Report of the NRCB/EARP Joint Review Panel
Application #9401 - Alberta Public Works, Supply and Services
February 1995

Pine Coulee Water Management Project
Willow Creek Basin
Southwest of Stavely, Alberta

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T5J 3L9

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Telephone: (403) 422-1977
Facsimile: (403) 427-0607

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1. INTRODUCTION

This Report incorporates the Panel's decisions and recommendations on matters that fall within the jurisdiction of both the *Natural Resources Conservation Board Act* and the federal *Environmental Assessment and Review Process (EARP) Guidelines Order*.

1.1 Joint Review Panel

The *Natural Resources Conservation Board Act* was proclaimed into law on June 3, 1991. It created a Board

> ...to provide for an impartial process to review projects that will or may affect the natural resources of Alberta in order to determine whether, in the Board's opinion, the projects are in the public interest, having regard to the social and economic effects of the projects and the effect of the projects on the environment.

The *NRCB Act* defines which types of projects are subject to review. A reviewable project cannot be started unless the NRCB, on application, has granted an approval for the project. The Regulations under the Act require a review of water management projects that involve construction of a dam more than 15 metres high or a canal or diversion capable of conveying more than 15 cubic metres of water per second. The proposed development is reviewable under the Act, as the dam height would exceed 15 metres.

The legal requirements for the federal Environmental Assessment and Review Process (EARP) are set out in the *EARP Guidelines Order*. The process applies to proposals that are:

- undertaken directly by the federal government;
- to which the federal government makes a financial commitment;
- that are located on federally administered land; or,
- that may have an environmental effect on an area of federal responsibility.

The EARP is to be applied early in the planning process and before irrevocable decisions are taken. Where adverse environmental effects are potentially significant, or where public concern warrants, the decision-making department shall refer the proposal to the federal Minister of the Environment for public review by a panel. For this Application, Transport Canada has a decision-making responsibility under the *Navigable Waters Protection Act* as the navigable waterway (Willow Creek) would be affected by the proposed project. Transport Canada, as the initiating department under the *EARP Guidelines Order*, requested a public panel review of the project.

In June 1994, the NRCB and the Federal Environmental Assessment Review Office (FEARO) entered into an agreement for the operation of a Joint Review Panel for the Pine Coulee Reservoir Water Management Project. The agreement covers the constitution of the Panel, cost-sharing arrangements and the conduct of the proceedings, as well as other administrative issues related to the operation of the Panel.

A Joint Review Panel consisting of Ken Smith, (Chair), Charles Weir and George Kupfer was established to review the Pine Coulee Project. The Panel will act as a Division of the NRCB under the *NRCB Act* and as an EARP Review Panel as detailed in the Terms of Reference for the Panel (Appendix A) issued under the *EARP Guidelines Order.*

This Report incorporates the Panel's deliberations on matters within the jurisdiction of both the *NRCB Act* and the *EARP Guidelines Order*. On matters that fall within NRCB jurisdiction, subject to the authorization of the Lieutenant Governor in Council, an approval is required if the proposed project is to proceed and any conditions attached to an NRCB approval are binding. On matters that fall within federal jurisdiction, the Panel makes recommendations to the federal Ministers of the Environment and Transport.

In its examination of the issues, the Panel will take into consideration all aspects of the two distinct areas of jurisdiction, federal and NRCB, and this will enable the process to be streamlined. For example, if the Panel concludes, on a preliminary basis, that a certain condition would be a necessary component of any approval issued in accordance with the *NRCB Act*, the Panel could consider the effects from both an NRCB perspective and an EARP perspective, as though the project were to incorporate such a condition. Having stated this, the Panel will not make continuous distinctions throughout this Report between the powers and mandates of each jurisdiction. The Panel will make reference to its conclusions in a fashion that should be clear to all parties.

1.2 The Pine Coulee Project

Alberta Public Works, Supply and Services (PWSS or the Applicant) requests approval to construct the Pine Coulee Project, a water management project that includes a diversion weir on Willow Creek, a 3.5-kilometre canal and a multiple-use, off-stream storage reservoir in Pine Coulee, approximately six kilometres west of Highway 2 near the Town of Stavely which is approximately 100 kilometres south of Calgary. (Map 1.1 and Map 1.2). The water in the reservoir would be held behind an earthfill dam standing approximately 21 metres above the valley floor and extending 450 metres between the valley walls across Pine Coulee just upstream of where Pine Creek meets Willow Creek. When full, the reservoir would cover 600 hectares (1,480 acres), store 50,573 cubic decametres (41,000 acre feet) of water and extend 13 kilometres north from the dam.

The proposed diversion weir and canal would carry water from Willow Creek to the Pine Coulee Reservoir. The 12-metre high weir and headpond, to be located approximately one kilometre upstream of the existing Secondary Highway 527 bridge across Willow Creek, would include a 48-metre wide concrete overflow section and a 100-metre wide emergency overflow section. Canal headgates, adjacent to the diversion weir, would control the diverted flow and protect the canal works from floods on Willow Creek. The canal would be constructed with a seven metre bed width and have a flow capacity of 8.5 cubic metres per second. The Pine Coulee Dam would stand 21 metres above the valley floor and would extend 450-metres between the valley walls. A

saddle dyke, some three kilometres long, would be located at the south east periphery of the reservoir. The outlet works, taking water from 1,035 and 1,041 metre levels, would consist of an inlet structure with trash racks, a concrete conduit or pipe, a gate well and structure with an overflow weir and an outlet stilling basin. The discharge rate at reservoir full supply level would be 27.2 cubic metres per second through outlet works to Willow Creek.

The Pine Coulee Project would be located in the Willow Creek basin, which is part of the Oldman River basin and the broad South Saskatchewan River basin that includes most of southern Alberta (see Map 1.3). The Willow Creek basin, except for the uppermost reaches, is largely agricultural land. The proposed project would be located within this agricultural area which was subdivided and settled nearly 100 years ago.

The project planning, which began in the mid-1980s and included five years of study and extensive public consultation, was managed by Alberta Environment. In 1989, responsibility for construction of large-scale water management projects was transferred to Alberta Public Works, Supply and Services (PWSS). It assumed responsibility for management of the project including the preparation of the environmental impact assessment (EIA). Should the Application be approved, Alberta Environmental Protection would assume responsibility for the ongoing operation of the reservoir once construction is completed.

1.3 Review Process

In December 1988, the Alberta Minister of the Environment announced that an EIA was required for the Pine Coulee Project. PWSS filed an application, which included the EIA, with the Natural Resources Conservation Board in January 1994, to obtain approval under section 5(l) of the *NRCB Act*. The timing of key events in the review process is listed in Appendix B.

In addition to applying to the NRCB, PWSS applied to Transport Canada in November 1993, for approval under part 1, section 5(1) of the *Navigable Waters Protection Act.* Transport Canada (Canadian Coast Guard) was the initiating department under the *Environmental Assessment and Review Process (EARP) Guidelines Order* and in March 1994, referred the proposal to the federal Minister of the Environment for a public review by an environmental assessment panel. The Minister of Transport identified potential unknown environmental effects and expressions of public concern from environmental organizations, the Peigan Nation, and Blood Tribe as the basis for a public review by a panel in accordance with sections 12(d) and 13 of the *EARP Guidelines Order*. Transport Canada asked the Minister of the Environment to establish a Joint Review Panel as provided for in the *Canada-Alberta Agreement for Environmental Assessment Co-operation* signed on August 6, 1993.

A Pre-Hearing Conference on Preliminary and Procedural Matters was held on June 15, 1994, in Stavely, Alberta. On July 4, 1994 the Panel issued a *Report of the Pre-Hearing Conference*. Copies of this report are available from the NRCB's office.

A public hearing was held in the Stavely Community Center from September 26 - 30 and October 4 -7, 1994 with Ken Smith, (Chair), Charles Weir and George Kupfer sitting. Individuals and organizations that attended and participated in the hearing are listed in Appendix C. A transcript of the hearing is available for review by appointment at the NRCB office.

1.4 Report Framework

There are a number of issues pertaining to the public interest the Panel believes it should consider prior to dealing with the economic, environmental and social effects of the Application. Participants in the hearing raised a number of matters related to public policy and jurisdiction, as well as other preliminary matters related to the adequacy of the evidence tendered during the hearing. The Panel is of the opinion that it should first consider:

- public policy on water management and related matters;
- jurisdiction; and,
- other preliminary matters.

The Panel believes that it must then consider, in some detail, the justification or need for the proposed project, including:

- the value of irrigation and municipal water supply within the concept of multiple use of water;
- the alternatives to and within the project;
- the ability of the Applicant to implement the proposed project; and,
- the economic viability of the proposed project.

A number of participants commented on the need for comprehensive ecosystem management in general, with emphasis on the cumulative effects of existing activities plus proposed activities on the state of the ecosystem. In addition, the Panel believes that it should have some regard for what some participants referred to as sustainable development and what that term might mean in relation to the proposed project. The Panel will consider cumulative effects, ecosystem integrity and sustainable development.

The Panel will then examine:

- instream flow needs; and,
- water management planning

before proceeding to consider the effects of the project.

The Panel then considers the effects, taking into account the input received from the participants at the hearing, that would likely result and the mitigative measures that may be taken.

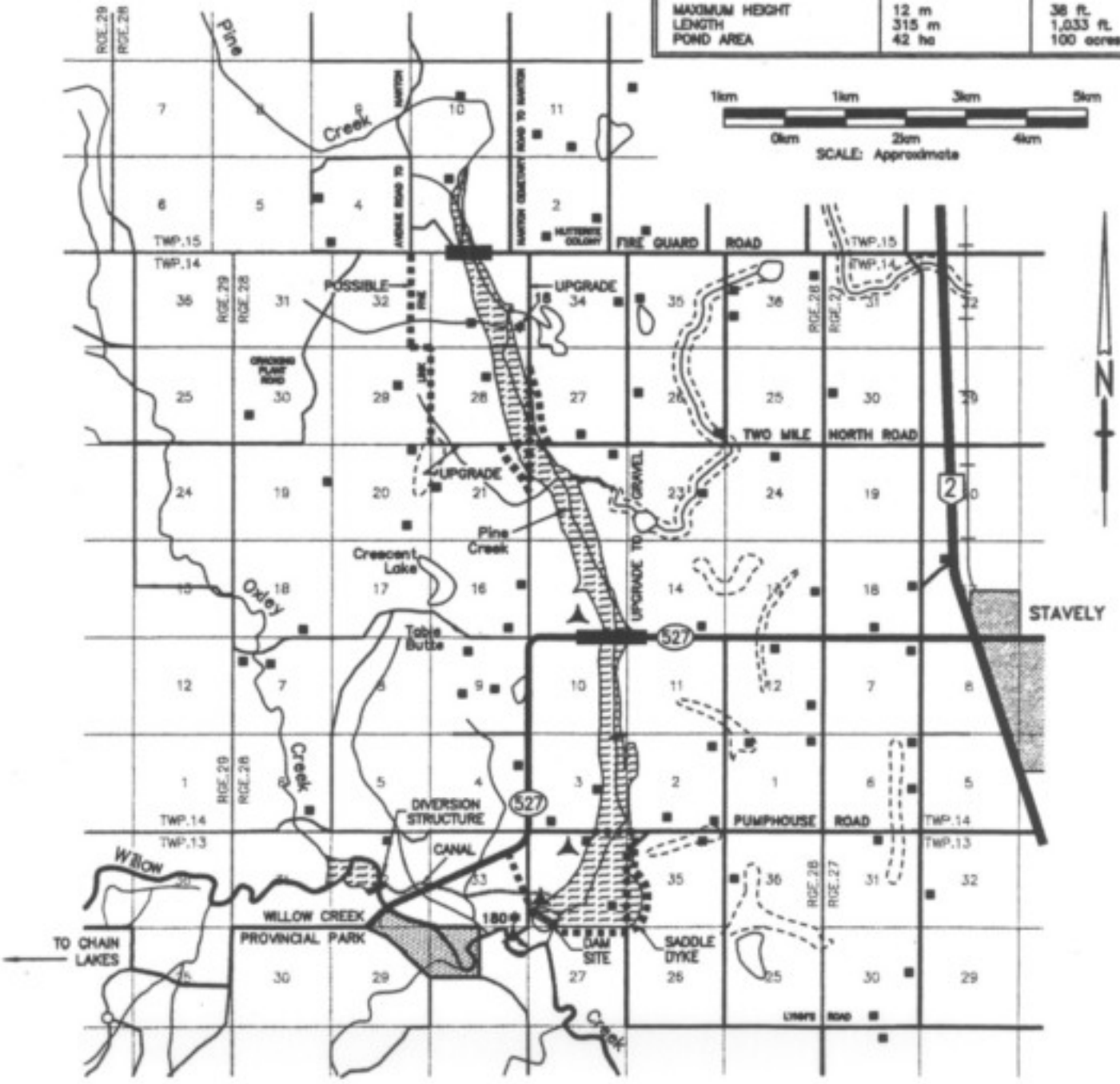
PROPOSED PINE COULEE PROJECT
MAP 1.1

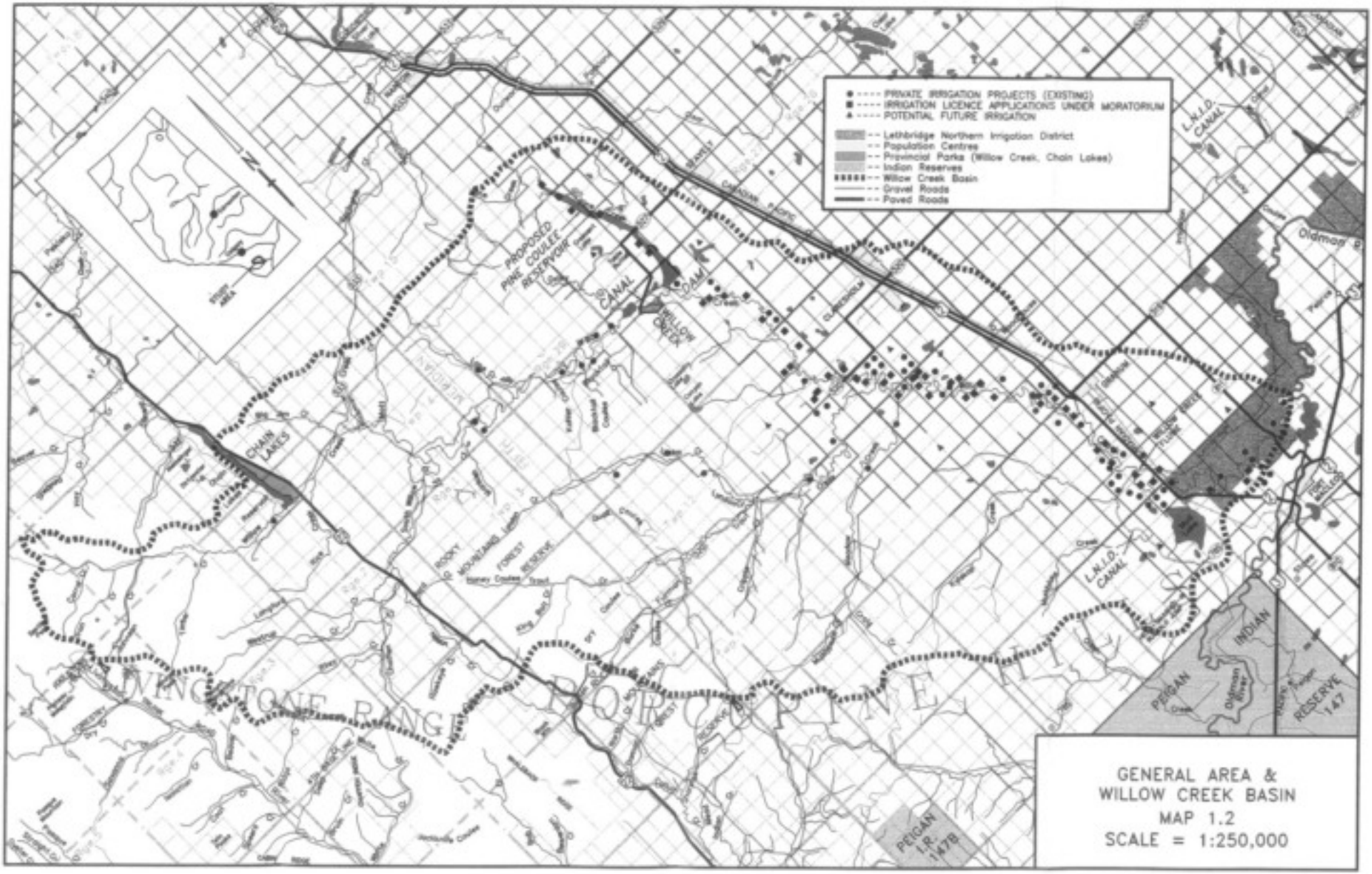
SOURCE: Exhibit 57 & 115 and Application

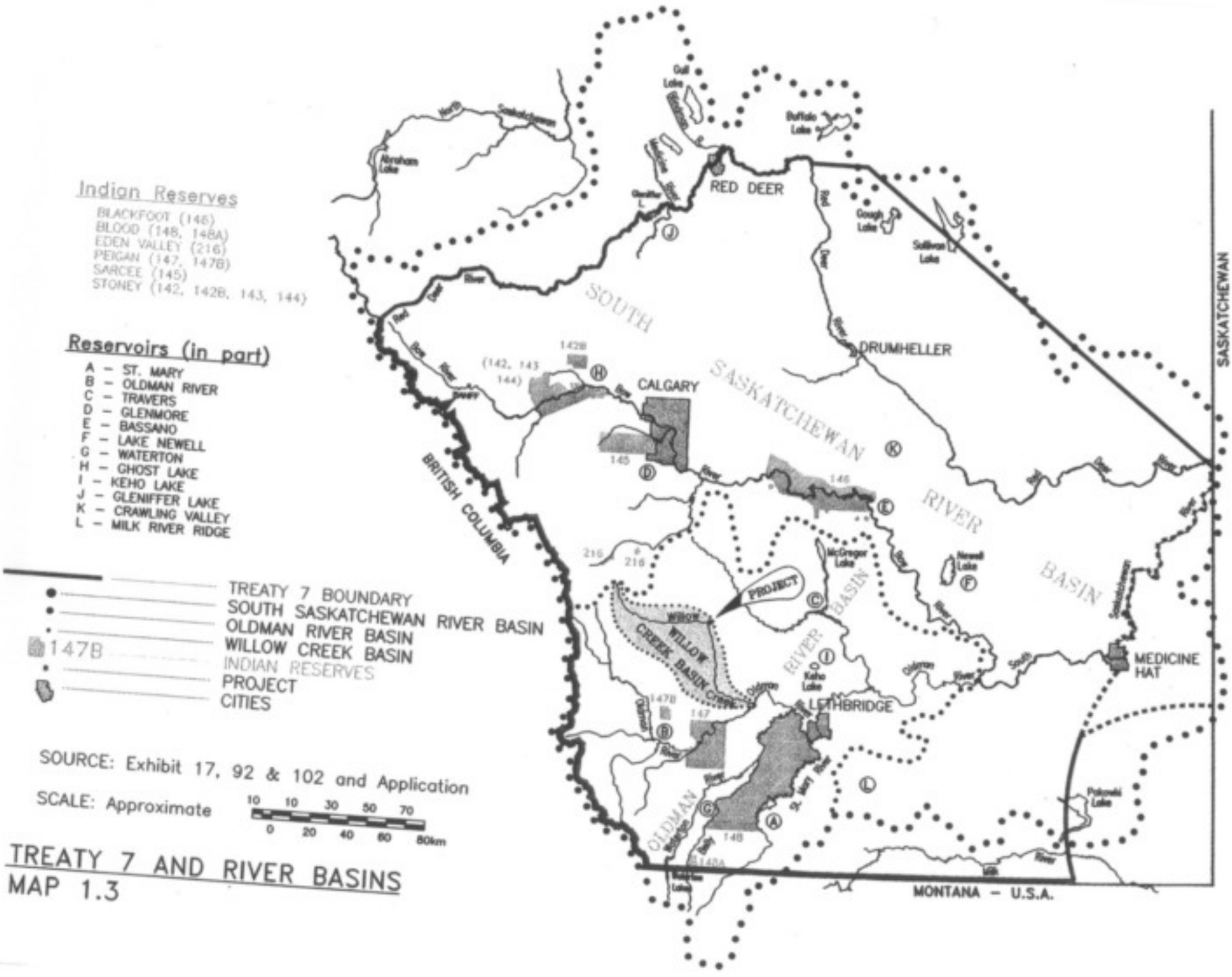
LEGEND

- FARM RESIDENCE
- SALINITY AREAS (approx.)
- PROPOSED RECREATION AREAS
- EXISTING GRAVEL ROAD
- PROPOSED REPLACEMENT ROAD
- ROAD/TRAIL TO BE ABANDONED
- RAISE EXISTING CROSSING (causeway)
- DIVERSION CANAL
- * 18 — Site EbPk 18 } Prehistoric Site for Avoidance
- * 180 — Site EaPk 180 } Prehistoric Site for Avoidance

DAM		
MAXIMUM HEIGHT	22 m	72 ft.
LENGTH	450 m	1,476 ft.
RESERVOIR		
AREA	600 ha	1,480 acres
MAXIMUM DEPTH	19 m	62 ft.
STORAGE VOLUME	50,800 dam³	41,000 acre-ft.
DIVERSION CANAL		
LENGTH	3150 m	2.0 miles
MAXIMUM FLOW CAPACITY	8.5 m³/sec	300 cfs
DIVERSION WEIR		
MAXIMUM HEIGHT	12 m	38 ft.
LENGTH	315 m	1,033 ft.
POND AREA	42 ha	100 acres




PRIVATE IRRIGATION PROJECTS (EXISTING)
IRRIGATION LICENCE APPLICATIONS UNDER MORATORIUM
POTENTIAL FUTURE IRRIGATION
Lethbridge Northern Irrigation District
Population Centres
Provincial Parks (Willow Creek, Chain Lakes)
Indian Reserves
Willow Creek Basin
Gravel Roads
Paved Roads
PROPOSED PINE COULEE RESERVOIR
L.N.I.D. CANAL
WILLOW CREEK
CHAIN LAKES
ROCKY MOUNTAINS
FOOTHILLS
PLAINS
PEIGAN INDIAN RESERVE 147
PEIGAN I.R. 147B
Oldman R.
GENERAL AREA &
WILLOW CREEK BASIN
MAP 1.2
SCALE = 1:250,000



TREATY 7 AND RIVER BASINS
MAP 1.3

The Panel must have regard to all significant social and economic effects that may reasonably be foreseen to result from the project, however, to fulfill the federal Terms of Reference the Panel will specifically identify those socio-economic effects that are caused by the environmental effects of the project. As directed by the Terms of Reference issued for the Panel, it will address issues falling within federal jurisdiction, including the impact of the project on: navigation and the safety of vessels on the waterway, both upstream and downstream of the works; fisheries and fish habitat; the concerns and interests of aboriginal people; migratory birds; and vulnerable, threatened or endangered species. These effects are also important to the jurisdiction of the NRCB.

Under the jurisdiction of both the *EARP Guidelines Order* and the *NRCB Act*, the Panel intends to review all the relevant environmental effects of the project of interest to both Alberta and Canada. In assessing the social and economic effects of the project, the Panel will examine those effects primarily in relation to the Alberta public interest. Social and economic effects that arise from environmental effects of the proposed project will be examined to determine their relevance to both Alberta and Canada.

The Panel will deal specifically with the following:

- environmental effects
  - water quantity and quality
  - fisheries
  - soils and drainage
  - vegetation
  - wildlife
- economic effects
  - benefit/cost analysis
  - economic impact
- social effects
  - secure water supply
  - community stability
  - land use effects
  - transportation effects
  - communications/consultation.

The Panel believes that it should:

- examine the aboriginal archaeological sites and artifacts; and,
- summarize the environmental concerns and issues of aboriginal people.

The Panel will make its decision as to whether the proposed project is in the Alberta public interest based on its conclusions respecting the various effects that would result, some of which may be beneficial and some of which may be adverse to the public interest. The Panel will make any

recommendations on the environmental and directly related socio-economic effects of the proposed project on areas within federal jurisdiction based on the conclusions it reaches on all of the environmental effects. The Panel will also identify any conditions that it believes are required to ensure that the proposed project is in the Alberta public interest, should the Application be approved.

2. POLICY FRAMEWORK, JURISDICTION AND PRELIMINARY MATTERS

2.1 Management of Water Resources in Southern Alberta

In Alberta, the *Water Resources Act* governs the management of water resources. Water diversion is prohibited unless authorized under the Act. The Act sets out the procedure to be followed in acquiring a right to divert and use water, the conditions under which works for the diversion and use of water may be constructed, and the responsibilities and rights of those authorized under the Act to divert and use water. The *Water Resources Act* also defines the powers of the Minister charged with the administration of the Act, including the construction of works by the Minister. The establishment of agreements with other jurisdictions for the management of water is also provided for within the Act.

Water management in Alberta takes place in the context of the larger river basins that originate in or flow through the province. The Pine Coulee Project is located within the broad drainage of the South Saskatchewan River basin. This basin is included within the interjurisdictional arrangement signed by the three prairie provinces and the federal government set out in the *Prairie Provinces Water Board Apportionment Agreement* which defines the apportionment of the flows of rivers crossing provincial boundaries. Under the terms of the agreement, Alberta is permitted to use or store one-half of the total annual natural flow of the rivers in Alberta that comprise the South Saskatchewan River basin. There are additional clauses that permit Alberta to keep, for its consumption, a minimum of 2,600,000 cubic decametres (approximately 2,100,000 acre-feet) annually from the South Saskatchewan River basin, while requiring that the river's instantaneous flow at the border does not drop below 1,500 cubic feet per second (approximately 40 cubic metres per second). The agreement is administered by the Prairie Provinces Water Board, which has membership from each of the governments affected.

The government of Alberta policy for water management considers the South Saskatchewan River as a single basin for apportionment purposes. On average, the total basin flow is made up as follows: 21 percent from the Red Deer River, 43 percent from the Bow River, and 36 percent from the Oldman River. The May 1990 *South Saskatchewan River Basin Water Management Policy* provides for the government of Alberta to manage the waters of the Red Deer, Bow, Oldman and South Saskatchewan rivers in concert, with due regard to the needs and potential of each sub-basin, to ensure that the province's interprovincial commitments under the *Prairie Provinces Water Board Apportionment Agreement* are met, and to best serve the needs of all water users in the basin.

The interjurisdictional aspects of water management in southern Alberta also include international agreements to recognize the interests of Canadians and Americans who live along the transborder Waterton, Belly and St. Mary rivers that originate in the United States. These rivers are the subject of international arrangements through the International Joint Commission. The *Canada Water Act* establishes the legislative framework for these arrangements as well as the commitments made by the government of Canada under the *Prairie Provinces Water Board Apportionment Agreement.*

The headwaters of the South Saskatchewan River basin lie in the eastern slopes of the Rocky Mountains. In Alberta, they are managed in accordance with the *Policy for Resource Management of the Eastern Slopes* (Revised 1984). Under this overall policy, the highest priority in the overall management of the eastern slopes is placed on watershed management. This priority on watershed management is directly linked to the water management policy for the South Saskatchewan River basin, since the quantity and quality of the water in the basin depends upon the protection of the lands in the eastern slopes headwaters.

A Policy for Resource Management of the Eastern Slopes (Revised 1984), sets policy objectives for more detailed sub-regional planning. It is, in part, based on the efforts of the Eastern Rockies Forest Conservation Board, which operated under joint federal-provincial legislation between 1948 and 1973 and provided policy and planning direction for the Rocky Mountain Forest Reserve, which is recognized as the critical headwaters region for the prairie provinces. The Reserve was formally established in 1964 "...for the conservation of forests and other vegetation and the conditions favourable to optimal water supply." Regional goals include ensuring a "...continuous, reliable supply of clean water to meet the needs of Albertans and interprovincial users now and in the future." The *Livingstone-Porcupine Hills Sub-Regional Integrated Resource Plan*, approved in 1987, sets management objectives for public land west of the proposed project. It states as a goal, "Achievement of social and economic benefits by providing for the optimal use of all resources, while maintaining the overall integrity of the natural environment for which the area is known." It is also important to note that this document states, "...watershed protection has the highest priority in the Livingstone-Porcupine Hills planning area." Resource management objectives stated for the Willow Creek area, not generally significant in terms of water production, are to maintain a high quality water supply for on-stream and downstream users and to minimize soil erosion and sedimentation from activities located near streambanks.

The principle of multi-purpose use governs the use and management of all water in Alberta, including the waters of the South Saskatchewan River basin. The government of Alberta's objective is to manage the resource to meet diverse needs including domestic, municipal, agricultural, industrial, fisheries, wildlife, recreation and aesthetic requirements.

Under the *South Saskatchewan River Basin Policy*, minimum flows are to be established on an individual river reach basis and these flows are to be maintained to protect basic water quality and instream needs. Individual rights to divert and use water are granted in the form of licences issued in accordance with the *Water Resources Act*. These licences and their priority, as established by the date of application, are to be respected under the policy. Preferred instream flows are to be established for individual river reaches to protect instream needs. Under the policy, the province of Alberta will reserve water when a predetermined level of allocation to licensed users and to instream flow requirements has been reached. A system of preferential use is to be used to determine further allocations of water.

The *South Saskatchewan River Basin Policy* requires consideration be given to individuals and communities that withdraw water for their use, as well as the need to retain water in

the river for instream needs, including recreation, fisheries, wildlife and the maintenance of adequate water quality to sustain the riverine ecosystem. The policy contemplates two levels of instream flow requirements: "minimum" to protect basic water quality and instream flow needs; and "preferred" to protect desirable instream flow needs. Regulated streams are to be managed to meet preferred instream flows most of the time. During low runoff periods, it is recognized that water shortages will occur and instream flows will occasionally drop below the preferred level. On regulated streams, projects are to be managed so that the instream flows drop to minimum levels only for short periods of time under drought conditions.

The *South Saskatchewan River Basin Policy* requires that maximum water allocation for irrigation purposes in the Red Deer, Bow and Oldman basins be established with consideration for the requirements of all other uses. Irrigation agriculture is the largest consumptive use of water in southern Alberta. The policy recognizes the need to establish guidelines to limit irrigation expansion in the South Saskatchewan River basin, based on the water supplies available. The policy provides for irrigation expansion to take place throughout the South Saskatchewan River basin, including areas served by irrigation districts.

To establish maximum water allocations for irrigation purposes, the government of Alberta has established the *South Saskatchewan Basin Water Allocation Regulation (Alberta Regulation 307/91),* pursuant to the *Water Resources Act.* This regulation provides that all water in the South Saskatchewan River basin that is not the subject of an existing licence or other authorization is reserved pursuant to section 12 of the *Water Resources Act*. The water reserved may be allocated in accordance with the regulation. The total amount of water allocated for irrigation purposes from the Oldman River basin to land, other than land in existing irrigation districts under licences issued in accordance with the regulation, and existing licences, must not exceed an amount sufficient for the irrigation of 152,000 acres (approximately 61,500 hectares). Of the amount made available for allocation by the regulation, not including existing authorized uses, amounts sufficient for the irrigation of the following areas are available only for specific named projects: Blood Indian Reserve (25,000 acres or approximately 10,000 hectares), Peigan Indian Reserve (15,000 acres or approximately 6,000 hectares), Keho/Barrens (10,000 acres or approximately 4,000 hectares), Western Oldman Area (6,000 acres or approximately 2,400 hectares), Oldman River Reservoir Area (15,000 acres or approximately 6,000 hectares), and Willow Creek (13,000 acres or approximately 5,300 hectares). In the regulation, the Willow Creek projects are defined to mean diversions from the proposed Pine Coulee Reservoir or Willow Creek downstream of the outlet from the proposed Pine Coulee Reservoir, or both, for irrigation of land within the Municipal District of Willow Creek.

The regulation also provides that any licence issued, in accordance with the regulation, may contain conditions limiting the amount of water that may be diverted and used when it is necessary to maintain minimum instream flows.

Instream needs are the water quantities and quality needed to maintain the river, lake, and riparian ecosystems. Depending on circumstances, it may not be possible to fully satisfy the water requirements for instream needs and meet other current allocations, and it therefore becomes

necessary to set an instream objective. The government of Alberta, as part of its overall review of water management policies, is working on both the scientific determination of instream needs and on water management planning and consultation processes to establish instream objectives.

During the extensive public consultations that preceded the adoption of the *South Saskatchewan River Basin Policy*, the Water Resources Commission received submissions regarding the need for additional storage in the basin. It specifically recommended, on an urgent basis, that storage and flow control options and priorities be developed and implemented for the upper tributaries reaches, including the Highwood and Little Bow sub-basins, the Willow Creek sub-basin, and other comparable areas where a variety of users are experiencing shortages. The Commission identified Willow Creek as a tributary stream where stabilizing water supply for the many uses served would be a justifiable provincial investment. It recommended that detailed planning options be advanced to develop adequate storage and flow control and the essential diversion to stabilize the supply, protect instream life, provide security for municipal supplies and support optimum irrigation in the Willow Creek sub-basin.

Water-related planning studies had started on the Willow Creek basin in 1983. They looked at a number of options for securing a reliable water supply. This included altering the operational plan for Chain Lakes Reservoir, groundwater wells, small off-stream reservoirs located throughout the basin, a combination of groundwater wells and small off-stream facilities, and major on-stream or off-stream storage facilities. The government of Alberta announced its intention to proceed with the construction of the Pine Coulee Project in December 1988, after five years of study and extensive public consultation to establish a feasible and acceptable solution to the water supply problems in the basin. The first step in the development of the project was the completion of an environmental impact assessment and the necessary regulatory reviews.

The province of Alberta grants the right to consume or use water through licences or permits. This right entitles the licensee or permit holder to direct or use water for specific purposes or to construct works within the beds, banks or shores of streams and lakes. The Controller of Water Resources is the regulator who grants these rights according to the procedures specified in the *Water Resources Act*. Applications submitted to the Controller provide sufficient detail to permit evaluation of the effect of the proposed works on the source of supply, other water users in the vicinity, and other lands and works. After public notification and review of the application, the Controller may grant an interim licence authorizing the construction of the proposed works, with any changes and variations, and subject to any conditions, the Controller considers necessary. After completion of the project, the Controller issues a permanent licence to the applicant for the diversion and use of the water, subject to any terms and conditions the Controller prescribes.

The application and supporting plans for a water resources licence for the Pine Coulee Project were submitted to the Controller in May 1994 by PWSS. The application includes information about both the diversion of water from Willow Creek and the impoundment of water in Pine Coulee. The Controller's office is holding the application pending the review and decision by this Joint Review Panel. In addition, information that may be relevant to the Controller's review

include the *South Saskatchewan River Basin Water Allocation Regulation*, instream flow requirements, the *Prairie Provinces Water Board Apportionment Agreement* and the impact the proposed project may have on other water users in the Willow Creek basin and on other lands and works.

The proposed project is also subject to the *Navigable Waters Protection Act*. Transport Canada (Canadian Coast Guard) received an application in November 1993 from PWSS for approval under this Act to construct the proposed Pine Coulee Water Management Project. Under the *Navigable Waters Protection Act*, the Coast Guard's responsibility is to protect the public right of navigation. Part I of the Act regulates the construction of works built or placed in, on, over, under, through or across navigable waterways. The Coast Guard determined that Willow Creek is navigable at the point of the diversion, and that sufficient information must be filed to enable a determination of the application under the Act including:

- the evaluation of the impact of the anticipated increase in water consumption on downstream waterways and the operation of their control structures;
- boat launch facilities and boating safety;
- operating procedures for the Willow Creek diversion weir and canal;
- Pine Coulee dam safety and emergency procedures plan;
- a monitoring program of changes in the flow regime, river bed changes and bank erosion; and,
- the environmental and socio-economic concerns of aboriginal peoples.

The *Dam Safety Regulations* under the *Water Resources Act* place certain responsibilities on the owner/operator of water diversion works to ensure public safety. The Controller of Water Resources is also required to examine the application to divert and use water to determine conformity to the regulation. Transport Canada indicated at the hearing that it accepts the Alberta dam safety procedures and agreed that the dam inspection branch of Alberta Environmental Protection is among the best in Canada.

2.2 Policy Framework

A number of public policies not specifically related to water management in southern Alberta, both federal and provincial, were raised during the review of the Application. The following provides a brief summary of federal, provincial and municipal legislation and policies relevant to the Panel's review of this Application.

2.2.1 *Federal Environmental Assessment and Review Process (EARP) Guidelines Order*

The basis for the federal government's participation in this joint review process is the *EARP Guidelines Order*. The EARP process applies to proposals that are undertaken directly by the federal government; to which the federal government makes a financial commitment; that are located on federally administered land; or that may have an environmental effect on an area of federal responsibility. The *EARP Guidelines Order* is to be applied early in the planning process before irrevocable decisions are taken. Where adverse environmental effects are potentially significant, or where public concern warrants, the decision-making department shall refer the proposal to the Minister of the Environment for public review by a panel.

2.2.2 *Navigable Waters Protection Act*

The *Navigable Waters Protection Act* provides Transport Canada (Coast Guard) with the mandate to protect the public right of navigation. This Act stipulates that an application must be made to the Minister of Transport to construct any works in, on, over, under, through or across navigable waterways. "Navigable waters" includes any body of water, be it coastal or inland, in its natural state or man-made and capable of being navigated by floating vessels of any description for the purpose of transportation, recreation or commerce. The *Navigable Waters Protection Act* served as the trigger for the *EARP* in this Application.

2.2.3 *Fisheries Act*

The *Fisheries Act* includes provisions for the conservation or protection of fish and fish habitat and specific provisions prohibiting the pollution of waters frequented by fish. The pollution prevention and control provisions of the Act are administered by Environment Canada on behalf of the Department of Fisheries and Oceans (DFO). In addition, the management of inland fisheries involves the provinces. The Fish and Wildlife Division of Alberta Environmental Protection administers the fisheries regulations in Alberta.

Under the *Fisheries Act*, DFO has developed a *Policy for the Management of Fish Habitat* as a framework for its assessment of development proposals. The overall objective of the policy is to achieve a net gain of fish habitat through conservation, restoration and development. A guiding principle under the policy is that DFO will seek to ensure there is no net loss in the productive capacity of fish habitat by avoiding or mitigating impacts, and failing that, by balancing unavoidable habitat losses with habitat replacement or compensation on a project-by-project basis. Productive capacity is defined in DFO's policy as the "...capacity of habitats to produce healthy fish, safe for human consumption, or to support or produce aquatic organisms upon which fish depend."

2.2.4 *Migratory Birds Convention Act*, *Canada Wildlife Act*, and *Alberta Wildlife Act*

The *Migratory Birds Convention Act*, administered by Environment Canada, provides for the protection of migratory birds and their habitat.

The *Canada Wildlife Act* provides for the protection of endangered wildlife and for wildlife conservation. It is the legislation under which the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was established to scientifically review the status of species. COSEWIC designates wildlife species as vulnerable, threatened or endangered if there is reason to believe that their populations are in danger. The federal and provincial governments have adopted and continue to develop policy frameworks for the shared administration of resources in maintaining and restoring biodiversity including the 1990 *Wildlife Policy for Canada* and the 1994 *Draft Canadian Biodiversity Strategy*. Canada has also signed international conventions such as the *United Nations' World Conservation Strategy* and the 1992 *International Convention on Biological Diversity*.

The *Alberta Wildlife Act* complements the federal legislation and provides for the day-to-day management of wildlife in Alberta.

2.2.5 *Indian Act*

The Federal Minister of Indian Affairs and Northern Development is responsible for administering the *Indian Act* (R.S.C., 1985, c.1-5). This Act covers matters related to Indians and lands reserved or designated for the use of Indians. During the hearing, reference was made to the concept that the Crown owed a fiduciary duty to Indian people. The historic relationship between the government and aboriginal peoples has been described by the Supreme Court of Canada as being *sui generis* (or, of a special class) and further characterized this relationship as trust-like, rather than adversarial.

2.2.6 Treaty 7

During the hearing, reference was made to Treaty 7 (1877). In return for ceding their interest in the territory defined under the treaty,

> Her Majesty the Queen agree(d) with her said Indians, that they shall have right to pursue their vocations of hunting throughout the Tract surrendered...subject to such regulations as may, from time to time, be made by the Government of the country, acting under the authority of Her Majesty and saving and excepting such Tracts as may be required or taken up from time to time for settlement, mining, trading or other purposes by Her Government of Canada; or by any of Her Majesty's subjects duly authorized therefor by the said Government.

Additionally, the treaty provided for the establishment of reserves (See Map1.3), an annuity, ammunition, teachers and other benefits. In 1982, certain rights devolving from treaties were recognized in the *Constitution Act*.

The Panel will consider evidence concerning the *Indian Act* and Treaty 7 later in this Report.

2.2.7 *Alberta Historical Resources Act*

The *Alberta Historical Resources Act* (R.S.A., 1980, c. H-8) provides for the co-ordination of the orderly development, the preservation, the study and interpretation, and the promotion of appreciation of Alberta's historic resources. In Alberta, the administration of the Act is currently assigned to the Minister of Community Development. The Act's definition of historic resources is very broad and includes any work of nature or of man that is primarily of value for its paleontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest including a paleontological, archaeological, prehistoric, historic or natural site, structure or object. When the Minister of Community Development is of the opinion that any operation or activity is likely to result in the alteration, damage or destruction of historic resources, the Minister of Community Development may order that person proposing the operation or activity to:

- carry out an assessment to determine the effect of the proposed operation or activity on historic resources in the area;
- prepare and submit to the Minister a report containing the assessment of the effect of the proposed activity; and,
- undertake all salvage, preservative or protective measures or take any other action that the Minister considers necessary.

Notwithstanding anything in any other Act, when the Minister of Community Development makes an order to carry out an assessment, he or she may also require any municipality or other approval authority to withhold or suspend any authorization until the Minister is satisfied that any action that he or she has required has been satisfactorily performed. Any person who discovers a historic resource in the course of making an excavation is required to notify the Minister of Community Development.

Unless the Minister of Community Development chooses to dispose of a resource, the property in all archaeological resources and paleontological resources within Alberta belongs to the Crown in right of Alberta. The Minister of Community Development may order the designation of any historic resource together with any land in, or on which it is located, and adjacent land as a provincial historic resource. If a historic resource is the subject of such an order and is owned by the Crown or wholly situated on Crown land, the Minister may restore, alter or demolish any structure

located within the designated area or make regulations governing the management and development of the provincial historic resource. The Act makes no provisions for public involvement in the historic resource impact assessment and mitigation process.

2.2.8 *Municipal Government Act*

In Alberta, those jurisdictions that have the status of a municipality under the *Municipal Government Act* (RSA, 1980, c. M-26) include cities, towns, villages, summer villages or municipal districts. The decision-making authority of a municipality is vested in and can be exercised by its council. Normally, powers and duties imposed or conferred on a municipality are exercised by means of resolution or by-law.

Of significance to this particular Application is the fact that the title to all public roadways and bridges in a municipality, other than a city, is vested in the Crown in right of Alberta. However, subject to other provincial acts, a municipal council is responsible for the control and management of the public roadways, bridges, waterways, lakes and other bodies of water within the municipality, including the air space above and the ground below with the exception of mineral rights.

The Panel is aware that the current *Municipal Government Act* is under review by Alberta Municipal Affairs. However, the Panel recognizes that any law is subject to change over time, so that any of its decisions may be affected by the passage of time. The Panel will have regard for this general condition within the context of its deliberation on this matter. This observation applies equally to the *Alberta Planning Act*.

2.2.9 *Alberta Planning Act*

The purpose of the *Alberta Planning Act* (RSA, 1980, c. P-9) and its regulations is to provide the means for preparing and adopting plans and related measures to achieve the orderly, economical and beneficial development and use of land and patterns of human settlement. The Act also provides the means to maintain and improve the quality of the physical environment within which patterns of human settlement are situated in Alberta, without infringing on the rights of individuals except to the extent that is necessary for the greater public good.

To achieve the planning objectives described, the local authority must assure that development takes place in accordance with several statutory planning documents which have a hierarchical relationship. In descending order of focus, the *Alberta Planning Act* provides for regional plans, general municipal plans (GMPs), area structure plans (ASPs) and land use by-laws. In the development of each of these planning instruments there are mandatory provisions for public notice, review and input. This Act governs land use around the reservoir under the jurisdiction of the Municipal District of Willow Creek.

2.3 Jurisdiction of the Joint Review Panel in Relation to Other Jurisdictions

As with most large projects reviewed by the NRCB or a panel established under the *EARP Guidelines Order*, there are other municipal, provincial and federal authorities that have a jurisdictional mandate in relation to the project. Several of these authorities made submissions to the Panel at the hearing, describing their mandate and describing the considerations relevant to their processes.

The Panel directs its review to the environmental, social and economic effects that could be expected if the project were to proceed. After considering these effects, the Panel will conclude whether the project is in the public interest and will make recommendations to the federal government. In some instances, there is an overlap between the considerations of issues by the Panel and another authority that will have or has exercised decision-making authority in respect to the project. The Panel acknowledges that the broad mandate given the Joint Review Panel may lead to the perception that there is duplication in the regulatory process. This perception is not supported on a closer review of the respective mandates of each decision-making authority.

The mandates of the various other regulatory authorities require that each of them assess certain aspects of the project and make decisions about those issues. None of these agencies is directed to apply as broad a test to their decision-making process as is the Panel. Therefore, it is reasonable to expect a detailed review of a narrower range of issues from these authorities rather than a broader consideration of a wide range of issues as is conducted by the Panel.

In many cases, the role of these agencies is ongoing regulation rather than a one-time review as is conducted by this Panel. Therefore, the relationship between the Panel and these authorities may be complementary. The Panel appreciates the cooperation and information that was presented to it from the municipal, provincial and federal agencies involved.

With an appropriate understanding of the mandate and process exercised by another regulatory authority, the Panel has several options in fulfilling its mandate, depending on the nature of the other authority. If the other authority has already exercised, or partially exercised, its mandate with respect to the proposed project, the Panel is able to benefit from the greater certainty or definition that is attached to the project. On the other hand, if the other authority has not considered the project, it is helpful if the Panel has an understanding of the types of considerations that will be given to a project by the authority. By having regard to the mandate of the other jurisdictions, the Panel is better able to assess the range of effects that could be expected from a project and how the ongoing regulation of a proposed project would be managed. Understanding these processes assists the Panel to assess the public interest of a project and make recommendations. The Panel observes that, within the scope of these authorities, the public interest is very well protected by the "specialist" nature of these regulatory authorities.

Conversely, it is possible that the views of the Panel may assist these other authorities through the attachment of conditions or recommendations in this Report or through observations made in the course of the review.

2.4 Preliminary Matters

During the hearing, various participants argued that the Panel had inadequate information on which to base its decision and recommendations. The Application, it was stated, was incomplete either because the Panel had inadequate information about the potential effects of the proposed project on the South Saskatchewan River basin as a whole, or alternatively, because information was lacking about more specific areas: the environmental and associated social and economic effects on the Peigan Nation, for example.

As a result of the information before it at the time of the Pre-Hearing Conference, the Panel decided that the Application was complete. On May 19, 1994, the Panel published a *Notice of Pre-Hearing Conference* advising of its intention to conduct a meeting to hear, among other items, matters related to the scope of its review, its jurisdiction and the timing of a hearing. As a result of its Pre-Hearing Conference in Stavely on June 15, 1994, the Panel prepared a written report that confirmed its belief that it had before it a complete application suitable for a public hearing.

Throughout the hearing, which began on September 26, 1994, at Stavely, the Panel heard evidence about the adequacy and sufficiency of the information before it and the relevance of this information to the Panel's expected decision and recommendations. The Panel closed the hearing on October 7, 1994 after considering all of the evidence presented during the public hearing, as well as closing arguments by some of the participants on these and other matters. This once again affirmed its decision that it had adequate information before it. After the hearing process, and during the preparation of this Report, the Panel had the opportunity to review its previous consideration of this issue and believes that it has information that satisfies its responsibilities under both the *EARP Guidelines Order* and the *NRCB Act*.

A cumulative effects assessment was stated as desirable by several participants. The Panel agrees that it is important to address developments in terms of the baseline ecosystem conditions found within the basin, as well as the additional impacts a project would have on existing conditions. Where scientific studies on various indicators of environmental impact are not available, the Panel undertakes qualitative analyses.

The Panel believes that the sustainability of ecosystems is the proper frame of reference when assessing environmental impacts. Sustainable development is recognized as a purpose of the new Alberta *Environmental Protection and Enhancement Act*. The Panel believes it appropriate to determine the public interest with the assistance of the framework of sustainable development. An ideal development would be one that brings long-term social and economic benefits and has a beneficial or neutral effect on the environment. Developments should be planned

and operated to minimize adverse impacts on the environment. However, where adverse effects on the environment are likely, the Panel believes social or economic benefits should be weighed and balanced in terms of their environmental effects and risks.

The Panel will have regard for the entire Willow Creek basin and the sustainability of the aquatic ecological resources of the basin, taking into consideration existing and future use of those resources.

Several participants indicated that the proposed development needs to be considered within the river basin on an ecosystem basis. The Panel agrees and also believes that the individuals and communities that depend on the water in the basin would be potentially affected by the proposed development and, therefore, must also be considered in determining the public interest.

The NRCB has recognized in past Decision Reports that in order to determine the public interest, it must consider a project in the context of the region in which the project would be located and the cumulative effects which the project may contribute in the region. Because societies, economies and ecosystems incorporate many components that are inter-related in a complex manner, the potential social, economic and environmental impacts of a project cannot be understood by considering only the effects of the project on its immediate locale. Projects have a wider impact and must be considered in light of the "baseline" or background condition of the society, economy and environment in which projects have significant impacts.

In the case of the proposed Pine Coulee Project, the Panel has found it impossible to consider the overall public interest in relation to the project without considering the overall management of water in the basin, and in particular, the state of the riverine environment in the basin.

The Panel emphasizes the links between the state of the environment, long-term economic viability and welfare of society. For example, the Panel heard from many participants as to the value of water to the regional economy and the potential contribution of the project to the development of sustainable ecosystems, communities and agriculture. The Panel heard that the potential exists for both continuing economic benefits from the proposed project and long-term social benefits of stable rural and urban communities in particular, but that the potential would not be realized without effective management of the water resources of the basin. These matters are elaborated upon in subsequent more detailed sections and, after full consideration, provide part of the basis for the overall conclusions reached by the Panel in determining whether the project is in the public interest.

3. PROJECT NEED AND JUSTIFICATION

It is the Applicant's position that water management in the Willow Creek basin has been exhaustively studied and the public consulted extensively in the process of developing water management strategies. The Applicant believes that development of the Pine Coulee Project is consistent with the social, economic, environmental and cultural objectives identified in the South Saskatchewan River Basin Planning Program, the recommendations of the Water Resources Commission resulting from public hearings held on water management in the South Saskatchewan River basin (SSRB), the findings of numerous feasibility and technical studies carried out during the last decade, and the wishes of the basin residents.

PWSS gave these reasons for its argument that some form of water management action in the Willow Creek basin was imperative:

- There is not enough water available to meet the requirements of licensed irrigators; current demand is met only 58 percent of the time. This level of water supply failure constitutes an unacceptable degree of financial risk for irrigators. Further, there is no supply available to meet additional applications filed with the province of Alberta for irrigation.

- Cattle ranchers who are dependent on Willow Creek for stockwatering have had their supply disrupted by low water levels in Willow Creek. Water availability can pose a constraint to herd expansion.

- The towns of Claresholm and Granum both rely on Willow Creek as their primary water source and have suffered severe water shortages. While these communities have reduced their immediate supply problems by developing small storage facilities, opportunities for town expansions and attendant industrial development are limited.

- Low water flows and accompanying low dissolved oxygen levels in lower Willow Creek have periodically led to large fish die-offs.

PWSS indicated that it believes that all demand and supply options have been carefully considered and development of the Pine Coulee Project was identified as the best solution. Potential options to the project that were considered included:

- increasing efficiencies through demand management;

- developing alternative water supply sources; and

- seeking alternative locations for a surface water storage facility once the need for such a project was justified.

These alternative locations are discussed in more detail in Section 3.2.

3.1 Multiple Uses of Water

According to the Applicant, the government of Alberta has made multi-purpose use the underlying principle of all water resource planning and development and it is the government's objective to manage the resource to meet diverse needs including domestic, municipal, agricultural, industrial, fisheries, wildlife, recreation and aesthetics. As outlined in the Application, the Pine Coulee Project has the following specific multi-purpose objectives:

- increased security of supply for existing municipal and domestic water users;
- provision of a secure water supply for livestock and irrigation water users;
- potential expansion of irrigated acreage in the Willow Creek basin to 8,500 hectares;
- provision of additional water-based recreational opportunities near existing facilities at Willow Creek Provincial Park; and
- improving the potential for meeting instream flow needs downstream of the reservoir, from the perspective of both water quantity and quality.

3.2 Alternatives to the Proposed Project

The Pine Coulee Project evolved over a number of years during which alternative sites and project designs were assessed. When Alberta Environment first identified the need to construct one or more storage reservoirs within the Willow Creek basin, 48 potential sites were identified. The list was subsequently narrowed to six sites, based on a preliminary assessment of land uses, geology and hydrology. By 1985, four sites were considered as candidates for the development of a water storage reservoir in the Willow Creek basin. In addition to the off-stream dam site described in the Application, three on-stream sites were investigated, including one that would have dammed Willow Creek just below its confluence with Pine Creek, flooding both Pine Coulee and the Willow Creek valley. Preliminary studies conducted on behalf of the Planning Division of Alberta Environment evaluated and ranked the potential impacts of creating reservoirs at the four locations on wildlife, fisheries, geology, soils and land uses, historic resources and water quality. The off-stream Pine Coulee site was ranked as the site least vulnerable to impacts on wildlife, surface erosion and historic resources. The on-stream site would have flooded Willow Creek Provincial Park and destroyed an active heron colony site and other wildlife habitat. The decision to select the off-stream Pine Coulee site was announced December 16, 1988.

In developing the Application for the Pine Coulee site, PWSS considered various within-project alternatives regarding roads, fishery issues, recreation, capacity, drainage concerns, archaeological and historical resources, operating plans and dam design. All of these issues were the

subject of considerable public discussion prior to and during the hearing. Road issues discussed included cost, access, privacy, school bus routes, commerce and routing across and around the reservoir. Fishery issues included the development of a cold-water fishery, the need for a fish ladder, pike spawning habitat, the level of the reservoir outlet and the development of a new reservoir fishery. Recreation matters considered were the number and location of boat ramps, the level of development of the associated park, the impact of reservoir and causeway design on boating and other recreational opportunities, and road access opportunities to the historic sites. In the initial design of the project, the storage capacity of the reservoir and the size and location of the dam and associated structures were evaluated. The full range of alternatives for dealing with potential seepage was addressed, including monitoring, drainage, land purchase and relief wells. Operations issues included instream flow needs (IFNs), irrigation allocation, riparian vegetation and the fishery.

3.3 Ability of the Applicant to Implement the Proposed Project

The proposed Pine Coulee Project would be constructed by Alberta Public Works, Supply and Services and would be operated by Alberta Environmental Protection. The Panel notes that PWSS is responsible for many projects in Alberta and was responsible for the design and construction of the Oldman Dam, a project costing almost 10 times as much as the project under discussion. The Panel also notes that Alberta Environmental Protection operates the Oldman Dam and many other major water management projects. Given the experience of the two responsible departments, the Panel believes that the Applicant has the ability to design and construct the proposed project and that the proposed operator would also have the ability to carry out the operational aspects of the facilities.

The Panel notes as well that the two departments are involved in the design, construction and operation of the proposed project and act on behalf of Her Majesty the Queen in right of Alberta. For the Panel's purposes, it will adopt the view that the government of Alberta will be the entity responsible for the design, construction and operation of the proposed project. Where convenient, the Panel will refer to the specific department involved in various phases of the project but such references are not intended to imply that the obligations of the government of Alberta for the project are divisible nor does the Panel adopt the view that the commitments of PWSS are binding only on that specific agency; rather, as indicated in the hearing, commitments made by PWSS were made on behalf of the government of Alberta.

3.4 Economic Viability

The Panel considers the economic viability of the project as one element in determining whether a proposed project is in the public interest. The Panel believes that its function in this regard is completely independent of the actual financing of an approved project. The Panel's duty is not to determine whether the Alberta Government should invest public money in a project that receives approval. The Alberta Government has the authority to make such a determination. If the

Panel finds a project is in the public interest, it does not commit the Alberta Government to investing public funds in the project. Nor does an approval of a Panel necessarily pre-empt any further decision by the Alberta Government about a project, including decisions regarding its financing. The *NRCB Act* makes it clear that the NRCB approval is one of many approval processes.

If the NRCB does not approve a project, the question of the Alberta Government financing all or part of that project will never arise. It is open to the NRCB to deny a project that is not in the public interest because of the adverse economic or other effects it could have.

The Panel believes that in considering potential economic effects of reviewable projects, it should also consider the return on public investment if the issue is relevant and if the proposed public investment is significant. The Panel notes that the issue of economic viability - the return on public money from particular projects, particularly in the context of infrastructure support - has been raised in previous NRCB hearings. The public is concerned about the use of public funds and public resources. The Panel believes it is appropriate that such concerns be heard and fully considered in its reviews of proposed projects.

In its previous decisions, the NRCB has considered the matter of the economic viability of a proposal and, although the current Application differs from private sector applications that would be financed from a purely private risk perspective, the Panel believes that it should consider the economic viability of a publicly funded project.

Where the financing of the proposal was dependent on government financial support, the NRCB has, in Decision Report 9201 regarding a recreational and tourism project, made the observation that it:

> ...believes investment criteria vary according to whether the investor is a private corporation seeking a 'return' on private capital or whether the investor is a Government seeking a 'benefit' on public funds. Expectations from investors in the private and public sectors are so different, given their differences in motive for investment and investment objectives, that completely different evaluation methods are often used to determine a project's viability. Private sector investors will often use return on investment criteria. Public sector investors often use a cost/benefit technique when considering alternative investments. The Board recognizes that any comparison between an investment by a private investor and an investment by a public sector investor involves comparing 'apples' and 'oranges' to some degree.

During the hearing, the Panel heard from a number of participants that one criterion to be used in relation to a public investment was whether or not the benefit/cost ratio resulting from an economic analysis was greater than one; or alternatively, whether the internal rate of return resulting from the benefit/cost analysis fell between four and 10 percent. It was observed that these different measures would convey slightly different information and that, in part, "...it depends on

whether what you are trying to do is get a return at least as high as alternative public investment." If this is the case, then it was stated that the public decision maker would want to use benefit/cost ratio because then the standard to be applied is whether or not the proposal reaches a benefit/cost ratio greater than one. The Pine Coulee Coalition stated that if the public decision maker is asking whether or not there is some positive return, then the internal rate of return may be the appropriate standard, even though the ratio of benefits to costs might be less than one, suggesting that the project might be less economically efficient.

Although there appeared to be agreement among participants as to the criteria to be applied to economic decisions associated with a publicly funded project, there was less agreement as to whether or not the Application met the criteria. The Applicant's benefit/cost analysis yielded a benefit/cost ratio for the proposed project of approximately 0.90 with an internal rate of return of 5.7 percent using a mid-point discount rate of seven percent.

According to the Applicant, a return of four to 10 percent is generally considered to be acceptable for public investments. Despite the participants' disagreement as to whether or not the Application meets a criteria that would affirm its economic viability, the Panel believes that there is sufficient evidence for it to consider the matter in more detail. The Panel recognizes that, regardless of its findings on the economic viability of a particular publicly funded project, a decision on whether to proceed with the financing of a specific proposal would have to be weighed by other decision makers, who would consider the relationship and priority of the particular project within broader public investment objectives. The Panel further recognizes that there are many non-quantifiable, qualitative and non-economic variables associated with determining whether an application is generally in the public interest. These other variables will be weighed in the Panel's decision.

The Panel has considered the reasons for the proposed project provided by the Applicant as well as the views of the participants. The Panel accepts that some form of water management action is required for the basin and that there is a need to improve the potential for meeting in-stream flow needs in Willow Creek, particularly downstream of the proposed reservoir, from the perspective of both water quantity and quality. The Panel also accepts that there is a need to provide increased security of supply for existing municipal, domestic, livestock and irrigation water users. The Panel also recognizes that the existing moratorium on new water rights in the basin has curtailed irrigation expansion in the basin, and many potential irrigators in the basin have filed water rights applications.

The Panel has also considered the reasonable alternatives to the proposed Pine Coulee Project. The Panel is satisfied that the water management options within the basin have been appropriately examined through a public planning process that included consideration of both structural and non-structural alternatives to meet the needs of the basin residents. The Panel particularly notes that many local participants affected by the proposed project were in agreement that the Pine Coulee Project would be preferable to other water management projects that have been considered for the basin.

The Panel notes that alternative locations for the project and a variety of within-project options have been extensively examined through an open planning process involving the public. The Panel is satisfied that the relevant options have been considered. The Panel, in later sections of this Report, will indicate its views on the matter of within-project alternatives that it believes would reflect the public interest should the proposed project proceed.

The Panel does not believe that the ability of the government of Alberta to design, construct, and operate the proposed project is an issue for the participants and the Panel is satisfied that the Applicant has the ability to implement the project.

The Panel acknowledges that the matter of the economic viability of the proposed project is a major issue among some participants and that the views of the participants on this matter are not all in agreement. Given the nature of the views expressed, the Panel believes that there is sufficient evidence to warrant proceeding with a more detailed consideration of the matter. The Panel has noted that the economic viability of the proposed project is one of a number of factors that the Panel believes that it should have regard for and that quantifiable economic analysis must be considered along with non-quantifiable, qualitative and non-economic variables. The Panel has also noted that any decision to proceed with the financing of a proposed project that might receive an approval from the NRCB, is a separate and independent decision that would not be made by the Panel.

4. WILLOW CREEK BASIN WATER MANAGEMENT

The Panel believes that it must have regard for the entire Willow Creek basin and the sustainability of the riverine ecological resources of the basin, taking into consideration existing and future use of those resources. This section of the Report focuses upon water management in the Willow Creek basin. The sustainability of the ecological resources of the basin are considered through a discussion of the concept of instream flow needs and its application to the riverine ecology of Willow Creek. The second part of the discussion focusses upon the planning and management of water resources for existing and future uses, within the context of the requirement for a sustainable riverine ecology for the Willow Creek basin.

The sustainability of the riverine ecological resources of the basin has been expressed in the Application in terms of the concept of instream flow needs, which in turn are used as a framework for the preliminary operating plan. The Panel believes that it would be helpful to consider in some detail both the basis for the preliminary operating plan, and the plan itself, before proceeding to examine the effects of the proposed project. Therefore, the Panel will consider these matters on a preliminary basis before examining the evidence regarding the social, economic and environmental effects in subsequent sections of this Report.

4.1 Instream Flow Needs

The Panel's discussion of instream flow needs includes the following:

- the characteristics of the Willow Creek basin, such as the underlying climatic features of the region, the influence of the headwaters in the Eastern Slopes and the foothills and the associated variations in seasonal and annual flows;

- the historical development of the basin and the associated conditions that affect water supply and sustainable development, including the water demands of municipalities, and the development of flow regulation at Chain Lakes, domestic and livestock uses, irrigation and instream flow needs; and

- the water policies and programs that govern the regulation of flows within the basin; the concept of instream flows and the relationship to operational plans for flow regulation; the specific instream flow criteria that are proposed as part of the Application before the Panel; and a qualitative comparison of the instream flow criteria to various policy and program requirements.

4.1.1 Willow Creek Basin Characteristics

Willow Creek, a tributary of the Oldman River, drains an area of approximately 2,500 square kilometres and is part of the South Saskatchewan River basin. Willow Creek drains a foothills region with headwaters originating on the eastern slopes of the Livingstone Range, flowing easterly

to the north of the Porcupine Hills and southeasterly along the Porcupine Hills/prairie transition to join the Oldman River. Ten percent of the drainage basin is located in the Rocky Mountain region, 65 percent in the foothills and 25 percent in the plains region. Willow Creek primarily drains the northerly portion of the eastern lee slopes of the Livingstone Mountain Range, the Porcupine Hills, and the associated foothills formation, so the creek has highly variable seasonal and annual flows. Without the winter storage capacity typical of west-facing slopes, Willow Creek flows quickly reflect low precipitation periods. Flood flows as high as 592 cubic metres per second have occurred, yet during low winter flow the creek has frozen and during summer drought it has gone dry. Annual yield is extremely variable, ranging from a low of 11,100 cubic decametres (1988) to a high of 261,500 cubic decametres (1953), with a mean value of 93,750 cubic decametres at the proposed diversion site (see Figure 4.1). The total annual basin yield has been as low as 14,785 cubic decametres during the period of record. Seasonal variation in flow rate is also high, with about three-quarters of the yearly flow total occurring from April to June and two-thirds of the yearly total occurring in May and June for a high flow year.

The annual water volume varies from 13 to 210 percent of the mean value of 138,680 cubic decametres. This large variation in annual flow is further complicated by the variable seasonal distribution of this flow, with more than 60 percent occurring during a short spring runoff period that does not coincide with irrigation needs. Flows during late summer and after winter freeze up can be extremely low. Irrigation demands occur throughout the summer and are highly dependent on the amount of precipitation.

In the upper basin, there are water consumption demands for livestock and domestic requirements. In the prairie reaches, there are also municipal and irrigation requirements. As of October 1991, 76 water licences had been issued along Willow Creek and its tributaries with a total allocation of 14,872 cubic decametres, including 1,630 cubic decametres to meet the municipal needs of Granum and Claresholm and 13,242 cubic decametres for the irrigation of 3,280 hectares of land. (See Granum Area and Willow Creek basin Map 1.2).

4.1.2 Basin Development History

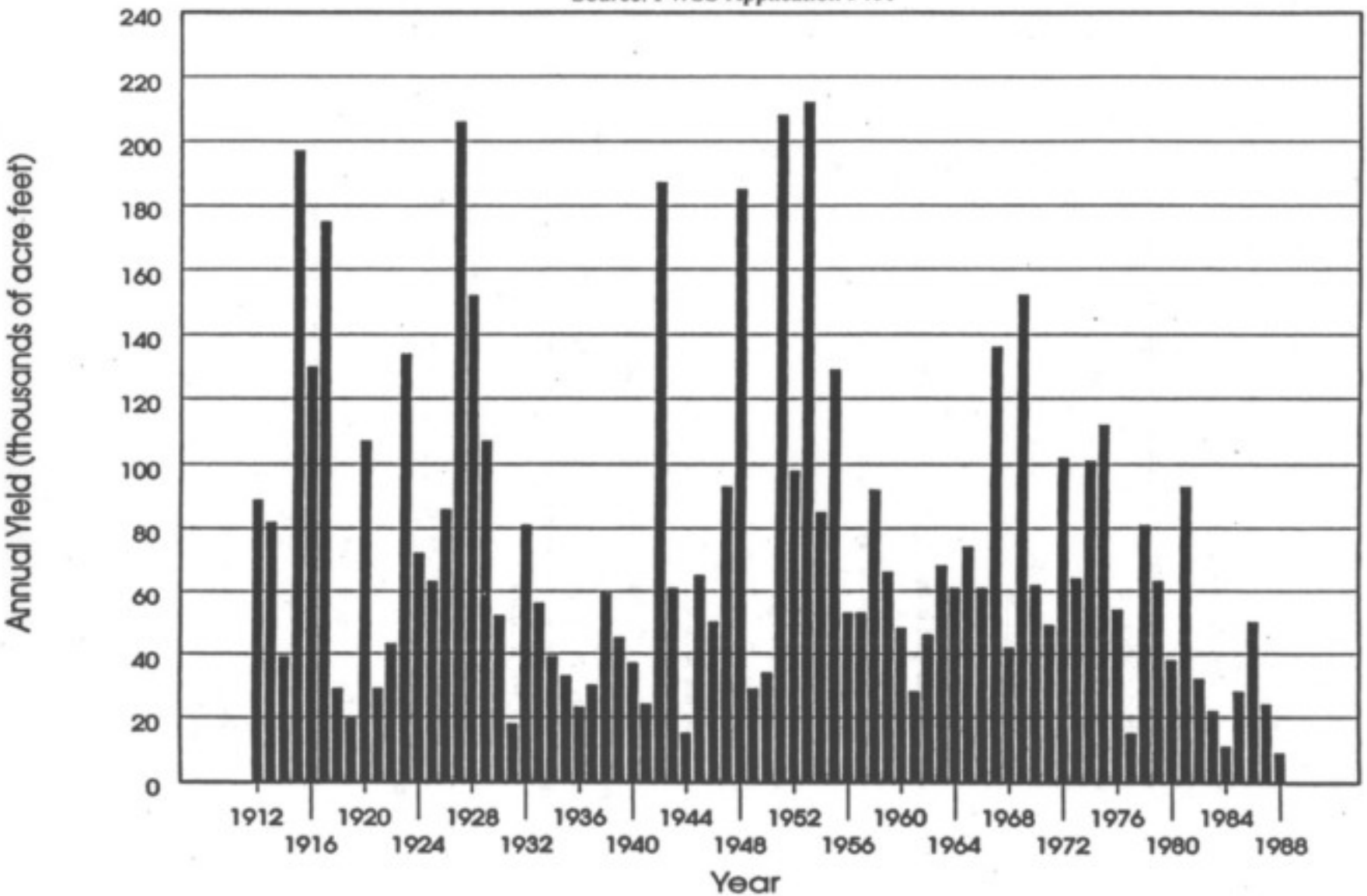
For nearly the past 100 years, the basin has been settled and developed for agricultural purposes with grazing in the foothills and farming on the prairie. According to the Application, low flows have historically led to the loss of municipal water supplies in the winter and restriction on irrigation during summer droughts. The sustainability of agricultural development and human settlement in the Willow Creek basin has been directly linked to the availability of a secure and stable water supply.

