WETLAND RESTORATION/ENHANCEMENT

A FEASIBILITY STUDY FOR A PILOT PROJECT TO IMPROVE MUSKRAT AND WATERFOWL HABITAT IN THE PEACE-ATHABASCA DELTA

PREPARED FOR

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

SUMMARY, SUGGESTED MANAGEMENT REGIME AND RECOMMENDATIONS

The feasibility study described in this report examines three areas in the Peace-Athabasca Delta where a habitat enhancement pilot project might be carried out on Provincial Crown lands. The main emphasis was placed on providing overwintering habitat for muskrats, with secondary emphasis on benefits to waterfowl. Possible effects on fish are described and measures are suggested for passage of fish over control structures, as well as providing for exit of y-o-y fish from the management area.

On the basis of detailed examination of large-scale aerial photos (1:15,000), plus a field reconnaissance in May, 1985, a location known locally as the Grey Wavey Lake area was judged to be clearly superior to others for a habitat enhancement pilot project. This location comprises a biologically diversified complex of four large sub-basins and numerous isolated basins, covering over 2,350 ha (6,000 a) within a total area of almost 200 km^2 (77 mi^2) of marsh, meadowland and deciduous cover.

Engineering surveys and analyses of river hydrology for the past 14 years indicate a high probability that recharge will occur each year from Athabasca River or secondary channels. Engineering analyses have also shown that construction of water control works will entail only moderate cost (under $100,000).

Benefits from the construction of a pilot project have been estimated, and are potentially very large, in relation to the costs involved. Potential benefits have been identified for production of muskrats through provision of optimum water depths, as well as for waterfowl resulting from improved habitat, including

vegetation. Potential benefits have also been identified for increased fish production. The possibility has been discussed of establishing wild rice in the marshland complex as a commercial crop for local residents, and the potential for this latter resource appears to be very large.

MANAGEMENT OF THE GREY WAVEY LAKE MARSHLANDS

Even with access to extensive field data (which was not the case in this study), it is not possible to estimate precisely the consequences of a water stabilization program for the Grey Wavey Lake marshland complex. Nevertheless, there is enough published information on the Peace-Athabasca Delta to draw conclusions with respect to the general requirements for vegetation, muskrats, waterfowl and fish, and the benefits to these components which are likely to result from water stabilization. As a corollary to such conclusions therefore, general outlines are presented below for a water management regime which is likely to increase production of and result in improved distribution of desirable plant species, achieve winter depths of water suitable for assured survival of muskrats, increase the amount and quality of habitat for waterfowl, and provide ideal conditions for spawning and rearing of several important species of fish.

Direct observation of vegetation response and muskrat, waterfowl and fish use of the Grey Wavey Lake marshland complex is the only way that information can be obtained on the degree of success of any water management program for the area. For that reason, it is suggested that a monitoring program be combined with the operating regime for water management in the Grey Wavey Lake marshland complex, and that some effort be made to document any changes which might occur in biological productivity, particularly in the first three years following initiation of a water management scheme. General management schemes for muskrats, waterfowl and fish are outlined separately below, although it is emphasized that the most important single consideration is muskrat production.

Water Management for Muskrat

Because semi-stable water conditions provide near-optimal regimes for muskrat production (Ambrock and Allison, 1973), stabilization of water levels in the Grey Wavey Lake marshland complex should promote the re-establishment of good quality of muskrat habitat.Based on data gathered during the Peace-Athabasca Delta Project (1973), an absolute minmum of 0.7m depth of water in winter is required to provide adequate overwintering habitat for muskrats. Under an intensive management scheme for muskrats, it is recommended that overwinter water depths in the Grey Wavey Lake marshlands be maintained at an average of not less than 1.0m, in order to provide some margin for severe climatic conditions (e.g, an early freeze with little snow cover). Although it is not possible to accurately predict the response to proposed water stabilization (e.g., distribution of plant communities throughout the basins; response time of vegetation to water stablization), it is known that a substantial drawdown will be required every 5-7 years in order to maintain vigorous growth of emergent vegetation. (Seeds of many emegent aquatic plants require exposure on mud flats in order to germinate).

