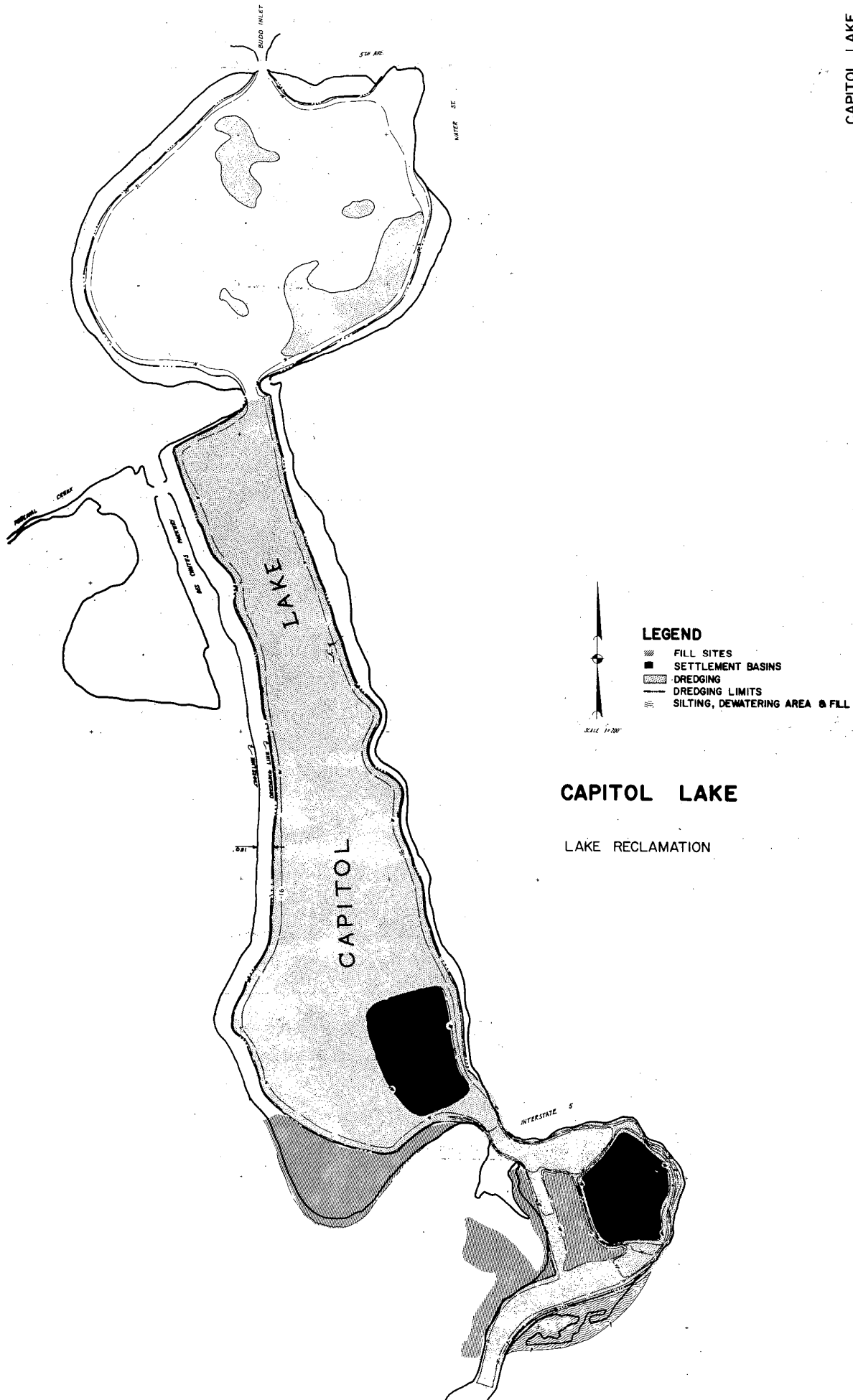
A small dredge will be used to pump an average of 60 cubic yards per hour of solids from the lake for 16 hours per day for 40 to 45 working days. The material will pass through an eight inch transmission pipe to a screen separating area. Sands and gravels of commercial value will be separated out with the finer material passing along into a silt settling pond.

The settlement pond has a detention time of 2 days (48 hours) before allowing the effluent to flow to the clarifier pond. If colloids require chemical additives to settle out these solids, the chemicals can be added as the effluent enters the clarifier ponds.

The final phase is the aeration of the effluent to bring up the oxygen content if required by the dredging permit. Also the use of sand filters is possible before the aerated water is returned to Capitol Lake.

