# Water and Health in Lake of the Woods and Rainy River Basins

For
Health Professionals Task Force
International Joint Commission

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FINAL REPORT

# Water and Health in Lake of the Woods and Rainy River Basin

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# 1 Background

## *1.1 Report Scope and Objective*

This report provides a broad look at the boundary waters of Rainy River and Lake of the Woods basins, identifying water quality issues and demonstrating how watershed management and health management issues are interrelated. It provides background information on existing and emerging water issues which have an associated human health component and provides information on agencies in both the United States and Canada which are involved in or responsible for legislation, collection and analysis of information related to health and water issues, and implementation of water quality and quantity protection measures in the region.

The report takes a watershed approach to identifying water and health related issues in boundary waters. It first provides some basic geographical information on the Rainy River and Lake of the Woods areas. The second section outlines some key water quality and quantity issues, provides a brief overview of each, identifies how each relates to health and then provides available local examples and other information. In the third section some observed information gaps are listed with suggestions for next steps in addressing these gaps as well as suggesting other initiatives. The following section presents background information on key government agencies which deal with water and health issues in some fashion, with information on available data bases. The final appendix provides specific contact information for the multitude of players in the field on both sides of the border.

## *1.2 Geographical Description*

### 1.2.1 General Physical Characteristics

The Rainy River and Lake of the Woods basins cover an area of 69,750 square kilometres (26,931 square miles) and are made up of four watersheds, the Upper, Central, and Lower Rainy River and Lake of the Woods (DeSellas et. al 2009). The Rainy River is 130 km long (DeSellas et. al 2009) and flows from east to west, initially flowing through Canadian Shield with the lower watershed comprised of old glacial Lake Agassiz clay. Rainy Lake is a remnant lake from the glacial lake as is a portion of Lake of the Woods which covers an area of 3,850 square kilometres (DeSellas et. al 2009).

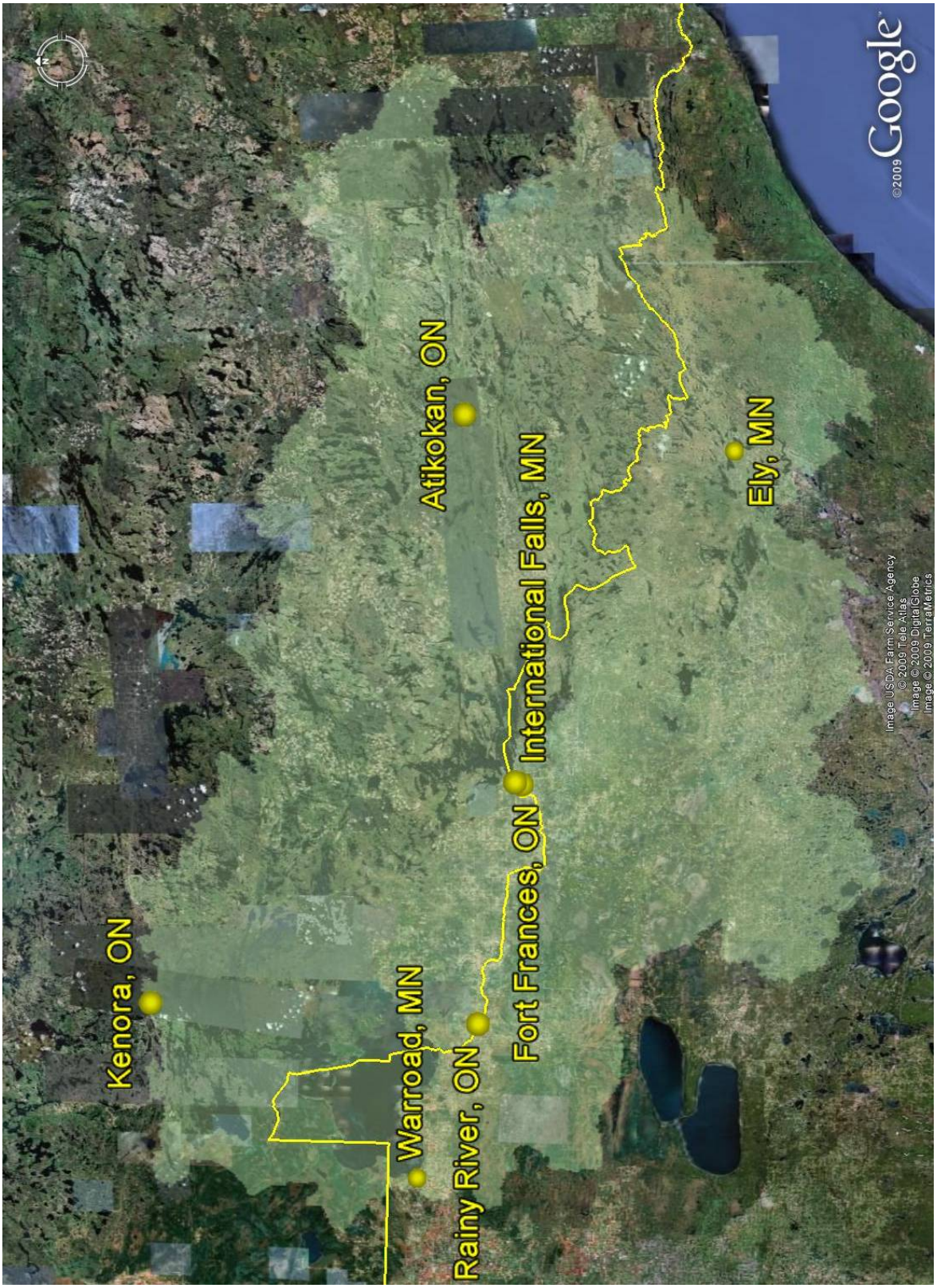
Lake of the Woods has a variety of geographical characteristics. Canadian Shield is to the north with associated shallow soils and deep waters, and flat clay plains are to the south with shallower waters and large areas of wetland. The Rainy River flows into Lake of the Woods, which then feeds the Winnipeg River at Kenora. A number of dams in the Rainy River basin influences water quantity and therefore potentially water quality, altering water levels and flow rates in different sections of the river and lakes according to management protocols. Collectively these features affect the Rainy River's flow, the presence and concentrations of naturally occurring substances in both surface waters and groundwater, and how the river responds to natural and anthropogenic occurrences related to water quality and quantity.

The basin's physical characteristics also play a large role in influencing historical and current land and water use which have an impact on water quality. Historically mining, logging, and associated settlements and farms have occurred along the river. Shortly after related industry such as pulp and paper and gold reduction were introduced. Currently recreation and tourism is the focus and this area is well known for fishing, boating and other water related tourism activities. Minnesota's Voyageurs National Park covers a large area of the Rainy Lake area with Superior National Forest east of International Falls. Ontario's Quetico Provincial Park covers a large part of the eastern basin on the Canadian side.

### 1.2.2 Political Features Description

The international boundary between the United States and Canada runs through the Rainy River, Rainy Lake, and Lake of the Woods. Fifty-nine percent of the basin falls in Canada, in the provinces of Ontario and Manitoba, and forty-one percent in Minnesota, U.S.A. (MPCA 2001). The Rainy River Basin is made up of numerous small cities, towns and villages located sporadically on both sides of the river, interspersed with forested parks and farms. There are a number of First Nations communities in the area. The largest riverside cities are International Falls in Minnesota (pop. approximately 6,700) and across the river Fort Frances in Ontario (pop. approximately 8,000). There are a number of First Nations/Tribal communities located in the basins.

In the Lake of the Woods region, Kenora Ontario is a small city of approximately 15,000 residents located on the lake, and the lakeside city of Warroad in Minnesota had a population in 2000 of 1,722.




**Figures 1.** Map of Rainy and Lake of the Woods Basins

# 2 Water Management and Human Health

Water management is typically broken down into two components, water quality and quantity, which may imply separate solutions are needed when addressing associated water issues. In reality the two are interrelated as quality is affected by quantity and both must be taken into account when solutions are developed. For example, reduced flow rates and water volumes in receiving waters results in increased concentrations of contaminants when effluents are released. Conversely flooding and heavy precipitation events can cause a number of contaminants to enter waterways due to overland flow picking up contaminants on adjacent lands or overflow of wastewater systems. Many of these contaminants may have adverse affects, either directly or indirectly, on human health as well as affecting ecosystem health.

The movement towards source water protection and water protection on a watershed scale recognizes that quality and quantity are interrelated and that it is crucial to prevent harmful contaminants, both bacterial and chemical, from entering either groundwater or surface water systems to the greatest extent possible. It further recognizes the relationship between human and ecosystem health as human consumption of drinking water and fish, as well as contact and incidental water consumption related to recreational uses are directly related to ecosystem health.

Contaminants types which may be present in water include microorganisms, parasitic worms (e.g. schistosomiasis), nutrients, heavy metals, and endocrine-disrupting substances. Some may be naturally occurring such as schistosomiasis which affect people through external exposure as in the case of swimmer's itch (cercarial dermatitis) or microrganisms that can be accidently ingested while swimming in contaminated water. Though naturally occurring, the concentrations of these microorganisms and the distribution of schistosomiasis can be modified as a result of human activity.

From a health perspective, as the number and range of potential anthropogenic substances increase with the potential to cause adverse health effects it becomes imperative to adequately control what enters our waterways and groundwater systems as monitoring and removal of these substances for safe use, once in the natural system, is often extremely difficult and costly.

Environment Canada's National Water Research Institute has identified 15 threats related to source water and aquatic ecosystem health. Thirteen of these threats were initially identified in 2001, with two added after initial meetings (points 8 and 9 below).

- Waterborne pathogens
- Industrial wastewater discharges
- Municipal wastewater effluents
- Algal toxins and taste and odour
- Pesticides
- Persistent Organic Pollutants and Mercury
- Urban runoff
- Agricultural and Forestry Land Use Impacts
- Natural sources of trace element contaminants
- Impacts of dams/diversions and climate change
- Nutrients

- Acidification
- Endocrine disrupting substances
- Genetically modified organisms
- Solid waste management practices (Environment Canada NWRI 2001)

As noted, water-related human health threats are closely related to source water health and this list serves as a basis for the discussion that follows. Additionally, we have chosen to add the some issues which have environmental health relevance, and modify or exclude others due to their lack of relevance in the basins. Hence, in this report, we will focus on the following issues:

- Industrial wastewater discharges
- Municipal wastewater effluents
- Bacterial Contaminants
- Algal toxins
- Pesticides
- Urban runoff and stormwater
- Water quantity due to climate change
- Water quantity changes due to diversion (water management)
- Water quantity and extreme events
- Nutrients
- EDS, pharmacueticals, and personal care products
- Acidification
- Endocrine disrupting substances
- Drinking water treatment and distribution systems
- Airborne originating contaminants
- Green energy initiatives and water

In each section a general description of the issue is provided, followed by potentially adverse health impacts and local examples of occurrences in the Basin have been provided wherever possible.

The following table (Table 1) provides a summary of the modified list of threats and identifies connections to three categories of human health concerns related to water; drinking water, local fish consumption, and beach management (recreational water use). It can be argued that all threats are related to all categories, however the table illustrates what may be considered to be primary concerns for each issue.

| Issue | Drinking Water | Fish Consumption | Beach Management |
|---|---|---|---|
| Industrial wastewater discharges | | | |
| pulp and paper effluent | ● | ● | |
| mining effluent | ● | ● | |
| Municipal and small community wastewater effluents | ● | ● | ● |
| Bacterial Contaminants | ● | ● | ● |
| Algal Toxins | ● | ● | ● |
| Pesticides | ● | ● | |
| Urban runoff and stormwater | ● | ● | ● |
| Climate change and water | ● | | ● |
| Water quantity and water management | ● | | ● |
| Water quantity and extreme events | ● | | ● |
| Nutrients | ● | | ● |
| EDS, pharmacueticals, and personal care products | ● | ● | |
| Acidification | ● | ● | |
| Drinking water treatment and distribution systems | ● | | |
| Airborne originating contaminants | | ● | |
| Green energy initiatives | | ● | |

**Table 1.** Human Health Linkages to Source Water Issues.

## *2.1 Wastewater Effluents Sources and Type*

Wastewater may come from a number of sources and can contain hundreds of chemical and biological substances. Treatment is specific to the type of wastewater and it is recognized that even in compliant discharges only a fraction of compounds are removed prior to release into receiving waters.

