A HISTORY AND POLICY REVIEW OF WATER MANAGEMENT IN THE LOWER RED RIVER BASIN

By

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ABSTRACT

The agricultural sector and communities in the lower Red River Valley in Manitoba have suffered a number of water related problems since the Basin was first settled. Initially a massive drainage system had to be constructed to render much of the area suitable for agricultural production. Major floods and droughts have also plagued the area, resulting in direct measurable costs to area residents and businesses. In a more indirect manner, the development of the area has been adversely affected by limited supplies of potable water, and due to a lack of irrigation water, the area has not been able to realize its full development potential. These problems became particularly acute between 1965 and 1980. During this period major Red River floods occurred in 1965, 1966, 1969, 1974, 1975, 1978 and 1979. In the sixty-five years previous to this period, there were only three major floods. Major drought occurred most recently in 1973, 1974, 1977 and 1980. Inevitably there was a public outcry for senior levels of government to initiate preventive action rather than merely providing compensation for losses. However, government has been slow to respond resulting in public frustration and disaffection.

This study can be divided into three sections. The first four chapters deal primarily with the history of water management, tracing the evolution of policy and attitude, the

transfer of responsibility from local government to more senior levels of government, and the evolution of institutional and methodological obstructions to resolving some of the recurring water management problems. The next four chapters examine the current situation in terms of potable water supply, the advantages and disadvantages of large scale irrigation and the controversy over solutions to flooding. The last chapter is comprised of a summary and recommendations.

A common theme throughout the paper is the fact that regional economic development is the ultimate goal of water management. However, policy decisions seem to have devolved from the elected representatives of the people to the technocrats, thereby limiting public recourse to unsatisfactory decisions. The technocrats' approach has been to disassociate development from water management due to an over-reliance on benefit-cost analysis of site-specific, problem-specific issues. In view of the fact that public input is limited and the public perceives government action as wholly inadequate, this paper seeks to empower people to act.

ACKNOWLEDGEMENTS

I am indebted to several people who provided the information, the guidance and most importantly, the inspiration necessary to complete this study. D.K. Friesen and Doug Fletcher have devoted a lifetime's energy to shaping the course of history in the lower Red River Basin. Their dedication to public service has exerted an exalting influence on my efforts to document the history of water management in the region. Not only has D.K. Friesen been an active participant in the region's development, but he has also left excellent records chronicling 26 years of regional efforts to effectively manage the water resources of the study area. These records have been of utmost importance to the completion of this study and they will allow others to follow and build on the work of all those men of vision who participated in the Lower Red River Valley Water Commission. I would also like to express my gratitude to David Freshwater from the Department of Agricultural Economics at the University of Manitoba and Darwin Donachuk from the provincial Water Resources Branch. Their objectivity and clarity of thought helped to temper my views, allowing me to express a more inclusive viewpoint and present a study which should be useful to a wider array of people. Special thanks are extended to Weldon Hiebert of the Geography Department at the University of Winnipeg, for the final maps and figures.

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INTRODUCTION

1.1 Background Information

Ever since the lower Red River flood plain was settled over 100 years ago, residents have endured the hardships resulting from recurrent water management problems. Floods and droughts have exerted a direct economic cost, and together with limited supplies of potable water have indirectly restricted the region's economic development. Although a number of different authorities have implemented various programs to redress these problems there has been no overall regional water management strategy and the problems persist. This section of the paper provides an overview of the water problems plaguing the region, the response to those problems, and the gap between the present situation and regional needs.

At the time of settlement much of the land was covered by extensive marshes and was subject to periodic flooding. To make the land suitable for agriculture it was necessary to construct a massive drainage system to remove excess surface water. Construction and maintenance of the drainage system was mainly the financial responsibility of the municipalities. However, dissatisfaction over the apportionment of costs, and difficulties arising over the absence

of a central authority to efficiently manage the operation of the system led the provincial government to assume a larger portion of the financial responsibility.

For the most part, the drainage system has worked well, removing normal spring meltwater. However, the latter part of the 1940's heralded the beginning of a period of increasingly frequent flooding. Major Red River floods this century have occurred in 1916, 1948, 1950, 1965, 1966, 1969, 1974, 1975, 1978 and 1979 (Calton, 1979:3,4). The drainage system was not designed to handle the excess flows associated with these larger floods and damage has been extensive. Although, levees, dams and ring dykes have more recently been constructed to protect some towns from flooding, these measures have not allayed the need for emergency dyking, nor the implementation of forced evacuation. In 1979, for example, more than 7,000 people had to evacuate their homes (Winnipeg Tribune, May 18, 1979:2). Over the years, senior levels of government have assumed almost total financial responsibility for flood protection and compensation. However, in view of the recent high frequency of major floods, and the need for emergency dyking and forced evacuation, valley residents regard the flood protection afforded by senior levels of government to be less than adequate.

Almost paradoxically, in spite of excessive surface water in the spring, summer droughts and limited potable water supplies also threaten the livelihood of the region's

people. The physiography of the region is such that only very limited supplies of groundwater are available. To meet their domestic water needs, early settlers relied on shallow wells or rainwater collected in home cisterns. When these sources ran dry, water had to be hauled from the Pembina and Red Rivers. During the drought of the 1930's the C.P.R. transported water in tank cars from Winnipeg to towns in the Red River Valley.

In an effort to help farmers, PFRA (Appendix 1) provided assistance to dig farm dugouts. Dugouts have also been a source of water for industry such as CSP Foods in Altona. In addition to dugouts, small dams were built by PFRA at Morden and Stephenfield to supply water to the areas around Morden and Carman. In 1960, a pipeline was built from the Pembina River at Neche, North Dakota to serve Gretna and Altona. Wells drilled in the 1970's supply water to Winkler and other locations along the Pembina escarpment. Although improvements have been made, Chapter 5 of this report illustrates that few of these sources of supply are adequate to meet projected needs and in many instances there is often a shortfall in meeting current needs. There is also evidence to suggest that limited potable water supplies have inhibited economic development by preventing major canning and food processing industries from locating in the region.

In addition to the problems of flooding and limited potable water supplies, the farmers of the study area remember well the economic devastation of drought. Recent

regional droughts in 1977 and 1980 were severe but not protracted like they were in the 1930's. Still there is a lingering fear that these recent droughts could have extended beyond one season. In addition to droughts which affect a large geograpic area, drought can also be very localized. While conditions are not severe enough to classify every year as a drought, the region experiences a moisture deficit in almost every year, prohibiting optimal crop yields. Not only is the amount of moisture important but also the timing of that moisture. Very often one or two inches of rain or supplemental moisture at the right time of year can mean the difference between a good crop and no crop. This is especially true in the case of various "special" crops which the region is ideally suited to growing. However, because water for irrigation is available on only a very limited scale this potential goes largely unrealized. Thus, there have been many proponents of large scale irrigation to provide insurance against drought and to promote the growing of special crops. By not using potentially irrigable land to its highest advantage the region loses the secondary economic benefits of a major canning and food processing industry.

Thus, in addition to the more obvious direct costs of floods and drought, there ar no less severe indirect costs. Flooding delays spring seeding, affecting crop selection, and interferes with normal business activity. A washed out bridge in 1979 interrupted CSP's use of rail transport

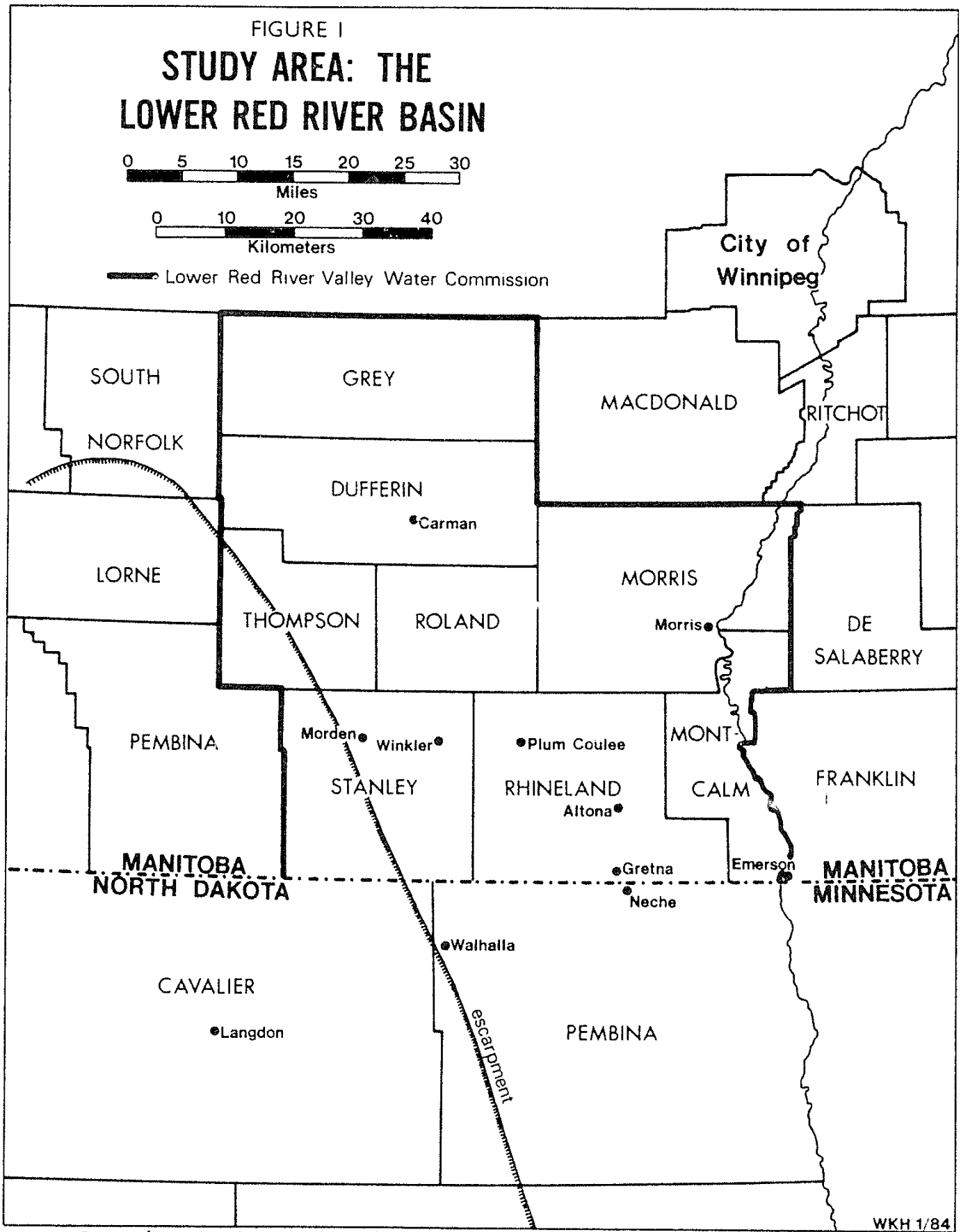
for 58 days (Red River Valley Echo, June 20, 1979), necessitating the use of more expensive modes of transportation in order to fulfill contract obligations and prevent the loss of markets. In these times of severe economic retrenchment, even slight perturbations in normal operating procedures severely threaten the economic viability of modern farms and businesses. Given the large capital investment required to run a modern farm, the associated debt load, and high interest rates many farmers are having difficulty surviving, even without the added threat of frequent episodes of flood and/or drought. In this predominantly agricultural area, any reduction in disposable farm income has a direct effect on local business and service centres.

Although water problems have always impacted negatively on the region's development, area residents endured the hardships and came to expect periodic problems as a natural consequence of farming the fertile flood plain. However, more recently the problems have become more acute for several reasons. First, during the 15-year period between 1965 and 1979, major floods occurred with alarming frequency and magnitude. Second, during the 8-year period from 1973 to 1980 significant droughts occurred in four of those years. Third, by 1980 it became apparent that potable water supplies in the growth centres of Winkler, and particularly Morden and Altona, were inadequate to permit any significant municipal expansion.

Coincident with this period of acute water problems, senior levels of government were unresponsive to area needs, although there was considerable water control activity in other parts of the Province. Not surprisingly public discontent over senior governments' lack of response, reached its zenith at this time.

Part of the reason for the growing alienation and frustration was the feeling of powerlessness amongst local levels of government. Resolution of the problems required a comprehensive regional development strategy but senior levels of government had not devised such a strategy. This was particularly disconcerting in view of the fact that when water management had been vested in the control of local governments a number of achievements had been accomplished. Municipal governments in the area have a long history of collective action, beginning initially with the formation of Drainage Districts. Acute water shortages and flood damage led to many public hearings in the 1940's and 1950's. The result was the formation of the Red River Valley Development Association (RRVDA) which, it is worth noting, recognized the association between water management and economic development. RRVDA was supplanted in 1958 by the Lower Red River Valley Water Commission (LRRVWC) which to this day represents the interests of: eight Rural Municipalities including Stanley, Montcalm, Rhineland, Thompson, Roland, Dufferin, Grey and Morris; the Towns of Morden, Winkler, Altona, Carman and Morris; and the Villages of Plum Coulee and Gretna (Figure 1). The Town of Emerson became a member of the Commission in 1981.

FIGURE I



SOURCE: Dept. of Geography, University of Winnipeg

While LRRVWC has from time to time supported various site-specific water programs, the Commission has displayed an unflagging devotion to implementing a comprehensive water development scheme which would incorporate the objectives of flood control, potable water supply and water for irrigation. To this end, their efforts have been frustrated.

In the presence of the water management problems discussed herein, the region will not achieve optimum benefits from its resource base. Aside from the direct economic cost of floods and drought, the constant threat and limitations imposed by these natural events impacts negatively on the region's vitality and development potential. Effective water management is essential to ensure economic stability and to promote economic growth.

1.2 Problem Statement

Although, various initiatives have been undertaken over the last 80 years to redress water management problems in the lower Red River Valley, the problems persist, and in the opinion of many, grow more severe. During the last decade: major damaging floods have occurred in 1974, 1975, 1978 and 1979; serious droughts have recently occurred in 1973, 1976, 1977 and 1980; and domestic, municipal and industrial water consumption has been restricted in a number of years, most recently in 1980. These water management problems exert direct economic costs and indirectly inhibit regional economic development. Previous water management

efforts have been ad hoc, project-specific. There is no overall management strategy to deal with the region's immediate needs, nor especially the long term development needs.

1.3 Purpose and Scope

Given that:

1) the problems remain unabated;
2) there has been a lack of action by individual landowners and senior levels of government; and
3) the situation is characterized by divisiveness between area residents and policy makers including technocrats;*

this study attempts to bridge the disagreements -- to bring the protagonists together to initiate action to rectify the problems in as far as is practically possible and economically feasible.

To achieve this goal this study is directed towards three groups: 1) the Lower Red River Valley Water Commission which represents regional interests; 2) individual landowners who affect or are affected by water problems; and 3) policy makers which is a disparate group comprised of senior levels of government and technocrats.

Water development in the lower Red River Basin can largely be attributed to local levels of government and LRRVWC. While senior governments have assisted this development, they were often not the initiators of development. Instead, the impetus for development has come from individuals acting with enlightened self interest and the immediate

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*A technocrat is an expert in a particular discipline who adheres strictly to the values implicit in that discipline. The technocrat is often only minimally concerned with societal uses of a resource. Ordinarily the role of the technocrat is to provide technical advice to policy makers who introduce a variety of other decision-making considerations.

representatives of these individuals, including municipal government and especially LRRVWC. Although it may be theoretically easier for senior levels of government to institute comprehensive development schemes one cannot rely on senior government to do the "right" thing for a number of reasons. For one, senior government and its administrative bodies are often not innovators. Governments are motivated by political expedience and are notorious for using short-term planning horizons. Bureaucrats and technocrats are unable to integrate diverse values because they often do not fall within their mandate. In short, bureaucrats and technocrats are often constrained by standard operating procedures and methodologies which do not permit visionary projections of the future. In any event, policies instituted from the top down often fall short of the intended objective if the primary decision-maker, the individual landowner is ignored. Therefore, it seems essential to maintain a vehicle for public input into the planning procedure.

Given LRRVWC's history of successful public advocacy and an ability to achieve inter-municipal co-operation it makes sense for LRRVWC to continue to represent regional interests. Continuity within LRRVWC and general agreement among its members is essential. However, as with any organization, especially one striving to achieve broad-based objectives rather than issue-specific goals, a lack of focus can develop. As the original members leave the Commission, new

members may be unaware of past achievements and the factors inhibiting problem resolution, so the wheel must be continually reinvented. Unaware of LRRVWC's history and impact, some communities choose to lobby independently, undermining to some extent, LRRVWC's influence. LRRVWC's effectiveness will increase if its members speak with a unified voice and if it is seen as the official representative of regional interests. By detailing a legacy of the achievements of LRRVWC and transmitting this information across a generation gap this study attempts to provide focus and continuity within LRRVWC as a first step in identifying a future course of action.

This study also attempts to demonstrate the inadequacy of previous ad hoc water management efforts and the need for an overall strategy. Water management decisions have been hindered by problems resulting from fragmented jurisdictions, a sometimes parochial approach, conflicting objectives of the many agencies administering water and related land resources, and the abrogation of individual responsibility for flood protection. The public demands a panacea -- a floodway, a dam, or whatever it takes. However, this study will attempt to show that there is no single long term solution. Solutions; depend on what questions are being asked, tend to benefit some groups more than others, and create new sets of problems. Solutions are more a matter of public policy based on social goals than they are a matter of

determining tne technological "fix" of resources. Yet, studies to date have mainly been technical works prepared by engineers who pay little attention to what the social goals are or ought to be. A fundamental characteristic of water resources management is that technological expertise has far outpaced policy making. The obstacles to better management are rarely the limitations of technical knowledge. The obstacles are set by the policy framework within which engineers and other technocrats must work.

To escape the vicious circle of crisis management, the ad hoc approach to water management must be replaced by a more comprehensive strategy, which in addition to dams, drains and diversions utilizes non-structural measures such as zoning and land use planning. Plans must be based on achieving multiple objectives, as opposed to single objectives such as flood control for example, which characterized many previous developments. Solutions depend on all levels of government working together for the broader purpose of meeting to the extent possible, through the conservation, development and management of water and related resources the achievement of a strong and viable social, cultural and economic structure.

In summary, the objectives of the study are:

1) to identify and describe the historical water management practices in the region;
2) to describe the role of LRRVWC in water management; and

3) to identify current water management issues in the region.

1.4 Study Outline

To achieve more effective water and related land resources management, decision makers at all levels must develop an understanding of how and why the problems occur and why they persist. Therefore, this study is basically an historical review of water management in the region. Chapter 2 examines the evolution of water policy and related legislation. In so doing, this chapter establishes that water management is an on-going problem. As conditions change, human responses also change. Thus, goals, objectives and methods must be constantly re-evaluated in light of the evolution of legislative and administrative institutions, physical conditions and public and private decision-making considerations. Chapter 3 traces the circumstances leading to the creation of the Lower Red River Valley Water Commission, its early achievements and the legislative, administrative and attitudinal problems with which it had to deal. Chapter 4 looks at the difficulties encountered in attempting to implement a comprehensive development scheme.

Chapters 5, 6, 7 and 8 are concerned primarily with current problems facing the region. Potable water supply in the growth centres of Altona, Morden and Winkler is discussed in Chapter 5. Chapter 6 examines the benefits and disbene-

fits of irrigation. The controversy over the cause of flooding is the central issue in Chapter 7, and Chapter 8 discusses flooding problems along the Red River mainstem, along the Aux Marais River at Gretna and the Boyne River at Carman.

A central theme throughout the study is the fact that regional economic development is the ultimate goal of water management, requiring the integration of many values. However, decisions have been constrained by a methodology based on a limited set of economic criteria applied to a limited range of alternative , resulting in an incrementalist approach to resources management which achieves less than optimal results.

1.5 Study Area

The study area corresponds roughly to that area delineated by the boundary of the Lower Red River Valley Water Commission. However, the boundaries of the Commission correspond to municipal boundaries rather than boundaries delimiting a particular watershed, thereby imposing artificial limits. The nature of water management dictates that areas contributing water be included in the study area. Therefore, the study area extends to slightly west of the Manitoba escarpment and south of the International boundary to take in the Pembina River Basin (Figure 1).

CHAPTER II

EVOLUTION OF WATER POLICY AND RELATED LEGISLATION

2.0 INTRODUCTION

In their natural state, much of Manitoba's prime agricultural areas were either marshes or subject to extended periods of seasonal flooding. As a result, drainage matters have preoccupied Provincial and local authorities since the early days of settlement. The problem of excess surface water was countered by the construction of physical works such as drains, dykes and channels. The drainage system was successful in bringing some two million acres of inherently wet but fertile land under cultivation between 1895 and 1935 (Zittlau, 1977:19). However, the system was expensive and there was widespread discontent over the apportionment of costs. Landowners in the lowlands were required to pay the costs of the drainage system. In their opinion, upland areas which contributed foreign water should also be made to contribute funds to the construction of that system. Central to their argument was the implicit belief that changes in land use, increased road construction, and a concomitant increase in ditch construction contributed to an increase in volume and rate of streamflow from upland areas to lowland areas.

The controversy over apportionment of costs and foreign water prompted a number of studies, the effect of which was basically: (1) to transfer a large portion of the financial responsibility for drainage from the municipalities to the Province; and (2) to enact legislation which permitted a more holistic approach to land and water management, embodied in the Watershed Conservation Districts Act (S.M. 1959). While the municipalities have eagerly accepted relief from the financial burden of drainage, the concept of Watershed Conservation Districts has gone largely unimplemented.

It would appear that the incentives favoring a radically new approach to water and land management were not sufficient to spur the municipalities to initiate such action. However, the apparent increasing incidence of flooding has prompted renewed discontent with current policy and management practices. Major Red River floods this century have occurred in 1916, 1948, 1950, 1965, 1966, 1969, 1974, 1975, 1978 and 1979 (Calton, 1979:3,4). As a result, there is growing conviction that changes in land use have given rise to an increase in the incidence and magnitude of flooding. If this is true then one must assume that major floods will continue to occur with greater frequency than the historic record would indicate. On the basis of that premise area landowners argue that further action is required. That action could take the form of diversions, dykes and compensation or a combination of structural works, non-structural

techniques and environmentally appropriate land use practices.

This chapter traces the evolution of legislation, administration and policy affecting water management. Water policy and related legislation has evolved in the face of changing economic, social, environmental and physical circumstances. This evolutionary process reveals government and public attitudes to water and related land management and the decision-making factors affecting current management practices. Examination of the historic response to water problems and the failures or successes of the efforts directed towards their amelioration sheds light on the on-going nature of the problems. A thorough understanding of this process is fundamental to shaping a new management strategy.

2.1 RESPONSE TO THE PROBLEM OF EXCESS SURFACE WATER: DRAINAGE DISTRICT FORMATION

The physiographic history of the Red River Valley gives rise to exceptionally fertile, but inherently wet land. As the bottom of former glacial Lake Agassiz, the Red River Valley is characterized by two prominent physical features: extreme flatness and heavy textured clay soils. The combination of these two features contributed to the formation of extensive wetlands for two reasons: (1) because of the flatness, channels originating to the west of the escarpment were

not continuous across the level plain; and (2) impermeable clay soils restrict the subsurface movement of water. As a result, prior to the construction of drainage channels, water discharged onto the level plain had nowhere to go. Thus, in their natural state, Ellis estimated that about 60 percent of the lands in the Red River Valley had been under the influence of periodic swamping (Elliott, 1978:9).

Although the level lacustrine plain, commonly referred to as the Red River Valley, is today regarded as some of the best agricultural land in Canada, the earlier settlers to Manitoba found it unattractive for settlement because of its wetness. Warkentin described the period of rapid settlement, from 1870 to 1891, as follows:

> Dry-point sites in higher districts or along ridges and at scarp-foot locations were also favoured early places for settlement, when farmers started to enter the Glacial Lake Agassiz Region in significant numbers after 1870. The Portage plain and the Clearsprings, Pembina and Balmoral Districts were all dry-point in direct contrast with adjacent lands which are not only wet and poorly drained but prone to occasional flooding...When the accessible dry-point sites on the Glacial Lake Agassiz clay play had been occupied, most settlers leap-frogged the wetlands and moved beyond the Glacial Lake Agassiz basin to the Manitoba plateau and further westward (Elliott, 1978:6).

As demand exceeded the supply of dryland homesteads, land values of all land generally increased. Railroad links with St. Paul and Eastern Canada provided access to lucrative markets, increasing the demand for agricultural

land. Thus, after the driest sites in agro-Manitoba were settled, late in the 19th century, the Province and municipal governments faced the problem of bringing thousands of acres of fertile, but inherently wet land into production and onto the tax rolls. This was to be accomplished by constructing a massive drainage system.

The construction of small scale drainage works was made possible in 1880 with the implementation of the Drainage Act (S.M. 1880, c.2 1st Session) (Elliott, 1978:14). This Act made the Province financially responsible for engineering and construction of drains.

> To add incentive to the drainage effort, parcels of land, which belonged as a natural resource to the Dominion Government, were granted to the Province on condition that the latter undertake sufficient drainage to make the land arable (Elliott, 1978:14).

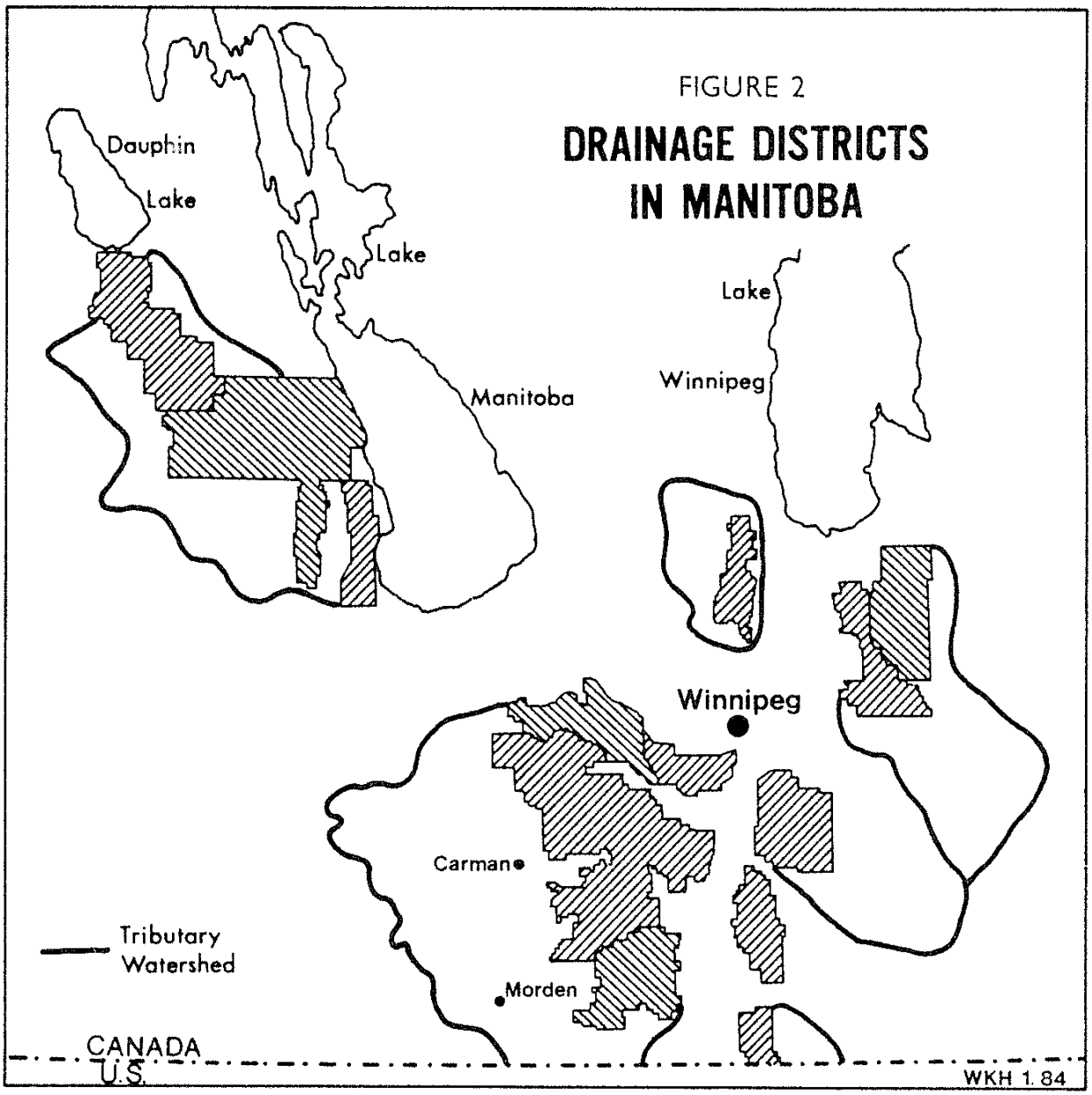
As early as 1883, the Provincial Government undertook to reclaim an area of marshland by constructing drainage works. The lands so drained were conveyed to the Province of Manitoba by the Dominion Government (Finlayson, 1936:11). Then in 1885 a federal act transferred from the Federal Government to the Province all Crown lands shown to be swamplands. Thus, the Province gained a vast new land resource but before these lands could be used, an extensive reclamation program was required to remove excess surface water. The Province attempted to achieve this objective by passing the Land Drainage Act (S.M. 1895, c.11). This Act permitted the creation of drainage districts in order to render an area

fit for occupation and cultivation, where such would be of public benefit (Elliott, 1978:16). The Land Drainage Act transferred financial responsibility for drainage from the Province to the drainage districts. Since the task of reclamation required more capital than the newly-formed drainage districts were capable of raising, the Province sold debentures to raise the necessary capital. The funds were then loaned to the municipalities whose responsibility it was to collect the appropriate levies through their tax rolls.

Between 1896 and 1914, 21 drainage districts were formed in Manitoba, many of which transcended municipal boundaries. In 1928 and 1929, three additional districts were created, two in the municipality of Franklin, and one in the municipality of Montcalm. By 1929, there were 24 drainage districts (Figure 2). By 1935 drainage district debentures amounted to $6,824,336 (Newton, unpublished paper), resulting in the drainage of slightly less than 2 million acres at costs ranging from $0.77 to $7.90 per acre (Zittlau, 1977:19).

2.2 DRAINAGE DISTRICT DISSATISFACTION AND CONFLICT RESOLUTION

Although the Drainage District Act was widely implemented there was much dissatisfaction over certain aspects of the Act. Even the first drainage district formed, in the area known as St. Andrews bog, met with opposition.



SOURCE: Ellis, 1938: 28

Complaints arose mainly over two issues. First, many ratepayers claimed that the flat rate levy was unfair since it did not account for differences in soil productivity which affected the ability of property owners to pay. Second, certain ratepayers were dissatisfied because some lands which did not benefit, or perhaps suffered indirect damages from the drainage works, were taxed, while other adjacent properties outside the drainage district derived benefits without having to contribute financially (Zittlau, 1977:19).

Thus, the complexity of water management became evident during the formative period of drainage. Widespread dissatisfaction over apportionment of cost, foreign water and drain maintenance resulted in the appointment of four Government Commissions. The first Royal Commission was appointed in 1899 to report on alleged inequalities of taxation in Drainage District No. 1. As a result of this inquiry, 40,000 acres were relieved of assessment with the Province assuming the debt (Elliott, 1978:21).

2.2.1 Manitoba Drainage Commission: Sullivan 1918-1921

Disputes over drainage were primarily the result of three factors: (1) the physical design of the drainage system; (2) statutory deficiencies; and (3) social policy questions. These problems were first identified in a consultant's report prepared by Elliot in 1918. Elliot claimed

that the drainage system was inadequately fulfilling its designated function because of technical limitations. He felt that the early drains were deficient because they were constructed as an emergency improvement to reclaim swamp land at a time when drainage conditions were imperfectly understood. Instead of constructing drains to correspond to the grid system Elliot recommended that topographic surveys be conducted to determine watershed boundaries and ditches be constructed to more closely follow the natural contours of the land, even if fields had to be divided. In addition to these technical shortcomings, statutory deficiencies restricted adequate drain maintenance which prompted Elliot to recommend that the control of maintenance be vested in one authority, such as the Public Works Department, which would carry out the necessary work and bill the municipalities. On the issue of levies, which is a matter of social policy, Elliot recommended that levies be determined in direct proportion to the assessed benefits. In actual fact, the determination of those benefits proved to be more difficult than Elliot probably suspected.

Following on the heels of the Elliot report was the appointment of a second commission in 1918, called the Manitoba Drainage Commission or the Sullivan Commission. The Sullivan Commission dealt primarily with statutory deficiencies and indirectly tried to answer some of the social policy questions underlying the statutes. In the Commission's opinion:

> ...the people of the drainage districts as a whole, have suffered much more from inefficient drainage than they have from excessive or inequitable taxation, and we say this in the face of the fact that about 600,000 acres of land has paid drainage taxes for which they received very little benefits, and in our opinion the major factor in bringing about this condition has been defective statutes and the lack of any central controlling body free to execute and administer the provisions of the statutes even if they had not been defective (Sullivan 1921:4).

The Sullivan report goes on to identify some of the statutory deficiencies which led to the grievances. For one, the Land Drainage Act made no provision for maintenance work. A second shortcoming was that the boundaries of any drainage district could not be extended, regardless of merit, without the consent of those whose taxes might be adversely affected, even though these people may be receiving benefits paid for by other people (Sullivan, 1921:9). In addition, for the purposes of municipal taxation, section 25 of the Land Drainage Act restricted the assessed value of land within the drainage district to the assessed value prior to formation of the district. As a result, land within the drainage district was assessed at a lower rate than land in the rest of the municipality, making it difficult to raise money for maintenance.

By 1915, many of the older drains were operating at a very low level of efficiency, so the Land Drainage Act (S.M. 1913 c.56 s.45,46) was strengthened by granting the

Municipal Commissioner the right to do anything necessary to enforce municipal maintenance (Zittlau, 1977:20). As a result, municipalities were forced to finance maintenance from general revenues, in effect forcing lands within municipal boundaries, but outside the drainage district, to subsidize the cost of repairing drainage works from which they received no direct benefits.

Considering this unfair, the Sullivan Commission recommended that the cost of maintenance be paid for by the District as a whole, regardless of municipal boundaries. This meant that inequities in taxation could only be countered by re-defining the boundaries of the drainage districts to include all lands which benefited from drainage. The Commission employed a broad interpretation of those "lands which benefited from drainage". They included upland areas which drained onto the lower areas, although the Commission felt that a uniform levy would be unfair (Sullivan, 1921:18). Thus, the Commission tried to justify the principle of taxing lands on higher levels claiming that it would be:

> ...an economic waste to see such fine land as is located in drainage district No. 2 and No. 12 not properly protected from flood waters or not properly drained,...and...with 250,000 acres paying no taxes whatever,...we do not see how any class of owner of land in this district could possibly be damaged or discriminated against to any serious extent (Sulli an, 1921:19,20).

The Commission cited a theoretical distribution of fees for Drainage District Nos. 2 and 12, whereby the cost of

flood protection works for land liable to severe annual damages was reduced from $5.33/acre to $1.60/acre, while other lands serviced by artificial drains but suffering no flood damage, would be charged at a rate of $0.40 to $0.80 per acre.

As further justification for taxing upland areas the Commission argued that:

> if the people on the higher lands have the right to do as they please on their own property, then the same should be true of those people within a drainage district who would have a right to dam against the waters from the higher lands and a Chinese wall along the west boundary of drainage districts No. 2 and No. 12, could do untold damage to those west of the district (Sullivan, 1921:24).

Thus, the Sullivan Commission viewed drainage problems from a regional perspective. Members of the Commission believed that all landowners would be better off if the social good transcended the private good. In other words, contributors of foreign water should pay a nominal sum to allay the high costs of draining lowland areas since upland areas benefited from the opportunity to dump water on those downstream and indirectly damaged their lowland neighbours. Underlying this principle is the belief that lands which contribute foreign water to a drainage district, both benefit from work undertaken in that district and are a liability to that district. By subsidizing lowland drainage, more land could be brought into agricultural production and onto the tax rolls, ultimately making everyone better off.

This issue introduces the concept of social cost. A negative externality is said to occur if an individual attempts to maximize his private benefit, to the detriment of society, by undertaking an action that while providing private benefits results in anticipated costs to society. Decisions by one individual have impacts that go beyond that individual. In this case, the externality arises from the decision to move water off one's land. Foreign water dumped on lower land represents an externality. The problem of internalizing the externalities is one which plagues modern man in his many endeavors from water management to air pollution. Any attempt to do so is more a matter of social policy than it is a matter of determining the appropriate allocation of resources. As such, the question is one which is open to debate and the issue of foreign water has been and continues to be a source of major contention among the many decision makers affecting water management.

In general, the Sullivan Commission felt that administration of the Drainage Act should be, as far as possible, removed from political influence. Some of the Commission's major recommendations were:

1) the appointment of a permanent, independent board to administer the Drainage Act;
2) the extension of the boundaries of any drainage district to include newly developed land which was contributing by artificial means to the flow of water in the district;

3) the equitable distribution of taxes on the basis of benefits received and relief from liability for damages;

4) that the Government assume responsibility for general maintenance of ditches, charging cost of same to the respective districts (Sullivan, 1921:5).

Of these recommendations, the Government only partially implemented the fourth. Consequently, the problems continued and ultimately forced the enactment of new legislation and the simultaneous appointment of a third Commission (Elliott, 1978:22).

2.2.2 Land Drainage Arrangement Commission: Finlayson 1935-1936

With the onset of the economic depression in the 1930's drain maintenance became more difficult for the drainage districts which were operating under severe financial constraints. Taxes were in arrears and Provincial sinking funds had become deficient. These problems prompted the third Commission, known as the Land Drainage Arrangement Commission, appointed in 1935. Headed by John N. Finlayson, the Commission was directed to determine the financial position of all drainage districts, in terms of the amount of debt for which they should assume responsibility, and to recommend "...the method and manner of providing a fund for the maintenance, repair, and upkeep of drains..." (Finlayson, 1936:7).

Four separate categories of general complaints were presented to the Commission. These included:

1) the problem of foreign water;

2) inequitable distribution of levies;

3) a lack of maintenance; and

4) the exemption of Crown lands from drainage levies.

Like the Sullivan Commission, the Finlayson Commission agreed that lowland areas should not be entirely responsible for enlarging ditches to accommodate water from higher lands. Underlying this belief was the generally held conviction that:

> ...this flow of water from outside areas has been accelerated since the formation of the district by the clearing of land formerly covered with timber, and by the construction of municipal roads and ditches (Finlayson, 1936:8).

However, because the Finlayson Commission determined that it was impossible to ascertain the proportion of additional flows attributable to such developments, and since there were discrepancies in estimates of the degree of changes in local conditions, upland areas could not be expected to contribute to drainage districts in the lower areas. Instead, the Commission recommended that the Province contribute one-third of the sum expended annually for maintenance. In Drainage Districts No. 2 and No. 12 the Commission recommended a Provincial contribution equal to one-half of the total maintenance expenditures because the abundance of

unproductive and, therefore, untaxable land in these Districts represented a "special problem" (Lyons, 1949:17). The Commission also recommended that Elm Creek and Shannon Creek Channels in Drainage District No. 2, and Hespeler and Rosenheim Channels in Drainage District No. 12 be double dyked, at the expense of the Province.

The Finlayson Commission also ruled the "flat rate" method of assessment unfair (Finlayson, 1936:9). However, since it was not possible to ascertain the proportion of benefits attributable to each piece of land, the Commission was unable to change the rate structure. Instead the Commission recommended that the Province assume responsibility for $1.8 million of the total $4.0 million in outstanding debentures (Finlayson, 1936:57).

Lack of maintenance and the inability of drainage districts to finance the construction of necessary improvements, caused the drainage system to function at less than optimal efficiency. To redress this situation the Finlayson Commission recommended the creation of drainage maintenance districts (Finlayson, 1936:62). Provision for the creation of drainage maintenace districts was incorporated into the Land Drainage Act in 1939 (Zittlau, 1977:24). This marked the first time that the legislature had enacted provisions specifically to facilitate the maintenance of existing drains.

Under section 125 of the BNA Act, Crown lands were exempt from taxation of any kind (Finlayson, 1936:19). However, the Finlayson Commission noted that Crown lands benefit as much as private lands from drainage schemes, so it was recommended that the municipalities be released from the responsibility of paying charges on Crown lands (Finlayson, 1936:60).

In 1935, the Land Drainage Arrangement Act was enacted simultaneously with the appointment of the Land Drainage Arrangement Commission. The Act incorporated most of the recommendations suggested by the Finlayson inquiry. For example:

1) the Province constructed the recommended double dykes;
2) the Province assumed a portion of the outstanding debentures;
3) drainage maintenance districts were created; and
4) municipalities were released from the responsibility of paying drainage levies on Crown lands.

However the Province did not increase its relative contribution to drainage maintenance. Instead, the Province agreed only to contribute 1/3 of 1 percent (1/2 of 1 percent in Drainage District Nos. 2 and 12) of annual capital expenditures (Elliott 1978:24). On the basis of this method of

calculation, the Provincial contribution for maintenance amounted to about 1/3 of the total expenditure for maintenance during the period 1935-42. However, 1941 marked the beginning of a period of wet years. The cause of this wetter period is open to debate. The U.S. Army Corps of Engineers, for example, argues today that this increased wetness was the result of climatic changes (Calton, presentation, 1979).

On the other hand the Finlayson Commission (1936:8), along with most farmers, especially those in the lowland areas, were of the opinion that increasing use of intensive cultivation, extensive land clearing on higher elevations, increased road construction and a concomitant increase in ditch construction, resulted in more rapid runoff from upland areas. Regardless of the cause of this accelerated runoff, the fact is that rapid runoff resulted in erosion and silt deposition in the lower areas, aggravating water problems in the lower areas. To cope with the additional water, Maintenance Districts were forced to install more drains, the cost of which was borne by the municipalities. Rapidly rising construction costs augmented the problems. Consequently, maintenance costs increased to $1,169,103 between 1941 and 1947, compared with $345,426 between 1935-41 (Lyons, 1949). As costs increased, the proportion of the provincial contribution to maintenance decreased.

2.2.3 Lyons Commission: 1947-49

Discontent continued to centre around two inter-dependent issues -- foreign water and the proportion of government assistance toward the cost of drain enlargement and maintenance. These concerns prompted a request in 1946 by the Union of Municipal Drainage Districts to appoint a fourth Commission. The following year the Lyons Commission began work on a report entitled "Foreign Water" and Maintenance Problems.

The Lyons Commission states:

> Since the belief still persists in the minds of Municipal officials that the higher lands in the watershed should bear a portion of the maintenance costs...then the difficulty of apportioning this cost as referred to by the Finlayson Commission should be considered in some detail (Lyons, 1949:9).

At the root of this investigation is the belief that changes in land use had affected the flow of water.*

It will be recalled that the Sullivan Commission argued that the region would be better off if the uplands, not subject to flooding, contributed a small amount towards draining the lowlands. As justification for cost-sharing, the Sullivan Commission believed that if the uplands had the right to dump on the lowlands then the lowlands have the right to dam against the flows from the uplands (Sullivan,

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*The flow of water might be affected in two ways: (a) by increasing the total runoff; and (b) by changing the order of run-off (i.e. peak flow).

1921:24). This logic was not generally accepted because of the claim that stream flow was a natural condition. However, by 1936, the Finlayson Commission argued that the flow of water had been accelerated due to the actions of man (Finlayson, 1936:8). As conditions became wetter after 1941, there was a general feeling that the flow of water from uplands to lowlands was greater than it would be under natural conditions. Thus, the Lyons Commission addressed this belief at some length, reviewing a number of scholarly papers on the effects of deforestation, cultivation and ditching upon stream flow and snow melt.

The review revealed many contradictions. For example, a study by W.C. Hayt concluded that forests do not regulate stream flow (Lyons, 1949:10), while a study by R. Zon concluded that forests tend to equalize flow throughout the year. The Lyons Commission resolved that "...it can only be concluded that it is uncertain if deforestation does or does not affect the total stream flow..." (Lyons, 1949:13).

