Prepared for:

Southwest Interlake Integrated Watershed Management Plan

Water Quality Report

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September 2014

Water Quality Investigations and Routine Monitoring:

This report provides an overview of the studies and routine monitoring which have been undertaken by Manitoba Conservation and Water Stewardship's Water Quality Management Section within the Southwest Interlake watershed. There is currently one long term water quality monitoring station (2011 – present) within the Southwest Interlake watershed; the Swan Creek Drain near Lundar. In addition, there is one long term beach water quality monitoring station at Twin Lakes Beach (2008 – present). Historic data from other stations in this watershed were sparse and so were not included in this report. There was no water quality data available for the Shoal Lakes in this watershed.

The Southwest Interlake watershed area is primarily characterized by agricultural land, both crop and livestock, as well as rural centres and a provincial park. All these land uses have the potential to negatively impact water quality, if not managed appropriately. Cropland can present water quality concerns in terms of fertilizer and pesticide runoff entering surface water. Livestock can present water quality concerns in terms of nutrient and pathogen runoff from feces, especially if they have direct access to surface water bodies. Urban and rural municipalities present water quality concerns in terms of wastewater treatment and effluent discharge. Provincial parks present similar water quality concerns in terms of wastewater treatment and disposal.

The tributary of most concern in the Southwest Interlake watershed is the Swan Creek Drain near Lundar. This long term water quality monitoring station is sampled on a quarterly basis for general chemistry, nutrients, metals, bacteria, and pesticides.

Total Phosphorus

Figure 1 illustrates the annual mean total phosphorus concentrations in the Southwest Interlake watershed. Typically, total phosphorus concentrations were near the Manitoba Water Quality Guideline for rivers of 0.05 mg/L (Water Science and Management Branch 2011). This is with the exception of the elevated total phosphorus concentrations which were observed in late autumn/ early winter of 2012 and 2013. Small exceedances were also observed in early spring each year. As part of the Lake Winnipeg Action Plan, Manitoba is implementing several strategies to better manage plant nutrients. Part of this Action Plan includes the development of more appropriate site-specific or regional-specific water quality objectives or guidelines for nutrients. In the meantime, the narrative guidelines will be retained for nutrients such as nitrogen and phosphorus until more site specific objectives are developed. It is generally recognized, however, that narrative guidelines for phosphorus likely do not apply to many streams in the Canadian prairie region since other factors such as turbidity, stream velocity, nitrogen, and other conditions most often limit algal growth. As well,

relatively high levels of phosphorus in excess of the narrative guidelines may arise naturally from the rich prairie soils. It should be noted that most streams and rivers in southern Manitoba exceed this guideline, in some cases due to the natural soil characteristics in the watershed and/ or due to inputs from human activities and land-use practices.

