East Duck Mountain/Sagemace Bay Watersheds
Water Quality Report

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Surface water quality data have been collected by the Water Quality Management Section, Manitoba Water Stewardship, to address various issues within the East Duck Mountain/Sagemace Bay Watersheds (05LG, 05LJ and 05LH). Surface water quality data are collected primarily to: 1) assess long-term, ambient water quality trends at routinely monitored sites, and 2) assess ambient water quality through short-term, intensive studies and activities. Results of water chemistry collected from the North Duck and Mossy Rivers portion of this watershed represent data that were generated from both long-term water quality sites and from short-term, issue-driven studies. While water quality samples have been collected fairly consistently from some sites, other data collections in the watershed are not as continuous or consistent in either date range or chemistry. Table 1 highlights stations in the watershed containing water chemistry data that is discussed below.

Table 1. Water quality monitoring stations within the Pembina River Watershed.

Station Number	Location	Period of Record	Sampling Frequency	Agency
MB05LGS001	North Duck River at PTH #10, near Cowan	1975-1977, 1988-2008	Monthly in open water season	Province
MB05LJS006	Mossy River at PR #364 near Winnipegosis	1974-1977, 1988 - 2008	Monthly in open water season	Province

Long-Term Trends - Surface Water Quality

Water quality monitoring in the East Duck Mountain/Sagemace watersheds dates back to the early 1970s. Two sample sites in this watershed have a continuous long-term data set. These are on the Mossy River near Winnipegosis and on the North Duck River near Cowan. Long-term monitoring on the Mossy River began in 1974 and in 1988 on the North Duck River. There are also clumps of time periods where continuous short-term issue driven monitoring has taken place. Water samples taken at all of these sites were analyzed for a wide range of water chemistry variables including phosphorus, nitrogen, pesticides, metals, nutrients, general chemistry, and bacteria.

