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An Institutional Framework for Managing Manitoba's Water

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Abstract

Most of Manitoba's water demand is in southern Manitoba apart from hydro generation in northern Manitoba river systems. River flows vary greatly from year to year and groundwater from aquifers is critical in supplying rivers, lakes and wetlands. Manitoba water policy analyses and reports completed in 1990-2001 are reviewed. The need for changes in water policy has received considerable debate. Manitoba rural and urban communities need to be assured of access to safe drinking water. Community environmental security with respect to water requires new standards of monitoring and enforcement. Increasing the price of water provides an incentive to avoid wasting water and provides a mechanism for generating investment capital for required improvements in water quantity and quality.

Executive Summary

Institutional Framework for Manitoba's Water Policy

- A cynic was described by Oscar Wilde as "one who knows the price of everything and the value of nothing"
- Interesting conflict between the values people hold and the price they pay
- Diamond and water paradox: Water a necessity of life is so inexpensive while diamonds having no life giving qualities are very expensive.
- Explained by economic theory that water because it is so plentiful the use of the last cubic meter adds little satisfaction and consumers are not willing to pay more. Diamonds are expensive because very few are available and consumers are willing to pay a lot.
- Another theory why water is so inexpensive or free is that the institutional system which allocates water is unable to take into account the value users place on its scarcity.

Manitoba Water Policy Debate 1990-2001

1990: Applying Manitoba's Water Policies: water quality, conservation, use and allocation, water supply, flooding, drainage and education.

1999: Water Use and Allocation: watershed management; priority of users: domestic, municipal, agricultural, industrial, irrigation and other, permit for use tied to land, backlog of 1619 applications for water rights.

2001: Building a Sustainable Future, Water: A Proposed Strategic Plan for Manitoba -discussion paper. Same outline as 1990, plus watershed management from 1999.

–What's new: Legislative Framework – Water Rights Act

- reallocation between users
- watershed management and ecosystem needs
- Fisheries Act
- management organizations (conservation districts, aquifer boards, municipalities)

Water Pricing and Demand Management

- Fees; cost recovery of operations and infrastructure and value of water
- Fee structure: increasing, constant or declining with use
- Metering

Water Markets

- Watershed based (intra-basin reallocation not inter-basin)
- transferable water rights (season, annually, permanently)
- clearing house for transparency, efficiency and any conditions from watershed management board
- all transfers at weekly, monthly clearing prices
- compensate owner using water for less valued uses
- increase value added from water

Institutional Arrangement for Water Management

- Watershed based
- Terms of reference set out in enabling legislation

- Board of Directors - appointed and elected
- Provide services at cost
- All infrastructure and operations self-financing
- Responsibility of allocation and assignment of water rights
- Responsibility for drainage, storage and flood control
- Responsible for water quality and ecosystem stability

1. Priority Water Policy Issues

1.1 Background

Multiple and increasing demands exist for water in agro-Manitoba including municipal, agricultural, industrial, irrigation, waterfowl, fish habitat and recreation. Future demands for water are subject to the 1988 *Water Rights Act*, as well as current water use and diversion licensing regulations. All property in, and all rights to the use or diversion of all water in the province are vested in the Crown in the right of Manitoba. The *Water Rights Act* provides considerable discretion to the minister, or the director of the Water Resources Branch on behalf of the minister. One of the major roles of water use licensing is “to ensure the optimum development and use of the province’s water supplies, while sustaining the resource base and maintaining environmental quality”(*Water Use & Allocation*, 2000, pp. 53-57). The minister is guided by policies and administrative rules developed in recognition of the Act’s over-riding principle, that being “what is in the best interests of the residents of Manitoba”.

The current value of water use and ownership rights to Manitoba residents is tied jointly to water licences and land ownership. The priority rank of licenced water users and the upper and lower limits of water use are specified for licenced sources. Licence limits of water use are estimated for periods of excess supply conditions and water shortages such as droughts, deterioration in aquifer rates of flow and reservoir depletion. Optimization of development and use of water by the Water Resources Branch implies maximization of the “value” of water benefits to the residents of Manitoba subject to conservation, environment and economic constraints. Investments in water supply and treatment infrastructure are cost shared by public and private investment capital in recognition of the “public good” as well as the private sector benefits achieved.