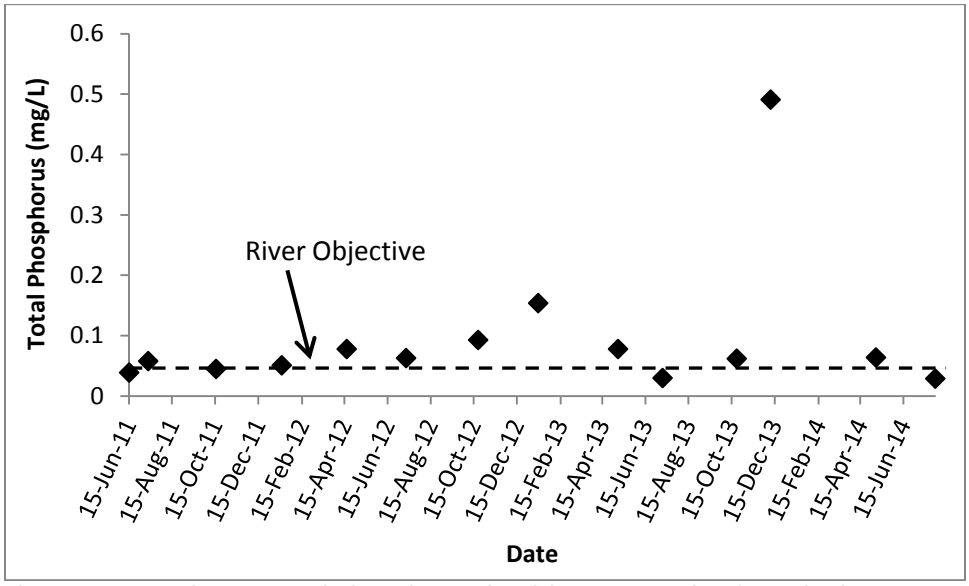

Figure 1: Annual mean total phosphorus (mg/L) concentration from the long term water quality monitoring station in the Southwest Interlake watershed; Swan Creek Drain near Lundar, between 2011 and July 2014.

Total Nitrogen

Currently there is no guideline for total nitrogen for the protection of aquatic life in Manitoba. However, other jurisdictions have adopted a chronic total nitrogen guideline of 1.0 mg/L (Alberta Environment 1999). The narrative objective for total nitrogen states nitrogen should be limited to the extent necessary to prevent nuisance growth and reproduction of aquatic rooted, attached and floating plants, fungi, or bacteria, or to otherwise render the water unsuitable for other beneficial uses (Water Science and Management Branch 2011). Nitrogen and phosphorus are two essential nutrients which stimulate algal growth in Lake Manitoba and its watershed. Figure 2 illustrates annual mean total nitrogen concentration in the Swan Creek Drain near Lundar. Total nitrogen concentration has remained relatively constant, but all samples are above the chronic guideline of 1.0 mg/L. Water quality samples collected in the late autumn/ early winter have elevated total nitrogen concentrations as compared to the remainder of the year. This indicates best management practices should focus on reducing nutrient loading in the autumn and early winter season.

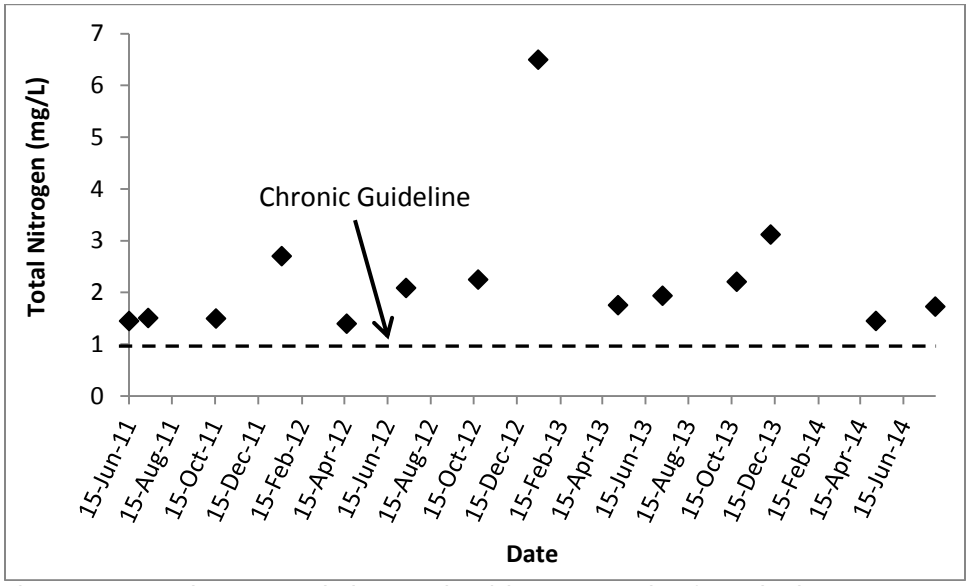

Figure 2: Annual mean total nitrogen (mg/L) concentration from the long term water quality monitoring station in the Southwest Interlake watershed; Swan Creek Drain near Lundar, between 2011 and July 2014.

