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**TILBURY SLOUGH
DYKE RECONSTRUCTION PROJECT**

*Construction and Post Construction
Environmental Impact Assessment*

R.N. NEUMEYER & V.G. BARTNIK

MARCH, 1981

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**Inland Waters Directorate
Pacific and Yukon Region
Vancouver, B.C.**

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CONSTRUCTION AND POST CONSTRUCTION ENVIRONMENTAL IMPACT ASSESSMENT

R. N. Neumeyer

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TILBURY SLOUGH
PANORAMIC PHOTOGRAPH

MARCH 1980



CANADA — BRITISH COLUMBIA
FRASER RIVER FLOOD CONTROL 1968 AGREEMENT
PROJECT No. 6 — DISTRICT OF DELTA

CONTRACT
No.23

▶ DYKE RECONSTRUCTION
TILBURY SLOUGH

ABSTRACT

The environmental impacts of a dyke reconstruction project at Tilbury Slough, Delta, British Columbia were assessed during construction and post-construction phases. The dyke alignment followed was the most costly of three alignment options considered but was the one which preserved the integrity of Tilbury Slough. The project was implemented under the Federal-Provincial Fraser River Flood Control Program with federal funding made available under the Canada Water Act. In accordance with the Federal Environmental Assessment and Review Process, construction and post-construction environmental monitoring was undertaken and the effectiveness of mitigatory measures recommended during the pre-construction Initial Environmental Evaluation study phase were evaluated. Serial colour photographs illustrate environmentally relevant aspects during the various stages of dyke reconstruction. No significant construction related environmental impacts occurred. On the other hand, project related actions such as a revegetation program along the dyke embankments, removal of illegally dumped refuse from the slough's riparian habitat and re-routing of high organic content agricultural drainage away from the upper reaches of the slough are expected to be of long term benefit to the biological communities of Tilbury Slough. The review of future proposed development activities on the lands surrounding Tilbury Slough raises concern for the long term success of the preservation of this valuable estuarine habitat.

RESUME

L'évaluation des incidences écologiques que présentait le projet de reconstruction des digues au marécage Tilbury, à Delta en Colombie-Britannique, a été menée pendant et après les travaux de construction. Des trois types d'alignement envisagés, on a retenu la solution la plus coûteuse qui préservera toutefois l'intégrité du marécage. Ce projet a été réalisé dans le cadre du Programme fédéral-provincial de lutte contre les crues du fleuve Fraser et financé à même les fonds alloués en vertu de la Loi sur les ressources en eau du Canada. Conformément au processus fédéral de révision et d'évaluation environnementale, on a entamé le contrôle de l'environnement pendant la construction et on l'a poursuivi après l'achèvement des travaux. Au cours de l'étude initiale visant à évaluer l'environnement avant la construction, on a également évalué l'efficacité des mesures de réduction des effets néfastes sur le milieu qui y ont été recommandées. Une série de photographies couleur vient illustrer les aspects écologiques pertinents aux diverses phases de la reconstruction de laquelle l'environnement n'a d'ailleurs subi aucun changement réel. Mis à part ce projet, on entend mettre à exécution des mesures connexes telles un programme de reboisement le long des digues, l'enlèvement des débris rejetés illégalement sur les berges du marécage et le déplacement des aires de drainage agricole à haute teneur en matières organiques des biefs supérieurs du marécage dont bénéficieront à long terme les communautés biologiques du milieu. En examinant les projets futurs d'aménagement des terres entourant le marécage Tilbury, on se demande toutefois si l'on pourra assurer en permanence la qualité de cet habitat estuarien.

ACKNOWLEDGEMENTS

The help of those who contributed to this report is gratefully acknowledged. The Environmental Department of the Corporation of Delta provided the historical ground level and aerial photographs. Messrs J. Oakey, J. Leong and Dr. S. D'Aquino of the Inland Waters Directorate, and Mr. John Payne of the Department of Fisheries and Oceans, reviewed sections of the report for technical content. Messrs D. Boak and M. Mazalek, also with IWD, were responsible for preparation of the figures and layout of the colour photographs.

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I. BACKGROUND

The governments of Canada and British Columbia signed an agreement in May of 1968 which provided for the construction of flood control works in the Lower Fraser Valley, including rehabilitation of existing dykes, construction of new dykes, increased bank protection, and where necessary improvement of internal drainage facilities. The Agreement is implemented through the Fraser River Flood Control Program, hereforth referred to as the "Program". In 1969, the Corporation of Delta made application to participate in the program and signed an agreement in November 1973. The proposed 83 kilometres of dyking was divided into sections. Contract No. 23 delineated the Tilbury Slough Dyke Reconstruction Project, henceforth referred to as the "Project". A site map of the Project is shown in figure 1.

At the time Delta made application for improved flood protection, a low dyke was in place around the perimeter of Tilbury Slough. However, the Final Design Report issued by the Program recommended a dyke realignment across the mouth of the slough (see figure 2). This new alignment was justified by a principle of the Program that required it to achieve the best return for Federal-Provincial contributions.

