

MEMORANDUM FOR RECORD

SUBJECT: Smith and Bybee Lakes: Completion of Water Quality Tasks Assigned to NPPEN-HH-R

1. In March 1982, the U.S. Fish and Wildlife Service (USFWS) was issued a conditional permit by Portland District, Corps of Engineers to place a water control structure on a tributary of Columbia Slough in the Rivergate area of North Portland, Oregon (Inclosure 1). This tributary, called North Slough, connects Smith and Bybee lakes to the Columbia River via Columbia Slough and the Willamette River (Inclosure 2). Water is exchanged between the lakes and the Columbia River by tidal action, which forces water back and forth through the slough channels (Inclosure 2). A portion of the North Slough channel passes the St. John's landfill (Inclosure 2), which is Portland's major solid waste disposal site.

2. In September 1982, the USFWS completed construction of an earth-filled dam on North Slough which contains 2,000 cubic yards of fill materials. Its purpose, as envisioned by the USFWS, was to impound the lakes and conserve water during late summer and early fall, when warm, dry weather usually reduces the lakes to shallow basins of high-temperature, stagnant, weed-choked water. These conditions have contributed to oxygen depletion and other water quality problems. Nighttime reductions in dissolved oxygen were thought to be severe enough to kill fish and other aquatic life. Depletion of dissolved oxygen also occurred in lake-bottom sediments which, along with fish carcasses and other

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accumulations of organic matter, provided favorable substrates for the proliferation of botulin-secreting bacteria. Local and migratory waterfowl ingested these bacteria and contracted botulism poisoning (Inclosure 3). Wildlife biologists from the USFWS and the Oregon Department of Fish and Wildlife (ODFW) concluded that maximum lake volumes during the drawdown period would avoid deteriorated lake conditions which, indirectly, caused the reported waterfowl die-offs.

3. In February 1982, Mr. Brian Lightcap, NPPND-RF, had requested my assistance in determining the feasibility and effectiveness of impounding Smith and Bybee lakes for botulism control (Inclosure 4). In early March 1982, I visited the lakes and later attended an interagency meeting at ODFW in Portland to discuss the Smith-Bybee project. It soon became apparent at the meeting that proponents of the lake restoration project (ODFW, USFWS) had little tangible evidence to support their claim that the lakes were sources of botulism poisoning in waterfowl. Most of the evidence presented for botulism was casual or poorly documented observations supplemented by pure speculation. In my opinion, the proponents did not have sufficient data for them to conclude the following:

- (a) Botulin-secreting bacteria had originated in Smith and Bybee lakes, primarily from chemically-reduced sediments and fish carcasses, (b) these bacterial sources were created as the result of lake drawdown and subsequent lakewater deterioration, (c) exposure to botulism killed some waterfowl using Smith and Bybee lakes, and (d) the solution to the botulism problem is lake restoration by means of impoundment. Mr. Lightcap and I were also concerned that the

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impoundments would inundate and destroy valuable wetlands, wildlife habitat, and riparian zones used by fishermen and hunters.

4. In May 1982, Mr. Lightcap requested that I initiate water quality investigations at Smith and Bybee lakes (Inclosure 5). This water quality work had three objectives: (a) determine the effects of summer drawdown on water quality and other limnological properties, (b) identify limnological and water quality features which could produce botulism, and (c) establish pre-impoundment baseline limnological data which, when compared with post-impoundment data, could indicate to what extent the lake restoration project had actually brought about water quality improvements. This was intended to provide an objective basis for assessing the project's worthwhileness.

5. In early June 1982, I met with Mr. Stu McKenzie and Ms. Daphne Clifton, U.S. Geological Survey in Portland, to discuss the Smith-Bybee project, and to determine if they would be interested in assisting Portland District in a limnological study of the lakes. They expressed interest, and submitted a proposal on 14 June (Inclosure 6) which included a scope of work and a cost estimate of \$7,720. Portland District, Corps of Engineers asked the USGS, in a letter dated 30 June 1982 (Inclosure 7), to proceed with the water quality study at Smith and Bybee lakes as outlined in their proposal of 14 June.

6. It was necessary to describe the lakes limnologically before the onset of seasonal drawdown, occurring usually in late June or early July. Thus, field

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work for the water quality study was initiated on 17 June 1982, or nearly two weeks before the cooperative interagency agreement between Portland District and the USGS could be finalized.

During the next two months, between 17 June and 20 August, the lakes were visited weekly to obtain water and biological samples, and to record vertical temperature, dissolved oxygen, pH, and conductivity gradients at two stations on each lake. On 20-21 July and 19-20 August, Smith Lake was monitored continuously, with automated instrumentation, over a 24-hour period to determine diel variations in temperature, dissolved oxygen, pH, and conductivity. I participated in all field work conducted during the June and July lake visits.

7. A preliminary report on the water quality of Smith and Bybee lakes during summer 1982 was presented to the Interagency Resource Management Group (IRMG) on 28 August and 13 September 1982 (Inclosure 8). The IRMG, whose purpose it is to provide guidance for improved management of Smith and Bybee lakes, consists of several organizations including: ODFW, the USFWS, the City of Portland, the Port of Portland, lakeside landowners, Metro, the Portland Audubon Society, the Oregon Department of Environmental Quality, and Portland District, Corps of Engineers. At the 13 September meeting at ODFW's fisheries laboratory in Clackamas, Oregon (Inclosure 8), I informed the IRMG members in attendance that Portland District had retained the consulting services of Dr. Ray Seidler, Professor of Microbiology at Oregon State University, to evaluate data and reports that had been used to build the case for botulism at Smith and Bybee

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lakes. Dr. Seidler also was being asked to assist in the water quality study by directing attention to those lake factors which contribute to botulism and, therefore, should be investigated. I emphasized that Dr. Seidler's involvement should not be interpreted as the Corps' rejection of the ODFW and USFWS waterfowl biologist's expert opinion about botulism at Smith and Bybee lakes. In fact, I suggested that ODFW and the USFWS draw on Dr. Seidler's expertise to possibly reinforce their positions, so that the question of whether a botulism outbreak had indeed occurred would be settled. Neither agency, to my knowledge, had sought such peer review, which Dr. Seidler, or others in the academic community, could have provided to verify the possible existence of botulism. Instead, valuable time was consumed in fruitless debate over whether the botulism reports were reliable, and whether botulism was a legitimate issue to justify the issuance of a Corps permit to impound the lakes.