### 2.1.1 Industrial Waste Discharges

#### 2.1.1.1 Pulp and Paper

Timber harvesting and processing has historically been a key industry in the Rainy River and Lake of the Woods basins and it continues to have a presence on both sides of the border (LOTW Museum 2006).

Pulp and paper effluents have traditionally included a number of substances including dioxins, furans, and other organochlorines. Some of these chlorinated compounds have been found to be persistent and toxic when they are released into receiving waters (EC 2004). Industry has had much success in addressing this issue through an 'toxic elimination strategy' (AET 1995).

Potential health effects from the by-products of dioxins include skin disorders, liver and immune systems problems, endocrine system and reproductive issues, as well as increasing risks of developing certain types of cancer (HC 2006). Bioaccumulation of these contaminants over time in humans occurs primarily through the consumption of contaminated fish.

In Canada, regulatory limits applicable to pulp and paper effluents were initially set in the 1990's and updated in 2004 with regards to dioxins, furans, Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) (Government of Canada 2008). Mills are required to carry out testing and submit results to Environment Canada under the Environmental Effects Monitoring program (EEM) a long term site specific monitoring program designed to measure the long term effectiveness of regulatory limits. EEM is in place for both the mining and the pulp and paper industries and also includes studies of lethal and sub-lethal effluent effects on fish and benthic communities.

Daily and quarterly effluent monitoring is done in Ontario at the Abitibi-Consolidated Fort Frances mill. Testing is for BOD and TSS (MOE 2007). In 2003 two spills were reported, exceeding allowable levels (IJC 2004). In 2004 there were no spills but two exceedences of toluene reported (IJC 2005). In 2005, 2006 and 2007 there were no spills and daily loads were below compliance levels (IJC 2006, 2007, 2008). One exceedence for toluene was reported in 2007 (IJC 2008).

Toxicological testing of effluents at the Fort Frances mill under EEM includes 40 benthic invertebrate samples along an effluent gradient as an indication of source water health as well as biannual fish, plant and invertebrate testing, done by the company with data being submitted to Environment Canada.

The Environmental Protection Agency (EPA) sets regulatory guidelines for pulp and paper effluent discharges in the U.S. Boise Paper Solutions in International Falls had no violations in 2003 through 2007 (IJC 2004 - 2008). Effluent was tested for BOD, TSS, dioxins and furans (IJC 2004), and Absorbable Organically Bound Halogens, (AOX) which includes chlorine. Effluent was tested for a number of other substances except for the years from 2001-2004 (IJC 2007).

Though there have been a few recorded spills and exceedences at the Abitibi-consolidated facility since 2003, fewer have been reported in more recent years.

### 2.1.1.2 Mining Effluent

Metal mining has had a presence in the Rainy River and Lake of the Woods basins since the 1800's with iron and gold being the main focus (Hinz 2002). There is always the potential for heavy metals in water and sediment located near mines, especially at older sites which may not have been managed to current standards. Some mining by-products such as arsenic may be found in effluents or entering waterways through tailings ponds leaching and these may pose a human health risk if found in great enough concentrations.

Historically there were a number of gold mines in the Lake of the Woods basin. The Lake of the Woods Gold and Silver Reduction Company, which processed metal from the mines was once located at the current site of Kenora's McLeod Park. In Ontario

preliminary gold exploration is currently occurring in Richardson Township northwest of Emo and at a number of sites in the Kenora district.

Minnesota's Mesabi Iron Range in the north-eastern part of the state was once a major source of Iron Ore. A rudimentary internet search did not identify any current mining in Minnesota with discharges within the Rainy River or Lake of the Woods basins. Minntac (US Steel) decided to divert effluent releases into Lake Superior instead of releasing into tributaries in the upper Rainy basin. There will still be some discharge from the tailings basin (IJC 2006) which will have Total Dissolved Solids (TDS) concentrations. There was also local concern raised about a sulphide mining proposal near Ely which could potentially have an impact on basin waters (IRLCB 2008).

Regulation of a number of substances found in mining effluent falls under the Environment Canada "Metal Mining Effluent Regulations" (EC 2006). In Canada, effluent and receiving waters are also tested for sub-lethal fish toxicity on a regular basis. Monitoring programs are done by the company under EEM and submitted to Environment Canada.

In the United States mining effluent is regulated federally by the Environmental Protection Act and uses a measure referred to as Whole Effluent Toxicity (WET) to determine the overall effect of an effluent on a number of organisms.

### 2.1.2 Municipal Wastewater Treatment

Municipal wastewater is a mixture of everything from chemicals to pharmaceutical products to human waste and therefore potentially has a wide range of chemical, viral and bacterial contaminants before treatment. Contaminants may include cyanide, sulfides, phenols, and heavy metals. Effluent toxicity may be caused by un-ionized ammonia or total residual chlorine (EC NWRI 2006). Newer systems include storm water in treatment systems prior to release; older systems may not have the capacity to treat stormwater.

Initially Municipal Water Treatment Plants (MWTPs) were designed to kill waterborne disease organisms, remove solids and oxygen-demanding material and in some cases nitrogen or phosphorus (Servos et. al 2008). Further treatment to remove other bacterial contaminants before release is now done but some chemical contaminants will remain. In some instances the treated sludge from MWTPs may be used on farm fields and, in this way, substances from this sludge may enter the water system as non-point-source pollution. Point source discharges such as wastewater outfalls provide an opportunity to closely monitor effluent and downstream receiving waters to determine site specific dilution rates and dispersion characteristics.

Untreated wastewater potentially contains bacteria and pathogens which are a health concern and at some facilities may be released during rainstorm events due to treatment plant overflow or combined sewer overflow (CSO). Certain strains of E. coli from wastewater can be of particular concern as they can affect safe use of recreational water downstream of discharge sites.

In the U.S. Minnesota sets rules on effluent levels to meet EPA regulations and in Canada the Ontario Ministry of the Environment regulates effluents through the Environmental Protection Act (MOE 2007).

A variety of municipal wastewater systems exist in the Rainy River basin. For example Fort Frances upgraded to a secondary treatment system in 1998 with phosphorus removal. Barwick and the Town of Rainy River both have what are referred to as lagoon systems (secondary treatment systems). Baudette's pond system is released seasonally as is Emo's lagoon system (IJC 2004).

In 2004 there was one bypass event at the Fort Frances facility (IJC 2005), and again in 2005 there was a bypass event at the Fort Frances facility due to heavy precipitation (IJC 2006). In 2007 there was a single discharge event reported at the Fort Frances treatment facility (IJC 2008), none were reported at other municipal sites. Locally there have been recent concerns expressed regarding bypass events in the basins (FFT 2009).

IJC IRRWPB/IRLBC reports (IJC 2004, IJC 2008) note that Rainy River municipal wastewater treatment BODs are likely to remain fairly constant until plants are further upgraded to be able to further remove contaminants.

### 2.1.3 Small Community Wastewater Treatment and Private Septic Systems

There are a number of First Nations/Tribal communities in the Lake of the Woods and Rainy River basins. Protocols have been developed which address wastewater and drinking water standards for people of First Nations in Canada by the federal Department of Indian and Northern Affairs and in doing so they have recognized the importance of source water protection and the need for cooperation with all affected water users (INAC 2009).

At the Rainy River First Nations Manitou Rapids facility in 2003, the sewage lagoon effluents levels exceeded federal guidelines (IJC 2004). In 2004 samples collected prior to discharge in May and September indicated the TSS were above federal guidelines (IJC 2005). In 2005 there were phosphorus exceedences but there were no exceedences in 2006. In 2007 there were various exceedences when monitoring was carried out by Health Canada (IJC 2008).

Information on any other small systems which may be operating in boundary waters was not readily available.

There are a number of septic systems in rural and cottage communities which may contribute nutrients and other wastewater products to surface waters in Rainy Lake, Rainy River and Lake of the Woods. General nutrient modelling of the Rainy River Basin indicates that almost 90% of phosphorus in the system annually comes from atmospheric deposition, non-agricultural rural runoff and stream bank erosion (DeSellas et. al 2009). Though this number is not broken out it is a clear indication that septic systems are likely a significant contributing factor to elevated phosphorus levels in the waterways. Excessive nutrient levels promote algae blooms which in turn may produce toxins which can impact human health (see Algal Toxins and Nutrients).

Overall, wastewater discharges in the Rainy River usually do not exceed limits but there appear to be one or two bypass events annually at the Fort Frances wastewater facility and some exceedences of effluent concentrations at the Manitou Rapids wastewater facility on a somewhat regular basis.

## *2.2 Bacterial Contaminants*

There are a number of naturally occurring bacteria and other microorganisms in surface rivers and lakes and in certain circumstances in groundwater which may adversely affect human health including some Escherichia coli (E. coli), cryptosporidium, and Giardia. E. coli is possibly the best known and is monitored at beaches and in drinking water due to its potentially adverse health effects when ingested. Presence of E. coli is used as an indicator of fecal pollution in fresh waters.

Sources of E. coli include feces from warm-blooded organisms such as humans, pets, livestock, and wildlife. E. coli may enter surface waters due to runoff and can be found in improperly treated wastewater effluent.

Maximum levels of E. coli at public beaches are regulated in both Canada and the U.S. with beaches being closed if levels are exceeded. Canadian beaches on Rainy River, Rainy Lake, and Lake of the Woods are tested by the Ontario Ministry of Health (i.e. Northwestern Health Unit) on a weekly basis for E. coli. Municipal beaches in the area experience closures over the summer due primarily to urban runoff and municipal sewer overflow associated with rain events though a few may be due to waterfowl gatherings or have no obvious cause (Dale Wiebe P.Eng.,Environmental Engineer, Northwestern Health Unit pers. comm. March 2009). Overall trends do not indicate a general increase in beach closures (Dale Wiebe and Bill Limerick, Environmental Health Manager, Northwestern Health Unit per. comm.).

In the state of Minnesota beach monitoring has historically been carried out for fecal coliform at two beaches in Sand Bay on Rainy Lake. Monitoring was discontinued for 2009 at these beaches and there is no inland monitoring at this time (Nolan Baratono, Water and Basin Planning Coordinator, MPCA pers. comm. March 2009). Records dating back to 2003 indicate that neither Rainy or City Beach have needed to be closed due to high fecal coliform numbers. There is little indication of any trend except that July and August test results may at times have been slightly higher than June results. When above normal counts have occurred follow up testing has shown that numbers drop significantly in a very short period. For example, on August 2$^{nd}$, 2004 tests showed a 300 count and on August 3$^{rd}$ counts were 4 when retested. (Susan Congrave, Director, Koochiching County Health Department pers. comm. April 2009).

## *2.3 Algal Toxins*

Algae are naturally occurring organisms found in lakes and rivers and prefer warm, slow moving shallow areas, areas which may also be considered as ideal for recreational use. Blue-green algae is a cyanobacteria which may experience large population increases, often referred to as an algae bloom, during warm summer months when nutrients such as phosphorus and nitrogen are more readily available. Some blue-green algae may release toxins, commonly microcystins. These may enter the water when the algae are exposed to chlorine or as the algae dies. Microcystins are difficult to remove from water putting the emphasis on prevention of

growth conditions for the algae, especially in the vicinity of drinking water intake systems or recreational water use areas such as beaches. Pre-filtering at intakes at water treatment plants can provide effective removal. The concentration of microcystin-LR allowed in drinking water is defined under the Ontario Drinking Water Quality Standard as 0.0015 mg/L. (MOE 2005).

