PFRA

PRAIRIE FARM REHABILITATION ADMINISTRATION SERVING THE PRAIRIE PROVINCES

PRAIRIE SOIL
PRAIRIE WATER

THE PFRA STORY

Canada

PRAIRIE SOIL
PRAIRIE WATER

THE PFRA STORY

FOREWORD

The Prairie Farm Rehabilitation Administration, better known as PFRA, was a product of those terrible years of drought and economic disaster known as the "dirty thirties". Between 1929 and 1937, the longest period of drought ever experienced in the West left thousands of farm families bankrupt and homeless. The region was on the brink of total economic collapse.

In 1935, PFRA was created to deal with the drought and soil-drifting problem in Manitoba, Saskatchewan and Alberta. It was an almost overwhelming task.

To meet this challenge, PFRA worked hand in hand with the Dominion Experimental Farms to help the region's struggling farmers. New ideas and methods were introduced to stop the drifting soil, store water and generally improve farming methods. Huge blown-out parcels of land were seeded for community pastures. Dams and dugouts were designed and built. Large-scale shelterbelt plantings were started. These programs played a key role in saving the Prairies and turning them into the productive agricultural region that exists today.

The objectives of conserving soil and water and promoting good farming practices are as valid now as they were in 1935. Farmers of today face a number of problems, both old and new. Salt patches dot the prairie landscape, erosion has taken a terrible toll and nearly half of our soil's original nutrients is gone. As a result, PFRA is placing a new emphasis on soil conservation. Without a concerted effort to save our soil now, the future of agriculture on the Prairies is at risk.

Over the years, we've done a lot to help the people of the West. This publication illustrates and explains those accomplishments, showing PFRA past and present. We look forward to continuing to build on our past work and to taking new steps to conserve and develop Prairie resources for future generations.

Harry Hill
Director General, PFRA

CONTENTS

PFRA HIGHLIGHTS

1935

Royal Assent was given to the Prairie Farm Rehabilitation Act, creating a temporary organization to rehabilitate the drought and soil drifting areas of Manitoba, Saskatchewan and Alberta. The sum of $4.75 million was to be spent over a five-year period.

1937

PFRA began to reclaim blown-out lands by removing them from cultivation, regrassing them and turning them into pastures. This marked the beginning of the Community Pasture Program.

1939

Its five-year limitation removed, PFRA became a permanent organization.

1949

The Demonstration Farm was established at Outlook, Saskatchewan to demonstrate modern irrigation methods and cropping practices.

1950

The Bow River Irrigation Project was purchased by Canada.

1951

The St. Mary Dam, main structure in the St. Mary Irrigation Project, was completed.

1958

Canada and Saskatchewan agreed to build the South Saskatchewan River Project, which created Gardiner Dam and Lake Diefenbaker.

1963

The Tree Nursery at Indian Head, Saskatchewan was transferred to PFRA.

1965

The Waterton Dam, an essential part of the St. Mary Irrigation Project, was completed.

1967

In conjunction with Canada's Centennial celebrations, the Gardiner Dam and Lake Diefenbaker were officially opened.

1969

PFRA was transferred to the Department of Regional Economic Expansion from Agriculture Canada.

1970

In Manitoba, the Shellmouth Dam-Portage Diversion project, designed to control flooding on the Assiniboine River, was completed.

1972

The Agricultural Service Centres Program was launched in Saskatchewan and Manitoba and in Alberta in 1973. It provided $54 million for the construction of sewer and water facilities in 49 prairie centres.

1973

Canada and Alberta signed the Canada-Alberta Irrigation Rehabilitation Agreement. Among other things, it provided for the transfer of the Bow River and St. Mary River Irrigation Projects to provincial jurisdiction.

1979

Canada and Saskatchewan signed a multi-million dollar agreement for water development projects and drought studies. A similar agreement was signed between Canada and Manitoba in 1980.

1981

The PFRA Soil Conservation Planning Section was established.

1983

PFRA rejoined Agriculture Canada.

1985

PFRA celebrated its 50th anniversary.

1. THE EARLY YEARS

The story of PFRA is an important chapter in the history of the Canadian Prairies, one of the world's great wheat producing areas. Farming has been the heart of the prairie economy since the earliest days of settlement, and the provinces of Manitoba, Saskatchewan and Alberta today boast more than 80 per cent of the country's improved farm land. Yet at one time, much of the region was thought to be unfit for agriculture.

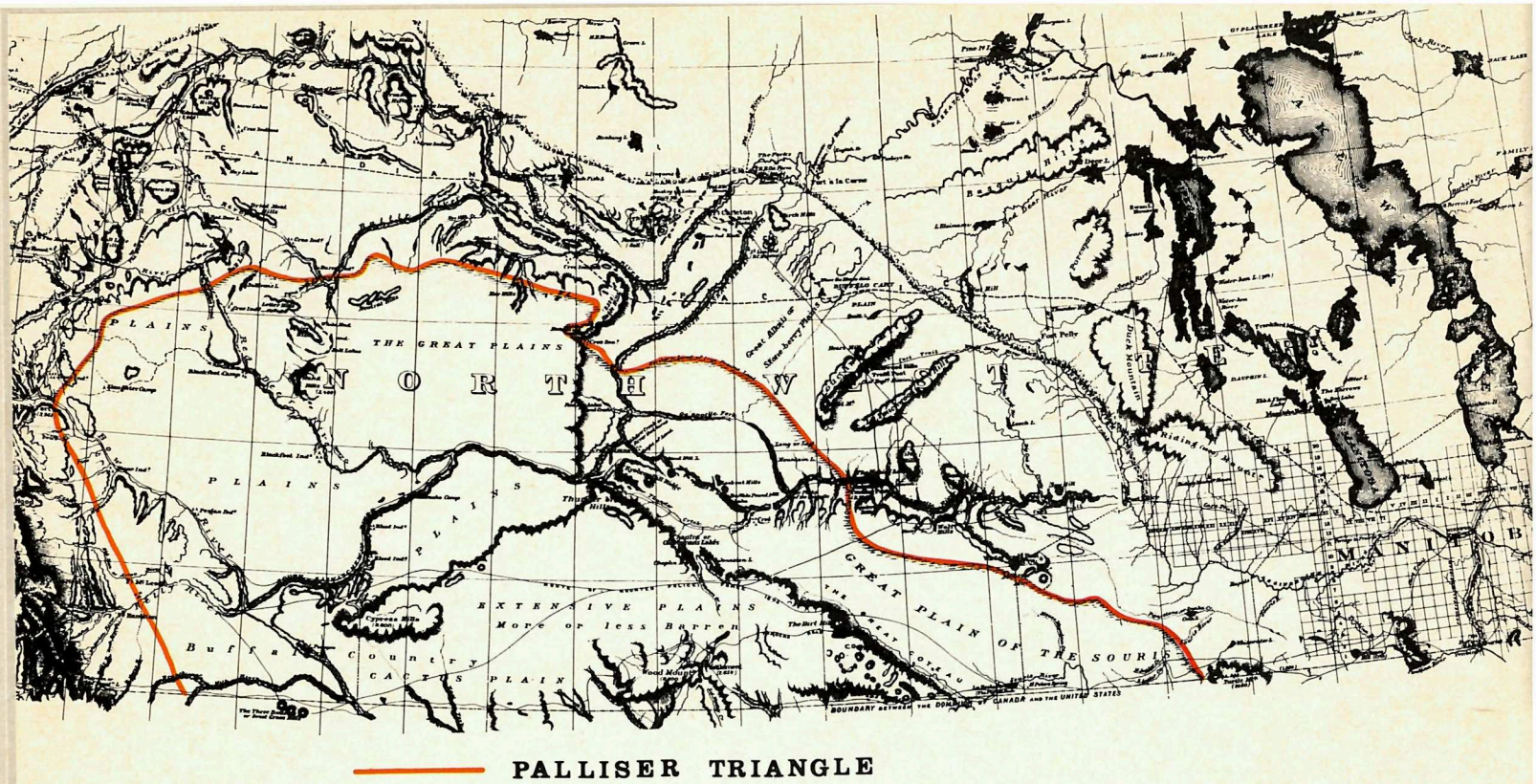


Figure 1: Early map of the Northwest Territories showing the Palliser Triangle (Courtesy Saskatchewan Archives).

When Captain John Palliser explored the Prairies for the British government in 1857, he identified an area of some 20 million hectares (ha), the so-called Palliser Triangle, as being too dry to support farming. (See Figure 1). His pessimism was understandable; in fact the Palliser Triangle would become infamous during the 1930s as the centre of the "dust bowl". However, Palliser had visited during a dry year, and given normal rainfall, much of the land in the area would later prove ideal for crop production.

Seeds of Disaster

In 1885, the population of the Prairies was barely 100,000 people. However, the completion of the Canadian Pacific Railway in that year opened the way for large-scale settlement. The Canadian government actively recruited immigrants from Europe, and in the land rushes that followed, the centuries-old grass cover was quickly broken.