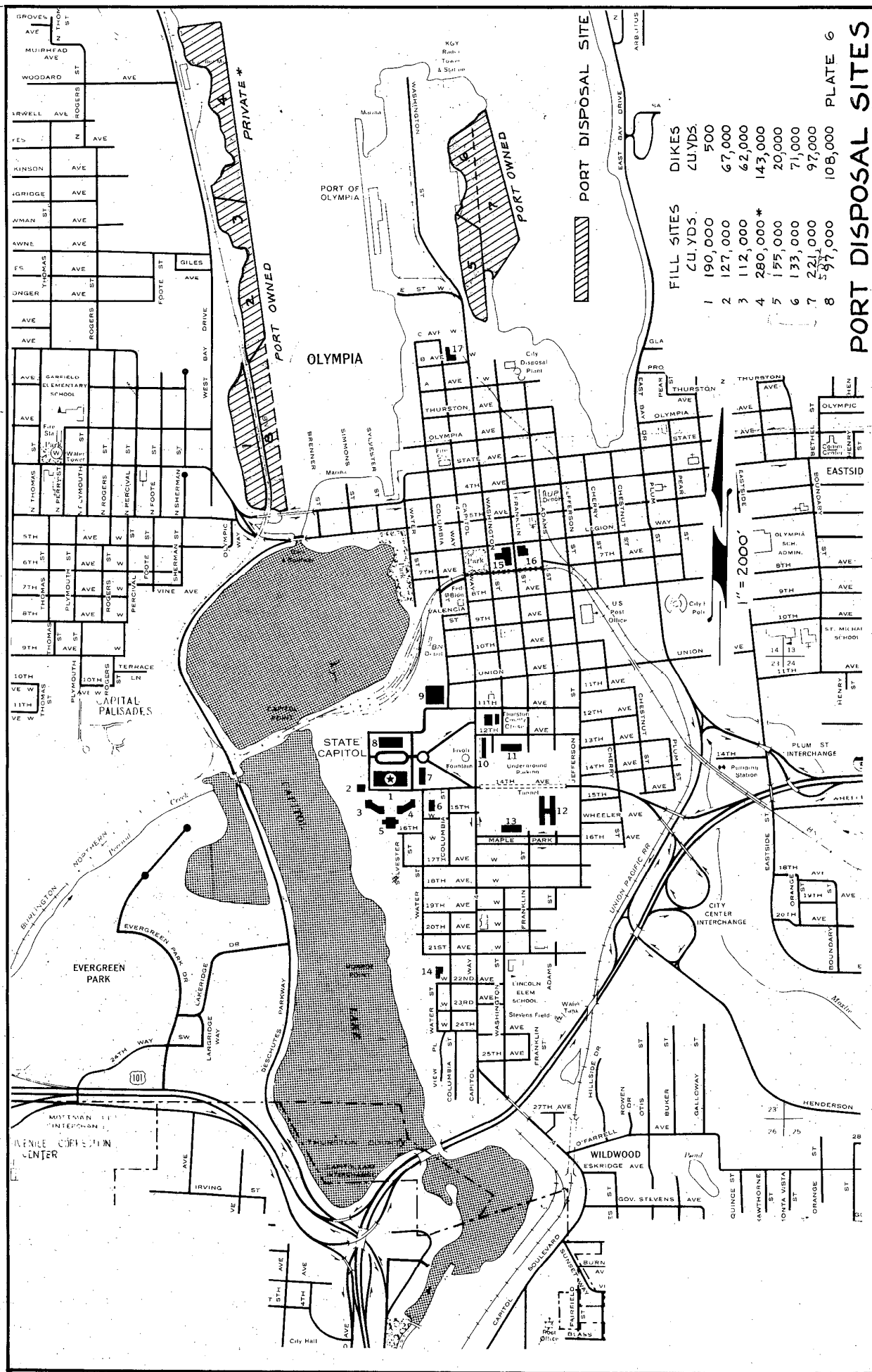
Mechanical equipment is kept to a minimum in the suggested plan with an estimate including possible future requirements for dredging effluent discharged into Capitol Lake. Cleaning of the ponds and loading the solids can be accomplished with a front end loader.

Commercial sands and gravels will have to be transported daily during dredging operations but silts and settleable solids can be removed after the periodic operation is completed. Ponds should be drained and the waste material allowed to dry sufficiently to allow hauling to fill sites.



