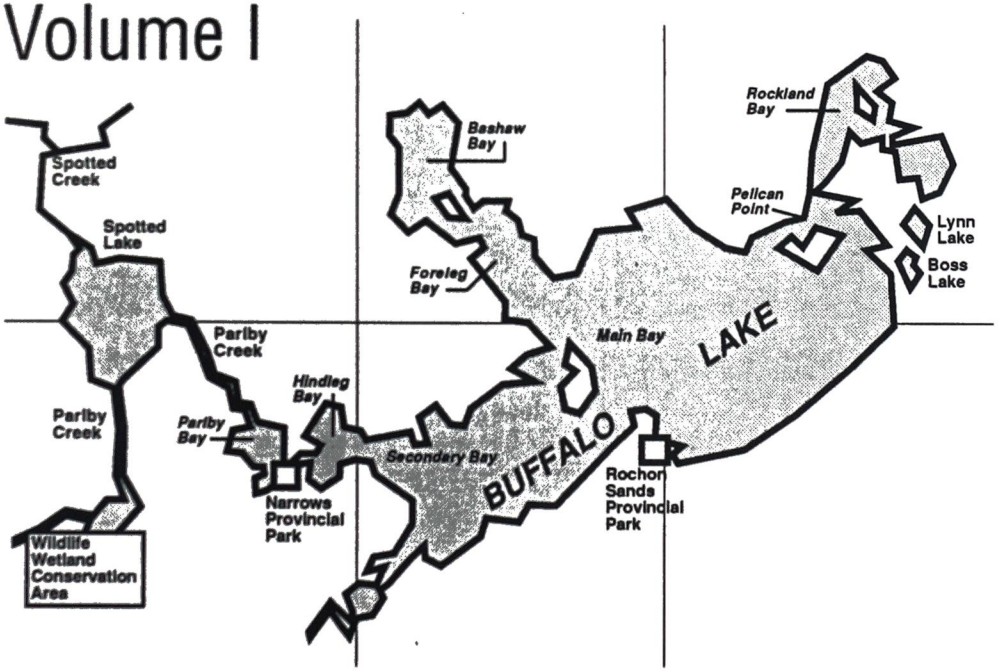
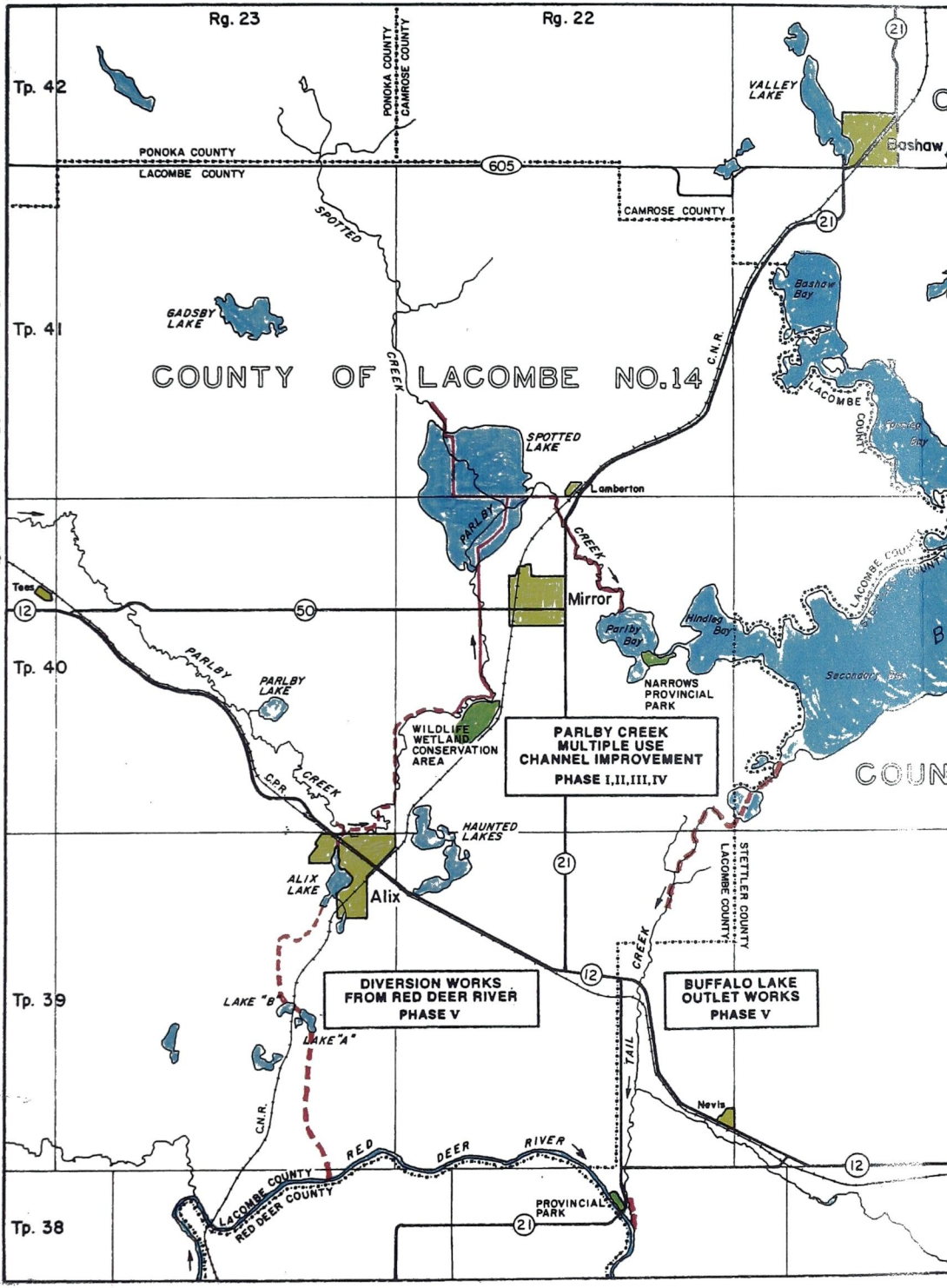
Report of the Parlby Creek–Buffalo Lake Water Management Project Review Board

Volume I



June 24, 1991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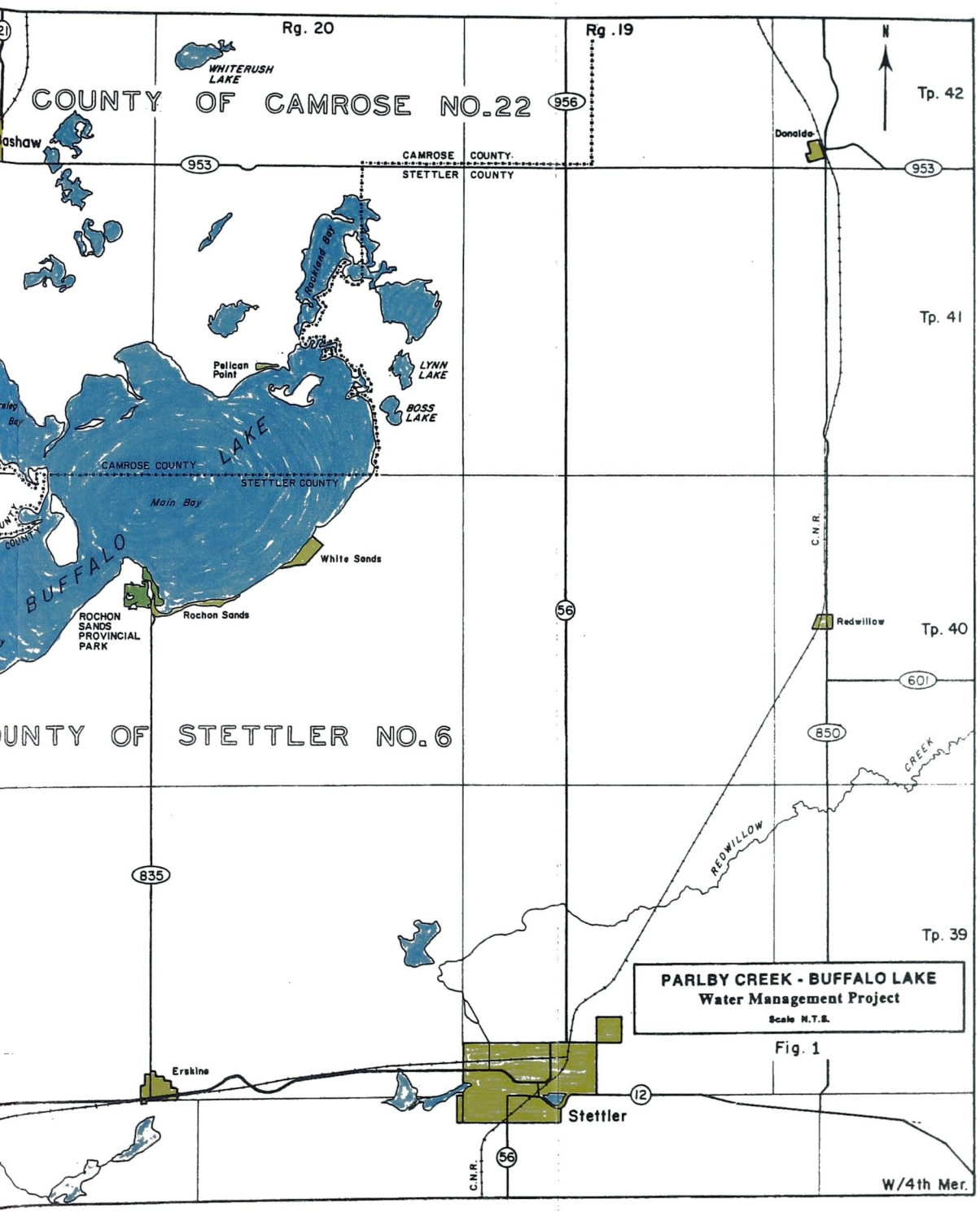
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PARLBY CREEK–BUFFALO LAKE
Water Management
Project Review Board

Office of the Chairman

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June 24, 1991

The Honourable Ralph P. Klein
Minister of the Environment
130 Legislature Building
Edmonton, Alberta
T5K 2B6

Dear Mr. Klein:

We are pleased to submit the three volume final report of the Parlby Creek–Buffalo Lake Water Management Project Review Board.

The project has generated a great deal of local and regional interest and this was reflected in the excellent turnout at the public hearings held in Alix May 21 and 22, 1991. The Review Board is satisfied that the concerns of the public were adequately reflected in the presentations at the hearings. The Board was pleased to receive a total of 56 submissions and was favourably impressed by the quality of these submissions.

We believe the public hearing process used to examine this project was a valuable exercise and we trust that it will be employed again.

We have appreciated the opportunity to serve on this Review Board and trust that our conclusions will address the concerns and issues raised by the project. This report bears the signatures of all members of the Review Board which attests to unanimity in endorsement of its contents.

Don Thorne

Ron Peiluck

Charlie Weir

Acknowledgments

The Review Board wishes to acknowledge the contributions made by both individuals and groups during its term. Special thanks to David A. Young of Symbion Consultants, Winnipeg. Mr. Young's experience as a senior economic advisor to provincial, national, and international governments was very valuable to the Board during its deliberations.

The Board wishes to acknowledge the people of Alix for being such gracious hosts during the public hearings and the Alix Anglican, Catholic and United Church women's groups for their contributions. The Board has appreciated the work of Sharon Murphy and Karen Staples.

The Review Board also thanks representatives of the many government departments and consultants who participated at the hearings.

The Review Board believes the submissions, regardless of their opinion, have made a valuable contribution to the process. However, the judgments, conclusions, and recommendations expressed in this report are solely those of the Review Board.

Executive Summary

The Parlby Creek–Buffalo Lake Water Management Project is a five phase multiple use water management project in Central Alberta, designed and constructed for Water Resources Management Services, a division of Alberta Environment (the proponent). The project was designed to provide agricultural flood control, fish and wildlife habitat enhancement, municipal water supplies and the stabilization of water levels in Buffalo Lake. Construction began in 1985.

An Environmental Impact Assessment (EIA) was carried out for the fifth and final phase of the project. The EIA was announced in 1989 and was conducted by Environmental Management Associates of Calgary in 1990. The EIA was the subject of an interdepartmental review and was accepted. The results of the EIA were released in March, 1991 by the Minister of Environment, the Honourable Ralph Klein. At the same time, Mr. Klein announced the appointment of the Parlby Creek–Buffalo Lake Water Management Project Review Board.

The Review Board was directed to hold public hearings on the project; to review the environmental impact of the project and proposed mitigative measures; to review the degree to which local citizens' concerns were addressed by the proponent; and to provide advice on the environmental acceptability of the project, including the recommendation of appropriate terms and conditions for inclusion in required permits and licences.

The proposed Buffalo Lake stabilization, the fifth and final phase of the Parlby Creek–Buffalo Lake Water Management Project, intends to raise and stabilize the present levels of Buffalo Lake. This would reduce lake level fluctuations and optimize the multiple use potential of the lake.

Implementation of Phase V will allow the lake water levels to fluctuate between the stabilization zone of 780.5 and 781.0 metres. Phase V consists of three parts: the diversion system from the Red Deer River to Parlby Creek, near Alix; the use of the Parlby Creek channel from Alix to Buffalo Lake, and the Buffalo Lake outlet works on Tail Creek.

Numerous municipalities will be affected by this final phase. The Village of Alix does not obtain its domestic water supply from Parlby Creek; however, the village does divert water into Alix Lake to supplement the lake's water supply. The stabilization of Buffalo Lake would remove the need for this annual diversion. Mirror uses a water reservoir to store water diverted from Parlby Creek in the spring and fall and pumping water through the conveyance system would provide an assured water supply for the village.

The Review Board established a project office in Lacombe and held a number of meetings to familiarize members with the terms and scope of the project. The EIA report was available at the Review Board office and in

the municipal offices of Alix, Bashaw, Mirror, Rochon Sands, and the County of Stettler. Site inspections by land and air were carried out in mid April and a panel member took a number of photographs which subsequently formed part of a display prior to and during the public hearings. The Review Board issued news releases and placed advertisements inviting written and oral submissions from groups and individuals. Written submissions were accepted until May 24 and a total of 56 presentations were made during two days of hearings, May 21 and 22, at the Alix Community Hall. The Alix Community Hall was set up so that audience members could view displays of the project area and a total of more than 150 members of the public, the news media, registered and non-registered intervenors were on hand for the hearings.

Some 39 written and oral submissions were clearly in favour of the project; eight were clearly opposed and an additional nine submissions raised questions and concerns about the project.