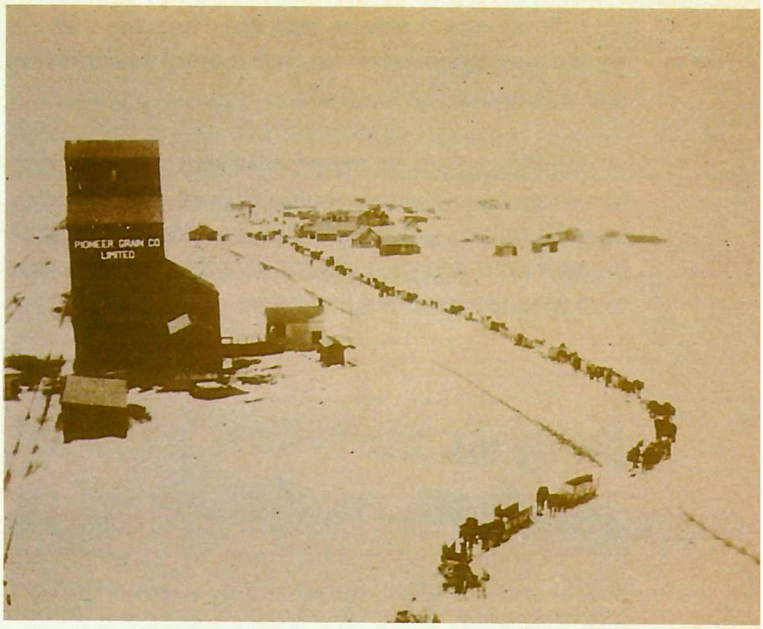
Few of these new farmers had ever experienced a semi-arid climate like that of the Prairies. Over much of southern Alberta and Saskatchewan, the annual precipitation averages less than 40 cm, and most of that falls in summer when evaporation is high. To make matters worse, the region is prone to serious, recurrent droughts — a fact that was not widely known when it was being settled. Given the lack of knowledge that prevailed at the time, it is not surprising that much dry land that should never have been homesteaded was put to the plow.

The government in Ottawa had anticipated the need to study and find solutions to the unique problems of farming the Prairies, and in 1886 the first of a series of Dominion Experimental Farms was set up at Brandon, Manitoba. It was on the experimental farm at Indian Head, Saskatchewan that the practice of summerfallowing was first developed.

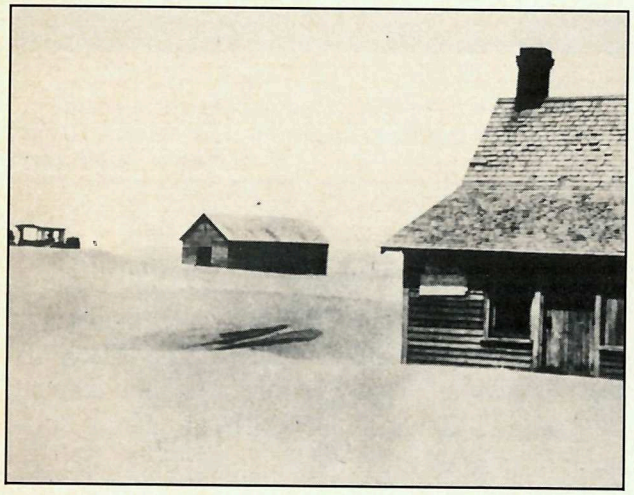
Because it allows extra water to be stored in the soil for crop use, summerfallowing was a major breakthrough in making the dry lands of the West economical to farm. But the weeds that sprouted in fallow fields had to be controlled. Farmers responded by

working their land more often, in keeping with the wisdom of the times. Good farmers, it was thought, plowed frequently, maintaining a "dust mulch" on the soil surface. As late as 1930, Department of Agriculture pamphlets were still urging farmers to cultivate fallow land regularly to keep down weed growth.

This constant tillage only served to pulverize the frail prairie soils into a fine powder that was easily carried off by the wind. In dry years such as 1910, 1914 and 1917-1919, the result was serious soil drifting. While a succession of wet years in the 1920s produced bumper crops and temporarily solved the problem of blowing soil, drought returned with a vengeance in 1929. Winds began to strip the land, creating the dust storms that gave the "dirty thirties" their name. From Hanna, Alberta, to Melita, Manitoba, fences, implements and even farm buildings were covered by drifting soil. Roads, choked with dirt, were impassable in mid summer. Crop failure followed crop failure.



Farmers lining up to receive relief.



A common scene during the 1930s. Soil drifting on an abandoned farm near Cadillac, Saskatchewan.

But the battered prairie farmer had more than the lack of rain and relentless wind to cope with. The world depression plunged wheat prices from $1.25 a bushel in 1929 to .40¢ in 1932. In 1933 crops were destroyed by grasshoppers and in 1935 a rust blight struck the region. By 1935, the drought had spread to more than 7 million ha and threatened the well-being of nearly a million people. Conditions were so bad that even the elected officials distributing relief to the farmers were unpaid and seeking welfare. It was the worst disaster in Canadian history.

PFRA Is Born

Clearly, drastic and far-reaching measures were needed. The future of the Canadian West was at stake. At one point, politicians in Ottawa even considered large-scale evacuations of farmers from the region. It was finally decided that because the federal government had encouraged the settlement of the Prairies, including the Palliser Triangle, it had responsibility for helping conquer the drought.

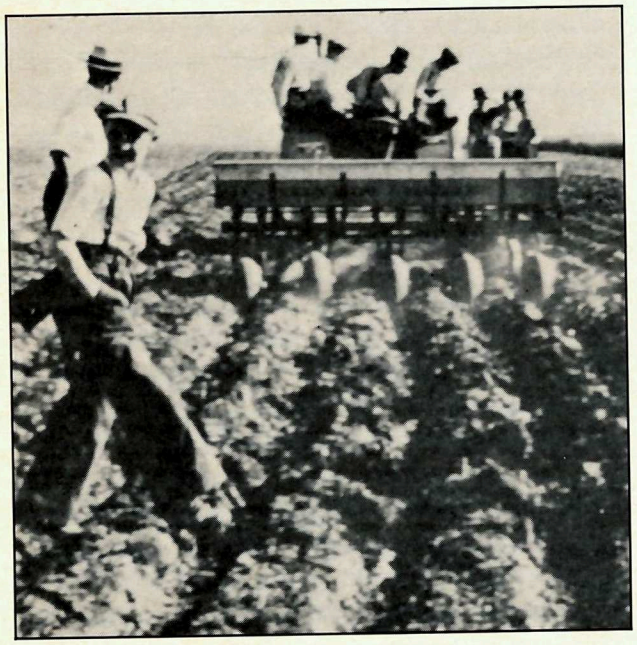
Help came in the form of the Prairie Farm Rehabilitation Act, passed on April 17, 1935 to "secure the rehabilitation of the drought and soil drifting areas in the Provinces of Manitoba, Saskatchewan and Al-

berta and to develop and promote within those areas systems of farm practice, tree culture and water supply that will afford greater economic security". To do so, the new organization had a budget of $4.75 million and a five-year lease on life.

PFRA's attack on the drought was planned along two lines. New farming methods were introduced to stop the drifting soil that filled prairie skies with a grim brown haze, and projects for saving every possible drop of water were set in motion.

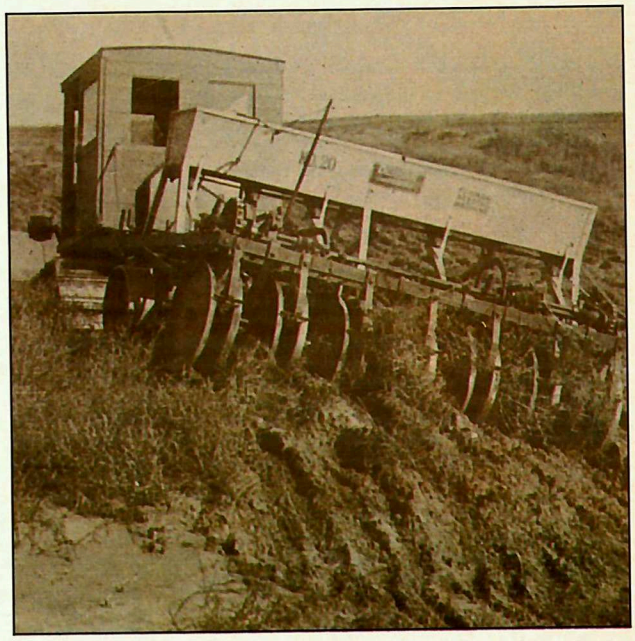
Saving the Soil

In the early years, PFRA staff worked closely with the Dominion Experimental Farms to show farmers how to undo the damage caused by years of drought and overtillage of the soil. Special stations were set up at 17 locations across the Prairies to reclaim severely eroded land, and successful farmers were persuaded to let their farms be used as models for their neighbours. These grew in number from 2 to 52 after 1935.



A 1936 AIA demonstration of listing, a method used to control soil drifting.

PFRA also organized more than 200 Agricultural Improvement Associations (AIAs) which had a membership of some 35,000 farmers. Through the AIAs, new techniques such as soil ridging, strip cropping and retaining stubble were promoted as ways of controlling soil drifting.



Creating one of the first community pastures. To prevent the seed from blowing away, grass was sown directly into the existing weed cover.

Planting trees en masse also helped to cut the wind and anchor the blowing soil. PFRA sponsored four large-scale shelterbelt projects, and within a few years, six million trees had been planted, creating more than 1,000 km of shelterbelts.

But not all of the land could be saved by using new farming methods or planting trees. Some of it was too light and sandy. On these lands, farmers were either fighting a hopeless battle for survival or had given up completely, abandoning their holdings and moving elsewhere. Such areas were in danger of becoming desert, and the soil that drifted from them threatened to bury the meagre crops on nearby land that was still holding its own against the wind.