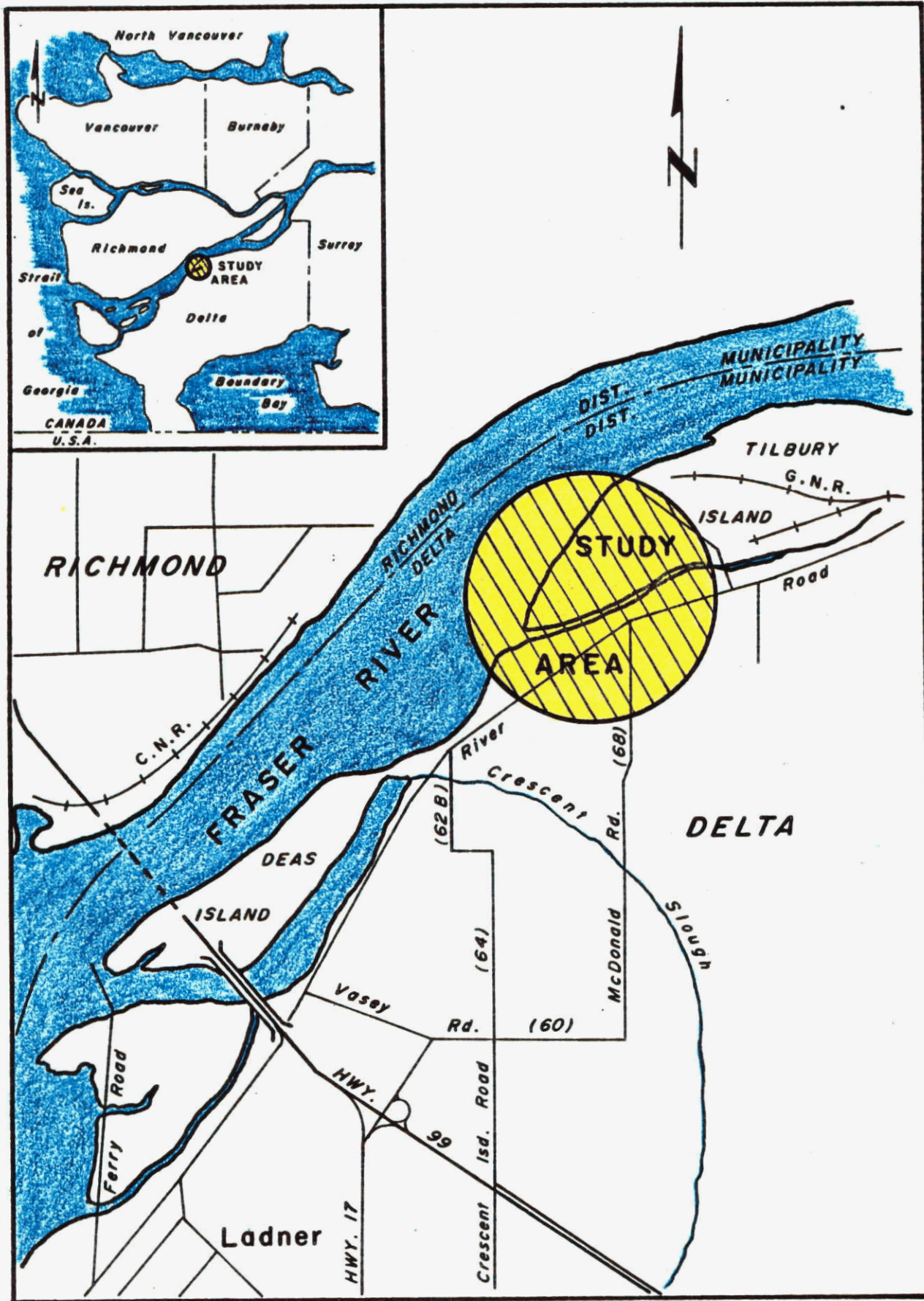


Figure 1. Site Map of the Tilbury Slough Dyke Reconstruction Project

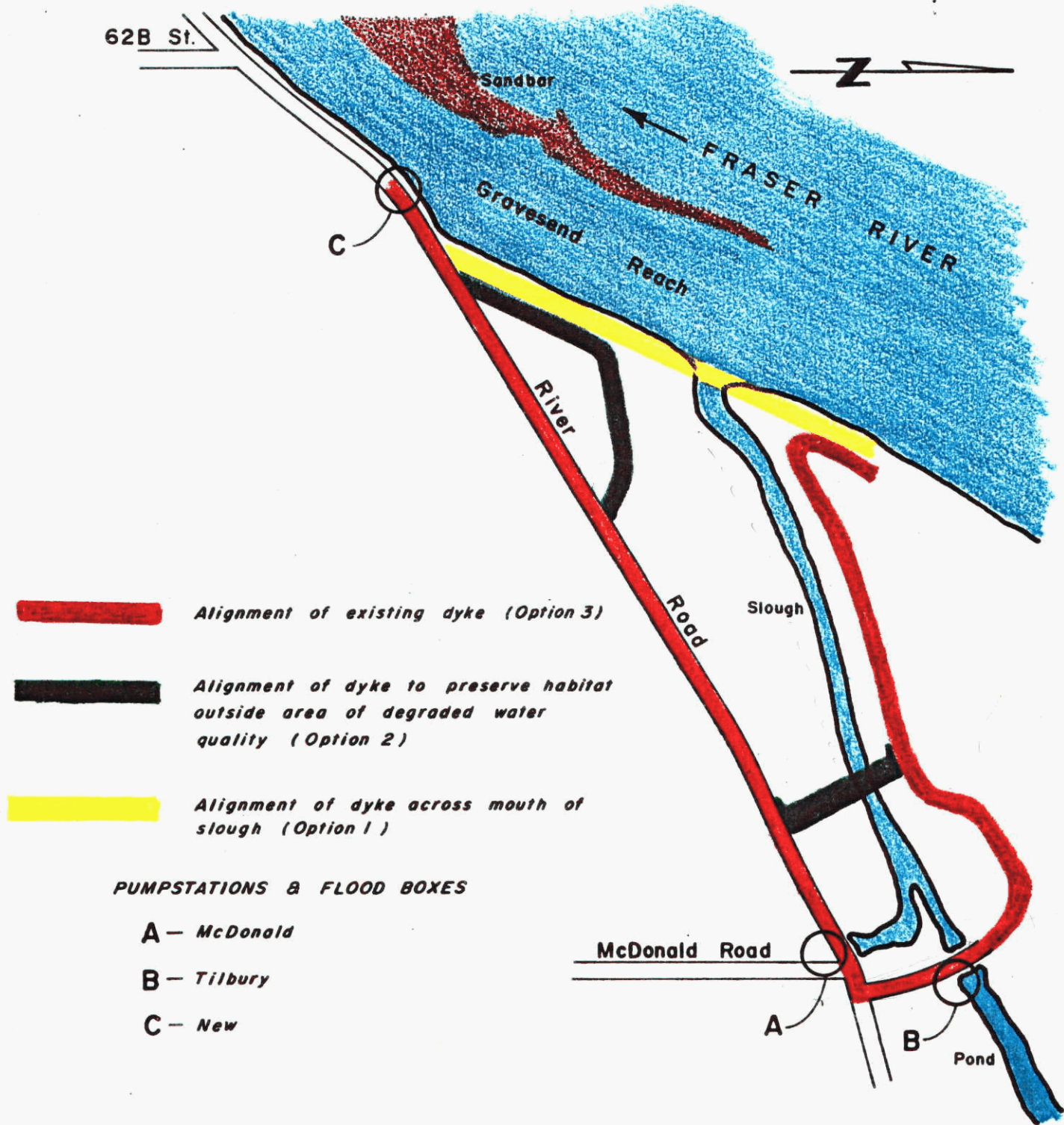


Figure 2. Dyke alignment options and associated drainage control structures.

II. PRE-CONSTRUCTION ENVIRONMENTAL IMPACT ASSESSMENT

When Federal and Provincial resource agencies were informed by Program authorities (normal procedure of the Program in these matters) of the recommended dyke realignment across the mouth of the slough, these agencies expressed strong disapproval. They claimed that the resulting closure of the slough would exclude it from contributing towards the overall productivity of the Fraser Estuary, as well as lead to the loss of valuable fish and migratory bird habitat. The resource agencies were not prepared to accept what they judged to be the ecologically irreversible consequences of the recommended alignment unless alternative alignments were not feasible.

Alternative alignments considered by the Program were determined to have a higher construction cost and could not be implemented without further justification, due to the least-cost philosophy embodied in the Program's terms of reference. Therefore, a Federal-Provincial Interagency Task Force was established to conduct an initial environmental evaluation (IEE) of various alignment options. The evaluation was intended to appraise the significance of environmental impacts associated with the dyking alignment alternatives at Tilbury Slough. This activity was in accordance with the 1973

Federal Cabinet Decision requiring that environmental matters be taken into account early in the planning stages of federally funded projects, (i.e. the Environmental Assessment and Review Process - EARP). The Task Force gave most serious consideration to the alignment options shown in figure 2.

Although the IEE, completed in the spring of 1977, did not determine the direct economic trade off between the value of this habitat and the cost of protecting it, it did establish that both the original proposal and a compromise alignment (see option 2, figure 2) represented a net loss of valuable estuarine habitat. Such an environmental consequence was found unacceptable and the Task Force rejected these two alignment options. They recommended instead that the existing dyke be upgraded, primarily because little or no environmental impact was anticipated as long as specified construction practices were followed. Program authorities, after reviewing the IEE report, accepted this recommendation. The "Notice-to-Proceed" on Contract No. 23, an upgrading of the existing flood control works, was issued in late August 1979.

The Initial Environmental Evaluation process followed for the Tilbury Slough Dyke Reconstruction Project is capsulated in figure 3.