FIGURE 4.1

WILLOW CREEK BASIN

Annual Yield at Pine Coulee Diversion

Source: PWSS Application 9401



The first municipal water diversion was initiated in 1904. The Town of Claresholm began investigating the use of Willow Creek for municipal use in 1909. The Chain Lakes facility was built in 1964 and became operational in 1966 to resolve the then-current water supply problems. Even the Chain Lakes Reservoir, constructed to supply water during summer drought and winter low flow, could not adequately overcome winter icing problems or high summer conveyance losses. The supply problem was exacerbated by subsequent expansion of irrigated acreage and cattle operations and by drought conditions in the 1980s. To address municipal supply problems, the towns of Granum (1984) and Claresholm (1989) constructed local municipal water supply reservoirs. These communities now have sufficient storage to satisfy four months of winter demand or two months of summer demand but these supplies do not allow for the development of significant future commercial and light industrial activity.

Irrigation in the Willow Creek basin dates back to 1891, when free flood irrigation projects were developed in the upper basin. This was largely abandoned by the 1920s. In the 1950s, the innovation of centrifugal pumps made irrigation practical. Further mechanization, higher land values and improved sprinkler systems led to requests for 30 more irrigation licences in the 1970s, with attendant increases in the size of irrigation projects. Irrigation activities in the basin depend upon drawing water directly from Willow Creek and is different from other irrigation activities in organized districts which generally rely upon headworks canals for water conveyance. Consequently, irrigated lands in this basin are located along the Creek (see Map 1.2). The first recorded irrigation supply shortage occurred in 1977. Chain Lakes Reservoir, influencing only 25 percent of the mean natural flow in the total basin and capable of providing a year-round flow of 0.28 cubic metres per second, was too small to be of major benefit to downstream irrigators. The receipt of 37 additional applications in the first five years of the 1980s resulted in the Controller of Water Resources placing a moratorium on further irrigation expansion in January, 1986. Coincidentally, six consecutive years of forced irrigation shutdown occurred from 1984 to 1989. Members of the farming community told the Panel that pressures for irrigation requirements continue with more potential users filing applications for water rights.

In the 1930s, the construction of stockwatering dams was initiated in the basin with the assistance of the Prairie Farm Rehabilitation Administration. This now accounts for 670 cubic decametres of licensed allocation.

The completion of municipal storage reservoirs in 1988 led to a request to shift winter releases from Chain Lakes Reservoir to mid-summer. Emergency releases from Chain Lakes Reservoir and the Lethbridge Northern Irrigation District canal, which crosses Willow Creek south of Claresholm, buffered the shortages. However, even with Chain Lakes Reservoir winter releases, 19 of 70 stockwater users reported winter flow problems and consequently Chain Lakes Reservoir operation was not changed. Figure 4.2 shows the history of water use in the basin.

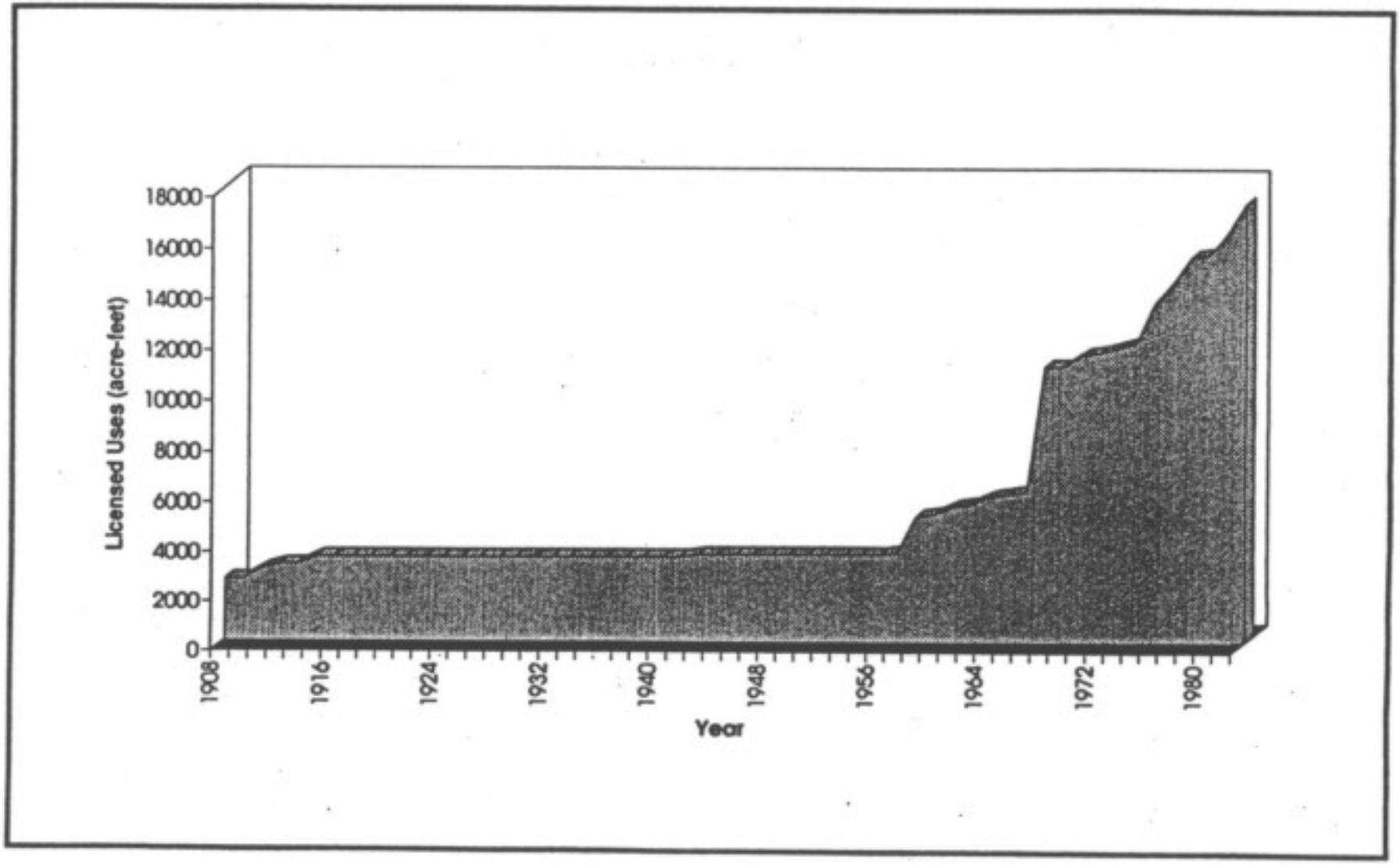


FIGURE 4.2 CHANGES IN LICENSED WATER USE IN THE WILLOW CREEK BASIN FROM 1908 TO 1983 (FROM FIGLUIZZI 1985).

Source: PWSS Application 9401

Each combination of seasons produces unique flow patterns. There is insufficient storage to offset known flow variability and provide for the established demand in the Willow Creek basin. Chain Lakes Reservoir management has been complicated by the five-to-10-day response lag time between the reservoir and the Oldman confluence. Beaver dams impede flow, but during drought conditions they benefit riparian vegetation, fish and their predators. The regulation of flow by beaver dams aids aquifer recharge and provides water sources for wildlife. Ice damming in the winter has led to flow blockage, fish kills and loss of municipal supply and has required chinook conditions to re-establish flows. At the present level of consumption, all consumptive demands can be met at a flow of two cubic metres per second or higher at the Claresholm measuring station.

The past 15 years have seen frequent drought conditions. A year with a dry winter and spring typically leads to the following chain of events:

- stockwatering dams and dugouts do not fill; exposed ground dries delaying forage growth and germination;
- temporary pumping programs move water to rangeland dugout storage;
- irrigation demand starts in early April;
- the combined high demand of irrigation and stockwatering causes supply shortages;
- requests are made to release water from the Chain Lakes Reservoir and to breach beaver dams on tributaries;
- Chain Lakes Reservoir storage is evaluated to determine possible surplus over the next year or more; and
- surplus volume, if any, is made available and a schedule of delivery is determined based on assessed risk (at maximum, total available is less than 20 percent of the allocated irrigation licence volume).

From 1983 to 1986, Alberta Environment, in consultation with the Local Volunteer Advisory Committee, conducted water supply feasibility studies within the Willow Creek basin. They concluded that an off-stream reservoir at Pine Coulee would provide the most appropriate solution. With the proposed project, new irrigation licence holders, under certain assumptions, would experience water shortages one year in eight at full expansion. Existing licence holders would go from the current one in two or three year shortfall to no shortfall.

Pine Coulee is a former glacial meltwater channel linking to the Willow Creek Valley. The climate in the proposed project area is characterized as semi-arid continental with an annual average precipitation of 419 millimetres and an annual average potential evaporation of 762

millimetres. Pine Creek is an intermittent stream in Pine Coulee, has a drainage area of about 110 square kilometres and flows into Willow Creek. The proposed reservoir would be located off-stream of Willow Creek with no appreciable sedimentation to limit its life. The selection of an off-stream storage site that is subject to minimal sedimentation improves the sustainability of the project. With ongoing maintenance, the earthen embankment dam would have an estimated life of more than 100 years and the diversion structure and canal and the outlet channel would have estimated lives of more than 50 years. Periodic rehabilitation would extend these periods.

4.1.3 Water Management Policies and Programs

The water management policies and programs that provide the context for the proposed Pine Coulee Project were briefly highlighted in Section 2 of this Report and are outlined in more detail here.

In Alberta, multi-purpose use is the principle governing the use and management of all water, including domestic, municipal, agricultural, industrial, fisheries, wildlife, recreational and aesthetic uses of water, and this policy applies in the Willow Creek basin. Within a basin, two levels of instream flow requirements are to be established for each stream segment or reach: minimum and preferred flows. Minimum flows are to be maintained to protect basic water quality and instream flow needs. Regulated streams are to be managed to meet preferred instream flows most of the time. During low runoff periods, water shortages will occur and instream flows will occasionally drop below the preferred level. On regulated streams in Alberta, projects are to be managed so that the instream flows drop to minimum levels only for short periods of time under drought conditions. Existing water rights are to be respected and any licence may contain conditions limiting the amount of water that may be diverted and used when it becomes necessary to maintain instream flows. Also, water will be reserved when a predetermined level of allocation to licensed users and instream flow requirements has been reached. A system of preferential use will determine further allocation of water.

4.1.4 The Concept of Instream Flow Needs

To implement the policies established for the South Saskatchewan River basin that apply to Willow Creek, a number of initiatives have been taken to develop the instream flow needs.

The Panel understands that the instream flow needs program is a new initiative that will continue to evolve and that the policy regarding instream flows is under consideration in the context of the review of the *Water Resources Act*. This circumstance of new and developing policy will be taken into consideration by the Panel in its deliberations; however, the Panel notes that the *South Saskatchewan River Basin Water Management Policy* is fully in effect and applies to the basin in which the project is proposed. The Panel believes that it is appropriate to have regard for the work in progress so that it can take such matters into consideration. This is particularly true of the work

of the Alberta Instream Flow Needs Task Force (IFN Task Force). The Panel reviewed their April 1993 report entitled *Instream Flow Needs and Water Management Planning in Alberta*. Because the matter of instream flows relates to evaluating the effects of the proposed project in the Willow Creek basin, the Panel will review in some detail the current approach to instream flow needs analysis adopted by the IFN Task Force (see Figure 4.3).

With respect to sustainable aquatic ecosystems, the IFN Task Force defined instream flow needs as quantities of water and water quality conditions needed to meet the demands for instream uses of water and to protect both the aquatic and riparian environments . The current trend in instream flow need analysis is toward relatively complex specifications that recognize varying seasonal requirements as well as natural variability of stream flows and water quality. In areas like the Willow Creek basin, where water resources are extremely variable, erratic and often in short supply, it is desirable to identify the maximum amount of water that can be withdrawn for consumptive uses while ensuring that an acceptable level of aquatic and riparian environmental protection is maintained and that demands for other instream uses are considered. The IFN Task Force also indicated that it is important to identify what instream flows are required for long-term sustainability of water supplies, water quality and environmental protection.

The IFN Task Force took the view that in developing strategies for management of water resources, it is important to separate the determination of IFN from the specification of water allocations in a water management process. The Applicant stressed a similar position in presenting its operating plan based on its analysis of instream flows. The reason given for this separation is to ensure that IFN specifications can be developed that are fully protective, and based on sound scientific analysis and include estimates of what is required for protection of both instream uses and the riverine environment.

The primary objective in undertaking instream flow needs (IFN) studies, according to the IFN Task Force, is to determine the instream flow regime and water quality conditions necessary to protect the various components of the aquatic and riparian environments and the processes of interaction among them. These are the conditions necessary to maintain sustainable riverine ecosystems. Ideally, determining instream flows needed to maintain ecosystems involves evaluation of the requirements and tolerance limits for each of the biological components of the system, as well as consideration of the interactions among them. When addressing environmental protection IFN, elements that need to be considered include fish, benthic invertebrates, algae, aquatic plants, riparian vegetation, wildlife, stream hydrology, water quality and geomorphological processes.

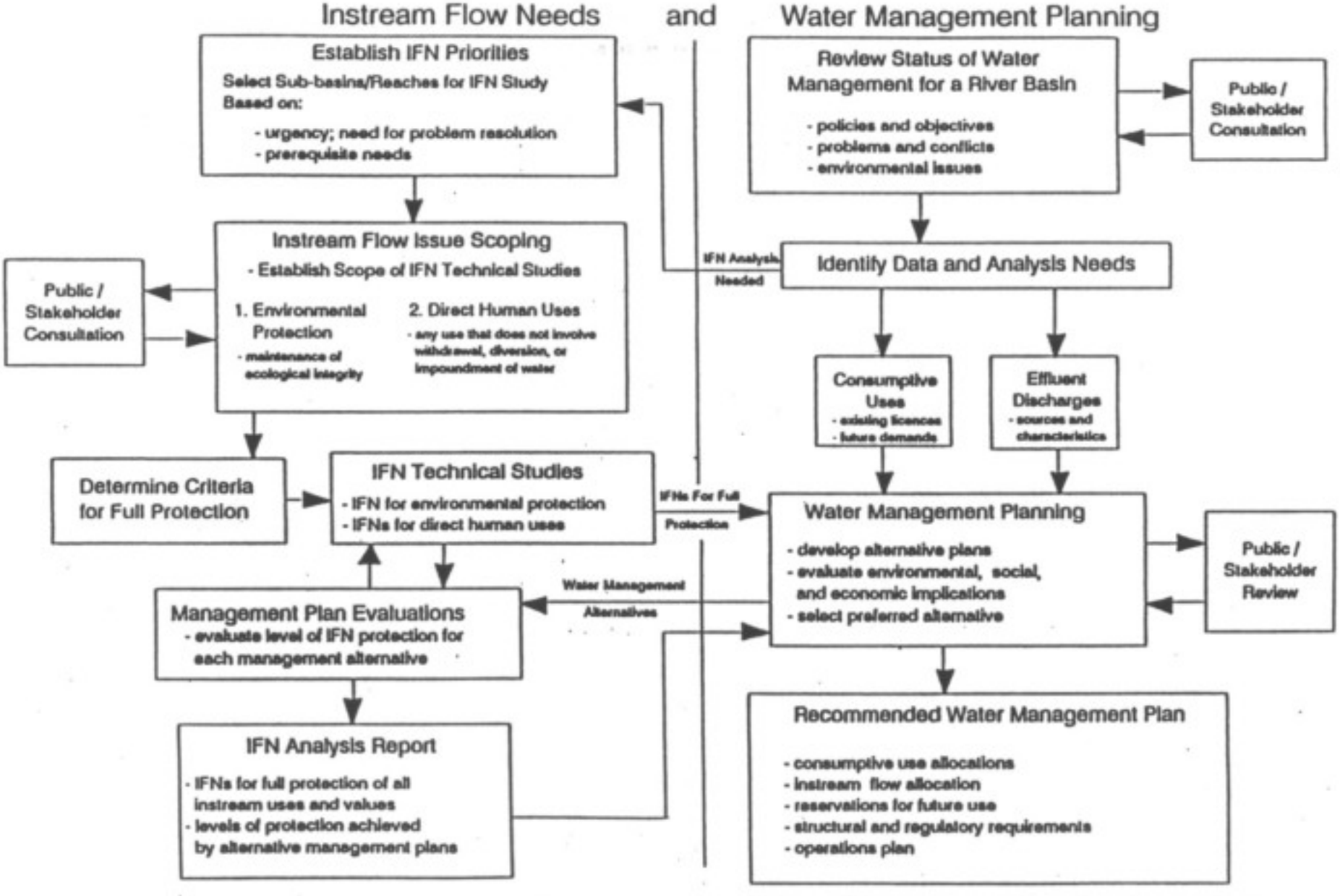


FIGURE 4.3 INSTREAM FLOW NEEDS STUDIES AND THEIR RELATIONSHIP TO WATER MANAGEMENT PLANNING ACTIVITIES

Source: Instream Flow Needs and Water Management Planning in Alberta, Draft Report of the Interdepartmental IFN Task Force, April 19, 1993 (Exhibit 67)

For the aquatic community, the primary physical and chemical factors are stream flow conditions, various aspects of water quality and physical channel characteristics. Water quality is strongly influenced by the volume of flow in a stream such as Willow Creek, and understanding of the relationship between water quality and water quantity is essential for evaluation of instream flow needs. Also of particular importance in the case of Willow Creek is the relationship between water quality and the health of the aquatic and riparian communities. There are two aspects to the flow needs of riparian vegetation: the instream flows needed to maintain existing vegetation, and the high flow events needed for riparian forest regeneration and succession.

IFN for sportfishery management include specific physical habitat and water quality requirements of the priority sportfish species as well as the need to maintain an ecosystem that can support the fish populations. Sportfishery management objectives may be to encourage establishment of non-native species, to increase production of preferred species over those that would prevail under natural conditions, or to reintroduce native species.

IFN for other direct human uses are defined by the management objectives for such uses. IFN for recreational use and aesthetics include both water quality and quantity.

Full environmental protection for sustainable riverine ecosystems is considered by the IFN Task Force to be the provision of stream flow and water quality conditions sufficient to support the community of native species, to maintain intact the basic structure and function of the ecosystem with no permanent changes in productivity of key components, and to sustain populations and the ecosystem over the long term. In some instances with extreme variability, such as occurs in Willow Creek, natural conditions can impose stresses on components of the ecosystem. Full protection criteria need not be stress free, but should create no greater stress than would prevail under natural conditions. The concept of full environmental protection is intended to be interpreted in the context of the dynamic nature of ecosystems and natural spatial and temporal variability. The IFN requirements for full protection are stream reach-specific and may vary seasonally and from year to year.

The IFN Task Force has adopted five levels of protection, as shown on Table 4.1.

PWSS stated that both the current and proposed water management legislation contain mechanisms to provide for IFN allocations. These include terms and conditions on consumptive use licences in the existing legislation, and a Crown licence for IFN having priority over consumptive use licences, under the proposed new *Water Resources Act*. The new Act, according to Alberta Environmental Protection, will provide new opportunities for the establishment of IFN and for the concept of water sharing. PWSS also explained the definition of instream flow objectives proposed in the new policy and legislation. As discussed in Section 2 of this Report, the Willow Creek projects are part of a larger water planning initiative in the South Saskatchewan River basin. PWSS stated that water quality IFN it had specified for particular months could be taken as minimum flows as fined by the *South Saskatchewan River Basin Water Management Policy*.

TABLE 4.1 LEVELS OF ENVIRONMENTAL PROTECTION

The following levels of protection are intended to be used as guidelines for specifying the level of environmental protection achieved by each alternative water management plan. It is recognized that it may not be possible in every instance to precisely identify a level of protection. Uncertainty about the level of protection that would be achieved should be reflected by indicating a possible range {e.g., between Level 2(a) and 2 (c)}. Five levels of protection are described, with sub-categories under levels 1 and 2:

Level 1. The natural ecosystem is maintained with native species, and with the basic structure and function intact.

(a) There is no significant change (i.e., outside the range of natural fluctuations) in the productivity of key components.

(b) There is some impairment or enhancement of one or more key components, but changes in productivity are temporary or occasional and are not sufficient to destabilize the system to the point that the basic structure and function are altered.

© There is some permanent impairment or enhancement of one or more key components. Changes in productivity are not sufficient to destabilize the system to the point that the basic structure and function are altered.

Level 2. An altered but functionally equivalent ecosystem is maintained. The species composition of the community is altered but the same functional components are represented (i.e., the same type of community remains).

(a) Productivity of key components remains similar to that in the unaltered system.

(b) There is some impairment or enhancement of one or more key components, but changes in productivity are temporary or occasional and are not sufficient to destabilize the system to the point that the basic structure and function are altered further.

© There is some permanent impairment or enhancement of one or more key components. Changes in productivity are not sufficient to destabilize the system to the point that the basic structure and function are altered further.

Level 3. An altered and functionally different ecosystem is maintained. There are significant changes in the basic structure and function of the ecosystem but a new healthy, viable, and diverse community is maintained.

Level 4. Certain specified human uses only are protected. There is no provision for maintenance of a stable ecosystem.

Level 5. There is no protection of any instream uses or values.

Source: Adapted from Instream Flow Needs and Water Management Planning in Alberta, Draft, April 19, 1993 (Exhibit 67)

4.1.5 Instream Flow Needs in Willow Creek

For its purposes, the Panel identified the following descriptions for the various reaches or segments of Willow Creek:

- Reach 1 - from the headwaters of Willow Creek to the Chain Lakes Reservoir;
- Reach 2 - from Chain Lakes Reservoir to the proposed diversion weir;
- Reach 3 - from the proposed diversion weir to the proposed Pine Coulee Reservoir outlet;
- Reach 4 - from the Pine Coulee Reservoir outlet to the mouth at the Oldman River.

The reaches are shown in Figure 4.4.

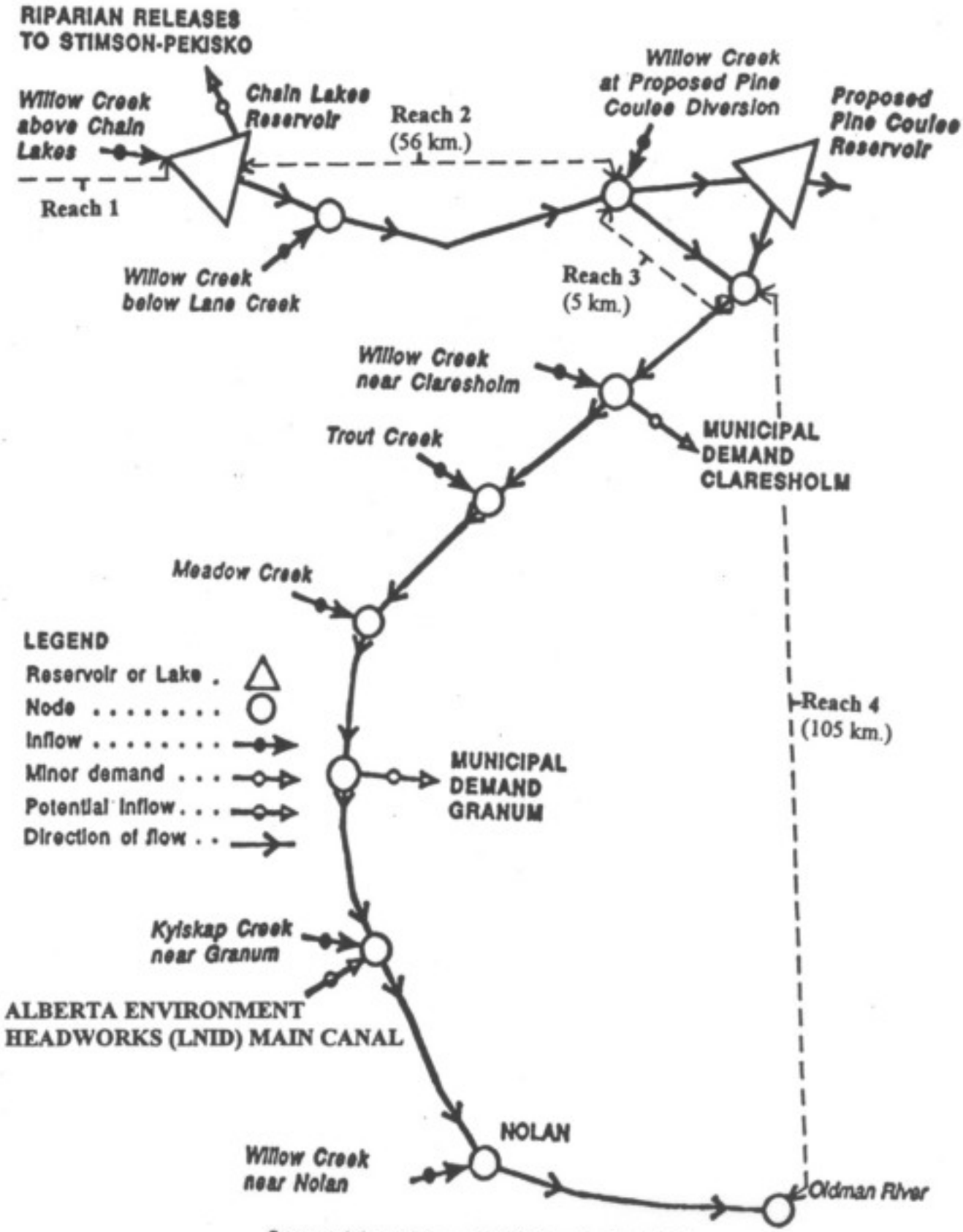
PWSS has adopted instream flow need analysis as a basic component of its proposed project. The proposed operating plan for the works is based on the analysis of IFN. Table 4.2 summarizes the PWSS findings about instream flow needs.

The issue of water quality as it relates to hydrology and fisheries was discussed during the hearing. Water quality objectives are defined in the Application through minimum IFN values for water quality and recreation. The objectives used in the evaluation by PWSS were a compilation of water quality objectives derived from the Bow River Water Quality Task Force, from federal government criteria and from provincial criteria used in the *South Saskatchewan River Basin Planning Program.*

The Application includes an instream flow analysis, including a summary of the methods and results from studies used to determine the IFN for Willow Creek. A water quality monitoring program was carried out in 1990-91. The Applicant stated that, compared to federal and provincial water quality guidelines, the data indicated that general water quality guidelines for the protection of freshwater aquatic life were met for most parameters and failed them for dissolved oxygen, aluminum, chromium, copper, iron, lead and phenols. The report states that for the Willow Creek IFN, sportfish were used as indicators for assessing aquatic environment protection. Different sportfish and their life stages would have different requirements. For Reach 2 above the Pine Coulee diversion weir, trout were selected as the indicator species; pike and walleye were selected for Reach 4 below Pine Coulee outlet. The analysis of water quality requirements for sportfish focused on temperature and dissolved oxygen. Because temperature and dissolved oxygen in Willow Creek below the Pine Coulee Reservoir outlet (Reach 4) were considered by PWSS to be unsuitable for trout, trout habitat studies were restricted to Reach 2 above the proposed diversion.

FIGURE 4.4

WILLOW CREEK BASIN SCHEMATIC
SHOWING STREAM REACHES



Source: Adapted from PWSS Application 9401

TABLE 4.2 SUMMARY OF INSTREAM FLOW NEEDS

Component	Location	Instream Flow Need
Fisheries	Upstream of the Pine Coulee Diversion	Fish Rule Curves*
	Downstream of the Pine Coulee Diversion	0.4 cms June 15 - June 30 0.8 cms July 1 - Aug. 31 0.4 cms Sept. 1 - Oct. 15
Recreation	Through Willow Creek Provincial Park	swimming, wading up to 2 cms** tubing, rafting > 2.0 cms
Water Quality	Downstream of the Pine Coulee Diversion	0.4 cms June 15 - June 30 0.8 cms July 1 - Aug. 31 0.4 cms Sept. 1 - Oct. 15
Riparian Vegetation and Wildlife	I) maintenance of major spring flood events ii) maintenance of the natural timing when floods occur iii) rate of decline of flood stage should not exceed 4 cm/day iv) during periods of low flow in July and August, minimum summer flows should not be less than 80% exceedence flow	

* The "Fish Rule Curves" largely indicate that natural flow are required for the fisheries IFN. However, during spring flooding the fisheries IFN falls below natural flows to 5.66 cms (200 cfs). During periods of high flows in the fall, the fisheries IFN may also fall below natural flows to a maximum of 5.66 cms.

** For typical recreational activities such as swimming and tubing, flows up to 2 cms (70 cfs) are acceptable. Velocity becomes a limiting factor for swimming at flows near 2 cms, while the tubing and rafting experience becomes more enjoyable.

Source: Adapted from PWSS Application 9401

Flows based on fishery requirements are only supplied during certain periods in Reach 2 of the creek upstream of the proposed diversion, under both current and proposed conditions. For Reach 4, the IFN for water quality is based on pike and walleye.

Additional evidence supplied by the Applicant indicated that the water quality criteria for cold-water fish species, based on dissolved oxygen and temperature, could extend down to Claresholm under conditions created by the project. This would add a further 20-kilometre stretch downstream from that stretch found suitable for trout in Alberta Environmental Protection's scientific evaluation carried out as part of its IFN determination. Oral evidence indicates that with releases to meet the irrigation needs, stream temperatures required for cold water fish would likely be maintained at or below 22 degrees Celsius between the reservoir outlet and Claresholm. The PWSS expert mentioned the possibility that there would be other factors detracting from the trout habitat value for this reach, such as good rearing habitat for juveniles.

Information submitted by PWSS during the hearing examined the effect on irrigation of meeting fishery objectives in Reach 2 upstream of the proposed site. This would require the Chain Lakes Reservoir to be operated in a mode other than that contained in "the recommended Pine Coulee Project preliminary operating plan" selected by PWSS for this Application. Operating the Chain Lakes Reservoir to satisfy the fishery objectives for Reach 2 above the Pine Coulee Project would have two primary impacts. It would alter the low levels in the Chain Lakes Reservoir during periods of low runoff, resulting in a low level five metres below the desired minimum level of 1,295.5 metres. There would also be an increase in the deficits projected for irrigation water in extreme drought years when flows are augmented by summer releases from Chain Lakes Reservoir. However, the simulation does indicate that fish requirements could be satisfied if these limitations were acceptable.

In considering the intent of the IFN Task Force and the status of the IFN assessment for Willow Creek, the Application states, "The IFN that has been determined by this process was based on the best information and technology available. In the future, better data and new information may result in adjustments to the flow values described in the following section." Also, the Panel notes that the document *Water Management in the South Saskatchewan River Basin* states, "First priority in establishment of these flow amounts should be given to reaches where flows are currently thought to be critical (where moratoria exist) and/or where storage or diversion works are in the planning phase." It mentions that Willow Creek would be such an area. "The portion of instream flow amounts associated with water quality assurance should provide an excess of assimilative capacity as a buffer to cope with unanticipated events...A portion of the annual flow that is available for consumption after meeting existing and anticipated instream flow needs should be reserved, unlicensed, for future growth and development needs."

The impact of the proposed project on riparian IFN was discussed in the Application. In Reach 4 downstream of the proposed project, there would be a minor effect on the magnitude of major floods and subsequent rate of river stage decline, resulting in minor impacts on seedling

establishment and first-year seedling survival for such species as riparian poplars. This impact could be mitigated by augmenting low summer flows with releases from the proposed reservoir.

The Panel believes it is important to understand both the conditions that would exist under natural flow conditions in Willow Creek relative to IFN, and the conditions that currently exist in the creek. For example, under natural flow conditions that existed upstream of the proposed project in Reaches 1 and 2 before the Chain Lakes Reservoir was developed, IFN would be expected to be met for all criteria, even though in some years the natural conditions would result in some significant stress to natural systems. Under existing conditions, reflecting the current operational strategy for the Chain Lakes Reservoir, the IFN for fisheries are not met in Reach 2 immediately below the Chain Lakes Reservoir during low flow conditions. The Panel heard some evidence about other factors, such as cattle grazing, that have also had some effect on the riparian and instream conditions in Reach 2.

In Reach 3, from the diversion works to the outlet from the Pine Coulee Project, the IFN based on human use (recreation at the park) are nearly attained under existing regulated flow conditions. Also in Reach 3, from the proposed weir downstream to the outlet of the reservoir, the IFN specified for maintenance of water quality for sportfish are met 71 percent of the time under natural conditions and 63 percent of the time under existing conditions.

In Reach 4, downstream from the Pine Coulee Reservoir outlet, the IFN for water quality for sportfish are met 73 percent of the time under natural conditions and 57 percent of the time under existing conditions.

The conditions that would prevail in Willow Creek under natural flow conditions, and the existing conditions which reflect the current operating plan for Chain Lakes Reservoir, are such that the IFN identified in the Application are not met in specific reaches for particular components of the proposed IFN, as indicated above. The Panel believes that recognition of this existing situation of less-than-required water quantities for sustainable riverine ecosystems is important to its consideration of the proposed Application. This is particularly significant because the Panel also recognizes that there have already been significant allocations of water for domestic, stockwatering, municipal, and irrigation requirements that must be respected under the current policies that apply to the Willow Creek basin.

As described earlier in the discussion of the historical development of the basin, there are already serious water management problems that must be addressed in the context of the sustainability of existing development before further allocations can be considered. Recognition of this situation as it relates to the sustainable development of the Willow Creek basin by the Controller of Water Resources resulted in the current moratorium on further water allocations in the basin, pending consideration of the current Application.

4.2 Water Management Planning

The preceding discussion has examined in some detail the basis for the preliminary operating plan set forth in the Application as it pertains to the concept of IFN. The discussion now turns to the water management planning considerations reflected in the Application. In particular, the Panel will address the recommended water management plan in terms of the operating plan itself, consumptive use allocations, instream flow allocation, reservations for future use and structural and regulatory requirements.

4.2.1 The Proposed Operating Plan

As discussed in Section 3, the Pine Coulee Project has the following multi-purpose objectives:

- increased security of supply for existing municipal and domestic water users;
- provision of a secure water supply for livestock and irrigation water users;
- potential expansion of irrigated acreage in the Willow Creek basin to 8,500 hectares (21,000 acres);
- provision of additional water-based recreational opportunities near existing facilities at Willow Creek Provincial Park; and
- improving the potential for meeting instream flow needs downstream of the reservoir from the perspective of both water quantity and quality.

To accomplish these objectives, a specific operating plan was prepared for the project, using a water resources management simulation model and data from the historical water records over a 77-year period. The summary of the operations plan is contained in Table 4.3.

The issues associated with determining surface water flows and needs were extensively covered during the hearing. Groups expressing an interest in water volumes included the Willow Creek Irrigators Association, the Public Advisory Committee, the Pine Coulee Coalition, the Peigan Nation, Trout Unlimited Canada, local municipalities, the federal government and Alberta Environmental Protection. The discussion of water volumes in Willow Creek was closely tied to water quality because water quantity is limited on both a yearly and seasonal basis. Consequently, the issue of adequacy of supply for sustainable development requires the concurrent consideration of fisheries, agriculture and irrigation, municipal, recreation and other uses.

TABLE 4.3 SUMMARY OF OPERATIONS OF MAJOR CONTROL STRUCTURES IN THE WILLOW CREEK BASIN (SOURCE: ALBERTA ENVIRONMENT 1992).

Structure	Operation Plan
Chain Lakes (No change in current operations)	Winter releases vary between 0.283 and 0.425 cms between November and March depending on ice cover and temperature conditions. No summer release between April and October*
Pine Coulee Diversion	Divert when flow greater than: 0.283 cms March 1 - May 21 1.0 cms May 21 - June 28 2.0 cms June 29 - September 7 0.4 cms September 7 - October 15 No diversion during winter from November to February inclusive.
Pine Coulee Reservoir	Full Supply Level 1052.5 m Irrigation Drawdown 1044.0 m Minimum Reservoir 1042.0 m Operation releases as required to meet downstream water demands.
Headworks Canal	A special authorization may be granted in an exceptional situation for a flow release

* Current operations include provision for summer releases under drought conditions if there is sufficient water available. In the proposed operating plan simulation, releases were made to meet the IFN during several years when Chain Lakes was above 1295.5 m and Pine Coulee Reservoir was at 1044.0 m (irrigation minimum).

Source: Adapted from PWSS Application 9401

The Willow Creek Irrigators Association (the Irrigators Association) represented its need for a stable water supply. This was particularly important during the growing months, when Willow Creek is often reduced in volume during dry years. The Irrigators Association supported maintaining IFN flows as a condition of the proposed project, even though this could mean less than optimal water supply for its members. It emphasized the importance of cooperation in allocating the available water for the use of its members, and referred to its past efforts in this regard. It expects to work with the Controller of Water Resources in achieving a fair distribution of the water resource available. Current irrigation technologies help irrigators make the most efficient use of available water, the Irrigators Association said, and pointed to past successes with irrigation, even with marginal access to water, as an indication of the benefits of this type of project. It saw any improvement in water supply availability and stability as positive and said that even if the proposed project would not be capable of supplying 100 percent of maximum allocation requirements, it would still be desirable. The Irrigators Association presented the concept of relative supply and the need for operator judgment, based on supply realities, in deciding the nature and mix of crops. In this respect the Irrigators Association strongly opposed the views expressed by the expert representing the Peigan Nation that optimum supply requirements should be assured to an irrigator.

The Pine Coulee Coalition's (the Coalition) position on water allocation as it affects the environment emphasized fish management concerns and associated IFN. The Coalition believes there is a need to protect fisheries and proposed that no diversion should occur, at any time of the year, that would reduce flow below the 80 percent exceedence level for the creek, that is, the weekly flows that would be exceeded 80 percent of the time under natural conditions. It pointed to its position about the historic status of this creek as an excellent fishery and felt that this condition should be re-established. According to the Coalition, the water quality IFN proposed by PWSS are not adequate. It also objected to the quantity of water that would be diverted during spring flows and felt that a significant portion of the flood flow should be maintained. In this respect, it was opposed to the operational plan advanced by PWSS, and wanted a riparian IFN as part of the plan.

As operator of the facility, Alberta Environmental Protection (AEP) would undertake monitoring before full irrigation development in the Willow Creek basin. If this indicated that water quality criteria were not met, the maximum proposed level of irrigation development in the basin could be adjusted downward. AEP also stated that IFN would be given priority over irrigation and irrigation expansion in its assessments. Further, AEP would monitor to determine the need for operational changes to meet criteria such as IFN and flushing flows. The decision to make changes to the operating plan would be made by AEP in cooperation with a public advisory group acting as a watchdog. The proposed new *Water Resources Act* affects this process by requiring the implementation of IFN and introducing the ability to transfer licences.

4.2.2 Consumptive Use Allocations

With respect to IFN, the proposed PWSS operating plan takes into account the existing AEP operating plan for the Chain Lakes Reservoir and recognizes that it does not satisfy the fisheries IFN in Reach 2 below Chain Lakes Reservoir. The recreational flow specified for Reach 3 of Willow Creek through the park during the peak recreation months of July and August is nearly attained under the preliminary operating plan and existing regulated flow conditions. In Reach 3, from Victoria Day long weekend to October 15, the human recreation use IFN criteria would be met 60 to 90 percent of the time. With respect to riparian vegetation in Reach 3, the flows under the proposed operating plan are somewhat lower during the spring runoff period because of diversions to the proposed reservoir. Downstream of the project in Reach 4, municipal water supplies for Claresholm and Granum and the IFN to maintain suitable water quality for fisheries are given priority in the proposed operating plan. These requirements in Reach 4 are satisfied in all but four weeks during the 77-year simulation period. Consumptive uses in Reach 4, such as municipal requirements for Claresholm and Granum would always be satisfied under the proposed operating plan. Riparian requirements in Reach 4 for domestic and stockwater uses, would also be satisfied.

The ability of the proposed project to meet sustainable irrigation requirements in Reach 4 is discussed in detail below.

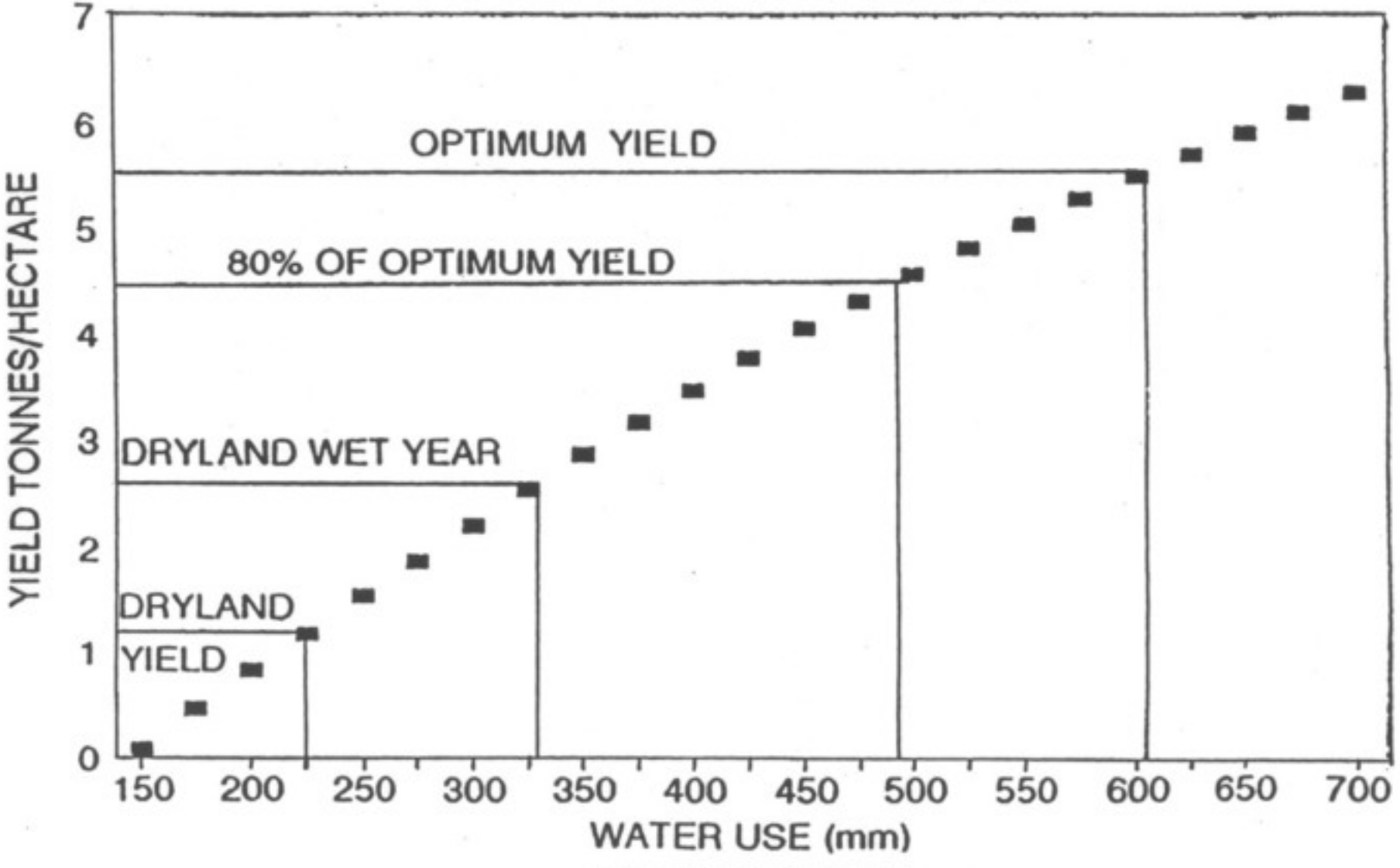
The maximum amount of water impounded during high flow periods, that would be available for irrigation purposes during subsequent low flow months, would be 37,000 cubic decametres. At a full irrigation buildout of 8,500 hectares and with a mean water allocation of 418.5 millimetres, total irrigation water use of 35,572.5 cubic decametres would be projected, very close to the storage potential of the proposed project. Seventeen percent of storage would be retained at a minimum level of 1,042 metres and would be intended to maintain adequate water quality conditions for fish survival and for recreational opportunities in the reservoir.

The mean water allocation of 418.5 millimetres compares to an optimum crop requirement of 610 millimetres for alfalfa and 410 millimetres for cereal crops. Figure 4.5 illustrates the relationship between crop yield and water use. Irrigation water application is only about 75 percent efficient. Consequently, if one were to assume all alfalfa and only irrigation water sources, a requirement of 813 millimetres would arise, almost twice the mean allocation of 418.5 millimetres. PWSS simulated an irrigation requirement of almost 800 millimetres once in the 77-year period of record, assuming 75 percent efficiency and a 70/30 crop mix of alfalfa and cereal.

This worst case scenario, a drought year during full buildout, with the most demanding crop, was the source of considerable discussion at the hearing. Based on its experience, the Applicant, however, only assigns 80 percent of the optimum crop water requirement calculated for normal farm operations as illustrated in Figure 4.6. The adjusted allocation is shown in Figure 4.7, including a 450 millimetre cap.

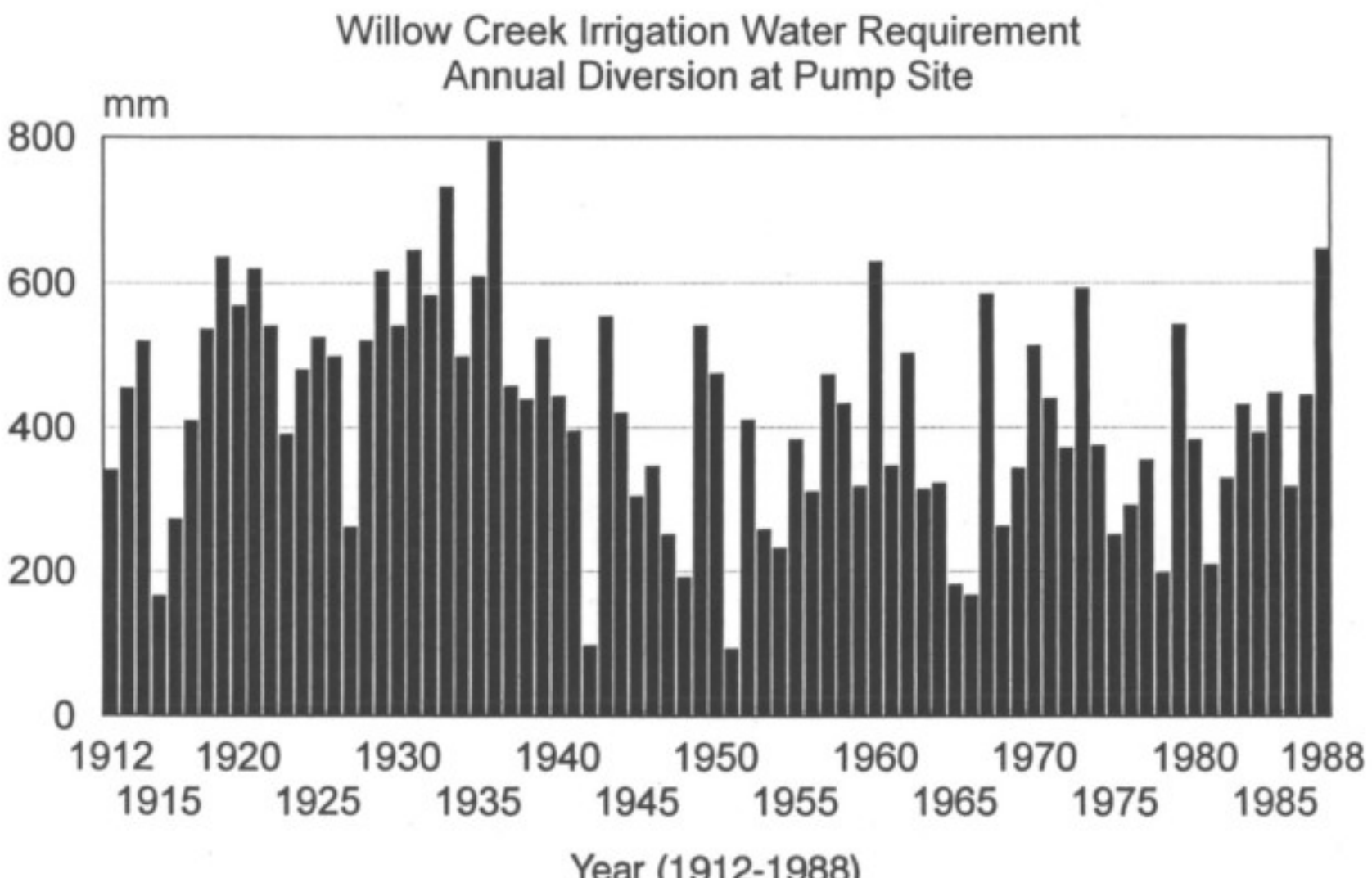
FIGURE 4.5

ALFALFA WATER USE VS. YIELD RELATIONSHIP



Source: PWSS Application 9401

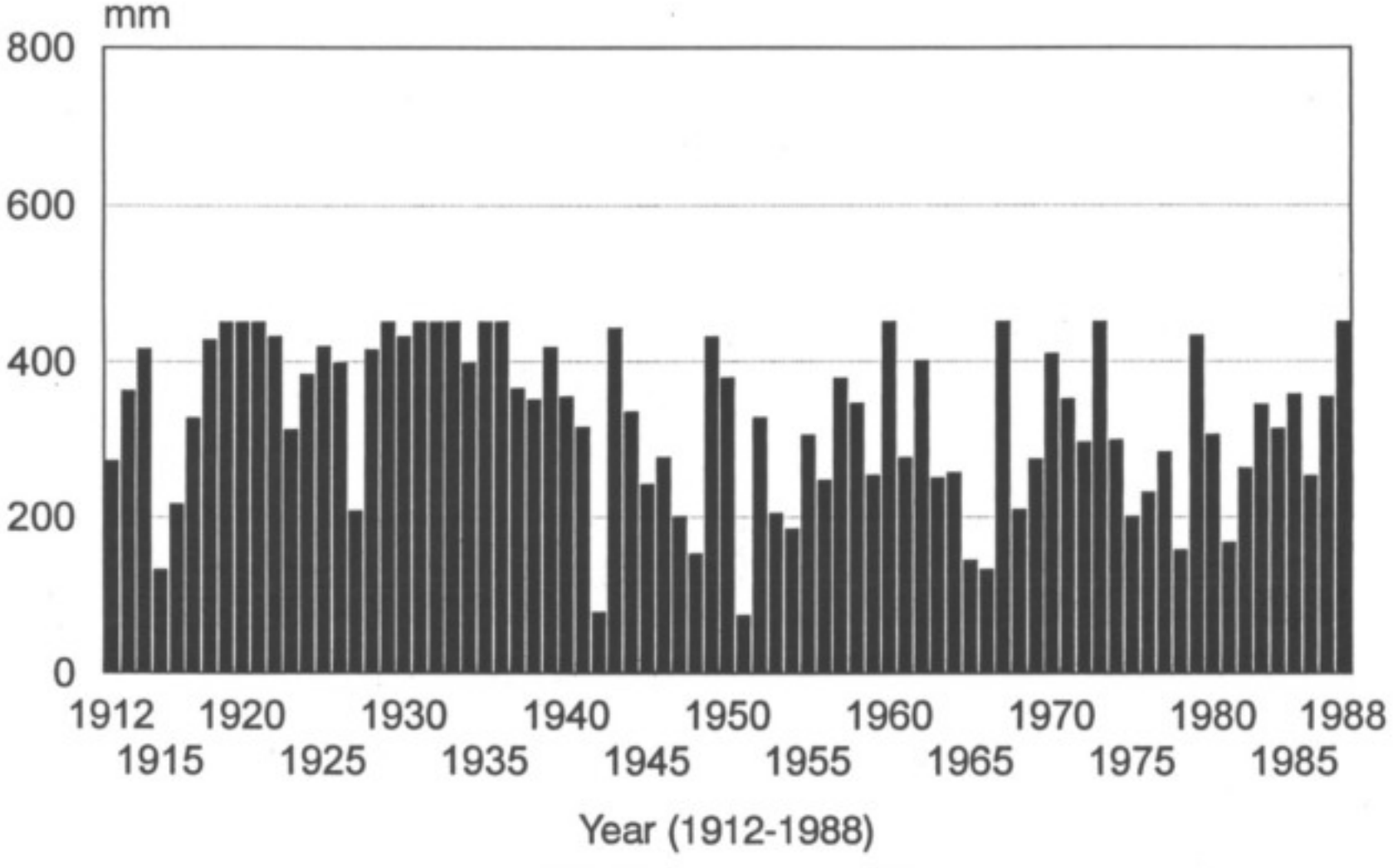
FIGURE 4.6



Source: Adapted from Willow Creek Basin Water Supply/Demand Modelling, March 1994 Draft, AEP (Exhibit 71)

FIGURE 4.7

Willow Creek Irrigation Water Requirement
Annual Diversion at Pump Site



80% of Optimum Capped at 450mm
On farm efficiency: 75% Crop mix: 70% alfalfa 30% annual crops

Source: Adapted from Willow Creek Basin Water Supply/Demand Modelling, March 1994 Draft, AEP (Exhibit 71)

Data from the Application show that during the 77-year period of record, precipitation between May 1 and August 31 was at or below a cumulative total of 100 millimetres for 16.9 percent of the years and at or below 200 millimetres for 58.5 percent of the years.

The Application stated that simulations for the 77-year period of record indicated that an irrigation requirement of more than 400 millimetres would have arisen for 42 (55 percent) of these years, an irrigation requirement of more than 500 millimetres would have arisen for 24 (31 percent) of these years and that an irrigation requirement of more than 600 millimetres would have arisen for nine (12 percent) of these years. It stated that any water allocation deficit greater than 100 millimetres would have the potential to cause yield loss and that this level of supply failure would not be acceptable more than 30 percent of the time. These periodic water supply failures would still occur with the development of the proposed Pine Coulee Project and expanded irrigation development.

The Application recognizes that under full development, water management would continue to require intensive control and close cooperation and communication between the proposed project operator and the water users.

PWSS provided information on reservoir replenishment by simulating the proposed project conditions over the period of record, 1912 to 1988. Those data indicate that in three years of the simulation the reservoir was drawn down to its lowest allowable level of 1,042 metres (1984, 1985 and 1988). In four years, it was not able to recover above the 1,046-metre level. In 16 of the 77 years, the reservoir was not able to recover above the 1,051-metre recovery level. The combination of drawdown and recovery data indicate the ability of the reservoir to satisfy irrigation demands, assuming that the 77-year modeling scenario is representative of future conditions. Irrigation demands are also affected by the timing of and net amounts of precipitation in any one year. Consequently, the effect of the inability of the reservoir to refill one year and supply the maximum allotment possible in the next year is moderated or exacerbated by the rainfall received. The proposed operating levels of the reservoir are shown in Table 4.4.

A comparison of the simulated irrigation demands and the simulated reservoir status data contained in the Application shows that conditions in the mid-1930s (1936) and the late 1980s (1988) provided the most extreme discrepancies between crop irrigation demand and reservoir supply. For example, in 1988 the reservoir would have recovered to only the 1,044.5 metre level and the irrigation water requirement was about 650 millimetres, well in excess of even the maximum allotment of 450 millimetres.

TABLE 4.4 PINE COULEE RESERVOIR - OPERATING LEVELS

Operating Level	Elevation (m)	Capacity (dam^3)	(ac-ft)
Full Supply Level	1052.5	50,600	(41,000)
Minimum Irrigation Level	1044.0	13,600	(11,000)
Minimum Operating Level	1042.0	8,600	(7,000)
Outlet Invert	1034.81	500	(400)

Source: Adapted from PWSS Application 9401

Examination of the data provided in the Application on calculated optimum irrigation water requirements over the 77-year historical record, in conjunction with the Pine Coulee Project operational simulation, provides an understanding of the ability of the reservoir to satisfy water demands in the Willow Creek basin (see Figure 4.8). Irrigation water availability depends on storage in the reservoir available for irrigation purposes and instream flows, independent of reservoir releases, available during the irrigation season. For at least those years when calculated irrigation water capacity of the reservoir was less than the drawdown for that year, water was required from the reservoir for creek maintenance IFN. This situation is noted in 13 years of the period of record used in the simulation.

In the model, the irrigation requirement in Reach 4 for these years outstripped reservoir supply. This is consistent with the observation that water from the reservoir was needed strictly for creek flow maintenance. Consequently, creek flow could not significantly augment the irrigation shortfall. Data show that there were 13 years when rainfall in the period May 1 to August 31 was equal to or less than 75 millimetres. On the other hand, during the years of higher rainfall, the data clearly shows that the water demand from the reservoir is significantly less than the total irrigation requirement. Since in many years only a portion of the irrigation capacity was actually required, a significant carryover exists from a normal year into the next year, which could prove to be a dry year.

The data showed that significant irrigation shortfalls arose primarily when dry years occurred in sequence (see Figure 4.9). Of the 13 years when water needed from the reservoir to augment creek flows caused the reservoir to drop below 1,044 metres, five were stand-alone years but the other eight significant irrigation shortfalls occurred in three-year and five-year sequences.

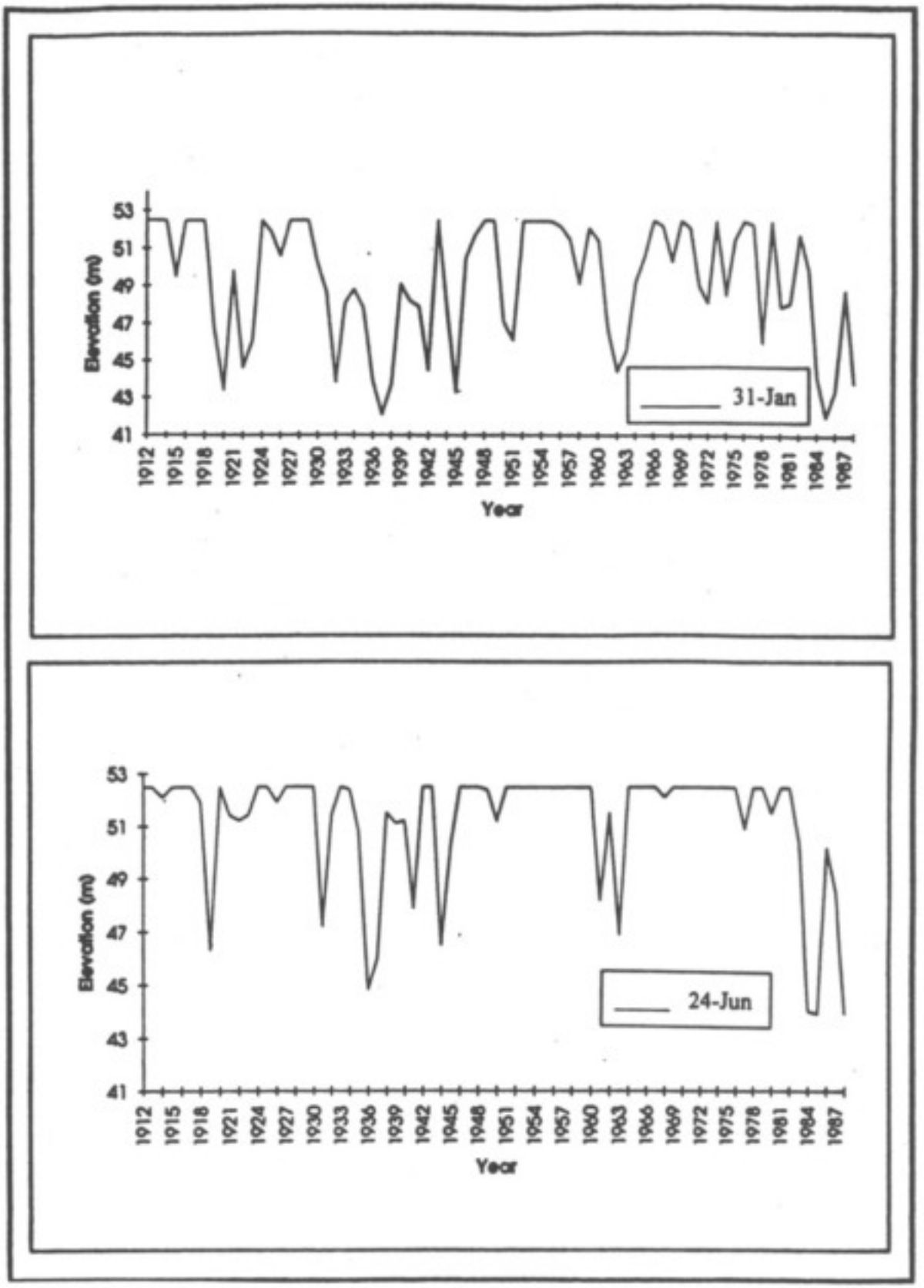


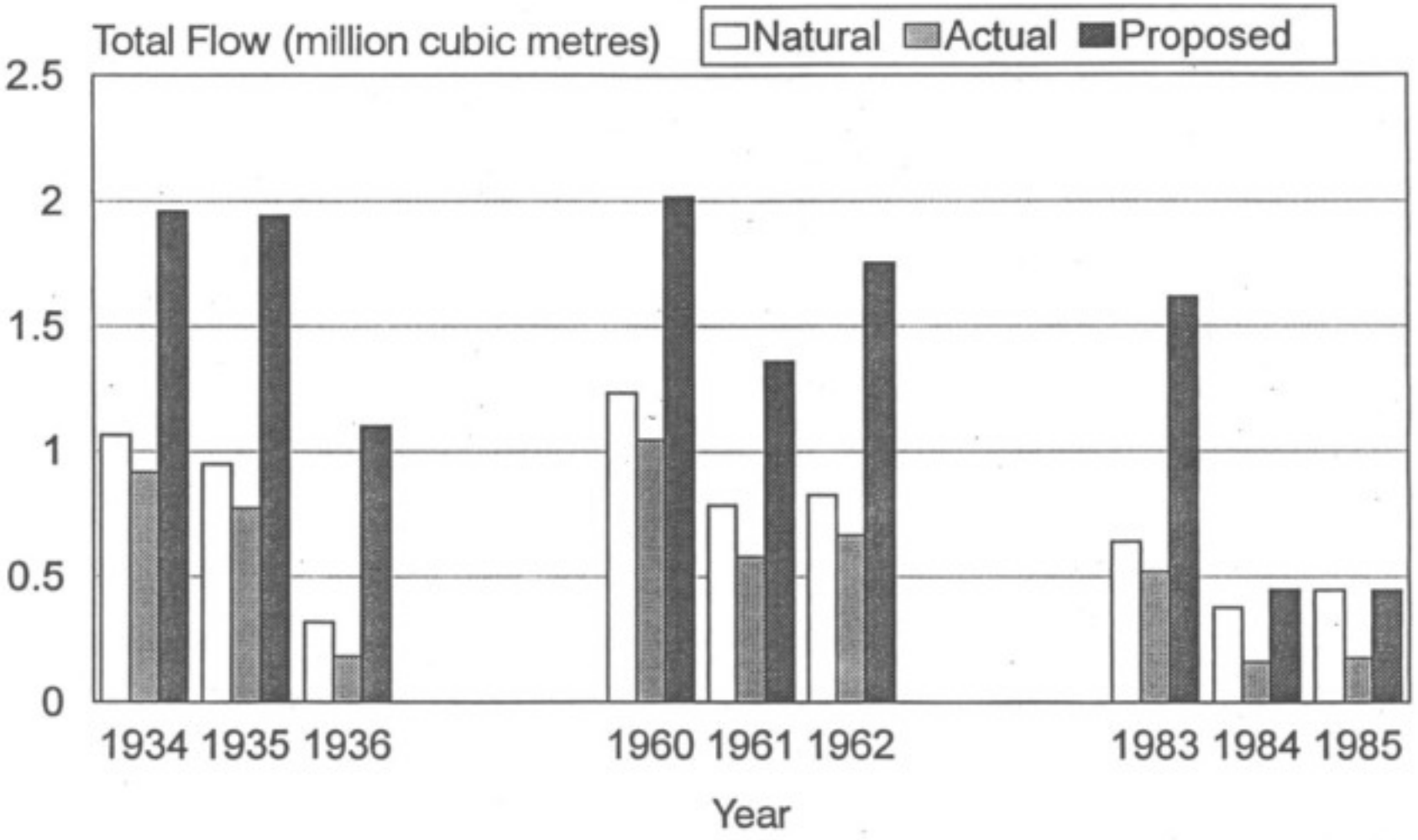
FIGURE 4.8 SIMULATED MINIMUM (JANUARY 31) AND MAXIMUM (JUNE 24) WATER LEVELS FOR PINE COULEE RESERVOIR

Source: PWSS Application 9401

FIGURE 4.9

EFFECT OF THE PROPOSED PINE COULEE OPERATING PLAN ON SUMMER STREAMFLOW OF WILLOW CREEK IMMEDIATELY DOWNSTREAM OF PINE COULEE DURING SEQUENCES OF EXTREMELY DRY YEARS

(Actual Conditions After 1962 Include Operations of the Chain Lakes Reservoir;
Proposed Conditions Include Operations of the Pine Coulee Reservoir)



Source: Adapted from PWSS Application 9401

4.3 Panel Views

The Panel recognizes the fundamental role that water plays in sustainable development and the quality of life of all people, including the many uses of water in human settlements and the environment. The Panel believes the conflicts, demands and competition for the equitable sharing of available water supplies is increasing with increasing populations, agricultural production, industrial development, and concern for the environment. In areas such as the Willow Creek basin, that have limited or variable water resources with consequent water shortages, the Panel believes it becomes particularly important to have comprehensive management strategies and procedures to determine, and at times to adjudicate on, the allocation or sharing of these limited water resources. The Panel believes that sustainable development in the Willow Creek basin is more possible with regulated water flows in Willow Creek. The Willow Creek basin, with its extremely variable flows, is a basin in which comprehensive water management strategies and procedures can be applied to achieve sustainable development based on multi-purpose water management objectives.

4.3.1 Instream Flow Needs

In the current circumstances in Willow Creek basin, where there are highly variable flows and demands that far exceed supply during low flow conditions, the Panel finds that the concept of IFN takes on a slightly different meaning. In most cases, flow regulation is proposed to provide additional opportunities for beneficial use of water over and above the basic requirement of environmental protection and meeting existing allocations of water. In essence, the IFN proposed for the Willow Creek basin can be considered in the context of overcoming pre-existing deficits of water and determining whether additional water allocations can be accommodated.

Keeping in mind the preliminary stage of development that characterizes the IFN program, the Panel has examined the degree to which the proposed IFN for Willow Creek meets the broad policy criteria established for the South Saskatchewan River basin and the IFN criteria established by the Alberta IFN Task Force.

The Panel, in its *Report of Pre-Hearing Conference*, concluded that it was beyond its jurisdiction to determine the operating requirements of the Chain Lakes Reservoir. It recognizes that PWSS has taken the existing Chain Lakes Reservoir operating plan into consideration in the proposed Pine Coulee Reservoir operating plan. The Panel notes, however, that the Chain Lakes Reservoir was initially developed to meet domestic and municipal needs. The requirement to operate Chain Lakes Reservoir to meet those needs has been substantially decreased by the off-stream storage capability and alternative sources developed in the basin over the last few years. These requirements could be further reduced if the proposed Pine Coulee Project were to proceed. Alberta Environmental Protection indicated that if the proposed project were to proceed, it would undertake a public review of the current operating plan for the Chain Lakes Reservoir. Under the current *South Saskatchewan River Basin Water Management Policy*, regulated streams are to be managed so that the instream flows drop to minimum levels only for short periods of time under drought conditions. The Panel

believes that the existing situation in Reach 2 immediately below the Chain Lakes Reservoir may not conform to this policy and recommends that Alberta Environmental Protection proceed with a re-examination of the operating plan of Chain Lakes Reservoir.

The Panel emphasized earlier the realities of the existing flow conditions in the basin. In that context, the IFN that are proposed in the Application are a significant improvement on the existing circumstances. The proposed IFN would be met most of the time; during low flow conditions it would be possible to achieve IFN over and above natural and existing conditions. The Panel believes that, with the level of environmental protection that would be achieved through the adoption of the recommended IFN, the proposed project would fall within the Level 2 specified by the Alberta IFN Task Force. (See Table 4.1).

Overall, the Panel is encouraged that the Application includes IFN specifications. It believes the work done in this regard serves to advance overall management of water in the Willow Creek basin.