The Review Board learned that the majority of municipal, community, and corporate representatives in the area affected by the Parlby Creek–Buffalo Lake Water Management Project overwhelmingly support the project. The Board considers the body of past studies and reports sufficient to permit a well-informed decision and concludes that there would be little value in additional public consultation initiatives or studies.

The Board is encouraged by the long history of community spirit, co-operation and mutual support for the project. Those concerned perceive the project as an important ingredient in the economic viability and quality of life in the region. The Board believes it is important that a Buffalo Lake Management Team consisting of representatives of stakeholders, special interest groups, and advisory committees be established to monitor the construction and operation of the project.

There will be positive impacts on the quantity and quality of the water supply to the Villages of Alix and Mirror. The impacts on the water quality of Buffalo Lake and the Red Deer River will not be significant. While no mitigation is planned, monitoring should be carried out to confirm the predictions found in the EIA. Further, the Board is convinced that the project will not hamper Alberta's ability to meet its water quality and quantity objectives under the Apportionment Agreement and the South Saskatchewan River Basin Plan.

There will be positive and negative impacts on waterfowl, shore birds and colonial nesting birds and the proposed mitigation must be implemented to minimize the negative impacts. Northern pike fisheries at Buffalo Lake will incur both positive and negative environmental impacts and the Board considers that continued management and co-operation of all concerned parties will minimize any negative impacts. The positive impacts of the project will have direct and indirect benefits for the area.

The Board accepts that there are no environmental parameters that indicate this project cannot proceed. There are no apparent public concerns about the design of the project and therefore the Board accepts the design with the wish that the proponent proceed with its self-described overly cautious approach, determining areas of potential cost savings in the process where possible.

The Board concludes that there will be no significant impacts on the population, resource land/use and services infrastructures of the area and no mitigative measure are planned.

The Board concurs with the analysis of the economic impact submitted by several presenters and agreed to by the proponent and concludes that benefits exceed costs. The Board agrees that the Parlby Creek–Buffalo Lake Water Management Project would bring economic and other benefits of significant magnitude to the communities surrounding Buffalo Lake and concludes that economic evaluation supports the prudence of carrying out the project.

benefits to who + costs to who?

The Review Board considers the existing regulatory framework sufficient for the implementation of this project. The Board believes the project is environmentally acceptable provided that the proposed mitigative measures are carried out, the project is operated in such a way that it recognizes the environmental parameters and that major stakeholders are represented on the Buffalo Lake Management Team.

After careful consideration of the evidence presented, the Parlby Creek–Buffalo Lake Water Management Project Review Board makes the following recommendations: the project should proceed; a Buffalo Lake Management Team should be established with membership reflecting the multiple use nature of the project; the Management Team should develop a management plan to address issues arising from the construction, operation, and monitoring of the project; and the project must comply with all relevant provincial acts and regulations.

What about Federal?

1. Introduction

The Parlby Creek–Buffalo Lake Water Management Project is a five phase multiple use water management project in Central Alberta, designed and constructed for Water Resources Management Services, a division of Alberta Environment (the proponent). The project was designed to provide agricultural flood control, fish and wildlife habitat enhancement, municipal water supplies and the stabilization of water levels in Buffalo Lake. Construction began in 1985. **Phase I,** completed in 1987, consists of a 3.8 kilometre (km) channel from Buffalo Lake to Highway 21; **Phase II**, also completed in 1987, consists of a 1.9 km channel from Highway 21 to Spotted Lake; **Phase III** was completed in 1988 and consists of a 4.1 km channel through Spotted Lake to Highway 50 near Mirror. **Phase IV** entails construction of a channel from Highway 50 to Alix, construction of a backflood structure and dyke near Mirror, and construction of a wildlife conservation wetland. An Environmental Impact Assessment (EIA) was carried out for the fifth and final phase of the project. The EIA was announced in 1989 and was conducted by Environmental Management Associates of Calgary in 1990. The EIA was the subject of an interdepartmental review and was accepted.

The results of the EIA were released in March, 1991 by the Minister of Environment, the Honourable Ralph Klein. At the same time, Mr. Klein announced the appointment of the Parlby Creek–Buffalo Lake Water Management Project Review Board.

The Review Board was directed to hold public hearings on the project; to review the environmental impact of the project and proposed mitigative measures; to review the degree to which local citizens' concerns were addressed by the proponent; and to provide advice on the environmental acceptability of the project, including the recommendation of appropriate terms and conditions for inclusion in required permits and licences.

1.1 Project Description Phases I, II, III and IV

Buffalo Lake is a large, shallow, moderately saline prairie lake characterized by numerous bays and a shallow shoreline. It is one of the larger lakes (ninth largest in the province, covering an area of 93.5 square kilometres) in the Central Alberta area suitable for recreational use and it provides significant fish and wildlife habitat. Fluctuating water levels in Buffalo Lake were first recorded in 1883 and continued to be documented throughout the early part of this century (see Figure 3). Formal water level monitoring began on Buffalo Lake in 1956 and since that time, water levels have fluctuated by almost 6 feet, although simulation hydrologic studies have indicated that the lake level has actually fluctuated by close to 12 feet.

Water level fluctuations have reduced the lake's recreational attractiveness, affected fish and waterfowl populations, hampered shoreline development, deteriorated water quality and affected agriculture. Low water levels resulted in high salinity and a rise in water temperature which in turn led to algae blooms, decay odours and oxygen depletion. High water levels meant flooding, erosion of beaches and shoreline loss.

In 1977 the Alberta Government responded to concerns raised by individuals, the County of Stettler and local municipalities by making a commitment to investigate stabilizing the water level in Buffalo Lake for recreational and environmental purposes. The Prairie Farm Rehabilitation Association's (P.F.R.A. is a federal government agency which operates under the jurisdiction of the Prairie Farm Rehabilitation Act) 1980 report recommended that Buffalo Lake be stabilized by pumping water from the Red Deer River north to Alix and down Parlby Creek into Buffalo Lake. Local residents and municipalities were in favour of the project but agreement on issues and funding created problems. During the 1980s the Buffalo Lake Action Committee was established to provide input to Alberta Environment on local studies and several studies looked at management alternatives, environmental impacts, and the social and economic impacts of pumping water from the Red Deer River. Background information continued to be collected until the EIA was commissioned in 1989.

Parlby Creek is the main tributary of Buffalo Lake and flooding problems have been reported in the area since the early 1900s. In 1908, the Government sent in a dredging machine to dredge Parlby Creek and one year later a crew dug a ditch and cleared and straightened the Parlby Creek channel. The P.F.R.A. surveyed the area for irrigation projects in the 1930s but no action was taken and in 1954 a drainage project was recommended due to flooding of agricultural land. Flooding persisted and the area was the subject of a number of studies by Alberta Environment and P.F.R.A.

Several attempts were made to build a ditch through Spotted Lake (an area of about 970 hectares [2400 acres] of hay flat north of Mirror on Parlby Creek), but limited success was realized. In 1980, a P.F.R.A. study recommended a channel on Parlby Creek through Spotted Lake in order to prevent flooding during the summer and to provide backflood capabilities during the spring. Land owners continued to petition the local authorities and the Provincial Government to resolve the area's water management concerns and in 1984, the Parlby Creek–Spotted Lake Project was announced. **Phases I, II,** and **III** were built between 1985 and 1988 (see Figure 1).

Phase I consisted of 3.8 kilometres of channel improvement, replacement of the Highway 21 bridge and the Carlyle backflood control structure. The structure replaced an existing private licensed backflood irrigation scheme and a fish ladder bay was added to allow for future needs. **Phase II** comprised 1.3 kilometres of channelization and the Spotted Lake control

structure which would assist in the operation of a 2370 acre backflood irrigation scheme for hay lands adjacent to Spotted Lake. Backflood waters would also provide excellent spawning habitat for pike and the control gates would allow lowering of backflood waters so fish fry could return to Buffalo Lake. **Phase III** consisted of 4.1 kilometres of channelization works to Highway 50 and channelization of North Spotted Creek into the Parlby Creek Phase III channelization works. Isolated mounds or islands were maintained above the maximum backflood elevation for wildlife bird nesting. In addition to the work included in these three phases, a flood forecast monitoring system comprising flow metering stations and precipitation gauges was installed and fish ladders were added to the Carlyle and Spotted Lake control structures. **Phase IV** will include an 11 kilometre channel, construction of the Mirror backflood structure to improve agricultural production and the establishment of a 400 acre wildlife conservation wetland to improve wildlife habitat. An initial 4.3 kilometre channel was completed in April, 1991 and work is scheduled to begin again in August. The Mirror backflood structure and the wildlife wetland control gates are to be completed in 1992-93.

1.1.1 Phase V — Buffalo Lake Stabilization

The proposed Buffalo Lake stabilization is the fifth and final phase of the Parlby Creek–Buffalo Lake Water Management Project. The project intends to raise the present levels of Buffalo Lake, reduce lake level fluctuations and optimize the multiple use potential of the lake. Numerous municipalities will be affected by this final phase. Alix does not obtain its domestic water supply from Parlby Creek; however, the village does divert water into Alix Lake to supplement the lake's water supply. The stabilization of Buffalo Lake would remove the need for this annual diversion. Mirror uses a water reservoir to store water diverted from Parlby Creek in the spring and fall and pumping water through the conveyance system would provide an assured water supply for the village.

Implementation of **Phase V** will allow the water levels to fluctuate between the stabilization zone of 780.5 and 781.0 metres. **Phase V** consists of three parts: the diversion system from the Red Deer River to Parlby Creek, near Alix; the use of the Parlby Creek channel from Alix to Buffalo Lake, and the Buffalo Lake outlet works on Tail Creek.

Part I The diversion system is comprised of an intake structure and pumping plant on the north bank of the Red Deer River and a pipeline to convey water up the side of the valley. A canal will convey pumped water from the pipeline outlet structure through Lakes A and B and downstream to Alix Lake. A gated control structure on the outlet of Lake B will maintain water levels in Lakes A and B and discharge the pumped water to the canal downstream. Alix Lake levels will be maintained by a control structure equipped with a self-regulating gate which is designed to discharge pumped water while maintaining the lake at its full supply elevation of 790.35 metres. The diversion system is estimated to cost $9.3 million.

Part II The improved channel capacity of Parlby Creek can safely convey the diverted Red Deer River water and the channel becomes part of the conveyance system with no additional costs to Phase V of the project.

Part III The Buffalo Lake outlet works on Tail Creek are designed to ensure the lake levels are kept within desired levels and any resulting outflow can be conveyed to Tail Creek. Channel improvements will be needed on Tail Creek upstream of the control structure in order to convey flood waters to the structure. Other work involves replacement of an east-west road crossing, additional protection to existing road crossings and channel erosion protection works on the lower end of Tail Creek.

1.1.2 Operation and Maintenance

Alberta Environment, through the Development and Operations Division of Water Resources Management Services, would be the owner and operator of the project. During the initial filling of Buffalo Lake, the pumping units would be operated from May to October and after the lake level has been raised above 780.5 metres, the pumping units would be shut down. The lake would then be allowed to fluctuate under natural conditions until the water level dropped by 0.15 metres below the full supply level. When this occurs, pumping would begin and would continue until the lake was again at the desired level. This cycle would be repeated as needed except in the case of high flows in Parlby Creek or high silt loads in the Red Deer River, or in the case of upstream spills. An average of 1.6 months of pump operation per season would be required to maintain the targetted full supply level after the initial filling.

The Lake B outlet structure will be opened when the pump units are operating and closed when the pump units are shut down. The Alix Lake structure has a self-regulating gate and will require no operating personnel. The Buffalo Lake stabilization zone is between 780.5 and 781.0 metres (see Figure 2). Depending on specific flood event, the stoplogs in the bays can be lowered or raised to reduce the impact of Buffalo Lake or Tail Creek floods.

The average total estimated annual cost to operate and maintain Phase V of the Parlby Creek–Buffalo Lake Water Management Project is $186,000.

1.2 The Review Board

In August, 1989, the Government of Alberta decided to undertake an Environmental Impact Assessment (EIA) for the fifth phase of the Parlby Creek–Buffalo Lake Water Management Project, specifically the proposed stabilization of water levels in Buffalo Lake. Environmental Management Associates of Calgary was appointed to conduct the EIA and its report was released in March 1991 by the Honourable Ralph Klein, Minister of Environment. At the same time, Mr. Klein appointed the Parlby Creek–

Buffalo Lake Water Management Project Review Board. The three member Review Board consisting of chairman Don Thorne and members Charlie Weir and Ron Peiluck was directed to review the Environmental Impact Assessment report and hold public hearings.

Specifically, the review board was to assess the environmental impact of the project and the proposed mitigative measures as they applied to the following:

- the quantity and quality of the water supply for the villages of Alix and Mirror
- the waterfowl, shore birds and colonial nesting birds of Buffalo Lake
- the Northern pike fisheries of Buffalo Lake and the Parlby Creek conveyance system
- the water quality of Buffalo Lake and the Red Deer River
- Alberta's requirement to meet its water quality and water quantity obligations under the Apportionment Agreement and the South Saskatchewan River Basin Plan
- the population, economy, resource/land use, and the services/infrastructure surrounding Buffalo Lake

In addition, the Review Board was to determine if local citizens' concerns had been addressed by Alberta Environment, the proponent of the project; and the Board was to provide advice on the environmental acceptability of the project and on appropriate terms and conditions for inclusion in the necessary permits and licences.

The Review Board was delegated the authority to recommend approval of intervenor funding and to set the terms and procedures by which public hearings would be held (see Appendix I).

1.3 The Review Process

The Review Board established a project office in Lacombe and held a number of meetings to familiarize members with the terms and scope of the project. The EIA report was available at the Review Board office and in the municipal offices of Alix, Bashaw, Mirror, Rochon Sands, and the County of Stettler. Site inspections by land and air were carried out in mid April and a panel member took a number of photographs which subsequently formed part of a display prior to and during the public hearings. The Review Board issued news releases and placed advertisements inviting written and oral submissions from groups and individuals. Written submissions were accepted until May 24 and a total of 23 presentations were made during two days of hearings, May 21 and 22, at the Alix Community Hall.

2. The Public Hearings and Written Submissions received by the Review Board

The Review Board decided to conduct the public hearings in an informal atmosphere to encourage participation, openness and friendly debate. The Alix Community Hall was set up so that audience members could view displays of the project area and a total of more than 150 members of the public, the news media, registered and non-registered intervenors were on hand for the hearings. Each of the two days began with the introduction of the Review Board and opening remarks from the chairman. The proponent made a brief presentation on the project and individuals and groups were invited to make presentations, beginning with those who had pre-registered and continuing with non-registered individuals and groups. The Board allowed ample time for questions and statements from the registered intervenors, the proponent and interested parties in the audience.