8. Dr. Seidler's participation with the IRMG was relatively inexpensive (\$202.75) and, unfortunately, brief. During his single day at Portland District, he discussed the botulism controversy with Corps and USGS personnel, and he spent the afternoon on a field trip to Smith and Bybee lakes. It was his opinion, based on this quick familiarization, that lake volumes should be increased incrementally over a period of several years rather than rapidly and totally during the initial filling. A total fill initially would inundate enormous quantities of in-lake and riparian vegetation which eventually would undergo bacterial decomposition. The lake basins would come to resemble peat bogs in which decomposing vegetation accumulated and gave rise to various water

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pollutants, such as hydrogen sulfide, methane, and dissolved organic matter, all capable of depleting dissolved oxygen and creating objectionable odors and visual properties. These conditions would likely exacerbate, rather than alleviate, any botulism problem.

9. Despite Dr. Seidler's recommendation for an incremental, carefully regulated lake fill, the USFWS stated that it intended to fill the lakes completely during the fall of 1982. This was prevented, however, by the Corps permit, issued in March 1982, which specified a more gradual rate of filling until the environmental effects could be ascertained. Moreover, to my knowledge, neither Dr. Seidler nor anyone else with his qualifications was ever called upon again to settle the botulism dispute. Consequently, the question of whether botulism poisoning actually occurred among waterfowl populations ingesting materials produced in Smith and Bybee lakes has not yet been answered. I am inclined to believe that the botulism issue was merely a ploy to obtain the Corps' permit to impound the lakes. The potential for recreational development is perhaps the real motivation for this attempt at lake restoration.

10. In September 1982, I met with Mr. Stu McKenzie and Ms. Daphne Clifton, USGS, to hear a status report on the Smith-Bybee water quality study, and to discuss the possibility of continuing the study through December 1982. Agreement was reached to continue the monitoring, and to undertake new tasks including collection and analysis of lake sediment cores, and identification and quantification of plankton and benthic samples collected during the previous

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three months. Additionally, the USGS was asked to prepare a final report, in the form of an open-file report, containing all the water quality and limnological data collected for Smith and Bybee lakes during the period June-December 1982. A proposal and cost estimate for this work was submitted to Portland District on 24 September 1982 (Inclosure 9). Portland District responded with a letter dated 28 September 1982 which authorized the USGS to proceed with monitoring and new research, for an additional cost of \$15,000 (Inclosure 10).

11. In late November 1982, the earth-filled dam placed in North Slough two months earlier began to disintegrate because of pressure exerted by the impoundment water. It became necessary to dewater the lake to avoid structural failure and the flood damage that could have been caused by escaping lakewater. Dewatering was done by reopening an old slough channel extending directly from Bybee Lake to the Columbia River.

12. A meeting was held on 19 May 1983 to update IRMG members on the status of the Smith and Bybee lakes rehabilitation project and the recently completed USGS limnological investigation of the lakes. I summarized the events that had led up to the Corps' limnological involvement in the project. I recounted the Corps' initiative and financial support of the USGS study (at the time, other IRMG members had not been willing to participate with funding). I recognized the importance of continuing the study, but I emphasized that the Corps would no longer fund this work, thus funds for future water quality studies at Smith and Bybee lakes would have to come from other sources.

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Ms. Daphne Clifton gave a brief presentation which highlighted the principal findings of the Smith-Bybee study. Her final report, titled "Water-quality data for Smith and Bybee lakes, Portland, Oregon: June to November 1982" (Inclosure 11*) is essentially a baseline characterization of the lakes. The report contains no interpretative analyses of its extensive lists of limnological data, but these were not a study objective. Rather the USGS was asked to merely describe the lake environments, consistent with their traditional approach to first-phase, reconnaissance studies. Interpretations would require an exhaustive office review within the USGS, and we had neither funds nor time to allow this. Eventually, if the study is allowed to continue, interpretations of data will be necessary in order to understand cause-effect relationships, particularly those relating to botulism.

13. Botulism was a hotly debated topic at the IRMG meeting. I said that I was skeptical of claims, by the U.S. Fish and Wildlife Service and the Oregon Department of Fish and Wildlife, that botulism was causing high mortality among waterfowl using Smith and Bybee lakes. I acknowledged that the disease had perhaps occurred, but I remained convinced that reports of "massive" die-offs, involving thousands of waterfowl, were not completely true. I was, and am, skeptical because there is no documentation or recorded observations indicating the magnitude and apparent cause of the die-offs. I was particularly

* Inclosure 11 includes only the text material. The entire report, including 5 figures, 11 tables, and an appendix, is on file in NPPEN-HH-R and in NPPND-RF-2.

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interested in purported laboratory autopsy results, supposedly on file somewhere, which attributed waterfowl mortalities at Smith and Bybee lakes to botulism. Since this information has not been made available, I can only surmise as to its whereabouts.

Mr. Dave Brown, one of the people at the meeting representing the U.S. Fish and Wildlife Service, mentioned that his agency had records on botulism outbreaks at Smith and Bybee lakes, and that he would be happy to provide me with this information (Inclosure 12). Although these records establish that large numbers of botulism-contaminated waterfowl were retrieved from the lakes, the information does not prove that (a) the waterfowl contracted the disease in Smith and Bybee lakes, or (b) the mortalities were caused by botulism poisoning. Possibly, the waterfowl contracted the disease elsewhere, but died in Smith and Bybee lakes. Or, the waterfowl were killed by something else, but their carcasses were invaded by botulism-secreting bacteria originating in lake sediments and fish carcasses.

13. Prior to the meeting with the IRMG, I informed Mr. Burt Paynter, Chief, NPPND-RF-2, that my assignment, as a water quality advisor in the Smith-Bybee lakes project, was completed, and that a report detailing my involvement in the project (the subject of this MFR) would be forthcoming. I suggested that if

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more of my time were needed for the project, he formally request my assistance
from Mr. Dick Cassidy, Chief NPPEN-HH-R.



DOUGLAS W. LARSON
LIMNOLOGIST, NPPEN-HH-R

INCLOSURE 1

NPPND-RF-2

1 March 1982

Jack Kincheloe
U.S. Fish and Wildlife Service
P.O. Box 457
Kingsfield, WA 98642

RE: 071-OYA-2-004236
(Bybee Lake - Fill)

Dear Mr. Kincheloe:

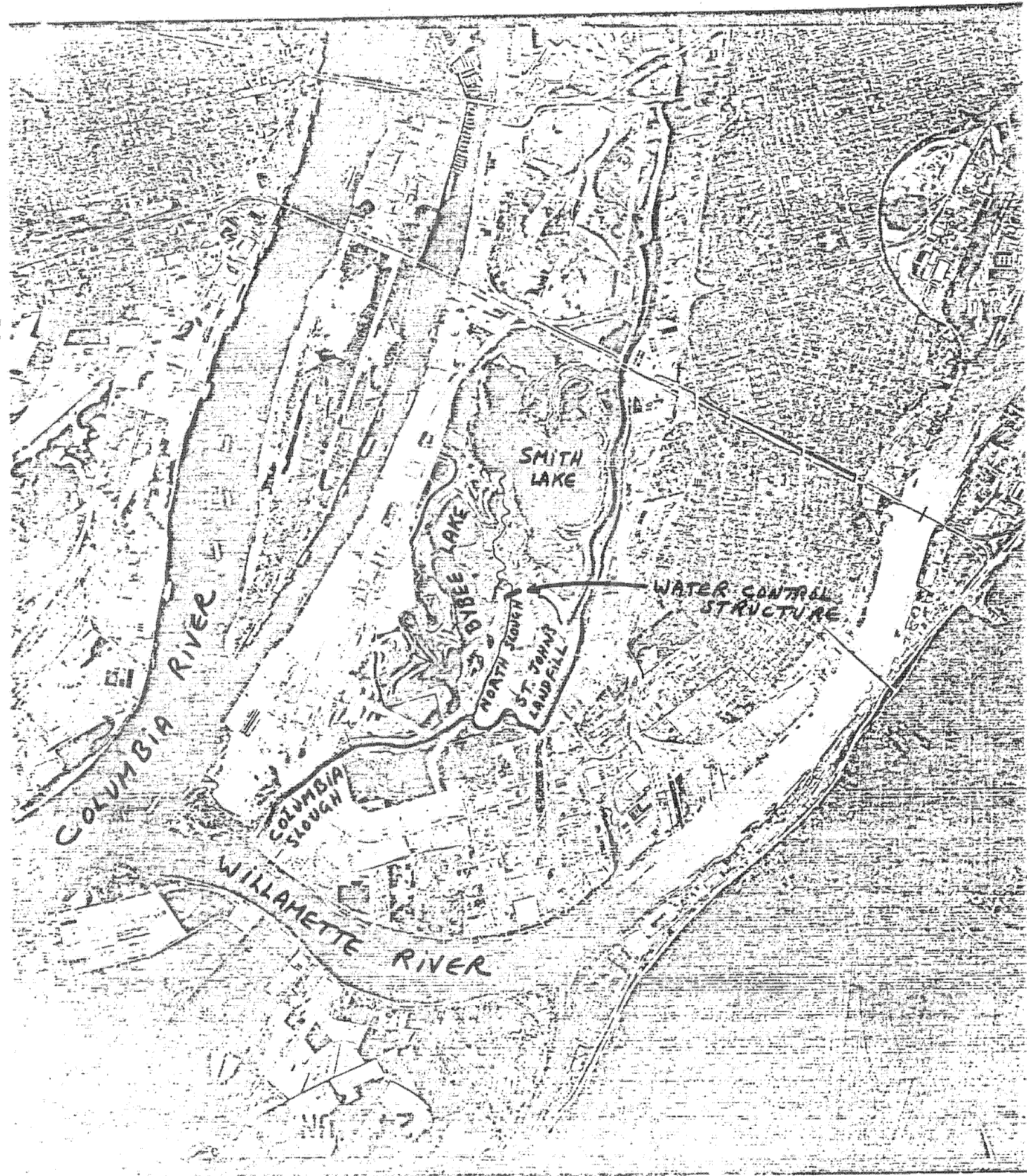
We are proceeding to issue a conditional permit for the work proposed as described in Public Notice No. 071-OYA-2-004236 (Fill near Bybee Lake). This permit will contain conditions similar to those in the State permit. Prior to proceeding with the work, a management plan will be required.

A discussion of the plan details will be initiated on 8 March 1982 during a walk through the project area. Also during this week, tentatively on 10 March 1982, at 1:00 p.m., Oregon Department of Fish and Wildlife (ODFW) will entertain additional discussion on the plan. The meeting place will be coordinated through Mr. Bob Maben of ODFW, 657-2008. Special guests at this meeting have been coordinated through Dr. Peter Klingeman (see Incl 1) who is studying a lake with water quality problems comparable to Smith and Bybee Lakes.

The Final Environmental Assessment will be made available prior to 8 March 1982. Copies of this Corps document will be mailed by Mr. Ron Mary (221-6995), Permit Coordinator for this permit.

Sincerely,

W. BURTON PAYNTER
Chief, Regulatory Functions Branch



Circulation 2/1/83

Agencies seek to end duck poisoning by cleaning up 2 lakes

By ROBERT LOTHIAN 281-7226
Correspondent, The Oregonian

Government agencies trying to solve a duck poisoning problem have set the wheels in motion for a plan to clean up Smith and Bybee lakes and perhaps turn the surrounding land into a natural park.

Representatives from agencies, environmental groups and private landowners are meeting to put together a resource management plan for the large North Portland wetland.

According to Lloyd Pierre, conservationist with the U.S. Soil and Water Conservation Service and secretary of the planning group, a high priority for it will be to seek funds for water quality improvement to end the botulism infection that plagues the lakes' waterfowl.

Ducks become infected and die by the hundreds when they eat rotten fish that have been stranded as the lake's dry up in the fall, Pierre said. A temporary earth dam to hold water through

the dry season was thought to be the solution, and one was installed at the behest of the U.S. Fish and Wildlife Service in August and September 1982.

But according to Brian Lightcap, environmental planner with the U.S. Army Corps of Engineers, which has regulatory authority over the area, the corps has not seen proof that the dam succeeded. It may even cause other problems such as destruction of wildlife habitat and fishing sites through higher water levels, Lightcap added.

Because of the potential problems, the Fish and Wildlife Service was required as part of the permit process to develop a "coordinated resource management plan," a task with which the planning group is charged.

The group will decide on possible projects in coming months, he said, and will almost certainly include water quality improvement and construction of trails and fishing access. Work could begin as soon as late summer, he said.

Major landowners in the Smith and Bybee area — the Portland Park Bureau, Port of Portland and private interests — are involved in the planning along with the East Multnomah Soil and Water Conservation District, U.S. Soil and Water Conservation Service, U.S. Geological Survey, state and federal fish and wildlife agencies and the Portland Audubon Society. The North Portland Citizens' Committee also has been asked to participate.

Over 1,100 acres are under study, including two large lakes, tidal mudflats, willow swamps and stands of Oregon white ash that provide a rich wetland habitat for geese, ducks, shorebirds, great blue herons, marshhawks and small mammals.

"The area is unique — one of the last natural wetlands of its type that used to occur along the Willamette," said Bob Maben, assistant regional director of the Oregon Department of Fish and Wildlife.

Maben said his agency is interested in preserv-

ing much of the area in its native state as wildlife habitat.

Also high on the planning agenda is opening the area for "passive" recreation — bird watching, nature walks, photography and canoeing.

Park Bureau plans call for a trail network connecting the Smith and Bybee area with Kelly Point Park to the north and Delta Park to the east part of an eventual 40-mile loop trail around the city.

Preservation of archaeological sites is another concern, as is protection of wappato, a once-abundant native food staple that is declining with the destruction of wetlands. According to Mike Houck, urban naturalist with the Audubon Society, there is concern that rising water could cover the marshy areas where wappato grows.