The purpose of the paper is to review Manitoba water policies and recommend changes. The report is organized under the following topics: 1. Priority water policy issues, 2. Hydrological issues and watershed planning, 3. Water demand and institutional rigidities, 4. Water pricing and demand management, 5. Water markets and basin planning, 6. Sustainable development, economic and financial constraints, 7. Constraints of other jurisdictions, and 8. Policy recommendations.

The need for changes in Manitoba’s water policies has been the subject of considerable debate. Manitoba rural and urban communities need to be assured of access to safe drinking water. Community environmental security with respect to water requires new standards of monitoring and

enforcement. What opportunities exist for increasing the “value” of water development and use to the residents of Manitoba? Are new water policies, management and organizational structures required?

Increasing the price of water provides an incentive to avoid wasting water and provides a mechanism for generating investment capital for required improvements in water quantity and quality (See R.N. Dzisiak, *The Role of Price in Determining Residential Water Demand*, M.Sc. Thesis, Department of Agricultural Economics, 1999). Metering is essential to provide management information on incremental water use. Given the increasing public funding demands for health and education as well as slowing economic growth and general revenue in Manitoba, water investments require reliance on project financing from public, business and consumers.

1.2 Manitoba Water Policy Debate, 1990-2001

Most of Manitoba’s water demand is in southern Manitoba apart from hydro generation in northern Manitoba river systems. River flows vary greatly from year to year and groundwater from aquifers is critical in supplying rivers, lakes and wetlands in agro-Manitoba. Water policy analyses and reports completed 1990-2000 are reviewed below.

- 1990, The Government of Manitoba adopted a strategy for sustainable development, water policies, principles and guidelines of sustainable development recommended by The Manitoba Roundtable on Environment and Economy summarized in *Applying Manitoba’s Water Policies*. Seven priority policy areas were identified: water quality, conservation, use and allocation, water supply, flooding, drainage and education.
- 1996, the letter of transmission from the chairman of the Assiniboine River Management Advisory Board emphasized the following to the Minister of Natural Resources based on its analysis of the quantity, quality, use and allocation of waters of the Assiniboine basin including The Assiniboine River, Assiniboine Delta aquifer and the Shellmouth Reservoir:
 - S** The need for an Assiniboine Delta aquifer management plan was highlighted. “In the absence of such a plan, the aquifer may well become the subject of considerable controversy. Increased demand for water from the aquifer to service expanding irrigation needs has the potential to create confrontation and conflict concerning use of the aquifer. As well, unknown environmental impacts associated with significant withdrawals from the aquifer should be better understood”.
 - S** In addition it was noted that the Manitoba Water Rights Act “has become outdated in terms of present day water management philosophy and policies...The growing importance and value of water indicates that radically new approaches to water management including consideration of water pricing, marketing of water rights and stringent water conservation measures are deserving of attention. The present Act does not specifically recognize or

assign high priority to the allocation of water for environmental maintenance or protection in its priorities for use. Further, while the Act recognizes 'best use' of water as a priority consideration; in practice, the old principle of 'first in time-first in right' often prevails in the allocation of water".