2.1 The Presentations

A large number of written and oral submissions were clearly in favour of the project.

Participants in favour

Municipal organizations	8
Community organizations	11
Corporations	4
Individuals	16
	39 *

*This total does not reflect the more than 1,400 individuals who signed various petitions in support of the project.

A small number of written and oral submissions were clearly opposed to the project.

Participants opposed

Municipal organizations	0
Community organizations	1
Corporations	1
Individuals	6
	8

Several individuals and groups expressed concerns and raised questions about the project but were not clearly in favour or opposed to the project.

Participants expressing concerns

Municipal organizations	1
Community organizations	2
Corporations	0
Individuals	6 *
	9

*This figure does not reflect 11 individuals who expressed concern about the project by signing a petition.

2.2 Extracts from the Presentations

The Review Board heard from 23 presenters at the two days of public hearings. Many of those who presented also made written submissions. In all, 56 submissions were received by the Board. What follows is a brief sample which, in the Board's view, sums up the input from the written and oral presentations. Refer to Volumes II and III for the full text.

"My town, business and family both need and deserve a reliable water supply, which I believe they will not have if the project does not go ahead." Edward Kingston, Alberta Foundry Ltd.

"We recognize that the cost expenditure to complete this project is significant ($13.1 million), but we feel that the benefits to the area will be far more significant than the costs over the long term." Alix Chamber of Commerce

"By proceeding with this Project Buffalo Lake will attract more people and the economic benefits and economic spin offs will affect a large part of East Central Alberta including Alix." Village of Alix

"My overall reaction to the present report is favorable and I feel that the authors have generally given an accurate and realistic picture of the key issues."

"It is not just simply a matter of making sure that, from a legal point of view, enough water is allowed to run downstream to Saskatchewan, it is a matter of making sure that the entire Red Deer River from Red Deer to the South Saskatchewan River be kept in a healthy and attractive condition."

Dr. Charles D. Bird

"In short, what we have here is one of the most significant tracts of waterfowl habitat in North America. Needless to say, Ducks Unlimited has a sincere desire to see the integrity of the area for waterfowl and wildlife enhanced and maintained."

"...if Members of the Board conclude that this project is worthy of pursuit, then an effort must be made to make it the very best it can be through the establishment of an integrated planning team with the specific goal to fine-tune the proposal and management plans necessary for a project of this magnitude. Only through this level of planning and management can we maximize social, economic and environmental benefits."

Ducks Unlimited

"The Parlby Creek–Buffalo Lake Development Project will help to diversify the economic base of an area in rural Alberta that has traditionally been dependent on servicing the agriculture and oil sectors. The improved opportunities for recreational activities on Buffalo Lake will increase the potential of attracting more tourist dollars into the area from Edmonton and Calgary."

"The benefits of the project to the Province of Alberta are greater than its costs and more important to the region, the development of the Parlby Creek–Buffalo Lake Development project will help to create many additional opportunities for employment and increased activity in the area. Many of these benefits are difficult to quantify, but should not be overlooked in the analysis of the project."

East Parkland Community Futures Association

"Since Alberta has very few lakes in the south part of the province, it would be unfortunate if Buffalo Lake cannot be stabilized in order to provide southern Alberta with a reasonable alternative to vacationing in British Columbia."

Gary Feltham

"...how do you arrive at a benefit figure in the analysis on fish and wildlife that represents the importance of this for present and future generations.

"...the stabilization of water levels would make farming operations more predictable with flooding conditions and pasture boundaries more controlled." Kathie Hankins

"The environmental impact assessment is incomplete because it does not include detailed plans to mitigate the impacts of the project, to monitor the predicted impacts or to respond to unpredicted negative impacts."

"Ecotourism has a large potential. And certainly Buffalo Lake area, Alix and Mirror and Stettler, could enormously benefit from ecotourism. You have real potential here, but not with the stabilization of the lake. And certainly it would require some promotion, promotion that you aren't getting now. It's obvious that the reason that the increase that's occurring in campgrounds now is the result of private promotion by private owners." Martha Kostuch

"The Lake is there for everyone to enjoy and shore boundaries especially should be protected against total private ownership.
Lacombe Chamber of Commerce

"There is good reason to doubt that 'lake level stabilization' is the true motive behind the proposed diversion of the Red Deer River through Buffalo Lake. Far more likely is this proposed diversion the first step in a watershed diversion via Buffalo/Cow Lake from the Red Deer River (South Saskatchewan system) to the Battle River (North Saskatchewan system)." Randy Lawrence

"I would like to charge you three people, give the Minister something to say 'yes' or 'no' to. The public want a 'yes' or a 'no.' They will live with either one. And gentlemen, I charge you to do that." John Lund

"A stabilized lake shore would improve an important breeding and nesting area for the many waterfowl this area has enjoyed through the years." George A. McTaggart

"For many years agriculture has improved the quality of water flowing into Buffalo Lake from Parlby Creek. This has gone largely unrecognized by the public. Some backflood land along the creek has been hayed regularly for nearly 100 years without the use of any additional fertilizer. All of the nutrients taken off in the hay came from the soil and the water. The yield and quality of hay has not decreased on these lands."

"Agriculture should be an important consideration in Parlby Creek–Buffalo Lake development." Neil Miller

"Our area has been suffering economically. All the ingredients for success are present but the area remains economically depressed. A consistent water supply is the missing ingredient to complete the formula for economic growth."

"...parties have intimated the stabilization of Buffalo Lake is a fairly new project to benefit a few. That is just not the case! The E.I.A., Volume 1, page 5, confirms that the first study into the feasibility of stabilizing Lake Levels was initiated in 1978." Village of Mirror

"It is painfully obvious that only the ecologically illiterate could speak of 'stabilizing' Buffalo Lake. The whole notion of 'stability' is an outdated Edwardian vintage vision of nature as 'eternal and unchanging.' The reality of this area is one of vast and profound cycles of change over long time frames."

"'Great things, these drainage ditches,' claim the engineers hired by Alberta Environment. They drain all the sloughs and a few farmers get a few extra tons of hay at public expense — of course now they have to buy fertilizer since the seasonal flooding doesn't enrich the meadows any longer." Michael O'Brien

"We submit that it is important to recognize that the stabilization proposal does not seek to create a new lake nor even raise the water beyond historical levels. Rather, the stabilization project seeks to enhance the recreational and economic benefit of Buffalo Lake by eliminating nature's extremes."

"It is obvious from this analysis presented to you, that benefits do exceed the costs and that the majority of this benefit accrues to the province as a result of additional economic activity undertaken by cottage owners that may not have taken place had the water level not been stabilized." Pelican Point Community Association

"Both the campers and cottage users have experienced considerable frustration trying to get boats into the lake because of the low water levels over the past several years."

Pelican Point Park Management Committee

"The potential for bird watching around Buffalo Lake has not been evaluated as part of the EIA. The economic potential of this sector of tourism activity should not be ignored."

Red Deer Regional Planning Commission, Ad Hoc Committee

"Pumping water from the Red Deer River would serve to stabilize flows in Parlby Creek, in dry periods, thereby ensuring adequate volumes of water were available to the Village of Mirror for their water supply requirements." Serv-Alta Engineering Ltd. for the Village of Mirror

"The Town of Stettler supports stabilization as adding stability to existing businesses, not only in the tourism industry, but throughout the commercial sector, and also by providing a stable water source for the agricultural industry in East Central Alberta." Town of Stettler

"Alberta Environment has on file 29 separate studies on the stabilization of Buffalo Lake. If the money that was spent for all of these studies was spent on the stabilization, wouldn't the project have been completed? Isn't it time for action?" Summer Village of White Sands

"...this project is an example of water management that should be repeated more often in rural areas. We believe that it has the potential to attract other development. We believe that it is well thought out and tested." Neil Gilliat, Westcan Malting Ltd.

2.3 Conclusions

Based on material submitted to the Review Board, both in writing and at the public hearings, the Board draws the following conclusions.

1. A number of municipal and provincial jurisdictions (authorities) in the immediate Buffalo Lake area have a sincere interest in the project. There are three rural counties (Lacombe, Stettler, and Camrose); five towns and villages (Mirror, Alix, Stettler, Donalda and Bashaw); and three hamlets (Nevis, Erskine, Red Willow). Buffalo Lake has two summer villages (Rochon Sands and White Sands), two provincial parks (Rochon Sands and the Narrows), several municipal and private recreation areas and several unincorporated communities (Pelican Point and Popular Beach). Within these areas, there are a number of registered societies and ad hoc groups such as the Pelican Point Community Association, Lacombe Chamber of Commerce, Bashaw and District Chamber of Commerce, Mirror Chamber of Commerce, Rochon Sands Hall and Recreation Association, Friends of Buffalo Lake and others. The organizations which participated in the hearings or made written submissions almost without exception supported the project.

2. The people directly and indirectly affected by the project live, for the most part, in Central Alberta and the Edmonton and Calgary areas. A large majority of individuals who participated in the hearings or made written submissions supported the project.

3. Public consultation on this project has been comprehensive. The Review Board examined material dating back to 1982. There have been public meetings, an open house information session, public distribution of the EIA, information newsletters, media information announcements and media monitoring. The project has received a great deal of media coverage which has served to increase public awareness of the project. Media coverage back to 1982 dealt with several aspects of the project; however, recent coverage has focussed on benefits and costs and has assigned political significance to the project. The hearings and submissions focussed on economic issues and, to a lesser extent, on environmental issues. The design aspects of the engineering works or structures were virtually ignored. The media has helped bring attention to the major public concerns and the Board is satisfied that these issues were well covered at the public hearings. Additional hearings and public involvement initiatives are not required.

4. Completion of the project has been discussed and anticipated for many years by many people both in the immediate Buffalo Lake region and elsewhere. Within the region, a certain sense of community spirit, co-operation and mutual support has developed. If the project is approved, this support will be a key factor in helping to make the region an economically viable and desirable place to live. If the project is not approved, or is delayed, the whole area will be adversely affected.

5. In the western part of the region, the Villages of Alix and Mirror, the agricultural community and those in support of wildlife have built a good understanding; they are working well together. Backflooding of the hay meadows supports farming practices which do not entail the use of fertilizers and, at the same time, backflooding provides fish spawning habitat and other wildlife benefits. This is an example of wise use of our environment. This project will support these endeavours particularly during years when spring runoff is low. Farmers and environmentalists are working in harmony to solve problems and it would be unfortunate to disturb this partnership.

6. The need for the project, although not part of the Review Board's mandate to determine, has actually been decided by the many requests from area residents over the years. The public hearings and written submissions emphasized repeatedly the need for a more secure water supply for Alix and Mirror, as well as other needs such as economic stability in the communities, a more reliable water supply for the farm community, and additional water for fish and waterfowl habitat. The Review Board considers that the need for the project has been both addressed and established and further, that the motives for this project are as stated by the proponent.

7. An environmental impact assessment (EIA) can continue endlessly; even with unlimited funding and further studies, scientists will still have unanswered questions. The public hearings and written submissions indicate that more than enough studies have been carried out. A list of studies is included in Appendix IV. The Review Board believes that the completed studies are sufficient to permit a well-informed decision.

8. There are positive and negative environmental impacts. The proponent has been careful to identify the negative environmental impacts and cautious in the application of mitigative measures to address these effects. Considering the information received and mitigative measures proposed, the Board considers the project environmentally sound and agrees with the assessment of the consultant which states, "Alberta Environment has made commitments to monitor and mitigate project-related effects on an ongoing basis. Again, with this appropriate mitigation and based on the operating procedures of Alberta Environment, the authors have concluded that there are no environmental parameters that indicate this project cannot proceed." (Volume II, 376.)

9. The stabilization of Buffalo Lake is not at a precise elevation but rather covers a stabilization zone over which lake elevations can fluctuate. Within this zone there are several operational scenarios which can be adjusted and used to comply with environmental requirements and multiple uses.

10. Water-flows in and out of Rockland Bay should be controlled by the modes proposed for Buffalo Lake. Some mitigation may be required for the Piping Plovers which are considered a "vulnerable species" in Alberta. The Review Board suggests the formation of a local advisory committee to oversee the operation and maintenance of Rockland Bay and its long term monitoring. The committee should include representatives from the National Piping Plover Recovery Team and adjacent land owners and should work with the Buffalo Lake Management Team (see Conclusion 14) and the proponent.

11. The design of the engineering works reflects a cautious and conservative approach in assessing mitigation of negative environmental impacts. The proponent may have been overly cautious with the Tail Creek works and this section of the design should be reviewed to determine if savings can be realized.

12. Economic effects of the project and the cost/benefit ratio was the key subject of the public hearings and written submissions. During the course of the hearing it was agreed by the intervenors and the proponent's consultant that an error had occurred and that the cost/benefit ratio was greater than one in a provincial perspective and much greater than one on a regional basis. Further, the overall economic impact to the province and to the region was determined to be positive. The Review Board agrees that the project is in the public interest and that this report should deal at considerable length with the matter of economic effects.

13. The works were designed by qualified engineers. The public hearings and written submissions did not indicate any flaws in the engineering design of the various structures or elements in the project and, consequently, the Review Board accepts the engineering design of the works as being satisfactory.

14. The regional interest, co-operative spirit, support and the demonstrated ability (Spotted Lake Group) indicates that a local Buffalo Lake Management Team could best look after and be responsible for the operation, maintenance and long term monitoring of the project. The team should include representatives from major stakeholders and special advisory groups for selected critical areas in the region of Buffalo Lake such as Rockland Bay, Bashaw Bay, Alix, Mirror, Spotted Lake, and others.

15. The Buffalo Lake Water Management Project is designed to allow water levels to fluctuate between 780.5 and 781.0 metres (see Figure 2). The fluctuation zone is below historic water levels and above recent low water levels (see Figure 3). The Review Board concludes that the fluctuation zone elevations are practical and provide flexibility. If, after several years of operation, adjustments are required, these can be made. Except for a very few cases, the proposed elevations agree with the desires of all of those favouring stabilization and the needs of lake users.

16. The operational mode of the project provides considerable flexibility and changes may be needed to comply with environmental concerns, domestic and agricultural water supply needs, and the needs of lake users. The Review Board considers that the risk of expensive changes or additional works to meet any unforeseen social, economic or environmental needs is minimal.