Flu like symptoms (nausea, headaches, fever, etc.) may occur if microcystins are ingested with more severe health outcomes possible if large amounts are ingested.

Algal blooms in Lake of the Woods were first noted over 200 years ago by explorers and settlers. Since continuous monitoring has not occurred for a long enough period of time, trend analysis is not available but observations are that the presence of algae in Lake of the Woods is increasing (DeSellas et. al 2009).

Blue-green algae blooms occur locally in Lake of the Woods in late summer and early fall and are monitored by the Ontario Ministry of the Environment and Environment Canada. Annual bloom severity is dependent on temperature and precipitation (Dale Wiebe pers. comm.). In Lake of the Woods microcystin-LR is "one of the most common toxins…based on spot surveys" (DeSellas et. al 2009). Water samples from beaches and off-shore areas in 2006 indicate that microcystin concentrations vary widely. Using World Health Organization (WHO) risk categories, 60% of Lake of the Woods beaches fell under the Low Risk category of concentrations of less than 0.010 mg/L, 6% fell in the moderation risk category of 0.010-0.020 mg/L, 8% had concentrations of more than 0.020 mg/L, and 26% had concentrations greater than 0.050 mg/L (DeSellas et. al. 2009). Though the report does not define the higher concentrations as high risk, WHO indicates that concentrations higher than 0.020 mg/L should trigger action and indicates that contact with algal scum should be avoided (WHO 2003).

Some limited algal blooms have recently been observed on Rainy Lake (Nolan Baratono, pers. comm.).

## *2.4 Pesticides*

The term pesticide includes insecticides, fungicides, herbicides, nematocides, and rodenticides (FAO 1996). Human health may be affected by pesticides through ingestion of pesticide-contaminated water as well as through direct contact or through inhalation.

Five and one half percent of land in the Lake of the Woods and Rainy River Basin was identified as agricultural in 2000 with the majority of it in the Lower Rainy River and Lake of the Woods (DeSellas et. al 2009). There is the possibility that pesticides may be present in water due to agricultural and urban runoff, making it necessary to determine which are most likely to be present locally if monitoring programs are to be initiated. In the Rainy River and Lake of the Woods census areas, typical types of agricultural products locally include livestock (beef and pigs) and feedcrops (hay, alfalfa, oats) (Statistics Canada 2006).

Pesticides may be persistent or may break down readily over a short period of time when exposed to water or air so data on specific local practices must be collected to determine types of chemicals present and potential adverse effects on human health. Some pesticides such as atrazine have more recently been identified as endocrine

disrupting substances (Env. Can. 2002 EDS) and may have sub-lethal effects on fish and wildlife (see Endocrine Disrupting Substances).

Canadian responsibilities for pesticide regulation and management are shared by a number of federal, provincial and municipal agencies. Federal responsibilities include human health and safety. In the province of Ontario there are regulations and permitting requirements which require training and reporting for handling of pesticides which are highly toxic, persistent or highly mobile (OMAFRA 2005).

Similarly in the state of Minnesota a regulatory system is in place under the U.S. Environmental Protection Agency with enforcement carried out by state authorities. Minnesota Department of Agriculture has a hazardous spill and applicator incident reporting system in place.

Pesticides have not been identified as a major contaminant of concern in the area. The Ontario Cosmetic Pesticide Ban which came into effect on April 22, 2009 will remove over two hundred fifty products from general use though there will be a number of exceptions including agricultural use. This should significantly reduce the amount of pesticides found in urban runoff. There may be localized issues adjacent to and downstream of agricultural and forest management areas where pesticides are applied.

## *2.5 Urban Runoff and Stormwater*

In general, urban runoff is from a wide number of sources, often but not always adjacent to rivers, lakes, and streams. Typically during rainfall and snowmelt, water flows across the land picking up contaminants before entering waterways. As well as chemical contaminants such as nutrients being flushed into natural water systems from residential and institutional lawns and golf courses, E. coli and other bacterial contaminants may enter waterways in this fashion. Pet and wildlife (aquatic birds) feces are a major source of E. coli contamination and often occur on beaches and parks adjacent to waterways as well as waterfront private residences. Residential septic systems may also contribute to nutrient and bacterial loading in waterways, primarily if placed close to surface water especially in flood prone areas.

Road salt, gasoline, and a number of other contaminants may enter waterways through older sewer systems where water may not be treated or directly through runoff during rainfall, flooding, and spring snowmelt. Urban runoff can also include contaminants from recreational facilities such as marinas and golf courses.

The challenge in addressing contamination from urban runoff is that it is widespread and much of it is from non-point sources so entry into waterways is pervasive though individual volumes may be quite small. This type of water contamination cannot readily be monitored except by general monitoring downstream of an urban area. Since much of it originates on privately owned lands, public outreach and cooperation is vital to adequately address the sources.

Though this region does not have any large cities located on boundary waterways, locally urban runoff is generated from all of the towns and villages which are adjacent to the lakes and river. This runoff affects local urban beach water quality and in 2003, 2005 and 2007, all summers which had significant periods of precipitation, most municipal beaches experienced some related closures. Modelling

has been developed to identify public beach areas in Canadian waters which are susceptible to E. coli levels rising due to runoff (Dale Wiebe pers. comm.) so that beaches may be proactively closed if excessive E. coli levels are suspected due to runoff. Work is also being carried out in Ontario to address identified urban point source issues related to storm events (Dale Wiebe pers. comm.).

## *2.6 Climate Change & Water*

Climate change will have both direct and indirect adverse effects on human health. Direct effects include increasing air temperature and falls outside the scope of this report. Climate change indirect effects include water quality degradation from increased bacterial and algal growth which may restrict recreational use of water and can affect the quality of drinking water. It also serves to augment some existing water quality issues due to changes in precipitation and temperature patterns which will affect water quantity. For example, shorter ice cover periods on lakes and rivers with earlier ice-off dates may contribute to increases in algae blooms as water temperatures rise earlier in spring. Another perhaps more indirect example is flooding. An extreme increase in water quantity causing flooding is an obvious safety risk but will also have some less obvious implications as contaminants in flooded areas enter waterways with the potential to affect water quality for aquatic communities, recreational use, and drinking water systems. Early spring flooding may occur more frequently as rising temperatures cause early rainfalls to combine with quick snowmelt conditions.

Decreases in water quantity will also affect quality as contaminants become more concentrated and can affect water temperature especially in shallow, low flow areas. Periods of reduced summer precipitation coupled with increased evaporation rates due to higher temperatures will reduce streamflow and water volume in lakes and rivers. Effluent discharges from municipalities and industry, if added at current volumes to a reduced volume of water will result in increased concentrations with the potential to affect downstream water quality, in turn impacting recreational use through beach closures and fish community health.

Annual temperatures are forecast to rise in the Rainy River and Lake of the Woods basins by approximately one to two degrees Celsius above annual temperatures for the period 1975-1995 in the period 2011-2040 (MNR 2007) under an A2 scenario which forecasts increases in greenhouse gases. Precipitation forecasts indicate a slight increase (0 to 10%) in summer precipitation and a slight decrease in winter precipitation (0 to -10%). These numbers do not tell the whole story. As air temperatures increase during the warm season, the corresponding water temperature increases will promote bacterial and algae growth, reducing water quality. Increased winter temperatures mean potentially more ice-free and frost free days which may provide more favourable conditions for the northward spread of disease and infections such as lyme disease. (Abelsohn, et. al 2008).

Distribution of seasonal precipitation may change, with an increase in the number of summer dry periods interspersed with more heavy rainfalls and storms than are currently experienced. Heavy summer storm events can flush a number of bacterial and chemical contaminants from adjacent land (see Urban Runoff) as well as disturb contaminants which may have collected in sediment on the river and lake bottoms.

Climate change affects health through affecting other, seemingly unrelated water quality and quantity issues so climate change adaptation can be done through identifying sector specific effects and incorporating them into management response plans.

## 2.7 Water Quantity and Water Management

Water quantity in a naturally flowing river system changes seasonally due to changes in precipitation and temperature. Flows can be and are modified beyond seasonal fluctuations for a number of reasons through water management, holding back water at times and increasing water flows beyond run-of-the-river flows at other times. Water control dams may be in place for a number of reasons, most often to reduce flood risk or for power generation. Some may have historical significance related to timber movement.

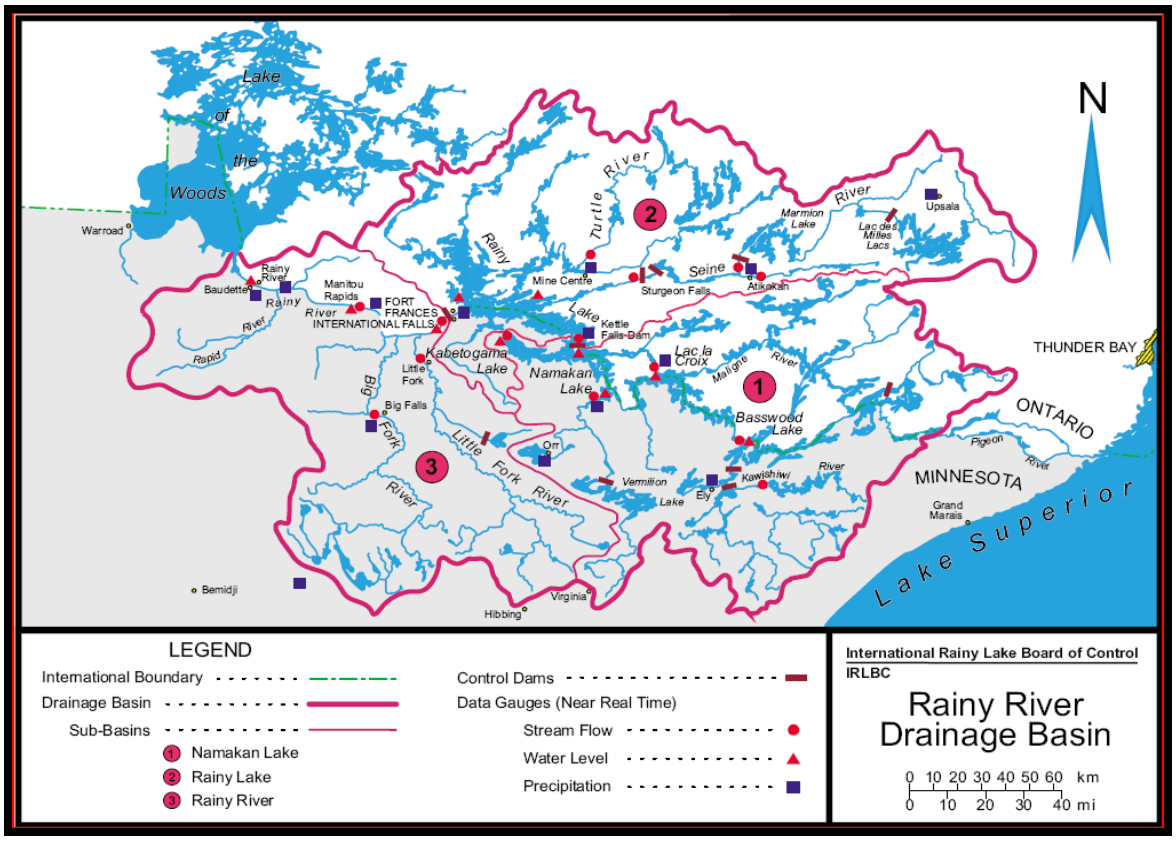



**Figure 2**. Location of control dams and data gauges in the Rainy River Drainage Basin. (Source: IRRWPB/IRLBC).

Management of water levels in a waterway can affect key characteristics of the watershed through systematically increasing and decreasing quantities of water in particular sections of the system. Changes in water levels and flows may affect water quality which can have direct or indirect adverse impacts on human health. An example of this would be in decreasing water levels in low flow beach areas. Summer water temperatures in such areas would increase and could provide

favourable conditions for increased bacterial growth. Changes in water temperature can also be a stressor for fish which increases vulnerability to disease.