- 1999, a report on sustainable development initiated by the Premier of Manitoba in 1997, *Report of the Consultation on Sustainable Development Implementation (COSDI)*, p. 7, recommended that "integrated sustainable development planning on a large area basis, such as watersheds" be required.
- 2000, Manitoba Water Resources reported on what stakeholders and Manitobans believe are the major water use and allocation issues. In *Water Use & Allocation, 1999 Public Consultation:*
 - S** "Watershed and aquifer planning was supported without exception as a way of providing for local involvement, integrating water quality and quantity and integrating resource management on a watershed and aquifer basis. Presently the Act does not provide for the allocation of water according to management plans. However, the Provincial Water Policies state, 'water management priorities shall be determined through a basin planning process that takes into account the protection of potable water supplies, environmental integrity, existing commitments and economic requirements'. Currently, management planning has been undertaken with stakeholder involvement and public consultation for the Winkler Aquifer, the Oak Lake Aquifer, and the Assiniboine Delta Aquifer. The resulting management plans address allocation limits, aquifer enhancement, aquifer protection, aquifer monitoring, education, and priorities of use. The Dauphin Lake Basin Advisory Board focused on water quality and slowing down runoff. The Assiniboine River Management Advisory Board has focused on the operation of the Shellmouth Reservoir and the Assiniboine Delta Aquifer" (*Water Use and Allocation*, p.6).
 - S** The order of priority for which water may be used or diverted, in descending order, is as follows: domestic, municipal, agricultural, industrial, irrigation, and other. "In a fully allocated situation, a new licence could be issued by displacing a licence for a lower priority use (subject to compensation). Water may also be reserved from a source for future high priority uses...There is a need to clarify how water use priorities can be factored into water allocation licensing decisions" (*Water Use and Allocation*, p.10).
 - S** "The current provisions for transferring licences should be retained. Licences are issued to the water user who must have legal access to all lands required for the project. When the licensee loses interest in the land, the licence automatically expires; however, the new landowner may apply for a transfer of the licence. The transferred licence retains its original precedence as well as other conditions" (*Water Use and Allocation*, p.11).
 - S** Licences for water use usually describe the following: use, source and location of withdrawal, location of use, limit to annual water use, limit to the rate of withdrawal, record

keeping requirements, time to expiry, for withdrawals from streamflow the lower limit of streamflow below which withdrawal of water must stop, and for withdrawals from a waterbody, a failsafe lower limit of a reservoir elevation at which withdrawal of water from a public reservoir must stop (*Water Use and Allocation*, p. 56).

Total valid licences were 869 as of December, 1998 (15 domestic, 97 municipal, 73 agricultural, 45 industrial, 453 irrigation, 44 other and 142 Ducks Unlimited). There were a total of 783 new applications and 836 expired licences creating a total backlog of 1619 applications (*Water Use & Allocation*, p. 58).

- 2000, The Report prepared for the Government of Manitoba by the Livestock Stewardship Panel, Finding Common Ground, p. 55-57, recommends that:
 - S** “water quality monitoring must be greatly expanded to provide an assessment of the impact of livestock production on soil and water...future ILOs should be located in order to provide sufficient acres for manure application according to phosphorus content.
 - S** The province should continue to implement the recommendations of the recently released Drinking Water Advisory Committee Report.
 - S** The Manitoba Cattle Producers Association should take the lead in developing a strategic initiative for riparian management in Manitoba. This should be done in partnership with groups such as Manitoba Habitat Heritage Corporation, Ducks Unlimited, Conservation Districts, and PFRA as well as Manitoba Agriculture and Food and Manitoba Conservation”.
- 2001, The Association of Irrigators of Manitoba (AIM) represents 380 irrigators in four regions and associations (Agassiz-Morden/Winkler, Souris Valley-Southwestern Manitoba, Central Manitoba-Portage La Prairie and the Assiniboine Delta Aquifer. Manitoba irrigators are adding about 5,000 acres per year to the total of 79,000 acres in 1999. The Association and Manitoba Agriculture and Food are working on a framework strategy for future development that can support sustainable irrigation (Association of Irrigators of Manitoba). The Association is supporting the concept of a “combined application for a water licence and an environmental licence” because of the delay in issuing water licences.
- 2001, Manitoba Conservation, Building a Sustainable Future, Water: A Proposed Strategic Plan for Manitoba, A Discussion Paper continues the debate and the Minister of Conservation indicates that a steering committee will consult with stakeholders, review input and make recommendations. The discussion of issues and strategies for use and allocation, as well as water supply are key elements of the proposed strategic plan.
The following use and allocation issues are outlined:
 - S** allocating water prioritizing amongst users
 - S** incorporating ecosystem needs
 - S** integrating quality and quantity

- S assessing intra basin transfers and
- S addressing the impacts of other activities in the watershed, both with Manitoba and in other jurisdictions.