17. During the course of the hearings the Review Board heard reference to a 1972 report, *Water Supply for the Saskatchewan–Nelson Basin*. This report proposed a dam to raise the level of Buffalo Lake to a full supply level of 786.4 metres (2,580 feet), some 5.4 metres (17.4 feet) higher than that which Phase V would entail. The Board believes that this proposed dam would not proceed on either environmental or economic grounds. It is the opinion of the Review Board that the Parlby Creek–Buffalo Lake Water Management Project further precludes the implementation of such a scheme in the future.

18. The proponent's staff has a long history of responsibility in the management of water resource projects in the province. A small percentage of intervenors posed questions in this regard. The Review Board believes that a *partnership* consisting of a Buffalo Lake Management Team, advisory committees for special areas and the proponent will provide secure operation and future monitoring of the project.

19. Some intervenors expressed concerns for the future. No doubt unforeseen problems will arise and operational adjustments will be required. Over time, ongoing monitoring will allow the best use of waterflows and lake levels for the benefit of the environment, the economy and the social needs of domestic, agricultural and lake water users. The Review Board agrees with the intervenors, the consultants and the proponent that the project, if managed as outlined, has the flexibility to provide for future needs.

20. The Board believes that the concerns of local residents raised by the Parlby Creek–Buffalo Lake Water Management Project have been adequately addressed by the proponent.

BUFFALO LAKE
PROPOSED STABILIZATION ZONE

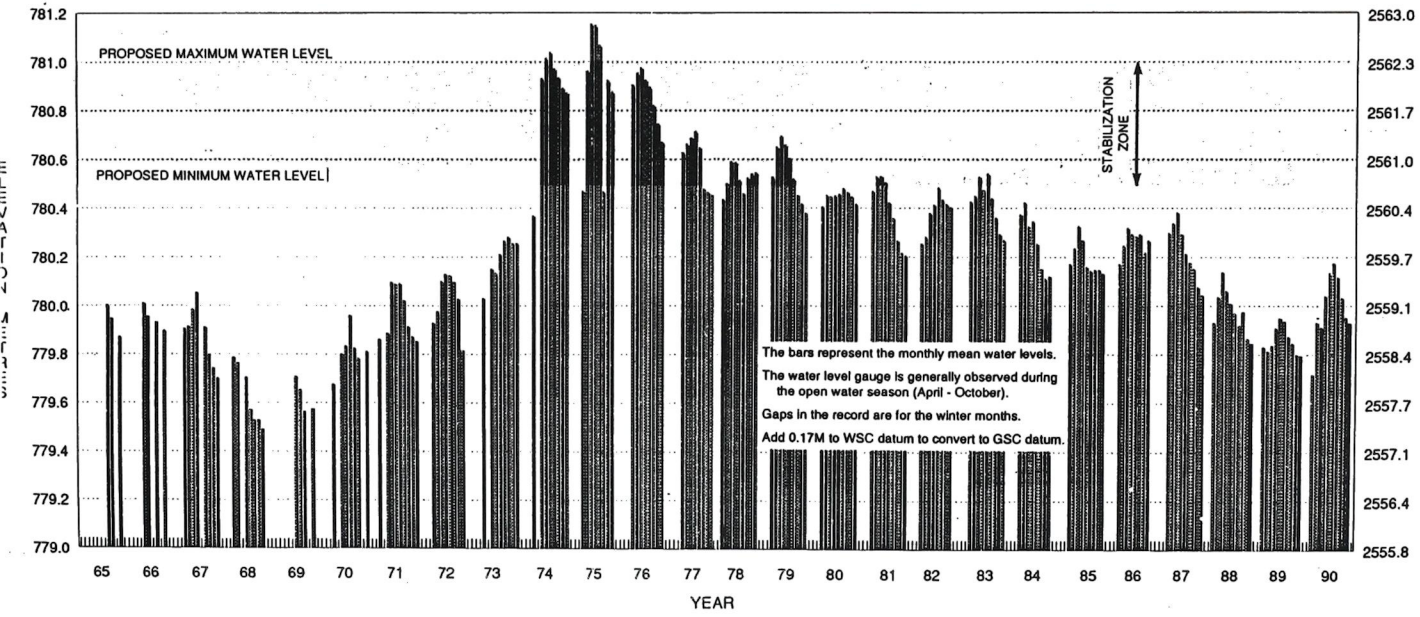


FIGURE 2

PARLBY CREEK - BUFFALO LAKE
Water Management Project

3. The Issues

The Parlby Creek–Buffalo Lake Water Management Project's Terms of Reference (see Appendix 1) set out a number of issues for the Review Board's consideration and recommendation. The Review Board examined the EIA, written and oral presentations at the public hearings, and submits the following.

3.1 What are the expected environmental impacts on the quantity and quality of the water supplies of the Villages of Alix and Mirror and what mitigative measures are proposed?

3.1.1 Alix

Alix currently pumps water out of Parlby Creek in order to maintain water levels in Alix Lake, mainly for recreational use. Stabilization of Buffalo Lake with water from the Red Deer River would also stabilize Alix Lake. If the Buffalo Lake stabilization proceeds, pumping from Parlby Creek to Alix Lake would no longer be necessary and the village would realize considerable cost savings.

A comparison of the quality of Red Deer River water to that of Parlby Creek (EIA, Volume 3, Appendix II, Table 1.3) indicates nutrient concentrations are much lower in Red Deer River water than in that of Parlby Creek. The flushing effect which would occur during the initial filling of Buffalo Lake to an elevation within the stabilization zone could reduce the nutrient content of Alix Lake. This potential nutrient reduction could mean less algae and aesthetic improvement. No change in coliform bacteria in Alix Lake is expected (EIA, Volume 2, Appendix A, 24).

The Village of Alix currently uses ground water for its domestic water supply. If the stabilization of Buffalo Lake proceeds, Alix Lake may offer a better raw water quality than ground water. However, any future plans to use surface water as a domestic water supply would mean additional water treatment at an estimated capital cost of approximately $0.2 to $0.5 million.

No negative effects are predicted for either water quantity or quality in Alix Lake and therefore no mitigation is planned.

3.1.2 Mirror

Mirror withdraws water from Parlby Creek for its municipal water supply. Even though discharge in Parlby Creek appears to provide sufficient water to supply the needs of the village (EIA, Volume 2, 323) the timing of the actual withdrawal has created problems (see submission by the Village of Mirror to the Review Board). If Buffalo Lake is stabilized, the increased flow through Parlby Creek would provide a more assured water supply for the village. Agreements to turn on the pumps could be negotiated to stabilize Buffalo Lake and such agreements would provide an assured water supply to Mirror.

Diversion of Red Deer River water through Parlby Creek would likely improve water quality in Parlby Creek through a reduction in salinity and dissolved organic carbon. The reduction of salinity would improve the quality of raw water and, of drinking water. Possible reduction of dissolved organic carbon would reduce trihalomethane formation during the chlorination treatment of raw water.

No negative effects are predicted for either the quantity or quantity of municipal water supply for the Village of Mirror, consequently no mitigation is planned.

3.1.3 Conclusion

The Review Board is satisfied that the environmental impacts on the quantity and quality of water supplies for the villages of Alix and Mirror will be positive. However, the Review Board believes that careful and continued monitoring of domestic water supplies is necessary.

3.2 What environmental impacts are expected on the waterfowl, shore birds and colonial nesting birds of Buffalo Lake and what mitigation is proposed?

3.2.1 Waterfowl

The shoreline of Buffalo Lake and its bays is gradually sloped and stabilization would increase not only the shallow area of the lake, but also its surface, resulting in a larger area to support emergent and submergent vegetation. This vegetation is important to waterfowl for feeding, nesting and cover. Shallow bays would be enhanced by stabilization thus creating productive waterfowl breeding habitats. An increase in waterfowl is anticipated. Water fluctuations which create productive shoreline vegetation and wildlife habitat will continue.

They seem to have largely ignored Ducks Unlimited's submission.

Conditions which foster waterfowl botulism include warm, shallow and stagnant water. Stabilization would increase the water level in areas which are currently shallow and this could alleviate some of the botulism out-

breaks which have been recorded at Buffalo Lake. However, the re-flooding of previously dry shallow bays could also create new areas where botulism could develop.

There is some concern that breeding and moulting waterfowl could be disturbed by recreational activity on Buffalo Lake. Mitigation measures could include restricting recreational activities such as power boating in environmentally sensitive areas of the lake.

The channelization of portions of Parlby and Tail Creeks will reduce their suitability as breeding waterfowl habitat. Measures such as providing water to cut-off channel meanders and establishment of permanent waterfowl wetlands similar to those incorporated into the Phase IV Mirror backflood project will mitigate the effects of channelization.

3.2.2 Shore Birds

Some existing beach habitat would be flooded by the slight increase in water levels and of particular concern is flooding of existing or potential Piping Plover habitat on Buffalo Lake and its associated bays, notably Rockland Bay. Flooding of Piping Plover and other shorebird habitat would appear to be minimal. The best Piping Plover habitat occurs in Rockland Bay and flooding prevention of this habitat could be achieved by controlling flows through the culverts connecting Buffalo Lake with Rockland Bay.

Shore birds prefer to nest and feed on beaches which are largely devoid of vegetation and fluctuating water levels help to keep beaches free of vegetation. Fluctuations between seasons and years will continue and these fluctuations are expected to continue to keep some beaches free of vegetation.

Some potential exists for recreation-related disturbance to shore birds. Mitigation measures could include designation of areas which provide high quality shore bird habitat as off limits to recreational activities.

3.2.3 Colonial Nesting Birds

If stabilization proceeds, some of the islands in Buffalo Lake would be flooded by the higher water levels. To mitigate this loss, the islands would be raised using boulders, gravel and soil, which would maintain or enhance colonial-nesting bird habitat.

Some recreational-related disturbance of birds nesting on islands could be expected. An educational program which includes the use of warning signs would be implemented to minimize disturbance of nesting birds.

3.2.4 Conclusion

There are positive and negative environmental impacts. The Review Board expects the proponent to undertake all necessary mitigation in order to minimize negative impacts and enhance the positive impacts on waterfowl, shore birds and colonial nesting birds, particularly the Piping Plover.

3.3 What are the expected environmental impacts on the northern pike fisheries of Buffalo Lake and the Parlby Creek conveyance system and what mitigation measures are proposed?

The channelization of Parlby Creek will result in a slight loss of fisheries habitat. However, operation of the Spotted Lake backflood will assist northern pike spawning and a very significant increase in northern pike production is expected from Parlby Creek. As Parlby Creek is the only spawning location for northern pike from Buffalo Lake, an increase in the northern pike population of Buffalo Lake is anticipated.

An increase in the northern pike population of Buffalo Lake would be realized through the proposed water management activities in Parlby Creek without lake stabilization. However, water from the Red Deer River would improve conditions in Spotted Lake which, in turn, would eliminate the need to provide access through fish ladders and backflooding. The stabilization of Buffalo Lake is anticipated to have a minor, short-term positive benefit for the northern pike population in the lake due to a temporary (15 to 20 year) freshening of the lake.

Mitigation measures proposed for the Parlby Creek-Buffalo Lake Water Management Project include the following: cessation of pumping from the Red Deer River when suspended sediment loads are high; studies to ensure fish passage facilities and backflood operations are managed to support northern pike production from Parlby Creek; location of the water intake on the Red Deer River at a site which is not sensitive or critical fish habitat; construction of the water intake so it does not create a barrier to fish movements; screening of the water intake to ensure it meets appropriate water velocity criteria; timing of instream construction in the Red Deer River as recommended by Alberta Forestry, Lands and Wildlife's Fish and Wildlife Division; construction activities at the pumping station will be carried out in a manner that minimizes the potential for accidental spills into the Red Deer River; monitoring to ensure that lake stabilization water requirements will not jeopardize instream flow needs of the Red Deer River; and conducting of required stabilization works on Tail Creek in a manner that minimizes or eliminates any potential impacts on the Red Deer River's fisheries resources or habitats.

3.3.1 Conclusion

The project will create both positive and negative environmental impacts. The Review Board believes that management and co-operative efforts in a partnership between the proponent, the management team and relevant ad hoc committees will assist in minimizing any negative impacts and optimizing positive impacts on northern pike fisheries.

3.4 What are the expected environmental impacts on the water quality of Buffalo Lake and the Red Deer River and what mitigation is proposed?

The major impact on water quality is potential weed and algae growth caused by increased phosphorus levels and a reduction in salinity inhibition.

The phosphorus levels in Buffalo Lake currently range between 0.06 and 0.07 mg/L and sources of phosphorus which contribute to this condition include atmospheric deposition, inflow from the surrounding watershed (particularly Parlby Creek) and internal recycling from the sediments. The EIA assessment indicates that in the case of Buffalo Lake, internal recycling is the most significant source, accounting for approximately 53% of the total annual phosphorus loading. Based on river monitoring records from 1982 through 1988, the pumping regime should only increase annual phosphorus loadings to the lake by approximately 2%. The effect will be even less if phosphorus retention through sedimentation or biological uptake occurs along the conveyance route. This small increase in phosphorus loading should not significantly alter existing phosphorus levels in Buffalo Lake.

The initial raising of water levels will cause a 10-15% reduction in lake salinity and salt levels will then continue to increase at a very slow rate as they have in the past.

Existing algal growth in Buffalo Lake is currently regulated by phosphorus levels and salt inhibition. With pumping, phosphorus levels should not be changed significantly and the slight reduction in overall salinity should not result in algal growth outside the range experienced in recent years. If algal growth is not enhanced, winter oxygen levels in the lake should not be affected and may, in fact, be improved due to greater oxygen storage capacity at the time of freeze-up.

The stabilization of Buffalo Lake will directly affect water quality in the Red Deer River only on those occasions when the lake spills through Tail Creek. The planned channel improvements along Tail Creek should ensure that erosion does not contribute suspended solids downstream. The contribution of salts and nutrients will have a slight effect on Red Deer River water quality, however, it should still be possible to meet Alberta and transboundary water quality objectives.

3.4.1 Conclusion

The Review Board accepts the EIA's new water quality assessment which is a result of more refined scientific techniques, computer modelling and new information such as the greater influence of bottom sediments and ground water flows. This new information indicates that the water quality

impacts of the project on Buffalo Lake or the Red Deer River are not projected to be significant. No mitigation is proposed, however the Board agrees that monitoring of the pumped water and the lake should be conducted to confirm the EIA predictions. The Board believes that careful, ongoing monitoring of water quality in Buffalo Lake and the Red Deer River is necessary.