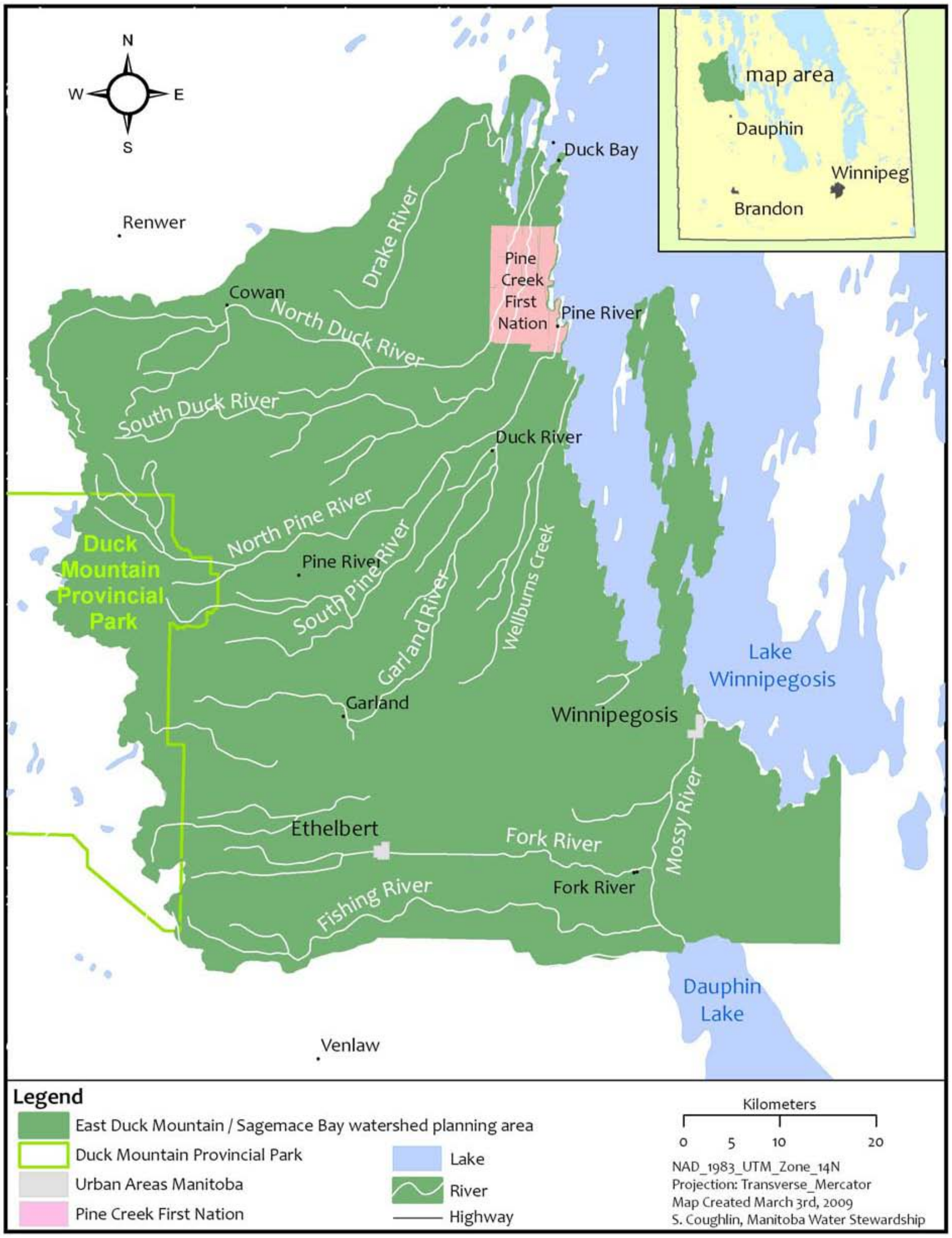

Figure 1: East Duck Mountain/Sagemace Bay Integrated Watershed Management study area.

The long-term monitoring site on North Duck River near Cowan indicates that phosphorus levels in the river are rising. Figure 2 displays the phosphorus levels measured at the site from 1992 – 2007. Since 2003 phosphorus levels have continued to spike in the spring and summer months. This may be related to run-off and drainage surrounding the river. The acceptable level of total phosphorus (TP) in a river is 0.05 mg/L. In July of 2007 levels of TP in the North Duck River were measured at 0.498 mg/L, which is almost ten times greater than the acceptable level.

