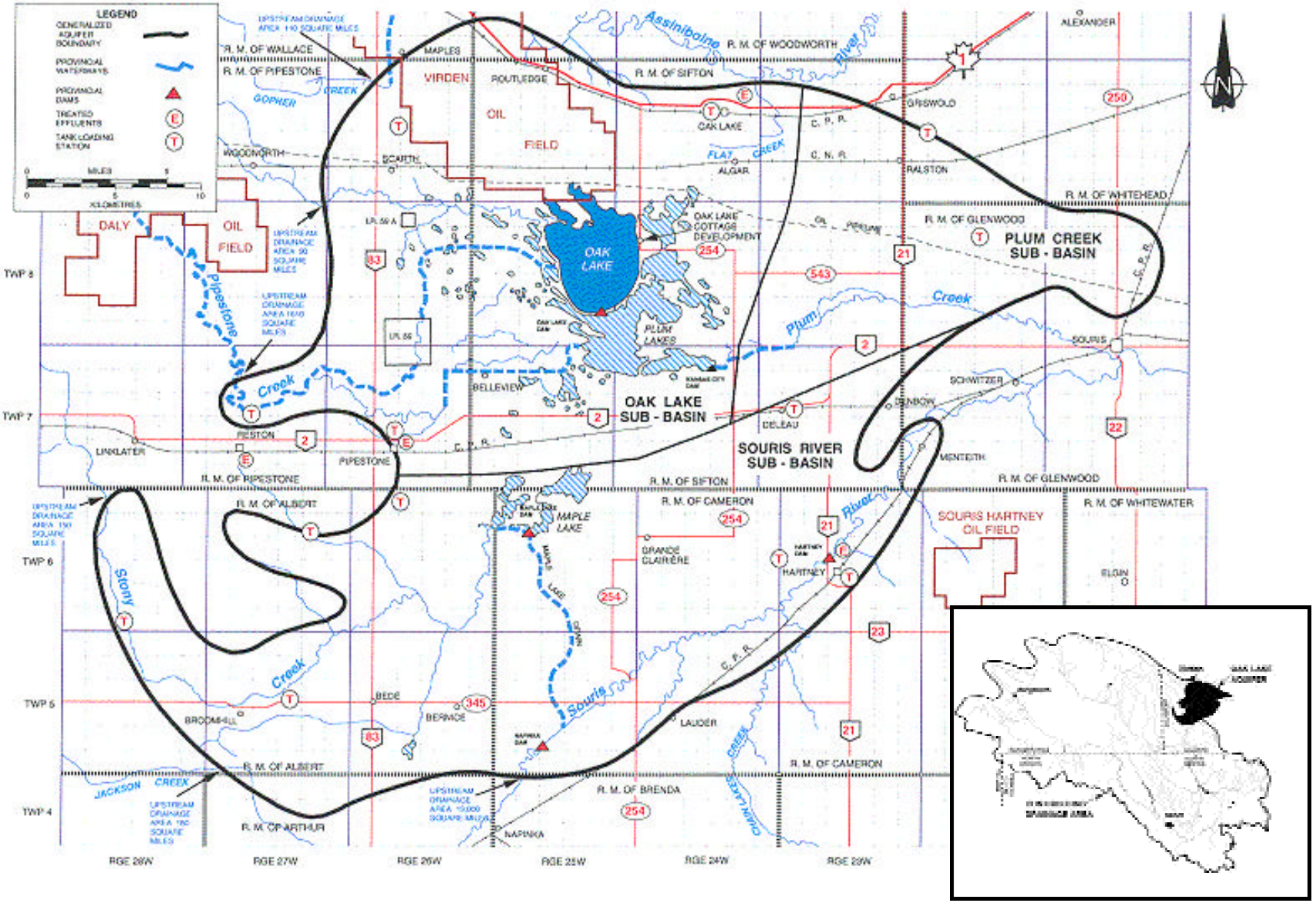
OAK LAKE AQUIFER MANAGEMENT PLAN

Planning for the Future of the Oak Lake Aquifer

March 2000

OAK LAKE AQUIFER STUDY AREA



OAK LAKE AQUIFER MANAGEMENT PLAN

March 2000

Director
Water Resources Branch
Manitoba Conservation

Dear Mr. Topping

This booklet contains the recommended management plan for the Oak Lake Aquifer, which lies beneath our countryside. In this drought prone region, we consider its water to be a valuable and vulnerable resource. When your Branch offered to assist us in developing a management plan to protect it, we were happy to participate.

We received a background report on the aquifer from the Technical Advisory Group and we worked with them and our memberships to compile a draft management plan. This draft plan provided background on the planning process, the study area and the aquifer. It outlined the aquifer issues, the options considered and the recommended actions. It also contained a survey to get inputs from the general public.

The draft plan was mass-produced, distributed throughout the area and presented in advertised open houses and public meetings. The study area residents were appreciative of the information and supportive of the recommended actions. The feedback received allowed us to finalize the plan including implementation recommendations and to feel confident that the aquifer water users will support it.

The Oak Lake Aquifer supplied water for our parents as it does for us, and we count on its water supply for our children. Water management has been a contentious issue in this area. We feel the planning process has been an effective one and that this plan, if implemented and maintained, can sustain the aquifer.

N o w, as requested, we forward this final plan to you. Thank you for your s t a ff's assistance and please continue to support us as we seek to implement the aquifer protection plan.