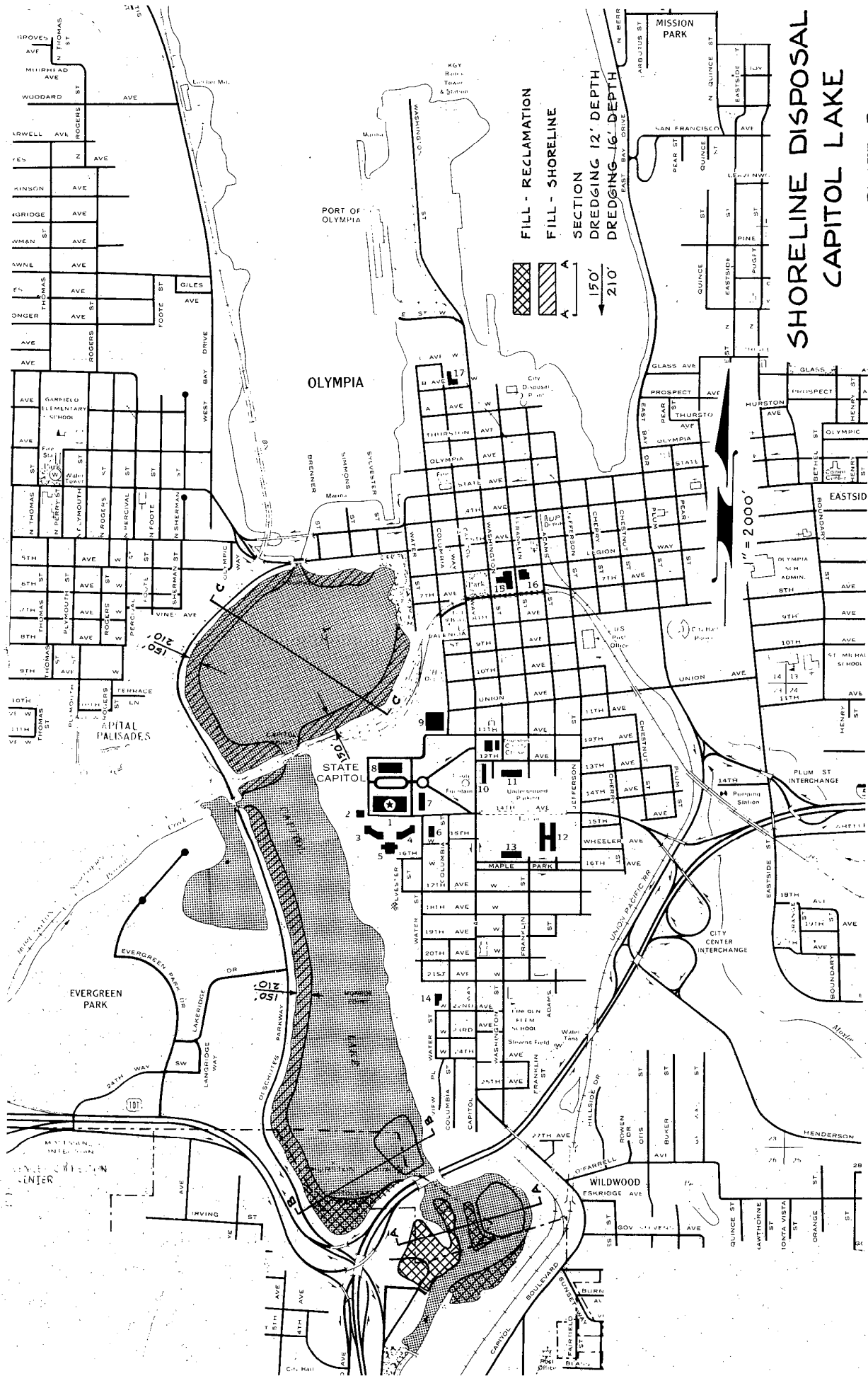
CAPITOL LAKE

LAKE RECLAMATION

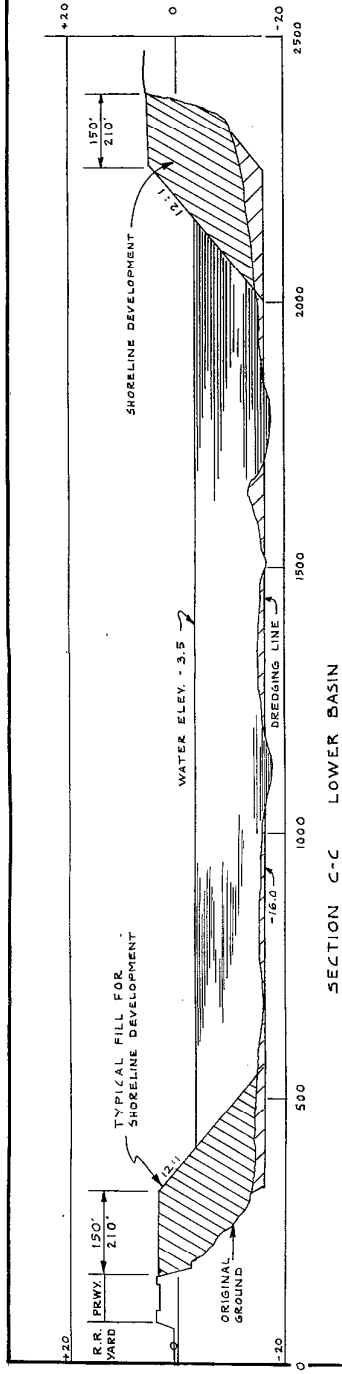


FILL SITES	CU. YDS.	DIKES	CU. YDS.
1	190,000	500	
2	127,000	67,000	
3	112,000*	62,000	
4	280,000*	143,000	
5	175,000	20,000	
6	133,000	71,000	
7	221,000	97,000	
8	377,000	108,000	