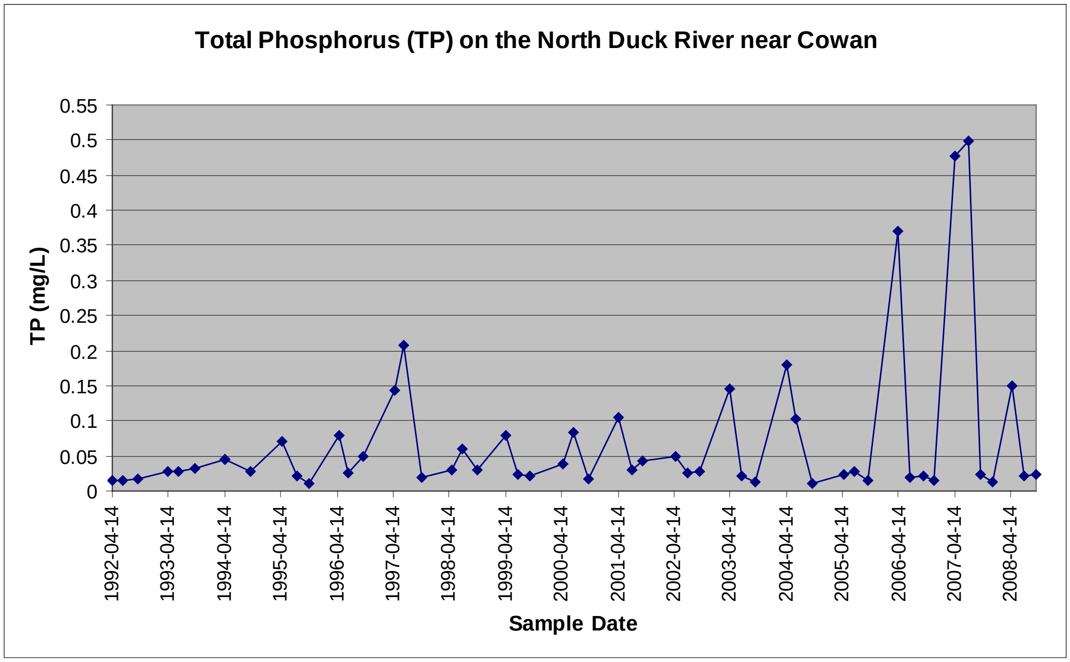

Figure 2: Total Phosphorus (TP) Levels in the North Duck River from 1992 – 2008.

The long-term monitoring site on Mossy River near Winnipegosis indicates high levels of phosphorus in the river. The acceptable level of phosphorus in a river is 0.05 mg/L. Figure 3 shows the levels to total phosphorus (TP) measured on the Mossy River. Although the levels do not reach the same concentration of TP as those found on the North Duck River, the levels on the Mossy River are consistently above the acceptable level. Figure 3 highlights the levels of TP measured on the Mossy River from the spring of 2004 until the summer of 2008. All of these samples show above acceptable levels of TP.

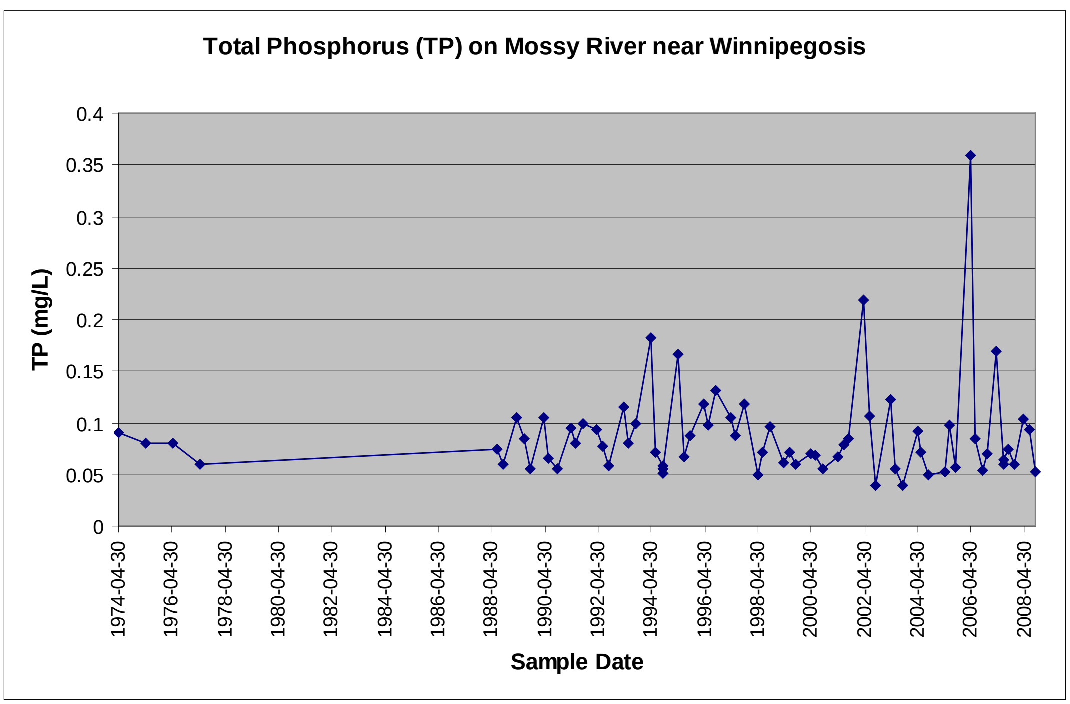

Figure 3: Total Phosphorus (TP) Levels in Mossy River near Winnipegosis.