A water management plan for muskrat should utilize the early spring (late April to early May) Athabasca River flood to augment water levels in the marshland complex. Flooding should be completed by no later than 21 May each year, in order to minimize flooding of muskrat houses during the whelping period and to prevent the drowning of muskrat kits. Water levels should be maintained at a stable level throughout the summer, although a small decline in water levels would not be harmful, and would promote the growth of Equisetum sp. on the exposed margins of the basins and in shallow water areas. Summer water levels in the vicinity of established emergent stands should not exceed 1.0m to 1.2m (deeper water will reduce plant vigour or drown palants). Releases of water during the summer should not result in water levels in the vicinity of muskrat houses at a depth of less than 0.7m, and preferrably should be maintained at 1.0m.

Water Management for Waterfowl

Stabilization of water levels in the Grey Wavey Lake marshlands will benefit waterfowl habitat primarily through the development and enhancement of emergent aquatic vegetation, which in turn will provide cover for nesting, brood rearing and cover and escape habitat for molting birds. Because most waterfowl production in the Peace-Athabasca Delta occurs during May and June (Hennan, 1973), water management for waterfowl should minimize any rises in water levels during these months. Flooding during this time would destroy nests both of dabbling and diving ducks, and would result in the loss of eggs and some young. A high flood will be required once every 3-5 years in order to flood the large number of perched basins in the complex, particularly in the southern portion of the area. Perched basins represent some of the best waterfowl habitat in the Peace-Athabasca Delta (Hennan, 1973) and should be managed for waterfowl, as well as for muskrat production.

A water management plan for waterfowl in general should reduce the probability of flooding during May and June, but should also allow for both low and high water on a regular bais. Periodic high water levels will maintain the productivity of perched basin habitats, and will also restrict the encroachment of shrubs into the meadows which are important for waterfowl nesting. Annual augmentation of water levels in the complex will have to be carefully planned, and should be carried out in an integrated fishion, to complement muskrat and fish requirements. Water depths of 0.7m to 0.8m are sufficient for most dabbling and diving ducks during the nesting and brood rearing period. Requirements for maintenance of water levels during summer months are very similar for both muskrat and waterfowl, and a relatively stable regime, with a slight decline during June through August would promote growth of Equisetum sp. and sedges on the exposed margins of basins and in shallow water areas.

Once every 3-5 years water levels should be increase significantly

with as sharp a rise and subsequent fall in level as can be physically achieved with the flood peak on the Athabasca River, either through the existing recharge channel at the Devil's Elbow on the Athabasca River, or through a larger, artificially constructed channel about 13km upstream of Devil's Elbow. During a managed recharge of perched bsisns, water level should be reduced to the operating optimum as quickly as possible, in order to minimize damage to muskrat and waterfowl production in the rest of the complex. Notwithstanding the impact on both waterfowl and muskrat, water levels in perched basins should be allow to drop to very low elevations once every 5-7 years to maintain vigorous growth of emergent aquatic plant communities.

Water Management for Fish

The prime consideration for water management in the Grey Wavey Lake marshland complex is for enhancement of muskrat production and (secondarily) for waterfowl. However, the area represents such a potentially valuable habitat for the rearing of fish that this aspect of the project should not be overlooked. Because of the need for a rather narrow range of operating levels in the major basins, there could be a conflict with minimum depths of water required for overwintering muskrats of too much water is drained from the basins in order to provide cues for migration of fish.

Water depths during the spring spawning period of fish are not considered to be critical, and providing fish can enter the marshlands with no delay, they will in all likelihood spawn succssfully under ideal environmental conditions in early May. After spawning, adults will return to the channels adjacent to the marshlands, as they do in the case of fish spwning in Richardson Lake, Blanche Lake and (presumably) other basins in the Peace-Athabasca Delta (Kristensen, 1978). In order to ensure that fish entrapment does not occur, environmental conditions

must be such that adult fish proceeding upstream can pass the control structures with no difficulty. Examination of the hydrographs for late April - early May indicate that with the recommended elevations for the control structure spillways. water will almost always be flowing into Grey Wavey Lake and Mud/Bog Lakes when fish are migrating toward spawning areas in these basins, so that there should be little possibility of adult migrants suffering any delay at the control structures.