3.5 What are the expected environmental impacts on Alberta's requirement to meet its water quantity and quality obligations under the Apportionment Agreement and the South Saskatchewan River Basin Plan and what mitigative measures are proposed?

3.5.1 Water Quantity/Quality

Water quantity obligations under the interprovincial Apportionment Agreement and the South Saskatchewan River Basin Planning Program are assessed for the entire South Saskatchewan River basin using the Water Resources Management Model (WRMM). All agreements from the South Saskatchewan River Basin Planning Program are built into this model.

The most recent scenario from the WRMM, 0D05, is the multi-year modelling scenario representing the period from 1928 to 1986. Water requirements for the Buffalo Lake stabilization are built into this scenario at a rate of 75 cubic feet per second during May 1 to September 30 (153 days). This rate represents a continuous withdrawal of 2.12 cms during the May to September period and would only occur during the filling phase. Results from the 0D05 simulation indicate that obligations under the interprovincial Apportionment Agreement would be met every year during the 63–year simulation period. The actual water withdrawal for stabilization of Buffalo Lake would be even less than the amount allocated for stabilization under 0D05. More detailed modelling representing the time period 1969–1988 was carried out as part of the EIA. This modelling demonstrated that, after filling, pumping would be required only during 5 of the remaining 18 years. The maximum withdrawal requirement of 103 days under Scenario 2 pumping is less that 70% of those flows used in 0D05 for stabilization of Buffalo Lake.

Therefore, stabilization of Buffalo Lake will not affect Alberta's ability to meet water quantity obligations under the Apportionment Agreement of the South Saskatchewan River Basin Plan and no mitigation has been proposed.

The stabilization of Buffalo Lake will only directly affect water quality in the Red Deer River when the lake spills through Tail Creek. Planned channel improvements along Tail Creek should ensure that erosion does not contribute suspended solids downstream. The contribution of salts and nutrients will have a slight effect on Red Deer River water quality, however, it should still be possible to meet provincial and transboundary water quality objectives.

In the EIA water balance simulation, monthly diversion during filling represents on average, less than 3% of the actual discharge of the long-term mean flow of the Red Deer River. Following initial stabilization, mean annual pumping requirements are less than 0.5% of the long-term mean flow of the Red Deer River. Thus, the indirect impact of Buffalo Lake stabilization on water quality/quantity is negligible and no mitigative measures are necessary.

3.5.2 Conclusion

The Review Board is satisfied that the project will not hamper Alberta's ability to meet its water quality and quantity objectives set out in the Apportionment Agreement and the South Saskatchewan River Basin plan.

3.6 What are the expected impacts on the population, economy, resource/land use and services infrastructure surrounding Buffalo Lake and what mitigation is proposed?

The proposed lake stabilization is not expected to cause significant population increase in the area once the facilities are in place. During the construction season a temporary increase in population would occur.

The infrastructure (i.e. canal, access road, control structures) associated with the project could result in some loss of agricultural lands. In addition a stabilized Buffalo Lake may result in some loss of Crown land currently under long term lease. Compensation for any such losses would be subject to current government practices. The project may result in higher frequency of backflooding success (e.g. Spotted Lake) which could enhance production and may result in diversification of farm activities plus expansion of related service industries.

The project would provide Mirror with more flexibility in the timing of municipal water supply withdrawals and a more dependable water supply. The cost of these improvements to Mirror would be less than the cost of available alternatives. Recreational activity and tourism in the region would be enhanced by the project and increases in tourism and recreation activity should occur. This could be expected to lead to some diversification and

expansion of recreation/tourism facilities and some additional employment opportunities for local residents. The increase in cottage development anticipated over the next few years will also provide additional employment opportunities.

The Review Board notes that the assessment of the project prepared for public consideration in 1990 did not address the matter of economic impact. The Board was informed that concerns raised by residents of the affected region led Alberta Environment to request that an analysis of benefits and costs be prepared and added to the environmental impact assessment. The report of this analysis was included in the final report prepared by Environmental Management Associates in March, 1991 (see EIA, Volume II, 7.0). This portion of the report has been the subject of considerable interest and some controversy within the affected region and throughout Alberta and was the focus of considerable attention during the May 21-22 public hearings in Alix. Consequently, the Board has examined and considered these matters with particular care.

Interesting Comments

The Board notes that it has not been the practice in Alberta or elsewhere to apply economic criteria to all public expenditures. Enhancement of community amenities and cultural facilities often proceeds at the local, regional, and provincial level without analysis of economic impact or economic benefit-cost ratios. Similarly, projects directed toward the protection of wildlife, the preservation of wilderness, and the preservation or enhancement of aesthetic aspects of community facilities are not usually assessed on economic grounds.

In this respect public decision-makers probably reflect our private decision-making. It does not seem likely that the value of reading, of music festivals and concerts, or of sports and athletic activities are measured in economic terms and probably most Albertans are not inclined to measure the value of wildlife and wilderness reserves in terms of dollars.

The Board observes that the purposes of the proposed Parlby Creek–Buffalo Lake Water Management Project include the maintenance and enhancement of wildlife habitat and fish habitat, agricultural benefits, improved tourism and recreation and, in addition, enhancement of both quantity and quality of potable water supplies for the communities of Alix and Mirror. More broadly, the project is intended to contribute to improving the opportunity to retain existing commercial and industrial activity and the opportunity to attract new activities and additional population. Some of these objectives are clearly economic and some are not. Some of the objectives of the project would ordinarily be subject to judgment within economic criterion and some would not. This would seem to indicate that it is appropriate to consider an assessment of the economic benefits and costs of this project as one factor significant to determining the prudence of carrying it out.

It was clearly apparent to the Board that people in the affected communities are seeking a stable and secure economic future. It is also clear that

they understand that an improved domestic water supply, preservation of wildlife and fish habitat, control of water for agricultural purposes, flood protection and enhanced aesthetic appeal will encourage continuation or expansion of existing commercial activities, tourism and industrial activity and will assist the communities in their efforts to attract new businesses, additional industrial activity and tourism. They wish to assure a prosperous future for their communities and spokespersons for the communities repeatedly stated that they believe the proposed Parlby Creek–Buffalo Lake Water Management Project would aid their pursuit of these economic goals. It is probably this belief which caused them to request that a benefit-cost assessment be added to the EIA.

The Review Board observes that the assessment of benefits and costs submitted by the proponent does not reflect or address some of the benefits perceived by residents of the affected communities. The analysis is limited to assessment of anticipated increases in recreational activity, increases in certain property values, improved water supply for Alix and Mirror, and to an estimate of the impact of the project on the province of Alberta. The analysis does not address the impact of the project on the economic future of the affected region. The economic study submitted by the proponent also appears to assume economic stability without the project, and to presume that property values in the vicinity of Buffalo Lake would also be stable without the project. The Board has heard challenges to both of these assumptions from the East Parkland Community Futures Association, from other representatives of the affected communities, and from the non-resident and resident owners of cottages at Buffalo Lake.

The Board notes that the request for an assessment of the economic impact of the project on the region placed a considerable burden on the proponent. Assessment of the economic impact of a project of this complexity is difficult and requires careful and sensitive evaluation of the effects of the project on the complex social and economic structures of the affected communities. The magnitude of this task is determined by the complexity of the project rather than by its size.

Perhaps the economic value of the rural community could be assessed by summing up the value of investment in the community, the income streams generated in the community, and the support which such communities provide to the nation at large. It would be necessary perhaps to measure investment in farms, housing, businesses and industries in the community, and add to this the income earned by residents. It would be necessary then to measure forward and backward linkage to suppliers of goods and services (both public and private), and to those enterprises and individuals in urban communities whose income derives in some measure from processing and handling the products produced by the rural community. It would perhaps also be necessary to measure investment in public infrastructure and to count the cost of replacing it. It would then be necessary to determine how all of those factors might be affected by the project.

Whether or not such an exercise is necessary or worthwhile is perhaps debatable. The Review Board is persuaded, however, that whether or not it is actually assessed, the integrity of the rural community is of value to all Canadians and all Albertans, rural and urban. The significance of the integrity of the rural community is certainly important to rural residents, and briefs and comments submitted to the Board by several participants made this point. The Board considers that this significance extends beyond the directly affected communities and that the economic health of the rural community has a positive impact on society at large. The Board believes that enhancement of the viability of the affected rural community should be considered a social and economic benefit of the project.

The Board is of the view that if benefit-cost analysis and economic criteria are to be applied to a project, it is of great importance to ensure that such analysis addresses all evident effect of such impacts. The Review Board notes that the assessment of benefits and costs submitted by the proponent, estimated costs to exceed benefits by some $2 million, and the Board further notes that this negative balance had been the cause of some comment and controversy within the area affected by the project and elsewhere in Alberta. The Board was, therefore, particularly interested in the economic report prepared and submitted on behalf of the Pelican Point Community Association.

The Board notes that the proponent and the author of the estimate submitted by the proponent, agree with the Pelican Point Community Association that the estimate of benefits shown in the proponent's Table 7.3.3 and summarized in their Table 7.5.1, were incorrectly calculated. Specifically, a correct calculation of benefits, as based on assumptions in the report, shows total present value benefits of $13,607,360 and net benefits of $477,360 and a benefit-cost ratio of 1:1.034. The submission of the East Parkland Community Futures Association also drew attention to the incorrect calculations and estimated the recalculated benefit-cost ratio at 1:1.1.

The Board also notes that estimates of the value of an assured water supply to the Village of Mirror have been shown to be approximately double the value shown in the proponent's estimate of cost, $2 million rather than approximately $1 million. The brief submitted by the East Parkland Community Futures Association draws attention to the same discrepancy. The Board finds no reason to doubt the accuracy of the information submitted by the Village of Mirror in this matter.

The Board notes that the East Parkland Community Futures Association, the Pelican Point Community Association and others have drawn attention to the absence of attribution of secondary benefits in the estimates of benefits submitted by the proponent. The Board notes with particular interest the estimate of such benefits provided by the East Parkland brief. Several participants cited, in particular, the value of adequate water sup-

plies and the need to maintain community amenities in order to preserve the integrity of the community, and in order to facilitate community efforts to attract new business and industry.

Disagreement arose during the public hearings, concerning the extent to which benefits of the project would accrue to present and future cottage owners. The Board notes that existing cottages are not estimated to increase in value, but that the land on which they rest is expected to increase, on the average, by about $1,500. It is also noted that undeveloped land would also increase as a result of the project, and that this increase is also estimated at $1,500 per lot. The Board believes this is the only benefit accruing directly to the residents of recreational properties. Existing cottages or summer homes would not increase in value, and the price of new cottages or homes would not be increased either. All existing cottages have been built at the owner's expense and all new cottages would also be built at the owner's expense. The benefit of accelerated cottage development would derive from advancing the time at which the expenditure would be made. This change in time would constitute a benefit to the economy of Alberta.

3.6.1 Conclusion

The Board accepts the estimate of costs of the project submitted by the proponent and summarized in Table 7.5.1. The Board also accepts the estimate of benefits of $13,607,360 re-calculated by the Pelican Point Community Association as representing the benefits described by the proponent in their submission.

The Board is of the view that the treatment of economic impact submitted by the proponent, even as corrected at the hearings, understates both the gross benefits and the net benefits of the project. The Board concludes that benefits exceed costs. The Board further concludes that the estimate submitted by the proponent probably understates the water supply benefit to the Village of Mirror by approximately $1 million. The Board also concludes that the Parlby Creek–Buffalo Lake Water Management Project would bring to the communities surrounding Buffalo Lake, economic and other benefits of significant magnitude. These benefits have not been quantified but they are in addition to the quantified benefits attributed to the project by the proponent.

The Board believes that the project will have significant impact on the viability of the affected rural communities, and that it will have a social and economic benefit to all of Alberta which, whether or not it is quantified, should be considered as additional calculated gross and net benefits attributed to the project.

The Board concludes that economic evaluation supports the prudence of carrying out the Parlby Creek–Buffalo Lake Water Management Project.

3.7 Is the project environmentally acceptable? What terms and conditions will be required in the necessary permits and licences?

The EIA has shown that with appropriate mitigation and operating procedures, there are no environmental parameters that indicate that project cannot proceed. Specifically, the EIA indicates the following:

- The proposed stabilization zone is within the historical range of lake level fluctuation.
- Productive shoreline vegetation and wildlife habitat will continue to exist with lake stabilization.
- Some potential exists for recreation related disturbance to shore birds; this can be mitigated by restricting recreational activities in sensitive areas.
- An assured water supply of improved quality would be available to the Village of Mirror; the Village of Alix would benefit by the stabilization of Alix Lake.
- An increase in the northern pike population in Buffalo Lake will be realized.
- All construction-related activities will be regulated to mitigate potential impacts on fish habitat, for example, in construction timing windows, screened water intake, etc.

Stabilization of Buffalo Lake will not affect Alberta's interprovincial obligations under the Master Agreement on Apportionment, or the water requirements to protect instream flow needs along the Red Deer River. Results from the EIA indicate minor changes in water quality; these results are different from previous studies based on a better understanding of the water balance (role of ground water), nutrient cycle within the lake (role of sediments) and role of calcite precipitation in the lake as well as additional water quality data and monitoring results available since 1982. The water quality impacts of this proposal on Buffalo Lake and the Red Deer River are insignificant.

Alberta Environment has made a commitment to establish a local advisory committee to provide advice to the Minister/the department on how the project should be built and operated and where appropriate mitigation should be taken. For example, concerns related to conflicts between recreation and wildlife, and flood easement, etc. would be discussed locally and mutually acceptable mitigation actions undertaken. This would be an extension of the public consultation that is occurring right now regarding project operations along the Parlby Creek component of the project (e.g. Spotted Lake Advisory Committee). The local advisory committee and the consultation process would be initiated subsequent to an approval of the

project by the government, and would continue throughout the operating life of the project.

A licence under the Water Resources Act of Alberta is required for the diversion and use of water from the Red Deer River and the construction of outlet control works on Buffalo Lake and Tail Creek. The review for licensing would involve input from the Fish and Wildlife Division of Alberta Forestry, Lands and Wildlife, to address requirements for fish and fish habitat. Authorizations under the Public Lands Act of Alberta would be required to construct the river intake structure and address any impacts on public (Crown) lands along any portion of the project.