Dissolved Oxygen

Maintenance of adequate dissolved oxygen levels is essential to the health of aquatic life inhabiting rivers and streams. The monitoring conducted in the Southwest Interlake watershed (Figure 3) demonstrates that typically dissolved oxygen levels are above the 5.0 mg/ L Manitoba objective (Water Science and Management Branch 2011) indicating there is typically adequate dissolved oxygen to support healthy aquatic life. This is with the exception of January 2012 and 2013 in which dissolved oxygen levels were well below the 5.0 mg/L objective. Low oxygen levels under ice conditions are not uncommon in small prairie rivers, as the decomposition of plant material consumes oxygen from the water. As well, low oxygen levels are not uncommon after a summer of intense algal blooms consuming oxygen from the water column. Overall, there is typically adequate dissolved oxygen in this watershed to support healthy aquatic life.

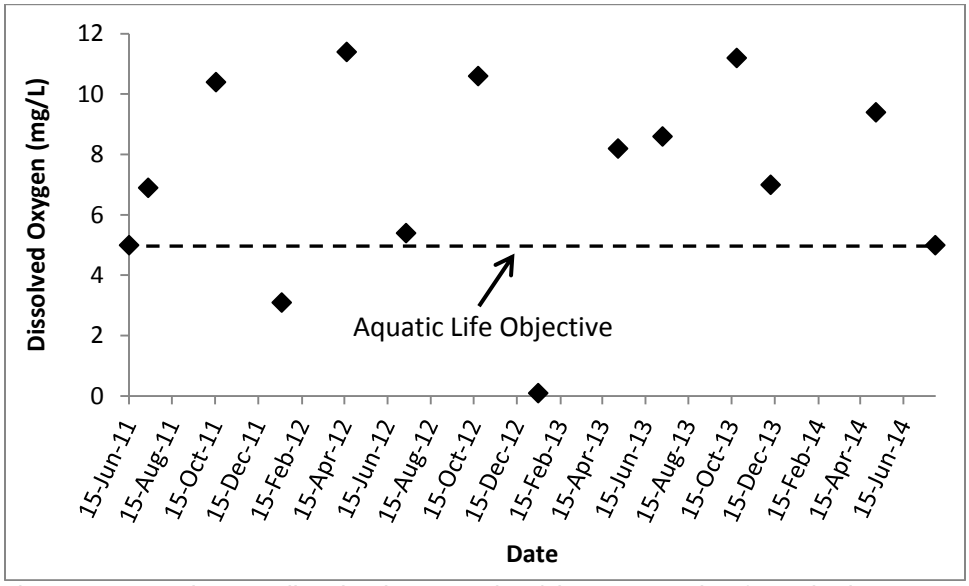

Figure 3: Annual mean dissolved oxygen (mg/L) concentration from the long term water quality monitoring station in the Southwest Interlake watershed; Swan Creek Drain near Lundar, between 2011 and July 2014.

***Escherichia coli (E*. coli)**

Escherichia coli (E. coli) is one type of fecal coliform, which is a bacteria commonly found all warm-blooded animals including humans, livestock, wildlife, and birds. *E. coli* itself does not generally cause illness, but when present in large numbers the risk of becoming ill from other organisms is elevated. The most common illnesses contracted by bathers are infections of the eyes, ears, nose, and throat as well as stomach upsets. Typical symptoms include mild fever, vomiting, diarrhea and stomach cramps. Extensive studies were undertaken by Manitoba Conservation and Water Stewardship in 2003 to determine the source of occasionally high *E. coli* counts and the mechanism of transfer to Lake Winnipeg beaches. Studies have shown large numbers of *E. coli* present in the wet sand of beaches. During periods of high winds, when water levels are rising in the south basin, these bacteria can be washed out of the sand and into the swimming area of the lake. Research shows less than 10% of *E. coli* found at Lake Winnipeg beaches is from human sources, with the remaining percentage from birds and animals.