Other problems on the planners' agenda include illegal hunting and recreational vehicle use, lack of fishing access and loss of habitat and diversity.

JNC 2030RE 3

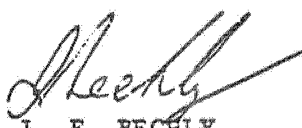
DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL NPPND-RF	SUBJECT Public Notice No. 071-OYA-2-004236 (Columbia Slough - Fill)
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TO Chief, Engineering Div. ATTN: NPPEN-PL-H	FROM Chief, Navigation Div.	DATE 17 February 1982 Lightcap/6995/kh	CMT 1
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1. A number of significant water quality issues have been informally discussed with Doug Larson (NPPEN-PL-H) regarding a permit application to impound water in Smith and Bybee Lakes. Interagency discussions on formulating a lake water level control plan will be continued on 1 and 2 March 1982. A special meeting guest will be Dr. Peter Klingeman who will discuss his ongoing water quality study at Sturgeon Lake on Sauvie Island.
2. We request that Mr. Larson attend this meeting and the field trip planned for the last week of February in order to contribute his knowledge and expertise to the discussion. Up to \$400 can be charged to CDXPG 1501020000 for Mr. Larson's time. Please contact Brian Lightcap (x6995) for meeting location and time and for technical information regarding the subject proposal.


 J. F. BECHLY
 Chief, Navigation Division

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL

SUBJECT

PP. -RF

Water Quality Investigations
in Smith and Bybee Lakes

Chief, Engineering Div

FROM

Chief, Navigation Division

DATE

26 May 1982
Lightcap/6995/bp

CMT 1

. We have issued a permit to U.S. Fish and Wildlife to place a culvert and fill in North Slough (a tributary of Columbia Slough) in order to hold water in Smith and Bybee Lakes. A condition of our permit stipulated that the permittee cooperate with other interested Federal and State resource agencies to monitor the existing and the new environment after the structure was placed.

. As one of the cooperating agencies in the "Task Force", we agreed to monitor some of the basic water quality parameters needed to document the limnological changes and possibly to assist the formulation of a plan to further investigate the causes of avian botulism, type C. The various aspects of our water quality needs have been discussed at length with Pam Moore (PL-AE) and Doug Larson (PL-H).

. There is a need to immediately augment existing water quality data gathering efforts. We also must assist the "Task Force's" mission to describe limnological changes that will occur in Smith and Bybee Lakes. We request your assistance in selecting a way or ways that Engineering Division can complement our efforts.

. We anticipate that our funding limitation during FY 82 will be \$7,000. Please contact Brian Lightcap, Chief, Environmental and Inspection (Ex 6995) if you would like additional information.



J. F. BECHLY

Chief, Navigation Division



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
847 N.E. 19th Avenue, Suite 300
Portland, Oregon 97232

June 14, 1982

Doug Larson
U.S. Army Corps of Engineers
Portland District
P.O. Box 2946
Portland, OR 97208

Dear Doug

The U.S. Geological Survey is looking forward to collecting limnological data on Smith and Bybee Lakes for the Corps. During your meeting with Stu McKenzie and Daphne Clifton in our office, the following program for this summer was discussed.

Work item

Description of work

Collection of general water-quality data

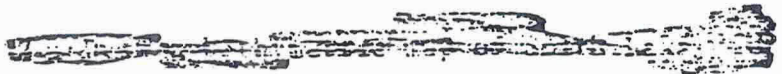
Collection of dissolved oxygen, pH, water temperature, specific conductance, light transparency, and stage on a weekly basis in Smith Lake. This same data will be collected monthly on Bybee Lake. Benthic invertebrates will be collected weekly on Smith Lake and monthly on Bybee Lake, data on numbers and general groupings of organisms will be provided. Phytoplankton samples will be analyzed for dominant species and total cells per ml.

Diel data

Data for dissolved oxygen, pH, water temperature, specific conductance and solar radiation will be collected over at least 24 hours three times during the June to September, 1982 period. In addition, eight phytoplankton samples will be collected for chlorophyll analysis and one water sample will be collected for analysis of nutrients, dissolved solids, organic carbon, and alkalinity during each diel study.

Special studies

1. Define the shore line of Smith Lake for ~~the~~ ~~the~~ low water conditions in 1982.



3. Determine the grain size, organic content, and immediate oxygen demand of bottom material.
4. Render an opinion on whether Smith Lake will likely hold or seep captured water into Bybee Lake or Columbia Slough.

In October 1982, a memorandum will be written to the Corps detailing work that has been accomplished and listing data collected in 1982 FY. The cost for this work in the 1982 FY is estimated to be \$7,720.

You can enable us to proceed with this effort by writing me a letter requesting us to do the work, referencing this letter, and stating that the above funds are available in 1982 FY. We feel that this study will prove worth while, and useful to several local agencies, and we look forward to continuing this work for the Corps in 1983 and 1984 fiscal years.

Sincerely,



Stanley F. Kapustka
District Chief

NPPEN-PL-H

30 JUN 1982

Mr. Stanley F. Kapustka
District Chief
Water Resources Division
U.S. Geological Survey
847 N.E. 19th Avenue, Suite 300
Portland, Oregon 97232

Dear Mr. Kapustka:

Reference your letter of 14 June 1982 concerning limnological studies at Smith and Bybee lakes, Oregon. We request that you proceed with the studies as outlined in your letter. Sampling of Bybee Lake should be done weekly, however, rather than monthly. Portland District, Corps of Engineers will provide funds for these studies in the amount of \$7,720.00.

In order to be reimbursed for costs, please bill the Corps of Engineers using Standard Form 1080.

Sincerely,

TERENCE J. CONNELL
Colonel, Corps of Engineers
District Engineer

CF:
Ch, NPPPB
Ch, NPPDC-F

MFR: This work is part of a water quality investigation by Regulatory Functions Branch, Navigation Division to determine the effects of a culvert and fill project in North Slough (Columbia River tributary) on Smith and Bybee lakes. The work will be funded under account number CDXPG1501020000 (O and M General, 96 x 3123).

NPPND-RF-1

20 October 1982

Lightcap/6995/bp

Mr. Robert Maben
Oregon Dept. of Fish and Wildlife
17330 S.E. Evelyn St.
Clackamas, OR 97105

RF

RE: 071-OYA-2-004236
(Bybee Lake - Fill)

Dear Mr. Maben:

The referenced Department of the Army permit (Special Condition j.) (Incl 1) requires that water levels behind the structure be managed in accordance with the recommendation of the Interagency Resource Management Group (IRMG) as represented by the Oregon Department of Fish and Wildlife and the U.S. Fish and Wildlife Service. We have participated with this informal group for six months, and are encouraged with the amount of preliminary data obtained by your staff on fisheries and wildlife. Other information of importance to the group has also been gathered on water quality and vegetation.