The only reasonably firm conclusion that the Commission was able to reach regarding the activities of man in relation to run-off was "...that the construction of road ditches and ditches for the draining of land in the higher portion of the drainage district watershed will, in general, have the effect of increasing...the total runoff and the rapidity of run-off" (Lyons, 1949:13,14).

The Lyons Commission goes on to state:

> The impossibility of determining the effect of changed conditions in the higher lands of the various watersheds on the flow of water onto the various drainage districts does not remove the fact that the various drainage districts should not be required, at their own expense, to provide for this additional water (Lyons, 1949:16).

The Lyons Commission concluded that:

> Additional assistance from the Provincial Government, or the apportionment of some of the costs to the higher lands, would not in itself have solved the "foreign water" problem. The solution requires definite interception, where feasible, of this water, its collection and its transfer to its outlet by means that will prevent it from flooding over the land (Lyons, 1949:22).

In the opinion of the Lyons Commission:

> It is not the duty of the drainage district to receive and remove "foreign water" flowing on to the land in the district due to assistance by any artificial agency. As has been shown, it is not possible to determine the increased amount of this water which is due to artificial agencies; neither is it possible to accurately determine the area from which this additional "foreign water" would flow onto the district (Lyons, 1949:22,23).

In other words it was generally conceded that the flow of water had been affected by the actions of man. However, since it was impossible to prove liability, the Commission recommended that the Province pay two-thirds of the cost of all future maintenance and construction of drains which intercept, collect, and carry "foreign water" together with local water. Works carrying only foreign water should be built and maintained as a Provincial responsibility. The

Province should pay one-third of the costs incurred by local drains (Lyons, 1949:23).

2.2.4 Land Drainage Arrangement Act: 1952

In 1952 the Land Drainage Arrangement Act was amended to effect most of the recommendations of the Lyons Report. The Province agreed to pay one-third of the cost of works draining essentially local water, and two-thirds of the costs of maintaining the floodways and major drains, which carried mainly foreign water (Zittlau, 1977:27).

This method of funding worked well for a time, permitting the drainage system some needed rejuvenation. However, by the 1960's the municipalities were once again experiencing financing difficulties due to high construction costs, and the high costs of services such as education and road building programs. Reconstruction programs, a local responsibility, put added pressure on the municipalities. As a result, there was no project co-ordination and many drainage works were never systematically or effectively implemented.

2.2.5 Royal Commission on Local Government Organization: Mitchener Commission 1964

In April 1964, the Royal Commission on Local Government Organization and Finance, also known as the Mitchener Commission, recommended the Province assume

responsibility for major waterways. This resulted in the formulation of a Provincial Waterways Policy whereby the Province devised an order system for rating drains and assumed full responsibility for all waterways of a third order or higher (see Appendix 2 for explanation).

The Provincial Waterways Policy has created some new problems. By abolishing Drainage Maintenance Districts the level of local influence in drainage decisions has been reduced. As a result there is some degree of alienation between provincial administrative agencies and municipal councils. This has developed in some cases into a "we" versus "they" attitude. There is also confusion on some municipal councils where it is believed that drainage is a provincial responsibility. Landowners, particularly those in upland areas, relying entirely on natural waterways for drainage, have difficulty indentifying the level of government to approach for drain repair.

2.3 A NEW APPROACH TO WATER MANAGEMENT

Throughout the history of land drainage there has been widespread dissatisfaction over the apportionment of cost. Theoretically, all three Commissions (Sullivan 1921, Finlayson 1936, and Lyons 1949) agreed that upland areas which drained onto lowland areas should pay a portion of the costs of draining lowland areas. Sullivan suggested that the statutes be revised to permit drainage districts to extend

their boundaries to include newly developed land which was contributing by artificial means to the flow of water in a district. Since this action would adversely affect the taxes of upland landowners, it is not surprising that they were opposed to such an amendment.

Finlayson and Lyons both felt that it was unfair to expect lowland areas to "...receive and remove 'foreign water' flowing onto the land in the district due to assistance by any artificial agency" (Finlayson, 1936:22), in view of the fact that this flow had been accelerated due to land use changes. However, since it was not possible to determine the amount or the source of every increase in flow, neither Finlayson nor Lyons could recommend a fair levy to impose on upland areas. The result was that the Province assumed a larger share of the responsibility for servicing the debt load and the costs of maintenance.

Transferring an ever-larger share of the financial burden from the municipalities to the Province had the effect of socializing the costs. A corollary effect was to absolve upland landowners of any responsibility to their lowland neighbours. In other words, the private good was permitted to transcend the social good, despite the belief that upland areas were contributing to increased flows. With its economic and administrative commitments to drainage works increasing annually, the Province recognized the need for a new administrative approach. The following section of this report

deals with that effort to provide a framework for integrated resources management, a framework which recognizes the individual landowner as the primary component of effective water management.

On September 15, 1959, two pieces of legislation were enacted to effect a more integrated approach towards the management of water and related land resources. These were: The Watershed Conservation Districts Act [S.M. 1959, (2nd Sess.), c.70, s.1], which provided municipalities the opportunity to co-ordinate their water management efforts through the establishment of a watershed conservation district; and The Department of Agriculture and Immigration Act Amendment Act (S.M. 1959, c.4), which consolidated the administration of all matters concerned with water control, distribution, use and conservation under the Minister of Agriculture and Conservation. These two acts and their implications will be discussed in the following sections.

2.3.1 Conservation Districts

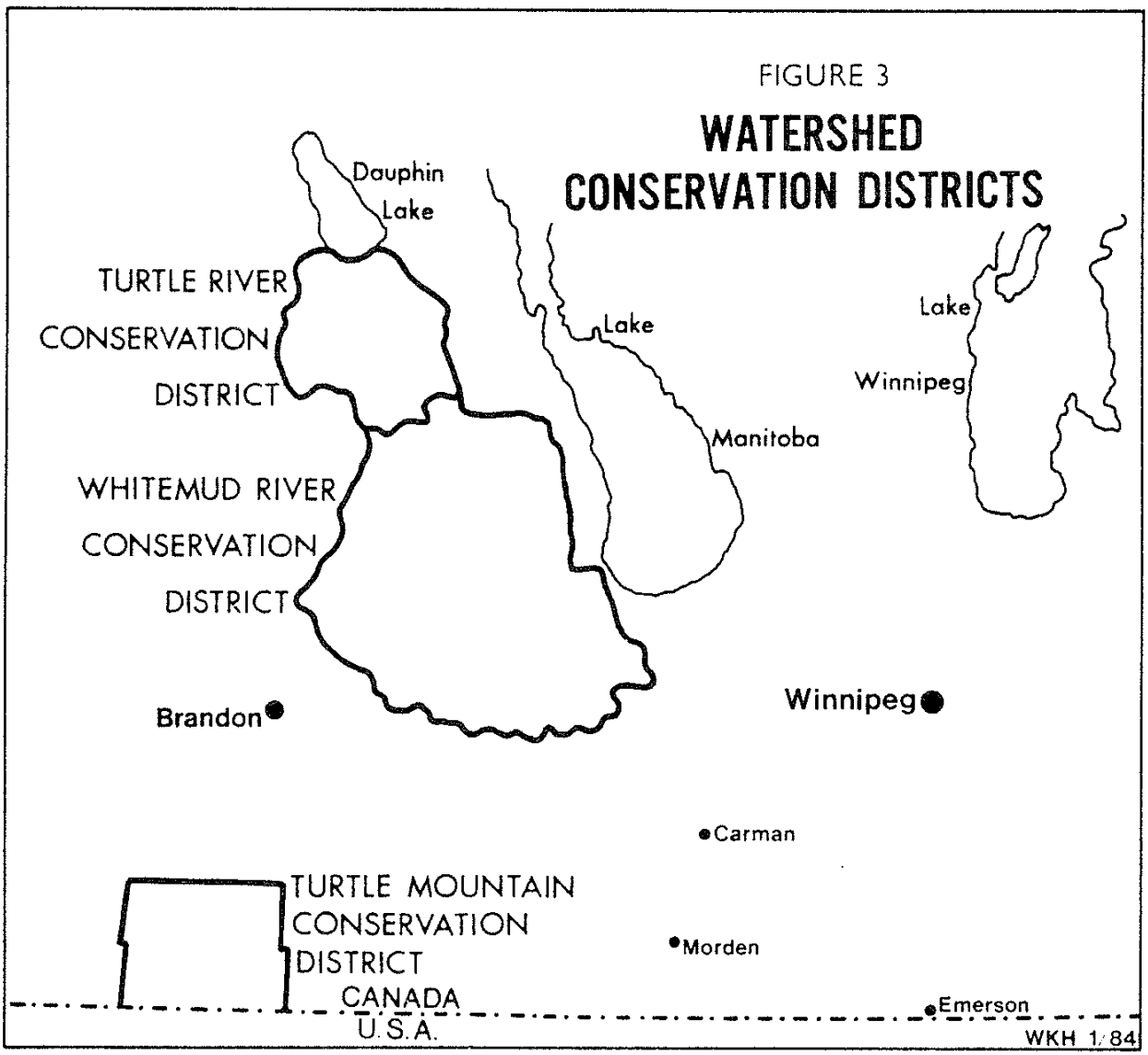
Water management efforts up to the late 1950's had centred almost entirely on removing excess surface water. The result was the cultivation of over two million acres of former wetlands. However, by the late 1950's there were a number of factors which indicated a need for a more holistic approach to water and related land management. In some areas improper land management led to severe erosion which

destroyed some lands and led to the siltation of many drains, rendering them ineffective. This led to increased flooding and higher maintenance costs. The combination of these factors led to the enactment of the Watershed Conservation Districts Act in 1959.

This Act provided municipalities the opportunity to co-ordinate (through a single authority -- the District Board) their water management efforts through the establishment of the watershed conservation district whose boundaries were coterminous with the watershed area (Elliott, 1978:40). The board has complete jurisdiction over all drains in the district, thereby eliminating the provincial-municipal and inter-municipal split in jurisdictions. The aims and objects of the District Board are:

> ...to promote the conservation and control of the water resources within the district and for that purpose (the board) shall...study, undertake, put into effect, operate or maintain a scheme in respect of the district for the purpose of conserving, controlling, developing, protecting, restoring or using,
>
> a) the water resources within or available to the district; and
> b) the land, forest, wildlife, and recreation resources within the district;
>
> as may be necessary or incidental to the achievement of those aims and objectives. [S.M. 1959 (2nd Sess.) c.70, s. 14(1)].

Two watershed conservation districts were formed under this act: (1) Whitemud River Watershed Conservation District No. 1 (1972); and (2) Turtle River Watershed Conservation District No. 2 (1975) (Figure 3).



SOURCE: Elliott, 1978: 41

Despite the apparent logic of this act, the progressive attitudes exemplified, and the altruistic intent, the application of this legislation was non-existent until 1972. Municipalities have been reluctant to form watershed conservation districts for reasons which are difficult to ascertain. One could speculate that the reasons for this are that municipalities: (1) lack initiative; (2) believe the long-term benefits and potential savings are of dubious merit; (3) are unable or unwilling to reach agreement among themselves; (4) fear a shift in financial responsibility from the Provincial Government back to the municipalities; or (5) suffer a lingering parochialism and fear the loss of administrative and legislative rights. Some members of municipal councils may be wary of the omnipotent powers of the District Board. For example, the board has the right to "...enter on, acquire, take, use, and expropriate without the consent of the owner, any land that it deems necessary or useful for the achievement of its aims and objects [S.M. 1959, (2nd Sess.) c.70, s. 16(1) (9)]. It is worth noting that the Province may also be somewhat hesitant because the board can, in effect, compel the Province to spend money.

Partly in response to the unwillingness to implement this permissive legislation, the Watershed Conservation Districts Act was supplanted by the Resource Conservation Districts Act (R.S.M. 1970). This second act is similar to the 1959 legislation but differs in the objectives and definition of the term "resource". Emphasis was shifted from water management to multiple use resources management. It

was expected that water management would be both an integral part of, and a by-product of a more holistic and multi-disciplinary approach.

Section 18(1) of the Act proclaimed:

> The aims and objects of the board of a district are to promote the conservation and control of the use of the resource [means land, and in relation to land use, use includes water] within the district and for that purpose shall put into effect, operate or maintain a scheme in respect of the district for the purpose of conserving, controlling, developing, protecting, restoring or using
>
> a) the land and soil within the district; and
>
> b) the forest, wildlife and recreational resources within the district;
>
> as may be necessary or incidental to the achievement of those aims and objects.

With the emphasis placed on the land rather than water resources, boundaries of resource conservation districts were to coincide with municipal boundaries and not the watershed area [R.S.M. 1970, R. 135, s.2(2)] (Elliott, 1978:42). Thus, there was an attempt to allay any apprehension over the erosion of municipal control. By focusing on land resources there could be more identification with the social benefits of a total management scheme. Two resource conservation districts were formed under the Resource Conservation Districts Act: (1) Turtle Mountain Resource Conservation District (1973); and (2) Alexander Resource Conservation District (1973). The latter district was later disbanded.

Faced with limited response to either the Watershed Conservation Districts Act (S.M. 1959) or the Resource Conservation Districts Act (R.S.M. 1970), the Provincial Government consolidated these two acts into the Conservation Districts Act (S.M. 1976). The combination of the former two acts is evident in the definition of resources as "the lands and waters within or available to a district, whether used for wildlife, recreation, agriculture, forest production or any other use" [S.M. 1976, c.38, s.1(n)]. The purposes of the Conservation Districts Act are:

(a) to provide for the conservation control and prudent use of resources through the establishment of conservation districts; and

(b) to protect the correlative rights of owners (S.M. 1976, c.38, s.2).

It would appear that purpose (b) was included to allay fears that the board would have too much power to dictate to individual landowners, what they should be doing on their own land.

2.3.2 Provincial Administrative Re-Organization

Prior to 1959, water related legislation came under the jurisdiction of several provincial departments, including: Mines and Natural Resources; Public Works (Land Drainage Arrangement Act); Agriculture and Immigration; and Industry and Commerce (Water Supply Districts Act) (Elliott,

1978: 28) (Zittlau, 1977:7). Because the different Departments operated under different mandates and were isolated from each other, co-operation between Departments was minimal. Conflicts often developed between resource development departments and resource conservation departments and branches.

To alleviate some of the administrative complexity, elicit more co-operation, and to achieve a more holistic approach to multiple use resources management, water legislation was consolidated under the auspices of one department through departmental re-organization. The Department of Agriculture and Immigration Act Amendment Act (S.M. 1959, c.4) did two things. The Act changed the Department's name to Agriculture and Conservation and consolidated the administration of all matters related to water control, distribution, use and conservation under the Minister of Agriculture and Conservation (Elliott, 1978:28). The Water Resources Branch in the Department of Mines and Natural Resources, and the Drainage Branch in the Department of Public Works were abolished with the personnel transferring into the newly created Water Control and Conservation Branch.

Amalgamation under a single administration was hailed as a significant step towards improved efficiency.

> In practice, these changes tended to be acceptable to the conservation oriented Branches, but were rejected by the Development Branches. Nevertheless, the

> re-organization process succeeded in diversifying the activities of the Department, thereby establishing more direct contact with resource users at all levels (Zittlau, 1977:5,6).

Since 1959 there have been some minor changes in the naming of Departments but the intent of the Water Control and Conservation Branch has remained essentially the same. For example, the Water Control and Conservation Branch was transferred briefly, 1966 to 1968, from the Department of Agriculture and Conservation to the Department of Highways. In 1968 the Branch was transferred to the Department of Mines and Natural Resources so that the planning and administration of water resources might be more closely co-ordinated with fisheries, wildlife, forestry and mining (Elliott, 1978:32). The Water Control and Conservation Branch is now named the Water Resources Division.

2.4 CONCLUSION

Emerging from this chapter are several factors with relevance to current water management. The most obvious is the fact that a large portion of the agricultural land in the Red River basin is inherently wet. As a result, early water management initiatives were directed toward drainage and the construction of physical works. The drainage system was relatively efficient at removing normal spring flows, although a lack of maintenance often militated against optimum efficiency. During the initial period of drain construction there

was implicit faith in the physical constructs. Dissatisfaction did not revolve around the physical calculus of drainage but rather around the problem of apportioning cost. Controversy over this issue continued until 1965 when the Provincial Waterways Policy provided that the Province assume full responsibility for all waterways of a third order or higher.

Throughout the course of Royal Commission investigations, fiscal responsibility for drainage was progressively transferred from the municipalities to the Province, but the problem of foreign water was never resolved. Finlayson (1936) and Lyons (1949) opined that changes in land use had increased the rate and the amount of runoff. However, given the myriad of variables it was not possible to derive a widely applicable formula to use in determining the amount of the increased flows. Nonetheless, there was a general conviction that land use changes had affected the hydrological regime, resulting in increased flooding, erosion, and siltation of drainage channels.

As fiscal responsibility was transferred from the individual landowner to a higher level authority, private costs became social costs. Faced with burgeoning public costs, the Province adopted a more embracing perspective or a systemic view and attempted to move towards integrated resources management by:

1. enacting permissive legislation embodied in the Watershed Conservation Districts Act (S.M. 1959); and

2. reorganizing the administrative agencies managing water and land resources.

Thus, there was an attempt to encourage management which incorporated drainage, water conservation and land use management. Implicit in this philosophy is the belief that: there is a relationship between the actions of man and water management; and social goals could more readily be accomplished by making individual landowners within a watershed area responsible to each other. Thus, there was an attempt to view the individual landowner as a component in the overall management and stewardship of the land-water base. In practice, however, these concepts have been difficult to implement and the trend has been to move from individual responsibility towards Provincial Government (public) responsibility -- in other words, to divorce the relationship between man and the environment.

To summarize, this chapter presents five important findings which have relevance to water management in the Red River basin. First, flooding is a natural event and it would be unrealistic not to expect some degree of flooding on a floodplain. Second, there is a long-held view that the actions of man affect flood levels. Third, the courts are ineffective in terms of dealing with the issue of foreign water. Fourth, the Provincial Government implicitly believed that the individual landowner should be socially responsible.

Fifth, water management is an on-going problem. Thus, goals, objectives and methods must be constantly re-evaluated in light of the evolution of legislative and administrative institutions, physical conditions, and public and private decision-making considerations.

CHAPTER III

THE EMERGENCE OF THE LOWER RED RIVER VALLEY WATER COMMISSION AND ITS EARLY ACHIEVEMENTS

3.0 INTRODUCTION

During the early period of settlement there was a need for individual farm water supply. The Public Works Department assisted by subsidizing municipal well drilling from 1894 to 1923, but few successful wells were found in the Red River Valley, between the Red River and the escarpment (Zittlau, 1977:72). Groundwater below an impervious clay layer, running 10 to 30 feet underground was highly saline. As a result, wells were shallow and often dried up forcing farmers to haul water from other sources to fill home cisterns. While domestic needs could be met, this method of water supply was inadequate to meet livestock needs, thus preventing farm diversification. During the 1930's PFRA provided limited help by assisting in the construction of farm dugouts.

With the growth of towns and industry, water demands increased. In many cases these demands could only be met at great cost by trucking water over great distances. Between 1941 and 1956, a period of ample rainfall, Altona reputedly spent $50,000 a year hauling water from as far away as Pembina, North Dakota and Morden, Manitoba (LRRVWC Minutes, Dec. 13, 1956). Water hauling and treatment cost

Co-op Vegetable Oils Ltd. $25,000 a year (LRRVWC Minutes, January 24, 1957). In addition to the cost of hauling water, limited supplies restricted the region's development potential. Thus, it became necessary to develop an assured supply of potable water.

According to the provisions of the Municipal Act of 1871 sewage and water services were a municipal responsibility (Zittlau, 1977:59). The Act empowered municipalities to divert water within their boundaries for the purpose of supplying water but insufficient supplies in most cases, plus the financial burden of sophisticated and extensive services on the limited population, militated against many municipalities providing water and sewage services prior to 1959. There was also no provision for extra-municipal construction. Thus, many municipalities were effectively powerless to supply adequate quantities of potable water.

This situation prompted collective action. Municipalities and local businesses co-operated to finance feasibility studies (LRRVWC Minutes, January 24, 1957). In the 1940's and 1950's inter-municipal public forums were held. Then, in 1956 the Red River Valley Development Association (RRVDA), representing the Rural Municipalities of Dufferin, Grey, Montcalm, Morris, Rhineland, Roland, Stanley and Thompson, plus the incorporated towns and villages in the area was formed to approach the Provincial Government. The result was the enactment in 1958 of the Water Supply Districts Act

(S.M. 1958). Section 3 of this Act provided for the establishment of the Lower Red River Valley Water Commission whose mandate was:

> ...to examine and consider all matters relevant to supplying the water commission area with an adequate and reliable permanent supply of potable water for the use of the inhabitants thereof.

In other words, the Water Supply Districts Act (S.M. 1958) provided regions in the Province with the authority to investigate matters relevant to the provision of potable water to the Water Commission area. The Manitoba Water Supply Board Act (S.M. 1959), the following year, made it possible to develop that source of supply and to bring it to the Commission area.

This chapter traces the circumstances leading to the creation of the Lower Red River Valley Water Commission, the early achievements of the Commission, and the legislative, administrative, and attitudinal problems which had to be dealt with.

3.1 IN SEARCH OF A WATER SUPPLY

The drought of the 1930's prompted the Federal Government to create the Prairie Farm Rehabilitation Agency (PFRA) in 1935, as an instrument of aid for western rural recovery.

> PFRA was designed on the assumption that improved resource use practices and physical resource investments would contribute to the rehabilitation of rural

> areas. Engineering services and financial aid were provided to farmers who wished to improve their land and local water resources. Projects included water resource management, soil conservation, community pastures and various land conversion projects (Nickel and Gillies, eds., 1977:5).

PFRA assisted in the construction of farm dugouts, and in 1941 constructed the Morden dam to supply water to the Dominion Experimental Farm (PFRA, 1973:1,2). Various water supply alternatives for the Red River Valley, were also investigated and rejected. For example, PFRA abandoned the idea of a Pembina River dam because of international complications. Construction of a dam at Stephenfield was dismissed by PFRA engineers who claimed that the sub-soil was unsuitable for dam footings. Buffalo Creek, in the Altona area, had also been surveyed by PFRA, but a reservoir was considered impractical because of unreliable flow and an extremely gradual gradient (LRRVWC Minutes, December 13, 1956).

These efforts fell far short of meeting regional needs, prompting Red River Valley residents to initiate their own studies and to conduct public meetings throughout the 1940's and 1950's. A number of municipalities drilled wells, at their own expense, in an unsuccessful bid to find water (LRRVWC Minutes, January 24, 1957).

The municipalities of Rhineland and Montcalm, along with Altona, and two local industries, Co-op Vegetable Oils Limited, Altona, and International Pipelines, Gretna,

commissioned their own study. The study investigated the feasibility of constructing a pipeline from the Red River at Letellier to St. Joseph, Altona and Gretna. This proposal was rejected because of the cost of servicing such a small area and because the source of supply was both undependable and of poor quality.

In addition to satisfying the need for potable water, Valley residents also recognized that prolonged drought could cause economic devastation. Thus, there was a desire to deal with the long-term regional water requirements. As a hedge against protracted drought, Valley residents were favourably disposed to a dam on the Pembina River which could provide water for irrigation, as well as water for domestic, municipal and industrial uses. A public meeting inviting "...persons interested in the construction of a dam on the Pembina River..." (LRRVWC Minutes, March 3, 1955) was held in Winkler March 3, 1955. The meeting attracted 440 people from the municipalities of Morden, Winkler, Plum Coulee, Altona, Gretna, Carman and Manitou, as well as the State of North Dakota.

Presentations were made by several professionals: Bob Wallace, Provincial Soils Specialist, spoke on "Advantages of Irrigation in the Solution of Problems in Farm Management and Wind Erosion"; and Dr. Chas Walkof, spoke enthusiastically about "Possibilities in Special Crop Production under Irrigation". A Pembina River dam received overwhelming

support from the constituents and Chamber of Commerce presidents from Morden and Winkler. A resolution was struck designating a committee, later called the Pembina River Water Control Association to ask the Province to study the question of water control (LRRVWC Minutes, April 4, 1961).

On December 13, 1956, a public meeting was held to discuss the possibility of supplying water to Valley towns by pipeline from the Greater Winnipeg Water District (GWWD). A delegation from Altona and Gretna had previously met with members of GWWD, who assured them that the Winnipeg aquaduct from Shoal Lake was large enough to serve Valley towns. A committee was formed to approach the Provincial Government to conduct a feasibility study of the pipeline proposal. This marked the beginning of the Red River Valley Development Association (RRVDA) which was "...designated the official body to deal with all aspects of water in the Lower Red River Valley" (LRRVWC Brief to the IJC, August 25, 1960). The area was comprised of the rural municipalities of Dufferin, Grey, Moncalm, Morris, Rhineland, Roland, Stanley and Thompson, and included the incorporated towns and villages in the area.

An executive committee* was elected at the next meeting held in Morris, January 4, 1957. The executive committee agreed to prepare a brief to the Provincial Government requesting a feasibility study of the GWWD pipeline and government support for a Pembina River dam.

The brief emphasized that the major obstacle to developing potential agricultural industries was the lack of an assured supply of potable water. The brief projected that with adequate water, the region's population would increase from 40,000 to 100,000 in 25 years (LRRVWC Minutes, February 8, 1957).

In view of the fact that PFRA surveys had shown construction of local dams and reservoirs, to be impractical and uneconomical, the GWWD pipeline appeared to be the most practical solution and garnered wide-ranging support. The scheme had been advocated by the director of PFRA and private engineers, and was suggested in the legislature in 1956 by the Honourable R.D. Robertson, Minister of Agriculture (LRRVWC Minutes, Submission to the Premier, 1957).

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*Executive members included:
Sven Jensen representing Carman
D.K. Friesen (Secretary) representing Altona
J.J. Peters (Convenor) representing Altona
Reeve Arthur Beaubien representing St. Jean
H.P. Friesen representing Winkler
Reeve Henry Magarell representing MacDonald
Mayor O.T. Johnson representing Morris

On February 8, 1957, members of RRVDA met with Premier Campbell, members of the Cabinet, MLA's, government officials, PFRA engineers and Winnipeg Water District officials.

In the opinion of H.R. Riesen, PFRA engineer, the only viable solution was a GWWD pipeline, although he added that former PFRA directors had suggested pumping water from the Assiniboine River, on the condition that the Assiniboine had ample flow. Other individuals at the meeting pointed out that the pipeline would not conflict in any way with the Pembina or Stephenfield projects since these were being considered for the purposes of irrigation and flood control. Premier Campbell stated that his Cabinet would give the GWWD pipeline proposal most serious consideration and assured the delegation that a feasibility study would be started immediately (LRRVWC Minutes, February 8, 1957).

3.1.1 A Proposal for a Lower Red River Valley Water Supply System: Arthur D. Little

The consulting firm, Arthur D. Little, Inc., submitted their report, in 1957 entitled "A Proposal for a Lower Red River Valley Water Supply System". The report agreed that the aquaduct proposal would provide a dependable potable water supply but the proposal was fraught with several inherent failings:

1) it would require construction of a number of costly pumping stations;

2) it would require a major initial installation prior to the generation of a level of demand for water adequate to provide the revenues necessary to defray capital and operating costs involved;

3) it would make no contribution to soil and water conservation or to irrigation needs.

After reviewing the economic development potential of the region, the Little report concluded that agricultural and industrial development was being retarded by the absence of adequate supplies of water for irrigation, industrial, and domestic use (Little, 1957:1). The report stressed that, while a potable water supply would be very beneficial to the region, the full agricultural and industrial potential of the Valley could be achieved only if additional irrigation water could be provided. The report states:

> ...there is need for both potable and irrigation water and...comparatively limited benefits would follow from the provision of water for only one of these purposes (Little, 1957:16).

In the opinion of the report's authors:

> We believe that a satisfactory solution to the potable water problem should satisfy in addition to the primary criteria of dependability and economic feasibility, the secondary criteria of contributing to the problems of conservation and agricultural development. We therefore present in this report a proposal designed to provide immediate assistance to the towns and villages that are most in need of water and the basis

> for a comprehensive water conservation and utilization program for the whole region (Little, 1957:23).

To fulfill these objectives, a three-phase water supply development plan was devised. The first phase involved the construction of a pipeline from the Morden reservoir to Altona and Gretna to ensure that the recently accelerated economic development of these towns could proceed. The second phase required construction of the Stephenfield dam to supplement the Morden water supply and bring Carman, Sperling, and several other villages into the system. A third phase involved the construction of a Pembina River dam to meet the region's ultimate water requirements. An integrated program of water conservation in the Pembina Hills was seen as the culmination of a comprehensive program aimed at solving the region's water problems.

The Little report concluded that in terms of administration and finance, a water distribution system must be publicly owned. Since the problem of bringing water into the area was common to the entire region, responsibility for construction of a water supply system should be borne by the inhabitants of the Lower Red River Valley. The study admitted to being influenced by the success of the GWWD, and therefore recommended that the Province create a Lower Red River valley Water District comprised of the Rural Municipalities of Montcalm, Morris, Roland, Rhineland, Stanley, Thompson, Dufferin, and MacDonald, and the municipalities of

Altona, Gretna, Plum Coulee, Morden, Morris, Carman, and Winkler (Little, 1957:30). Each of these municipalities would have a representative on the governing board.

There were a number of problems identified in creating such an organization. For one, because user fees would be insufficient to cover the capital costs of a water supply and distribution system the Board would have to be empowered to levy taxes. Second, the Board would require sweeping powers over all aspects of water use and distribution, and should co-ordinate the activities of the various agencies and government departments concerned with water conservation. Third, a federation of municipalities would require some sort of hierarchical structure, since a group of volunteers could not be expected to co-ordinate complex economic development programs. Thus, it was feared that municipalities would be reluctant to forfeit so much of their autonomy to an independent board with such sweeping powers.

A RRVDA general meeting was called September 19, 1957, to discuss the draft "Proposal for a Lower Red River Valley Water Supply System", at which time some issues related to the forfeiting of municipal power surfaced. Morden representatives, for example, voiced their concern that their use of water from the Morden reservoir could be curtailed during dry years (LRRVWC Minutes, September 19, 1957). However, the representatives from Morden did not use this rationale to oppose the scheme but merely used it as

justification for a second dam. Mayor Harris, from the Town of Carman wanted phases 1 and 2 started simultaneously, assuring both districts a supply of water at the same time. He also felt that the whole district should not be expected in any way to finance construction of the Stephenfield dam. This is reminiscent of drainage disputes over the apportionment of a fair levy, in view of the fact that some regions would benefit more than others.

Municipalities were understandably concerned about protecting their self-interests, but parochialism did not create an impasse. It was agreed to proceed and to seek federal/provincial assistance for the two proposed dams and pipeline. So RRVDA met with representatives of the Manitoba Government on November 20, 1957. Together with the Tobacco Creek Association and the Red River Valley Water Conservation Study Group they recommended to the Province:

1) the immediate initiation of an engineering study;
2) the creation of a water authority as recommended in the Little report; and
3) the immediate construction of Phase I and II, to be followed as soon as possible by Phase III.

The Manitoba Government indicated their interest in the project, having already submitted a formal written request to the Honourable Douglas S. Harkness, Federal Minister of Agriculture, requesting that:

1) PFRA carry out the engineering study;
2) permission be granted to use the water from the Morden reservoir;
3) the Government of Canada assume responsibility for construction of the Stephenfield dam.

The Honourable C.E. Greenlay confided that the Manitoba Government was prepared to retain a firm to undertake the entire engineering study if PFRA refused.

The proposal met with mixed reactions from those in attendance. Jack Griffiths, Director of Water Control and Conservation, disagreed with the costs of the project, as presented in the Little report and expressed concern about the adequacy of supply from the Morden reservoir, and about the feasibility of the Stephenfield dam. He claimed that PFRA was also of the opinion that the Morden and Stephenfield reservoirs would not assure a sufficient quantity of water for the Red River Valley. In Griffiths' opinion, a Pembina River dam would make a greater contribution to the regional economy by providing irrigation water as well as water for industrial and domestic use.

Not everyone agreed with D.K. Friesen's request that the Government prepare legislation which would establish a Red River Valley Water Development District. Several individuals expressed concern over taxation by the District Board.

Bruce MacKenzie from Morris was doubtful that grain farmers in his area would see water as any benefit. The

Honourable C.E. Greenlay had reservations about establishing a District prior to identifying a source of water. Nonetheless, he committed himself to introduce the subject to Cabinet.

The pressure for potable water led ultimately to government enactment of the Water Supply Districts Act, assented to April 10, 1958. Under Section 3 of this Act, the Lower Red River Valley Water Commission was established by Order-in-Council on August 29, 1958. (See Appendix 3 for list of member communities and municipalities along with their respective representatives).

3.2 LRRVWC ACHIEVEMENTS 1958-1962

The Water Supply Districts Act (S.M. 1958, s.8) provided LRRVWC with the mandate to:

> ...examine and consider all matters relevant to supplying the water commission area with an adequate and reliable permanent supply of potable water for the use of the inhabitants thereof.

LRRVWC immediately set out to fulfill this objective. At the first executive meeting September 30, 1958, resolutions were received from (1) the Town of Altona and the Village of Gretna requesting inclusion in a water district; and (2) the Rural Municipality of Dufferin requesting immediate reconsideration of the Stephenfield dam. To be more effective, LRRVWC recognized the need for two changes. First, they resolved to approach the Provincial Government to

provide engineering and technical services. Second, it was acknowledged that "...drainage, water conservation, irrigation, flood control, and a potable supply of water go hand in hand, and that all water problems should be under the jurisdiction of one provincial government department" (LRRVWC Minutes, September 30, 1958). One could assume that these attitudes influenced the Province's subsequent enactment on September 15, 1959, of The Watershed Conservation Districts Act (S.M. 1959) and The Department of Agriculture and Immigration Act Amendment Act (S.M. 1959, c.4).

By October 29, 1958, the Department of Mines and Natural Resources was actively engaged in the search for a source of water for the Lower Red River Valley (LRRVWC Minutes, October 29, 1958). Mr. Mudry, an engineer from the Water Resources Branch, reported to the LRRVWC, the following week, that his Branch was conducting studies on various alternative water sources. Projects under consideration included:

1) a dam on the Roseau River;
2) the Morden reservoir;
3) pumping water from the Assiniboine River into the Boyne River;
4) a dam at Stephenfield;
5) piping water from the Pembina River at Neche;
6) a dam on the Pembina River; and
7) connection to the Winnipeg aquaduct

LRRVWC then passed a resolution asking the Province to immediately implement the following projects:

1) a pipeline grid, the main line from Neche, North Dakota north to highway #2, with laterals running east and west; and

2) an immediate start on the Pembina, Stephenfield, and Roseau dams to serve as a source of supply for the pipeline.

At the ensuing meeting, November 13, 1958, LRRVWC representatives met with Premier Roblin and several members of the Provincial Cabinet. The Premier reported that the Province had so far been unable to obtain Federal Government approval for the Stephenfield dam, even on the basis of Provincial contributions. The Premier did, however, hold out more hope for the proposed pipeline indicating that there was a possibility of Provincial assistance. Prior to any final decision on the pipeline, an engineering firm would be provided at Provincial expense to ascertain the exact costs. It was also indicated by the Premier that the project would be considered a public utility, owned by the area it served, and administered by LRRVWC.

The executive met December 12, 1958, to prepare terms of reference for the engineering study and to set priorities for the works to be undertaken. The first priority was a study of a pipeline from Neche to Gretna and Altona. LRRVWC divided the Red River Valley into a northern and

southern section and decided that other cost studies should be done according to the following order of priority:

A. Southern Section

1) a pipeline from Altona to St. Joseph, Letellier and St. Jean;

2) a pipeline from Morden to Plum Coulee;

3) a pipeline from Plum Coulee to Altona;

4) A pipeline serving other rural areas in the southern section.

B. Northern Section*

1) a pipeline to Carman, branching off in the first year to Roland, Elm Creek, and Sperling;

2) an extension of the pipeline network to Starbuck, Lowe Farm, and Sanford.

At the following meeting, February 19, 1959, LRRVWC unanimously agreed that the Neche/Altona pipeline be the first constructed. There was also a desire for greater involvement in the planning and evaluation process. Therefore, it was recommended that the Government appoint the Director of Water Control and Conservation to the Commission in order to establish liaison between the Commission and government departments.

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*These plans were contingent on a dam at Stephenfield, with supply augmentation via pumping from the Assiniboine River.

Later that year, the Water Supply Board Act was enacted on August 4, 1959. This Act provided for the creation of a provincial water utility and marked the beginning of provincial/municipal cost-sharing of water services. Prior to this Act, the Municipal Act of 1871 made sewage and water services a municipal responsibility (Zittlau, 1977:59). However, as already mentioned, insufficient supplies, in addition to the cost of serving a small population militated against many municipalities providing water and sewage services prior to 1959. The Water Supply Board Act (S.M. 1959) transferred the costs of water supply projects either directly to the Province or to the Water Supply Board (LRRVWC Minutes, Chairman's Report, April 4, 1961). This legislation enabled many rural communities, including those outside LRRVWC, to acquire water services.

In the following two years there were a number of positive developments:

1) the Neche/Altona pipeline was completed in 1960;
2) the Water Supply Board was drilling wells in the Winkler area in 1961 and it was reported that the discovery of an adequate supply of potable water appeared imminent (LRRVWC Minutes, May 25, 1961);
3) an engineering study of the Winkler distribution system had been completed;

4) the IJC was reportedly in favour of a full scale study on the Pembina River;

5) PFRA was prepared to build a dam at Stephenfield (LRRVWC Minutes, October 3, 1961).

3.2.1 LRRVWC AND REGIONAL ECONOMIC DEVELOPMENT

The Water Supply Districts Act empowered LRRVWC with the right to:

1) make inquiries as to the need and demand for a water supply distribution system;

2) hold meetings of inhabitants of the area for the purpose of informing them of the matter being examined...,, or the results of such examination...;

3) obtain professional or technical assistance...;

4) request a council of a municipality that has not passed a resolution in favour of that municipality or a part thereof being included in a water district to conduct a referendum on matters relating to the supply of water. (LRRVWC Minutes, Chairman's Report, April 4, 1961).

In his report to the Commission, Mr. Pokrant, LRRVWC Chairman, pointed out that the Commission had been given the responsibility of promoting the use and development of water in the area, and it is only natural that there be a

strong link between Commission activities and regional economic development. He stated that the work of the Commission may have "...spawned the establishment of the recently organized Pembina Valley Development Association" (LRRVWC Minutes, Chairman's Report, April 4, 1961). Given LRRVWC's official capacity, its thorough knowledge of the area, and the ability to make strong representations to the Government, Mr. Pokrant believed that LRRVWC should take an active role in developing water resources for regional economic development. On December 29, 1960, the executive of LRRVWC met with George Hutton, the Minister of Agriculture, and asked him to widen the powers of the Commission "...to include development of water supplies for all purposes". The Minister complied and on April 15, 1961, the legislature passed Bill No. 4 entitled "An Act to Amend the Water Supply Districts Act" (S.M. 1961).

3.2.2 Wait and See 1962-1965

By 1962, LRRVWC was basically monitoring the progress of various projects and studies, and acted as a sounding board for municipal complaints and suggestions. PFRA was preparing to construct the Stephenfield dam and was examining the possibility of expanding the Morden reservoir. The Provincial Water Control and Conservation Branch lacked an overall water development scheme, contingent on the findings of the IJC Pembina River study, commenced in 1962 and

scheduled for completion by June 1964. Therefore, it was still unclear, for example, whether water might be pumped from the Assiniboine River to maintain the level of Stephenfield. Similarly, in lieu of a Pembina River dam it was anticipated that water might be pumped from Stephenfield to the Morden reservoir (LRRVWC Minutes, May 11, 1962). Thus, meetings over the course of the next several years occurred less frequently consisting primarily of progress reports given by J. Griffiths and later T. Weber. representing the Water Control and Conservation Branch.

Almost a year elapsed between the 1962 meeting and the next meeting April 24, 1963. By this time it was generally recognized that the Pembina project could be justified only on the basis of irrigation. Therefore, after J. Griffiths reported on the status of various projects, J.M. Parker, Director of Soils and Crops, and John Peters, Soil Conservationist for the area, spoke about the pros and cons of irrigation. They warned that all aspects of irrigation must be contemplated before spending large sums of money, pointing out that the skills of the farmer are of more importance than the quality of the land.

At the next meeting January 31, 1964, G.A. Kristjanson spoke on the "Economics of Irrigation". He focused on the more sobering aspects of irrigation pointing out that capital costs are high and yields are only slightly better than under dryland farming. In his opinion, the main advantage of irrigation was that it provided insurance against

drought, resulting in a better credit rating and income stability. Mr. Griffiths gave the Commission cause for rejoicing, reporting that the Stephenfield dam had been completed and the Winkler wells, pumping facilities, and pipelines were in place. The filtration plant and overhead storage was scheduled for completion by March 15. Mr. Griffiths also reported that the Water Resources Branch had requested PFRA to construct: (1) a $145,000 dam on Tobacco Creek; and (2) a dam on the Morris River, although PFRA apparently had reservations about the latter.

Later that year, LRRVWC demonstrated the merit of a locally based administrative agency. Opposition from a property owner had caused an impasse in the Tobacco Creek negotiations. In April 1964, the Rural Municipality of Thompson asked LRRVWC to intervene on their behalf and by diplomatically approaching the landowner LRRVWC was able to resolve the conflict.

LRRVWC did not meet again until April 2, 1965, when J. Griffiths reported that the Winkler water distribution sysem had been completed. The Province had also asked PFRA to include the Tobacco Creek project in their 1965 estimates. Most of the other project proposals issued by LRRVWC were in a state of suspension.

3.3 SUMMARY AND CONCLUSIONS

This chapter has focused on the events leading to the creation of LRRVWC and the early achievements of this

Commission. Project proposals and developments did not come from benevolent governments. Instead, it took organized public initiative. In fact, prior to 1958, neither the Federal Government, through PFRA, nor the Provincial Government had done much to assist the municipalities in meeting short-term or long-term regional water requirements.

Given limited supplies and the cost of servicing a small population, municipalities were effectively powerless to provide an adequate supply of potable water. The situation forced municipalities to act collectively and resulted in the formation of the Red River Valley Development Association (RRVDA). As an official regional representative, RRVDA approached the Provincial Government in a non-confrontational manner and asked for enabling legislation so that they might deal with this regional problem. The result was the enactment of the Water Supply Districts Act. This Act provided for the creation of the Lower Red River Valley Water Commission (LRRVWC) which was vested with the authority to investigate matters relevant to the provision of potable water. It is worth noting that LRRVWC could never have been created if municipalities had been unwilling to overcome their differences.

LRRVWC assiduously pursued their primary objective, initiating numerous studies and proposing ambitious plans for development. While these proposals may not have been particularly well conceived, they did prompt action from the

Provincial and Federal Governments. For example, the Federal Government, through the International Joint Commission (IJC) became involved in a mammouth study of the Pembina River, and PFRA constructed the Stephenfield reservoir. The Province also undertook several projects and passed enabling legislation. For example, the Province passed the Water Supply Board Act (S.M. 1959) which permitted the development of the Neche/Altona pipeline and the Winkler wells and distribution system.

LRRVWC also saw the need for a more integrated approach to water management and recommended that the various objectives of drainage, water conservation, irrigation, flood control, and potable water should be under the administration of one Provincial Government department (LRRVWC Minutes, September 30, 1958). The Province responded by enacting two pieces of legislation less than a year later. This legislation (discussed in Chapter 2) included: (1) The Department of Agriculture and Immigration Act Amendment Act (S.M. 1959, c.4) which consolidated the administration of all matters concerned with water control, distribution, use and conservation under the Minister of Agriculture and Conservation; and (2) The Watershed Conservation Districts Act [S.M. 1959 (2nd Sess.), c.70, s.1], which provided municipalities the opportunity to co-ordinate their water management efforts through the estabishment of a Watershed Conservation District.