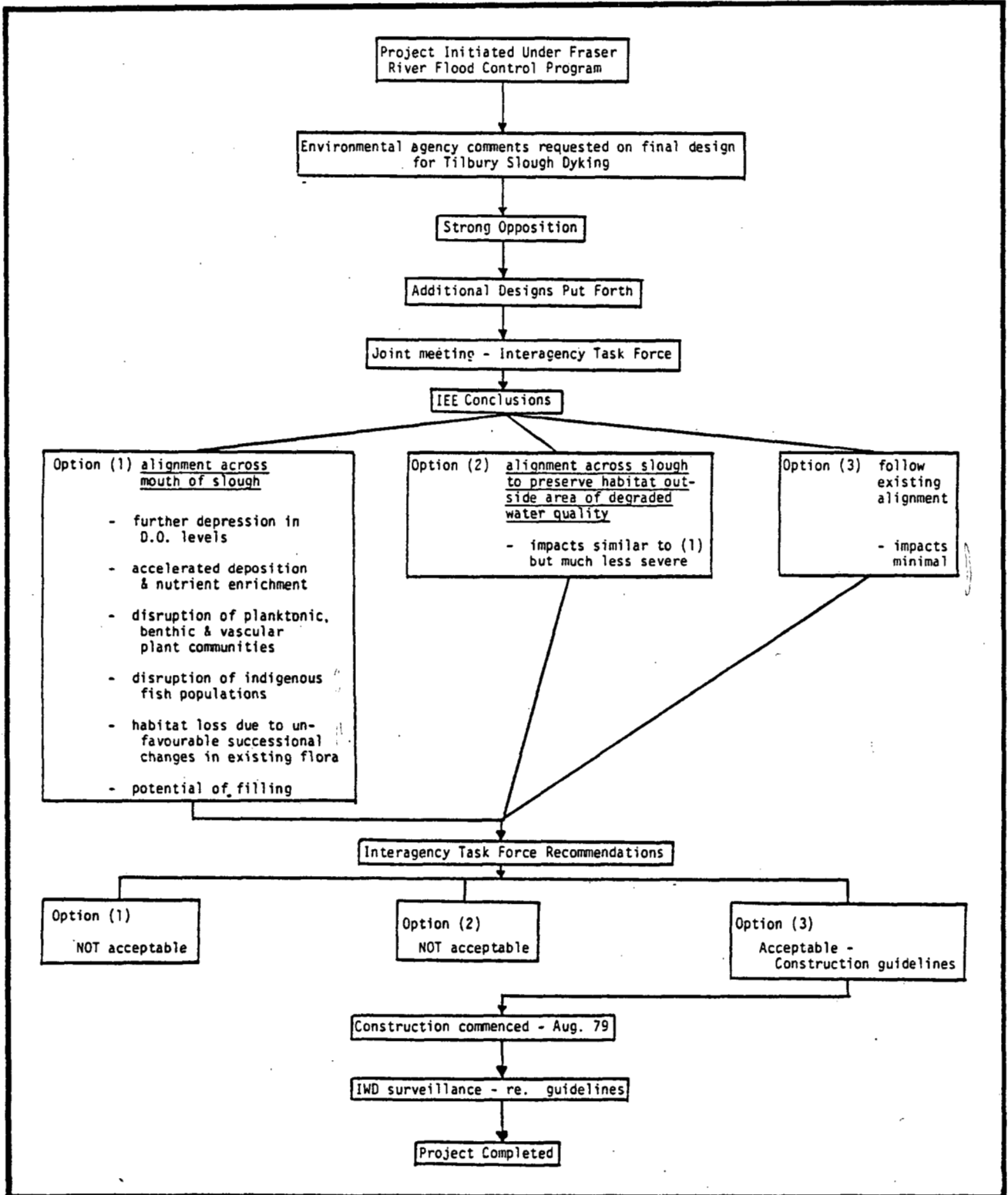


Figure 3. The initial environmental evaluation process followed for the Tilbury Slough Dyke Reconstruction Project.

III. CONSTRUCTION AND POST-CONSTRUCTION ENVIRONMENTAL IMPACT ASSESSMENT

The Tilbury Dyke Reconstruction Project was cost shared by the governments of Canada and British Columbia. The Government of Canada's funding was made available under the Canada Water Act which provides the framework for joint Federal-Provincial management of Canada's water resources. These federal funds were administered by the Inland Waters Directorate, an agency of the Department of the Environment. Therefore, the Directorate assumed the role of an initiator, in accordance with the terms of the Federal Environmental Assessment and Review Process. The duties of an initiator, as defined by the recent departmental policy statement, "DOE Role in EARP" (1980), include construction and post-construction environmental monitoring. This policy requires federal agencies to ensure that the results of environmental impact assessments and reviews are incorporated in the design, construction, implementation and operation of projects. The initiator is further required to evaluate the effectiveness of the recommended mitigatory measures.

The Inland Waters Directorate, in compliance with this departmental policy, carried out a routine environmental assessment of the Project, both during and after construction.

The assessment activity was planned; (a) to prepare a collection of still photographs that documented construction practices used to avoid impacts along the environmentally sensitive portion of the alignment, (b) to keep the Directorate advised of any environmental problems which might occur during construction and (c) to appraise the long term environmental benefits of preserving this habitat as well as the effectiveness of the design details recommended to achieve this end. The Directorate will maintain a periodic surveillance of the Project to fulfill the intent of the last objective.

A. Environmental Surveillance

Surveillance of the Project area began around the time construction started up, in October 1979. Although some attention was paid to the River Road portion of the dyke alignment, it was not inspected on a regular basis. Most of the Directorate's surveillance activities were conducted along the

remaining portion of the alignment since its proximity to the slough constituted a higher degree of environmental sensitivity (see figure 4). This section was walked during each visit and 35 mm photographs were taken from various locations (see figure 5).

To provide a better appreciation of the slough environment prior to the initiation of the Project, the Directorate obtained and incorporated into this report, historical ground level and aerial photographs of Tilbury Slough. These photographs were made available to the Directorate by the Environmental Control Department of the Corporation of Delta.

B. Assessment of Construction and Post-Construction Impacts

1) Construction related impacts

The contractor is obliged to comply with the terms and conditions in the "Tender Document". Aspects of this agreement pertaining to the mitigation of identifiable environmental impacts are cited in Table I. From the information and supporting figures and prints referred to in this table, it may be seen that the contractor did comply with these specifications. The Directorate can therefore



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The environmental impacts of a dyke reconstruction project at Tilbury Slough, Delta, British Columbia were assessed during construction and post-construction phases. The dyke alignment followed was the most costly of three alignment options considered but was the one which preserved the integrity of Tilbury Slough. The project was implemented under the Federal-Provincial Fraser River Flood Control Program with federal funding made available under the Canada Water Act. In accordance with the Federal Environmental Assessment and Review Process, construction and post-construction environmental monitoring was undertaken and the effectiveness of mitigatory measures recommended during the pre-construction Initial Environmental Evaluation study phase were evaluated. Serial colour photographs illustrate environmentally relevant aspects during the various stages of dyke reconstruction. No significant construction related environmental impacts occurred. On the other hand, project related actions such as a revegetation program along the dyke embankments, removal of illegally dumped refuse from the slough's riparian habitat and re-routing of high organic content agricultural drainage away from the upper reaches of the slough are expected to be of long term benefit to the biological communities of Tilbury Slough. The review of future proposed development activities on the lands surrounding Tilbury Slough raises concern for the long term success of the preservation of this valuable estuarine habitat.

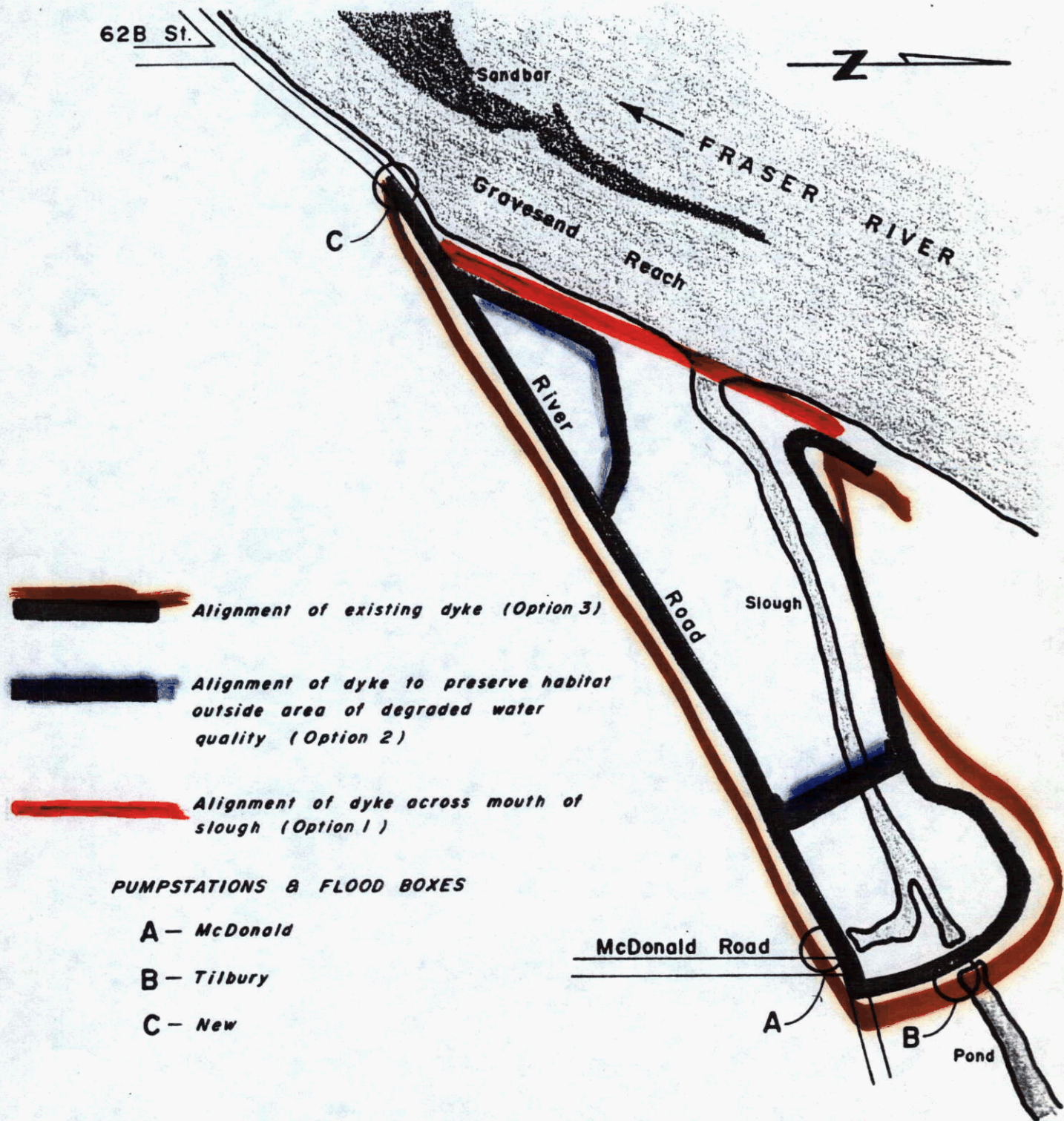


Figure 2. Dyke alignment options and associated drainage control structures.