A use & allocation strategy is defined:

- S draft new water legislation
- S review water rights licensing
- S incorporate all uses and users appropriately into aquifer, basin, and watershed based management
- S integrate water quantity and quality in use and allocation decisions
- S include in legislation, requirements to sustain life within the ecosystem as a priority allocation
- S negotiate agreements with appropriate agencies to co-operatively manage local water resources
- S conduct water use monitoring.

The following water supply issues are outlined:

- S it is becoming increasingly necessary to find methods to achieve sustainability by balancing increasing demands with existing supplies
- S a complete understanding of the long term impacts of development on the water supply is necessary
- S methods to finance and apportion the costs of development and management do not currently exist
- S a complete understanding of the effects of climate change on our water supply is not available.

A water supply strategy is defined:

- S draft new water legislation
- S incorporate water supply issues into the aquifer, basin, and watershed based management framework
- S consider fair licensing fees and user charges
- S develop a plan for water storage options, including maintenance of existing facilities, as part of broad based water planning in Manitoba
- S coordinate with other jurisdictions to ensure the sustainability of our water supply
- S determine possible effects of climate change on water supplies and study options to deal with possible changes.

2. Hydrological Issues and Watershed Planning

Manitoba is located in the Hudson Bay drainage basin (Fig. 1, *Applying Manitoba Water Policies*, pp. 4 & 5). There are five major basins with agricultural production in Manitoba: Red River, Assiniboine River, Lake Manitoba, Lake Winnipeg, and Winnipeg River (Fig 2). In addition, there are two high yield

aquifers the Assiniboine Delta Aquifer and the Carbonate Aquifer. Water flows in basins from rivers, aquifers and groundwater sources are modified by diversion, storage, treatment, irrigation and drainage infrastructure. Such infrastructure projects have many interrelated effects within and between basins.

2.1 Red River Basin

Municipal water demand and supply diverted from the Red River is managed by the Pembina Valley Water Cooperative which was initiated in 1991 in the Pembina Valley in response to a need for a long-term regional water strategy to replace short term ad hoc solutions during drought periods (Pembina Valley Water Cooperative. 1992).

2.2 Assiniboine River Basin

The Assiniboine River Management Advisory Board was initiated to advise the Manitoba Government in response to the Pembina Valley request for diversion of water from the Assiniboine and Red Rivers. The Board has identified the need for new water management policies consistent with increasing municipal, agricultural, industrial and irrigation demands. Water studies completed for the Assiniboine River indicate that the withdrawal of 20 cfs (.57 m³/s) from the Assiniboine River could be accommodated by regulation of the Shellmouth Reservoir (Fig. 3) but if a drought worse than that of 1942 occurs then projected water withdrawals can not be met consistent with a minimum in stream flow requirement through the City of Winnipeg (MacMillan et al 1994a).

3. Water Demand and Institutional Rigidities

A multiplicity of Manitoba planning institutions and overlapping geographical administrative units exists with respect to water allocation and use (Poyser 1999). Municipalities are a basic unit of local community decision making and 79 out of a total of 201 municipal units in Manitoba are covered by a Planning District development plan (Manitoba Intergovernmental Affairs 2001). The number of Conservation Districts is also increasing.

- In most cases municipalities do not have powers to control settlement and building patterns, or have jurisdiction over sufficient area to allow them to deal with inter-municipal infrastructure, watershed runoff, flooding and drainage problems.
- Planning Districts, in addition to controlling location of physical assets and area infrastructure, need to embody riparian and flood land zones, land and water conservation statements and watershed protection and wild life habitat lands within their development plans.
- Conservation Districts, in addition to establishing local land, water and resource conservation priorities in their plans, should partner with the Crown (Province) to establish riparian and flood land zones, identify lands critical to watershed and wildlife habitat protection and to develop comprehensive water management plans.

Management plans are needed for watershed basins including:

- Large area plans, developed for a watershed basin to provide the means for establishing the

opportunities and constraints, guidelines and targets and the major land, water and resource allocations with which conservation districts, planning districts and municipalities can exercise their powers to manage environmental security and community growth.