By developing a good working relationship with the Provincial Government, LRRVWC was able to achieve positive results in a very short time. In view of their success, LRRVWC was imbued with optimism and they presented several priorized lists of project proposals for Provincial consideration. For a time, this approach worked well but it did cause problems in that the "professionals" grew weary of responding to LRRVWC resolutions. Nonetheless, LRRVWC's lobbying proved successful in changing the engineers' stand on several projects. For example, what was originally considered impossible by PFRA engineers in terms of the Stephenfield reservoir, became quite possible once governments were convinced of the merits of that project. In addition, through the course of deliberations to determine a source of supply, there was much disagreement among engineers. These observations are particularly noteworthy in view of the fact that engineers in the years to come would try to convey the impression that their decisions were absolute. However, facts are subject to a time element and there are many factors influencing all decisions. Thus, engineers like other decision makers are constrained by the state of the art and the assumptions implicit in their discipline.

Unlike government departments concerned with water management, LRRVWC is a grassroots, regional organization with a vision. Discontented with stop-gap government efforts to meet the regior's water requirements, LRRVWC was formed to

pursue a more comprehensive development scheme. Implicit in their plans was a vision of the region's development potential. The Pembina River dam was seen as the inevitable culmination of their efforts. The Pembina River dam would provide water for domestic, municipal and industrial use, as well as provide irrigation water and reduce flood damages, primarily in the U.S. portion of the Pembina River Basin and along the Aux Marais River. Irrigation would enhance crop diversification and provide insurance against drought. LRRVWC was optimistic that it would be only a matter of time until the long awaited project was undertaken and completed.

CHAPTER IV

LRRVWC AND THE PEMBINA RIVER DEVELOPMENT PLAN

4.0 INTRODUCTION

Through the years, flood and drought in the Red River Basin have prompted a number of studies which looked specifically at the Pembina River. Following the protracted drought of the 1930's water supply was a primary concern. In 1942, the U.S. Congress recommended storage reservoirs with a capacity of 7000 acre-feet, be constructed on the Pembina and Tongue Rivers (U.S. Army Corps of Engineers, 1976:4,32,95) (Canada Department of Resources and Development, 1953:15). Although authorized, this project was never constructed because local residents were opposed to the high local costs. The Canadian Department of Resources and Development, in 1953, proposed the construction of a Pembina River dam and 175,000 acre-foot reservoir in Manitoba to ameliorate flood damage along the Red River in Manitoba (Canada Department of Resources and Development, 1953:33). In 1948, the IJC prepared a preliminary report on the feasibility of a cooperative undertaking by both countries to develop the water resources of the Pembina River. On August 25, 1960, LRRVWC presented a brief to the IJC emphasizing the relationship between irrigation and economic growth (LRRVWC Brief to the IJC, August 25, 1960). The Provincial Government was at this time conducting a soils analysis in the Pembina Triangle to ascertain which soils were most suitable for irrigation. In

view of these initiatives, and on the basis of their preliminary report, the IJC recommended April 12, 1961, that the Governments of Canada and the United States consider transmitting to the IJC a reference specifically pertaining to the waters of the Pembina River Basin (IJC Report, 1967:1).

The IJC began an exhaustive study of the resources of the Pembina River Basin in 1962. After public hearings and negotiations with both governments, the IJC in 1967 recommended Plan #2. The plan called for a 250,000 acre-foot irrigation-water supply storage reservoir in Manitoba and a 130,000 acre-foot flood control reservoir in North Dakota. The plan had a benefit-cost ratio of 1.2 and envisioned the irrigation of 21,300 acres, divided equally between both countries. By providing flood control and water for domestic, municipal, industrial and irrigation uses, this plan of development seemed to address many of the region's short term and long term water requirements.

LRRVWC has, over the years examined and promoted various water management schemes but the Pembina project was seen as the culmination of their efforts and necessary to the achievement of the region's full economic development potential. Thus, from 1962 to the present most of LRRVWC's efforts have been directed towards the eventual implementation of the Pembina project. The Pembina project, envisioned in the 1940's and widely supported in the 1950's (LRRVWC Minutes, March 3, 1955), appeared to be progressing favourably

from the conceptual stage to reality. In 1968, resolutions endorsing the project were sent to Provincial and Federal Governments from LRRVWC, the Pembina Valley Development Corporation (PVDC) and several municipalities. The following year, Premier Weir expressed his support on the basis of satisfactory cost-sharing arrangements with the Federal Government. A delegation, which included the Minister of Mines and Resources and the Director of Water Control went to Ottawa in 1969 to win Federal approval (LRRVWC Minutes, January 29, 1969).

The Pembina project was dealt a severe blow later that year when the Progressive Conservative (PC) administration was replaced by the New Democratic Party (NDP) which did not consider the development a high priority. In the years which followed, LRRVWC made numerous presentations to the Provincial and Federal Governments and at one time in 1973 appeared ready to undertake construction on their own. The State of North Dakota, weary of waiting for Canadian approval, attempted to proceed unilaterally. Their efforts were hampered by the fact that the U.S. portion of the project is uneconomical without Canadian participation.

During the course of negotiations, water management problems have grown more severe. Drought in 1973, 1976, 1977 and 1980 resulted in restrictions being placed on water use in several towns, indicating the need for more water. Large floods occurred on the Pembina River in 1948, 1949, 1950,

1956, 1960, 1966, 1969, 1970, 1971, 1974, and 1979 (U.S. Army Corps of Engineers, 1976:18). Although the major portion of flood damage occurs in North Dakota, flooding along the Pembina is a major concern to Manitobans. Overflows from the Pembina River flow northward into the Aux Marais drainage system causing local flooding around Gretna. Because some individuals blame uncontrolled dyking in the U.S. for aggravating this problem, the situation has created tension and animosity on both sides of the International Boundary. Increasing international tension and flood damage have worked in favour of LRRVWC's attempts to win Provincial support for the Pembilier dam but progress has been slow. Major floods along the Red River occurred most recently in 1965, 1966, 1969, 1974, 1975, 1978, and 1979. While Pembina River flows seldom peak at the same time as Red River flows, the Pembina River can contribute to the duration of Red River floods.

Thus, there has been a desire to control Pembina River flows for three purposes: (1) to conserve scarce water resources; (2) to reduce flood damages along the Red River; and (3) to reduce flood damage along the Pembina River, primarily in North Dakota. The achievement of these water management objectives was seen as a necessary precondition to regional economic development. It is primarily to this end that LRRVWC has devoted its endeavors. This chapter deals mainly with LRRVWC's efforts to bring the Pembina project to fruition.

4.1 STUDY OF THE INTERNATIONAL JOINT COMMISSION

Floods and drought exert economic costs, reduce the agricultural and ancillary economic output of the region and have a negative sociological impact. In an attempt to deal with these economic and social factors, the International Joint Commission was instructed in April, 1962, to investigate measures to develop the water resources of the Pembina River Basin, to the mutual advantage of both countries.

4.1.1 Plan Formulation

In the initial stages of the IJC study, five alternative water supply schemes were examined:

Scheme 1. Winkler Ground Water Project;

Scheme 2. Winkler Ground Water and Pembina River Diversion Dam Project;

Scheme 3. Pembina River Diversion Dam Project;

Scheme 4. Water Trucking Project; and

Scheme 5. Pembina River Basin Project.

Scheme 5. Pembina River Basin Project, was selected by the IJC for further study. Fifteen plans of improvement utilizing three principle storage sites -- Swan Lake, Pembina, and Pembilier -- were then considered. For each plan, each reservoir has a different combination of purposes, although both Swan Lake and Pembina had irrigation as one of their objectives.

Of the fifteen plans, preliminary analysis by the Pembina River Engineering Board showed Plans 1, 2 and 4 most

closely met the reference objectives and were selected for detailed presentation. The reference objectives were to provide maximum net benefits in terms of municipal and industrial water supply, improvement of water quality, flood control, irrigation, recreation and enhancement of fish and wildlife values. All three plans involve multiple purpose reservoir storage with the same main conduit and supply canal extending northward from the vicinity of Walhalla to near Winkler.

4.1.2 Description of Plans

Plan 1 proposed a single dam and reservoir at the Pembilier site with an optimum capacity of 299,000 acre-feet of storage. Of that total 115,000 acre-feet would be assigned to flood control, 164,000 acre-feet to irrigation and water supply, and 20,000 acre-feet to sedimentation. In the lower portion of the flood control range, 36,600 acre-feet would be used for the dual purposes of irrigation and water supply. The plan envisaged irrigation of 18,300 acres. (IJC Report, 1967:22).

Plan 2 featured two multiple purpose reservoirs, the Pembina, near Kaleida and the Pembilier near Walhalla. The Pembina reservoir was designed to provide 246,000 acre-feet for irrigation and water supply, as well as 4,000 acre-feet for sedimentation. The Pembilier reservoir would provide 110,000 acre-feet for flood control and 20,000 acre-feet for sedimentation. Dual use storage of 42,600 acre-feet

would also be provided in the flood control zone at the Pembilier. The total storage at both reservoirs would be 380,000 acre-feet. Although the assigned storage for irrigation and water supply would be increased by about 50 percent over that in Plan 1, the productive area for irrigation would increase by only 16 percent to 21,300 acres due in part to greater evaporation losses with the dual reservoir areas. The area irrigated would be equally divided between both countries. Plan 4 is similar to Plan 2 except that irrigation and water supply storage in Canada would be at the Swan Lake site with storage for flood control and a limited capacity for reregula ion of releases for irrigation and water supply at the Pembilier site. Swan Lake reservoir would provide 540,000 acre-feet of storage for irrigation and water supply and 10,000 acre-feet for sedimentation. Pembilier reservoir was designed to provide 110,000 acre-feet for flood control, 20,000 acre-feet for irrigation, and 30,000 acre-feet for sedimentation. Dual use storage of 50,600 acre-feet would also be provided in the flood control zone at Pembilier. Plan 4 would provide water to irrigate 25,300 productive acres. (IJC Report, 1967:23).

It is important to note here that these optimum capacity levels are a result of detailed economic analyses and are more a reflection of benefits and costs than they are a reflection of physical limitations. Thus, the optimum levels will vary through time with price fluctuations.

4.1.3 Plan Selection

LRRVWC conducted a meeting attended by a large number of visitors May 25, 1965, to discuss the IJC report and to prepare a brief for presentation at the upcoming IJC public hearing. LRRVWC members unanimously supported Plans 2 and 4,. both of which featured Manitoba reservoirs for the purposes of irrigation, water supply and recreation. Public hearings were held at Manitou, Manitoba, and Walhalla, North Dakota on June 9 and 10, 1965. Throughout the course of the hearings, "No one expressed opposition to the proposed development of the Pembina River Basin." (IJC Report, 1967:24). LRRVWC's brief to the IJC pointed out that according to the COMEF* report March 6, 1963, the potential benefits would be much greater than those estimated in the IJC report (LRRVWC Brief to the IJC, June 9, 1965).

During a meeting later that year, (November 12, 1965) Mr. Nes Mudry, respresenting the Water control and Conservation Branch, conveyed the government's interest in the project but cautioned that prior to a Provincial Government decision many details remained to be worked out, including:

1) the difference in interest costs between the two Federal Governments;

2) Federal/Provicial cost-sharing; and

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*COMEF refers to the Committee on Manitoba's Economic Future which released a report in 1963, entitled Manitoba 1962-1975.

3) the possibility of staging, by starting for example, with the Pembilier dam at Walhalla.

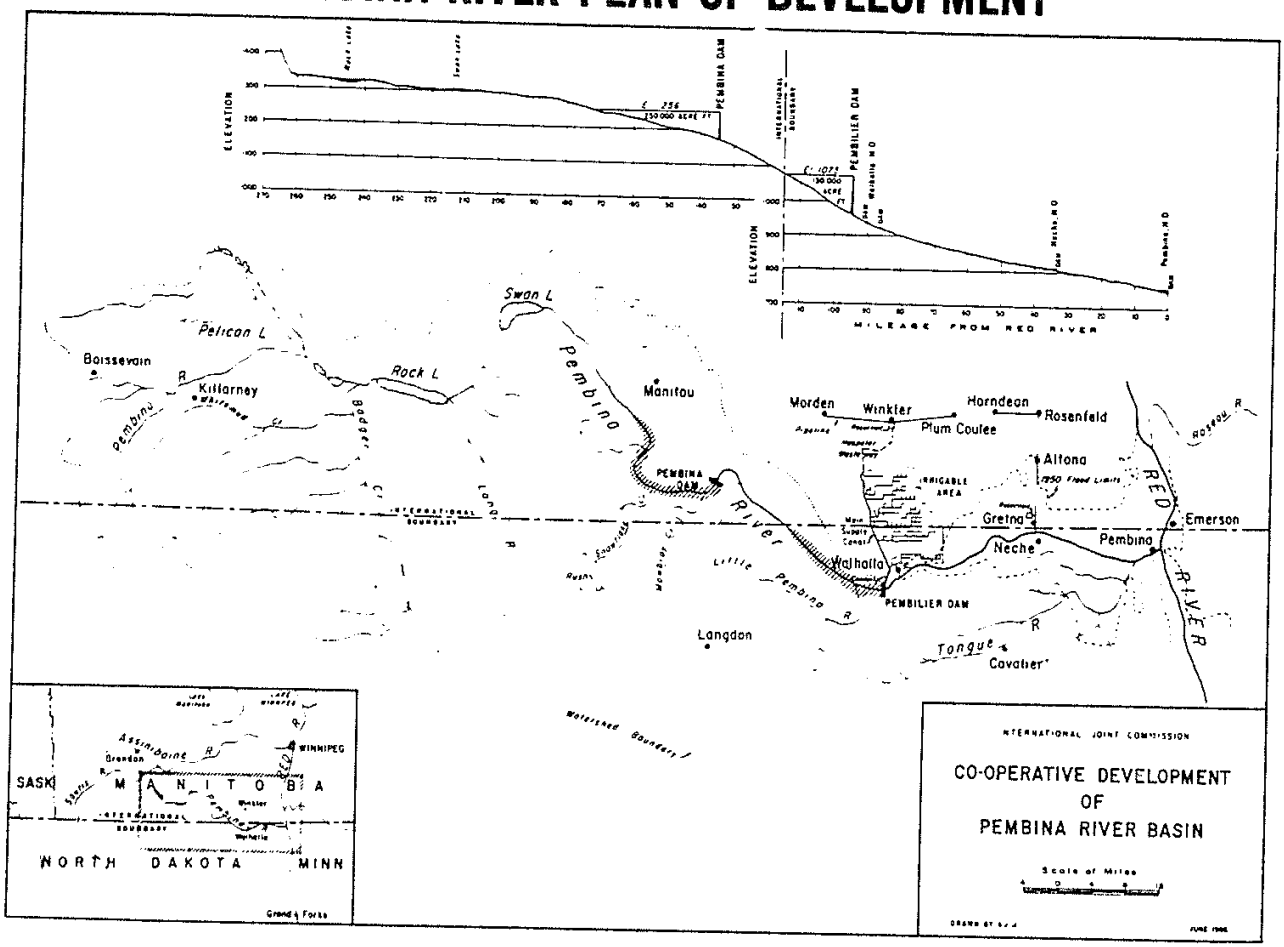
At the next meeting November 15, 1966, four LRRVWC members who had recently met with the IJC gave their impressions regarding the likelihood of the Project's implementation. Neither Mr. Kroeker nor Mr. Vick were overly optimistic in view of the fact that many complex problems remained to be resolved. Mr. Weber, who had recently replaced J. Griffiths as Director of Water Control and Conservation, stated that in lieu of the Pembina project, water could be pumped from the Assiniboine into the Boyne and brought by canal along the escarpment as far south as Morden.

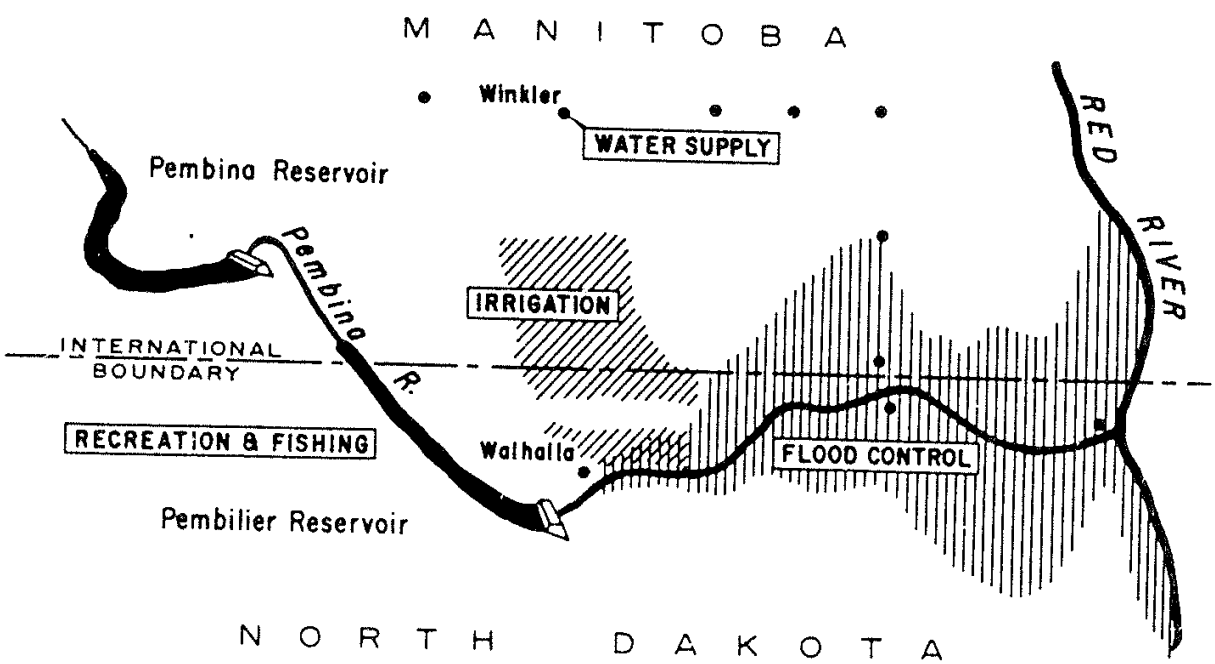
4.1.4 PLAN OF DEVELOPMENT

In 1967, the IJC recommended Plan 2 which called for an irrigation-water supply storage reservoir in Manitoba, a flood control reservoir in North Dakota, and irrigation facilities in both Canada and the United States (Figure 4). The Pembina dam, located about 11 miles upstream of the International Boundary would create a reservoir 30 miles in length which at maximum water level would encompass a flooded area of 7800 acres. The Pembina reservoir would have a capacity of 250,000 acre-feet, of which 215,000 acre-feet would be for irrigation, providing an annual dependable yield of 49,000 acre-feet. Of the remaining capacity 31,000 acre-feet would be devoted to water supply and 4,000 acre-feet would be reserved for sedimentation. (Manitoba Water Commission

FIGURE 4

PEMBINA RIVER PLAN OF DEVELOPMENT





1973:18). Although this reservoir controls a significant portion of the primary contributing drainage area above Walhalla, its effect on downstream flood peaks is limited, because of proposed project operating procedures (Manitoba Water Commission 1973:19 and the International Pembina River Engineering Board Report to the IJC, 1964).

The Pembilier dam in North Dakota, located two miles southwest of Walhalla would create a reservoir 22 miles in length, extending six miles beyond the International Boundary. The reservoir would flood 1800 acres with periodic and temporary flooding of 4000 acres at maximum water level. The reservoir would impound 130,000 acre-feet of water -- 110,000 acre-feet for flood control and 20,000 acre-feet for sediment accumulation. Approximately 45,000 acre-feet of this flood control storage would be available for irrigation, water supply, and recreational use, following the recession of spring floods (Manitoba Water Commission, 1973:19).

Ancillary features such as supply conduits and canals would be built to convey water to the designated development areas. Recreation facilities would be developed at both reservoirs.

4.2 LRRVWC AND THE FRUSTRATIONS OF LOBBYING

LRRVWC met with representatives from North Dakota in Winkler, February 1, 1968, to discuss the IJC report. It was agreed that North Dakota and Manitoba should co-operate

to achieve an early start on the Pembina project. To this end a resolution stressing the urgency of this project was sent to all Manitoba M.L.A.'s, Manitoba M.P.'s, Federal Cabinet Ministers, and other interested parties. The Pembina Valley Development Corporation and several municipalities sent their own resolutions (LRRVWC Minutes, November 28, 1968). However, over the course of the next year, several events occurred which: (1) militated against the implementation of the Pembina project; and (2) demonstrated the frustration of lobbying unstable political structures.

Federally, Pierre Trudeau's victory June 25, 1968, resulted in the shuffling of several government departments, rendering much of the prior negotiations and lobbying efforts useless. The Project was now under the jurisdiction of the Honourable J.J. Greene, Federal Minister of Energy, Mines and Resources. Recent changes in the PFRA program meant that the Federal Government would only consider 50/50 cost-sharing of the Pembina project (LRRVWC Minutes, November 28, 1968). These complications, plus disagreement between the two countries over interest rates and the apportionment in costs, delayed the negotiations.

Concerned that negotiations between the Canadian and U.S. Federal Governments seemed to be stagnating, over relatively minor issues, LRRVWC together with North Dakota and PVDC presented a brief January 29, 1969 to Premier Weir and several members of his Cabinet. This coalition of groups

asked the Province to sanction the project and support the request for immediate agreement between the two Federal Governments. In this regard, the Premier agreed to have Harry Enns, Minister of Mines and Natural Resources, and Tom Weber, Director of Water Control, accompany a LRRVWC delegation to Ottawa to seek Federal co-operation. Most importantly, "...the Premier agreed that this project would have the highest priority if satisfactory cost-sharing arrangements could be concluded with the Federal Government" (LRRVWC Minutes, January 29, 1969).

A delegation comprised of W.C. Vick, D.K. Friesen, Charles Anderson, Art Vermette, Roy Compton, Rudy Hink, Don Livingston, the Honourable Harry Enns and T.E. Weber met with the Honourable Mitchell Sharpe and other officials in Ottawa, March 14, 1969, (LRRVWC Minutes, March 14, 1969). The delegation went to Ottawa primarily to voice their concern regarding the Federal Government's procrastination in reaching an agreement with the United States' Federal Government regarding the Pembina project. The brief discussed the benefits of the Pembina project including: irrigation; flood control; potable water supply; recreation; insurance against drought; economic diversification and opportunities for young people to find jobs and remain in the area. In short, LRRVWC made the case that the Pembina project would help to stabilize the economy and foster economic growth. The brief presented a very compelling argument reminding the Honourable Mr. Sharpe

that on the basis of $1.5 million in studies, the IJC had recommended construction of the Project despite the fact that secondary economic benefits had not even been considered. The brief pointed out that the Project had the support of the Premier and in the opinion of LRRVWC:

> The Pembina development will be implemented eventually because of its sheer force of necessity to our communities.

LRRVWC expressed concern that the Canadian Government proceed without delay lest unilateral American action establish "...prior water rights detrimental to Canadian future interests as happened some time ago in the case of the Souris River" (LRRVWC Brief to the IJC, March 14, 1969).

On June 25, 1969, a significant event occurred Provincially which dealt the Pembina project a serious blow. On that date, the NDP under the leadership of Ed Schreyer replaced the Progressive Conservatives, rendering the assurances of former Premier Weir, null and void. The NDP policy was to focus on northern development and the reduction of regional disparities. Thus, the new administration was not interested in the Pembina project (LRRVWC Minutes, October 23, 1969).

Changes in governments and Cabinet Ministers proved most frustrating for LRRVWC. Every change required LRRVWC efforts to update the new officials and to try to impress upon them the importance of water management in the lower Red River Valley.

4.3 UNILATERAL ACTION BY NORTH DAKOTA

Because of the Manitoba Government's reluctance to proceed with the works recommended by the IJC, North Dakota requested unilateral construction of the Pembilier dam. LRRVWC and PVDC endorsed unilateral action in a brief to the U.S. Senate Sub-Committee (Investigating the Pembina River Basin Project), October 22, 1970. LRRVWC spoke in favour of unilateral action partly because they had been petitioned by a group of farmers suffering flooding in the Aux Marais area. A study by John Rempel, commissioned by LRRVWC, estimated Manitoba damage at $47,396 in 1969 and $167,405 in 1970. LRRVWC feared that "The foregoing recorded losses will be progressively increased each year, as upstream drainage facilities are constantly being improved" (LRRVWC Brief to the U.S. Senate Sub-Committee, October 22, 1970). Further to flooding along the Manitoba-North Dakota border, LRRVWC presented a brief to the Minister of Mines and Natural Resources, the Honourable Sidney Green March 8, 1971, reiterating their support for unilateral construction of the Pembilier dam. LRRVWC explained that the situation warranted immediate attention because international tension was growing due to the fact that many local farmers believed that water was being diverted into Canada.

The result of the Senate Sub-Committee's investigation, was a feasibility study by the Army Corps of Engineers to evaluate the economics of a flood control and water supply

reservoir, in the State of North Dakota. Started in 1971, the study was based on the recognition that "The predominant problem in the Pembina River basin is the flood threat in the United States and overland flooding in Canada" (U.S. Army Corps of Engineers, 1976:syllabus). Water supply and the preservation and beneficial development of basin assets were also recognized as interests of area residents. A draft report was completed in May 1972 recommending construction of the Pembilier dam, contingent upon Canadian participation in proportion to the flood control benefits received by that country (U.S. Army Corps of Engineers, 1976:89).

After attending numerous meetings of the Pembina River Basin Planning Committee, North Dakota, the Chairman of LRRVWC reported to Commission members that the U.S. would probably proceed with a lower level dam at Walhalla (LRRVWC Minutes, March 20, 1972). However, the Manitoba Provincial Government placed low priority on the Pembina (LRRVWC Minutes, March 20, 1972). Since a single dam would be uneconomic without Canadian participation, the Pembilier proposal was at an impasse (LRRVWC Minutes, January 30, 1973), prompting the U.S. Department of State to approach the Canadian Department of External Affairs for a negotiating meeting. Negotiations led to the establishment in February 1973 of an inter-governmental Task Force (Manitoba Water Commission, 1973), known in Canada as the Pembilier Dam Review Committee. This Committee prepared a report in 1974 which forms the

basis for determining present value of project costs attributable to each country in proportion to the flood control benefits received (U.S. Army Corps of Engineers, 1976:90).

4.4 THE MANITOBA WATER COMMISSION AND THE PEMBINA DEVELOPMENT PLAN

The Honourable Sidney Green, Minister of Mines and Natural Resources, instructed the Manitoba Water Commission on September 1, 1972, to "...review all existing plans and proposals of the development and utilization of the water resources in the Pembina River in Manitoba, and recommend which of these existing plans and proposals is most advantageous to the Province of Manitoba" (Manitoba Water Commission, 1973:2). The Manitoba Water Commission decided to focus its attention on the further evaluation of "Modified Plan No. 2" recommended by the IJC.

During the review process, LRRVWC was invited to appear before the Manitoba Water Commission March 19, 1973, to present their case for the Pembina project. LRRVWC made a strong presentation. Once again the brief discussed the benefits of the Pembina project -- irrigation, flood control, municipal water supply, recreation, employment opportunities, farm diversification, investment capital -- and the deleterious effects of doing nothing. In view of the touchy situation regarding Aux Marais flooding, the recent closing of the

Del Monte cannery in Morden and the looming prospect of a serious drought, LRRVWC's arguments were especially credible.

The brief states:

> We are desperate. The Morden Dam is 4 feet below level after the present runoff. The water table has gone down as much as 16 to 30 feet in the area. Creeks above the escarpment which have always had a flow of water, and sloughs, have dried up. In our opinion, severe dust storms experienced this spring are an indication of a recurrence of a drought cycle similar to that experienced in the 1930's.

LRRVWC reminded the Manitoba Water Commission that studies costing over $3 million had shown the project to be practicable and economically feasible. The former Premier had in 1969 agreed that the project would be given top priority. Despite previous approval of various departments, the potential for economic growth, and the potential for economic devastation due to drought, the Province had done nothing. What was particularly galling was the fact that "The governments of today have offered no good reason for the delay in negotiations" (LRRVWC Brief to the Manitoba Water Commission, March 19, 1973). LRRVWC echoed their commitment to the Pembina project, proclaiming:

> The Pembina Development will be implemented eventually because of its sheer force of necessity to its communities. We believe that this project cannot be delayed any longer (LRRVWC Brief to the Manitoba Water Commission, March 19, 1973).

According to LRRVWC minutes of the meeting, the Manitoba Water Commission agreed in principle with the proposal, and "Everyone from both Commissions agreed that the solution to this problem lay strictly in the hands of the Manitoba Government, not with federal authorities..." (LRRVWC Minutes, March 19, 1973). LRRVWC "...was encouraged by the Manitoba Water Commission to press the Manitoba Government for an immediate start on this project".

The day after their meeting with the Manitoba Water Commission, LRRVWC issued a news release stating that at the meeting it was pointed out that:

> ...the sole responsibility for this project rests with the Manitoba government, as provinces have jurisdicition in Canada over their water resources. Federal participation has been promised, similar to that given to the Winnipeg Floodway (LRRVWC News Release, March 20, 1973).

The news release also pointed out that "Unless heavy rains come shortly, the Pembina Triangle will face disaster". Because of the drought conditions LRRVWC's concerns received excellent publicity, engendering wide ranging support. Buoyed with confidence, a letter was drafted April 16, 1973, requesting a meeting with Provincial Cabinet. LRRVWC was so convinced of the benefits of this project that they proposed as a last alternative that the Manitoba Government "...give their blessing...to LRRVWC to proceed with the project in conjunction with the municipalities" (LRRVWC Minutes, April 16, 1973). This was indeed a bold suggestion, but not

impractical in view of the long history of inter- municipal co-operation to drain wetlands and to bring potable water to Red River Valley towns.

Three months later, in July 1973 the Manitoba Water Commission released their report. The report updated the costs and benefits computed in the IJC study. Estimates were made in 1972 dollars and calculated on the basis of interest rates of 7 1/2% in Canada and 5 1/2% in the United States (Manitoba Water Commission, 1973:31). The benefit-cost ratio was reduced to 0.85 from 1.2 calculated in 1967 (Manitoba Water Commission, 1973:34). As a result, the Manitoba Water Commission concluded that the Pembina project could not be justified on economic grounds. That conclusion was qualified by adding "...the Government of Manitoba may feel that the application of the stay option* to this region may justify this development on social grounds" (Manitoba Water Commission, 1973:36).

The Manitoba Water Commission also believed that "...from Manitoba's point of view, the two-dam project is preferable to any single dam development on the Pembina River (Manitoba Water Commission, 1973:34). This conclusion is partly derived from the fact that water demand in the Pembina Triangle is greater than the ability of exisiting water

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*The "STAY" option was a policy of rural and regional development designed to disseminate economic growth to rural areas in order that young people looking for work need not be forced to leave the rural areas to seek employment in Winnipeg.

treatment and ancillary facilities to supply water under drought conditions. As such, the Commission called for a plan of development whereby an economic balance could be achieved between the "...expansion and interconnection of exisiting facilities, the development of new facilities, such as the diversion of water from the Pembina River and the Assiniboine River, and the periodic importation of water by truck and rail during drought periods" (Manitoba Water Commission, 1973:34).

The Commission also made a recommendation on the Winkler aquifer, stating:

> It appears that the Winkler aquifer will be an important component of regional water supply facilities. In view of this fact, it is important that a detailed hydrogeological study be undertaken immediately to determine the dependable yield of the aquifer. This study is of consequence due to the fact that the aquifer contains an upper zone of fresh water and a lower zone of saline water. If excessive or incorrect withdrawals are made from the aquifer, this lower saline zone could contaminate the potable supply of water to the communities supplied therefrom (Manitoba Water Commission, 1973:34,35).

While the Manitoba Water Commission did not recommend construction of the Pembina project, they did recognize the limitations of the present situation. LRRVWC decided to approach the Honourable Sidney Green one more time. After excessive flooding in 1974, LRRVWC met on May 9 with Mr. Green to discuss the flooding problems along the U.S.-Manitoba border and especially as it affects the Aux Marais River area. Flood damage in the Aux Marais area was expected to exceed one-half million dollars. LRRVWC pointed out that

"...flood waters seem to be rising higher year by year and the damage progressively increases as upstream drainage facilities are constantly being improved, brush and trees cleared" (LRRVWC Brief to the Honourable Sidney Green, May 9, 1974). The mean daily discharges of the Pembina River at Walhalla were: 5,800 c.f.s. in 1950; 7,810 c.f.s in 1971; and over 13,000 c.f.s. in 1974. In view of this trend LRRVWC questioned why the Gretna dyke must "...be constructed <u>every spring</u> at high expense to the small municipality of the Village of Gretna" (LRRVWC Brief to the Honourable Sidney Green May 9, 1974). The brief argued that benefit-cost ratios had been calculated using commodity prices which had little relationship to prices only a year later. As an example, the brief cited the Stow Associates' Report of 1973 which used commodity figures such as: oats 68¢, barley $1.01, wheat $1.67 and flax $3.00 per bushel. LRRVWC added that damage cannot be estimated only in monetary terms. In LRRVWC's opinion flood losses could be minimized by a dam or dams on the Pembina River. "The responsibility for approving such flood control measures... rests...solely with the Government of Manitoba".

The brief concluded, rather acrimoniously:

> The peoples along the U.S.-Manitoba border have suffered flood losses unnecessarily over many decades. We say unnecessarily because only the government of Manitoba stands in the way of minimizing or preventing these losses. With a reasonably small contribution, and the green light to let other governments

> proceed, your Government could alleviate a situation that is becoming an international issue of ever-increasing seriousness (LRRVWC Brief to the Honourable Sidney Green, May 9, 1974).

Mr. Green was unsympathetic to the Pembina dam, but on the basis of 50/50, Federal/Provincial sharing of the $2 million Canadian contribution, he agreed to recommend construction of the Pembilier dam.

Finally it appeared that the Pembilier dam would become reality but progess was slow. The Army Corps of Engineers prepared a feasibility report in July, 1975, identifying the Pembilier dam as the selected plan of improvement for the Pembina River Basin. In a meeting October 23 of the same year, Premier Schreyer assured D.K. Friesen of Provincial support for the dam, subject to Federal contributions (LRRVWC Minutes, October 23, 1975). After public input, the Army Corps of Engineers released the final report of the Pembilier dam in March, 1976. On December 13, 1976, it was reported that the Aux Marais Flood Control Review Committee had completed their report and were awaiting the Government's decision on cost-sharing (LRRVWC Minutes, December 13, 1976). By June 9, 1977, it was reported that the Province had made submissions to the Federal Treasury Board regarding the Aux Marais and Pembilier projects so that the Federal Government could proceed with discussions with the U.S. Federal Government (LRRVWC Minutes, June 9, 1977).

It took many years to gain Provincial approval for the Pembilier dam but once approved Tom Weber (Water Resources Branch) reported April 17, 1978, that the Province was pushing it on a monthly basis and apparently all governments were in agreement (LRRVWC Minutes, April 17, 1978). However, Jimmy Carter, the President of the United States, later vetoed Pembilier construction (LRRVWC Minutes, December 18, 1978). The complicated process of impact assessments and the need for Congessional approval at every stage of project design, led the Army Corps of Engineers to predict in 1979 that if all went well, the earliest possible date for construction would be 1986 (Pembina River Water Control Association meeting, June 26, 1979).

4.5 NEW HOPE FOR THE PEMBINA PROJECT

Almost paradoxically, at the same time that flooding problems were a major concern to LRRVWC, summer drought was experienced in 1976 and 1977. Having gained Provincial approval for Canadian participation in the Pembilier dam, LRRVWC decided November 18, 1976, to continue to pressure the Province for a Canadian dam to firm up water supplies in the Pembina and Red Rivers and via pumping, the Morden reservoir (LRRVWC Minutes, November 18, 1976 and April 25, 1977).

Several things happened which improved the chances of progress in supplying water to the region. First, the NDP was replaced by the Conservative party in the fall of 1977.

The new administration was apparently supportive of the Pembina project. During a Miami nominating convention April 27, 1977 Sterling Lyon remarked, "When we form the next government, we will take steps to reactivate the Pembina Project" (paraphrased in LRRVWC Minutes, January 8, 1979). Mr. Vick, LRRVWC Chairman, also reported favourable responses from his meeting with the PC caucus (LRRVWC Minutes, April 17, 1978). Second, PFRA had completed many of their projects and were prepared to consider new ventures if specific amounts of water were requested (LRRVWC Minutes, April 17, 1978). Later that year the Federal Government instructed PFRA to suggest methods of mitigating the effects of drought. To this effect, Assiniboine River Diversion proposals were being updated (LRRVWC Minutes, December 18, 1978). LRRVWC did not favour this proposal. Mr. St. Hilaire, Commission member representing the R.M. of Montcalm, argued that the Diversion would bring more water into the Pembina Triangle, increasing the possibility of flooding while not providing any flood control (LRRVWC Minutes, December 18, 1978).

Low water levels in the Morden reservoir in 1977 (LRRVWC Minutes, June 9, 1977) and water demand in excess of the amount permitted by the Water Resources permit (LRRVWC Minutes, December 18, 1978) prompted the Towns of Morden and Winkler to initiate action. On November 8 and 29, 1978, the Towns asked LRRVWC to spearhead a renewed series of talks with the Province to increase the capacity of the Morden reservoir. At their own expense, Morden and Winkler had also

undertaken to update the Toman study (1972) and the Canada, PFRA study (1973), both of which had examined the possibility of augmenting the water supply at Morden. At the request of the Towns of Morden and Winkler and the R.M. of Stanley, LRRVWC met February 29, 1979, with representatives of these municipalities to discuss the draft report from the Toman Engineering Company* and to prepare a brief to the Provincial Government. The group unanimously agreed to pursue an upstream dam on Deadhorse Creek which they believed would:

1) act as a water conservation project;
2) provide flood control;
3) provide some irrigation water; and
4) provide water to recharge the Winkler-Stanley aquifer. (LRRVWC Minutes, February 20, 1979).

Progress in water management endeavors has been slow and arduous. Despite many years of lobbying effort, recurrent problems of flood and drought, and numerous studies, the situation, to say the least, leaves something to be desired. On July 17, 1979, LRRVWC met with Provincial Cabinet members and raised the following concerns:

1) the need for additional water supplies at Morden;

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*The title of the report is "Consolidated Report for Proposed Control Dam -- Deadhorse Creek near Morden, Manitoba".

2) the benefits of a Pembina River dam;

3) the need for flood control works at Carman;

4) the need for flood damage reduction on the Red River mainstem; and

5) the need for a flood damage reduction and compensation policy.*

LRRVWC asked that the Government consider these problems in light of their effect on the regional economy. However, the response from the Honourable Brian Ransom, Minister of Mines and Natural Resources indicated less of a forward thinking approach and more of a problem solving approach. Mr. Ransom stated that he was fully aware of the need to redress water supply deficiencies at Morden and to reduce flood damage at Carman and along the Red River mainstem. In this respect, Mr. Ransom claimed that there was no need for LRRVWC to belabour the need for action since the government already considered these priority items. Mr. Ransom also announced that the Premier would be meeting with the Governors of North Dakota and Minnesota July 27, 1979, to discuss Red River flooding. The Minister also stated that he

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*At that time government flood assistance was only available if damage taxed the ability of the municipality to pay. Thus municipalities do not know how much assistance they can expect to receive. (LRRVWC Minutes, December 18, 1978). During the 1979 flood some municipalities had to pay for sandbags.

was not in favour of a Pembina River dam and his opinion remained unchanged through the course of the meeting.

Thus, the Pembina dam remains a conceptual construct. Despite apparent support voiced during electioneering in 1977, the Conservative government was pursuing a policy of fiscal restraint and no money was allocated for construction of the Pembina dam.

4.6 CONCLUSION

There has, for many years, been an interest in controlling Pembina River flows to conserve scarce water supplies and to reduce flood damage. The protracted drought of the 1930's alerted residents in the area to the need for emergency water supplies. Pembina River floods in 1948, 1949 and 1950, and Red River floods in 1948 and 1950 prompted serious consideration of a Pembina dam. It is also worth noting that the period extending from the 1950's through to the mid-1960's was an era of unprecedented progress and economic growth. People were generally imbued with a sense of optimism and a pervasive belief that man could control the vicissitudes of nature. Hence, there was both a need to control the Pembina River and a vision of the Pembina Triangle as a verdant garden producing "special" crops. The Pembina project was seen as a precondition to the achievement of the region's full development potential, and it is to this end which LRRVWC has assiduously devoted its efforts.

In the early 1960's the prospects looked good. LRRVWC had a good working relationship with the Provincial Government and even the Federal Government complied with LRRVWC's request for a study by the IJC. Senior governments, while not the initiators, often demonstrated a willingness to encourage economic growth by providing many different types of infrastructure.

Thus, it appeared, in 1969, that LRRVWC's commitment to the Pembina project, would result in its implementation. Three million dollars in studies had shown the project to be cost-effective. The project had the support of the Premier and the Manitoba Water Control Branch. Then, in the summer of 1969, a new Provincial Government was elected. The new Government opposed the Pembina project. There are, of course, many good reasons why the NDP may have held the planned development in disfavour. For example, governments have limited resources to allocate amongst competing uses, and by virtue of their election, the NDP had been given a mandate by the majority of Manitobans to pursue a different set of priorities. In addition, a project such as the Pembina provides direct benefits to relatively few people. Hence, the expenditure of large amounts of public funds would, in this case, represent a significant transfer of wealth to a region which, while not affluent, was at least relatively prosperous. Finally, the magnitude and incidence of water problems experienced from 1969 to the present, were greater than could

have been predicted from the historic record. Hence the NDP could be excused, especially during the early years, for disregarding requests for action from residents of the lower Red River Valley.

From reading the literature, one gets the impression that, in addition to being disappointed, LRRVWC members were bitter and frustrated by the lack of co-operation shown by the new Provincial administration. For example, in their brief to the Manitoba Water Commission, March 19, 1973, LRRVWC stated "The governments of today have offered no good reason for the delay in negotiations" (LRRVWC Brief to the Manitoba Water Commission, March 19, 1973). Thus, one is left with the impression that certain members of the Provincial Government adopted a supercilious attitude towards the needs of Red River Valley residents and the representations made by LRRVWC.

Thus, 1969 signalled the beginning of a new era -- an era of unresponsive "big government". As demonstrated in Chapter II, fiscal responsibility for water management was progressively transferred from local levels of government to more senior levels. Naturally, there was a corresponding shift in decision-making power, but until 1969 this development did not present LRRVWC with any real problems. LRRVWC had developed a good relationship with the Provincial Government and the Government had responded by initiating numerous studies and by enacting enabling legislation such as the

Water Supply Districts Act (S.M. 1958). Prior to 1969 it was understood that development initiated from the private sector and interestingly enough, many of LRRVWC's members were prominent corporate citizens who were a force majeure behind the region's development. Therefore, it was not unrealistic for there to be a strong relationship between local and senior levels of government. However, after 1969, LRRVWC was not very successful in terms of changing the attitudes of politicians. From 1969 to 1977 LRRVWC was faced with the task of lobbying unsympathetic and/or unstable governments. The situation did not improve in 1977 when an unsympathetic Provincial Government was replaced by one which was apparently "sympathetic" but primarily inactive because of a policy of fiscal restraint.

All the while, the problems grew more critical. Water management problems today do not just limit economic growth, they threaten the region's socio-economic stability. Recurrent floods and drought limit agricultural and ancillary output while imposing direct costs on individuals, municipalities and senior levels of government. Flood compensation and flood protection, while heavily subsidized by senior governments, is for the most part, inadequate. Tired of waiting for action on critical problems, local levels of government have recently initiated their own actions. For example, Gretna residents have built a border dyke several times in the last decade to protect the town from Aux Marais

floods and Pembina overflows. Inaction by Provincial and Federal authorities in terms of investigating the possibility of increasing the capacity of the Morden reservoir, prompted the residents of Morden and Winkler to fund their own study. In short, local governments have been forced to assume responsibility for water management, but they generally lack the resources and the authority to undertake those projects which would meet short term and long term water management needs. Senior governments have the ability to make the necessary improvements, but except for conducting a few feasibility studies, they have recently been largely unresponsive, despite severe problems.