Something had to be done to take these so-called "submarginal" lands out of crop production — permanently. Beginning in 1937, PFRA, in cooperation

with the provinces, began turning them into community pastures which would eventually provide grazing for thousands of hungry cattle. First, the land was fenced. Farmers and others on relief were paid to dig post holes and string wire by hand. Next, drought-resistant grass was sown directly into the weeds in an effort to restore grass cover to the land. By 1939, some 11,000 cattle grazed on more than 200,000 ha of PFRA community pastures.

Water For a Dry Land

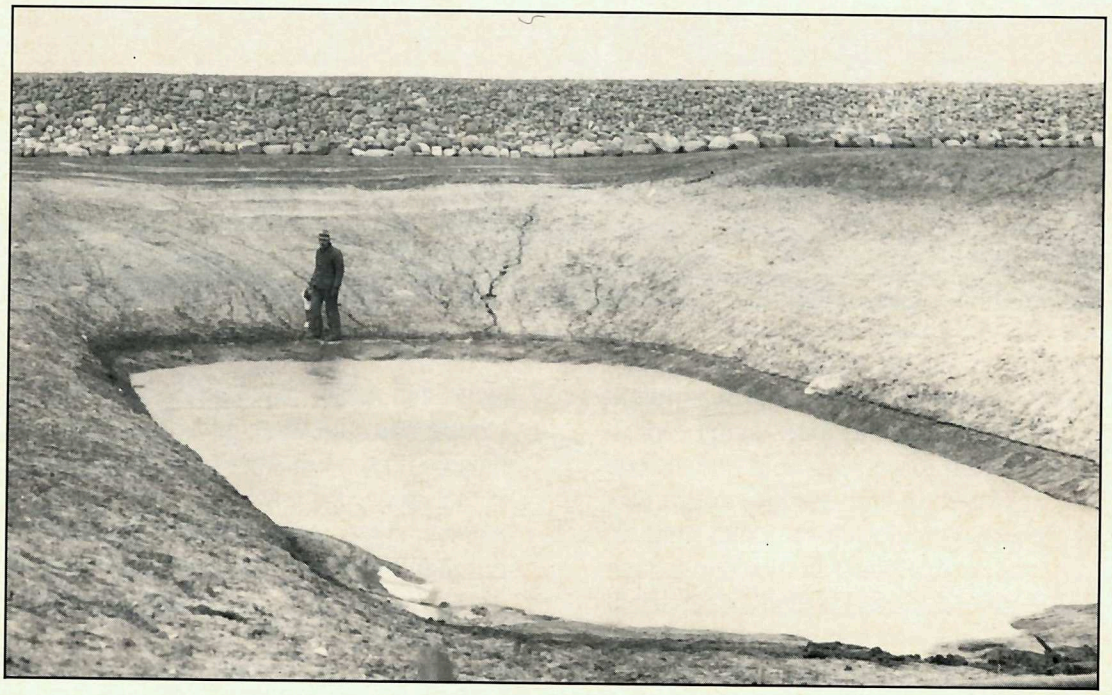
During the 1930s water became the Prairies' most precious commodity. Farm families had little or none for themselves or their livestock. Many natural water sources failed. Supplies for towns and cities dwindled under the heat of successive dry summers.

Storing every available drop of water became vital. PFRA designed dugouts to catch spring runoff to supply water for a farm family's use, the irrigation of a garden and the needs of 25 head of livestock. Farmers were paid a subsidy to construct dugouts and small stockwatering dams. Within six years, 14,000 dugouts had been completed.

However, it was realized that meeting the needs of individual farmers was not enough. What was also needed were ways of storing larger quantities of water that could be used for community supplies and irrigation. As early as 1935, dams were underway at Middle Creek, Val Marie and Eastend, all in Saskatchewan. The latter dam still supplies the town with water and irrigates some 1,200 ha of land in the area.

The End of the Beginning

Nature, which had turned fickle beyond belief in the West during the 1930s, saved the worst for last. In 1937, Regina received less than 23 cm of rainfall and record high temperatures were set across the Prairies. The total value of grain produced in Saskatchewan that year was less than 10 per cent of what it had been in 1928. Although the rains returned in 1938, infestations of rust and grasshoppers meant that once more, farmers had to wait until "next year" for a decent crop.



An early dugout.

It was realized that one year of moisture could not repair the damage done by nearly a decade of drought. The rains had failed before and would probably fail again, underlining the need for ongoing development and management of the West's soil and water resources. Therefore, in 1939, PFRA was made a permanent organization to continue its work on the Prairies.

Strip cropping, adopted during the Depression to control soil drifting, has become common practice on prairie farms.

2. ACTIVITIES AND PROGRAMS

From rather modest origins, PFRA has grown to an organization employing more than 800 people. Our objectives remain much the same as they were in 1935, and many of our original programs for soil and water conservation and development continue to this day. New projects and activities have been undertaken as needed over time.

From headquarters in Regina, a network of field offices in Alberta, Saskatchewan and Manitoba is coordinated. It is from these centres that our programs are brought to the farmers, ranchers and communities of the region. Staff provide information and on-the-spot technical know-how to producers seeking help with water supplies, soil problems or grazing space for their cattle for the coming season. At the Demonstration Farm at Outlook and our Tree Nursery at Indian Head, both in Saskatchewan, a variety of other specialized advice and services is provided. More information on PFRA offices and facilities is found in Figure 2.

Figure 2: PFRA Offices and Facilities.

HEADQUARTERS

REGINA ★

LIAISON OFFICES

EDMONTON ■
WINNIPEG ■

ENGINEERING OFFICES

CALGARY ●
LETHBRIDGE (Sub – Office) ●
REGINA ●
SASKATOON (Geotechnical Laboratory) ●
WINNIPEG ●

DEMONSTRATION FARM

OUTLOOK ⬢

CONSTRUCTION DIVISION

MOOSE JAW ⬢

TREE NURSERY

INDIAN HEAD

SOIL AND WATER CONSERVATION AREA OFFICE

BRANDON ●
HANNA ●
ROSETOWN ●
SWIFT CURRENT ●
WATROUS ●
WEYBURN ●

SOIL CONSERVATIONISTS' OFFICES

EDMONTON ●
SASKATOON ●
WINNIPEG ●

PFRA AREA BOUNDARIES ▬

SOIL AND WATER CONSERVATION FIELD OFFICES

ALBERTA

HANNA ●
LETHBRIDGE ●
MEDICINE HAT ●
PEACE RIVER ●
VEGREVILLE ●
WESTLOCK ●

SASKATCHEWAN

GRAVELBOURG ●
MAPLE CREEK ●
MELFORT ●
MELVILLE ●
MOOSE JAW ●
NORTH BATTLEFORD ●
ROSETOWN ●
SHAUNAVON ●
SWIFT CURRENT ●
WATROUS ●
WEYBURN ●

MANITOBA

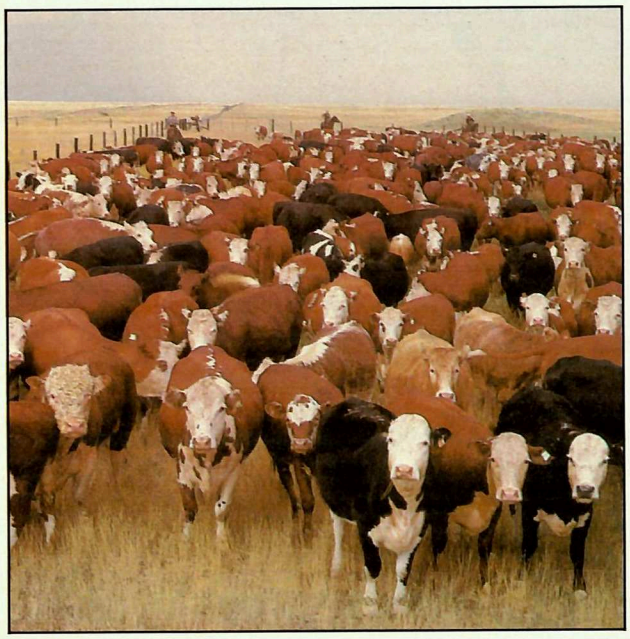
BRANDON ●
DAUPHIN ●
MORDEN ●

SOIL CONSERVATION

Community Pastures

The Community Pasture program is PFRA's largest and longest-running contribution to soil conservation on the Prairies. Started in the 1930s to reclaim badly eroded areas, the program has returned more than 900,000 ha of poor quality cultivated lands to grass cover since 1937.

Originally, the lands in question were acquired by the governments of Saskatchewan and Manitoba and turned over to PFRA, which was responsible for building and operating the pastures. Progress was slow at first because of the lack of moisture and severe erosion. While only 3,000 head of cattle grazed on 77,000 ha of pasture at the end of 1938, these numbers had tripled by the following year.



Cattle on a community pasture being herded into a corral where they can be picked up by their owners.

As part of the original program, PFRA was responsible for relocating the farm families whose lands were to be taken for community pastures. This was handled in two ways. In the so-called "short-moves", farmers were offered better quality Crown or municipal land in exchange for their existing holdings. Mortgages were transferred to the new land and moving expenses were paid by PFRA.

When the supply of public land had run out, families were moved to irrigable lands in southern Alberta. The Rolling Hills project, built near Brooks in 1939, was the first large-scale resettlement onto irrigated land. Consisting of some 25,000 ha, it would eventually provide new homes for 126 families. To encourage moves into the area, PFRA bought the old farmsteads and paid the costs of relocating the farmers and their effects. Many families even moved the lumber from their homes, barns and other buildings. Moving, building new homes and making the switch from dryland to irrigation farming were not easy tasks, but for farmers struggling on blown-out land, it was often the only chance for a better future.