Yours Truly,

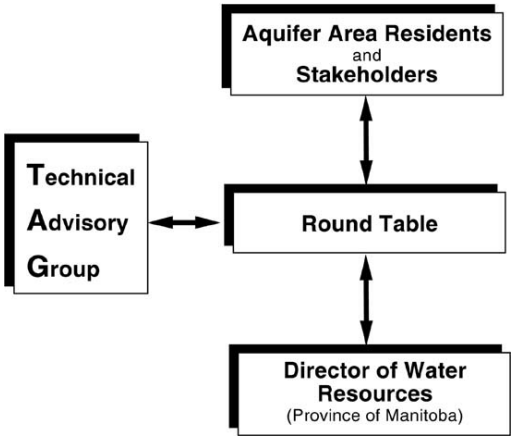
Gaston Boulanger

Gaston Boulanger
Chairperson
OLAMP, Round Table

PLAN DEVELOPMENT

In September 1997, Manitoba Water Resources initiated a consensus building process to develop a management plan for the Oak Lake Aquifer. This was done to obtain planning inputs from the residents of the area and to protect and preserve the aquifer water resource. A Technical Advisory Group (TAG)comprised of 15 representatives from various provincial and two federal agencies was established in September 1997 to provide technical support for plan development.

A Round Table comprised of 19 agencies representing the major stakeholders from the area was established in March of 1998. The Round Table worked with the TAG and with local resource owners and users in developing the draft plan.



The Oak Lake Aquifer management planning process required the Round Table and the TAG to identify the resource issues, prepare a draft plan, obtain public input and incorporate that input into a final plan. The final plan was forwarded to the Director of the Water Resources Branch, Manitoba Conservation on March 23, 2000.

ROUND TABLE
METHOD OF OPERATION

- THE ROUND TABLE SHALL REQUEST THE COORDINATOR TO MAKE AVAILABLE SUCH EMPLOYEES OF THE DEPARTMENTS AS MAY BE REQUIRED TO PROVIDE TECHNICAL ADVICE AND INFORMATION ON VARIOUS ISSUES RELATING TO THE AQUIFER.
- THE ROUND TABLE SHALL ELECT FROM ITS MEMBERSHIP A CHAIRPERSON AND A VICE- CHAIRPERSON.
- MEMBERS OF THE ROUND TABLE SHALL RECEIVE NO REMUNERATION OR COMPENSATION FOR OUT-OF -POCKET EXPENDITURES INCURRED WHILE ATTENDING MEETINGS.

ROUND TABLE
TERMS OF REFERENCE

- THE ROUND TABLE SHALL WORK TOGETHER WITH THE OTHER RESOURCE OWNERS, USERS AND MANAGERS AS A TEAM TO FORMULATE AN AQUIFER MANAGEMENT PLAN THAT WILL PRESENT GUIDELINES FOR MANAGING, PROTECTING AND USING THE GROUNDWATER RESOURCE IN THE AQUIFER.
- THE ROUND TABLE IN CONJUNCTION WITH THE TECHNICAL ADVISORY GROUP (TAG) SHALL PROVIDE TECHNICAL AND EDUCATIONAL INFORMATION TO LOCAL RESIDENTS ON THE ISSUES AND OPPORTUNITIES REGARDING THE AQUIFER.
- THE ROUND TABLE IN CONJUNCTION WITH THE TAG SHALL SOLICIT AND SYNTHESIZE LOCAL INPUT ON AQUIFER ISSUES AND OPPORTUNITIES.
- THE ROUND TABLE IN CONJUNCTION WITH THE TAG SHALL APPLY THE MANITOBA WATER POLICIES DURING THE DEVELOPMENT OF THE AQUIFER MANAGEMENT PLAN.

ROUND TABLE

Back Row (Left to Right): Richard Thiry, Claude Martin, Lloyd Atchison and Camile Gofflot.
Center Row (Left to Right): Cecil Huff, Al Polwarth, Robert Masson, Roland Perreault, John Vachon and Grant Fotheringham.
Front Row (Left to Right): Darcy Gerow, Joyce Marsh, Ron Renwick, Leo Peloquin, Gaston Boulanger and John Johnston.
Missing: Barry Caldwell, David Rolfe and Darwin Donachuk.

Preparing the Oak Lake Aquifer Management Plan (OLAMP) has included, over a two year period, 15 meetings, two tours and one workshop. The meetings were rotated through the communities of Grande-Clairière, Hartney, Oak Lake and Pipestone. The first eight meetings focused on background information including presentations, mainly from the TAG, and on discussions regarding various aspects of the aquifer and issues relating to its management. The next four meetings focused on the preparation of the Draft OLAMP, which was accepted on February 11, 1999. Public input was obtained on the Draft and incorporated into the final plan along with a section on implementation during three additional meetings. The final OLAMP was accepted by the Round Table and the TAG on March 23, 2000.

IN HIS MEMORY

Ron Renwick re p resented the RM of A rthur and was chairperson of the OLAMP Round Table during the p reparation of the draft plan. He previously worked on many local and regional re s o u rce planning initiatives. Ron passed away on April 1, 1999. This management plan is dedicated to his memory.