This is not meant in any way to suggest that Provincial Governments between 1969 and 1981 made "bad" decisions based on the data available -- only that the decisions were unresponsive to perceived local needs. The spirit of collective grassroots participation and co-operation between local and senior governments was replaced by a form of centralized planning which made decisions from the top down.

The move towards centralization transcended water management decisions. All sectors were affected by new economic and organizational realities. While the 1950's and 1960's was a period of unprecedented economic growth, high expectations and active development, the 1970's were a period of less ambitious undertakings. The process from decentralized to centralized planning resulted in a change in perspective and senior governments were less able to accommodate

local interest groups. The result was public disaffection with big government and the rift has exacerbated over time. As local involvement waned, there developed a growing expectation that government was responsible for providing solutions.

One is left with the impression that, throughout the 1960's, LRRVWC was actively involved in the planning process and was perceived by senior government as a partner in the development of resources in the lower Red River Valley. In the 1970's, however, LRRVWC was relegated to the role of lobbyist. Lobbying is not a satisfactory approach to regional development, for it does not guarantee action; nor does it guarantee action which will benefit the majority of people. During the 1970's, a senior official of the Water Resources Division continued to attend LRRVWC meetings, but that member assumed an information-giving role. Thus, there remained some level of accountability but the process became relatively non-participatory. If true development is to be achieved, it will be essential that a public spirited group continue to press for change. The concept of development embodies more than simply developing resources. Development is a process which incorporates self-esteem, participation and interdependence.

Unfortunately, the public, has to some extent, lost faith in its collective impact. In the 1960's, community

leaders dedicated themselves to the realization of a vision. They were rewarded by the fact that governments acknowledged and listened to their proposals. More recently, however, LRRVWC's effectiveness has diminished, and as the original members leave the Commission, the Commission members seem less aware of the importance of public participation. LRRVWC and senior governments must recognize that conditions have changed and there exists a need for a new approach to water and land use planning. That new approach must not ignore perceived regional needs nor the actions and aspirations of individual landowners. It is the aggregate effect of those individual decisions which will ultimately determine the success of any planning decision.

CHAPTER V

WATER SUPPLY FOR DOMESTIC, MUNICIPAL AND INDUSTRIAL USE

5.0 INTRODUCTION

LRRVWC has, from its inception, directed a major portion of its efforts toward augmenting the region's potable water supply. During the early 1960's many communities, through the efforts of LRRVWC, were able to develop water supply systems. Most notably, the Neche/Altona pipeline was completed in 1960 and the Stephenfield dam and Winkler wells and distribution system were completed in 1964. These developments along with the Morden dam, met the region's most immediate water requirements. The IJC study, commenced in 1962, examined the possibility of developing the resources of the Pembina River to meet the region's ultimate water requirements. The Pembina project, however, remains a conceptual construct and a number of communities have not had sufficient excess water supply to attract new industry. According to the Canada-Manitoba Interim Subsidiary Agreement on Water Development:

> Although this area has the best climate and soil resources for agricultural production in Manitoba, related industrial activity has been limited in this area due to the lack of adequate water resources (Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing. Schedule "A", 1980).

The Agreement also points out that:

> The type and distribution of new jobs in secondary centres have been strongly affected by the adequacy of water supplies to sustain resource development and industrial and centre growth (Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing. Schedule "A", 1980).

This chapter will examine the contention that the inadequacy of water supplies has limited resource development and industrial and centre growth. In so doing, it is necessary to examine the various sources of water in the Pembina Triangle, their ability to meet demand over the years and their ability to meet present and future requirements. The problem of determining optimum staging of water supply projects is also discussed. Historically, there have been two viewpoints concerning the question of bringing extra supply on-stream. The Provincial Government and their agencies have been seen to be obstructionist. They are faced with the difficult task of allocating scarce resources between competing demands for public funds. Meanwhile development proponents have argued for extra water supply as infrastructure essential to encourage resource development and growth. Development proponents have traditionally viewed the situation from the perspective of unrealized potential and opportunities foregone. The Government, on the other hand, has based its decisions on the basis of extrapolating past trends -- which, by its very nature is limiting. Unfortunately, until

recently, this difference in opinion has not been recognized and water management has been promoted as a value-free science. This chapter will demonstrate that water management is anything but value-free.

The signing May 30, 1980, of the Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing bodes well for the region's future development. The Agreement makes federal funds available for water projects and has already resulted in an expansion of the Morden reservoir in the fall of 1981. Perhaps more importantly, the Agreement introduces a new approach to water management. In one study by Decter and Framingham*, the authors emphasize the need to do scenario analyses, which involves projecting outcomes under various development strategies as opposed to simply projecting past trends. Since a water supply for irrigation would change existing conditions it really makes little sense to use a methodology which focuses on the past. Another study being conducted under terms of the Agreement is a drought sensitivity analysis. Rather than simply measuring drought damages, this approach projects lost economic activity in all sectors resulting from droughts of various magnitude. This new approach may enable communities to satisfy their ultimate

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*Canada. Department of Regional Economic Expansion, Prairie Farm Rehabilitation Administration. Assiniboine South-Hespeler Area Projects Preliminary Analysis. Prepared by consultants Michael Decter and Charles Framingham, February, 1982.

water requirements and help them achieve their full development potential.

5.1 WATER SUPPLY FOR WINKLER, MORDEN AND ALTONA

To date, three sources of water have been developed in the Pembina Triangle:

1) a high yield aquifer supplies the needs of Winkler and surrounding area, although the availability of groundwater varies considerably from place to place;
2) the Morden dam on Deadhorse Creek provides Morden with water; and
3) the Pembina River serves as a source of supply for Neche, Pembina, Gretna, Altona and the Rural Municipality of Rhineland.

These sources of supply and their ability to meet present and future requirements are discussed herein.

5.1.1 Groundwater Resources: the Winkler Aquifer

Storage in the Winkler aquifer is estimated to be 535,000 acre-feet of which 358,000 acre-feet is fresh water. By comparison, the capacity of the Morden reservoir is currently 3100 acre-feet. Thus, the quantity of groundwater held in storage is very large. However, because there is no impermeable boundary between them, saline water can readily intrude into the fresh water zone. Therefore, water must be withdrawn judiciously. Potential yield depends on the rate of recharge, although the large volumes in storage makes it

possible for withdrawal rates to exceed recharge in periods of drought (Manitoba Water Resources Division, 1979).

In 1973, the Manitoba Water Commission stated that the well field serving the Town of Winkler was capable of providing a dependable yield of 160 million gallons per annum (589 acre-feet) (Manitoba Water Commission, 1973:13). Winkler's water consumption in 1972 was 50.2 million gallons (185 acre-feet) so there appeared to be sufficient excess capacity to meet demand well into the future. At that time, a preliminary evaluation by the Department of Mines, Resources and Environmental Mangement, Water Resources Branch indicated that the Winkler aquifer could supply a dependable flow of 700 million gallons (2579 acre-feet) (Manitoba Water Commission, 1973:15). The Manitoba Water Commission noted that:

> ...the aquifer contains an upper zone of fresh water and a lower zone of saline water. If excessive or incorrect withdrawals of water are made from the aquifer, this lower zone of saline water could contaminate the potable supply of water to the communities supplied therefrom (Manitoba Water Commission, 1973: 15).

In view of the importance of the aquifer, the Manitoba Water Commission recommended that, "...it is essential that a more detailed hydrogeological study be undertaken."

Such a study was undertaken by the Water Resources Division in 1979. Natural recharge estimates were revised down from 2579 acre-feet to somewhere between 730 and 2430 acre-feet per year (Manitoba Water Resources Division, 1979:12). 730 acre-feet per year is a conservative estimate

based on the assumption that recharge is 0.05 m of water (2 inches) over an area of 10 km^2 where the recharge conditions are very good, and 0.01 m (0.4 inch) over the remainder of the recharge area.

> Taking a considerably less conservative approach it can be assumed that recharge takes place in areas where the aquifer is at or near ground surface and in adjacent shallow sand areas. The recharge area then is about 100 km (40 sq. miles) (Manitoba Water Resources Division, 1979:12).

Assuming that the average recharge is 0.03 m (1.2 inches) over the recharge area, the Water Resources Division determined total recharge to be 2430 acre-feet. Hence, under natural recharge conditions yield could be as much as 2430 acre-feet or as little as 730 acre-feet.

The study by the Water Resources Divison estimated water withdrawal in 1978 to be about 365 acre-feet -- 185 acre-feet by Winkler and 180 acre-feet by domestic and farm wells. On the basis of that level of consumption, and the maximum potential natural recharge, the report gives the impression that the aquifer could meet demand for many years.

However, Winkler's water consumption in 1978 was not 185 acre-feet, but 365 acre-feet (Table 1). If it is true that domestic and farm wells withdrew 180 acre-feet, then water withdrawal from the Winkler aquifer in 1978 was 545 acre-feet (365 + 180). In 1981 Winkler used 113.95 million gallons (Table 1) or 420 acre-feet. Assuming no increase in withdrawal by domestic and farm wells, withdrawal

TABLE 1

ANNUAL WATER CONSUMPTION

(Fiscal Year May - April)

1966 - 1981

Millions of Imperial Gallons

MAY:	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
ALTONA	23.21	26.31	31.24	30.16	33.86	35.75	39.93	40.54	40.71	47.17	50.68	56.50	56.31	61.71	68.61	74.36
GRETNA	3.67	4.24	4.53	4.50	4.77	4.89	6.40	6.46	5.89	6.31	9.79	10.31	8.66	9.24	8.83	9.53
RHINELAND	1.40	2.20	1.59	.84	1.01	1.52	1.73	2.39	2.91	5.42	4.97	3.60	4.60	4.40	4.73	5.35
WINKLER	21.96	26.59	38.98	43.67	50.86	46.97	45.44	51.60	56.79	67.03	79.39	88.98	88.10	99.39	103.73	113.95
MORDEN	103.76	117.54	105.85	124.16	106.57	116.39	122.47	121.89	137.12	149.21	145.72	139.70	137.38	141.79	145.40	---
TOTAL	154.00	176.90	182.20	203.30	197.00	205.50	216.00	222.90	243.40	275.10	290.50	299.10	295.10	316.50	331.30	---

SOURCE: Manitoba Water Supply Board Annual Figures and Town of Morden.

from the Winkler aquifer in 1981 was 600 acre-feet (420 + 180). That amount comes dangerously near the lower end of the estimated annual dependable yield. Given, an average annual growth rate of 11.6% between 1966 and 1981 (Table 1), Winkler's water use could double in 6.3 years. In other words, it is conceivable that by 1987 water consumption in Winkler may reach 840 acre-feet. Added to this is an unknown quantity withdrawn by domestic and farm wells.

Given:

1) the change in estimated dependable yield from 2579 acre-feet (1973) down to somewhere between 730 and 2430 acre-feet (1979);
2) the fact that Winkler's water consumption was 97% higher than the estimate used by the Water Resources Division;
3) the lack of information on withdrawal by domestic and farm wells; and
4) the potential to do untold damage to an invaluable resource through imprudent use;

it would appear that use of the Winkler aquifer must be examined again, without delay.

The saving grace is that dependable yield could be substantially increased by artificial recharge of two high-yield aquifers; one located in the vicinity of Winkler and the other at Miami. In the area just north of Deadhorse Creek, sand and gravel deposits which form the aquifer are at

or near the surface. Without pumping, water could be diverted into the aquifer from Shannon Creek and Deadhorse Creek with mean annual discharges of 13,700 and 5550 acre-feet, respectively. In view of the aquifer's high transmissivity artificial recharge has the potential to supply several times as much water as currently supplied by natural recharge. (Manitoba Water Resources Division, 1979:13).

What the Water Resources Division does not mention, however, is the fact that water users downstream from the diversions may oppose such a proposal. In fact, in 1973 PFRA considered diverting neighbouring streams into Deadhorse Creek to firm up Morden's water supply. However, this proposal was summarily rejected because of potential opposition. Thus, artificial recharge is physically possible but legal and social implications may hinder its eventual implementation.

To summarize, groundwater supply is sufficient to meet considerable municipal expansion if the aquifer is recharged artificially. If, on the other hand, there is no artificial recharge, water withdrawal could approach the lower limit of the estimated recharge rate within a couple of years. For example, between May 1980 and May 1981 Winkler withdrew 420 acre-feet. Given, an average annual increase of 11.6% compounded, Winkler's water demand could reach 583 acre-feet per year, by May of 1984. This is approximately equal to the 589 acre-feet estimated dependable yield of the

Winkler well field (Manitoba Water Commission, 1973:13). Add to this, 180 acre-feet for domestic and farm wells, and withdrawal by 1984 could easily exceed 769 acre-feet. In view of the most recent estimates of natural recharge, ranging somewhere between 730 and 2430 acre-feet, there would seem to be ample cause for concern.

The Manitoba Water Resources Division states:

> The total present groundwater withdrawal from the aquifer is 450,000 m^3 per year (365 acre-feet). This is less than one sixth of the estimated maximum natural recharge of potential sustained yield of the aquifer (Manitoba Water Resources Divison, 1979:15).

Given the potential to despoil the aquifer, it would seem more sensible for the Water Resources Division to focus on the minimum potential sustained yield and not on the maximum potential sustained yield. From a more cautious perspective, withdrawal from the Winkler aquifer in 1978 was 75% ($\frac{365+180}{730}$) of the conservatively estimated sustained yield. That, would seem to be a more telling statistic.

5.1.2 The Morden Dam

PFRA built a dam on Deadhorse Creek in 1941 to supply water to the Dominion Experimental Farm, located just east of Morden. In 1953, the dam was raised 13 feet to provide a water supply for the Town of Morden. Total storage

capacity of the Morden reservoir was 2100 acre-feet. The location of water intake pipes limited usable storage to only 650 acre-feet, with a dependable yield of 430 acre-feet (Canada PFRA, 1973:24). Anticipating, that the reservoir would be incapable of meeting future needs the Province asked PFRA in 1962 to examine alternative methods of increasing annual dependable yield (Canada PFRA, 1973:1,2). PFRA submitted a report later that year but no action was taken. By 1972, Morden used 122,470,000 gallons (451 acre-feet) (Table 1). That level of demand exceeded annual dependable yield by 21 acre-feet, prompting the Province to request another study by PFRA the following year. Still, no action was taken and drought in 1976 and 1977 caused mounting local concern. In 1978, the Towns of Winkler and Morden asked LRRVWC to spearhead talks with the Province about increasing the capacity of the Morden reservoir. The next year, the Water Control and Conservation Branch asked PFRA to increase the water supply for Morden (PFRA interdepartmental correspondence, June 6, 1979). PFRA responded by releasing another study in May, 1980.

Despite a critical need for additional water, authorizaton for the Morden dam improvements depended ultimately on the signing of the Canada-Manitoba Interim Subsidiary Agreement on Water Development (Manitoba Water Resources Branch correspondence, May 28, 1980). The agreement was signed May 30, 1980, and usable storage was expanded in the

fall of 1981. This section briefly examines the PFRA studies and the efforts to get storage capacity increased.

Five alternatives to increase Morden's water supply were studied in 1962. These included:

1) raising the existing dam;
2) building a new dam about two miles upstream from the existing dam;
3) increasing the drainage area by diverting water from adjacent watersheds into Deadhorse Creek;
4) utilizing existing dead storage by lowering the intake pipe or using portable pumps; and
5) supplemental pumping from the Pembina River.

PFRA (1962) determined that annual dependable yield could be increased to 230 million gallons (847 acre-feet) by increasing usable storage by 2100 acre-feet (Manitoba Water Commission, 1973:14). Storage could be increased incrementally in two phases. Initially, water intake pumps could be installed on a floating platform, making available 600 acre-feet of storage presently unused. Later the dam could be raised to store an additional 1500 acre-feet. PFRA also examined the possiblitiy of a Pembina River dam with a storage capacity of 470 acre-feet and an annual dependable yield of 276 acre-feet.

In 1973, PFRA projected that demand would increase to 880 acre-feet by the year 2000 (Canada PFRA, 1973:11). In

an effort to meet this demand, PFRA re-examined the five alternatives previously investigated in 1962.

Based on annual inflows into Lake Minnewasta for the period 1921-1973 PFRA determined that a dependable yield of 880 acre-feet could be achieved by raising the existing dam seven feet to impound an extra 1000 acre-feet of water, at a cost of $580,000. Alternatively, a new upstream dam storing 1500 acre-feet could increase annual dependable yield to 1020 acre feet. Cost was estimated at $1.3 million and it was determined that a second reservoir would be less efficient than a single large reservoir because of greater losses from evaporation and seepage. A third alternative involved lowering the intake pipe from 1066.5' to 1050' ASL*. This action would increase usable storage to 1800 acre-feet, with a dependable yield of 950 acre-feet for only $200,000. This action, however, was undesirable since a 25 foot drawdown would jeopardize recreation and would disrupt embankment stability. A fourth alternative involved the use of portable pumps to utilize capacity below the level of the intake pipe during times of emergency. Portable pumps could increase the dependable yield by 450 acre-feet. It was determined that this alternative would have no capital cost and annual costs would only be $1,800. The fifth alternative was to pump water from a 1000 acre-foot reservoir on the Pembina River to compensate for any shortfall in supply from Lake Minnewasta. This scheme would cost an estimated $670,000, plus pumping

costs. Also considered was the possibility of increasing the drainage area of Deadhorse Creek by diverting neighbouring streams. This alternative was summarily rejected because of the cost and potential opposition from water users downstream from the diversion.

PFRA recommended a combination of two of these alternatives. They suggested raising the spillway crest by two feet and lowering the water intake pipe invert by eight feet. This action would not endanger the stability of the embankment and recreational use would be affected only slightly since the greater part of the drawdown would occur in the fall and winter months after the recreation season had passed. The result would be 1700 acre-feet of usable storage providing an annual dependable yield of 900 acre-feet, sufficient to meet Morden's needs to the year 2001 at a cost of $90,000.

PFRA added that:

> ...when the water requirements of this whole area (the Pembina Triangle) for domestic and industrial purposes exceed the dependable yield of the local streams and groundwater, diversions from the Assiniboine River by way of the Boyne River and canals will likely provide the least costly source of water (Canada PFRA, 1973:22).

Despite the need for additional water, and the relatively low cost of the recommended works, no action was taken. Droughts in 1976 and 1977 caused growing alarm, prompting the Towns of Morden and Winkler in 1978 to update

the Toman study (1972) and the PFRA study (1973) at their own expense. The Towns also asked LRRVWC to spearhead a renewed series of talks with the Province to increase the capacity of the Morden reservoir. In 1979, the Water Control and Conservation Branch asked PFRA to increase the water supply for Morden (PFRA interdepartmental correspondence, June 6, 1979). PFRA investigated three alternatives:

1) lowering the pump intake to increase usable storage;

2) increasing storage by raising the dam; and

3) a combination of #1 and #2.

In May of 1980, PFRA recommended the intake be lowered eight feet and the dam be raised seven feet -- to impound an additional 1000 acre-feet. The combination of these two actions increased the annual dependable yield to 885 acre-feet (personal communication, Donachuk, July 9, 1982). PFRA determined that this action would provide a firm supply to meet Morden's expected requirements to 1995. The cost of the improvements was estimated at $2.52 million (Water Resources Branch correspondence May 28, 1980). On July 22, 1980, the costs were revised upward to $3.065 million. The project was completed in November 1981.

It is interesting to note several important points arising from the deliberations on the Morden reservoir. For one, the reservoir's capacity was enlarged only after the signing of the Canada-Manitoba Interim Subsidiary Agreement

on Water Development. In other words, funding arrangements often take precedence over proven need. Also worthy of note is the fact that hydrological calculations change over time, based on the availability of better information. For example, in 1962 PFRA determined that annual dependable yield could be increased to 847 acre-feet by increasing usable storage by 2100 acre-feet. Then, in 1973 PFRA claimed that dependable yield could be increased to 900 acre-feet by increasing usable storage by 1050 acre-feet. That was to be accomplished by raising the spillway crest two feet and lowering the water intake pipe eight feet. Alternatively, the 1973 study stated that dependable yield could be increased to 880 acre-feet by raising the dam seven feet. In 1981, the dam was raised seven feet and the intake lowered eight feet. The result is a dependable yield of 885 acre-feet.

In other words, each report is based on different hydrological calculations. These calculations can fluctuate markedly, depending upon which period of recorded flows the water engineers base their calculations. A longer period of record will supposedly yield more accurate results. Streamflow records for Deadhorse Creek have been kept since 1958. Streamflow prior to 1958 has only been estimated. The most recent calculations project that present capacity will meet demand to the year 1995. Of course, if there is no protracted drought similar to that of the 1930's, the present storage capacity may meet demand well past the year 1995. On the

other hand, if climatic conditions become more droughty, dependable yield may be less than the estimated 885 acre-feet and storage capacity could become deficient before 1995.

The foregoing discussion illustrates that projections are based on imperfect information and are only estimates. As physical, social and economic conditions change through time, estimates also change. Decisions should be based on the best information available but the decision-maker should remember that the data base is imperfect and all projections are limited by the current state of the art.

5.1.3 Water Supply for the Altona Area

The pipeline from the Pembina River at Neche to Altona provided Altona and Gretna with a relatively secure source of supply for a 20-year period between 1960 and 1980. Prior to 1960, Gretna, Altona and other communities depended on dugouts, cisterns and water hauling to supply water. Groundwater supply has been inadequate and of poor quality. The few wells in the area are low-yielding and unpredictable. Thus, the pipeline was essential to Altona's growth and development. However, insufficient storage and treatment capacity at Neche is again imposing constraints on development in the area. In addition, the purchase agreement between the City of Neche and the Manitoba Water Services Board stipulates that the agreement can be terminated with five years notice and the agreement can be cancelled during

times of drought. In other words, the supply is tenuous, at best. This places Altona, Gretna, and the Villages of Rhineland, Sommerfeld, New Bergthal and Gnadenfeld in a very vulnerable position. In view of these problems and the demonstrated development potential of Altona, there is a need to make the Pembina River supply more secure or to develop an alternative source of water to meet the area's long-term interests.

Since Altona/Gretna/Rhineland will continue to depend upon the Neche source for a number of years to come, and since that water supply and distribution system is already developed, it is necessary to look at the limitations of the Neche supply. Both storage and treatment capacity are insufficient.

The people of the Altona area are very conscious of the need to conserve water, having the lowest per capita domestic use in the Province. Drought has been frequent in recent years, occurring in 1976, 1977 and 1980. Thus, water consumption has probably not grown as fast as it might have in the absence of these restrictions. Nonetheless, between May 1980 and April 1981, Altona, Gretna and Rhineland used 89.24 million gallons (310 acre-feet), or about 80% of the total 350 acre-feet treated at Neche. Meanwhile, storage capacity at Neche is only 212 acre-feet -- 148 dam^3 (120 acre-feet) behind the weir on the Pembina River and 114 dam^3 (92 acre-feet) in an old oxbow (Canada PFRA, 1981:13). In the eventuality of a complete cessation of discharge on

the Pembina River as occurred in 1938/39, 1939/40, or 1940/41 the storage at Neche would be incapable of meeting demand (Manitoba Water Commission, 1973:12). Given Altona's modest per capita use, there seems to be little opportunity to cut back in times of water shortages. In fact, there is so little excess capacity that the opening day of Altona's public swimming pool is often delayed because of restrictions on the rate at which the pool may be filled. This situation is hardly conducive to attracting water-using industry.

In addition to the need for extra storage there is also a need to expand treatment capacity. Maximum output of the Neche plant is 28 L/s (355 imperial gallons/min)* in the summer and 21 L/s (266 imperial gallons/min) in the winter. The rated capacity of the plant is 25 L/s (330 imperial gallons/min) (Canada PFRA, 1981:6).

In 1980, average daily consumption in Altona, Gretna and Rhineland was one million litres with a peak daily demand of 1.75 dam^3 (385,000 gallons) (Canada PFRA, 1981, appendix:6). At a rated capacity of 25 L/s the plant can treat 2.16 dam^3 (475,000 gallons/day). However, the peak hourly demand cannot be met by the plant. To meet peak hourly demand there is extra storage at Gretna and Altona. The water tower at Gretna holds 360,000 litres (.288 acre-feet)

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*There is some discrepancy in the figures in different reports. For example, the Manitoba Water Commission reported in 1973 that the plant was capable of treating 590,000 gallons per day, which corresponds to 31 L/s.

and a reservoir at Altona holds 1,450,000 litres (1.16 acre-feet) (Canada PFRA, 1981:6). PFRA claims that within a few years, storage at Gretna and Altona will be insufficient to meet peak hourly demand (Canada PFRA, 1981, appendix:6). PFRA states:

> ...during summer months the plant is forced to produce water at or over its rated capacity (25 L/s) to satisfy the demand. Any further increase in demand will require an expansion of the plant
>
> (Canada PFRA, 1981:7).

In 1981, PFRA projected that expanding the treatment plant at Neche from 25 L/s to 45 L/s would meet demand to the year 2005. The treatment plant at Neche could only be expanded if there were sufficient storage on the Pembina River. Had the Pembilier dam been built, Pembina River flows at Neche would have been firmed up and Altona's water supply would have been relatively secure. However, after years of study, public hearings, and environmental assessments, the Army Corps of Engineers in May 1982 postponed the Pembilier indefinitely because of a low B/C ratio. A severe flood or drought in the next couple of years could generate public pressure to resurrect the project. Nonetheless, the project would still be a number of years away from construction, forcing Manitoba to examine other alternatives implementable in Manitoba.

Developing a water supply in the Altona area was not a simple matter. Unlike many areas, there was no consensus on which source of supply to develop. Over the years

proposed many different options. A brief review of some of these studies is instructive in indicating that there is no technological "fix" of resources. Development decisions depend upon a myriad of other factors. The following paragraphs discuss some of the previous studies and the current proposals for expanding the water supply in the Altona area.

In 1951, PFRA examined the possibility of storage on the South Buffalo Drain but this proposal was not particularly attractive because the gradient in this area is exceptionally gradual, sloping only one foot in every mile. In 1953, PFRA looked at building a pipeline from the Red River at Letellier to Altona, Gretna, Winkler, Plum Coulee and Roland. However, the cost was prohibitive at $3.9 million in 1953 dollars. In 1956, Haddin, Davis and Brown Ltd. completed a study for PFRA entitled "Report on Water Supply for Letellier, St. Joseph, Altona and Gretna areas of Southern Manitoba". The study considered the Buffalo Drain, the Morden dam, the Pembina River and the Red River as sources of supply. The Red River was considered the most dependable source, so the study recommended a treatment plant at Letellier to supply Altona and Gretna at a capital cost of $1.3 million. The following year, Arthur D. Little Inc. rejected the Red River as a source of supply because of poor water quality and flow. A link with the Greater Winnipeg Water District was also rejected because of the cost. Instead, the Little report recommended a Pembina River dam to firm up

supply at the Morden reservoir which would serve Winkler, Plum Coulee, Horndean, Rosenfeld, Altona and Gretna. A study by the Manitoba Department of Mines and Natural Resources in 1959 considered the Roseau River and the Pembina River at Neche as sources of supply for Altona and Gretna.

In 1960 the pipeline from Neche to Altona was completed and a twenty year agreement signed between the Water Supply Board and the City of Neche. This source of supply appeared relatively secure, especially in view of the IJC's 1967 recommendation to build dams at the Pembina and Pembilier sites. However, neither of these dams has been constructed to date.

In 1973, the Manitoba Water Commission reviewed water resource development proposals for the Pembina River Basin. In 1972, the Neche plant treated 228 acre-feet (Manitoba Water Commission, 1973:12). Noting that the Pembina River dried up in 1938/39, 1939/40, and 1940/41, the Commission concluded that the 160 acre-foot reservoir at Neche "...is not adequate to guarantee a dependable supply of water to meet future requirements" (Manitoba Water Commission, 1973:12). Storage was subsequently increased to 212 acre-feet (Canada PFRA, 1981:13).

In 1978, the Manitoba Water Services Board conducted a feasibility study on supplying water to the Unincorporated Village of Rosenfeld from the Buffalo Drain. The terms of reference were later expanded to include all possible

sources for Altona and the R. M. of Rhineland. In April 1980 the Manitoba Water Services Board published a report entitled "Report of Alternatives for the Expansion of the Altona Area Water Supply System". The report recommended discussions with the affected communities to decide on either: (1) use of Red River water with a treatment plant at Letellier or Emerson; or (2) use of water from the Buffalo Drain with a treatment plant at Altona. In either case, these works were to supplement Neche initially and replace it at the end of its useful life (Canada PFRA, 1981:2,3,4).

Despite the need for a more secure, long-term water supply, the situation remains unchanged. However, the signing May 30, 1980, of the "Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing" bodes well for future improvements. This Agreement provides cost-sharing on water projects, thereby enhancing the possibility of action from the Manitoba Water Services Board.

The Manitoba Water Services Board sent terms of reference to PFRA May 4, 1981, to determine the most economical way to augment the water supply for Altona, Gretna and Rhineland to 1990 and to replace the existing supply altogether after 1990. PFRA was asked to investigate the Red River, Pembina River, Roseau River, Buffalo Drain and groundwater as sources of supply. In addition, PFRA was to consider the possibility of firming up supply on Buffalo Drain by

diverting water from the Pembina River. Pembina River flows could be firmed up with additional storage in Swan Lake or the proposed Pembilier reservoir. Also considered was the prospect of diverting water from the Assiniboine River to the Altona area, as a component of the Assiniboine South-Hespeler area project.

In December 1981, PFRA released their study called "Water Supply Alternatives for the Altona Area: Preliminary Engineering Report". The study states that:

> The town of Altona and Village of Gretna have suffered shortages of water in recent years as the increasing municipal and industrial demand has exceeded the available output from the Neche water treatment plant in North Dakota. Additional supplies of water are needed if the projected future needs of Altona and Gretna are to be met and the water supply network expanded in the R.M. of Rhineland (Canada PFRA, 1981:Synopsis).

The PFRA study projected that water consumption by Altona, Gretna and Rhineland in the year 2005 would be about 670 dam^3 (540 acre-feet). Meeting this demand will require extra storage and expanded treatment capability from the present 25 L/s to 45 L/s. The most economic proposal would be to expand the water treatment plant at Neche ($700,000) and provide additional storage on Swan Lake. Construction of the Pembilier dam would obviate the need to increase storage at Swan Lake. However, at the moment, progress on the Pembilier is in a state of suspension, although a serious flood or political pressure could change that situation. The next most

economical alternative would be to pump raw water from the Pembina River at Neche to Gretna where a treatment plant could be constructed. This alternative would require extra storage on the Pembina River and does not obviate the fact that Manitoba has no legal right to use the water from the Pembina River at Neche.

PFRA determined that a dam on Buffalo Drain near Altona and the construction of treatment facilities in Altona would be the next most economical alternative. This proposal could meet area needs to the year 2005 if supplemental water from the Pembina River was diverted into the Drain, and Neche continued to provide 370 dam^3 (296 acre-feet). In the absence of water from Neche, additional water would be needed from an alternative source. This could be provided from the Assiniboine River by way of the canal now being investigated for the Assiniboine South-Hespeler Area Project. Alternatively, water could be pumped from the Pembina to the Buffalo Drain from:

1) south of the Village of Blumenort in the United States at a cost of $630,000; or
2) the point where the Pembina crosses the International Boundary at a cost of $1.7 million (Canada PFRA, 1981:17).

To meet the total need of 670 dam^3 (540 acre-feet) in 2005 the Buffalo reservoir could be expanded to 1400 dam^3 (1100 acre-feet) at a total cost of $2.7 million. A treatment plant at Altona would cost an extra $1.45 million.

Alternatively, the Red River could be developed as a source but this would be more expensive than developing the Pembina River or Buffalo Drain. Despite the higher costs the Red River proposal is politically more stable than Pembina River development and would provide a more integrated water supply system.

Roseau River water quality is better than that from other sources but distance and elevation make this alternative too expensive in terms of constructing pipelines and pumping facilities.

The foregoing discussion on a water supply for the Altona/Gretna/Rhineland area serves to illustrate a number of issues which are recurring factors in water management decisions. For one, the issue is very complex. Developing a water supply for the area is not simply a matter of determining the technological "fix" of resources. Development decisions are dependent on, among other things, political considerations, contractual arrangements, the status of other projects, the availability of funds, political interest, and the changing preoccupations of PFRA and the Manitoba Water Services Board. The economics of any particular proposal change with time and depends, to some extent, upon the predilections of the consultants investigating the matter. Water management is not a "value-free" science.

5.2 PROBLEMS IN PROJECTING FUTURE DEMAND

By 1980, the water supply situation in Morden and the Altona/Gretna/Rhineland area was cause for mounting local concern. In 1972, Morden used 122,470,000 gallons (451 acre-feet) which exceeds the annual dependable yield from the Morden reservoir. As a result of these limitations, and drought in 1976, 1977 and 1980, Morden water consumption peaked in 1975. In 1980, the purchase agreement beween the City of Neche and the Manitoba Water Services Board, expired. In addition, between May 1980 and April 1981 Neche treated about 350 acre-feet of water, 80 percent of which was used in Manitoba. This water was supplied from 212 acre-feet of storage at Neche. While recent water shortfalls from Morden and Neche have not been serious, the possibility exists that water supplies could be drastically curtailed. In the event of such an emergency, shortages in Morden could be alleviated by pumping water from "dead" storage at Morden and water trucking in the Altona area. Thus, from the viewpoint of the Waters Services Board the water supply situation may not be considered critical. Overlooked, however, is the fact that the absence of an assured supply of potable water may have unnecessarily constrained economic development. This allegation has been made by LRRVWC in numerous briefs to the Provincial Government, and it raises the problem of projecting future demand and determining when extra supply should be brought on-stream.

5.2.1 Optimum Staging of Projects

From the viewpoint of development proponents the optimum situation is to have enough surplus capacity to allow for and encourage industrial expansion. Thus, an assured supply of potable water is seen as infrastructure essential to development. However, from the viewpoint of government and water planners the question is one of determining optimum staging of projects to meet a demand which grows over time. They must decide whether to build one large project or a series of smaller projects. For example, the Morden reservoir has been expanded twice, in 1953 and 1981 to the present capacity of 3100 acre-feet. PFRA has projected that the annual dependable yield should satisfy demand to the year 1995. Had the Morden reservoir been expanded in 1953 to 3100 acre-feet, capacity would have exceeded demand for many years, although one could argue that demand may have increased at a higher rate. Increased demand could have resulted from the attraction of new industry or simply from domestic and municipal consumption for non-essential purposes such as watering lawns. For expample, the Tupperware plant in Morden is the biggest water user, but none of the water is used in the production of goods. Instead the water is used to maintain the grounds for aesthetic purposes. Similarly, the golf course at Morden used about 35 acre-feet of water in 1981 for the greens. In 1982, after the expansion of the reservoir the golf course has been granted a permit to water fairways. One

could question the prudence of a $3 million expenditure to water lawns.

In determining how large to make each increment in capacity, and the timing of that increment, Howe (1971) has identified three basic facts that are nearly always in conflict:

1) It pays to build large increments to the system because there usually are cost savings (economies of scale) involved in increasing project size.

2) The commitment of resources to a capacity that will not be used for a long time is costly. It pays to defer investment as long as possible since future costs are more heavily discounted than present costs.*

3) Maintenance of flexibility is important (Howe, 1971:90).

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*According to Howe, there are two schools of throught on how the discount rate r should be determined:

1) The parameter r should represent the pretax rate of return foregone on physical investments in the private sector to finance public activities (the opportunity cost approach).

2) The value r is a planning parameter reflecting society's feelings about providing for the future as opposed to current consumption (society's time preference), and r need bear no relation to the rates of return in the private sector, interest rates, or any other measurable market phenomena (Howe, 1971:66).

In essence then, a very small increment might not be optimum since small plants are likely to be high cost plants in terms of cost per unit of capacity. However, a huge plant which has a low cost per unit of capacity, involves a huge expenditure today and the carrying of substantial excess capacity for a long time. The huge plant also locks us into a fixed technology, limiting future options for a long period of time. On the other hand, industrial expansion may be constrained by limited excess capacity.

The problem can be illustrated by Figure 5

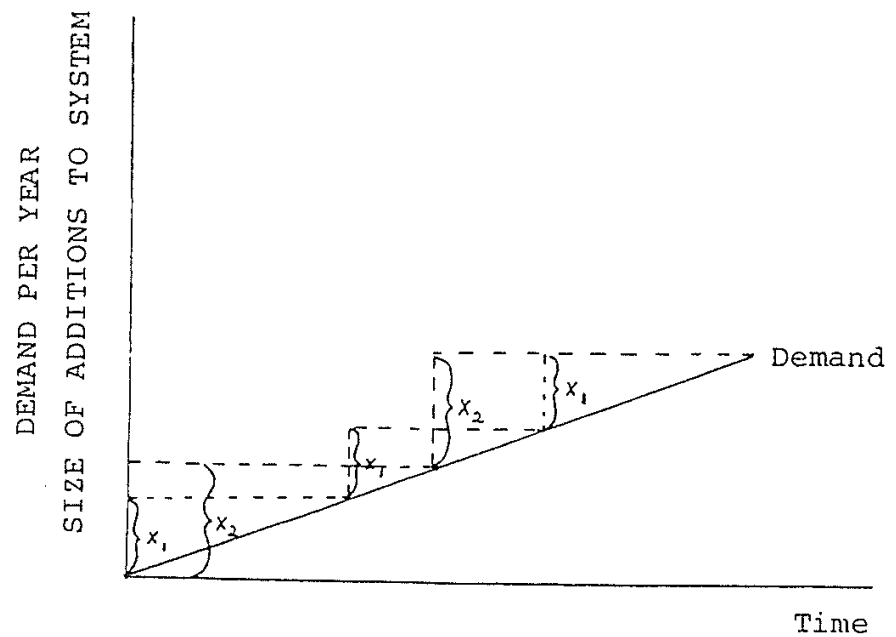

FIGURE 5 SEQUENCING OF ADDITIONS TO A SYSTEM

The size of the additions is specified as x_1 (smaller additions) and x_2 (larger additions). In this case, two larger additions would provide the required capacity for about the

same time period as three smaller additions. In this illustration it has been assumed that no shortage is permitted to occur, "a policy that may make little sense in practice since occasional shortages during unusual drought may be much cheaper than carrying great excess capacity" (Howe, 1971:91).

Figure 6 illustrates a situation where occasional shortages are permitted.

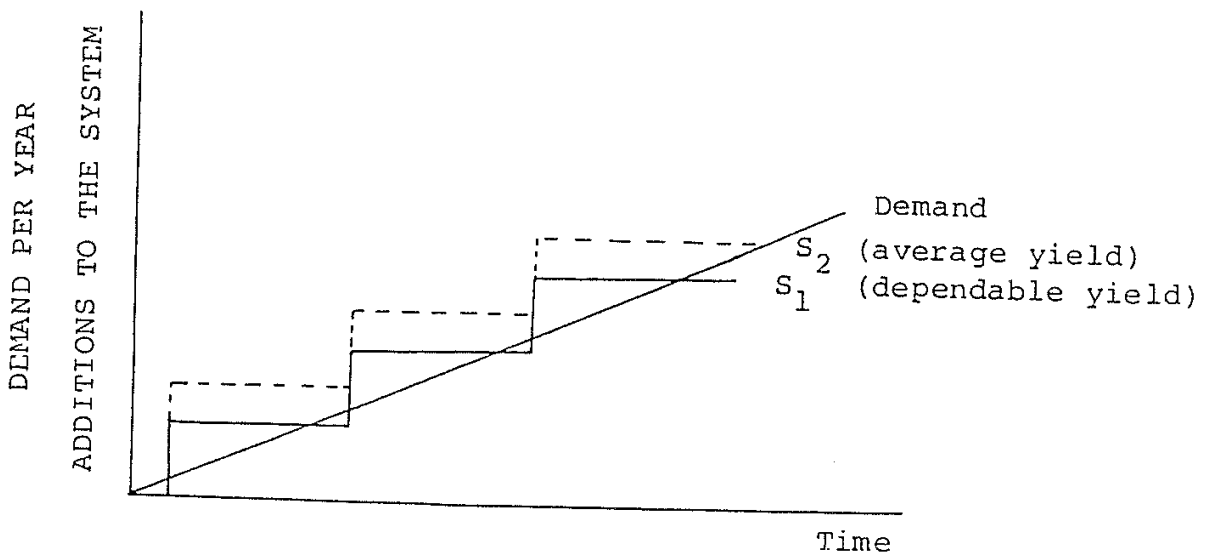

FIGURE 6 ADDITIONS TO THE SYSTEM

In this illustration S_1 represents the dependable yield from a given storage, and S_2 represents the average yield from that storage. In this case, dependable yield may dip below demand during times of drought, resulting in minor shortages. However, in the absence of prolonged drought, average yield is often well above the demand. Thus, from the

standpoint of government and water planners this does not represent a critical situation. From the viewpoint of those who live in the community and operate businesses dependent upon an assured supply of potable water, the situation takes on emergency proportions.

Since governments are faced with the problem of allocating limited resources between competing demands their outlook tends to focus on probability as opposed to possibility. In terms of water supply, the government's objective is to derive the timing and size of additions to the system that will meet demands at minimum present value of all costs. In practice, an optimum solution to these sequencing problems is difficult to determine. The solution usually involves the mathematical representation of the entire sequence of costs appropriately discounted. Unfortunately this method has many inherent failings. Economists, for all their quantitative techniques do not have any clearer vista of the future than any other group. They cannot predict future costs or future physical, political or social developments. In fact, their vision may be particularly myopic since predictions are based primarily on projections of past trends. Projecting past trends ignores possibilities and the dynamics of development.

Largely overlooked is the fact that the Morden-Winkler-Altona area is atypical of other rural areas. For example, the major towns in the study area have grown much

faster than comparable Manitoba towns in the decade from 1970 to 1980. In addition, population decline in rural areas has been slower than in the rest of Manitoba's rural areas. According to a preliminary report on the Assiniboine South-Hespeler Area Projects:

> Underlying the population growth, has been a strong economic performance characterized by agricultural diversification, intensification, and the addition of manufacturing facilities in several towns. the emergence of new crops such as corn, potatoes, sunflowers, and rapeseed has dramatically altered the previous wheat economy. New industries have included metal fabricating, agricultural processing, and transportation equipment. (Decter and Framingham, February, 1982: executive summary, p. viii.).

Emerging from this assessment are several important factors relevant to projecting regional development. For one, the situation has changed with the introduction of new crops and the farming community has demonstrated an ability to adapt to viable alternative types of crops and methods of production. In association with agricultural performance there has been a growth of related industries. More importantly, has been the ability of towns to attract "footloose" industries, or industries which are free to locate where they will since they are neither material nor market-oriented. This develoment may be related to, among other things, the presence of dynamic individuals or attractive labour markets. Certainly all of these circumstances are factors in determining future growth and demand for water.

Projections of past trends, however, have not accounted for these dynamics of growth. Overlooked is the fact that these communities have demonstrated a capacity for development in the face of water shortages. Overlooked is the propensity for Mennonites to re-invest in their own communities. Overlooked is the fact that irrigation of large acreages would make a definite departure from past trends in agricultural production. In other words, a more accurate method of projecting future demand may involve the use of scenario analysis which projects economic development possibilities and related water use.

5.2.2 Previous Projections

Previous studies have made projections of future water demand, based on only one or two parameters. In view of the limited information base, these projections could easily be disputed. Yet it is impossible to plan without making projections, and therein lies the conundrum. What standardized format does one use to predict the future? Recently, planners have attempted to correlate more information in search of an all-embracing formula. They have looked for a relationship beteen water use and factors such as cost, population growth rate, etc. However, projections for the most part have assumed that there will be no change in the relationship of factors. A simple projection of past trends

can be very limiting. This section questions some of the previous projections and briefly discusses the advantages of scenario analysis.