- Crown decisions under powers of environmental, agricultural, water, wildlife, forestry, fisheries and related acts need to be consistent with the conservation framework established by Large Area Plans and Conservation and Planning Districts.
- Industrial and infrastructure projects, to be sustainable, need to be examined for feasibility within the framework of capabilities and constraints established in Large Area Plans and Conservation, Planning District, and Municipal Plans.

4. Water Pricing and Demand Management

“Fees are used for two purposes, to prevent overuse and for cost recovery. A Water Rights Act Regulation establishes licence fees. Annual fee rates, based on volumes, are specified for industrial. Fees are only charged to new industrial users whose licenses have been renewed since 1988...Cost recovery for water use should be implemented for all users based on a “fair” equation. A strategy to address water pricing involving all stakeholders should be developed immediately” (*Water Use and Allocation*, p. 4). Water demand management in Manitoba is differentiated by type of priority use. Municipal water is sold to users under various pricing schemes and some industrial licence holders are charged an annual fee (See Tate et al 1992 for a discussion of industrial water pricing in Canada). Other licence holders including: domestic, agricultural, irrigators and Ducks Unlimited do not pay a water use charge. It is important to note that the construction and operating costs of waterfowl habitat projects are covered by Ducks Unlimited and partners including Manitoba Habitat Heritage Corporation, Manitoba Conservation and Conservation Districts.

One of the major roles of water use licensing is “to ensure the optimum development and use of the province’s water supplies, while sustaining the resource base and maintaining environmental quality”(*Water Use & Allocation*, 2000, pp. 53-57). Water pricing and demand management can ensure optimum development and use. Pricing and demand management needs to be consistent across all types of users and tied to the incremental volume of water use. Metering is essential to provide management information required on incremental water use. The Water Resources Branch has proposed that irrigation pumps be fitted with a flow metering device at irrigators expense(*Water Use & Allocation*, 2000, p. 40).

Marginal cost pricing of water in the peak season should include the cost of future capacity and off peak pricing should cover marginal operating costs (McNeill and Tate. 1991). In addition, marginal costs of waste water treatment related to the intake of water should apply year round. Charges such as constant or increasing block rates, can be initiated to encourage conservation and penalize high consumption to match available sustainable water supply sources. In contrast, flat rates or declining block rates encourage higher rates of consumption because of the lower unit costs at higher consumption levels. If water pricing is sufficient to cover only current costs then financial deficits will occur in the future if revenue is required to finance investments for capacity expansions.

Investments in water supply and treatment infrastructure are often cost shared by public and private investment capital in recognition of the job creation and other “public good” benefits as well as the private

sector benefits achieved. For this reason, food processing industries and rural municipal water treatment capital costs are often covered by government infrastructure grants.

5. Water Markets and Basin Planning

Water pricing and demand management reforms have been initiated in many countries because of financial crises, low cost recovery and droughts. In Australia for example, a comprehensive reform of water policy and pricing is in process (Musgrave 2000). Reform has led to increasing levels of cost recovery in urban and irrigation water markets. To develop an irrigation water market, entitlements were established in volumetric terms instead of fixed per hectare units and transfers permitted. Irrigation markets after price reforms still have imperfections but have generated transfer prices higher than cost recovery prices.

Water demand in Manitoba is growing for all uses. The introduction of basin management, planning and modeling can facilitate increasing the net benefits/profits (PT) to agricultural water use (PA) and municipal and industrial use (PMI) over water demand sites in a river basin (Cai et al 2001):

$$PT = 3PA + 3PMI.$$

A Fixed Water Rights Scenario is compared to alternatives in a model which permits water trading and allocates water to the most profitable uses in the Maipo River Basin in Chile. Minimum in stream flows are entered into the model as constraints. The scenario with trading shows increasing profits per acre to irrigators and water transfers from irrigators to municipal and industrial uses. Application of a similar model to analyze the water demand and supply in the Assiniboine Delta Aquifer and the Assiniboine River would provide useful information for Manitoba water allocation policy.