IV. FUTURE POTENTIAL ENVIRONMENTAL IMPACTS ON TILBURY SLOUGH

At the time the I.E.E. was prepared for the Project, the land between Tilbury Slough and River Road was owned by the British Columbia Development Corporation and a private company. B.C.D.C. had, over the past few years, improved their property immediately southwest of the slough mouth by preloading it with a large quantity of dredged river sand (see aerial photograph series, Appendix II). This property was subsequently sold to Chapman Industries who propose to develop the land for industrial use, with a barge loading facility planned for the property's foreshore area. More recently, B.C.D.C. acquired the privately owned land adjacent to this property for purposes of transferring it to the federal Department of Fisheries and Oceans for their management.

In addition, an application has been made to preload the agricultural land north of the slough with dredged river sand. This property, which is shown in Print 9, comprises the western tip of Tilbury Island and is now protected from flooding by the Project alignment. Once preloaded, this property north of the slough will also likely support some type of industrial development.

Finally, River Road, parallel to the southern perimeter of the

slough, is being widened to four lanes. Apparently this is to accommodate expected growth in both private and industrial traffic. To what degree the widened road will encroach on the slough is not certain but increases in noise and vibration are likely.

In terms of 1979/80 dollars rejection of the direct route across the mouth of the slough in favour of the alignment as constructed represented an additional cost to the Program of \$402,428.00 By implementing this more costly alignment option for the Project, the Program successfully protected the environmental integrity of Tilbury Slough. However, the concern remains that this valuable estuarian habitat may be degraded or lost entirely as a result of subsequent development. In this regard, the Directorate will monitor the status of Tilbury Slough from time to time, summarizing significant changes as an appendix to this report.