In order that adult fish which have spawned can migrate downstream in response to current movement through the outlet creeks from the marshlands, a flow thought the control structures should be maintained over the open water period (late April to mid-June). In order to meet the requirements of muskrat and waterfowl discussed earlier, a flow through the controlstructures would have to be supplied from upstream recharge channels. This objective can be met by providing a recharge capacity from upstream which can match the twin losses of evaporation/evapotranspiration and outflow through the downstream controls, while at the same time, maintaining stable water levels in the basins.

Adequate flow through the Grey Wavey Lake marshlands for the movement of adult fish will provide cues also for the downstream movement of larval fish produced in the basins where fish have spawned. It is known from previous studies (Kristensen, 1978) that larval fish and y-o-y of several species migrate out of lakes where they were spawned from early June to late August. It would appear that a managed flow-through of water from upstream on Athabasca River would provide optimum environmental conditions for the downstream movement of these young fish.

Compatibility of Various Biological Requirements

The operating regimes for water in the Grey Wavey Lake marshlands can easily accommodate requirements for muskrat, waterfowl and fish, largeley because of the high degree of flexibility inherent in the basin

characteristics, plus the wide range in elevations which occur in the Athabasca River flood peaks. If this project were to proceed, there should be no reservations with respect to the suggested operational water regime as to any conflict of requirements for the three major biological components - muskrat, waterfowl and fish.

RECOMMENDATIONS

1. It has been clearly shown that the feasibility is high for a habitat enhancement pilot project in the Peace-Athabasca Delta, and it is recommended that the Grey Wavey Lake marshland complex be chosen as the prime location.

2. It is recommended that control dams be constructed on the two downstream outlets which drain the Grey Wavey Lake marshlands to Lake Athabasca, via Grey Wavey Creek and the lower Embarass River.

3. Because of the timing of flood peaks, fish passage into the Grey Wavey Lake marshlands should not be impeded, and it is not recommended that fishways initially be installed on the control dams, but fish movements should be closely monitored at the dams.

4. It is recommended that capability for high elevation flooding, as well as drawdown, be incorporated into the control structures. In addition, substantial flow-through from upstream should be provided, in order to maximize vegetation enhancement and provide cues for migrating fish.

5. In view of the potential for additional water management and habitat enhancement projects in a number of other locations on Provincial Crown lands in the Peace-Athabasca Delta, it is considered essential that a monitoring program be established to assess the degree of success achieved by any project of a nature similar to that recommended in this report. Otherwise, without biological data, it will not be possible to determine whether benefits have accrued from any habitat enhancement projects.

6. It is recommended that the Grey Wavey Lake marshland lakes be planted with wild rice. These basins are ecologically superior to many other areas in Canada for the production of wild rice, and could eventually provide a substantial cash crop to local residents, as well as being of direct benefit to muskrats and waterfowl. Wild rice has been successfully established in 11 areas in the Fort Chipewyan region (Smith et al, 1985).

Results of engineering and hydrological analyses (Sections 4.0 and 5.0) clearly have demonstrated the feasibility of managing the water levels in the Grey Wavey Lake marshlands to accommodate the requirements of muskrats, waterfowl and fish. In order to provide an overview of the project, in which surface and bottom elevations of the major basins in the Grey Wavey Lake complex can be related to levee heights, elevations of control structures, operating ranges and recommended operating regime, these data have been been compiled in a schematic (Figure i on the page following) which summarizes all of the essential details concerning operating levels of control structures in relation to levee heights and basin elevations in the Grey Wavey Lake marshlands.