ROUND TABLE

Name	Address	Representing
Leo Peloquin	Hartney	Town of Hartney
Barry Caldwell	Melita	Town of Melita
John Johnston	Oak Lake	Town of Oak Lake
Al Polwarth	Souris	Town of Souris
Roland Perreault	Pipestone	R. M. of Albert
Floyd Cheyne	Melita	R. M. of Arthur
Claude Martin	Hartney	R. M. of Cameron
Joe Goodwill	Souris	R. M. of Glenwood
Joyce Marsh	Pipestone	R. M. of Pipestone
John Vachon	Oak Lake	R. M. of Sifton
Gaston Boulanger	Hartney	Keystone Agricultural Producers
Lloyd Atchison	Pipestone	Manitoba Cattle Producers Association
David Rolfe	Elgin	Manitoba Pork Established
Cecil Huff	Oak Lake	Oak Lake Cottage Owners Association
Grant Fotheringham	Reston	Souris Valley Irrigation Centre Inc.
Darwin Donachuk	Winnipeg	Water Resources Branch
Robert Masson	Oak Lake	Water Table Preservation Association
Richard Thiry	Oak Lake	West Souris River Conservation District
Camile Gofflot	Pipestone	Hunters and Maple Lake Hay Growers Association

TECHNICAL ADVISORY GROUP

Name	Address	Representing
David Hay	Shoal Lake	Manitoba Agriculture and Food
Glenn Podolsky	Winnipeg	Manitoba Agriculture and Food
Bernie Chrisp	Brandon	Manitoba Conservation
Bruce Webb	Winnipeg	Manitoba Conservation
Ray Bodnaruk	Winnipeg	Manitoba Conservation
John Little	Winnipeg	Manitoba Conservation
Frank Render	Winnipeg	Manitoba Conservation
Steve Wiecek	Winnipeg	Manitoba Conservation
Perry Stonehouse	Brandon	Manitoba Conservation
Les Ciapala	Brandon	Manitoba Intergovernmental Affairs
Ron Tompkins	Brandon	Manitoba Intergovernmental Affairs
Bruce Dunning	Virden	Manitoba Conservation
Stella Fedeniuk	Brandon	Prairie Farm Rehabilitation Administration
John Oosterveen	Winnipeg	Prairie Farm Rehabilitation Administration
Pat Rakowski	Winnipeg	Environment Canada

The consensus building process was facilitated by:

John Towle	Winnipeg	Manitoba Conservation
Barry Oswald	Winnipeg	Manitoba Conservation

THE STUDY AREA

GEOGRAPHY

The study area is located in southwestern Manitoba between the Assiniboine and Souris Rivers. It is comprised of the 800 square miles of land that lies above the Oak Lake Aquifer. Approximately 2,400 urban and 1,400 rural residents live in the area. They all depend on the aquifer for water supply.

The topography of the study area is generally flat and sloping down 100 feet to the east. The prominent physical features of the landscape include; the flat farmlands on the Souris Plain, Oak Lake, the undulating wetland/grassland areas of Plum Lakes and Maple Lake, the treed and rolling Lauder Sandhills and the Souris River corridor.

The major industry of the area is dry land agriculture but there is also some irrigation and some oil production. Agricultural activities are focused on the production of beef cattle and forage but they also include cereal and some special crop production. Most cattle are ranged during the summer but there is one feedlot operation. In addition, there are several large hog operations in the study area.

The soils within the study area are lighter textured, most are sands. More than half of the area is under native vegetation cover, only one third is regularly cultivated.

STUDY AREA ESTIMATES

Current User Communities	Population [1]
Hartney	480
Lauder	10
Oak Lake	360
Oak Lake Resort	420
Oak Lake Reserve	290
Pipestone	160
Reston *	650
Rural	1,450
TOTAL	**3,820**

[1] Derived from 1996 Statistics Canada data.

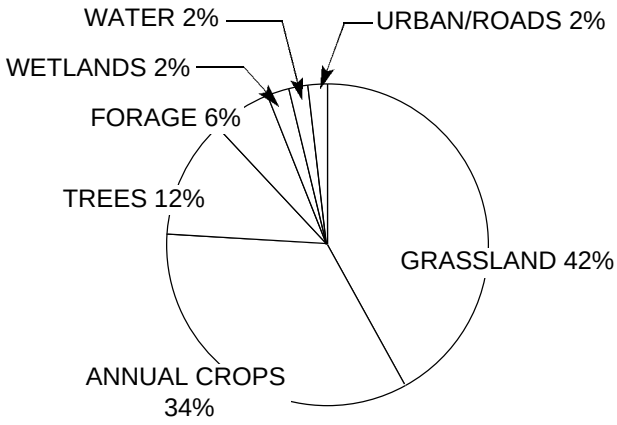
* Reston lies beyond the study area but obtains its water from the aquifer.

LIVESTOCK NUMBERS [1]

Cattle	42,000
Hogs	4,400
Chickens	48,000
Other Poultry	5,400
Sheep	100

[1] Derived from 1996 Statistics Canada data.

LAND USE [2]



[2] Based on 1994 Landsat Imagery.

WATER RESOURCES

The study area lies within a chronic drought region of Manitoba. The average annual precipitation is 18 inches. There is little r u n o ff from the area. Most snow meltwater and spring rainfall infiltrates. The average summer precipitation is 12 inches. Most of this water is used by the vegetation cover.

Pipestone and Stony Creeks usually flow during spring and Pipestone Creek during early summer but they are often dry by fall. Oak Lake is fed by Pipestone Creek and by the aquifer. Lake levels are controlled by a perimeter dike and an outlet dam. Generally the lake remains above elevation 1,409 feet above sea level (ASL).

The Plum Lakes area is used for waterfowl habitat and for hay production. This area is drained by Plum Creek. The Maple Lake area is used mainly for the production of hay and is drained by the Maple Lake Drain.

With regard to groundwater resources, the Oak Lake Aquifer underlies the entire study area and will be discussed later in greater detail.

Domestic water use for household and livestock under 5,500 gallons per day (7.4 acre-feet per year) does not require a licence. All other water uses are allocated by the granting of water rights licences. Streamflow in the study area is nearly fully allocated. Groundwater from the aquifer is approximately one third allocated.