Based on an average annual growth rate of just over 2%, PFRA (1981) projected in 1981 that Altona's population would increase from 2,680 in 1980 to 4,690 in 2005 -- an overall increase of 75%. Given a 75% increase in Altona's population, zero growth in Gretna and Rhineland, and a slight increase in per capita water consumption, PFRA projected that the area would require 670 dam^3 (536 acre-feet) by the year 2005 -- an increase of 81% (Canada PFRA, 1981:7).

Between 1966 and 1981, Altona's population increased from 2,129 to 2,757 (Table 2). In other words, the population increased by 29.5% over a 15-year period at an average annual rate of 1.75%. During that same period, water demand increased 220% at an average annual rate of 8% (Table 3). At that rate Altona's water consumption could double from 274 acre-feet in 1981 (Table 1) to 548 acre-feet in 1990. It may be unrealistic to expect that level of exponential growth to continue but this example demonstrates that projections are made on the basis of very limited information. The problem is that these projections often become self-fulfilling. For example, by constraining the availability of water, industrial development is also constrained.

Projections of Morden's water demand provides another example of projections based on limited information

TABLE 2

POPULATION OF SELECTED TOWNS

	1956	1961	1966	1971	1976	1981	TOTAL GROWTH	%CHANGE 1956-81	AVERAGE ANNUAL RATE OF GROWTH 1956-81
ALTONA	1,698	2,026	2,129	2,122	2,480	2,757	1,059	62.4%	1.96%
GRETNA	603	575	561	510	510	545	- 58	- 9.6%	- 0.37%
MORDEN	2,237	2,793	3,097	3,266	3,883	4,579	2,345	104.7%	2.91%
WINKLER	1,634	2,529	2,570	2,983	3,750	5,046	3,412	208.8%	4.61%

SOURCE: Manitoba Department of Industry and Commerce. Manitoba Community Reports, 1978 (1956-76 data). Canada Census 1981.

PERCENTAGE CHANGE IN POPULATION

(5 year periods)

	1956	1961	1966	1971	1976	1981
ALTONA		19.3	5.1	0.0	16.9	11.2
GRETNA		- 4.6	- 2.4	- 9.1	0.0	6.8
MORDEN		24.9	10.9	5.5	19.0	17.9
WINKLER		54.8	1.6	16.1	25.7	34.6

TABLE 3

ANNUAL PERCENTAGE CHANGE IN WATER CONSUMPTION

1966-81

	1966	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	AVERAGE
ALTONA	13	19	- 4	12	6	12	2	0	16	7	11	0	10	11	8		+ 8.0%
GRETNA	16	7	- 1	6	3	31	1	-10	7	55	5	-19	7	- 5	8		+ 7.4%
RHINELAND	57	-38	-47	20	50	14	38	22	86	- 9	-38	+28	- 5	8	13		+13.3%
WINKLER	21	47	12	16	- 8	- 3	14	10	18	18	12	- 1	13	4	10		+12.2%
MORDEN	14	-11	17	-14	9	5	0	12	9	- 2	- 4	- 2	3	3	--		+ 2.8%
TOTAL	15	3	12	- 3	4	5	3	9	13	6	3	- 1	7	5	--		+ 5.8%

which inevitably become self-fulfilling. Assuming a population growth rate of 1.6% per year compounded, and an annual increase in per capita usage of one gallon per capita per day, the Manitoba Water Resources Branch estimated in 1973 that demand in the year 2000 would double to 880 acre-feet (Canada PFRA, 1973:11). A doubling time of 27 years represents an average annual percentage change in water consumption of 2.6%. In this case, that is the rate at which Morden's annual consumption increased between 1966 and 1980.

However, one might question whether this rate of growth may have been higher, had surplus water been available. Morden's water demand actually peaked in 1975 (Table 1). That may be partially attributable to the fact that Morden's water demand exceeded annual dependable yield by 1972, and serious drought occurred in 1976, 1977 and 1980. Given, a surplus of water, indications are that there is a demand for it. For example, with the impending expansion of the Morden reservoir, J. Cousin, senior engineer from "Agri-Water" requested the Water Resources Branch July 15, 1980, to supply Cheval Water District with 320,000 gallons per day (430 acre-feet per year) (Manitoba Water Resources, correspondence). PFRA responded July 25, 1980, writing:

> If such a demand were realized there would be insufficient water in the reservoir to meet both town and rural requirements.

Mr. Cousin was apparently overly optimistic and after consultations with PFRA his request was revised to "...a more

realistic demand...in the order of 100,000 gallons per day or 135 acre-feet per year" (PFRA, correspondence). Obviously by limiting water supply the growth in demand is also limited and projections can be made to come true.

Since predictions of the future vary according to who makes the predictions and which information they use to make those predictions, all would-be seers should recognize that theirs is an inexact science, constrained by the state of the art. Rather than attempting to find a correlation between various factors, in the search for an all-embracing formula to predict the future, planners may be better advised to do scenario analysis. This approach accounts for changes in relationships between factors. Scenario analysis considers the possibilities and recognizes the uniqueness of each area. Scenarios must be developed to project demand under various development strategies. To do otherwise is to be extremely short-sighted.

5.3 CONCLUSION

This chapter has examined the water supply situation for the Towns of Morden, Winkler and Altona. Winkler is the only town with sufficient excess capacity to meet rising demand. In the case of Altona, demand has been met but supply is tenuous during drought because of: (1) limited reservoir capacity at Neche; and (2) the nature of the agreement between Neche and the Manitoba Water Services Board

which permits Neche to curtail supply to Manitoba communities. Morden's water use exceeded annual dependable yield in every year since 1972. As a result of this situation, between 1975 and 1980 Morden's water demand declined by 2%. Meanwhile, between 1975 and 1981, water use in Altona increased by 47% and water use in Winkler increased by 56%. There would appear to be some correlation between increasing demand and water supply.

Despite limitations in water supply in Altona and Morden, both towns have experienced rapid growth between 1971 and 1981. During that period Altona grew by 30% and Morden grew by 40%. In comparison, Winkler's population increased 69%. Obviously, water supply is not the only factor affecting population growth. However, it is indisputable that a tenuous water supply will not attract any water using industry. Prior to the expansion of the Morden reservoir in the fall of 1981, it is unlikely that Morden could have attracted any new water using industries. Similarly, Altona has little chance of attracting water using industries under existing supply conditions.

The conventional approach to supplying water has been one which requires the municipality to prove to the Water Services Board that a need exists. Understandably, the Water Services Board acts only after the situation has become extreme because it makes good economic sense to defer investments as long as possible. From their point of view it does

not make sense to build extra unused capacity. However, LRRVWC has long argued for augmented water supply in the interests of regional economic development. LRRVWC has seen the opportunities foregone and untapped potential. Government departments, however, have been little interested in possibility, focusing instead on probability based on extrapolating past trends. Probabilities of course often become self-fulfilling, leading the projectors to sometimes believe that theirs is a value-free science.

This chapter has demonstrated that water management is anything but a value-free science. There is really no absolute technological "fix" of resources. Decisions depend on political considerations, contractual arrangements, the status of other projects, the availability of funds, the changing predilections of planners and developers, and a myriad of other factors. This chapter has also shown that decisions are based on limited and imperfect information. The problem with this is that, from the developers' perspective, planners are wasting time and money on innumerable studies which invariably yield different results. From the planners' perspective, their analysis is an accurate representation of the facts. However, this is disputable in view of the large number of decision-making factors, and the limited information base used by the planners. For example, there has been an overreliance on projecting past trends. This approach

ignores the changing relationship of factors and the opportunities which could be provided by an assured supply of potable water. The result has been a worsening water supply situation and dissatisfaction on the part of development proponents.

Fortunately, the Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing, has recognized that:

1) the area's economic development has been constrained by a lack of potable water; and
2) there is a need to take a new approach to water planning.

That new approach is one which sees the link between water development and regional economic expansion.

Over the last twenty years, the major towns have been provided with a potable water supply, but in all cases this amount appears inadequate to meet the area's long term needs or to permit significant municipal expansion. At the moment there is no long range strategy to meet these needs. To limit future growth of secondary centres, and the subsequent stimulation of the regional economy, because of insufficient water, represents short-sighted economic planning in the extreme. To lack water for domestic, municipal and industrial use is to lack the most basic of infrastructure needs.

CHAPTER VI

IRRIGATION BENEFITS RECONSIDERED

6.0 INTRODUCTION

Water management in the Red River Basin has progressed through three distinct phases. The first phase, extending from the earliest period of settlement until 1969, is characterized by the recognition that water and related land management is inextricably linked with regional economic development. Aware of the need to develop agriculture and agriculturally related industry, the Province promoted development by assisting the municipalities to drain land and develop water supply systems. These water development projects were largely regarded as preliminary steps towards the eventual implementation of a comprehensive water management and regional development strategy. During the second phase of water management, between 1969 and 1980, the Province largely ignored LRRVWC efforts to develop a comprehensive water management strategy. The NDP administration, 1969 - 1977, focussed instead on priorities of northern development, the construction of hydro projects, and the reduction of regional disparities. The Conservative administration, 1977 - 1981, was pursuing a policy of fiscal restraint. During this period, 1969 - 1980, water problems impacted severely on the region's development. Expansive floods occurred in 1969, 1974, 1975, 1978 and 1979. Severe drought occurred in

1973, 1976, 1977 and 1980. It also became apparent that municipal water supplies in growth centres such as Altona, Morden and Winkler were insufficient to permit any significant municipal or industrial expansion. In view of the negative effect which these problems exerted on the region's development potential, and the lack of alternative options for economic growth in Manitoba, the Provincial Government embarked on the third phase of water management, primarily in response to a Federal initiative. This third phase was signalled by the signing of the Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing. The purpose of the agreement is to enable Canada and the Province:

> to improve the potential for economic and socioeconomic development in Manitoba by alleviating the constraints imposed on economic performance by recurrent water shortages and droughts [Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing, 1980: section 2(1)].

Recognizing the need to view water management from a broader perspective, the Agreement states:

> The problems associated with periods of drought and their constraining effect on economic performance have emphasized the importance of a longer water development program to relieve constraints of economic growth (Canada-Manitoba Interim Subsidiary Agreement. Schedule A. 1980).

Thus, there has recently been a shift from investigating small site-specific water supply projects to a more embracing water management program. There are three major reasons for this shift:

1) most remaining town water supply problems are not readily solvable based on site-specific projects;
2) drought and near-drought conditions recently experienced in Manitoba have prompted a desire to drought proof the economy; and
3) the potential for special crop production presents an opportunity for economic growth.

Therefore, there is presently a renewed interest, on the part of Provincial and Federal Governments, in developing a large scale water supply and irrigation project. To this effect investigations are now being conducted on the Assiniboine South-Hespeler Area Project. This scheme envisions the irrigation of 264,450 acres. Total project costs over the 50-year project life, at discount rates of 5 and 7 percent are $218 million and $226 million respectively (Decter and Framingham, 1982: executive summary).

Given the possibility of a large scale irrigation and water supply project, this chapter examines some of the potential beneficial and detrimental benefits of such a project.

6.1 IRRIGATION PROSPECTS REVIVED

Visions of mega-irrigation grew from the fear of a recurrence of 1930's type drought and from the implicit faith in growth and progress extant during the 1950's and 1960's. Given a desire to drought proof agricultural activity and the inherent faith in large scale water development projects, the Pembina project was promoted as a means by which the Pembina Triangle could achieve economic growth and social stability. Even by omitting the secondary and tertiary economic benefits of irrigation, the IJC showed the plan of development to be cost-effective. Thus, there was a weak argument made concerning the need for irrigation. Instead, it was, more or less, assumed that irrigation would strengthen the regional economy in the Pembina Triangle:

1) by reducing the risk and uncertainty associated with moisture deficits; and
2) by permitting the growth of specialty crops, particularly horticultural crops, which would spawn the expansion of food processing industries.

The new Provincial Government which assumed office in 1969 was unconvinced of the merits of the Pembina project for any of a number of possible reasons. For one, although irrigation would reduce risk for irrigators and food processors, the number of farmers so protected was relatively small. For example, the Pembina project would only irrigate

12,800 acres or 20 sections of land. Therefore, the argument that irrigation would reduce risk associated with moisture deficits was not particularly valid from a broader Provincial perspective. The Pembina project also represented a significant social transfer of wealth to relatively few people in an area where the existing agricultural sector is viable, and if not wealthy, at least relatively prosperous. The redistributional effects of a public project merit consideration. Yet, these effects were not evaluated. In addition, at the time that the Pembina project was rejected, there were other growth sectors in the Provincial economy, competing for limited public funds.

From a federal perspective, irrigation dollars could, more profitably, have been spent in areas with a longer growing season or in areas where irrigation was a necessary input to production, rather than merely supplementary in nature. The argument that irrigation would permit the production of higher value special crops was not particularly valid either, since special crop production was occurring in the absence of supplementary irrigation. For example, in 1961 the Aylmer-Del-Monte plant at Morden contracted with 73 producers to grow about 1880 acres of peas, beans and sweet corn (Sawatzky, 1963:86). In 1971, sunflower production reached a high of 195,000 acres (Red River Valley Echo, February 15, 1978). Thus, the area was already producing special crops and even without a major canning industry,

the major towns in the region were quite highly industrialized, particularly in comparison with other similar sized Manitoba towns. Thus, although the Pembina project was cost-effective (i.e. benefit-cost ratio greater than one) and offered regional benefits, the benefits were not sufficient on a broader scale to convince Provincial authorities that the plan of development be implemented.

More recently, interest in supplementary irrigation has been revived particularly on the part of Provincial and Federal Governments. Indicative of this revival is the signing, in 1980, of the Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing. Under terms of the Agreement, a study is being conducted on the Assiniboine South-Hespeler Area Project which would divert water from the Assiniboine River to irrigate 264,000 acres.

This large irrigation scheme has, for a variety of reasons, twigged the interest of both the Provincial Government and the Federal Government through the Department of Regional Economic Expansion (DREE). The signing of the Agreement indicates a desire to expand agricultural production and drought proof a significant portion of the agricultural sector. Recent interest in strengthening the agricultural sector has sprung partly from the realization that Manitoba has few alternative options for growth. Agriculture is a significant component of Manitoba's economy and represents a potential growth sector.

As an indication of agriculture's importance to the Manitoba economy it is necessary to examine Manitoba's economic performance in 1980 and 1981. The Manitoba economy experienced a disastrous year in 1980 but recovered well in 1981 with real Provincial growth reaching 3.3 percent, the third highest rate in Canada (Canada DREE, 1982:1). More than half of Manitoba's real output growth during 1981 was accounted for by agriculture which achieved a real gain of 32.3 percent over 1980 (Canada DREE, 1982:18,1).

> Agriculture's contribution to total provincial growth is even more impressive given the fact that this sector accounts for approximately 8 percent of the economy, on an historical basis. Statistics for 1981 are somewhat misleading, however, as for the most part, they reflect a normal recovery from the disastrous level of agricultural output achieved in 1980. Poor growing conditions during that year decimated a large portion of the provincial crop, and total agricultural output declined by 15 percent compared to 1979 (Canada DREE, 1982:18).

In view of agriculture's contribution to the performance of the Manitoba economy, the harsh economic environment and the lack of major capital projects in the Province, efforts should be made to improve the performance of the agricultural sector. The Pembina project did not go far enough towards achieving this goal. On the other hand, the Assiniboine South-Hespeler Area Project would drought proof a significant portion of the agricultural sector and would prevent serious declines in agricultural output such as was experienced in 1980.

Given that, escalating costs will seriously erode net farm income, despite increased production in 1981 and 1982, it may be advantageous to attempt to increase net farm income. This may be achieved by growing higher value specialty crops under irrigation.

According to a 1982 DREE report on the Manitoba economy:

> The context, then, for federal support to Manitoba's long-term development is clear: effective measures must be implemented to stimulate the economy and to establish the basis for self-sustaining growth (Canada. DREE, 1982:5).

Thus, the possibility of a large scale irrigation project has become a very real prospect. The next section of this paper examines, more closely, the need for irrigation and the potential benefits contributed by irrigation, to the regional and provincial economies.

6.2 THE BENEFITS OF IRRIGATION: RESOURCE BASE AND ECONOMY

The most important resource in the Red River Valley is fertile soil. Consequently, agriculture and agriculturally linked industries and services are the mainstay of regional economic activity. Of the 83 manufacturing firms within the area of the Pembina Valley Development Corporation in

1971, 20 had forward linkages with agriculture and 18 were backward linked firms* (Bond, 1975:21). A high level of employment is related to agriculture. In 1978, in the towns of Altona, Morden and Winkler, between 500 and 600 people were employed full-time in agriculturally related industry (Table 4). In these same towns there were about 265 seasonal jobs. In addition, Farm King Ltd. of Morden employed 55 workers to assemble farm equipment. In Carman, food processing, horticultural products and the sale of agricultural inputs provided employment for between 122 and 190 people, depending on the season.

Bond states:

> Agriculture, whether measured in terms of persons employed or cash value of output produced, remains as the predominant economic activity in southern Manitoba. A highly productive and economically robust farm sector is essential to the continued success of secondary and tertiary industries located in the region (Bond, 1975:17).

However, agriculture is susceptible to the weather. As a result, economic activity in the region is highly susceptible to the vagaries of the weather, most notably, moisture deficiency and drought. Unreliable rainfall affects the

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*Forward linkages with agriculture include: livestock and poultry feeds; fertilizer production; agricultural implements; custom machinery manufacturing and repair.

Backward linked agriculutural activities include: abbatoirs and meat processing; dairies, creameries and egg processing; seed cleaning and milling; and vegetable processing and vegetable oils.

TABLE 4

EMPLOYMENT FIGURES FOR AGRICULTURALLY LINKED INDUSTRY IN THE AREA INCORPORATED UNDER PEMBINA VALLEY DEVELOPMENT CORPORATION

LOCATION	INDUSTRY	ACTIVITIES	PERSONNEL
Winkler	A.A. Kroeker	potatoes, cereals, grains, hogs, cattle	100-199 inc. sesasonal
Altona	C.S.P. Foods Ltd.	vegetable oils	125
Winkler	Southern Manitoba Potato Company	potato processing	75-79
Morden	Morden Fine Foods Limited	processing beans, peas, carrots, corn	50 (+ 100 seasonal)
Winkler	Kroeker Seeds Ltd.	seeds, chemicals, machinery	30-49
Winkler	Four Seasons Potatoes	potato processing	30-49
Winkler	Manitoba Dairy and Poultry	dairy products	30-49
Winkler	Winkler Wholesale Meat		10-29
Morden	Pembina Poultry Packers Limited	poultry processing	4 (+65 seasonal)
Morden	Domtar Fine Paper Limited	flax straw processing	15
Morden	J.P. Riediger and Sons	feed and fertilizer distributors	12
Winkler	Winkler Potato Company	potato processing, livestock feed, & seed cleaning	9 or less
Altona	Altona Feed Service	poultry and livestock feed	8
Morden	Morden Creamery	creamery storage	8

choice of crops and results in production levels which are less than optimal. In 1967, the IJC stated:

> Agricultural risks associated with marginal and variable rainfall have strongly influenced the selection of crops, farm practices, and the economy of the area. The success of agriculture and its related industries is primarily dependent on the adequacy and timely occurrence of rainfall during the growing season. Moisture required for full crop production is approximately 20 inches a year, if ideally distributed. Precipitation during the growing season seldom exceeds 13 inches. During the past 42 years the annual moisture requirements to supplement rainfall have varied from 6 to 14 inches, and during six years of drought exceeded 12 inches a year (IJC Report, 1967:12).

While the magnitude and impact of water shortages vary, moisture deficits of some level can be detected in almost every year (Tyrchniewicz, 1979:1). "The uneven and nonoptimal distribution of soil moisture was shown to significantly reduce yield of cereal grains and oil seeds in every crop reporting district" (Tyrchniewicz, 1979:62). Thus, irrigation would increase agricultural output and would lessen the region's vulnerability to climatic fluctuations.

The Pembina River Engineering Board, in 1964, envisioned irrigation primarily for the purpose of improving dryland crop yields. The Board speculated that:

> Irrigation development would modify farming practices by increasing and stabilizing production from crops and livestock. More abundant and more stable feed supplies would be conducive to diversified livestock enterprises. The trend in present farm organization is to increased

> livestock production, and it is anticipated that this trend would be more pronounced with irrigation development. Potato production would continue to be the principal cash crop, and barley and hay would be grown principally for livestock feed (International Pembina River Engineering Board, 1964: Volume III, Appendix F, p. 229).

However, irrigating to close the gap between potential output and output from dryland farming techniques is not particularly cost-effective. It is difficult to justify large public expenditures for works designed to increase the yield of forage and cereal crops, especially in an area which has adjusted well to unfavourable growing conditions.

However, the area is advantageously endowed climatically to permit the cultivation of special crops. Given the physical characteristics of land and climate, intensive land use, a demonstrated capacity to adapt to new crops and new agricultural techniques, the area has long been considered as one of the few areas in the northern Great Plains to present the potential for large scale production of special crops.

The possibility of growing horticultural crops attracted considerable attention during the 1960's. Various LRRVWC briefs to government speculated that horticultural crop production could promote the expansion of food processing industries, providing employment and encouraging the growth of vibrant towns. Concurring with this opinion was a massive report by the Committee on Manitoba's Economic Future (COMEF) (1963), which had been commissioned by the Provincial

Government to report on measures for promoting and accelerating the growth of Manitoba's economy. A follow-up study by the Commission on Targets for Economic Development (1969) also supported the Pembina project (1969:169).

LRRVWC and COMEF were particularly interested in creating jobs. The slow rate of job creation in rural areas traditionally expressed itself in out-migration statistics, as opposed to resident unemployment. Unfortunately, the out-migrant population was over-represented by the very people who are needed to build future growth; the young, educated, and entrepreneurially adventurous. Thus, out-migration could be viewed as a contributory factor, rather than a symptom of slow growth. It was also felt that increased yields and special crop production would result in increased per capita income and increased profits, which are a key ingredient of economic expansion. In the final analysis, irrigation was regarded as the socio-economic salvation of this predominantly agricultural area.

6.2.1 THE CANNING INDUSTRY

Despite the absence of large scale irrigation there have been a number of efforts to establish a viable canning industry in the Pembina Triangle.

The canning industry dates back to 1945, when a group of farmers from the Reinland district, with the assistance and advice of the Dominion Experimental Station at Morden, set up a one-room, hand-operated cannery, to can locally

grown sweet corn (Sawatzky, 1963:83). During the off-season portions of 1946 and 1947, in an effort to reduce fixed costs, the cannery was leased to the Mennonite Central Committee which processed meat for European relief. Prospects were promising and the plant was expanded in 1947. In the same year, a cannery opened in Winkler. The following year witnessed a disastrous drop in prices, and the shakily-financed, heavily-indebted Reinland operation was forced to terminate operations in 1949.

The Winkler cannery, financed privately by Manitoba Canners, contracted for 2000 acres of canning crops in 1947. However, construction of the cannery was not completed in time and most of the crop was lost. In 1948, attempts were made by a new company called Prairie Canners, to re-establish the cannery. However, underfinancing forced down the scale of operations. In 1957, the growers bought out the company, and reorganized it as Co-op Prairie Canners. Financing was provided, in part, by the required purchase of $50.00 share capital for each contracted acre of peas and corn.

The Aylmer-Del-Monte plant at Morden commenced operations in 1952, contracting with 200 growers. The number of growers was reduced to 73 in 1961 for two reasons:

1) large contracts insured that for the farmers involved it was imperative to their survival that yields be of high quality and volume; and,

2) growers with large acreages contracted, could grow several different canning crops, reducing the risk of crop failure.

In contrast, Co-op Prairie Canners contracted to a greater number of small one-product producers which reduced planning and production flexibility (Sawatzky,. 1963:86).

During the 1960's, both Campbell's and Green Giant exhibited considerable interest in establishing plants in the area. They chose not to locate because of the lack of an assured supply of water for irrigation and processing. Without irrigation water, yield and quality cannot be guaranteed. This presents problems for growers and processors. Erratic year-to-year quality and production volume makes it difficult to negotiate and maintain contracts with food distributors and wholesalers, especially for small independent producers. Lost accounts are hard to replace and new short-term arrangements usually require the granting of a price premium.

In view of these problems, it is not surprising that in 1982 there was only one vegetable cannery in Manitoba. The plant, known as BESTPAC, operated between 1970 and 1978 as a ward of the Manitoba Government, under the name Morden Fine Foods. After the former owners, Canadian Canners Ltd., decided to shift operations to Ontario, the plant was purchased by the Provincial Government for $220,000 with the hope of maintaining seasonal jobs and vegetable production in the area. The Manitoba Development Corporation invested

another $2.8 million in new equipment but the plant lost money in seven of eight years between 1970 and 1978.

Proceeding with an election promise to privatize government owned firms, the Conservatives sold the plant to Morden farm machinery-maker, John Buhler for $1 million. Losses continued for 2 1/2 years, changing to a profit situation in 1981. However, success is coming not from the green vegetable operations that once constituted the largest part of capacity, but rather from strong sales of pork and beans and juice products. It was discovered during the drought of 1980, when production and sales of peas, corn and beans were halved, that these products were the source of the red ink.

According to John Buhler:

> The drought forced us to discontinue the green vegetable canning and we found out by accident where the losses were coming from. The fresh produce won't keep in storage - it has to go directly from field to processing - so at harvest time we had to can and stock up. With thousands of cases on hand and major distributors usually offering prices below cost of production, we were faced with unprofitable sales or added costs of carrying the inventory.
>
> This may have been viable when interest rates were under 10 percent, but it can't be done viably today (Winnipeg Free Press, Cannery in the Black After Owner Finds Greens Gave Plant Financial Indigestion, June 6, 1981).

Thus, it was discovered that the profitable lines were the ones which operated on a year-round basis, using easily stored dried beans and juice concentrates. Most of

the beans come from Reg Stow, a Carman area grower, while the juice concentrates are imported mainly from Brazil. In 1981, the plant was operating at only 60 percent capacity, with a permanent staff of 12 which expanded to 30 at peak packing time. This compares with a staff of 50, plus 100 seasonal workers in 1978 (Table 4). The green vegetable canning equipment remains ready for use but it will be used only when it becomes economically feasible to do so.

Irrigation would alleviate production uncertainties. However, given the limitations of our climate, the harvesting and processing season for perishables cannot be extended much beyond five weeks. Therefore, processing plants in the area will have a higher production capacity and capital commitment relative to their production output than competing plants in more climatically suitable areas. For example, plants in California, the Fraser Valley, or the Niagara Peninsula can amortize their fixed costs at a lower rate of return since they can operate more months of the year. These other areas are also favourably located in relation to nearby large markets. Given a disadvantageous position, vegetable production and processing may not be profitable even with irrigation.

Today, the prospects of the Pembina Valley becoming a major vegetable producer, have diminished. As recently as the late 1960's, entrepreneurs and senior administrators believed that the Pembina project could accomplish important

social and economic goals. However, attitudes and conditions were different then. Growth, was the hallmark of the 1960's and many people espoused faith in the trickle down theory of economics. The accepted belief was that, as long as the economy was growing, everyone would benefit. Hence, it mattered little, that very few farmers would actually benefit directly from the Pembina project. The Project was viewed as a stimulant to growth and the future envisioned was one of new food processing industries, more jobs, higher levels of income, growing towns and an increased level of demand for goods and services.

Perhaps that viewpoint was well-founded, especially in an area settled predominantly by Mennonite people who had a propensity to reinvest in their own communities. However, today, society as a whole seems less willing to accept that economic indicators such as: increase in Gross National Product, increase in per capita income or traditional benefit - cost analyses are the sole criteria of progress. Especially in a slow-growth economy, government would be hard-pressed to justify a large public expenditure to benefit an area, which although not affluent, is at least relatively prosperous.

Thus, it seems reasonable to conclude that despite the potential for producing horticultural crops and the long history of attempts to bring such an eventuality to fruition, there will be no large scale irrigation project in the near future with the express purpose of making the Pembina Valley

a major vegetable producer. There will, however, be irrigation on a smaller scale and that development will likely be geared to:

1. the expanding demand for those crops not suited to dryland production; and
2. a shift in competitive advantage, favouring local production over long-haul transportation of vegetables.

6.2.2 The Assiniboine South - Hespeler Area Project

Preliminary analyses have shown the Assiniboine South-Hespeler Area Project to be cost-effective but the primary returns are not particularly high. It is anticipated that irrigation will increase yields of feed corn by 20 bushels per acre under normal conditions and by 50 bushels per acre under drought conditions. That means that, at a price of $3.85 per bushel, the benefits will range between $77.00 and $192.00 per acre. To achieve those results will require a public expenditure of about $226 million ($850.00 per acre in 1982 dollars), plus the cost to the individual farmer of converting his operation. Solely on the basis of primary returns this project may be cost-effective but cost-effectiveness does not, in and of itself, justify a large public investment.

Since a project of this magnitude would provide a significant public subsidy to an economically stable population of predominantly middle income people, the project must

also demonstrate a capacity to contribute to the larger regional, provincial and national economies. To this end, the Federal Government has commissioned a drought sensitivity analysis which will determine the impact of droughts of various duration, upon the economy. By constructing a model which recognizes the forward and backward linkages of agriculture with the Manitoba economy, an economic development strategy can be devised. Such a strategy may include a future which utilizes large scale irrigation to achieve economic and social goals.

There are, however, other considerations besides economic viability. Because of the potential damaging and irreversible effects of large scale irrigation, it is imperative that the public be made aware of the potential effects. Then, it should be a public decision to proceed or not to proceed, for it is they who must ultimately make the project successful. A project of this magnitude demands that certain tradeoffs be made. Different objectives are often not mutually exclusive, and, hence, contributions to one can only be made at the expense of others. In an effort to avoid discontent and to maximize benefits, it is necessary to speculate on the potential costs of irrigation.

6.3 Potential Negative Impacts of Irrigation

Only recently has there been much attempt to evaluate the potential harmful environmental and social impacts of

large scale irrigation. Historically, the main objective of water resources development has been economic efficiency and the technique for its evaluation has been benefit-cost analysis. Benefit-cost analysis is based upon the efficiency criterion, i.e., benefits, to whomsoever they accrue, must exceed costs, to whomsoever they accrue.

> Gradually other objectives have emerged, and these in order of their emergence are regional income redistribution, environmental quality and social well-being (Biswas, 1973:746).

Inclusion of environmental quality and social well-being as objectives of water resources development has made the planning process less a function solely of objective criteria and more dependent on the perceptions and subjective analyses of planners. These added new dimensions have undoubtedly made the planning process more relevant and meaningful but at the same time they have rendered a complicated process further complex. Because of the speculative nature of projecting potential damaging effects of large scale irrigation, there is much room for disagreement. Therefore, this section of the paper does not attempt to project what the long-term effects will be. Rather, this section considers the conditions and attitudes prevailing when irrigation was being promoted as the economic salvation of prairie agriculture. With the benefit of hindsight, serious questions arise as to whether irrigation would accomplish the objectives it was supposed to achieve. By extension, one must also question whether large scale irrigation today would accomplish

the stated goals or whether other options could more readily accomplish the goals of economic growth, regional income redistribution, environmental quality and social well-being.

The drought of the 1930's is at the root of a long-standing desire to drought-proof agricultural and related economic activity. In Canada, the Federal Government's response to the drought was the enactment in 1935 of the Prairie Farm Rehabilitation Act (PFRA). PFRA promoted small scale soil and water conservation practices but these measures did not address the problem of protracted drought.

During the same period in the United States, a number of large-scale multiple-purpose reservoirs were constructed (Holmes, 1979:iii). In 1944, the Flood Control Act authorized the Pick-Sloan Missouri River Basin Project which was intended to divert Missouri River water into central and eastern North Dakota. This Act led to the construction of the Garrison Dam across the Missouri River, creating Lake Sakakawea in 1956. The 1944 Act also authorized construction of the Garrison Diversion Unit which would pump water from Lake Sakakawea, across the continental divide, and via canal, across the State of North Dakota. This provision, however, was not implemented and had to be reauthorized by the U.S. Congress in 1965 (Carroll and Logan, 1980:25,26,27). Two years later, the IJC recommended construction of the Pembina project. A characteristic of both of these projects was the almost total lack of environmental and social analyses.

To fully appreciate the lack of environmental and social concern, one must recall that the 1950's and 1960's was an era of grand designs. This was a period of economic growth unparalleled in human history. Characteristic of the time was unbounded and often, unfounded, faith in technology, modernization, progress and unlimited growth. For example, during the 1960's the focus of the U.S. Federal water research and development program was on weather modification and desalinization of ocean water (Holmes, 1979:iii). Desalinizing ocean water and irrigating the deserts of the world enjoyed almost hysterical endorsements in the U.S. throughout the 1950's and 1960's. In 1962, President Kennedy predicted such a possibility before the end of the decade (White, 1969:94). In 1966, a Special Commission on Weather Modification, appointed by the National Science Foundation, as well as the Environmental Science Services Administration, and a special panel appointed by the Academy of Sciences predicted the possibility of large-scale weather modification (White 1969:91). Gilbert F. White wrote in 1969:

> The very exciting aspects of weather modification ... lie in the possibility of changing the pattern of atmospheric circulation and thus affecting precipitation or temperature over large regions, as well as in dealing with catastrophic situations such as the routes of tropical hurricanes... (White, 1969:91).

The passage of time has proven these predictions to be greatly exaggerated. The mere fact that so much research effort could be devoted to something so improbable, indicates

a complete disregard for the delicate balance between ecosystems. It is, then, not surprising that the Bureau of Reclamation Report on Garrison in 1965 did not contain a single reference to the effects of Garrison on Canada (Carroll and Logan, 1980:29). In fact, the Council on Environmental Quality and the Environmental Protection Agency were not established in the United States until 1970 (Carroll and Logan, 1980:27).

Thus, there has, until recently, been a failure to recognize externalities and off-site damages associated with large scale water development projects. Similarly, farmers in the Red River Basin have tended to neglect long-term damage to their land. For example, while natural soil fertility remains high, 80 years of agricultural use and erosion has reduced the organic matter content of soils in the Red River Basin by over 50 per cent (Stobbe, personal communication). Increasing soil mineralization and excessive erosion have gone largely unnoticed primarily because the use of technology has more than compensated for any loss of production consequent to environmentally inappropriate practices.

It is also apparent that the decision to irrigate did not consider the long-term consequences. For example, a recent report on the Garrison Diversion Unit stated that:

> Once the newly irrigated lands have been flushed of their natural salts and nutrients, the affected land cannot be returned to dry-land farming within a relevant time frame (ten millenia, the time it took the existing soil to develop to its present state.
> (Carroll and Logan, 1980:18).

In addition to disturbing the natural equilibrium:

> ...irrigation water will flush from the soil salts that have accumulated there since the passage of the last ice age and will discharge them into the area's watercourses.
> (Carroll and Logan, 1980:16).

The flushing of salts and fertilizers can seriously affect the quality of water supply. Increased levels of phosphates and nitrates can cause algal blooms, leading to lower dissolved oxygen levels, thereby endangering aquatic life and aquatic dependent terrestrial wildlife.

Not only have the deleterious effects of irrigation been understated but the benefits have also been overstated. In the case of the Garrison Diversion Unit, the U.S. Environmental Protection Agency has been highly critical of the Bureau of Reclamation's environmental impact statement on water quality (Carroll and Logan, 1980:17). The U.S. EPA also purports that the harmful effects on waterfowl and wildlife will be far greater than originally envisaged.

Today, a significant number of people are questionning the wisdom of a scheme which will consume as much presently productive land in reservoirs, canal rights-of-way,

and other appurtenant works, as will be irrigated (Carroll and Logan, 1980:14). A 1980 plan of development called for the reclamation of 59,000 hectares of previously drained uplands to mitigate the loss of wildlife habitat. Thus, questions arise concerning the net benefit of a project which requires 59,000 hectares of mitigation area to offset losses resulting from the irrigation of 100,000 hectares.

As a result, of chronic cost overruns, questionable economic efficiency and the potentially harmful impact on the environment, important segments of senior planning have become increasingly disenchanted with large scale reclamation projects (Carroll and Logan, 1980:27). In fact, President Carter vetoed large scale reclamation projects in 1977, in an attempt to terminate wasteful "pork barrel" politics and the practice of "logrolling".*

In an article in the New York Times concerning the Carter veto, Adam Clymer claimed that Congress could hardly be expected to achieve objectivity until it learned to examine public works projects individually and not in omnibus bills (Carroll and Logan, 1980:28). In Canada, a large scale public works project like the Assiniboine South-Hespeler Area

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*The term "pork barrel politics" refers to government projects yielding rich patronage benefits, while "logrolling" is the practice of trading political favors for supporting various Congressional bills.
(Carroll and Logan, 1980:46,26)

Project, would likely be considered in a separate bill. While the decision-making process differs markedly between the two countries, decisions in both countries are, nonetheless, politically motivated. Since projects of this nature can sometimes create their own momentum, despite dubious merits, it is necessary for the public to guard against being swept along on a wave of optimism.

6.3.1 Potential Social Effects of Irrigation

Previous studies of irrigation projects have focused almost exclusively on the aggregate effect. In other words, previous studies have concentrated on the net economic gain resulting from yields attained under irrigation as compared to yields attained under dryland agriculture. Very little attention has been devoted to determining the income redistributional effects of irrigation or the effect of irrigation on individual farmers or the communities they are a part of. Instead, it has been more or less assumed that increasing farm incomes would have a positive effect on rural communities. It is possible, however, to envision a scenario in which irrigation could impact negatively on the "rural way of life".

For example, irrigation may provide major inducements for small farmers to sell their land. Since irrigation

implies the intensification of factor inputs and the utilization of different technology, some farmers, especially older owner/operators, may not be in a position to transform their operations. Given that anticipated benefits will likely drive up the price of land within the irrigated area, small farmers may be impelled to sell their land. That land would most likely be purchased by large scale farmers. Large operators have access to sufficient capital resources to acquire irrigation equipment and can take advantage of economies of scale, giving them a competitive advantage over small operators. Wider avenues of credit and a larger production base, over which to average a debt load also place the larger farmer in an advantageous position. Additionally, when it comes to horticultural crops, food processors may prefer to contract with several large suppliers rather than numerous small independent producers. The contracts give these operators the ability to refinance and carry a large debt load.

Excessive corporate concentration could have a deleterious effect on the rural way of life and on local service centres. Traditionally, rural communities have been characterized by a strong sense of community and interdependence. The Rural Municipalities of Rhineland and Stanley have been particularly cohesive because the area was settled primarily by a close-knit cultural-religious group, namely the Mennonites. The sense of permanence, derived from

a healthy community, serves to encourage the maintenance of services within the rural area. The corporate farmer, however, is often only minimally associated with the local community and tends to bypass local service centres, preferring to take advantage of economies of scale available from larger urban centres. In so doing, corporate farms may contribute to the disintegration of the local community and to diminished economic viability of local services.

On the other hand, one could argue that the presence of large wealthy farms in the area has helped to promote service centre growth. In any case, income redistributional impacts and social well-being are normative aspects of large scale irrigation to which policy makers will have to address themselves. Before implementing a large scale irrigation project policy makers will want to consider the following questions:

Benefits:

1. Who should benefit?
2. What groups actually do benefit?
3. What is the distribution of benefits among beneficiaries?
4. What is the current distribution of income and wealth among actual and among intended beneficiaries?

Costs:

5. Who should pay the costs?
6. What groups actually do pay the costs?
7. How are the total costs distributed among the burdened group?
8. What is the current distribution of income and wealth among the actual and among the intended burdened group?

(Gardiner, 1973).

6.3.2 Economic Considerations: Risk and Uncertainty

It has already been established that the economic stability of south-central Manitoba depends, to large measure upon the area's agricultural viability. That viability is subject to the vagaries of the weather, i.e., moisture deficiency, protracted drought, late spring and early frosts, and floods. Irrigation obviates the risk of moisture deficiency and alleviates production uncertainties marginally, but moisture deficiency is only one factor in the economic equation determining economic stability. To assume that irrigation begets economic growth and healthy communities requires a quantum leap of faith.

In fact, irrigation may increase the economic risk factors. The change-over from dryland to irrigated farming demands a high degree of capitalization and, in most cases, debt financing. This renders the farm unit vulnerable to economic pressures, while restricting avenues of retrenchment in times of economic recession.

In the case of growing horticultural crops, monopsonistic markets often develop, to the detriment of the farmer. Food processing is often controlled by multi-national corporations, which are extensively integrated, horizontally

and vertically. The contracting company often sells the farmer seeds and fertilizers, and sets the price for the product. The large integrated company has all the advantages in bargaining and the farmer may get locked into an alliance in which he has little control. Such development poses a serious threat to the farmer's traditional desire for self-determination. (For a more complete discussion of multi-national food processors and erosion of local autonomy see Donham, October, 1979).

6.4 CONCLUSION

For four decades, through the 1930's, 40's, 50's and 60's, large scale irrigation was widely regarded as the economic salvation of prairie agricultue. However, after deliberations on the Pembina project were terminated in 1969, the prospect for large scale irrigation appeared to wane noticeably during the 1970's. Growing environmental awareness and general disaffection for large scale projects did not bode well for irrigation in Manitoba. However, water problems were severe in the 1970's. Floods occurred in 1974, 1975, 1978 and 1979. Drought of some magnitude occurred in 1973, 1976, 1977 and 1980. It also became apparent that municipal water supplies were inadequate to meet any significant expansion in demand. Add to this a worsening economic climate, characterized by slow growth, and it is not difficult to see why interest in large scale water development

projects was revived. This renewed interest is expressed by the signing in 1980 of the Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing.

Recognizing the importance of agriculture to the regional and provincial economies, the Agreement authorized a study of the Assiniboine South-Hespeler Area Project, designed to irrigate 264,450 acres. Preliminary analysis has indicated that the project is cost-effective, although large-scale projects are known to experience chronic cost overruns, partly due to unforeseen effects. There are also many potentially irreversible environmental and social costs. Nonetheless, one can make a strong argument for large-scale irrigation. To this end the government is conducting a drought sensitivity analysis which projects the effect of irrigation on the regional and provincial economies. This is a very positive development for it goes beyond merely projecting primary benefits. This approach is not so much an attempt to justify a particular project as it is an attempt to devise an economic development strategy.

In view of the potentially irreversible damaging environmental effects which may accompany any large-scale irrigation project, it would seem imperative:

1. to consider alternative methods of achieving the desired economic and social goals; and

2. to project not only the "best case" scenario but also a "worst case" scenario.

Prior to accepting irrigation as the economic salvation of agriculture in south-central Manitoba, alternative avenues of stabilizing agricultural production and the regional economy should be assiduously pursued. If the potential for irrigation is just cause for its implementation, then what about the lost potential of water drained away? Similarly, technological advances in fertilization, plant breeding and weed control have significantly narrowed the gap between what was previously attainable under dryland practices, and what can reasonably be attained under irrigation. Institutional barriers affecting special crop production such as the availability of private contracts to market sugar beets, for example, must also be considered. Secondary economic activities are also restricted by factors other than agricultural production. For example, crushing plants are at a competitive disadvantage because raw rapeseed is moved at a lower subsidized rail rate than semi-processed products.

In other words, many of the problems in agriculture revolve primarily around farmers lack of economic strength to affect the price of agricultural inputs and outputs. Constant productivity increases have not made the farmer significantly better off. Nonetheless, decreases in productivity such as were experienced during the drought of 1980 have a damaging impact on farmers and on the Provincial economy.

Stabilizing farm incomes and increasing the viability of the regional economy are desirable goals, but irrigation may be only one of a number of methods to achieve those goals.

CHAPTER VII

THE CONTROVERSY OVER FLOODING

7.0 INTRODUCTION

It is generally accepted that the Red River Valley east of the escarpment is susceptible to flooding because of certain physical characteristics such as low slope, low stream capacity and low soil permeability. These factors do not in themselves cause flooding, as evinced by the fact that flooding does not occur every year. However, in conjunction with certain climatic conditions, they can combine to produce extensive floods.