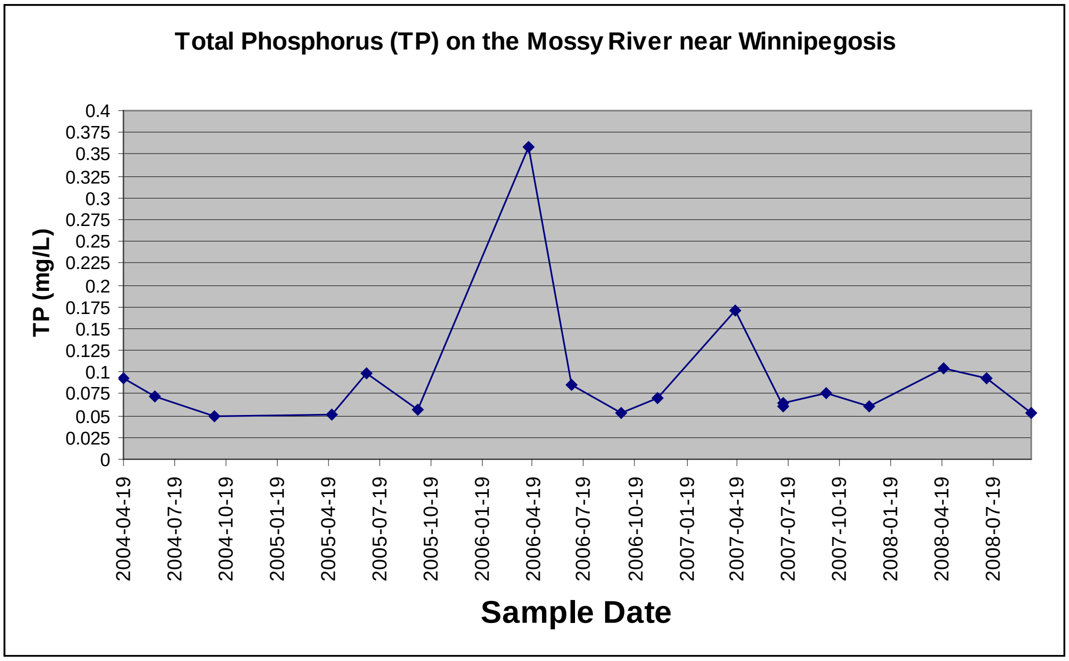

Figure 4: Total Phosphorus (TP) levels on Mossy River from the spring of 2004 until the summer of 2008.

Water Quality Index:

Water quality at long-term water quality monitoring stations can be assessed with the Canadian Council of Ministers of the Environment (CCME) Water Quality Index. The Water Quality Index is used to summarize large amounts of water quality data into simple terms (e.g., good) for reporting in a consistent manner. Twenty-five variables are included in the Water Quality Index (Table 1) and are compared with water quality objectives and guidelines contained in the Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson 2002 and Table 1).

Table 2. Water quality variables and objectives or guidelines (Williamson 2000, Williamson 1988) used to calculate Water Quality Index (CCME 2000).

Variables	Units	Objective Value	Objective Use
Fecal Coliform MF	Bacteria/100mL	200	Recreation
Ph	Ph Units	6.5-9.0	Aquatic Life Greenhouse
Specific Conductivity	uS/cm	1000	Irrigation
Total Suspended Solids	mg/L	25 (mid range)	Aquatic Life
Dissolved Oxygen	mg/L	5 (mid range)	Aquatic Life
Total or Extractable Cadmium*	mg/L	Calculation based on Hardness (7Q10)	Aquatic Life
Total or Extractable Copper*	mg/L	Calculation based on Hardness (7Q10)	Aquatic Life
Total Arsenic	mg/L	0.025	Drinking Water, Health
Total or Extractable Lead*	mg/L	Calculation based on Hardness (7Q10)	Aquatic Life
Dissolved Aluminium	mg/L	0.1 for pH >6.5	Aquatic Life
Total or Extractable Nickel*	mg/L	Calculation based on Hardness (7Q10)	Aquatic Life
Total or Extractable Zinc*	mg/L	Calculation based on Hardness (7Q10)	Aquatic Life
Total or Extractable Manganese	mg/L	0.05	Drinking Water, Aesthetic
Total or Extractable Iron	mg/L	0.3	Drinking Water,