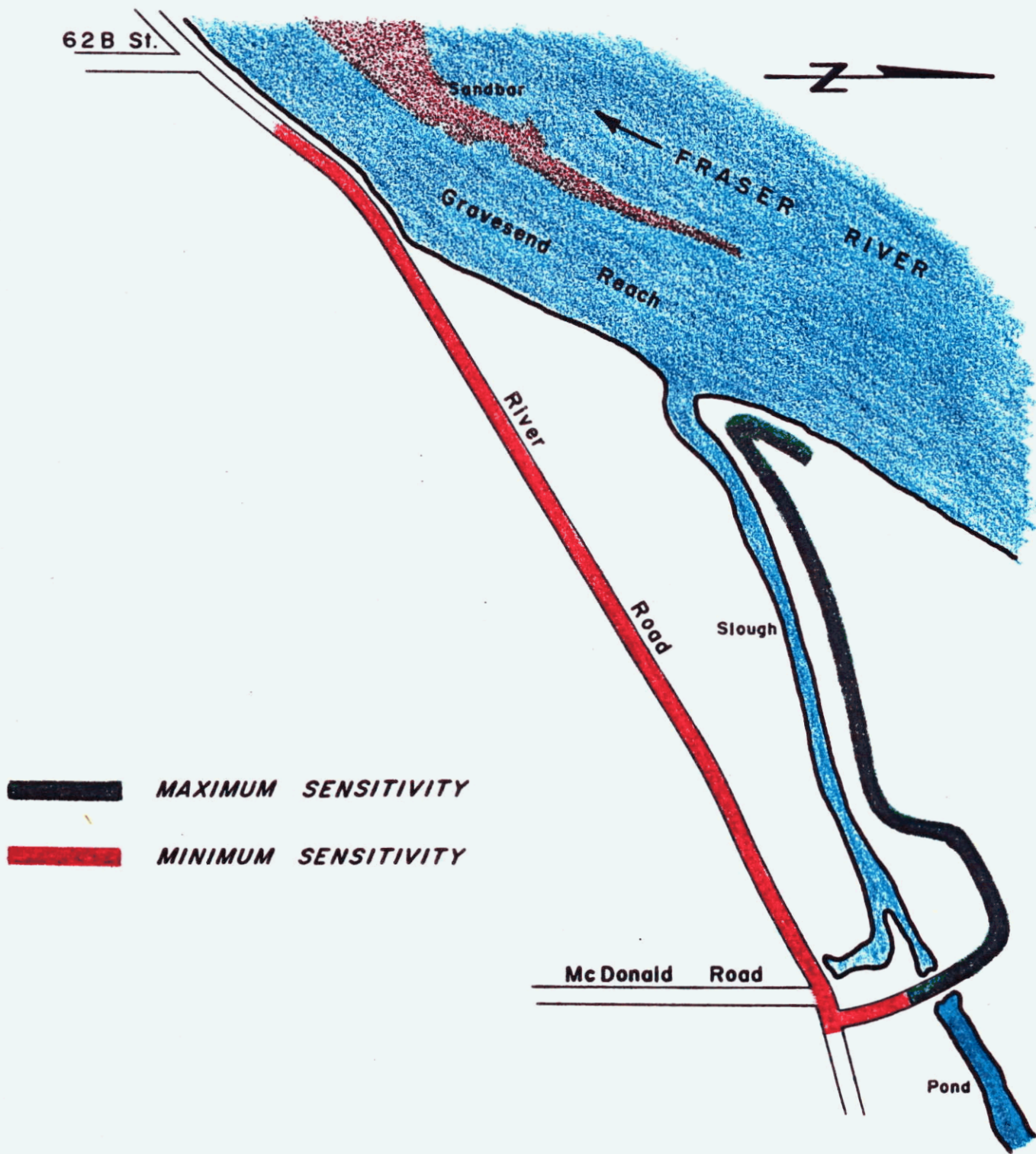


Figure 4. Environmental sensitivity along the alignment

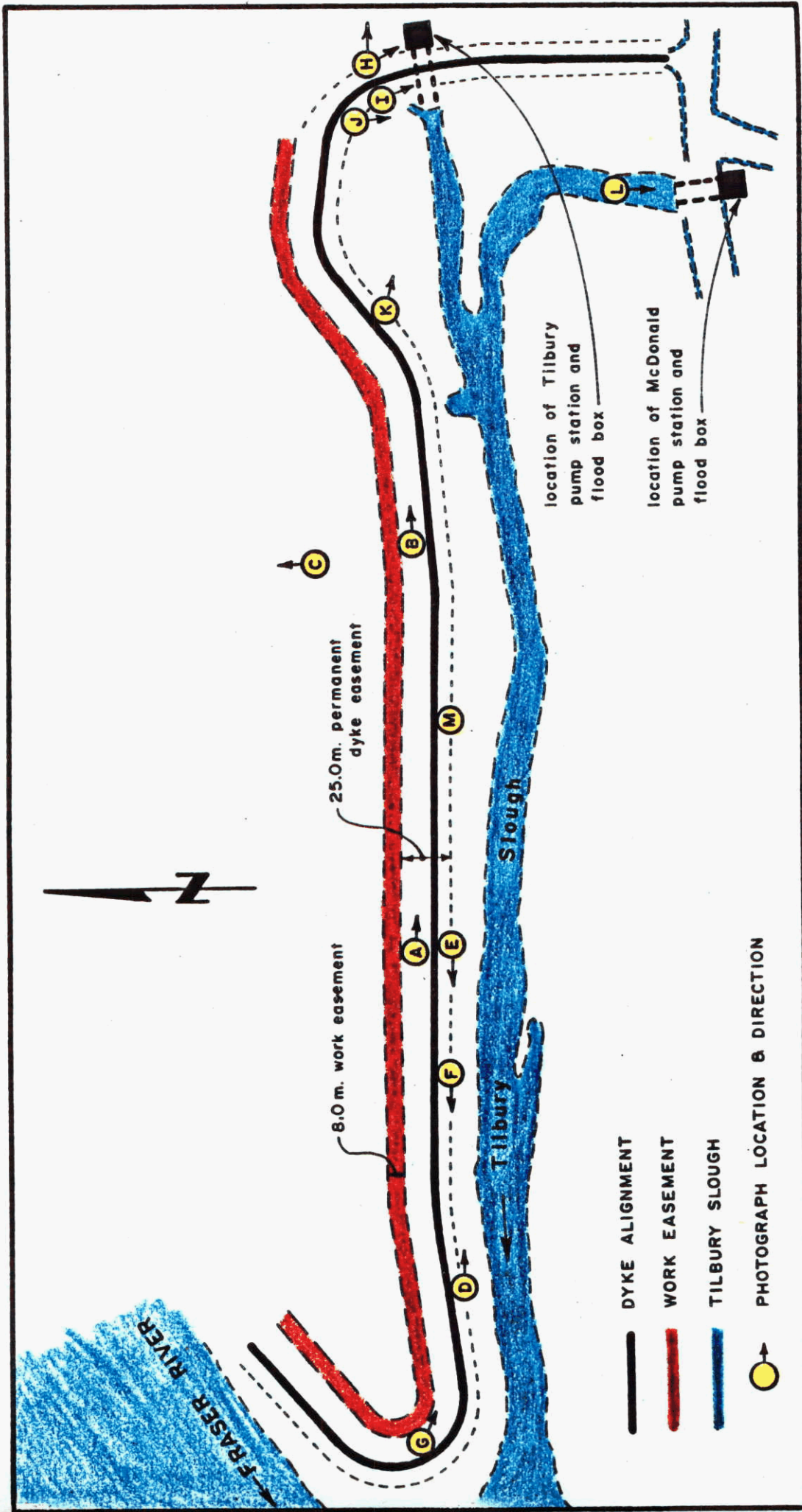


Figure 5. Plan of the environmentally sensitive area of the Project, illustrating the position of the work easement, permanent dyke easement, drainage structures and the slough. The location and direction of the serial photographs (Appendix I) is also shown.

TENDER ITEM	FOLLOWED	FIGURE NUMBER	PRINT NUMBER
<p><u>Vol. 1</u></p> <p>IC.14 STOCKPILING</p> <p>".....Stockpiling of construction material will not be permitted on the river-side of the dyke."</p>	Yes	-	8
<p>IC.17 SPOIL AREAS</p> <p>".....No debris, vegetation, excavated materials from construction activities or other deleterious substances shall be deposited within the high water wetted perimeter of the Fraser River."</p>	Yes	-	7,8
<p><u>Vol. 2</u></p> <p>Plan, profile & sections</p> <p>- sections show water side of dyke adjacent to slough do not exceed toe of existing dyke</p> <p>- plans indicating work easement restricted to inland side of dyke</p>	Yes	7	2
	Yes	5	7

Table I. Contractor compliance with "Tender Document" specifications.

report that no significant construction related, environmental impacts occurred during the building of this project.

2) Water quality impacts

As a result of the Project, the McDonald pump station and floodbox are now inactive and no longer release high organic content agricultural drainage to the upper reaches of Tilbury Slough, (see figure 2 and print 13). Instead this water has been re-routed to the new combined pump station and floodbox facility downstream of the slough near the foot of 62B Street (see prints 14 and 15). In the IEE report, prepared by the Interagency Task Force, water quality degradation in the slough was identified and linked to drainage from the McDonald discharge structures. With the redirecting of this discharge into the south arm of the Fraser River, a gradual improvement in the water quality of the slough should become evident. [If such improvement [benefits the slough's indigenous biological community, then it will constitute a positive impact of the Project on Tilbury Slough.

Some inland drainage, however, does continue to enter the slough through the remaining Tilbury pump station and floodbox, located at the apex of the slough (see figures 2 and 6, prints 12 and 16). These structures release water from a portion of the slough that has been isolated from tidal influences by previous dyking and fill, becoming, in essence, a large freshwater pond (see print 17). Neither the pond's water chemistry nor the structure of its aquatic community has been investigated. Therefore, it is not known what effect this remaining discharge has on the slough's ecology. Consequently, any possible future salmonid enhancement activity at Tilbury Slough by the Department of Fisheries and Oceans should include a detailed examination of the role that this pond plays in the productivity and quality of the slough's aquatic habitat.

3) Slough habitat impacts

The riparian habitat of Tilbury Slough was protected by designing and constructing the new dyke so that its centre line was shifted inland relative to the existing dyke. In this manner, the toe of the new dyke did not encroach upon the slough (see figure 2). Furthermore, both the quality and aesthetics of the riparian habitat have been improved,

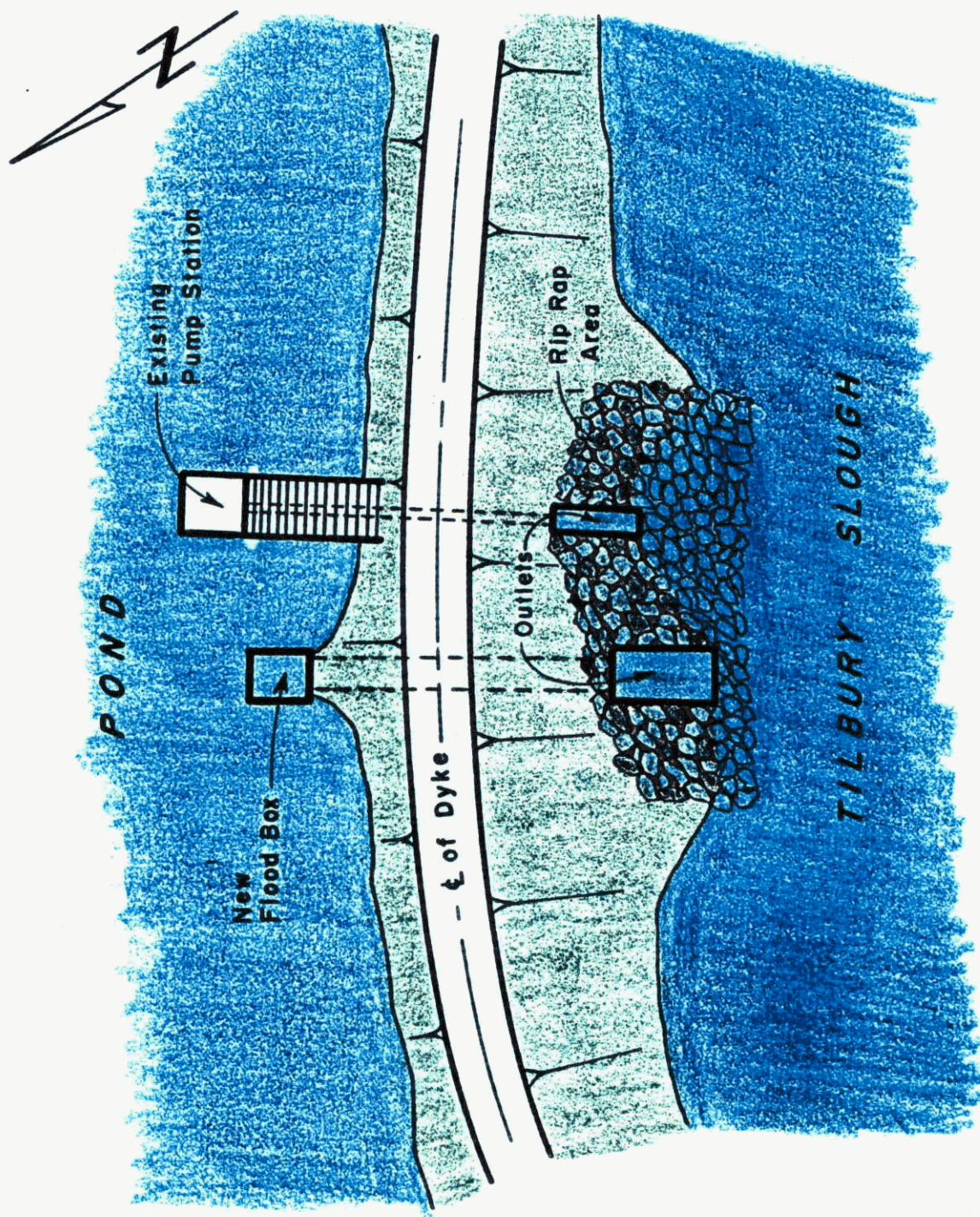


Figure 6. Site plan for the Tilbury pump station and flood box.