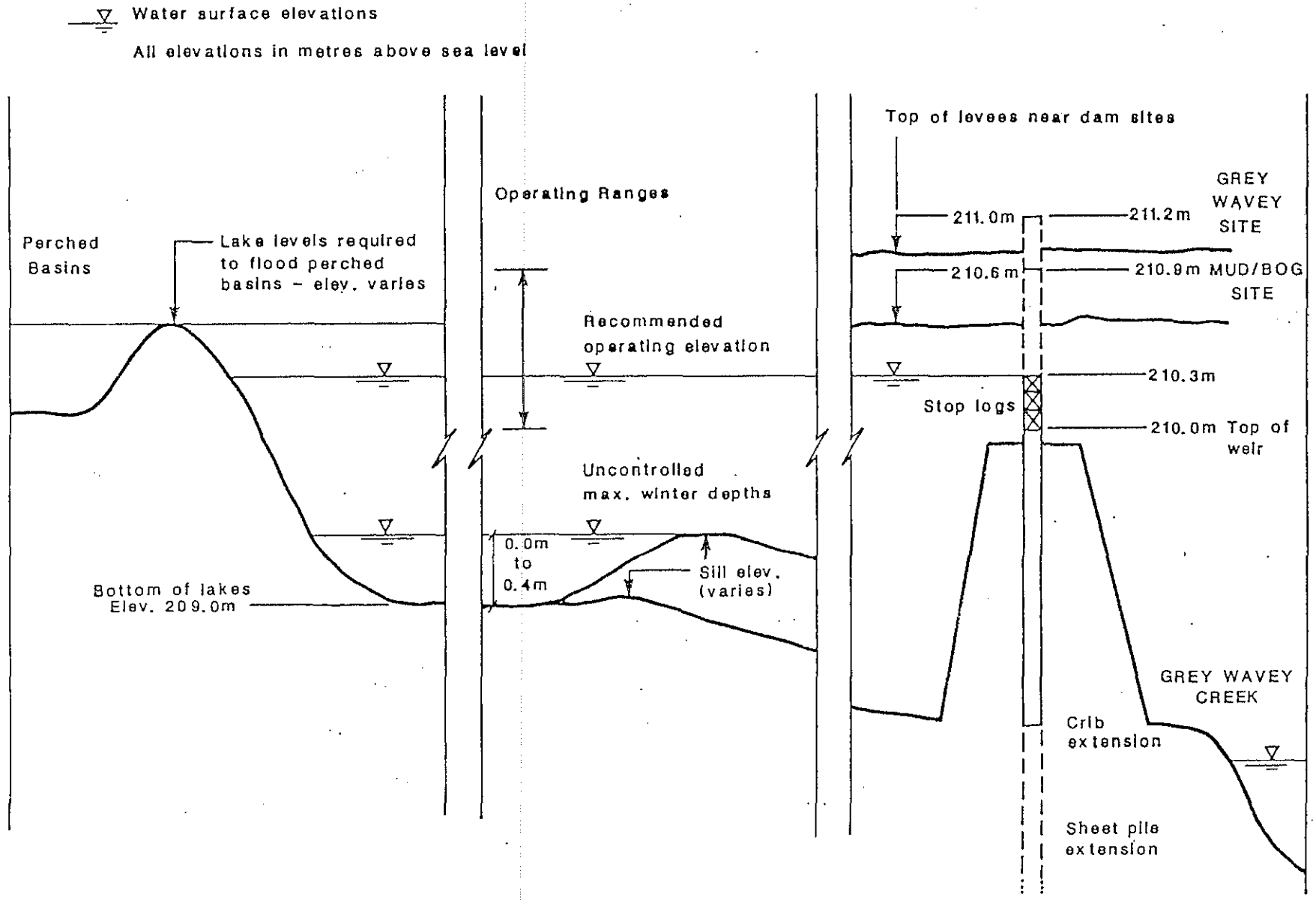


Figure i. Schematic showing existing uncontrolled surface elevations and winter depths of lakes, elevations of contol structures, recommended operating elevation and ranges of of operation for control structures, in the Grey Wavey Lake marshland complex.