Pastures Today

PFRA currently runs 88 community pastures which provide grazing for some 230,000 head of livestock each year. With the exception of Suffield, in Alberta, all pastures are located in Manitoba and Saskatchewan.

Each pasture has a full-time manager overseeing its operation. In the fall, grazing privileges are assigned to eligible farmers for the following spring, with smaller producers being given priority for grazing space. The length of the grazing period and number of cattle that will be pastured are also decided at that time. An advisory committee elected by the patrons reviews the allocation of grazing privileges on each pasture and suggests changes if necessary.

The major benefit of community pastures is that they allow farmers to supplement their own grazing lands and operate larger, more economical herds of cattle. To help improve the quality of western cattle, a herd of about 3,000 high-quality bulls is kept for breeding purposes. Other services are provided on the pastures as required and include inoculation, spraying, branding, dehorning and castration. While fees are charged for grazing and all services, they are tied to costs and are thus kept as low as possible.

The day-to-day upkeep of each pasture takes a tremendous amount of work. Just maintaining the roughly 10,000 km of fencing in the pasture system is a major task in itself. To insure that pastures can continue to support large numbers of cattle, improvements and maintenance are ongoing and include brush clearing, weed control, fire guarding, cultivation, grass seeding and constructing and maintaining water storage and irrigation works. Because of the importance of water, more than 1,800 dugouts, 770 wells, 420 windmills and 130 dams have been built over the years on the community pastures. Over 1,800 ha of pasture land are irrigated, including a whole section at the Rudy Rosedale pasture near Outlook, Saskatchewan. Alfalfa grown on this pasture is used as winter feed for the PFRA bull herd.

The Community Pasture program is an excellent example of PFRA's conservation policies at work. Not only have once-barren areas been returned to grass, but careful planning and management have made these lands more productive than if they had remained in their natural state.

Tree Distribution

Throughout history, man has valued trees as a source of beauty, shade and shelter. They are taken for granted in many parts of this country, but on the Prairies, where the climate is harsh, trees and shrubs are scarce and therefore valuable. Early settlers who planted trees brought from eastern Canada found that such species could not survive the extreme cold and dryness of the West. To provide settlers with hardy tree seedlings for farm shelterbelts, the federal government established the Forest Nursery Station at Indian Head, Saskatchewan in 1902.

At first, most trees were used for farmstead shelterbelts to protect buildings and livestock. By 1920, however, a period of drought had made soil erosion a serious problem in many parts of the Prairies. Farmers began planting field shelterbelts to help cut the wind, thereby reducing soil drifting.

Figure 3: PFRA Com munity Pastures 1985.

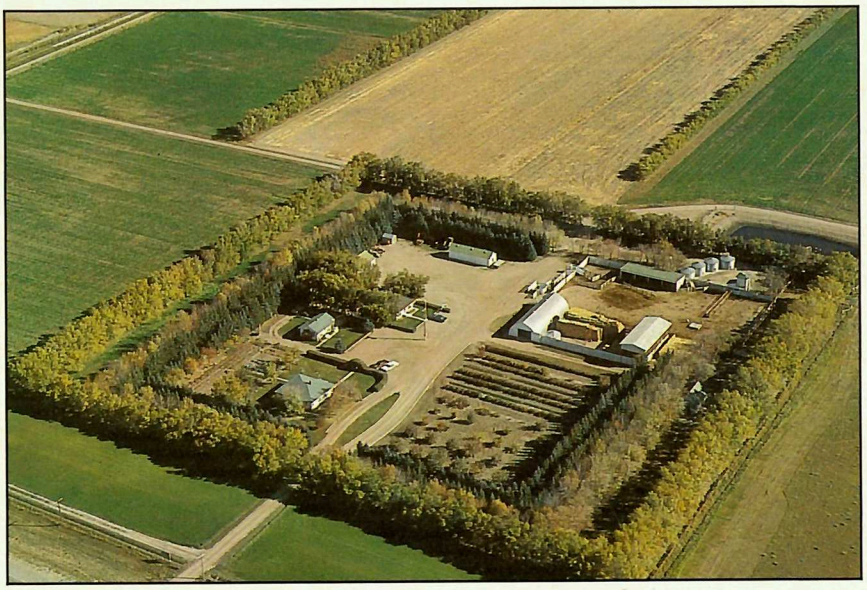
88 PASTURES

TOTAL AREA IN PASTURES
924,634 ha (2,284, 739ac.)

After 1935, tree planting was given greater emphasis under PFRA's sponsorship. Four large-scale field shelterbelt associations were formed, each consisting of a group of farmers in a compact area, usually a township. PFRA provided financial help for the planting and maintenance of shelterbelts along the borders of their fields. The oldest and largest planting was at Conquest, Saskatchewan, while others were at Lyleton, Manitoba, Porter Lake, Alberta and Aneroid, also in Saskatchewan. By 1942, six million seedlings had been planted to create 1,120 km of shelterbelts. The projects proved that such plantings could reduce soil erosion, and helped popularize the idea of shelterbelts among farmers. They stand today as living monuments to soil conservation on the Prairies.

More than 10,000 applications for trees are filled each year on a first-come, first-served basis. Since 1902, the nursery has shipped more than 450 million tree and shrub seedlings — enough to create a shelterbelt that would circle the world.

Selecting the correct species for shelterbelts is very important. As part of its service, the Tree Nursery will advise recipients of trees on all phases of establishing shelterbelts, including planning, planting, maintenance and weed and insect control. In this way, the nursery helps insure that shelterbelts will be effective and that a high percentage of seedlings will survive to become mature trees.



Well-planned farmstead and field shelterbelts provide a number of benefits.

Trees for Tomorrow

In 1963, the Tree Nursery was transferred to PFRA from the Research Branch of Agriculture Canada. As the demand for trees has risen over the years, the nursery has grown to meet this need. It now occupies a section of land near Indian Head, and distributes about six million seedlings each year. They are sent to farmers, ranchers, owners of small rural holdings, Indian bands, charitable organizations and government agencies in Manitoba, Saskatchewan and Alberta.

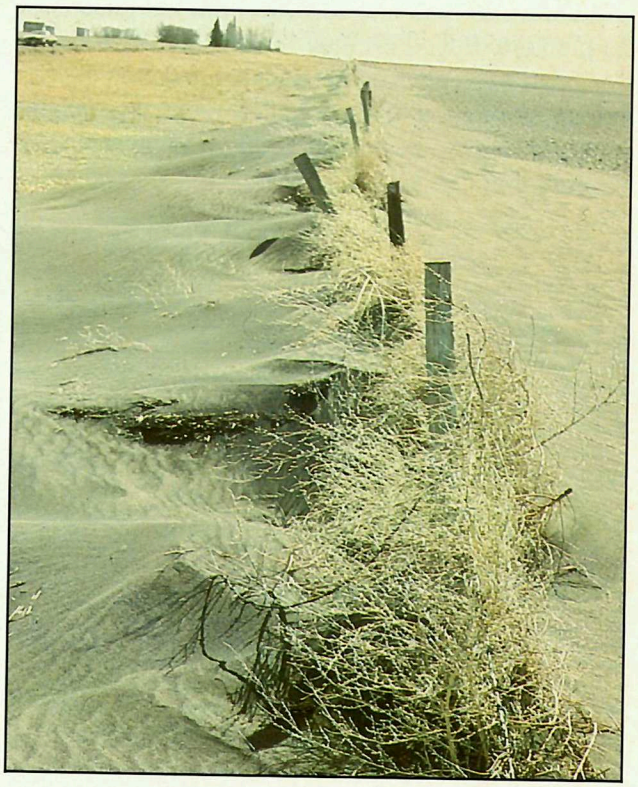
To improve the quality of its stock, the nursery conducts an ongoing program of investigations into tree production and storage, irrigation, insect and disease control and plant nutrition. New species are tested for hardiness and drought resistance to find the best strains for use on the Prairies. The nursery now produces 22 species of deciduous trees, shrubs and conifers, with green ash, caragana and Colorado spruce being the most popular varieties in each category. Occasionally, circumstances restrict the use of a species. Because of the spread of Dutch elm disease in recent years, the nursery no longer sends elm to Manitoba and has reduced its distribution in Saskatchewan.

Transplanting conifers at the Tree Nursery.

A variety of other investigations and activities is also underway at the nursery. Recently, studies have been carried out to gain specific information about the effects of shelterbelts on crop yields and their role in cutting farm heating costs. It has been found that for a typical farm home the saving can be more than $500 per year. In other projects, reminiscent of the 1930s, the nursery is helping farmers plant shelterbelts to fight severe soil erosion in the areas near Canora, Saskatchewan and Winkler, Manitoba.

Soil Conservation Planning

While the crisis of the 1930s that led to PFRA's creation has long since passed, soil erosion continues to cost prairie farmers millions of dollars each year. Naturally occurring problems like acidic and solonetzic soils have been joined by other difficulties such as salinity and organic-matter loss. Salinity now affects more than 2 million ha of western farmland, and is still spreading. In 1984, just replacing nitrogen lost due to organic-matter depletion cost farmers more than $70 million in fertilizer. It is clear that current farming practices must change to insure the long-term fertility of prairie farmlands.



Wind erosion — a chronic problem. This photograph was taken in 1981.