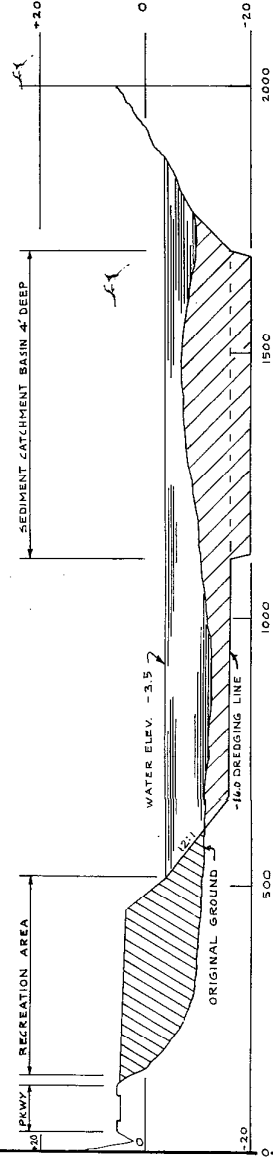
PORT DISPOSAL SITES



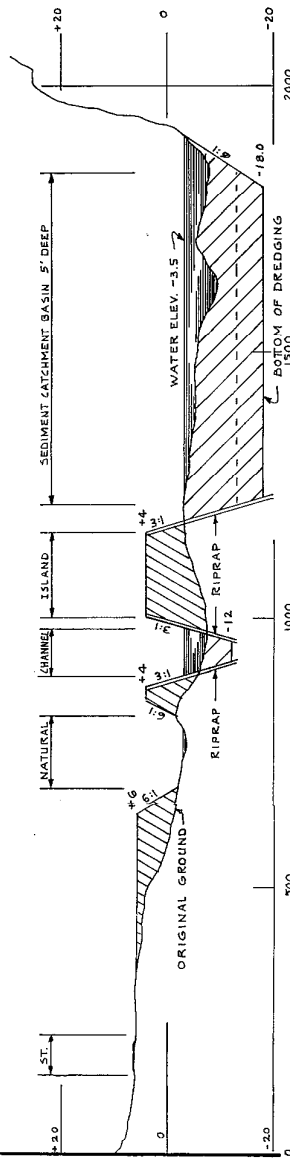
SHORELINE DISPOSAL CAPITOL LAKE



SECTION C-C LOWER BASIN

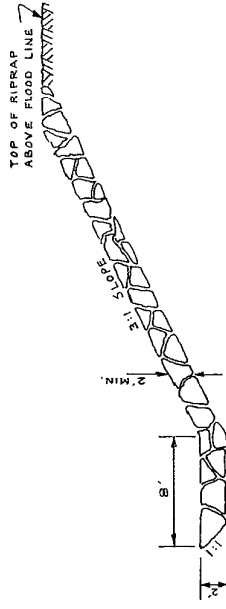