The Panel recognizes that Reach 1 of Willow Creek above the Chain Lakes Reservoir is in a relatively natural condition and not subject to flow regulation. Consequently, Reach 1 can be expected to meet IFN reflective of natural conditions. The Panel believes that the current circumstances may not be satisfactory in Reach 2 immediately below the Chain Lakes Reservoir and upstream from the confluence of South Willow Creek.

The IFN specified in the five kilometres of Reach 3 from the diversion weir to the outlet of the proposed reservoir is less than satisfactory but unavoidable if downstream benefits are to be realized. Reach 3 includes the provincial park which is based on the presence of the creek and the natural environmental conditions found there. Current flows and the IFN specified for Reach 3 do not satisfy the sportfish water quality objective one-third of the time. It is also uncertain what performance level can be expected with respect to the riparian vegetation that is significant to the park and its users. The IFN Task Force has documented the need to establish fully protective IFN as a basis for considering water management allocations. Reach 3 requires that IFN be established that are fully protective of water quality both for sportfish and for riparian vegetation in order to be consistent with the IFN approach advocated by the IFN Task Force. Making such environmental protection IFN explicit would help to clarify the implications of the Application and the water allocation decisions inherent in the proposed operating plan.

The Panel recognizes that Reach 3 of Willow Creek between the proposed diversion weir and Pine Coulee Reservoir outlet would not be able to receive the beneficial flows from the proposed reservoir. During low flows the proposed operating plan for the weir would only provide for flows that approximate the current flows in Reach 3. The Panel views the proposed operating plan for the weir as ensuring that flows in Reach 3 would be no worse than current low flows.

In Reach 4 of Willow Creek, downstream of the proposed outlet for approximately 105 kilometres to the mouth at the Oldman River, the IFN has satisfactorily identified the water

quality criteria for cool-water fisheries. Reach 4, since it is a transition zone between cool and cold-water fish species, should also include a recognition of the IFN for cold water species for at least the portion of the reach closest to the outlet. Since the water quality criteria for these species may be met some of the time under existing and natural flow conditions in the area above Claresholm and below the outlet, the IFN should make explicit the requirements for cold-water fish in this area. This is particularly important since the proposed project can further influence the water quality downstream of the outlet in a manner that may extend the time that the criteria may be met.

The riparian vegetation component of the IFN in Reach 4 downstream of the proposed outlet has been identified in the Application as clearly as current science allows. However, the Panel believes the degree to which this IFN can or should be met under the final operating plans needs to be made more explicit and precise.

4.3.2 Willow Creek Water Management Planning

The Panel notes that a final operating plan could make provision for water to be made available for commercial or light industrial use other than agriculture, and could provide for assimilative capacity that in the future may be required to accommodate commercial or light industrial or municipal effluent discharges. The Panel also notes that such a plan could reserve water for other unspecified requirements or contingencies that may arise in the future. Such a plan could also address the role of the flow regulation on Willow Creek if any, in the overall flow management in the South Saskatchewan River basin, and any implications of the proposed project for meeting interprovincial obligations. The final operating plan would also be improved by addressing the flexibility in the plan to accommodate increased IFN based on an improved understanding of stream needs that may arise from future research.

The Panel recognizes, based on historical precedent, that the current proposal substantially reduces but does not entirely remove all risk to the agricultural operator. The Panel believes that irrigators should not be under the misapprehension that there would be no shortfalls. Data from the Applicant's agricultural expert indicates that some on-farm crop shortfall could be anticipated one year in six when crop needs are considered to be met by ignoring a capped irrigation withdrawal maximum.

This is qualitatively consistent with the evidence of the expert for the Peigan which indicated shortfalls, possibly equal to or greater than 12 percent on average over the period of his analysis of 1966 to 1990. The primary difference leading to the variation in conclusions is the 450 millimetre cap extended to the irrigation water requirements, as assumed in the simulation made by PWSS. Consequently, the PWSS conclusion is based on crop need criteria overridden by allocation criteria based on the ability of the reservoir to supply water (allocation is limited by an absolute maximum of 450 millimetres).

This difference in approach is clearly identified in the document prepared by the PWSS agricultural expert. The report, *Appraisal of the Pine Coulee Operating Plan*, provides two tables demonstrating different levels of deficits, one based on the 450-millimetre level of restriction and the other based on the failure rate for optimal irrigation. Two levels of failure are considered and failure at either level is considered undesirable. Level one is a shortage of irrigation water supply in excess of 75 millimetres (net to the crop) one year in five, while level two is a shortage in excess of 150 millimetres (net to the crop) one year in ten. Information is also provided to show that failure criteria one and two could be met if the total acreage is reduced from 21,000 acres (8,500 hectares) to 16,000 acres (6,478 hectares). Alternatively, it states that variation of crop mix from 70 percent alfalfa and 30 percent cereal to 50 percent or less alfalfa will also meet the defined failure criteria. The criteria are based on optimum levels of crop use of water as recommended by Agriculture Canada.

The Panel notes the evidence as it pertains to the current irrigation activities on Willow Creek and observes that this presently consists primarily of an augmentation of farming based on natural precipitation and is highly limited and uncertain. It does not lend itself to planned and dependable irrigation initiatives. The Panel agrees with the irrigation participants and concludes that the evidence indicates that the proposed project would provide a significant improvement over current water availability for irrigation but it would not eliminate risk. The Panel particularly points to the historical sequence of the two periods when shortages occurred over a three and a five year stretch. The Panel therefore cautions that average benefits of the proposed project not be construed to imply the development of no-risk conditions for all irrigators who would be operational if the full 5,260 hectare expansion occurred. PWSS has only stated that current irrigators would go to a no-shortage situation if the proposed project were implemented. Consequently, benefits from possible water stability must be considered in the light of the clearly identified residual risks.

The Panel also notes that PWSS stated in one of its submissions that, "When the natural flow is unable to meet licensed demands and water is available in storage, that stored water could be released for IFN and for existing and expansion acreages equally, not according to the priority system. The priority system would only apply to natural flow." The Panel is interested in the proposal by PWSS implicit in this statement. This varies from the current licensing status in that priority of licence would not apply to reservoir waters. It also varies from the intent of the IFN Task Force and the report *Water Management in the South Saskatchewan River Basin* that stated that water for IFN should be assured. IFN are further addressed in Section 5.1.3.1. The Panel accepts that, with these statements, PWSS recognizes that an operating and regulatory scenario distinctly different from that of past practice might be required in the proposed circumstances. The Panel is, however, concerned that PWSS has also indicated that IFN would not be established as a first priority during periods of limited water availability. PWSS's application to the Controller of Water Resources would, according to AEP's evidence, likely result in any license that might be issued being subject to terms or conditions regarding such matters.

The Panel believes that it should consider the proposed operating plan in relation to the multi-purpose objectives of the Application. The proposed operating plan satisfactorily meets the

criteria of increased security of supply for existing municipal and domestic water users including livestock. It would improve the potential for meeting IFN downstream of the reservoir in Reach 4 from the perspective of both water quality and quantity and it would also provide additional water-based recreational opportunities in Reach 3 near existing facilities at Willow Creek Provincial Park.

The proposed plan would also result in a significant increase in the security of supply for existing irrigation water users, although it does not remove risk of water shortage to these users during drought conditions. It also provides for the expansion of irrigation in the basin. Under the *South Saskatchewan Basin Water Allocation Regulation (Alberta Regulation 307/91)*, a maximum allocation for irrigation is specified at 21,000 acres (8,500 hectares) of irrigated land. The addition of 13,000 acres (5,260 hectares) to the existing 8,000 acres (3,240 hectares) is possible under certain assumptions regarding water requirements and crop mix, and the degree of risk acceptable to those relying upon irrigation water supplies. The proposed plan does not satisfy the basic water requirements outlined by Alberta Agriculture, Food and Rural Development, based on the specified crop mix (70/30) and irrigation efficiencies. To reach the objective of irrigation expansion to 8,500 hectares, the Panel believes significant changes in the crop mix found in the area would have to occur. The Panel believes that such changes toward a 50/50 crop mix would occur over time in response to water limitations and the need to reduce risks.

With respect to IFN, the Panel is encouraged by the work completed to date and believes it serves to advance overall sustainable development and management of water in the basin. Given the circumstances in the basin, the Panel accepts that the instream flow needs identified in the Application are generally acceptable as a basis for developing an interim operating plan for the proposed project. The Panel would require, should the project proceed, that the Applicant further refine the IFN to more fully reflect the riparian and aquatic needs in Reach 3 between the proposed diversion weir and reservoir outlet to Willow Creek, and more fully reflect the riparian needs in Reach 4. In addition, to maintain sustainable development options for the future, the IFN should be re-examined to give explicit consideration for reservation of water for other future requirements. Should a change occur in the operating plan of the Chain Lakes Reservoir in the future, any final IFN for Willow Creek should be flexible enough to accommodate such a change.

With respect to the operating plan, the Panel would require that the operator manage releases from the reservoir in a manner that ensures minimum instream flow needs for protection of the aquatic and riparian environment, and for domestic and municipal drinking water requirements, as established by Alberta Environmental Protection, are always met within the physical limitations of the reservoir and weir.

Overall, with respect to water management in the Willow Creek basin, the Panel finds that the proposed project is consistent with the *South Saskatchewan River Basin Water Management Policy* and the multiple water use principles of the government of Alberta, and the proposed project, should it proceed, would result in the improvement of water management in the Willow Creek basin.

5.0 ENVIRONMENTAL EFFECTS

The Panel recognizes that water is fundamental to life and all aspects of environmental quality. Water is also essential to sustainable development. The proposed Pine Coulee Water Management Project is intended to produce a change in the flow characteristics of Willow Creek through the diversion and storage of water during high flows for subsequent release during periods of natural low flows. The direct and deliberate manipulation of water flows is intended to produce regulated flows that are capable of supporting beneficial uses of the water for a variety of purposes. The proposed project would also result in a variety of environmental effects, some of which are positive and some which are adverse.

The Panel is required to consider the environmental effects of the proposed Pine Coulee Project. This section of the Report discusses the environmental effects of the proposed project that are relevant to the Panel's deliberations, particularly water quantity and quality, fisheries, soils and drainage, vegetation and wildlife.

The Panel recognizes that natural systems are dynamic. The nature and extent of impacts of proposed developments are not independent of the state of the ecosystem or component at the time the development takes place. During the hearing, the Panel heard of evidence about historical, current and possible future states of the Willow Creek basin ecosystem and especially the riverine components. As discussed in Section 4, the Panel understands that the Willow Creek ecosystem and the aquatic components have been subject to numerous impacts since settlement and that some of the impacts during drought conditions have been severe. The Willow Creek riverine ecosystem has exhibited resilience in rebounding from many adverse impacts but evidence before the Panel about the past management of scarce water resources suggests that the riverine ecosystem has not always returned to a state similar to that which existed at the time of impact. The frequency, and increasing number and extent, of water demands now occurring makes it necessary to recognize that the aquatic ecosystem in the Willow Creek basin is already under pressure. Whether or not flow regulation can improve the sustainability of Willow Creek aquatic ecosystems will be discussed in this section of the Report.

In past decisions, the NRCB has taken the view that examination of potential environmental effects of a project must include consideration of cumulative effects because project impacts do not occur in isolation from the many other effects influencing ecosystems and their components. For example in the Three Sisters Decision Report, the NRCB wrote:

> Because of the interdependence of ecosystem components and the scale of the areas occupied by ecosystems, the Board believes that the potential impact of a project cannot be understood by attending only to local effects on individual components. The Board also believes that because of the likelihood of additive or synergistic effects of developments it is important to examine the effects of any one project in a cumulative and a regional context.

Given the historical development of the Willow Creek basin, and the relatively high water demands to which Willow Creek aquatic ecosystems are subjected, the Panel believes that it would be unwise to review the potential effects of the Application before it in any other than a cumulative and basin context.

The Panel is also aware that most development projects give rise to secondary impacts in addition to the direct or primary impacts that occur at or adjacent to a project site. PWSS, in its Application, dealt in detail with potential direct impacts within the immediate project area and, in the case of water quality, fisheries and hydrology, with impacts within the Willow Creek basin. However, the Panel believes that it should have some regard for the inevitable secondary impacts arising, for example, from the provision of water from the proposed project. Furthermore, the Panel recognizes that effects on the Willow Creek basin ecosystems and their components may potentially be manifested in the Oldman or South Saskatchewan River basin. The effects of blocking movements of fish in Willow Creek might be an example of a *direct effect* having potential consequences in the Willow Creek basin. Increased availability of a stable water supply previously difficult to obtain might be an example of an *indirect effect* having potential consequences in the Willow Creek basin.

In past decisions, the NRCB has recognized that the fundamental properties of ecosystems, and populations of living organisms, make predicting responses to impacts difficult and in many cases impossible. Even where prediction is theoretically possible, lack of information, lack of understanding of ecological processes or practical difficulties may obstruct determination of the probable effects of an impact. The Panel has dealt with this problem by concentrating on the potential response of ecosystem components about which more is known, by examining evidence before it about the historical record of the ecosystem under consideration and similar ecosystems elsewhere and by making conservative assumptions in the face of uncertainty. By these means, the Panel has arrived at qualitative assessments of the risk that ecosystems will undergo changes of state and has examined the potential of management measures to control or avoid unwanted changes.

Under some conditions, ecosystems or ecosystem components may respond monotonically or even linearly to disturbance; in others the response may be sudden and large. Sometimes changes are reversible, sometimes they are not. Sudden, large changes are less likely to be reversible than small gradual ones. As noted earlier, several participants pointed out that riverine ecosystems are dynamic and will change with or without interference by people. Naturally, the Panel is most concerned about the risk of large, potentially undesirable changes that may be difficult or impossible to reverse. The risk to the Willow Creek basin ecosystem from current water demands, and the associated risks to individuals and communities was identified by many participants in the hearing. The Panel believes that the approach the NRCB has adopted in past decisions is appropriate to its examination of that risk.

The Panel intends to examine the effects of the proposed project on the various components of the Willow Creek ecosystem that would be most affected by the project, and then will consider the effects of the project as a whole in terms of cumulative effects in the Willow Creek basin.

5.1 Water Quantity and Quality

The environmental effects of the proposed Pine Coulee Project are inherently tied to the operational plan for the diversion works and the reservoir, since this would determine the flows in Willow Creek and the related effects on water quantity, water quality, riparian vegetation and fisheries. The effects on water quality and quantity that result from particular flows in Willow Creek have further effects, both positive or negative, on other matters such as the availability of water for use for domestic, municipal, stockwatering and irrigation purposes.

5.1.1 Water Quantity

Assessment of the environmental effects of the Pine Coulee Project involves an analysis of the impacts of the proposed project on the hydrological regime, not only of Willow Creek, but any consequence on the hydrology of the Oldman River and the associated downstream portions of the South Saskatchewan River basin system. The subsequent two sections will assess the downstream magnitude of this hydrological linkage between the proposed project and downstream reaches including linkages to other water management facilities in the South Saskatchewan River basin.

5.1.1.1 Impact of Reservoir Operation on Willow Creek Hydrology

The Pine Coulee Project would have an impact on the flows in Willow Creek. Diversions would be made to the reservoir when creek flows are:

- greater than 0.283 cubic metres per second between March 1 - May 21;
- greater than 1.0 cubic metre per second between May 21 - June 28;
- greater than 2.0 cubic metres per second between June 29 - September 7;
- greater than 0.4 cubic metres per second between September 7 - October 15.

No diversion would occur during the winter period from November to February inclusive.

This plan involves no change to the current normal operation of the Chain Lakes Reservoir which makes no summer releases. Its winter releases, between November and March, are between 0.283 and 0.425 cubic metres per second depending on ice cover and temperature conditions. The Pine Coulee Reservoir would be operated on a release schedule dictated by downstream demands between a full supply level of 1,052.5 metres, containing a volume of 50,600 cubic decametres, and a minimum operating level of 1,042 metres, containing 8,600 cubic decametres. Eighty-eight percent of the maximum potential drawdown, to 1,044 metres would be available for

irrigation. The remaining twelve percent would provide for releases to meet instream flow needs (IFN) and the contingency needs of municipalities. Based on a 77-year simulation, it is estimated that the reservoir would be above the minimum 1,044 metre irrigation level 92 percent of the time. Under this operating regime, downstream water quality IFN (Section 5.1.2) would be the minimum target, projected to be met 99 percent of the time compared to the current 57 percent of the time.

Information supplied by the Applicant on the effects on Willow Creek hydrology of releases from the proposed reservoir shows that flows downstream of the reservoir would be altered significantly, primarily during the summer season. Because irrigation would be a primary target for the operating plan, flow augmentation during low-flow summer months would be a requirement. The need for additional releases from the reservoir would be determined by the natural flow in the creek and the precipitation status for the season. Summer flows would be increased and become more constant and controlled. The ability of the creek to meet summer IFN, as set by Alberta Environmental Protection (AEP) and evaluated in the operating plan, would be increased. This would eliminate extremely low flows that have happened in the past when the creek went dry in the summer during drought episodes. To achieve this objective, water would be taken from the creek during periods when more is available. This occurs during the spring runoff and during heavy precipitation periods. The operating plan, as defined above, has set certain flows above which diversion to the reservoir could be initiated. The decision to divert would also be based on considerations such as the water level in the reservoir, anticipated need and seasonal cycle. Figure 5.1 simulates the increase of flow during the summer season that would arise from the Pine Coulee Project and its impact on downstream creek flow during dry periods. The effect of this redistribution on the seasonal profile during a dry year is also shown. The curves are twentieth percentiles, or so-called "80 percent exceedence" curves, meaning that lower flows would be expected 20 percent of the time. Flow during runoff in April and May would be reduced. Impact on the spring runoff would vary, from that shown in this figure for a dry year, to only a small fraction of the total runoff during years when the spring freshet is heavy. The Application states that for flows of at least 20 cubic metres per second, operation of the Pine Coulee Reservoir would have little effect on the duration and temporal distribution of runoff in Willow Creek. These flows have return periods of 1:1.5 to 1:2 years. It is within the context of this range of spring flow impacts that IFN have to be evaluated, particularly regarding the needs of riparian vegetation.

The lower zone of Willow Creek, as defined in the Application, lies in the Western Prairie region and is characterized by relatively mild channel gradients, bed material with a mean particle diameter of about 20 millimetres and greater concentrations of suspended sediment. Sediment transport occurs during high flow conditions, about one to three percent of the time and corresponding to a 1:2 year flood event. For the lower zone, long-term degradation of the stream bed would not be expected, even if the armouring layer is disturbed. Channel invert and cross-section have been very stable over the 35-year history of records. The primary source of transported material is from local runoff. The Application states that neither aggradation nor degradation of the channel in the lower zone would be expected, since the supply of suspended sediments would be reduced and the channel has existing armour. The only location that would have the potential for degradation is the reservoir outlet channel and this has been accounted for in the project's design. The Applicant

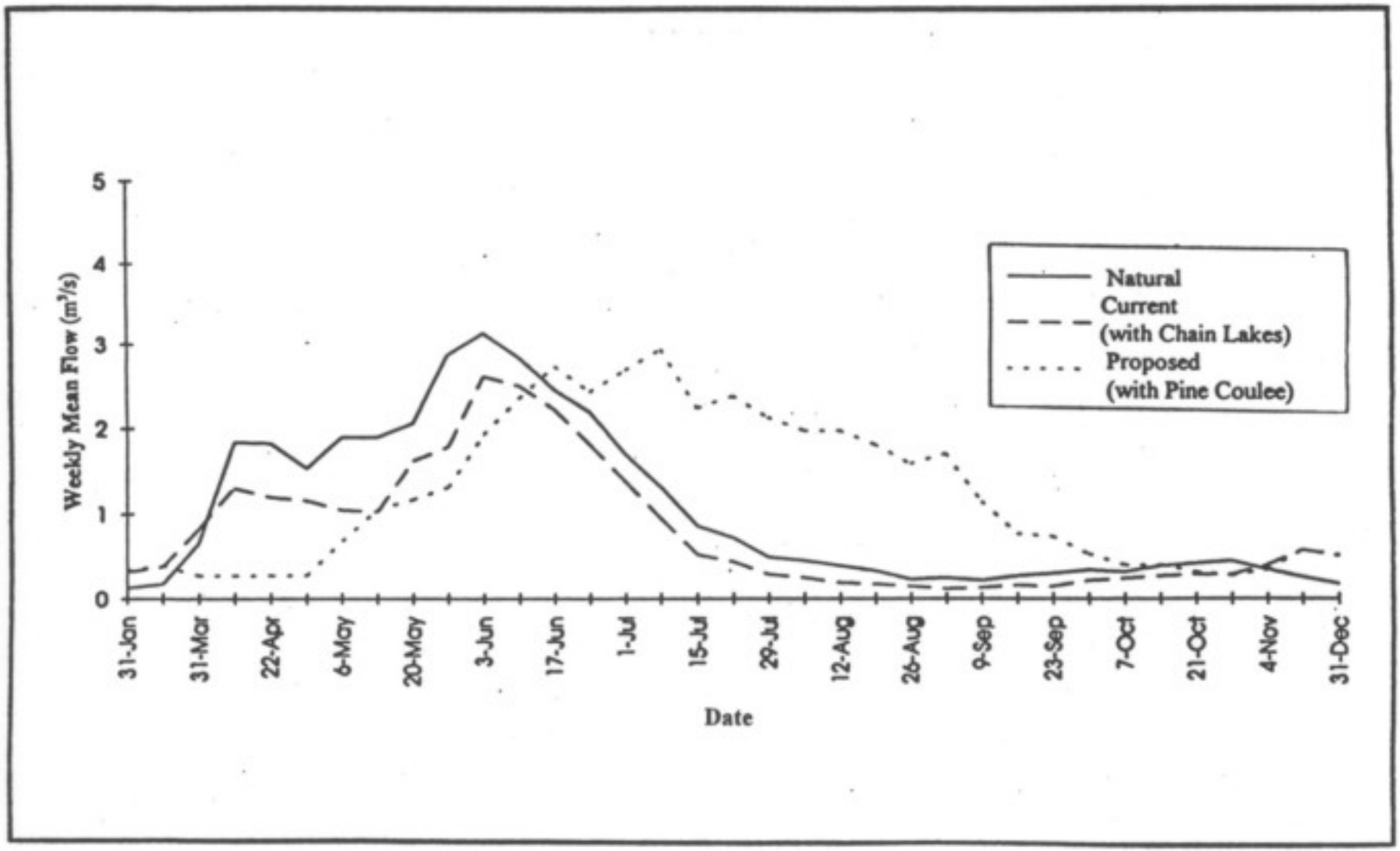


FIGURE 5.1 COMPARISON OF WEEKLY MEAN STREAMFLOW DURING LOW FLOW (80% EXCEEDENCE) YEARS UNDER NATURAL, CURRENT AND PROPOSED CONDITIONS UPSTREAM OF CLARESHOLM

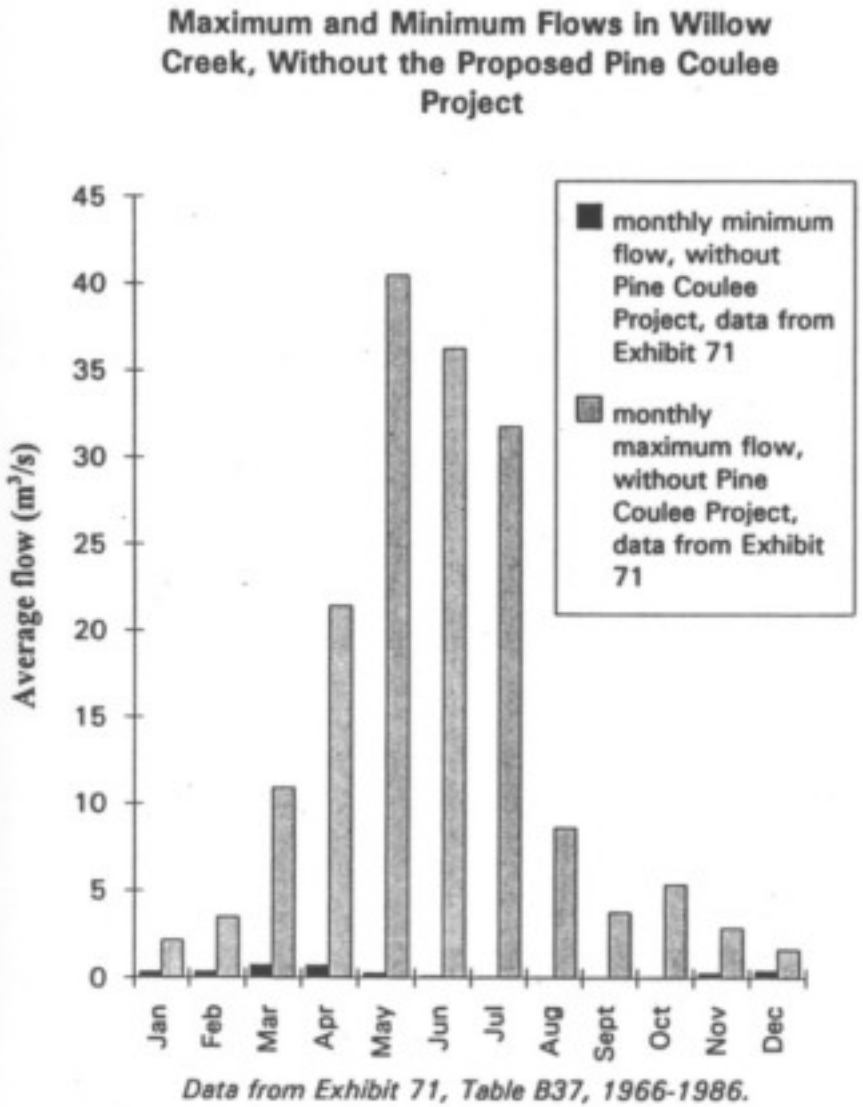
Source: Adapted from PWSS Application 9401

states that flushing flows should not be increased in frequency beyond the natural frequency of about once every five years, to prevent an increase in bank erosion. Figure 5.2 illustrates the effects of the project on minimum and maximum flows in Willow Creek downstream of the proposed project.

Evidence from Transport Canada indicated that Willow Creek has been determined to be a navigable water. The question of navigability as it relates to Willow Creek and the proposed project is pertinent to this review because of the Terms of Reference under which the Joint Federal-Provincial Panel was struck and federal jurisdiction under the *Navigable Waters Protection Act*, giving Transport Canada the decision making responsibility regarding a licence for this project. According to their representative, the purpose of the legislation is to regulate the effects of obstructions on the waterways so as to protect the public's right to navigate on all waterways in Canada. The Applicant recognized that the licence approval sought under the Act may have conditions attached. It looked to Transport Canada to provide its expertise in the design of the boat launches on the reservoir.

In its written submission, Transport Canada identified the type of matters which might be relevant to regulatory approval under the *Navigable Waters Protection Act*. These included:

- Warning signs upstream of the diversion weir and downstream of the confluence with Pine Coulee Creek;
- Haulout and portage facilities around the diversion weir;
- Consultation with Navigable Waters Protection with respect to fisheries compensation works;
- Responsibility for debris control;
- Transport access for inspection and monitoring;
- Provision of debris booms downstream of construction sites;
- Provision of a control boom upstream of the dam;
- Additional information requirements, including evaluation of the impact of the proposed project on downstream waterways and control structures, examination of boat launch facilities and their safety, provision of the operating procedures for the facility, provision of a safety and emergency procedures plan and development of a monitoring program.



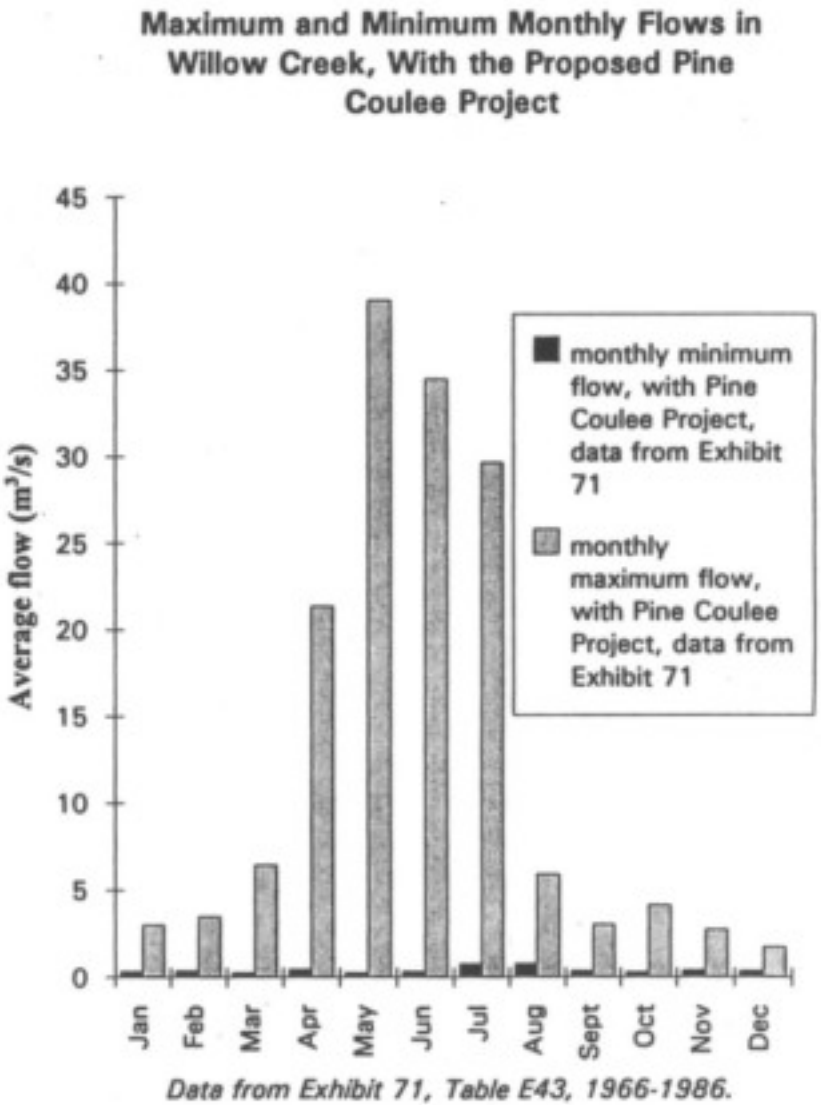


FIGURE 5.2 **FLOWS IN WILLOW CREEK IMMEDIATELY UPSTREAM FROM ITS CONFLUENCE WITH THE OLDMAN RIVER**

Transport Canada clarified at the hearing that the actual conditions for licensing would be contingent on the Panel's determination. It also stated that some of the matters in its written submission had already been answered. Transport Canada stated that it believed, within the Terms of Reference, that all the matters it would be looking at had been covered in the present information before the Panel.

Transport Canada indicated conditions that might be part of a licence could include further information requirements on the effect of increased water consumption on Willow Creek, due to the project, on downstream users and its effect on downstream waterways such as the Oldman River and its associated dam operations. It might also require a monitoring program to track changes to the water regime, riverbed, and banks due to degradation and erosion. It indicated inspections of the dam and site would occur over the years to ensure that the conditions of the approval would be upheld. Transport Canada stated that navigation safety was the primary concern and that jurisdiction largely centred around the weir and dam. It stated that it would have preferred that an alternative, such as a bridge, had been proposed for free passage between reservoir basins, rather than a causeway with culverts, for Secondary Highway 527 crossing of the reservoir. With respect to engineering, structural integrity, and emergency response plans, it accepted the standards and procedures of the Alberta Environmental Protection, Dam Safety Branch and recognized them as being one of the best in Canada.

Other participants did not focus on navigability as an issue. When questioned by the Panel, the Pine Coulee Coalition stated that current water transportation was minimal and not of major concern. Under cross-examination by AEP, the Peigan water expert referred to the *Navigable Waters Protection Act* but only with respect to the Oldman Dam approval and its effects on the Peigan Reserve.

The Pine Coulee Project, as proposed, would affect navigability on Willow Creek in that it requires a weir to allow water diversion to an off-stream storage reservoir. Boaters travelling between Reach 2 and Reach 3 would have to portage around the weir. During operation, the facility would affect downstream flows, by increasing minimum summer flows and decreasing flows during high flow periods such as during spring runoff. Periods of sufficient flow for boating on Willow Creek could be slightly increased for short periods. The reservoir created by this project would also allow for boating opportunities previously unavailable. The Applicant has included provisions in its proposal to develop these opportunities, such as the construction of boat ramps.

5.1.1.2 Hydrological Impacts Downstream of Willow Creek in the Oldman Basin

PWSS, Alberta Environmental Protection and the Peigan Nation all submitted written and oral evidence discussing the relationship between the proposed project and the hydrology of the Oldman River. Discussion during the hearing centred on the effect of the Willow Creek flows on Oldman River flows, the Oldman Dam operation and their effects on the Peigan Reserve. This involved analysis of the change in Willow Creek flows that would occur as a result of the proposed project and the impact of these changes downstream. The primary effect of the proposed project

would be the removal of water from the creek by diverting it into the Pine Coulee Reservoir during spring runoff and possibly during other high flow episodes whenever the reservoir requires topping. This stored water would be released as required during the summer season. The effect at the mouth of Willow Creek would be a decrease in flow during the spring and during any other diversion episodes, and an increase in flow during natural low flow summer periods. This could directly influence the flow in the Oldman River downstream of the confluence with Willow Creek with a potential gain in summer flow and a loss of spring flow. A change in the net annual flow in the Oldman River, due to Willow Creek, would arise from two causes. Firstly, it would arise due to the removal of Willow Creek water that would be allocated to consumptive activities. Secondly, it would arise due to year-to-year flow averaging made possible through the operation of a reservoir (storing water for a dry year). The effect of the proposed project on flows in the Oldman River upstream of the confluence with Willow Creek and on the Peigan Reserve (Brocket, Alberta) were also discussed. Effects upstream would be indirect since these are only realized if the operating regime of the Oldman River dam were altered as a result of consideration for the downstream effects of Willow Creek on the Oldman River. It is within this context that the Peigan submission was developed. Alberta Environmental Protection addressed these potential operational changes.

AEP submitted a simulation of Oldman River flows as affected by the Pine Coulee Project over a 59-year historical record. This simulation, using PWSS data for Willow Creek, indicates that the flows in the Oldman River and consequent releases from the Oldman Dam would be affected by the proposed project during 22 percent of the 708-month simulation period. Data indicate that the effect on the Oldman River at the Peigan Reserve would exceed one percent of the annual volume once during the period of 59 years. The largest decrease calculated was 2.5 percent of the instantaneous flow, corresponding to a change in river stage or level of 1.3 centimetres. The largest increase was 5.8 percent of the instantaneous flow, corresponding to a change in the river stage of 3.6 centimetres. Based on this simulation, Alberta Environmental Protection told the Panel the effect of the proposed project, even in the worst case scenario, would be insignificant.

The Peigan Nation also submitted evidence regarding predicted changes in flows in the Oldman River at the Peigan Reserve that could arise through changes in the operations of the Oldman Dam arising from the regulation of flows in Willow Creek. According to their evidence, the operation of the Pine Coulee Project could lead to a 2.16 cubic metres per second average increase in the flows across the Peigan Reserve. Their expert calculated, from an analysis of data for the period 1966 through 1990, that changes in releases from the Oldman Dam, reflecting the effects of the Pine Coulee Project on Oldman River flows, would be required during 55 percent of the time in the five-month irrigation season. This was arrived at through a calculation independent of the determinations of AEP and PWSS.

The Peigan expert agreed that these independent assessments were largely in agreement on the magnitude of the Willow Creek impact on the Oldman Dam operating regime but the Peigan assessment principally differed from the approach of AEP by highlighting the cumulative impacts of the changes in the flows at the Peigan Reserve. Releases from the Oldman Dam for downstream minimum flow requirements and releases for the Lethbridge Northern Irrigation District

(LNID) canal are included in their assessment of the incremental impact on the Peigan Reserve. The Peigan concluded that these incremental effects, including those caused by Willow Creek, could have significant environmental impacts on the Peigan Reserve. The Peigan submission also argued that the Panel's review of the proposed project should include the consideration of the Peigan claim for an irrigation allocation of 52,269 acres (21,163 hectares) rather than the 15,000 acres (6,073 hectares) already allocated and included by PWSS in their planning.

Figure 5.3 shows average, maximum and minimum monthly flows in the Oldman River and Willow Creek, and the Oldman River flow near Brocket. The changes in the flows in the Oldman River at the Peigan Reserve simulated on the basis of historical data show that the changes would be very small compared to the flows in the Oldman River. The Panel was advised that actual physical measurement of stream flows are generally considered accurate within a measurement error range of plus or minus five percent, and many of the changes predicted through simulation models would be within the error range of plus or minus five percent of the source data. The error inherent within the model used to simulate the flows is a further factor to be considered, and the Panel heard that such models are normally considered to have an accuracy primarily limited by the input data and may predict changes that are so small that they may not be physically measurable.

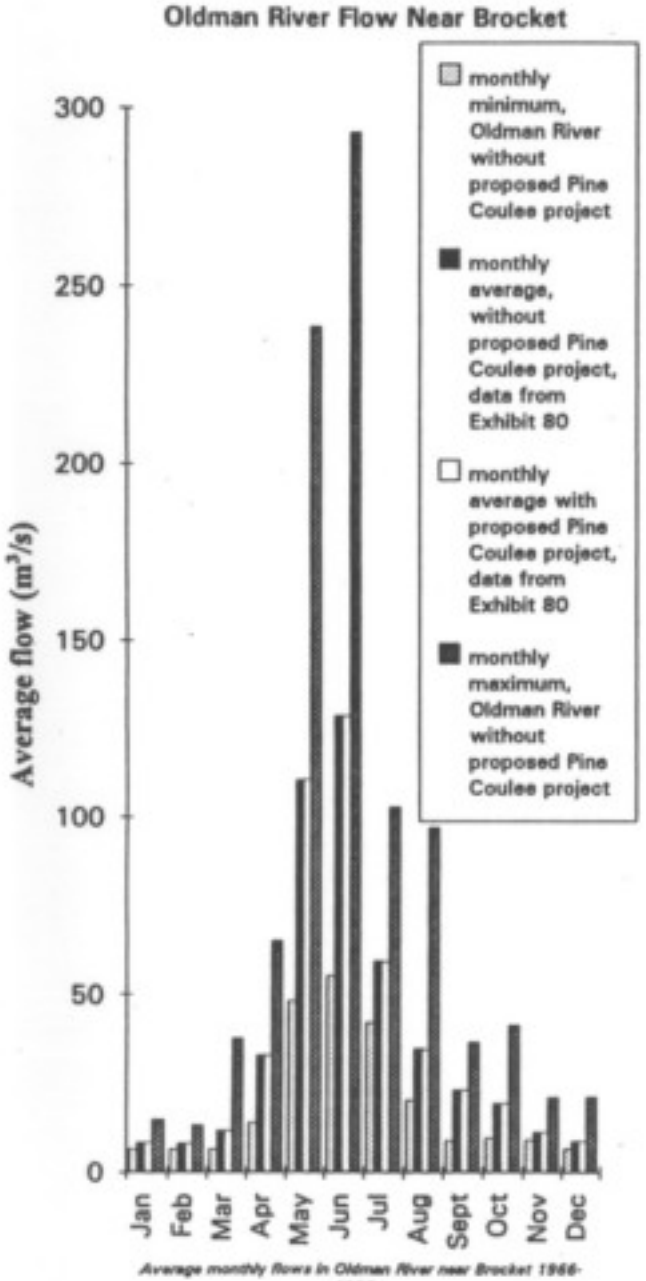
5.1.2 Water Quality

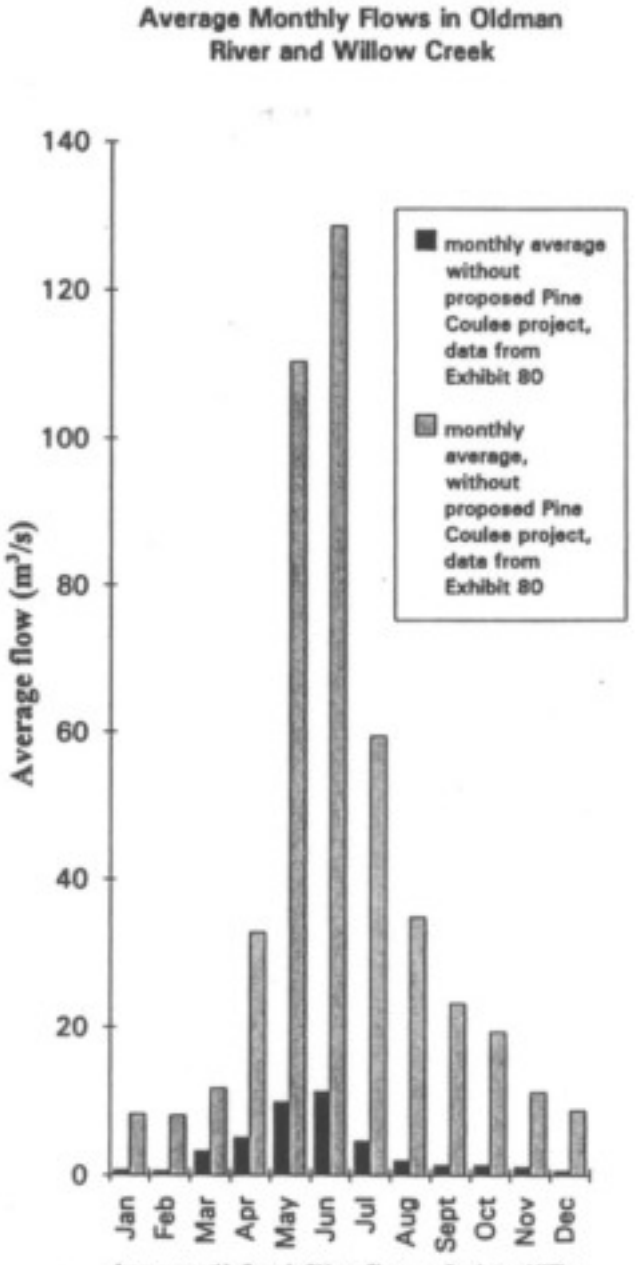
The Applicant's summary of surface water quality impacts is shown in Table 5.1. Water quality in Willow Creek is in part determined by water quantity. Consequently, the water quality anticipated as a result of this project has been projected by the use of models using the proposed hydrological operating scenario for the Pine Coulee Project. The following two sections indicate the type of water quality determined in the modelling exercises for the Pine Coulee Reservoir and for Willow Creek. Changes to the operating plan and its associated hydrological profiles could also effect the water quality characteristics determined by the Applicant. It is within this context that the Panel assessed water quality issues.

5.1.2.1 Reservoir

The proposed reservoir, as presented in the Application, consists of three portions. These are: the 280-hectare portion adjacent to the dam (south basin), the 300-hectare portion separated from the south basin by Secondary Highway 527 (middle basin) and a 20-hectare portion also discussed as the potential permanent wetland (north basin).

Issues discussed in the Application and during the hearing with respect to the proposed reservoir included reservoir capacity, water quality, fishery, road crossings, leakage, dam design, archaeological resources and wetland habitat. The reservoir as proposed has a nominal capacity of 50,600 cubic decametres and has a low-level retention of 8,600 cubic decametres, intended as the minimum maintenance level of the reservoir for a potential walleye fishery.





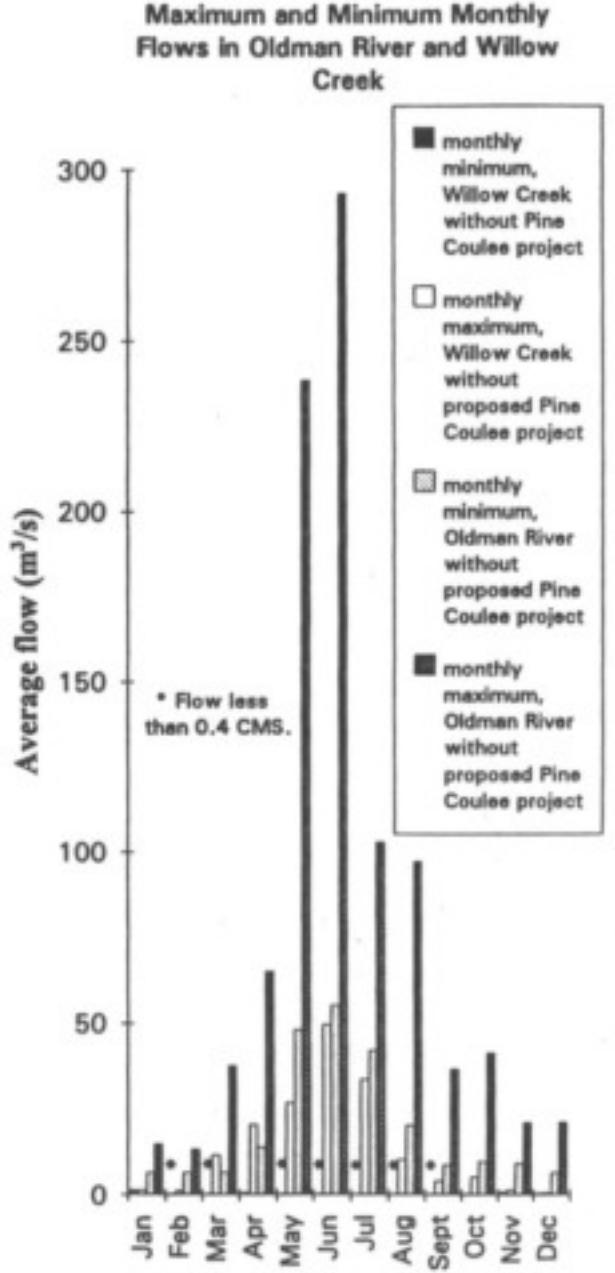


FIGURE 5.3 COMPARISON OF WILLOW CREEK AND OLDMAN RIVER FLOWS

TABLE 5.1 IMPACT SUMMARY TABLE - WILLOW CREEK SURFACE WATER QUALITY

Potential Impact Description	Impact Rating / Duration	Mitigation Options	Mitigation Cost	Residual Impact	Residual Impact Rating/Duration	Proposed Mitigation
increased sediment load in Willow Creek as a result of construction of dam, outlet works, and diversion canal	Dependent on amount and extent of exposed soil, season of construction and weather	use surface drainage control structures		none	N/A	Yes
increased sediment load in Willow Creek as a result of weir construction	Negative, Low, Short-term	use clean granular material for instream works		minor increased sediment load in Willow Creek as a result of construction methods	Negative, Low, Short-term	Yes
potential for hydrocarbon spills during construction	Negative, dependent on nature of spill	use fuel containment structures, refuel and store fuels in designated safe locations, and develop a spill contingency plan		reduced risk of hydrocarbon contamination	Negative, Low?, Short-term	Yes
periodic increase in dissolved phosphorus concentrations downstream of the reservoir release	Negative, Low, Long-term	include a variable or multi-level release system in dam outlet works	$375,000	none	N/A	No
periodic increase in ammonia concentrations donwstream of the reservoir release	Negative, Low, Long-term	include a variable or multi-level release system in dam outlet works	$375,000	none	N/A	No
		design outlet works to maximize aeration of water released	minimal additional cost	none	N/A	Yes

Potential Impact Description	Impact Rating / Duration	Mitigation Options	Mitigation Cost	Residual Impact	Residual Impact Rating/Duration	Proposed Mitigation
periodic decrease in dissolved oxygen downstream of the reservoir release	Negative, Low, Long-term	include a variable or multi-level release system in dam outlet works	$375,000	none	N/A	No
		design outlet works to maximize aeration of water released	minimal additional cost	none	N/A	Yes
periodic increase in aquatic plants and therefore decrease in dissolved oxygen concentrations at Willow Creek Provincial Park, exceeding the WWAE objective	Negative, High, Long-term	greater dilution by reducing diversions to reservoir		some oxygen depletion	Negative, Low?, Long-term	Yes
		narrow channel to increase velocity, to improve scouring action	$100,000 (est)	some oxygen depletion	Negative, Low?, Long-term	Monitor and implement if required
periodic increase in heavy metal concentrations downstream of the reservoir release	Negative, Low, Long-term	include a variable or multi-level release system in dam outlet works	$375,000	none	N/A	No

Positive Impact: An impact that improves water quality in terms of meeting water quality uses and objectives (as defined by the Bow River Water Quality Task Force (BRTF) 1991).
Negative Impact: An impact that degrades water quality in terms of water quality uses and objectives, or a species requirements.
High Impact: A change in water quality that would affect water use or cause a water quality objective to be exceeded.
Low Impact: A measurable change in water quality but not of a magnitude that would affect water use or exceed water quality objectives.
Long-term Impact: An impact that persists beyond project construction and/or for more than three years.
Short-term Impact: An impact occurring only during the duration of project construction and/or implementation, or for less than three years.

Source: Adapted from PWSS Application 9401

The water quality in the reservoir was estimated by a simulation model. The model was calibrated using information from the Crawling Valley Reservoir, an off-stream irrigation reservoir near Bassano. Total dissolved solids (TDS) was used as a conservative (is not created or destroyed) variable. The three sources of TDS included in the model were: inflow from the creek diversion, watershed runoff and diffusion from flooded substrate. A range of reservoir elevations was assessed. The causeway (Secondary Highway 527) effects were simulated by a reduction in the modelling parameters at that location. Water quality parameters determined by the model included temperature, nutrient concentrations, dissolved oxygen and algal turbidity.

Variations, both seasonal and yearly in total phosphorous concentrations (TP) at the surface, are predicted to be small. Potential coliform concentrations, while not considered in the model, are not anticipated to be high enough to impair recreational use. The reservoir would experience significant algal growth. Depletions in oxygen would be most severe at the north end of the reservoir and in close proximity to the sediments. In the long-term, TDS would remain below 450 milligrams per litre in the south basin and below 600 milligrams per litre in the middle basin. Significant mixing between basins would only occur during periods of water elevation change. The Application states that the determination of water quality for the reservoir was subject to a degree of uncertainty because the simulation model could not be calibrated to current conditions. Reservoir water quality, according to the Applicant, is expected to be suitable for contact recreation. Excessive weed growth is not expected.

The Application provided information on the temperature profile anticipated for the proposed reservoir. The surface temperature is predicted to peak at 15 to 20 degrees Celsius in the summer. Temperatures would increase rapidly from near zero to 15 degrees during April, May and June. In July and August, temperatures would range between 15 and 20 degrees, depending on the weather, and would occasionally and briefly exceed 20 degrees. Temperatures would begin to decline in September and reach minimum values by early November. Temperature and temperature stratification in the reservoir would also be affected by the level of the reservoir. Bottom temperatures might be as much as five to 10 degrees cooler than at the surface but would not be limiting to fish or contact recreation. The reservoir would be moderately productive, somewhere in the low end of the eutrophic range to the high end of the mesotrophic, and algal blooms might be expected in the spring and late summer. The Application states that the middle basin would be more productive than the area near the dam because of the difference in frequency of drawdown and refilling in the two sections.

Anoxic conditions (reduced dissolved oxygen concentrations) in the middle basin could severely threaten aquatic life once every 10 years. Dissolved oxygen in the discharge from the reservoir is predicted to be frequently less than five milligrams per litre. Levels of dissolved oxygen at the outlet would periodically fall below 2.0 milligrams per litre and would approach zero one year in five. Reservoir nitrogen and phosphorus levels would increase over those in Willow Creek and in the first one to five years, high deep-water concentrations would occur during anoxic conditions. Ammonia levels might occasionally be elevated at the outfall but would not exceed Canadian

guidelines for the protection of aquatic life. As a result of initial bank erosion, high concentrations of suspended solids in the initial years would be likely.

Discussion at the hearing included the examination of the impact of the causeway proposed in the Application to route Secondary Highway 527 across the reservoir. An expert representing the federal government stated that it had considered the issue of the causeway with respect to a fishery in the reservoir. Reduced water quality is expected in the sections further removed from the dam as a result of less circulation and shallower depth. The opportunity for fish to move between these sections is consequently important during poor water quality conditions when the lower portions of the middle basin would become anoxic. The Applicant stated that two metre culverts would be used for fish movement from the middle basin to the south basin. These culverts would be staggered at different depths to improve access.

Not building the causeway would alleviate degradation of water quality in the portion identified as the middle basin, provide unrestricted fish movement and would also provide for unrestricted boat access to the usable portion of the reservoir. Only the wetlands portion in the north basin would be isolated for development as waterfowl habitat.

Concern was raised about the quality of the water that would be released from the reservoir into Willow Creek. The Application indicates that water released during certain periods characterized by stratification of the reservoir might be of poorer quality with elevated ammonia, nutrient and metal levels and low dissolved oxygen levels. Structures have been proposed for the outlet canal to increase turbulence, entrain oxygen and remove ammonia. At the hearing, the Applicant also stated that it had added a supplementary intake for the mid-level outlet at 1,041 metres to the original 1,035-metre level intake. The Department of Fisheries and Oceans expressed its concurrence with this action and said this would address its concern about the lower quality of water that could arise during release by increasing the management options for controlling water quality.

The potential for high mercury levels in the reservoir water and consequent bioaccumulation in the tissue of fish was raised in the Application. Mercury levels in tissue of pike and sucker in Willow Creek are already very high. Although the mercury methylation potential for the reservoir is predicted as moderate, concentrations of mercury in predatory fish could exceed consumption guidelines and would require restrictions on consumption. According to the Applicant, the supply of labile organic matter would be insufficient to sustain accelerated rates of methyl mercury production for more than one or two years. However, internal reservoir production would probably continue to elevate the methylation rates considerably. At the recommendation of the federal government, PWSS has committed to undertake a mercury monitoring program for fish if the project is approved. The mercury issue is discussed further in Section 5.2.4.

5.1.2.2 Willow Creek

The Application states that current water quality in Willow Creek is generally typical of prairie rivers in southern Alberta. The water is basic, hard, alkaline and rich in dissolved ions with low to moderate suspended solids. Concentrations of phosphorus and nitrogen are sufficient to support a moderate level of plant production, and nitrogen and ammonia levels are low throughout the creek. Bacteriological quality is quite good, except for frequent high counts of fecal coliforms in the summer and fall, probably due to livestock. The water quality of Willow Creek is not affected by industrial or municipal effluent discharges and reflects the conditions found in the Willow Creek basin.

The proposed Pine Coulee Reservoir would provide water for sustaining creek flows at levels greater than natural flow levels during low flow episodes, consequently benefiting seasonal water quality. Enhanced low-flow levels and the associated reduction in high flow levels would have different types of impacts on the various components of the ecosystem. According to the Applicant, the development of an off-stream reservoir would minimize negative water quality changes in Willow Creek as compared to an on-stream reservoir. This would include the positive impact of cooler water from the reservoir that would be released into Willow Creek during periods of low summer flow.

The Application states that ammonia and nitrate levels in Willow Creek would increase by as much as one order of magnitude and dissolved phosphorus would approximately double in the reaches below the reservoir if the proposed project was to proceed. This would stimulate algal growth, but Alberta and Canadian water quality guidelines for protection of aquatic life or aesthetics would not be exceeded.

Much of the discussion about water quality in Willow Creek focused on the cold- versus cool-water fisheries issue. According to the Applicant, the differences between the cold- water aquatic ecosystem (CWAE) and the warm-water aquatic ecosystem (WWAE) objectives are with respect to temperature, oxygen, and ammonia, which is temperature-specific. For the CWAE, the dissolved oxygen (DO) is 6.5 milligrams per litre and the temperature is 22 degrees Celsius: for the WWAE, the DO is five milligrams per litre and the temperature is 29 degrees. The WWAE objectives which correspond to a cool-water fishery, would be met in Reach 4 under the proposed operating plan. The CWAE objectives would be met most of the time for as far downstream as Claresholm in Reach 4.

5.1.3 Panel Views

5.1.3.1 Water Quantity

The Panel notes the extreme variability of both the annual water yields of the Willow Creek basin (from 11,100 to 261,502 cubic decametres) and the average weekly stream flows of

Willow Creek. The Panel believes that controlling these extreme variations could lead to greater multi-use options for this valuable natural resource. The multi-use needs for water include those of communities, instream flows for aquatic and riparian ecosystems, irrigation of agricultural lands, wildlife, recreation, natural areas, industrial, water conservation, and other demands. Controlling flows becomes particularly important during low-flow conditions. The Panel recognizes that the existing flows are not dependable for sustainable multi-purpose uses in the Willow Creek basin. The Panel believes that the proposed Pine Coulee Project could provide the necessary control of these extreme variations in yield and flows so as to better manage a significant amount of the available water resources for consumptive and other demands in the Willow Creek basin.

With respect to water quantity, the Panel concludes that the flow regulation features inherent in the proposed project would primarily have a positive and beneficial effect on the flows in Willow Creek. The ability to capture and store water for discharge according to the proposed operating plan would result in a significant improvement in the amount of water available to meet IFN, including requirements for environmental protection of the aquatic and riparian environment and requirements for consumptive uses such as municipal downstream water supply and irrigation demands. The reservoir does not have sufficient capacity to store enough water to eliminate risks associated with low flows during drought conditions, but the reduction in the degree of risk would improve with the management of water flows in the basin. The direct physical impact on flows within the basin and the associated implications for the stream bed, channel and aquatic environment are not considered by the Panel to constitute significant adverse environmental impacts and post project flows would be generally within the range of historical flows in the basin. The Panel fully recognizes the dynamic nature of the riverine environment along Willow Creek and believes the wide historical variations in flows that have characterized Willow Creek within each year, and from year to year, are much more significant than the relatively small changes in flows that will be associated with the operation of the project should it proceed.

The Panel heard that the downstream flows in Willow Creek and the flows of the Oldman River below the Oldman River Dam would be affected by the operation of the proposed Pine Coulee Project. The Panel heard that the Oldman River flows could also be affected by water allocations made for IFN, water quality, irrigation, domestic and other consumptive water uses in the Oldman and the broader South Saskatchewan River basin. Flows from all sources can become more important during low-flow conditions. The Panel recognizes that there could be some interaction between the two operating regimes of the Oldman River Dam and the proposed Pine Coulee Project. The Panel notes the flows in Willow Creek can only directly affect the flows in the Oldman River below their confluence. Should the project proceed, the flows in the Oldman River above the confluence may be indirectly affected through the interaction between the operating regime of the Oldman River Dam and the operating regime of the proposed Pine Coulee Project.

The Panel has considered the evidence, particularly the evidence of Alberta Environmental Protection and the evidence of the Peigan's expert, regarding the significance of the indirect effects of the proposed Pine Coulee Project on flows in the Oldman River below the Oldman

River Dam. These independent assessments, in the opinion of the Board, are largely in agreement on the magnitude of the indirect effects on flows in the Oldman River.

The significance of the effects of the proposed Pine Coulee Project on the proposed operational regime of the Oldman River Dam and the flows of the Oldman River at Brocket were carried out using computer modelling techniques. The results show that the magnitude of the increases or decreases in flows would be very small, largely average out over time, are not physically measurable and could only be identified by computer analysis. (See Figure 5.4)

For its purposes, the Panel accepts the evidence provided by Alberta Environmental Protection that indicates that the indirect effect on the flows in the Oldman River below the Oldman Dam at the Peigan Reserve could be expected to exceed one percent of the annual volume once during a period of 59 years. The largest decrease over the period was 2.5 percent of the instantaneous flow, corresponding to a change in river stage of 1.3 centimetres; the largest increase was 5.8 percent of the instantaneous flow, corresponding to a change in river stage of 3.6 centimetres. The Panel notes that the Oldman River is subject to a wide range in river stage from season to season and year to year and that changes equivalent to a few centimetres in river stage are extremely small compared to natural fluctuations. In the opinion of the Panel, the indirect effect of the proposed Pine Coulee Project under most conditions on the Oldman River at the Peigan Reserve would be inconsequential in terms of the flows of the much larger Oldman River, and even in the extreme cases of high or low flow conditions would be insignificant in terms of the flows of the Oldman River.

In consideration of the evidence before it, the Panel finds that the proposed project would have no direct effect and only an inconsequential indirect effect on the present operating regime of the Oldman River Dam and the stream flows immediately below the dam. The Panel believes that the Controller of Water Resources has the flexibility to make adjustments if required.

The Panel notes that Willow Creek basin is a small part of the Oldman River basin which in turn contributes approximately 36 percent of the total basin flow of the South Saskatchewan River basin (SSRB). The SSRB contains many water management structures each having their own operational regimes which may interact to varying degrees to determine overall management strategies. Nevertheless, the Panel finds that should the proposed project proceed it would have a very small positive effect on downstream flows in the SSRB particularly during low flow periods. In summary the Panel finds that in regard to water flows the benefits of the proposed project are largely confined to and should properly accrue to the various water demands in the Willow Creek basin.

With respect to the effects of the project on navigable waters, the Panel notes that Willow Creek currently receives little use for canoeing primarily due to low flows during most months during the open water season. The proposed project would create a 42 hectare headpond, and a 600-hectare reservoir which would be navigable. The diversion weir would create a barrier to navigation along Willow Creek, and the diversion weir outlet works and the reservoir outlet works may have

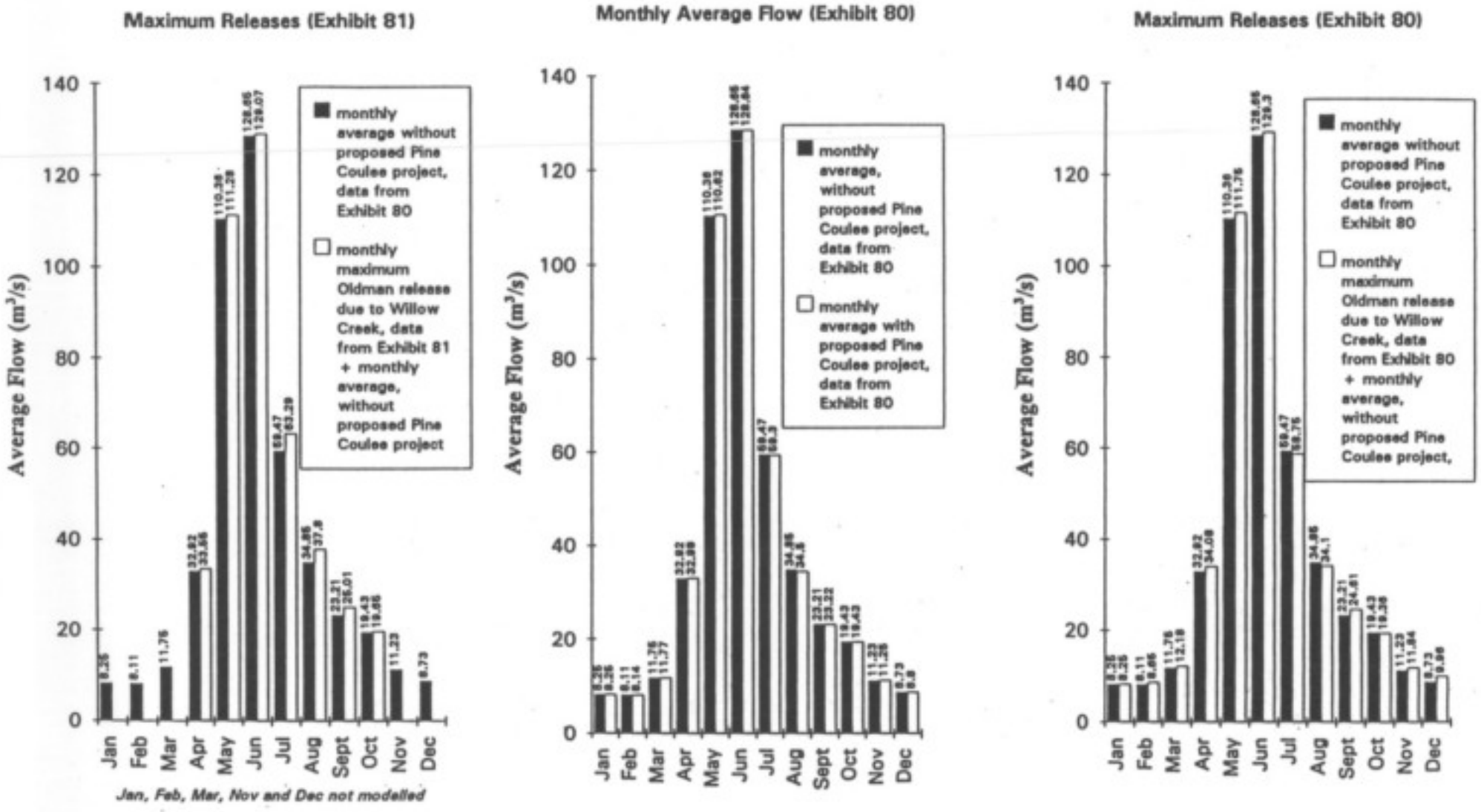


FIGURE 5.4 OLDMAN FLOWS NEAR BROCKET WITH AND WITHOUT THE PROPOSED PROJECT, 1966-1986

some effects on flows that may present some degree of navigation concern. Due to the limited current and expected use of Willow Creek for navigation purposes, the Panel does not believe that it would be necessary to develop extensive compensating works to enable passage, but some attention should be given to permit a safe and convenient portage around the weir should it be required. The Panel would require, should the project proceed, that the Applicant, to the satisfaction of Transport Canada, establish a safe and convenient portage around the weir. The Panel believes that the weir and outlet works may present some degree of hazard to canoes or other small craft, but has confidence that relevant federal and provincial authorities will ensure that appropriate steps are taken to mitigate such effects.

The Panel believes that the proposed causeway for Secondary Highway 527 warrants more serious consideration with respect to navigation on the reservoir. The causeway would create a barrier to small craft passage between the middle and south basins. The causeway would also necessitate the development of access facilities in each basin at additional cost. The reservoir would create navigable waters where none previously existed. Overall, the Panel expects that the proposed Pine Coulee Project would have a minor impact on navigation on Willow Creek due to the limited use the creek receives for such purposes and the Panel notes that a causeway would create a barrier to navigation in the proposed reservoir.

5.1.3.2 Water Quality

The Panel notes that fish in Willow Creek are reported to contain high levels of mercury from existing background conditions in the basin. The Panel accepts the evidence that the proposed project will likely cause the methylating of inorganic mercury in inundated soils and vegetation, and that some additional mercury would bioaccumulate in fish. The Panel notes that there is no practical way to avoid increased mercury production in newly formed reservoirs. The Panel accepts that some incremental mercury contamination of fish will be associated with the creation of the proposed reservoir. Should the project proceed, the Panel would require that the operator, in a manner satisfactory to Alberta Environmental Protection, Fish and Wildlife Division, monitor and report on mercury levels in fish from the reservoir and from Reach 4 of Willow Creek. The Panel understands that Alberta Fish and Wildlife, in consultation with appropriate health authorities, ensures that the public is aware of any health risk associated with the consumption of mercury-contaminated fish, and provides advice on the steps the public should follow to minimize any potential adverse health effects. Having regard for the role and responsibilities of other authorities with respect to the consumption of mercury contaminated fish, and the incremental nature of any effect that may be attributable to the proposed project, the Panel is satisfied that the effects of the project with respect to mercury contamination in water would not lead to significant adverse effects.

Water discharged from the reservoir to Willow Creek will be of a good quality most of the time. The potential for poor quality water to be discharged from the lower depths of the reservoir has been reduced by adding a higher outlet. The Panel would require, should the project proceed, that PWSS design the reservoir outlet works and carry out its operations in a manner

satisfactory to Alberta Environmental Protection, that minimizes the potential adverse impacts of reservoir discharges on dissolved oxygen and ammonia levels in Willow Creek. The Panel concludes that the quality of water in the reservoir will be acceptable for recreational uses most of the time and is likely to support a sustainable cool-water fishery under the proposed reservoir's operating plan.

The Panel is concerned about the water quality effects of the proposed causeway to accommodate Secondary Highway 527. The causeway, even with the provision of culverts at various elevations, would significantly reduce the degree of water mixing that would occur in the reservoir. This would directly contribute to the development of poor water quality conditions particularly during drought years, and during ice covered winter months once every ten years, in the middle basin north of Secondary Highway 527, conditions are predicted to lead to anoxic conditions and fish kills. The matter of the causeway across the reservoir is discussed in Section 7 of this Report.

The Panel notes that agricultural discharges such as irrigation runoff and effluent from cattle grazing and feedlot operations could be of potential concern. The Panel concludes that these matters, if properly regulated, would not constitute a water quality concern. The Panel recognizes that no allocation was made in the operating scenario for assimilative capacity for wastes discharged to the stream because none were expected. The Panel deals with this matter further in Section 9 of this Report.

With respect to water quality, the effects of the proposed project, should it proceed, would be primarily positive through the beneficial effects of increased flows in Willow Creek during low flow conditions. In reaching this conclusion, the Panel is also of the opinion that the proposed project would not result in significant adverse water quality effects to Willow Creek. The Panel believes that the proposed Secondary Highway 527 causeway will contribute to poor water quality in the reservoir, and reduce the potential of the reservoir for fisheries and recreational purposes.