In a Manitoba context, establishing a market in water rights associated with water licences can be expected to generate a movement of licences and water use to higher value uses. A current licence holder not using water would have an incentive to sell his water rights water to a user who can earn economic rents associated with use of additional water. In addition, licence holders earning substantial economic rents from water use can be expected to bid for water rights currently associated with low economic rents.

Licences transfers can be structured on a short-term seasonal, annual and multi-year lease basis to match market needs and financing requirements. Governmental control over licences and water use and market regulation would continue to exist in recognition of Crown ownership. For example, it has been determined that the Winkler Aquifer is over allocated and the Water Resources Branch has requested that all users have their allocations cut back by fifty percent (*Water Use & Allocation*, 2000, p. 39). Allocation of water by a market system is a substitute for arbitrary rationing schemes.

Increases in economic value added can be expected to generate opportunities for capital investment in water using sectors and water technology equipment and service sectors, including environmental protection equipment and services. Are water related economic value adding opportunities large enough to cover the transaction costs associated with a water market operated by a Manitoba water business? Given the evidence available from water markets elsewhere, the development of a water market can be expected to increase the value of water to Manitoba residents.

6. Sustainable Development, Economic and Financial Constraints

Implementing a market mechanism to facilitate purchase of water use rights from current licence holders subject to conservation and environmental constraints would recognize the ownership value of current licences and promote the allocation of water to the “highest value uses”. Decoupling the water licence transfer from land ownership will increase economic efficiency. Marginal cost pricing concepts could be used to cover the incremental public and private costs associated with projects initiated to increase the value of water allocation and use in Manitoba. A Manitoba regulated water business entity could be initiated to achieve increases in the public and private value of water to rural and urban communities. A business entity is required to permit water project financing and revenue collection separate from provincial government general revenue accounts. Analysis is required to establish the feasibility of a Manitoba water business entity with respect to sustainability, environmental and economic constraints.

Manitoba infrastructure demands have been estimated by PFRA at \$230 million in 1998 for large water and small water projects (*Water Development in the Rural Prairies Infrastructure Strategy*, p. 5). Potential areas for irrigation development have been identified in Manitoba, 53,533 acres with a total cost of \$70 million (Irrigation The Economic Impact on Manitoba, 2002). Potential block areas have been identified with available water and mitigable potential environmental impacts (Manitoba Sustainable Irrigation Development, A Discussion Paper, 2001). From an international investment perspective the economic value of water is receiving increasing attention. The German utility group RWE AG made a \$4.6 bln bid for American Water, the largest regulated water business in the United States (Yahoo Finance, Financial Times, Aug 27/01). RWE Germany’s second-largest utility indicated that it wanted to build up its international water operations where it is world number three behind French rivals Suez Lyonnaise and Vivendi. In Manitoba and other provinces water cooperative businesses have been established. Is a cooperative, regulated structure such as Manitoba Hydro or publicly traded US regulated water utility structure the best for a Manitoba water business?

California water district organizations have been described as reflecting the principles of cooperatives by providing services at cost as a nonprofit organization and distributing benefits in proportion to use (McCann and Zilberman 2000, p. 80). The requirement in California law that agricultural water districts must approve any transfer of water rights outside their borders has been noted as major impediment to applying cost recovery concepts in the management of water markets in California. Such water market inefficiencies and major infrastructure subsidies such as the California Water Project as well as the recent economic disaster in the deregulation of energy in the State of California indicate that Manitoba has a substantial international industrial competitive advantage in both water and energy supply. Value added benefits obtained from export of Manitoba products from water using industries are likely to be greater than exporting water as is proposed by Klymchuk (See proposal for Manitoba water exports to California by D. Klymchuk 2001). The absence of sensible pricing of water in the US results in a subsidy to agriculture estimated at \$3.5 billion and to developing country agriculture estimated at \$20 - 25 billion (Lomborg, 2001).

Community environmental security with respect to water quality requires new standards of monitoring, enforcement and reporting to establish public confidence concerning the quality of rural and urban drinking water (See Manitoba Conservation reports on water quality and nutrient management

strategy), as well as increase the competitiveness of Manitoba businesses. Climate change is expected to seriously affect water management, “the growing season will be longer, water and drought management could become significant challenges for Manitoba” (Manitoba Climate Change Task Force Report, p. 6).