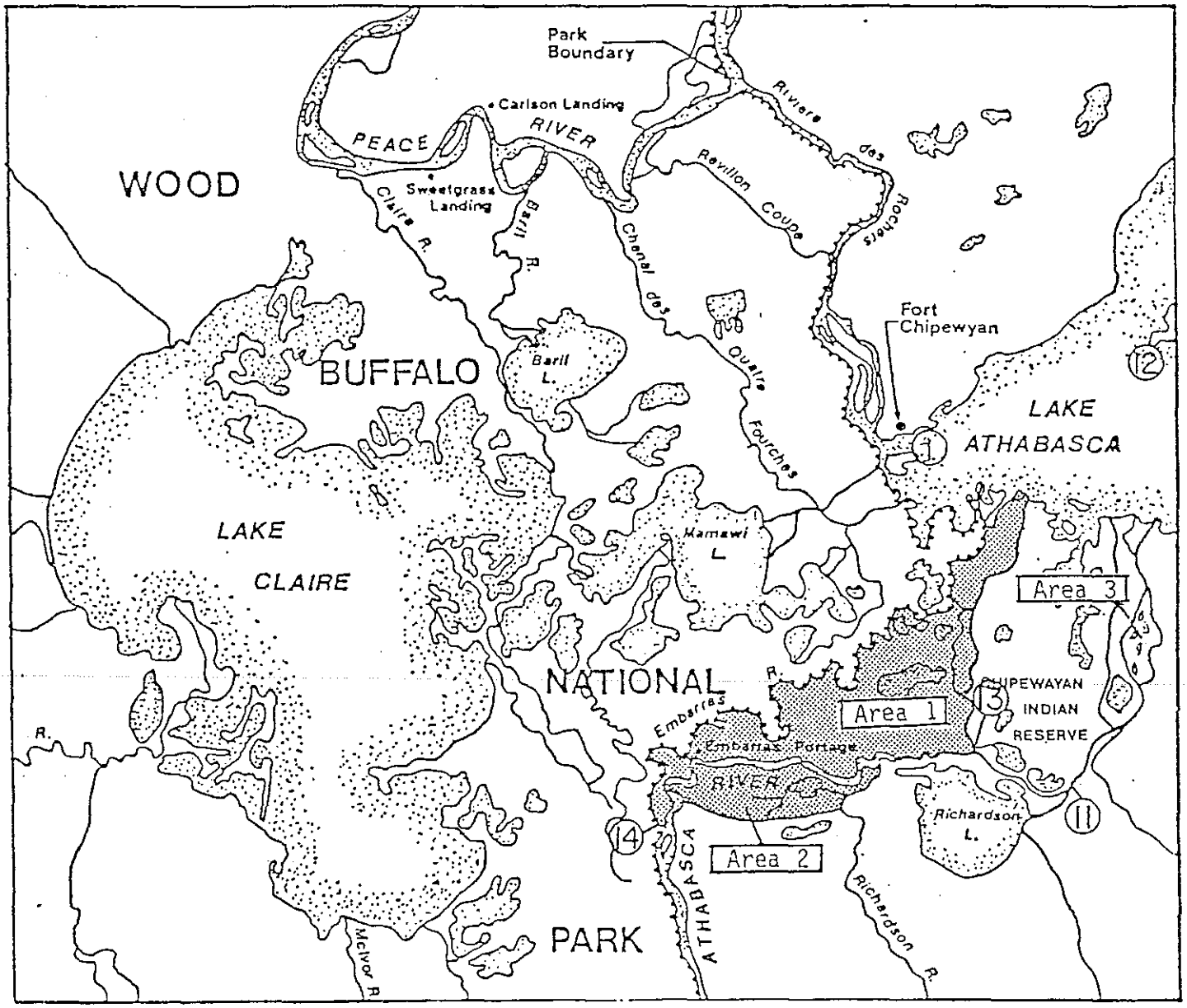


Figure 1. The Peace-Athabasca Delta in northern Alberta, showing the study area as the shaded portion lying between Embarras River and the Chipewyan Indian Reserve. Location of hydrometric stations used to determine marshland recharge feasibility are shown in numbered circles.