Figure 4 illustrates the annual mean *E. coli* densities from the Swan Creek Drain near Lundar. *E. coli* densities were all well below the irrigation objective of 1000 CFU/ 100 mL, and were typically below the recreation objective of 200 CFU/ 100 mL (Water Science and Management Branch 2011). This is with the exception of the Swan Creek Drain in October 2013 which exceeded the recreation objective. *E. coli* densities were also typically below the recreation objective of 200 CFU/ 100 mL during the annual summer monitoring of Twin Lakes Beach (2008 – 2013). This is with the exception of one occasion during July of 2009 and June of 2013.

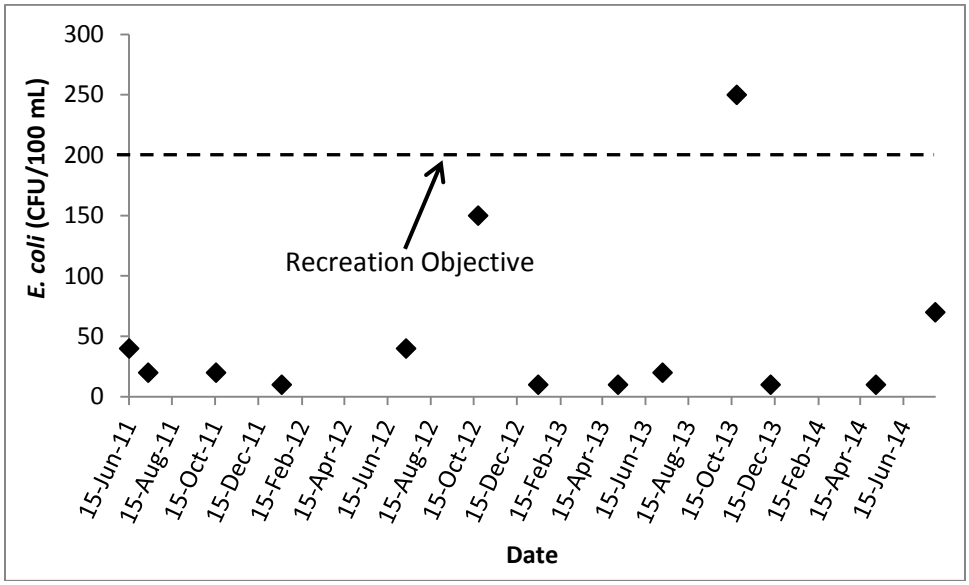

Figure 4: Annual mean *E. coli* densities (CFU/ 100 mL) from the long term water quality monitoring station in the Southwest Interlake watershed; Swan Creek Drain near Lundar, between 2011 and July 2014.

Drinking water variables

Drinking water variables of greatest concern are typically nitrates (objective value = 10 mg/L), arsenic (objective value = 0.025 mg/L), barium (objective value = 1 mg/L), boron (objective value = 5 mg/L), fluoride (objective value = 1.5 mg/L), uranium (objective value = 0.020 mg/L) and total dissolved solids (objective value = <500 mg/L) (Water Science and Management Branch 2011). It should be noted that the above stated drinking water objectives and guidelines only apply to treated, potable water. The data presented in this report however, are ambient natural untreated water quality samples, presented only for comparative purposes. At no time should raw untreated surface water be consumed for drinking water purposes, due to potential health concerns.

Drinking water variables for the long term station, Swan Creek Drain near Lundar, were always well below the objectives with the exception of total dissolved solids. Total dissolved solids typically were below the drinking water objective of 500 mg/L, with the exception of five occasions; January and October 2012, January and October 2013, and December 2014 (Figure 5). Total dissolved solids are a secondary drinking water objective, meaning they are primarily an aesthetic concern, rather than an immediate health concern. Total dissolved solids are related to ‘hard’ water which can cause problems and increased costs to drinking water and hot water systems. In addition, high concentrations of total dissolved solids can be an indication of elevated concentrations of potentially harmful ions such as nitrates, arsenic, aluminum, lead, copper, etc. which can be detrimental to health if ingested.