Land Side

Slough Side

DYKE
 ϕ

Gravel
Driving Surface

Topsoil
and Seeding

DITCH

Existing
Dyke Contour

Existing
Ground Surface

Fill

Figure 7 - Profile of new and existing dykes near photograph location D figure 5

first by the removal of illegally dumped refuse (see print 10), and second, by a successful revegetation program (see prints 3, 6 and 12). The latter has resulted in a vigorous legume-grass community (see prints 19 and 20) becoming established along the dyke embankment adjacent to the slough's northern perimeter. This area of new vegetation provides excellent ground cover and prevents erosion of fines into the slough.

4) Conclusions

No significant short term, construction related environmental impacts were encountered during the Directorate's surveillance activities. On the other hand, Project related actions such as revegetation, refuse removal and drainage re-routing should bring long term benefits to the biological community of Tilbury Slough. The full realization of these benefits will depend, in large measure, on how the surrounding land is developed.

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APPENDIX I

SERIAL PRINTS OF TILBURY SLOUGH DYKE RECONSTRUCTION PROJECT

1
OCT. 79



2
JAN. 80



3
OCT. 80



PRINT 1

Early stage of dyke reconstruction. Surface debris has been scraped from sloping face of existing dyke. This material is visible on top of the dyke where it will form part of new fill. Tilbury Slough is seen on the right (location D figure 5, October, 1979).

PRINT 2

Later stage of dyke reconstruction. Sand added to raise the dyke is visible. Note that this new fill has not encroached upon the slough (location D figure 5, January 1980).

PRINT 3

Completed dyke reconstruction. Reseeding has successfully produced a vigorous plant community above high water (location D figure 5, October 1980).

4
JAN. 80



5
JUNE 80



6
OCT. 80



PRINT 4

Face of reconstructed dyke before reseeding, note slough-dyke boundary (location E figure 5, January 1980).

PRINT 5

Early stage of plant growth after reseeding. B.C.D.C. landfill is visible in the upper left of photo (location F figure 5, June 1980).

PRINT 6

Project has been completed and vigorous grass-legume community is now evident along the dyke face bordering the slough (location E figure 5, October 1980).

7
OCT. 79



8
OCT. 79



9
OCT. 80



PRINT 7

Early stage of construction with the inland work easement visible as a tire tracked sand area to the left of the existing dyke (location B figure 5, October 1979).

PRINT 8

Sand stockpile located on pasture area inland of dyke (location C figure 5, October 1979).

PRINT 9

The sand stock pile site shown in print 8 after completion of the Project. The old pasture area has been returned to production (location C figure 5, October 1980).

10
1976



11
FEB. 80



12
JUNE 80



PRINT 10

1976 (summer) photograph of illegally dumped refuse in the headwater area of Tilbury Slough adjacent to the Tilbury pump station outlet (location K figure 5, 1976).

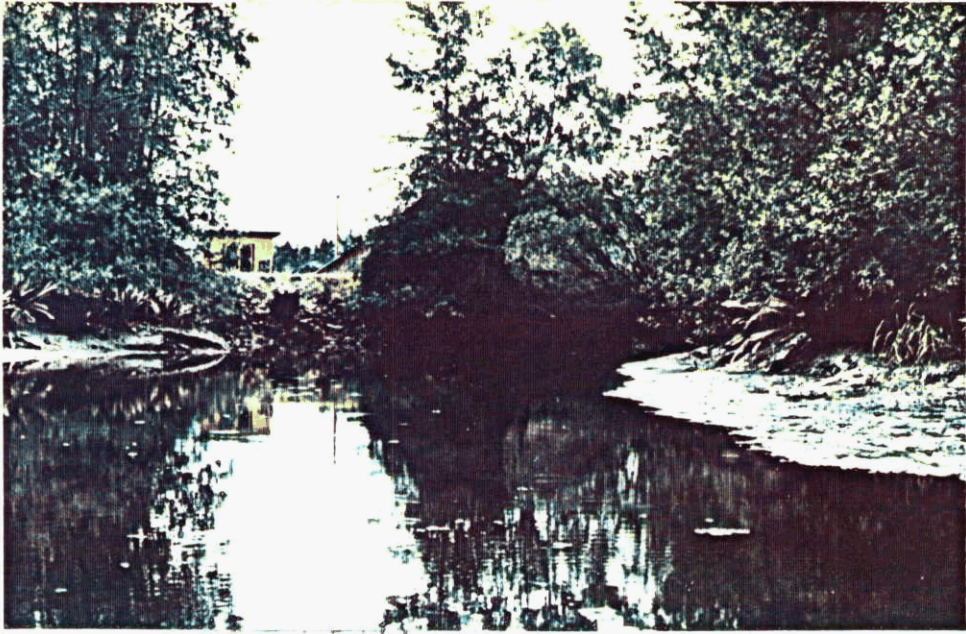
PRINT 11

Early stages of work on improvements to the Tilbury discharge structures. Note the debris shown in print 10 has been removed (location K figure 5, February 1980).

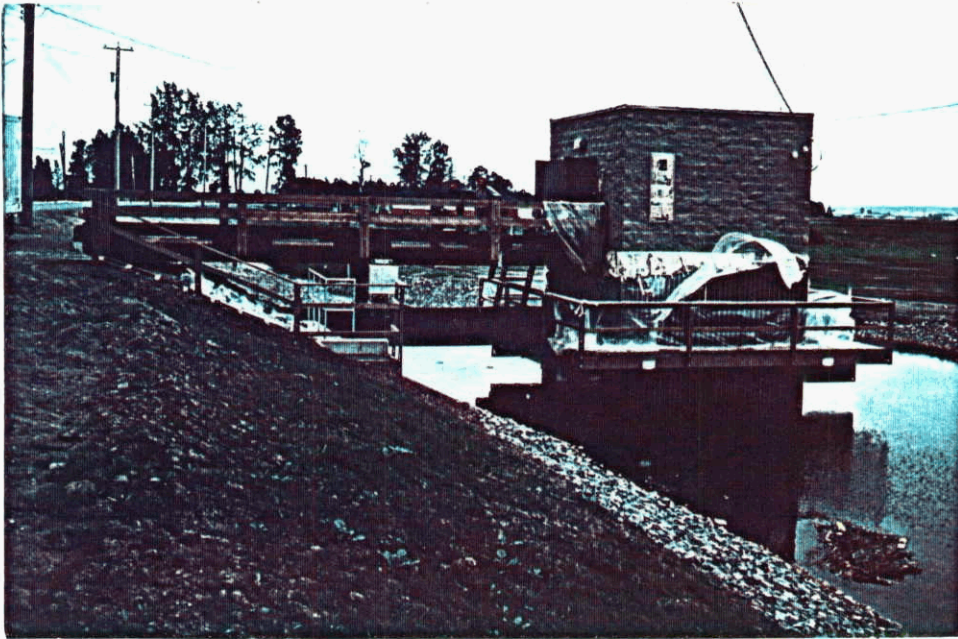
PRINT 12

The completed Tilbury discharge outlets. Riprap and reseeded grasses provide erosion protection (location J figure 5, June 1980).

13
1976



14
JUNE 80



15
JUNE 80



PRINT 13

1976 (summer) photograph showing the upper reaches of Tilbury Slough with McDonald Rd. pump station and discharge pipe visible in the background (location L figure 5, 1976).