SECTION B-B MIDDLE BASIN



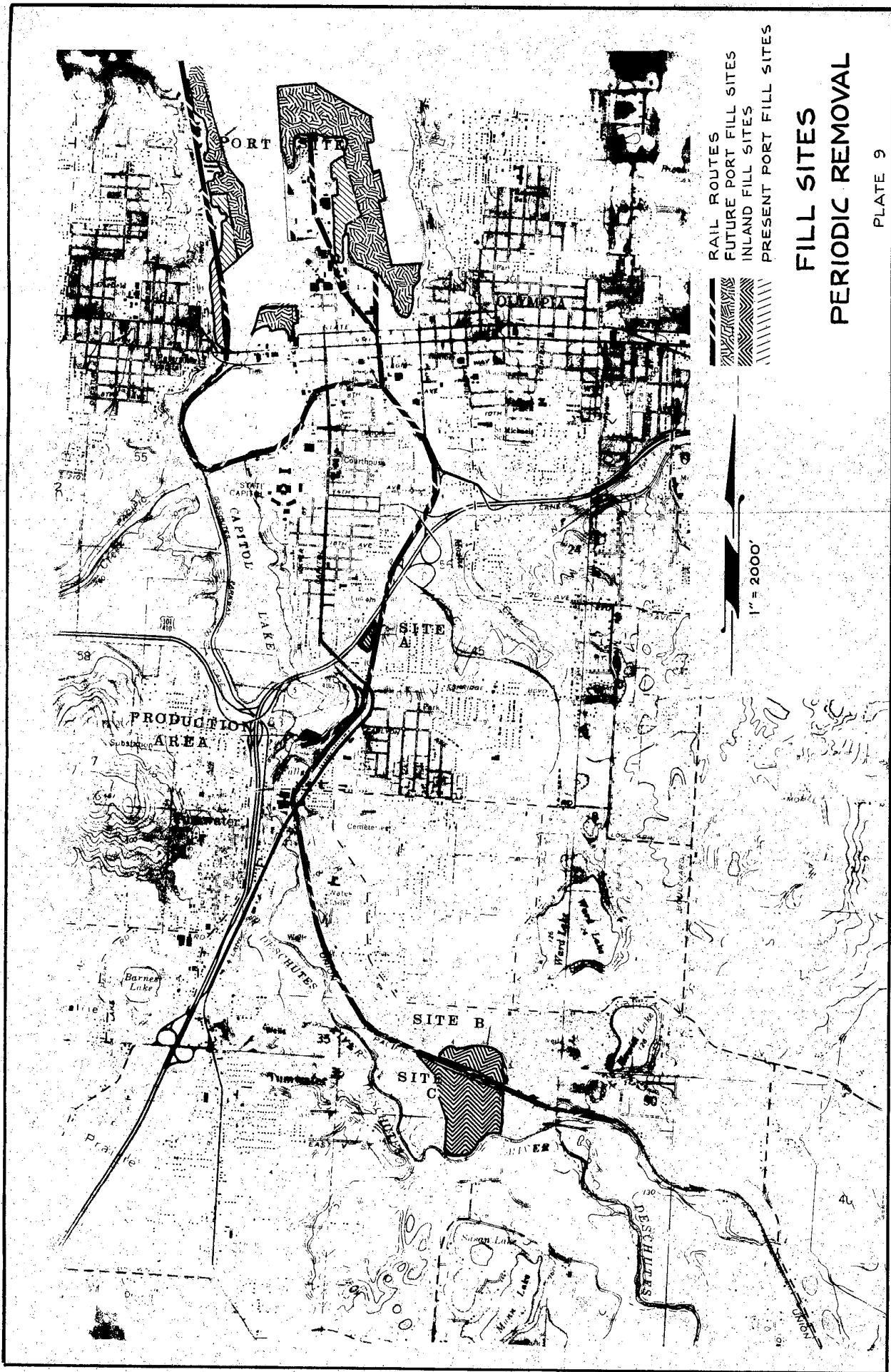
SECTION A-A UPPER BASIN

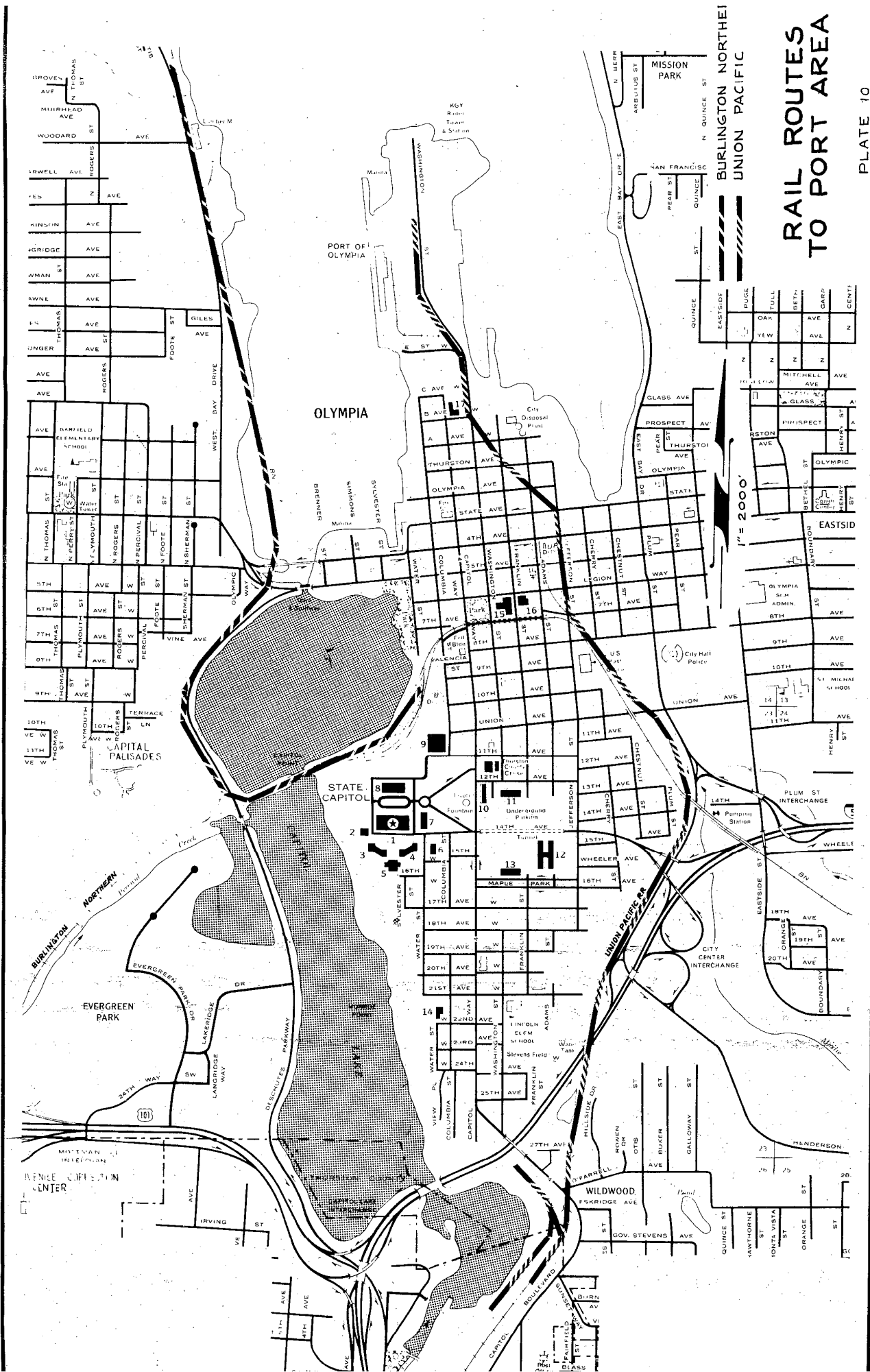
SCALE HOR. 1" = 200'
VERT. 1" = 20'