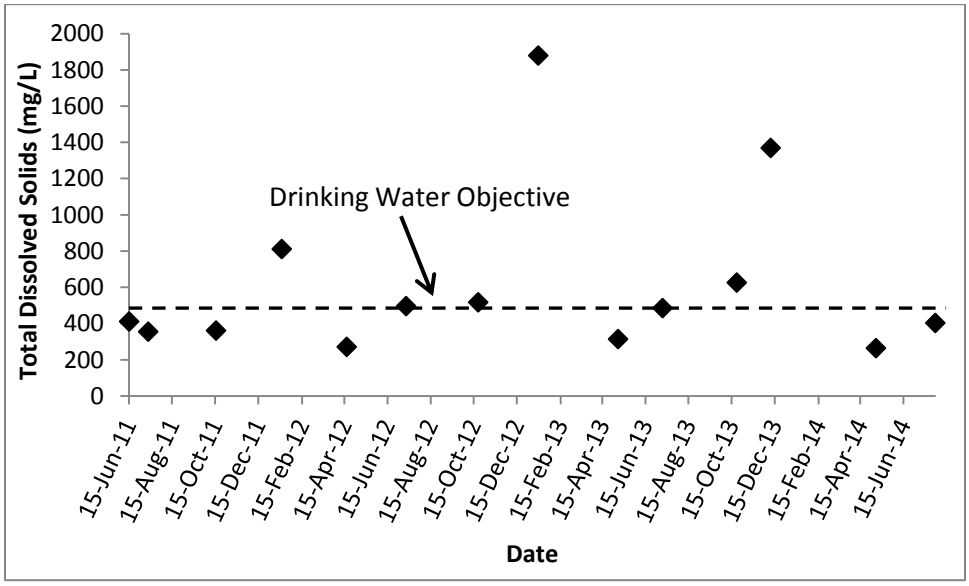

Figure 5: Mean annual total dissolved solids concentration (mg/L) from the long term water quality monitoring station in the Southwest Interlake watershed; Swan Creek Drain near Lundar, between 2011 and July 2014.

Currently there is no guideline for total suspended solids for the protection of aquatic life in Manitoba. Total suspended solids include organic and inorganic materials suspended in the water column, including soil, plankton (algae) and wastes. Total suspended solids can result from erosion, including soil, stream bank, urban, agricultural and industrial, as well as bottom feeders such as carp and algal growth. High concentrations of total suspended solids absorb light thereby increasing water temperatures which reduces the ability of water to hold oxygen necessary for aquatic life. Therefore, high concentrations of total suspended solids are in indication of deteriorated water quality. Total suspended solids are quite variable in the Swan Creek Drain near Lundar (Figure 6). Temporally, the greatest total suspended solid concentrations were observed during spring and autumn. Hence future programming should target best management practices aimed at reducing soil erosion, stream bank erosion, and reducing spring runoff via retention ponds and incorporation of wetlands on the landscape.