In general, all relevant plans and reports (e.g. EIA) would be filed as part of the licence application under the Water Resources Act. Specific terms and conditions would include: instream construction timing windows on the Red Deer River, Buffalo Lake, and Tail Creek; minimizing siltation in the Red Deer River, Buffalo Lake and Tail Creek; reclamation of disturbed areas (within one growing season); the time period for construction; the maximum annual diversion quantity from the Red Deer River; specific time period during which diversions from the Red Deer River can take place, and a minimum flow on the Red Deer River at which diversions cease; maintenance specifications for structures and channels (weed controls, etc.); actions for emergency spills (contaminants) on the Red Deer River, Parlby Creek, etc.; and general statements on how to obtain local input on project operations.

3.7.1 Conclusion

The Review Board considers that the existing regulatory framework (the Water Resources Act, the Land Surface Conservation and Reclamation Act and the Historical Resources Act, etc.) will be sufficient for the implementation of this project. The Board believes the project is environmentally acceptable provided that the proposed mitigative measures are carried out, the project is operated in such a way that it recognizes environmental parameters and that major stakeholders are represented on the Buffalo Lake Water Management Team.

4. Summary of Conclusions by the Review Board

"...at the same time all we have to do is look at the plight of our small rural communities. Anyone can see that economic development is essential to preserve even the slightest vestige of life, as we have known it, in rural Alberta. If we have any care for people, any sensitivities at all for the future we must support this type of rural development. Not unequivocally, but with sensible common sense, a commodity, Mr. Chairman, that if used more widely would see less strife, more co-operation and intelligent progress." Neil Gilliat, Westcan Malting Ltd.

The Parlby Creek–Buffalo Lake Water Management Project is a multiple use water management project which will provide agricultural flood control, fish and wildlife habitat enhancement, municipal water supplies and the stabilization of water levels in Buffalo Lake. The first four phases of the project are nearing completion and the fifth phase is awaiting final approval. The fifth phase is a crucial part of the whole project as it supplies the water to enhance the first four phases, municipal water supplies, environmental considerations, lake stabilization and the criteria as a multi use water project.

The majority of municipal, community, and corporate representatives in the area affected by the Parlby Creek–Buffalo Lake Water Management Project overwhelmingly support the project. Most of those who appeared before the Board directly and indirectly representing other Central Alberta centres, and the Calgary and Edmonton areas also support the project. Public consultation has been comprehensive over a long period of time, in fact, the EIA prepared by Environmental Management Associates is the latest in a long list of studies on the subject. This body of material is sufficient to permit a well-informed decision and there would be little value in additional public consultation initiatives or studies.

There is a long history of community spirit, co-operation and mutual support for the project. Those concerned perceive the project as an important ingredient in the economic viability and quality of life in the region. The Villages of Alix and Mirror, the agricultural community, and fish and wildlife interests have already demonstrated their ability and desire to work together. This is a valuable illustration of the multiple use nature of the entire five phases of the project.

The project is complex and will affect several provincial, municipal and community organizations, and many individuals both in the region and elsewhere. A "Parlby Creek–Buffalo Lake Management Team" involving major stakeholders could best look after and be responsible for the operation, maintenance and long term monitoring of the project. Special advisory groups could provide valuable input for selected critical areas. This support and interest is available in the region. This type of partnership could best provide the integrated management to maximize the social, economic and environmental benefits of the project.

Local requests for government assistance to deal with problems caused by water fluctuation began about 1900 and intensified in the mid 1970s. Additional environmental considerations and requirements for secure quantity and quality of water supplies further establish the need for the project and are in concert with the project motives as stated by the proponent.

There will be positive impacts on the quantity and quality of the water supply to the Villages of Alix and Mirror. The impacts on the water quality of Buffalo Lake and the Red Deer River will not be significant and while no mitigation is planned, monitoring should be carried out to confirm the predictions found in the EIA. The project will not hamper Alberta's ability to meet its water quality and quantity objectives under the Apportionment Agreement and the South Saskatchewan River Basin Plan.

There will be positive and negative impacts on waterfowl, shore birds and colonial nesting birds and the proposed mitigation must be implemented to minimize the negative impacts. Northern pike fisheries at Buffalo Lake will incur both positive and negative environmental impacts and continued management and co-operation of all concerned parties will minimize any negative impacts. The positive impacts of the project will have direct and indirect benefits for the area.

Based on the commitment by the proponent to mitigate and monitor environmental impacts, together with the operational flexibility of the project, there are no environmental parameters that indicate this project cannot proceed.

Stabilization is not a precise action. Lake levels can fluctuate within the stabilization zone and the project has ample operational flexibility to accommodate the multiple use aspect of the lake as well as incorporating the potential to handle any future unknowns.

There are no apparent public concerns about the design of the project and the design is accepted with the direction that the proponent proceed with its self-described overly cautious approach, determining areas of potential cost savings in the process, where possible.

There will be no significant impacts on the population, resource land/use and services infrastructures of the area and no mitigative measure are planned.

The Board concurs with the analysis of the economic impact submitted by several presenters and agreed to by the proponent and concludes that benefits exceed costs. The estimate submitted by the proponent probably understates the water supply benefit to the Village of Mirror. The Parlby Creek–Buffalo Lake Water Management Project would bring economic and other benefits of significant magnitude to the communities surrounding Buffalo Lake.

Economic evaluation supports the prudence of carrying out the Parlby Creek–Buffalo Lake Water Management Project.

The existing regulatory framework is sufficient for the implementation of this project. The project is environmentally acceptable provided that the proposed mitigative measures are carried out, the project is operated in such a way that it recognizes the environmental parameters and that major stakeholders are represented on the Buffalo Lake Management Team.

5. Recommendations

After careful consideration of the evidence presented, the Parlby Creek–Buffalo Lake Water Management Project Review Board makes the following recommendations:

1. Phase V of the Parlby Creek–Buffalo Lake Water Management Project should proceed.

2. A Buffalo Lake Management Team should be established. The team should consist of representatives of the proponent and major stakeholders who can work in partnership to reflect the multiple use nature of the project. The Management Team should have the benefit of input from special advisory groups for selected critical areas in the region.

3. The Management Team should develop a detailed project management plan to address the following issues:

   a) implementation of the construction phase of the project
   b) development of an operational plan to reflect the multiple use nature of the project
   c) the type and timing of mitigation measures
   d) ongoing monitoring
   e) planning to respond to unpredicted events
   f) establishment of a land use, surface water shoreline plan to optimize the natural resource use, reduce potential conflicts, and ensure adequate public access.

4. The project must comply with all relevant provincial acts and regulations.

Appendix I

PROVINCE OF ALBERTA

DEPARTMENT OF THE ENVIRONMENT

MINISTERIAL ORDER NO. 04/91

THE DEPARTMENT OF THE ENVIRONMENT ACT

WHEREAS the Minister of the Environment (the "Minister") may establish a board to act in an advisory capacity in connection with any of the policies, programs, services, or other matters under his administration.

AND WHEREAS the Minister has established a policy and program to identify and assess the environmental impacts of proposed developments in Alberta through the Environmental Impact Assessment Guidelines for the preparation of environmental impact assessment reports.

AND WHEREAS the Minister, pursuant to Section 8 of the Land Surface Conservation and Reclamation Act, has the authority to require the preparation of an environmental impact assessment report.

AND WHEREAS it has been proposed that a multi-purpose water management project for the purposes of agriculture, flood control, wildlife habitat enhancement, municipal water supply and stabilization of water levels in Buffalo Lake be implemented by the pumping of water from the Red Deer River (the "project").

AND WHEREAS the Minister has required on November 7, 1989 pursuant to Section 8 of the Land Surface Conservation and Reclamation Act, the preparation and submission of an environmental impact assessment report.

AND WHEREAS it is required that public consultation be undertaken in the preparation of an environmental impact assessment so that the public is able to identify potential environmental impacts and concerns.

AND WHEREAS Environmental Management Associates has prepared and submitted an environmental impact assessment report to the Minister entitled "Parlby Creek–Buffalo Lake Development Project Environmental Impact Assessment" together with associated supplemental information.

AND WHEREAS it is necessary and desirable to conduct public hearings regarding the environmental impact assessment report of the project.

THEREFORE I, RALPH P. KLEIN, Minister of the Environment, pursuant to Section 6 of the Department of the Environment Act hereby establish a board to be known as "The Parlby Creek–Buffalo Lake Water Management Project Review Board" to advise and make recommendations on the environmental impact of the project upon the following terms and conditions:

A. Membership

1. The Review Board shall consist of the members set out on the attached Schedule "A."
2. The members of the Review Board shall be paid remuneration and reasonable travelling and living expenses as specified in *Schedule 1, Part A of the Committee Remuneration Order being Order in Council 1175/80.*
3. The term of the Review Board shall be until a final report as described in section "D" is accepted by the Minister.

B. Terms of Reference

The Terms of Reference of the Review Board shall be to hold public hearings:

1. To review the environmental impact of the project and the proposed mitigative measures, including an examination of the following:
   a) the expected impacts on the quantity and quality of the water supply for the villages of Alix and Mirror;
   b) the expected impacts on the waterfowl, shore birds, and colonial nesting birds of Buffalo Lake;
   c) the expected impacts on the Northern pike fisheries of Buffalo Lake and the Parlby Creek conveyance system;
   d) the expected impacts on the water quality of Buffalo Lake and the Red Deer River;
   e) the expected impacts on Alberta's requirement to meet its water quality and water quantity obligations under the Apportionment Agreement and the South Saskatchewan River Basin Plan, and
   f) the expected impacts on the population, economy, resource/land use, and the services/infrastructure surrounding Buffalo Lake.
2. To review the degree to which the local citizens' concerns have been addressed by the proponent.
3. To provide advice regarding the environmental acceptability of the project and terms and conditions as appropriate for inclusion in the necessary permits and licences.

C. Procedures

1. Subject to the approval of the Minister and the procedures hereinafter described, the Board shall make rules or procedures governing the calling of meetings and hearings, intervenor funding, the procedure to be used at and conduct of the meetings and hearings, reporting, and any other matters as required.
2. The Review Board shall hold public hearings in the Village of Alix.
3. The Review Board will establish and announce the date of public hearings in a reasonable and timely manner.
4. The Review Board will receive written and oral submissions from the public upon the EIA and any matter falling within the Terms of Reference of the Board.

D. Reporting

1. The Review Board shall complete its review on a timely basis consistent with the Terms of Reference.
2. The Review Board shall provide a report to the office of the Minister of the Environment.
3. The Minister of the Environment will make the report public in a timely fashion.

DATED at the City of Edmonton, in the Province of Alberta, this 27 day of March, 1991.

signed
Ralph P. Klein
Minister of the Environment

Appendix II

Parlby Creek–Buffalo Lake Water Management Project Review Board

Written and Oral Submissions

Name	Type of Organization
A. Grice	Individual
Alberta Foundry Ltd.	Corporate
Alix Chamber of Commerce	Community
Alix Wagon Wheel Museum	Community
Bashaw & District Chamber of Commerce	Community
Dave Hagen	Individual
Debra Ferrey	Individual
Donald Stockwood	Individual
Donna & Mike Festeryga	Individual
Dr. C.D. Bird	Individual
Ducks Unlimited	Community
East Parkland Community Futures Association	Community
Friends of Buffalo Lake (1,395 signatures)	Community
Gary Feltham	Individual
George McTaggert	Individual
Glenn Feltham	Individual
Grace & P.D. Sproule	Individual
H.I. Barritt	Individual
Jack McTavish	Individual
Jeff Hansen	Individual
John Lund	Individual
Kathie Hankins	Individual
Kay and Garvin Anderson	Individual
L. & C. Thurston	Individual
Lacombe Chamber of Commerce	Community
Lindsay Smith	Individual
Lucinda Gold Resources Ltd.	Corporate
Mannclan	Community

Name	Type of Organization
Margaret Vallet & 11 others	Individual
Martha Inions	Individual
Martha Kostuch	Individual
Michael O'Brien	Individual
Mirror Chamber of Commerce	Community
Neil Miller	Individual
Pelican Point Community Association	Community
Pelican Point Park Management Committee	Community
Postma & Edmunds	Individual
R. Carlyle	Individual
Randy Lawrence	Individual
Red Deer Regional Planning Commission (Ad Hoc Committee)	Municipal
Red Deer River Naturalists	Community
Rene & Mary Anne Gendre	Individual
Richard Kutt (and 25 others)	Individual
Rochon Sands Hall & Recreation Association	Community
Serv-Alta Engineering Ltd. for the Village of Mirror	Municipal
Stettler & District Chamber of Commerce	Community
Stettler Economic Development Board	Municipal
Summer Village of White Sands	Municipal
Tom Rider	Individual
Tony's Bay Marina	Corporate
Town of Lacombe	Municipal
Tom W. Sprague	Individual
Town of Stettler	Municipal
Village of Alix	Municipal
Village of Mirror	Municipal
Westcan Malting Ltd.	Corporate

Appendix III

The Review Board

Don Thorne

Chairman, of Lacombe, is an independent businessman and a former mayor of the town of Lacombe. Mr. Thorne has served at several levels of government, as a director of the Lacombe Regional Solid Waste Authority and the Red Deer Regional Planning Commission and as a member of the Ministers Council on Local Development. He was a founding member of the Alberta Association of Safety Personnel, a director and past president of the Red Deer Real Estate Board and a former director of the Alberta Real Estate Association.

Ron Peiluck

Board Member, of Bragg Creek has a B.Sc. in bio-chemistry and microbiology and completed post graduate studies in business administration (D.Bus.Admin.) at the University of Western Ontario and Resource Planning (M.A.) at the University of Manitoba. Mr. Peiluck has spent the last 26 years working as an environmental and management consultant to senior levels of government and industry on an international scale. He has served as an expert witness and has contributed to numerous judicial and quasi-judicial bodies including the National Energy Board, Manitoba Water Resources Commission, Saskatchewan Qu'Appelle Valley Planning Authority, Alberta Energy Resources Conservation Board, Federal Environmental Assessment Review Office and the United States Federal Power Commission. Formerly a rancher in the Foothills, he now resides west of Bragg Creek and is chief executive officer of Scope Environmental Auditing Services Corporation, Calgary.

Charlie Weir

Board Member, of Edmonton, a professional engineer and professional surveyor has more than 35 years experience in engineering, surveying, planning and consulting. He has represented Canada and Alberta at provincial, national and international meetings. A former principal and senior partner of Stewart, Weir Group, Mr. Weir has extensive experience in multi-use transportation corridor planning in Alberta and was the consulting engineer for the Secondary Roads Study which covered almost half of the province. He has extensive experience as a consultant in drainage, water source projects and lake side subdivision and development for rural municipalities. A recipient of numerous awards within his profession, Charlie Weir has been appointed Honorary Life member of several professional organizations.