There are a number of control dams in the Rainy River basin and Lake of the Woods (Figure 2). Water levels are managed by international control boards for Lake of the Woods and Rainy Lake as well as the Canadian Lake of the Woods Control Board. Operations at the Rainy River dams at International Falls and Fort Frances have previously included 'ponding' and 'peaking', together referred to as peaking. Water levels may fluctuate in a 24 hour period, in their approach to managing flows in relation to their fluctuating energy demands.

According to the spring 2005 IRLBC/IRRWPB report submitted to IJC, peaking was a contentious issue which was addressed by the Peaking Committee (IJC 2005). The committee submitted its final report in January 2005. The report identifies a number of outstanding issues and areas where further information is required to fully understand environmental impacts of this practice. In response a "Peaking Workgroup" was formed in 2006. A two year trial was agreed upon to stop the practice during spring fish spawning, with dates set from April 15$^{th}$ through June 30$^{th}$, with provision that these dates could be modified if necessary due to monitoring results. In February 2009 it was agreed that the process would continue "subject to annual review with amendments subject to consensus (IJC 2009).

## *2.8 Water Quantity and Extreme Events*

High water levels and increased water flows in spring are a normal occurrence in many watersheds, especially where heavy snowpacks may melt quickly and are augmented by spring rains, often resulting in water levels which may increase quickly over a short period of time. In areas such as the Rainy and Lake of the Woods watersheds where water control structures are in place, flooding can often be alleviated to an extent through management. In Ontario traditional flood areas are usually identified through flood plain mapping which will indicate areas which would be affected by sixty and one hundred year events which is based on historical data. These areas may have restrictive use incorporated into the land use zoning which minimizes safety risk and loss of property in these areas and which may include restriction of storage and use of some substances which could be harmful to waterways if flooding occurs.

IJC's Water Control Board reports from a number of years indicate that there are some instances when water levels rise above the operating range but reports only indicate water levels and managers' response to them and do not include specifics on impacts such as flooding. Anecdotal evidence through media reports can be found on high water events such as that which occurred in spring of 1997. Further investigation is required to determine the local impacts of high water levels due to extreme events and determine the degree of associated potential health impacts such as drinking water contamination and mold growth in flooded buildings.

Heavy rains and flooding at 'non-traditional' times such as in summer washes nutrients, pesticides and other contaminants from lawns and farm fields into waterways resulting in increased nutrient concentrations, increased E. coli levels and a number of contaminants entering the system during a time when water levels are

likely to decrease dramatically after the event. Resulting eutrophication from nutrient loading in aquatic systems then affects downstream water quality and, as with increased concentrations of effluent in the water system, will decrease beach water quality as well as having the potential to affect fish communities. Increased contaminants in the water source for water treatment for drinking water may have an effect on how water is treated and increase associated costs.

Low flows traditionally occur in late summer and summer drought events are predicted to become more prevalent over time as the climate changes. As water quantity is reduced in summer, coupled with higher temperatures, bacterial and organic problems will increase. This usually becomes evident through the predominance of swimmer's itch in swimming areas and may be the time when other waterborne diseases flourish. Recreational contact and involuntary ingestion of untreated water is likely to be where human health affects become evident as drinking water treatment systems should continue to address contaminants. Drinking water quality may also be affected in areas where effluent discharges are not reduced when the volume and/or flow of receiving waters is low as effluent concentrations will then be higher in the downstream waterway, potentially increasing levels of some contaminants not addressed in drinking water treatment.

## *2.9 Nutrients*

Phosphorus and nitrogen are common elements which are necessary for plant life. Having an overabundance of these nutrients can lead to eutrophication, a process of accelerated aging of the waterbody that includes excessive algal growth; some species of algae are harmful to human health (see Algal Toxins). Eutrophication also leads to reduced amounts of dissolved oxygen (DO) being available in the water for living organisms due to consumption of DO by large masses of decaying plants.

Nutrients originate from a variety of sources. Wastewater treatment plant effluents have been identified as nutrient sources (see Wastewater Effluents), however treatment now typically includes some level of removal of phosphorus before release. Fertilizers from farm fields and residential lawns can also contribute significant amounts of nutrients to water either through being flushed into adjacent waterways or sewer systems which are not treated prior to release, or through entering the ground water. The practice of spreading treated solid waste from treatment plants on agricultural fields means that nutrients (and other substances) which were originally diverted from release in waterways via effluent eventually enter waterways through runoff from agricultural fields. Private septic systems which are working improperly or are flooded during high water periods may also be a nutrient source.

In 2008 Minnesota identified Lake of the Woods as impaired for water quality due to "nutrient/eutrophication" (phosphorus) and "biological indicators" (algae) issues (DeSellas et. al 2009). Algae blooms occur during summer months in some parts of the watershed on an annual basis (Dale Wiebe pers. comm.). These may be due to elevated phosphorus levels in the southern portions of Lake of the Woods augmented locally by nutrients from non-point sources such as cottage septic systems in the northern regions of Lake of the Woods as well as phosphorus inputs from the Rainy River (DeSellas et. al 2009).

Environment Canada (EC) has a new program in place for monitoring nutrients and mercury in Lake of the Woods and the Rainy River. Though there is historical data

for Rainy River from the 1980s, EC has not conducted any monitoring in the river for over a decade. Water monitoring in Lake of the Woods is in its second year and similar testing in the Rainy River is being initiated in 2009 (Paul Klawunn, Water Quality Monitoring and Surveillance-Ontario, Environment Canada pers. comm. March 2009).

## *2.10 Endocrine Disrupting Substances, Pharmaceuticals and Personal Care Products*

A number of endocrine disrupting substances (EDS) may be found in municipal or industrial effluents including nonylphenol and estrone. Dioxins and furans have also been identified as potentially affecting the endocrine system (HC 2006). Others such as atrazine may enter the waterways through runoff from agricultural areas (Env. Can. 2002 EDS). Fish and wildlife reproduction and development may be affected by exposure to EDS.

In Canada, studies of a number of substances previously included studying the subtle, sub-lethal effects of EDS on organisms under Environment Canada's Toxic Substances Research Initiative (EC 2002). Environment Canada continues to conduct research into sub-lethal effects of EDS on organisms, fish, and wildlife (Melanie Nelson, Environment Canada, Manager, Water Quality Monitoring & Surveillance – Ontario, pers. comm. June 5, 2009).

In 2007 and 2008 in the U.S. the EPA developed draft policies, procedures and substance lists (EPA 2008) related to EDS.

A number of chemicals are found in wastewater which originate from pharmaceuticals and personal care products (PPCPs). This is a relatively new field of study with some indication that some pharmaceuticals and personal care products may cause environmental harm though there is little information at this point on potential adverse impacts to human health. In Canada it is recognized that a coordinated monitoring program is needed to further identify issues and determine specific compounds for study (Environment Canada 2008) and Health Canada recently announced that this will be going forward.

In the U.S., the EPA has developed a strategy to increase the understanding of PPCPs, develop monitoring programs and education programs, and determine whether and when related legislation may be required (EPA 2009).

## *2.11 Acidification*

Acidification of waterways is influenced by the geology of the watershed. In Lake of the Woods, granite occurs at the north side of the lake and peat-based soils to the south, and both are acidic. Both will reduce pH levels of the water entering the lake from surface runoff or groundwater. Beyond naturally occurring acidification, water pH levels can further be affected by fertilizers entering waterways, the presence of livestock on adjacent lands, and airborne-transported contaminants, commonly sulphur dioxide, nitrous oxide or ammonia, collectively known as 'acid rain'.

Potential health effects may occur from exposure to concentrations of some airborne contaminants which cause acidification (Netherlands EAA 2005). Acidification may

also result in increased human and fish exposure to heavy metals such as mercury and aluminum in toxic amounts which was found to be released from sediment in the Experimental Lakes area of Ontario when pH was lowered (DFO 2009).

## *2.12 Drinking Water Treatment and Distribution Systems*

Drinking water treatment addresses key bacterial and known chemical contaminants in water prior to distribution. Treated water may contain trace amounts of a number of other substances depending on the water source, and these substances may fall outside monitoring parameters as their presence in the water is either not known or they have been determined to not pose a health risk.

In the past many municipal drinking water systems have used surface water sources. In discussions the author has had with individuals involved with municipal drinking water it appears that there is an attempt to replace at least some water intakes with groundwater as surface waters have been exposed to an increasing variety of contaminants. Though some municipalities may be moving towards use of groundwater, in some areas this is not feasible due to the lack of large aquifers or due to costs associated with researching ground water sources and installation of wells. Source water protection of groundwater used as drinking water then becomes important to ensure that groundwater recharge areas and well areas are not exposed to contaminants. Sustainable use is also important to ensure aquifers are not depleted over time.

Municipal drinking water sources in the Rainy River and Lake of the Woods watersheds are from surface water, accentuating the importance locally of ensuring source water protection (in this case the lakes and river) is in place through adequately addressing water issues such as those which have been identified above.

In the U.S., the EPA sets standards through regulating drinking water quality while the MPCA and municipalities carry out water quality administration and enforcement. In Canada, Health Canada sets guidelines which are incorporated into provincial (Ontario) regulations.

Water treatment is an important component of providing safe water but it is not the complete picture. Drinking water distribution systems require protection and monitoring to ensure that contamination does not enter the system between the treatment system and access points. This can occur due to water main breaks or improper systems maintenance procedures as well as through failures in the treatment system or untreated substances entering the system. Successful water treatment then is somewhat dependent on the 'raw' water which is entering the system, locally in some instances from boundary waters.

Protocols which address drinking water treatment for systems supplying five or more private households as well as larger public systems have been developed for First Nations communities in Canada under the federal Department of Indian and Northern Affairs Canada (INAC). These protocols include the design and implementation of water monitoring programs that incorporate the multi-barrier approach to providing safe drinking water and that recognize the importance of source protection (INAC 2009). Additionally, the INAC protocols for safe drinking water include ensuring protection of drinking water distribution systems from re-infecting drinking water after treatment (INAC 2009).

## 2.13 Emerging Issues

### Airborne originating contaminants

It is recognized that a number of airborne contaminants are eventually deposited in surface waters. These contaminants may cross international boundaries from the point of origin either during transport by air currents or later when traveling by water.

The primary source of mercury found in local waterways in the Rainy River and Lake of the Woods area has been determined to be from atmospheric deposition (MPCA 2001). Mercury is monitored locally in fish and fish advisories in both the U.S. and Canada are issued partially based on these levels as well as other substances. Rainy Lake has been monitored for over thirty years for mercury and "has one of the most extensive mercury-fish records of any lake in Minnesota" (Bruce Monson pers. comm.). This data does not indicate any trends in mercury concentrations in fish tested, specifically northern pike, walleye, sauger, and yellow perch (Bruce Monson pers. comm. March 2009) in Rainy Lake. Interestingly, this does not reflect the overall results of Monson's recent study which indicates that mercury levels over a twenty-five year period are increasing in top predator fish in Minnesota lakes. Overall, levels declined in fish in Minnesota lakes from the period 1982-1995, followed by an overall increase from 1996-2006 (Monson 2009). Monson indicated, however, that data for individual lakes did not show consistent trends in mercury concentrations over time but collectively trends were found (Bruce Monson pers. comm.).

The National Atmospheric Deposition Program/National Trends Network is a U.S. cooperative program which has a network of precipitation montoring sites including two which appear to be within the Rainy River Basin. The Mercury Deposition Network (MDN) has 90 monitoring sites throughout the U.S. including one in the Rainy River Basin (NADP/MDN undated).