We have monitored water quality conditions in Smith and Bybee Lake in cooperation with the United States Geological Survey (USGS) in order to describe that parameter before installation of the fill, to detect any changes which may occur after its installation, and to make practical suggestions to the IRMG. The USGS work will be preliminarily published in early spring. Some advance water quality information was presented 28 August 1982 at the ODFW W. Hill Street office, and on 13 September 1982 at your office.

The distinct vegetation differences known to exist between Smith and Bybee Lakes appear to be supported by equally measurable water quality differences. The vegetation map that is being prepared cooperatively between USFWS (Ecological Services) and this office depicts these differences and should be available through Nancy Ellifrit (USFWS, phone 231-6179).

Our staff limnological expert, Mr. Doug Larsen, presented Doctor Ray Sidler to the IRMG at the 13 September 1982 meeting where the USGS presentation was made again by Mr. Stewart McKenzie. Dr. Sidler is a botulism expert from Oregon State University that we feel would add unbiased guidance to IRMG's efforts. He visited the two lakes and could be made available to advise us of the botulism risks faced when various water control measures are selected and implemented. His preliminary suggestion was to raise the lake in stages over a period of years in order to prevent massive vegetation die-offs and other aesthetic degradation impacts that could aggravate the botulism dilemma experienced in the past.

NPPND-RF-1
Mr. Robert Maben

20 October 1982

Based on that information, we recommend that the IRMG consider raising the lake level to only 7.5 feet, mean sea level, if the water level control structure is closed this fall. Further, the USFWS (Ecological Services) and this office should be able to initiate an experimental transplanting of wapato (Sagittaria latifolia) in wetland, Carex/reed canarygrass swales that lie at an elevation where permanent inundation during the late growing season can be avoided.

We support your interest in establishing some kind of official status for IRMG. This could facilitate the pooling of funds which, in turn, enhances the information gathering capabilities among the participating agencies. We understand that USGS will be prepared to assist the IRMG's efforts in FY-83 with "seed" funds from such a group. The Oregon Department of Environmental Quality is also exploring appropriate ways to become directly involved with water quality investigation.

The extra efforts spent by ODFW staff personnel is appreciated, as well as your support of Audubon Society's activities to familiarize the general public of these wetlands. We would appreciate if you would help the IRMG reach a decision on our water elevation/revegetation suggestion.

Sincerely,

1 Incl
As stated

J. F. RECHLY
Chief, Navigation Division



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
847 N.E. 19th Avenue, Suite 300
Portland, Oregon 97232

September 24, 1982

Douglas Larson
Corps of Engineers, Portland District
Hydrology Section
P.O. Box 2946
Portland, OR 97208

Dear Doug:

The U.S. Geological Survey would like to prepare an interim report about Smith and Bybee Lakes summarizing limnological data collected in cooperation with the Corps of Engineers. The open-file report would include:

- (1) Tables listing data collected between June and September 1982
- (2) Illustrations summarizing the data
- (3) Explanation of methods used.

The report will be ready to review and to take to the printer by December 30, 1982. This work will be done in the 1983 fiscal year and will cost \$5,000.

Please let me know by letter as soon as possible if this is agreeable.

Sincerely yours,


Stanley F. Kapustka
District Chief



United States Department of the Interior

GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
847 N.E. 19th Avenue, Suite 300
Portland, Oregon 97232

September 24, 1982

Douglas Larson
Corps of Engineers, Portland District
Hydrology Section
P.O. Box 2946
Portland, OR 97208

Dear Doug:

The U.S. Geological Survey recommends the following water-quality program for Smith Lake during October to December 1982:

(1) Collect and analyze samples of bottom material	\$ 5,450
(2) Identify biological organisms collected between June and September 1982	2,280
(3) Continue water quality sampling program through December 1982	<u>2,270</u>
Total	\$10,000

Details on the proposed program are shown on a separate page.

Please let me know by letter as soon as possible if this work program and its cost is agreeable.

Sincerely yours,


Stanley F. Kapustka
District Chief

Enclosure

October-December 1982 Smith Lake Program

- (1) Collect and analyze samples of bottom material:
 - (a) Collect 4 samples, 2 from Smith and Bybee Lakes each.
 - (b) Complete particle size analysis on each sample.
 - (c) Determine if an immediate oxygen demand exists and describe appearance of material.
 - (d) Analyze 4 samples for total-organic carbon, nutrients, and trace metals.
 - (e) Analyze 2 samples, one from each lake, for organics.
- (2) Identify biological organisms collected between June and September 1982:
 - (a) 16 Phytoplankton samples.
 - (b) 14 Zooplankton samples.
 - (c) 6 Benthic invertebrate samples.
- (3) Continue water quality sampling program through December 1982:
 - (a) 3 samplings of water quality.
 - (b) 1 diel sample.
 - (c) 2 phytoplankton samples.
 - (d) 2 Zooplankton samples.
 - (e) 1 benthic invertebrate sample.
 - (f) 1 water sample analyzed for chlorophyll, nutrients, and total-organic carbon.

28 SEP 1982

NPPEN-MH-R

Mr. Stanley F. Kapustka
District Chief
Water Resources Division
U.S. Geological Survey
847 N.E. 19th Avenue
Portland, Oregon 97232

Dear Mr. Kapustka:

Reference your letter proposals of 24 September 1982 concerning continued water quality studies at Smith and Bybee Lakes, Oregon. We request that you proceed with the studies as outlined in your letters, including preparation of an interim open-file report on the limnology of the lakes as determined during the summer of 1982. Portland District, Corps of Engineers will provide funds for these projects in the amount of \$15,000.

In order to be reimbursed for costs, please bill the Corps of Engineers using Standard Form 1080.