In 1981, PFRA created a Soil Conservation Planning section to assess the extent of soil problems and determine how the agency could help find solutions. Since then, PFRA has worked closely with farm groups, agricultural businesses, universities, research institutes and provincial departments of agriculture to organize a comprehensive program for soil conservation on the Prairies. PFRA recently hired a team of 14 soil specialists who are responsible for gathering information about soil degradation, and more importantly, for working directly with farmers to solve soil problems.

Pilot Projects

In 1981, a group of farmers in Warner County, Alberta asked for government help to deal with dryland salinity that was affecting an estimated 25,000 ha in the area. Subsequently, PFRA carried out a detailed hydrogeological study of the salt-affected area. A soil conservationist and technician were provided to test several sites and thereby learn the causes of the problem. Based on their findings, farmers in the area have been advised to use a combination of continuous cropping and deep-rooted crops like alfalfa. Such practices prevent the build-up of excess soil moisture that can lead to salinity.

Testing for soil salinity, Warner Country, Alberta.

The Warner County project, a cooperative venture involving PFRA, Alberta Agriculture and Environment and the farmers, has become a model for soil conservation work across the Prairies. Five other "pilot" projects are now in operation and several more have been proposed. PFRA soil staff are helping farmers in the Swift Current and Weyburn areas of Saskatchewan find solutions to local salinity, while other investigations into the problem are underway near Deloraine in southwestern Manitoba. At other projects, erosion is the focus of attention. The PFRA Tree Nursery is helping plant shelterbelts to control soil drifting in an 18,000 ha area north of Canora, Saskatchewan. In the Tobacco Creek watershed in south-central Manitoba, crop rotations and special tillage are being demonstrated as ways of reducing soil loss caused by water erosion.

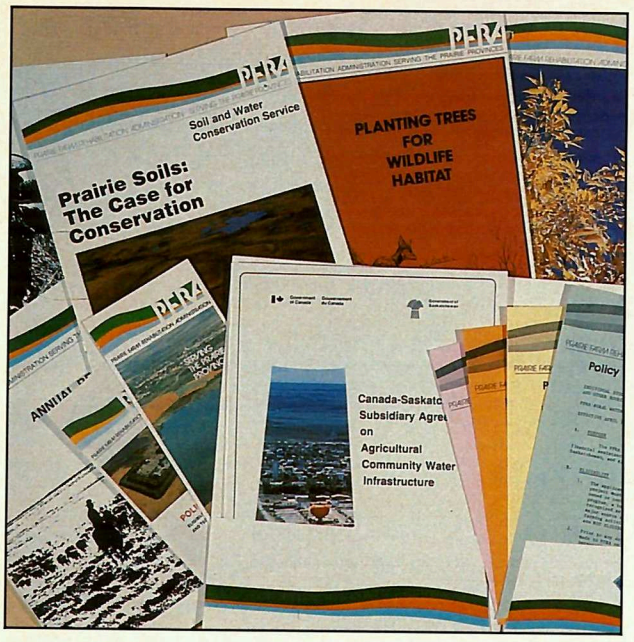
Information the Key

Because present-day farming practices have been major contributors to salinity, erosion and organic matter loss in soils, solving these problems will mean creating new attitudes about how prairie farmland should be used. Bare summerfallow was the prime cause of the severe soil drifting that occurred during the 1930s. Today, we understand that summerfallowing also causes salinity and organic-matter loss.

On fallow land, water that would normally be used by plants builds up in the subsoil, where it dissolves salts. Over time these are carried upward into the root zone, where they interfere with crop growth. Organic matter content is reduced because no new plant material is contributed to soils when fallowing, and oxidization takes place. For these reasons, the amount of land being left fallow on the Prairies must be drastically reduced.

These problems are understood by many farmers. Innovative farming methods like continuous cropping and zero till are being used, but they need encouragement. Out of these attempts at conservation farming will come the common practice of tomorrow.

While a conservation approach must be promoted, farmers must also be given hard facts about solutions to soil problems and the economics of conservation farming. To meet these needs, PFRA, in cooperation with other interested organizations is un-



Spreading the word about soil conservation.

dertaking a major program to inform producers and the general public about soil issues. The campaign is directed at a range of audiences, including farm groups and farm-related businesses; community and service organizations; the media and schools from the elementary to post-secondary levels.

A wide variety of methods are being used to promote soil conservation, including workshops, conferences and group presentations; field tours; displays; publications and advertising. Courses in conservation are also being proposed for school curricula. PFRA is directly involved in many of these activities, with its work designed to complement the soil conservation efforts of the provincial governments.

WATER DEVELOPMENT

The dry prairie climate has meant that water supply has been a problem since the earliest days of settlement. Dams and dugouts to trap water flow are a necessity in a region where 75 per cent of each year's water supply typically comes from spring runoff. In the hot summer months, when evaporation is high, rainfall is often insufficient to maintain minor rivers, streams and springs. Because natural sources are usually inadequate, supplies for farms, towns and cities alike have had to be developed, often at considerable expense.

With the prolonged drought of the 1930s, the moisture situation on the Prairies became critical. When PFRA was created, water supply was given high priority, and programs to build storage works of all sizes were quickly put in place.

Farm Water Supply

During the drought years, farm families suffered greatly because of their isolation from dependable

With only a horse-drawn scraper, excavating a dugout was a difficult task.

water supplies. Often, there was little or no water for drinking, washing, watering stock or irrigating gardens or shelterbelts. Beginning in 1935, farmers were offered a subsidy of up to $75 to build dugouts or, if more water was needed, stockwatering dams. To qualify for the money, the dams and dugouts had to be built to certain standards. They were intended to provide at least a two-year water supply, and were designed to be 4 to 5 m deep to minimize evaporation.

So great was the need for such assistance that PFRA was deluged with thousands of applications. However, most farmers lacked the proper equipment to do the job, and in the first year only 49 dugouts were completed. Later, when the subsidy was increased, it became economical for farmers to pay contractors equipped with draglines to do the work that was beyond their ability. In 1937, 1,493 dugouts were built under the new arrangement, and the momentum of the program was assured.

Dugouts provide water for a variety of farm needs.

The Current Program

As in the 1930s, the encouragement of self-help continues to be the basis of PFRA's aid to farmers for water development. In addition to dugouts and stockwatering dams, grants and technical advice are now provided for wells, irrigation projects, pipelines and spring developments. Farmers are paid as much as one-third of the cost of their water supply, up to a maximum figure which is upgraded according to prevailing costs. As well, PFRA staff will help locate, survey, design and inspect such projects.

In order to qualify for assistance, water projects must meet certain technical standards. Dugouts, for example, must be at least 1,900 m^3 in capacity with a depth of 3.65 m. Wells are required to produce a flow of at least 4.5 litres per minute (L/minute) and meet all provincial standards for siting and water quality. Two ha is the minimum allowable size for irrigation projects.

Since 1935, PFRA has spent more than $62 million for over 185,000 water supply projects on farms. The majority of these have been dugouts. In his book *Men Against the Desert,* prairie historian James Gray paid tribute to the dugout when he wrote, "The dugouts were as inelegant a collection of holes in the ground as ever devised by man. They did nothing aesthetically for the landscape. They were utilitarian in the extreme. Yet, if acceptance is a measure of worth, few more valuable projects were ever devised."

Community Water Development

At the same time that PFRA began helping farmers with dugouts and stockwatering dams, it was also constructing a number of bigger projects to benefit larger areas. Some of the earliest work of this type was done in the dry lands of southwest Saskatchewan and the Special Areas of east-central Alberta. Frequently, this meant building dams to improve natural water supplies that would otherwise go dry during times of drought. Where this was not possible, large dugouts were excavated.

Decades later, hundreds of these reservoirs dot the prairie. Although most of them were built to store water for stockwatering or irrigation, they could often be used to supply nearby towns and villages as well. Many communities continue to take their water supplies from reservoirs built by PFRA.

Junction Reservoir, typical of the hundreds of community-scale water storages built by PFRA.

The PFRA Program

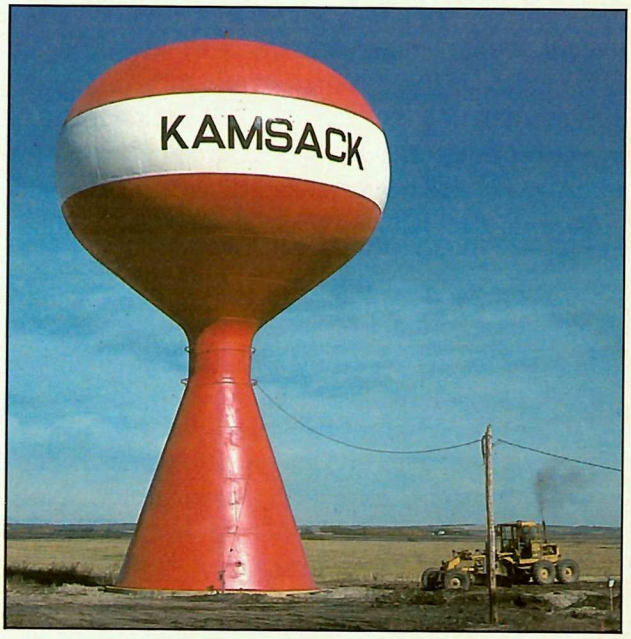
Under its current program, PFRA will help establish water supplies for groups of five or more farmers or ranchers and towns or villages with a population of up to 300. The water source may be any type, including wells, dugouts, dams and pipelines. Engineering help is available to the group or community for choosing the best water source for its needs and for drawing up construction plans and tenders. Inspections of the finished project will also be carried out.