5.2 Fisheries

PWSS provided evidence about the current distribution of fish and fish habitat in Willow Creek as a baseline for the assessment of the proposed project's potential impacts. Its consultants examined 166 kilometres of Willow Creek from the Chain Lakes Reservoir to the confluence with the Oldman River, classified the physical habitats of each reach and took samples to determine which species were present. A total of 19 fish species were observed.

On the basis of habitat and fish distribution, PWSS identified three stream sections with different characteristics. The upper section from the Chain Lakes Reservoir to approximately 120 kilometres upstream of the Oldman River was classified as cold-water habitat of moderate quality. This section supports self-sustaining populations of whitefish, brook trout and brown trout. The rainbow trout in this section of Willow Creek may be sustained by the artificial stocking of the Chain Lakes Reservoir. Fish production in upper Willow Creek is limited primarily by low flows leading to a shortage of deep-water habitat for adult trout and whitefish.

The next section of the creek, from 80 to 120 kilometres upstream of the Oldman River, was classified as a transitional zone. The diversion weir, at 110 kilometres, and reservoir outlet, at approximately 105 kilometres, would be located in this section. It is used seasonally by both cold-water and cool-water fish species, although the habitat quality for cold-water species is rated as low. The principal cool-water sportsfish species in this section is northern pike. The Applicant's consultant rated habitat quality for pike in this section as moderate with limitations due primarily to low flows. The lower section of the creek, from the Oldman River confluence to 80 kilometres upstream, provides cool-water habitat of good quality for northern pike, walleye and burbot. The Applicant stated that this section appears to meet the habitat requirements for all life stages of pike.

PWSS told the Panel that most angling for trout occurs immediately below the Chain Lakes Reservoir. The fishery, it said, is inconsistent and used mainly by local residents. Downstream of Willow Creek Provincial Park, fishing effort is directed primarily at northern pike. PWSS reported that recent winter kills related to low flows have reduced fishing success in this section of the creek.

PWSS said that the potential adverse impacts of the Pine Coulee Project on fish and fish habitat in Willow Creek would be minor and mitigable with the possible exception of mercury contamination, and that the potential for creating a fishery in the proposed reservoir (Section 5.2.3) would be a positive benefit of the project.

To address the sportfish capability in Willow Creek in Reach 2 upstream of the project (see Figure 4.4), PWSS examined instream flow needs (IFN) for trout using fish rule curves for target management species: rainbow trout, brown trout and bull trout. These curves identify flow targets for the upstream reach that provide desired trout habitat conditions by season and by stream reach. The fish rule curves were based on physical habitat and did not consider water quality. In a separate analysis, water temperature was investigated to determine the fisheries potential of Willow Creek. PWSS concluded that fisheries habitat downstream from the confluence of Pine Creek had temperature and other limitations for trout. As a consequence, IFN downstream of the proposed reservoir outlet in Reach 4 were based on water quality considerations primarily for walleye and northern pike.

The compilation of the water quality and fisheries information within the basin, combined with the development of IFN criteria and an associated operating plan for the proposed reservoir, has resulted in the identification of a number of fisheries management options and opportunities within the basin.

PWSS made certain fisheries management assumptions in designing the project and in planning the mitigation of potential adverse impacts. Specifically, PWSS assumed that upstream fisheries management objectives in Reach 2 would focus on trout, whereas the downstream fisheries management objectives in Reach 3 and Reach 4 would focus on cool-water species such as pike. The participants said that some of the assumptions used by PWSS would change if other objectives were adopted. The federal Department of Fisheries and Oceans (DFO) pointed out, for example, that

blockage of upstream migration of pike by the diversion weir would be advantageous only if the fisheries management objectives upstream of the weir in Reach 2 were to manage cold-water species and stipulated exclusion of pike from the upstream reach.

DFO indicated that, if the project was approved, additional information would be requested, regarding the mitigation or compensation that would be required under the DFO no-net-loss policy. According to DFO, the studies of fish migration patterns in the Application established that the spawning migrations of both cold-water and cool-water species traverse the proposed diversion weir site, so a more detailed assessment of the effects of blocking spawning migrations would be needed.

Participants voiced a number of specific fisheries concerns about the desirability of the project and also about the Applicant's plans to mitigate fisheries impacts. The potential impacts of the project identified by PWSS and other participants are described in the following sections. For the purposes of discussion, the impacts of the proposal are examined in three areas: Reach 3 and Reach 4 of Willow Creek downstream of the proposed weir (Section 5.2.1), Reach 2 upstream of the diversion weir (Section 5.2.2) and in the proposed Pine Coulee Reservoir (Section 5.2.3).

5.2.1 Downstream Fishery

PWSS stated that the construction phase impacts of the proposed project would be limited to the effects of temporary dewatering of the channel, which could strand some fish, and the potential for increased downstream sedimentation or contamination. The consequences of dewatering would be local and temporary, and the potential for sedimentation and contamination could be limited with proper precautions.

Following construction of the project, the primary effects on Willow Creek downstream of the reservoir outlet would be a change in the flow regime. PWSS said that since the primary purpose of the project is to augment summer flows, the frequency of low flows below the reservoir outlet would be reduced. PWSS concluded that fish habitat in Reach 4 would be improved and that this would have a positive, long-term, high impact on fish populations.

If no fish ladder were constructed, the diversion weir would block any upstream movements of pike to spawning areas. The Applicant's fisheries consultant estimated that the pike spawning area in Reach 2 upstream of the weir was 1.9 hectares, representing approximately 16 percent of the total pike spawning area in Willow Creek. Some pike spawning habitat downstream of the weir would also be lost as a result of lower flows during the spring spawning period. To compensate for these losses, PWSS proposed to construct a five-to-10-hectare pike spawning pond near the reservoir outlet.

As noted above, IFN for cool-water fish in Reach 4 were based on water quality rather than fish rule curves. Water quality in Reach 3 between the diversion weir and the dam outlet would

be affected by the weir. Water quality downstream of the reservoir outlet in Reach 4 would be affected by releases from the reservoir. PWSS estimated that in Reach 3 between the proposed diversion weir and the dam outlet, water quality IFN would be met 67 percent of the time, compared to 63 percent and 71 percent under existing and natural conditions respectively. IFN for water quality downstream of the reservoir outlet in Reach 4 would be met 99 percent of the time under the proposed operating plan as compared to 57 percent and 73 percent under existing and natural conditions respectively. The principal effects of the proposed project on water quality would be to reduce maximum water temperatures and increase dissolved oxygen concentrations downstream of the reservoir outlet.

DFO concurred with the PWSS approach of using water quality criteria to determine IFN for cool-water fish downstream of the reservoir outlet. DFO also recommended that an additional quantitative evaluation of the amount of habitat available downstream in Reach 4, under various flow regimes, be undertaken to determine the potential gain or loss of fish habitat from the proposed operating regime. This would provide DFO with the information it requires to confirm whether its no-net-loss management objective would be met. In addition, this data would identify the need for mitigation measures and the scope of such measures.

The Pine Coulee Coalition (the Coalition) argued that the IFN for Reach 4 of Willow Creek were too low to support a cold-water fishery. It proposed an IFN equal to the natural instream flow of an 80 percent exceedence year; that is, the flow that would be met or exceeded 80 percent of the time under natural conditions. This flow was selected to represent flows in Willow Creek from 1930 - 1950 (i.e. prior to the 1962 construction of the Chain Lakes Reservoir) when, the Coalition said, Reach 4 supported a significant trout fishery. The apparent objective of flows proposed by the Coalition was to support trout populations in Reach 4 of Willow Creek and to provide spawning habitat for fish from the Oldman River.

Another factor that may affect fish downstream in Reach 4 would be the water quality of water released from the reservoir into Willow Creek. PWSS concluded that the quality of water discharged from the Pine Coulee Project could, at times, have an adverse effect on the fish in Reach 4. High ammonia concentrations and low dissolved oxygen levels were primary concerns. The assessment of downstream water quality impacts in the EIA was based on a low-level intake design for the reservoir outlet. During the hearing PWSS said it would modify the design to include an additional intake six metres above the planned one. The result of this change, the Panel was told, would be an improvement in downstream water quality because the anoxic water concentrated at the bottom of the reservoir would not be released.

In its presentation to the Panel, Environment Canada stated that the change in the reservoir outlet design would likely mitigate downstream effects on water quality but further evaluation would be required to confirm the extent of the mitigation.

Brown trout would probably continue to use Willow Creek downstream to Claresholm, especially with the potential stabilization provided by the reservoir. However, PWSS

would not expect to see major increases in numbers because other physical habitat components might well be missing, such as good rearing habitat for juveniles. An expert for PWSS also stated that the temperature effect from reservoir release would be almost undetectable downstream of Claresholm and agreed that pike were likely to preferentially occupy areas downstream of Claresholm.

5.2.2 Upstream Fishery

PWSS stated that the proposed project would have little effect on the upstream fishery in Reach 2. The principal effect, PWSS said, would be to block upstream migration of pike, which it said would be a positive benefit given its assumptions about cold-water fishery management objectives in Reach 2. A pool of approximately 42 hectares, that would be created upstream of the diversion weir, would provide deep-water trout habitat that is now lacking in Reach 2 of Willow Creek. During the hearing, however, PWSS noted that about 50 percent of the pool would fill with sediment within 15 years, potentially reducing its long-term value as deep-water trout habitat. PWSS assessed the potential impacts of the project on the upstream fishery in Reach 2 assuming that operations of the Chain Lakes Reservoir would be unchanged and would remain at current levels.

Other participants asserted that PWSS had not sufficiently studied the spawning movements of the various species of fish to assess the potential impacts of blocking fish movements at the proposed diversion weir.

Several participants identified the opportunity for restoring and enhancing Reach 2 of Willow Creek to improve the trout fishery. An important element of such an enhancement program would be an assessment of the operation of the Chain Lakes Reservoir to determine if flow releases to Willow Creek could be increased during certain periods to improve the upstream fishery. Alberta Environmental Protection, as the operator of Chain Lakes Reservoir and the future operator of the Pine Coulee Project, made a commitment to review the operation of the Chain Lakes Reservoir if the Pine Coulee Project was implemented. Trout Unlimited told the Panel that if instream flow needs for cold-water fish species could be incorporated into the operation of the Chain Lakes Reservoir, it would be prepared to act as the lead agency for the restoration of the cold-water fishery in Reach 2 of Willow Creek. In addition to improved flow conditions capable of sustaining a cold-water fishery, some stream channel and riparian zone restoration would also be required. Both Trout Unlimited and DFO are already involved in pilot projects on upper Willow Creek under Trout Unlimited's "cows and fish" program. Trout Unlimited would seek to develop a partnership among conservation groups, government agencies and landowners to implement the restoration program. PWSS took the position that upstream enhancement in Reach 2, however desirable, was not its responsibility.

5.2.3 Reservoir Fishery

PWSS stated that the proposed project would create a reservoir fishery where no fish habitat currently exists. Pine Creek, which drains the coulee, is an intermittent stream with no fisheries capacity. At full supply level (FSL) of 1,052.5 metres above sea level, PWSS estimated, the Pine Coulee Reservoir would hold 50,600 cubic decametres and occupy approximately 600 hectares. The reservoir would be drawn down to 1,044 metres about one year in 10 and to 1,042 metres about one year in 50, reducing the volume of water by about 73 percent and 83 percent respectively, with corresponding declines in the availability of fish habitat. PWSS stated that the 1,042 metre minimum level was intended to maintain adequate water quality conditions for fish survival.

The reservoir would be divided into three basins by causeways constructed for road crossings (see Map 1.1). The small (20-hectare) north basin would be shallow even at full supply level. PWSS concluded that this basin would not be capable of supporting fish and recommended that it be managed as permanent wetland habitat. The 300-hectare middle basin and the 280-hectare southern basin would be divided by the proposed Secondary Highway 527 causeway. Under late summer draw-down conditions, water quality in the middle basin would deteriorate (Section 5.1.2) and could lead to fish kills. Dissolved oxygen levels in the middle basin would also fall below levels required by fish one in 10 winters. To mitigate this potential impact, PWSS proposed to include a layered system of culverts at both ends of the causeway to provide fish passage and to allow better mixing of water between these two basins.

PWSS said that without enhancement, the reservoir fishery would consist primarily of white and longnose suckers, pike and burbot. With enhancement, several options would be possible, including stocking the reservoir with rainbow trout or walleye. PWSS believed that a self-sustaining walleye population could be established and rainbow trout would probably have to be stocked on an ongoing basis. The potential for walleye could be enhanced by constructing spawning habitat in the southeast end of the reservoir and by introducing prey species.

PWSS addressed the potential for the bioaccumulation of methyl mercury in reservoir fish. This problem is common in newly created reservoirs where anoxic conditions promote the growth of bacteria capable of methylating inorganic mercury in inundated soils and vegetation. The methylated form of mercury then accumulates in the fatty tissues of organisms. Elevated mercury levels have been observed in both newly created reservoirs and downstream areas. PWSS concluded that the potential for the proposed Pine Coulee Reservoir to produce methyl mercury would be moderate initially, and that the rate of release could be expected to decline over time. However, tests on white suckers and northern pike from Willow Creek indicate that mercury levels are already high from natural conditions. The Applicant, therefore, noted that mercury levels in the reservoir may be greater than predicted. There is also the potential for elevated methyl mercury levels in the newly created reservoir to increase mercury levels in fish downstream of the reservoir since the release water may contain methyl mercury. PWSS told the Panel that practically little could be done, to mitigate for increased mercury production in newly formed reservoirs. The standard practice is to monitor mercury levels in fish and to issue warnings if levels exceed those established for human consumption.

Concerning fish movements from Willow Creek, PWSS predicted that northern pike and burbot from Willow Creek would enter the reservoir via the diversion canal. Depending on the fisheries management objectives for the reservoir, this impact may be either positive or negative. For example, pike and burbot entering the reservoir may prey on fish stocked in the reservoir. In addition, when the reservoir is near full supply level, fish from the reservoir could migrate via the diversion canal into upper Willow Creek. If a pike fishery developed in the reservoir and upper Willow Creek was managed for cold-water species, such movements would have a negative impact.

The federal Department of Fisheries and Oceans was not convinced on the evidence provided by PWSS that a sustainable sportfishery could be established in the proposed reservoir:

> ...given the projected water quality and physical characteristics of the proposed reservoir, successful establishment of a self-reproducing population of any sport fish should not be considered a foregone conclusion.

It was therefore DFO's view, if PWSS were to include the benefit of a potential reservoir sportfishery as mitigation or compensation for any losses of fish or fish habitat that might be attributed to the proposed project, that this would be premature. It recommended that PWSS undertake further assessment of the suitability of the reservoir as better information about water quality and hydrology became available. Concerning fish migration, DFO observed that movement of fish from the reservoir into upper Willow Creek could be a potential management problem depending on the fishery management objectives selected for Reach 2. It recommended that the Applicant assess the issue further.

5.2.4 Panel Views

Fish populations in Willow Creek have been affected by activities in the watershed over the past decades. These activities include construction and operation of the Chain Lakes Reservoir, municipal and domestic water use, agricultural development and associated water withdrawals for irrigation. The Panel concludes that releases from the proposed Pine Coulee Project during the summer low flow period are likely to have a positive effect on cool-water fish populations in Reach 4 downstream of the reservoir outlet, but they would not improve conditions in Reach 4 of Willow Creek sufficiently to create the basis for a sustainable cold-water fishery. The Panel doubts whether a sustainable cold-water fishery could be established in Reach 4 of Willow Creek under any operating regime which could be adopted for the reservoir. It is also the Panel's view that a multi-use policy for water management precludes the project from being managed for fishery management purposes alone. Water management policies require that the proposed project be operated to realize potential positive downstream fisheries benefits in Reach 4 while meeting overall multi-purpose operational objectives.

The Panel views enhancement of the cold-water fishery in Reach 2 of Willow Creek as a potentially significant positive spin-off from this proposed project and notes the proposal from

Trout Unlimited to act as the lead agency for this fishery management initiative. According to Trout Unlimited, Reach 2 of the creek has the potential to support a significant trout fishery. The Applicant's consultant has rated the fish habitat in Reach 2 of Willow Creek as moderate with limitation primarily related to low flows. The Panel notes that Alberta Environmental Protection will review the operation of the Chain Lakes Reservoir if the Pine Coulee Project is implemented. Current water management policy for the South Saskatchewan River basin requires that regulated streams are to be managed to meet preferred instream flows most of the time. Any review of the operations of Chain Lakes Reservoir should involve consideration of all multiple purpose uses of water, including sportfish, in the context of existing and future needs. The review should include examination of the flows in Reach 2 of Willow Creek necessary to enhance the cold-water fishery upstream of the proposed Pine Coulee diversion weir.

An issue that affects both the downstream and upstream fishery is the question of whether fish passage should be provided at the diversion weir. The current design for the diversion would facilitate the installation of works to allow fish passage. However, fish passage works would not be installed since, in the Applicant's view, the blockage of pike could enhance the development of a cold-water fishery upstream of the weir. The Department of Fisheries and Oceans recommended that the fish passage design option be maintained. Management objectives may change over time or new information may come forward that would make fish passage desirable. Should the project be approved, the Panel would require that the design and construction of the weir provide for the installation of works to allow fish passage should they be required in the future but would not require that fish passage be installed at this time.

For the reservoir fishery, the Panel believes that establishment of a self-sustaining walleye fishery would be a desirable option and, based on the information provided to the Panel, a potentially viable alternative. Creation of additional spawning areas and, if necessary, the introduction of forage species could be undertaken to enhance the likelihood of success. The Panel notes that walleye enhancement could be undertaken as soon as the reservoir is created to take advantage of the initial nutrient bloom and before other less desirable species become established. The Panel would require further study by the operator on the issue of whether fish migration into or out of the reservoir should be blocked, if the project was approved.

The Panel is concerned, however, that the potential fishery benefits of the proposed project might not be realized unless and until fisheries mitigation and enhancement management plans are finalized, and certain fisheries management features are incorporated into the design and operation of the project.

In the Panel's view, the creation of a reservoir fishery where no fishery presently exits would constitute a clear benefit of the proposed project. The evidence before the Panel is that intervention in the form of habitat enhancement and stocking of desirable species immediately following reservoir filling would be necessary to establish a sportfishery in the reservoir. Of the two sportfish species actively considered by the Applicant, rainbow trout would appear to be the poorer choice. Experience in other reservoirs has shown that rainbow trout are not self-sustaining after the

initial nutrient flush associated with inundation is exhausted. Ongoing stocking would likely be required to maintain a population. The trout anglers represented by Trout Unlimited expressed little interest in a reservoir rainbow fishery. The Panel believes, should the project proceed, that the alternative of stocking the reservoir with walleye should be given further consideration to determine the feasibility and desirability of the habitat enhancement measures outlined in the Application to increase the likelihood of establishing a self-sustaining walleye population.

The Panel concurs with the PWSS assessment that the north basin would not provide fish habitat and would agree with its proposal to manage the area as an enhanced wetland and waterfowl habitat. The Panel would require, should the project proceed, that PWSS establish control gates at the causeway across the north end of the reservoir so that the water levels in the north basin are stabilized and consistent with the establishment of a permanent wetland capable of supporting waterfowl and wildlife. There remains some doubt about the value of the middle basin as fish habitat. The Panel is concerned that low oxygen levels and elevated ammonia in the middle basin of the reservoir, particularly during drought years when the reservoir was drawn down, could result in periodic fish kills. The Panel doubts that the multi-level culvert system PWSS proposed between the middle and southern basins would satisfactorily alleviate this problem.

As discussed earlier, the potential for increased methylation and bioaccumulation of mercury in the reservoir raises the prospect that any fish established in the reservoir might contain relatively high mercury levels. It also raises the prospect that the already high mercury content of fish in Willow Creek might be increased downstream of the reservoir. The Panel has indicated that it concurs with PWSS that no effective mitigation of the mercury methylation and bioaccumulation impact of the project is possible, with the exception of issuing public advisories of the health risks of consuming mercury-contaminated fish. The Panel also agrees with the PWSS consultant's recommendations that mercury levels be monitored both in the reservoir and downstream, and would make this a condition of any approval.

The Panel concludes that the Pine Coulee Project, should it proceed, must include a number of fisheries management features within the design and operation of the facilities. From the evidence available to the Panel, the project would create the opportunity to achieve certain fisheries enhancements. The final design of the project must reflect a series of fisheries mitigation and enhancement decisions. Some of the key features of the project design are dependent upon fisheries management considerations: (1) the design and operation of the weir (i.e. fish passage and headpond habitat), (2) the design of the canal (i.e. fish passage), (3) the design of the dam and saddle dyke (outlet/intake level and spawning habitat), (4) the design of the outlet works (aeration and pike spawning habitat), and (5) the design of the road crossings (culverts).

Should the project proceed, the Panel concludes that PWSS, to the satisfaction of Alberta Environmental Protection, would be required to prepare and implement a fisheries mitigation and enhancement plan as an integral component of the project. The fisheries mitigation and enhancement plan should be prepared at the earliest opportunity so that fisheries management decisions could be appropriately reflected in the final design and operation of the facilities. PWSS

should seek appropriate input from the public and the various federal and provincial agencies in the preparation of the fisheries plan. The plan should be reviewed by Alberta Environmental Protection, in consultation with the Department of Fisheries and Oceans.

The fisheries mitigation and enhancement plan, in the opinion of the Panel, should address several issues and options raised during the hearing. Specifically, the Panel would require that the plan address, among other relevant factors, the following:

- the feasibility and desirability of managing fisheries upstream of the diversion weir in Reach 2 primarily for cold-water species, taking into consideration the role of the weir, diversion canal, and headpond and the implications for cool-water species;

- the feasibility and desirability of the establishment of a sustainable cool-water fishery in the reservoir, particularly walleye, taking into consideration the role of the saddle dyke in providing spawning habitat; the minimum water level and quality that would be required to ensure a sustainable fishery; the effect of mercury contamination; the nutrient requirements of fish; and the effect on reservoir water quality and fisheries of not constructing the causeway for Secondary Highway 527;

- the feasibility and desirability of managing fisheries in Reach 3 and downstream of the reservoir outlet in Reach 4, primarily for cool-water species, taking into consideration the role of the weir, the design of the outlet channel from the reservoir, the need for pike spawning habitat at the outlet, and the water quality discharged to Willow Creek;

- the fisheries habitat compensation requirement of the Department of Fisheries and Oceans; and,

- the ongoing monitoring of the effectiveness of mitigation and enhancement.

The Panel would also require PWSS to conduct such further modelling and water quality monitoring to confirm in a manner satisfactory to Alberta Fish and Wildlife that water released from the reservoir at the raised elevation is of sufficient quality to meet water quality and fisheries management objectives established for Reach 4 of Willow Creek.

The Panel notes the policy of no-net-loss of productive capacity of fish habitat, and recognizes that a fish habitat compensation component of the fisheries mitigation and enhancement plan would be required by the Department of Fisheries and Oceans. The Panel believes that the project as proposed would result in some loss of cold-water fish habitat in Reach 3 and the upper potion of Reach 4 that has been identified of poor quality with significant limitations due to water quality and limited habitat suitable for spawning and rearing of fry. The diversion weir crossing

Willow Creek would pond about 42 hectares of water, to a maximum depth of about nine metres at the structure, this level drawing down to about 6 metres over the winter. The average depth of the headpond would be about two metres. The Panel would require, should the project proceed, that the design and operation of the weir and associated headpond would be satisfactory to Alberta Fish and Wildlife and would be done in a manner that provides trout habitat and ensures that sedimentation is minimized and adequate water depth is maintained. The development of the headpond in association with the weir would add new habitat for cold-water fish in Reach 2 of a kind and nature that would in the opinion of the Panel, offset any cold-water habitat losses due to the restrictions of the weir to poor habitat in Reaches 3 and 4.

With respect to cool-water fisheries habitat, the Panel notes that in Reach 2 of Willow Creek, 1.9 hectares of pike spawning habitat would be inaccessible due to the blockage of migration by the weir. The Panel accepts the need to replace this habitat loss to meet the requirements of the no-net-loss policy. Therefore, the Panel would require, should the project proceed, that the Applicant design and implement a program to establish a suitable pike spawning habitat of 5-10 hectares near the outlet of the reservoir at Willow Creek as proposed. In the Panel's opinion, this mitigation measure could fully compensate for any loss of pike spawning habitat loss in Reach 2.

The Panel also notes that any fish habitat created in the proposed Pine Coulee Reservoir would be an enhancement over and above the current habitat available in the Willow Creek basin.

With respect to fisheries, the Panel concludes that the project would not result in any net loss of fisheries productive capacity after various mitigative measures required by the Panel were implemented, and the Panel further concludes that improved flows in Willow Creek and establishment of a reservoir fishery would result in a significant beneficial effect on the fishery resource in Willow Creek basin.

5.3 Soils and Drainage

Soils and drainage were major issues raised by landowners living near the proposed project.

5.3.1 Land Classification and Irrigation

The Application provided several documents that explained the land classification system for irrigation used in Alberta. Land irrigability classification in Alberta is provided for in the *Irrigation Act* and is carried out as set out in *Standards for the Classification of Land for Irrigation in the Province of Alberta* and *Procedures Manual for Land Classification for Irrigation in Alberta 1992*. The standards are set out in section 113 (1) of the *Irrigation Act*. A parcel of land is assigned a Land Class of 1 to 6, with Class 1 being the most suitable for irrigation with fewest restrictions.

Class 5 is a provisional non-irrigable class and Class 6 is non-irrigable. The Land Class results from an investigation carried out at an intensity level ranging from Level I to Level V, Level I being the most intense. The purposes and characteristics of these intensity levels are set out in the *Procedures Manual for Land Classification for Irrigation in Alberta 1992*. For each parcel of land a soil category and a topography category are determined. These are combined to arrive at the land classification. Lands falling within a given classification have similar irrigability.

Land is classified with respect to its suitability for irrigation using procedures and standards set out by Alberta Agriculture, Food & Rural Development. The physical, chemical, and morphological properties of a unit of land are examined to arrive at a classification from Class 1 to Class 6. These classes reflect the general capacity of the land for irrigation use in its present state. The principle on which this classification scheme is based is that land should be permanently productive under the changes anticipated with irrigation. The aim of the land classification scheme is to predict whether a parcel of land is suitable for irrigation.

The properties of land may be grouped into two types: permanent land features and changeable factors. Irrigation shifts the natural balance among water, land, vegetation, fauna and man. The structure of the soil can be changed by physical or chemical processes. Of major concern is the migration of soluble salts that may occur as a result of irrigation. Poor drainage, low hydraulic (water) conductivity or other factors can cause leaching of salts and accumulation in the root zone. Increased salinity may impair plant growth and lower crop yields by decreasing the amount of water available to the plant through increased osmotic pressure in the soil solution. Increased sodicity (sodium content) also inhibits plant growth.

5.3.1.1 Land Suitability for Irrigation

At the hearing, the Applicant addressed the issue of land use as it pertains to possible salinization and the concern that land developed for irrigation may not remain permanently productive. It stated that current irrigation development is based on a land classification system that dates back to about 1930, when the first standards were developed. This was replaced by the *Irrigation Act* in the late 1960s, requiring all land developed for irrigation to be classified and suitable for irrigation according to specified standards. From then to the present, irrigation methods have been evolving; today, center-pivot irrigation is becoming dominant. With this development, land classification standards were revised in 1983 through a special committee formed by the Irrigation Council that involved Agriculture Canada and Alberta Agriculture, Food & Rural Development.

According to the Applicant, the potential for salinization of land suitable for irrigation is minimal under proper irrigation management and it was not aware of any land classified as suitable for irrigation being salinized through normal irrigation practices. Most of the salinity problems have been attributed to canal seepage and other factors. Farmers tend to irrigate at levels lower than the optimum consumptive requirement level of their crop, so most water is managed so that it will be

stored in the soil, with minimal deep percolation. Studies have shown that there is enough leaching to control the salt balance within the root zone.

According to PWSS, land within the proposed project area that would be excessively saline would be excluded through the land classification process. A parcel of land containing more than 15 percent of its area as a non-irrigable soil type would be excluded. The Applicant stated that among the four different levels of land falling within the irrigable category, there is no policy to give preference to the better classes of land. The order of development is determined by the licence application system. The Applicant's current assessment of the area is that most of the land suitable for irrigation would be Class 2 and Class 3, but some might fall into Class 4. Most of the land is suitable for sprinkler irrigation.

5.3.2 Salinity, Drainage and Groundwater

Considerable evidence was submitted on the issue of salinity in the area immediately adjacent to the proposed reservoir. Related technical considerations involve seepage from the reservoir, groundwater flow regimes, salinity potential of local soils, and drainage options available to mitigate the potential effects. This issue was addressed primarily by the Applicant and the Area Landowners Group. Other participants, including strong proponents of the proposal, were very supportive of the concerns expressed by the Landowners Group with respect to potential direct effects on it and its lands and stated that this issue should be resolved to the satisfaction of the landowners if this project was to proceed.

Saline soils in western Canada are classified on the basis of their origin and degree of salinity. Primary salinity refers to soils that were saline before cultivation and secondary salinity refers to saline soils that developed as a result of agricultural practices or changes to surface runoff patterns. Since solutions of salts are electrically conductive, the salinity of soils may be assessed using electrical conductivity measurements. On the basis of conductivity, soils are separated into five salinity categories: non, weak, moderate, strong and very strong. The primary effect of salts in saline soils on plants is to deprive them of water, but high salt levels may also result in toxicity. The development of soil salinity results from a combination of the effects of soil type, groundwater conditions and surface moisture. Changes in hydrologic conditions such as increased water tables and altered flow patterns may enhance the development of saline soils. Water containing dissolved salts that rises to the surface leaves behind salts as it evaporates or accumulates in saline sloughs.

The Application provides information on the salinization and drainage of cultivated farmlands close to the reservoir. Because the land surface at the southeast periphery of the proposed reservoir would be below the full service supply level, a saddle dyke is required to confine the water. The Applicant recognized the concerns of the Landowners Group that farmland to the east and southeast could be affected by seepage from the reservoir causing soil salinization. The Applicant provided information about the types of seepage that might occur, the level of risk and the Applicant's suggestions for possible mitigation.

The Applicant identified four areas of potential concern:

- Deep seepage could affect the groundwater aquifer and lead to related soil salinity problems. This would occur if reservoir seepage were to cause mounding of the groundwater in the Stavely Buried Valley aquifer, resulting in water rising to the surface. However, because the groundwater level is 13 to 18 metres below the surface and the mounding is expected to be about four metres, this impact is not expected to occur.

- Seepage through the reservoir sides is expected to occur through sandstone in the coulee walls along a one-mile length of the reservoir. The Applicant expects that this seepage will follow the sandstone bed downward and be isolated from the surface by a thick layer of clayey till. The impact is rated as negative, low and long-term. PWSS stated that primary mitigation options in suspect locations would be to construct an impermeable barrier or to install a deep drainage system.

- Seepage through and under the saddle dyke was identified by the Applicant as the seepage source of most concern. Because there are some exposures of permeable sandstone under the area, which are covered by only a thin layer of till, seepage through these exposed sandstone layers could affect shallow groundwater systems to the south and southeast of the dyke. The lower-lying parts of these areas could become waterlogged and salinized. This was the only seepage source the Applicant considered to be of significant concern. The primary mitigation options identified by the Applicant were to construct an impermeable barrier beneath the dyke or to install a deep drainage system beneath the dyke.

- At the hearing, the Applicant recognized that the construction of the reservoir could also lead to altered surface drainage and to cutting off surface water drainage to Pine Coulee, potentially resulting in surface water ponding and loss of agricultural land. PWSS identified the primary mitigation options as connection to existing natural drainage systems and pumping surface drainage over the dyke.

Cost effectiveness was a key consideration in the Applicant's assessment of potential mitigation options. Impermeable barriers and deep drainage systems are costly options. Topographic considerations led the Applicant to conclude that surface water, including that from seepage, would initially drain into three low areas east of the dyke. Consequently, the mitigation favoured by the Applicant would be to monitor the situation and purchase affected lands or to improve affected surface/subsurface drainage only if a problem were to develop. According to PWSS, this approach would be cost effective, and current monitoring methods would allow detection of problems before extensive loss of soil productivity would occur.

The Landowners Group's concern was with the uncertainty of the effect of the project on potential salinization of its lands. The Group felt that it was being expected to bear all the risk with no potential benefits. It felt the transition from no effect to significant effect was small and hard to determine. For this reason, the group was critical of how PWSS intended to determine significant effects that could affect landowners and which would require mitigation. It did not accept the purchase of affected lands by the Applicant as an option. It also was concerned about the availability of funds to undertake mitigative action if needed, with the current budgetary constraints on the provincial government.

The Landowners Group argued that its members could be negatively affected if the project did not include drainage. This group stated that alternative drainage designs had been put forward in the past but that there had not been a resolution of the issue. Their representative indicated that drainage had been proposed to the Public Advisory Committee in June 1992. The committee moved it forward but the Applicant apparently had not acted on the proposal. The Landowners Group was concerned that if the Pine Coulee Project proceeds as designed, they will face grave danger of salinization of soils, ponding and marshing from excess groundwater and seepage or direct leakage from the dam and from proposed irrigation activities.

The Landowners Group said the original Alberta Environment study suggested that seepage through the east side of the reservoir is likely and that artesian pressure will cause seepage through onsite sand and gravel lenses. The group disputed certain results of other studies, such as the Pine Coulee soil salinity mapping project undertaken by PWSS to define the project's effect on this group, basing their opposition on their own experience - its members have accumulated some 350 working years on this land. If half again as much acreage is put at risk as benefits from the project, the group questions the benefit-cost ratio of the project. It also questioned the Applicant's proposal to monitor salinity, only installing drainage or purchasing the land after a problem is identified. What this amounts to, the group felt, is irresponsible land management, allowing degradation of the land before taking remediation action. Consequently, this group supported the construction of a prime drainage ditch, addressing drainage concerns six miles (about 10 kilometres) to the north and also reducing risk to landowners to the east. All members of the group are located in the sub-basin; the concerns affect their livelihood as well as that of their children.

The Landowners Group felt that the statement by PWSS of its intent to monitor sounded good but that PWSS had not addressed the key issue of the "event horizon" or the trigger mechanism that would be used to determine the need for action. It stated that a criterion such as an increase in groundwater level of two inches or ten feet might not properly represent the relationship to the actual salinization effects on their land. Their concerns might then be ignored. The Applicant's expert stated that at the present time the specific value of such a trigger had not yet been assessed, whether it should be one, two, or three metres. In his view, the data would have to be monitored on a monthly basis by an individual with hydrogeological experience, who would be able to assess whether mounding was taking place and whether it was at a level of concern, since the data would have to be assessed within the context of the hydrometeorological regime.

Discussions between the Landowners Group and the Applicant progressed during the course of the hearing. The position of the Landowners Group in its written submission was that, if the proposed project were to be approved, it would have seven recommendations for the Panel to consider. At the hearing the parties resolved six of the seven issues involved in the recommendations. The agreement was based on the Applicant agreeing to the following undertakings:

- study discrepancies between EM-38 and soil sample salinity readings by a committee consisting of representatives from the Applicant, Alberta Agriculture, Food & Rural Development, the Landowners Group, and a consultant of the Landowners Group's choice. Based on the committee's determination, further necessary studies would be carried out at the Applicant's expense;

- after review by the Prairie Farm Rehabilitation Administration (PFRA), if current seepage estimates are determined to be inadequate, the Applicant will do whatever further studies are recommended by PFRA;

- the Applicant will recommend to the Controller of Water Resources to include a condition in the project licence to require a groundwater/soil monitoring system (as described in the Landowner Group's submission) to be undertaken to the satisfaction of Alberta Agriculture, Food & Rural Development. The Applicant has also undertaken to add four monitoring wells in low-lying areas north of Secondary Highway 527.

- the Applicant will recommend to the Controller of Water Resources to include a condition in the project licence to require the Applicant or the Applicant's successor to implement trigger mechanisms for mitigation to be determined jointly by Alberta Agriculture, Food & Rural Development, PFRA and the Landowners Group.

- the Applicant will recommend to the Controller of Water Resources to include a condition in the project licence to require that the monitoring results be made available to the public on an on-going basis; and

- the Applicant will recommend to the Controller of Water Resources to include a condition in the project licence to require the public detailing of agency responsibilities and turnover schedules by the owner/operator of the project. When responsibility for the project moves from the Applicant to another operator such as Alberta Environmental Protection, this operator would also be required to meet the agreed-on conditions which are to become part of the licence.

Based on these understandings, the only issue left outstanding between the Landowners Group and the Applicant is that of drainage. The Landowners Group wanted assurance that the opportunity to install drainage would be available when it would be needed. Their preference

would be to have drainage installed from the outset. The Landowners Group asked the Panel to require as a condition of approval that a contingency of 1.5 to two percent of construction costs be earmarked specifically for drainage and salinity mitigation. The Landowners Group's final position was that the project should not be approved, but if it were and the above recommendations implemented, the Applicant must be responsible for all effects either caused or aggravated by the proposed project.

If the project were to proceed, the Group said, construction of the saddle dyke would prevent the completion of a drainage system started in 1974. It stated at the conclusion of the hearing that the subsurface drainage system is now its preferred choice. In its written submission, it had suggested that the total area subject to waterlogging and salinity might be in the order of 375 to 600 hectares if it is assumed that seepage would increase the area subject to these effects by 50 percent. According to the expert report submitted by the Landowners Group, seepage from the proposed reservoir has the potential to increase the salinity on the lands below Full Supply Level (FSL) east of Pine Coulee, with the areas south and southeast of the proposed saddle dyke being the most susceptible to potential seepage based on existing studies. Evidence at the hearing from the Landowners Group expert was that it would be possible to design a monitoring program so as to give adequate warning of salinity arising from the project and allow mitigative action to be taken.

Also during the hearing, PWSS stated that its most recent studies indicate that seepage levels would be quite low, lower than had earlier been anticipated. It proposed a monitoring system to track the level of seepage, with further mitigation to be implemented only if the monitoring data indicated a sufficiently serious problem. It also stated that it was intending to install relief wells and that its current information indicated that the level of flow could effectively be intercepted by these relief wells and the toe drainage system, and returned to the reservoir, so that no salinization would occur on the adjacent lands as a result of the proposed project.

The Applicant also provided additional information on options and costs if drainage were to be required. Three options were examined which included an open ditch, a buried drain and a pumping system. The Applicant's expert stated that if it was responsible for the water, it could definitely determine "the most cost effective way out." The stated that based on the elevation of the drain, the open ditch might not be the correct solution. The cost of pumping was quoted as ranging from about $100,000 to $500,000, depending on the slough elevation objective and the period of pumping. The cost of the buried drain was still uncertain, estimated at more than $100,000, but would be within the allowable cost range. It was also pointed out that the cost associated with this option was not very sensitive to depth, so that if more complete drainage was required, this might be a very cost-effective option. Alternatively, the expert stated, if the Applicant were not responsible, "the entire discussion with the land owner becomes fairly mundane." PWSS indicated that all landowners who might be affected by potential drainage solutions would have to be informed about and involved in such consideration.

5.3.3 Panel Views

The Panel notes the evidence regarding the suitability of lands located along Willow Creek for irrigation purposes and concludes that should the project proceed, there are sufficient suitable lands capable of supporting irrigation that the irrigation benefits would not be limited by the availability of irrigable lands and unsuitable lands would not be permitted to receive irrigation water.

The Panel understands that the aspect of land use classification for irrigated lands are extensively addressed in the current regulatory framework. The Panel is also very conscious of the limited water resource in this basin. The Panel has confidence that the relevant authorities responsible for water and land resources would carefully review future resource allocations and development to optimize the benefits from this project, if it were to be approved.

The Panel has concerns regarding seepage and potential salinization of agricultural lands. If the project were to proceed and result in the salinization of lands and the loss of productivity for a large area near the reservoir, in creating the benefit of water availability for irrigation, then the Panel would have concerns about some of the benefits of the project. The Applicant has identified the potential sources of seepage from the project and the mitigation options available to avoid directly related salinization problems. The Panel believes that the project can incorporate appropriate mitigation measures in the design and operation of the reservoir to prevent project related salinization of agricultural land in the vicinity of the project. Therefore, the Panel would require in a manner satisfactory to the Controller of Water Resources, should the project proceed, that PWSS:

- design the reservoir, dam and saddle dyke to incorporate appropriate mitigative measures that will restrict and control seepage to prevent the project from causing the salinization of agricultural lands.

The Panel believes that such a requirement would address directly the primary concern of the Area Landowners; preserving the quality of surrounding lands. The Panel agrees with the Landowners that all reasonable steps should be taken in the design of the works to minimize and manage seepage. The Panel notes that PWSS has identified a range of specific project design alternatives that might be included in the project to accomplish the protecting of the quality of surrounding lands. The determination of the best alternative is a matter to be resolved during the detailed design of the works and the Panel would expect that the Controller of Water Resources would include such matters within the scope of the review of the application made by PWSS pursuant to the *Water Resources Act*.

The Panel further notes that PWSS has agreed to undertake specific follow-up actions regarding a number of the detailed matters raised by the Area Landowners and filed with the Panel during the hearing. The Panel accepts the commitments made by PWSS and would require that they be fulfilled, should the project receive approval from the Panel. Specifically, PWSS agreed to:

- studies of the discrepancies noted between EM-38 and soil sample salinity readings by a committee composed of members of PWSS, Alberta Agriculture, Food & Rural Development, the Area Landowners and a consultant of the Landowners' choice, and, if necessary, any further studies would be done at the expense of PWSS; and

- perform further calculations of seepage estimates based on new and expanded data, for the review by Prairie Farm Rehabilitation Administration (PFRA) and, if required by PFRA, do such further studies as are recommended by PFRA.

The Panel believes that the seepage estimates would be considered by PWSS in selecting among project design alternatives for inclusion in the project to accomplish protecting the quality of surrounding lands. The Panel believes that the resolution of soil sample salinity readings would contribute toward PWSS meeting its commitment to:

- expand, in a manner satisfactory to Alberta Agriculture, Food & Rural Development, a ground water/soil monitoring system to provide an ample early warning of potential changes in soils, including four additional monitoring wells in low-lying areas north of Secondary Highway 527;

- establish, based on recommendations from Alberta Agriculture , Food & Rural Development, PFRA, and the Area Landowners, the criteria or trigger mechanisms that would indicate the need for mitigative action; and

- provide monitoring results to the public on an ongoing basis.

The Panel notes, in particular, that the Area Landowners requested and PWSS agreed that the preceding commitments could be included as conditions on any licence that might be issued by the Controller of Water Resources. The Panel is mindful of the role of the Controller and agrees that the Controller may wish to consider a variety of detailed matters at a later stage in the project planning process. To complement the undertakings made by PWSS in response to the Area Landowners' concerns, the Panel would further require that:

- PWSS establish, to the satisfaction of the Controller of Water Resources and well in advance of the project proceeding to operation, the following measures:

  1. An appropriate groundwater observation network adjacent to the project that would ensure that any seepage that could lead to salinization of agricultural land is detected at an early stage;

  2. Specific mitigation plans that would be implemented to prevent seepage from causing the salinization of agricultural land;

3. An appropriate monitoring and detection program that would identify, in accordance with generally recognized methods, any salinization of soils that might be attributable to the project; and,

4. In the event that salinization were to occur, an appropriate course of action that would be followed to correct any salinization attributable to the project, including the specification of the financing and timing of corrective steps.

The Panel does not believe that the Applicant should be responsible in any way to implement measures that might be taken to resolve any pre-existing salinization problems that are independent of the project. There is, however, one special matter that the Panel believes needs to be recognized as part of the proposed project. The Panel believes the evidence indicates that should the project proceed, some options for dealing with pre-existing surface drainage problems may no longer be available or feasible. To the extent that the proposed project may cause an increase in the cost of any surface drainage solutions which may have been viable prior to the commencement of the project, then the Panel believes that AEP should be responsible for any associated incremental costs of drainage projects that might be undertaken by the landowners in the future.

With respect to soils and drainage, the Panel concludes that should the project proceed, the proposed project would not result in significant adverse impacts to soils and drainage provided that the mitigation program, and the conditions of the Panel, are implemented.

5.4 Vegetation

Pine Coulee is in the fescue grass ecoregion of Alberta, not far from the mixed grass ecoregion to the east. Vegetation within the coulee is primarily cattle-grazed native grassland, although some parts of the coulee have been seeded and cultivated. Shrub associations (buckbrush - rose; saskatoon - chokecherry) dominate north-facing slopes and moist sites. Vegetation along Willow Creek near the coulee includes a willow - reed grass association in the active floodplain, balsam poplar stands with buckbrush - golden bean understories at slightly greater elevation and, further from the stream bed, trembling aspen - saskatoon - buckbrush and silverberry - buckbrush - rose associations.

The project would inundate grasslands within the coulee and could indirectly affect nearby grasslands by increasing the likelihood of expanded irrigation and recreational development. It would also affect the riparian communities of Willow Creek. The construction and back-flooding of the proposed diversion weir would directly remove some riparian vegetation, while operations of the proposed reservoir would alter the hydrology of Willow Creek, potentially affecting riparian communities. Further impacts could arise from the intensification of use in Willow Creek Provincial Park and adjacent areas that could be developed for recreation. Overall, PWSS estimated that 800 hectares of vegetation would be lost to construction and reservoir flooding.

The potential effects of the Pine Coulee Project on vegetation are discussed below under the two broad categories of grasslands and riparian vegetation. The implications for wildlife habitat of changes to vegetation communities and the overall loss of vegetation to the reservoir are discussed in Section 5.5.

5.4.1 Grasslands

Of the three broad grassland ecoregions in Alberta, the fescue grassland is the smallest. Although Pine Coulee is within the fescue grass ecoregion of Alberta, much of its vegetation is not typical of fescue grasslands. The sides of the coulee are dominated by blue gramma, spear grasses and wheat grasses more typical of the mixed grass ecoregion to the southeast. Vegetation on the floor of the coulee is influenced by alkaline soils; vegetation on colluvial and alluvial fans has been altered by cultivation. Uncultivated areas have been grazed by cattle.

The composition of remnant fescue grasslands such as those within Pine Coulee reflects the historical pattern of agricultural development, in which sites with good topography and soils were preferentially cultivated. This practice continues today and has been codified in the land classification scheme (Section 5.3.1) employed to select irrigable lands. The natural vegetation of Pine Coulee, limited by soil and moisture conditions, differs from the vegetation characteristic of the ecoregion.

PWSS stated that the construction and flooding of the reservoir would result in the direct loss of grasslands that provide habitat for a variety of species. It said that further potential losses of grasslands surrounding the proposed reservoir could be expected because of slumping of unstable slopes and the development of recreational facilities. PWSS estimated that the total area of grassland removed by the reservoir would be 600 hectares. Indirect and off-site impacts identified by PWSS included the potential losses to cultivation made possible by the expansion of irrigation and the potential fragmentation of some small parcels of native grasslands to the west of Pine Coulee if the Link 5 road (see Map 1.1) is built. PWSS stated that no rare or endangered plant species would be threatened by the proposed project.

PWSS said it would undertake a habitat compensation plan to mitigate the loss of grasslands and the wildlife habitat it represents. Under the plan, lands near the coulee would be managed to increase their value to wildlife and to ensure that all plant species that would normally occur in native fescue grassland would be represented. PWSS said it would enhance the condition of fescue grasslands on sites near Pine Coulee by removing or significantly reducing grazing. It would also consider the option of naturalizing cultivated lands, although this option was not favoured because it is both the more expensive option and the one that would entail the greatest delay between implementation and effective mitigation. PWSS estimated that rehabilitating cultivated land to fescue grassland would take 50 years. PWSS said it was confident that it could, over a number of years, rehabilitate grazed lands to approximate the condition of native grassland. Based on the experience of others, PWSS estimated that it could generally expect a 25 percent improvement in range condition

over a 20 to 30-year period. In its view, the gains realized through rehabilitating these lands would compensate for the losses caused by the project. Progress would be monitored both in terms of range condition and in terms of wildlife habitat units (see Section 5.5) for the wildlife species for which its consultants have employed habitat suitability indices.

The habitat compensation plan would be implemented through a number of administrative arrangements including agreements with grazing lease holders and outright purchase. In evaluating lands for potential inclusion in the habitat compensation plan, PWSS said that preference would be given to fescue grasslands over mixed grasslands and to sites close to Pine Coulee over sites further away. Grasslands in relatively poor condition would be sought because the prospects for gains in range condition and consequent quality of wildlife habitat would be greater than on lands already in moderate to good condition. The compensation lands would likely include grasslands in a range of conditions. PWSS would attempt to assemble contiguous parcels of land to avoid edge effects, that is, the adverse effects of species intrusion from dissimilar communities.

In response to questions from the Pine Coulee Coalition, PWSS said that it did not have an inventory of the range condition of prospective compensation lands, but that it was generally aware of the disposition and condition of the lands surrounding the project. It said there would be little opportunity to include lands to the east of the coulee, because they are almost completely under cultivation. Much of the fescue grassland to the west of the coulee has also been cultivated, but some unbroken land persists in the vicinity of Crocodile and Canon lakes. Lands in those areas and other nearby areas with uncultivated land would be considered. The actual selection of compensation lands and the administrative arrangements for their management would depend on discussions with the landowners and leaseholders. The issue of who would have responsibility to oversee the ongoing management of compensation lands is not yet settled, but the lands would be "...under a provincial park type of management structure." PWSS was exploring the possibility of a co-management arrangement with the Nature Conservancy or alternatively, management by a government agency. Alberta Environmental Protection said that it had given no consideration as yet to its potential role in managing the compensation lands.

Some participants expressed general support for the notion of habitat compensation, but sought clarification of the philosophy behind the habitat compensation plan. Environment Canada asked if it was the Applicant's policy to ensure no-net-loss of grassland. PWSS said that it was not its goal to ensure no net loss of grassland, but rather to ensure no net loss of habitat capacity for wildlife. The habitat compensation plan would attempt to replace the habitat lost to the reservoir by increasing the capacity of the compensation lands by an equivalent amount. The habitat value of the compensation plan would be measured using a range condition index and six habitat suitability indices for wildlife (Section 5.5).

The Pine Coulee Coalition expressed support for the objectives of the Applicant's habitat compensation plan for grasslands, but expressed doubts about the time frame. It suggested that rehabilitation of fescue grasslands to a quasi-natural state would take roughly 80 years.

5.4.2 Riparian Vegetation

River valleys occupy only a small part of the prairie landscape, but exert a disproportionate influence on the region's biodiversity. The riparian wetlands, shrub communities and poplar forests associated with the riverine environment in Alberta provide habitat for birds, mammals, reptiles and amphibians. Riparian communities also provide aesthetic enjoyment and tangible economic and social benefits through recreational use, livestock sheltering, regulation of runoff and improved water quality. In its Application, PWSS recognized that riparian poplar forests, in particular, provide critical and productive habitat for wildlife (see Section 5.5.1).

The government of Alberta undertook studies of the riparian communities of Willow Creek and conducted an instream flow needs study so that the impact of the proposed project on riparian communities could be assessed. It also provided background information on the biology and management of riparian communities.

The evidence provided to the Panel by PWSS and participants is briefly summarized below. A brief account of the biology of riparian communities in relation to stream characteristics which explains why riparian communities are potentially vulnerable to water diversion projects (5.4.2.1), is followed by a discussion of the practical and policy initiatives that have been taken in Alberta to promote the responsible management of riparian communities (5.4.2.2). These are followed by a description of the riparian communities of Willow Creek (5.4.2.3), the instream flow needs study (5.4.2.4) and finally, the anticipated impacts of the Pine Coulee Project on riparian vegetation (5.4.2.5). The Panel's views on the impacts of the project on riparian vegetation are presented in Section 5.4.3.

5.4.2.1 The Biology of Riparian Communities

Riparian communities are sustained by streams and their associated shallow groundwater flows. Many of the plant species found near streams are adapted to riparian conditions and cannot survive on the dry prairies beyond the watercourses. Water, in the form of spring runoff, is also the physical force that scours streambeds and transports sediment to create the germination sites that some riparian species require in order to reproduce. The dependence of riparian plant species on aspects of surface and groundwater hydrology and fluvial geomorphological processes is only imperfectly understood and is the subject of ongoing research. Nevertheless, certain general relationships are well established and these are sufficient to codify provisional instream flow needs (IFN) for the protection of riparian vegetation (see Section 5.4.2.4) pending further advances in scientific understanding. The current approach to IFN assessment for riparian communities in southern Alberta relies on the assumption that if poplars are protected, other less conspicuous species will also be protected.

The status of poplar populations, whether increasing or decreasing, depends on the relative levels and timing of recruitment and mortality. Unlike many other species, however, poplars

are a long-lived species in which recruitment, either by seedling establishment or suckering (in balsam poplar) may be an infrequent event. A viable population might therefore exhibit a pattern of slow decline associated with adult tree mortality, punctuated by intermittent episodes of recruitment. The frequency of recruitment events depends on climate as well as on a number of stream-specific factors including the stream gradient and kind of streambed material, channel morphology and movement, and annual variation in stream flows.

Poplar seeds are viable for only two to four weeks and can establish only if recently disturbed, unshaded moist silt or sand sites are available for germination. Young seedlings are particularly vulnerable to desiccation in their first year when their roots are not deep enough to exploit relatively stable groundwater supplies. The exacting sequence of hydrological conditions that makes seedling recruitment possible occurs only intermittently even under natural stream flows. Suckering (i.e. the growth of new stems from roots) is uncommon in two of the three common species of poplar in southern Alberta, but is common in balsam poplar, the most abundant species in Willow Creek (see Section 5.4.2.3). Suckering is promoted when flooding or ice scouring exposes and shears poplar roots. The relative importance of these two modes of reproduction in the maintenance of balsam poplar forests in southern Alberta is not well understood. Balsam poplar stands are fully grown by age 60 or even sooner, after which they begin to senesce (i.e. decline with age) and gradually die out over a period of years. Older trees are especially vulnerable to drought stress.

Riparian poplar populations are vulnerable to human activities that reduce or alter the pattern of natural stream flows and to other activities, such as livestock grazing and recreation, that may increase seedling and sapling mortality rates. The removal of water for consumptive purposes can increase mortality rates, particularly in the vulnerable younger and older age classes, by increasing the frequency or severity of drought stress. Decreased or altered flows can also reduce the frequency of the conditions required for successful recruitment. In the extreme, the conditions required for recruitment, which occur intermittently under natural flow conditions, may occur too seldom to sustain a viable poplar forest. The adverse effects of other forms of disturbance, such as livestock grazing and recreation, may act synergistically with changes in river hydrology to prevent the recruitment of young trees. The cumulative effects of these factors may not become apparent without detailed studies of the age structure of the population because mature trees can survive for many years after the conditions for the maintenance of the population have been compromised. Furthermore, it is not always possible to attribute a long gap in recruitment to the effects of a water management project or other disturbance because variation in the natural hydrological regime is large.

5.4.2.2 Management of Riparian Communities in Alberta

The planning, environmental assessment and public review of the proposed Pine Coulee Project have coincided with the recent development of initiatives by both public authorities and nongovernmental organizations to help protect riparian communities from unsustainable water and land use planning and management practices. Public policy on the protection of riparian

communities is evolving as better means become available to identify the scientific basis for environmental protection and to reconcile the needs of environmental protection with demands for use of water and land resources.

Experience in Alberta and several western states has shown that riparian communities can be damaged and even destroyed by dams and water diversion projects undertaken without due regard for the water needs of vegetation. Some onstream water management projects damage vegetation, particularly riparian poplar forests, by flooding upstream of dams, by altering flows and sedimentation processes and by stabilizing channels downstream of dams and diversions. A late 1980s assessment of the impacts of dams constructed on the St. Mary and Waterton rivers in 1951 and 1964, respectively, concluded that the dams were responsible for the decline of downstream poplar forests. Since the Oldman River Dam project in the late 1980s, provincial authorities have sought to address adverse impacts to riparian communities by having due regard for their instream flow needs in planning water management projects. IFN studies have been done or are underway for several rivers supporting riparian poplar forests in southern Alberta including the Oldman, Bow and Red Deer Rivers, the southern tributaries of the Oldman and Willow Creek.

A 1984 report of the Alberta Water Resources Commission, *Water Management in the South Saskatchewan River Basin*, recognized the value of proactively establishing instream flow needs as a means to ensure that consumptive water allocations are made without compromising the sustainability of other uses. The report recommended that IFN be established on a priority basis for streams where flows are currently thought to be critical, where moratoria exist, and/or where storage or diversion works are in the planning stage. Willow Creek, which warranted priority under both criteria, was specifically mentioned and has since been the subject of IFN studies (see Sections 5.1.2 and 5.4.2.4).

A provincial IFN Task Force was established to review the scientific basis for establishing IFN and to address the relationship between IFN determination and water management planning (see Section 4). Of particular relevance to the following discussion is the distinction the Task Force made between IFN based on a scientific assessment of the needs for environmental protection and instream flow allocations (IFA) that result from the water management planning and decision making process. The latter will sometimes reflect a trade-off between environmental protection and consumptive uses and will not necessarily meet all needs and demands.

Conservation and Management Strategy for Riparian Forests in Southern Alberta, released in 1992 recognizes that activities such as livestock grazing and recreational uses can adversely affect riparian communities and may act synergistically with the impacts of water management projects. This report supports a comprehensive approach to the management of riparian communities that integrates land and water management decisions.

5.4.2.3 The Riparian Communities of Willow Creek

Poplars are found in discontinuous bands primarily on meander lobes, from the Chain Lakes Reservoir to a point 12 kilometres downstream of Pine Creek. They are absent from that point until they reappear about nine kilometres upstream of Willow Creek's confluence with the Oldman River. Their distribution, which coincides with armoured reaches with cobble streambeds, has apparently changed little, based on air photos taken in 1922 and 1951. Of the roughly 190 hectares of poplar forest downstream of the proposed diversion, 20 percent occurs upstream of the confluence with Pine Creek, another 50 percent occurs between Pine Creek and the site 12 kilometres downstream, and the remaining 30 percent is found near the confluence of Willow Creek with the Oldman River. PWSS did not provide an estimate of the areal extent of riparian poplars upstream of the proposed diversion, but indicated that poplars have encroached on the intermittently dewatered streambed immediately below the Chain Lakes Dam.

Most of the poplars along Willow Creek are balsam poplar (*Populus balsamifera*), but narrowleaf poplar (*Populus angustifolia*) and hybrids between these species are also present. The plains cottonwood (*Populus deltoides*) is also present but rare. The significance of the species composition of riparian poplar forests lies in their different biological requirements, which could influence the potential impact of the proposed project. Balsam poplar, the most abundant poplar in Willow Creek, often grows away from riparian habitats and is known to be less sensitive to rapid water table declines than the other species, which are restricted to riparian habitat.

PWSS found that nearly all the poplars sampled on five sites within a 15-kilometre reach above and below the proposed diversion site are 55 years of age or older. Recruitment of these trees occurred over a 20 to 30-year period with the majority establishing in a 10 to 15-year period. No evidence was found to suggest that the stands were being maintained by asexual reproduction and there was also some doubt as to whether sexual reproduction has been successful. Saplings were limited to within 50 metres of the active stream channel and, with very few exceptions, were younger than 10 years of age, indicating either that recruitment of saplings has occurred only recently, or that saplings recruited earlier have not survived. PWSS concluded that seedling establishment has been relatively unsuccessful over the last 40 to 50 years. The Applicant speculated that the lack of vegetative propagation may be the result of heavy cattle grazing but did not provide any supporting evidence.

5.4.2.4 Instream Flow Needs for Willow Creek Riparian Vegetation

In 1992, Alberta Environment completed a study of IFN for the riparian vegetation and wildlife of Willow Creek, entitled *Willow Creek Instream Flow Needs Study: Riparian Vegetation/Wildlife Component*. The assessment was limited to an evaluation of the requirements of riparian poplar, on the assumption that if instream flows for these species were maintained, the requirements of other plant and animal species would also be protected. The study recognized that riparian poplar forests could only persist in the Willow Creek basin if recruitment compensated for

mortality over the long term. Although poplars reproduce both sexually (by seed) and asexually (vegetative reproduction), the study concentrated on streamflow characteristics that promote seedling recruitment because the conditions that promote recruitment through vegetative propagation are poorly understood. The impacts of low flow conditions on the condition and survival of trees were also considered. The following IFN criteria were recommended to maintain streamflows that would promote seedling establishment in favourable flood conditions and limit drought stress and drought-induced mortality in low flow years:

- Floods occurring between June 10 and July 15 (the seed dispersal period) and having a magnitude greater than or equal to the one in seven year return flood over this period should be maintained along reaches of Willow Creek occupied by riparian poplars.

- The natural timing of floods greater than or equal to the one in seven year return flood should not be modified so that peak flooding occurs before or after the seed dispersal period (June 10 to July 15).

- In years in which floods greater than or equal to the 1:7-year return flood occur between June 10 and July 15, the natural rate at which streamflow declines after peak flooding to the time of minimum summer flows should not be modified so that the river stage declines at a rate greater than four centimetres per day.

- During periods of low flow in July and August, natural streamflow levels should be maintained in Willow Creek at times when natural flows would be equal to or less than the weekly 80 percent flow exceedence level.

5.4.2.5 Impacts of the Pine Coulee Project on Riparian Vegetation

PWSS identified three ways that the proposed Pine Coulee Project would affect riparian vegetation. Construction of the diversion weir and impoundment of water upstream of the weir would remove the communities from the affected area. The proposed project would also alter the hydrology of Willow Creek downstream of the weir, potentially affecting riparian communities, particularly those between the diversion weir and the dam outlet, if instream flow needs for the protection of riparian communities were not met. Finally, the proposed project would attract greater recreational activity, in the vicinity of Willow Creek Provincial Park and the newly created reservoir which could increase damage to vegetation.

In its Application, PWSS estimated that construction of the diversion weir and the impoundment of water upstream of the weir would inundate approximately 25 hectares, removing approximately 11 hectares of riparian poplars and another six hectares of riparian shrub communities. During the hearing, PWSS stated that the diversion weir would be constructed downstream of the location described in the environmental impact assessment (EIA) and that the size of the headwater

pond would be approximately 42 hectares rather than 25 hectares as stated in the EIA. Specifics were not provided on how this change in plans would modify the area of riparian poplar and shrub communities that would be cleared or backflooded. At the hearing, PWSS described the loss of riparian vegetation at the headpond area as "small but significant."

One mitigation measure proposed was establishing replacement habitats through planting and managing riparian poplars and willows on nearby lands and around developed wetlands. This could take 10 to 20 years to develop. When questioned about how much confidence PWSS had in this approach, given recent experience at the Oldman River Dam Project and in Fish Creek Provincial Park, PWSS stated that a preferred approach for offsetting the loss of riparian vegetation would be to enter into land use agreements with owners along Willow Creek to fence parts of the riparian zone from cattle. To achieve no net loss of riparian poplars, PWSS suggested fencing 44 hectares of stands near the project area, a 4:1 ratio with respect to the original estimate of area of poplars lost.

Representatives of Trout Unlimited Canada and the Department of Fisheries and Oceans mentioned that they are participating in a riparian habitat management project ("cows and fish project"), in partnership with local ranchers and the Alberta Cattle Commission, the Canadian Cattlemen's Association, Alberta Environmental Protection and Alberta Public Lands. Project participants are exploring grazing management strategies that protect riparian habitats and aquatic ecosystems. One of the demonstration sites is on Willow Creek in Reach 2 below the Chain Lakes.

Loss or damage of some riparian poplars because of the proposed increase in recreational activity in the project area is a potential negative impact. In the EIA, PWSS suggested this would be offset by the removal of grazing pressures from areas set aside for recreation activity. Suggested mitigation measures within and adjacent to recreation areas were public education programs and the prohibition of all terrain vehicles.

The proposed project would also alter the hydrology of Willow Creek downstream of the reservoir outlet, which could potentially affect riparian communities, particularly if the operating regime did not meet instream flow needs for the protection of riparian communities. The Panel was advised that IFN for riparian vegetation were not incorporated into the proposed operating plan for the Pine Coulee Reservoir. Reasons given for this were: 1) assessment of IFN for riparian poplars is still fairly qualitative, and 2) models used in developing the operational plan are based on weekly flows rather than daily flows which are more relevant to riparian poplar physiology and ecology. The validity of this position was questioned by the Pine Coulee Coalition who suggested that AEP was willing to accept weekly flows rather than daily flows when establishing IFN for other rivers in southern Alberta.

In the EIA, PWSS provided an assessment of the extent to which the instream flow allocations under the proposed operating plan would deviate from the IFN developed for riparian poplars. Flows under the proposed operating plan were compared to both existing flows (i.e., with Chain Lakes Reservoir operational) and natural flows in Willow Creek. The deviations from the IFN

for riparian poplars downstream of the dam outlet to the mouth based on the recorded flows for the period 1912 to 1988 are as follows:

- The magnitude of June 10 - July 15 floods at or greater than the one in seven year return event (i.e. 40-60 metres per second) would be significantly reduced 23 percent of the time, relative to existing and natural flows, especially in the lower reaches. Very large floods, thought to be responsible for major recruitment events, are presumed not to be significantly affected, as the capacity of the diversion (8.5 metres per second) is small relative to the flood rate. However fringe replenishment associated with relatively minor floods and channel shifting could be affected.

- The timing of June 10 - July 15 floods would reduce replenishment of riparian poplars, especially fringe replenishment due to bar formation. The primary mitigation strategy suggested by PWSS was to monitor the populations and alter reservoir operations if necessary.

PWSS suggested long-term monitoring of vegetation changes and sedimentation along 12 permanent transects established during the preliminary studies related to the project. As well, piezometers were established at a number of sites in 1991 to help determine the relationships between river stage, groundwater and riparian vegetation. Short-term monitoring for annual changes in branch growth was also being considered.

5.4.3 Panel Views

In general, the Panel accepts the Applicant's assessment of the potential impacts of the project on grazed grasslands. The major impact would be the direct loss of the grassland area in Pine Coulee. Smaller amounts would be lost to slumping, recreation and the expansion of irrigation to uncultivated lands. The Panel believes that the removal of 600 hectares of vegetation as a direct consequence of the proposed project represents a permanent loss of grassland. The Panel concludes that the residual impact of direct grassland removal would be negative, of high magnitude and of long-term duration. Any further removal of grassland remnants through expanded recreation and irrigation of uncultivated lands would add to the magnitude of this adverse impact. The Panel notes, however, that the Applicant, landowners and lessees can, and in the Panel's view should, endeavour to minimize these indirect impacts to grassland. In contrast, the direct losses of grassland would be an inevitable consequence of a decision to proceed with the proposed project. The Panel must therefore weigh this adverse impact against the project's projected benefits in assessing the overall merits of the proposed project.

Although no mitigation is possible for the direct loss of the inundated land, the Panel believes it is possible and desirable to recover some or all of its value to the native flora and fauna of the region by restoring native vegetation on other land currently used primarily for cattle grazing.

In the Panel's view, the undertaking by PWSS to develop a habitat compensation plan is an appropriate mitigation for the direct loss of the habitat capability that would result if the Pine Coulee Project were built. The Panel agrees with the stated objective of ensuring no-net-loss of habitat value and is also of the view that the restoration of plant species characteristic of native grasslands would be a benefit in addition to any benefit to wildlife species (Section 5.5) as a consequence of the improvement of rangeland condition. The Panel also agrees with the priority PWSS would give to fescue grassland, because of its relative rarity, and to lands in the vicinity of the proposed project over more remote sites. The Panel recognizes that the rehabilitation of compensation lands to a quasi-natural state would occur over many years. Consequently, the Panel is of the view that some detrimental effect of the project on grassland vegetation would be inevitable in the interval between the relatively immediate impacts of the project and the eventual rehabilitation of quasi-natural grassland.

The Panel has some concern with the feasibility and practicality of recovering cultivated lands to quasi-natural grassland. In the Panel's view, the high cost of obtaining cultivated lands, the need for relatively intensive long-term management and the prospect of long delays make this option the least desirable. While recognizing the argument that grasslands in poor condition have greater scope for improvements which may be tallied against the anticipated losses due to the proposed project, the Panel is also aware that it will take longer to rehabilitate these lands than it would to rehabilitate grasslands in better condition. The Panel recommends that PWSS follow a mixed strategy, involving some lands over a range of conditions to combine the benefits of some immediate gains with the prospects for greater long-term gains. The Panel recognizes that the details of the plan would depend on negotiations with landowners and lessees and the assessment of the potential costs and value of candidate lands.

Should the project be approved, the Panel would require PWSS to prepare and implement a detailed habitat compensation plan, in a timely manner, approved by the Fish and Wildlife Division of Alberta Environmental Protection, based on its stated objective of no-net-loss of grassland habitat capability. The Panel recommends that the cost of the compensation plan be included in the Pine Coulee Project capital and operating budget, and be implemented in a timely manner.

The Panel is concerned about the conservation of riparian communities. The importance of these ecosystems for wildlife and several human uses is highly disproportionate to the relatively small area they occupy. The Panel accepts that by managing to sustain native riparian poplar communities, the whole riparian ecosystem will benefit.

Impacts of the proposed project on riparian vegetation were a key issue for the Applicant and some participants at the hearing. The Panel will first consider the impacts of weir construction and inundation, and then the effects of operations, on riparian vegetation.