Historic records indicate that major Red River floods occurred in 1776, 1798, 1809, 1826, 1850, 1852, 1860, 1861, 1882 and 1897 (Calton, 1979). Particularly severe were the floods in 1826, 1852 and 1861. Apparently, the 1826 flood was six feet higher than the 1950 flood at Pembina. Floods this century occurred in 1916, 1948, 1950, 1965, 1966, 1969, 1974, 1975, 1978 and 1979. All of these floods were less severe in magnitude than those which occurred in the early and mid-1800's.

Thus, it would appear that flooding is a natural event in the Red River Valley. However, most recently, the incidence of flooding appears to have increased. In the 15-year period between 1965 and 1979 there have been seven floods, while there were only three floods in the preceding

65 years. As a result, there is a growing conviction among residents of the Red River Valley that conditions have changed and floods will continue to occur with greater frequency than indicated by long-term averages. Therefore, many believe that present flood prevention and flood damage reduction measures are inadequate and major improvements are urgently needed.

Water engineers are largely of the contention that major floods are almost totally a consequence of climatic variables. Therefore, although they will admit that we have recently experienced a wetter than normal period, there is no proof that the climate has changed on a long term basis. Similarly, the engineers generally reject the popular notion that land use changes, road construction, and increased drainage have had any appreciable impact on flood frequencies. These attitudes have two important ramifications:

1) the long-term historic period is used to calculate flood frequencies; and

2) major floods are regarded as unpreventable.

Using long term historic records results in flood probabilities which are lower than they would be if only the last twenty or thirty years of record were used. This tends to reduce the benefit-cost ratio of flood damage reduction measures. As a result, in many instances, flood damage reduction is not economically feasible and relatively little action has been undertaken. Preventative action has taken the form of:

1) structural solutions such as levies, ring dykes, or flood pads; and/or

2) non-structural measures such as flood insurance, flood plain zoning, and improved flood forecasting techniques to allow for evacuation and emergency dyking.

Given that the climatic variable is uncontrollable, then engineers and insurance companies basically regard floods as "acts of God". "Acts of God" have for many years been addressed by senior levels of government providing compensation to the unfortunate victims. However, for those residents who must face anew the perennial flood threat every spring, inadequate levels of compensation are not regarded as a satisfactory solution. Similarly, ring dykes, forced evacuation, emergency dyking and flood plain zoning done after the fact, are regarded as wholly inadequate. From the flood victim's perspective, they are not so much the victims of an "act of God" as they are the victims of "inaction of government".

Public dissatisfaction and controversy between the public and water engineers have been hallmarks of flood plain management. Engineers are seen to be obstructionist, doctrinaire and supercilious. The public argues that the engineers have taken a too-narrow approach. A large segment of public sentiment favours the belief that environmentally appropriate land use techniques could greatly reduce the

frequency and magnitude of floods. The public also contends that long-term averages yield unrealistic flood probabilities. Water engineers refute these claims, arguing that they are not statistically supportable.

Given that flood victims want solutions to their problems, and no solutions have been forthcoming, it is only natural that opposing views tend to become more polarized. The result has been friction between flood victims and the technocrats whose attitudes are seen as impediments to the resolution of flood problems. It is worthwhile noting that in this instance, politicians, who are normally the policy makers, have somehow managed to insulate themselves from harsh criticism. In addition to examining the controversy between flood victims and engineers, this chapter discusses various pervasive attitudes and background institutions which impede changes in our approach to land and water management.

7.1 HUMAN IMPACT ON FLOODS

The controversy stems from the fact that in the last 15 years four floods have exceeded 50,000 cfs at the International boundary, whereas only two floods have exceeded that peak flow in the preceding 65 years. As a result, many questions are being asked regarding the cause of the apparent increase in flood frequency and severity in recent years.

An international forum on the causes of, and solutions to flooding, held November 30, 1979, at the Manitoba

Legislative Building, featured two diametrically opposed views on the subject. Robert Calton, assistant to the chief, U.S. Army Corps of Engineers, St. Paul, Minnesota maintained that man's activities have little or no effect on major flood levels. Lloyd Jones of the U.S. Fish and Wildlife Services (FWS) contended that wetland drainage and other human activities contribute significantly to flooding.

The arguments presented at this forum were similar to those which emerged at other forums held in Grand Forks and Fargo in the spring of 1979. The following section presents the arguments advanced November 30, 1979, as a case study, since they reflect the opposite extremes of the controversy. It should be added that the views expressed by Mr. Calton are not necessarily those of all water engineers, but his views do reflect the platform adopted by the Army Corps of Engineers. This agency makes many important decisions affecting water and land management in the United States and since Red River floods originate in the United States it would be instructive to examine the attitudes of the Army Corps of Engineers. Similarly the views of Lloyd Jones do not necessarily represent the official position of the U.S. FWS. Notwithstanding this disclaimer, Robert Calton and Lloyd Jones represent themselves as experts and their opinions indicate widely held views.

7.1.1 The Army Corps of Engineers' Evaluation of Flood Causes

Mr. Calton contended that people have over-reacted to the recent high incidence of floods. He pointed out that floods occurred long before the arrival of agricultural man and the climate has fluctuated from one extreme to the other over the course of the last fifty years. During the 1930's there was concern about too little water and in the 1960's and 1970's there was too much water. Mr. Calton attempted to convey the impression that climatic fluctuations are natural so recent floods must be viewed in light of long-term averages.

Mr. Calton then continued to dispel other "myths" and "misconceptions". For example, he stated that the amount of snow has never been correlated with floods and "...frost in the ground is not a major factor -- at least it can't be correlated with anything" (Calton, 1979; Presentation). Calton also stated that "...available evidence indicates that transportation facilities (i.e. roads, bridges and culverts) have had little impact on major flood occurrences" (Calton, 1979:7). Ring dykes were also absolved from having any measurable impact on flood elevations (Calton, 1979:10).

In terms of drainage improvements, Calton suggested that the evidence is inconclusive, even though drainage systems have recently been improved and many new drains have been added. He noted that on-farm drains are usually

accompanied by outlet channel improvements constructed and managed by organized political entities.

Mr. Calton cited a study by Moore and Larson which concluded that:

> ...enlarging and straightening main channels in small watersheds usually increase peak discharges by causing the water to be discharged in a shorter time and that drainage of depressional areas increases annual runoff, storm runoff volumes, and peak discharges (Moore and Larson, 1979:9).

Calton stated that this effect cannot be projected downstream, and concluded that there is no correlation between flood peak discharges and drainage development.

In terms of the recent construction of a continuous system of levees paralleling the Red River north of Grand Forks, Calton stated:

> About 36 miles of levees have been constructed in Minnesota and 19 miles in North Dakota. ...As presently constructed these levee systems probably have no measurable effect on flood flows at the international boundary. However, if unregulated levee construction were continued on both sides of the river to or near the international boundary, the loss of overbank storage could result in some increase in flood peak flows and river elevations (Calton, 1979:10).

Calton summarized his conclusions, stating:

> Based on our analyses of the many factors involved in and affecting runoff and river elevations, works of man in the Red River Valley do not appear to have had a significant effect on flood peaks on the main stem. Roads and bridges, channel improvements, drainage

> ditches, and local levees have changed upland pothole and marsh storage in many areas and may have increased or eliminated flooding in some areas, but the effects of such changes have not been measurable on the main stem. In some cases ice jams have raised river levels at points of channel constriction, but the backwater effect has generally diminished upstream so that the effects have been primarily localized. Drainage systems and channel improvements are, for economic reasons, limited in size and are most effective in reducing overflows during the more frequent smaller floods. To date we have found no sound hydrologic analyses to support the view that drainage or other activities in the basin have had a measurable effect on major flood peaks on the Red River at Emerson (Calton, 1979:10).

Calton claimed that the recent increased frequency of major floods was the result of a gradual change in climatic conditions. Assuming a general trend to above normal precipitation and a delay in spring snowmelt temperatures, Calton warned that more frequent spring floods seem inevitable over the next 20 to 30 years. Since major floods cannot be prevented, Calton concluded that damage could be minimized by constructing levees and ring dykes to protect communities and farmsteads or by implementing non-structural measures such as flood insurance, flood plain zoning and improved flood forecasting techniques.

7.1.2 The Opposing View

Lloyd Jones, of the United States Fish and Wildlife Services (FWS) cited several studies which were compatible with his assertion that land use and wetland drainage affect flooding. A study done under the auspices of the FWS in the spring of 1979 compared runoff from undrained control blocks

of land with runoff from drained land in the J. Clark Salyer National Wildlife Refuge section of the Souris River Basin. Discharge hydrographs reveal that undrained study blocks reduce streamflow volumes and flood peaks are more flattened and extended over a longer period of time (Table 5). On the other hand, wetland drainage increases streamflow.

Table 5

Comparison of In-flow and Out-flow to Four Study Blocks along Small Drainages in Central Bottineau County during Spring Run-off of 1979

	ACRE-FEET			
STUDY BLOCK	In-Flow	Out-Flow	Increase	Decrease
Westhope Coulee (Undrained control)	109	46		63 (58%)
Westhope Coulee (Drained Block)	46	74	28 (61%)	
Landa Coulee (Undrained control)	136	103		33 (24%)
Stone Creek (Drained Block)	723	1,609	886 (122%)	

(Malcolm, 1979).

The FWS study concluded:

> The data presented herein make it rather obvious that wetland drainage has compounded the frequency and severity of flood problems. Every additional wetland that is drained in the Souris Basin will further compound the flood problems. On the other hand, every wetland that is restored will ease the problem (Malcolm, 1979:28).

This conclusion is significant in view of the extensive drainage which has been carried out. The Souris-Red-Rainy River Basins Commission report (1972) estimated that 162,477 acres of wetlands had been drained in the North Dakota portion of the Souris River Basin. Projections were that another 60,346 acres would be drained by 1980. Assuming that 200,000 acres have been drained, and that these wetlands would have held one foot of water, prior to their drainage the study claims that 200,000 acre-feet of approximately 585,000 acre-feet flowing into Manitoba at Westhope in 1979 was due to wetland drainage (Malcolm, 1979:23). Mr. Jones claimed that Minnesota has also been losing 15,000 to 20,000 acres of wetlands annually, the authority for which is delegated to local level permits granted after the fact (Jones, presentation, November 30, 1979).

Mr. Jones opined that wetland drainage caused local flooding which was addressed by digging bigger ditches which caused larger floods downstream. This conventional method of

dealing with flood waters and land management led Jones to conclude that engineers were part of the problem. He stressed that wetland drainage adds some indeterminable but controllable amount of water to floods. The degree to which wetland drainage contributes to flooding is not an issue. Whatever the amount may be, that amount is controllable. Afterall, it is the top couple of percent which causes the greatest suffering.

Other agencies such as the U.S. General Accounting Office (GAO) have also begun to recognize the many values of wetlands, heretofore ignored. A report to the Congress of the United States from the comptroller general of the General Accounting Office questions whether the Nation is paying more in federal public works projects to achieve flood control, pollution control, and water supply objectives, than it would have cost to obtain the same benefits by preserving wetlands (U.S. General Accounting Office, 1979:ii). The GAO report states that:

> In some instances, ...Federal drainage projects may have contributed to increased flooding with the resultant requirement for additional protective works. ...the evidence ...suggests that the nation may now be paying to correct mistakes of not preserving wetlands in the past.
>
> Wetland basins and lands with problems of excess water are natural catchments which provide significant water storage capacity, when they are drained, this storage is lost with a resultant faster and greater runoff of roadside ditches, tributaries, and water bodies. During periods of high rainfall intensity, the runoff that would have been

> stored is added to what would have been the natural levels, so that flood crests will be higher (U.S. General Accounting Office, 1979:25).

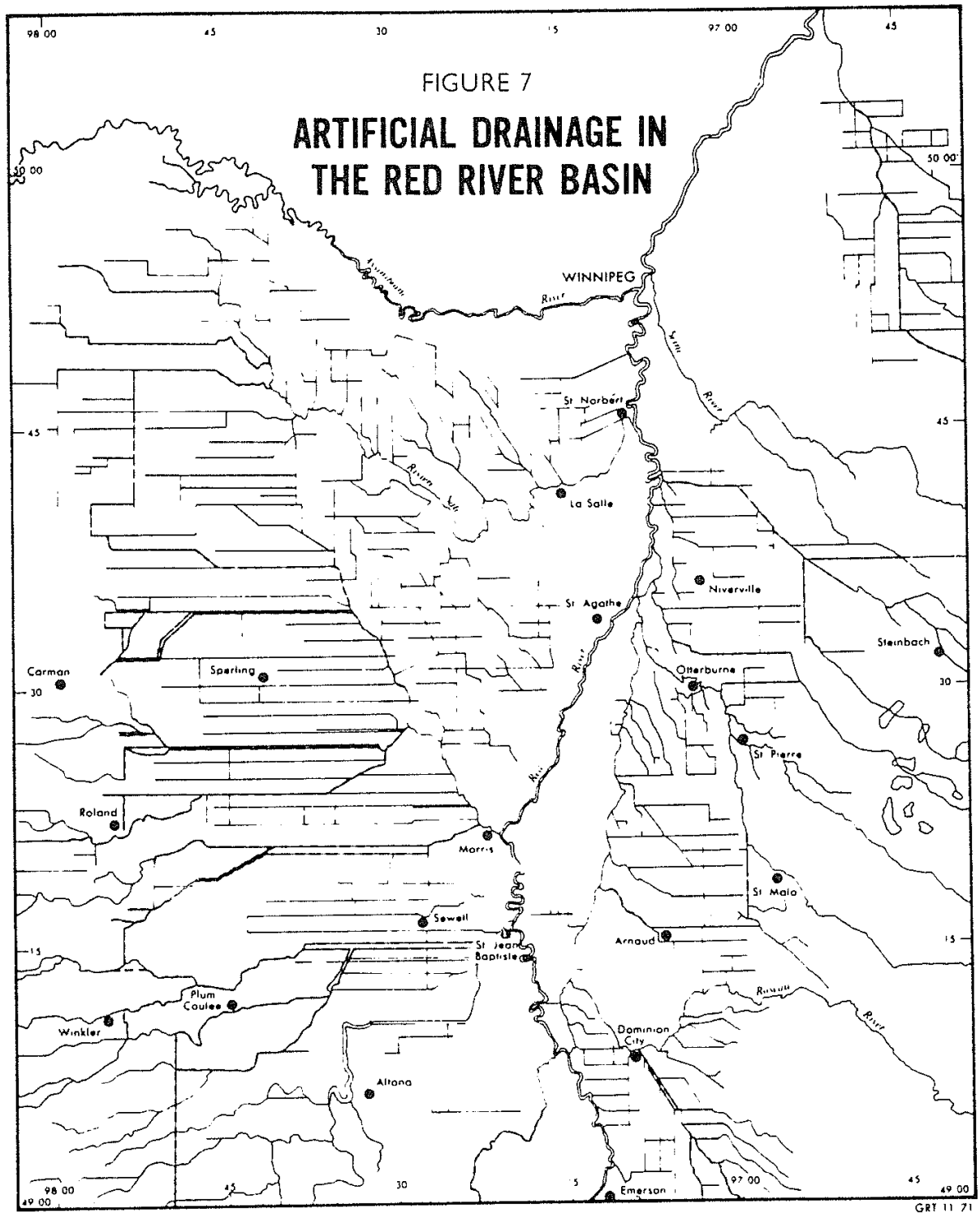
The degree to which wetland drainage has added to present problems of flooding, groundwater depletion, pollution and sedimentation is not quantifiable with present data but recent studies show that the relationships may be significant.

7.2 DISCUSSION AND IMPLICATIONS

There has, for many years, been general agreement that flooding has been exacerbated, or at least, transferred to other areas, as a result of man's activities. Both the Finlayson Royal Commission, 1936 and the Lyons Royal Commission, 1949 acceded to this popular notion. However, unable to establish the degree of responsibility in every situation, these Commissions were restricted to counteracting excess water in those places where it manifested itself in the form of severe damages. The only option was for senior governments to provide transfer payments for the construction of larger drains. Structural works proved inadequate in dealing with floods since they ran headlong into the original constraints of low slope and low stream capacity. Figure 7 illustrates the extent of artificial drainage in the lower Red River Valley, while Figure 8 illustrates how the area's topography creates the conditions for extensive floods.

FIGURE 7

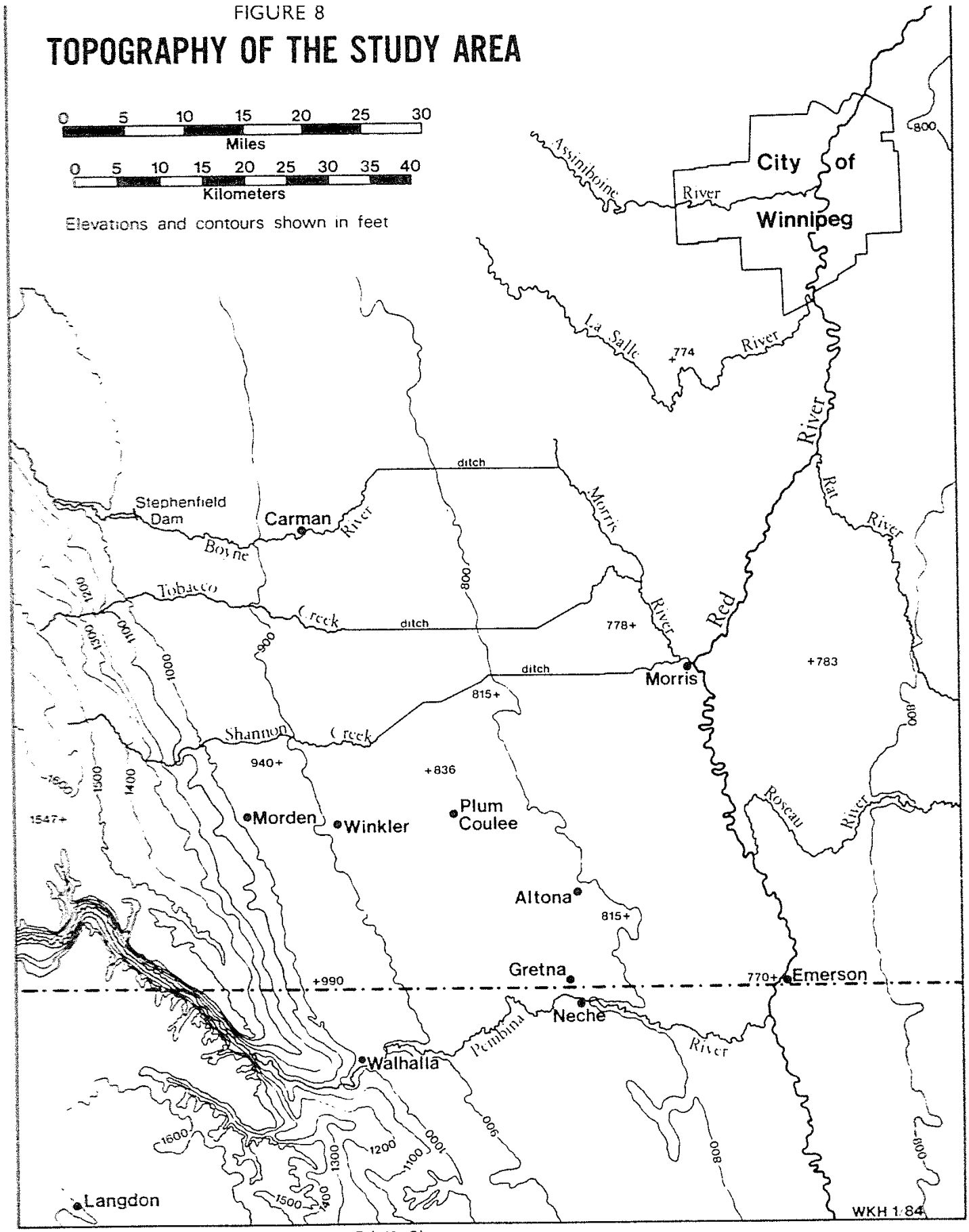
ARTIFICIAL DRAINAGE IN THE RED RIVER BASIN



SOURCE: Dept. of Geography, University of Winnipeg

FIGURE 8

TOPOGRAPHY OF THE STUDY AREA



SOURCE: N.T.S. No. 62 NE (S1/2) & 62 SE (N1/2)

A 1958 Soils and Crops Branch publication stated that:

> Water control in Manitoba has developed into a programme involving a continual increase in the size of the artificial drainage systems to speed water on its way to the lakes.
>
> ...Unplanned drainage programmes have aggravated the flooding in towns and lowlands as the drainage ways are inadequate to carry the larger peak flows caused by speeding up the runoff (Poyser, 1958:1).

In other words, there was an explicit belief that drainage exacerbated flooding in some areas, and structural works would be inadequate in relieving the problem. Aware that direct liability could not be established there was a move to implement a co-operative approach to comprehensive land and water management, embodied in the Watershed Conservation Districts Act (S.M. 1959, (2nd Sess.), c.70). That approach, however, remains largely unimplemented and there remains continuing controversy over whether or not man's activities affect flood peaks.

Various studies on small watersheds demonstrate rather conclusively that drainage can exacerbate flooding. Engineers argue that such a trend cannot be extrapolated over a larger watershed. The layman might ask, "Why not?". It seems logical to assume that if drainage has the effect of increasing flood peaks in a small watershed, then it might have a similar effect on a larger watershed. However, different portions of the drainage basin experience peaks at different times. Thus, in some instances it might be possible to imagine a situation where flood peaks in the southern portion of the basin were delayed to coincide with flood

peaks in the northern portion of the basin. Engineers also argue that drainage draws down water tables and may actually increase the water retentive capacity of certain areas, thereby decreasing the possibility of flooding. However, findings in the FWS study (1979) do not bear this out.

To better understand the underlying reasons for the controversy one should examine the implications of accepting the tenet that the actions of man exacerbate flooding. There are three readily identifiable implications:

1) liability would be established;
2) the need for environmentally appropriate land use would be established; and
3) it could be established that flood frequencies based on long-term historic records are too low.

Obviously, a major impediment to resolving the controversy involves the issue of liability. In view of U.S. federally sponsored programs to drain and the involvement of the Army Corps of Engineers in implementing these schemes, it seems not unreasonable to suspect that the Corps of Engineers is constrained by an obligation to vindicate policy which was designed primarily to encourage agricultural development. Further, if it can be shown that drainage in the upper watershed affects the lower watershed, then in the case of Red River flooding, the onus is placed on the U.S. to do something about the problem from whence it originates.

The Army Corps of Engineers' unyielding stance on this issue has been construed by some as an attempt to absolve the United States from any blame for flooding in Manitoba.

In Canada, there appears to be less need to vindicate drainage and land use policy and engineers have been slightly less insistent that floods have no relation to man's activities. In fact, there is some degree of conflicting opinion and a lack of consistency among engineers in this country. For example, a recent study by PFRA states that in the case of the Roseau River, "Swamp areas in Minnesota and Manitoba reduce runoff peaks during flood years" (Canada PFRA, 1981:23). Also, efforts by the Water Resources Division to encourage the concept of watershed conservation leads one to conclude that some water engineers accept, at least implicitly, that there is indeed a relationship between land use and water management. Unfortunately, for every study that shows that drainage contributes to flood peaks, there is another study to show the opposite (Whitney, personal communication, August, 1983). The hydrologic community here has not necessarily ruled out the fact that there may be a connection. Engineers are continually investigating the problem in an attempt to determine the effects conclusively, one way or another -- and therein lies the conundrum.

Proof requires the derivation of a formula which could be applied to any part of any drainage basin. In view of the myriad of related factors affecting runoff it seems

highly unlikely that the relationship will ever be proven, except perhaps in very small drainage basins where all related factors could be measured. The results, however, cannot be extrapolated over larger drainage basins. Failure to provide absolute proof does not mean that a relationship does not exist. The situation is in many ways similar to the problem of establishing a link between smoking and lung cancer. There are many scientific reports denying such a relationship. However, one could hardly consider people irrational, if, on the basis of the available evidence, they concluded that smoking may indeed contribute to cancer.

The smoking public may wishfully grasp at studies disproving the relationship in a woeful attempt to rationalize their habits. Non-smokers, on the other hand, may question the intent of research which supports monied interests. This is not to cast aspersions on the veracity of the research, only that some relationships are difficult to prove conclusively, especially in environmental matters.

In the case of acid rain, for example, because it is not possible to show that a particular molecule of suphur dioxide, orginating from a particular smokestack, caused a measurable amount of damage at a specific point, then it is not possible to prove that acid rain may be killing lakes and damaging forests. Despite general acceptance of this tenet by most scientists, and the establishment of liability in northern Europe, the Reagan administration denies the

problem. Hence, it is not surprising that the public has started to question the motives and rationale of certain policies.

It is the lack of appreciation for alternate viewpoints which incenses the layman the most. The layman takes what seems to be a logical approach and is rebuffed by the so-called experts who often offer an unsatisfactory response. For example, in view of the fact that drains are built to carry water off the land as quickly as possible, the layman concludes that ditches must be fulfilling their purpose or they would not be constructed. In other words, it seems reasonable to conclude that drainage adds some amount to flood peaks. Of course this does not prove the hypothesis but arguments of this type appear to the layman to be as valid as the rationale offered by engineers. For example, the argument presented by the Army Corps of Engineers centred around establishing the fact that floods occurred prior to agricultural activity. From this they conclude that flood levels have been unaffected by man and are purely a consequence of climatic conditions. Obviously, the conclusions of the Army Corps of Engineers have a sounder philosophical and scientific basis than the one presented. However, the layman is presented with little or no information and asked to trust the engineer because he is the expert.

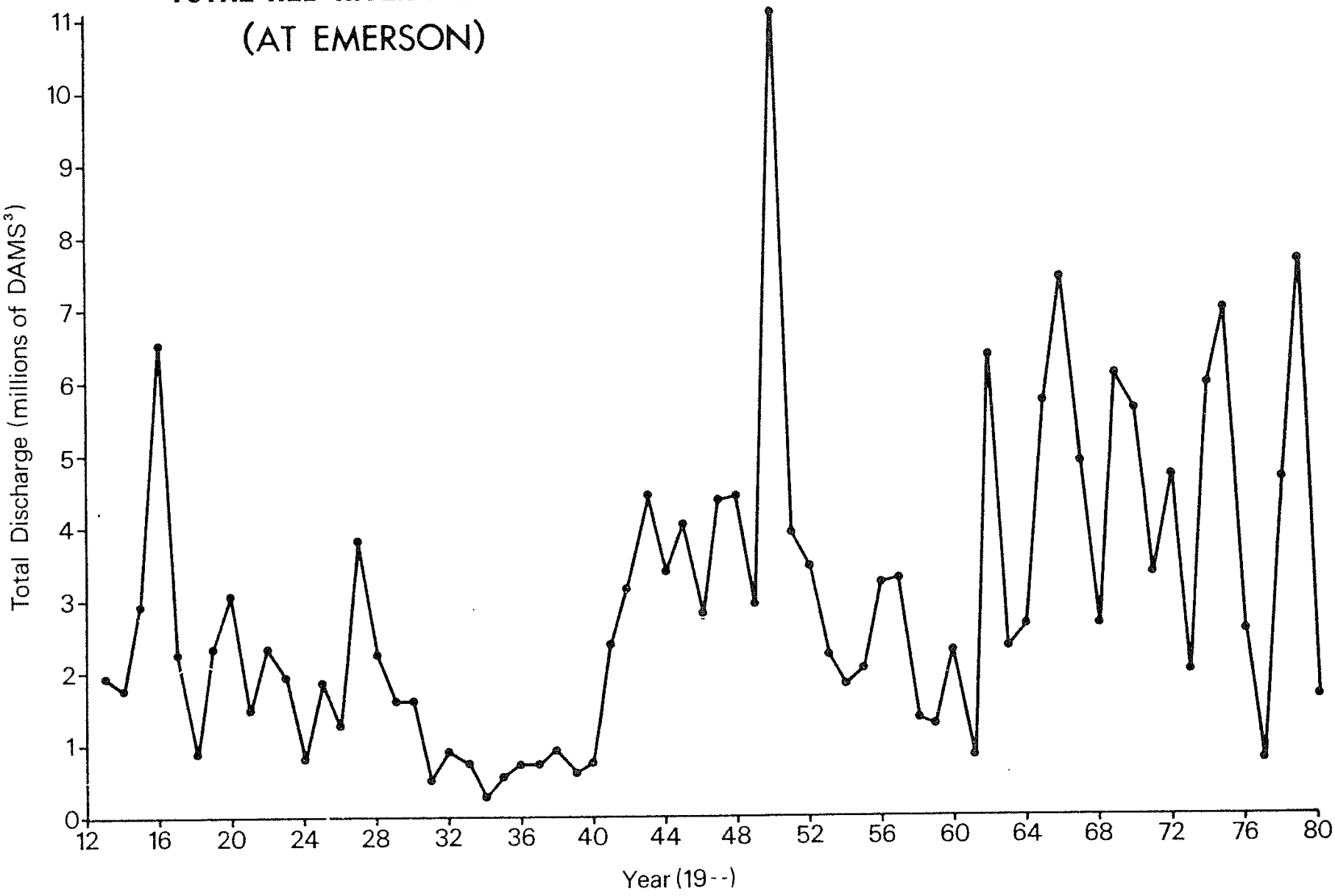
Another factor which confuses the layman is the engineers' resistance to accede to the fact that conditions

may have changed, for whatever reason, and the last 20 or 30 years of record give a more reliable forecast of what lies in store in the future. For example, if one examines the historic record of total annual Red River discharge for the period 1913-1980 (Figure 9), it becomes apparent that there have been several cycles of wet and dry years. However, the trend appears to be one of increasing levels of runoff and increasing peak flows (Figure 10). Whether this upward trend is a result of climatic changes or land use changes seems a moot point. To the layman, total runoff appears to be increasing, leading him to believe that engineers should use only the last 20 or 30 years of record to calculate benefit-cost ratios for flood protection and compensation. The engineers disagree.

The preceeding discussion does not prove that climatic conditions have changed, or that land use changes affect floods. Engineers, for the most part, maintain that one cannot prove absolutely that anything other than climate affects floods -- and they are right. There is no absolute proof. However, this unyielding stance, in the face of reasonable doubt broaches several problem areas. First, the public perceives engineers to be unreasonably implacable and is beginning to question the intent of the engineers' stance. To be fair, the nature of the engineering profession dictates that engineers deal in absolutes. However, since this controversy cannot be resolved absolutely, then engineers really cannot accept, even implicitly, that flood magnitudes and

FIGURE 9

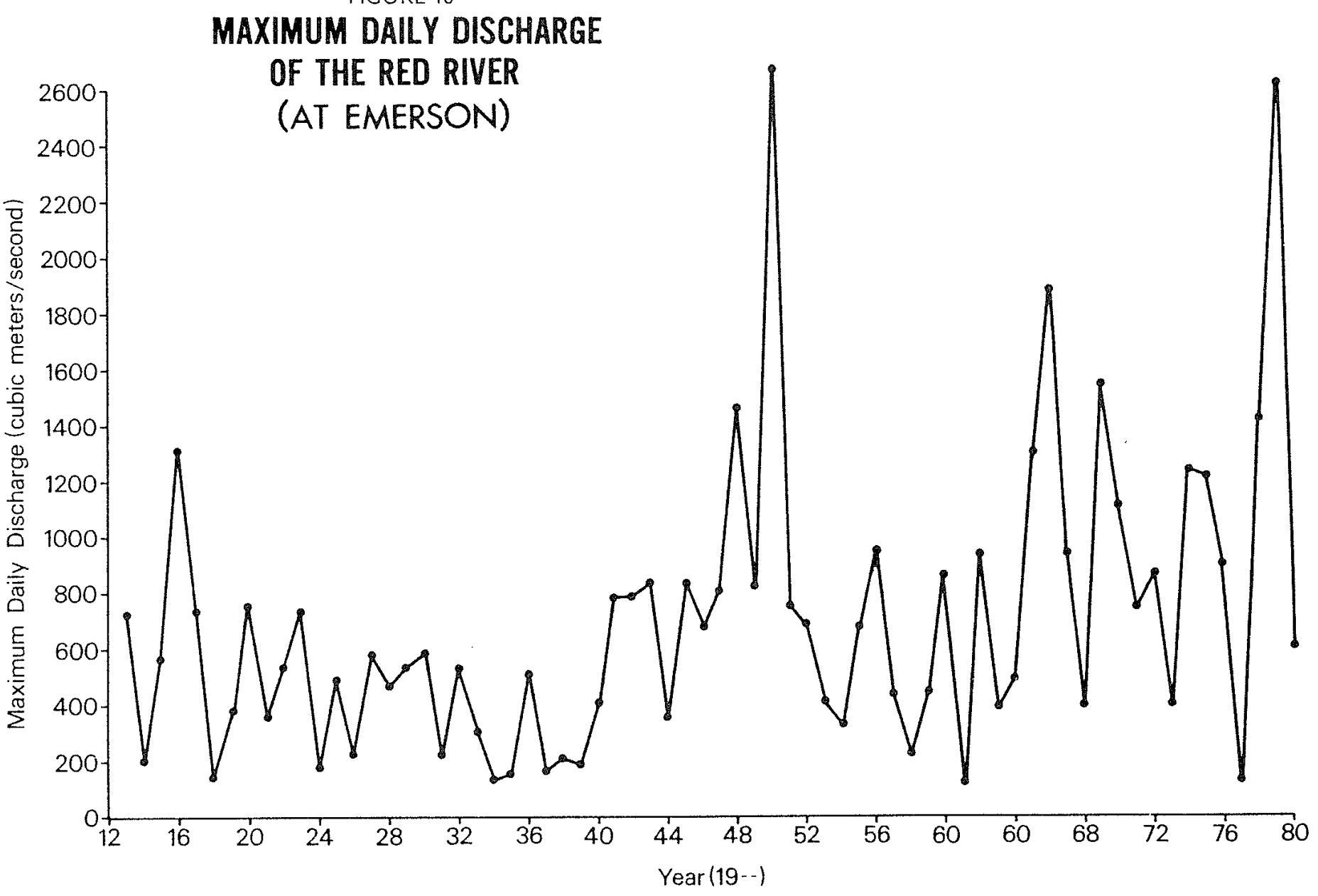
TOTAL RED RIVER DISCHARGE
(AT EMERSON)



SOURCE: Canada, Dept. of Environment, 1979

WKH 1/84

FIGURE 10



SOURCE: Canada, Dept. of Environment, 1979

WKH 1/84

frequencies have diverged from long-term averages. Second, engineers have become the scapegoats, while politicians who are normally perceived as the policy makers, seem to have escaped harsh criticism. This may be a result of the fact that politicians have cleverly manipulated the situation in their favour, or the public has identified the wrong level of decision maker. Or, a third alternative might be that engineers, who are normally technocrats, are, in this case, actually the policy makers. If engineers are in effect setting policy then some criticism is valid, especially in view of the fact that the public has little recourse regarding the experts' opinions.

The remaining sections of this chapter investigate the benefits of watershed conservation and the impediments to a different methodological approach to land and water management.

7.3 THE CASE FOR WATERSHED MANAGEMENT- A REGIONAL APPROACH

Hardly a year goes by without disaster headlines -- drought one year, flood the next, or oddly enough, both flood and drought in a single year. Engineers would have us believe that these are natural disasters or "acts of God". Others have argued for many years that behind this litany of tragedy is a story of the use and abuse of land and water resources. In fact this was the underlying rationale for

establishing watershed conservation districts. When the Watershed Conservation Districts Act was passed in 1959, it was estimated that 3 million acres out of a total of 11 million acres of cultivated land in Manitoba had been severely affected by erosion (Poyser, 1958). The remaining 8 million acres had been slightly to moderately eroded. Poor land and water management were manifested in a number of forms: knolls in cultivated fields turned white as the surface soil was washed away; gullies developed on hillsides; stream channels filled with silt; heavy rains caused local flooding in areas where flooding was previously unknown; and streams which once ran slowly and clearly became floodways in rainy seasons, but remained parched and dry the rest of the year (Poyser, 1958).

Watershed management was seen as a means of conserving soil and water resources, and integrating other resources into an overall management scheme to ensure a lasting economic base for the people of the watershed. Proponents of watershed management believe that water management starts with land management. Implicit in their belief is the belief that natural conditions have a moderating effect on runoff. Thus, an improvement over present conditions would involve: maintaining pastures or forests on hilly land to protect the soil from gullying and excessive erosion, and to slow down the rate of runoff; maintaining some wetlands to slow down runoff, recharge groudwater supplies and provide

for diverse wildlife habitat; and increasing the organic matter content of the soil so that it can hold more water, releasing it slowly via evaporation, transpiration, and groundwater recharge. Construction of water control structures is only one aspect of watershed management, for without proper land use, water control devices may be rendered useless, for example, when reservoirs and drains silt-up. Thus, flooding is seen as a manifestation of controllable factors.

Despite general acceptance of the tenets of watershed management, the actual incorporation of Watershed Districts has been little implemented. The major reasons appear to be:

1) apprehension over the cost and the broad powers of the Board;
2) an apparent lack of interest in Watershed Conservation Districts by the Department of Agriculture*; and
3) the fact that flood control is a relatively new initiative.

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*In recent years the Department of Agriculture has shown more interest in Watershed Conservation Districts. This may be attributed, at least in part, to the transfer of four agrologists from Water Resources to the Department of Agriculture. These agrologists had been active in the program while employed by Water Resources.

A Watershed District is governed by a Board with wide-ranging powers, some of which include:

1) The Board can buy lands and develop policies and programs to regulate the use of those lands.

2) The Board may build and operate water control structures and can regulate any works which may have a demonstrable impact on water flow.

3) The Board may conduct educational programs directed at good land and water management.

4) The Board may enter into agreements with individuals to implement good land treatment practices such as tree planting, land retirement and erosion prevention programs.

(Conservation Districts Act, S.M. 1976, c. 38, s. 21 and Watershed Conservation Districts Act, S.M. 1959, (2nd Session), c. 70, s. 16.1).

The aim of the Board is to develop the region's resources to the optimum level, for the benefit of the majority. Unfortunately, all too often, the public interest is seen to be in conflict with private interests. Attempts to reconcile the two, or to set the public interest first are met with the familiar appeal to the rights of the individual proprietor to do with his land as he wishes. A higher level authority is seen as a limitation on individual freedom, so the Board is perceived to be at odds with the laissez-faire system.

Had the Department of Agriculture and the Wildlife Branch endorsed watershed management together with the Water Resources Branch, there quite probably would have been more Watershed Districts. However, there has been no co-ordinated representation to municipalities, even though watershed management appears to accomplish the objectives of each of these departments.

Finally, flood control has really only been an issue for about the last 15 years. When LRRVWC was formed, the major emphasis was to develop a water supply system for the region. The concept of flood control was not mentioned in the minutes of LRRVWC until late 1966 (LRRVWC, Minutes, November 15, 1966). As flooding became more prominent over the ensuing years there were more discussions about watershed mangement (LRRVWC, Minutes, March 20, 1972 and January 30, 1973). In fact, Mr. Weber implied that it was only a matter of time before LRRVWC would be replaced by one or more watershed districts (LRRVWC, Minutes, March 20, 1972).

LRRVWC has from time to time entertained the benefits of watershed management. Mr. Fletcher, Mayor of Carman, has been one of the most outspoken proponents of a conservationist approach to water management (LRRVWC, Minutes, December 13, 1976). Because of Mr. Fletcher's concern that changes in land use and drainage were contributing to a serious flood threat in Carman, he moved in 1978, "That the Commission go on record as supporting a joint meeting along with

PVDC regarding conservation and watershed districts ..." (LRRVWC Minutes, April 17, 1978). Later that year a joint meeting between LRRVWC and PVDC was held to discuss the possibility of creating watershed conservation areas. Bill Newton and D. Sexton of the Water Resources Division presented to the 45 mayors, reeves and council members in attendance, the soil and water conservation advantages of watershed management (LRRVWC Minutes, June 22, 1978). It was decided to do some consciousness-raising by conducting further discussions in various areas. The eventual implementation of this concept will require public acceptance of the belief that the program will serve both the private and the social good. This can probably best be accomplished by presenting case studies of already established Watershed Districts.

7.3.1 Regional Planning at Work -- The Whitemud Watershed

The Whitemud Watershed Conservation District, formed in 1972, provides evidence of the economic benefits of managing water and land resources, on a regional scale. The District encompasses 1,777,000 acres and transcends the boundaries of 13 municipalities, plus a portion of the Local Government District of Alonsa and a part of Riding Mountain National Park. The District was created in reaction to flooding which was becoming more serious and prevalent in the

lowland area east and south of Riding Mountain, especially in the Gladstone area. The initial response was to build more drains and floodways to remove the excess water. According to the Whitemud River Watershed Resource Study (1974), prepared by the Manitoba Department of Mines, Resources and Environmental Management, this action only served to compound the problem, which was caused by uncontrolled land use on the escarpment. Landowners in the upland area had cleared trees from the mountain side and planted grain crops in soils which needed protective cover crops. The result was that the rapidity of runoff was magnified, resulting in severe erosion. Thus, the farmlands on the slopes were, within a few years, rendered infertile. Topsoil was deposited in drainage ditches downslope, rendering them unserviceable. As a result, flood peaks increased in number and degree, bridges and roads were washed out, ditches had to be reconstructed and the taxpayer on the lowlands was burdened with unnecessary costs.

To counter these problems, the Whitemud River Watershed Conservation District was formed and appropriate land use practices were instituted on the uplands. Trees and shrubs were planted on the most severely eroded areas to stop erosion, while less severely eroded lands were seeded to forage crops. The result has been: reduced soil erosion; reduced shale and silt deposition in drainage channels; spring snowmelt has been slowed; runoff from summer rains is

distributed over a longer period, reducing the occurrence of localized flash flooding; streams run longer and with less violence; formerly eroded and unproductive land now produces hay; and flood damage to roads and bridges has been reduced (Pamphlet - Rosedale Farm Conservation District. Department of Mines, Resources and Environment).

7.4 IMPEDIMENTS TO WATERSHED CONSERVATION AND INTEGRATED RESOURCES MANAGEMENT

For some unexplained reason the search for solutions to flood problems has come to lie, almost exclusively, within the domain of the engineering community. Yet, one must seriously question whether engineers are the only actors who should be involved in the search for creative solutions. Perhaps society's reliance on engineers is indicative of a general preoccupation with structural solutions. This approach to problem solving was one which reached its zenith during the 1950's and 1960's when the prevalent attitude seemed to be man's inexorable domination of the environment. Indeed, man has demonstrated a remarkable ability to rise above certain environmentally imposed limitations, especially where cost was not a factor. However, one must bear in mind that physical infrastructure is expensive to build and to maintain, and if the costs exceed the benefits, then structures will likely not be built. Therefore, given a limited range of policy options and methodological approaches, it

seems highly unlikely that engineers on their own will be able to identify and implement a cost-effective solution to Red River flooding. The issue of water management is a systemic problem requiring a more holistic approach than that which may be within the purview of the engineering community. Only by recognizing this limitation on the range of options will it be possible to move towards a radically different approach to water and land use management. Thus, this section focuses on institutional and attitudinal impediments to a new approach to flood plain management.

This document has demonstrated that the historical response to excess surface water has focused primarily on drains, dykes and control structures. As a result of this emphasis, engineers have come to be the managers of water resources. It is hardly a mystery then that engineers, by virtue of their educational background, would tend to reinforce the need for physical works. Structural works have also been perceived by politicians as attractive solutions in that the works achieve the transfer of large amounts of federal funds and have a way of becoming political monuments (Sawatzky, unpublished paper, 1981:13). Thus, while engineers have been responsible for designing the physical works, their particular predilections have been supported by politicians and the public alike. Nonetheless, political and public attitudes, to a large extent, owe their implicit underpinnings to historical precedent. Thus, it may be

instructive to examine certain attitudes extant within the engineering community.