The Integrated Atmospheric Deposition Network is a binational (Canada/US) network that monitors contaminants in air and precipitation in the Great Lakes Basin (EC 2006). Though this network does not monitor directly in the Rainy Basin, stations on Lake Superior may provide general information on substances found in the larger geographic region. Additionally, in 2008, Environment Canada began monitoring nutrients in precipitaton at two sites in the Lake of the Woods basin.

### Green energy initiatives

Globally there is a movement towards 'green' energy with an emphasis on renewable energy from sources such as water power. In Canada, the Ontario provincial government provides incentives to encourage development of green energy facilities. Power generation through small- and medium-sized power facilities is becoming more common in Ontario. There have been a number of potential environmental issues associated with hydroelectric generation and with that comes some potential indirect human health issues (see Water Quantity and Water Management) and public concerns regarding impacts on fisheries and recreational waterways are common.

A local example of this is occurring in the Namakan River which feeds into boundary waters so does not fall directly under IJC jurisdiction. Questions have been raised

regarding potential impacts on fish passage and spawning by the proposed addition of hydro dams by Ojibway Power and Energy Group. Concerns have been expressed as to whether there may also be impacts on the Rainy River, since the Namakan is a main tributary (IJC 2007). These types of issues, associated fish community impacts linked to changes in water quantity and quality, and related human health threats may continue to be of concern in the region.

**Chemicals of Concern**

A number of chemicals may enter waterways through release of effluents, direct release or spills, from atmospheric deposition, or from overland runoff. Monitoring is carried out for some of these substances and some are removed from drinking water during treatment but there may be others which remain after treatment, often at very low concentrations. Potential adverse effects of many of these substances are not currently known.

# 3 Data Collection and Gaps

## *3.1 Data Collection and Analysis*

Numerous agencies and organizations collect and analyze water and health information. The following are some examples of their activities in the basin.

Public beach water quality samples are collected by the Northwestern Health Unit and sent away for analysis for E. coli and there is generally a three day turn-around period before test results are available. Since this lag time has been identified as too long to address immediate health concerns, the health unit is now using ecological models (i.e. forecasting conditions by using various weather patterns and sources of local bacterial contamination) based on historic information to identify when certain beaches may have high contamination levels. This allows them to respond in a proactive manner to potential health threats at beaches in Canadian waters, which are then followed up by on-site testing.

Environment Canada will be addressing some information gaps when it initiates a new monitoring program for nutrients (phosphorus and nitrogen) and mercury in the Rainy River in 2009; this information will complement monitoring data collected in the River by MPCA. Monitoring was done in the 1980s for nutrients and trace elements (Paul Klawunn pers. comm.) and discontinued in the 1990s, so this program will provide current data which can be compared to the historical information. In addition to monitoring being conducted by Ontario Ministry of Environment, MPCA and Department of Fisheries and Oceans, Environment Canada also began monitoring in the Lake of the Woods in 2008 (P. Klawunn pers. comm.). Mercury monitoring in fish has been ongoing for over thirty years in Rainy Lake (Bruce Monson pers. comm.).

Lake of the Woods appears to have a very active volunteer base which participates in a number of monitoring programs. It may be feasible to extend this type of data collection program to Rainy River and Rainy Lake. Standardization of collection

protocols would be part of such a program to ensure the quality of the data, which would then be available for analysis.

Water quantity data has been collected for decades in the basins. The 1925 treaty between Canada and the U.S. Lake of the Woods Convention and Protocol sets elevation and discharge requirements which then require monitoring to determine compliance. The LWCB collects data on elevations as well as daily data on inflows and outflows. Information on LoW and other lakes and rivers within the basins is available at http://www.lwcb.ca/waterflowdata.html.

The IRLBC provides data on water levels, inflows, and outflows on Rainy Lake at; http://www.ijc.org/conseil_board/rainy_lake/data/IRLBC-RainyLakeGraph2009.06.24.pdf.

### 3.1.1 Data distribution

Generally data distribution for regulated activities such as water treatment or effluent discharge is up to the regulating agency. Secondary distribution of information may include providing data to specific agencies such as the health unit for general information. Recent initiatives aim to make more data available to the public through websites.

### 3.1.2 Examples of Interaction and Coordination between Agencies

#### 3.1.2.1 Local Examples

The following are a few examples of interaction between agencies to study or manage water resources in relation to human health.

1. Northwestern Health unit is part of emergency response team on Ontario
2. MNR and MOE in Ontario collaborate on developing fish consumption advisories through coordination of collection and sample analysis
3. The Pesticide Management Plan committee in Minnesota includes MDA, MDH, MPCA

#### 3.1.2.2 Trans-boundary Examples

The following are examples of U.S. and Canadian agencies and organizations involved in studies, coordinated water monitoring programs and other related activities. There do not appear to be any trans-boundary health programs beyond shared fish testing.

1. Fish consumption analysis and advisories. The province of Ontario and the state of Minnesota share fish testing. The parties include MNR, MOE, MDNR,and MDH.
2. Water level and flow control in boundary waters is supervised by IRLCB, ILWCB, and managed by the (Canadian) Lakes of the Woods Control Board.
3. In 2009 a Multi-Agency Working Arrangement has been developed between a number of organizations within the Lake of the Woods basin. The intention of this arrangement is “to foster trans-jurisdictional coordination and collaboration on science and/or management activities to enhance/restore water quality in the LOW Watershed (LOW and Rainy River Basins), according to each agency’s respective mission.” (Multi-Agency Working Arrangement, May 2009). The parties include; Environment Canada, Lake of the Woods Water Sustainability Foundation, Minnesota Department of Natural Resources,

Minnesota Pollution Control Agency, Ontario Ministry of the Environment, Ontario Ministry of Natural Resources, Manitoba Water Stewardship, Red Lake Band of Chippewa Indians and United States Environmental Protection Agency.

4. Rainy River Basin Watershed Resource Centre is involved with a number of water monitoring and water management initiatives as well as facilitating the sharing of information.
5. The development of the State of the Basin Report for the Lake of the Woods and Rainy River Basin was a bilateral, multi-agency project.
6. The joint fisheries monitoring program in Rainy Lake and Rainy River – MNR and MPCA.
7. IJC International Water Initiative Rainy River hydraulic modeling project.

### 3.1.3 Observed and Identified Information Gaps

The following are information gaps which were identified during the development of this report and through personal communication with individuals. It should be noted that in some instances the information may be available but was not found.

1. Rainy River and Rainy Lake information on non-point source nutrient loading does not appear to be available.
2. Local beach monitoring and associated beach closure information not readily available on public websites in either the U.S. or Canada.
3. U.S. beach monitoring at two beaches on Sand Bay in Rainy Lake has been discontinued (Nolan Baratono pers. comm.).
4. There is currently no beach monitoring occurring on the U.S. side of the Rainy basin or Lake of the Woods (Nolan Baratono pers. comm.).
5. Localized temporal information on the presence of microcystin-LR in Rainy Lake and Rainy River, especially in recreational waters.

### 3.1.4 Information Distribution Gaps

There is a wide arrange of local health information available on regional websites, providing the public with background and response information to issues such as boil water advisories, with one exception. Local beach water quality information for the public does not appear to be available.

Mapping and water quality information for Lake Superior Minnesota beaches is available through http://www.mnbeaches.org/beaches/index.html. An extension on that website to include Rainy and Lake of the Woods Basins' beach quality information, or use of the site as a model for providing beach advisory status information to the public, would provide local agencies with the opportunity to distribute current information to local beach users on advisories and water quality.

### 3.1.5 Capacity to Anticipate and Respond to Water-related Health Threats

It appears that there is capacity to respond to a number of water-related issues in the basins. Defined hierarchies are in place such as in Ontario where the local health unit is part of emergency response team. Water control agencies currently regulate water levels and circulate event information if water levels are forecast to be very high or low.

Current contact information is important within the basins. This report includes a number of contacts throughout the basins but due to time constraints not all individuals could be identified. A system should be developed which will ensure that contact information is kept current.

Recreational water at public beaches is not monitored on the U.S. side of the Rainy River or Lake of the Woods though previously it was monitored for fecal coliform. There is some monitoring at beaches in the Superior National Forest. Not having current localized information on water quality at public beaches may hamper responses to water related health issues for swimmers.

Standardization of source water protection, drinking water, fish consumption guidelines and other water-related regulations between countries would make the job of managing the shared watershed much easier, including the process of identifying health issues in shared waters. As this may not occur in the near future, standardization of monitoring efforts where possible to meet needs in both countries may reduce duplication of effort and free resources which then would be available to address other areas of common concern. This, in conjunction with development of a communication strategy to share this information, would be a step towards ensuring adequate health related information is made available to decision makers in a timely fashion.

## *3.2 Opportunities for Shared Programs*

There are a large number of water-related agencies which are involved in water management, many of which have either an implicit or explicit role in affecting water and human health threats in the Rainy River and Lake of the Woods basins on both sides of the border. The challenge lies first in understanding each agency's role in addressing human health issues through what may initially appear to be unrelated functions, then to integrate health-related issues into the larger water management processes to ensure adequate standardized information is available in the decision-making process.

There are a number of areas where there may be opportunities to develop and implement integrated cross-boundary programs, for example a beach monitoring program for public beaches on boundary waters which would have common monitoring parameters and address the current deficit in beach monitoring on the U.S. shores of the Rainy River, Rainy Lake, and Lake of the Woods. A coordinated health services response team for water-related trans-boundary issues such as beach warnings and closures between countries is needed.

As well as a coordinated beach monitoring information, distribution of information on water quality by geographic sub-watersheds should be considered so that consistent information is available on both sides of the international boundary.

Standardization of fish consumption advisory programs between the U.S. and Canada has been attempted in the past. Due to the increasing recognition of the importance of resource management integration it may be possible to finds solutions which would address regulatory requirements in both countries, and due to its importance it is recommended that this issue be revisited. Cooperative collection and sampling efforts are currently in place which may be considered for expansion to

include development of uniform fish consumption advisory information on a sub-watershed basis.

Initiation of integrated monitoring programs for substances which may affect surface drinking water treatment should be considered, again on a sub-watershed basis with information distribution to relevant agencies in both countries.

# 4 Organizational Structures, key responsibilities and associated programs

In both the United States and Canada water protection and management is shared among a number of agencies, all with their own focus and many with what appear to be overlapping or shared responsibilities. Federal responsibilities in both countries include setting direction on protection of water from a human health and an environmental perspective. In the U.S., drinking water legislation is set federally and, in Canada, federal guidelines are in place for drinking water which are followed by provincial legislation and implemented locally.

Source water protection is the direction both countries are moving towards, with well-head protection programs being implemented at the state and provincial levels. Source water protection also applies to protection of surface water quality and quantity and efforts towards reducing the volume and types of contaminants is occurring internationally.

In some instances there are not clear cut lines as to a department's health and/or water management responsibilities and in these cases the same organization may appear under either health and/or water management agencies, listed under each in relation to a specific responsibility.

## *4.1 International*

These organizations and networks typically have members from both the United States and Canada and take a cooperative approach to addressing boundary water issues. As noted in the issues section above, not all of these organizations deal directly with human health issues but there is a human health connection.

### International Lake of the Woods Control Board (ILWCB)

This board was created by the U.S. and Canadian federal governments to address concerns over changes in water levels on the lake. This board operates when water levels are higher or lower than the upper and lower thresholds. This board reports to IJC annually. It consists of two engineers, one from the U.S. and one from Canada.

### International Rainy Lake Board of Control (IRLBC)

The IRLBC is an IJC board created in 1941 to address emergency conditions on the lake and monitors and may direct water levels of the Namakan and Rainy Lakes. It strives to retain water levels with a predetermined range. The Board acts as a technical advisor to IJC and is a participant of the International Watersheds Initiative (IWI).

### International Rainy River Water Pollution Board (RRWPB)

The IRRWPB is an IJC board which advises the IJC on water quality issues in the Rainy River, or advise on water-quality problems and what actions are being taken to address them. It was formed in 1966. The Board is a participant of the International Watersheds Initiative (IWI).