WATER DEMAND

It is estimated that by the year 2038, human populations in the study area could grow to 4,900, cattle numbers to 125,000 and hog numbers to 25,000. Future water use estimates were based on these numbers. Irrigation water use was fixed at the current level because of uncertainty with regards to expected growth. Under this scenario, water demand would reach three quarters of the aquifer's allocation limit by the year 2038.

Some residents think irrigation demand will be large enough within 5 years to use all water available for allocation.

THE AQUIFER

PHYSICAL ENVIRONMENT

The Oak Lake Aquifer is a water bearing deposit of sand and gravel that lies beneath the study area. In general, the top of the aquifer is within 5 to 10 feet of the ground surface. The aquifer thickness varies considerably between zero and 90 feet. The average thickness is 25 feet but over large areas it is quite thin. The grain size of the aquifer materials and consequently the capacity to convey water also varies considerably throughout the aquifer.

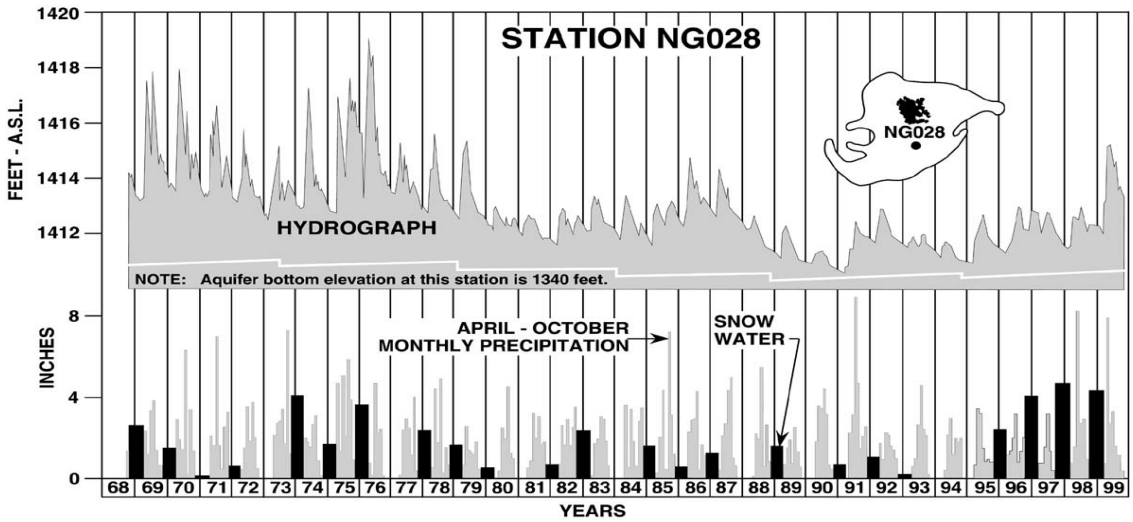
Aquifer water levels are continuously recorded by a set of 28 monitoring stations. The aquifer water table slopes from 1,470 feet ASL at the west side of the study area to 1,400 feet near the east side. In addition, it slopes towards the lakes and the surface waterways. For planning purposes, the aquifer's internal flow regime was used to divide the area into three sub-basins called; Oak Lake, Plum Creek and Souris River (labeled on the study area map). To a degree, these sub-basins function separately.

In general, groundwater levels at station NG028, located near Grande Clairière, are representative of levels throughout the aquifer. Since 1976, the aquifer's fall water levels have been approximately 1 foot lower and the spring water levels approximately 3 feet lower than during the previous wetter period. In the 1990's, water levels have been rising in response to the increase in precipitation.

DEVELOPMENT

The first wells were developed in the aquifer during the 1880's in conjunction with the settlement of the area.

To date, 16 licences have been issued from the aquifer and an additional 6 have been requested. These 22 licences request a total allocation of 2,444 acre-feet of water per year. The distribution of this water by use sector is; 1,912 acre-feet for irrigation, 440 municipal and 92 agriculture.



GROUNDWATER LEVELS and PRECIPITATION

WATER BUDGET

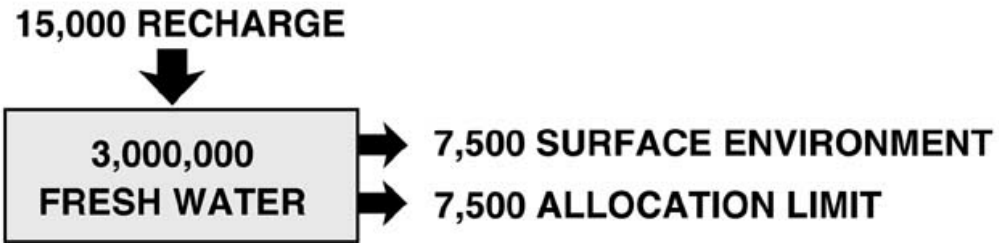
The aquifer contains 3,000,000 acre-feet of fresh water. Its average annual recharge is conservatively estimated to be 15,000 acre-feet. This is the quantity of water that the aquifer can discharge each year and continue to maintain the current water level regime. Common practice is to require that one half of this discharge be reserved to maintain the surface environment as in streamflows, lake and wetland water levels, water supply for vegetation that can access the water table and for domestic use. The balance of this discharge, 7,500 acre-feet per year, is the allocation limit available for licensing.

WATER REGIME

Recharge water for the aquifer infiltrates mainly from snow meltwater and spring rainfall and, to a lesser degree, from streamflow in Pipestone and Stony Creeks. Summer precipitation is used mainly by the vegetation. During this period, only heavy rainfalls infiltrate past the root zone and reach the aquifer.

The aquifer discharges water mainly through springs in Oak Lake, Plum Creek, Maple Lake Drain, Souris River and wetland areas. Aquifer water is also used by humans, animals and plants.