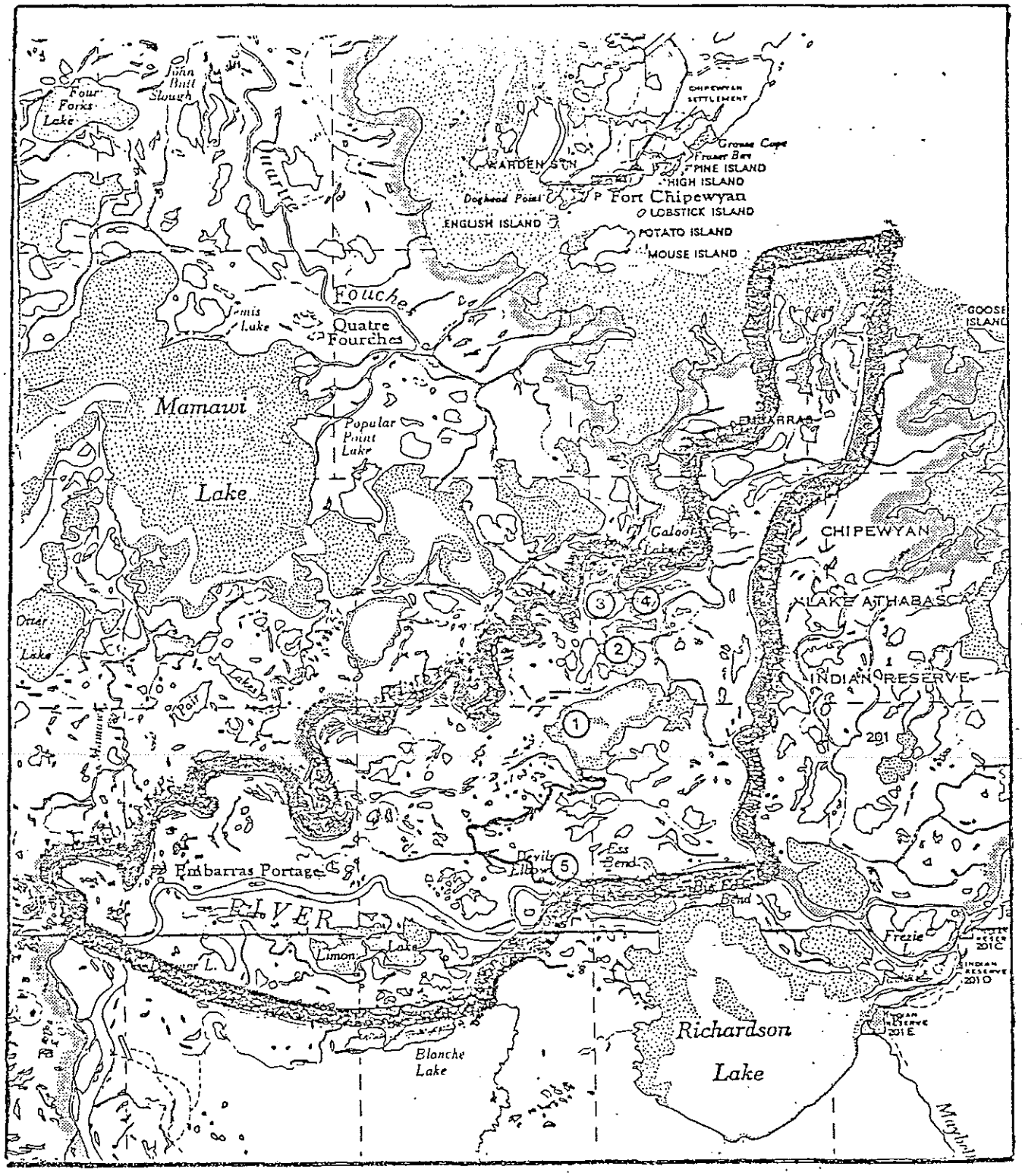


Figure 2. Peace-Athabasca Delta, with study area outlined in shaded black border. Sub-basins in the Grey Wavey Lake marshland complex are: (1) Grey Wavey Lake; (2) Bog Lake; (3) West Mud Lake; (4) East Mud Lake; (5) Existing recharge channel from Athabasca River to Grey Wavey Lake