Riparian poplar forest would be flooded by the diversion weir and the headpond. Approximately 10 percent of the 190 hectares of riparian poplar forest downstream of the project could be affected by the weir and headpond. The mitigation proposed by PWSS was based on the

original estimate that 11 hectares of riparian poplar forest would be lost to weir construction and inundation. The relocation of the diversion weir and the larger size of the headwater pond necessitate revisions to the assessment of impacts on riparian poplar and other vegetation communities. The Applicant proposed to plant replacement stands on nearby lands and around developed wetlands. The Panel accepts this mitigation measure but believes that considerable effort would be needed to ensure success. The Panel would recommend establishing a mitigation fund and management plan (i.e. goals, benchmarks, monitoring, research and regular reporting of progress) in order to improve the potential success of this mitigation measure for the Pine Coulee Project.

Planted stands may be less productive for wildlife in terms of understorey composition and structure compared to the native stands. The Panel would recommend monitoring understorey development and use by wildlife of planted stands compared to native stands. This information would be useful in assessing impacts and appropriate mitigation for loss of riparian poplar communities in future.

PWSS stated a preference for fencing poplar stands elsewhere along Willow Creek as a mitigation measure for poplars lost to weir construction and inundation. The Panel did not receive documentation of the extent, intensity or impact of cattle grazing on riparian poplar regeneration and survival along Willow Creek. However, anecdotal evidence of heavy use by cattle was provided at the hearing by participants and the Panel is aware that studies elsewhere in Alberta and western North America show significant increases in riparian poplars along reaches where livestock pressure is reduced or eliminated.

The Panel is aware that fencing of riparian areas to exclude cattle completely is only one of several range management options and is now not generally considered to be the preferred option. This option generally requires public funding for construction and annual maintenance of fences. The costs are relatively high compared to other fencing given the rough topography and changing nature of the riparian zone. If, as is usually the case, the landowner does not voluntarily relinquish the riparian area, then there would also be costs of compensation or purchase. PWSS estimated that fencing four hectares of riparian poplar from livestock for every one hectare lost would result in no-net-loss. The initial area to be fenced was 44 hectares given that 11 hectares would be lost to weir construction and inundation, however this would require revision given the change in area affected by the weir.

The Panel accepts a mitigation approach which would address the impacts of livestock grazing on riparian vegetation recognizing that it does not negate the need for water management sensitive to the instream flow needs of riparian poplars; reflects an understanding of cumulative effects and the need to integrate land and water management (as expressed in *Conservation and Management Strategy for Riparian Poplars in Southern Alberta*); and is consistent with an ecosystem management approach.

The Panel is concerned that the mitigation of the riparian effects of the proposed project through a program to reduce the impacts of livestock grazing be dealt with in a manner which

is sensitive to the needs of landowners and lessees and builds on the range management experience of ranchers and public land managers. To do so requires the involvement and cooperation of private landowners and/or public land managers along Willow Creek throughout the mitigation process. The "cows and fish project", which involves one project directly on Willow Creek in Reach 2 below Chain Lakes, is a partnership among ranchers, Alberta Public Lands, Alberta Environmental Protection, Alberta Cattle Commission, the Canadian Cattlemen's Association, Trout Unlimited Canada and the Department of Fisheries and Oceans, and may serve as an appropriate model. The Panel understands that the steps in the process include range inventories, development of ranch management plans (inclusive of, but not exclusively, riparian habitats), implementation of the plans and periodic monitoring, evaluation and modification.

Should the project be approved, the Panel would require that a more detailed plan for mitigating the loss of riparian poplars by establishing replacement stands and reducing livestock impacts, be developed by PWSS and reviewed and approved by Alberta Environmental Protection and Alberta Agriculture, Food & Rural Development. Furthermore, the Panel would recommend that funds to cover the immediate and long-term costs associated with developing and implementing riparian zone mitigation plans be included in the project capital and operating budget.

In the Panel's opinion, the impacts on riparian poplars associated with increased recreation would be localized. The Panel would recommend guidelines be developed for Willow Creek basin recreation areas by appropriate management agencies to provide direction regarding facility development in native riparian poplar stands; all-terrain and other vehicle use in the riparian zone; and recreation users walking in riparian poplar stands and using bars where poplar seedlings are establishing.

The hydrology of Willow Creek that was the "base case"for this assessment has already been altered from its natural state, both by the Chain Lakes Reservoir and by numerous private irrigation projects. Information relevant to a comprehensive assessment of riparian poplars and riparian communities generally along Willow Creek was provided in Alberta Environmental Protection's IFN studies and the Application.

The operation of Chain Lakes Reservoir and existing consumptive demands result in reductions in the amount of flow during natural low summer flow periods and an increase in the frequency of weeks with low summer flows. Vegetation on some point bars immediately below the dam has increased and there are signs that vegetation cover near to the active channel immediately below the Chain Lakes Reservoir, has increased or grown in. This is characteristic of decreased stream flow. The current distribution of riparian poplars is similar to that observed on air photos from 1951/52 and 1922, as well as the distribution shown on vegetation maps prepared in the 1880s. The current age-class structure of riparian poplar forests indicates that there has been very little recruitment in the population over the last 40 to 50 years. The current operating plan for Chain Lakes Reservoir and existing consumptive demands in the basin were shown not to have a significant effect on the magnitude or timing of major spring flood events, or on the rate of stage decline

following major spring flood events. Therefore, they probably do not affect major recruitment events of riparian poplars.

Considering the lack of recruitment over the last 40-to-50 years and the fact that the current population is approaching senescence, the Panel concludes that the riparian poplar population along Willow Creek may be a population at risk. However, the factors responsible for this, be it climate, current water management or heavy livestock grazing, and their relative and/or cumulative contribution to decline are not known. As well, key regeneration characteristics of the population, such as the relative importance of seedling establishment versus suckering and general replenishment versus fringe replenishment, are unknown. Obtaining such information would require long-term study. The Panel believes that an appropriate management strategy in this situation is one which would approximate, as closely as possible, given economic and social needs, the natural factors and processes acting on the population.

Even though the science is imprecise, the Panel found very credible and useful the information on IFN requirements for riparian poplars, contained in Alberta Environmental Protection's *Willow Creek Instream Flow Needs Study Riparian Vegetation/Wildlife Component*, as well as the assessment of how the proposed operating plan for the project would deviate from the requirements contained in the EIA. The Panel agrees that general replenishment associated with extremely major floods of long recurrence interval and major channel shifting is unlikely to be affected by the proposed Pine Coulee Project, unless rates of stage decline between the time of the peak flooding and the end of the seed dispersal period are significantly increased from what would occur under natural conditions. To prevent rates of stage decline that deviate significantly from the natural (and particularly that exceed four centimetres per day), the Panel would expect day-to-day operation of the Chain Lakes and Pine Coulee Reservoirs would eventually be based on "real-time" hourly/daily flow data and computerization of the dam operation based on a set of guidelines, developed by a multidisciplinary team, that the operator would use in making decisions.

Given that the role of fringe replenishment for riparian poplars along Willow Creek is not known, but that it has been shown to be important for maintaining viable seed sources between infrequent, general replenishment events along other rivers, the Panel would recommend monitoring lateral or point bar formation from sites upstream of the proposed diversion weir, between the diversion weir and the confluence of Pine Creek with Willow Creek, and downstream of Pine Creek to determine if these bars would support successful poplar regeneration. Consideration should be given to an assessment of the role of moderate peak flows, which are affected by Chain Lakes Reservoir and the Pine Coulee Project, in incremental channel migration and bar formation and of how stabilization of banks due to decreased streamflow has and potentially could affect riparian poplar replenishment. As well, the work could include controlling for the effects of livestock through a comparison of heavily-grazed sites and other sites which are managed to prevent trampling and browsing of young seedlings.

The Panel recognizes that there could be a need to modify operation of Chain Lakes Reservoir and the Pine Coulee Project if the monitoring regarding the rate of stage decline and the

role of fringe replenishment show that it is necessary to more closely approximate the natural flow regime in order to maintain a self-sustaining riparian poplar population. Such modifications could lead to reductions in the amount of water available for other multi-purpose water demands before the basin becomes fully allocated.

The Panel notes that as various IFN become more precisely defined, there may be a need to adjust the operating plan for the reservoir. Flexibility to meet such future contingencies should be retained in the water allocation process.

With respect to the riparian vegetation impacts, the Panel concludes that the implementation of replacement stands and minimization of livestock impacts in riparian stands along Willow Creek would reduce the affects of the proposed project on riparian vegetation due to direct loss in the headpond area. The adoption of the planned operating regime, in the opinion of the Panel, would provide sufficient protection to the riparian vegetation downstream of the reservoir outlet in Reach 4 and any impact would be minor.

With respect to existing grasslands that have been primarily used for grazing, the Panel accepts that the proposed project would result in the direct loss of some grassland that would be almost fully compensated through timely implementation of the habitat mitigation program. The Panel accepts that some losses would occur, but believes that the residual impacts would be relatively minor.

The Panel concludes that the project, should it proceed, would not lead to any significant adverse impacts to vegetation provided that the mitigation measures that the Panel would require, are implemented.

5.5 Wildlife

PWSS provided an assessment of the impact of the proposed project on wildlife, including an inventory of wildlife species and habitat in the project area; a description of the anticipated impacts of the construction, flooding and operations of the reservoir; proposals for mitigation and monitoring; and an assessment of the residual impacts anticipated after mitigation. Since it was not feasible to assess the impacts of the project on all of the species that occur in the study area, the Applicant's consultants identified species they designated as "valued ecosystem components" (VECs). Some of the species selected for the assessment were chosen to be representative of groups of species with similar ecological requirements. Other species were chosen because they are known to be threatened or endangered and are therefore of special concern. The species and groups selected were: the long-tailed weasel, mule deer, white-tailed deer, great blue heron, trumpeter swan, ducks as a group, ferruginous hawk, prairie falcon, burrowing owl, long-billed curlew, upland sandpiper, Baird's sparrow, other songbirds as a group, northern leopard frog and western painted turtle. The Applicant's consultants provided information on the current abundance

and distribution of each of the VECs in the study area and assessed the current amount and value of habitat available to these species.

For the purposes of this discussion, the evidence provided by PWSS and concerns raised by other hearing participants about the overall impacts of the project on wildlife are presented first (5.5.1), followed by a discussion of impacts and proposed mitigation for individual species of concern (5.5.2).

5.5.1 Overall Effects on Wildlife

Much of the potential impact of the proposed project would be caused by the removal or degradation of existing wildlife habitat in the study area. The Applicant's consultants employed Habitat Evaluation Procedures (HEP) to assess these habitat-mediated impacts. They quantified the value of the habitat to each of the VECs using either habitat suitability indices adapted from existing U.S. Fish and Wildlife Service models or indices created specifically for this assessment. Habitat suitability indices rate the relative value of habitat based on current scientific understanding of a species' habitat requirements. The Applicant's consultants provided a quantitative assessment of the impacts of the proposed project on habitat for each of the VECs by comparing the amount and quality of habitat available prior to the project with the amount and quality of habitat that would be anticipated if the project was to proceed.

The habitat compensation plan described in the previous section would be designed to mitigate the habitat-mediated impacts of the project. The goal would be to replace the amount and quality of habitat removed by the project. PWSS said it could initiate the compensation plan before it begins construction of the dam. This, PWSS said, would reduce the residual effects of habitat removal and degradation to either low or negligible short-term impact for all species. Eventually, as the condition of vegetation on the compensation lands improved, they concluded, there would be no residual impact.

Other impacts of the Pine Coulee Project would not be caused by habitat loss or degradation and could not be mitigated by habitat replacement or enhancement. Among possible impacts of this kind identified by the Applicant's consultants were: disturbance and disruption of breeding in some species by construction activities; direct mortality of birds and small mammals during the inundation of the reservoir; road kills of long-tailed weasels during construction; disruption of deer movements; and the potential for increased ongoing disturbance of wildlife by recreationists. Consultants for PWSS proposed ways to mitigate these adverse impacts, some of which are described below, and concluded that the residual adverse impacts of the project could be reduced to acceptably low levels. Detailed mitigation to limit adverse impacts to wildlife would be included in a proposed environmental protection plan. In some instances, further surveys and monitoring would be required to verify the consultant's predictions.

Other participants expressed the view that the scale of the wildlife assessment was too small to place the anticipated impact of the project in the appropriate context of the state of populations in the region. The Peigan Nation, in particular, were concerned that the proposed project could interfere with movements of deer between the Pine Coulee and Willow Creek area and the Porcupine Hills to the west.

5.5.2 Species of Concern

Both federal and provincial authorities responsible for the preservation of biodiversity have developed rating systems for species thought to be in peril. The Committee on the Status of Endangered Species in Canada (COSEWIC) designates certain species of concern as:

vulnerable -	at risk because of low or declining numbers;
threatened -	likely to become endangered if the factors affecting its vulnerability do not become reversed; or
endangered -	threatened with imminent extirpation or extinction.

Alberta Environmental Protection also designates species according to their population status as:

yellow -	sensitive species not at risk that may nevertheless require special management;
blue -	known or suspected to be vulnerable to decline; and
red -	not viable or at immediate risk of declining to a nonviable level. Species in the red category are regarded as being in peril and may be designated as endangered animals under the provisions of the *Alberta Wildlife Act*.

The Pine Coulee Project could adversely affect a number of animal species including Baird's sparrow, the burrowing owl and the ferruginous hawk, which are designated as endangered animals under the *Alberta Wildlife Act*. Other species singled out for specific mitigation were the mule deer, northern leopard frog, the blue heron and the prairie falcon. PWSS recognized the importance of implementing specific measures beyond the habitat compensation plan to mitigate the adverse effects of the proposed project on these species of concern.

5.5.2.1 Ungulates

Four species of ungulates were observed in two late-winter aerial surveys of Pine Coulee and Willow Creek. In both years, nine moose were seen west of the proposed reservoir site, just downstream of the Chain Lakes Reservoir and in one instance northwest of Pine Coulee near Pine Creek. Two elk were spotted: one immediately below the Chain Lakes Reservoir in 1992 and one east of Pine Coulee in 1991. By far, the majority of ungulates found in the study area were white-

tailed deer, with 19 and 40 sightings, and mule deer, with 445 and 250 sightings in the two surveys.

Both deer species were found along Willow Creek, particularly in areas of riparian poplar, that provide winter thermal cover. The greatest concentration of mule deer was found in the rugged terrain northwest of Pine Coulee along Pine Creek. Three other concentrations of mule deer were found near Willow Creek: upstream of the proposed diversion but downstream of the Chain Lakes reservoir; in the riparian forest extending roughly 15 kilometres downstream of the diversion; and near Willow Creek's confluence with the Oldman River. Both species were occasionally observed in Pine Coulee "...apparently moving between more suitable areas to the north and the south."

PWSS assessed the potential impacts of the project on deer habitat and populations based on published information about the habitat requirements of the two species and a habitat suitability model for mule deer. It concluded that Pine Coulee represents poor quality habitat for deer because it lacks cover and woody browse. Browse surveys and pellet group surveys confirmed that neither species uses the coulee heavily. PWSS concluded the impact of the project on white-tailed deer would be negligible because habitat for this species is abundant in the area. The impact on mule deer would be minor and mitigable. The reservoir would remove some mule deer habitat of poor quality in the coulee which would be more than compensated by the grassland habitat compensation lands. The diversion weir and headwater pond would remove some riparian poplar habitat used for fawning and wintering. This loss would be minimized by the environmental protection plan and mitigated by the restoration of riparian habitat under the habitat compensation plan for riparian vegetation. PWSS noted that at least some of the riparian habitat that could be used by mule deer is not used because mule deer avoid areas heavily used by cattle.

PWSS acknowledged the possibility that localized mule deer movements between important local habitats north and south of the project area could be restricted by the reservoir, dam and diversion. Based on the topography of the local area, PWSS identified three potential movement corridors between Willow Creek and the north end of Pine Coulee including the coulee itself, Oxley Creek and an area of sheltered terrain between Pine Coulee and Oxley Creek (known locally as Boneyard Coulee). Mule deer could move up and down Willow Creek from Chain Lakes to the riparian forest downstream of the proposed project. They could move west to the Porcupine Hills both through sheltered terrain south of Pine Coulee and west of Nanton Creek to the north. It is not known whether this population undertakes seasonal migrations to higher elevation summer range in the Porcupine Hills. PWSS proposed to determine "the nature, timing and importance of deer movements within the study area" and mitigate impacts by establishing escape cover if necessary. To deal specifically with the potential disruption of movements past the weir and headwater pond, PWSS said it would develop a habitat design incorporating planting and vegetation management criteria to maintain a functionally intact movement corridor.

Local residents agreed with the Applicant's assessment that the coulee was poor habitat for deer. Deer were seldom seen in the coulee, they said. Instead, deer concentrate in the riparian forest, particularly in winter, venturing onto the nearby hay and croplands to forage and to

fawn. Local residents indicated that deer in the project area are local populations that are not known by them to move regionally.

The Peigan said that the assessment of impacts to big game in general and deer in particular was deficient. The assessment of habitat losses was based on habitat evaluation procedures developed in the United States which were not calibrated to local conditions and were therefore unreliable. PWSS did not address the potential for deer to become accustomed to feeding on alfalfa, which could prompt non-native hunters and wildlife control officers to kill deer on agricultural land, deer that might otherwise migrate to the Porcupine Hills, where the Peigan hunt. The Peigan were concerned that the reservoir, diversion weir and canal, and headwater pond might block regional movements of deer. These effects, they said, could disrupt traditional movement patterns and affect the availability of deer to Peigan hunters in the Porcupine Hills. The Peigan's wildlife expert said that these potential adverse impacts of the project were raised as hypotheses requiring study rather than as conclusions based on evidence. The said that these potential adverse impacts of the Pine Coulee Project should be assessed in the context of the cumulative effects of development in the region.

The Peigan did not dispute the evidence of local landowners concerning the use of habitat by deer. In response to a question from a local landowner, the Peigan expert said he could not rule out the possibility that the reservoir would enhance the deer population. He also agreed with the Applicant, during cross examination, that it would be appropriate to monitor the movements of mule deer as proposed in the Application.

5.5.2.2 Baird's Sparrow

Baird's sparrow breeds in localized areas of undisturbed or lightly grazed mid-tall grasslands and grassy wetlands in southern Alberta. Its range and abundance have declined dramatically as most of its habitat has been destroyed by cultivation and the remaining habitat fragments have been rendered less suitable by moderate to heavy grazing. The present Baird's sparrow population is believed to be less than five percent of what it was prior to European settlement. The species remains vulnerable to further losses as the remaining habitat fragments are developed for agriculture and other purposes. Baird's sparrow is recognized by COSEWIC as a nationally threatened species and also appears on Alberta's red list.

The Applicant estimated that no fewer than 20 Baird's sparrow territories would be lost as a direct consequence of filling the reservoir, forcing displaced birds to compete for suitable breeding habitat nearby. Flooding of the reservoir could also result in the direct mortality of eggs and nestlings, since flooding would occur in the spring. To partially compensate for the loss of habitat, PWSS would attempt to restore the condition of grassland near the reservoir by eliminating or restricting grazing and by planting permanent areas of dense herbaceous cover. PWSS said it was optimistic that breeding densities of this species could be increased substantially because the habitat provided would be more suitable than that which would be lost to inundation. No mitigation was proposed to deal with the direct mortality of eggs and nestlings.

The Pine Coulee Coalition expressed concern that the proposed mitigation would not be as effective as PWSS claimed because the restoration of overgrazed grassland would take considerable time, while the adverse impacts of habitat destruction and direct mortality would be immediate.

5.5.2.3 Burrowing Owl

The burrowing owl is designated as threatened by COSEWIC, is listed as an endangered animal under the *Alberta Wildlife Act* and appears on Alberta Environmental Protection's red list. Concern for its status both provincially and nationally reflects this species' historical decline in range and abundance. The owl's decline is attributed to the direct loss of habitat to agricultural and urban development and to the loss of suitable burrows in remnant habitat through the widespread control of burrowing mammals. Additional sources of mortality related to human activities include collisions with vehicles, shooting and inadvertent insecticide poisoning. Both provincial and national management plans have been developed in an attempt to increase the abundance of the burrowing owl.

Although Pine Coulee is near the western limit of the burrowing owl in Alberta, surveys conducted on behalf of PWSS and independent surveys by others found burrowing owls both in and near the coulee. Owl breeding within the proposed reservoir area could not be confirmed, but experts for PWSS surmised, based on observations of breeding behaviour, that at least one pair attempted to breed there in the year of their survey. The consultants suggested that the lower portion of the coulee would provide better owl breeding habitat than the upper portions where the high walls of the coulee would reduce security. The consultants also noted that a large area of apparently suitable, but unoccupied, owl habitat exists in the vicinity of Pine Coulee, possibly indicating that factors other than habitat availability may limit owls in the area.

The Pine Coulee Reservoir would directly remove grassland habitat suitable for burrowing owls and could also reduce the suitability of adjacent areas for owl breeding if the proposed project results in a greater level of human disturbance. Construction in spring and early summer could disturb any birds that chose to breed in the lower reaches of the coulee. Flooding the reservoir could inundate nests.

PWSS recognized that although the owl is not abundant in the proposed project area, any habitat losses must be viewed with concern in light of the species' threatened status. It proposed specific mitigation measures in addition to the habitat compensation. To partially mitigate the loss of habitat and potential deterioration of other habitat, PWSS would restrict ground squirrel control and install artificial nest burrows in areas of secure nesting habitat at least two years before flooding the reservoir. To prevent direct mortality, areas of suitable breeding habitat would be monitored during reservoir filling and any eggs and young discovered would be relocated.

5.5.2.4 Ferruginous Hawk

PWSS told the Panel that the ferruginous hawk has disappeared from roughly 50 percent of its former range. It is listed as an endangered animal under the *Alberta Wildlife Act*, as threatened on the COSEWIC list and is included on the Alberta red list. The loss of native grassland has been identified as the principle factor responsible for its decline.

Two ferruginous hawks were observed on several occasions at the southern end of the proposed Pine Coulee Reservoir, although no nest site was found. The species is a grassland forager, so removal of the grasslands could affect them. To mitigate the potential impact of the project on this species, PWSS would conduct nest surveys so that means to avoid disturbing nests could be incorporated into its environmental protection plan. Artificial nest sites could be constructed near grasslands in the habitat compensation lands.

5.5.2.5 Prairie Falcon

The prairie falcon is on Alberta's blue list. It is considered vulnerable because it inhabits a restricted range. Falcons nest on ledges and cliff banks and exhibit fidelity to their eyries year after year. The construction of the diversion weir within 500 metres of an eyrie could lead to its abandonment or to reproductive failure in the year of construction. Inundation of the reservoir would also remove foraging habitat. To limit disturbance of the eyrie, PWSS proposed that a buffer zone be established as part of its environmental protection plan.

5.5.2.6 Great Blue Heron

The great blue heron is recognized as a sensitive species that may require special management because it is a colonial nester known to abandon long-established nesting sites (heronries) when exposed to human disturbance. It appears on Alberta's yellow list. A heronry 1.2 kilometres downstream from the proposed project could be affected. However, observations of the site during 1991 indicated that the site was not used for breeding in that year and there is some question as to whether the site may have already been abandoned.

PWSS considered means to mitigate disturbances related to dam construction and the potential increase in recreational activity associated with the proposed project. To mitigate construction-related disturbance, machinery movements would be restricted to designated construction zones and construction activities would be restricted during breeding and nesting. During the hearing, PWSS said it could attempt to construct alternative nest sites. To protect the heronry site from disturbance caused by increased recreational use, PWSS said it would: establish a buffer zone to keep intensive recreational use at a distance; undertake a public awareness program; and prohibit the use of all-terrain vehicles in recreation areas. PWSS also advised that the heronry is on private land and suggested that this in itself would prevent excessive human disturbance.

The Pine Coulee Coalition agreed with the objectives of the Applicant's mitigation plans for the heronry, but was not satisfied that the proposed monitoring would allow its effectiveness to be assessed. Moreover, the Coalition was not convinced that the private ownership of the land occupied by the heronry would guarantee its protection in the future.

5.5.3 Panel Views

The Panel is of the view that the significance of potential losses to any species must be assessed in relation to the size of the regional population and the degree to which other local breeding populations in the region are threatened. Losses of a species designated by COSEWIC or by Alberta Environmental Protection as vulnerable, threatened or endangered are of concern and the Panel would require that all reasonable means be taken to prevent or mitigate losses. The Panel believes it is appropriate for PWSS to seek opportunities to incorporate specific measures into project planning to countervail the predominant threat to such species, where the source of the threat is understood. For many species, where habitat loss is the primary threat; habitat restoration and conservation are the primary remedies. The Panel therefore commends PWSS for exhibiting leadership by implementing a habitat compensation plan.

The Panel agrees with the objective, stated by PWSS and endorsed by many of the hearing participants, of assuring no-net-loss of habitat capability for wildlife species. The Panel is also aware that the translation of this objective into practical action will be costly, require detailed planning, monitoring of progress and ongoing evaluation. Choices will have to be made, particularly where the habitat needs of species conflict. The habitat compensation plan is a crucial component of the mitigation proposed for virtually all of the species discussed in the Application. Should the project be approved, the Panel would therefore require PWSS to prepare and implement in a timely manner a detailed habitat compensation plan to the satisfaction of Alberta Environmental Protection and provide funds within its project budget for this work.

The Panel also agrees with the Applicant that field-oriented guidelines should be prepared as a practical means of implementing specific mitigation measures. Should the project proceed, the Panel would require PWSS to prepare a field-oriented operations plan, to the satisfaction of Alberta Environmental Protection, to ensure that all personnel involved in the construction and operations of the project would be informed of their responsibilities in implementing the environmental mitigation plan undertaken by PWSS.

The Panel has concluded that with the mitigation achieved through a successful habitat compensation program, the residual impacts on wildlife species would be low or negligible. The Panel believes it is appropriate to verify the EIA predictions of low or negligible impact with biological effects monitoring and to re-evaluate predictions and management practices if predictions are not borne out. The Panel notes the commitment of PWSS to implement an effects monitoring program as outlined in the EIA.

With respect to specific measures for individual species, the Panel agrees that the specific mitigation measures specified in the Application would minimize impacts to the ferruginous hawk, prairie falcon and leopard frog.

With respect to the mule and white-tailed deer, the Panel is satisfied that the habitat compensation plan would more than compensate for the loss of poor quality habitat in the coulee. The loss of riparian poplar forest is of greater concern because it is crucial winter habitat. The Panel notes that management of the riparian zone within the habitat compensation plan could enhance the suitability of riparian habitat for deer. In particular, the observation that mule deer avoid areas frequented by cattle suggests that reducing cattle grazing in the riparian zone near the proposed project would benefit deer.

The Panel agrees with the Applicant that some further study of local deer movements near the proposed project should be included as part of the habitat compensation program that the Panel would require, should the project proceed. PWSS identified the potential for the weir and headpond to block movements up and down Willow Creek and proposed mitigation in the form of vegetation management to ensure that a useful corridor was provided.

In the Panel's view, the existence of movement corridors between the Pine Coulee-Willow Creek area and the Porcupine Hills to the west and southwest is speculative at present. The Panel does not discount the existence of topographic features that might facilitate movement, but it has no evidence as to whether such movements occur, much less their frequency and importance.

The Panel received evidence that the effects of the proposed project on the local deer population will be minor with appropriate mitigative measures and would not be a significant adverse wildlife impact. Given the nature of these effects, the Panel would expect that the proposed project would have even less effect on regional deer populations.

The Panel believes that the project would have a negligible impact on elk and moose. Only two elk were spotted during the study, indicating that the study area is rarely used by elk. Nine moose were observed in the Chain Lakes area and northwest of the proposed project along Pine Creek in an area that would not be subject to any construction or flooding.

The Panel notes that Baird's sparrow has declined to its current low numbers in Alberta because much of its former habitat has been destroyed by cultivation and development, while the suitability as breeding habitat of remnant grassland fragments has declined due to grazing. In the absence of mitigation, the Pine Coulee Project would compound the cumulative loss of habitat by affecting roughly 600 hectares of habitat to construction and inundation. The Panel believes that the Applicant's proposed habitat compensation plan, and measures proposed to deal with Baird's sparrow habitat losses specifically, could compensate, to some extent, for the loss of habitat that the proposed project would entail. However, the Panel is concerned that the mitigation plan described by PWSS does not establish objectives for the amount of breeding habitat to be restored, and when this will be done in relation to the filling of the reservoir. The Panel believes that an appropriate objective for

the successful mitigation of Baird's sparrow habitat losses would be to increase the number of breeding territories in the compensation lands by no fewer than the number of territories displaced by the proposed project. Should the proposed project proceed, the Panel would require PWSS to instigate its habitat mitigation measures as part of the habitat compensation plan before filling the reservoir to provide alternative habitat to breeding sparrows displaced from their territories.

The Panel notes that factors other than habitat availability may limit the abundance of the burrowing owl near Pine Coulee as apparently suitable habitat is unoccupied. The Panel believes that a number of explanations are possible for the relative scarcity of the owl at the site. It is therefore not certain that efforts to enhance habitat through the installation of artificial burrows and encouraging ground squirrel populations will be successful, although such techniques have proven successful in restoring burrowing owl populations elsewhere. The Panel believes that the mitigation methods proposed by PWSS would be appropriate as part of the habitat compensation plan and that the effort would be warranted by the threatened status of the burrowing owl.

The evidence before the Panel suggests that the heronry may have been abandoned. In the Panel's view, this does not obviate the need to mitigate future impacts; colonies are known to be dynamic, changing in abundance and distribution with time. The Panel would therefore recommend that every effort be made by PWSS to ensure the protection of the heronry site. In this manner, the potential value of the habitat to herons would be maintained.

With respect to overall wildlife impacts, the Panel concludes that the proposed habitat compensation program would reduce the wildlife impacts and the Panel believes that the proposed project, should it proceed, would not result in any significant adverse wildlife impacts.

5.6 Overall Panel Views on Environmental Effects

As described in the preceding discussion, the proposed Pine Coulee Project will have effects on water quantity and quality, fisheries, soils and drainage, vegetation, and wildlife. The Panel, in the discussion that follows, provides its overall views regarding the environmental effects.

With respect to environmental effects, the Panel believes that the environmental effects of the project pertain primarily to water quantity and quality, fisheries, vegetation, soils and drainage, vegetation, and wildlife. No other major effects to the environment are expected.

The Panel concludes that the flow regulation function inherent in the proposed project would primarily have a positive and beneficial effect on the flows in Willow Creek, very small positive effects on downstream flows in the South Saskatchewan River basin particularly during low flow periods, and the benefits of the flow regulation would be largely confined to and properly accrue to the various water demands in the Willow Creek basin. The proposed project would have no direct effect and only an insignificant indirect effect on the present operating regime of the Oldman River Dam and the flows immediately below the dam. The Panel expects that the proposed project would

have only a minor impact on navigation on Willow Creek since it is seldom used except for occasional canoeing when flows permit.

The Panel concludes that the effects of the proposed project on water quality would be primarily positive through the beneficial effects of increased flows in Willow Creek during low flow conditions. There would be no significant adverse water quality effects on Willow Creek. The project would not result in any net loss of fisheries habitat after various mitigation measures are taken into consideration. Improved flows in Willow Creek and the establishment of a reservoir fishery would result in significant positive and beneficial effects on the fishery resource in the Willow Creek basin.

With respect to soils and drainage, the Panel concludes that the proposed project would not result in significant adverse impacts to soils and drainage provided the mitigation program, and the terms and conditions of the Panel are implemented.

With respect to riparian and grassland vegetation effects, the Panel concludes that the effects of the proposed project taking into consideration the appropriate mitigation and compensation programs, would not be significant or adverse and the residual effects would be relatively minor.

With respect to wildlife impacts, the Panel concludes that the proposed habitat compensation program would reduce the wildlife impact to insignificant levels and that there would not be any significant adverse effects to wildlife.

The Panel has considered the cumulative nature of the effects of the proposed Pine Coulee Project on the riverine ecology of the Willow Creek basin and the other environmental characteristics of the basin. In the opinion of the Panel, the Willow Creek aquatic ecosystem is already at risk due to the various water demands that exist within the basin, and the proposed project must be considered within the cumulative and regional context of other developments in the basin and their synergistic effects. When examined within the context of the historical development of the Willow Creek basin and the current baseline conditions that characterize the basin, the Panel concludes that the proposed project, including the mitigative measures that the Panel would require should the project proceed, would tend to improve the ecological conditions of the Willow Creek basin when the various project impacts are considered as a whole. In the opinion of the Panel, flow regulation associated with the proposed project could improve the sustainability of Willow Creek aquatic ecosystem.

The fisheries mitigation and enhancement plan, the riparian vegetation mitigation plan, and the habitat compensation plan could, when fully implemented, lead to ecological conditions in the Pine Coulee area that are as good as or better than current conditions found in the basin.

The Panel notes the Applicants commitments to the monitoring of the environmental effects predicted in the Environmental Impact Assessment and agrees that they should be undertaken.

In conclusion, the proposed Pine Coulee Project would result in significant and positive environmental impacts with respect to water quality, quantity and fisheries; and the soils and drainage, vegetation and wildlife effects of the project could be mitigated such that the residual adverse project effects on the environment would not be significant. Given the positive nature of some of these effects and the limited extent of the residual adverse effects, the Panel also concludes that any socio-economic implications of the adverse environmental effects would be small.

6. ECONOMIC EFFECTS

In reviewing the economic effects of the proposed project, the Panel has considered the evidence filed by the Applicant and other participants. The primary evidence filed by PWSS was a benefit/cost analysis and an analysis of the economic effects that would result from the expenditures required to construct and operate the proposed project as well as the ongoing expenditures associated with irrigation farming in the area. A review of the evidence and the positions of the participants is described in this section along with a description of the Panel's views related to economic effects.

6.1 Benefit/Cost Analysis

6.1.1 Method

A benefit/cost analysis is intended to evaluate a project from a public interest perspective rather than from the perspective of a party proposing a project. A benefit/cost analysis compares the present value of an expected stream of revenues against the present value of an expected stream of costs over the time affected by the project. Incremental benefits and costs associated with an application are included. Benefits or costs that will be increased whether or not a reviewable project proceeds, or costs or benefits that have already been accrued, would not be included. The revenue and cost streams must be discounted by an appropriate discount rate to obtain the net present value for each of the streams. A discount rate is the rate of interest at which the streams of cash inflows and outflows associated with an investment project are to be discounted. The appropriate discount rate to use in a benefit/cost analysis is one that reflects the social opportunity cost of capital.

According to the Applicant's expert, the discount rate is used to express costs and benefits, that are received at different points of time in the future, to a common base. The rationale for discounting future benefits and costs is based on the notion that a dollar received today is perceived to be worth more than a dollar to be received at some time in the future. This is so not only because inflation may erode the purchasing power of money, although that certainly can be a factor, but also because future benefits, expressed in monetary terms, are not available for current consumption or immediate reinvestment and because there is a risk that these benefits will not in fact be realized.

The Applicant's expert advised that a social discount rate is a discount rate that is appropriate for public expenditures. It has a broad perspective and includes societal interests, such as the optimal allocation of societal resources and maximization of society's total future production and consumption opportunities.

The social opportunity cost of capital is defined as the weighted average of the return to investment in the private sector, the consumption rate of interest or the premium that consumers require to postpone consumption, and the cost of foreign borrowing. The weighting of these different components that make up the social discount rate reflects the proportion of public funds drawn from

each source. Estimates of the social discount rate using this general methodology range between 7.5 percent and 10 percent.

6.1.1.1 Views of the Applicant

PWSS told the Panel that the proposed project's economic impact was examined from the perspective of its economic efficiency and its potential for regional income distribution. It argued that some projects may be shown to be economically attractive from both the economic and regional equity perspectives; in other cases, the findings may be contradictory.

According to PWSS, the economic feasibility analysis or benefit/cost analysis consisted of the following steps:

- identification of all incremental costs and benefits associated with the proposed project;
- estimation of the monetary value of these incremental costs and benefits in uninflated and undistorted dollars throughout the economic life of the proposed project (for example 50 years,);
- adjustment of the stream of future incremental benefits and costs by using an appropriate real social discount rate to reflect the fact that costs incurred or benefits received in the future are not of equal value to those incurred or received now; and
- comparison of the cumulative values of the incremental costs and benefits by calculating the ratio of benefits to costs (benefit/cost ratio), the difference between the cost and benefit streams, or related criteria.

PWSS computed the benefit/cost ratios for three illustrative discount rates (four, seven, and 10 percent). The discount rate selected by PWSS for illustrative and comparative purposes in the benefit/cost analysis was seven percent, because it represented the mid-range of the discount rates.

A sensitivity analysis was also completed by PWSS as a means of re-assessing the accuracy and comprehensiveness of its original analysis.

The Applicant believes the potential benefits of the proposed project include: expanded crop and livestock production; improved recreational opportunities; increased security of water supply; improved water quality for municipalities and other existing and future needs such as domestic use and stock watering; and, enhanced water flows below the reservoir.

In the Applicant's view, other potential benefits to the province are an increased ability to manage water and the option value of potentially higher valued water use in the 21st century. PWSS stated that, "... it is recognized that these non-quantifiable potential benefits are a significant component of total potential benefits." These benefits were not incorporated into the quantitative economic analysis.

PWSS also identified the potential costs associated with the project. These were:

- construction costs (dam, diversion, etc.);
- project operation and maintenance costs;
- costs of flooded land;
- capital costs for on-farm irrigation;
- capital costs for on-farm beef herd expansion;
- production costs for on-farm annual crop and livestock;
- recreation infrastructure; and
- other costs, particularly net negative changes to the existing ecosystem not currently identified or not proposed for mitigation.

The total cost of developing the Pine Coulee Project, including the environmental impact assessment and environmental mitigation, was estimated to be about $37 million, expressed in 1992 dollars. This amount did not include land acquisition costs and other costs incurred before 1992. It was estimated that the physical facilities associated with the proposed project would retain 66 percent (weighted average) of their value in year 54 (2045) or about $20.6 million.

The benefit/cost analysis also included: project operation and maintenance costs of $170,000 beginning in year six; flooded land costs of approximately $13,300 per year; on-farm irrigation capital costs; on-farm beef herd expansion capital costs; on-farm annual crop and livestock production costs; and recreational infrastructure. On-farm irrigation capital costs were estimated to be $440 per acre as agricultural areas are converted from dryland to irrigated production. PWSS advised that the total cost was based on 5,260 hectares pro-rated over years five to 14. Similarly, for on-farm beef herd expansion, costs included 8,664 additional cows for 5,260 hectares of new irrigation (pro-rated over years five to 14) plus 1,424 additional cows for 3,240 hectares of intensified irrigation on existing irrigated lands. The on-farm herd expansion costs were said to include a factor of one percent for cow death losses and three percent for additional bulls resulting in an effective surviving cow price of $961.54 per head. This portion of the analysis was said to assume a steady state herd resulting in a residual value of $6.7 million in year 54. Additionally, on-farm annual production costs included additional input costs and an annual depreciation cost for "... all machinery, irrigation equipment, etc. ..." to allow for replacement as required. The annual irrigation operating, maintenance and depreciation costs were estimated to equal $70.60 per acre per year. Investment in recreational infrastructure was estimated to equal about $1.4 million with these costs being incurred in years four through nine. The additional cost of cottage property development near the reservoir was estimated to be about $500,000 in year four.

Using the mid-point discount rate of seven percent and these cost figures, PWSS estimated the benefit/cost ratio and net present value of the project would be .90 and minus $6,475,000 respectively. The discount rate where the benefit/cost ratio equals unity (referred to as the internal rate of return) would be about 5.7 percent. The internal rate of return of 5.7 percent was said to be within the four to 10 percent range that is generally considered to be acceptable for public investments.

According to PWSS, a generic sensitivity analysis assuming a 10 percent increase or decrease for each of the benefit and cost categories indicated that the variables with the greatest potential to significantly affect the result of the analysis are:

- incremental annual farm costs of production with irrigation, since a 10 percent change in these costs would be expected to change the benefit-cost ratio by about 4.5 percent; and

- incremental gross farm revenue with irrigation, since a 10 percent change in this variable would be expected to change the benefit-cost ratio by about 8.6 percent.

Also, PWSS advised that a sensitivity analysis was undertaken for specific assumptions that were considered to produce a conservative result. The assumptions and the conclusions based on the sensitivity analysis were stated as follows:

- water balance simulations for reservoir operations were modeled on optimal water requirements and costed accordingly. However, the forecast agricultural revenues were based upon existing regional average yield estimates. The selection of adjusted regional production averages, while allocating water to irrigation area based upon optimal production, was said to result in a significant underestimation of potential yields, or conversely, an underestimation of the amount of area that could be irrigated from the proposed project, based on water requirements to achieve regional production averages.

- in examining the number of cattle that can be supported by the increased forage supplied, it was said to be conservatively assumed that there is a feeding loss of 10 percent on an already generous cattle feed ration. PWSS concluded that a probable feed loss would be two percent, more representative of the feedlot/feed bunk situation characterized in the analysis.

- there would likely be no pasture opportunities available for the cattle herd expansion associated with the newly-irrigated 5,260 hectares (13,000 acres). It was stated that this would likely not be the case. The net annual revenue anticipated for the 5,260 hectares under irrigation was $223 per acre while

that for the existing 3,240 hectares (8,000 acres), where 197 days of pasture is available per animal, was $369 per acre.

- if optimal yields could be obtained and feed losses reduced to two percent, the benefit/cost ratio for the seven percent scenario would increase to 1.12 and the internal rate of return would increase to 8.8 percent.

- with optimal yields (with existing technology) and a moderately increasing real value for water (0.5 percent per year), the benefit/cost ratio for the seven percent scenario would increase to 1.22 and the internal rate of return would increase to 14.2 percent.

PWSS told the Panel that almost all economic assessments of proposed water developments in Alberta during 1975 to 1993 used a basic discount rate exclusive of inflation of between five and seven percent per annum. PWSS believed the internal rate of return of 5.7 percent indicated that the project is economically feasible when based upon an estimated opportunity cost of capital of five percent per annum.

PWSS also emphasized that the original benefit/cost calculations did not incorporate non-quantifiable benefits such as increased ease of water management, higher water quality for the towns of Granum and Claresholm and the potential for increased water availability in the town of Stavely, and improved water quality for domestic farm use and stockwatering. These components were recognized as being a significant component of total potential benefits even though they could not be quantified.

6.1.1.2 Views of the Pine Coulee Coalition and the Applicant's Rebuttal

The Pine Coulee Coalition (the Coalition) reviewed the benefit/cost analysis prepared by PWSS and argued that the analysis did not use correct values nor did it take into account all potential costs. It was also the position of the Coalition that the benefits were incorrectly calculated. According to the Coalition, the PWSS benefit/cost analysis was unacceptable because:

- The data contradicted all previous findings of provincial economic analysis of irrigation that, in general, have found that very substantial subsidies are necessary to make irrigation supply projects feasible. The Coalition asked why the Alberta Government needs to subsidize this irrigation project if private gains are sufficient to finance the necessary investments: "Either the Pine Coulee is an exceptional irrigation project in southern Alberta or the benefit-cost analysis is in error."

- Actual market values for irrigated and non-irrigated land in southern Alberta indicate that the advantage created by the availability of irrigation water is far less than the benefits calculated by PWSS.

- The Applicant's estimated irrigation benefits are almost entirely associated with estimated gains from raising more cattle. "This assumes that irrigation in southern Alberta encourages cow-calf operations and that the availability of on-farm cattle feed is required for cattle feeding operations. In the Coalition's judgement, neither of these is true." It was the Coalition's view that irrigation would likely decrease cow-calf operations in southern Alberta.

- The Applicant's estimates of the net benefits from irrigation are exaggerated by assuming that the increased income that can be derived from raising cattle is directly tied to the availability of irrigation water: "If instead of assuming that water sprinkled on land produces cattle, one assumes that it is crops that are grown with the water, the estimated benefits associated with irrigation shrink considerably."

- The benefit/cost analysis by PWSS assumed that it is water and not other resources that create the additional value associated with irrigation. The Coalition believes that this is untrue because "Increased crop production and increased cattle raising requires considerable additional labor and management effort." These additional inputs contribute to higher agricultural productivity just as water does.

- The Applicant's benefit/cost analysis assumed that the increased operator labor necessary to make use of irrigation technology has zero opportunity cost. The Coalition believed that this assumption is "clearly incorrect."

- If an opportunity cost of operator and farm family labour is assumed and it is assumed that the new irrigation water is used to raise crops rather than cattle, the irrigation benefits are reduced to a level that matches the differential market-based land values between irrigated and dryland farm land. The Coalition concluded that, "...this confirms the appropriateness of using the market for agricultural lands to determine the economic value of irrigation."

- For estimated on-farm benefits, PWSS assumed that agricultural commodity prices will return to average levels over the last 15 years. The Coalition believed that, "...long-run commodity prices and land prices do not suggest that this is likely." The Coalition believes that prices will be lower.

- The public investment in irrigation will be quickly "privatized" and "confiscated" by the private land owners whose land values are raised by the

availability of irrigation water: "Once any of the original recipients of irrigation water sells or leases, they will be able to 'pocket' the gains from irrigation and prevent the new owners from seeing hardly any of the benefits of irrigation."

In the Coalition's view, applying these assumptions to the benefit/cost analysis of the proposed project would give a more accurate, and significantly reduced, benefit/cost ratio and internal rate of return.

However, in order to more accurately characterize the nature of the issues before the Panel some additional clarification of the evidence is provided.

In its quantitative review of the Applicant's benefit/cost analysis, the Coalition adjusted costs and benefits in a manner that it believed more closely reflected the economics of the proposed project. In doing so, the Coalition used estimates of land rents and land values contained in a report entitled *Value of Irrigated Crop Production in Alberta* produced for Alberta Agriculture, Food & Rural Development by their Economic Services Division. In its assessment of this information, the Coalition estimated that dryland farm acreage is valued at about $400 per acre and irrigated land is valued at about $800 per acre. Similarly, the Coalition estimated that non-irrigated land rents for about $30 per acre and irrigated land for about $70 per acre. These averages were based on the weighted averages of farm enterprises and were said to be confirmed by conversations with farmers and real estate professionals in southern Alberta. According to the Coalition, the capitalized land value is "...simply the ratio of annual income and the interest rate." The Coalition said that the land value and rental rates described above indicate that a 7.5 to 8.5 percent interest rate is being used in the calculations by the buyers and sellers of agricultural land in southern Alberta, values that reflect the range of interest rates reported in the farm budget analysis.

The next step in the Coalition's analysis was to "...test the plausibility of the estimated agricultural benefits associated with the Pine Coulee Project." According to the Coalition, if the Applicant's estimates of the increased value of production resulting from the proposed project is compared to rental rates for irrigated land in southern Alberta, then the Applicant's production values are three to five times too large. The Coalition argued that the reason these production values are larger than the rental rates is that PWSS failed to take into account on-farm capital costs of additional irrigation (except for the depreciation of those assets which the Coalition agreed were included). According to the Coalition, this means that those additional capital costs have to be subtracted from the implied land values and rental rates. In order to adjust the accounting of these costs, the Coalition subtracted the value of these additional on-farm costs. Once the analysis is adjusted in this manner, the Coalition found that the net farm benefits "...are still three to five times the rental rates for irrigated land" and that the Applicant's estimates of the net on-farm benefits "...are contradicted by the market data...available."

The Coalition then used land values to recalculate the net benefits associated with irrigation. It was stated that the differential values between irrigated and dryland rents, and land

values, indicate the market's estimate of the net benefits associated with irrigation. The Coalition stated that the difference in value is $40 per acre per year for the rented land and $400 per acre per year from the market land values. The Coalition then converted these values to an annual value by multiplying by an interest rate of eight percent. Consequently, the Coalition's market estimate suggested that the net benefits of irrigation come to between $30 and $40 per acre per year and that the net benefits of the proposed project represent a loss about equal to the cost of the project.

In its analysis of the Application, the Coalition also considered the opportunity cost associated with a reallocation of labour by farm families. It noted that in the Applicant's analysis an additional 69 full time workers or 138,000 hours are required to produce the outputs assumed. It is stated that the increased productivity of this additional labour and management is not assigned a cost and instead the productivity is assigned to the irrigation water alone. The Coalition valued this labour at $7.50 per hour, "the value used by Alberta Agriculture in its farm budget analyses..." If the Applicant's figures were adjusted to account for the investment in irrigation equipment and larger cattle herds, the Coalition stated that the net farm revenues resulting from the project would decrease from $1.8 million to $1.3 million. With a further adjustment to account for the opportunity cost of labour, the increase in farm net income would be reduced by 75 percent, from $1.3 million to $340,000. The Coalition also estimated the value of the opportunity cost associated with cattle production. It assumed 8.7 hours of labour per cow wintered would be needed. It based this figure on an estimate by Alberta Agriculture, Food & Rural Development for southern Alberta. In applying this labour estimate and a wage value of $7.50 per hour, the Coalition valued the associated opportunity cost at $565,000 and concluded that "...the on-farm gain from cattle feeding is completely eliminated and the project generates a loss."

The Coalition then argued that the correct way to analyze on-farm irrigation benefits was to look at crop production as opposed to "the cattle-feeding benefit approach" and to take into account all of the additional resources required, including the opportunity cost of additional operator and farm family labour. If this approach is taken and the additional crops raised on irrigated land are assumed to be sold at market values, the Coalition estimated that the incremental net value produced comes to about $62 per acre rather than the Applicant's $99 per acre, a value adjusted by the Coalition to account for on-farm capital costs. According to the Coalition, subtracting an estimated opportunity cost of labour from the $62 leaves "...an irrigation benefit of $33 per acre which at an interest rate of eight percent implies a differential land value for irrigated acres of $413.00..." The Coalition observed that the $413 value is comparable to the Coalition's differential land value test of $400 per acre.

The Coalition also analyzed the value of displaced agricultural land required for project-related purposes such as a reservoir setback. The Coalition stated that PWSS valued production on displaced agricultural land at about $5 per acre thereby indicating a land value of about $63 per acre assuming an eight percent interest rate. The Coalition observed that PWSS used the lower agricultural productivity figure as opposed to the value paid for these land acquisitions. According to the Coalition, "If we assume that the Provincial government paid no more than it had to to obtain the land, those market prices reflect the expected productivity of that land and should be

used to reflect the opportunity costs." As a result, the Coalition adjusted this value by multiplying its $400 per acre estimate of the value of non-irrigated land by the number of acres required for the project and arrived at a total cost of approximately $1,052,800. It was further estimated that the annual rental value for this land would equal about $84,000, a figure described as being more than six times that used in the Applicant's analysis. Additionally, the Coalition stated that an analysis could use the PWSS estimate of net revenues from dryland operations in the Pine Coulee area. Applying a figure of $81.20 per acre to the 2,362 acres led the Coalition to the conclusion that the cost in lost agricultural production on displaced agricultural land would equal about $214,000 per year, a figure 16 times the amount included in the benefit/cost analysis.

In response to Coalition arguments, PWSS stated that it disagreed on two general points. It said that many of the Coalition's objections are based on financial arguments and "...you cannot falsify an economic analysis on the basis of financial arguments." It also said that many of the Coalition's objections discuss irrigation in general terms which, if true, cannot falsify project and site specific findings. In elaborating further on these points, PWSS stated that an economic analysis differs from financial analysis in that the former concerns itself with the total return (or productivity, or profitability) to the whole economy of all resources committed to the project regardless of who contributes them or who gets the benefits. Also, the economic analysis was said to measure real resource flows only and that a cost in benefit/cost analysis is the value of a resource (land, labour or capital) that cannot be used for something else. A benefit was described as the creation of a real resource and thus the extension of the total consumption and investment opportunities in the economy. PWSS said that an economic analysis will always question the appropriateness of the "market" prices that are paid for real resources because market prices may not measure accurately the economic or social value of that resource if markets are not free: "hence the use of shadow prices." Shadow prices are those prices that would prevail if the economy were in perfect equilibrium and operating under conditions of perfect competition, and they may differ from prevailing market prices due to subsidies, institutional rigidities, imperfect information, monopoly power of suppliers and other market imperfections.

It was the Applicant's view that a financial analysis, in contrast, concerns itself with the return on equity capital contributed by individuals and or organizations, and on financial flows. Cost, in a financial sense, includes all money flowing out and a benefit includes all money flowing in. In the Applicant's view, a financial analysis concerns itself with market prices only, "...because that is what the individual or organization needs to pay, regardless if that price is a true equilibrium price or distorted by inefficiencies in the market."

In support of its view on the distinction between a financial analysis and an economic analysis and the appropriate method to be used in a benefit/cost analysis, PWSS provided the Panel with a copy of a text entitled *Economic Analysis of Agricultural Projects*. This text was written by J. Price Gittinger for the Economic Development Institute, in part, as a result of the World Bank's concern to hasten agricultural and rural development. PWSS shares the World Bank's view that, "The book presents a sound, careful methodology for project analysis based on the efforts of agricultural specialists in the Bank and throughout the World."

PWSS also responded to specific matters raised by the Coalition with regard to its benefit/cost analysis.

On the Coalition's conclusions that the PWSS benefit/cost analysis is not plausible and contradicts past provincial analysis and policy, PWSS replied that the Coalition equated instream flow needs (IFN) benefits with agricultural benefits thereby concluding that the "vast majority (97 percent) of the calculated benefits are on-farm benefits." PWSS responded that IFN benefits are not agricultural benefits, "...they are a proxy value for fish, riparian vegetation, etc." PWSS advised that any comparison with past studies of the benefits of irrigation will be misleading because the Pine Coulee Project is a multi-use project that has agricultural, instream flow, and recreational benefits. PWSS said the Coalition uses the general to draw conclusions about the specific. PWSS stated that one of the strengths of its analysis is its specificity: "It relates to a very defined area; it does not draw inferences about irrigation in general. Past studies of the benefit of irrigation may be correct but that does not (render) implausible" the Applicant's results. For example, PWSS said, strong real estate prices in a particular neighbourhood can co-exist with flat or declining prices for the market as a whole.

PWSS disagreed that their benefit/cost analysis was contradicted by agricultural land values: "...land values are financial and not necessarily economic data ... economic analysis ignores certain monetary flows that are included in financial analysis, such as taxes and subsidies and the mere buying and selling of land." In the Applicant's view "...economic analysis often uses 'shadow prices' to assess the economic (i.e., non-distorted) value of real resources, while financial analysis always uses the actual expenditures. Thus, any analysis based on financial information can be but an approximate cross-check on the validity of an economic analysis." PWSS stated further that if its analysis needed to be made to fit a financial analysis framework then the results would have to be adjusted for the exclusion of financial flows, taxes and subsidies and the use of economic (long-term, undistorted) prices. PWSS said that a financial analysis of the relationship between land value and irrigation benefit will need to use a nominal rate of return that reflects the short-term risk associated with agriculture, a rate PWSS believed is "...surely above the risk-free bank deposit interest rate of eight percent."

On the Coalition's position that increased irrigation decreases cow-calf operations in southern Alberta, PWSS responded that farmers affected by the proposed Pine Coulee Project have stated that they will increase their cattle holdings. PWSS found no fault with the general statement expressed by the Coalition that in order to raise cattle, one does not have to grow all the cattle feed on one's own farm. However, PWSS said that the empirical fact is that farmers in the Pine Coulee area do not expand herds if they have to buy the feed but do expand their herds under irrigation.

On the issue raised by the Coalition of a failure on the part of the Applicant to consider the opportunity cost of labour associated with cattle raising, PWSS stated that its analysis does not assume that additional farm labour is freely available and costs less. According to PWSS, instead of attributing an arbitrary value to that labour, its analysis treats the farm as an integrated unit, with the return to operator labour included in the return to the farm: "Thus, if the analysis shows that shifting

to irrigation increases the return per acre by $142, then that economic return captures the economic value of the operator's labour." In its rebuttal of the Coalition's comments on this issue, PWSS stated that grain farming, by its seasonal nature, causes under-employment within the farm business: "Farmers can't grow wheat and crops in the wintertime. So if they don't have an off-farm job, then they are idle. And it was clearly pointed out by those who made presentations on behalf of the irrigators, that they prefer not to work off-farm, they would prefer to work on-farm." PWSS said that, with irrigation, many who currently have off-farm jobs would move into greater amounts of cattle production or to cattle production for the first time which then becomes a full-time job. It was the Applicant's position that, by making this transition, "...the people they are freeing up jobs for, who are unemployed, have, in economic terms, zero opportunity cost or even a negative one, because we have to supply incomes to them through such programs as the Unemployment Insurance."

Another issue raised by the Coalition and responded to by PWSS was the Coalition's belief that the Applicant implied unrealistically high values for cattle feed. PWSS responded that its analysis does not imply any prices for feed or labour but rather calculates the return to the total enterprise. PWSS emphasized its report states that, "In an integrated livestock-grain operation, the irrigation benefits are captured through the improved profit margin on the livestock *enterprises* and on the ability of the benefitting farms to expand their livestock herds" (emphasis in original). PWSS agreed that there are additional ways to analyze irrigation benefits. In the absence of more detailed information, PWSS concurred that the net returns from increased crop production generated by the introduction of irrigation represents a value of water. However, PWSS advised that it is known that local area farmers have integrated livestock-grain operations and that they have in the past and plan in the future to expand those operations if irrigation water becomes available: "The (PWSS) analysis models (an) integrated livestock-crop enterprise, because that is what is actually expected in the study area."

Another of the Coalition's criticisms of the Applicant's analysis was that the Applicant exaggerated the benefits of irrigation by using high agricultural prices. According to PWSS, its analysis used economic or undistorted prices and a 15-year average price as a proxy. PWSS stated that, "No two economists will agree on what the economic price of agricultural crops is, but it is clear that the economic value does not equal the market price." In the Applicant's view this is because international agricultural prices have been subject to extensive subsidization by virtually all countries.

In response to the above issue, PWSS advised that if it were exaggerating the benefits of irrigation it could have picked higher priced specialty crops as the basis of its analysis. PWSS further advised that it did not pick specialty crops because, "...we would naturally have been accused of manipulating the end result of the economic analysis. What we simply did was take what the agricultural industry is currently doing in the area and replicate it in our analysis."

On the issue of the value of displaced agricultural lands, PWSS said that it did not use inconsistent land values because it did not use land values at all. Land values were described as relating to the financial price at which land changes hands and may not relate to the economic value or productive capacity: "Hence, the $3.4 million land acquisition costs are netted out of the

construction costs ... and land lost due to flooding is valued at its foregone production, which is grazing." PWSS concluded that the apparent difference between the land's purchase price and its productive capacity is a clear indication that the assessment of the irrigation benefit based on land values needs to be approached with caution.

PWSS recognized as a policy issue the Coalition's belief that the public investment in irrigation will be quickly converted into private values through the sale or lease of newly irrigated land but did not see this as a relevant critique of its economic analysis: "The (benefit/cost) analysis concerns itself with project efficiency and not the distribution of benefits or costs." If a sale were to take place, it was the Applicant's position that the financial value is captured by the original owner, but the economic value is not affected by the sale of the land at whatever price.

Before proceeding to a discussion of the evidence surrounding the potential economic impacts of the proposed project, the Panel would like to note that additional evidence regarding the potential benefits and costs of the proposed project, not described in the above account, has been considered in weighing its decision. In the Panel's view, it is not necessary to describe this additional evidence because the foregoing description of the evidence includes, either directly or indirectly, the significant economic issues raised by other participants. This lack of additional detail in this Report should not be taken to imply that the Panel views other participant's evidence as being unimportant to its decision making process; rather, it is a result of the Panel's attempt to avoid unnecessary repetition in its description of the evidence before it, while at the same time making its decision understood to the participants in the process.

6.2 Economic Impact

The proposed project's economic impact was examined by PWSS from the perspective of its economic efficiency and its potential for regional income distribution. PWSS stated that some projects may be shown to be economically attractive from both the economic and regional equity perspectives. In other cases the findings may be contradictory. In such cases, PWSS considers that the relative weight to be applied to each analysis may need to be adjudicated by political and regulatory decision makers.

Section 6.1 of this Report examined the economic feasibility analysis or benefit/cost analysis of the proposed project. A second consideration in the economic evaluation is the proposed project's effects on income distribution. According to PWSS, government expenditures may be undertaken to preserve or to stimulate the economy in a specific region and the evaluation of the proposed project from the perspective of income distribution and regional development is important. If regional benefits would be larger than regional costs, PWSS considered that the proposed project would be deemed to contribute to the general economic development of the region and may help to achieve a more equitable income distribution across the provincial economy.

A regional perspective was adopted by PWSS in the analysis of the economic and fiscal impacts of the Pine Coulee Project on the surrounding area. The analysis examined the effects of the proposed project on the regional economy in terms of income and employment generation and the fiscal position of the affected municipalities. It further evaluated the proposed project's worth as a stimulus to regional economic development.

In conducting its socio-economic analysis, PWSS defined the local area to be portions of Townships 13, 14 and 15, Ranges 28 and 29, West of the 4th Meridian encompassing 154.1 square kilometres. The local area includes all population (estimated at 220 individuals) and services within three kilometres of the proposed facility. PWSS defined the region to include the Municipal District of Willow Creek and the towns of Nanton, Stavely, Granum and Claresholm which has a total population of 10,471, about 0.3 percent of Alberta's population.

6.2.1 Construction Impacts

The total cost of developing the Pine Coulee Project including the environmental impact assessment and environmental mitigation, is estimated by the Applicant to be about $37 million expressed in 1992 dollars. The analysis of impacts excludes additional amounts (approximately $145,000 - $345,000) identified by PWSS as costed additions resulting from commitments or undertakings agreed to during the hearing. Income benefits generated by the project for the region would include:

- local spending directly associated with the proposed project's construction phase;
- recurring costs to operate and maintain the reservoir and recreation areas; and,
- increased income for local farmers and suppliers of goods and services.

These would be compounded through the subsequent spending and re-spending of the new income resulting from revenue gained by increased agricultural production in the region.

PWSS estimated that 75 to 80 percent of the required construction labour would be sourced from the region and 75 to 80 percent of the required materials would be purchased locally. About 10 percent of the project machinery requirements would be filled by locally based contractors.

Approximately 50 percent of projected expenditures ($18.2 million in construction expenditures) are expected to be made in the local area. Most of this would accrue to the local construction labour force and to suppliers of construction materials. Most of the remaining project expenditure costs would accrue to suppliers in other parts of Alberta.

PWSS estimated that $28.1 million would be expended in the region to construct the reservoir, irrigation and cottage infrastructure. PWSS considered that this would likely be

compounded by 60 percent when re-spending effects are considered. Over a five to 10 year period, the total direct, indirect and induced income impacts to the region were estimated to be $28.3 million from the reservoir construction activities, $8.9 million from irrigation development, and $6.6 million from cottage development, totaling almost $44 million. The Panel was advised that much of the initial capital expenditure (perhaps $20 million over four years) would be a capital injection from outside the region.

Based on estimates prepared by PWSS, the total direct labour requirements for the proposed project during the construction phase are expected to total 169 person years over the four-year construction period. Eighty percent of the construction employment, or 135 person years, would likely be provided by workers from the region with the rest from nearby parts of the province, primarily the Calgary or Lethbridge areas. During the construction phase, labour requirements would range from a minimum of 30 jobs during the initial and later stages of the project, to a maximum of 110 on-site jobs during peak levels of activity. In addition to the direct construction labour requirements, the proposed project would generate approximately 54 person years of employment for engineers and consultants, including an estimated 22 that have already been created during the period from 1989 through the end of 1992.

The cumulative direct and indirect construction impacts are estimated to total about 306 years of employment, or an average 75 person years per year.

In summary, PWSS projects that the construction of the proposed Pine Coulee Project and of the associated irrigation and cottage facilities would generate estimated direct and indirect income effects of $43.8 million in the region and approximately 306 person years of employment. Most of these impacts, in the order of 75 percent, would be experienced during the period 1993 to 1996 with the remainder spread over the subsequent 10 year period.

6.2.2 Operational Impacts

It is estimated by PWSS that the total annual impact on the region would be $4.9 million when all irrigable acres have been developed. This would include operating and maintenance costs for the reservoir of approximately $170,000 per year, operating and maintenance costs for the recreational facilities of approximately $36,000 per year, and farm level expenditures of approximately $4.7 million per year. Considering the multiplier effects generated from the initial round of spending, which compound the direct income impacts, PWSS estimated that the total direct and indirect income impacts to the region would be approximately $8.9 million annually. Almost all of the subsequent capital and annual operating and maintenance requirements (about $4 million per annum over 50 years) would be generated from within the region.

According to PWSS, the annual long-term employment impact on the region would be concentrated in the farming sector. PWSS advised that expansion of irrigated agriculture along Willow Creek has a potential impact on more than 50 farm units including three Hutterite colonies

and several corporate and extended-family farms. PWSS concluded that an estimated 204 person years of additional direct and indirect employment per year would mean that less off-farm employment would be required of local farmers, perhaps creating an almost equal number of regional job opportunities for others.

The Panel was advised that an expected increase in land values related to the introduction of irrigation and cottages would have fiscal effects. If all potentially irrigable acres are converted from dry land, PWSS advised that the total increase in municipal and school taxes is estimated to be between $26,000 and $32,000 annually. According to PWSS, the fiscal benefits to the Alberta Government would include provincial personal and corporate income taxes associated with the income effects of the construction activities and the ongoing expansion of agricultural output. PWSS stated that at project maturity, based upon 209 added jobs, provincial and federal tax revenues from the region should increase by approximately $1.6 million annually.

6.2.2.1 Views of the Participants

According to the Pine Coulee Coalition, socio-economic analysis seeks to step away from the economic efficiency analysis upon which benefit/cost analysis focuses and looks at local economic impacts, economic development, employment opportunities, and flows of funds to local and provincial governments. It was the Coalition's position that socio-economic impacts are not just whatever positive impacts one can postulate or calculate. They include only those impacts that are uniquely associated with the particular project being considered.

The construction of the dam, the on-farm investments, and the ongoing expenditures associated with operating the dam and the irrigated farms were all projected to have an impact on local employment, income and tax revenues. According to the Coalition, these were taken by PWSS as socio-economic benefits of the proposed project. However, the Coalition argued that almost any conceivable use of funds that would otherwise go into the Pine Coulee Project would trigger similar expenditures, income flows and employment opportunities. It was the Coalition's position that it is the government investment that generates jobs and income, not the Pine Coulee Project.

According to the Coalition, all that can be claimed for the Pine Coulee Project is its particular advantage in contributing to local jobs and income generation and this is never discussed in the Applicant's analysis. It further stated that the Applicant's approach, which ignores the impact of alternative uses to which those funds could have been put, would be appropriate if there were no other conceivable uses of those funds and if the proposed project were the one and only productive use to which the funds could be put. The Coalition considered it unlikely that anyone could make such a claim and for that reason, "...we have to do more than add up generic jobs and incomes that flow from any public expenditure; we have to specify the *advantage* of this project over the alternative uses to which the funds will be put." (Emphasis in original)

The Pine Coulee Coalition also stated that the future economic development of southern Alberta will not be built around agriculture. It was its position that Alberta agriculture is a mature industry facing limited demand, low and unstable prices, and stiff international competition. It further stated that agriculture, despite being extremely important to the region, will be a source of a decreasing percentage of the region's employment and income. For this reason, it has the capacity for significant overproduction. The Coalition stated that it is the excess production capacity that keeps prices depressed and profits low or non-existent. In this situation, the Coalition advised that government-subsidized expansion of agricultural production causes the region to increase its production of already surplus commodities. According to the Coalition, given the government's commitment to supporting farm incomes, this overproduction, in turn, brings forth additional government support payments or a diluting of the support payments already being provided. The Coalition argued that as responsibility for agricultural support payments increasingly shifts to the provinces, these support payments cannot be seen as positive net inflows of income. Increasingly, they become subsidies paid from within the provincial economy. In the Coalition's view, this makes subsidized expansion of agriculture an even more unlikely route to economic development.

The Coalition argued that southern Alberta is not primarily a rural agricultural economy, but rather it is largely an urban diversified economy that has steadily grown less and less dependent on agriculture. The Coalition claimed that agriculture in the Oldman basin has been providing a smaller and smaller percentage of the region's jobs and that despite ongoing innovation, including expansion of irrigation, has continued to face a very difficult price-cost squeeze.

6.3 Panel Views

The benefit cost/analysis provided by the Applicant, in the opinion of the Panel, uses generally accepted methods that are satisfactory to the Panel. The Panel believes that the major benefits and costs of the project have been considered within the analysis presented by the Applicant. In this specific case, the Panel accepts the view that the project will produce multiple benefits and costs that must be considered. Some of these costs and benefits do not easily lend themselves to quantitative economic analysis, and have been identified as non-quantifiable factors that are relevant to any consideration of the economic effects of the project. The Panel believes that these factors are significant in the consideration of the proposed Pine Coulee Project, and will discuss them in more detail after considering the more readily quantifiable economic aspects of the project.