**Rainy River Basin Water Resource Center**
The [virtual] Center is located in Rainy River Community College in International Falls, Minnesota, promotes an international watershed approach to water management issues in the trans-boundary basin and serves as a database warehouse, provides research, and facilitates education and communication between various organizations, agencies, and the public.

**Integrated Atmospheric Deposition Network**
Monitoring Stations
This network is a cooperative effort between the U.S.Environmental Protection Agency and Environment Canada and focuses on the Great Lakes basin. As such it does not relate directly to the Rainy River and Lake of the Woods area but regionally may be of interest and be able to provide large scale information on atmospheric deposition in the area. The closest monitoring stations are on Lake Superior, Eagle Harbor master station with Sibley as a satellite station.

**Ontario / Minnesota Boundary Waters Fisheries Atlas**
This is not an organization or network but is an international effort. Minnisota's MNDNR and Ontario's MNR publishes information on sampling and fish communities in boundary waters every five years (DeSellas et. al 2009).

## *4.2 United States*

### 4.2.1 Health Agencies

#### 4.2.1.1 Federal Health Agencies

**U.S. Environmental Protection Agency (EPA)**

**Safe Drinking Water Act and Drinking Water Data**
The EPA sets nation wide drinking water standards through the Safe Drinking Water Act which are reviewed at least every six years. EPA has a number of water related databases. The agency develops list of contaminants found in water which may require further research which helps set research priorities, the Drinking Water Contaminant Candidate list and maintains a national contaminant occurrence database. It also has databases on watershed health and water related research projects (EPA 2008).

The EPA has a Safe Drinking Water Information System/Federal Version (SDWIS/FED) national database which contains monitoring information on 175,000 public water systems. There is also a state version which has been developed to assist states to run their systems (EPA 2008).

The EPA posts beach data on their website for beaches in the Great Lakes Region.

**Centers for Disease Control and Prevention (CDC)**

**National Center for Environmental Health**
The center provides information on a number of agencies which collect data related to environmental health.

#### Agency for Toxic Substances and Disease Registry

This federal public health agency provides information on a large number of toxic substances and includes fact sheets on a number of substances which have been identified as harmful to human health.

#### Department of Health and Human Services

This department is the primary U.S. federal agency for protecting citizens' health and has over 300 programs.

### 4.2.1.2 State Health Agencies

#### Minnesota Department of Health

#### Drinking Water Protection

The state carries out activities related to ensuring the community public water supplies comply with the federal Safe Water Drinking Act. Activities include site visits and sample collections as well as providing training and education for local staff (MDH 2008).

#### Source Water Protection Program

The Source Water Protection program considers how susceptible a public water source may be to contamination, whether it is surface water such as a lake or river or whether it is groundwater. Under the federal Safe Water Drinking Act states are required to do source water assessments for all public systems. The results must be available to the public and in Minnesota are available on the Minnesota Department of Health website (MDH 2006).

#### Fish Consumption Advisories

Testing for mercury and PCBs in the Rainy River, Rainy Lake, Lake of the Woods is a shared responsibility with Department of Natural Resources. The Department of Health issues the annual fish consumption advisory. The state health department has a fish advisory coordinator to provide consumption advice based on a number of categories.

### 4.2.1.3 Regional and Local Health Agencies

#### Health Agencies

There are a number of local health agencies; Koochiching County, Lake of the Woods County, St. Louis County and Lake County.

#### Beach Management

The Koochiching County Health Department historically monitored fecal coliform at two beaches on Rainy Lake in Sand Bay. Historical data from this monitoring is available from the Koochiching County Community Health Department (Nolan Baratono pers. comm.).

## 4.2.2 Water Management Agencies

### 4.2.2.1 Federal Agencies

The Environmental Protection Agency (EPA) is the key federal water management agency. The United States Geological Survey (USGS) has been included in this section due to its involvement in relevant work in the basins.

#### Environmental Protection Agency

The U. S. Clean Water Act is the basis for water quality standards across the country and state programs are developed to meet Clean Water Act requirements. The EPA's STORET data system is the main storage system for much of the water quality monitoring which is done by the state.

**Pulp and Paper Effluent**

The Environmental Protection Agency sets regulatory guidelines for pulp and paper effluent discharges in the U.S. These are designed to meet water quality standards under EPA's Water Quality Act.

**Watershed Management**

The EPA encourages the development of watershed management plans to protect local water quality and quantity. It takes in integrated stakeholder approach to the development of local management plans and to encourage the sharing of information and best practices.

**Beach Monitoring**

The EPA sets criteria for bacteria criteria which states are required to meet or exceed. States submit plans for federal approval based on the Clean Water Act. Beach water quality monitoring results and closure information is posted on the USEPA website by location in some areas but not for local beaches in Rainy Basin or Lake of the Woods.

#### Department of the Interior

**United States Geological Survey**

The U.S. Geological Survey, a federal science agency, conducts baseline sampling, such as from 2004 through 2006 in four headwater lakes in Voyageurs National Park to establish "ambient" conditions of mercury, nutrients, and major ions in water in these high-quality headwaters (IRLBC/IRRWPB Fall 2005, 2006, and 2007). A study of interior lakes of Voyageurs National Park found that methalmercury concentrations in gamefish exceeded criteria for human health. The study also concluded that in five lakes the majority of mercury in sediment from the 1900's was from anthropogenic sources (Weirner et. al 2006).

The USGS also monitors stream flow on the main stem and larger U.S. tributaries of the Rainy basin. All USGS data are store in the National Water Information System (NWIS).

## 4.2.2.2 State Water Management Agencies

**Minnesota Pollution Control Agency (MPCA)**

The MPCA oversees a large number of water quality programs related to the federal EPA regulations.

### Beach Management

MPCA sets guidelines for monitoring E. coli which meet federal bacteria standards for coastal and Great Lakes beaches in water at beaches and local municipalities implement programs. The state monitors water at state parks and the U.S. Forest Service monitors some waters in Superior National Forest. It appears there are currently no other beach monitoring programs in Minnesota on Rainy River, Rainy Lake or Lake of the Woods (Nolan Baratono, pers. comm.) though two beaches on Sand Bay, City Beach and Rainer Swimming Beach, were tested for fecal coliform until 2008.

### Water Quality

The MPCA assesses lakes and streams to determine whether they meet the goals of the Federal Clean Water Act. It has developed the Clean Water Legacy Act to meet federal requirements. MPCA has a number of monitoring data bases which have been made publically accessible on its website. Water monitoring is done under the guidelines of the Minnesota Water Quality Monitoring Strategy.

The MPCA monitors water quality in the Rainy River and five tributaries monthly for ten months (Figure 3). This is done consecutively for two years within a five year window. Testing is carried out for a number of substances including E. coli, BOD and TSS as well as temperature (IJC 2004).

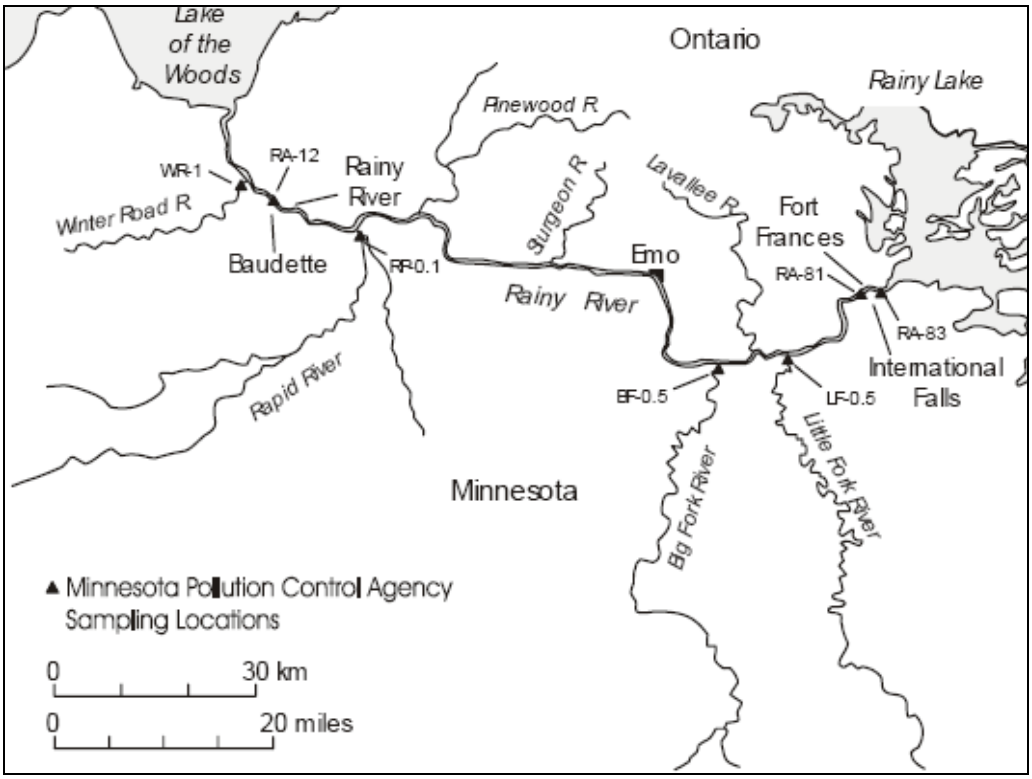



**Figure 3.** Minnesota Pollution Control Agency Rainy River Long-term Water Quality Sampling Stations (Source: IRRWPB/IRLBC Fall 2006 report).

The Rainy River Basin Overview (MPCA 2001) provides local information on general water quality in the basin in relation to swimming and aquatic life. Swimming water quality standards are based on EPA guidelines for fecal coliform monitoring and all data is available through the EPA's STORET system.

The Overview also provides Fish Consumption Advisory information in Minnesota based on fish size and amount consumed. An interesting point raised in this report is that the primary source of mercury found in the waterways has been determined to be from atmospheric deposition (MPCA 2001).

### Stormwater Program

Stormwater management in urban areas is necessary to capture urban runoff and reduce the number and concentrations of contaminants which enter waterways. The MPCA administers federal requirements for the Clean Water Act through its Stormwater Program. Permitting is required for developing stormwater management facilities (MPCA 2009).

## Minnesota Department of Natural Resources (Minnesota DNR)

### Fisheries

In international waters Minnesota and Ontario agencies share responsibilities for fish tissue monitoring and analysis. In the U.S. fish samples are tested for mercury and PCBs. The state then issues consumption advice in the Rainy

River, Rainy Lake, and Lake of the Woods waters based on mercury levels from specific sites.

**Stream flow Monitoring**

This is a cooperative program with DNR Waters staff working with MPCA. Stream flow monitoring programs measure water levels and flow rates in Minnesota streams and rivers to anticipate local flooding and water levels, providing data for modeling river and lake behaviours. Data is stored in a HYDSTRA system with information available to DNR staff and other agencies.

**Minnesota Department of Agriculture (MDA)**

**Pesticide Management**

MDA has a pesticide management plan to protect ground and surface waters from pesticide contamination. The Pesticide Management Plan Committee is involved with water quality monitoring data review. MDA also works with the MDH and MPCA to assess health and environmental impacts of pesticides (MDA 2009).

## *4.3 Canada*

Canada has developed an integrated multi-barrier approach to ensure reliable, safe drinking water is the norm. This is done through the coordinated effort of all levels of government and multiple agencies. Source water protection, drinking water treatment and proper management of the drinking water distribution system are all components of this approach (CCME 2002).

### 4.3.1 Health Agencies

#### 4.3.1.1 Federal Health Agencies

**Health Canada**

**Healthy Environments and Consumer Safety Branch, Safe Environments Program: Water Quality and Health Bureau.**

This agency sets guidelines for drinking water quality through the Federal-provincial-territorial committee on drinking water. It publishes "Guidelines for Canadian Drinking Water Quality". The agency participates in World Health Organization development of drinking water guidelines and works closely with U.S. EPA (Health Canada 2008).