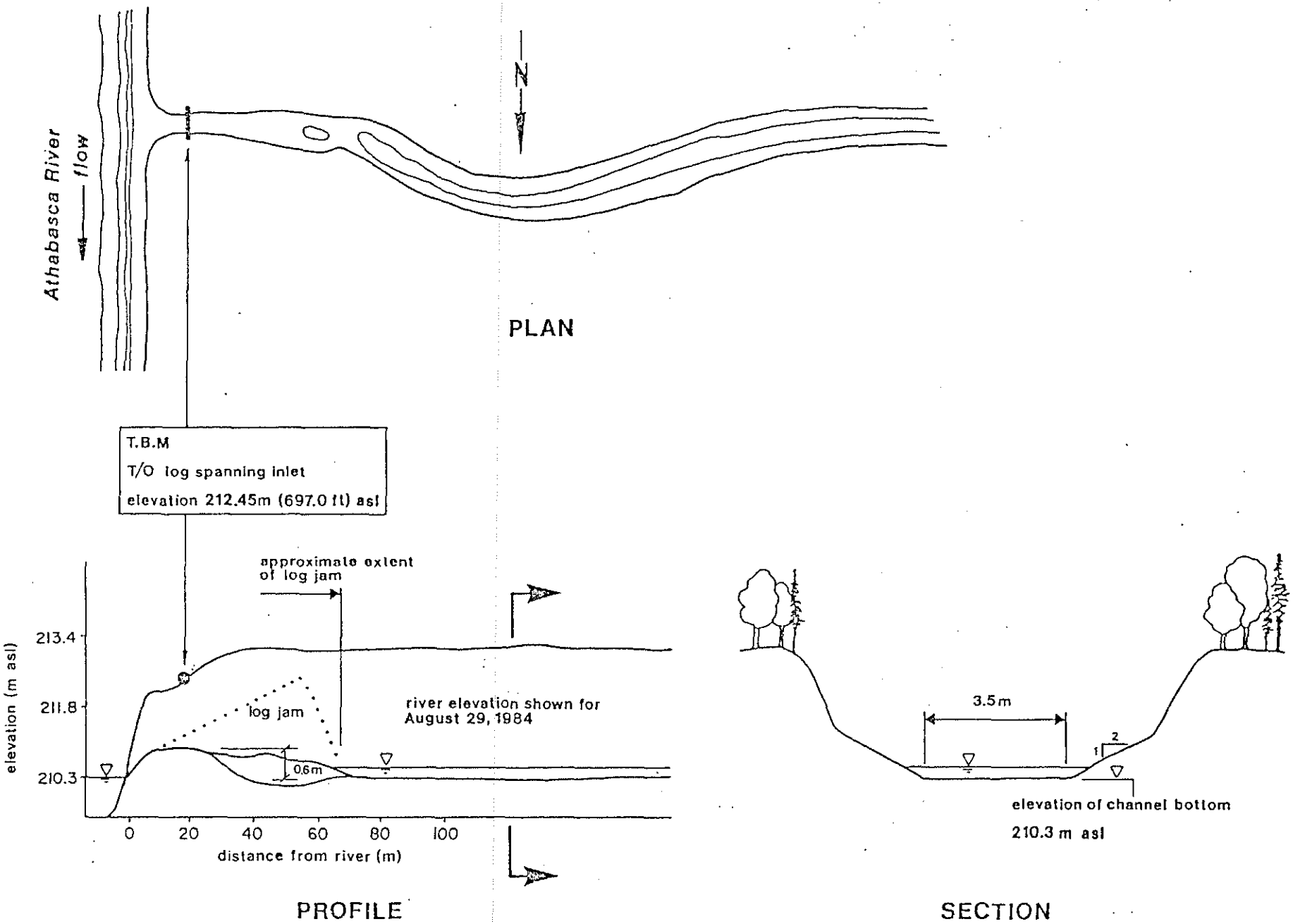
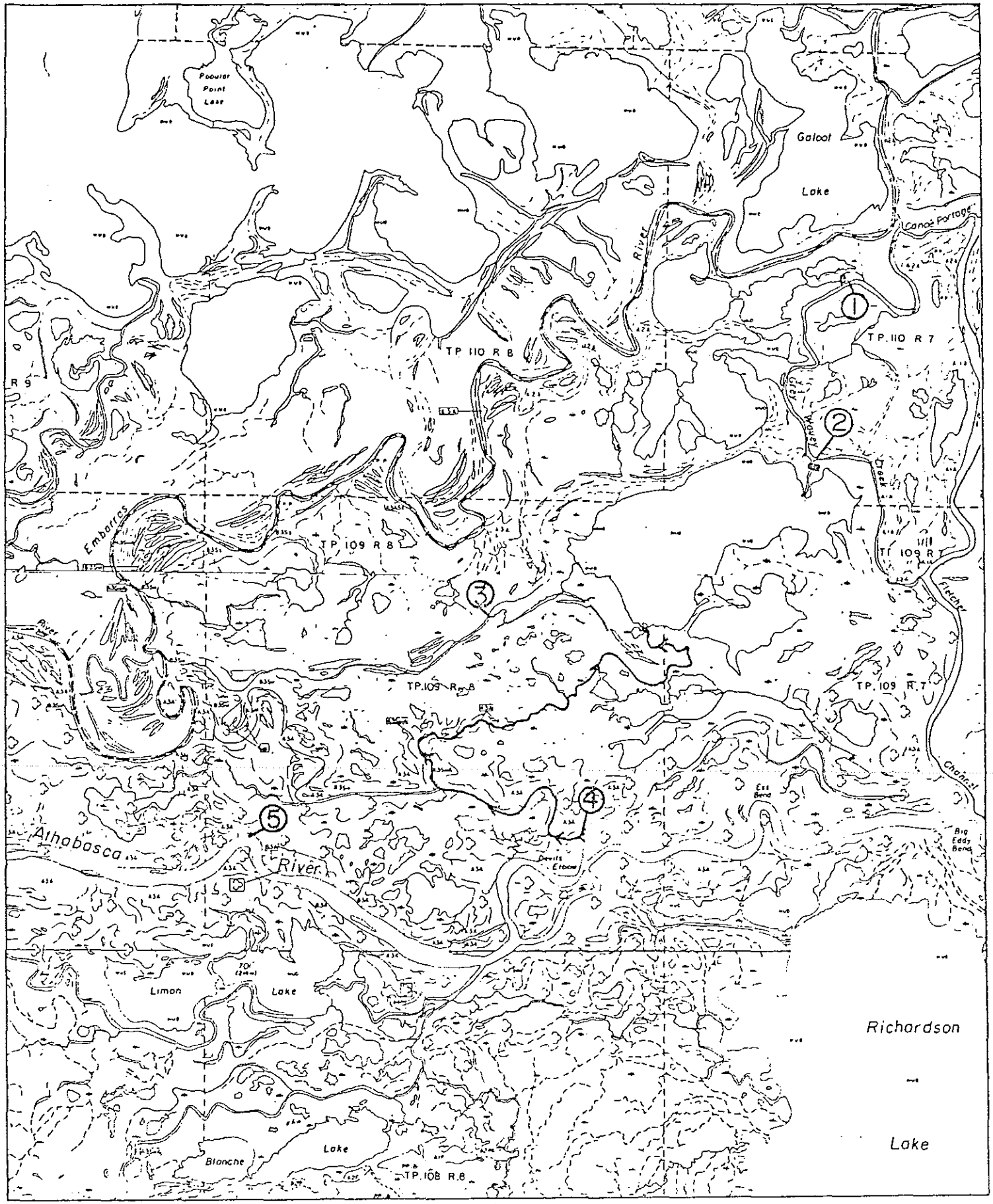


Figure 5. Plan, profile and cross-section of the upstream recharge channel at Devil's Elbow on the Athabasca River.



Figue 7. Grey Wavey Lake marshlands, showing location of downstream controls (1) and (2) interconnectivity of Grey Wavey Lake and Bog/Mud lakes (3); existing rcharge upstream recharge channel (4); alternate upstream recharge location (5)