The costs of creating such water supplies are shared equally between the group or community and PFRA. Normally, the limit on PFRA's contribution is $15,000, but more expensive projects are considered for assistance.

Special Agreements

In recent decades, a number of trends have created the need for newer and larger water facilities in rural communities across the West. General rates of water use have increased considerably since the Depression. The tendency for more and more farmers to live in a town or small city has further swollen the demand for water in such centres. Without an adequate supply of good water, the quality of life and economic prospects of rural communities deteriorate. Businesses are less likely to locate or stay in such centres.

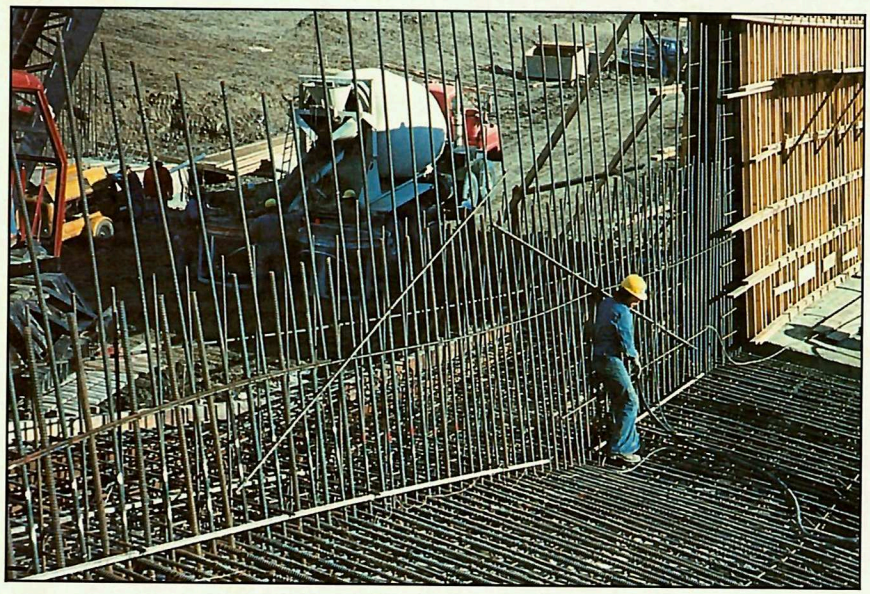
Water, as a natural resource, is developed according to provincial government strategies. However, as part of its commitment to the economic well-being of the prairie region, the federal government has con-



An Agricultural Service Centres project, this tower was part of a new water supply for the town of Kamsack, Saskatchewan.

tributed special financing for a number of water-related projects. Over the years, the federal and provincial governments have entered into numerous agreements to carry out water development work. Often, this has allowed the construction of projects that were beyond the resources of the individual provinces. PFRA's long experience in water development has given it a key role in the negotiation and management of such agreements.

Although the Agricultural Service Centres Agreements had expired in all three Prairie provinces by 1983, other arrangements have been ongoing to continue federal-provincial cooperation in this type of work. In 1979, Canada signed an agreement on water development and drought proofing with the province of Saskatchewan. This was followed by a similar agreement with Manitoba in 1980. A number of medium-sized projects for storing and delivering water were built as a result, including the $6.7 million Albert Douglas Dam for the city of Weyburn, Saskatchewan. Costs of both agreements have been shared between the provinces and Canada.



Construction underway on the Albert Douglas Dam near Weyburn.

The most ambitious program of water development at the community level occurred under the federal-provincial Agricultural Service Centres Agreements. Beginning in 1972, $54 million was provided to build new water and sewage works in 49 towns and cities in Alberta, Saskatchewan, and Manitoba. This included a wide variety of structures: reservoirs, wells, pumphouses, water and sewer mains and treatment plants. The federal government, through PFRA, financed the program in the form of a 50 per cent grant, 50 per cent long-term loan.

Communities were given assistance according to their growth potential and their ability to provide business services to a surrounding farming area. In addition to PFRA administering the funding for the program, our engineers designed a number of the water-supply projects and supervised much of the construction.

In addition to designing the water-supply works described above, PFRA has helped carry out other work provided for under the agreements. Studies have been undertaken to identify drought-prone areas in the two provinces, assess the economic effects, and develop long-term water management plans to ease the drought problem. The agency has also investigated water supplies for specific communities and looked at ways of developing water on a larger scale. While both of the above agreements expired in 1985, a similar pact, valued at $32 million and extending over 5 years, was signed by Canada and Saskatchewan in 1984.

Southwest Saskatchewan Irrigation Projects

The southwest corner of Saskatchewan lies within the driest zone of the semi-arid plains. In this land of rolling range and sagebrush, the annual precipitation averages less than 38 cm, only half of which is received during the growing season. The failure of the rains in the 1930s brought devastation to this 50,000 square kilometre (km^2) area. Conditions were so bad that the Canadian government even considered evacuating all of the farmers and turning the cultivated land into pastures.

Rather than abandoning the southwest, it was decided that a program of water management could restore the land's productivity. By 1936, PFRA was either building or had completed four dams to store water for irrigation: McDougald on the east Maple Creek, Adams on Adams Creek and Eastend and Val Marie on the Frenchman River. Areas near the reservoirs were levelled for irrigation and used to resettle farmers from poorer quality land that had been badly affected by the drought. While some of the newly irrigated areas proved suitable for raising wheat, other settlers were urged to concentrate on raising livestock. Eventually more than 200 farmers were moved onto these projects.

In all, 26 sizeable dams have been built in southwest Saskatchewan, providing water to irrigate more than 18,000 ha of land. While three of these have been turned over to the province, PFRA continues to operate the remainder and also manages six irrigation projects which have a total size of slightly over 9,000 ha. They are located at Val Marie, West Val Marie, Consul, Eastend, Maple Creek and Swift Current.

Irrigated lands contrast sharply with the surrounding area in the Spangler district of southwest Saskatchewan.

Irrigation in the southwest provides a number of economic and social benefits. Irrigated haylands have helped diversify farming by providing this short-grass region with badly needed cattle feed. As a result, the livestock population remains fairly constant at about 90,000 head. The reservoirs created by the many PFRA dams supply water to three towns and the city of Swift Current, and are centres for fishing, boating and other recreation activities. Water stored in the reservoirs is also released into the United States, fulfilling Canada's obligations under the 1909 Boundary Waters Treaty.

Demonstration Farms

In preparation for the South Saskatchewan River Project and the irrigation it would make possible for the surrounding area, PFRA built the Demonstration Farm at Outlook, Saskatchewan in 1949. Land for the farm, which comprises nearly a quarter section (63 ha), was donated by the town of Outlook. The farm was designed as a centre for testing and demonstrating a variety of irrigation methods, equipment and crops, in order to help farmers in the area make the transition to irrigation from dryland farming.

Each year the farm raises field-sized plots of a number of specialty crops to test their suitability for the Outlook area. A wide variety have been demonstrated over time, including grain corn, lentils, canary seed, peas, triticale, sunflowers and faba beans. Information on crop yields; timing of water applications; costs of water, fertilizer, drainage, labour and machinery; and the effects of various crop rotations is recorded by farm staff so that farmers may be advised on how to get the best return from their irrigation operations.

A number of factors affect the method of irrigation to be used, including the crop being grown, type of soil, slope of the land, and the amount of water available. The farm at Outlook demonstrates several techniques, including gated-pipe and furrow (which use gravity to move the water) and sprinklers.

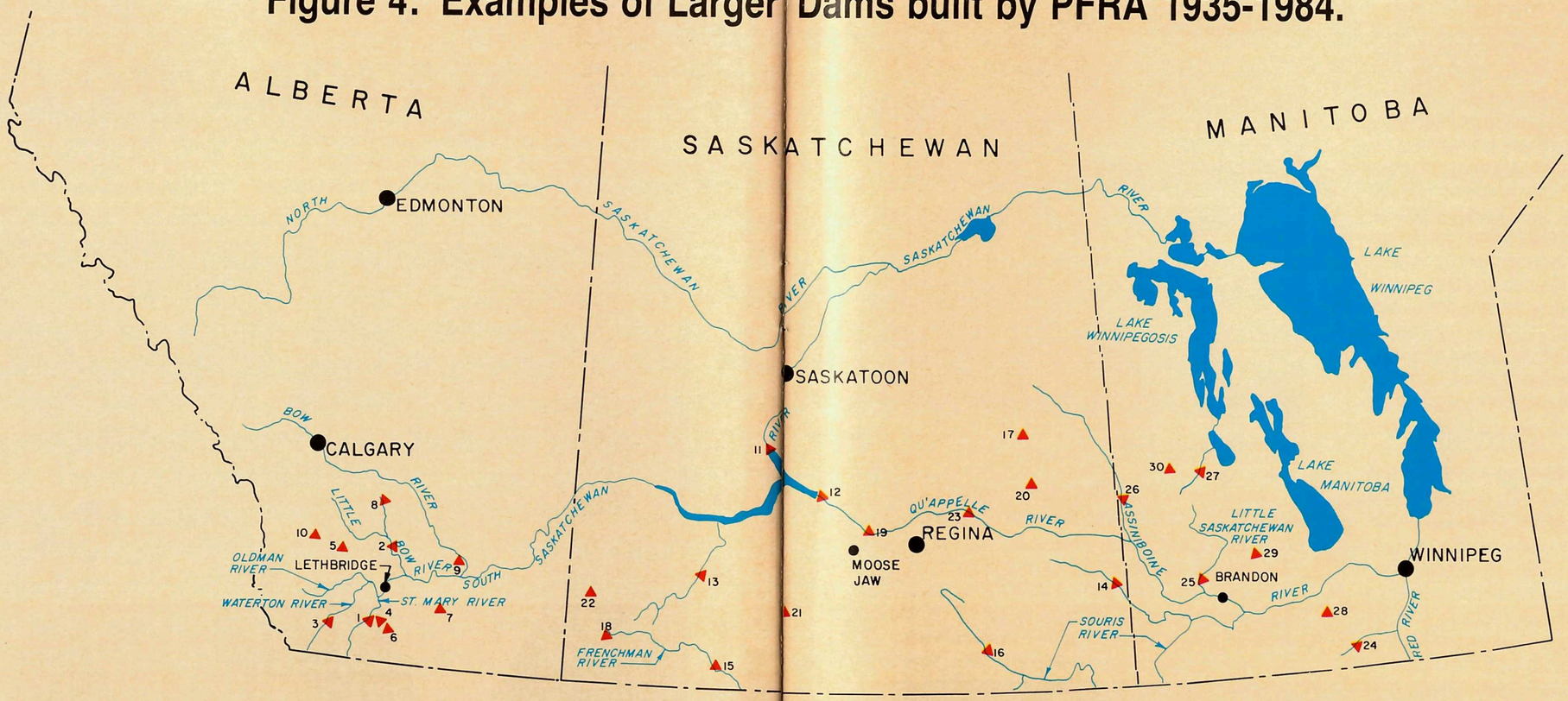
Since the completion of Gardiner Dam and Lake Diefenbaker in 1967, the Demonstration Farm has done much to introduce new crops into what was primarily a wheat growing area. PFRA is also expanding its irrigation activities with the development of an irrigation demonstration farm in southern Manitoba.