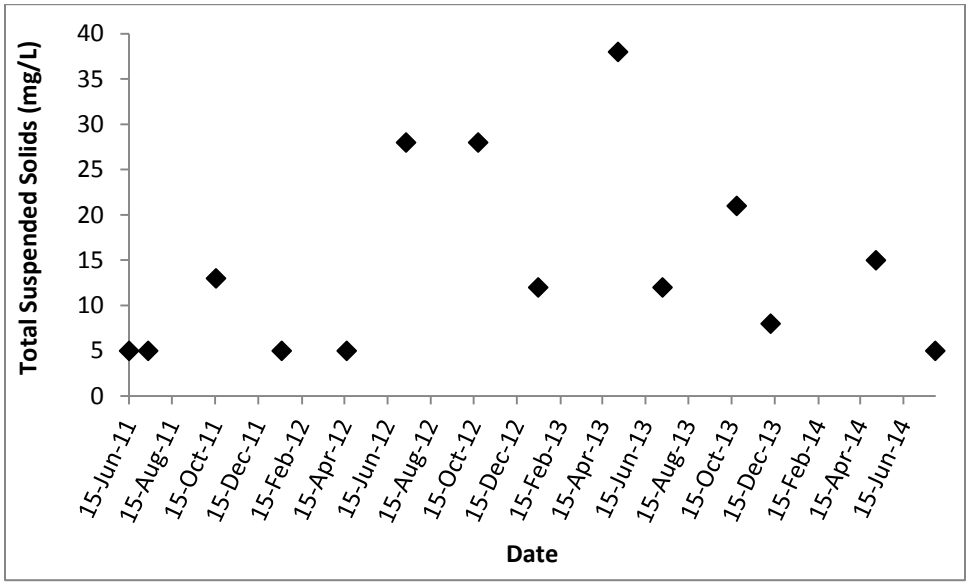

Figure 6: Mean annual total suspended solids concentrations (mg/L) from the long term water quality monitoring station in the Southwest Interlake watershed; Swan Creek Drain near Lundar, between 2011 and July 2014.

Pesticides

Pesticide concentrations for the Swan Creek Drain near Lundar were always below the level of detection, and therefore did not exceed water quality objectives between 2011 and July 2014.

Discussion

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% to Lake Winnipeg and nitrogen loading has increased by about 13%. A similar phenomenon has also occurred in many other Manitoba streams, rivers, and lakes.

Manitobans, including those in the Southwest Interlake watershed, 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 Southwest Interlake watershed. The Lake Winnipeg Stewardship Board's 2006 report "Reducing Nutrient Loading to Lake Winnipeg and its watershed: Our Collective Responsibility and Commitment to Action" (LWSB 2006) provides 135 recommendations on actions needed to reduce nutrient loading to the Lake Winnipeg watershed. However, reducing nutrients loading to the Lake Winnipeg watershed, including the Southwest Interlake watershed, is a challenge that will require the participation and co-operation of all levels of government and all watershed residents. Ensuring good water quality in the Southwest Interlake watershed and downstream is a collective responsibility among all living in the watershed.

Water Quality Management Zones

In June 2005 *The Water Protection Act* received royal ascension. This Act is intended to enable regulations to be developed for strengthening adherence to water quality standards, for protecting water, aquatic ecosystems or drinking water sources, and to provide a framework for integrated watershed management planning. The first regulation under *The Water Protection Act* — the *Nutrient Management Regulation (see:* www.gov.mb.ca/waterstewardship/wqmz/index.html) —defines five Water Quality Management Zones for Nutrients to protect water from excess nutrients that may arise from the over-application of fertilizer, manure, and municipal waste sludge on land beyond the amounts reasonably required for crops and other plants during the growing season.

As of January 1, 2009, substances containing nitrogen or phosphorus cannot be applied to areas within the Nutrient Buffer Zone or land within Nutrient Management Zone N4 (Canada Land Inventory Soil Capability Classification for Agriculture Class 6 and 7, and unimproved organic soils). The width of the Nutrient Buffer Zone varies depending upon the nature of the body of water and is generally consistent with those contained in the Livestock Manure and Mortalities Management Regulation (42/98).

The *Nutrient Management Regulation* (MR 62/2008) prohibits the construction, modification, or expansion of manure storage facilities, confined livestock areas, sewage treatment facilities, and wastewater lagoons on land in the Nutrient Management Zone N4 or land in the Nutrient Buffer Zone. Further, the construction, installation, or replacement of an on-site

wastewater management system (other than a composting toilet system or holding tank) within Nutrient Management Zone N4 or land in the Nutrient Buffer Zone is prohibited (Part 4: Section 14(1): f).

It is recommended that measures are taken to prevent the watering of livestock in any watercourses to prevent bank erosion, siltation, and to protect water quality by preventing nutrients from entering surface water.

No development should occur within the 99 foot Crown Reserve from the edge of any surface water within the rural municipalities. Permanent vegetation should be encouraged on lands within the 99 foot crown reserve to prevent erosion, siltation, and reduce the amount of nutrients entering surface water.

The Nutrient Management Regulation under *The Water Protection Act*, prohibits the application of a fertilizer containing more than 1% phosphorus by weight, expressed as P_2O_5, to turf within Nutrient Management Zone N5 (built-up area such as towns, subdivisions, cottage developments, etc.) except during the year in which the turf is first established and the following year. In residential and commercial applications, a phosphorus containing fertilizer may be used if soil test phosphorus (using the Olsen-P test method) is less than 18 ppm.