Sincerely,

R. L. FRIEDENWALD
Colonel, Corps of Engineers
Commanding

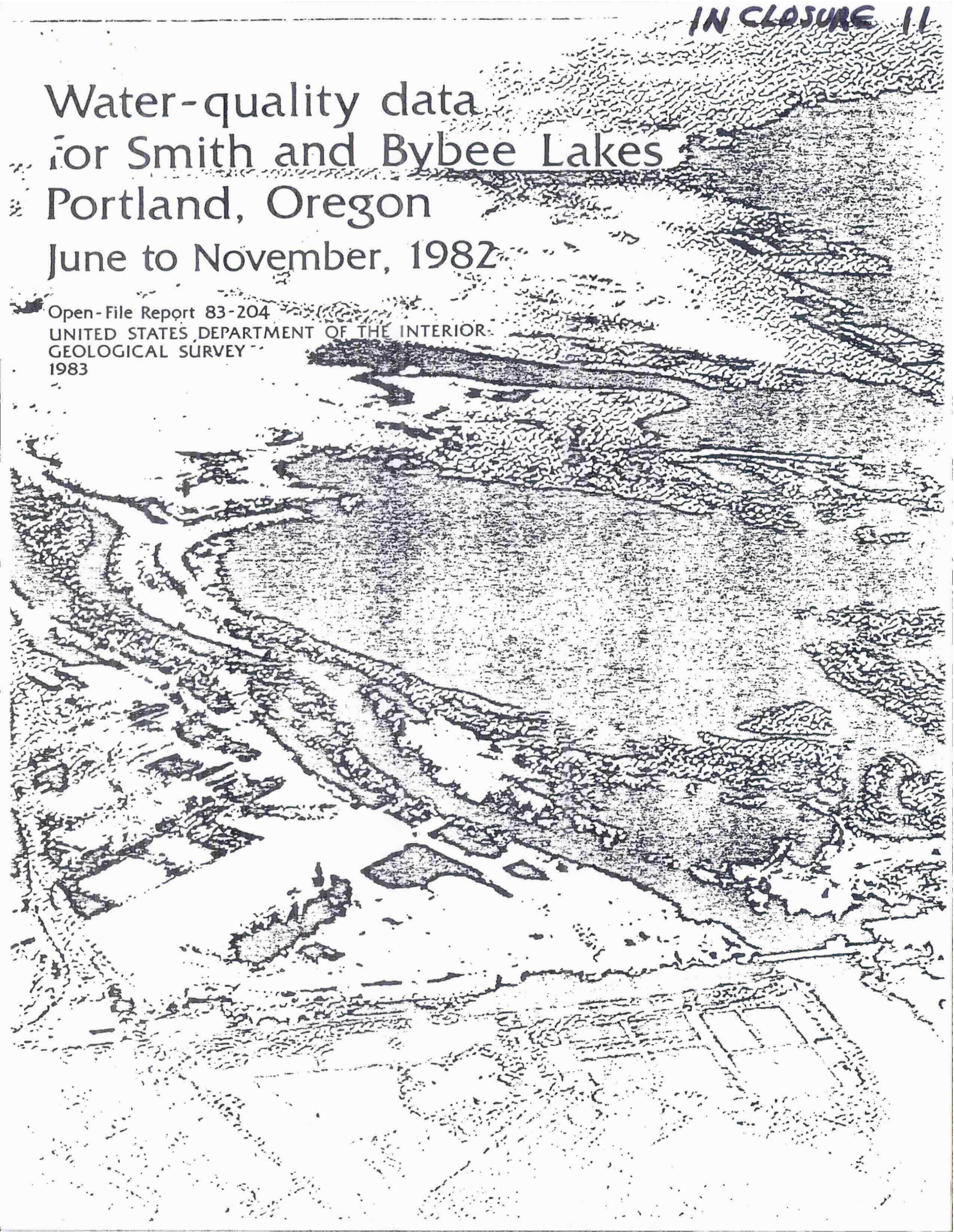
CF:
Ch, NPPPB
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MFR: This work is part of a water quality investigation by Regulatory Functions Branch, Navigation Division to determine the effects of a culvert and fill project in North Slough (Columbia River tributary) on Smith and Bybee lakes. The work will be funded under account number CDXPG1501080000 (O and M General, 96X3123).

IN CLOSURE 11

Water-quality data for Smith and Bybee Lakes Portland, Oregon June to November, 1982

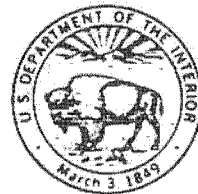
Open-File Report 83-204
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
1983



Water-quality data
for Smith and Bybee Lakes, Portland, Oregon
June to November 1982

By Daphne G. Clifton

U. S. GEOLOGICAL SURVEY
Open-File Report 83-204



Portland, Oregon
1983

WATER-QUALITY DATA FOR SMITH AND BYBEE LAKES, PORTLAND, OREGON
JUNE TO NOVEMBER, 1982

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By Daphne G. Clifton

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ABSTRACT

Water samples were collected from June to November, 1982, from Smith and Bybee Lakes (adjacent to the Columbia River near Portland, Oregon) for the analyses of physical, chemical, and biological characteristics.

Weekly water-quality monitoring at the two lakes included the measurement of water temperature, dissolved oxygen, percent oxygen saturation, pH, conductivity, lake depth. Alkalinity, dissolved carbon, total dissolved solids, secchi-disk light transparency, nutrients, and chlorophyll a and b were monitored at both lakes on a monthly basis. Diel studies were conducted at Smith Lake in July, August and October to measure temperature, dissolved oxygen, pH, specific conductance, and solar radiation continuously for a 24-hour period. Samples of the phytoplankton and zooplankton were collected at least twice a month and benthic invertebrate populations were collected once each month from both lakes. Lakebed sediment was sampled from each lake to determine particle size, percent organics, immediate oxygen demand, and concentrations of trace metals, nutrients, and organic constituents.

INTRODUCTION

The U.S. Geological Survey (USGS) in cooperation with the U.S. Army Corps of Engineers (COE) made physical, chemical and biological measurements on Smith and Bybee Lakes from June through November of 1982.

The purpose of this report is to present data on the limnological conditions in Smith and Bybee Lakes. Water-quality monitoring included measurement of water temperature, dissolved oxygen concentration and percent saturation, pH, specific conductance, lake depth, alkalinity, dissolved carbon, total dissolved solids, secchi disk light transparency, nutrients, and chlorophyll a and b. In addition, phytoplankton, zooplankton, and benthic invertebrate populations were identified and enumerated. Lakebed sediment was analyzed for particle size, volatile solids, immediate oxygen demand, trace metals, total organic carbon, nutrients, and organic constituents.

Special thanks are due Douglas W. Larson, COE, for his assistance in the collection of water-quality samples.

Physiographic Setting

Smith and Bybee Lakes are located in the northwest corner of the city of Portland, and are part of the lower Columbia River drainage basin (fig. 1 and 2). The climate in the area is moderate. The average daily temperature (by month) ranges from 3.4°C in January to 19.5°C in July. Average annual precipitation is 95.5 cm, most of this occurring in the winter months.

Bybee Lake is connected to the Willamette River via the Columbia Slough, and a narrow channel connects Smith Lake to Bybee Lake. Tidal flushing occurs in Bybee Lake, but not in Smith Lake (COE, 1982).

Smith Lake has a flat, uniform bottom. Polygonum coccinum (a broad-leaved aquatic plant) and willow cover most of the lake in the summer months, with the majority of the willow around the periphery.

Bybee Lake has an uneven lake bottom and open water, with tidal changes of 0.3 to 0.6 meters per day throughout the summer. Phalaris arundaceae (reed canary grass), Sagittaria latifolia (wapato), Carex sitkensis, Polygonum spp. and spike rushes are found near the water's edge, and on the mudbars and small islands. Stands of willow are evident along the perimeter. Further information on vegetation is shown on a habitat map by Nancy Ellifrit, U.S. Fish and Wildlife (USFW) and Brian Lightcap (COE) (written communication, October 25, 1982).