Total Ammonia as N	**mg/L**	**Calculation based pH**	**Aesthetic Aquatic Life**
Soluble or Dissolved Nitrate-Nitrite	**mg/L**	**10**	**Drinking Water, Health**
Total Phosphorus	**mg/L**	**0.05 in Rivers or 0.025 in Lakes**	**Nuisance Plant Growth**
Dicamba	**ug/L**	**0.006 where detectable**	**Irrigation**
Bromoxynil	**ug/L**	**0.33**	**Irrigation**
Simazine	**ug/L**	**0.5**	**Irrigation**
2,4 D	**ug/L**	**4**	**Aquatic Life**
Lindane	**ug/L**	**0.01**	**Aquatic Life**
Atrazine	**ug/L**	**1.8**	**Aquatic Life**
MCPA	**ug/L**	**0.025 where detectable**	**Irrigation**
Trifluralin	**ug/L**	**0.2**	**Aquatic Life**

The Water Quality Index combines three different aspects of water quality: the 'scope,' which is the percentage of water quality variables with observations exceeding guidelines; the 'frequency,' which is the percentage of total observations exceeding guidelines; and the 'amplitude,' which is the amount by which observations exceed the guidelines. The basic premise of the Water Quality Index is that water quality is excellent when all guidelines or objectives set to protect water uses are met virtually all the time. When guidelines or objectives are not met, water quality becomes progressively poorer. Thus, the Index logically and mathematically incorporates information on water quality based on comparisons to guidelines or objectives to protect important water uses. The Water Quality Index ranges from 0 to 100 and is used to rank water quality in categories ranging from poor to excellent.

- **Excellent (95-100)** - Water quality never or very rarely exceeds guidelines
- **Good (80-94)** - Water quality rarely exceeds water quality guidelines
- **Fair (60-79)** - Water quality sometimes exceeds guidelines and possibly by a large margin
- **Marginal (45-59)** - Water quality often exceeds guidelines and/or by a considerable margin
- **Poor (0-44)** - Water quality usually exceeds guidelines and/or by a large margin

While water chemistry has been monitored at the long-term monitoring stations on the Mossy and North Duck Rivers since 1974 and 1988 respectively for several periods between 1974 and 2007; and 1988 and 2007, certain pesticides that are required to calculate the WQI were not monitored prior to 1992. Therefore, the graphs highlighting the WQIs' are representative of 1992 to 2007.