Sprinkler irrigation at the Demonstration Farm.

3. MAJOR PROJECTS

In addition to its ongoing programs and activities in the field of soil and water conservation, PFRA has, over the years, played a key role in a number of major water-related projects in Western Canada. Usually these have been cost-shared between the federal government and the concerned province. PFRA has provided the technical expertise needed for the design of such projects and has supervised their construction. When completed, the ownership, operation and maintenance of such works have generally become the responsibility of the province. Locations of a number of major works built by PFRA are shown in Figure 4.

Figure 4: Examples of Larger Dams built by PFRA 1935-1984.



DAM	YEAR COMPLETED	HEIGHT (m)	STORAGE CAPACITY (dam³)	PURPOSE
ALBERTA				
1. St. Mary	1951	61.7	396,000	Irrigation
2. Travers	1954	44.5	317,000	Irrigation
3. Waterton	1965	56.4	173,000	Irrigation
4. Jensen	1948	40.8	22,000	Irrigation
5. Berry Creek	1948	16.8	18,500	Stockwatering/ Irrigation
6. Ridge N.	1955	25.3	128,600	Irrigation
7. Chin	1954	15.2	206,000	Irrigation
8. Lake McGregor S.	1972	11.3	382,000	Irrigation
9. Scope #1	1951	14.6	19,200	Irrigation
10. Chain Lakes N.	1966	14.3	16,400	Irrigation

DAM	YEAR COMPLETED	HEIGHT (m)	STORAGE CAPACITY (dam³)	PURPOSE
SASKATCHEWAN				
11. Gardiner Dam	1967	64.0	9,363,000	Multi-purpose
12. Qu'Appelle Dam	1967	27.4	6,900,000	Multi-purpose
13. Duncairn	1941	19.2	103,000	Multi-purpose
14. Moosomin	1953	13.7	11,300	Multi-purpose
15. Val Marie	1936	6.6	11,500	Irrigation
16. Albert Douglas (Weyburn)	1983	12.0	16,000	Community Supply
17. Theodore	1964	14.6	14,800	Multi-purpose
18. Cypress Lake	1939	7.6	128,600	Multi-purpose
19. Buffalo Pound	1939	4.7	91,300	Multi-purpose
20. Crescent Creek	1979	11.1	4,600	Community Supply
21. La Fleche	1957-1976	18.3	37,000	Multi-purpose
22. Junction	1939-1977	13.0	12,900	Irrigation
23. Echo Lake	1942	4.0	122,700	Flow Regulation

DAM	YEAR COMPLETED	HEIGHT (m)	STORAGE CAPACITY (dam³)	PURPOSE
MANITOBA				
24. Morden	1953-1976	22.5	3,800	Community Supply
25. Rivers	1960	21.9	30,000	Multi-purpose
26. Shellmouth	1969	22.9	480,000	Flood Control
27. Vermilion	1979	17.7	3,200	Community Supply
28. Stephenfield	1963	14.3	4,400	Multi-purpose
29. Neepawa	1960	11.3	4,700	Community Supply
30. Pleasant Valley	1971	5.5	15,000	Rural/Community Supply

St. Mary Irrigation Project

The St. Mary River is an important source of water for irrigation in southern Alberta. By 1900, the first phase of irrigation on the river was in place, and over time, expansion of the project transformed thousands of hectares of short-grass plains into fertile farmland. As early as the 1930s, however, the demand for irrigation had outstripped the water supply.

After the Second World War it was decided to expand the project so that a greater percentage of the water in the St. Mary, Waterton and Belly rivers in southern Alberta could be used for irrigation. It was agreed that Canada, through PFRA, would design, construct and operate the new reservoirs and connecting canals needed, while the province would be responsible for the system to distribute the water for irrigation.

The key structure for the project is the St. Mary Dam, built between 1946 and 1951. Located on the St. Mary River, southwest of Lethbridge, it stands nearly 62 m high and creates a reservoir with a storage capacity of 395,000 cubic decametres (dam^3). PFRA also built smaller reservoirs, such as the Jensen, Chin and Ridge, to balance water flows in the system and provide extra storage.

The second stage of the expansion saw a diversion weir constructed on the Belly River, immediately west of the St. Mary Dam. Some 42 km of canals were then dug to carry water from the Belly River into the St. Mary reservoir. Completed in 1957, this made possible the irrigation of an additional 18,000 ha of land. The first phase of construction, described above, added 38,000 ha to the irrigable area.

In 1958, construction of the last major structure on the project began. Designed to store and divert additional water into the St. Mary system, the Waterton Dam has a storage capacity of 173,000 dam^3. It was completed in 1965.

While the cost of PFRA's work on the St. Mary Irrigation Project exceeded $25 million, the benefits

Waterton Dam.

Main canal of the St. Mary Irrigation Project near the town of Taber, Alberta.

to the area have been considerable. Fewer than 50,000 ha were irrigated prior to expansion, while this figure exceeded 115,000 ha in 1983. The irrigated land supports a number of specialty crops, including sugar beets, corn, peas, beans, potatoes and oil seeds. As a result, food processing has become an important industry that has helped diversify the economies of centres like Lethbridge.

The livestock industry has also benefitted. Forages and legumes are grown in rotation with specialty crops, and the by-products from sugar beets, peas and other crops provide an additional source of feed.

PFRA's involvement in the St. Mary project ended in 1973 when Canada's interest in the project was transferred to Alberta under the Canada-Alberta Irrigation Rehabilitation Agreement. Details of that arrangement are provided later in this brochure.

Bow River Irrigation Project

The present-day Bow River Irrigation District, formerly the Bow River Irrigation Project, is located on the south side of the Bow River between the towns of Taber and Brooks, Alberta. Irrigation along the Bow began in 1905, but the owners of the project suffered continual financial difficulties and by 1950 only about 20,000 ha of land had been irrigated.

The government of Canada recognized the potential for expansion of irrigation in this area, and hoped to use newly irrigated lands to resettle farmers from marginal areas across the Prairies that had been badly affected by the drought of the 1930s. In 1950, the Bow River project was acquired by Canada for $2.3 million, and PFRA was given responsibility for its renovation and further development.

A variety of construction was required to enlarge the project. The Carseland Dam on the Bow River was repaired and the main irrigation canal was rebuilt to allow higher volumes of water to be carried. In 1954, the $3 million Travers Dam was built on the Little Bow River, greatly increasing the water storage on the project. The total cost of these and other developments was just under $25 million.

PFRA was also responsible for resettling farmers onto an area of nearly 11,000 ha near the town of Hays, Alberta. To help these new arrivals make the transition to irrigation from dryland farming, advice on irrigation practices and techniques was provided. As well, the farmers were assisted with the design of farm layouts, shelterbelt planting and the building of on-farm water supplies. Four hundred thirty-six families were eventually relocated to the project.

A farm family dismantles its house in preparation for resettlement onto the Bow River project.

The work carried out by PFRA on the Bow project has allowed the irrigated area to more than double since 1950, exceeding 54,000 ha in recent years. Specialty crop production has been encouraged by the presence of food-processing plants in such centres as Vauxhall and Taber. As was the case with the St. Mary Irrigation project, the Bow River project was transferred to the province under the 1973 Canada-Alberta agreement and the farmers in the area were organized into an irrigation district.

Assiniboine River-Shellmouth Dam Project

Although a lack of water is a perennial concern across most of the Prairies, the opposite case — an unwanted surplus — occasionally occurs. On the lower Assiniboine River in Manitoba, spring flooding has always been a serious matter, causing millions of dollars worth of damage since the beginning of settlement.

In 1950, PFRA took responsibility for existing dikes along the river and began improving the natural channel in an attempt to reduce the effects of flooding. At the same time, studies were being conducted to find a more permanent solution to the problem.