Sustainable development, economic and financial assessments are required for prioritizing opportunities for stimulating Manitoba economic development from water dependent projects such as the proposed Simplot Potato Processing Plant and associated alterations to the Portage la Prairie Water Pollution Control Facility. The Manitoba Clean Environment Commission is scheduling Simplot proposal hearings for late November or early December, 2001 (<http://www.cecmanitoba.ca>). Water use information and value added economic impact information is required for the licensed priority use sectors: domestic, municipal, agricultural, industrial, irrigators, other and Ducks Unlimited. A substantial potential exists for job and income creation associated with Manitoba water investments (MacMillan et al 1994b) as well as waterfowl habitat development in low productivity agricultural areas (MacMillan 1998) and (Chorney and Josephson 2000).

7. Constraints of Other Jurisdictions

The federal government has responsibility for water on federal lands, First Nations lands and water located on or across international boundaries, as well as federal fisheries, navigable waters and aspects of environmental protection.

The International Joint Commission has directed the International Red River Board (Feb/2001) to “establish continuous supervision over the quality of the waters crossing the boundary in the Red River”. Manitoba has concerns with the proposed Garrison Diversion and the Devils Lake Outlet relative to water quality and the impact on the stability of water flow in the Red River.

The City of Winnipeg water supply annual flow in 2000 was 50 percent of the maximum allowable water taking authorized by a Ontario Order in Council, Government of Canada and the International Joint Commission in 1913 and 1914. Current usage is more than 20 percent less than the peak levels observed in 1988 because of Winnipeg’s water conservation program initiatives (See Shoal Lake Watershed Management Plan 2001, p. 24). The City of Winnipeg has met water demands exclusively through gravity flow in all years except 1988. The value of Shoal Lake water supply is determined by “full cost pricing” which is supported by the Council of Ministers of the Environment (CCME). In order to meet increasingly stringent Canadian Drinking Water Quality Guidelines Winnipeg City council approved construction of a \$204 million new water treatment facility to be operational in 2006. Analysis indicates that average annual runoff in the region could fall significantly in the next 30 years associated with climate change (See Shoal Lake Watershed Management Plan 2001, p. 117).

The Prairie Provinces Water Board (PPWB) is an independent agency that receives administrative support from Environment Canada, and resources of member governments. PPWB objectives include promoting the integrated development and use of water and water-related resources (Upper Assiniboine River Basin Study-2000, p. 107).

The Prairie Provinces Water Board has recognized the need for information on the value of water in the prairie provinces (Kulshreshtha 2001) and has requested water research proposals. The report by Kulshreshtha documents Canadian and international water related activities including:

- The Inquiry on Federal Water Policy,
- the appointment of a secretariat to develop water resource-related infrastructural development by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2000) the Environment Canada, in cooperation with Statistics Canada,
- the three year study of natural resources including estimation of the national value of Canada's water resources and a monetary national water resource account,
- a conference organized March 27, 2001 in Ottawa by the National Round Table on the Environment and the Economy,
- Environment Canada, in cooperation with Statistics Canada, has initiated a three-year study on the "Value of Natural Capital" including estimates of the national value of Canada's water resources and a monetary national water resource account.

8. Policy Recommendations

Opportunities for increasing the public and private value of water to Manitoba residents constrained by conservation, environment and economic factors need to be assessed. A business plan for a Manitoba Water entity is needed to establish the economic, financial and operational feasibility of an organization to:

- improve water quantity and quality by setting new standards of monitoring and enforcement; recognizing current and future problems;
- initiate pricing/conservation/metering strategies to recover water investment costs from public, business and consumer sources;
- implement a market mechanism to:
 - S** facilitate exchange of water use rights between licence holders,
 - S** decouple water licence transfers from land ownership;
- allocate water under drought and excess water conditions on a watershed basis;
- review and initiate water related economic development opportunities which meet sustainable development and economic criteria including:
 - S** watershed development projects including water treatment and other infrastructure,
 - S** expansion of livestock production and processing,
 - S** expansion of livestock/forage production and riparian management investments,
 - S** expansion of potato production and processing,
 - S** water exports;
- initiate river basin planning and economic modeling.