AVERAGE ANNUAL WATER BUDGET IN ACRE-FEET



ANNUAL WATER USE IN ACRE-FEET BY AQUIFER SUB-BASIN

Sub-basin	Allocation Limit	Requested Total
Oak Lake	2,750	940
Plum Creek	1,460	586
Souris River	3,290	918
Total Aquifer	**7,500**	**2,444**

AQUIFER ISSUES

The people in the study area see the aquifer as a resource to be protected. The technical information indicates the aquifer water supply is delicate and in need of protection but that additional water is available for development. That development, in conjunction with land management practices in the study area, will likely dictate the long term sustainability of the Oak Lake Aquifer.

The issues relate to the sustainability of both water quantity and water quality. The people within the study area depend on the aquifer for water supply and, to a large degree, they control the quality of its recharge. A long term plan that will protect it, needs to be implemented and maintained.

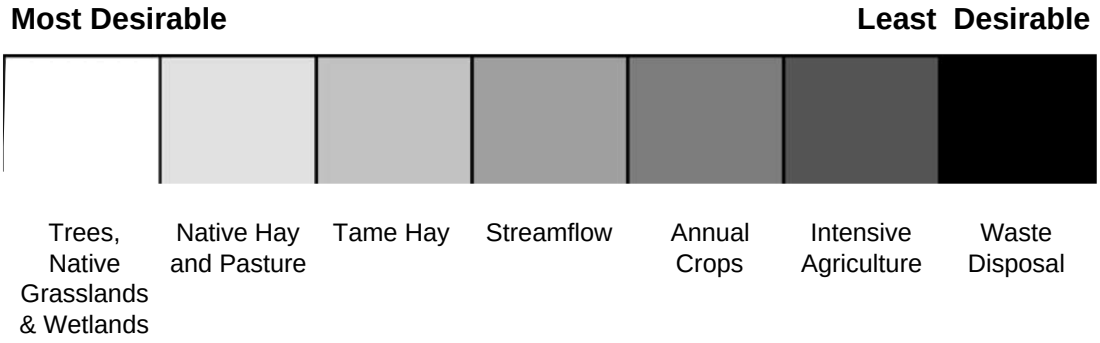
WATER QUANTITY

Water quantity issues arise from the fact that the aquifer is the only reliable source of domestic water available for approximately 3,800 people. Water use greater than recharge would result in reduced aquifer water levels and, beginning with people whose wells are located in thin sections near the edge of the aquifer, the eventual loss of water supply.

On the other hand, water use less than aquifer recharge results in an increase in water levels and additional discharges to the surface environment.

Most aquifer recharge occurs within the study area. Activities and works that encourage runoff or reduce snow accumulation or water ponding also reduce recharge.

LAND COVER / USE DESIRABILITY FOR QUANTITY AND QUALITY OF AQUIFER RECHARGE WATER



WATER QUALITY

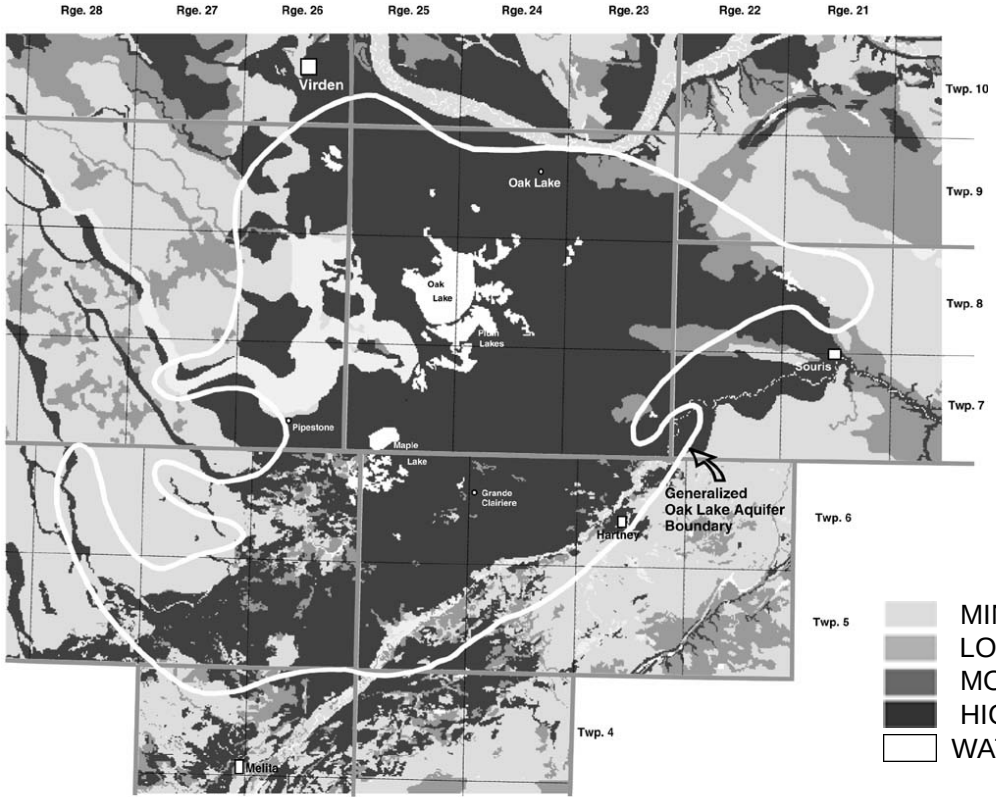
Currently, the aquifer water quality is good. Water quality issues arise from the fact that as quality decreases, treatment can become prohibitively expensive, even impossible. The aquifer could be of little use if polluted. Many aquifers, located beneath intensively used agricultural areas throughout North America and Europe, suffer from nitrate contamination. As this area's industries intensify, the aquifer water quality will require protection.