It was eventually decided that two major structures would be needed to keep the Assiniboine in check. In 1965, construction began on the Shellmouth Dam and the Portage la Prairie diversion. To enable the control of flows along a major stretch of the river, the dam was located a considerable distance upstream from the area most prone to flooding. The diversion was designed to handle excess flow in the lower reaches of the river, moving it to Lake Manitoba via a 100 m wide artificial channel.

Under the federal-provincial agreement for the project, PFRA planned and constructed the dam, while Manitoba was responsible for building the diversion. The total cost to Canada of the project was $14.8 million. Completed in 1969, the Shellmouth Dam created a reservoir, known as Lake of the Prairies, with a capacity of 480,000 dam^3. The 30 km-long diversion has the ability to carry a flow of 7,100 cubic metres per second (m^3/s) and was finished in 1970. Together these structures provide security against flooding and make possible a more efficient use of water from the Assiniboine.

In 1975, PFRA transferred ownership and maintenance responsibilities for the Shellmouth Dam to Manitoba. However, the agency continues to operate a 160 km-long system of dikes on the lower Assiniboine, maintaining and upgrading them as necessary.

Shellmouth Dam and reservoir.

South Saskatchewan River Project

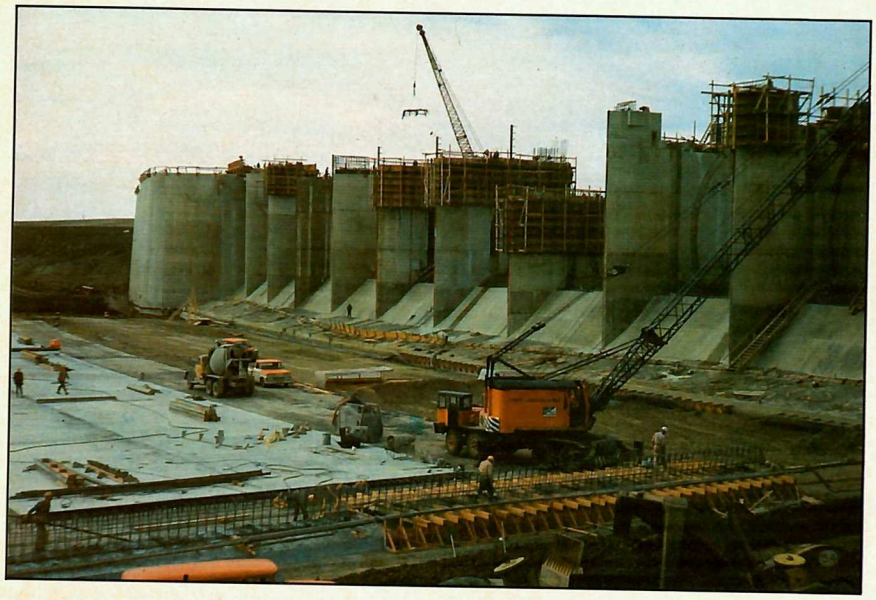
The South Saskatchewan River Project was the culmination of a century-old dream, and stands as one of PFRA's greatest achievements. The idea of a dam across the South Saskatchewan River was first proposed by Professor Henry Hind during his exploration of the Prairies in 1858. Hind reasoned that such a dam would allow the South Saskatchewan to be connected to the Qu'Appelle River, creating a navigable waterway stretching from Lake Winnipeg to the Rocky Mountains.

One hundred years after Hind's visit, the governments of Canada and Saskatchewan signed the agreement that would bring such a dam into being. The objective? to create a huge reservoir in the centre of the Palliser Triangle and thereby use the waters of the South Saskatchewan for a variety of purposes — irrigation, urban and rural water supply, hydroelectric

power generation and recreation. Prior to construction of the project, less than one per cent of the river's flow in Saskatchewan was being used.

To bring Lake Diefenbaker into existence, two dams had to be built — the Gardiner, which was the main structure, and the Qu'Appelle, which was needed to control the amount of water flowing from the South Saskatchewan into the Qu'Appelle River system. PFRA was responsible for the planning, design and supervision of construction for this massive undertaking. Construction costs were shared by Canada and Saskatchewan, with the province contributing $25 million and the remainder, which would total $95 million, being provided by Canada.

The design and construction of the Gardiner Dam was a tremendous engineering challenge, due partly to the difficult nature of the shale foundation rock underlying the damsite. Work on the structure began in 1959, and was completed in 1967. One of the largest earth-fill dams in the world, it measures 64 m in height and 5,000 m in length and contains 65 million m^3 of material. Its 1.2 km-long spillway is capable of discharging water at the rate of 7,500 m^3/s. The Qu'Appelle Dam, though smaller, is still impressive.



Constructing the massive spillway crest of the Gardiner Dam, 1964.

A centre-pivot irrigation pattern near the shores of Lake Diefenbaker

Gardiner Dam. The spillway is shown in the centre, while the hydroelectric station can be seen in the upper half of the photo.

Begun in 1963, it is 27 m high and 3,300 m long. Together they create Lake Diefenbaker, which stretches for 225 km and contains 9.4 million dam^3 of water.

The South Saskatchewan River Project provides an array of benefits to both the surrounding area and beyond. With water from Lake Diefenbaker, the province has developed some 30,000 ha of land for irrigation, which represents nearly 50 per cent of the current Saskatchewan total. Using water from the project, the potential to irrigate a much greater area exists.

Irrigation has brought a diversification of agriculture in what was primarily a wheat-growing area. The PFRA Demonstration Farm at Outlook has played an important part in this conversion. With specialty crop production, food processing and other irrigation-related businesses have grown up, bolstering the economies of such communities as Outlook.

But more than the farm sector has reaped rewards. The hydroelectric station at the damsite, constructed by the province, provides a significant portion of Saskatchewan's power needs, while the reservoir helps supply water to a variety of municipal and industrial users and the cities of Saskatoon, Regina and Moose Jaw. Lake Diefenbaker's roughly 800 km of shoreline offers ample opportunity for recreation, and the lake now hosts three provincial parks.

As agreed in 1958, Saskatchewan assumed ownership of the South Saskatchewan River Project in 1969. However, PFRA staff will continue its maintenance and operation until 1994. An important aspect of this work is the monitoring of the foundations, embankments and corrosion prevention systems of the dams.

Alberta Irrigation Rehabilitation Program

Under the 1973 Canada-Alberta Irrigation Rehabilitation Agreement, federal interest in the Bow River and St. Mary River irrigation projects was transferred to the province. To compensate Alberta for as-

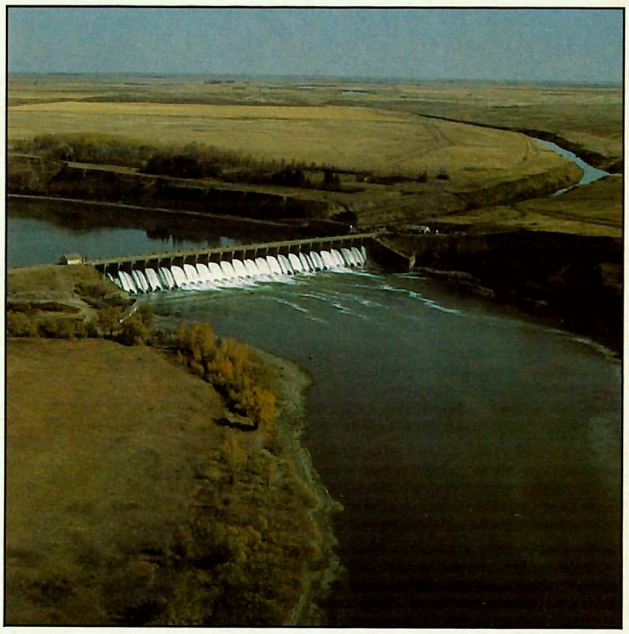
suming the ownership, operation and maintenance of these projects, it was agreed that PFRA would repair or replace a number of important irrigation works. At present, work on the Carseland Dam, the Western Irrigation District headworks and the new Brooks Aqueduct has been finished. The reconstruction of the Bassano Dam will complete work under this agreement.

The Carseland Dam diverts water from the Bow River to the McGregor and Travers reservoirs, for use in the Bow River Irrigation District. Completed in 1974 at a cost of $4.2 million, the new dam is actually the third at that location. Earlier structures were built in 1916 and 1929. Also on the Bow River, the weir at Calgary which supplies water to the Western Irrigation District was replaced at a cost of $3.6 million.

Although the old Brooks Aqueduct was replaced in 1979 by a $7.9 million canal and siphon, PFRA is still involved in the project due to rather unusual circumstances. The original concrete aqueduct was built in 1913 to carry irrigation water for the Eastern Irrigation District across a valley. In 1983, the National Monument Board of Canada declared it an historic structure worthy of preservation. The details of what this will involve are now being worked out by PFRA, Parks Canada and the province.

The final structure, the Bassano Dam, is located on the Bow River a short distance southwest of the town of Bassano. Constructed between 1911 and 1914 by the Canadian Pacific Railway, the dam supplies water to some 93,000 ha of land in the Eastern Irrigation District. Rehabilitation of the dam was to have started in 1978, but was delayed due to questions about the ownership of land at the damsite.

Reconstruction of the Bassano Dam began in 1984 and is expected to take three years. Although the basic structure will remain the same, virtually all of the exposed parts of the dam above the low-water line will be replaced, including piers, gates, hoists, walls and wall facings. A new bridge deck will complete work on the dam.



Bassano Dam.

The Brooks Aqueduct. The old concrete aqueduct, at right, was replaced with a canal and syphon.

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