IV Appendix IV

Buffalo Lake Studies and Reports In Chronological Order

1. Prairie Farm Rehabilitation Administration. 1968. *Parlby Creek Project — Preliminary Engineering Report.*
2. Alberta Environment. 1976. *Summary Report — Parlby Creek — Spotted Lake Flood Control Project.*
3. Red Deer Regional Planning Commission and Research Section. 1977. *Buffalo Lake Management Plan: A Summary Statement.*
4. Alberta Environment. 1978. *Buffalo Lake Environmental Overview and Review of Management Alternatives.*
5. Acres International Consulting Services Ltd. 1979. *Buffalo Lake Regulation — Phase I*-Pre-Planning Study. Prepared for Alberta Environment.
6. Alberta Environment. 1979. *Buffalo Lake Regulation Study Phase I — Regulation Alternatives.*
7. Alberta Environment. 1979. *Generation of Hydrological Data and Stabilization Alternatives.*
8. Reid Crowther. 1979. *Buffalo Lake Water Quality Review.*
9. Alberta Environment. 1980. *A Review of the Potential for Multi-Purpose Use of a Pump Diversion from the Red Deer River to Buffalo Lake.*
10. Prairie Farm Rehabilitation Administration. 1980. Engineering Report — *Parlby Creek-Spotted Lake Flood Control Study.*
11. Acres International Consulting Services Ltd. 1981. *Buffalo Lake Stabilization — Phase II* — Engineering Feasibility. Prepared for Alberta Environment.
12. Alberta Environment. 1981. *Buffalo Lake Stabilization.*
13. Chemical & Geological Laboratories Ltd. 1981. *Buffalo Lake Macrophyte and Littoral Sediment Survey.*
14. Ducks Unlimited. 1981. *Preliminary Multi-Use Proposal for the Parlby Creek–Buffalo Lake Area.*
15. Environmental Management Associates. 1981. *Wildlife Investigation Related to a Proposed Diversion of Water from the Red Deer River to Buffalo Lake via Parlby Creek.*
16. IBI Group. 1981. *Buffalo Lake Recreation Study.*
17. IBI Group. 1981. *Buffalo Lake Recreation Study — Appendices.*
18. Acres International Consulting Services Ltd. 1982. *Final Report — Buffalo Lake Regulation Study — Phase II — Modes of Operation.* Prepared for Alberta Environment.

19. Alberta Environment. 1982. *Buffalo Lake Regulation Study — Phase II.*

20. Alberta Environment. 1982 *Groundwater Study, Buffalo Lake Stabilization — Phase II.*

21. Alberta Environment. 1982. *Preliminary Multi-Use Proposal for the Parlby Creek–Buffalo Lake Area.*

22. Buffalo Lake Action Committee. 1982. *Buffalo Lake Stabilization Study, Social and Public Participation Component — Final Report Phase II.*

23. Hardy B.B.T. 1982. *Environmental Summary Report Stabilization Project.*

24. Lifeways of Canada Ltd. 1982. *Historical Resources Impact Assessment — Buffalo Lake Stabilization Project.*

25. Acres International Consulting Services Ltd. 1983. *Buffalo Lake Regulation Study — Parlby Creek Flood Control.* Prepared for Alberta Environment.

26. Hardy B.B.T. 1983. *Geotechnical Investigation — Proposed Spotted Lake Project.*

27. Hickman, M.E. Bombin and M. Bombin, 1983. *A Paleo-environmental History Derived from Core Taken from Buffalo Lake Alberta.*

28. UMA Engineering Ltd. 1983. *Report on Flooding Problems on Upper Parlby Creek and on Regulation of the Water Levels of Buffalo Lake.*

29. Alberta Environment. 1984. *Buffalo Lake Conductivity Profiles Under Ice, 1982-1983.*

30. Alberta Environment. 1984. *Buffalo Lake Mass Balance Study.*

31. Alberta Environment. 1984. *Buffalo Lake Regulation Studies: Phase III — Water Quality* Main Report.

32. Norecol Environmental Consultants Ltd. 1984. *Buffalo Lake Water Quality Modelling Study — Volume I.* Prepared for Alberta Environment.

33. Alberta Environment. 1985. *Spotted Lake Management Dyke Alternatives — Level I Feasibility.*

34. Alberta Environment. 1985. *Spotted Lake Management Review of Development Scenarios.*

35. W-E-R Engineering Ltd. 1985. *Report of Management Options for Spotted Lake.*

36. Alberta Environment. 1986. *Spotted Lake Channelization Level I.*

37. Alberta Environment. 1986. *Spotted Lake Channelization Level I Design — Revised.*

38. Alberta Environment. 1987. *Studies into the Effects of Proposed Buffalo Lake Stabilization on Algae Growth.*

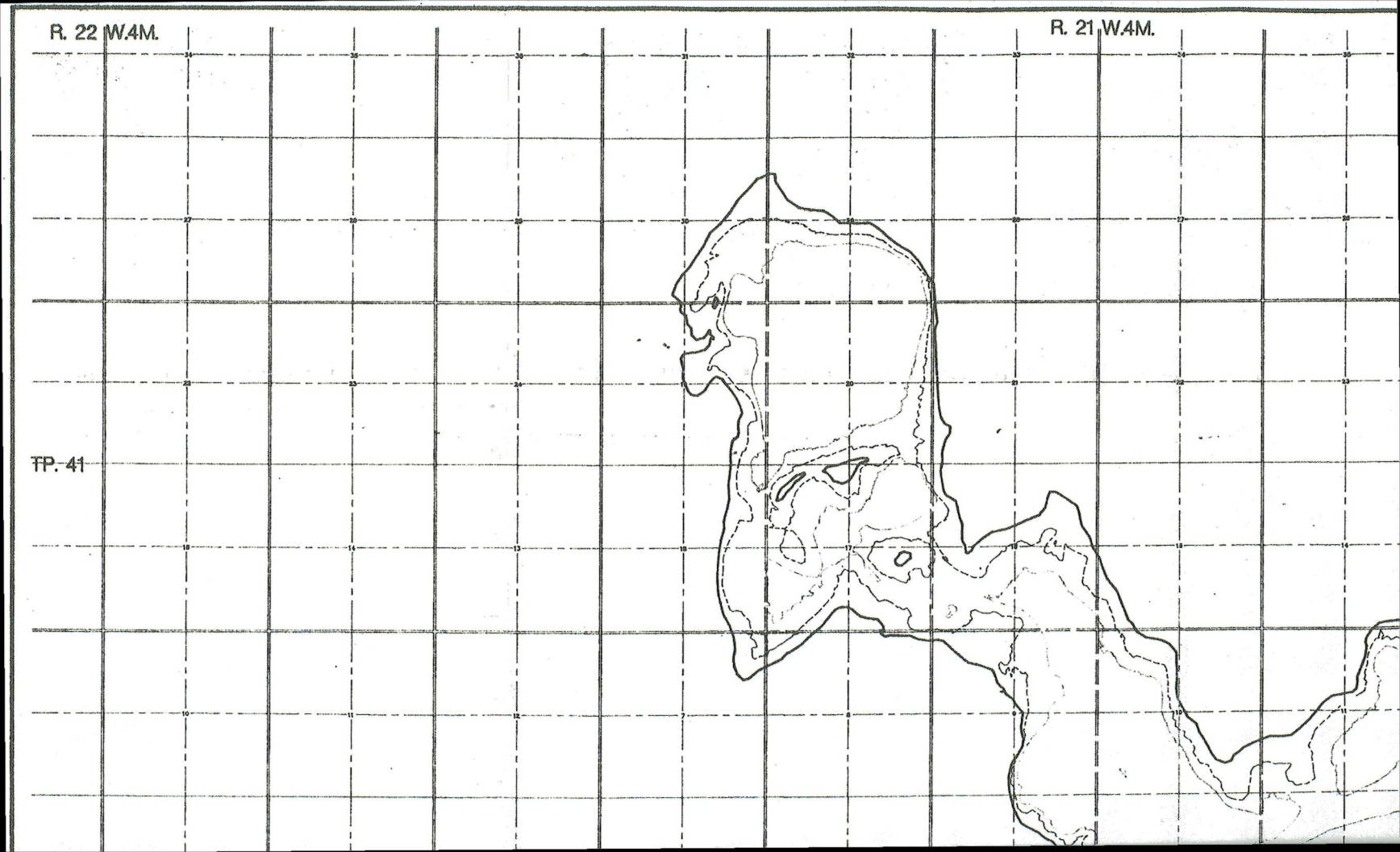
39. Alberta Environment. 1989. *Water Quality Evaluation of Buffalo Lake Stabilization Project.*

40. Alberta Environment. 1990. *Parlby Creek–Buffalo Lake Development Project — Buffalo Lake Stabilization Component, Level I Engineering Report.*

41. Environmental Management Associates. 1991. *Parlby Creek–Buffalo Lake Development Project — Environmental Impact Assessment Volume One — Summary Report.*

42. Environmental Management Associates. 1991. *Parlby Creek–Buffalo Lake Development Project — Environmental Impact Assessment Volume Two — Main Report.*