The Panel notes that the Applicant has based its analysis on the specific circumstances found within the project area and not on generalizations about similar projects. The Panel believes that such an approach is desirable and lends itself to a more realistic presentation of the economic effects that might be associated with the specific project under review. For example, the proposed Pine Coulee Project involves a combination of public investment in water management infrastructure and subsequent private investment in agricultural facilities and practices which are based on a more secure water supply. The project does not require public investment in major water conveyancing

infrastructure (headworks, canals, etc.) that has been required in most irrigation districts in southern Alberta.

The Panel accepts the Applicant's treatment of agricultural benefits from irrigation based on an integrated livestock-grain operation and the agricultural commodity prices used in the Applicant's analysis.

The Panel notes the Applicant's treatment of the integrated livestock-grain operation as an enterprise, since that is what is expected in the study area. The Panel accepts this approach in this case; however, the Panel also believes that there is some merit to the view that the more intensive on-farm labour requirements of an integrated operation that relies upon irrigation of crops, will also have some impacts on local employment. The Panel notes that the evidence indicated that most farm incomes in the study area are supplemented by off-farm incomes. Should the project proceed, and the additional integration of livestock-grain operations materialize, the Panel would expect that new on-farm incomes would replace off-farm incomes in some cases.

The Panel has considered the Applicant's approach to land costs associated with the project, and concludes that there may be some underestimation in this factor since the proposed project will involve both pasture and some cultivated land.

The Panel believes that receiving economic analyses based on differing underlying assumptions was of benefit to it. The Panel is of the opinion that the analysis presented by the Coalition underestimates the economics of the proposed project, and represents a view that characterizes one end of the continuum. Similarly, the Applicant's analysis, in the opinion of the Panel, tends to overestimate the economics of the proposed project in certain aspects. The Panel, based upon its assessment of the analysis presented, would estimate the internal rate of return for the proposed project taking into consideration local employment and land costs discussed above, to be just below the Applicant's estimate of 5.7 percent. The Panel notes that its view of the economic effects does not take into account future optimization of both crop, irrigation and feed management. Over time, the Panel expects that such factors will tend to improve the return from the project, if approved.

The Panel believes that any consideration of the economic effects of the proposed project must weigh the non-quantifiable effects. In the case of the Pine Coulee Project, the Panel is prepared to place considerable weight on such factors, as increased security of water supply; improved water quality; enhanced flows below the reservoir; an increased ability to manage water; and the option value of potentially higher valued water use in the future. The Panel also notes the potential improvements in aquatic and riparian ecosystems, recreational and fishing opportunities, and, more generally, the enhanced quality of life that these effects will provide.

With respect to economic impacts and the potential for regional income distribution, the Panel notes that the construction and operational effects on the economy of the area surrounding the project will be significant and positive. Within the context of the provincial economy, Willow

Creek region is relatively depressed, and has fewer employment and investment opportunities than found in other parts of the province. The Panel agrees that stimulation of the economy in a relatively depressed area would be a benefit to the region, should the project proceed.

The Panel heard of no specific proposals to produce long term sustainable economic benefits that are in competition with the proposed project. The Panel did hear that agriculture represents the most favoured sector for investment in the local area, and that within southern Alberta the proposed project was considered to be a high priority project for public investment in water resource infrastructure.

The Panel has already noted in Section 3 of this Report that any decision to invest public funds in the project is a decision that is beyond the jurisdiction of the Panel. The Panel is not aware of the range of alternative opportunities for public investment that provides the context for considering a decision to invest over $37 million in the proposed project. However, the Panel is aware that the Alberta Government has embarked upon a fiscal restraint initiative that causes all public capital investments to be considered within the fiscal context of overall capital investment requirements and the implications for ongoing operating expenditures.

The Panel notes that it must have regard for any socio-economic effects associated with the environmental effects of the project. Given the positive nature of the environmental impacts on water quality, quantity, and fisheries, the Panel would expect that the economic effects associated with such environmental impacts would also be positive but are difficult to quantify. An improved sportsfishery in the basin is likely to produce some positive economic effects due to the recreational expenditures of sportsfishermen. Improved availability and quality of water have economic effects relevant to agricultural development, reduced costs of water treatment and negative economic effects of insecure water supplies on potential industrial or commercial water users. The Panel believes that the loss of relatively poor quality agricultural lands found in the areas to be flooded would be fully offset by the improved productivity of agricultural lands receiving irrigation water. The mitigation of soils and drainage, vegetation and wildlife impacts minimizes any related economic effects that might occur due to the project, and although qualitative in nature, the Panel believes any such effects would not be significant.

The Panel has additional comments regarding the agricultural benefits examined in the economic analysis. The Panel notes its conclusions regarding the potential for irrigation expansion; specifically that to achieve the objective of irrigation expansion to 8,500 hectares, significant changes in the crop mix found in the area (70/30 alfalfa/cereal) would have to occur. While such a change to a 50/50 crop mix, for example would have a direct bearing on the nature of the feed available for cattle, the Panel does not believe that the resulting economic effect would be material to the Panel's overall conclusions regarding economic effects.

The Panel concludes that the proposed Pine Coulee Project would have significant, positive economic effects in the local area, should it proceed. The Panel specifically notes that while the quantifiable economic effects of the project are favourable, additional non-quantifiable benefits

and costs considered by the Panel tend to improve the relative economic effects of the project. The construction and operational effects on the economy of the area surrounding the project will be significant and positive should the project proceed.

7. SOCIAL EFFECTS

7.1 Secure Water Supply

In a direct and personal manner, the Panel heard what local residents believed were the effects of the proposed project on the sustainable development of their communities. Economic and environmental issues were viewed by many participants within a broader social context, based on an unequivocal wish to obtain a stable water supply for the area.

In its submission, the Public Advisory Committee made the Panel aware of the importance of a secure water supply to their farms and communities, along with the added benefit of improving overall stream flow and water quality in Willow Creek. The chairman of the committee said, "A secure water supply is taken for granted in most areas but does not seem to apply in our area. We know what it is to do without water, and we see firsthand the effects of water shortages on all forms of life."

The chairman of the Public Advisory Committee asked the Panel to:

> Take a little time while you're in the area to look around our communities and learn firsthand how our communities have been affected by droughts and the threat of water shortages that limit our future. Learn how Stavely, in the early years, and, more recently, how the business area of Granum almost burned to the ground due to water shortages; how Granum had to haul water for several weeks and limit water use to a few hours each day or how difficult it has been to control brush fires and grass fires in this region because there are few places to obtain water.
>
> As you wade through the many issues and details, remember, Willow Creek dries up, and Chain Lakes Reservoir is too small to be of any assistance during droughts, which leaves few management options.
>
> We hope you will come to understand what this insecurity and lack of water has done to this area over the last 30 years and see that this is not just another irrigation project.
>
> It is not simply a question of the Panel approving or not approving this project. The Panel must consider the consequences of not allowing this project to proceed, and the consequences of placing our area at a disadvantage compared to other areas of the province. You must consider the consequences of not allowing us to have the same secure water supply everyone else takes for granted.
>
> If you look closely at the facts, it should be very clear that there are some few alternatives to (the) Pine Coulee Project other than allowing our communities to slowly -- and maybe 'die' is a strong word, but diminish.

The chairman of the Public Advisory Committee told the Panel that the area now has wages 16 percent lower than the provincial average and that the per capita base assessment of the Municipal District is only half the level for all municipal districts because of the lack of an industrial base. "How can we attract industry to diversify this area when at times we cannot provide enough water for the people who now live here?" The chairman said many of the communities no longer have enough population to support services such as roads, stores, schools, hospitals and recreational facilities. "Unemployment statistics are not a good indicator of what's happening here, as many of our young people must leave the area to find work."

The Public Advisory Committee noted that interim and small local solutions had been tried, including small dugouts and wells, but that they failed when they were most needed. Also, the small reservoirs that have been added to meet immediate emergency needs were seen as a short-term effort. "It is difficult to manage water, and there are few options to improve water use efficiency when Willow Creek is dry, not from withdrawal but due to the fact that most of the available water is passed down the system in a few months in the spring....some criticize but offer no workable options or solutions other than buying out our farms." The Public Advisory Committee's chairman asked, "Who will buy these farms if the people now living there cannot make it go? Should the government buy up a good portion of this area during a time of restraint? Who is going to supply the food we need?"

The chairman of the Committee offered to help place this project in perspective "for the opponents and media" by comparing it to the developments in the City of Calgary. According to the Public Advisory Committee, Calgary's future water licence will allow that city to divert over 400,000 acre feet (493,000 cubic decametres) of water annually. The Committee stated that this is 10 times as much as the water to be diverted and stored in Pine Coulee. "Without present storage, Calgary would not exist or continue to exist as it is today." Further, the Committee stated that since the Pine Coulee Project was announced in 1988, residential housing in Calgary has consumed about 6,000 acres (2,400 hectares) of land, or four times the total land area of this project.

Similarly, according to PWSS, "The drought years of the 1980s emphasized the fragility of water supplies in the Willow Creek basin. In the past, water supplies to the towns of Claresholm and Granum were disrupted when Willow Creek froze solidly in 1982. Water was hauled for a period of 40 days to supply the Town of Granum." And again, "In the summers of 1984 and 1992, the water ceased to flow downstream of Claresholm."

In various ways, many local participants reflected these views in their description of circumstances prior to and after the construction of the Chain Lakes Reservoir and their expressions of anxiety about the future. Most shared the emotional anxiety caused by their experience of previous drought conditions. As a representative of the Willow Creek Irrigators Association told the Panel:

> I recall well Claresholm hauling water for 40 consecutive days in the winter of 1984, and I was present and an onlooker while a Granum elevator burned to the ground and

> the fire spread across the street and burned down the hotel as well, and the fire fighters couldn't do a thing about it because there just wasn't the water.

The mayor of Claresholm told the Panel the town had recently constructed a 60-million gallon (273 million litre) reservoir. The mayor noted that the existing reservoir is filled from an existing pumping station and treatment plant on the banks of Willow Creek. Using this system, the normal water use in the Town of Claresholm, other than the spring, summer and fall months, was said to run anywhere from 2.0 million up to about 3.6 million litres. During the non-peak period Claresholm directs between 900,000 litres and 1.4 million litres of water a day into its reservoir, with the objective of filling it by December.

Despite the system in place, the mayor told the Panel that it should not conclude that the water supply was adequate. "For example, this summer which started out with a wet spring, and (there) was quite a bit of moisture around July, we used up approximately half of the water in that 60 million gallon (273 million litre) reservoir." The mayor then informed the Panel that, during the four years the municipal reservoir has been in use the water level has gone down to as low as 20 million gallons (91 million litres): "So there is definitely a need to do something in the future with Willow Creek so that we can keep that reservoir filled."

> And so I would like to focus the hearing in on the fact that we have 3,600 people living in the Town of Claresholm who are totally, and I emphasize, totally dependent on Willow Creek as a source of drinking water, and for all other needs that an urban community needs with water such as fire fighting. And I would hope as this hearing goes on and in your decision, Mr. Chairman, that this will be remembered, because it seems to me that the -- some of the focus has been on irrigation. That's important to the economy to the Town of Claresholm, because when our farmers and ranchers are doing well, we are also doing well in the town. But to come back to the basic need, that if we do not have an adequate supply of water, our town will cease to exist and function as it should.

In the NRCB's Request for Supplemental Information, PWSS was asked to elaborate on the need for increased security of supply for existing domestic and municipal users, taking into consideration the operation of the Chain Lakes Reservoir, recently constructed municipal storage and projected demand based on population trends. PWSS was asked to describe and take into account current and proposed demand-side management initiatives as recommended in the report on *Water Management in the South Saskatchewan River Basin* and a number of other attachments to its Application.

PWSS responded with a review of the security of supply issue. With the construction of storage facilities in the 1980s, the towns of Claresholm and Granum alleviated municipal supply problems for the near future. PWSS believed there would be significant benefits to these communities, including the following:

- cost savings by allowing communities to fill their reservoirs when suspended sediments in the creek are low;
- minimized occurrence of double treatment of water supply by the Town of Claresholm;
- reduced need for vigilant water metering to ensure these communities' needs would be met during severe droughts; and,
- improved security of supply to the municipalities and domestic users along Willow Creek by having a reliable supply closer to the communities than Chain Lakes Reservoir, and a travel time half that from Chain Lakes.

PWSS recognized that demand management initiatives would be required to deal with periodic problems such as equipment failure or prolonged low flows.

In the long term, when existing infrastructure requires replacement or expansion, a secure supply would be assured. Opportunities for gravity-fed supply pipelines could eliminate primary pumping costs and reduce treatment costs.

PWSS provided a description of the current municipal water supply systems and operations for the towns of Claresholm and Granum and mentioned that Stavely is currently supplied by groundwater and would also have the option of being serviced by a gravity-fed pipeline.

7.2 Community Stability

Local area government authorities and area residents made the Panel aware of the difficulties the lack of a stable water supply had created for them throughout the years. The 1980s in particular were very difficult for irrigation farmers and for the communities of Granum, Claresholm, Stavely and Nanton. Water had to be rationed for some of the communities on a number of occasions and irrigation farmers had to be shut off because of the drought during that period. There were additional concerns about fire protection and limits on future business or population growth because there was no assured or stable water supply. Recreational opportunities were also negatively affected.

During the 1980s, a number of water management options were extensively examined to select the best approach to the region's water problems. The Pine Coulee off-stream storage proposal received considerable support from the local communities and many of the Willow Creek and Pine Coulee area landowners. In 1988, the Alberta Government announced its intention to develop the Pine Coulee off-stream storage project. Local residents and municipal governments were very supportive of these announcements.

The Panel heard arguments and evidence that stressed that the communities in the MD of Willow Creek do not have the assurance of a basic water supply, an assurance that many other communities in Alberta take for granted. The lack of a stable water supply also jeopardized the potential economic security and sustainable development of the region, and made any growth doubtful. Participants felt a more stable source of water would strengthen the area's agricultural industry, the nearby communities, and the municipal district.

The communities also recognized that the construction of the project would bring some short-term benefits to the area through local purchases of goods and services and some local employment. For the future, the communities believed that the recreational aspects of the project would create economic spin-offs for them. People using the proposed expanded Willow Creek Park and the additional recreational opportunities afforded by the reservoir could also purchase local goods and services. It was also believed that some additional recreational housing could be built in the area near the project and that this would bring in some additional tax payers and benefit local businesses.

The general argument concerning community stability in the Municipal District that was repeatedly emphasized was that the Pine Coulee Project could assist in reducing economic uncertainty for communities and provide a basis for expanding agriculture and recreation in the area. Together this would help stabilize the area and even promote some additional economic growth. Without the project, economic uncertainty and perhaps decline would occur in the agricultural industry and for the communities in the region.

7.3 Land Use Effects

The development of the proposed Pine Coulee Reservoir could affect land use adjacent to the reservoir and associated issues including access to the reservoir, and the development of new facilities and residential property.

7.3.1 General

The Panel heard from the Oldman River Regional Planning Commission (ORRPC) about the requirements for public input into decisions on changes in land use. Some aspects of the Alberta development approval process discussed by the ORRPC are outlined within the context of the description of the *Alberta Planning Act* in Section 2.2.9, including the need for, and public input into, development decisions related to an area structure plan (ASP).

As part of the consultation process with area residents, the ORRPC conducted a survey of residents' views in 1989. The ORRPC distributed 103 copies of the survey within a three-mile radius of the Pine Coulee Project and had a return rate of 40.7 percent. The major findings of the survey were stated as follows:

- about 75 percent of the respondents favoured the proposal of a reservoir on Pine Coulee;
- almost 70 percent preferred additional recreational development;
- about 25 percent favoured no development at all along the reservoir;
- potential benefits of a reservoir were seen as increased irrigation and recreational opportunities;
- potential problems raised included landowner/camper conflicts, water fluctuation and sewage disposal;
- respondents were about evenly divided on whether fencing should occur along the proposed reservoir;
- respondents thought essential requirements for improved recreation included tree planting, fish stocking, parking, wildlife or natural areas, swimming areas and boat launches;
- the "main preference" for recreational facilities included a provincial day use area or provincial park; and,
- most respondents preferred a causeway crossing the proposed reservoir to join Secondary Highway 527.

Many of these responses reflect consistency with land use objectives currently described in the *General Municipal Plan* for the MD of Willow Creek:

The conservation of agricultural land and the protection of the agricultural base of the local economy are of paramount importance. It is, therefore, the intention of the municipality's objectives:

1. To support and encourage the agricultural land base of the Municipal District of Willow Creek, No. 26.
2. To discourage the fragmentation of agricultural land and viable farming units into small parcels intended for non-agricultural use.

For these reasons the following general policies are adopted:

1. Good agricultural land, comprising Canadian Land Inventory classifications 1 through 4, shall be reserved for agricultural uses wherever practical.

2. The only exceptions to the above policy which will be considered are those where, in the opinion of the municipality, a parcel is so badly fragmented by existing uses or ownership patterns that it is impractical to use it for agricultural purposes.

The MD of Willow Creek believed problems would arise, not as a result of recreation, but rather as a result of people coming into the area looking for a place to live. As an example, the MD cited the potential for "... tremendous conflict there that somebody moves out to the country for, he thinks, lower taxes, land is a little cheaper to build on, and then he gets there and discovers that somebody is raising pigs a mile or two to the west of him, and they smell." The MD advised that conflicts between country residential and agricultural land use is "...an immense problem for us right at the moment."

The MD of Willow Creek advised that planning problems would arise as a result of changing land ownership around the proposed reservoir and the potential for future non-agricultural land use development. The MD is concerned that reservoir lands would be acquired in a manner similar to land acquisition for the Oldman Dam where an excess of land was purchased for reservoir development and later sold to private interests.

In order to manage problems associated with changing land use patterns, the MD advised that it would try to concentrate developments and "...that there would have to be some way of grouping these. And I don't know whether you make a hamlet or not. And until we can see the direction it's going to go, it's pretty hard to come up with a plan."

To conform with the requirements of the *Alberta Planning Act* (Section 2), the MD of Willow Creek currently has a land use bylaw in place to implement its *General Municipal Plan*. According to the bylaw, areas in the MD are designated "Rural General" or "Grouped Country Residential."

Rural General districts are intended to provide for the protection of better agricultural land by limiting and regulating development other than cultivation or grazing through the regulation of permitted, discretionary and prohibited land uses. Within Rural General districts, permitted uses include: extensive agriculture, primary farm residences, secondary farm residences, accessory buildings, mobile homes, modular homes, residential additions and horticulture. The list of discretionary land uses in Rural General areas is extensive, including campgrounds, farmsteads, golf courses, grain elevators, guest ranches, home occupations, intensive agricultural operations, public and institutional uses, utilities, rural industrial uses, veterinary clinics and similar uses. Within the Rural General designation these land uses are prohibited: grouped country residential, grouped rural industrial and single undeveloped country residential parcel. Within Rural General districts, land fragmentation is controlled by providing for a minimum parcel or lot size of one acre.

Grouped Country Residential districts are intended to accommodate clustered country residential development within comprehensively planned multi-lot areas designated on fragmented or poor agricultural land provided the proposed uses:

- do not conflict with the agricultural, recreational or rural industrial uses on lands adjacent to, or in close proximity, to the proposal;

- do not compromise the safe, efficient operation of the road network or urban expansion of neighboring municipalities; and,

- comply with the pertinent development standards and requirements outlined in a detailed area structure plan for the area, this land use district and other conditions required under the land use bylaw.

As with lands designated Rural General, Grouped Country Residential districts are assigned permitted, discretionary and prohibited uses. Generally, these uses include residential use such as single family dwellings and home occupations and prohibit intensive agricultural operations. Unlike Rural General districts, Grouped Country Residential districts allow lot sizes as small as one-half acre for serviced lots. Also, unlike Rural General land use districts, Group Country Residential districts require an ASP as defined under the *Alberta Planning Act*.

Within the MD of Willow Creek, an ASP for a Grouped Country Residential application "shall consider and address" the following:

(a) the implementation of urban expansion strategies of neighbouring municipalities;

(b) the safe and efficient use of nearby highways or secondary roads;

(c) possible future impact on resource developments;

(d) the effect on access to or development of existing or potential recreation amenities;

(e) the effect on surrounding agricultural operations;

(f) the effect on a critical wildlife zone ... or environmentally sensitive area;

(g) the visual environment of the surrounding landscape;

(h) the natural amenities provided by the land. These amenities may include, but are not limited to, varied topography, sloping land, a scenic view and tree cover;

(i) areas prone to flooding or groundwater inundation. These areas shall not be considered for grouped country residential use;

(j) water supply and sewage disposal for the proposed development;

(k) areas of historical and archaeological interest; and,

(l) such other matters considered necessary and appropriate by the Municipal Planning Commission.

In concluding its submission, the ORRPC said a particular concern to the municipal district was the construction of alternative transportation routes that would be required as a result of flooding of the proposed reservoir. The municipality may wish to continue to administer land use through the general municipal plan and the land use bylaw, without the benefit of an area structure plan. Lands identified for residential usage would require rezoning to Grouped Country Residential status, while more passive uses such as campgrounds, day use areas and private or public recreation can be accommodated as discretionary uses within the existing Rural General district. At present, the municipal district is committed to addressing the concerns and aspirations of the ratepayers in the immediate area as well as the rest of the municipality: "Any proposed changes to land use policy would not be undertaken without providing the forums for dialogue between the elected officials and the general public." Further, the ORRPC stated: "As construction of the facility is scheduled to take place over several years, opportunity exists to closely examine the pros and cons of non-agricultural development in the immediate vicinity, with the end result being a land use plan or strategy to accommodate these anticipated development pressures in the future." According to the MD, "The Council feels that the Municipal District of Willow Creek No. 26 is in the best position to evaluate the transportation needs of the area and is definitely going to have to live with the situation after the project is completed. We therefore request full consultation before any decision is made that we may not be in a position to accept."

7.3.2 Recreation

In describing current access to recreational and other public opportunities along Willow Creek, PWSS explained that the project is proposed for a settled area of rural southern Alberta where the predominant land use is agricultural. Lands here are about 90 percent privately owned with no access by the general public. The pattern of land use is scattered farmsteads, cattle pastures and crop lands, roads and fences. In the area along Willow Creek, public access is currently restricted to Willow Creek Provincial Park and to the bridge crossing at Secondary Highway 527. Currently, all other access is through private land or at a road crossing. Also, PWSS said it was not aware of any public land, other than Willow Creek Provincial Park, that was not under lease. If the project were to be built, PWSS stated that the amount of public land accessible along Willow Creek would increase because of the diversion structure and the new access to the creek along the canal route. PWSS said an attempt would be made to locate intensive recreation next to the dam site area but that this would not prevent anyone from traveling around the reservoir: "the only reason why we might restrict them is if there were some reason with respect to wildlife or sensitive ecological areas. ...So that in terms of access to the reservoir, it basically would be open all the way around its perimeter."

PWSS told the Panel it was committed to construction of one boat launch in each of the two main reservoir basins. Three sites were shown on a map contained in the Application, however PWSS now proposes only two launch sites. One of the two sites would also function either as a day-use area or a combined day-use and campsite area. The Public Advisory Committee suggested a campsite and PWSS was still investigating the possibility. In addition, PWSS would develop a viewpoint at the dam site, required initially to allow people safe viewing of the construction site and retained afterward for viewing of the dam and the inlet structure. PWSS said it might also make a walking path along the canal route to allow some appreciation of the headpond area as a wildlife viewing area.

In response to a concern raised by the Alberta Parks Service that it would be required to operate whatever recreation facilities were built, PWSS said that it believed it was proposing the minimum facilities required to ensure safe public access to the reservoir site and to minimize problems with adjacent landowners. PWSS assured the Panel that it recognized Alberta Parks Service's concern and that it had no intention of "building something that they don't approve of."

Alberta Parks Service told the Panel that the main impact of the proposed project on Willow Creek would be significantly increased visitation and use of the facilities at Willow Creek Provincial Park. Willow Creek Provincial Park would require upgrading and expansion of its existing facilities to accommodate the anticipated increase in use. The Parks Service outlined the funding options available for upgrading and expansion: it could continue to work toward integration and coordination of facility upgrading and expansion within the context of construction of the proposed project; request additional funding necessary for upgrading and expansion through the government's standard budget request and approval process (a process that it believed would encounter some difficulty within the current budgetary policies); or, it could invite proposals from the private sector for a possible long-term operating agreement or contract that would include a commitment to develop the required facilities.

The chairman of the Public Advisory Committee advised the Panel that Willow Creek Provincial Park needed road improvement, an increase of the existing 80 camping sites to 100, two playgrounds, water-system improvements, two shelters, landscaping and additional signage. The Public Advisory Committee estimated that this work would cost approximately $500,000.

The Alberta Parks Service advised that firearms are currently prohibited in provincial parks and recreation areas without specific authorization, a policy that was expected to continue into the future and would apply to the facility because it would attract a significant number of recreational users.

A recreation demand study was used by PWSS. An opportunities and constraints analysis was used to identify the potential for reservoir-based recreation. The analysis included superimposing the proposed project on the existing landscape and undertaking field and office analysis. It also included a review of experiences with other Alberta reservoirs and the operating plan for reservoir levels.

The impact of the proposed project on instream recreation activities in Willow Creek was examined at two levels: a more detailed examination restricted to that reach of Willow Creek that contains Willow Creek Provincial Park; and a less detailed study of Willow Creek from downstream of the reservoir outlet to its confluence with the Oldman River. Current flow conditions were compared with flows expected under the proposed operating plan.

The impact on instream activities was measured by calculating the time during which preferred conditions for that activity would be available under the proposed operating plan and comparing that to existing conditions. For purposes of analysis, the instream recreation season was subdivided into peak (May 21 to September 2) and shoulder (April 30 to May 20, September 3 to September 30) seasons. The instream flow analysis included activities such as wading, tubing, canoeing, kayaking and swimming.

In addition, a landscape architect examined the study area and identified potential impacts to visual resources. According to PWSS, the assessment was subjective and based upon professional judgment and experience.

As a result of its assessment, PWSS advised that minimum impacts would result during the construction phase of the project. However, as a result of introducing water into the reservoir, PWSS anticipated the following consequences:

- a negative, low, long-term impact resulting from the loss of nature viewing and hiking opportunities within Pine Coulee below the reservoir;

- a positive, high, long-term impact resulting from the creation of a large water body that would increase the water-based recreation capability of Pine Coulee; and,

- a positive, high, long-term impact resulting from the presence of beach and day use camping areas, access to water for angling and boating, and opportunities to view wetland wildlife. Consequently, an increase in recreation capability from the existing moderately low rating in the Canada Land Inventory to a rating of moderately high would be expected if the project was completed.

PWSS concluded that the introduction of water to the current arid landscape would result in a positive, high and long-term aesthetic impact, although the appearance of the dam structure and saddle dyke as well as the temporary visibility of mud flats in the northern and middle part of the reservoir during some periods of drawdown were assessed as negative, low and long-term effects.

Many of the local hearing participants supported a multiple-use concept for the project for economic and social reasons. Some participants believed that PWSS may have overestimated the economic benefits from recreation. They believed that demand for reservoir-based

recreation activities would be limited by the drawdown effects and water quality effects characteristic of many reservoirs.

The Application before the Panel also included provision for the development of a small number of private cottages. The Applicant's recreation study indicated that, although there is some local interest in cottage development, there are no naturally occurring sites adjacent to the proposed reservoir that are ideally suited to cottage development. A lack of suitable slopes at the proposed reservoir precludes waterfront development. However, at the proposed full supply level approximately 75 lots with 50 metre water frontage could be accommodated at the southern end of the reservoir, south of Secondary Highway 527. The recreational study also stated that an additional 50 lots could be developed north of Secondary Highway 527.

7.4 Transportation Effects

A number of participants were concerned about the effect of changes needed to the existing transportation system within the MD of Willow Creek in order to accommodate the location of the proposed reservoir. In its submission, PWSS stated it believed that, if the proposed project were approved, it would be maintaining a system that is equal to, or better than, the existing transportation system.

One north-south roadway would be inundated by the reservoir. Four other routes would be affected by the proposal: east-to-west crossings of Pine Creek at Pumphouse Road, Secondary Highway 527, Two Mile North Road, and Fireguard Road (See Map 1.1). A number of road links in the area of the proposed reservoir were discussed. Beginning at Secondary Highway 527, Link 1 would cross the dam headworks and turn north along the saddle dyke and connect with Pumphouse Road. Link 2 would require the construction of a causeway (Causeway 1) across the reservoir at Secondary Highway 527 with the link extending north to Two Mile North Road from the eastern intersection of the causeway. Link 3 would also be located on the east side of the proposed reservoir extending in a northerly direction from Two Mile North Road to connect with the existing north-south artery leading to Fireguard Road. Link 4 would be located on the west side of the proposed reservoir and extend in a southerly direction from Two Mile North Road to connect with an existing artery leading to Secondary Highway 527. A further part of this proposed road system included a second causeway (Causeway 2) crossing the reservoir in an east-west direction at Fireguard Road. The cost of the system described above was estimated at more than $4 million. PWSS advised that, for at least one of the proposed routes noted below, its cost estimate did not include the cost of land purchase, mitigation for loss of grassland, reclamation work and the cost of culverts for cattle crossings.

The Panel also heard evidence about a more contentious proposal on the west side of the proposed reservoir, Link 5, that would form an extension south from Avenue Road between Two Mile North Road and Fireguard Road. Because of the steep terrain along this proposed route, PWSS estimated the cost of this link at approximately $330,000. Additionally, PWSS was concerned that,

if Link 5 were constructed, its construction would have an adverse environmental effect by fragmenting some existing pastured grassland, consequently, PWSS did not believe that Link 5 should be required as a mitigative measure associated with the proposed project.

PWSS believes that impacts of the proposed transportation routes would not be very large. The effect of changes to two school bus routes were estimated by PWSS to be about two and four additional miles. In its cross-examination of the MD of Willow Creek, PWSS questioned the need for construction of Link 5 because, in the Applicant's view, this particular route was not needed as part of the project and was being requested by the MD at this time in order to shift the cost of the MD's future transportation requirements into the cost of the project.

In its submission, the MD of Willow Creek told the Panel it would like to see Link 5 constructed. It pointed out that a failure to construct this artery would result in additional hauling distances from its gravel pit which is the only gravel pit in the area. In the MD's view, failure to construct this road would cause additional inconvenience and expense. The MD wants this route to provide north-to-south transportation access for residents living on the west side of the proposed reservoir. It believed that this road would be the shortest route for traffic from the area south and west of the reservoir to travel north to the Town of Nanton and beyond, and also that farmers on both sides of the proposed reservoir would require this road to reach their property and for potential future school bus routes. The MD believed that present land ownership should not be the criteria for planning roads because estate settlements, land sales, and other land tenure changes could change the requirements for access within a relatively short period. The MD told the Panel that Alberta Transportation and Utilities had informed the municipality that provincial funding would not be available for road construction caused by the reservoir development and as the municipality has limited resources "...it is essential that proper planning be done." The MD strongly advocated building Link 5 and told the Panel that if the only way to ensure the inclusion of Link 5 within the context of the proposed development was by way of a condition to any forthcoming approval, the MD would ask the Board to "...put it on as a condition."

The Town of Nanton stated in its submission that it was also in favour of the construction of Link 5 in order to facilitate commercial traffic movement into Nanton from the area to the west of the proposed reservoir. It also supported the MD of Willow Creek ".. in getting the infrastructure done in the way that they need it done."

Contrary to the view expressed by the MD of Willow Creek and the Town of Nanton, Mr. Cody Waters, speaking on behalf of himself, Deb Waters and C. K. Waters, advised that the Waters are opposed to construction of Link 5. The family is concerned that increased traffic during dry years may lead to an increase in the risk associated with fire. Mr. Waters also advised that the Waters property contains unusual sandstone formations that attract public interest and he believes that increased traffic would result in increased numbers of people stopping to view and walk to the formations. Additionally, Mr. Waters pointed out that the MD of Willow Creek wanted to limit the amount of land fragmentation, but if Link 5 were to proceed, it would create at least two more cut-off parcels of land. In response to the MD's concern about the increased hauling distance from its gravel

pit, Mr. Waters said that the MD would be able to use a less steep route. Mr. Waters had once worked for the MD driving a gravel truck and concluded from his experience that an alternative route along Kim Cochlan Road from the gravel pit to Table Butte Road and west was "quicker than the pull up the Cracking Plant hill." Mr. Waters also felt that if Link 5 were built it would seriously hurt business in Stavely. He believes that traffic should be kept to Highway 2 which he said was designed to carry the additional traffic. Mr. Waters said that not building Link 5 would add only an extra mile to the driving distance to Nanton, which would be "really insignificant." Nor did he think it would be difficult to find satisfactory alternative school bus routes without the Link 5 route. When Mr. Waters purchased his property, he selected the site because, among other reasons, it was secluded. He is concerned that increased traffic would create dust that would affect his calves. Mr. Waters was also concerned that because his home is located near the end of the existing road, his children have developed a habit of walking far from home, and that increased traffic resulting from the construction of Link 5 could increase the risk of their being involved in an accident.

Mr. Waters believed that Link 5 should not be constructed but the Panel should recommend that PWSS negotiate with the family with the intention of providing compensation for additional mileage they would have to travel if the Application were approved. "We are sure that it will not be anywhere near the half million dollars the road will cost anyway," said Mr. Waters.

Regarding issues raised by the Waters family, the MD asked that Link 5 continue up the west side of the reservoir to connect with Avenue Road but did not believe it was necessary that the road cross the Waters' property.

The Parkland Hutterite Brethren advised that, if Link 5 were constructed, it would require a livestock underpass to connect its lands separated by the roadway. Additionally, the Brethren said that the colony did not need a roadway going into their land at the south end but stated that there should be a road "...good enough to get there." The Hutterite Brethren said they would not interfere if the MD of Willow Creek wanted Link 5. On the other hand, PWSS said the Brethren were concerned about land fragmentation and preferred not to see Link 5 constructed.

A final transportation issue raised during the hearing was the PWSS proposal to construct a causeway across the reservoir rather than a bridge. Many participants preferred a bridge to a causeway for reasons of safety and to facilitate the movement of water, fish and recreationists between the various parts of the reservoir. These participants believed although there would be increased cost for a bridge ($1.1 million) rather than a causeway, the bridge would enhance the overall value of the proposal from both an environmental and recreational perspective. Contrary to this view, PWSS believed that a less expensive causeway would satisfactorily meet environmental needs, although it acknowledged there would be some inconvenience to recreational users of the proposed reservoir. According to PWSS, the estimated annual recreational benefits associated with the project were approximately $80,000, an expensive proposition "simply to move boats from one basin into the other basin."

PWSS reluctantly suggested that one alternative to the controversial causeway would be to move Secondary Highway 527, when it approaches the reservoir, to swing down to the south to cross the dam. "It would save us $3 million or $4.4 (million), if the bridge was in there. And then there might be a good argument for building Link 5." Later in the hearing PWSS advised that making this change would result in savings of less than $3 million but more than $1 million, when additional road construction and design standards are accounted for.

On cross-examination PWSS assured the Panel that it

> ...had always intended, during the course of implementation, to strike an acceptable solution to all parties. And we felt that given sufficient time that a reasonable solution would be achieved. The issue has come up at our public advisory committee meeting. There is no strong consensus either way. At times they have had votes on it, and it's been close one way or the other. We would certainly welcome any guidance that the Panel might have to offer in this area. But our -- I guess our bottom line is that we still believe that through communication that a solution can be found to satisfy both the MD and the Waters family.

7.5 Communication and Consultation

PWSS made a presentation to the Panel outlining the history of the communication and consultation process undertaken to date. This process began when Alberta Environment undertook the South Saskatchewan River Basin Planning Program in 1980 to address water management issues across the entire southern part of the province. The culmination of that process was 15 days of public hearings held in 10 communities in 1984 by the Water Resources Commission that heard 233 presentations including some from groups represented at the current hearing into this Application.

A Willow Creek basin Local Volunteer Advisory Committee was active from 1984 to 1988 that included directly affected groups and individuals representing municipal governments, landowners at potential reservoir sites, local irrigators, the local fish and game association and the local historical society. The Local Volunteer Advisory Committee was selected by the local community at a publicly sponsored meeting. Representatives of these local and regional interest groups were nominated and elected to the committee. The Panel was informed that the Local Volunteer Advisory Committee held nine public meetings, distributed two newsletters to 5,500 households in the Willow Creek basin, and sponsored open houses in late 1986 in the towns of Granum, Nanton, Stavely and Claresholm. The Local Volunteer Advisory Committee became the Public Advisory Committee for the Pine Coulee Project in 1988 and remained active throughout the entire review process. PWSS told the Panel it believes that community interests have been fully represented.

PWSS held open houses in April 1990 in the towns of Claresholm, Nanton and Stavely to solicit public comment on the scope and content of the environmental impact assessment (EIA). In July 1991, draft terms of reference for the EIA were presented at an open house in Stavely. Similarly, in November 1993, open houses were held in Stavely and in Claresholm to review the draft EIA. In order to advertise the 1993 open houses, PWSS circulated a newsletter to 5,400 mailboxes and placed advertising in all local newspapers from Fort Macleod to Okotoks, as well as in two native newspapers. PWSS submitted as an exhibit a compendium of media advertisements and articles about the project, dating from 1983 to the present.

During the course of the hearing, PWSS advised the Panel that public consultation would continue on outstanding issues such as road relocation, water drainage, fisheries and fishways, and archaeological and historical resources.

Although PWSS and some participants believed that communication and consultation during the review process were satisfactory, the Pine Coulee Coalition, Peigan Nation and Blood Tribe expressed dissatisfaction with the Applicant's efforts. The views of aboriginal people on this matter will be discussed in greater detail in Section 8 of this Report; however, the Pine Coulee Coalition shared a common concern with the Peigan that greater effort could have been made by PWSS to communicate with parties with a regional interest in the Application. The Coalition told the Panel that the Federation of Alberta Naturalists and the Alberta Wilderness Association felt they were unwelcome at the Public Advisory Committee.

Many of the PWSS comments regarding the public consultation and communication process were echoed in the Public Advisory Committee's evidence. According to the committee's chairman:

> The people in our towns and rural area volunteered their time for over 10 years to find a balanced solution to our water shortages. Many have also volunteered for three years of instream flow needs studies. We have held numerous meetings, all open to the public; co-sponsored three open houses in 1986, 1991 and 1993; as well as attending local community fairs, et cetera, with booths of information, so that we've passed information out through the area as much as we could to get as much input back in, negative or positive, to focus on completion.

As part of its submission, the Public Advisory Committee provided a copy of its minutes and those of its various sub-committees. In his closing arguments, the chairman of the Public Advisory Committee advised:

> ...it is extremely important that the role of the Pine Coulee Advisory Committee be expanded and the land use committee include members of the First Nations and Alberta Culture (Alberta Community Development) to protect, preserve archaeological issues, sensitive issues and artifacts, past history for the future. Further, the recreation committee (should) be expanded to include fishery people

including Fish & Game Association, Trout Unlimited, and any separate fish type groups along with the Lands, Forest, Fish & Wildlife department (Alberta Environmental Protection, Fish and Wildlife Division).

7.6 Panel Views

7.6.1 Social Effects

Lack of a secure and stable water supply in the drought prone Willow Creek basin is, in the opinion of the Panel, a major underlying factor affecting the social stability and well-being of the residents of the basin.

The Panel concludes that, if approved, the proposed project would have positive social effects on the municipal district and the communities within it, and on irrigation agriculture and as well as the larger farming community. A secure and stable water supply would provide assured water to local communities and complement their current water supply systems, particularly in times of drought and low flows. Present irrigators would have their uncertainty reduced and would experience more stable agricultural productivity. New irrigators would add investment and employment opportunities to the local area. The negative impacts of drought and crop losses would be reduced in frequency. Recreational use will increase and there will be economic spin-offs from that increase. If anticipated development of cottages and residences near the reservoir is successful, additional economic and social benefits would occur.

The proposed project, with its range of benefits including those of fisheries and recreation, would also add to the economy of the area and the stability of the population. The Panel believes the Pine Coulee Project, if approved, will result in local and regional economic benefits and is persuaded that the social stability and quality of life for residents of the region will be increased.

The Panel finds that positive social effects of the proposed project in maintaining employment, with some possible employment growth, expanded recreation and community stability is positive and compelling. The Panel concludes that the potential social stability of the area must be given regard in reaching its overall decision regarding the Application.

7.6.2 Transportation

The Public Advisory Committee, with input from the Applicant, dealt extensively over several years with the need to provide for replacement roads and roads to accommodate new land uses in the immediate vicinity of the proposed project.

The Panel notes, should the proposed project be approved, that the existing rural road system in the immediate vicinity of the project would need to be revised to provide replacement roads for those inundated by the proposed reservoir and also to accommodate existing uses and potential future needs of water-based recreationalists and non-agricultural users.

The Panel has considered the requests of the Applicant, the Municipal District of Willow Creek, and other participants to provide guidance on the transportation implications of the proposed project. The Panel believes that such matters are normally dealt with in a satisfactory manner through consultation between the Applicant and various local parties and authorities. However, in this case such a resolution has not been reached.

The Panel has concluded that transportation issues are an important component of the overall project that need to be resolved to ensure that the long-term public interest in the social, economic, and environmental aspects of the project are met. Therefore, the Panel has concluded, should the project be approved, that it would be necessary to place certain conditions on transportation aspects of the Application.

The Panel agrees with the Municipal District of Willow Creek that there is a need for a link substantially similar to Link 5. The Panel further concludes that there is a need to mitigate the inundation of the existing road crossings of Pine Coulee and to provide for safe and efficient road access to the new land-uses that would result from the creation of a significant new water body. The Panel would require that PWSS, with the advice and consent of the Municipal District of Willow Creek, establish a good standard perimeter road around the reservoir that would include a link substantially similar to Link 5, the causeway on Fireguard Road on the north, the relocated Pumphouse Road across the saddle dyke and dam to the south, and any other links required to complete a perimeter road around the reservoir. Most of the perimeter road already exists or would be completed as part of the project.

The Fireguard Road is proposed to continue to cross Pine Coulee on a causeway creating a permanent wetland for wildlife in the most northerly part of the proposed reservoir and the Panel is satisfied with this road. The replacement road proposed from Pumphouse Road south and west along the saddle dyke and across the dam to connect with Secondary Highway 527 is satisfactory to the Panel.

The remaining replacement roads and the upgrading of the road between section 14 and 15 and sections 22 and 23 - twp. 14 - rge. 28 - w. 4th appeared acceptable to most participants and are satisfactory to the Panel.

There is no nearby access road to the reservoir along the west side of sections 2 and 11 - twp. 14 - rge. 28 - w 4th south from Secondary Highway 527 to Pumphouse Road and this would be required for the proposed perimeter road. A proposed replacement road (Link 5) between sections 28 and 29 and section 32 and 33 would complete an access road system on the west side of the proposed reservoir.

Willow Creek Provincial Park is served by Secondary Highway 527 which connects to Highway 2 at the Town of Stavely. Construction of a major causeway is proposed for Secondary Highway 527 at a cost of some $3 million. To address water quality, fishery-related issues and boating navigation a bridge could be added which would increase the cost to $4.1 million. An alternative to this crossing would be to have Secondary Highway 527 turn south along the east side of the proposed reservoir and connect to the proposed Pumphouse replacement road along the saddle dyke and dam which in turn re-connects into Secondary Highway 527 on the west side of the reservoir.

The proposed Secondary Highway 527 causeway raises serious concerns about the public cost of the transportation proposal and its environmental effects. These two factors, when combined, have a significant bearing on the proposed project.

Having regard for the need for a perimeter road around the reservoir; the large financial expenditure proposed for the causeway; the negative environmental effects; and balancing positive and negative social effects, the Panel concludes that the proposed causeway crossing near the midpoint of the reservoir to accommodate Secondary Highway 527 is a costly and unnecessary crossing. In the opinion of the Panel, upgrading the relocated Pumphouse Road to accommodate Secondary Highway 527 across the saddle dyke and dam would provide access to Willow Creek Provincial Park and the municipal district road to the west at less cost.

The Panel believes that with the completion of a perimeter road, including the substantially similar Link 5 and upgrading the relocated Pumphouse Road across the saddle dyke and dam to accommodate rerouting Secondary Highway 527, there could be a substantial cost saving. This cost saving must be considered in terms of its potential inconvenience to some residents. On balance, the Panel believes that the cost saving is justified.

The Panel recommends, therefore, that PWSS achieve a significant cost saving by eliminating the costly and unnecessary proposed causeway crossing near the midpoint of the reservoir to accommodate Secondary Highway 527, and further recommends the upgrading of the relocated Pumphouse Road to accommodate Secondary Highway 527 across the saddle dyke and dam to provide access to Willow Creek Provincial Park and the municipal road to the west.

An important element in the rural road system is providing for efficient school bus routes. Each of the existing east - west crossings of Pine Coulee that would be affected by the proposed Pine Coulee Project are used by one or more of the three school buses serving the area. School bus routes must remain flexible to accommodate changing student needs, availability of drivers and other requirements. Should the proposed project proceed, some changes will be required. The Panel believes that the revised road system should be able to serve both basic rural, educational, and agricultural needs in a manner sensitive to other economic, social and environmental concerns.

The Panel notes in particular the effects of Link 5 on the Waters family, the Hutterite Brethren and other families on the west side of the reservoir. In concluding that Link 5 is required,

the Panel has considered this impact in light of the overall benefits of the project and the transportation changes required. With respect to the Waters, and similar families, the Panel realizes that they may experience some negative impacts. The Panel has no jurisdiction regarding the compensation requested by the Waters. With respect to the Hutterite Brethren in the vicinity of Link 5, the Panel agrees that reasonable access arrangements should be made to accommodate their use of their land near the proposed reservoir.

The Panel observes that an important element in an area structure plan is the transportation network. It may affect access to, or development of, existing or potential recreational amenities and would also be a factor relating to the safe and efficient use of nearby highways and secondary roads.

7.6.3 Land Use Effects

The Panel notes that the proposed Pine Coulee Project, except for Willow Creek Provincial Park, would be located in and surrounded by lands that have been used for agricultural pursuits for many years. These lands are designated "Rural General - RG" under the *Municipal District of Willow Creek General Municipal Plan and Land-Use Bylaw* which is predominantly an agricultural zoning. The Panel heard that, should the project proceed, the large body of water created by the reservoir, and other aspects of the project would create a strong demand for non-agricultural development. The Panel believes that to accommodate this additional development, which many of the participants concurred with, a land-use redesignation would be required along with a revised land-use plan and strategy for the lands in the immediate vicinity of the proposed reservoir. In the Panel's view, this process should involve PWSS, AEP, the MD of Willow Creek, interested stake holders and the land owners in the vicinity of the reservoir.

The Panel heard that many communities have experienced similar pressure for non-agricultural development as a result of the construction of a water storage facility, and had chosen to adopt a statutory document pursuant to the *Alberta Planning Act* called an area structure plan (ASP). The Act requires that an ASP conform to any general municipal plan. Such plans provide a framework for subsequent subdivision and development in a specified area and normally includes the sequence of development, land uses, population density, transportation routes, public utilities and other matters.

The MD of Willow Creek stated that if the project were to be approved it would begin to finalize a land use strategy and that any plan would require a public hearing before changing the bylaw. The ORRPC stated "As construction of the facility is scheduled to take place over several years, opportunity exists to closely examine the pros and cons of non-agricultural development in the immediate vicinity, with the end result being a land use plan or strategy to accommodate these anticipated development pressures in the future."

The Panel notes that the local municipal authorities, PWSS, the Public Advisory Committee and others have considered the matter for several years and support non-agricultural development, if properly managed. The Panel also notes that, through the activities of several local entities, and the information contained in the Application, much of the initial work and activities associated with the preparation of an ASP has been completed. The Panel concludes that these non-agricultural uses of the land and water are beneficial and an important part of the proposed project and that consideration of this aspect should be an integral part of the final planning and design phase, should the project be approved.

The Panel would require that PWSS, as part of its final planning and design phase, prepare an area structure plan for the lands in the immediate vicinity of the reservoir. Preparation of the area structure plan should include a public involvement program to involve, where applicable, the MD of Willow Creek, ORRPC, local communities, interested stakeholders, Alberta Environmental Protection, Alberta Community Development, and land owners in the vicinity of the proposed reservoir. Matters to be considered should include the following:

- the basic perimeter road system and standards to safely and efficiently service the existing and future land uses adjacent to the reservoir;
- the use of fragmented parcels that would result from the project;
- the need for improvements to, and extension of, the existing provincial park area and the relationship between the park and camping areas, day use areas, boat launching areas, view points, foot trails along the proposed canal, and other similar features which may arise in the preparation of the area structure plan;
- preservation and exhibition of areas of historical and archaeological interest including the buffalo stone (site EbPk 18) and petroglyph (site EaPk 180) in cooperation with Alberta Community Development, aboriginal people, and other interested parties;
- habitat compensation lands adjacent to the reservoir and the need for environmental reserve lands that might be set aside;
- recreation and country residential development;
- mitigation of the conflicts that may arise between the new land-uses and the existing agricultural community including air and water pollution or other conflicts for the lands in the vicinity of the reservoir that are to remain under agricultural land uses; and,

- any extra or special administrative infrastructure that may be required and other normal items that need to be considered in an area structure plan of this nature.

The Panel would require, should the project be approved, that this plan be completed by PWSS and an amendment to the local land use by-law requested from the MD of Willow Creek prior to commencement of reservoir operations.

7.6.4 Consultation and Communication

Overall, the Panel finds the Applicant's public consultation process for the Pine Coulee Water Management Project was extensive and satisfactory.

However, the Panel notes three participants (the Blood Tribe, Peigan Nation and the Pine Coulee Coalition) did not find the consultation process satisfactory. The two aboriginal groups stated that they were not directly notified or informed about the project; did not participate in any of the meetings or open houses and did not know about the project until late in 1993. The Coalition said that they did not feel welcome at the meetings and open houses held. All three felt that PWSS and the Public Advisory Committees should have covered the larger southern Alberta region. PWSS and the Public Advisory Committee believed that the proposed project was relatively small, local and situated on private land in a well established agricultural community. The project was on a small stream within a minor water basin and they believed the consultation process was properly directed. They also stated that they had expected that aboriginal interest would have come forward as a result of the general media announcements, project meetings and open houses.

The Panel notes that this difference of opinion regarding the proper scope of the consultation, may have been partly caused by the lack of due diligence on the part of responsible persons within some of the local and regional organizations. They must watch for projects that might affect their members and their interests. The lack of response to advertisements and attendance at meetings may have been interpreted as a lack of interest by PWSS and the Public Advisory Committee.

Over the past 10 years there has been extensive media coverage, notices, ministerial announcements, government news releases, information letters sent to a large mailing list, and open houses on both the Terms of Reference for the environmental impact assessment (EIA) and the EIA itself. The Panel agrees that there were numerous opportunities for most residents within the Municipal District of Willow Creek to become aware of the project and to participate in the consultation process. The Panel notes that many people did participate through the years and local participation at the hearing was extensive.

With respect to the scope of the consultation and aboriginal people, the Panel agrees that additional and earlier official notification of project related matters would have been advisable.

In order to deal with this matter in the future, the Panel recommends that all Treaty 7 nations receive official notification regarding major water projects throughout the South Saskatchewan River basin from inception. The Panel will set a condition that should the Pine Coulee Project be approved, all official notices about this project be sent to all Chiefs and Councillors for each Treaty 7 Indian Band.

7.6.5 Conclusions

With respect to social effects, the Panel finds that the proposed project, should it proceed, would provide significant and positive social benefits to the Willow Creek basin, with few, if any, adverse social effects. The Panel concludes that the proposed project, through providing a secure and stable water supply, would remove a significant barrier affecting the social stability and well-being of the residents in the basin. This positive social effect is compelling, in the opinion of the Panel, and must be given appropriate weight in reaching any overall conclusions regarding the proposed project.

The existing transportation network in the project area would be disrupted and would result in some inconvenience to a few residents in the area. However, the Panel does not view such effects to be significant and these would be largely mitigated through the road improvements proposed by the Applicant.

In the opinion of the Panel, a good standard perimeter road should be built around the reservoir that would include a link substantially similar to Link 5, the causeway on Fireguard Road on the north, and a relocated Pumphouse Road on the south. The Panel concludes that the relocated Pumphouse Road across the saddle dyke and dam should be upgraded to accommodate a re-routed Secondary Highway 527 so as to provide direct access to Willow Creek Provincial Park and the municipal district road to the west, should the proposed project proceed. The Panel believes that with the completion of a perimeter road, including Link 5 and upgrading the relocated Pumphouse Road across the saddle dyke and dam to accommodate rerouting Secondary Highway 527, there could be a substantial cost saving. This cost saving must be considered in terms of its potential inconvenience to some residents. On balance, the Panel believes that the cost saving is justified. The Panel also concludes that as part of its final planning and design phase, should the Application proceed, PWSS would be required to prepare, and initiate the approval of an area structure plan for the lands in the immediate vicinity of the reservoir before the project commenced operations.

The Panel finds that the Applicant's public consultation in respect to the proposed project was satisfactory.

8. ABORIGINAL ARCHAEOLOGICAL SITES AND ARTIFACTS AND OTHER CONCERNS AND INTERESTS

8.1 Introduction

The Panel is directed by the Terms of Reference issued by the federal Minister of the Environment to review the environmental impacts of the project relating to the concerns and interests of aboriginal people. The Panel believes it should provide a summary of the concerns and interests expressed by aboriginal people to the Panel. The Panel understands the following to be the major concerns and interest of aboriginal peoples about the effects of the project:

- in and around the proposed Pine Coulee Reservoir are aboriginal sites and artifacts that are or may be affected by the proposed project;
- the proposed Pine Coulee Reservoir would affect flows in Willow Creek and the Oldman River and could affect the interests of the Peigan Nation;
- the proposed Pine Coulee Reservoir would affect wildlife that could affect the interests of the Peigan Nation; and
- aboriginal interests and concerns have been inadequately reflected in the assessment of the effects of the proposed project due to inappropriate consultation.

In the region surrounding the Municipal District of Willow Creek and the proposed project there is a large aboriginal population both on and off-reserve. To place the proposed project in perspective in relation to the management of water and the location of aboriginal people, the Panel will provide a brief summary from the evidence of statistical information on each Indian reserve located within the South Saskatchewan River basin. (See Map 1.3).

The interests and concerns of aboriginal people regarding sites and artifacts are discussed in detail in this Section. The Panel will then proceed to provide a summary of the other concerns and interests expressed to the Panel regarding environmental effects and public consultation. The Panel views on the environmental effects of the proposed project were presented in Section 5 of this Report.

Water plays a critical role in southern Alberta, and the Indian reserves in the South Saskatchewan basin are associated with water in many ways. Water management considerations in southern Alberta affect, and are influenced by, the Indian reserves that are an integral part of the South Saskatchewan basin. The Panel notes that it received presentations from the Peigan Nation and Blood Tribe, and appreciates that had it received presentations from other aboriginal people within the basin, it would have more complete information about the potential effects of the proposed Pine Coulee Project on aboriginal interests and concerns. It also appreciates that the Blood and Peigan do not represent all aboriginal interests within the Blackfoot Confederacy and Treaty 7. The

Panel does, however, believe that the submissions are indicative of aboriginal interests and concerns associated with the proposed project, particularly as they relate to the potential effects of the proposed project on the environment. The Panel believes that the degree of interest and concern of aboriginal people in the environmental effects of the proposed Pine Coulee Project would be less for those further away from the project. The Panel believes that the concerns of aboriginal people regarding the cultural and religious significance of the buffalo stone and petroglyph received from the Blood and Peigan would be indicative but not fully representative of those concerns.

8.2 Indian Reserves in the South Saskatchewan River Basin

Treaty 7 and the South Saskatchewan River basin (SSRB) have different boundaries, but most of the area is common to both. This land area covers over 100,000 square kilometres of the most southerly part of the province of Alberta with more than one million residents. Indian reserves are located in two of the major sub-basins within the SSRB. Each reserve has significant existing water management projects within its boundaries or located nearby. *The South Saskatchewan Basin Water Allocation Regulation* has allocated water for irrigation purposes to three Indian reserves: the Siksika, Blood and Peigan. The proposed Pine Coulee Project would be located near Willow Creek, which is a tributary of the Oldman River. The Willow Creek basin (see Map 1.2), except for the uppermost reaches, is settled agricultural lands, contains no Indian reserves and is one of the smaller sub-basins within the Oldman River basin. The Indian reserves that lie within the SSRB and the lands covered by Treaty 7 are between 50 and 150 kilometres south or north of the project. The existing water management structures within or near these Indian reserves, as well as other structures throughout the system, including the project, all have their own operational regimes that interact in varying degrees to directly or indirectly affect the flow of water to accomplish the overall management strategies of the South Saskatchewan River basin.

Following is a brief summary from the evidence of statistical information on each Indian reserve located within the South Saskatchewan River basin.

The Siksika Indian Reserve (146) straddles the Bow River in the lower part of the Bow River basin. An on-stream control structure, the Bassano dam, is located on the eastern extremities of the reserve. Water to irrigate an additional 15,000 acres is allocated for Blackfoot Indian Reserve projects in the *South Saskatchewan Basin Water Allocation Regulation*. This reservoir has irrigated land and can divert water from both the Bow River and the Carseland - Bow River Headworks System. The Western Irrigation District adjoins the reserve's northern boundary and the Eastern Irrigation District is its eastern boundary. The reserve is located 80 kilometres northeast of Pine Coulee in settled prairie farmland and adjacent to the Bow River Irrigation District. Residents of the reserve did not actively participate in the hearing.

Blood Indian Reserve (148, 148A) is bounded on the northeast by the Oldman River, on the southeast by the St. Mary River, on the northwest by the Belly River and on the south by an east-west line running just north of Cardston, Alberta. The St. Mary River and Belly River are

tributaries of the Oldman River. The reserve lies within the Oldman River basin. Water to irrigate an additional 25,000 acres is allocated for the Blood Reserve in the *South Saskatchewan Basin Water Allocation Regulation*. Diversions can be made to the reserve from the Belly River, the St. Mary River and the Waterton-St. Mary Headworks system. The St. Mary Reservoir is located on this reserve's southeastern boundary. The Waterton Reservoir, located on the Waterton River (a tributary of the Belly River), lies a few kilometres to the west. Several other water management projects and irrigation projects are located on the reserve. The Mountain View, Leavitt, Aetna, United, Magrath, Raymond, Lethbridge and part of the Lethbridge Northern irrigation districts are either adjacent to or near the reserve. The reserve is located 60 kilometres southeast of Pine Coulee, in settled prairie farmland. Representatives from the reserve made presentations at the SSRB Planning Program review as well as at the hearing on the current Application. Their focus in the current hearing was on religious concerns regarding archaeological and historic matters.

Stoney Indian Reserve (142, 142B, 143, 144) straddles the Bow River in the upper part of the Bow River basin. The Ghost Lake Reservoir is located along part of its northern boundary and was created by an on-stream hydro dam. Several storage reservoirs are located on tributaries in the mountainous upper reaches of the Bow River. The reserve is located approximately 130 kilometres northwest of Pine Coulee in the foothills of the Rocky Mountains. Residents of the reserve did not actively participate in this review.

Sarcee Indian Reserve (145) is located largely in the watersheds of the Elbow River and Fish Creek, which are both tributaries of the Bow River. Both the Elbow River and Fish Creek pass through the reserve. The Glenmore Reservoir, a water storage project resulting from an on-stream dam on the Elbow River, is located on the eastern boundary of the reserve. The reserve is located approximately 90 kilometres north of Pine Coulee adjoining the southwest limits of the City of Calgary. Residents of the reserve did not actively participate in this review.

Eden Valley Reserve (216) consists of two parts, one part along the Highwood River and the other part on a tributary of Pekisko Creek that flows into the Highwood River. The Highwood River basin is a sub-basin within the Bow River basin. The reserve is located approximately 50 kilometres northwest of Pine Coulee in the foothills of the Rocky Mountains. Residents of the reserve did not participate in this review.

The Peigan Reserve (147, 147B) is located approximately 50 kilometres south of Pine Coulee on the Oldman River within the Oldman River basin. An on-stream control structure, the Oldman River Dam, impounds water flows from the upper reaches and tributaries of the Oldman River and is located approximately 10 kilometres upstream from the western limits of the reserve. Water is diverted into the Lethbridge Northern Irrigation District (LNID) canal by a water management structure located on the Oldman River just above where the river leaves the reserve at its northeastern corner. Part of the LNID lies several kilometres to the northeast, and the United Irrigation District lies to the southeast of the reserve. There are no irrigation projects on the reserve. Water to irrigate 15,000 acres is allocated for the Peigan Reserve in the *South Saskatchewan Basin Water Allocation Regulation*. The Peigan participated extensively in the hearing.

Within the land area covered by Treaty 7, the Siksika and Blood tribes have existing irrigation projects on their lands and the Peigan Nation has conducted studies on irrigation. All three have water allocations for future irrigation projects. The irrigation projects on the Blood Reserve and the irrigation studies on the Peigan Reserve were discussed during the hearing. One of the Blood Tribe's representatives felt irrigation benefits the people of the reserve. It was also stated that: "The construction, the entire development of that particular project was well within the consultation of the elders," and "...was a process that took almost 20 years." The Peigan Nation has no irrigated land on their reserves but reference was made to several feasibility studies which identified potential irrigable reserve lands. The Peigan presentation to the SSRB Planning Program made reference to 30,000 acres (12,147 hectares) as potentially suitable for irrigation on the Peigan Reserve. The study by a consultant for the Peigan Nation referred to: "...the water diversion requirements for 52,269 acres (21,164 hectares) of irrigation on the Peigan Reserve. The Peigan have determined that irrigation will require 146,500 acre feet (180,705 cubic decametres) annually, in addition to rural, municipal, industrial, environmental and commercial water requirements. Irrigation development of 44,000 acres (17,816 hectares) on the reserve (part of the irrigable acreage) will cost an estimated $94.4 million (1986 dollars) and produce annual primary and secondary benefits of $38.1 million with a benefit to cost ratio of 5.25:1." The current Peigan position on the need to protect future water requirements was made known to the Panel, but no specific estimate of water requirements was provided to reflect their current position.

The Peigan were concerned about the diversion of water for the LNID from the Oldman River on the Peigan Reserve. These flows are diverted into the LNID headworks canal by a water management structure located in the northeast corner of the reserve, approximately 35 kilometres upstream from the confluence of Willow Creek with the Oldman River. The LNID canal flows north, crosses the Oldman River, crosses Willow Creek on a structure that includes a water management feature, and then runs east and north to serve the LNID (Map 1.2). The LNID canal was originally constructed in the 1920s. The Peigan are concerned that increasing flows from the Oldman River Reservoir into the LNID canal are being used to accommodate increasing irrigation of agricultural lands in the LNID as well as to supplement low flows in the lower segment of Reach 4 of Willow Creek.

An agreement signed in 1981 between the Peigan Nation and Her Majesty the Queen in right of Alberta, covers the use, control and access to the lands required for a weir, canal, flume, access roadway and construction site on the reserve to divert water into the LNID canal from the Oldman River. Additional documentation submitted on the agreement included copies of two band resolutions and the permit from the Minister of Indian and Northern Affairs pursuant to the *Indian Act.*

The LNID canal crosses Willow Creek approximately 24 kilometres downstream from its diversion structure on the Peigan Reserve, and approximately 28 kilometres upstream from Willow Creek's confluence with the Oldman River. In the past, low flows in this reach of Willow Creek have been supplemented by water from the LNID canal. PWSS indicated that, should the proposed project be approved, these water flows from the LNID canal into Willow Creek would not be required, but

would be supplemented directly from the Pine Coulee Project. PWSS indicated this was one of the benefits of the project.

8.3 Archaeological and Historical Resources Assessment

This section provides a summary of information provided to the Panel on the archaeological and historical resources (this term refers to both historic and prehistoric resources) of the Pine Coulee area. The primary sources of this information were studies undertaken by the Applicant. Archaeological significance of the sites is discussed in Section 8.4 based on submissions from the Applicant, the Peigan Nation (Piik ni), the Blood Tribe (Kainaiwa), and submissions from Alberta Community Development, Historical Resources Division.

The Panel received a submission from the Historical Resources Division of Alberta Community Development outlining the process of historical resource management and protection required by the *Alberta Historical Resources Act* (Section 2.2.7). As required under the Act, a Historical Resources Impact Assessment (HRIA) for the Pine Coulee Project was completed, reviewed and accepted by Alberta Community Development. In addition, the first stage of a mitigation program required by Alberta Community Development was completed and included in the Application before the Panel.

The *Alberta Historical Resources Act* states that all archaeological and palaeontological resources are the property of the Crown and responsibility for managing these resources currently rests with the Minister of Alberta Community Development. The position of PWSS, is that it has followed, and will continue to follow, the direction of Alberta Community Development on both the study of historical resources and mitigation of potential project related impacts.

The historic and prehistoric resources of this region were reviewed in an *Overview Environmental Assessment of Four Potential Reservoir Developments on Willow Creek* (LGL, 1986) prior to the selection of the proposed site. Subsequently, a historical resources impact assessment was prepared at the direction of Alberta Community Development for PWSS by Fedirchuk McCullough & Associates in 1991 and was submitted as part of the Application. Further follow-up work was also done in 1993 by Environmental Management Associates. The primary objectives of the HRIA were to identify historic and prehistoric resources within the proposed development zone, evaluate the significance of sites identified, predict the impact of the project on the sites and identify mitigation measures. The assessment consisted of a review of existing documentation and field studies, including surficial inspection and backhoe testing. The study area included Pine Coulee to approximately 0.5 kilometres from the rim, the areas surrounding the head gates and diversion weir on Willow Creek and alignment of the diversion canal between Willow Creek and the proposed reservoir.

A total of 35 prehistoric sites and nine historic components were identified by the HRIA. The prehistoric sites consist of 22 stone feature sites, eight campsites, two stone feature sites with campsites and three killsites with campsites. The nine historic components relate to early settlement of the area and comprise one trail, rock carving sites and six farmsteads and ranches. No burial sites were identified by this assessment.

Among the prehistoric sites, stone features include both stone circles and cairns. Stone circles identify areas of habitation where a number of associated activities such as tool production and food preparation may have taken place. Cairns are piles of stones that may have served as directional markers, burial chambers, cache pits or animal traps. Campsites are habitation sites that lack such structural evidence as stone circles for dwellings. In the study area, two campsites were associated with stone features and another three with areas where game was killed.

Two of the prehistoric sites identified in the HRIA were of specific note and received considerable attention during the hearing: a petroglyph site (site EaPk 180) and a ribstone also termed buffalo stone or Iniskim (site EbPk 18). The petroglyph site, close to the initial planned alignment of the diversion canal, consists of a number of petroglyphs on the glacial erratic and 18 well-defined stone circles. The Panel was told that, based on recommendations from Alberta Community Development, the Applicant relocated the proposed canal to avoid this site. In addition, PWSS has acquired the land surrounding the petroglyph site to ensure that the land would remain under Crown control. The ribstone is located on the east side near the north end of the reservoir above the full supply level and would not be subject to primary impact. The ribstone site includes 20 stone circles, two cairns and a potential rock alignment. The ribstone represents the shape of a reclining bison with a series of parallel man-made incisions indicating ribs. According to the HRIA, ribstones are relatively rare artifacts. PWSS indicated that they were willing either to "...secure the land or assist in negotiating a settlement with the current landowners, and achieve some sort of arrangement, if we could, for the use of that site."

Although the prehistoric petroglyph site would be avoided by realigning the diversion canal, and the ribstone is above the full supply level, protection of these sites is of concern to aboriginal people and PWSS. In particular, the petroglyphs would be within an area of intensive development and near the canal, the emergency spillway for the dam, the day use area, and the relocated Secondary Highway 527. The HRIA recommended that this site be fenced to avoid disturbance during construction and that interpretative activities at Willow Creek Provincial Park could include this site. The HRIA also recommends some unspecified form of protection for the ribstone, which could be subject to vandalism or theft because of its exposed location.

Historic petroglyph sites or rock carvings are locations where individuals have left permanent inscriptions, often in the form of initials. The farmstead ranch sites are remnants from early agricultural settlers in the area. One of the historic sites (EaPk 196) is the location of the former Oxley Ranch. This site, located in the vicinity of the proposed headpond, would not be inundated but would be subject to increased flooding and an elevated water table.

Twenty-five of the 35 prehistoric sites are associated with proposed development zones, most of which are located within the full supply level of the proposed reservoir. Three of the historic sites would be located within the full supply level. The HRIA provides an evaluation of each site and provides recommendations for further study and mitigation. A two-staged program including verification of features, site mapping and individual feature mapping was recommended for 19 prehistoric and three historic sites. Because of the spiritual nature of the petroglyph and ribstone sites, the HRIA recommended that aboriginal people in the area be contacted for information on the relationship between these sites and other sites within Pine Coulee and their aboriginal religious significance.