In many countries as well as other Canadian provinces, water policy reforms are being introduced to because of environmental problems, government subsidized water use and the negative effects of drought. In contrast, Manitoba has an opportunity to introduce water policy changes to increase the value of water by improving water quality standards and facilitating water dependent economic opportunities on a project financing basis. Substantial information on water use benefits and costs by sector are needed to facilitate job and income creation associated with Manitoba water projects.

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 Oak Lake Aquifer Management Plan, March 2000
 Winkler Aquifer Management Plan, March 1997
<http://www.cecmantoba.ca>

Agriculture and Agri-Food Canada (AAFC) Environmental Sustainability

http://aceis.agr.ca/environ_e.phtml
 Water Quality and Use
http://aceis.agr.ca/policy/environment/eb/public_html/ebe/water.html

"Health of our Rural Water"

"Health of Our Soils: Agrochemical Entry into Groundwater"

<http://sis.agr.gc.ca/cansis/publications/health/intro.html>

Agri-Environmental Indicators website

http://www.agr.ca/policy/environment/eb/public_html/ebe/aei.html

APPENDIX A

Guiding Principles and Priorities in Addressing Water Issues (D. Lobb): land use, ecology and sustainable development concepts; a biophysical/ecological perspective:

- S Water is integral to the function of ecosystems, including agroecosystems.
- S All life is dependent on water.
- S Water is greatly responsible for the transportation and transformation of materials and energy within our environment.
- S Water passes from one ecosystem to another; it serves as a link or a bridge between systems and across scales.
- S Consequently, water is a critical resource whose quantity and quality must be protected and valued. All property in, and all rights to the use or diversion of all water in the province are vested in the Crown in the right of Manitoba. The *Water Rights Act* provides considerable discretion to the minister, or the director of the Water Resources Branch on behalf of the minister. The protection of water quantity and quality is both an individual and societal responsibility. Government must serve to balance the rights of the individual against society.

APPENDIX B

Research Projects dealing with water allocation policy

Background Manitoba Water Allocation Policy Question - What is the value generated by an acre/foot of Manitoba water allocated to: 1. Water Quality/In Stream Flows, 2. City of Winnipeg, 3. Rural Communities, 4. Manufacturing Sector, 5. Food Processing, or 6. Farm Production?

Manitoba Water Allocation Policy: Agriculture and Agribusiness Research

Select a Manitoba watershed with both livestock and irrigated crop production using the same water source. For that watershed,

Project 1. What is the economic return to an acre foot of water in livestock vs irrigated crops a) in 2000 and b) under the drought conditions of the late 1980s? Or

Project 2. The Manitoba Conservation, Discussion paper, *Water: A Proposed Strategic Plan for Manitoba*, p 9, indicates a requirement to sustain life within the ecosystem as a priority water allocation in new water policy legislation. Define ecosystem in the context of watershed planning and analyze the impact of this legislative requirement on the profitability of livestock versus irrigated crops.

The specific thrust of projects 1 & 2 above can focus on one of the following: 1) Agrometeorological Centre of Excellence (ACE) water sensor and efficiency of producing irrigated crops, 2) Boyne River dam at Treherne, 3) farm drainage in the Whitemud Conservation District, 4) the Simplot potato processing plant application to the Clean Environment Commission, 5) water markets and water use efficiency, 6) livestock manure and chemical fertilizer application and water quality, 7) market potential for specialty vegetables produced on irrigated land, 8) sustainable agriculture/trade/competitiveness of

Manitoba vs Mexico, etc.

Firstly, students are expected to review the literature and available sources of information relevant to the project and develop a specific plan of what questions they will address, what data sources they will use, and how they will carry out the analyses they intend to perform.

Secondly, students are expected to perform the analyses and interpret the results, and present a written and oral report. The analysis in either project 1. or 2. should conclude with a list of recommended policy changes and a rationale for the recommendations.