Smith and Bybee Lakes are located in the midst of an industrial area near a sewage treatment plant, a sanitary landfill, and fill material from past dredging activities in the Columbia River. Historical land-use activities in the area are described in previous reports (COE, 1982; Oregon Department of Environmental Quality, 1974; and Sobolewski, 1971.) On August 31, 1982, a water control structure was placed on the Columbia Slough near Bybee Lake by the Port of

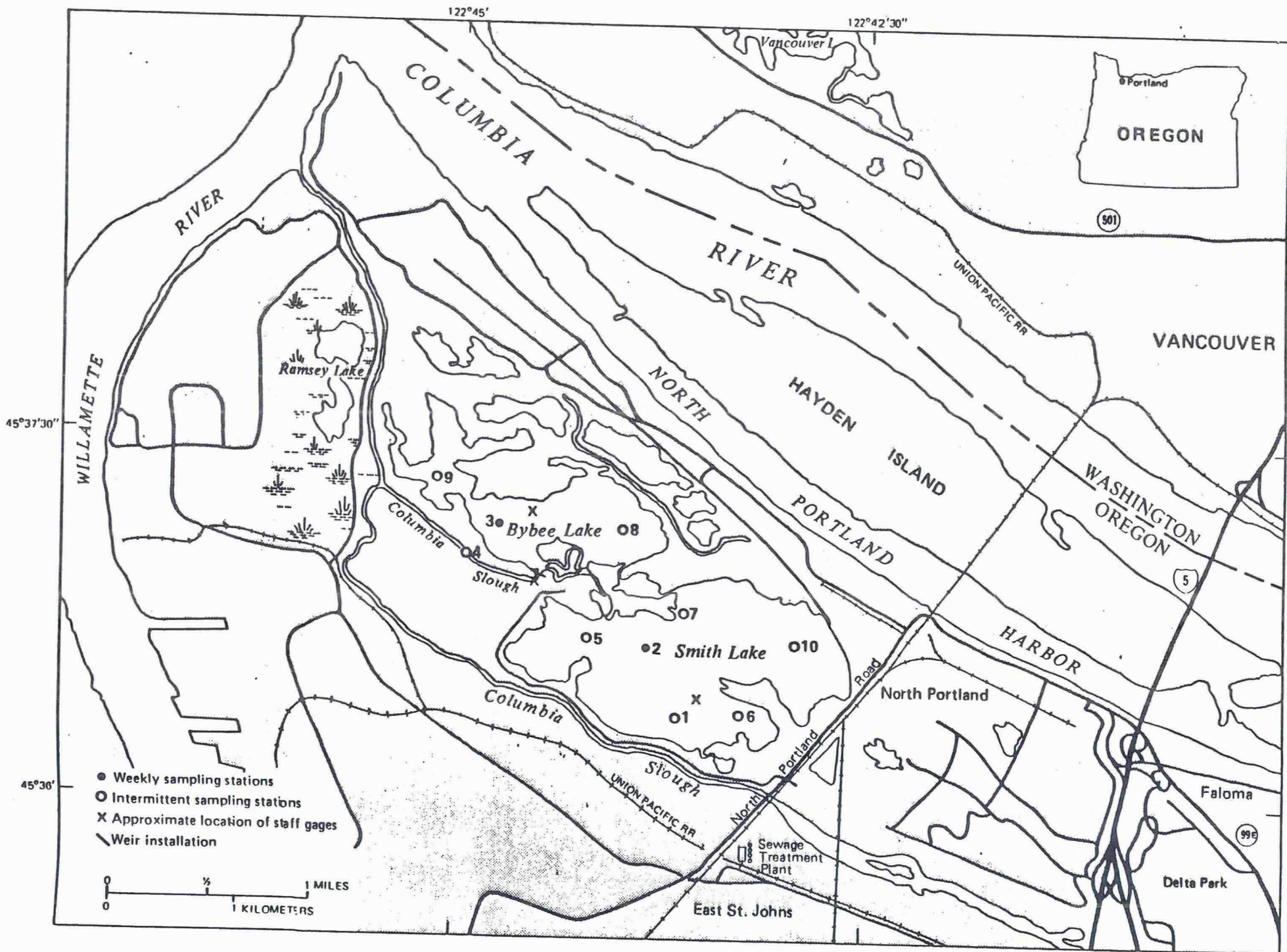


FIGURE 2. — Location map and sampling sites in Smith and Bybee Lakes

Portland for USFW. When in operation, this structure will eliminate tidal flushing in Bybee Lake, except during very high flows (COE, 1982).

METHODS OF SAMPLING AND ANALYSIS

Collection and analysis of the physical, chemical, and biological constituents in the lakes are described in the following section. Sample preparation and analysis followed standard USGS methods (Skougstad and others, 1979; Greeson and others, 1977; Guy, 1969; American Public Health Association and others, 1976). Locations of sampling sites are shown in figure 1 and table 1.

Physical and Chemical Water Quality Data

Field measurements of temperature and dissolved oxygen were made with a Yellow Springs Instrument Co. (YSI)^{1/} (Model 57) dissolved-oxygen meter. An Orion Research pH meter (Model 401) and probe was used to measure pH in the field. The YSI (Model 32) specific conductance meter connected to a Labline cell was used to measure conductivity in the field. A secchi disk was used to measure light transparency. Lake depth was measured using a weighted, calibrated line. A horizontal Van Dorn sampler was used to collect water samples at specific depths. Monthly samples for chlorophyll analyses were filtered through a glass-fiber (type A-E) filter and analyzed at the USGS Central Laboratory in Atlanta, Georgia.

A Martek (Mark 2) unit connected to an Elnik recorder was used during the diel (24-hour) studies for continuous monitoring of temperature, pH, dissolved oxygen, and conductivity. Solar radiation was measured with a Weathermeasure Star Pyranometer. The Martek probe was suspended from a boat, 0.1 to 0.3 meters below the water surface depending on maximum lake depth. Diel studies were done in July, August and October at site 2. When water levels were too low in September to use the Martek probe, instantaneous measurements were taken in late afternoon and early morning.

Water temperature, dissolved-oxygen concentration, percent oxygen saturation, pH, specific conductance, depth of samples, secchi disk readings, solar radiation and chlorophyll analyses are shown in table 2. Graphs in figures 3 and 4 show selected depth profiles of dissolved-oxygen saturation and temperature at sites 2 and 3. Solar radiation, water temperature, dissolved-oxygen saturation, and pH measurements are shown in figure 5 for the diel studies in July, August and October.