RIPRAP SECTION

TYPICAL CROSS SECTIONS
CAPITOL LAKE

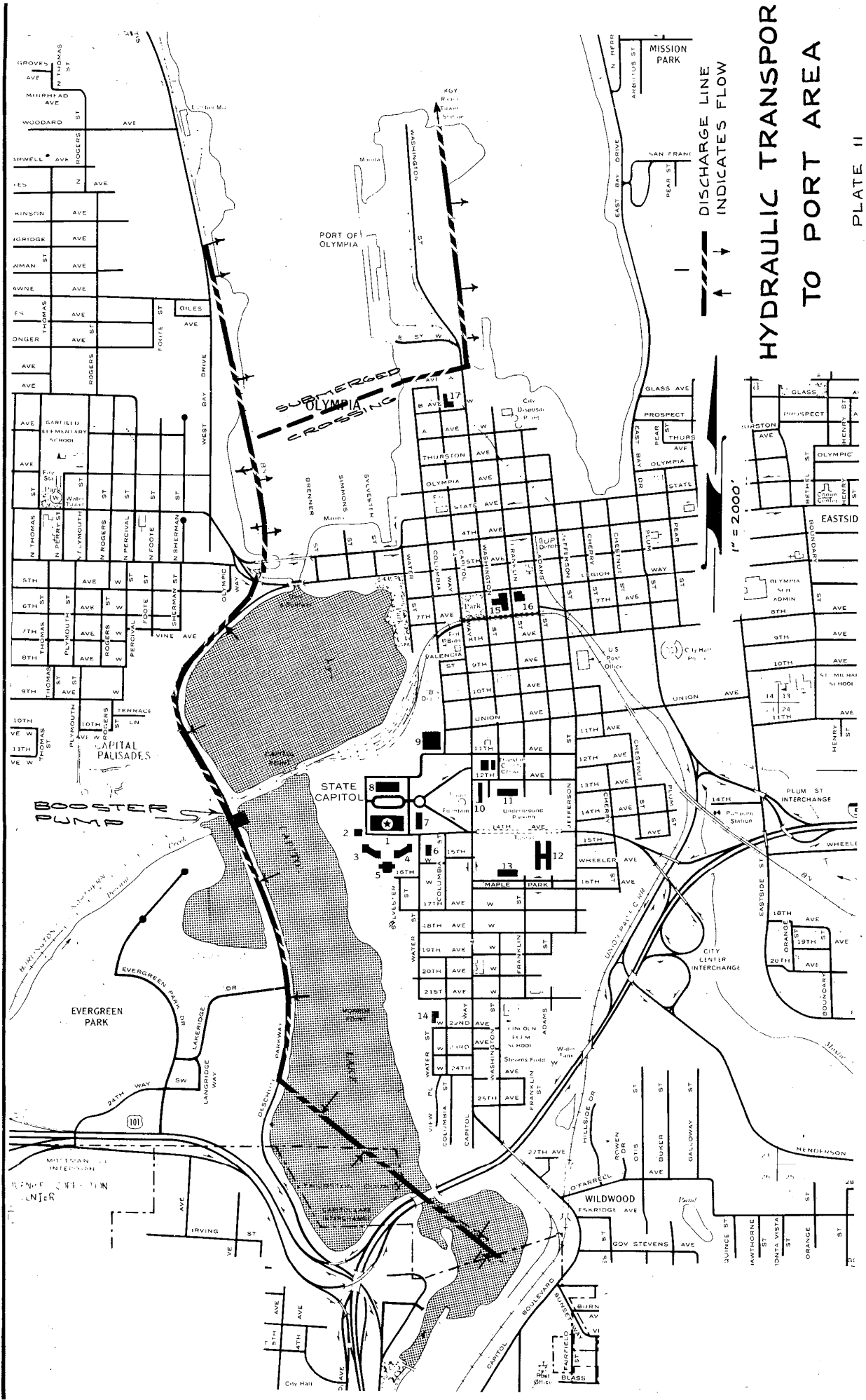




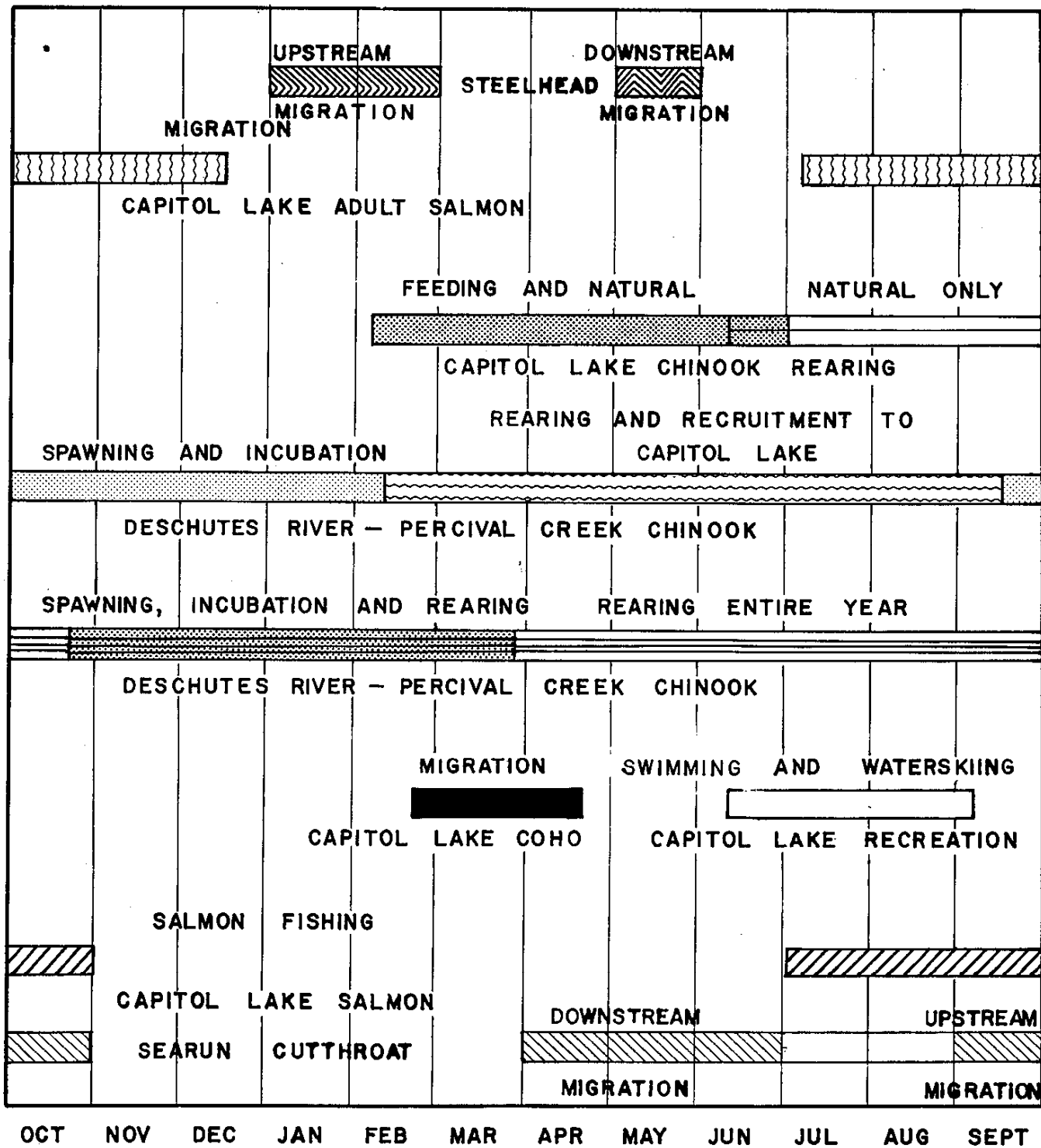
RAIL ROUTES TO PORT AREA

BURLINGTON NORTHEAST
UNION PACIFIC

PLATE 10



**HYDRAULIC TRANSPORT
TO PORT AREA**



CAPITOL LAKE ACTIVITIES CHART

FISH

PLATE 12

Appendix A

BIBLIOGRAPHY

PRELIMINARY REPORT - SEDIMENT REMOVAL AND MAINTENANCE SYSTEM
FOR THE UPPER BASIN OF CAPITOL LAKE AND SUPPLEMENTS

The R. L. Albrook Laboratory

Department of Civil and Environmental Engineering
College of Engineering, Washington State University
Pullman, Washington

ENGINEERING INVESTIGATION FOR REHABILITATION OF CAPITOL
LAKE, OLYMPIA, WASHINGTON (Vol. I, Vol. II)

Patrick J. Byrne and Associates

610 South Columbia
Olympia, Washington 98501

SEDIMENT TRANSPORT BY STREAMS IN THE DESCHUTES AND NISQUALLY
RIVER BASINS Open-File Report

by Leonard M. Nelson November 1971 - June 1973

U. S. Department of Interior
Geological Survey
Water Resources Division

WATER SUPPLY BULLETIN NO. 15

Monthly and Yearly Summaries of Hydraulic Data in the State
of Washington

Division of Water Resources
Department of Conservation
State of Washington

PATRICK J. BYRNE & ASSOCIATES

APPENDIX B

Sources of Estimating Data

Port of Olympia
915 North Washington
Olympia, Washington
(Fill areas)

MUDCAT DIVISION

National Car Rental Systems, Inc.
Cupertino, California
(small dredge)

Willamette-Western Corp.
North Portsmouth Avenue