First, engineers appear to accept current rates and volumes of runoff as essentially having no causative human involvement. They then attempt to deal with the problem at the point where it is manifested in the form of a flood as opposed to attacking the source of the problem. For example, the Canada Department of Resources and Development in 1953 estimated that 2 million acre-feet of storage on Red River tributaries would have been required to reduce the 1950 flow at Winnipeg to a point allowing one foot of freeboard on the dykes constructed by the Greater Winnipeg Dyking Board in 1951 (Canada Department of Resources and Development, 1953:6). The researchers concluded that this amount of suitable reservoir storage is non-existent. At an international forum on flood control held in Fargo in 1979, the Army Corps of Engineers reiterated that conclusion. However, their assessment of the situation is limiting in that they assume that the water would have to be withheld in large reservoirs. A growing body of public opinion believes that the water retentive capacity of the land could be increased.

Examining this contention further we find that the drainage area of the Red River at Winnipeg is 44,000 square miles (Canada Department of Resources and Development, 1953:4). Two million acre-feet, therefore is equivalent to .85 inches over the entire drainage basin. Assuming that the

effective drainage area (that area which would be effective in producing rapid peak discharges) is only half of the total area, there is still less than two inches of runoff from the effective drainage area which produced a flood. In other words, if an extra inch or two was retained on the land, for some undetermined length of time, there would not have been serious flooding in 1950. This possibility may not be as remote as may first appear.

Hydrologic data for the Pembina River Basin help to illustrate the possibility of retaining an extra inch of water. During the 50-year period from 1900 to 1950 mean annual precipitation was approximately 18 inches (Canada Department of Resources and Development, 1953:19).

> The average annual runoff of the Pembina River watershed near Manitou, Manitoba, for the 30-year period 1921-1950 is equivalent to a depth of about 0.8 inches on the total drainage area or about 4.5 percent of the average annual precipitation. About 85 percent of this runoff takes place during the three months of April, May and June (Canada Department of Resources and Development, 1953:20).

Thus, of the 18 inches of yearly precipitation, only 0.8 inches ends up as runoff. The remainder is either evaporated or goes to replenishing groundwater supplies. Obviously, the land has a tremendous capacity to hold water. This capacity has been reduced due to the increasing mineralization of the soil. Agricultural practices such as stubble burning have reduced organic matter content of Red River soils by over 50 percent. Stubble also helps to maintain a blanket of snow which prevents deep ground frost. Thus,

although fields may dry more slowly, delaying spring seeding, the ground may warm up faster, permitting earlier germination in the heavy clay soils. Runoff could also be reduced by preventing snow from drifting into deep depressions which are areas of high runoff. For example, in the Pembina River Valley, of the gross drainage area of about 2,600 square miles at the proposed Pembina dam site, it has been estimated that only 475 square miles would be effective in producing rapid peak discharges (Canada Department of Resources and Development, 1953:25). Thus, it would appear that certain land use practices such as maintaining stubble over the winter and reintroducing it to the soil could reduce runoff.

As discussed previously, a number of studies have shown that wetlands reduce flooding. However, past attempts to preserve wetlands have been largely unsuccessful because of a general lack of appreciation of the multiple private and public benefits of wetland preservation (U.S. General Accounting Office, 1979). Wetlands have been valued principally for their production of fish and wildlife and we have overlooked other values such as flood control, groundwater recharge, and pollution and sediment control. The GAO report (1979) claims that in some cases benefits from ancillary wetland values have dwarfed those derived from fish and wildlife production.

Solely on the basis of wildlife production, there is a strong argument for wetland preservation. For example,

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Solely on the basis of wildlife production, there is a strong argument for wetland preservation. For example,

the U.S. Department of Agriculture conducted a benefit-cost evaluation of the Water Bank Program, which attempts to forestall the conversion of important migratory waterfowl nesting and breeding areas to farming, within certain regions of Minnesota, North Dakota and South Dakota. Based only on the benefits to duck hunters the evaluation yielded a benefit-cost ratio of 0.85. However, by omitting non-waterfowl benefits, the impression was conveyed that taxpayers were supporting expensive programs to put surplus ducks in the hunter's bag (U.S. General Accounting Office, 1979:7). In other words, the public considers the benefits of wetland preservation to be largely private while the costs are social.

On the other hand, the individual landowner sees the costs of wetland preservation to be private while the benefits are public. The owner's decision to drain is based on the difference between the benefits of increased agricultural production minus the costs of draining. The value of wetland benefits to the public, do not enter into the farmer's evaluation. In other words, the benefits of wetland drainage are private but the cost of wetland benefits foregone are largely public.

The GAO report claims wide-ranging public and private benefits of wetland preservation and would argue that the benefits foregone as a result of drainage are not restricted to the public domain. This viewpoint was contested by Robert Calton of the Army Corps of Engineers. He conceded

that wetland preservation makes sense on the basis of waterfowl production, but adamantly opposed attempts by FWS to attribute statistically unproven values of flood control and water quality enhancement (Calton, Presentation, November 30, 1979). He accused FWS of using their argument to further their own goal of preserving wildlife habitat.

As a result of this narrow view of wetland benefits, the U.S. Federal Government has devised many programs which support or facilitate wetland drainage. Many public works drainage projects have been carried out by the Army Corps of Engineers, USDA's Soil Conservation Service, and USDI's Bureau of Reclamation. Other programs have promoted drainage by providing assistance in the form of loans, cost-sharing, and technical assistance (U.S. General Accounting Office, 1979:21). Even in the absence of direct federal assistance, in an indirect way other policies have made it economically beneficial to drain. For example, construction costs for drainage works favourably affect an individual's income tax, while crop loans and price supports constitute guaranteed income from drained wetlands. Thus, the incentives to drain have been legion.

In those instances where wetlands are recognized only for their benefits to waterfowl, wetland drainage will continue. The General Accounting Office and other agencies believe that continued drainage will increase the cost of flood control and water quality enhancement. In addition,

the result will be a less aesthetically pleasing, and a less stable environment. The General Accounting Office believes that wetland preservation is consistent with the emphasis of the administration, on reduced capital expenditures and non-structural solutions, to water resource problems (U.S. General Accounting Office, 1979:30).

In Manitoba, one can identify certain background institutions which contribute to the destruction of wetlands and which insidiously promote what might be described as counterproductive use of land formerly devoted to native pasture and woodlots.

Firstly, the Canadian Wheat Board's system of marketing grain by acreage quota allotment, contributes to the conversion of land from native conditions to an "improved" state. The delivery quota system provides for acreage transfers of land under certain uses to the acreage in crops subject to quota. For instance, land devoted to summerfallow or any uncropped "improved" acreage such as newly broken native pasture, can be applied to quota allotments.

Secondly, land assessments place a taxable evaluation on "unimproved" or wasteland, providing an incentive for the landowner to get some economic return from this acreage. There is also a perceptual problem because the tax bill only reflects the total assessment without showing the rate on different types of acreage. Thus, there may be an added incentive to realize an economic return. However, that return

has, in many cases, been realized by its cultivation, thus making it quota eligible -- not by its productivity.

In the best interests of soil and wildlife management at least, some land should never have been cropped. However, landowners have in many cases ignored long-term damage to their land incurred through the use of environmentally inappropriate agricultural practices. On the one hand, stubborn adherence to traditional practices such as summer-fallowing and stubble burning, have contributed to soil erosion. On the other hand, the modern trend towards gigantic farm equipment, for example, militates against field practices finely attuned to the natural detail of landscape and terrain. The use of huge machinery for some farmers, justifies the draining of prairie potholes, the clearing of shelterbelts and the levelling of land (which one might add incidentally, destroys the soil profile).

All of these factors, in addition to numerous others, degrade the soil and reduce its ability to absorb and conduct water. Whether or not this is a factor in increasing the level of large floods is impossible to state categorically. Still, land use practices commensurate with the tenets of watershed conservation and integrated resources management do appear to have numerous private and social benefits. Unfortunately, a number of factors militate against their widespread implementation.

7.5 METHODS OF PROMOTING COMPREHENSIVE LAND USE MANAGEMENT

While there may be disagreement as to whether or not drainage and certain land use practices exacerbate flooding, resource managers generally agree on other private and public benefits of environmentally appropriate land management. For example, woodlots and shelterbelts, by reducing the windfactor can reduce soil erosion and municipal snow clearing costs. They also provide cover for larger game and enhance the aesthetics of the countryside. Those wetlands classified as recharge potholes, have little or no crop producing potential, by virtue of their soil salinity (Osborne, 1979). They do, however, have obvious benefits to waterfowl and wildlife.

Field practices which leave crop residue can increase moisture availability by increasing soil moisture retention. Crop residue captures snow, preventing deep ground frost, and slows snow melt, permitting more in situ infiltration during spring melt, in some soil types. The Prairie Production Symposium of the Advisory Committee to the Canadian Wheat Board in October, 1980, claimed that for each additional inch of moisture between approximately 6 and 16 inches, during May, June and July, grain yield response is in the order of 3.6 bushels of wheat per acre (Sawatzky, unpublished paper, 1981:13). In other words, modification of land management practices aimed at maximizing capture of incoming

moisture could increase crop yields. Therefore, in some instances, runoff represents lost productivity.

Thus, land management practices commensurate with watershed conservation, have many private and social benefits. To encourage such practices, there are basically three broad policy options:

1) pass regulations prohibiting certain practices;
2) remove positive reinforcing incentives to drain and clear woodlots; and/or
3) provide economic inducements.

Regulating land use practices is an unattractive option because of public and government resistance, and the need for expensive bureaucracy to administer and enforce the regulations.

Removing incentives to drain and clear woodlots could be easily accomplished by:

1) having the Canadian Wheat Board extend the quota entitlement to include a portion of wetlands and woodlots; and
2) exempting wasteland from property taxes.

These modest changes would encourage landowners to leave marginal and sub-marginal land in its natural state. Agricultural problems do not stem from the need to increase cultivated acreage.

Wildlife authorities could also encourage the maintenance of wetlands and woodlots by issuing farmers who maintain wildlife habitat with complimentary hunting licences and perhaps declaring a short "special" season for them prior to the opening of the general season (Sawatzky, unpublished paper, 1981:11).

Finally, land stewardship makes good economic sense, especially in the long run. As the private benefits of land stewardship become more obvious, landowners are slowly adopting more environmentally appropriate agricultural techniques. One organization which has assiduously promoted the concept of watershed management has been Ducks Unlimited. By demonstrating the non-waterfowl benefits of watershed management, Ducks Unlimited has successfully negotiated long-term easements with landowners to use their land for water control structures. In other words, Ducks Unlimited has achieved their objective of preserving wetlands for waterfowl production by selling the idea of private economic gain.

Thus, with some fundamental yet modest changes in perspective it may be possible to achieve the objectives of land stewardship, increased agricultural productivity, increased wildlife productivity, lower private and social costs, and increased profitability while preserving the integrity of the natural environment. It may also be possible to reduce expenses for flood compensation and flood control structures. Small changes in public policy and land taxation

could have a pervasive and mutually reinforcing effect on our natural and economic environment. The solutions are not necessarily a matter of government regulation and ever-more massive engineering works but rather, a matter of public policy and private decision making.

7.6 CONCLUSION

It is impossible to determine whether the recent increased incidence of floods is a result of climatic changes or partly a result of changes in land use. Some studies, (Moore and Larson, 1979, and Malcolm, 1979) have shown that wetland drainage increases the rapidity and volume of runoff. This effect cannot, however, be extrapolated to all watersheds or to larger watersheds. Nonetheless, despite the lack of unequivocal proof there is general acceptance of the merits of watershed conservation and comprehensive land use management, by agencies as diverse as the Department of Agriculture, the Finlayson Royal Commission 1936, the Lyons Royal Commission 1949, the U.S. General Accounting Office and the U.S. Fish and Wildlife Service. Even the Manitoba Water Resources Branch implicitly accepts the basic concepts of watershed management as evinced by their efforts to promote Conservation Districts (S.M. 1976).

Still, it remains impossible to prove a relationship between land use changes and floods. The Army Corps of Engineers and many other flood forecasters remain adamant in

their rebuttal of this hypothesis. It is important here to summarize how this attitude affects land and water management.

By creating the impression that floods are an "act of God" or an unavoidable disaster, automatic federal compensation for many years took the place of pre-emptive planning. Planners, developers, landowners and homeowners were all absolved of any blame, and flood assistance reinforced continued development in flood hazard areas. When floods did occur, the military was called in to defend the hapless residents from the menacing foe. Then, when the floodwaters receded, homeowners began again to remove sandbags from their yards and developers continued to build in flood prone areas -- ever hopeful that disaster would not strike again.

More recently, there has been some attempt to preclude development in flood prone areas. However, since this has been done after the fact, it will have severe economic repercussions in some areas. For example, the Town of Carman has been unable to satisfy benefit-cost criteria for flood control works and the Town was to be designated as a flood risk area in 1982 (Freshwater, 1982, executive summary). Under terms of the Canada-Manitoba Flood Damage Reduction Agreement, this will preclude any federal or provincial direct or indirect expenditures within those areas subject to flooding. Consequently, there will be no federal or provincial funding available to upgrade the existing hospital or

municipal offices. If the municipality, on its own is unable to finance any upgrading, the only alternative will be to construct new high-cost facilities in areas outside the flood zone.

These efforts may be construed as an attempt by the Federal Government to reduce flood compensation payments. Flood plain zoning done after the fact does not maximize the social welfare of Red River Valley residents. Flood plain zoning does not prevent the insidious erosion of agricultural land or the erosion of farm incomes which result from expansive floods. It is little wonder then that the public is dissatisfied with the relative inaction of government policy makers and water resource managers, i.e. engineers.

It is time for a fundamental rethinking of government policy in regards to land and water management. At the moment there is a distinct lack of comprehensive resources management. Since each of the many levels of decision makers operate under a different mandate, the result is an incrementalist approach to resources management. What is required is a new set of policies which have as their primary objective the maximization of social welfare. Instead, we have a set of anachronistic institutions and attitudes. Decision makers at all levels have become inured to static practices and techniques, and flood damages continue almost unabated. Rather than investing resources to investigate new initiatives, we end up expending resources doing flood forecasting and figuring out compensation payments.

The irony of it all is that no one seems prepared to assume any responsibility to rectify a bad situation. The politician maintains that he is unable to recommend any structural solution because of a low benefit-cost ratio. Water engineers can claim that they are not policy makers. The individual landowner feels powerless in the face of an expansive flood and he abrogates responsibility for making any precautionary attempts to protect his property from flood damage. The individual landowner also feels powerless, alienated and frustrated because he does not know where to take his problem. So, we drift with the rising tide.

There are many actions which could reduce flood damages but the public does not simply want to reduce damages, they want to eliminate flooding. Unfortunately, there are no cost-effective structural solutions in the offing. Neither is it possible to advocate categorically that proper land use management will reduce floods. Good land use management practices will, however, achieve many private and public benefits such as reduced erosion, augmented crop yields, increased wildlife production and an aesthetically pleasing landscape. If, as a consequence of watershed conservation, flood levels are reduced even marginally, well then what's wrong with that?

CHAPTER VIII

FLOODS AND THE NEED TO EXAMINE METHODOLOGICAL APPROACHES TO FLOOD CONTROL

8.0 INTRODUCTION

Chapter 5 of this report demonstrated that water management decisions are dependent on, among other things, political considerations, contractual arrangements, the status of other projects, the availability of funds, political interest, the predilections and preoccupations of decision makers and consultants, economics, hydrological information, social considerations and an imperfect data base. The relationship between factors is constantly in flux so goals, objectives and methods must be constantly re-evaluated. In other words, water management is an on-going concern which has witnessed the evolution of legislation, administration, attitude and methodology.

Aware of the close relationship between water management and regional economic development, the Province undertook or assisted in the construction of numerous water projects. At the time of settlement, the Province promoted economic development by assisting the municipalities to remove excess water from the fertile, but inherently wet land. Then in the late 1950's, in response to requests from the Red River Valley Development Association, the Province passed enabling legislation to facilitate the delivery of

potable water for domestic, municipal and industrial use. These actions permitted many regions to capitalize on development opportunities. However, over the last decade, water problems in the form of inadequate water supplies and frequent massive floods have become so severe that in many areas development has been constrained and the economic stability of some regions has been threatened. Despite the severity of these problems, little has been done to alleviate the situation.

As municipal responsibility for water management has been eroded, there has been a growing rift between local and senior government. From a local perspective, the Province has ignored local concerns for augmented water supplies and flood control. Both levels of government agree that the current situation leaves much room for improvement. The problem is that the Province, on the basis of a limited set of economic criteria, has justified a response which local governments regard as wholly inadequate.

Although it is theoretically easier for a higher level authority to develop comprehensive plans, which integrate multiple objectives, this has not been borne out by recent experience. In fact, the Province has, since 1969, taken a very narrow approach to water management which seems to disregard the relationship between water management and economic development. LRRVWC, on the other hand, has from its inception, pursued a comprehensive management strategy

in the form of the Pembina project to achieve the objectives of irrigation, a potable water supply, flood control and soil conservation.

Local concerns argue that the methodology of water management decisions does not yield optimum results. The Province claims that decisions are based on objective economic criteria. Of course, decisions are objective only insofar as one accepts the underlying assumptions, goals and methods. The many factors associated with water management decisions means that there are many implicit values and assumptions. Hence there will always be differences of opinion. The problem is one of overcoming these differences of opinion in order to effect more optimum results.

If LRRVWC is to have any influence on water management decisions and overcome the stalemate, LRRVWC has several options:

1) it can apply political pressure and engage the government in debate; and/or
2) it can attempt to re-establish a good working relationship with the Province; and/or
3) it can demonstrate weaknesses in the methodology of water management decisions.

As we have already seen, political pressure and lobbying can achieve results but it is frustrating lobbying unstable and/or unsympathetic governments. Also it is improbable that LRRVWC will have any influence on the Canadian Department of

External Affairs or the United States State Department regarding international waters. Thus, applying political pressure or attempting to curry political favour are not necessarily likely to bring positive results. It may be more advantageous to demonstrate weaknesses in methodology in a non-confrontational way. If the Water Resources Branch can be convinced of the merits of a new approach -- an approach which escapes the "we" versus "they" stand-off and views problems from a common perspective -- then the problems may be resolved. Emotional arguments may beget sympathy, but economic logic is more likely to garner support and action.

This chapter examines flood problems in three areas:

1) along the Red River mainstem;
2) in the Aux Marais area, and
3) at the Town of Carman

Rather than providing an exhaustive overview of flood problems in these and other areas, this chapter will present three case studies to demonstrate some shortcomings in the methodology of decision making and how that methodology has evolved.

8.1 FLOODING ALONG THE RED RIVER

Flood damages have been extensive along the Red River. The 1950 flood resulted in damages estimated at $81.2 million in Winnipeg and $11.3 million to the area between

Emerson and St. Norbert (Manitoba Water Resources Branch, 1979: Information Package). Since the potential for damage was so great in Winnipeg, the first priority was to reduce the flood hazard in the City. To this effect, several improvements were undertaken:

1) a permanent system of dykes was built through the City immediately after the 1950 flood, at a cost of $4.6 million;
2) the Red River floodway 'a 30-mile diversion around the City) was completed in 1968 at a total cost of $62.7 million; and
3) to control Assiniboine River flows, the Portage Diversion was built in 1970 at a cost of $20.5 million, and the Shellmouth Reservoir was completed in 1972 at a cost of $10.8 million (Manitoba Water Resources Divsion, 1974 pamphlet).

It is estimated that these works prevented estimated damages of $200 million in the 1974 flood and $300 million in the flood of 1979 (Manitoba Water Resources Branch, 1979: Information Package).

Flood damage reduction measures have also been implemented in the rural areas south of Winnipeg. Permanent ring dykes were constructed around the communities of Emerson, Letellier, Dominion City, St. Jean Baptiste, Morris, Rosenort and St. Adolphe. Total cost of the program, completed in 1972, was $2.7 million. Ring dykes, in combination

with emergency dyking and evacuation procedures, reduced flood damage by $11 million in 1979. Still, $24 million in damages occurred in the area south of Winnipeg as 230,000 acres were inundated by floodwaters (Figure 11).

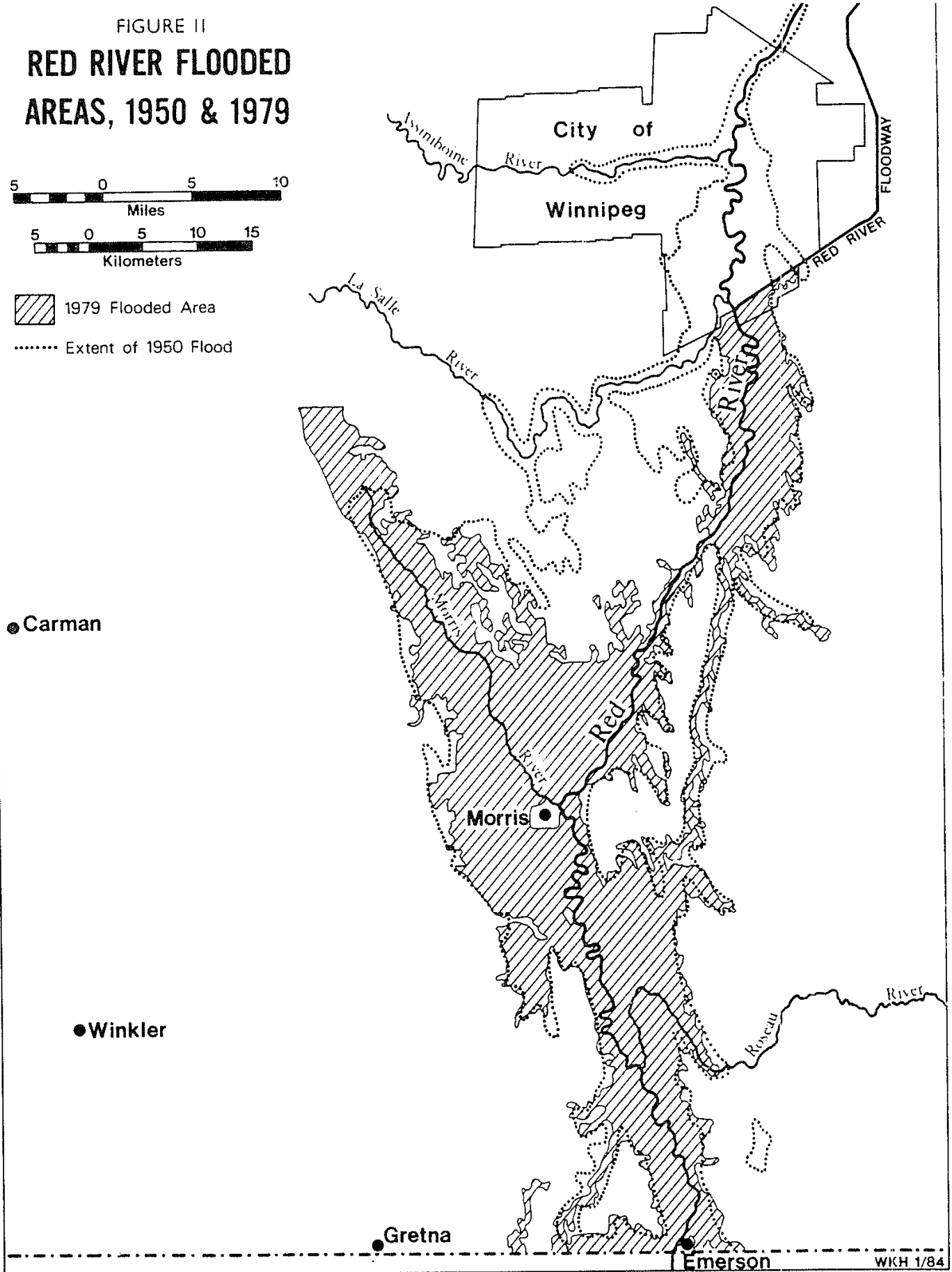
Damages have also been extensive south of the International Border. In 1979, over one million acres were flooded in Minnesota and North Dakota, resulting in damages close to $98 million.

Prior to the construction of flood control works in Manitoba, numerous investigations were conducted on alternative methods of flood control. This paper now turns its attention to one such study completed in 1953 by the Canada Department of Resources and Development, Engineering and Water Resources Branch. The objective of this study was to reduce the flood hazard in Winnipeg and investigations were made on:

1) storage on Red River tributaries in Canada and the U.S.;
2) storage on the Pembina River (175,000 acre-foot reservoir);
3) storage on the Assiniboine River (450,000 acre-foot reservoir); and
4) a detention basin on the main stem of the Red River near Ste. Agathe.

FIGURE II

RED RIVER FLOODED AREAS, 1950 & 1979



SOURCE: Water Resources Branch, 1979 and Dept. of Geography, University of Winnipeg

The study concluded that headwater retention was not a viable solution. The topography of the Red River Basin precluded the possibility of sufficient reservoir storage on Red River tributaries and it was felt that dams on the Pembina and/or Assiniboine Rivers would not provide adequate flood protection either.

The alternative most effective in reducing Winnipeg flooding was adjudged to be the Ste. Agathe Detention Basin. This scheme envisioned a 25-mile earth dyke across the Valley, immediately south of Ste. Agathe to create a dentention basin along the main stem of the Red River between Emerson and Ste. Agathe. The study states:

> The practicability of this project will depend on whether the damages prevented downstream in the rural and in the Greater Winnipeg areas are of more concern than the cost of structures and the additional damages that would result between Ste. Agathe and Emerson from the higher controlled flood levels. (Canada. Department of Resources and Development, 1953:36).

Although never implemented, this "Hadrian's Wall" recommendation by the Canada Department of Resources and Development, illustrates rather pointedly, some of the theoretical shortcomings of the traditional approach to water and land management. The problem-solving approach does not always yield optimum results. Instead, problem-solving is often meant to "satisfice" a single objective and the only caveat is that the solution satisfy economic efficiency considerations. In this case since the benefits of protecting

Winnipeg were greater than the costs of periodic flooding in rural areas, south of Ste. Agathe, a 25-mile dyke was preferred as an economically viable solution. This approach merely transfers problems from one area to another. Thus, each solution creates a new set of problems which will be redressed only when certain economic criteria can be satisfied.

This study is somewhat dated, and is no longer relevant to the issue of flood hazard reduction in Winnipeg. Today, other factors such as environmental values and social objectives would be considered. Nonetheless, current methodology continues to ignore opportunities foregone. Investigations are largely based on extrapolating past trends instead of developing scenarios of the future. Ignoring the future, narrows the range of policy options.

Basing decisions solely on economic criteria does not objectify the decision. Values are implicit in all decision making. Therefore, solutions are correct only insofar as one accepts the assumptions, methods and objectives. In view of the narrow perspective of some studies, one can conclude that professional recommendations do not necessarily reflect the best choice.

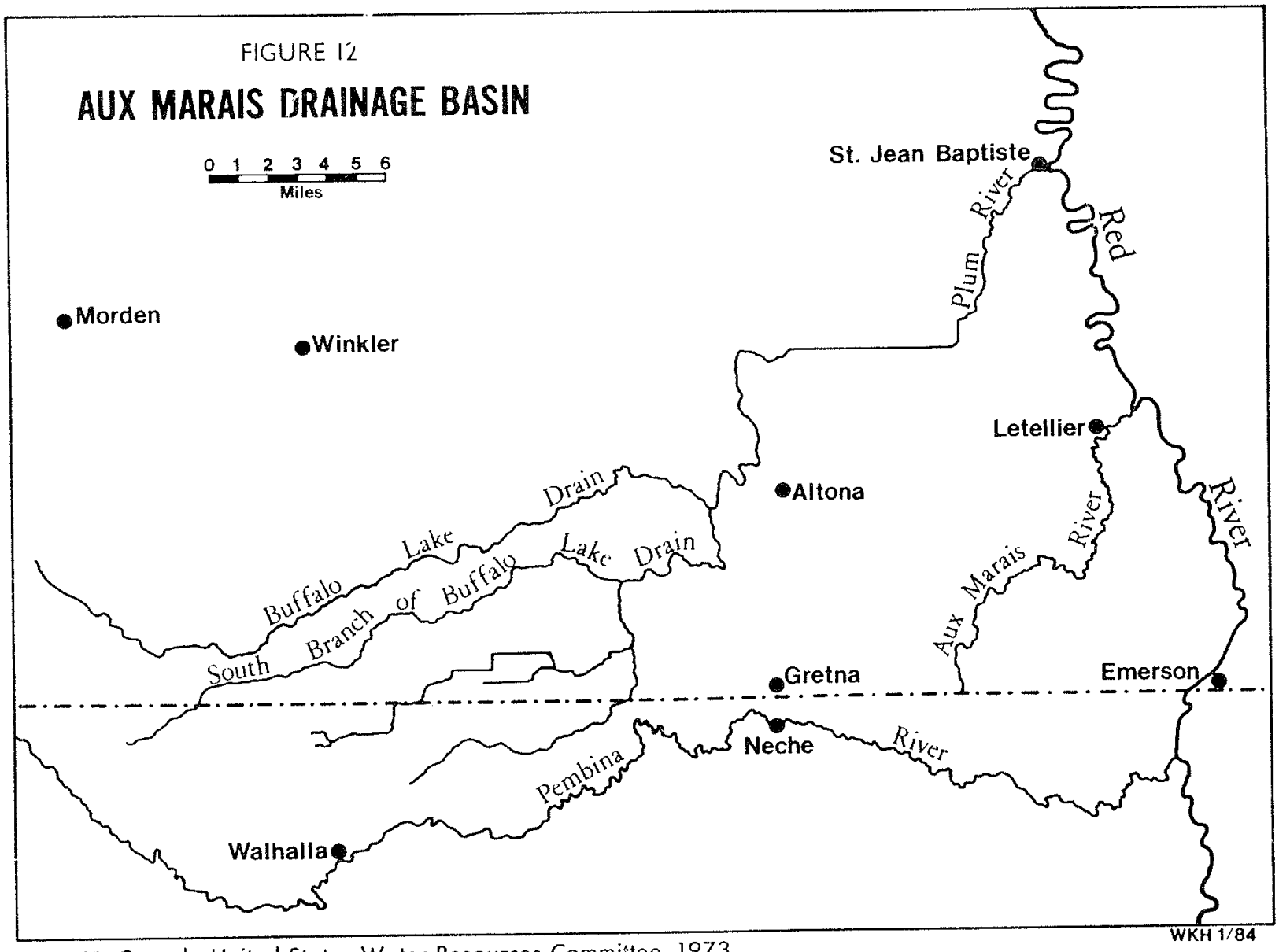
8.2 THE AUX MARAIS DRAINAGE BASIN AND THE WALHALLA - SOUTH BRANCH OF BUFFALO LAKE DRAINAGE BASIN

Perennial flood damage has occurred in the Aux Marais Basin (Figure 12) on both sides of the International Boundary in the vicinity of the Town of Neche, North Dakota and the Town of Gretna, Manitoba. Flood damages have been small relative to damages along the Red River main stem. A study by John Rempel commissioned by LRRVWC estimated flood damage in Manitoba to be $47,396 in 1969 and $167,405 in 1970. Despite the small damages, flooding in the area presents a situation every spring which threatens to explode into an international confrontation. An investigation of this situation reveals a difference in attitude between Canadians and Americans and has wider implications in terms of the whole question of foreign water and international co-operation.

Very briefly, the situation is that in 1957, the International Boundary Drain was constructed from Gretna to the Aux Marais River to alleviate flooding in the south-westerly part of the Aux Marais watershed. The flow of water from North Dakota, across the Boundary was unimpeded by any control until 1964. In the summer of that year, extensive flooding was experienced in Manitoba after heavy rains. It was felt that much of this flooding resulted from waters originating in North Dakota so the R.M. of Rhineland constructed a dyke on the north side of the International Boundary Drain. During spring flooding in 1966, Pembina River

FIGURE 12

AUX MARAIS DRAINAGE BASIN



SOURCE: Canada-United States Water Resources Committee, 1973

floodwaters in North Dakota escaped overland into the Aux Marais Basin resulting in flooding along the International Boundary Drain. To ensure that the K.C.N.D. T.V. tower would not be flooded the dyke was breached in three places, flooding Manitoba farmlands. These events have caused considerable dissatisfaction on both sides of the border.

Manitoba landowners were disinclined to accept excess water from south of the border for two reasons:

1) they felt that spring flood flows should rightfully be channelled through the Pembina drainage system; and

2) they believed that uncontrolled dyking, drainage and certain land use practices by their southern neighbours had exacerbated the flood problem.

In a brief to Sidney Green, March 8, 1971, LRRVWC states:

> The irony of the situation is that the damages in the Aux Marais area, as well as those referred to later in the South Buffalo main area, are caused by waters not originating in Manitoba, but in North Dakota, and are aggravated by control structures constructed in North Dakota to protect their own citizens. In other words, water is being diverted into Canada that should and could be channelled into the Pembina River in North Dakota. (LRRVWC Brief, March 8, 1971).

Meanwhile, North Dakota landowners saw it as their right to remove water from their land and wanted Canadian

water controls eliminated. Since Manitoba would not comply, and North Dakota authorities wanted to improve drainage in that area, the State approached Manitoba authorities in 1968 with a proposal to improve the Aux Marais River on a cost-sharing basis. A study was undertaken and certain improvements recommended on the basis of a North Dakota contribution of 29.4% of the capital costs or $116,400 (Manitoba, Water Control and Conservation Branch, 1969).

Manitoba was not prepared to implement the improvements for several years and the potentially explosive situation prompted North Dakota Governor Guy to approach the Canadian Federal Government. The matter then became a subject of negotiation between the Canadian Department of External Affairs and the U.S. State Department. A meeting was held October 13, 1971, involving the Governments of Canada and the United States, the State of North Dakota and the Province of Manitoba. A committee known as the Canada-United States Water Resources Committee was struck at this meeting comprised of one representative from each level of government involved. This committee involved members of the United States, Souris, Red, Rainy River Basin Commission, the North Dakota State Water Commission, the Water Management Boards of Pembina and Cavalier counties in North Dakota, the Government of Canada's Department of Environment, the Manitoba Department of Mines, Resources and Environmental Management and the rural municipalities of Rhineland and Stanley, in Manitoba. (Canada-U.S. Water Resources Committee, (1973:2).

The terms of reference directed the Committee to make recommendations to alleviate flooding problems due to local drainage in the Aux Marais and the Walhalla-South Branch of the Buffalo Lake Watersheds (Canada-U.S. Water Resources Committee, 1973: Memorandum of Understanding). The recommended works were designed to remove surface agricultural waters which represent that flow of water which would occur on average once every eight years. Thus, the recommended works were not designed for flood protection, which generally conceded, would necessitate some control of the Pembina River, since periodic overflows of the Pembina River compound flooding in the Aux Marais watershed. The recommended works cost over $3 million in 1972 and required 2987 acres of land for right-of-way for channels and dykes (Canada-United States Water Resources Committee, 1973: Appendix C, October 1971).

The Committee report was discussed in Winnipeg on October 31, 1974, when local people voiced their displeasure. The Committee was disbanded and a new committee was organized, consisting of: Mr. Hugh McKay (Province of Manitoba); Mr. Baldwin (Federal Government of Canada); Mr. Smith (External Affairs); Mr. Fahy (North Dakota State Water Commission); Mr. Fiske (North Dakota Soil Conservation Service); and Mr. Yanowsky (U.S. State Department) (LRRVWC, Minutes, February 3, 1975).

To this date, the problem remains unresolved. The Canadians have delayed any action pending an American decision on the Pembilier dam. Proceeding with the recommended drainage works, prior to construction of the Pembilier dam would reduce the benefit-cost ratio of the Pembilier, thus militating against its construction. In 1982, the Pembilier was shelved because of a low benefit-cost ratio and the Army Corps of Engineers are considering the construction of a border floodway which, after preliminary investigations, appears to have a positive benefit-cost ratio

8.2.1 Canada-United States Water Resources Committee Negotiations

Bi-lateral negotiations revealed several fundamental differences between Canadian and American law, administration and attitudes. By examining some of the contentious points in the negotiations, it is possible to highlight some of the impediments to conflict resolution, and some of the difficulties in effecting comprehensive water management.

On October 28, 1971, two weeks after the original meeting, the Committee recommended certain emergency works including dyking around the south and west periphery of the Town of Gretna, and installing additional culverts on the Aux Marais at the border and on the Walhalla-South Branch of the Buffalo Lake Watersheds (Canada-United States Water Resources Committee, December 1973:4) (see Appendix A of Committee Report for detailed description of works).

However, two contentious issues arose which necessitated another six meetings over the course of a year and a half. There was considerable controversy between Committee members regarding a 300-foot section of road dyke just south of the Canadian border. There was also considerable disagreement on cost sharing the works recommended in "Interim Report on Permanent Solutions to the North Dakota-Manitoba Boundary Flood Problem (Canada-United States Water Resources Committee, 1973:4).

The road dyke contravened Item 2 of the terms of reference which stated that "...all unilateral action affecting the flow of water in the watershed of the Pembina, east of Walhalla as well as the Walhalla-Buffalo Lake and Aux Marais Watersheds cease immediately" (Canada-United States Water Resources Committee, 1973:3).

The Canadians wanted the dyke removed. Mr. Hildebrand reported that the dyke had upset local Canadian farmers especially after they went along with adding an additional culvert at the boundary (Canada-United States Water Resources Committee, 1973, June 28, 1972:49). However, the farmer who had constructed the road dyke refused to do any levelling (Canada-United States Water Resources Committee, 1973, December 15, 1971). Mr. Newton, Canadian co-chairman felt that it was the responsibility of the respective governments to police these works. However, Mr. Jochim, legal council for the North Dakota State Water Commission, advised that:

> the North Dakota State Water Commission or the County Water Management Board has not the right through law or statute to prevent individuals from undertaking drainage works on their lands (Canada-United States Water Resources Committee, 1973, October 22, 1971:3).

Mr. Jochim, went on to caution that any agreement between the North Dakota Water Management Board and Manitoba were extremely vulnerable since they could be overruled by individuals (Canada-United States Water Resources Committee, 1973 December 15, 1971:33).

Mr. Jochim said that the removal of the dyke should await the results of a topographic survey to determine if the dyke had any appreciable effect on flood levels. If it did have any appreciable effect on flood levels and the farmer refused to lower the dyke, Mr. Jochim advised that the plug at the Canadian border should be removed (Canada-United States Water Resources Committee, 1973, December 15, 1971:25). The Americans argued later that the dyke had no appreciable effect (Canada-United States Water Resources Committee 1973, June 28, 1972:50). Mr. Hildebrand, representing the R.M. of Rhineland contended that whether it had any adverse effects or not was not the point. The point was that the Americans were not bargaining in good faith (Canada-United States Water Resources Committee 1973, December 15, 1971:27).

Mr. Newton explained that he had cautioned the municipalities in Manitoba that the Province could not tolerate any further activity along the International Border and

he expected that the Americans would endeavour to do the same. Mr. Newton stated that "If one individual in the United States can frustrate this undertanding, then the Canadians are placed in the position where they cannot negotiate on equal terms" (Canada-United States Water Resources Committee, 1973, December 15, 1971:27).

It is not difficult to understand the frustrations of Canadian representatives. To resolve the problem over the road dyke, it was decided that a topographic survey be conducted to determine whether the dyke had any appreciable effect on flooding. If it did, there were two options available:

1) Mr. Brown of the Pembina County Water Management Board and Mr. Hildebrand of Rhineland were to attempt to convince the individual to remove a section of the dyke; and
2) in the event that they were unsuccessful, they were instructed to remove the plug at the Canadian border.

(Canada-United States Water Resources Committee, 1973, November 24, 1971 and December 15, 1971).

Although the topographic survey revealed that the road dyke had a negligible effect (Canada-United States Water Resources Committee, 1973, April 20, 1972) local farmers in

Rhineland were incensed, and requested Manitoba authorities to delay complying with a commitment to install an additional pipe at the boundary. However, the Province insisted that its commitment be fulfilled and that any failure of the American groups to fulfill their obligation be left as a subject of debate by the Committee (Canada-United States Water Resources Committee, 1973, June 28, 1972:50). The Committee maintained that the road should be lowered to prairie level. The farmer complied and the work was carried out (Canada-United States Water Resources Committee, 1973, December 14, 1972).

There were also lenghtly discussions and difficult negotiations on cost-sharing, i.e., devising a method of apportioning responsibility, determining what items should be shareable, and determining who should absorb additional costs for openings in excess of the agricultural design.

Four methods of cost-sharing were considered:

1) Contributing Drainage Area Method;
2) The Design Discharge Apportionment Method;
3) The Incremental Cost Method; and
4) Benefited Acreage Method.

Also debated were the items to include in capital costs. This involved discussions on:

1) the cost of rights-of way;
2) the cost of excavation, construction of embankments and excavation disposal;

3) the cost of bridges, culverts, ford crossings, drop structures, field inlet culverts, and all other hydraulic structures;

4) the cost of relocating cables, pipelines and electrical, telephone and telegraph lines;

5) legal costs;

6) survey costs; and

7) engineering contingencies.

There was also disagreement on whether the Americans should contribute to the total cost of structures or just that portion meeting design standards (Canada-United States Water Resources Committee, 1973, April 20, 1972:44).

At one point in the negotiations, Mr. Brown representing the Canadian Federal Government, claimed that in his opinion, the Canadians were subsidizing the Americans. Mr. Nelson, engineer for the North Dakota State Water Commission pointed out that the Americans felt the reverse was true (Canada-United States Water Resources Committee, 1973, December 15, 1971:32).

One other important aspect of the negotiations was American pressure to coax their Canadian counterparts to endorse construction of the Pembilier dam (Canada-United States Water Resources Committee, 1973, June 2, 1972). LRRVWC was at this time also applying pressure on the Provincial Government to win approval for the Pembilier dam (Chapter 4). Convinced that flooding was a consequence of

changes in land use and upstream drainage, LRRVWC emphasized that flood damages would increase progressively as drainage, brush clearing and changes in land use continued (LRRVWC Brief, March 8, 1974). Therefore, in association with the fact that Pembina River overflows compound Aux Marais flooding, some means of control on the Pembina River was necessary. A Pembilier dam would also alleviate a touchy international dispute and would reduce Red River flooding (U.S. Army Corps of Engineers, 1976), which was another of LRRVWC's concerns. However, because a Pembilier dam was beyond the terms of reference, and no study had been completed, Mr. Newton, Canadian co-chairman of the Committee, could not endorse a resolution in favour of the Pembilier dam. He thought it more appr iate to imply in the preamble that the drainage works recommended by the Committee were not a complete solution to flooding since flooding is compounded by overflow from the Pembina River Basin (Canada-United States Water Resources Committee, 1973, December 14, 1972:76).

8.2.2 Discussion

The discussion on negotiations of the Canada-United States Water Resources Committee, reveals:

1) some fundamental differences between Canadian and American attitudes to regional planning and resource management;

2) Shortcomings of the sequential, single-objective problem-solving approach; and

3) the complications of resolving international problems.

In the United States, only minimal constraints are imposed on the individual, thereby militating against any systematic approach to land and water management. The cumulative effects of individual actions is ignored. Instead the focus has been on whether a particular individual action contributes appreciably to a problem. Obviously the actions of one individual are not likely to have an appreciable effect, and there is even less likelihood of proving that effect. It is inevitably the cumulative effect of these negligible impacts which exacerbate the problem. This situation is reminiscent of Garrett Hardin's "Tragedy of the Commons". According to this theory, it is to each individual's benefit to consume as much as possible of a common property (represented in this case by the ability to remove water from one's land). The result is that the commonly owned good is degraded by overuse and is in the end able to provide fewer benefits.

Without an overall management strategy and no ability to influence individual actions, water management discussions are limited to a single option -- building structural works to remove the water. Ignored are more comprehensive strategies, such as the Pembilier dam proposal and/or

environmentally appropriate land use. This sort of narrow approach to water management presents several problems. First, if improvements are made to the Aux Marais drainage system, the result is a lower benefit-cost ratio for the Pembilier. Second, structural works are expensive and often cannot be justified on the basis of economic efficiency criteria. Third, the productive potential of 2987 acres would be lost forever since this area of land would be devoted to rights-of-way for channels and dykes.