The Oak Lake Aquifer is susceptible to contamination because it is located close to the surface and is covered by light textured soils. Non point source pollution such as agricultural chemicals or wastes and point sources of pollution such as domestic, municipal and industrial wastes, or spills of contaminants could easily infiltrate to the underlying aquifer.

The oil industry has been active in the area since the mid 1950's and continues to increase production. Major rail lines and pipelines cross the study area in addition to many roads. The future may include considerable increases in livestock numbers and irrigation activities in this area.

Streamflow, which provides some of the aquifer's recharge, has been found to occasionally contain trace levels of commonly used agricultural chemicals well below the guideline limits for drinking water.

POTENTIAL ENVIRONMENTAL IMPACT UNDER IRRIGATION



Factors considered include: soil texture, hydraulic conductivity, geological uniformity, depth to water table and topography.

OPTIONS CONSIDERED

A variety of options were considered to maintain, enhance and protect the aquifer. They are outlined in the following. Some were considered undesirable or impractical at this time.

MAINTAIN THE STATUS QUO

Current activities and planning processes could be relied on to protect the aquifer.

This option was considered undesirable because currently there is no ongoing planning activity devoted to the protection of the aquifer. Furthermore, ongoing land and water development increases the risk of aquifer pollution or depletion.

DATA REVIEW

Considerable data has been gathered and evaluated by the Technical Advisory Group. A key determination has been the estimation of the aquifer's average annual recharge. This number provides the basis of a sustainable long term plan. An independent review of this critical value could be sought to ensure our planning is well based.

This option was not considered desirable at this time. Such a review, from qualified sources, may be prohibitively expensive. This option should be pursued at some future point when funding is available or when water levels appear influenced by use rates less than the current allocation limit of 7,500 acre-feet per year.

MONITORING

Various aquifer monitoring activities are currently conducted by Manitoba Conservation, (formerly Natural Resources, Environment, Energy), Manitoba Inter-governmental A ffairs (Rural Development) and several municipalities. This monitoring could be reviewed, coordinated and extended where necessary to ensure collection of comprehensive recharge and discharge information and early detection of potential quality problems.

To allow for accurate estimation of aquifer recharge and discharge, streamflow information could be collected on the waterways upstream and downstream of the study area. To ensure that contaminants are not leaching into the aquifer, intensive monitoring of soil and groundwater could be conducted on, or adjacent to, industrial or intensively managed agricultural areas.

This was considered desirable because of the essential nature of the water supply and the lack of alternate sources in the region.

WATER USE REPORTING

To ensure the accuracy of water budget information, water use measurements and reporting could be required by all licensed water users.

This was considered desirable because accurate information on use is necessary to evaluate the balance with recharge and because a complete and accurate understanding of the aquifer regime will facilitate its maximum sustainable use by all.

WATER CHARGES

To facilitate water conservation and protection, water charges could be set for all licensed users and revenues could go into an aquifer planning and protection fund.

This was considered undesirable at present because user charges for water are likely not widely supported. Such measures could be reconsidered at a later date.

CONTROLS ON AGRICULTURE

The aquifer lies close below the sandy surface soils. Agricultural activities such as the application of chemicals and nutrients on these soils risks their leaching into the aquifer. Manure management regulations have recently been established for large livestock operations. Additional controls could be sought on agricultural activities.

This option was considered undesirable at this time. There is no evidence of aquifer water quality deterioration to date. In addition, the use of agricultural best management practices is expected to minimize this risk.

If it is demonstrated through future monitoring that the aquifer is being degraded by agricultural activities, additional controls could be sought at that time.

REVIEW DRAINAGE

Drainage reduces infiltration and aquifer recharge. Furthermore, drains excavated into the aquifer water table waste aquifer water. A group could be formed that would review the current drainage regime for potential impact on the aquifer and develop information to guide decisions on future drainage proposals in the study area.

This was considered desirable in order to preserve existing aquifer water and potential recharge water.

INFRASTRUCTURE RISKS

The roads, railroads and pipelines that cross the aquifer and the oil exploration and development activities that are conducted through the aquifer present some risk to water quality. The infrastructure could be routed around the aquifer and oil activities could be restricted.

These options were considered undesirable because the degree of associated risk was considered to be small relative to the inconvenience and cost of change.

PLAN IMPLEMENTATION

In order to implement the Oak Lake Aquifer Management Plan, some group or organization could be responsible for its administration. This group could include representatives from involved government agencies and from the study area.

This was considered desirable in order to keep the plan active over the long term. The study area could be represented by the West Souris River Conservation District or a newly formed group comprised of representatives from the 19 agencies on the current Round Table.

EDUCATION

The aquifer is not an evident feature in the countryside. A group could be formed to prepare and distribute current aquifer information throughout the study area.

This was considered desirable because it is not sufficient just to “have” aquifer information, it must be shared to become common knowledge. It can then become part of private and business interests and planning considerations.

PUBLIC INPUT

A Draft OLAMP was completed in February 1999 and distributed to the area residents through the schools and municipal and town o ffices. Public comment on the draft plan was obtained through a postage paid survey included in the draft and during five advertised public meetings held in April 1999 at Reston, Oak Lake, Hartney, Pipestone and Grande-Clairière. Open houses were also held during the afternoon in the first three communities.