**Beach Management**

Health Canada sets guidelines for maximum E. coli levels in recreational waters and recommends posting warning signs at beaches if the E. coli count exceeds 200 per 100ml of water in 5 samples (i.e. their Geometric mean) within a 30 day period. Actual standards are set provincially and the local health unit is responsible for public beaches samples being taken and tested, as well as ensuring notices are displayed at affected areas (MHLTC 2008).

#### Wastewater Effluent Montoring

Health Canada monitors First Nations wastewater effluent at Manitou Rapids (IJC 2008).

#### Pest Management Regulatory Agency

The Pest Management Regulatory Agency is responsible for compliance and enforcement of Pesticide Control Products Act and regulations. Federal responsibility in relation to pesticides also includes human health and safety.

**Public Health Agency of Canada**

This agency is responsible for providing information on waterborne diseases and collects information on a number of communicable diseases.

### 4.3.1.2 Provincial Health Agencies

Provinces have primary responsibility over drinking water, while municipalities must meet provincial requirements. Provinces set regulations in line with federal guidelines. In the province of Ontario there is a law for source protection for municipal water supply systems, both surface and subsurface (Cleanwater Act of 2007).

**Ontario Ministry of Health and Long Term Care**

The Ontario Public Health Standards (OPHS) fall under the Health Protection and Promotion Act and specify mandatory health programs and services which must be carried out by health units; one of these standards is the Safe Water Standard. There are three protocols, the Drinking Water Protocol, the Beach Management Protocol and the Recreational Water Protocol under this standard. Data collected by health units in accordance with these protocols is reported to the Ministry of Health and Long Term Care, Public Health Division, under the Safe Water Program. The Ministry has recently taken over responsibility for Small Drinking Water Systems from the Ministry of the Environment. This responsibility falls under the Drinking Water Protocol.

**Ontario Ministry of the Environment**

#### Drinking Water

The Ontario Ministry of the Environment (MOE) has set up a program to advise the public of water systems where there have been issues which range from aesthetics to health related contaminants (MOE 2007). The Adverse Water Quality Incidents Reports are posted on the ministry website.

MOE Regulation O. Reg. 170/03 sets standards for drinking water in Ontario.

#### Beach Management

The Ontario E. coli standard is 100 per 100 ml water, more stringent than the Health Canada recommendation of posting signs at beach sites if E. coli count exceeds 200 per 100ml water in 5 samples within a 30 day period and falls under Ontario Ministry of the Environment's Provincial Water Quality Objectives.

#### Sport Fish Contaminant Monitoring Program

Fish collection in Ontario is the joint responsibility of Ministry of Natural Resources (MNR) and Ministry of the Environment (MOE). MOE, in cooperation with MNR, carries out analysis and publishes the Guide to Eating Ontario Sport Fish once every two years. Monitoring includes testing for mercury, total PCB's, dioxin-like PCBs TEQ, and Dioxins/Furans TEQ. Consumption information includes a separate category for children under 15 and women of childbearing years.

In the Rainy Lake, Rainy River and Lake of the Woods region fish at a number of sites are tested for one or more of the following; mercury, PCBs, mirex/photomirex, pesticides, chlorinated phenols, dioxins, furans, chlorinated benzenes, and polycyclic aromatic hydrocarbons (MNR 2009).

In Rainy Lake data is collected at two sites, Brule Rapids and Redgut Bay. Monitoring in the Rainy includes testing sturgeon below the Fort Frances dam for PCBs and mercury for other fish. A number of fish species are also tested at Lake of the Woods, Kenora district (MOE 2008).

### Ontario Ministry of Natural Resources

#### Fisheries Assessment Unit

The FAU monitors water quality for fish habitat assessment under the Core Data Program in Lake of the Woods.

#### Beach Management

MNR is responsible for recreational water sampling at provincial parks (MHLTC 2008).

## 4.3.1.3 Regional and Local Health Agencies

### Board of Health Responsibilities

Local health boards cover a wide range of health related issues. They primarily follow program standards and protocols set out by the Ontario government.

With respect to water and human health, health boards inspect;

- drinking water
- Beach management
- Recreational water

The Safe Drinking Water Act legislates that the Medical Officer of Health responds to problems associated with drinking water. The local board of health maintains inventories of all drinking water systems within their area though they do not collect the data. Inspection data for all systems must be recorded and adverse drinking water notifications must be reported. A database on small systems risk assessments is maintained by the health unit. All drinking water sample results are also maintained. The local health boards meet with MOE semi-annually to share information on issues related to drinking water such as problems with drinking water and water-borne illnesses as well as flood issues (MHLTC 2008).

Risk assessments of all larger systems must be done every one or two years and inspections of small systems occur every two to four years. Investigations occur beyond that if there is suspicion of problems with the system (MHLTC 2008).

**Northwestern Health Unit**

The Northwestern Health unit has a safe water program which includes;

- monitoring drinking water quality,
- initiating boil water advisories where needed,
- monitors water quality at municipal swimming areas and posts advisories where needed,
- public outreach through website, phone numbers and information posted.

The Unit's website has a number of factsheets on emergency water supplies.

The Unit is part of the regional emergency preparedness group which develops emergency response plans and is responsible for coordination of health related issue.

The health unit monitors beaches on Rainy Lake, Rainy River, and Lake of the Woods in summer months on a weekly basis or more frequently if an issue is suspected. Data on beaches is collected and retained by the health unit but currently does not post information on their web site on beaches or beach monitoring programs. (Dale Wiebe, per. comm.)

**Municipalities**

Municipalities are required to meet provincial standards in Canada. Smaller drinking water facilities are also regulated in Ontario when they serve year-round populations or facilities that provide water for 'vulnerable populations' such as elderly residences and seasonal children's camps (MOE 2006).

## 4.3.2 Water Management Agencies

### 4.3.2.1 Federal Water Management

**Lake of the Woods Control Board (LWCB)**

This is a federal and provincial board which was formed in 1919 by Canada and Ontario. It regulates lake levels in Lake of the Woods and Lac Seul as well as flows in the Winnipeg River and English River within a predetermined range under normal conditions. It also reports on lake levels on its website. LWCB has four members, one each representing Canada and the province of Manitoba and two representing the province of Ontario who are appointed by the government being represented. Members must be engineers.

**Environment Canada**

**Water Science & Technology Directorate (WSTD)**

The Aquatic Ecosystem Management Research Division (AEMRD) and the Water Quality Monitoring and Surveillance Division (WQM&S-Ontario) are both actively engaged in conducting research and monitoring in Lake of the Woods and the Rainy River, including scientific assessment of existing LoW hydrologic and water quality databases; improved characterization of hydrological loading and physical limnology of LoW; improved estimation of LoW nutrient loading and nutrient budget; improved characterization of biological community and productivity; modelling of the lake; and monitoring of water quality in Rainy River.

**Water Use Data**
Environment Canada has municipal and industrial water use databases from 1999 for which include wastewater treatment levels. Under Canadian Council for Ministries of the Environment (CCME) there is an effort to develop a data referencing system to bring together all levels of water monitoring information (EC 2008).

**Environmental Effects Monitoring (EEM)**
The Environmental Effects Monitoring Program (EEM) in Canada was introduced after federal regulations were set in place. EEM monitors environmental factors downstream of effluent discharge, periodically testing benthic and fish communities under a plan which is developed by the mills, then submitted to and approved by Environment Canada's Environmental Protection Operations Division. Regional directors chair a local technical advisory panel or technical monitoring committee which advises on quality of study design, and does some analysis of data quality. An objective of this program is to ensure regulations are adequate to address environmental considerations in a number of situations (EC 2004).

**Canadian Environmental Assessment Agency**
**Pulp and Paper and Mining Effluent**
The Environmental Protection Operations Division of Environment Canada is regulator of a number of substances found in effluents as well as the testing programs on aquatic communities. If monitoring indicates levels are exceeding limits the director notified (EC 2004).

**Natural Resources Canada (NRCan)**
NRCan is involved with internal (government) federal water conservation programs and wastewater programs.

**Department of Fisheries and Oceans (DFO)**
DFO regulates Canadian inland waters, protecting fish habitat in inland waters from degradation or destruction.

### 4.3.2.2 Provincial Water Management Agencies

**Ontario Ministry of the Environment (MOE)**

**Effluent Regulations**
The Ontario Ministry of the Environment regulates effluents through the Environmental Protection Act.

MOE regulates municipal effluent through standards set in Level of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters which sets E. coli at 100 cfu/100 ml.

The Ontario Water Resources Act sets water quality objectives for non-drinking water and it governs approvals for water works including Permits to Take Water, discharges to water, and sewage works.

**Drinking Water Regulations**
The Safe Drinking Water Act sets standards for safe drinking water and regulates public drinking water systems.

**Ontario Ministry of Natural Resources (MNR)**

The MNR has a wide range of responsibilities including considering climate change impacts and provincial adaptation options, aquatic ecosystem management, and is responsible for fish collection programs and works with MOE which carries out contamination analysis.

The following is a list of some legislation related to water quality protection in Ontario, taken from the Canadian Environmental Law Association website (CELA undated) which illustrates this approach;

**Ontario Ministry of Agriculture, Food, and Rural Affairs**

The Nutrient Management Act (Bill 81) regulates the management of agricultural waste, sets standards for some water monitoring and nutrient application to land, facility construction.

### 4.3.2.3 Regional and Local Water Management Agencies

Drinking water monitoring in municipalities is the responsibility of the municipality in Ontario. Annual testing is done on 'raw' water for inorganic and organic substances. It is assumed that surface water sources will have bacterial contamination so it does not appear that this falls under extensive testing. Data is retained by municipalities and distributed to MOE and the local health unit. This information should be publicly available as well (Dale Wiebe, per. comm.).

**Lake of the Woods Water Sustainability Foundation**

This organization was founded in 2005 to address sustainability issues in Lakes of the Woods. Priorities for 2009-2010 include focusing on coordination of monitoring activities in the lake (LWWSF 2009). This organization, in cooperation with Ontario MNR, Environment Canada, and the MPCA released the "State of the Basin Report" in March 2009 (DeSellas et. al 2009).

# Appendix

## Agency Contact Information

The following contact list includes names of individual contacts within the organizations wherever possible.