Finally, it is difficult to resolve international problems because: (1) each country does not share common objectives; (2) each country may espouse different values and attitudes; (3) it is difficult to achieve concensus on cost-sharing and interest rates; and (4) each country has different cost-sharing arrangements between local and senior levels of government. In other words, goals, objectives, attitudes and methods differ between countries.

Countries will only co-operate if there is some mutuality of interest. The United States is not so altruistic as to attempt to alleviate flooding in Canada. They may alleviate flooding as a consequence of providing flood control to their own citizens. However, if as a consequence of protecting American citizens, flooding was reduced in Manitoba, the United States would probably expect a Canadian contribution equal to the proportion of benefits provided. Thus, short of donating money to American water management

projects, Manitoba has little influence on private or public decision makers in the United States.

The situation can be characterized in the following manner. If an upstream landowner dumps water on a downstream landowner, then the downstream landowner has a problem. If the downstream landowner dams against water from upstream, then the upstream landowner has a problem. Thus, the only fair solution appears to be one which recognizes that both parties share a common problem. Theoretically, this should be easier in an area where there is only one jurisdiction.

8.3 FLOODING AT THE TOWN OF CARMAN

Significant floods occurred in Carman in 1880, 1894, 1902 and 1923 (Freshwater, 1982:12). The next half century, however, was relatively flood free. Then in the 1970's three major floods occurred in 1970, 1974 and 1979. Flood damages in 1970 and 1974 were about $500,000 in each year (1975 dollars) but the 1974 damage figure would have been much higher, at an estimated $1,320,000, had emergency measures not been undertaken (Manitoba Water Resources Branch, 1975:3). These recent floods prompted a number of benefit-cost studies of various flood proofing schemes.

> The results of the studies have always indicated a benefit-cost ratio of less than one. Over the time of those studies the ratio has increased from 0.18 in the 1970 study to 0.9 in the January 1981 study for the Canada-Manitoba Flood Damage Reduction Steering Committee.

> Changes in the ratio can be attributed to a number of factors. These include changes in flood frequencies, changes in the value of property to be protected, and changes in discount rates (Freshwater, 1982:1).

In attempts to win Federal/Provincial support for permanent flood protection, the Town of Carman has taken exception to the methodology of benefit-cost studies. Specifically, the Town has argued that flood frequencies based on long-term averages do not reflect the present reality. A submission from the Town of Carman, to the Honourable Brian Ransom, Minister, Department of Mines, Resources, and Environmental Management June 12, 1979, claimed that "The experience of the past nine years demonstrates positively that the assumed probability of flood recurrences is unrealistic under present conditions..." (Town of Carman Submission, 1979:12). Implicit in this statement is the belief that due to changes in land use, conditions have changed, and flood frequencies have increased far more dramatically than the long-term calculations indicate.

Once again, we are faced with the controversial question whether man's activities affect flood peaks. The Water Resources Branch takes the view that climatic anomalies are responsible for floods. For example, a report from Water Resources claims that the 1970 flood:

> ...was mainly due to a late ice break-up combined with above normal precipitation immediately prior to, and during the melt period. During April precipitation was

> over 200 percent of normal, mostly in the form of wet snow. Because of below normal temperatures, most of the snow cover remained intact until late April when a rapid melt occurred causing record discharges. Similar conditions prevailed prior to the 1974 flood in Carman.
> (Water Resources Branch 1975:4)

In addition to this information the Manitoba Water Commission states:

> Soil moisture prior to freeze-up is an important parameter in determining spring run-off....This, with total precipitation, accounts for 82.5% of the variation in run-off volumes.
> (Town of Carman Submission, 1979:4)

This implies that changes in climate are primarily responsible for abnormal flood frequencies. However, the submission from the Town of Carman makes an interesting comparison with weather conditions in 1950 and 1967 when Carman was neither flooded nor threatened. In the spring of 1967, April rainfall was 4.8 inches, almost double that of any April previously recorded. (April 1970 was 2.6 inches and April 1974 was 2.9 inches). This was preceded by autumn rainfall in 1966 of six inches and winter snowfall of 38.2 inches which converts to a total of 14.6 inches of water equivalent, which is the fourth highest since 1949. In 1967, there was another late spring, as the recorded ice-free date of the Assiniboine River at Winnipeg was April 23: in 1950 it was April 24; in 1970, April 25; and in 1974, April 20 (Town of Carman, Submission, 1979:5).

Thus, if one believes that climate is the sole determinant of floods, there is little apparent reason for floods to have occurred in 1970 and 1974 when they did not occur in 1950 or 1967.

> Long time residents of the area claim that in the past, prior to clearing of the upland area two distinct peaks in streamflow could be observed. The first was the result of snow melting in the lower reaches on cleared land, the second from the later melting of snow that was sheltered from the direct rays of the sun.
> (Freshwater, 1982:30).

It is argued that, as a consequence of cultivation, clearing and drainage, there is now just a single intense peak which passes through Carman in a very short period of time. The explanation for this phenomenon is that the absence of trees and ground cover allows snow to drift into ravines which are areas of high run-off. The absence of ground cover promotes a faster melt and rapid run-off of water from fields to ditches. This water runs into the ravines where it is impounded by snow dams. When sufficient pressure is developed to break the obstruction, the water rushes downstream breaking the next blockage, causing a rapid build-up of water moving down the channel. This process is similar to a flash flood which has a single high peak discharge.

The fact that Carman experienced flooding in 1880, 1894, 1902 and 1923, a period prior to any drainage and

clearing scheme in the upland portion of the watershed, may or may not substantiate the fact that climatic conditions are primarily responsible for flooding. Early floods, for example, may have been augmented by ice dams.

Also, the magnitude of the floods in 1880, 1894 and 1902 is unknown. Peak discharge in the 1923 flood was 2490 c.f.s. which compares with a peak discharge of 2460 c.f.s. in 1969 when minor damages resulted from seepage into some basements (Manitoba Water Resources Branch, 1975:5). By comparison, the three most recent floods had peak discharges of 3710 c.f.s. in 1970; 4670 c.f.s. in 1974; and 4710 c.f.s. in 1979 (Freshwater, 1982:31). Thus, although early floods prior to clearing and drainage may substantiate the fact that climate is the primary determinant of floods, they do not negate the potential for additional flood damage resulting from clearing and drainage.

The floods of the 1970's necessitated the recalculation of flood frequencies. In 1970, the forecast probability of floods of the magnitude of 1970 and 1974 were 4% and 2.5%. In 1975, the recurrence probability of these floods was adjusted upwards to 6% and 4% respectively (Town of Carman Submission, 1979:2). The flood frequency curve was calculated again after the 1979 flood and it was estimated that the 1979 flood would have a recurrence probability of 5.5% (Freshwater 1982:55), even though it was the same magnitude as the 1974 flood and was the third devastating flood to

occur in ten years. The Town of Carman attempted to build their case on the belief that flood frequencies based on long-term averages were unrealistically low, in view of the events of the last decade. In addition, the Town of Carman submission posited that flood frequencies would continue to remain higher than the long-term average because of changed conditions.

As we have seen through the course of this paper, this line of reasoning is futile. A 1982 report prepared for DREE by David Freshwater and Shannon Coughlin takes a different approach to assessing the economic feasibility of flood protection for Carman. This study shows that regardless of the fact that flood frequencies may have been underestimated one can make the case for flood control.

The Freshwater study basically does three things:

1) it demonstrates that the methodology of benefit-cost analysis has evolved over a ten-year period;

2) it shows that minor changes in the underlying assumptions can have a great impact on the final results; and

3) it shows a further refinement in benefit-cost analysis -- a refinement which includes a more embracing view through the use of scenario analysis.

The three previous benefit-cost studies on flood control for Carman (1971, 1975 and 1981) adopt a similar methodology and conclude that flood control for Carman is uneconomic. While these studies adopt a similar methodology they do exhibit an evolutionary approach to the study of methods of providing flood relief for Carman (Freshwater, 1982:40).

The 1975 study, like the 1971 study was undertaken by the Manitoba Water Resources Branch. The methodology is similar, but the 1975 study introduced several new things. For example, the flood frequency curve was re-estimated, additional types of damage (including the cost of volunteer labour) were included and the discount rate was changed from 7 1/2% to 10% (Freshwater, 1982:41). However, no additional primary data was gathered and many of the costs and benefits are updated figures of the 1971 report. The benefit-cost ratio of the diversion increased from 0.18 to 0.3 despite raising the discount rate, which would act to reduce the ratio (Freshwater, 1982:43).

The 1981 study was undertaken jointly by Environment Canada and the Province of Manitoba with representation from the Department of Municipal Affairs and the Water Resources Branch. This study had a much broader focus, incorporating a significant extension in terms of methodology. For example, the study recognized that since the value of property increases over time then so must the flood frequency

damage relationship. Assuming a 1% annual growth in benefits, the benefit-cost ratio increased by approximately 11% (Freshwater, 1982:45). A further innovation of the 1981 report was the inclusion of additional flood costs such as the cost of evacuating residents of senior citizen homes and housing them in other communities.

Using a 5% discount rate and a 1% annual increase in benefits, the benefit-cost ratio of a diversion increased to 1.08 (Freshwater, 1982:47). However, a 5% discount rate is inconsistent with the rate required by Federal projects. Thus, the ratio remained below 1 and a diversion could not be justified on the basis of economic efficiency criteria.

The Freshwater study goes on to make further refinements in methodology. Freshwater points out that the flood frequency damage curve "...uses actual damages associated with the most recent flood when potential damages are the relevant consideration" (Freshwater, 1982:49). Actual damages understate potential damages because actual damages were reduced by removal of property and emergency dyking. "These measures are really alternatives to a structural protection scheme and should not be considered in evaluating benefits and costs associated with structural measures" (Freshwater, 1982:50)

In view of uncounted or understated damages and the omission of potential damages, Freshwater suggests that it would not be unreasonable to increase 1979 flood damage by

$900,000. This would increase average annual benefits of a diversion from $358,000 in the 1981 study to $528,000 if no other flood protection had been undertaken.

Freshwater also presents another hypothetical but not unrealistic assumption that, given the confidence interval associated with the flood frequency damage curve, it is not unreasonable to assume that the 1979 flood was a 6.5% flood rather than a 5.5% flood. This assumption increases average annual benefits of a diversion to $400,500 from $358,000 as ascertained by the Ad Hoc Task Force Report 1981. (Freshwater, 1982:55).

These hypothetical, but not unrealistic, assumptions demonstrate that minor adjustments in the underlying assumptions produce significant adjustments in the final results. However, these changes did not alter the conclusion that a diversion was not cost-efficient. Nonetheless, Freshwater was able to build a strong argument for a Carman diversion through the use of scenario analysis.

Given that these previous benefit-cost analyses have shown that structural protection is not economically justifiable, the Canada-Manitoba Flood Damage Reduction Agreement will designate much of Carman as a flood hazard area. This will preclude any new development in flood-prone areas, and will therefore result in major adjustments in the development pattern of the Town. Thus, two scenarios for

development are possible. One involves a Boyne River diversion. The other leaves the Town to adjust to the restrictions imposed by designation. Freshwater states:

> In order to appropriately evaluate the benefits and costs of providing a diversion one must forecast the development pattern of Carman without the diversion and compare it to that with the diversion.
> (Freshwater, 1982:69)

Designation will result in significant costs to the Provincial Government and the Town of Carman which includes businesses, taxpayers and residents. Much of the commercial sector, one-third of the housing units, the town hall, the hospital, public school and most churches will have to be relocated. The result would be major expenditures for constructing new buildings and extending infrastructure. This will cause higher taxes and/or a decline in services. The Town would be left with a decaying central core and a widely dispersed commercial district. In addition to detracting from the attractiveness of the Town, businesses and consumers will be faced with higher costs. Designation will lower the value of many properties and will contribute to a more rapid deterioration of the existing housing stock. In effect, designation means that a higher level of government is taking property rights from landowners without providing compensation. Thus, the social costs of flood assistance are reduced but the private costs are high. On the basis of previous

benefit-cost analyses, designation is economically justifiable to the Province but it is not economically justifiable to the residents of the Town of Carman.

> There are however, grounds to argue that with designation, sufficient change will take place in the institutional structure affecting the town that the results of these previous studies are not applicable to the new situation (Freshwater, 1982:60).

On the basis of alternative development scenarios, Freshwater recommends construction of a diversion since it imposes lower social costs than designation and gradual flood plain abandonment (Freshwater, 1982:76). The approach used in this study is merely a further refinement in benefit-cost analysis and is another step in the evolution of methodology.

8.4 CONCLUSION

This chapter has presented case studies of flood damage reduction efforts in three areas: 1) along the Red River main stem; 2) in the Aux Marais area; and 3) at the Town of Carman. Discussion of flooding along the Red River and at the Town of Carman illustrates the evolution of methodology in terms of flood damage reduction decisions. The discussion of efforts to redress flooding in the Aux Marais area demonstrated that differences in attitude, legislation and financial arrangements, and conflicting objectives make negotiations difficult. The three cases considered together,

illustrate the need for a more holistic approach to water management. Such an approach must incorporate multiple objectives and be viewed from a variety of perspectives. Most importantly, water management must be seen as a component of regional economic development. The most satisfactory way to do this is to assess the benefits and costs of constructing flood control works and not constructing such works. Thus, various scenarios of development must be considered in order to arrive at a decision which is to the mutual advantage of all interest groups.

Flood damage reduction studies have in the past created a great deal of dissatisfaction. The dissatisfaction has revolved primarily around the methodology of constructing the analyses. For example, in 1953, a plan to create a detention basin south of Ste. Agathe was proposed as an economic solution to flooding in Winnipeg. Although this proposal satisfied economic criteria, in terms of providing more benefits than disbenefits, it could hardly be viewed as an optimum solution. Single objective problem solving ignores opportunities foregone and creates new sets of problems.

Similarly, benefit-cost studies of a diversion around Carman showed the diversion to be uneconomical. Only when one considered the costs of not providing a diversion, does it become economic to build the diversion.

Most importantly, the discussion of studies on flood control for Carman, illustrates the evolution of methodology is constructing benefit-cost analyses. At each point in time, decisions have been justified on the basis of "objective" economic analysis. It is axiomatic, however, that decisions are objective only to the degree that the basic premises are factual and everyone agrees with the assumptions, objectives and methods. In view of the different perspectives and the multitude of factors affecting economic analysis, decisions have been regarded by some groups as highly subjective. At any rate, decisions based on a limited set of economic criteria applied to a limited range of alternatives, are often not the most optimum.

CHAPTER IX

SUMMARY AND CONCLUSIONS

The lower Red River Valley is today one of the most prosperous regions in rural Manitoba. A large part of that success derives from an ability to overcome economic development constraints imposed by recurrent water management problems. Overcoming the constraints required a high level of organization by local levels of governmment, a spirit of cooperation with senior levels of government and the identification of a series of common endeavors for mutual economic benefit. When the area was first settled it was necessary to construct a massive drainage scheme to make the land suitable for agricultural production. Initially this was the responsibility of local levels of government. It soon became apparent, however, that water problems transcended municipal boundaries and the resolution of problems required a more embracing level of administration. Recognizing this situation, and the fact that a healthy agricultural sector would contribute to the economic performance of the Province, successive Provincial administrations accepted an ever-larger share of the fiscal and administrative responsibilities for water management. For the most part, this shift in responsibility from local to senior levels of government was welcomed

by local taxpayers. In effect, this trend established the Province's willingness to invest public funds to promote economic development through water resources management. A corollary effect has been a loss of public input to planning decisions and a tendency for the public to look to government for solutions to water management problems.

Originally it appeared that a shift in water management responsibilities was compatible with regional economic development objectives, as perceived by local concerns. Both the Provincial and Federal Governments displayed a willingness to participate with local interest groups to develop water projects. That period extending from around the turn of the century until the late 1960's was characterized by a spirit of cooperation between local and senior levels of government and grassroots involvement in regional economic development decisions.

Organized public representations to the Provincial Government resulted in the enactment of the Water Supply Districts Act (S.M. 1958, c. 71) and the creation of the Lower Red River Valley Water Commission (LRRVWC), which has represented region interests since its inception in 1958. Between 1958 and the late 1960's, LRRVWC was immensely successful in promoting their vision of development to senior governments. LRRVWC recognized from the beginning that:

> ...drainage, water conservation, irrigation, flood control and a potable water supply go hand in hand, and that all water problems should be under the jurisdiction of one provincial government department (LRRVWC Minutes, Sept. 30, 1958).

Thus, it seems reasonable to assume that LRRVWC attitudes influenced the Province's subsequent enactment of 2 statutes. The first was the Watershed Conservation Districts Act (S.M. 1959), which was designed to promote the conservation and control of water resources within a watershed district by eliminating provincial-municipal and intermunicipal splits in jurisdiction. The second statute was the Department of Agriculture and Immigration Act Amendment Act (S.M. 1959, c.4). This Act consolidated water legislation under the auspices of one Provincial Government Department and changed the name of the Department of Agriculture and Immigration to the Department of Agriculture and Conservation, indicating a change in philosophy.

LRRVWC representations also resulted in the enactment of the Manitoba Water Supply Board Act (S.M. 1959), which made it possible for communities throughout Manitoba to develop municipal water supply systems. Among the other significant accomplishments of LRRVWC during the early years was the construction of the Neche/Altona pipeline in 1960 and the development of the Winkler aquifer and water supply distribution system. LRRVWC was no less successful in its dealings with the Federal Government, convincing PFRA to build a dam at Stephenfield (completed in 1964) and convincing the Federal Government to request the IJC to conduct an exhaustive study of the Pembina River Basin (1962-67).

By the late 1960's however, LRRVWC was somewhat less effective. Since water management decisions were vested in the control of senior levels of government, LRRVWC's role had changed from one of active participation to one as lobbyist. Meanwhile, between 1965 and 1980, water problems in the lower Red River Basin occurred with alarming frequency and magnitude. Major damaging Red River floods occurred in 1965, 1966, 1969, 1974, 1975, 1978 and 1979. In the 65 years previous to this period there were only 3 floods which occurred in 1916, 1948 and 1950. Similarly the Town of Carman experienced major floods in 1970, 1974 and 1979 after half a century of flood-free years. Major regional drought occurred most recently in 1973, 1976, 1977 and 1980. In addition, by the late 1970's limited supplies of potable water were beginning to impose constraints on economic development.

Despite these severe and recurring water problems, senior levels of government did little to redress the problems in the lower Red River Basin during the period extending from the mid-1960's to 1980. This, however, was by no means a period of inactivity in the area of water management in Manitoba. The Red River Floodway was completed in 1968. Two years later the Shellmouth Reservoir and Portage Diversion were also completed. These three projects cost a total of $94 million at the time they were constructed. In addition, several large hydro projects were constructed. Thus,

although there was a large public investment in water control during this era, limited funds were invested in the lower Red River Basin for the purpose of water control. The only major undertaking by the Provincial and Federal Governments was the construction of ring dykes around the communities of Emerson, Letellier, Dominion City, St. Jean Baptiste, Morris, Rosenort and Ste. Adolphe, at a cost of $2.7 million (Manitoba, Water Resources Division, 1974). Although ring dykes reduced flood damages, they did not eliminate the need for emergency dyking and forced evacuation.

From an objective viewpoint, one could hardly say that the government's actions were unreasonable, especially in view of the fact that the magnitude and frequency of water problems in the lower Red River Basin were greater than could be predicted from the historic record. Nonetheless; for those people flooded by the Red River seven times in fifteen years between 1965 and 1979, or for Carman area residents flooded 3 times in 10 years between 1969 and 1979, or for those people in Altona and Morden who lacked sufficient supplies of potable water, the situation called for immediate action.

Naturally, the affected public was discontented with Government's failure to initiate preventive action. LRRVWC continued to lobby vigorously on behalf of the affected communities but their efforts proved futile and frustrating. What was particularly frustrating was the fact that

LRRVWC was from its inception pursuing a comprehensive vision of development. The Province, on the other hand, exhibited a lack of sensitivity to public attitudes and a rather limited response to water development opportunities which could encourage growth of service centres and expand agricultural production. A major area of contention developed over the reliability of projecting the future based on the past, in view of the fact that conditions had changed. For example, in Chapter 5 it was demonstrated that the Manitoba Water Supply Board evaluates the need for augmented water supply by projecting historic population growth trends. The public argues that given an augmented supply of potable water, local towns may have been able to attract industry and grow at a faster rate. In other words, limited supplies of potable water have constrained development. Similarly, major flooding has been significantly more frequent from 1965 to 1980, than in the preceding sixty-five years. Hence, a large number of people have argued that changes in land use and/or climate have affected floods and floods will continue to occur more frequently than indicated by the historic record. Water resource planners have tended to disagree, claiming that the long-term record yields a more realistic projection of the future than would be obtained by using only the last twenty or thirty years of record. The result of this approach is that benefit-cost studies on flood control and water supply yield results which are inadequate to justify action.

Thus, from the perspective of the affected public, government policy makers and technocrats have assumed complete decision-making power and have divorced their decisions from public goals and economic development considerations. There is no management strategy -- no phased plan of development. Individual projects are examined on an ad hoc basis without any relation to a development plan. Particularly disconcerting is the fact that LRRVWC has little input to planning decisions, little or no recourse after the decisions are made, and a limited awareness of the Province's plans. The public is left to flounder, waiting for the next flood or drought. This situation has led to divisiveness, misunderstanding and a feeling of powerlessness among the public and local levels of government.

Thus, despite the gains and accomplishments in the area of water development, there remain a number of problems to resolve and a number of opportunities unrealized. This study seeks to empower people to act -- to resolve the problems and to realize the opportunities. By tracing the evolution of problems, attitudes, legislation and methodology, this study increases the level of understanding among the various actors involved in decision-making. The study to this point has documented past and present problems. The question remains, "Where do we go from here?".

LRRVWC's first priority should be to conduct a "force field analysis". That is, LRRVWC should identify

the positive forces working towards change and the negative forces impeding action. This approach may help LRRVWC identify where their efforts might most profitably be concentrated.

Several positive developments come readily to mind. First, the Provincial and Federal Governments espoused their intention to promote economic expansion in rural Manitoba, emphasizing the role of water management in that expansion, when they signed the Canada - Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing, May 30, 1980. This Agreement represents a profound change in outlook -- a change which recognizes the need for a more embracing regional approach to water management and economic development. An early benefit of this agreement was the expansion of the Morden reservoir in 1981. A second positive force concerns the fact that the Department of Regional Economic Expansion (DREE) appears to have changed its mandate. Originally, DREE sought to reduce regional disparities. Such a policy was possible, and indeed desirable, in a high growth economy. However, the latter part of the 1970's marked the beginning of a period of slow growth and senior governments began to search for growth sectors. Special crop production may present such an opportunity in Manitoba's slow growth economy. Thirdly, the lower Red River Basin has a long history of collective action and a tradition of strong community leadership. Fourth, senior levels of government are examining the prospects of large

scale irrigation, namely the Assiniboine South-Hespeler Area Project. Fifth, the methodology of water management decisions has evolved over the years to include additional decision-making considerations, such as regional income distribution, environmental quality and social well- being.

Among the negative forces impeding action, one could include the fact that governments are running exeedingly high deficits and the affected areas have a relatively small tax base over which to spread the cost of physical constructs. Also, the Federal Government relies on benefit-cost analysis as a technique of allocating public funds betwen competing uses. Thus, given that there are competing demands for public funds, there is no guarantee that the Federal Government would choose to invest in the region, even if a proposed development had a benefit-cost ratio greater than one. Another negative force concerns the fact that individuals have, to a large extent, abrogated individual responsibility for their actions and increasingly look to government to solve their problems. In other words, individuals have failed to relate their individual preference functions with the problems they face. Concentration of decision-making power in the upper levels of technocracy has caused the public to lose faith in its collective impact. Also, the large number of issues with which LRRVWC must contend causes some diffusion of focus and energy.

The previous discussion of positive and negative forces affecting water management decisions is by no means exhaustive. It serves to illustrate that there may be a number of different scenarios which could be pursued. It also leads one to the conclusion that the various problems of potable water supply, flood control or flood damage mitigation, and irrigation may require different approaches.

It is not sufficient for LRRVWC to approach government to build a particular project. That approach leaves the government with the option of citing technical reports which may demonstrate that the project is not cost-effective. LRRVWC would be better advised to approach government and ask that government to articulate their objectives for the region. The production of a management plan would remove decision making from the hands of the technocrats and place it in the hands of the elected representatives of the people, where it should be in a democratic society.

The real questions are not technical or economic. The real questions are: what goals are being sought; whose goals are being sought; and who decides whether these are the right long-range societal goals?

BIBLIOGRAPHY

Biswas, Asit K. August, 1973. "Socio-Economic Considerations in Water Resources Planning". Water Resources Bulletin. American Water Resources Association. Vol. 9 No. 4.

Bond, Wayne. November, 1975. Innovative Development Policy for Southern Manitoba: Industry and Manufacturing. Faculty of Environmental Studies, Student Discussion Paper, No. 1 York University.

Calton, J.R. November 30, 1979. "Floods on the Red River". Unpublished paper presented at a public forum called Red River Flooding: Causes and Solutions. Sponsored by the Manitoba Environmental Council at the Manitoba Legislative Building. J.R. Calton is Special Assistant to the Chief, Engineering Division, U.S. Army Corps of Engineers, St. Paul District, Minnesota.

Calton, J.R. November 30, 1979. Presentation given at a public forum called Red River Flooding: Causes and Solutions. Sponsored by the Manitoba Environmental Council at the Manitoba Legislative Building. J.R. Calton is Special Assistant to the Chief, Engineering Division, U.S. Army Corps of Engineers, St. Paul District, Minnesota.

Canada. Department of Regional Economic Expansion. March, 1982. "The Manitoba Economy: Performance and Prospects". unpublished mimeo.

Canada. Department of Resources and Development. March, 1953. Report on Investigations into Measures for the Reduction of the Flood Hazard in the Greater Winnipeg Area. Appendix "F" Flood Storage. Prepared by Red River Basin Investigation Water Resources Division.

Canada. Department of the Environment. 1981. Canada Water Yearbook 1979-80: Water Research Edition. Queen's Printer, Ottawa.

Canada. Department of the Environment. 1981. Historical Streamflow Summary: Manitoba Inland Waters Directorate, Water Resources Branch, Water Survey of Canada. Ottawa, Canada.

Canada. Prairie Farm Rehabilitaton Administration. 1973. Report on Engineering Investigations: Morden Water Supply Study. Submitted to the Department of Regional Economic Expansion by W.F. Hall.

Canada. Prairie Farm Rehabilitation Administration. June 6, 1979. Interdepartmental correspondence. File available at Manitoba Water Resources Branch.

Canada. Prairie Farm Rehabilitation Administration. 1981. Water Supply Alternatives for the Altona Area: Preliminary Engineering Report. The Department of Regional Economic Expansion.

Canada - Manitoba Subsidiary Agreement on Value Added Crops Production. Agreed to December 15, 1978.

Canada - Manitoba Interim Subsdiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing. Agreed to May 30, 1980.

Canada - United States Water Resources Committee. December, 1973. Report on Drainage in the Aux Marais Drainage Basin and The Walhalla-South Branch of Buffalo Lake Drainage Basin.

Carroll, John E. and Roderick M. Logan. June, 1980. The Garrison Diversion Unit. C.D. Howe Research Institute, Montreal.

Commission on Targets for Economic Development. 1969. Manitoba to 1980. Winnipeg.

Committee on Manitoba's Economic Future (COMEF) 1963. Manitoba 1962-1975. Committee Report, Winnipeg.

Decter, Michael and Charles Framingham. February, 1982. Assiniboine South-Hespeler Area Projects Preliminary Analysis. Consultant's report, prepared for the Department of Regional Economic Expansion, Prairie Farm Rehabilitation Administration.

Donachuk, Darwin. July 9, 1982. Personal Communication. Water Supply and Conservation Engineer, Water Development and Planning Section, Manitoba Water Resources Branch. Department of Natural Resources.

Donham, Parker. October, 1979. "The Low Road to Agricultural Oblivion" Harrowsmith. Number 23, Volume IV:3.

Elliot, C.G. 1918. Report on Land Drainage in the Province of Manitoba. Consultant's report, Elliot and Harman Engineering Co., Peoria, Ill. and Washington, D.C. Submitted to the Honourable George A. Grierson, Minister of Public Works, Province of Manitoba.

Elliott, William P. 1978. Artificial Land Drainage in Manitoba: History -- Administration -- Law. The Natural Resource Institute, University of Manitoba.

Ellis, J.H. 1938. The Soils of Manitoba. Economic Survey Board. Province of Manitoba.

Finlayson, J.N. (Chairman). March 14, 1936. Report of the Land Drainage Arrangement Commission Respecting Municipalities Containing Land Subject to Levies Under "The Land Drainage Act". Manitoba Department of Public Works. King's Printer: Winnipeg.

Freshwater, David and Shannon Coughlin. January 31, 1982. The Impacts of Flooding on the Town of Carman 1970 - 1980 With Projections for the Future. Consultant's Report prepared for the Department of Regional Economic Expansion under Contract No. 6236.

Gardiner, E.A. 1973. Public Investment Criteria: Application to a Project in the Souris River Basin. Research report No. 8. Agassiz Centre for Water Studies, University of Manitoba.

Hardin, Garrett. "The Tragedy of the Commons", Science. Vol. 162 (13 December, 1968). pp. 1243-1248.

Holmes, Beatrice Hort. 1979. History of Federal Water Resources Programs and Policies, 1961-1970. U.S. Department of Agriculture, Economics, Statistics, and Cooperatives Service. U.S. Government Printing Office, Washington, D.C.

Howe, Charles W. 1971. Benefit Cost Analysis for Water System Planning. Water Resources Monograph 2. American Geophysical Union. Washington, D.C.

International Joint Commission (IJC). October, 1967. Report on the Cooperative Development of the Pembina River Basin.

International Pembina River Engineering Board. December, 1964. Joint Investigation for the Development of the Water Resources of the Pembina River Basin. Vols. I, II and III. Report to the International Joint Commission.

Jones, Lloyd. November 30, 1979. Presentation given at a public forum called "Red River Flooding: Causes and Solutions". Sponsored by the Manitoba Environmental Council at the Manitoba Legislative Building. Lloyd Jones is with the U.S. Fish and Wildlife Service, Valley City, North Dakota.

Little, Arthur D. 1957. A Proposal for a Lower Red River Valley Water Supply System. Consultant's report prepared for the Manitoba Department of Industry and Commerce. New York, unpublished.

Lower Red River Valley Water Commission. August 25, 1960. Brief to the International Joint Commission on the Pembina River Project.

Lower Red River Valley Water Commission. December 29, 1960. Brief to the Provincial Cabinet.

Lower Red River Valley Water Commission. June 9, 1965. Brief to the International Joint Commission on the Pembina River Project.

Lower Red River Valley Water Commission. January 29, 1969. Brief to the Cabinet of the Manitoba Government.

Lower Red River Valley Water Commission. March 14, 1969. Ottawa. Brief to the Honourable Mitchell Sharp, Secretary of State for External Affairs.

Lower Red River Valley Water Commission. October 22, 1970. Brief to the U.S. Senate Sub-Committee Investigating the Pembina River Basin Project.

Lower Red River Valley Water Commission. March 8, 1971. Brief to the Honourable Sidney Green, Minister, Department of Mines and Natural Resources.

Lower Red River Valley Water Commission. March 19, 1973. Brief to the Manitoba Water Commission.

Lower Red River Valley Water Commission, Minutes. D.K. Friesen from Altona, Manitoba recorded the minutes from 1958 to 1983. References cited in the text between 1955 and 1958 are notes from preliminary meetings recorded by D.K. Friesen and can be found incorporated with LRRVWC Minutes.

Lower Red River Valley Water Commission. March 20, 1973. News Release.

Lower Red River Valley Water Commission. May 9, 1974. Brief to the Honourable Sidney Green, Minister, Department of Mines and Natural Resources.

Lower Red River Valley Water Commission. July 17, 1979. Brief to the Honourable A. Brian Ransom, Minister, Department of Mines, Resources and Environmental Management.

Lyons, M.A. (Chairman). December 20, 1949. Report and Recommendations on "Foreign Water" and Maintenance Problems in Drainage Maintenace Districts constituted under "The Land Drainage Arrangement Act, 1935". Manitoba Department of Public Works. King's Printer: Winnipeg.

Malcolm, J.M. 1979. The Relationship of Wetland Drainage to Flooding and Water Quality Problems and Its Impacts on the J. Clark Salyer National Wildlife Refuge. Department of the Interior, U.S. Fish and Wildlife Service. Upham, North Dakota.

Manitoba Community Reports. 1978. Manitoba Department of Industry and Commerce.

Manitoba. Department of Agriculture and Immigration. 1958. The Whitemud Watershed. Queen's Printer, Winnipeg.

Manitoba. Department of Mines, Resources and Environmental Management. August, 1974. Whitemud River Watershed Resource Study.

Manitoba. Water Control and Conservation Branch. 1969. Aux Marais Study. Department of Mines and Natural Resources. Winnipeg, Manitoba.

Manitoba. Water Resources Branch. January, 1975. Flood Reduction Alternatives for the Town of Carman. Department of Mines, Resources and Environmental Management. Winnipeg, Manitoba.

Manitoba. Water Resources Branch. November, 1979. "Information Package" unpublished mimeo. Distributed to participants attending a public forum November 30, 1979, called Red River Flooding: Causes and Solutions. Forum sponsored by the Manitoba Environmental Council at the Manitoba Legislative Building.

Manitoba Water Resources Branch. May 28, 1980, July 15, 1980 and July 25. Interdepartmental correspondence. File available at Manitoba Water Resources Branch.

Manitoba. Water Resources Division. 1974. Flood Control. Department of Mines, Resources and Environmental Management. Winnipeg, Manitoba.

Manitoba. Water Resources Division. January, 1977. Whitemud Watershed Resource Scheme. Department of Mines, Resources and Environmental Management. Winnipeg, Manitoba.

Manitoba. Water Resources Division. 1979. Groundwater Resources in the Morden, Stanley, Thompson, Winkler (M.S.T.W.) Planning District. Department of Mines, Resources and Environmental Management. Winnipeg, Manitoba.

Manitoba Water Commission. 1973. Pembina River Basin: Review of Existing Water Resource Development Proposals. Winnipeg.

Manitoba Water Supply Board. Annual Figures on Water Consumption for Altona, Gretna, Rhineland, Winkler 1966-81. Uncompiled source.

Moore, I.D. and C.L. Larson. 1979. Effects of Drainage Projects on Surface Runoff from Small Depressional Watersheds in the North Central Region. Water Resources Research Centre University of Minnesota Bulletin 99.

Newton, W.R., Director, Operations Division, Water Resources Branch, Department of Mines Resources and Environmental Management. "Land Drainage -- Policies and Practices in Manitoba". Unpublished, undated paper.

Newton, W.R., P. Eng., Director, Operations Division, Water Resources Branch and Chairman, Watershed Conservation District Board of Manitoba. "Watershed Management in Manitoba". Unpublished, undated paper.

Nickel, Paul and Ian Gillies, eds. 1977. Regional Development in Manitoba's Interlake: Two Perspectives. The Natural Resource Institute, University of Manitoba.

Osborne, Arthur Edward. 1979. Classification and Potential Land Use of Prairie Sloughs in the Minnedosa Area of Manitoba. The Natural Resource Institute, University of Manitoba.

Pamphlet. 1978. "Rosedale Farm Conservation District". Manitoba Department of Mines, Resources and Environment.

Pembina River Water Control Association. June 26, 1979. Association meeting conducted in Walhalla, North Dakota.

Poyser, E.A. May, 1958. Your Watershed. Manitoba Department of Agriculture and Immigration, Soils and Crops Branch. Queen's Printer, Publication No. 298, Winnipeg.

Red River Valley Echo. February 15, 1978. Newspaper article. Altona, Manitoba

Red River Valley Echo. June 20, 1979. "Train Back After 50-day Absence". Newspaper article. Altona, Manitoba.

Remple, John. 1970. Marais River Flood Damage Report 1969 and 1970. Consultants report prepared for the Lower Red River Valley Water Commission.

Sawatzky, H.L. 1963. The Pembina Project: A Socio-Economic Evaluation of a Proposed Irrigation District in the Agassiz Lake Basin in Manitoba. University of California, unpublished Masters Thesis.

Sawatzky, H.L. 1968. "The Pembina Project: Socio-Economic Implications of Irrigation Development". Geography Department, University of Manitoba, unpublished paper.

Sawatzky, H.L. 1981. "Present Land-Resouce Management -- How Are We Doing?" Manitoba Land Use Conference Proceedings. March 11 and 12, 1981, Winnipeg.

Statutes of Canada, 1935, c.23, s.1. "Prairie Farm Rehabilitation Act". Queen's Printer, Winnipeg.

Statutes of Manitoba. 1958, c.71, "The Water Supply Districts Act". Queen's Printer, Winnipeg.

Statutes of Manitoba, 1959, c.4. "The Department of Agriculture and Immigration Act Amendment Act". Queen's Printer, Winnipeg.

Statutes of Manitoba, 1959, c.69. "The Manitoba Water Supply Board Act". Queen's Printer, Winnipeg.

Statutes of Manitoba, 1959, (2nd Sess.), c.70 s.1. "The Watershed Conservation Districts Act", Queen's Printer, Winnipeg.

Revised Statutes of Manitoba, 1961, c.71. "An Act to Amend the Water Supply Districts Act". Queen's Printer, Winnipeg.

Revised Statutes of Manitoba, 1970, R135. "The Resource Conservation Districtis Act". Queen's Printer, Winnipeg.

Statutes of Manitoba, 1976, c.175. "The Conservation Districts Act". Queen's Printer, Winnipeg.

Stobbe, Elmer. 1979. Personal communication. Professor of Plant Science. Department of Agriculture. University of Manitoba.

Sullivan, J.G. (Chairman). 1921. Report of the Manitoba Drainage Commission. Manitoba Department of Public Works. King's Printer, Winnipeg.

Toman Engineering Company. 1972. Economic and Technical Soundness Analysis of Flood Control Holding Dam Supplemental Water Uses from the Impoundment near Morden, Manitoba. Consultant's Report prepared for the Town of Morden. Boissevain, Manitoba.

Toman Engineering Company. 1979. Consolidated Report for Proposed Control Dam -- Dead Horse Creek Near Morden, Manitoba. Consultant's Report prepared for special committee representing the Morden, Stanley, Thompson, Winkler Development District. Boissevain, Manitoba.

Town of Carman. June 12, 1979. Submission to the Honourable Brian Ransom, Minister, Department of Mines Resources and Environmental Management. Unpublished mimeo.

Town of Morden. Annual Figures on Water Consumption 1966-80. Unpublished.

Tyrchniewicz, E.W. et al., July 11, 1979. Drought Sensitivity Analysis Proposal. Department of Agricultural Economics, University of Manitoba, draft copy.

United States Army Corps of Engineers. St. Paul District 1976. Pembina River Noth Dakota Feasibility Report for Flood Control and Related Purposes.

United States General Accounting Office (GAO). Better Understanding of Wetland Benefits Will Help Water Bank and other Federal Programs Achieve Wetland Preservation Objectives. Report by the Comptroller General to the Congress of the United States.

White, Gilbert F. 1969. Strategies of American Water Management. Ann Arbour Paperbacks, The University of Michigan Press.

Whitney, Larry. August, 1983. Personal communication. Head, Water Development and Planning Section. Manitoba Water Resources Branch. Department of Natural Resources.

Winnipeg Free Press. June 6, 1981. "Cannery in the Black After Owner Finds Greens Gave Plant Financial Indigestion". Newspaper article. Winnipeg, Manitoba.

Winnipeg Tribune. May 18, 1979. "Huge Lake Slowly Crawled Northward". Newspaper article, p. 2. Winnipeg, Manitoba.

Zittlau, Willie and Jill Vaisey. 1977. "A History of Water Policy Development in Manitoba". Prepared for the Manitoba Water Commission. Unpublished paper.

APPENDIX 1

BACKGROUND INFORMATION ON PFRA

By the mid 1930's the drought in the Canadian Prairies had become such a national disaster that the Federal Government introduced the Prairie Farm Rehabilitation Act "... to provide for the rehabilitation of drought and soil drifting areas in the Province of Manitoba, Saskatchewan and Alberta" (S.C. 1935, c.23, s.1).

The purpose of the Act is:

> "... to develop and promote within these areas systems of farm practice, tree culture, water supply, land utilization and land settlement that will afford greater economic security (to farms and farmers) ..."
> (S.C. 1935, p. 23, s.1).

Originally PFRA was instituted as a five-year program to mitigate the impact of drought on prairie farms. The 1935 amendment removed the time limits on the program, extending it indefinitely (Zittlau and Vaisey, 1977:78).

The mandates of the program have changed over the course of time. Initially, projects included everything from dugouts for stock-watering and farm domestic use to regionally oriented storage and/or irrigation. By the late 1950's PFRA was made responsible for large scale irrigation and reclamation projects throughout western Canada. Nickle and Gillies wrote:

> PFRA was designed on the assumption that improved resource use practices and physical resource investments would contribute to the rehabilitation of rural areas. Engineering services and financial aid were provided to farmers who wished to improve their land and local water resources. Projects included water resources management, soil conservation, community pastures and various land conversion projects. Conceptually, PRFA was in bold contrast to the direct subsidization and price stabilization programs of the first years of the depression because the agency proposed a developmental solution to a regional problem.
> (Nickel and Gillies, 1977:5).

In 1962, PFRA was assigned responsibility for the implementation of the Agricultural Rehabilitation and Development Act (ARDA) in the four western provinces. In 1968, PFRA was transferred from the Canada Department of Agriculture to the Canada Department of Forestry and Rural Development. A year later it was placed under authority of the Canada Department of Regional Economic Expansion (Elliott, 1978:59). PFRA remains the agency through which the majority of federal monies for water development in the prairies are administered.

APPENDIX 2

PROVINCIAL WATERWAYS POLICY

The Provincial Waterways Policy produced a method for determining whether a drain was a local or a provincial responsibility. An order ranking was assigned to all drains on the following basis:

1. First-order Waterway -- an upper, single unbranched tributary within a system having a drainage area of one square mile or less.

2. Second-order Waterway -- one which has a drainage area in excess of one square mile or tributaries of the first order.

3. Third-order Waterway -- is formed by the junction of second-order waterways and may have any number of first- and second-order waterways.

Manitoba. Department of Mines, Resources and Environmental Management. August, 1974. Whitemud River Watershed Resource Study. pp. 17, 18.

APPENDIX 3

LOWER RED RIVER VALLEY WATER COMMISSION MEMBERSHIP
AUGUST 29, 1958

Municipalities	Representatives
The R.M. of Dufferin	Ivan Langtry
The R.M. of Grey	E.A. Baragar
The R.M. of Montcalm	A.S. Beaubien
The R.M. of Morris	B. MacKenzie
The R.M. of Rhineland	D. Wall
The R.M. of Roland	W.N. McCallum
The R.M. of Stanley	O.R. Gruener
The R.M. of Thompson	L.C. Kennedy
The Town of Altona	D.K. Friesen
The Town of Carman	Sven Jensen
The Town of Morden	J.J. Riediger
The Town of Morris	F. Recksiedler
The Town of Winkler	G.W. Neufeld
The Village of Gretna	H.F. Friesen
The Village of Plum Coulee	D.W. Wiebe

In addition, there were 4 members at large chosen from the district.

This included the following persons:

J.J. Peters	-	Altona
E. Pokrant	-	Rhineland
J.R. Empson	-	Letellier
M.J. Hamm	-	Winkler

At an organization meeting on September 5, 1958, the following members were elected to serve as officers and executive members:

J.J. Peters	Altona	Chairman
A.S. Beaubien	Ste. Jean	Vice-Chairman
D.K. Friesen	Altona	Secretary
Ivan Langtry	Homewood	Executive
E.A. Baragar	Elm Creek	Executive
W.N. McCallum	Roland	Executive
O.R. Gruener	Winkler	Executive