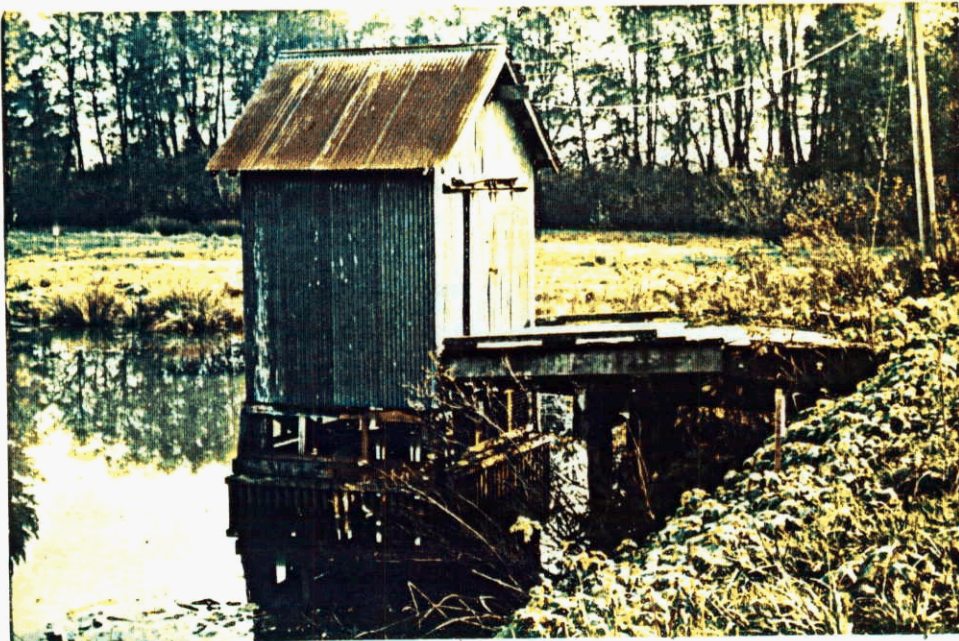
PRINT 14

New combined pump station and floodbox near the foot of 62B Street. (see figure 2, June 1980).

PRINT 15

Outlets for the 62B Street pump station and floodbox. These are located on the Fraser River foreshore, approximately 500 m downstream from the mouth of Tilbury Slough (see figure 2, June 1980).

16
OCT. 79



17
OCT. 80



PRINT 16

Tilbury pump station located at the head of
Tilbury Slough (location H figure 5, October
1979)

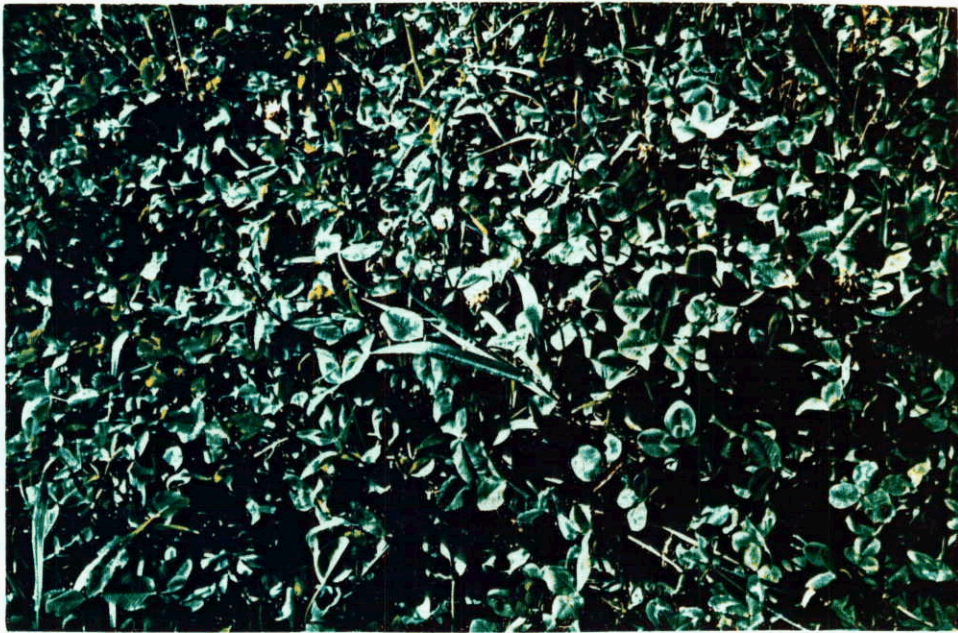
PRINT 17

Pond drained by the Tilbury discharge structures.
Pump station is visible on the right (location H
figure 5, October 1980).

18
MARCH 80



19
OCT. 80



20
OCT. 80



PRINT 18

Toe of dyke in relation to slough (location E figure 5, March 1980).

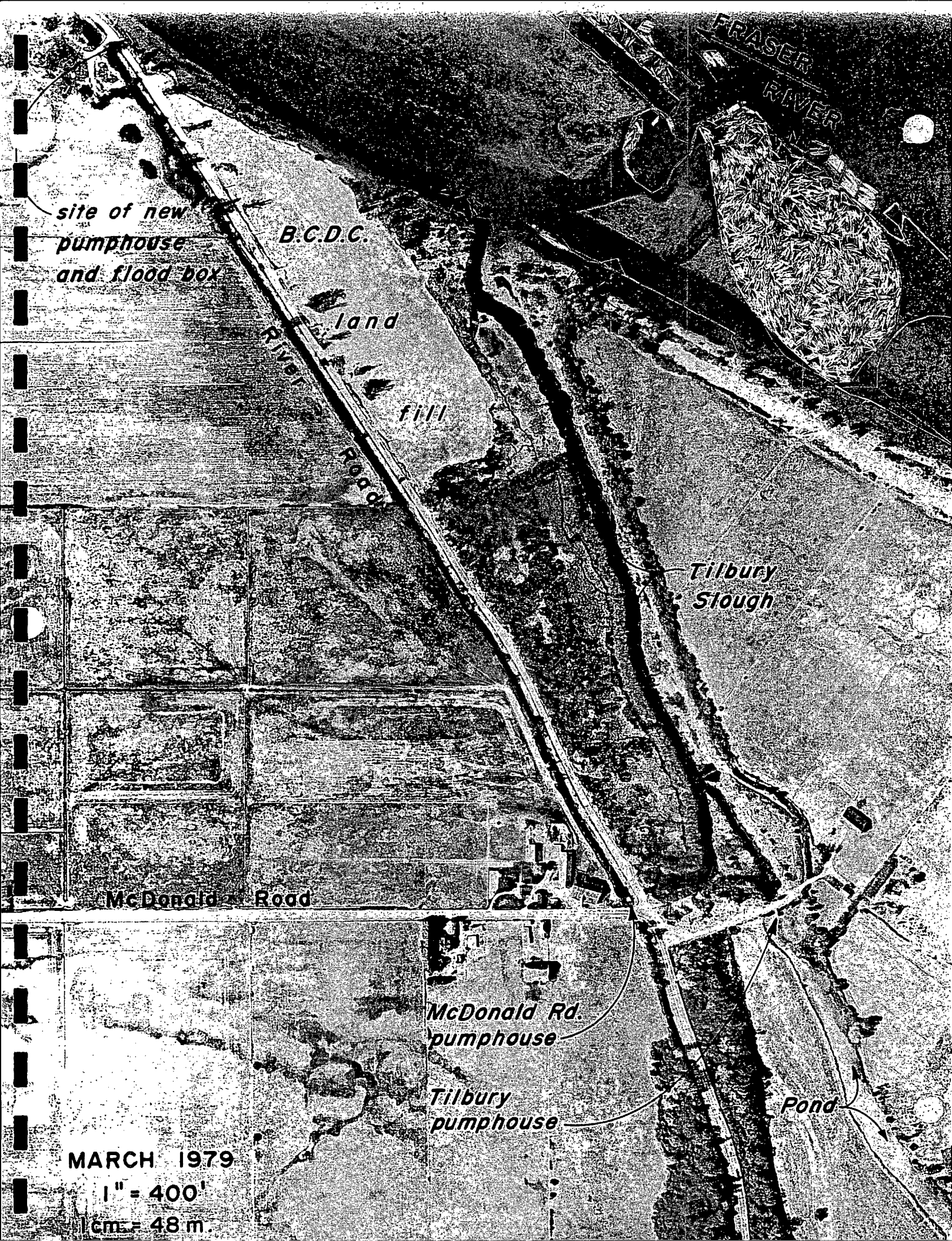
PRINT 19

Vigorous legume-grass community established along the dyke embankment adjacent to the slough (location M figure 5, October 1980).