Portland, Oregon
(dredging 20")

Port of Grays Harbor
111 Wooding
Aberdeen, Washington
(Dredging settlement basin)

General Construction Co.
3840 Iowa Avenue S. W.
Seattle, Washington
(Dredging 16")

Enviro Development Co. Inc.
750 Welch Road
Palo Alto, California
(Clarifiers, screens, etc.)

PATRICK J. BYRNE & ASSOCIATES

Appendix B

Previous Studies

ENGINEERING INVESTIGATION FOR REHABILITATION OF CAPITOL
LAKE, OLYMPIA, WASHINGTON (VOL. I & VOL. II)

Patrick J. Byrne and Associates

610 South Columbia

Olympia, Washington 98501

PRELIMINARY REPORT - SEDIMENT REMOVAL AND MAINTENANCE
SYSTEM FOR THE UPPER BASIN OF CAPITOL LAKE AND SUPPLEMENTS

The R.L. Albrook Hydraulic Laboratory

Department of Civil and Environmental Engineering

College of Engineering

Washington State University

Pullman, Washington

ANNUAL DREDGING COST
(State Owned Equipment)

ESTIMATE OF COST

Lump Sum	L.S.	Mobilization & Maintenance	L.S.	\$ 8,240
40,000	C.Y.	Dredging	.40	16,000
700	Hrs.	Running booster pump	3.00	2,100
Lump Sum	L.S.	Chemical additives	L.S.	500
700	Hrs.	Operating Aerator (power)	1.00	700
700	Hrs.	Run & Maintain conveyor belts	2.00	1,400
30	Hrs.	Operating pump (power)	2.00	<u>60</u>
		Dredging Sub Total		\$29,000
36,000	C.Y.	Hauling (R.R.)	1.00	36,000
36,000	C.Y.	Loading R.R. cars or Hwy. Trucks	.50	18,000
8,000	C.Y.	Cleaning, loading & hauling (clarifiers & sediment pond)	2.00	<u>16,000</u>
		Loading & Hauling Sub Total		\$70,000
		TOTAL		\$99,000