The Nutrient Management Regulation (MR 62/2008) under *The Water Protection Act*, requires Nutrient Buffer Zones (set-back distances from the water's edge) be applied to all rivers, streams, creeks, wetlands, ditches, and groundwater features located across Manitoba including within urban and rural residential areas and within agricultural regions (Table A1 in Appendix 1).

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.

Surface Drainage

- 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.

Tile Drainage

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

Manitoba Conservation and 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.

Conclusions and Recommendations:

1. Total phosphorus and nitrogen show elevated concentrations during the late autumn/ early winter. Therefore, management decisions should focus on reducing nutrient loading to the Swan Creek Drain primarily in the autumn. Management decisions should also strive to reduce nutrient loading to the Swan Creek Drain as well as other surface water sources all year, to ensure the overall reduction of phosphorus and nitrogen to the Southwest Interlake watershed and Lake Manitoba.

2. Although *E. coli* densities were always below the irrigation and recreation objectives, management decisions should ensure cattle are excluded from having direct access to water bodies. This will continue to minimize bacterial contamination and nutrient loading to surface waters in the Southwest Interlake watershed and Lake Manitoba.

3. Total dissolved solid and total suspended solid concentrations tend to be elevated during the spring and autumn in the Swan Creek Drain near Lundar. Therefore, future programming should target best management practices aimed at reducing soil erosion, stream bank erosion, and reducing spring runoff via retention ponds and incorporation of wetlands on the landscape.

4. Overall, strategies need to be implemented to protect and enhance the water quality and habitat in the Southwest Interlake watershed. Best Management Practices should be adopted to reduce nutrient loading to the watershed, and ultimately Lake Manitoba. Consistent with the interim water quality targets set out in the Lake Winnipeg Action Plan, the Southwest Interlake watershed could consider setting a nutrient reduction goal of 10%.

5. Many steps can be taken to protect the Southwest Interlake watershed and its downstream environment. These include:

- Maintain a natural, riparian buffer along waterways. Natural vegetation slows erosion and helps reduce the amount of nitrogen and phosphorus entering lakes, rivers and streams.
- Where feasible, “naturalize” drainage systems to reduce streambed and stream bank erosion, and allowing opportunities for nutrients to be assimilated and settled out of the stream.
- 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.
- Reduce or eliminate the use of phosphorus-based fertilizers on lawns, gardens, and at the cottage.
- Choose low phosphorus or phosphorus-free cleaning products.
- Prevent soil from eroding off urban and rural properties and reaching storm drains or municipal ditches.
- Ensure that septic systems are operating properly and are serviced on a regular basis. It is important that septic systems are pumped out regularly and that disposal fields are checked on a regular basis to ensure that they are not leaking or showing signs of saturation.
- Evaluate options for potential reduction of nutrients from municipal wastewater treatment systems. Consider options such as effluent irrigation, trickle discharge, constructed wetland treatment, or chemical treatment to reduce nutrient load to the watershed.
- Review the recommendations in the Lake Winnipeg Stewardship Board 2006 report “Reducing Nutrient Loading to Lake Winnipeg and its Watershed: Our Collective Responsibility and Commitment to Action” with the intent of implementing those that are relevant to the Southwest Interlake watershed.

Contact Information

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

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Appendix 1:

Table A1. The Nutrient Buffer Zone widths as outlined in the Nutrient Management Regulation (MR 62/2008) under *The Water Protection Act*.

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

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

A healthy riparian zone is critical to river ecosystem health providing shade, organic inputs, filtering of nutrients and habitat creation (falling trees). Preserving space along rivers gives the river freedom to naturally meander across the landscape and buffers the community from flooding impacts. Reference to the Nutrient Buffer Zone and its significance can be coupled with **Section 3.1.8 – Environmental Policies** which identifies the goals of enhancing surface water and riverbank stability, and the importance of respecting setbacks.