^{1/}The use of brand names in this report is for identification purposes and does not imply endorsement by the U.S. Geological Survey.

Samples were analyzed once per month for alkalinity, dissolved organic carbon, dissolved solids and nutrients at sites 2 and 3. Samples for dissolved organic carbon were filtered through a 0.45-micron pore-size silver membrane filter. Chemical analyses were made at the USGS Central Laboratory in Denver, Colorado. Dissolved nutrients, dissolved organic carbon, total dissolved solids, alkalinity, and turbidity data are presented in table 3.

Maximum and minimum values for data collected at sites 2 and 3 are presented in table 14.

The Port of Portland in cooperation with COE established staff gages in both lakes and in the Columbia Slough; locations are plotted in figure 1. Staff gage measurements are presented in table 5. During the period of study, the combined capacity of both lakes ranged from 260,000 cubic meters (1.8 meters, stage) to 460,000 cubic meters (3.6 meters, stage), based on staff gage measurements in table 5 and the area-capacity curve developed for the lakes by the Port of Portland (1981).

Biological Data

Phytoplankton samples were collected at least twice a month at sites 2 and 3. Samples were preserved in a 5 percent formalin - copper-sulfate solution and identified and counted using the membrane filter method, a compound microscope, and identification keys by Collins and Kalinsky (1977), Hilliard (1966), Hustedt (1930), Javornicky (1976), Patrick and Reimer (1966, 1975), Prescott (1962), and Smith (1950).

Phytoplankton abundance and species diversity are shown in table 6. Species diversity was calculated using the Shannon formula (Wetzel, 1975). Many phytoplankton species found in the two lakes are also found in the Columbia River according James Sweet, USGS, (personal communication, October 15, 1982).

Zooplankton samples were collected twice a month at sites 2 and 3 using a plankton net (.026 mm², mesh porosity). A column of water was sampled from a point just above the bottom sediment, by pulling the net up through the water, or by dipping a sample bottle and pouring its contents through the net. Zooplankton were preserved in formalin solution and identified using a compound microscope and identification manuals by Pennak (1978) and Edmundson (1959). Zooplankton were counted using a Sedgewick-Rafter cell on an Olympus 40-power dissecting microscope.

Zooplankton abundance and species diversity are shown in table 7. The presence of Diaptomus reighardi in a Pacific Coast lake represents an extension of range of distribution of this species (written communication, Harry Yeatman, The University of the South, Department of Biology, Sewanee, Tenn., Dec. 23, 1982).

Benthic invertebrates were collected once a month using an Ekman grab sampler (0.15 x 0.15 meters size). Samples were first rinsed through 0.351 mm sieves, then sorted, identified, and counted using the Olympus dissecting microscope, and identification keys by Pennak (1978), Brinkhurst (1964, 1965), Brinkhurst and Cook (1966) and Edmundson (1959). Abundance and species diversity of benthic invertebrates are listed in table 8.

Physical and Chemical Lakebed Sediment Quality Data

A sediment corer (3.5-cm I.D. diameter) was used to collect sediment samples at sites 2, 3, 8 and 10. The samples varied in depth from 0.2 to 0.5 meters. Near each site, four samples were composited after collection from open-pool and vegetated areas. Because the upper portion of the sediment core samples were less compacted than the sediments in the lower portion of the core, the upper and lower portions were analyzed separately.

Sediment samples were analyzed for particle-size, percent volatile solids, and immediate oxygen demand at the USGS laboratory in Portland, Oregon. Table 9 shows sample depth, description of sediment, immediate oxygen demand, and percent volatile solids in each sample. Particle-size analyses are presented in table 10.

At each of the four sites, upper portions of the sediments in the core were analyzed for trace metals, total organic carbon, and nutrients; these analyses are shown in table 11. A composited sample of upper-portioned sediments from Smith Lake sites 2 and 10, and a composite sample from Bybee Lake sites 3 and 8 were used for determination of organics with gas chromatograph-mass spectrometric semiquantitative (GC/MS) analyses. Results of the analyses for organic constituents are presented in Appendix I.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Lower Columbia River Refuge Complex
1309 N. E. 134th Street, Room C
Vancouver, Washington 98665

May 20, 1983

Mr. Doug Larson
U.S. Corp of Engineers
Hydrology Branch
Box 2946
Portland, Oregon

Dear Doug:

As we discussed at the Land Use Planning meeting yesterday, I checked our files regarding the occurrence of botulism at Smith and Bybee Lakes.

The following information regarding this botulism problem was summarized from correspondence and reports on file at the Lower Columbia River Refuge Complex, Vancouver, Washington:

September 16, 1974

Memorandum to Regional Director from Associate Regional Refuge Supervisor

"A rare outbreak of botulism is occurring on Smith Lake along the Columbia River. Dead bird pick-ups were made Friday, Saturday and Sunday. ...Roughly 1,500 ducks have been picked up, of which about 1,300 were dead, and the balance in tough shape. Breakdown by species was about one-third of each, mallard, pintail and green-winged teal."

"Chet Kebbe, Oregon Game Commission said this is very unusual to have botulism die-off in this area. Past records show very little botulism in the western part of the state. Botulism confirmation was made by our Research Laboratory in Bear River Refuge."

March 11, 1976

Letter to Portland Mayor Neil Goldschmidt from FWS Regional Director

"I request your cooperation in trying to solve a waterfowl disease problem which is present in the Smith and Bybee Lakes area in North Portland. These two lakes become stagnated by late summer and support the bacterial agent causing fowl botulism. During September and October of the last two years, a total of over 5,000 ducks have died from this disease."

September-October 1976

Waterfowl Disease Loss Report to Disease Biologist, Sacramento National Wildlife Refuge from Lower Columbia River Refuge

Disease losses recorded for Smith and Bybee Lakes during September and October included 1,124 ducks and 24 shorebirds. Mallard, pintail, shoveler and green-winged teal were the main species lost. This was the number of birds picked up, estimated loss was 2,000.

September 1978

Report from National Fish & Wildlife Health Laboratory, Madison, Wisconsin

Mallard examined was diagnosed as positive for type C botulism.

August 1980

Memorandums from Al Clark biologist to Manager Lower Columbia River Refuge Complex

"I first visited Smith Lake on 8/15/80. The botulism outbreak was noted earlier that week, and the carcasses of approximately 400 ducks and 300 shorebirds had been picked up. ...An additional 40 ducks and 52 shorebirds that were still alive were being held... On August 18, we picked up 96 dead ducks and 2 dead shorebirds. ...This brings the total mortality thru 8/26 to approximately 1,020 ducks and 460 shorebirds. There undoubtedly are many unrecovered carcasses among the thick willows."

I hope this information will be useful to you. There may be additional data available, but this is all I could put together with the short time frame for your report.

Sincerely,



David J. Brown
Refuge Manager

DJBrown:jg