A review of the 1991 HRIA was undertaken by staff of Alberta Community Development. The review concurred with the consultant's recommendation that a two-staged mitigation program be implemented. The first stage would consist of small-scale excavations to define areas where large-scale excavations could then be conducted. Alberta Community Development would review these results and identify additional work required. The department took the position that neither the ribstone nor the petroglyph site would be damaged by the proposed development and that native spiritual knowledge about the area would not be directly affected. Alberta Community Development cannot require consultation under the *Alberta Historical Resources Act*. It commented that such contact might be appropriate and could yield very useful information. Alberta Community Development did not agree that it has the authority to require that aboriginal people must be contacted prior to implementing the second stage of the mitigation program.

In the fall of 1993, Environmental Management Associates (EMA, currently a member of the Golder Associates group of companies) completed the first stage of the *Historical Resources Impact Mitigation Study* (final report issued in September 1994), a program required by Alberta Community Development based on recommendations in the 1991 HRIA. A total of 16 sites were examined in the 1993 program, which included site boundary definition involving subsurface testing, visual observations and sample excavations. EMA recommended that development could proceed with no significant impact in all areas with the exception of seven heritage resource sites. Of these, two may be affected by road relocation and further assessment was recommended by the consultant. Hand excavation was recommended at five sites prior to construction or inundation.

The EMA report indicates that within a regional context Pine Coulee is located in a strategic position as part of a north-south travel corridor between the Oldman River drainage and the Highwood River drainage, leading eventually to the Bow River. EMA notes that for pedestrians and horses it would be relatively simple to continue northward through Pine Coulee and still travel in a protected area with access to fresh water and other resources. EMA also notes that the lack of potable water and the geomorphology of the coulee would be major factors in limiting prehistoric habitation in Pine Coulee. The HRIA did not identify any evidence of the presence of the Old North Trail, an ancient trail of importance to aboriginal people, in Pine Coulee.

Requirements for the second stage of the mitigation program remain to be established by Alberta Community Development. The Panel was advised that the final mitigation program for

this project would involve oral interviews with different constituencies, including aboriginal and local. Alberta Community Development stated that, if the project proceeds, it would be working with PWSS to design a mitigation strategy and conduct studies of the sites known to be affected: "So that would require collaboration between our office, we will be issuing a call for proposals, there would be reviews of that, there would be new permits issued, and then there would almost certainly be follow-up studies after that as well." Alberta Community Development advised that it would recommend PWSS consult with aboriginal groups during the mitigation process.

With regard to consultation with aboriginal groups, PWSS told the Panel that this aspect of the mitigation program was underway. Following the Pre-Hearing Conference, the Applicant's archaeologist contacted six aboriginal groups: Peigan Nation, Blood Tribe, Siksika Nation, Tsuu T'ina, Stoney Tribes and Columbia Lake Band (Kootenay). The consultant advised the Panel that she had conducted a site visit with members of the Blood Tribe and the Siksika Nation, and had made arrangements to meet with Peigan elders following the close of the hearing.

A historical resources monitoring program was conducted by Fedirchuk McCullough and Associates in 1992 and a report was prepared in March 1993. The monitoring program was required by Alberta Community Development to ensure that archaeological features were not disturbed during field testing procedures related to proposed project. Sites monitored included 25 sand and gravel prospects, alternative alignments for the diversion channel and weir dykes, and test holes in the dam site area. The report contains recommendations for further study or site avoidance.

8.4 Significance of Aboriginal Sites and Artifacts

Assessment of the archaeological research significance of sites that could be affected by the proposed development was a major focus of the *Historical Resources Impact Mitigation Study* prepared by Environmental Management Associates (1994). The objective was to determine which were significant research sites and would require additional mitigation prior to construction. Significance of archaeological sites was based on four research criteria: site integrity, content, uniqueness and scale. Site integrity refers to the amount of disturbance to the site that would reduce interpretative potential. Among the sites examined, overall site integrity was rated as good to excellent, with only one site subject to cultivation. Site content, which refers to the quantity and complexity of archaeological materials, was rated high enough at five sites to warrant further investigation. These five sites were also considered to contain unique features or artifacts. The fourth research criterion, scale, refers to the potential of the site to contribute to an understanding of prehistory or history. On the basis of scale, four sites were not found to be significant. Eight sites were deemed to be significant at a local level, one at the provincial level and three at provincial and regional levels.

The Peigan Nation told the Panel it was of the view that there were several deficiencies in the heritage resource assessment. It said it had not been consulted about ethnohistorical or ethnological information on the project area and that studies undertaken for PWSS

failed to consider the heritage resources of nearby lands in assessing the significance of the concentration of sites found in Pine Coulee. The Peigan said that the province has been in possession of actual knowledge of the research significance of at least some sites in this area for three years and failed to notify the Peigan of this fact. The Peigan advised that it is impossible to assess the spiritual and cultural value of the heritage resources to be found in the Pine Coulee until proper consultation with native peoples has taken place. The Peigan also said the studies failed to assess the impact of the project on the Old North Trail that it believes passes directly through Pine Coulee. In addition, it noted that the assessment did not consider the effects of increased irrigation development on remaining portions of the trail in the valley.

The Peigan Nation and its expert witness took the position that the Applicant's research studies did not consider the sites in a regional context nor did they assess the significance of the sites either individually or collectively within this context. In particular, the association of the sites with the petroglyph and ribstone may, according to the Peigan, confer spiritual and cultural significance to all sites within Pine Coulee. Sections of the HRIA were quoted by the Peigan in support of this position. The passage quoted referred to the uncommon number of ideological constructs in the area. According to the HRIA, the spiritual connotation of these features and the spiritual significance of this area was also reflected in a Stoney origin myth. The passage from the EIA concluded that, "Viewed within a 'spiritual' context, *every* site within the Pine Coulee Project area is significant because each potentially represents different aspects of activity associated with 'reverence' of or association with the ribstone and glyph sites in this section of the coulee." (Emphasis in original). The Peigan again referred to the EIA to support its view of the above analysis: "Because of the spiritual nature of site EaPk 180, the Willow Creek Petroglyph Site, and EbPk 18, the Pine Coulee Ribstone Site, it is recommended that the aboriginal peoples in the area be contacted for information as to the relationship between these sites and the Pine Coulee." The HRIA also recommended, and PWSS accepted, that both of these sites be avoided by development and that another site be avoided by the proposed road realignment.

In support of the Peigan's belief that Pine Coulee represents a larger complex of spiritually significant sites, an expert for the Peigan recommended that the historical resource studies be extended to include adjacent areas both upstream and downstream on Willow Creek, upstream on Pine Creek and the adjacent Boneyard Coulee to provide comparative data for assessment of sites within the project area. In his opinion, the significance of the sites within Pine Coulee can only be assessed if the nature and extent of sites outside the project area are known.

In response, the Applicant's consultant stated that the HRIA had addressed the question of regional significance. However, she did point out that the HRIA was primarily a field inventory and, with the exception of the petroglyph and ribstone sites, it did not provide the detailed information necessary to relate specific sites to a regional pattern. Alberta Community Development informed the Panel that historic and prehistoric resources of this region were reviewed extensively in an *Overview Environmental Assessment of Four Potential Reservoir Developments on Willow Creek* (LGL, 1986). Further, Alberta Community Development did not support the position that the historic sites should be viewed as a complex. It stated that many of the archaeological sites, such as

tepee rings and campsites, are common in Alberta and there is no archaeological research reason to believe that they are associated with the ribstone or petroglyph sites. Another expert witness for the Applicant told the Panel from an archaeological research perspective that the density of artifacts even at the best site in Pine Coulee (EaPk 201) is considerably less than that at Head-Smashed-In Buffalo Jump or at a site at Fort Macleod.

The third major issue raised by the Peigan's expert witness related to the potential impact of the proposed project on the Old North Trail. According to the witness, the Old North Trail is an ancient Indian trail used by the Peigan and other tribes. In addition, the trail was used by white traders, travelers and explorers. In his submission to the Panel, the expert observed that trail markings can still be found at crossings of Willow Creek and in Pine Coulee. The Peigan's expert witness indicated that his evidence of the trail in Pine Coulee was based on air photo interpretation and agreed that two trails identified in the HRIA were of recent vintage and were not evidence of the Old North Trail.

PWSS took the position that there is no evidence that the Old North Trail is located in Pine Coulee. In support, Alberta Community Development indicated that it had no documentation indicating that the trail ran through Pine Coulee.

The Blood Tribe panel of five witnesses made a submission and presentation to the Panel concerning the cultural significance of heritage sites in the project area. It submitted that the Crown has a fiduciary obligation to ensure that cultural and religious rights of First Nations people are protected and said that the Panel must act to ensure protection and recognition of their cultural rights and religious freedoms.

The position of the Blood Tribe was that sites with special religious, spiritual and cultural significance at Pine Coulee should not be disturbed and it was "...greatly concerned that if these sites were not protected they will be lost, vandalized, or shown great disrespect at the least. Such action will be tantamount to desecration or sacrilege in any other religion."

The Panel was informed that religion continues to be the underlying foundation of the Blood Tribe and serves as a guideline for the positive functioning of all other social, economic and political activity. "Our religious beliefs and our ceremonies are the cement that bind our society together. They give our people sustenance; they have seen us through many trials and hardships." Accordingly, the Panel was advised that "...it is time to re-evaluate how Indian culture and religion are viewed and treated. There needs to be a maturing process and a commitment to examine existing views and relationships between Indian people and Euro-Canadian institutions and governments who have assumed responsibility for our heritage, our history, our lands, and the bones of our grandfathers and grandmothers."

One of the Blood Tribe representatives said that he had visited the area with his grandfather when the was approximately 10 years old and for many years he had hoped that other

people would not discover certain things that are very precious to the Blood people. These things included the buffalo stone, campsites, burial sites, fasting sites and buffalo jumps.

As part of its submission, the Blood Tribe made the following recommendations to the Panel:

1. The Iniskim, buffalo stone site (EaPk-18) should be designated a spiritual site and protected.

2. The burial sites should be designated as such and given the same protection and respect as any cemetery in this country.

3. In the event the Panel is not prepared to make recommendations to extend that protection to these sites, that the Blood Tribe be allowed to relocate the Iniskim, buffalo stone to their Sundance grounds.

4. That an information centre be developed as part of the recreational plan to inform the public of the origins and use of this land.

5. The Joint Panel Review support a call for a re-evaluation of social policy and legislation as it relates to the view and treatment of Indian burial, cultural and sacred sites, as part of an overall review of our cultural and religious rights, with a view to an enactment of legislative protection.

With regard to the third recommendation, the Blood Tribe believed that the Blackfoot Confederacy would consent to the Iniskim being moved to its Sundance site. The Blood Tribe said that their representatives would communicate with the Peigan before this was done, if the project were approved. "The main thing is that rock be protected, whether it's on our Sundance grounds or with the Peigan, wherever they designate. So to us it is not a question of jurisdiction or getting into those kind of arguments." Additionally, the Blood Tribe said that the Horn Society on its reserve is a religious society that "...basically has never interrupted its ceremonies, even with the prohibition of our religion." Members from the larger Blood Confederacy were said to be included in the membership of the Horn Society, so "...it would be a given that they would consent to it being on the sacred Sundance site."

With regard to the fifth recommendation, the Blood Tribe offered an example from the United States of the type of legislation that would fulfill this recommendation. Also, the Blood Tribe submitted a Band Council Resolution that identified the Band's responsibility to protect historical, cultural and religious resources both on and off reserves and explained the general value orientation of the Blood Tribe to these resources.

During the hearing, the Blood Tribe representatives were asked how they saw this recommendation within the context of the more narrow scope of the Panel's jurisdiction, particularly in relation to the Panel's jurisdiction under the *Natural Resources Conservation Board Act*. They answered that "...it would give future panels, certainly, a better guidance when it comes to (a) situation like this. And it certainly wouldn't hurt to make that kind of recommendation so that we are clear on how these should be dealt with." Additionally, the Panel was advised that, in reviewing the Terms of Reference issued by the federal Minister of the Environment, there are specific instructions to the Panel to deal with issues that fall within federal jurisdiction, including the impacts of the project as they relate to the concerns and interests of aboriginal people. "It is this particular aspect of the Terms of Reference that we had addressed."

The Blood Tribe advised the Panel that the field of archaeology and Alberta Community Development have their research criteria for determining the significance of archaeological and historic sites based on Euro-Canadian scientific valuation. However, the Blood Tribe "...deem all sites where our ancestors have marked their presence as culturally and historically significant."

The Blood Tribe noted that there are some significant developments that are taking place within offices such as that of Alberta Community Development and "...their policy has been to get in touch with us and get the appropriate people to come in...." to inform landowners as to the cultural significance of sites located on private property. However, the Blood Tribe was reluctant to make any reference as to how burial sites can be identified because of the potential for damage to those sites.

Representatives of the Blood Tribe also told the Panel that they have confidence in the ability of particular individuals within Alberta Community Development to "understand our situation and assist us" when issues regarding historical resources arise. Additionally, the Peigan Nation's expert advised the Panel that they saw Alberta Community Development playing a favourable role in managing historical impacts associated with the project if it were approved.

The Blood Tribe shared the Peigan's position that Pine Coulee was part of the Old North Trail. When asked whether there was any evidence to support this proposition, the Panel was advised that "...it is within our knowledge that that is part - it's a given, as far as we are concerned."

In responding to the Blood Tribe's recommendations, PWSS noted that the Iniskim is currently located on private land, and it is not land that is required for the proposed project, but that "...without question should the project go ahead, we would do everything in our power to either secure the land or assist in negotiating a settlement with the current landowners, and achieve some sort of arrangement if we could, for the use of that site." PWSS believed that the Iniskim would best be kept as it is and where it is, rather than relocated. With respect to the Blood Tribe's interest in a visitor centre, PWSS advised that it has already had discussions with Alberta Community Development and the Parks Service Division of Alberta Environmental Protection about the possibility of an interpretive program and ongoing education. Both departments indicated their

willingness to participate, as did PWSS for the period of its involvement in the project. Without prejudging where future consultation would go, PWSS thought that there are other opportunities for aboriginal involvement in various project-related programs, including the possibility of employing aboriginal people on archaeological crews, having school tours, or volunteer programs. "And certainly the opportunities exist for ongoing management of the resources that are left on Crown land."

In its closing address to the Panel, PWSS undertook to ensure First Nations involvement in interpretation of features with particular concern for burial sites and to form an agreement for an appropriate manner of dealing with any burial sites identified. As well, PWSS restated its intention to involve First Nations in its archaeological mitigation program.

The Public Advisory Committee also indicated their preference that the aboriginal ribstone remain in its current location and that the petroglyph and other artifacts become part of a public education and interpretive program. They also supported the active participation of aboriginal people in the development of an interpretive program.

Unrelated to aboriginal historical and cultural concerns but of historical significance is the site of the former Oxley Ranch (EaPk 196). The Panel was told that the first headquarters of the Oxley Ranch was located northwest of the Town of Claresholm and that the ranch was subsequently relocated to site EaPk 196. The remnants of the ranch buildings were described as being badly deteriorated and excavation of the site has been proposed as a mitigation measure. According to the Applicant's consultant, the significance of the site is that it is an early ranch and that it was owned by British people. The Applicant's consultant felt the potential impact of the proposed project at the EaPk 196 site is mitigable.

8.5 Panel Views Regarding Aboriginal Artifacts

The Panel heard extensive technical and historic evidence on archaeological resources in the Pine Coulee area, including detailed questioning and discussion about this research and its implications. The Panel commends the Applicant, Alberta Community Development and their consultants for their careful and thorough research work. It also commends them and the aboriginal participants for the way they sought to address the issues of archaeological and historic resources during the hearing.

The Panel is concerned that the religious, spiritual and cultural significance of the archaeological sites at Pine Coulee to the aboriginal people be fully identified, understood, and reflected in the planning and development of the Pine Coulee Project, should it proceed. The Panel accepts that the petroglyph and Iniskim buffalo stone are significant to the religious, spiritual and cultural interests of the aboriginal people.

The Panel notes the reluctance of the aboriginal elders to identify and explain the importance and significance of various sites and artifacts for a variety of reasons based on past experience. The Panel also notes the request to re-evaluate how Indian culture and religion are viewed and treated and that there needs to be a maturing process and a commitment to examine existing views and relationships between Indian people and "Euro-Canadian institutions and governments."

The Panel believes that the presentations made by the elders and Band members are an important part of the process. Protection and recognition of cultural and religious freedoms depends upon awareness and understanding. The aboriginal presentations to the Panel have emphasized that there are sites at Pine Coulee that have special religious, spiritual, and cultural significance to elders.

The Panel is cognizant that the criteria used to assess the significance of the sites at Pine Coulee from a research perspective may not yet fully reflect the criteria used by aboriginal elders; with understanding of the Indian culture and religion, the criteria used by archaeologists and elders may coincide. The Panel also notes that the objectives of Alberta Community Development's heritage resources program is to ensure that significant artifacts are protected and preserved, and that the Department has been working more closely with aboriginal people in identifying, assessing, and managing historical impacts associated with proposed developments.

The Panel has considered the issue of the entire complex of sites that were found in and around Pine Coulee and their sacred or religious significance in combination with each other. The Panel accepts that many of the archaeological sites, such as tepee rings and campsites, are common in Alberta and may not be associated with the ribstone or petroglyph sites. However, the Panel notes that further archaeological assessment remains to be completed and that the evidence from the aboriginal presentations indicated that based on their traditional knowledge, the sites contained more information than was made known to the archaeologists. The Panel notes that some important features of the sites may not have been recognized by the researchers, and that the aboriginals had a different understanding of the sites and the artifacts and their interpretation. The Panel is concerned that the aboriginal people mentioned burial sites that were not made known to the researchers, and left the Panel with the impression that the sites may have more spiritual and religious significance than known or understood through the research conducted to date. The Panel believes that in the face of uncertainty a more prudent and cautious approach should be taken before any final conclusions are drawn regarding the significance of the various sites and artifacts that have been identified to date near the ribstone and petroglyph. In this case, where it is recognized that the petroglyph and ribstone may be relatively rare and are considered to be significant at provincial and regional levels, conservative assumptions regarding mitigation should be made there and at nearby sites until sufficient evidence has been considered to warrant reaching other conclusions.

The Panel has concluded from the evidence currently available, there is a need to require that the Applicant, in a manner satisfactory to Alberta Community Development, protect two sites that were discussed during the hearing; the petroglyph (site EaPk 180) and the Iniskim or buffalo

stone (site EbPk18). The Panel understands that the petroglyph site has already been purchased by PWSS and that the Iniskim site is under protection. The Panel would also require that this site also be purchased and protected.

The Panel heard that, in regard to developments such as the proposed project, all significant aspects of the archaeological, prehistoric and historic resources are safeguarded and managed through the existing regulatory regime in Alberta. The activities include: identification, designation, and where appropriate preservation of significant resources; establishing responsibility for mitigation of negative impacts that may be caused by a development; ongoing monitoring; and where required final disposition of artifacts. The Panel notes that participants expressed confidence in the ability of Alberta Community Development to fulfill their role in this matter. The Panel concludes that, with respect to archaeological, prehistoric and historic resources, they are protected through the existing regulatory regime.

The Panel accepts the evidence presented by government agencies and archaeological consultants indicating that, the Pine Coulee sites and artifacts are important, and that they have been, or will be adequately researched and considered before any project construction or operation. If there are unidentified sacred and burial sites at Pine Coulee overlooked by the Applicant and referred to by the Blood Tribe in its presentation, the Panel is of the opinion that these matters can be resolved between Alberta Community Development and the aboriginal people. The Panel understands the wishes of the aboriginal people not to identify missed grave sites and their wish to see them left undisturbed. However, the Panel believes that without specific guidance from aboriginal people, any unidentified sites, could be disturbed during construction, or flooded during operations, should the project proceed. The Panel recommends that any further identification or elaboration of the burial sites or artifacts and their meaning to aboriginal people should continue to be addressed through consultation between the aboriginal people involved and Alberta Community Development. This consultation should involve aboriginal elders and take place to the satisfaction of Alberta Community Development before the proposed project is constructed.

The Panel agrees that there should be multi-stakeholder input to monitor and manage the Pine Coulee archaeological resources; including monitoring the mitigation process during project construction and subsequent operation, including any future educational or spiritual use of either the sites or artifacts. The Panel supports including an interpretive program as part of the Pine Coulee Project and the Panel believes multi-stakeholder input should be sought about its feasibility, development, and management. Stakeholders include Alberta Community Development, PWSS, the operator (Alberta Environmental Protection), the Public Advisory Committee, aboriginal groups and representatives from the Municipal District of Willow Creek and other communities in the project area. The Panel appreciates that a spirit of cooperation was expressed by local residents to such a process.

The Panel notes that the participation of the public is an essential component of the resource development process, and was a requirement of the E.I.A. process that has identified the need for various mitigative actions to be implemented, should the proposed project proceed. The

public participation associated with the proposed project has resulted in the project being more sensitive to public concerns and needs and more consistent with sustainable development. In this context, the Panel notes the concerns and interests of the aboriginal people and others in the historical resource impact assessment conducted for the proposed Pine Coulee Project. Mandatory public participation has become a legislated requirement of environmental impact assessments. The Alberta legislative requirements for historical resource impact assessments contain no equivalent requirements for public involvement and consultation. In cases such as the proposed Pine Coulee Project, the historical resource impact assessment would, in the Panel's opinion, have benefited from a requirement to notify the public of the work involved and the results, with appropriate opportunities for consultation. Therefore, the Panel recommends that Alberta Community Development establish public participation requirements for historical resource impact assessments for projects like Pine Coulee that are consistent with and complementary to similar requirements now mandatory for environmental impact assessments in Alberta.

The Blood Tribe asked that the Panel consider commenting on the ownership and handling of prehistoric aboriginal sites and artifacts. It was recognized that this could be of assistance to future review panels. The Panel understands that under the existing laws of Alberta all archaeological and palaeontological resources belong to the Crown.

The Panel received evidence that the Pine Coulee area was in the traditional territory of the Blackfoot Confederacy which included, among others, the Peigan Nation and the Blood Tribe. The Panel was informed and understands that it is difficult, if not impossible, to associate any of the prehistoric sites conclusively with any particular present-day aboriginal group. The Panel believes that discussions should continue to take place between PWSS, Alberta Community Development and the Treaty 7 aboriginal people about the identification, proper treatment, ownership and use of all Pine Coulee archaeological and historic sites and artifacts. The Panel understands that such discussions are already taking place and believes that more discussion would be of value to all parties.

The Panel notes the fiduciary obligations of the Crown and the Blood assertion that such obligations include ensuring that cultural and religious rights of First Nations people are protected. The Panel particularly notes the Blood Tribe concern regarding the treatment of Indian burial, cultural and sacred sites and their request regarding the need for legislative protection of aboriginal burial sites. The Panel notes again the Blood position regarding the need to re-evaluate how Indian culture and religion are viewed and treated. The Panel realizes that Alberta legislation regarding historical resources has some relevance to certain aspects of this concern. However, the matter is much more complex and pervasive than the purview of this legislation. The Panel also notes the importance of these matters to the Blood Tribe as expressed through the existing Band Council Resolution regarding these on and off their reserve. In the opinion of the Panel, the examination of the interests and concerns of aboriginal people in the context of the Pine Coulee Project supports the need for a re-evaluation of social policy and legislation, as it relates to the treatment of Indian burial, cultural and sacred sites that are located off Indian reserves on private lands, as part of an overall review of aboriginal and religious rights. The Panel notes the lack of evidence regarding the current

level of protection provided to such matters by Indian and Northern Affairs Canada. The Panel will address this matter in its recommendations to the Government of Canada.

The Panel notes the assertion of the Peigan Nation and Blood Tribe that the Old North Trail was a part of their culture. The Panel believes that further research would be required to establish its location along the Eastern Slopes of the Rocky Mountains and far beyond the scope of the proposed project. The Panel believes that the testimony before the Panel from both the Peigan Nation and Blood Tribe that the Trail passed through or near Pine Coulee should be given further consideration by Alberta Community Development and PWSS to decide whether further investigation is appropriate. The Panel believes that the two trail segments identified in the HRIA as recent settlement trails need no further consideration. The Panel believes that should the Trail be identified at Pine Coulee that with appropriate mitigative measures, if required, this matter could be properly attended to and would not have an effect on the project, should it proceed.

The Panel was asked by the Blood Tribe to consider whether or not the buffalo stone could be removed from its present location and moved to the Blood's Sundance grounds; an area used by all the Blackfoot Confederacy. This request was conditional upon whether it could be protected in its present location. As noted, should the project proceed, the Panel would require that the buffalo stone lands be purchased and the site protected. The Panel believes that with appropriate protection the buffalo stone would be fully accessible to the Blackfoot Confederacy for its spiritual and religious purposes, making the relocation unnecessary. However, if protection at the present location could not be accomplished, the Panel believes that relocation would have to be further considered by Alberta Community Development and affected parties.

Subject to the Panel's requirements regarding protection of the petroglyph and buffalo stone and the other necessary or required mitigative work identified by PWSS and required by Alberta Community Development, the Panel believes that if the proposed Pine Coulee Project were approved, it could proceed without undue damage or disrespect to aboriginal artifacts and sites.

8.6 Summary of Aboriginal Environmental Concerns and Interests

The Panel provides the following summary without comment. The Panel views regarding environmental matters were presented in Section 5 of this Report and are discussed further in Section 9.

The Peigan Nation and the Blood Tribe told the Panel the Pine Coulee area was of particular cultural relevance to their people. They pointed out that aboriginal people hunted, camped and traveled north and south through the area for many hundreds of years. Many signs of their occupation exist in the area and are important to the Blackfoot people. Pine Coulee includes sites that are sacred to them. The Peigan Nation said that it opposes the approval of the Pine Coulee Project on two grounds related to environmental issues. The Peigan believe the Applicant's study of the impact of the proposed project on the wildlife resources on Crown lands does not make it clear

whether the interests of the Peigan Nation will be detrimentally affected. The Peigan also believe that the project will require additional water to be released into the Oldman River through the Peigan Reserve causing damage to the riverbed within the reserve and depleting the water supplies available "...to meet the treaty entitlement of the Peigan Nation."

Several personal stories from aboriginal people were related about the Pine Coulee area: 1) a Peigan elder reported some sacred activities in the Pine Coulee area in the 1930s when he traveled through the area with his parents on their way north to the Siksika Reserve; 2) one Blood witness indicated that his grandfather was born close to the area; 3) another Peigan man was reported to have hunted on private land in the area in the recent past; and 4) one Peigan participant indicated that reserve members often hunted in the Crown forestry reserve land to the west of Pine Coulee.

Ms. L. Cropearedwolf outlined on behalf of the Elders Council of the Blood Tribe some of the Blood's philosophy toward the environment in the following manner:

> This land is not ours to exploit. We were taught to respect all of the Creator's creations. Everything in the world was sacred to us native people. I always like to compare the native people's perspective of the world to the most beautiful church in the world. It could be any church of any denomination. In as much as everything in a church is revered as sacred, you walk into a church with the respect, you walk in there with a lot of respect and sacredness in your spirit, in your thoughts, and in your actions. And you take care not to make any noise. You are in there with all the respect that you can give. In the same manner, all of the creations in the world is sacred and is respected by our people, our native people. The whole world is a church of the native people. I have said that, and I am saying it again. Through the fact that we respect everything, we respect the air, we respect the light, the rain, thunder, flowers, grass, trees, herbs, everything that you see around you in the world. The birds in the spring, we greet the birds in the spring and the grass and the berries, and we never forget to thank the Creator for all these things that were given to us.

Mr. Wilton Goodstriker stated:

> Our religion, in most part, defines our relationship, defines the harmony that is necessary between the universe, Mother Earth, and all that lives. At all times when one is considering even a minor act of pulling a blade of grass out of the ground, there is rituals that govern that particular activity. If you were to ask your brothers and sisters of the sky, the four-leggeds, to change their ways, there is requirements of ritual involved, otherwise an imbalance is created. Unless one pays respect to the harmony that exists, the imbalance that is created will bring hardship, not only to those involved, but to the whole environment. These hills hold our people. These hills are our people.

Similarly, Mr. Goodstriker also stated, "Among our people, there are several things that are terrifying to many of our elders. One is to lose property to fire. Secondly, is to lose property to water. It brings tremendous pain to our people to discover, to come home one day and to discover our home is now under water."

8.6.1 Water Management

The Peigan are concerned about the cumulative effects on stream flows within Willow Creek and the Oldman River. It was the Peigan's view that, until recently, the Applicant denied there would be any impact on the Peigan Reserve from the proposed project. "In response to submissions by the Peigan, the applicant has produced models showing that there will be a frequent, but usually negligible, impact." According to the Peigan's expert there was fairly close agreement between the Peigan and Alberta Environmental Protection on the magnitude of the Willow Creek impact. Where these parties disagreed was on the "cumulative impacts of releasing water from the Oldman River Dam for the Main Environment Canal (Lethbridge Northern Irrigation District canal) and the minimum flows required downstream from the diversion works for that canal to meet downstream requirements in the Oldman River."

The Peigan said that, "... here, as throughout the EIA, the Peigan, and First Nations in general, are invisible. The issue is not that the assessment is wrong. The issue is that no one asked the questions of relevance to the Peigan Nation."

> In view of the major impacts already suffered by the Peigan Nation, and in view of the shared view that there will be at least some impact of the present project on water flows through the Peigan Reserve, we submit that the impact, direct and cumulative, of the Pine Coulee Project on the Peigan Reserve must be expressly addressed and directly considered.

In addition to issues associated with direct and cumulative impacts potentially associated with the Application, the Peigan were concerned that the proposed project would interfere with its claim to water rights believed to be conferred by Treaty 7.

The Peigan Nation believes that they were guaranteed water rights as part of treaty land allocation, a matter of legal dispute between the Peigan Nation and the province of Alberta. It is the Peigan Nation's view that "an eventual entitlement to be awarded will take precedence over any local allocation both because it is prior (dated to 1877) and because it is a treaty right, and thus constitutionally protected." The Peigan submitted that no new water licences should be issued, whether or not the Pine Coulee Project proceeds, unless such licences are compatible with the Peigan's view of its entitlement. "To do otherwise is to risk creating a major conflict between the local white and Native communities."

The Peigan said that the Applicant is unable to say whether the capacity of the river system is sufficient to meet the needs of both the local irrigators and the Peigan Nation. "It is our submission that no allocations should be made unless it is clear that those allocations can clearly be met without interference with the future demands of the Peigan. This avoids placing the Panel in the position of having to guess whether the consequence of conflict would be visited on the heads of the Peigan who would fail to obtain water, or on an irrigator who would lose previously allocated rights."

The Peigan Nation urged the Panel to defer its decision "...until proper studies are done on the impact of the proposed project on the Peigan wildlife, heritage and water rights."

If the Panel were to approve the project, the Peigan recommend that they be directly contacted and involved in ongoing mitigation studies in all of these areas. "We do not consider that it is possible or proper for 'whites' to determine what is appropriate mitigation to protect the interests of the Peigan. To the contrary, these are matters in which Peigan participation is necessary."

PWSS responded saying that "...the Peigan Nation is not directly affected by this project." PWSS believes that any impact on the flow of water in the Oldman River would be either negligible or beneficial to the Peigan Nation, and that one aspect of the Pine Coulee Project would be to 'even out' the flow of Willow Creek. "Under current situations, the majority of the flow of Willow Creek occurs during the spring runoff period and often there is a minimal flow during the summer when it is most needed." PWSS said that Willow Creek currently has limited flow regulation, while the Oldman River is regulated. "These two systems must be managed, in concert with the Bow and Red Deer rivers, to ensure that the province of Alberta meets its commitment to the province of Saskatchewan to pass 50 percent of the flow of the South Saskatchewan River Basin." PWSS said that Environment Canada agreed with the Applicant's approach to water modelling in the basin and said that it would have used the same model.

8.6.2 Wildlife

In the view of the Peigan's expert "...neither the design or results of the wildlife studies answer the questions that are relevant to the protection of Peigan treaty rights associated with hunting and the use of big game. These studies focused almost entirely on Pine Coulee and Willow Creek. They did not consider seasonal movements of big game animals from Pine Coulee or Willow Creek to the forested areas to the west that are favoured hunting areas of the Peigan. They did not consider the value of Pine Coulee as a movement corridor for wildlife ...the database is totally inadequate to come to any kind of even speculative sort of conclusions concerning movement corridors." Also, the Peigan said the Applicant should have discussed how irrigated alfalfa affects the behaviour of big game animals, particularly mule deer and elk.

The Peigan said that there were also interpretive deficiencies. For example, the Peigan felt that the fact that nine moose were observed "...requires some kind of interpretation because they have significance to the Peigan hunting and treaty rights." Also, the Peigan were concerned about

the Applicant's use of habitat evaluation procedure models. The Peigan's expert said that he could not evaluate what the Applicant did with these models because there was no discussion of the results of the models. The Peigan's expert was not willing to accept the Applicant's analysis that some of the vegetation in Pine Coulee is poor habitat: "This is very good winter food habitat for mule deer and this is overlooked." The Panel was also told that no data was presented to allow interpretations of the relationship of habitats in Pine Coulee to those in the Crown's forest reserve.

Another criticism of the Application by the Peigan was that there was no cumulative effects analysis of how various projects including the Oldman River Dam, Chain Lakes, Pine Coulee, irrigation development, and grazing have affected or would affect big game populations in the future. "I believe that this is crucial in terms of the Peigan's interests. They are concerned over many of these developments which could affect their use of the wildlife resource." To emphasize this point, the Peigan's expert made reference to the following statement of the Department of Fisheries and Oceans: "The fisheries data provided in this EIA are a snapshot in time of the existence of particular species in Willow Creek study areas, but are deficient with respect to understanding migration requirements and population structures of these fish and their habitat utilization." It was the Peigan expert's view that the same is true of big game. He said that these concerns illustrate the importance of a basin-wide ecosystem approach to this environmental assessment in order to fully understand the impacts of the proposed project with respect to big game.

Another Peigan concern was associated with mitigation and compensation planning. "Because the studies were not designed and did not produce information that would allow evaluation of impacts to Peigan treaty rights, there are no answers or no indications as to what the impacts to the Peigan would be with the incremental addition of the Pine Coulee to the other projects that are out there that affect wildlife." The Peigan's expert told the Panel that it is not possible at this time to design a mitigation and compensation plan because the impacts on and costs to the Peigan are not known. He said costs associated with mitigation and compensation should be included in the PWSS benefit/cost analysis.

Although the Peigan did not bring forward information to the Panel to indicate any significant contemporary use of Pine Coulee for cultural or subsistence purposes, the Peigan's expert said the Applicant's wildlife analysis should have contained some consideration of the social use of wildlife and the related social impact on the Peigan. In his view, it is not possible to design a study that would identify potential impacts to Peigan hunting rights without knowing "where they hunt, what they hunt, and how they hunt and, there was no communication with the researchers when they designed or conducted the studies that would allow them to obtain the information from the Peigan to design their studies properly." The expert said social impacts were not really discussed: "I would have felt that an environmental assessment should have addressed different cultural concerns, historic interests of different cultural groups, and in general, be committed to looking at human elements of the study areas."

During questioning of the Peigan, PWSS expressed its view that, if the project were to proceed, private land would be converted to public land and that this would increase the amount

of public land that might be available as habitat for animals of various kinds. The Peigan said this conclusion was a possibility.

One member of the Public Advisory Committee took issue with the Peigan's evaluation of the EIA: "I circled Pine Coulee Project every day; four times a day I cross there. So 800 times a year I am in that area, and I can tell you from experience, after 10 years of doing that, that there is no major deer movement in there, and I guess when we looked at the report, we thought that it was exactly true as said."

In closing arguments, PWSS said that the Panel had testimony before it from three local landowners that supported the results of its deer survey.

On the issue of possible reduction of native hunting success if the Pine Coulee Project interfered with deer migration: PWSS pointed out that the Peigan representative had told the Panel that the Peigan traditional hunting area is some distance from the proposed project, within the forestry reserve to the west. PWSS said that deer generally do not move very far and as a result rejected the Peigan claim that the deer population in the traditional hunting area will be affected. PWSS believed, through the habitat compensation plan, "...it is very likely that there would be more unoccupied Crown land (if the project is constructed) on which the Peigan may exercise their treaty hunting rights." PWSS took the position that it is very likely that the reservoir will result in a higher deer population, an assessment based on the fact that the deer population around the Oldman dam has increased in the face of a province-wide decline. In any event, PWSS believes that even if any of the comments made with respect to the terrestrial biology component of the EIA were in any way inaccurate, the proposed mitigation program should help increase habitat and, therefore, wildlife populations.

8.6.3 Consultation

As was described in Section 7 of this Report, both the Peigan Nation (Piik ni) and the Blood Tribe (Kainaiwa) said they were not aware of the Pine Coulee Project in any detailed way until late in the EIA and joint panel review process. The Peigan said that they were notified in November 1993, when a summary of the EIA was forwarded to the band council by officials from the federal Department of Indian and Northern Affairs for review and comment. The Blood Tribe said they did not become aware of the proposed project until they were contacted by the Applicant's archaeological consultant shortly before the start of the hearing. They believe consultation should be an important step in preparing an EIA.

PWSS believes the members of the Peigan Nation had many opportunities to become aware of and respond to the project over the past 10 years as a result of information contained in media articles, published government notices, project newsletters and open houses associated with its public consultation process. PWSS said that it was usual that only the impacts on downstream water users are assessed for a project like this. In the case of the Willow Creek basin, PWSS said that

the confluence of Willow Creek and the Oldman River was considered to be the furthest point at which significant impact from the project would occur.

PWSS told the Panel that the approach it adopted regarding archaeological resources was to follow the steps laid out by Alberta Community Development in preparing its Historical Resources Impact Assessment. A consultant working for the Applicant recommended that PWSS consult with aboriginal people about the significance of archaeological and historical resources found within and near Pine Coulee. After PWSS examined the consultant's recommendations it decided, if the project was approved, it would involve the native communities in the area in developing a mitigation program. PWSS said that there is no legal requirement for it to consult with aboriginal people with respect to archaeological artifacts or historic sites.

PWSS said that the Public Advisory Committee was responsible for identifying potentially affected groups or individuals in the project area and that the committee had not identified the Peigan as potentially affected, nor were they approached by the Peigan. PWSS indicated that it believed that local residents in the basin were in the best position to identify such groups for inclusion in the public consultation process and that PWSS respected and relied upon the Public Advisory Committee's judgment.

The Peigan said, whatever the formal status of the Public Advisory Committee, it was wholly inappropriate that this body should have become a screen or filter for public participation in the consultation process. They said the government has a legal and moral obligation to consult with various constituencies including First Nations, "...and that obligation is not discharged by delegating the consultation process to the self-selection of local project advocates." The Peigan believe that, for public projects, the government must insist on a committee that represents the various constituencies needed to be consulted, or it must engage in consultation beyond the limits of the locally created committees. The Peigan told the Panel that by allowing a self-appointed committee to function as a screen through which the study of treaty hunting rights failed to emerge is both unfair to the Peigan and to the local committee.

In contrast to the Applicant's views regarding its consultation process, the Peigan noted the Applicant's failure to consult with and involve the Peigan Nation directly in the planning process for the project. The Peigan did not acknowledge their own responsibility to keep informed about developments in the region and said they had been unaware of the proposed development. Failure by PWSS to inform the Peigan about the effects of the project meant that PWSS did not become aware of the issues of relevance to the Peigan. The Peigan adopted the position that PWSS is responsible for proper notification of and consultation with affected First Nations and that this is an absolute condition, morally as well as legally, of proper preparation of a proposal for major land developments. The Peigan did not dispute that notices had appeared in newspapers, public meetings had been held and extensive consultation had taken place in the process of preparing the Pine Coulee Application. However, the Peigan believed that the process was a "total failure" in terms of attracting native involvement, but that native peoples are greatly concerned about the project-related impacts on their interests and concerns.

The Peigan advocated that native participation should be included as soon as the public consultation process is initiated. The Peigan told the Panel that "it must be understood in no uncertain terms that the local white press is not effective for this purpose. Material must be included in the native press." It was the Peigan's position that such notices must not be simply "legal notices," but should fully describe the project including, maps and, where possible, photographs. Accompanying maps should indicate such relevant information as Indian reserves, communities with large aboriginal populations, and Crown lands known to be frequented for hunting purposes. The Panel was further advised that meetings should be advertised and held directly in native communities in cooperation with the band council or other appropriate persons.

The Peigan told the Panel that notice to First Nations must be timely. "Whatever the merit of distribution of leaflets in Fort Macleod (mailboxes) it...took place after the EIA had already been completed and filed for approval. This is far too late and does not constitute effective consultation."

In the Peigan's view, a First Nation should be notified of a project the same way as is any other government: "by direct communication." The Peigan advised that "no less than formal and direct communication with a First Nation government is the minimum required standard. ...Such standard was not met in this case until the Department of Indian Affairs communicated with the Peigan Nation at the end of 1993."

In their closing submission, the Peigan stated their belief that there has been a sub-text in many of the submissions of the Applicant: that the project was so widely known in the local (white) community that it must have been known to the Peigan and the Blood. "And yet the unchallenged direct evidence was that it was known to neither community." The Peigan said their early silence is evidence that they did not know of the project: "It is simply not credible, given the rapid response to the federal notification last December, and the subsequent participation in the NRCB/EARP hearings that the Peigan would have remained silent for a period of years during which they knew of this proposed project."

The Peigan completed its submission on the issue of consultation by emphasizing its view that contact with First Nations should be mandatory: "It should be clearly understood by the government that a project from which First Nations have been excluded, by design or neglect, will not win approval. This is a position based on principle and ethics. It is also a practical position. Non-consultation has had an impact on the quality of the presentation to date."

In closing arguments, and referring specifically to issues surrounding historical resources, PWSS responded that it may be that there is an evolution of thinking and that there should be consultation with aboriginals at early stages in the review process but that this is not the present law in Alberta.

Also in closing argument, PWSS said there is a general issue as to whether the Panel owes a fiduciary duty to the Peigan Nation or any other aboriginal group. It was Applicant's

submission that no such duty is owed by the Panel to aboriginal people. PWSS told the Panel that it is the position of Alberta, and the Applicant, that the Panel does not owe a fiduciary duty to aboriginal peoples. PWSS quoted from a Supreme Court decision: "...the Court must be careful not to compromise the independence of quasi-judicial tribunals and decision-making agencies by imposing upon them fiduciary obligations which require that their decisions be made in accordance with a fiduciary duty. "

In its submission, the Blood Tribe said: "The Crown has a fiduciary obligation to ensure that cultural and religious rights of First Nations people are protected, and the Panel has indicated that it will have due regard to those obligations."

9. SUMMARY OF OVERALL CONCLUSIONS

9.1 Overall Conclusions

The proposed Pine Coulee Water Management Project is the first project reviewed pursuant to the *Canada-Alberta Agreement for Environmental Assessment and Cooperation* by a Joint Review Panel established under the jurisdiction of both the *EARP Guidelines Order* and the *NRCB Act*.

Alberta Public Works, Supply and Services (PWSS or the Applicant) requests approval to construct the Pine Coulee Project, a water management project that includes a diversion weir and headpond on Willow Creek, a 3.5-kilometre canal and a multiple-use, off-stream storage reservoir in Pine Coulee, approximately six kilometres west of Highway 2 near the Town of Stavely which is approximately 100 kilometres south of Calgary. (Map 1.1 and Map 1.2). The water in the reservoir would be held behind an earthfill dam standing approximately 21 metres above the valley floor and extending 450 metres between the valley walls across Pine Coulee just upstream of where Pine Creek meets Willow Creek. When full, the reservoir would cover 600 hectares (1,480 acres), store 50,573 cubic decametres (41,000 acre feet) of water and extend 13 kilometres north from the dam.

The Pine Coulee Project has the following specific multi-purpose objectives:

- increased security of supply for existing municipal and domestic water users;
- provision of a secure water supply for livestock and irrigation water users;
- potential expansion of irrigated acreage in the Willow Creek basin to 8,500 hectares;
- provision of additional water-based recreational opportunities near existing facilities at Willow Creek Provincial Park; and
- improving the potential for meeting instream flow needs downstream of the reservoir, from the perspective of both water quantity and quality.

The Application was received in January 1994 and public hearings held from September 26 - October 7, 1994 in Stavely, Alberta. Submissions to the Panel touched on all facets of the proposed development and contained a wide range of views and extensive supporting information. This information is available for review at the NRCB Office.

9.1.1 Project Need and Justification

The Panel has considered the reasons for the proposed project provided by the Applicant as well as the views of the participants. The Panel accepts that some form of water management action is required for the basin and that there is a need to improve the potential for meeting in-stream flow needs in Willow Creek, particularly downstream of the proposed reservoir, from the perspective of both water quantity and quality. The Panel also accepts that there is a need to provide increased security of supply for existing municipal, domestic, livestock and irrigation water users.

The Panel has considered the reasonable alternatives to the proposed Pine Coulee Project. The Panel is satisfied that the water management options within the basin have been appropriately examined through a public planning process that included consideration of both structural and non-structural alternatives to meet the needs of the basin residents. The Panel particularly notes that many local participants affected by the proposed project were in agreement that the Pine Coulee Project would be preferable to other water management projects that have been considered for the basin. The Panel also notes that alternative locations for the project and a variety of within-project options have also been examined through a process involving the public and is satisfied that the relevant options have been considered. The Panel is satisfied that the Applicant has the ability to implement the project.

The Panel acknowledges that the matter of the economic viability of the proposed project is a major issue among some participants. The Panel has noted that the economic viability of the proposed project is one of a number of factors that the Panel believes it should have regard for and that quantifiable economic analysis must be considered along with non-quantifiable, qualitative and non-economic variables. The Panel has also noted that the decision to proceed with the financing of a proposed project that might receive an approval from the NRCB, is a separate and independent decision that would be made by the government of Alberta.

The Panel recognizes the fundamental role that water plays in sustainable development and the quality of life of all people, including the many uses of water in human settlements and the environment. The Panel believes the conflicts, demands and competition for the equitable sharing of available water supplies is increasing with increasing populations, agricultural production, industrial development, and concern for the environment. In areas such as the Willow Creek basin that have limited or variable water resources with consequent water shortages, the Panel believes it becomes particularly important to have comprehensive management strategies and procedures to determine, and at times to adjudicate on, the allocation or sharing of these limited water resources. The Panel believes that sustainable development in the Willow Creek basin is possible with regulated flows of Willow Creek. The Willow Creek basin, with its extremely variable flows, is a basin in which comprehensive water management strategies and procedures can be applied to achieve sustainable development based on multi-purpose water management objectives.

A cumulative effects assessment was stated as desirable by several participants. The Panel agrees that it is important to address developments in terms of the baseline ecosystem conditions found within the basin, as well as the additional effects a project would have on existing conditions. The Board believes that the sustainability of ecosystems is the proper frame of reference when assessing environmental impacts. Sustainable development is recognized as a purpose of the new Alberta *Environmental Protection and Enhancement Act*. The Panel believes it appropriate to determine the public interest with the assistance of the framework of sustainable development. An ideal development would be one that brings long-term social and economic benefits and has a beneficial or neutral effect on the environment. Developments can be planned and operated to minimize adverse impacts on the environment. However, where adverse effects on the environment are likely, the Panel believes social or economic benefits should be weighed and balanced in terms of their environmental effects and risks.

The Panel has had regard for the entire Willow Creek basin and the sustainability of the riverine ecological resources of the basin, taking into consideration existing and future use of those resources.

Several participants indicated that the proposed development needs to be considered within the river basin on an ecosystem basis. The Panel also believes that the individuals and communities that depend on the water in the basin would be potentially affected by the proposed development, and must also be considered, therefore, in determining the public interest.

The NRCB has recognized in its past Decision Reports that in order to determine the public interest, it must consider a project in the context of the region in which the project would be located and the cumulative effects which the project may have in the region. Because societies, economies and ecosystems incorporate many components that are inter-related in a complex manner, the potential social, economic and environmental effects of a project cannot be understood by considering only the effects of the project on its immediate locale. Projects can have a wider impact and must be considered in light of the "baseline" or background condition of the society, economy and environment of the regions in which projects could have significant effects.

In the case of the proposed Pine Coulee Project, the Panel has found it impossible to consider the overall public interest in relation to the project without considering the overall management of water in the Willow Creek basin, and in particular, the state of the aquatic environment in the basin.

The Panel emphasizes the links between the state of the environment, long-term economic viability and welfare of society. For example, the Panel heard from many participants as to the value of water to the regional economy and the potential contribution of the project to the development of sustainable ecosystems, communities, and agriculture. The Panel heard that the potential exists for both continuing economic benefits from the proposed project and long-term social benefits of stable rural and urban communities in particular, but that the potential would not be realized without effective management of the water resources of the basin. These matters provided

part of the basis for the overall conclusions reached by the Panel in determining whether the project is in the public interest.

The sustainability of the riverine ecological resources of the basin has been expressed in the Application in terms of the concept of instream flow needs, which in turn are used as a framework for the preliminary operational plan set forth in the Application. The Panel has considered in some detail both the basis for the preliminary operational plan set forth in the Application, and the plan itself, before proceeding to examine the effects of the proposed project.

9.1.2 Instream Flow Needs

In the current circumstances in Willow Creek basin, where there are highly variable flows and demands that far exceed supply during low flow conditions, the Panel finds that the concept of instream flow needs (IFN) takes on a slightly different meaning. In most cases, flow regulation is proposed to provide additional opportunities for beneficial use of water over and above the basic requirement of environmental protection and meeting existing allocations of water. In essence, the IFN proposed for the Willow Creek basin can be considered in the context of overcoming pre-existing deficits of water and determining whether additional water allocations can be accommodated.

Keeping in mind the preliminary stage of development that characterizes the IFN program, the Panel has examined the degree to which the proposed IFN for Willow Creek meets the broad policy criteria established for the South Saskatchewan River basin and the instream flow need criteria established by the Alberta IFN Task Force.

The Panel, in its *Report of Pre-Hearing Conference*, concluded that it was beyond its jurisdiction to determine the operating requirements of the Chain Lakes Reservoir. It recognizes that PWSS has taken the existing Chain Lakes Reservoir operating plan into consideration in the proposed Pine Coulee Reservoir operating plan. The Panel notes, however, that the Chain Lakes Reservoir was initially developed to meet domestic and municipal needs. The requirement to operate Chain Lakes Reservoir to meet those needs has been substantially decreased by the off-stream storage capability and alternative sources developed in the basin over the last few years. These requirements could be further reduced if the proposed Pine Coulee Project were to proceed. Alberta Environmental Protection indicated that if the proposed project were to proceed, it would undertake a public review of the current operating plan for the Chain Lakes Reservoir. Under the current *South Saskatchewan River Basin Water Management Policy*, regulated streams are to be managed so that the instream flows drop to minimum levels only for short periods of time under drought conditions. The Panel believes that the existing situation in Reach 2 immediately below the Chain Lakes Reservoir may not conform to this policy and recommends that Alberta Environmental Protection proceed with a re-examination of the operating plan of Chain Lakes Reservoir.

The Panel emphasizes the realities of the existing flow conditions in the basin. In that context, the instream flow needs that are proposed in the Application are a significant improvement

on the existing circumstances. The proposed IFN would be met most of the time; during low flow conditions it would be possible to achieve IFN over and above natural and existing conditions. The Panel believes that a relatively high level of environmental protection would be achieved through the adoption of the recommended IFN. Overall, the Panel is encouraged that the Application includes IFN specifications. It believes the work done in this regard serves to advance overall management of water in the Willow Creek basin.

9.1.3 Willow Creek Water Management Planning

The Panel recognizes, based on historical precedent, that the current proposal substantially reduces but does not entirely remove all risk to the agricultural operator. The Panel believes that irrigators should not be under the misapprehension that there would be no shortfalls. Data from the Applicant's agricultural expert indicates that some on-farm crop shortfall could be anticipated one year in six when crop needs are considered to be met by ignoring a capped irrigation withdrawal maximum, or one year in eight with a cap.

The Panel particularly points to the historical sequence of the two periods when shortages occurred over a three and a five year stretch. The Panel therefore cautions that average benefits of the proposed project not be construed to imply the development of no-risk conditions for all irrigators who would be operational if the full 5,260 hectare expansion occurred.

The Panel believes that it should consider the proposed operating plan in relation to the multi-purpose objectives of the Application. The proposed operating plan satisfactorily meets the criteria of increased security of supply for existing municipal and domestic water users, including livestock. It would improve the potential for meeting instream flow needs downstream of the reservoir in Reach 4 from the perspective of both water quality and quantity and it would provide additional water-based recreational opportunities in Reach 3 near existing facilities at Willow Creek Provincial Park.

The proposed plan would result in a significant increase in the security of supply for existing irrigation water users. It provides for the expansion of irrigation in the basin. Under the *South Saskatchewan Basin Water Allocation Regulation (Alberta Regulation 307/91)*, a maximum allocation for irrigation is specified at 21,000 acres (8,500 hectares) of irrigated land. The addition of 13,000 acres (5,260 hectares) to the existing 8,000 acres (3,240 hectares) is possible under certain assumptions regarding water requirements and crop mix, and the degree of risk acceptable to those relying upon irrigation water supplies. The proposed plan does not satisfy the basic water requirements outlined by Alberta Agriculture, Food and Rural Development, based on the specified crop mix (70/30) and irrigation efficiencies. To reach the objective of irrigation expansion to 8,500 hectares, the Panel believes significant changes in the crop mix found in the area would have to occur. The Panel believes that such changes toward a 50/50 crop mix would occur over time in response to water limitations and the need by irrigators to reduce risks.

Given the circumstances in the basin, the Panel accepts that the IFN identified in the Application are generally acceptable as a basis for developing an interim operating plan for the proposed project. The Panel would require, should the project proceed, that the Applicant, to the satisfaction of Alberta Environmental Protection, revise the IFN used as the basis for the interim operating plan: (1) to more fully reflect the aquatic and riparian needs in Reach 3 between the proposed diversion weir and reservoir outlet to Willow Creek, and riparian needs in Reach 4; (2) to give explicit consideration for reservation of water for future requirements; and (3) to provide contingent operating flexibility to accommodate any foreseeable changes in the operating regime of the Chain Lakes Reservoir.

With respect to the operating plan, the Panel would require that the operator manage releases from the reservoir in a manner that ensures minimum instream flow needs for protection of the aquatic and riparian environment, and for domestic and municipal drinking water requirements, as established by Alberta Environmental Protection, are always met within the physical limitations of the reservoir and weir.

Overall, with respect to water management in the Willow Creek basin, the Panel finds that the proposed project is consistent with the *South Saskatchewan River Basin Water Management Policy* and the multiple water use principles of the government of Alberta, and the proposed project, should it proceed, would result in the improvement of water management in the Willow Creek basin.

The Panel recognizes that water is fundamental to life and all aspects of environmental quality. Water is also essential to sustainable development. The proposed Pine Coulee Water Management Project is intended to produce a change in the flow characteristics of Willow Creek through the diversion and storage of water during high flows for subsequent release during periods of natural low flows. The direct and deliberate manipulation of water flows is intended to produce regulated flows that are capable of supporting beneficial uses of water for a variety of purposes. The proposed project would also result in a variety of environmental effects, some of which are positive and some of which are adverse.

The Panel has considered the environmental effects of the proposed Pine Coulee Project that are relevant to the Panel's deliberations, particularly water quantity and quality, fisheries, soils and surface drainage, vegetation and wildlife.

The Panel recognizes that natural systems are dynamic. The nature and extent of impacts of proposed developments are not independent of the state of the ecosystem or components at the time the development takes place. During the hearing, the Panel heard a great deal of evidence about historical, current and possible future states of Willow Creek basin ecosystem and especially the aquatic components. The Panel understands that the Willow Creek ecosystem and the aquatic components have been subject to numerous impacts since settlement and that some of the impacts during drought conditions have been severe. The Willow Creek riverine ecosystems have exhibited resilience in rebounding from many adverse impacts but evidence before the Panel about the past management of scarce water resources suggests that the riverine ecosystem has not always returned

to a state similar to that which existed at the time of impact. The frequency, and increasing number and extent, of water demands now occurring makes it necessary to recognize that the aquatic ecosystem in the Willow Creek basin is already under pressure. Whether or not flow regulation can improve the sustainability of Willow Creek aquatic ecosystems has been considered by the Panel.

The Panel has taken the view that examination of potential environmental effects of a project must include consideration of cumulative effects because project impacts do not occur in isolation from the many other effects influencing ecosystems and their components.

Given the historical development of the Willow Creek basin, and the relatively high water demands to which Willow Creek aquatic ecosystems are subjected, the Panel believes that it would be unwise to review the potential effects of the Application before it in any other than a cumulative and basin context.

Participants pointed out that riverine ecosystems are dynamic and will change with or without interference by people. Naturally, the Panel is most concerned about the risk of large, potentially undesirable changes that may be difficult or impossible to reverse. The risk to the Willow Creek basin ecosystem from current water demands, and the associated risks to individuals and communities was identified by many participants in the public hearing.

The Panel examined the effects of the proposed project on the various components of the Willow Creek ecosystem that would be most affected by the project, and then considered the effects of the project as a whole in terms of cumulative effects in the Willow Creek basin.

The environmental effects of the proposed Pine Coulee Project are inherently tied to the operational plan for the diversion works and the reservoir, since this would determine the flows in Willow Creek and the related effects on water quantity, water quality, riparian vegetation and fisheries. The effects on water quality and quantity that result from particular flows in Willow Creek have further effects, both positive or negative, on other matters such as the availability of water for use for domestic, municipal, stockwatering and irrigation purposes.

The Panel notes the extreme variability of both the annual water yields of the Willow Creek basin (from 11,100 to 261,502 cubic decametres) and the maximum and minimum average weekly stream flows of Willow Creek. The Panel believes that controlling these extreme variations could lead to greater multi-use options for this valuable natural resource. The multi-use needs for water include those of human settlements, instream flows for aquatic and riparian ecosystems, irrigation of agricultural lands, wildlife, recreation, natural areas, industrial, water conservation, and other demands. Controlling flows becomes particularly important during low-flow conditions. The Panel recognizes that the existing flows are not dependable for sustainable multi-purpose uses in the Willow Creek basin. The Panel believes that the proposed Pine Coulee Project could provide the necessary control of these extreme variations in yield and flows so as to better manage a significant amount of the available water resources for consumptive and other demands in the Willow Creek basin.

9.1.4 Water Quantity

With respect to water quantity, the Panel concludes that the flow regulation features inherent in the proposed project would primarily have a positive and beneficial effect on the flows in Willow Creek. The ability to capture and store water for discharge according to the proposed operating plan would result in a significant improvement in the amount of water available to meet instream flow needs, including requirements for environmental protection of the aquatic and riparian environment and requirements for consumptive uses such as municipal downstream water supply and irrigation demands. The reservoir does not have sufficient capacity to store enough water to eliminate risks associated with low flows during drought conditions, but the reduction in the degree of risk would improve with the management of water flows in the basin. The direct physical impact on flows within the basin and the associated implications for the stream bed, channel and aquatic environment are not considered by the Panel to constitute significant adverse environmental effects and post project flows would be generally within the range of historical flows in the basin. The Panel fully recognizes the dynamic nature of the riverine environment along Willow Creek and believes the wide historical variations in flows that have characterized Willow Creek within each year, and from year to year, are much more significant than the relatively small changes in flows that will be associated with the operation of the project should it proceed.

The Panel heard that the downstream flows in Willow Creek and the flows of the Oldman River below the Oldman River Dam would be affected by the operation of the proposed Pine Coulee Project. The Panel heard that the Oldman River flows could also be affected by water allocations made for instream flow needs, water quality, irrigation, domestic and other consumptive water uses in the Oldman and the broader South Saskatchewan River basin. Flows from all sources can become more important during low-flow conditions. The Panel recognizes that there could be some interaction between the two operating regimes of the Oldman River Dam and the proposed Pine Coulee Project. The Panel notes the flows in Willow Creek can only directly affect the flows in the Oldman River below their confluence. Should the project proceed, the flows in the Oldman River above the confluence may be indirectly affected through the interaction between the operating regime of the Oldman River Dam and the operating regime of the proposed Pine Coulee Project.

The Panel has considered the significance of the indirect effects of the proposed Pine Coulee Project on flows in the Oldman River below the Oldman River Dam. Analysis of the significance of the proposed Pine Coulee Project on the proposed operational regime of the Oldman River Dam and the flows of the Oldman River at Brocket were carried out using computer modelling techniques. In the opinion of the Panel the magnitude of the increases or decreases in flows would be very small, largely average out over time, are not physically measurable and could only be identified by computer analysis.

The Panel notes that the Oldman River is subject to a wide range in river stage from season to season and year to year and that changes equivalent to a few centimetres in river stage are extremely small compared to natural fluctuations. In the opinion of the Panel, the indirect effect of the proposed Pine Coulee Project under most conditions on the Oldman River at the Peigan Reserve

would be inconsequential in terms of the flows of the much larger Oldman River, and even in the extreme cases of high or low flow conditions would be insignificant in terms of the flows of the Oldman River.

The SSRB contains many water management structures each having their own operational regimes which may interact to varying degrees to determine overall management strategies. The Panel finds that should the proposed project proceed it would have a very small positive effect on downstream flows in the SSRB particularly during low flow periods. The Panel finds that in regard to water flows the benefits of the proposed project are largely confined to and should properly accrue to the various water demands in the Willow Creek basin.

With respect to the effects of the project on navigable waters, the Panel notes that Willow Creek currently receives little use for canoeing primarily due to low flows during most months during the open water season. The proposed project would create a 42 hectare headpond, and a 600-hectare reservoir which would be navigable. The diversion weir would create a barrier to navigation along Willow Creek, and the diversion weir outlet works and the reservoir outlet works may have some effects on flows that may present some degree of navigation concern. Due to the limited current and expected use of Willow Creek for navigation purposes, the Panel does not believe that it would be necessary to develop extensive compensating works to enable passage, but some attention should be given to permit a safe and convenient portage around the weir. The Panel would require, should the project proceed, that the Applicant, to the satisfaction of Transport Canada, establish a safe and convenient portage around the weir. The Panel believes that the weir and outlet works may present some degree of hazard to canoes or other small craft, but has confidence that relevant federal and provincial authorities will ensure that appropriate steps are taken to mitigate such effects.

The Panel believes that the proposed causeway for Secondary Highway 527 warrants more serious consideration with respect to navigation on the reservoir. The causeway would create a barrier to small craft passage between the middle and south basins. The causeway would also necessitate the development of access facilities in each basin at additional cost. The reservoir would create navigable waters where none previously existed.

Overall, the Panel expects that the proposed Pine Coulee Project would have a minor effect on navigation on Willow Creek due to the limited use the creek receives for such purposes and the Panel notes that a causeway would create a barrier to navigation in the proposed reservoir.

9.1.5 Water Quality

The Panel accepts that some incremental mercury contamination of fish will be associated with the creation of the proposed reservoir. Should the project proceed, the Panel would require that the operator, in a manner satisfactory to Alberta Fish and Wildlife, monitor and report on mercury levels in fish from the reservoir and from Reach 4 of Willow Creek. The Panel understands that Alberta Fish and Wildlife, in consultation with appropriate health authorities, ensures

that the public is aware of any health risk associated with the consumption of mercury-contaminated fish, and provides advice on the steps the public should follow to minimize any potential adverse health effects. Having regard for the role and responsibilities of other authorities with respect to the consumption of mercury contaminated fish, and the incremental nature of any effect that may be attributable to the proposed project, the Panel is satisfied that the effects of the project with respect to mercury contamination in water would not lead to significant adverse effects.

Water discharged from the reservoir to Willow Creek will be of a good quality most of the time. The potential for poor quality water to be discharged from the lower depths of the reservoir has been reduced by adding a higher outlet. The Panel would require, should the project proceed, that PWSS design the reservoir outlet works and carry out its operations in a manner, satisfactory to Alberta Environmental Protection, that minimizes the potential adverse effects of reservoir discharges on dissolved oxygen and ammonia levels in Willow Creek. The Panel concludes that the quality of water in the reservoir will be acceptable for recreational uses most of the time and is likely to support a sustainable cool-water fishery under the proposed reservoir's operating plan.

The Panel is concerned about the water quality effects of the proposed causeway to accommodate Secondary Highway 527. The causeway, even with the provision of culverts at various elevations, would significantly reduce the degree of water mixing that would occur in the reservoir. This would directly contribute to the development of poor water quality conditions particularly during drought years, and during ice covered winter months once every ten years, in the middle basin north of the proposed causeway, conditions are predicted to lead to anoxic conditions and fish kills.

The Panel notes that agricultural discharges such as irrigation runoff and effluent from cattle grazing and feedlot operations could be of potential concern. The Panel concludes that these matters, if properly regulated, would not constitute a water quality concern. The Panel has made recommendations regarding this matter in the context of watershed protection for the Willow Creek basin. The Panel recognizes that no allocation was made in the operating scenario for assimilative capacity for wastes discharged to the stream because none were expected.

With respect to water quality, the effects of the proposed project, should it proceed, would be primarily positive through the beneficial effects of increased flows in Willow Creek during low flow conditions. In reaching this conclusion, the Panel is also of the opinion that the proposed project would not result in significant adverse water quality effects to Willow Creek. The Panel believes that the proposed Secondary Highway 527 causeway will contribute to poor water quality in the reservoir, and reduce the potential of the reservoir for fisheries and recreational purposes.

9.1.6 Fisheries

Fish populations in Willow Creek have been affected by activities in the watershed over the past decades. These activities include construction and operation of the Chain Lakes Reservoir, municipal and domestic water use, agricultural development and associated water

withdrawals for irrigation. The Panel concludes that releases from the proposed Pine Coulee Project during the summer low flow period are likely to have a positive effect on cool-water fish populations in Reach 4 downstream of the reservoir outlet, but they would not improve conditions in Reach 4 of Willow Creek sufficiently to create the basis for a sustainable cold-water fishery. The Panel doubts whether a sustainable cold-water fishery could be established in Reach 4 of Willow Creek under any operating regime which could be adopted for the reservoir. It is also the Panel's view that a multi-use policy for water management precludes the project from being managed for fishery management purposes alone. Water management policies require that the proposed project be operated to realize potential positive downstream fisheries benefits in Reach 4 while meeting overall multi-purpose operational objectives.

An issue that affects both the downstream and upstream fishery is the question of whether fish passage should be provided at the diversion weir. Should the project be approved, the Panel would require that the design and construction of the weir provide for the installation of works to allow fish passage should they be required in the future.

The Panel concurs with the PWSS assessment that the north basin would not provide fish habitat and would agree with its proposal to manage the area as an enhanced wetland and waterfowl habitat. The Panel would require, should the project proceed, PWSS to establish control gates at the causeway across the north end of the reservoir so that the water levels in the north basin are stabilized and consistent with the establishment of a permanent wetland capable of supporting waterfowl and wildlife.

Should the project proceed, the Panel concludes that PWSS, to the satisfaction of Alberta Environmental Protection, would be required to prepare and implement a fisheries mitigation and enhancement plan as an integral component of the project. The fisheries mitigation and enhancement plan should be prepared at the earliest opportunity so that fisheries management decisions could be appropriately reflected in the final design and operation of the facilities. PWSS should seek appropriate input from the public and the various federal and provincial agencies in the preparation of the fisheries plan. The plan should be reviewed by Alberta Environmental Protection, in consultation with the Department of Fisheries and Oceans Canada.

The fisheries mitigation and enhancement plan, in the opinion of the Panel, should address several issues and options raised during the hearing. Specifically, the Panel would require that the plan address, among other relevant factors, the following:

- the feasibility and desirability of managing fisheries upstream of the diversion weir in Reach 2 primarily for cold-water species, taking into consideration the role of the weir, diversion canal, and headpond and the implications for cool-water species;

- the feasibility and desirability of the establishment of a sustainable cool-water fishery in the reservoir, particularly walleye, taking into consideration the role of the saddle dyke in providing spawning habitat; the minimum water level and quality that would be required to ensure a sustainable fishery; the effect of mercury contamination; the nutrient requirements of fish; and the effect on reservoir water quality and fisheries of not constructing the causeway for Secondary Highway 527;

- the feasibility and desirability of managing fisheries in Reach 3 and downstream of the reservoir outlet in Reach 4, primarily for cool-water species, taking into consideration the role of the weir, the design of the outlet channel from the reservoir, the need for pike spawning habitat at the outlet, and the water quality discharged to Willow Creek;

- the fisheries habitat compensation requirement of the Department of Fisheries and Oceans; and

- the ongoing monitoring of the effectiveness of mitigation and enhancement.

The Panel would also require PWSS to conduct such further modelling and water quality monitoring to confirm in a manner satisfactory to Alberta Fish and Wildlife that water released from the reservoir at the raised elevation is of sufficient quality to meet water quality and fisheries management objectives established for Reach 4 of Willow Creek.