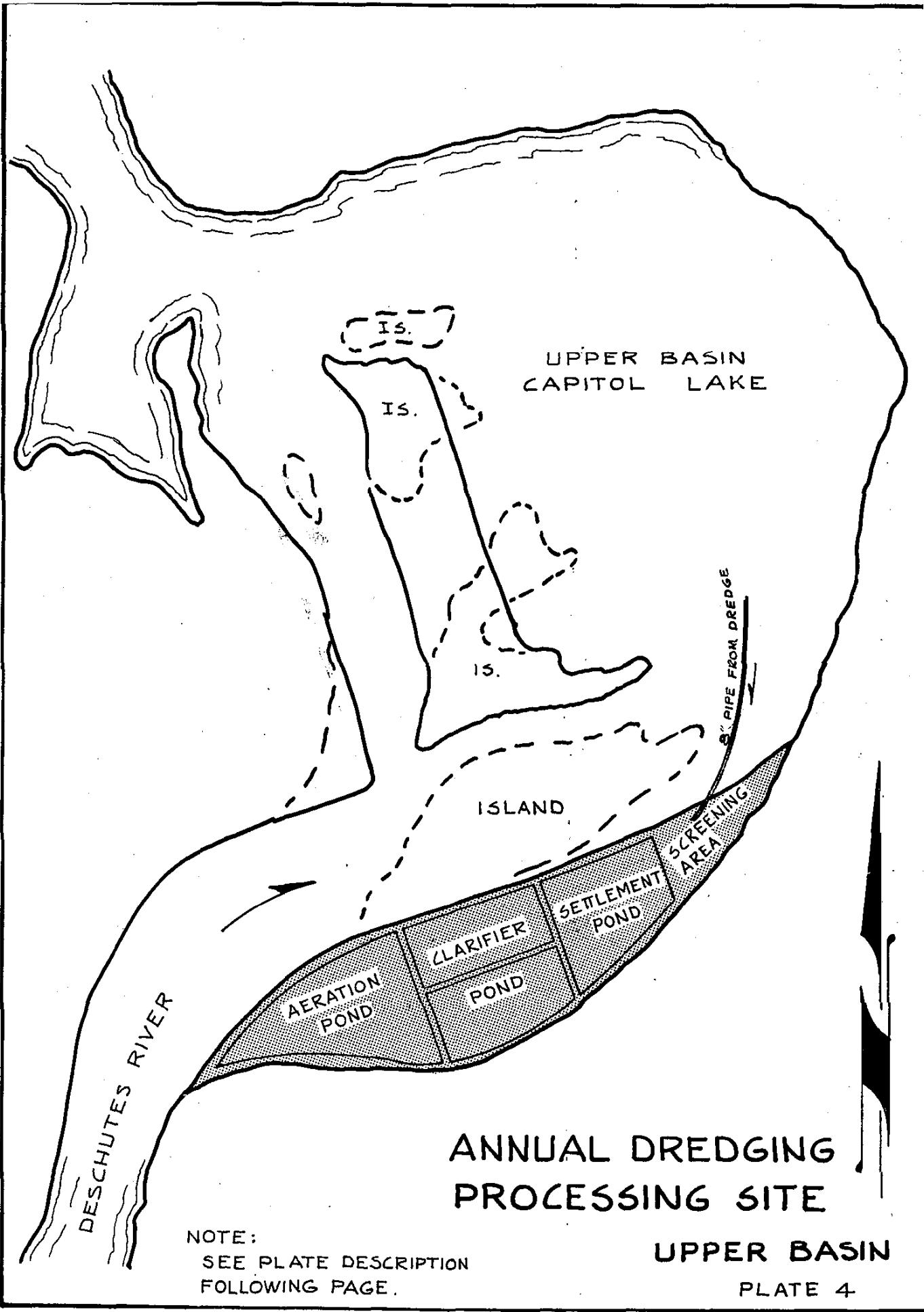
Note: If Highway Department agrees to haul sanding gravel at their own expense, a savings of \$36,000 [±] could be realized.

No amortization is calculated on the dredging equipment, on the site, or on the loading and hauling equipment.

ANNUAL DREDGING SITE PREPARATION

ESTIMATE OF COST

Lump Sum	L.S.	Mobilization	L.S.	\$ 19,500
18,000	C.Y.	Excavation & embankment	1.90	34,200
62	C.Y.	Concrete	100.00	6,200
Lump Sum	L.S.	Mixing (chamber & bldg.)	L.S.	14,000
300	L.F.	C.M.P. 18" Dia. & valves & Tide Gate	18.00	5,400
8.6	MBM	R.R. Loading bin at 4.50/BF		39,000
800	L.F.	R.R. Spur, tracks, ballast & switch	44.00	35,200
Lump Sum	L.S.	Screen or cyclone & conveyor	L.S.	10,800
Lump Sum	L.S.	Pipe 8" dia., valves & pump	L.S.	9,900
2	Only	Aerators (floating)	10,000	20,000
2	Only	Clarifiers	61,000	122,000
1	Only	Dredge (small)	96,000	96,000
TOTAL				\$412,000
Contingencies 10%				41,200
Engineering 8%				32,960
Administration 3%				12,360
Utilities Connections				3,480
GRAND TOTAL				\$502,000



UPPER BASIN
CAPITOL LAKE

DESCHUTES RIVER

ISLAND

3' PIPE FROM DREDGE

AERATION
POND

CLARIFIER
POND

SETTLEMENT
POND

SCREENING
AREA

**ANNUAL DREDGING
PROCESSING SITE**

NOTE:
SEE PLATE DESCRIPTION
FOLLOWING PAGE.

**UPPER BASIN
PLATE 4**