## International

### International Lake of the Woods Control Board

**Canadian Membership**

Dr. Syed M. A. Moin
Co-Chair
International Upper Great Lakes Study
International Joint Commission
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Rick Walden
Engineering Advisor
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Mailing Address
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K1A 0H3

**U.S. Membership**

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**International Rainy Lake Board of Control**
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Edward Eaton
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Bill Darby
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stoner@usgs.gov

Nolan Baratono
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nolan.baratono@pca.state.mn.us

# Canada

## 1. Health Agencies

### Federal Agencies

**Health Canada**
**Public Health Agency of Canada**
130 Colonnade Road
A.L. 6501H
Ottawa, Ontario K1A 0K9

Thunder Bay Office
33 South Court Street, Suite 101
Thunder Bay, Ontario
P7B 2W6

Ontario/Nunavut Area
Simone Smullen
180 Queen Street West,
11th Floor
Toronto, ON M5V 3L7
(416) 973-0003

### Provincial Agencies

**Ministry of Health and Long Term Care**
Safe Drinking Water Coordinator
(416) 327-7623

### Regional and Local Agencies

**Northwestern Health Unit**
**Medical Officer of Health and CEO**
James Arthurs
Northwestern Health Unit
21 Wolsley Street
Kenora, ON P9N 3W7
(807) 468-3147
(807) 468-4970 (Fax)
jarthurs@nwhu.on.ca

**Environmental Health Manager**
Bill Limerick
1 800 830-5978

**Environmental Engineer**
Dale Wiebe
1 800 830-5978
dwiebe@nwhu.on.ca

**Health Unit Office Locations within Rainy River Basin**
**Emo**
76 Front Street
P0W 1E0
Tel. (807) 482-2211
Fax (807) 482-1678

**Fort Frances**
396 Scott Street
P9A 1G9
Tel. (807) 274-9827 or 1-800-461-3348
Fax (807) 274-0779

**Rainy River**
210 Atwood Avenue
P0W 1L0
Tel. (807) 852-3268
Fax (807) 852-3015
http://www.nwhu.on.ca/about/office-locations.php

**Sioux Narrows-Nestor Falls**
P.O. Box 246
P0X 1N0
Tel. (807) 226-9626
Fax (807) 226-9626

**Kenora**
21 Wolsley Street
P9N 3W7
Tel. (807) 468-3147 or 1-800-830-5978
Fax (807) 468-4970

Market Square
209-308 Second Street South
P9N 1G4
Tel. (807) 468-4948
Fax (807) 468-8940

# 2. Water Management Agencies

## Federal Agencies

### Department of Fisheries and Oceans

### Regional Office

Fisheries and Oceans Canada
501 University Crescent
Winnipeg, Manitoba
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Telephone: (204) 983-5000
Fax: (204) 984-2401

### Environment Canada

### Environmental Effects Monitoring - Ontario Regional Office

Regional Coordinator
Nardia Ali
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Phone : (416) 739-5884
Fax : (416) 739-4342
eem.ontario@ec.gc.ca

### Water Science and Technology Directorate

Canada Center for Inland Waters
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### Environmental Monitoring

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## Joint Federal and Provincial Agency

**Lake of the Woods Control Board**
Executive Engineer
Lake of the Woods Control Board
Ottawa ON K1A 0H3
1 800 661-5922
secretariat@lwcb.ca

## Provincial Agencies

**Sport Fish Contaminant Monitoring Program**
Ministry of the Environment
125 Resources Road
Etobicoke, ON M9P 3V6
Tel.: (416) 327-6816 or 1 800 820-2716
sportfish.moe@ontario.ca

**Ministry of the Environment**
Kenora Area Office
Kelli Saunders, M.Sc.
Lake of the Woods Coordinator/
Kenora Acting Area Supervisor
808 Robertson St.
P. O. Box 5150
Kenora ON P9N 3X9
Toll free from area code 807: 1 888 367-7622
Tel: (807) 468-2734
kelli.saunders@ontario.ca

## Regional and Local Agencies

**Water Management**
**Lake of the Woods Water Sustainability Foundation**
Executive Director Todd Sellers
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866 379-8891
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**Town of Fort Frances**
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Fort Frances, ON P9A 3P9
(807) 274-5323
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**Environmental and Facilities Superintendent, Fort Frances**
Doug Herr
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dherr@fort-frances.com

**Fort Frances Power Corporation**
President and CEO
Jorg Ruppenstein
(807) 274-9291 x232
http://ffpc.fort-frances.com/

**Ojibway Power and Energy Group**
226 Edward Street, Suite 2
Aurora, ON
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(905) 726-8321 ext. 223
contact@opeg.ca

**First Nations**
**Indian and Northern Affairs**
100 Anemki Drive, Suite 101
THUNDER BAY, ON P7J 1A5
Tel.: (807) 737-2800, 1 800 567-9604
Fax: 807-623-3536, 1 866 817-3977
TTY: 1 866 553-0554
InfoPubs@ainc-inac.gc.ca

**Indian and Northern Affairs Canada**
Ontario Region
Indian and Northern Affairs Canada
8th Floor 25 St. Clair Avenue East
Toronto, Ontario
M4T 1M2
(416) 973-6234
fax: (416) 954-6329


**Figure 4.** Ontario First Nations Locations in the Rainy River and Lake of the Woods Basin (Source: Modified from Indian and Northern Affairs Canada Ontario First Nations Map).

**Rainy River First Nations**
Box 450
Emo, ON P0W 1E0
Canada
Tel: (807) 482-2479
Fax: (807) 482-2603

**Couchiching First Nation**
Band Chief - Charles McPherson
RMB 2027, R.R. #2 Fort Frances, ON
P9A 3M3
Tel: (807) 274-3228
Fax: (807) 274-6458

**Wabigoon First Nation**
Site 112, Box 24
Dinorwic, Ontario
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Tel: (807) 938-6684
Fax: (807) 938-1166

**Wauzhushk Onigum First Nation (Rat Portage)**
P.O. Box 1850

Kenora, Ontario
P9M 3X8
Tel: (807) 548-5663
Fax: (807) 548-4877

**North West Angle #37 First Nation**
P.O. Box 267
Sioux Narrows, Ontario
P0X 1N0
Tel: (807) 226-5353
Fax: (807) 226-1164

**Big Grassy First Nation**
General Delivery
Morson, Ontario
P0W 1J0
Tel: (807) 488-5614
Fax: (807) 488-5533

**Big Island First Nation**
General Delivery
Morson, Ontario
P0W 1J0
Tel: (807) 488-5602
Fax: (807) 488-5942

**Lac La Croix First Nation**
P.O. Box 640
Fort Frances, Ontario
P9A 3N9
Tel: (807) 485-2431
Fax: (807) 485-2583

**Naicatchewenin First Nation**
Box 15, RR #1
Devlin, Ontario
P0W 1C0
Tel: (807) 486-3407
Fax: (807) 486-3704

**Nicickousemenecaning First Nation**
P.O. Box 68
Fort Frances, Ontario
P9A 3M5
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Fax: (807) 481-2511

**Ojibways of Onegaming (Sabaskong)**
P.O. Box 160
Nestor Falls, Ontario
P0W 1K0
Tel: (807) 484-2162/2518
Fax: (807)484-2737

**Seine River First Nation**
P.O. Box 124
Mine Centre,Ontario
P0W 1H0
Tel: (807) 599-2224
Fax: (807) 599-2865

**Stanjikoming First Nation**
P.O. Box 609
Fort Frances, Ontario
P9A 3M9
Tel: (807) 274-2188
Fax: (807) 274-4774

**Ochiichagwe'babigo'ining First Nation (Dalles)**
P.O. Box 1770
Kenora, Ontario
P9N 3X7
Tel: (807) 548-1929
Fax: (807) 548-1976

**Grassy Narrows First Nation**
General Delivery
Grassy Narrows, Ontario
P0X 1B0
Tel: (807) 925-2201/2486
Fax: (807) 925-2649

**Wunnumin Lake First Nation**
P.O. Box 105
Wunnumin Lake, Ontario
P0V 2Z0
Tel: (807) 442-2559
Fax: (807) 442-2627

# United States

## 1. Health Agencies

### Federal Agencies

**Department of Health and Human Services**
Agency for Toxic Substances and Disease Directory
4770 Buford Hwy NE, Atlanta, GA 30341
1 800 232-4636

**Environmental Protection Agency**
Safe Drinking Water Hotline
1 800 426-4791

### State

**Minnesota Department of Health**

Regional Offices
Northwest District Office
1705 Anne St., Suite 3
Bemidji, MN 56601
(218) 755-3820

Duluth District Office
Gov't Service Center Rm 703
320 W 2nd St
Duluth, MN 55802-1402
(218) 723-4642

**Source Protection**
625 Robert Street North
P.O. Box 64975
St. Paul, MN 55164-0975
(651) 201-4681
(651) 201-4700

**Drinking Water Protection Section**
Dept. of Health
625 Robert Street North
P.O. Box 64975
St. Paul, MN 55164-0975
(651) 201-4700
http://www.health.state.mn.us/divs/eh/about/dwp.pdf

### Health Risk Assessment Unit
Fish Consumption Advisory Coordinator
Patricia McCann
patricia.mccann@state.mn.us
(651) 201-4915

## Regional and Local Health Agencies
**Lake of the Woods Health Department**
600 Main Ave. S.
Baudette, MN 56623
(218) 634-1795

**Koochiching County Community Health Department**
Susan Congrave, Director
1000 5th St W
International Falls, MN 56649
(218) 283-6224
susan.congrave@co.koochiching.mn.us

**St. Louis County Health Department**
222 E Superior St
Duluth, MN 55802
(218)725-5200
1 800 450-9777

**Lake County Health Department**
Courthouse
616 3rd Ave.
Two Harbors, MN 55616
(218)834-8400

## 2. Water Management Agencies

### Federal

**Environmental Protection Agency**
77 West Jackson Boulevard
Chicago, IL 60604-3507
http://www.epa.gov/region5/
Phone: (312) 353-2000
Toll free within Region 5: (800) 621-8431

### State

**Minnesota Pollution Control Agency (MPCA)**
**Water and Basin Planning Coordinator**
Nolan Baratono
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International Falls, MN 56649
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nolan.baratono@pca.state.mn.us

**Water Quality Monitoring**
Jesse Anderson
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(218) 302-6621 or 1 800 657-3864
jesse.anderson@pca.state.mn.us

**Environmental Analysis and Outcome Division**
Research Scientist
Bruce Monson
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**Biological Monitoring**
Scott Niemela
(218) 316-3919
scott.niemela@pca.state.mn.us

**Hazardous Waste**
Kit Grayson
525 South Lake Avenue, Suite 400
Duluth, MN 55802

(218) 302-6627 or 1 800 657-3864
kit.grayson@pca.state.mn.us

**Minnesota Department of Natural Resources**
**Fisheries**
Baudette Office
204 Main St E
Baudette, MN 56623
218-634-2522
baudette.fisheries@dnr.state.mn.us

International Falls Area Fisheries Office
392 Hwy 11 E
International Falls, MN 56649
(218) 286-5220
internationalfalls.fisheries@dnr.state.mn.us

## Regional and Local Agencies

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Lake of the Woods County
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**Water Plan Coordinator**
Koochiching County
Richard Lehtinen

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## First Nations/Tribal Communities

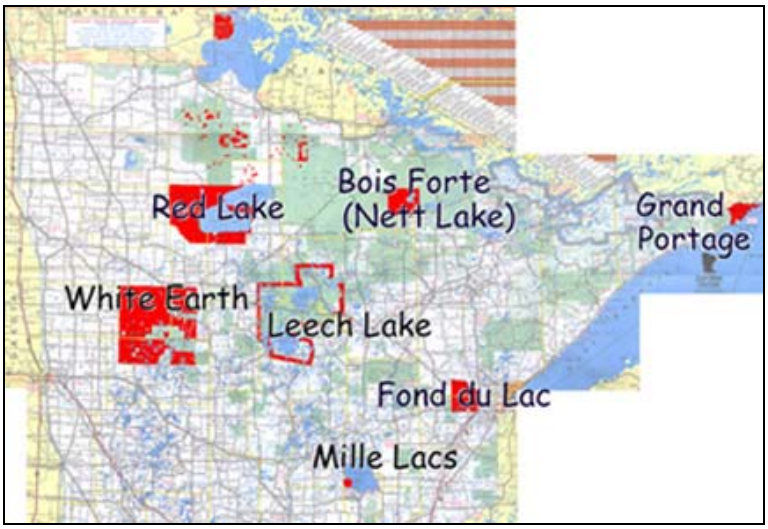


**Figure 5.** Northern Minnesota Tribal Community Locations in or near Lake of the Woods and Rainy River Basins**.** (Source unknown)

**Indian Affairs Council**
Executive Director: Joseph Day
3801 Bemidji Ave, Suite 5, Bemidji, MN 56601
Phone: (218) 755-3825
Fax: (218) 755-3739
miac@mail.paulbunyan.net

**Bois Forte (Nett Lake) Reservation**
**Band of Chippewa Indians**
Tribal Chair: Kevin Leecy
(218) 757-3261
kevin.leecy@boisforte-nsn.gov

**Leech Lake Reservation**
(218) 335-8200

**Red Lake Band of Chippewa Indians**
P.O. Box 550, Red Lake, MN 56671

**Grand Portage Band of Chippewa Indians**
P.O. Box 428, Grand Portage, MN 55604

# List of References

Note* All websites accessed in February, March, and May 2009.

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