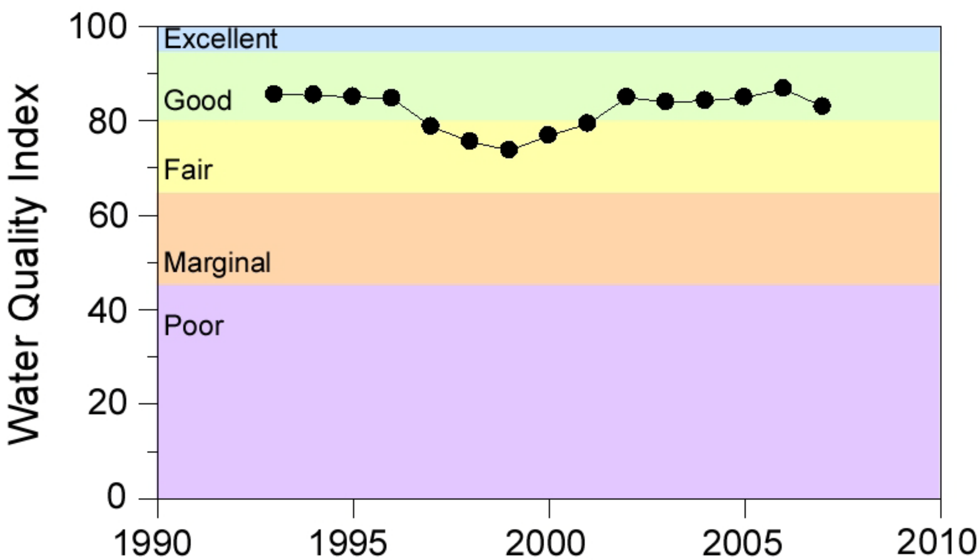

Figure 5. Water Quality Index calculated from 1992 to 2007 for the long-term monitoring site on the Mossy River near Winnipegosis

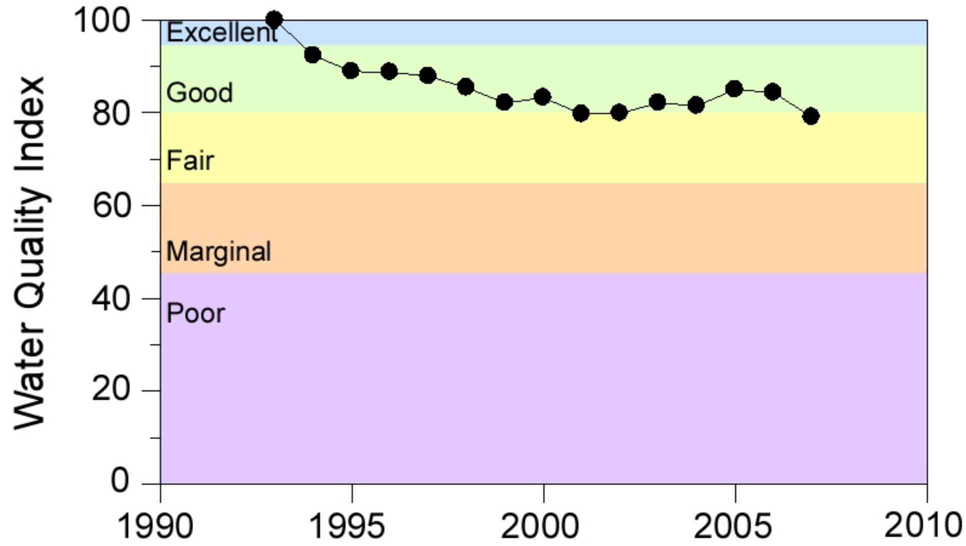

Figure 6. Water Quality Index calculated from 1992 to 2007 for the long-term monitoring site in the North Duck River near Cowan.

The Water Quality Index from 1993 to 2007 was overall quite good. However the province and the public have to continue to monitor and manage such issues as water quality, exceedences of total suspended solids, manganese, total phosphorus, and pesticides. Management of these issues is truly one of upstream contributions. Government continues to support and develop numerous initiatives to reduce nutrient contributions within the Lake Winnipeg drainage basin. For a detailed discussion concerning Government's actions and initiatives on reducing nutrient contributions to Lake Winnipeg, please visit:

http://www.gov.mb.ca/waterstewardship/water_quality/lake_winnipeg/index.html .

Nutrients

Nutrient enrichment or eutrophication is one of the most important water quality issues in Manitoba. Excessive levels of phosphorus and nitrogen fuel the production of algae and aquatic plants. Extensive algal blooms can cause changes to aquatic life habitat, reduce essential levels of oxygen, clog fisher's commercial nets, interfere with drinking water treatment facilities, and cause taste and odour problems in drinking water. In addition, some forms of blue-green algae can produce highly potent toxins.

Studies have shown that since the early 1970s, phosphorus loading has increased by about 10 per cent to Lake Winnipeg and nitrogen loading has increased by about 13 per cent (Jones and Armstrong 2001, Bourne *et al.* 2002). A similar phenomenon has also occurred in many other Manitoba streams, rivers, and lakes.