In summary, the public:

- was supportive of the four proposed action plans. No additional plans were recommended.
- emphasized the importance of maintaining aquifer water quantity and quality.
- appreciated the education plan's emphasis on keeping the stakeholders informed.
- welcomed additional factual information on the aquifer.
- perceived the monitoring plan as essential in order to ensure the success of the first two plans.
- favored implementation of the final plan by a group comprised of representatives from government agencies and from the planning Round Table.
- expressed the high value that is placed on the aquifer water supply.

RECOMMENDED ACTIONS

After reviewing the available information, we believe the Oak Lake Aquifer can be sustained as a high quality water supply. However, the aquifer is susceptible to pollution and action is needed to protect and manage it over the long term.

Considering the development and protection issues and options, we recommend the following four action plans be put in place and maintained. The order the plans are presented in is not meant to imply relative importance.

WATER QUANTITY PROTECTION PLAN

Protecting aquifer water quantity requires that water use be less than or balanced with recharge. Changes in land use and increased drainage in the study area and reduced streamflow duration upstream of the study area can reduce aquifer recharge.

Because infiltration rates are high throughout most of the study area, the more runoff is detained, the more recharge there will be. Aquifer water levels or water use can be increased if the quantity of recharge is improved.

The aquifer water quantity protection plan will focus on the study area and its objectives will be to:

- encourage and assist with the identification and development of land and water management practices and activities that enhance aquifer recharge.
- review the existing drainage infrastructure for potential impact on the aquifer and develop information to guide decisions on future drainage proposals in the study area.
- seek to formally reserve a portion of the streamflow in Pipestone and Stony Creeks upstream of the study area to protect aquifer recharge.
- seek to obtain and enforce a requirement that all licensed aquifer water users measure and report annually on water use.
- maintain a current water use database.
- evaluate aquifer water quantity information and provide an annual status report on the sustainability of the water budget to interested councils and organizations.

WATER QUALITY PROTECTION PLAN

Protecting aquifer water quality requires that harmful substances are prevented from infiltrating or leaching into the aquifer. Throughout the study area, the most likely source of such substances relates to agricultural activities. Other potential sources include streamflow and accidental spills.

Land use activities should minimize cultivation and the addition of agricultural wastes and chemicals.

The aquifer water quality protection plan will focus on the study area and its objectives will be to:

- encourage and assist with the identification and implementation of land and water management practices that enhance or maintain aquifer water quality.
- seek to discourage, by regulation or bylaw and by enforcement, land and water management practices that are demonstrated to degrade aquifer water quality.
- evaluate aquifer water quality information and provide an annual status report to interested councils and organizations.

EDUCATION PLAN

It is most likely the aquifer will be valued, protected and sustained if all understand how it works. The aquifer underlies a large area and can be impacted by the activities of many people.

A great deal of information is available on the Oak Lake Aquifer. Additional data will continue to be collected and analyzed. The resulting information should be distributed to all aquifer water users.

The objectives of the aquifer education plan will be to:

- encourage and assist study of the Oak Lake Aquifer water regime.
- distribute current and comprehensive aquifer information throughout the study area.
- distribute information on recommended agricultural "best management" practices to sustain the aquifer.
- distribute information on recommended drainage and land use practices to sustain the aquifer.

MONITORING PLAN

Judicious management requires current and comprehensive information on aquifer water quantity and quality. The quantity monitoring network must be extensive enough to allow for the estimation of the components of aquifer recharge and discharge. The quality monitoring network must be sensitive enough to warn of local water quality deterioration prior to prolonged, extensive or irreversible damage.

The objectives of the aquifer monitoring plan will be to:

- integrate and extend, where necessary, the current monitoring activities to ensure ongoing, comprehensive information is collected for all necessary aquifer parameters.
- include testing for nitrates, pesticides and other potential contaminants.
- design and conduct monitoring programs near sites of intensive agriculture or industry.
- provide data collected to the water quantity and quality protection plans.

PLAN IMPLEMENTATION

The four recommended OLAMP action plans in the previous section itemize a variety of objectives. They have been approved by the TAG, the Round Table and the area residents. Now they need to be implemented.

The implementation strategy should satisfy the following considerations:

- Some objectives are short term. They may be satisfied by the establishment of policies or procedures and may be completed in one or two years.
- Some objectives are long term. They will require the establishment of detailed work plans and the completion of duties in a regular, reliable and ongoing fashion.
- Some objectives may require different activities be pursued in different parts of the study area.
- Activities should be coordinated to ensure that they are comprehensive and complementary and that they are without duplication or contradiction.
- Work plans and objectives should be periodically evaluated and may with time require altering to accommodate changing circumstances. Major changes to the OLAMP objectives may require the review and approval of all aquifer users.
- Aquifer users throughout the study area should be kept informed of all work activities and plans.

IMPLEMENTATION STAGES

OLAMP implementation is expected to have two stages with the following goals.

INITIAL SETUP STAGE (one or two years)	• Setup administrative group. • Setup action groups. • Plan and complete short term objectives. • Establish detailed and coordinated work plans to meet long term objectives.
ONGOING MAINTENANCE STAGE	• Carry out ongoing work. • Evaluate plan's objectives and alter as required.

IMPLEMENTATION WORKING GROUPS

Meeting the OLAMP objectives will require the establishment of working groups with the following memberships and duties.

ADMINISTRATIVE GROUP
(Round Table members)

- Assist action groups as needed.
- Approve action groups' work plans.
- Coordinate work activities.
- Evaluate Plan progress.
- Approve alterations to action plans' objectives.

ACTION GROUPS
(Round Table and TAG members)

- Establish work plans to meet action plans' objectives.
- Present work plans for administrative group approval.
- Carry out approved activities.
- Recommend alterations to action plans' objectives as needed.