PRINT 20

Insect (a Dipteran) utilizing the revegetated area on the dyke embankment adjacent to the slough (October 1980). Analyses of stomach contents from salmon captured in Tilbury Slough have shown that Dipteran larvae, pupae and adults are an important food source.

APPENDIX II
SERIAL AERIAL PHOTOGRAPHS OF PROJECT SITE



site of new
pumphouse
and flood box

B.C.D.C.

land

fill

Tilbury
Slough

McDonald Road

McDonald Rd.
pumphouse

Tilbury
pumphouse

Pond

MARCH 1979

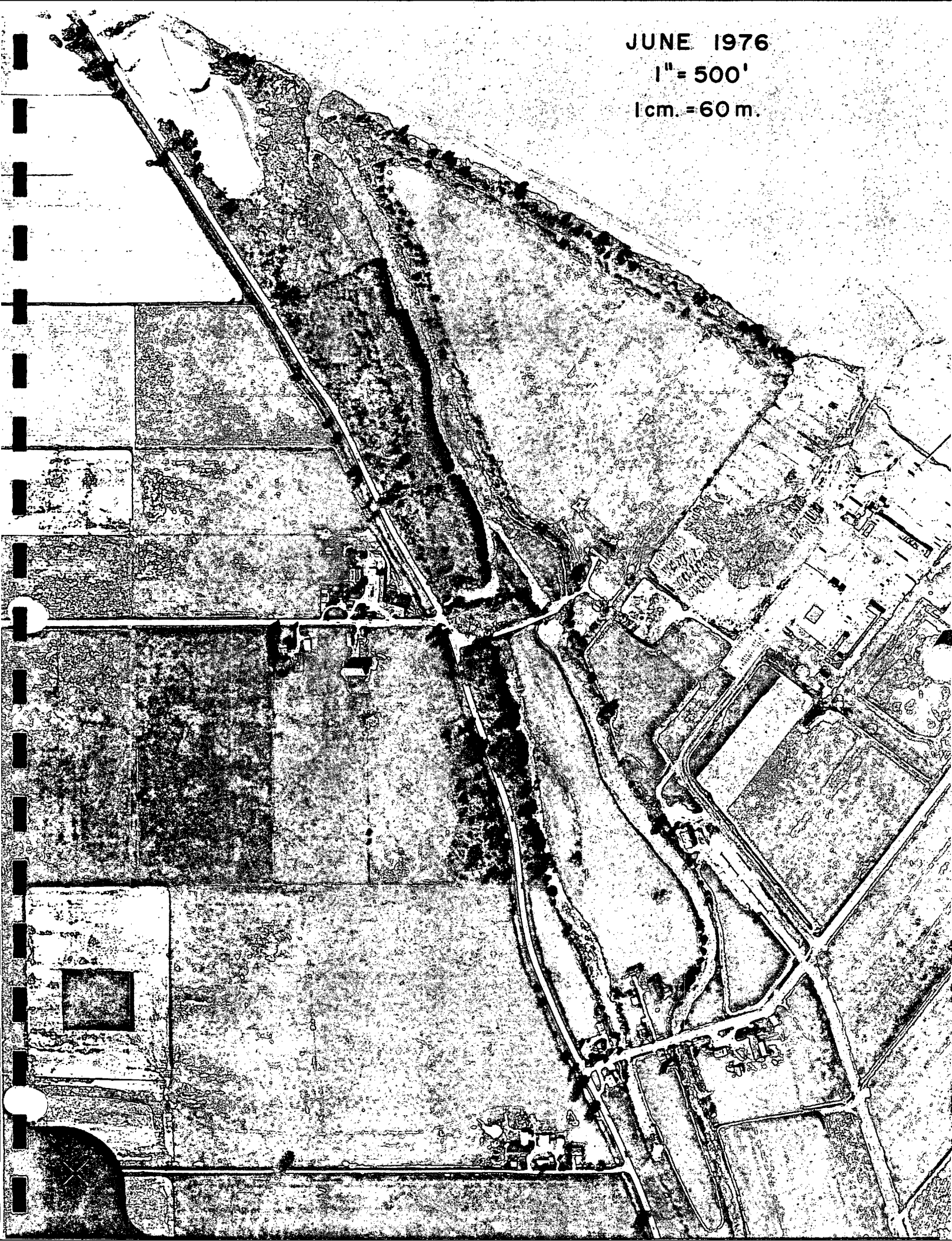
1" = 400'

1cm = 48 m.

JUNE 1976

1" = 500'

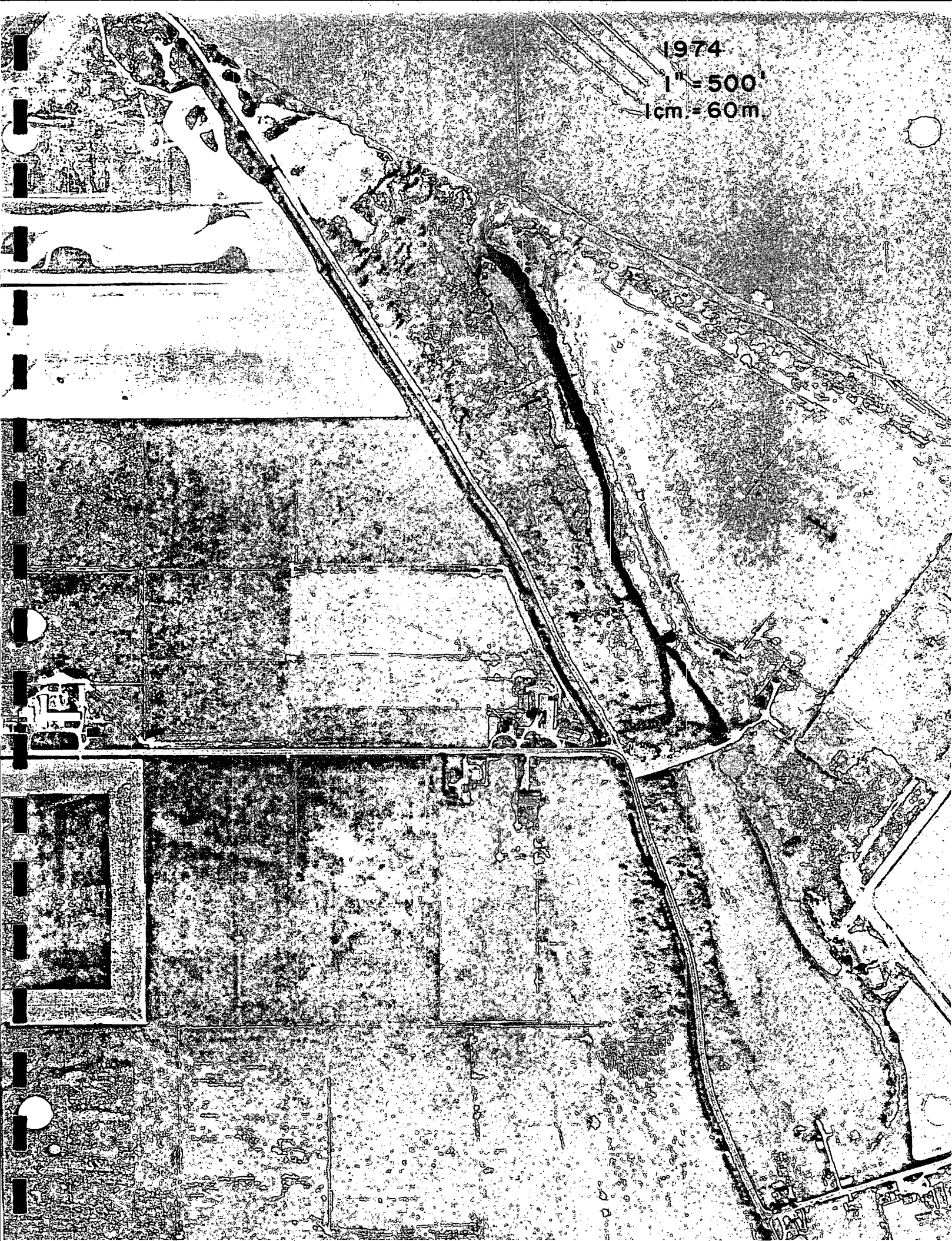
1cm. = 60 m.



1974

1" = 500'

1cm = 60m



1969

1" = 500'

1cm = 60m.