Manitobans contribute about 47 % of the phosphorus and 44 % of the nitrogen to Lake Winnipeg (Bourne *et al.* 2002, updated in 2006). About 15 % of the phosphorus and 6 % of the nitrogen entering Lake Winnipeg is contributed by agricultural activities within Manitoba. In contrast, about 9 % of the phosphorus and 6 % of the nitrogen entering Lake Winnipeg from Manitoba is contributed by wastewater treatment facilities such as lagoons and sewage treatments plants.

As part of Lake Winnipeg Action Plan, the Province of Manitoba is committed to reducing nutrient loading to Lake Winnipeg to those levels that existed prior to the 1970s. The Lake Winnipeg Action Plan recognizes that nutrients are contributed by most activities occurring within the drainage basin and that reductions will need to occur across all sectors. Reductions in nutrient loads across the Lake Winnipeg watershed will benefit not only Lake Winnipeg but also improve water quality in the many rivers and streams that are part of the watershed including the Pembina River.

Nutrient reduction targets under the Lake Winnipeg Action Plan are interim targets that reflect the need to take immediate action to reduce nutrient loads to Lake Winnipeg. Manitoba Water Stewardship is working to develop long-term, ecologically-relevant objectives for nutrients in Lake Winnipeg and its contributing basins such as the Pembina River watershed. Long-term, ecologically-relevant objectives will also replace narrative guidelines that are currently applied across Manitoba. However, reducing nutrients across Manitoba, the Pembina River watershed, and the Lake Winnipeg watershed is a challenge that will require the participation and co-operation of all Manitobans and will involve:

- Implementing expensive controls on nutrients in municipal and industrial wastewater treatment facilities.
- Developing scientifically-based measures to control the application of inorganic fertilizers, animal manure, and municipal sludge to agricultural lands.
- Reducing nutrient contributions from individual cottagers and homeowners.
- Working with our upstream neighbours.

Individual Manitobans can help by taking the following steps:

- Maintain a natural, riparian buffer along waterways such as the Pembina River, Badger Creek and their tributaries. Natural vegetation slows erosion and helps reduce the amount of nitrogen and phosphorus entering lakes, rivers and streams.
- Value and maintain wetlands. Similar to riparian buffers along waterways, wetlands slow erosion and help reduce nutrient inputs to lakes, rivers, and streams. Wetlands also provide flood protection by trapping and slowly releasing excess water while providing valuable habitat for animals and plants.
- Don’t use fertilizer close to waterways. Heavy rains or over-watering your lawn can wash nutrients off the land and into the water.
- Use phosphate-free soaps and detergents. Phosphates have been prohibited from laundry detergents but many common household cleaners including dishwasher detergent, soaps, and other cleaning supplies still contain large amounts of phosphorus. Look for phosphate-free products when you are shopping.
- Ensure that your septic system is operating properly and is serviced on a regular basis. It’s important that your septic system is pumped out regularly and that your disposal field is checked on a regular basis to ensure that it is not leaking or showing signs of saturation.

Nutrient Management Regulation

Manitoba is proposing a Nutrient Management Regulation under *The Water Protection Act*. The purpose of the proposed regulation is to protect water quality by encouraging responsible nutrient planning, regulating the application of materials containing nutrients and restricting the development of certain types of facilities in environmentally sensitive areas. When nitrogen and phosphorus are applied to land surfaces in greater amounts than can be used by growing plants, excess nutrients can leach into ground water or run-off into surface water with heavy rainfall, floods, and melting snow.

Manitoba’s landscape has been separated into five zones. Zones N1, N2, and N3 consist of land that ranges in agricultural productivity while Zone N4 is generally unproductive land that represents a significant risk of nutrient loss to surface and groundwater. Zone N4 land consists of Canada Land Inventory soil classification 6 or 7 or unimproved organics. Zone N5 consists of urban and rural residential areas.