The Panel notes the policy of no-net-loss of productive capacity of fish habitat, and recognizes that a fish habitat compensation component of the fisheries mitigation and enhancement plan would be required by the Department of Fisheries and Oceans. The Panel believes that the project as proposed would result in some loss of cold-water fish habitat in Reach 3 and the upper portion of Reach 4. Reach 4 has been identified as having poor habitat quality for trout with significant limitations due to water quality and limited habitat suitable for spawning and rearing of fry. The diversion weir crossing Willow Creek would pond about 42 hectares of water, to a maximum depth of about nine metres at the structure, this level drawing down to about 6 metres over the winter. The average depth of the headpond would be about two metres. The Panel would require, should the project proceed, that the design and operation of the weir and associated headpond satisfactory to Alberta Fish and Wildlife, and would be done in a manner that provides trout habitat and ensures that sedimentation is minimized and adequate water depth is maintained. The development of the headpond in association with the weir would add new habitat for cold-water fish in Reach 2 of a kind and nature that would in the opinion of the Panel, offset any cold-water habitat losses due to the restrictions of the weir to poor habitat in Reaches 3 and 4.

With respect to cool-water fisheries habitat, the Panel notes that in Reach 2 of Willow Creek, 1.9 hectares of pike spawning habitat would be inaccessible due to the blockage of migration by the weir. The Panel accepts the need to replace this habitat loss to meet the requirements of the

no-net-loss policy. Therefore, the Panel would require, should the project proceed, that the Applicant design and implement a program to establish pike spawning habitat of 5-10 hectares near the outlet of the reservoir at Willow Creek, as proposed. In the Panel's opinion, this mitigation measure could fully compensate for any loss of pike spawning habitat loss in Reach 2.

The Panel also notes that any fish habitat created in the proposed Pine Coulee Reservoir would be an enhancement over and above the current habitat available in the Willow Creek basin.

With respect to fisheries, the Panel concludes that the project would not result in any net loss of fisheries productive capacity after various mitigative measures required by the Panel were implemented, and the Panel further concludes that improved flows in Willow Creek and establishment of a reservoir fishery could result in a significant beneficial effect on the fishery resource in Willow Creek basin.

9.1.7 Soils and Drainage

The Panel notes the evidence regarding the suitability of lands located along Willow Creek for irrigation purposes and concludes that should the project proceed, there are sufficient suitable lands capable of supporting irrigation that the irrigation benefits would not be limited by the availability of irrigable lands and unsuitable lands would not be permitted to receive irrigation water.

The Panel understands that the aspects of land use classification for irrigation are extensively addressed in the current regulatory framework. The Panel is also very conscious of the limited water resource in this basin. The Panel has confidence that the relevant authorities responsible for water and land resources would carefully review future resource allocations and development to optimize the benefits from this project, if it were to be approved.

The Panel has concerns regarding seepage and potential for the proposed project to cause salinization of agricultural lands in the vicinity of the outlet and saddle dyke. If the project were to proceed and result in the salinization of lands, and the loss of productivity for a large area near the reservoir, while creating the benefit of water availability for irrigation, then the Panel would have concerns about some of the benefits of the project. The Applicant has identified the potential sources of seepage from the project and the mitigation options available to avoid directly related salinization problems. The Panel believes that the project can incorporate appropriate mitigation measures in the design and operation of the reservoir to prevent the project related salinization of agricultural land in the vicinity of the project. Therefore, the Panel would require, should the project proceed, that PWSS in a manner satisfactory to the Alberta Controller of Water Resources:

- design the reservoir, dam and saddle dyke to incorporate appropriate mitigative measures that will restrict and control seepage to prevent the project from causing the salinization of agricultural lands.

The Panel believes that such a requirement would address directly the primary concern of the Area Landowners; preserving the quality of surrounding lands. The Panel agrees with the Landowners that all reasonable steps should be taken in the design of the works to minimize and manage seepage. The Panel notes that PWSS has identified a range of specific project design alternatives that might be included in the project to accomplish the protecting of the quality of surrounding lands. The determination of the best alternative is a matter to be resolved during the detailed design of the works and the Panel would expect that the Controller of Water Resources would include such matters within the scope of the review of the application made by PWSS pursuant to the *Water Resources Act*.

The Panel further notes that PWSS has agreed to undertake specific follow-up actions regarding a number of the detailed matters raised by the Area Landowners and filed with the Panel during the hearing. The Panel accepts the commitments made by PWSS and would require that they be fulfilled should the project receive approval from the Panel. Specifically, PWSS agreed to:

- studies of the discrepancies noted between EM-38 and soil sample salinity readings by a committee composed of members of PWSS, Alberta Agriculture, Food & Rural Development, the Area Landowners and a consultant of the Landowners' choice, and, if necessary, any further studies would be done at the expense of PWSS; and

- perform further calculations of seepage estimates based on new and expanded data for the review by Prairie Farm Rehabilitation Association (PFRA) and, if required by PFRA, do such further studies as are recommended by PFRA.

The Panel believes that the seepage estimates would be considered by PWSS in selecting among project design alternatives for inclusion in the project to accomplish the protecting of the quality of surrounding lands. The Panel believes that the resolution of soil sample salinity readings would contribute toward PWSS meeting its commitment to:

- expand, in a manner satisfactory to Alberta Agriculture, Food & Rural Development, a ground water/soil monitoring system to provide an ample early warning of potential changes in soils, including four additional monitoring wells in low-lying areas north of Secondary Highway 527;

- establish, based on recommendations from Alberta Agriculture , Food & Rural Development, PFRA, and the Area Landowners, the criteria or trigger mechanisms that would indicate the need for mitigative action; and

- provide monitoring results to the public on an ongoing basis.

The Panel notes, in particular, that the Area Landowners requested and PWSS agreed that the preceding commitments could be included as conditions on any licence that might be issued by the Controller of Water Resources. The Panel is mindful of the role of the Controller and agrees that the Controller may wish to consider a variety of detailed matters at a later stage in the project planning process should the project proceed. To complement the undertakings made by PWSS in response to the Area Landowners' concerns, the Panel would further require that:

- PWSS establish, to the satisfaction of the Controller of Water Resources and well in advance of the project proceeding to operation, the following measures:

  1. An appropriate groundwater observation network adjacent to the project that would ensure that any seepage that could lead to salinization of agricultural land is detected at an early stage;

  2. Specific mitigation plans that would be implemented to prevent seepage from causing the salinization of agricultural land;

  3. An appropriate monitoring and detection program that would identify, in accordance with generally recognized methods, any salinization of soils that might be attributable to the project; and

  4. In the event that salinization were to occur, an appropriate course of action that would be followed to correct any salinization attributable to the project, including the specification of the financing and timing of corrective steps.

With respect to soils and drainage, the Panel concludes that, should the project proceed, the proposed project would not result in significant adverse impacts to soils and drainage provided that the mitigation program, and the conditions of the Panel, are implemented.

9.1.8 Vegetation and Wildlife

In general, the Panel accepts the Applicant's assessment of the potential impacts of the project on pastured grasslands. The major impact would be the direct loss of grassland in Pine Coulee. Smaller amounts would be lost to slumping, recreation and the expansion of irrigation to uncultivated lands. The Panel believes that the removal of 600 hectares of vegetation as a direct consequence of the proposed project represents a permanent loss of grassland. The Panel concludes that the residual impact of direct grassland removal would be negative, of high magnitude and of long-term duration. Any further removal of grassland remnants through expanded recreation and irrigation of uncultivated lands would add to the magnitude of this adverse impact. The Panel notes, however, that the Applicant, landowners and lessees can, and in the Panel's view should, endeavour

to minimize these indirect impacts to grassland. In contrast, the direct losses of grassland would be an inevitable consequence of a decision to proceed with the proposed project. The Panel must therefore weigh this adverse impact against the project's projected benefits in assessing the overall merits of the proposed project.

Although no mitigation is possible for the direct loss of the inundated land, the Panel believes it is possible and desirable to recover some or all of its value to the native flora and fauna of the region by restoring native vegetation on other land currently used primarily for cattle grazing.

In the Panel's view, the undertaking by PWSS to develop a habitat compensation plan is an appropriate mitigation for the direct loss of the habitat capability that would result if the Pine Coulee Project were built. The Panel agrees with the stated objective of ensuring no-net-loss of habitat value.

Should the project be approved, the Panel would require PWSS to implement a habitat compensation plan approved by the Fish and Wildlife Division of Alberta Environmental Protection based on its stated objective of no-net-loss of grassland habitat capability. The Panel recommends that the cost of the compensation plan be included in the Pine Coulee Project capital and operating budget, and be implemented as soon as possible.

The Panel is concerned about the conservation of riparian communities. The importance of these ecosystems for wildlife and several human uses is highly disproportionate to the relatively small area they occupy. Protecting native riparian forests along southern Alberta rivers is needed so that current and future generations of Albertans can enjoy their benefits and appreciate their intrinsic values. The Panel accepts that by managing to sustain native riparian poplar communities, the whole riparian ecosystem will benefit.

Should the project be approved, the Panel would require that a more detailed plan for mitigating the loss of riparian poplars by establishing replacement stands and reducing livestock impacts, be developed by PWSS and reviewed and approved by Alberta Environmental Protection and Alberta Agriculture, Food & Rural Development. Furthermore, the Panel would recommend that funds to cover the immediate and long-term costs associated with developing and implementing riparian zone mitigation plans be included in the project capital and operating budget.

With respect to the riparian vegetation impacts, the Panel concludes that the implementation of replacement stands and minimization of livestock impacts in riparian stands along Willow Creek would reduce the affects of the proposed project on riparian vegetation due to direct loss in the headpond area. The adoption of the planned operating regime, in the opinion of the Panel, would provide sufficient protection to the riparian vegetation downstream of the reservoir outlet in Reach 4 and any impact would be minor.

With respect to grasslands, the Panel accepts that the proposed project would result in the direct loss of some grassland that would be almost fully compensated through timely

implementation of the habitat mitigation program. The Panel accepts that some losses would occur, but believes that the residual impacts would be relatively minor.

The Panel concludes that the project, should it proceed, would not lead to any significant adverse impacts to vegetation provided that the mitigation measures that the Panel would require, are implemented.

The Panel agrees with the objective, stated by PWSS and endorsed by many of the hearing participants, of assuring no-net-loss of habitat capability for wildlife species. The habitat compensation plan is a crucial component of the mitigation proposed for virtually all of the species discussed in the Application. Should the project be approved, the Panel would therefore require PWSS to prepare and implement in a timely manner a detailed wildlife habitat compensation plan to the satisfaction of Alberta Environmental Protection.

The Panel also agrees with the Applicant that field-oriented guidelines should be prepared as a practical means of implementing specific mitigation measures. Should the project proceed, the Panel would require PWSS to prepare a field-oriented operations plan, to the satisfaction of Alberta Environmental Protection, to ensure that all personnel involved in the construction and operations of the project would be informed of their responsibilities in implementing the environmental mitigation undertaken by PWSS.

The Panel has concluded that, with the mitigation achieved through a successful habitat compensation program, the residual impacts on wildlife species would be low or negligible. The Panel believes it is appropriate to verify the EIA predictions of low or negligible impact with biological effects monitoring and to re-evaluate predictions and management practices if predictions are not borne out. The Panel notes the commitment of PWSS to implement an effects monitoring program as outlined in the EIA.

With respect to specific measures for individual species, the Panel agrees that the specific mitigation measures specified in the Application would minimize impacts.

With respect to overall wildlife impacts, the Panel concludes that the proposed habitat compensation program would reduce the wildlife impacts to insignificant levels and the Panel believes that the proposed project, should it proceed, would not result in any significant adverse wildlife impacts.

The Panel has considered the cumulative nature of the effects of the proposed Pine Coulee Project on the aquatic ecology of the Willow Creek basin and the other environmental characteristics of the basin. In the opinion of the Panel, the Willow Creek aquatic ecosystem is already at risk due to the various water demands that exist within the basin, and the proposed project must be considered within the cumulative and regional context of other developments in the basin and their synergistic effects. When examined within the context of the historical development of the Willow Creek basin and the current baseline conditions that characterize the basin, the Panel

concludes that the proposed project, including the mitigative measures that the Panel would require should the project proceed, would tend to improve the ecological conditions of the Willow Creek basin when the various project impacts are considered as a whole. In the opinion of the Panel, flow regulation associated with the proposed project could improve the sustainability of Willow Creek aquatic ecosystem.

The proposed Pine Coulee Project has focused attention on Willow Creek and highlighted the importance of this valuable water resource to the residents of the basin. The compilation of existing and new information about the riverine ecosystem has resulted in the identification of a number of management options and opportunities within the basin. Watershed protection to maintain the riverine ecosystem is needed, in the Panel's opinion. The Panel notes a number of inter-related factors brought forward through the review of the proposed Pine Coulee Project. In Reaches 1 and 2 of Willow Creek, the review of the role and operations of the Chain Lakes Reservoir has been proposed. Attention is already focused on the interaction between cattle grazing and the riverine ecosystem through the joint efforts of various participants in the "cows and fish" initiative. The Panel notes the water quality data that indicates that high fecal coliform levels exists in Willow Creek during the summer and fall that largely relate to grazing along Willow Creek. The evidence also indicates the critical role played by riparian vegetation in the Willow Creek basin ecosystem, and the need to protect and in some cases restore the quality of this important resource. Riparian vegetation is important to maintaining diversity within the ecosystem and plays and important role in maintaining both aquatic and terrestrial ecosystem components. Wildlife habitat and vegetation mitigation programs associated with the proposed Pine Coulee project would involve careful consideration of the riparian vegetation. Fishery management objectives in Reach 2 above the proposed weir and in Reaches 3 and 4 below the weir are dependent upon the protection of the watershed, especially streambank protection. While other examples could be noted, the Panel believes that the importance of the valued water resources and riverine ecosystem of Willow Creek suggests that more effort should be devoted to ensuring its long term integrity. The Panel recommends, therefore, that the Municipal District of Willow Creek take a leadership role in focusing the attention of basin residents on the importance of protection and maintaining the valued riverine ecosystem of Willow Creek, the creek that gives the municipality its name and upon which many basin residents depend.

The fisheries mitigation and enhancement plan, the riparian vegetation mitigation plan, and the habitat compensation plan could, when fully implemented, lead to ecological conditions in the Pine Coulee area that are as good or better than current conditions found in the basin.

In conclusion, the proposed Pine Coulee Project would result in significant and positive effects on water quality, quantity and fisheries. The soils and drainage, vegetation, and wildlife effects of the project can be mitigated so that the residual project effects on the environment would not be significant. Given the positive nature of some of these effects and the limited extent of the residual adverse effects, the Panel also concludes that any socio-economic implications of the adverse environmental effects would be small.

9.1.9 Economic Effects

The Panel concludes that the proposed Pine Coulee Project would have significant, positive economic effects in the local area, should it proceed. The Panel specifically notes that while the quantifiable economic effects of the project are favourable, additional non-quantifiable benefits and costs considered by the Panel tend to improve the relative economic effects of the project. The construction and operational effects on the economy of the area surrounding the project will be significant and positive should the project proceed.

9.1.10 Social Effects

Lack of a secure and stable water supply in the drought prone Willow Creek basin is, in the opinion of the Panel, a major underlying factor affecting the social stability and well-being of the residents of the basin.

The Panel concludes that, if approved, the proposed project would have positive social effects on the Municipal District of Willow Creek and the communities within it, and on irrigation agriculture and as well as the larger farming community. A secure and stable water supply would provide assured water to local communities and complement their current water supply systems, particularly in times of drought and low flows. Present irrigators would have their uncertainty reduced and would experience more stable agricultural productivity. New irrigators would add investment and employment opportunities to the local area. The negative impacts of drought and crop losses would be reduced in frequency. Recreational use will increase and there will be economic spin-offs from that increase. If the anticipated development of cottages and residences near the reservoir is successful, additional economic and social benefits would occur.

The proposed project, with its range of benefits including those of fisheries and recreation, would also add to the economy of the area and the stability of the population. The Panel believes the Pine Coulee Project, if approved, will result in local and regional economic benefits and is persuaded that the social stability and quality of life for residents of the region will be increased.

The Panel finds that positive social effects of the proposed project in maintaining employment, with some possible employment growth, expanded recreation and community stability is positive and compelling. The Panel concludes that the potential social stability of the area must be given regard in reaching its overall decision regarding the Application.

The Public Advisory Committee, with input from the Applicant, dealt extensively over several years with the need to provide for replacement roads and roads to accommodate new land uses in the immediate vicinity of the proposed project.

The Panel notes, should the proposed project be approved, that the existing rural road system in the immediate vicinity of the project would need to be revised to provide replacement roads

for those inundated by the proposed reservoir and also to accommodate existing uses and potential future needs of water-based recreationalists and non-agricultural users.

The Panel has considered the requests of the Applicant, the Municipal District of Willow Creek, and other participants to provide guidance on the transportation implications of the proposed project. The Panel believes that such matters are normally dealt with in a satisfactory manner through consultation between the Applicant and various local parties and authorities. However, in this case such a resolution has not been reached.

The Panel has concluded that transportation issues are an important component of the overall project that need to be resolved to ensure that the long-term public interest in the social, economic, and environmental aspects of the project are met. Therefore, the Panel has concluded, should the project be approved, that it would be necessary to place certain conditions on transportation aspects of the Application.

The Panel agrees with the Municipal District of Willow Creek that there is a need for a link substantially similar to Link 5. The Panel further concludes that there is a need to mitigate the inundation of the existing road crossings of Pine Coulee and to provide for safe and efficient road access to the new land-uses that would result from the creation of a significant new water body. The Panel would require that PWSS, with the advice and consent of the Municipal District of Willow Creek, establish a good standard perimeter road around the reservoir that would include a link substantially similar to Link 5, the causeway on Fireguard Road on the north, the relocated Pumphouse Road across the saddle dyke and dam to the south, and any other links required to complete a perimeter road around the reservoir. Most of the perimeter road already exists or would be completed as part of the project.

The Fireguard Road is proposed to continue to cross Pine Coulee on a causeway creating a permanent wetland for wildlife in the most northerly part of the proposed reservoir and the Panel is satisfied with this road. The replacement road proposed from Pumphouse Road south and west along the saddle dyke and across the dam to connect with Secondary Highway 527 is satisfactory to the Panel.

The remaining replacement roads and the upgrading of the road between section 14 and 15 and sections 22 and 23 - twp. 14 - rge. 28 - w. 4th appeared acceptable to most participants and are satisfactory to the Panel.

There is no nearby access road to the reservoir along the west side of sections 2 and 11 - twp. 14 - rge. 28 - w 4th south from Secondary Highway 527 to Pumphouse Road and this would be required for the perimeter road. A proposed replacement road (Link 5) between sections 28 and 29 and section 32 and 33 would complete an access road system on the west side of the proposed reservoir.

Willow Creek Provincial Park is served by Secondary Highway 527 which connects to Highway 2 at the Town of Stavely. Construction of a major causeway is proposed for Secondary Highway 527 at a cost of some $3 million. To address water quality, fishery-related issues and boating navigation, a bridge could be added which would increase the cost to $4.1 million. An alternative to this causeway crossing would be to have Secondary Highway 527 turn south along the east side of the proposed reservoir and connect to the proposed Pumphouse replacement road along the saddle dyke and dam which in turn re-connects into Secondary Highway 527 on the west side of the reservoir.

The proposed Secondary Highway 527 causeway raises serious concerns about the public cost of the transportation proposal and its environmental effects. These two factors, when combined, have a significant bearing on the proposed project.

Having regard for the need for a perimeter road around the reservoir; the large financial expenditure proposed for the causeway; the negative environmental effects; and balancing positive and negative social effects, the Panel concludes that the proposed causeway crossing near the midpoint of the reservoir to accommodate Secondary Highway 527 is a costly and unnecessary crossing. In the opinion of the Panel, upgrading the relocated Pumphouse Road to accommodate Secondary Highway 527 across the saddle dyke and dam would provide access to Willow Creek Provincial Park and the municipal district road to the west at less cost.

The Panel believes that with the completion of a perimeter road, including the substantially similar Link 5 and upgrading the relocated Pumphouse Road across the saddle dyke and dam to accommodate rerouting Secondary Highway 527, there could be a substantial cost saving. This cost saving must be considered in terms of its potential inconvenience to some residents. On balance, the Panel believes that the cost saving is justified.

The Panel recommends, therefore, that PWSS achieve a significant cost saving by eliminating the costly and unnecessary proposed causeway crossing near the midpoint of the reservoir to accommodate Secondary Highway 527, and further recommends the upgrading of the relocated Pumphouse Road to accommodate Secondary Highway 527 across the saddle dyke and dam to provide access to Willow Creek Provincial Park and the municipal district road to the west.

An important element in the rural road system is providing for efficient school bus routes. Each of the existing east - west crossings of Pine Coulee that would be affected by the proposed Pine Coulee Project are used by one or more of the three school buses serving the area. School bus routes must remain flexible to accommodate changing student needs, availability of drivers and other requirements. Should the proposed project proceed, some changes will be required. The Panel believes that the revised road system should be able to serve both basic rural, educational, and agricultural needs in a manner sensitive to other economic, social and environmental concerns.

The Panel notes in particular the effects of any Link 5 on the Waters family, the Hutterite Brethren and other families on the west side of the reservoir. In concluding that a Link 5

is required, the Panel has considered this impact in light of the overall benefits of the project and the transportation changes required. With respect to the Waters and similar families, the Panel realizes that they may experience some negative impacts. The Panel has no jurisdiction regarding the compensation requested by the Waters. With respect to the Hutterite Brethren in the vicinity of Link 5, the Panel agrees that reasonable access arrangements should be made to accommodate use of their land.

The Panel observes that an important element in an area structure plan is the transportation network. It may affect access to, or development of, existing or potential recreational amenities and would also be a factor relating to the safe and efficient use of nearby highways and secondary roads.

The Panel would require that PWSS, as part of its final planning and design phase, prepare an area structure plan for the lands in the immediate vicinity of the reservoir. Preparation of the area structure plan should include a public involvement program to involve where applicable, the MD of Willow Creek, ORRPC, local communities, interested stakeholders, Alberta Environmental Protection, Alberta Community Development, and land owners in the vicinity of the proposed reservoir. Matters to be considered should include the following:

- the basic perimeter road system and standards to safely and efficiently service the existing and future land uses adjacent to the reservoir;
- the use of fragmented parcels that would result from the project;
- the need for improvements to, and extension of, the existing provincial park area and the relationship between the park and camping areas, day use areas, boat launching areas, view points, foot trails along the proposed canal, and other similar features which may arise in the preparation of the area structure plan;
- preservation and exhibition of areas of historical and archaeological interest including the buffalo stone (site EbPk 18) and petroglyph (site EaPk 180) in cooperation with Alberta Community Development, aboriginal people, and other interested parties;
- habitat compensation lands adjacent to the reservoir and the need for environmental reserve lands that might be set aside;
- recreation and country residential development;

- mitigation of the conflicts that may arise between the new land-uses and the existing agricultural community including air and water pollution or other conflicts for the lands in the vicinity of the reservoir that are to remain under agricultural land uses; and,

- any extra or special administrative infrastructure that may be required and other normal items that need to be considered in an area structure plan of this nature.

The Panel would require, should the project be approved, that this plan be completed by PWSS and an amendment to the local land use by-law requested from the M.D. of Willow Creek prior to commencement of reservoir operations.

The Panel acknowledges that the Applicant conducted extensive public consultation about the Pine Coulee Project through a variety of means and over a number of years. This consultation was focused on the communities and rural residents which were located largely on Willow Creek or the proposed project area. The documentation provided by both the Applicant and the Public Advisory Committee was extensive. Overall, the Panel finds that the Applicant's public consultation in respect to the proposed project was satisfactory.

With respect to social effects, the Panel finds that the proposed project, should it proceed, would provide significant and positive social benefits to the Willow Creek basin, with few, if any, adverse social effects. The Panel concludes that the proposed project, through providing a secure and stable water supply, would remove a significant barrier affecting the social stability and well-being of the residents in the basin. This positive social effect is compelling, in the opinion of the Panel, and must be given appropriate weight in reaching any overall conclusions regarding the proposed project.

9.1.11 Aboriginal Archaeological Sites and Artifacts

The Panel heard extensive technical and historic evidence on archaeological resources in the Pine Coulee area, including detailed questioning and discussion about this research and its implications. The Panel commends the Applicant, Alberta Community Development and their consultants for their careful and thorough research work. It also commends them and the aboriginal participants for the way they sought to address the issues of archaeological and historic resources during the hearing.

The Panel is concerned that the religious, spiritual and cultural significance of the archaeological sites at Pine Coulee to the aboriginal people be fully identified, understood, and reflected in the planning and development of the Pine Coulee Project, should it proceed. The Panel accepts that the petroglyph and Iniskim buffalo stone are significant to the interests of the aboriginal people.

The Panel notes the reluctance of the aboriginal participants to identify and explain the importance and significance of various sites and artifacts for a variety of reasons based on past experience. The Panel also notes the request to re-evaluate how Indian culture and religion are viewed and treated, and the request that there needs to be a maturing process and a commitment to examine existing views and relationships between Indian people and "Euro-Canadian institutions and governments."

The Panel believes that the presentations made by the elders and Band members are an important part of the process. Protection and recognition of cultural and religious freedoms depends upon awareness and understanding. The aboriginal presentations to the Panel have emphasized that there are sites at Pine Coulee that have special religious, spiritual, and cultural significance to elders.

The Panel is cognizant that the criteria used to assess the significance of the sites at Pine Coulee from a research perspective may not yet fully reflect the criteria used by aboriginal elders; with understanding of the Indian culture and religion, the criteria used by archaeologists and elders may coincide. The Panel also notes that the objective of Alberta Community Development's heritage resources program is to ensure that significant artifacts are protected and preserved, and that the Department has been working more closely with aboriginal people in identifying, assessing, and managing historical impacts associated with proposed developments.

The Panel has considered the issue of the entire complex of sites that were found in and around Pine Coulee and their sacred or religious significance in combination with each other. The Panel accepts that many of the archaeological sites, such as tepee rings and campsites, are common in Alberta and may not be associated with the with the ribstone or petroglyph sites. However, the Panel notes that further archaeological assessment remains to be completed and that the evidence from the aboriginal presentations indicated that, based on their traditional knowledge, the sites contained more information than was made known to the archaeologists. The Panel notes that some important features of the sites may not have been recognized by the researchers, and that the aboriginal people had a different understanding of the sites and the artifacts and their interpretation. The Panel is concerned that the aboriginal people mentioned burial sites that were not made known to the researchers, and left the Panel with the impression that the sites may have more spiritual and religious significance than known or understood through the research conducted to date near the ribstone and petroglyph. The Panel believes that in the face of uncertainty a more prudent and cautious approach should be taken before any final conclusions are drawn regarding the significance of the various sites and artifacts that have been identified to date near the ribstone and petroglyph. In this case, where it is recognized that the petroglyph and ribstone may be relatively rare and are considered to be significant at provincial and regional levels, conservative assumptions regarding mitigation should be made about them and nearby sites until sufficient evidence has been considered to warrant reaching other conclusions.

The Panel has concluded from the evidence currently available, there is a need to require that the Applicant, in a manner satisfactory to Alberta Community Development, protect two

sites that were discussed during the hearing; the petroglyph (site EaPk 180) and the Iniskim or buffalo stone (site EbPk18). The Panel understands that the petroglyph site has already been purchased by PWSS and that the Iniskim site is under protection. The Panel would also require that this site also be purchased and protected.

The Panel heard that, in regard to developments such as the proposed project, all significant aspects of the archaeological, prehistoric and historic resources are safeguarded and managed through the existing regulatory regime in Alberta. The activities include: identification, designation, and where appropriate preservation of significant resources; establishing responsibility for mitigation of negative impacts that may be caused by a development; ongoing monitoring; and where required final disposition of artifacts. The Panel notes that participants expressed confidence in the ability of Alberta Community Development to fulfill their role in this matter. The Panel concludes that, with respect to archaeological, prehistoric and historic resources, they are protected through the existing regulatory regime.

The Panel accepts the evidence presented by government agencies and archaeological consultants indicating that, the Pine Coulee sites and artifacts are important, and that they have been, or will be adequately researched and considered before any project construction or operation. If there are unidentified sacred and burial sites at Pine Coulee overlooked by the Applicant and referred to by the Blood Tribe in its presentation, the Panel is of the opinion that these matters be resolved between Alberta Community Development and the aboriginal people. The Panel understands the wishes of the aboriginal people not to identify missed grave sites and their wish to see them left undisturbed. However, the Panel believes that without specific guidance from aboriginal people, any unidentified burial or other sites, could be disturbed during construction, or flooded during operations, without any knowledge about, or regard and respect for them, should the project proceed. The Panel recommends that any further identification or elaboration of the burial and sacred sites or artifacts and their meaning to aboriginal people should continue to be addressed through consultation between the aboriginal people involved and Alberta Community Development. This consultation should involve aboriginal elders and take place to the satisfaction of Alberta Community Development before the proposed project is constructed or operated.

The Panel agrees that there should be multi-stakeholder input to monitor and manage the Pine Coulee archaeological resources; including monitoring the mitigation process during project construction and subsequent operation, and any future educational or spiritual use of either the sites or artifacts. The Panel supports including an interpretive program as part of the Pine Coulee Project and the Panel believes multi-stakeholder input should be sought about its feasibility, development, and management. Stakeholders include Alberta Community Development, PWSS, the operator (Alberta Environmental Protection), the Public Advisory Committee, aboriginal groups and representatives from the Municipal District of Willow Creek and other communities in the project area. The Panel appreciates that a spirit of cooperation was expressed by local residents to such a process.

The Panel notes that the participation of the public is an essential component of the resource development process, and was a requirement of the EIA process that has identified the need for various mitigative actions to be implemented, should the proposed project proceed. The public participation associated with the proposed project has resulted in the project being more sensitive to public concerns and needs and more consistent with sustainable development. In this context, the Panel notes the concerns and interests of the aboriginal people and others in the historical resource impact assessment conducted for the proposed Pine Coulee Project. Mandatory public participation has become a legislated requirement of environmental impact assessments. The Alberta legislative requirement for historical resource impact assessments contain no equivalent requirements for public involvement and consultation. In cases such as the proposed Pine Coulee Project, the historical resource impact assessment would, in the Panel's opinion, have benefitted from a requirement to notify the public, including aboriginal people, of the work involved and the results; with appropriate opportunities for consultation. Therefore, the Panel recommends that Alberta Community Development establish public participation requirements for historical resource impact assessments for projects like Pine Coulee that are consistent with, and complimentary to, similar requirements now mandatory for environmental impact assessments in Alberta.

The Blood Tribe asked that the Panel consider commenting on the ownership and handling of prehistoric aboriginal sites and artifacts. It was recognized that this could be of assistance to future review panels. The Panel understands that under the existing laws of Alberta all archaeological and palaeontological resources belong to the Crown.

The Panel received evidence that the Pine Coulee area was in the traditional territory of the Blackfoot Confederacy which included, among others, the Peigan Nation and the Blood Tribe. The Panel was informed and understands that it is difficult if not impossible, to associate any of the prehistoric sites conclusively with any particular present-day aboriginal group. The Panel believes that discussions should continue to take place between PWSS, Alberta Community Development and the Treaty 7 aboriginal people about the identification, proper treatment, ownership and use of all Pine Coulee archaeological and historic sites and artifacts. The Panel understands that such discussions are already taking place and believes that more discussion would be of value to all parties.

The Panel notes the fiduciary obligations of the Crown and the Blood assertion that such obligations include ensuring that cultural and religious rights of First Nations people are protected. The Panel particularly notes the Blood Tribe concern regarding the treatment of Indian burial, cultural and scared sites and their request regarding the need for legislative protection of aboriginal burial sites. The Panel notes again the Blood position regarding the need to re-evaluate how Indian culture and religion are viewed and treated. The Panel realizes that Alberta legislation regarding historical resources has some relevance to certain aspects of this concern. However, the matter is much more complex and pervasive than the purview of this legislation. The Panel also notes the importance of these matters to the Blood Tribe as expressed through the existing Band Council Resolution regarding these on and off their reserve. In the opinion of the Panel, the examination of the interests and concerns of aboriginal people in the context of the Pine Coulee Project supports the need for a re-evaluation of social policy and legislation as it relates to the treatment of Indian burial,

cultural and sacred sites, that are located off Indian reserves on private lands as part of an overall review of aboriginal and religious rights. The Panel notes the lack of evidence regarding the current level of protection provided to such matters by Indian and Northern Affairs Canada. The Panel will address this matter in its recommendations to the Government of Canada.

The Panel notes the assertion of the Peigan Nation and Blood Tribe that the Old North Trail was a part of their culture. The Panel believes that further research would be required to establish its location along the Eastern Slopes of the Rocky Mountains and is far beyond the scope of the proposed project. The Panel believes that the testimony before the Panel from both the Peigan Nation and Blood Tribe that the Trail passed through or near Pine Coulee should be given further consideration by Alberta Community Development and PWSS to decide whether further investigation is appropriate. The Panel believes that the two trail segments identified in the HRIA as recent settlement trails need no further consideration. The Panel believes that should the Trail be identified in Pine Coulee that with appropriate mitigative measures, if required, this matter could be properly attended to and would not have an effect on the project, should it proceed.

The Panel was asked by the Blood Tribe to consider whether or not the buffalo stone could be removed from its present location and moved to the Blood's Sundance grounds; an area used by all the Blackfoot Confederacy. This request was conditional upon whether it could be protected in its present location. As noted, should the project proceed, the Panel would require that the buffalo stone lands be purchased and the site protected. The Panel believes that with appropriate protection the buffalo stone would be fully accessible to the Blackfoot Confederacy for its spiritual and religious purposes, making the relocation unnecessary. However, if protection at the present location could not be accomplished, the Panel believes that relocation would have to be further considered by Alberta Community Development, aboriginal people and other affected parties.

Subject to the Panel's requirements regarding the protection of the petroglyph and ribstone and the other necessary or required mitigative work identified by PWSS and required by Alberta Community Development, the Panel believes that if the proposed Pine Coulee Project were approved, it could proceed without undue damage or disrespect to aboriginal sites and artifacts.

10. NRCB DECISION RESPECTING THE PUBLIC INTEREST AND FEDERAL RECOMMENDATIONS

10.1 NRCB Decision Respecting the Public Interest

The Panel, pursuant to the *Natural Resources Conservation Board Act,* is required to determine whether in the opinion of the Panel, the proposed Pine Coulee Water Management Project is in the public interest, having regard for the social and economic effects of the project, and the effect on the environment. The Panel has concluded that the proposed Pine Coulee Project would result in significant and positive water quality, quantity and fisheries effects, and further concluded that the soils and drainage, vegetation, and wildlife effects of the proposed project could be mitigated so that the residual project effects on the environment would not be significant. The Panel concludes that the proposed project would provide significant and positive social benefits to the residents of Willow Creek basin, with few, if any, adverse social effects. The proposed project, through providing a secure and stable water supply, would remove a significant barrier affecting the social stability and well-being of the residents of the basin. The Panel concludes with respect to economic impacts and the potential for regional income distribution, that the construction and operational effects on the economy of the area surrounding the project would be significant and positive. The Panel would estimate the internal rate of return for the proposed project to be just below the Applicant's estimate of 5.7 percent. The Panel concludes that the benefits of the proposed project tend to improve when non-quantifiable effects, such as an increased security of water supply, improved water quality, enhanced flows below the reservoir, an increased ability to manage water, and the option value of potentially higher valued water in the future are all taken into consideration.

The Panel has weighed the social, economic and environmental effects of the proposed Pine Coulee Project. The Panel finds that the social benefits of the proposed project are persuasive since the project would substantially remove the lack of a secure and stable water supply as a major factor affecting the social stability and well being of the residents of the basin. The Panel finds that the economic effects of the project in the local area are significant and positive; however, in relation to the Alberta public interest such effects are not large when compared to all other economic activity undertaken in Alberta. The Panel finds that the environmental effects of the proposed Project are also persuasive and compelling in relation to the public interest. The net environmental effects of the project, in the opinion of the Panel are positive and significant particularly with respect to water quality, quantify, and fisheries when weighed against the minor residual project effects on soils and drainage, vegetation, and wildlife. The positive social and environmental effects of the project, combined with the economic benefits, more than compensate for the minor negative residual effects of the project, when mitigative measures are taken into consideration.

In the opinion of the Panel, having regard for all the evidence before it, the proposed Pine Coulee Water Management Project, subject to certain conditions, is in the public interest having regard to the social and economic effects of the project, and the effects of the project on the environment.

The Panel notes the numerous commitments of the Applicant to mitigative measures contained in the Application and the undertakings given at the hearing. All the commitments and

undertakings are an integral part of the proposed project and must be discharged by the Applicant. The panel highlights in particular the following commitments and undertakings:

- to operate the reservoir according to the proposed operating plan;
- to mitigate transportation effects through the development of new roads;
- to establish a safe and convenient portage around the weir;
- to monitor and report on mercury levels in fish;
- to design and operate the reservoir outlet works to minimize impacts on dissolved oxygen and ammonia levels in Willow Creek;
- to design and construct the diversion works to facilitate the future installation of works to allow fish passage should they be required;
- to establish a permanent wetland capable of supporting waterfowl and wildlife in the north end of the reservoir;
- to prepare and implement a fisheries mitigation and enhancement plan;
- to create trout habitat associated with the weir headpond;
- to create pike spawning habitat near the outlet of the reservoir at Willow Creek;
- to implement the six point mitigation plan regarding salinization of lands;
- to prepare and implement a habitat compensation plan;
- to implement the restoration of riparian vegetation and carry out related studies;
- to monitor and evaluate the programs discussed in the environmental impact assessment as part of the ongoing project mitigation;
- to continue to consult with the affected parties;
- to protect archaeological resources and mitigate effects where possible, particularly regarding the petroglyph and buffalo rock; and

- to consult aboriginal people regarding the interpretation of archaeological resources.

The Panel also notes the Applicants commitment to seek the advice, direction, and approval of appropriate government department and agencies with respect to the mitigation measures contained in the proposed project, and highlights in particular the role and responsibility of Alberta Environmental Protection (Controller of Water Resources, Dam Safety, Fish and Wildlife), Alberta Community Development, Alberta Agriculture, Food & Rural Development, Alberta Transportation and Utilities, Transport Canada, Fisheries and Oceans, Environment Canada, the Department of Indian and Northern Affairs Canada, and the MD of Willow Creek.

The Panel acknowledges that many of these commitments and undertakings were proposed by the Applicant and the Panel believes that they would be fulfilled in a responsible manner.

For example, the Panel notes from the Application that the estimated financial cost to implement the proposed Pine Coulee Project in 1994 dollars would be $38.7 million, with an estimated $23.3 million required for construction of the works. The mitigation of the impacts on local roads is a major project cost estimated at $5.0 million, or 12.9 percent of the total project cost, and includes over $3.0 million for the proposed causeway to accommodate Secondary Highway 527 at the reservoir midpoint. The Panel also notes that an additional $1.3 million has been estimated for environmental mitigation, including wildlife and vegetation compensation ($350,000), historical resources mitigation ($500,000), outlet pond ($100,000), recreation infrastructure ($200,000), and monitoring and evaluation ($150,000). Included within construction costs would be topsoil salvage costs, seepage-related mitigation, provision of a fishway bay, culverts in Secondary Highway 527 crossing, a gated culvert at the Fireguard Road crossing, site reclamation costs, and most of the access related infrastructure for the recreation sites.

The Panel, to provide additional certainty regarding these matters, has included a number of specific conditions in the draft form of Approval (Appendix D).

The Panel noted earlier that Alberta Public works, Supply and Services and Alberta Environmental Protection are involved in the design, construction, and operations of the proposed project and act on behalf of Her Majesty the Queen in right of Alberta. The Panel has adopted the view that the government of Alberta would be the entity responsible for the design, construction, and operation of the proposed project, and that commitments and undertakings made by Alberta Public Works, Supply and Services were on behalf of the Government of Alberta.

The Panel also realizes that many of the conditions that the Panel would require to be met, should the project proceed, would be to the satisfaction of various operating units of Alberta Environmental Protection such as Fish and Wildlife and Controller of Water Resources. On the surface, there may appear to be the potential for conflict between the responsibility to operate a water control structure such as the proposed Pine Coulee Project, and the various regulatory responsibilities of Alberta Environmental Protection. The Panel has considered this potential concern and is satisfied

the Panel's requirements that certain conditions be met to the satisfaction of ongoing regulatory authorities is appropriate, since these authorities are entrusted to discharge their regulatory duty in accordance with established legislation and public policy that binds the Crown.

The Panel is prepared to make an order granting an approval for the project, with the authorization of the Lieutenant Governor in Council, and subject to the conditions contained in the Draft Form of Approval found in Appendix D.

10.2 Federal Environmental Assessment and Review Panel Recommendations

The Panel is required to fulfill the Terms of Reference and mandate established by the federal Minister of Environment.

The Panel has concluded that the proposed Pine Coulee Project would result in significant and positive water quality, quantity and fisheries effects, and further concluded that the soils and drainage, vegetation, and wildlife effects of the proposed project could be mitigated so that the residual effects on the environment would not be significant. Therefore, the Panel recommends that the Pine Coulee Project receive regulatory approval from the Government of Canada.

The Panel notes the primary interests of the Government of Canada with respect to the effects of the proposed Pine Coulee Project pertain to navigation; fisheries and fish habitat; migratory birds; vulnerable, threatened or endangered species; and to the concerns and interests of aboriginal people.

The Panel expects that the proposed Pine Coulee Project would have a minor effect on navigation on Willow Creek due to the limited use the creek receives for such purposes. The Panel recommends that Transport Canada, in considering an application for approval for the proposed diversion works and outlet structures, require that the Applicant provide for a convenient means of portage passage around the diversion works and require that the works be designed and operated in a manner so as to minimize the risk of navigation hazards to the small number of canoeists or other small craft users that might utilize Willow Creek in the vicinity of the proposed works. The Panel notes that it has recommended that the proposed reservoir remain largely unobstructed to boating through the elimination of the proposed causeway for Secondary Highway 527 across the middle of the reservoir, and that the project includes the establishment of boating access facilities.

With respect to fisheries and fish habitat, the Panel has given detailed consideration to these matters and the NRCB approval would contain a number of conditions upon the Applicant to ensure that fisheries and fish habitat are appropriately integrated into the design and operation of the proposed project. The Panel believes that the detailed fisheries mitigation and enhancement plan, that the NCRB approval would require to be completed, would provide the basis for the Department of Fisheries and Oceans to reach final conclusions confirming the no-net-loss and fisheries habitat policy has been fully met through the mitigation measures required of the Applicant. NRCB Approval

requires that the Applicant complete the fisheries habitat compensation plan required by the Department of Fisheries and Oceans, as part of the fisheries mitigation and enhancement plan, and in addition the Panel recommends that the Department of Fisheries and Oceans take an active role in the development and evaluation of the fisheries mitigation and enhancement plan, contributing its expertise and experience in a manner that will result in the protection and enhancement of the fishery resources of the Willow Creek basin, along with groups like Trout Unlimited.

With respect to migratory birds, the Panel believes that the project will have a positive and beneficial impact on migratory birds through the creation of some additional waterfowl habitat in southern Alberta. In particular, the establishment of a permanent and managed wetland in the northern basin of the reservoir, combined with the balance of the habitat available on and near the reservoir, will be a positive addition to waterfowl habitat. The Panel recommends that Environment Canada work closely with the Applicant and appropriate groups such as Ducks Unlimited to provide its expertise and experience toward realizing this positive environmental effect of the proposed project.

With respect to threatened, rare and endangered species, the Panel has concluded that the proposed project will not result in any significant adverse environmental effects. Specific species of concern have been identified through the EIA process, and a habitat compensation program has been proposed to mitigate project effects. The Panel believes that the ferruginous hawk, prairie falcon, and leopard frog will be receiving specific attention in the mitigation planning to ensure that the residual effects of the project on these species of concern are minimized. The Panel is also satisfied, subject to certain requirements of the Panel, that the effects on the Baird's sparrow, burrowing owls, and blue heron are mitigated in a satisfactory manner. The Panel again recommends that Environment Canada support the mitigation planning of the Applicant in an advisory capacity, providing expertise and advice that will improve the effectiveness of the mitigation measures required by the Panel of the Applicant.

The Panel understands the following to be the major concerns and interest of aboriginal peoples about the effects of the project:

- in and around the proposed Pine Coulee Reservoir are aboriginal sites and artifacts that are or may be affected by the proposed project;
- the proposed Pine Coulee Reservoir would affect flows in Willow Creek and the Oldman River and could affect the interests of the Peigan Nation;
- the proposed Pine Coulee Reservoir would affect wildlife that could affect the interests of the Peigan Nation; and
- aboriginal interests and concerns have been inadequately reflected in the assessment of the effects of the proposed project due to inappropriate consultation.

Water plays a critical role in southern Alberta, and the Indian reserves in the South Saskatchewan basin are associated with water in many ways. Water management considerations in southern Alberta affect, and are influenced by, the Indian reserves that are an integral part of the South Saskatchewan basin. The Panel notes that it received presentations from the Peigan Nation and Blood Tribe, and appreciates that had it received presentations from other aboriginal people within the South Saskatchewan River basin, it would have more complete information regarding the potential effects of the proposed Pine Coulee Project on aboriginal interests and concerns. It also appreciates that the Blood and Peigan do not represent all aboriginal interests within the Blackfoot Confederacy and Treaty 7. The Panel does, however, believe that the submissions are indicative of aboriginal interests and concerns associated with the proposed project, particularly as they relate to the potential effects of the proposed project on the environment. The Panel believes that the degree of interest and concern of aboriginal people in the environmental effects of the proposed Pine Coulee Project would be less for those further away from the project. The Panel believes that the concerns of aboriginal people regarding the cultural and religious significance of the buffalo stone, petroglyph, and other sites in the Pine Coulee area received from the Blood and Peigan would be indicative but not fully representative of those concerns.

With respect to the interests and concerns of Aboriginal people in the region, the Panel has a number of observations. The Panel has concluded that the primary effect of the project on the interests and concerns of aboriginal people, particularly the Peigan Nation and the Bloods Tribe, pertains to the archaeological resources found in the project area. The Panel has placed specific conditions on the Applicant to ensure that the most significant of these resources, the petroglyph and ribstone, are specifically protected and preserved for the benefit of all concerned. Consultation will be undertaken to ensure that the spiritual and cultural significance of these artifacts to the aboriginal people are recognized, and that the ability of aboriginal people to obtain the beneficial use of those artifacts is not diminished unnecessarily and only to the extent that is necessary for the project to proceed. The Panel notes that both sites are above the reservoir and the petroglyph has been avoided through changes in the alignment of the diversion weir canal. Further discussions will take place regarding the meaning and interpretation of these sites. The Panel has concluded that the proposed project would not have significant adverse effects on the environmental interests and concerns of the aboriginal people, including the effects on the Oldman River.

The Panel believes that the matter of early consultation between the Applicant and aboriginal people in this case can provide guidance for the future. The Panel believes that all parties involved in the current Application, including the Peigan, Blood, and other members of the Blackfoot Confederacy and Treaty 7 would benefit from planning processes that are more inclusive. The responsibility to inform, and be informed, is one which is shared by all. Failure to seek out those who may be affected is unwise. Similarly, failure to seek out and become informed about matters that may affect key interests is also unwise. In the Panel's view, the fiduciary obligations of the Crown in this case may have been fulfilled in a more efficient manner by the Department of Indian and Northern Affairs Canada and other government agencies that had knowledge of the project. The Panel recommends that the Department of Indian & Northern Affairs Canada take a more direct responsibility in ensuring that aboriginal people are in a position to participate in development

decisions at the earliest stage by ensuring they are appropriately informed so that they can choose to participate, should they wish to do so.

The Panel particularly notes of the concerns of the aboriginal people, expressed regarding the proposed Pine Coulee Project, pertaining to the policy and legislation of the government of Canada regarding the treatment of Indian burial and sacred sites located off Indian reserves on private lands. It also takes note of the assertion of the Blood Tribe that the Crown has a fiduciary obligation to ensure that cultural and religious rights of First Nation people are protected. Therefore, the Panel recommends that the Department of Indian and Northern Affairs Canada give further consideration to the need for protection of Indian burial and sacred sites.

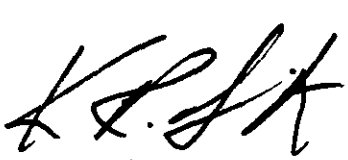
The Panel recommends the Pine Coulee Project receive regulatory approval from the Government of Canada. Appendix A contains the Panel Terms of Reference established by the federal Minister of Environment and a summary listing of the Panel's recommendations responding to the mandate.

10.3 Endorsement

Having regard for the Panel's overall conclusions respecting the proposed Pine Coulee Water Management Project, the NRCB decision with respect to the public interest, and the recommendations to the Government of Canada, now therefore the Joint Natural Resources Conservation Board/Federal Environmental Assessment Review Panel concludes the review.

DATED at Edmonton, Alberta on February 14, 1995.

Joint Natural Resources Conservation Board/Federal Environmental Assessment Review Panel



Ken Smith
Chairman

Charles Weir
Member

George Kupfer
Member

APPENDIX A

PANEL TERMS OF REFERENCE

JOINT REVIEW PANEL - PINE COULEE WATER MANAGEMENT PROJECT SOUTHWESTERN ALBERTA

INTRODUCTION

The federal Minister of Transport referred the Pine Coulee Project to the federal Minister of the Environment for a public review in accordance with the *Environmental Assessment and Review Process* (EARP) *Guidelines Order*. In doing so, the asked that negotiations be entered into with the Government of Alberta for the establishment of a joint review panel as provided for in the *Canada-Alberta Agreement for Environmental Assessment Cooperation*. The also asked that the review address the environmental effects of the proposal and the socio-economic effects directly related to these environmental effects, especially those effects which would have an impact on aboriginal interests.

As a result of this referral, officials from the Federal Environmental Assessment Review Office (FEARO) and the Alberta Natural Resources Conservation Board (NRCB) have entered into an agreement outlining the basis for the establishment and operation of a joint review panel.

These terms of reference are being issued in accordance with the requirements of the *EARP Guidelines Order* and to identify, from a federal perspective, the issues to be addressed in the joint review and how the review will proceed.

MANDATE

The proposal to be reviewed consists of the construction and operation of water management facilities on Willow Creek including a diversion of a portion of the Creek and the construction and operation of an off-stream dam in Pine Coulee. The project is located southwest of Stavely in southwestern Alberta.

The panel will address in its review issues falling within federal jurisdiction, including the impacts of the project:

- on navigation and the safety of vessels on the waterway, both upstream and downstream of the works;

- on fisheries and fish habitat;

- relating to the concerns and interests of aboriginal people;

- on migratory birds; and

- on vulnerable, threatened or endangered species.

The panel's final report, including recommendations relating to the above issues and any other issues that may arise during the review that relate to matters of federal jurisdiction, will be conveyed to the federal Ministers of the Environment and Transport at the same time as it is conveyed to the Government of Alberta.

The panel will be managed in accordance with the agreement signed by FEARO and the NRCB, having regard for the general terms and conditions set out in the Subsidiary Agreement on Joint Review Panels that forms part of the *Canada-Alberta Agreement for Environmental Assessment Cooperation* signed on August 6, 1993. It will also meet the duties and responsibilities of a federal EARP panel.

REVIEW PROCESS

The Joint Review Panel is authorized pursuant to the *EARP Guidelines Order* and the *NRCB Act*. The main steps in the review process will be as follows:

- Public hearing conducted in accordance with the procedural requirements of the *NRCB Act*.

- Preparation by the panel of its final report and submission of this report to the Government of Alberta and to the federal Ministers of the Environment and Transport. The report will incorporate the panel's decisions on matters that fall within provincial jurisdiction in accordance with the provisions of the *NRCB Act* and will include recommendations on matters that fall within federal jurisdiction in accordance with the requirements of the *EARP Guidelines Order*.

Summary of Recommendations of the Federal Environmental Assessment and Review Process Panel

WHEREAS the federal Minister of the Environment established the federal Environmental Assessment and Review Process/Natural Resources Conservation Board Joint Review Panel to consider the proposal of Alberta Public Works, Supply and Services to construct and operate the Pine Coulee Project, a water management project that includes a diversion weir on Willow Creek, a canal and an off-stream storage reservoir in Pine Coulee, Alberta; and

WHEREAS the Panel had regard for the terms of reference provided the panel by the federal Minister of the Environment in the completion of its public review of the project.

NOW THEREFORE in response to the federal terms of reference, the Joint Review Panel makes the following recommendations to the federal government:

1. The Panel recommends the Pine Coulee Project receive regulatory approval from the Government of Canada.

2. The Panel recommends that Transport Canada require a convenient means of portage passage around the diversion works and outlet structures and require that the works be designed and operated in a manner so as to minimize the risk of navigation hazards to small craft users in the area.

3. The Panel recommends that the Department of Fisheries and Oceans take an active role in the development and evaluation of the fisheries mitigation and enhancement plan to be prepared by the Applicant, and especially with respect to the approval of the fisheries habitat compensation component of the plan.

4. The Panel recommends that Environment Canada work closely with the Applicant and appropriate groups, to provide its expertise and experience regarding the establishment of a permanent and managed wetland in the northern basin of the reservoir, combined with the balance of the habitat available on and near the reservoir.

5. The Panel recommends that Environment Canada support the wildlife and vegetation habitat mitigation planning of the Applicant in an advisory capacity, providing expertise and advice that will improve the effectiveness of the mitigation measures required by the Panel.

6. The Panel recommends that the Department of Indian and Northern Affairs Canada take a more direct responsibility in ensuring that aboriginal people are in a position to participate in development decisions at the earliest stage by ensuring they are appropriately informed so that they can choose to participate should they wish to do so.

7. The Panel recommends that the Department of Indian and Northern Affairs Canada give further consideration to the need for protection of Indian burial or sacred sites.

APPENDIX B

Key events in the Pine Coulee Reservoir Water Management Project Review Process

DATE	EVENT
August 6, 1993	*Canada-Alberta Agreement for Environmental Assessment Cooperation* providing for joint reviews of projects signed.
November 2, 1993	Applicant applied to Transport Canada for approval under the *Navigable Waters Protection Act.*
January 5, 1994	Application filed with NRCB for approval under Section 5(1) of the *NRCB Act.*
January 7, 1994	NRCB issued Preliminary Notice of Application.
March 4, 1994	NRCB published a Notice to Interested Parties requesting those parties wishing to address preliminary matters to register with the NRCB on or before April 7, 1994.
March 11, 1994	NRCB forwarded Request for Supplemental Information to the Applicant.
March 31, 1994	Federal Minister of Transport referred the proposal to the Federal Minister of the Environment for a panel review under Section 12(d) and Section 13 of the *EARP Guidelines Order* and requested establishment of a joint review panel under *Canada-Alberta Agreement for Environmental Assessment Cooperation.*
April 21, 1994	Applicant filed its response to the Request for Supplemental Information
May 4, 1994	Federal Government announced availability of Participant Funding for Pine Coulee Review. Deadline for submission May 27, 1994.
May 11, 1994	O/C #277/94 approved by the Lieutenant Governor in Council authorizing the NRCB to enter into an agreement with FEARO to conduct a joint review.
May 12, 1994	Chairman of the NRCB established a Division of the NRCB to review the project consisting of K. Smith, C. Weir, and G.Kupfer.
May 16, 1994	Alberta Environmental Protection advised the NRCB that the EIA was suitable for review at a public hearing.
May 19, 1994	Notice of Pre-Hearing Conference issued.
June 1, 1994	NRCB and FEARO signed a Joint Review Agreement.
June 9, 1994	Federal Minister of the Environment announced a Joint Review Panel consisting of K. Smith, Chair, C.Weir and G. Kupfer and issued its Terms of Reference.
June 15, 1994	Pre-Hearing Conference held in Stavely, Alberta
July 4, 1994	Notice of Hearing and Report of Pre-Hearing Conference on Preliminary and Procedural Matters issued.
July 8, 1994	Federal Participant Funding awarded.
July 14, 1994	Panel requested supplemental information from the Applicant.
August 15, 1994	Applicant filed its response to request for supplemental information.
Sept 26 - Oct 7,1994	Hearing held in Stavely, Alberta.

APPENDIX C

HEARING CONFERENCE PARTICIPANTS
APPLICATION # 9401,
September 26, - October 7, 1994

Participants (Abbreviations Used in Report)	Witnesses
Alberta Public Works Supply and Services (PWSS or the Applicant)	
Stan Rutwind Terry DeMarco Gilbert Van Nes Maarten Ingen-Housz	Jim Barlishen Al Nilson John Englert Dieter Lindner Ron Middleton All of PWSS Richard Spencer, Spencer Environmental Management Services Ltd. Lawrence Brusnyk, D.A. Westworth & Associates Jim Allan, Pisces Environmental Consulting Ltd. Allan McCann, Omni-McCann Consultants Ltd. Gordon MacDonald, Environmental Management Associates Gloria Fedirchuk, Fedirchuk McCullough & Associates Ltd. Maarten Ingen-Housz, Nichols Applied Management Sandy Larsen Annette Trimbee Both of Alberta Environmental Protection Richard Heywood, Rodney Bennett, Both of Alberta Agriculture Dr. Marv Anderson, Marv Anderson & Associates Rebecca Balcom, Golder & Associates Ltd.

Participants (Abbreviations Used in Report)	Witnesses
Willow Creek Irrigators (the Irrigators Association)	
George Gaschler Doug Leeds	George Gaschler Lauren Kirychuk, AFC Agra Services Ltd. Kirk Strom, AXYS Environmental Consulting Ltd.
Doug Leeds (self)	Doug Leeds
William van Rootselaar (self)	William van Rootselaar
Cody Waters (Self)	Cody Waters
Public Advisory Committee	
Ed Nelson Duane Southgate	Duane Southgate,Chair Doug Leeds, Vice-Chair John Berns, Mayor of Nanton Ken Dahl, MD of Willow Creek Ed Nelson, Local Area Rancher
Alberta Environmental Protection (AEP) & Alberta Community Development (Community Development)	
Ev Bunnell Aldo Agento	Dick Hart, Water Resources Dan Chambers, Parks and Services Jack Brink Brian Ronaghan Both of Historical Resources Division

Participants (Abbreviations Used in Report)	Witnesses
Controller of Water Resources Government of Alberta (the Controller)	
Ron Kruhlak	Peter Watson, Water Rights Branch
Peigan Nation (the Peigan)	
David Paterson	Kirby Smith, Band Councillor Dr. Joe Elliott, Ecological Consultant Dr. Brian Reeves Lifeways of Canada Ltd. Thomas Watson, Morrison-Maierle/CSSA Dale Smith, Band Administration Maryann McDougall,President Peigan Elders
Town of Stavely	
Mayor John Berns	Mayor John Berns
Town of Nanton	John Blake, Councillor
Municipal District of Willow Creek No. 26 (MD of Willow Creek)	
Ken Dahl Evan Berger	Ken Dahl, Councillor, Division 4 Evan Berger, Councillor Division 6 Dave Claypool, Councillor Division 2 Brian Nelson, Superintendent of Public Works Ruben Hartfelder, Municipal Administrator

Participants (Abbreviations Used in Report)	Witnesses
Oldman Regional Planning Commission (ORRPC)	
Mike Burla	Mike Burla
Town of Claresholm	Mayor Ernie Patterson
Area Landowners Group (Landowners Group)	
David Yates Brent Carey	David Yates Brent Carey Kris Snethun John Perrot Gary Brown all Area land owners John Wipf, Parkland Hutterite Coloney Murray Riddell Marc Sabourin Both of EBA Engineering Ltd.
Pine Coulee Coaltion (the Coalition)	
Jim Harvie Maryhelen Posey Cliff Wallis	Jim Harvie, Highwood Restoration & Conservation Society Cliff Wallis, Alberta Wilderness Assoc. Maryhelen Posey, Federation of Alberta Naturalists Ross MacDonald, Zone 1 Fish & Game Association Dr. Thomas Power,University of Montana Dr. Robert Scace, Sentar Consulting Ltd.

Participants (Abbreviations Used in Report)	Witnesses
Trout Unlimited Canada (Trout Unlimited)	
Greg Shyba	Garry Szabo
Blood Tribe (the Blood)	
	Councillor Dorothy First Rider Wilton Goodstriker, Cultural Resource Person Elder Louise Cropeardwolf Councillor Navcisse Blood Annabel Cropeardwolf,Staff - Blood Tribal Administration
Transport Canada, Government of Canada	
Steve Faulknor Reg Watkins	Reg Watkins, Navigable Waters Protection
Fisheries & Oceans, Government of Canada (DFO)	
Glen Hopky	Glen Hopky Garry Linsey

Participants (Abbreviations Used in Report)	Witnesses
Environment Canada, Government of Canada	
William Gummer	William Gummer David Donald Both of Ecosystem Quality Division, Regina Larry Wiens, Atmospheric & Hydrological Sciences Division Paul Grossen, Canadian Wildlife Service Lutz Rauhe, Conservation & Protection
Written Submission:	
Town of Granum Claresholm Fish & Game Association Southern Alberta Environmental Group Porcupine Hills Wildlife Association Local Area Residents - Stavely	
Pine Coulee NRCB/EARP Joint Panel Secretariat:	
John Mathers Patrick Cleary Joyce Ingram William Kennedy Dr. Albert van Roodselaar Dr. Robert Powell Jim McKee	
Patsy Cross, Board consultant	

APPENDIX D
FORM OF APPROVAL

THE PROVINCE OF ALBERTA
NATURAL RESOURCES CONSERVATION BOARD ACT
NATURAL RESOURCES CONSERVATION BOARD

IN THE MATTER of a project of Alberta Public Works, Supply and Services for the construction of a water management project on Willow Creek near the Town of Stavely

APPROVAL NO. 7

WHEREAS the construction of water management facilities proposed for Willow Creek by Her Majesty the Queen in Right of Alberta as represented by Alberta Public Works, Supply and Services (PWSS), including a diversion weir, a canal and an off-stream storage reservoir in Pine Coulee, is a reviewable project under s.4(d) of the *Natural Resources Conservation Board Act* being chapter N-5.5 of the Statutes of Alberta, 1990; and

WHEREAS the Natural Resources Conservation Board is prepared to grant the application by Alberta Public Works, Supply and Services for the construction and operation of water management facilities on Willow Creek and in Pine Coulee, subject to the conditions herein contained, and the Lieutenant Governor in Council has given authorization, hereto attached.

THEREFORE, the Natural Resources Conservation Board hereby orders as follows:

1. The project of Her Majesty the Queen in Right of Alberta as represented by Alberta Public Works, Supply and Services, hereinafter called "the Operator", for construction and operation of water management facilities on Willow Creek and in Pine Coulee as described in Application No. 9401, from PWSS to the Board dated January 5, 1994 and descriptive material supporting the Application marked as exhibits at the Stavely, Alberta joint hearing of the Natural Resources Conservation Board and the federal panel established pursuant to the Federal Environmental Assessment and Review Guidelines Order held from September 26 to 30, 1994 and October 4 to 7, 1994, including undertakings of the Applicant, is approved, subject to the terms and conditions herein contained.

2. The Operator shall, to the satisfaction of Alberta Environmental Protection, revise the IFN analysis used as the basis for the interim operating plan:

(1) to more fully reflect the riparian and aquatic needs between the proposed diversion weir and reservoir outlet to Willow Creek (Reach 3), and riparian needs downstream from the reservoir outlet to the confluence with the Oldman River (Reach 4);

(2) to give explicit consideration for reservation of water for future requirements, and

(3) to provide contingent operating flexibility to accommodate any foreseeable changes in the operating regime of the Chain Lakes Reservoir.

3. The Operator shall manage releases from the reservoir in a manner that ensures minimum instream flow needs for protecting the aquatic and riparian environment, and domestic and municipal drinking water requirements, as established by Alberta Environmental Protection, are always met within the physical limitations of the reservoir and weir.

4. The Operator shall, to the satisfaction of Transport Canada, establish a safe and convenient portage around the weir.

5. The Operator shall, in a manner satisfactory to Alberta Fish and Wildlife, monitor and report on mercury levels in fish from the reservoir and from Reach 4 of Willow Creek.

6. The Operator shall design the reservoir outlet works and carry out its operations in a manner satisfactory to Alberta Environmental Protection that minimizes the potential adverse effects of reservoir discharge on dissolved oxygen and ammonia levels in Willow Creek; and shall conduct such further modelling and water quality monitoring to confirm that water released from the reservoir at the raised elevation is of sufficient quality to meet water quality and fisheries management objectives established for Reach 4 of Willow Creek.

7. The Operator shall design and construct the weir to provide for the installation of works to allow fish passage should they be required in the future.

8. The Operator shall establish control gates at the causeway across the north end of the reservoir so that the water levels in the north basin are stabilized and consistent with the establishment of a permanent wetland capable of supporting waterfowl and wildlife.

9. The Operator shall, to the satisfaction of Alberta Environmental Protection, in consultation with the Department of Fisheries and Oceans, prepare and implement a fisheries mitigation and enhancement plan as an integral component of the project; the plan shall address, among other relevant factors, the following:

(1) the feasibility and desirability of managing fisheries upstream of the diversion weir (Reach 2) primarily for cold-water species, taking into consideration the role of the weir, diversion canal, and headpond and the implications for cool-water species;

(2) the feasibility and desirability of the establishment of a sustainable cool-water fishery in the reservoir, particularly walleye, taking into consideration:

(a) the role of the saddle dyke in providing spawning habitat;

(b) the minimum water level and quality that would be required to ensure a sustainable fishery;

(c) the effect of mercury contamination;

(d) the nutrient requirements of fish; and

(e) the effect on reservoir water quality and fisheries of not constructing the causeway for Secondary Highway 527;

(3) the feasibility and desirability of managing fisheries in Reach 3 and downstream of the reservoir outlet in Reach 4, primarily for cool-water species, taking into consideration:

(a) the role of the weir;

(b) the design of the outlet channel from the reservoir;

(c) the need for pike spawning habitat at the outlet; and

(d) the water quality discharged to Willow Creek.

(4) the fisheries habitat compensation requirements of the Department of Fisheries and Oceans.

(5) the ongoing monitoring of the effectiveness of the mitigation and enhancement program; and

10. The Operator shall, subject to condition 9(1), design and operate the weir and associated headpond to the satisfaction of Alberta Fish and Wildlife and in a manner that provides trout habitat, and ensures that sedimentation is minimized and adequate water depth is maintained.

11. The Operator shall, subject to conditions 9(3) and 9(5), design and implement a program to establish pike spawning habitat of 5 to 10 hectares near the outlet of the reservoir at Willow Creek.

12. The Operator shall design, in a manner satisfactory to the Controller of Water Resources, the reservoir, dam, and saddle dyke to incorporate appropriate mitigative measures that will restrict and control seepage to prevent the project from causing the salinization of agricultural lands.

13. The Operator shall, in a manner satisfactory to the Controller of Water Resources and well in advance of the project proceeding to operate, establish the following measures:

(1) An appropriate groundwater observation network adjacent to the project that will ensure that any seepage that could lead to salinization of agricultural land is detected at an early stage;

(2) Specific mitigation plans that would be implemented to prevent seepage from causing the salinization of agricultural land;

(3) An appropriate monitoring and detection program that would identify, in accordance with generally recognized methods, any salinization of soils that might be attributable to the project; and

(4) In the event that salinization were to occur, an appropriate course of action that would be followed to correct any salinization attributable to the project, including the specification of the financing and timing of corrective steps.

14. The Operator shall prepare and implement in a timely manner a detailed habitat compensation plan to the satisfaction of the Fish and Wildlife Division based on an objective of no-net-loss of grassland habitat capability.

15. The Operator shall prepare and implement a detailed plan, approved by Alberta Environmental Protection and Alberta Agriculture Food & Rural Development, to mitigate the loss of riparian poplars by establishing replacement stands and reducing livestock impacts.

16. The Operator shall prepare and implement in a timely manner a detailed wildlife habitat compensation plan to the satisfaction of the Fish and Wildlife Division.

17. The Operator shall design and implement a study as part of the habitat compensation program, and to the satisfaction of Alberta Environmental Protection, to confirm the nature or extent of local ungulate movement patterns in and around the project, and implement mitigative measures to ensure movement is provided for around the headpond and weir.

18. The Operator shall, to the satisfaction of Alberta Environmental Protection, prepare a field oriented operation plan to ensure that all personnel involved in the construction and operations of the project would be informed of their responsibilities in implementing the environmental mitigation plans.

19. The Operator shall, with the advice and consent of the Municipal District of Willow Creek, establish a good standard perimeter road around the reservoir that would include a link substantially similar to Link 5, the causeway on Fireguard Road on the north, the relocated Pumphouse Road across the saddle dyke and dam to the south, and any other links required to complete a perimeter road around the reservoir.

20. The Operator shall, as part of its final planning and design phase, prepare an area structure plan for the lands in the immediate vicinity of the reservoir and request an amendment to the local land use by-law from the M.D. of Willow Creek prior to commencement of operations.

21. The Operator shall, in a manner satisfactory to Alberta Community Development, purchase and protect the petroglyph and buffalo rock sites.

22. The Operator shall send all official notices about the further development of the project to all Chiefs and Councillors for each Treaty 7 Indian Band.

23. The Operator shall comply with all approvals required pursuant to the *Water Resources Act* and the *Alberta Environmental Protection and Enhancement Act* issued by Alberta Environmental Protection, and with all other applicable regulations and standards of the Province of Alberta.

Made at the City of Edmonton, in the Province of Alberta, this day of , 1995.

NATURAL RESOURCES CONSERVATION BOARD