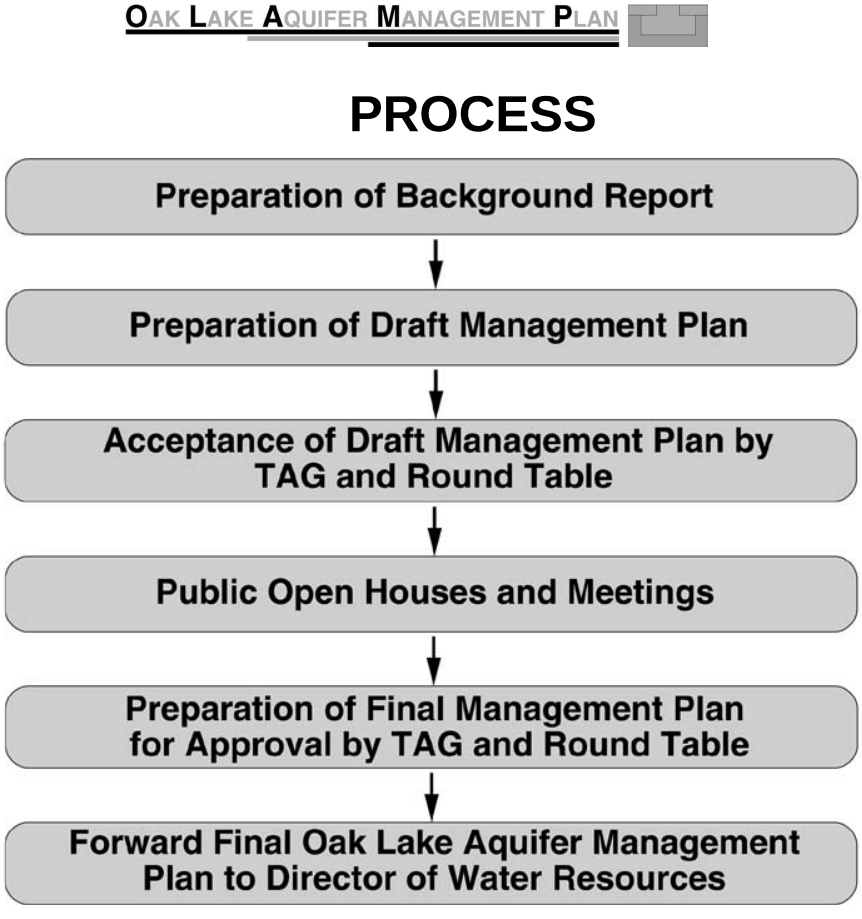
The administrative group is to ensure that the activities of the action groups are coordinated and focused on accomplishing the objectives of the OLAMP's action plans.

The action groups are to ensure that the OLAMP's recommended action plans are carried out in an effective and ongoing fashion and that they are evaluated and altered as required to respond to changing aquifer issues.

The workload of the working groups will be greatest during the initial setup stage. The groups may need to meet four or five times a year or more during this period. Fewer meetings will be required during the ongoing maintenance stage, except when special issues arise.

The OLAMP process and the work of the Round Table and the TAG is complete once the plan is forwarded to the Director of the Water Resources Branch. The plan will also be distributed throughout the study area at this time.

Plan implementation will be initiated by the Director. The Round Table and the TAG will be disbanded when the implementation working groups have been formed.



Some Aquifer Facts

Area	800 square miles
Average Thickness	25 feet
Maximum Thickness	90 feet
Water Volume	3,000,000 acre-feet
Average Annual Recharge	15,000 acre-feet
Annual Allocation Limit	7,500 acre-feet
Requested Total Water Use	2,444 acre-feet
Cover	Sandy Soil - 7.5 feet
Average Annual Precipitation	18 inches

Some Conversion Factors

1 acre-foot = 271,470 imperial gallons
1 imperial gallon = 4.55 litres
1 acre-foot = 1.23 cubic decametres
1 cubic decametre = 1,000,000 litres

An acre-foot of water is the volume contained on an acre, one foot deep. It is a common imperial unit of measurement for water. Its advantages include being based on commonly understood units of measure and being a large enough volume to keep water planning numbers more manageable. Domestic water use of 5,500 imperial gallons per day for one year is equal to an annual water use of 2,007,500 gallons or 7.4 acre-feet.

Oak Lake has a surface area of approximately 12.5 square miles or 8,000 acres. If we assume it is on average 7.5 feet deep, it contains 60,000 acre-feet of water; sufficient to supply:

- the total municipal water use in the study area for 135 years.
- the total aquifer recharge for 4 years.
- a one and one-half inch rainfall over the entire study area.
- three average annual runoffs on Pipestone Creek.
- a refill of two percent of the Oak Lake Aquifer.

If the 3,000,000 acre-feet of water in the aquifer is compared to 1 hour, then the 7,500 acre-foot allocation limit would compare to 9 seconds and the 2,444 acre-foot current requested total water use would compare to 3 seconds.

ACTION GROUP OBJECTIVES

Water Quantity Protection Plan

This action group will compile and distribute an annual status report on aquifer water storage and use and it will strive to protect recharge sources, encourage practices that enhance recharge and discourage those that reduce it.

Water Quality Protection Plan

This action group will compile and distribute an annual status report on aquifer water quality and it will strive to encourage practices that enhance aquifer water quality and discourage those that degrade it.

Education Plan

This action group will distribute, throughout the study area, information on the aquifer and on best agriculture and drainage practices to sustain its water supply capacity. It will also strive to encourage additional study of the aquifer.

Monitoring Plan

This action group will ensure that the data necessary to manage the aquifer is collected and provided to the aquifer water quantity and water quality protection plans.