The proposed regulation also describes a Nutrient Buffer Zone with widths outlined below:

Water Body	A [1]	B [1]
o a lake or reservoir designated as vulnerable	30 m	35 m
o a lake or reservoir (not including a constructed stormwater retention pond) not designated as vulnerable o a river, creek or stream designated as vulnerable	15 m	20 m
o a river, creek or stream not designated as vulnerable o an order 3, 4, 5, or 6 drain or higher o a major wetland, bog, swamp or marsh o a constructed stormwater retention pond	3 m	8 m

(1) Use column A if the applicable area is covered in permanent vegetation. Otherwise, use column B.

Under the proposed regulation, no nitrogen or phosphorus can be applied within Zone N4 or the Nutrient Buffer Zone.

More information on the proposed *Nutrient Management Regulation* is available at http://www.gov.mb.ca/waterstewardship/wqmz/index.html.

Drainage

Although it is recognized that drainage in Manitoba is necessary to support sustainable agriculture, it is also recognized that drainage works can impact water quality and fish habitat. Types of drainage include the placement of new culverts or larger culverts to move more water, the construction of a new drainage channels to drain low lying areas, the draining of potholes or sloughs to increase land availability for cultivation and the installation of tile drainage. Artificial drainage can sometimes result in increased nutrient (nitrogen and phosphorus), sediment and pesticide load to receiving drains, creeks and rivers. All types of drainage should be constructed so that there is no net increase in nutrients (nitrogen and phosphorus) to waterways. To ensure that drainage maintenance, construction, and re-construction occurs in an environmentally friendly manner, the following best available technologies, and best management practices aimed at reducing impacts to water quality and fish habitat are recommended.

The following recommendations are being made to all drainage works proposals during the approval process under *The Water Rights Act*:

- There must be no net increase in nutrients (nitrogen and phosphorus) to waterways as a result of drainage activities. Placement of culverts, artificial drainage and construction and operation of tile drains can sometimes result in increased nutrient (nitrogen and phosphorus), sediment and pesticide loads to receiving drains, creeks and rivers.
- Synthetic fertilizer, animal manure, and municipal wastewater sludge must not be applied within drains.

Culverts

- Removal of vegetation and soil should be kept to a minimum during the construction and the placement of culverts.
- Erosion control methodologies should be used on both sides of culverts according to the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat.
- A strip of vegetation 1 to 3 metres wide should be maintained along drainage channels as a buffer. This will reduce erosion of channels and aid in nutrient removal.
- The proponent should revegetate exposed areas along drainage channels.

<u>Surface Drainage</u>

- Surface drainage should be constructed as shallow depressions and removal of vegetation and soil should be minimized during construction.
- Based on Canada Land Inventory Soil Capability Classification for Agriculture (1965), Class 6 and 7 soils should not be drained.
- There should be no net loss of semi-permanent or permanent sloughs, wetlands, potholes or other similar bodies of water in the sub-watershed within which drainage is occurring.
- Erosion control methodologies outlined in Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat should be used where the surface drain intersects with another water body.
- A strip of vegetation 1 to 3 metres wide should be maintained along surface drainage channels as buffers. These will reduce erosion of channels and aid in nutrient removal.
- The proponent should revegetate exposed areas along banks of surface drainage channels.

<u>Tile Drainage</u>

- Discharge from tile drainage should enter a holding pond or wetland prior to discharging into a drain, creek or river.

Manitoba Water Stewardship is working towards the development of an environmentally friendly drainage manual that will provide additional guidance regarding best management practices for drainage in Manitoba.

Summary

1. The Water Quality Index indicates that water quality is “fair - good” in both the East Duck and Mossy Rivers, which are situated in the North Duck Mountain/Sagemace Bay watershed.
2. While most water quality variables were well below the water quality standard, objectives, and guidelines, total phosphorus occasionally exceeded objectives.

Contact Information

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And visit the Department’s web site: http://www.gov.mb.ca/waterstewardship

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