43. Environmental Management Associates. 1991. *Parlby Creek–Buffalo Lake Development Project — Environmental Impact Assessment Volume Three — Technical Appendices.*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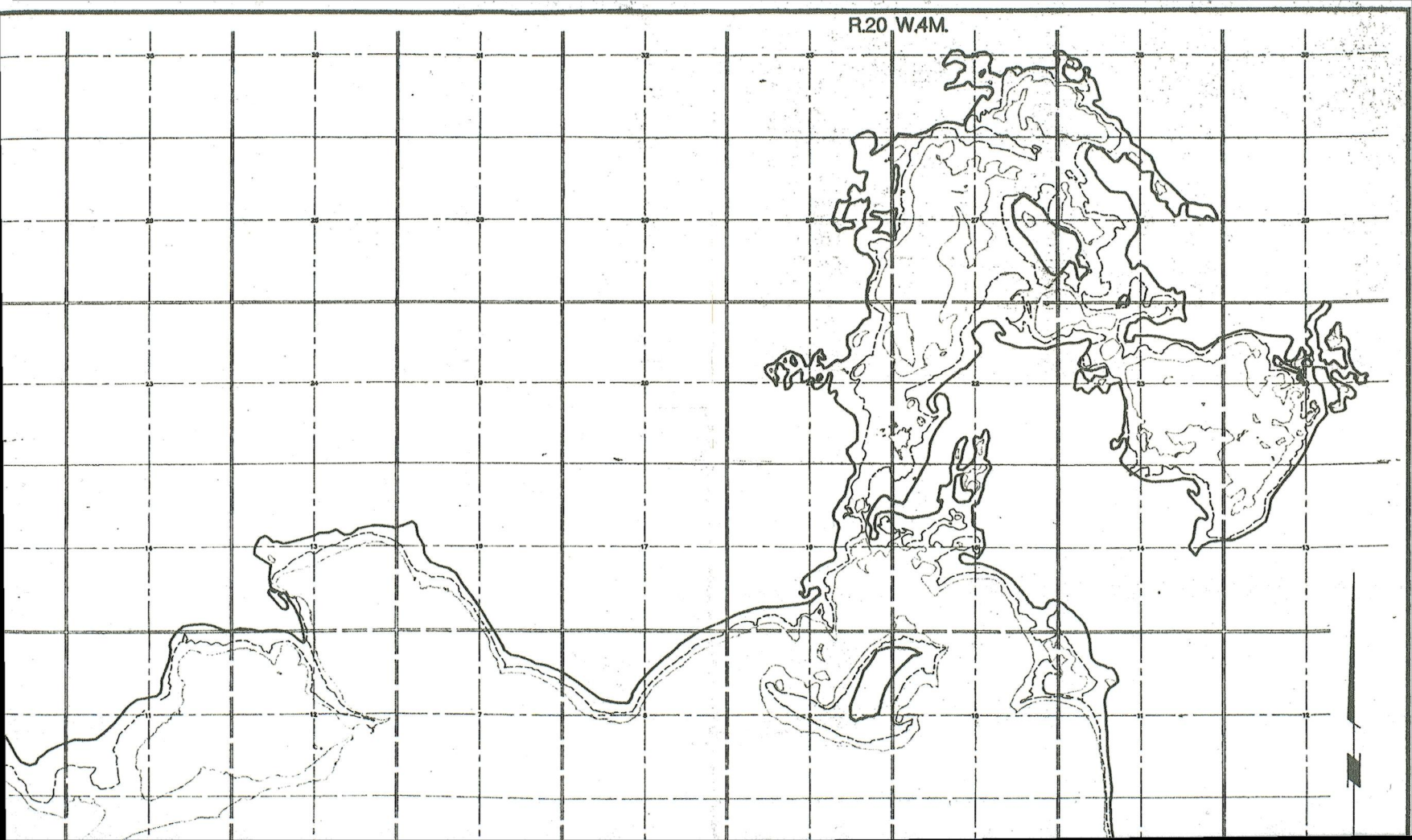
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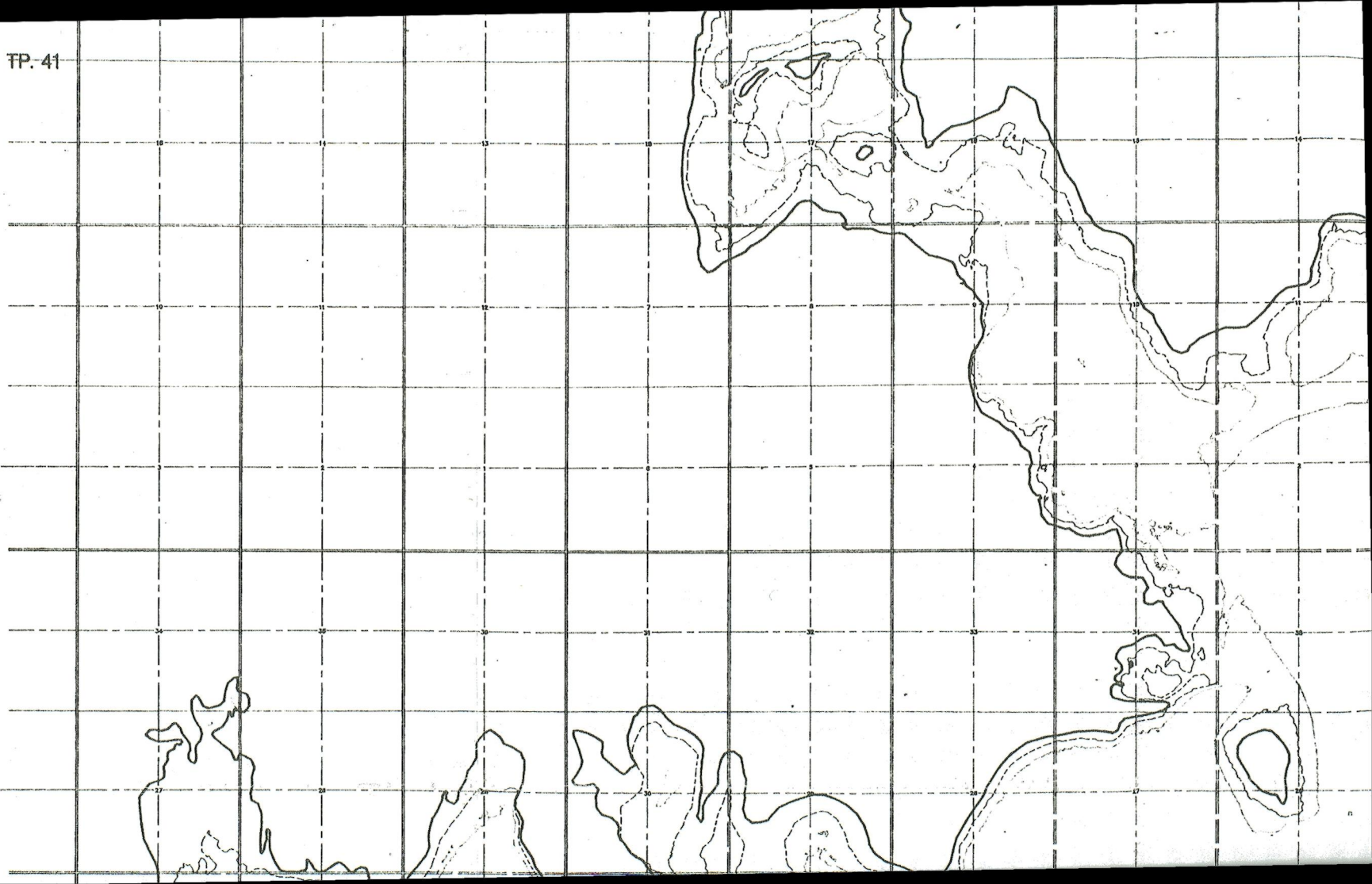
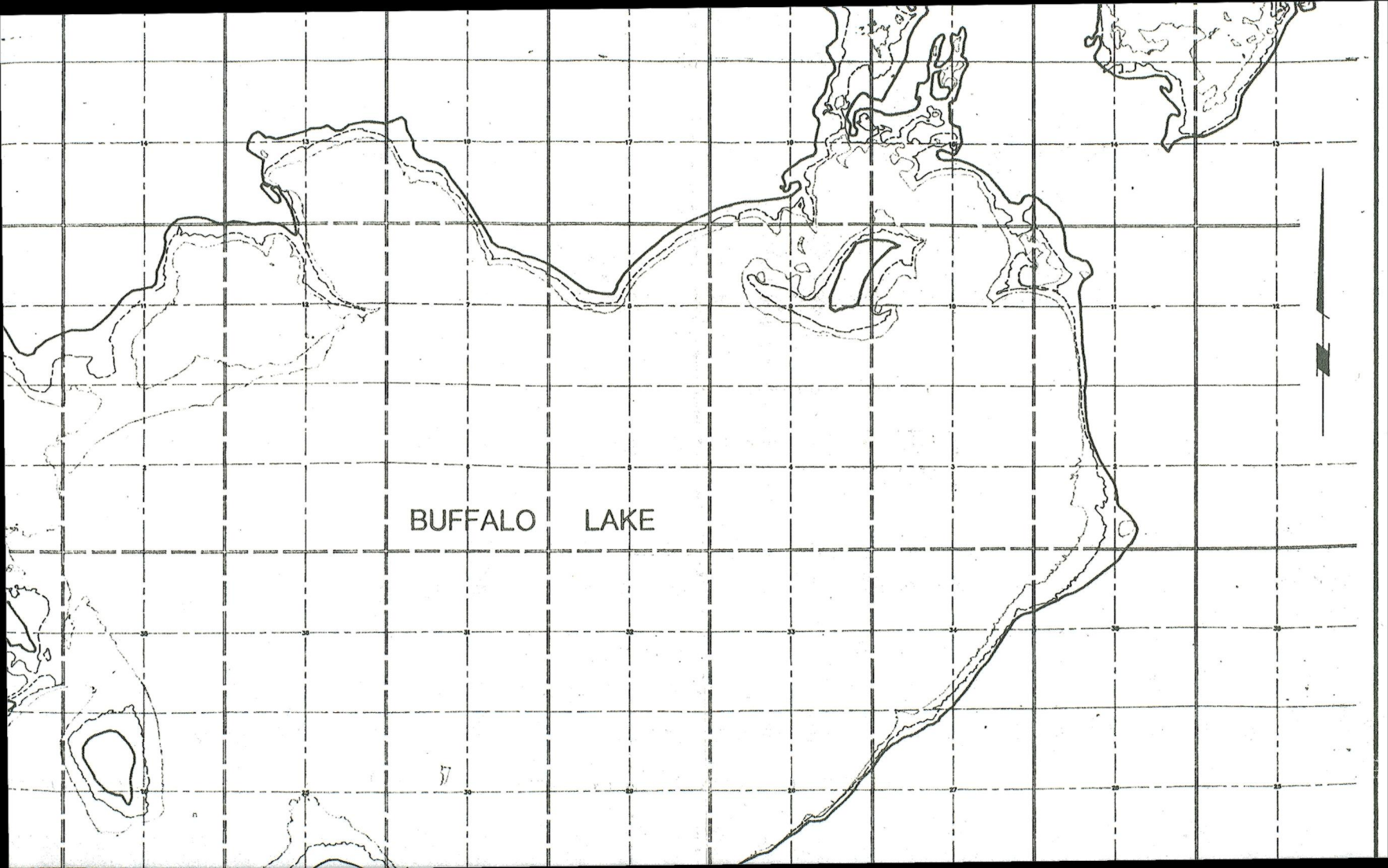
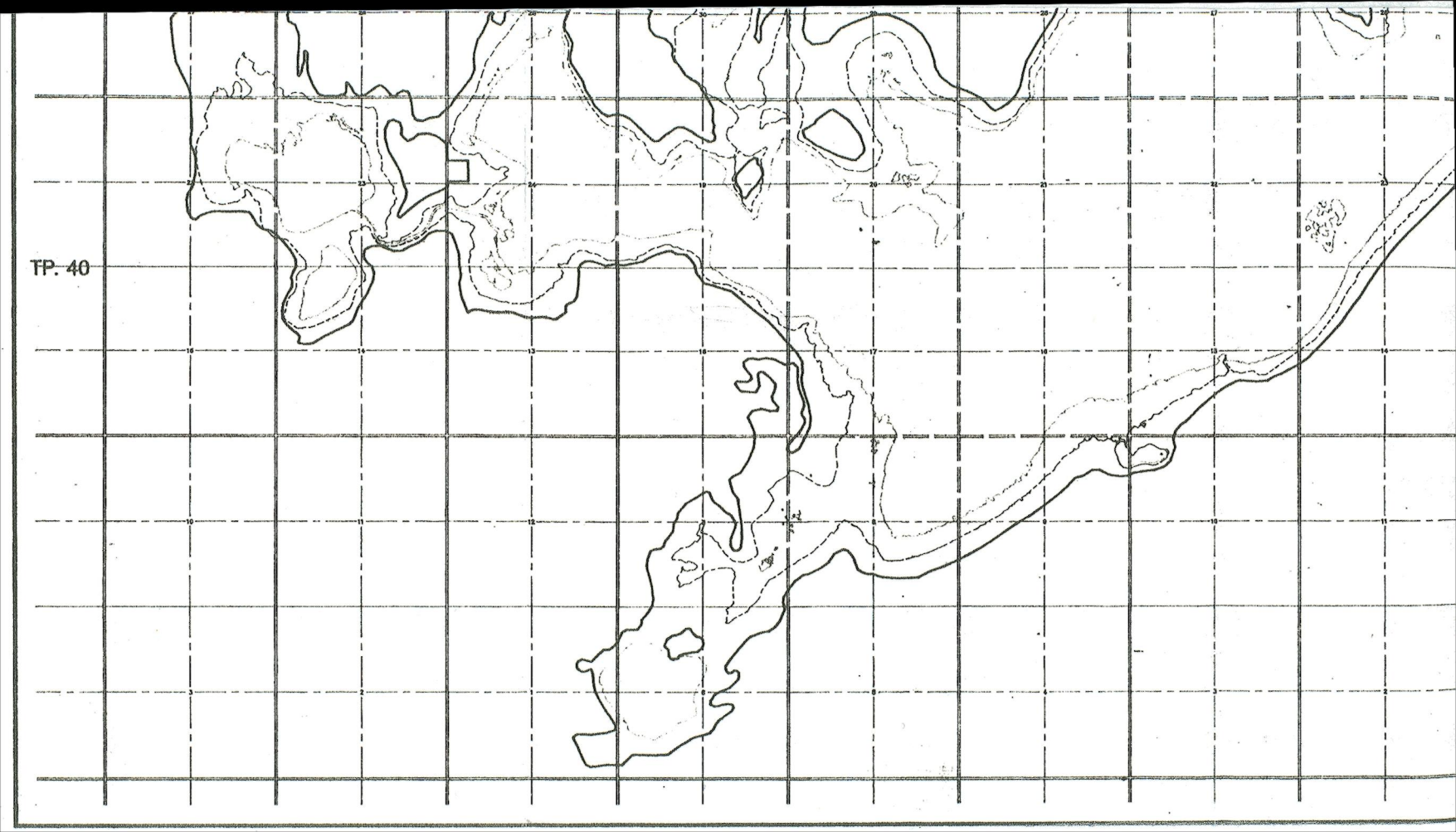



BUFFALO LAKE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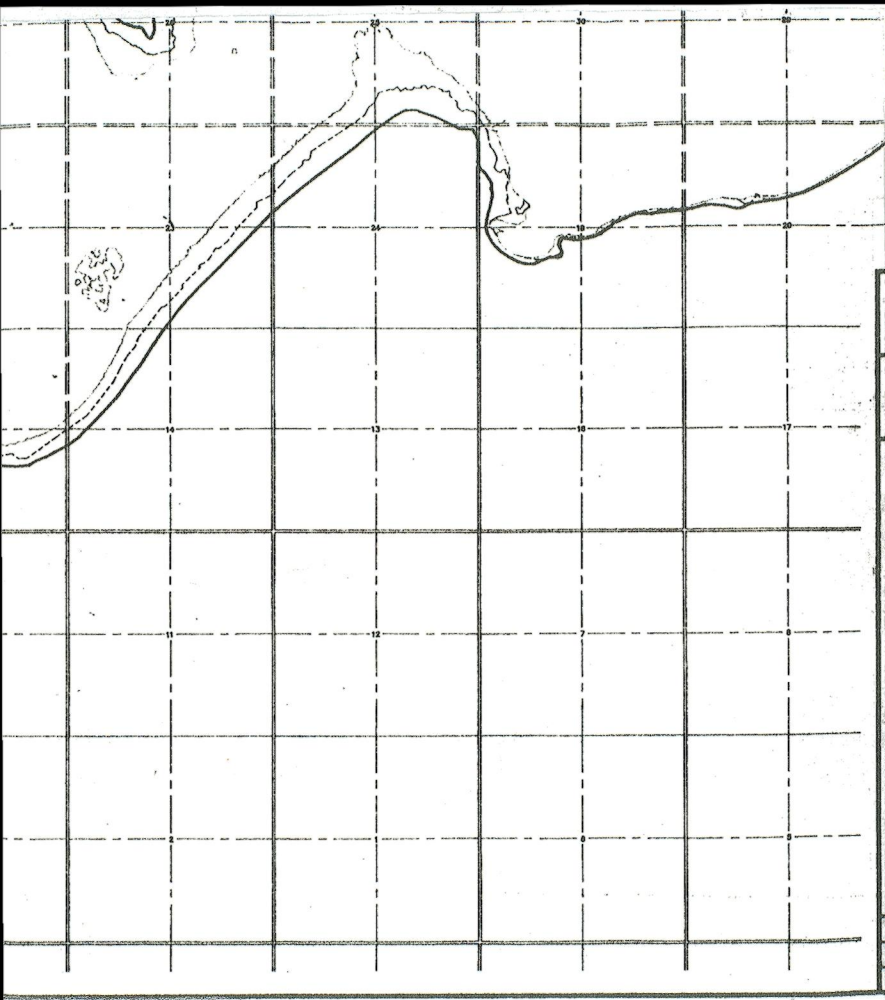

PARLBY CREEK - BUFFALO LAKE WATER MANAGEMENT PROJECT

SKETCH SHOWING APPROXIMATE POSITIONS OF THE WATERLINE IN 1976 AND 1989 RELATIVE TO THE BANK AS SHOWN ON THE OFFICIAL PLANS OF THE TOWNSHIPS

WATERLINE TAKEN FROM AN ORTHOPHOTO MAP PREPARED FOR ALBERTA ENVIRONMENT BY STEWART WEIR LAND DATA INC. IN 1991, INTERPRETED FROM AERIAL PHOTOGRAPHY TAKEN ON 3 MAY, 1976, SHOWN THUS: ----------

WATERLINE TAKEN FROM AN ORTHOPHOTO MAP PREPARED FOR ALBERTA ENVIRONMENT BY STEWART WEIR LAND DATA INC. IN 1991, INTERPRETED FROM AERIAL PHOTOGRAPHY TAKEN ON 19 OCT., 1989, SHOWN THUS: ----------

BANK COPIED FROM OFFICIAL PLANS OF THE TOWNSHIPS, WHICH ARE BASED ON TRAVERSES BY W.H. NORRISH, D.L.S., IN 1917 AND 1918.
SHOWN THUS: ——————

THE POSITION OF THE BANK ACCORDING TO THE TRAVERSES BY W.H. NORRISH (1917/18) IS SIMILAR TO THE POSITION SHOWN ON THE FIRST EDITIONS OF THE PLANS OF THE TOWNSHIPS WHICH ARE DATED 1894.

FIGURE 3

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0 500 1000 2000 3000 4000
METERS

STEWART, WEIR & CO.
11405 – 163 STREET, EDMONTON

DWN BY: S.M.B.
DATE: JUNE 14th, 1991.
FILE No.: 11.1.20872