
Nutrient Characterization of Discharges from Winnipeg

Nutrient Characterization

Outline

- **Concern with Nutrients**
- **Background**
- **Monitored Water Quality**
- **Management Options for Winnipeg**
- **Loadings on Lake Winnipeg**
- **Nutrient Removal**
- **Overall Strategy Needed**
- **City's Recommendation**

Nutrient Characterization

Background: Concern with Nutrients

- Excessive amounts of nutrients, that is, Nitrogen (N) and Phosphorus (P) can over stimulate aquatic plant growth and result in an unhealthy aquatic environment.
- Main factors for high N and P in Prairie streams
 - Erosion of soils
 - Runoff from fertilizers
 - Urban runoff
 - Agriculture and sewage effluents
 - Source: MB Conservation NMS (April 2000)

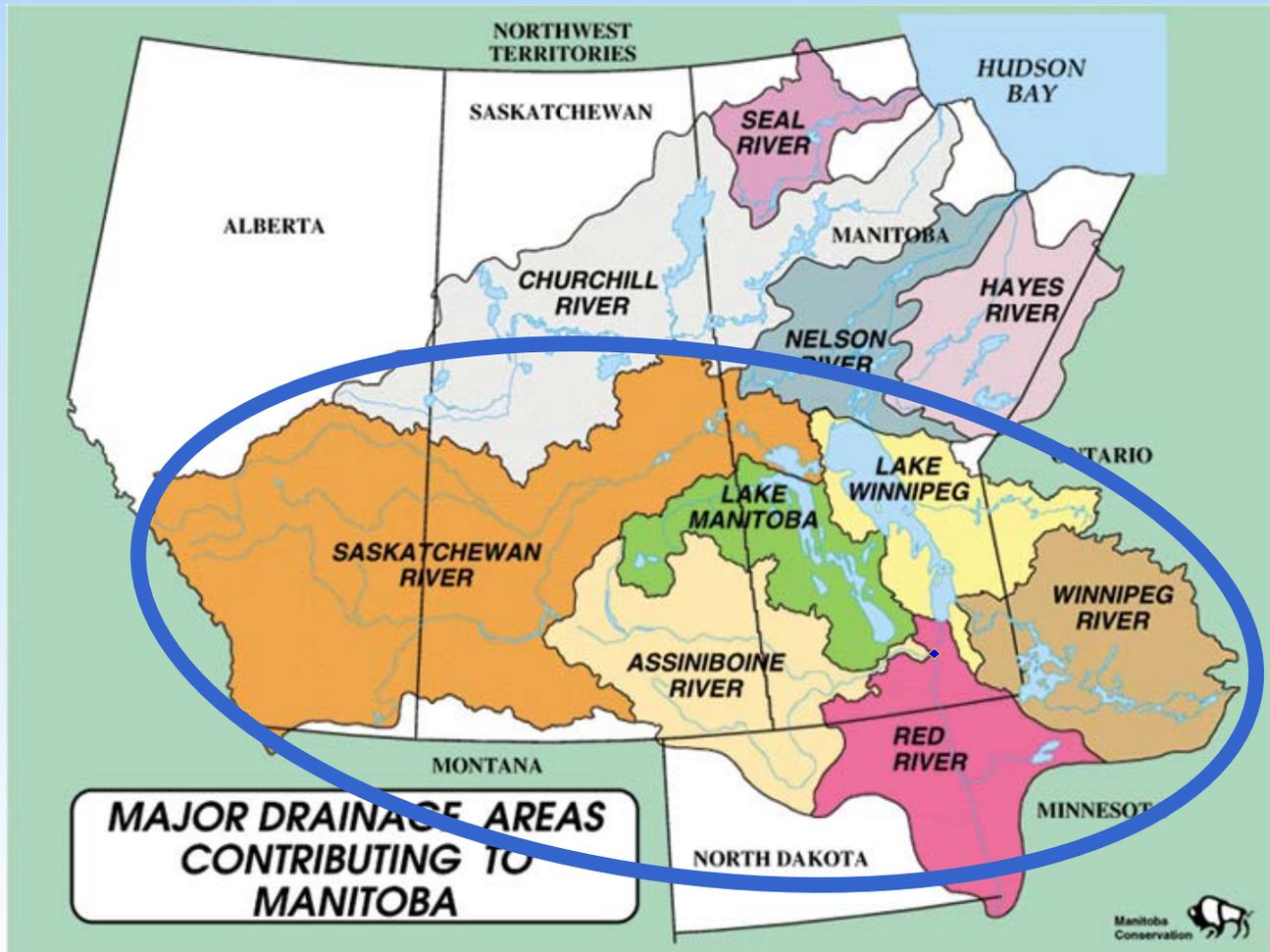
Nutrient Characterization

Background:

- **Manitoba Water Quality Standards, Guidelines, and Objectives**
 - ◆ **Phosphorus**
 - ▶ Tier 3 substance, Guideline
 - ▶ not to exceed 0.025 mg/L in Lakes
 - ▶ not to exceed 0.050 mg/L in Streams
 - ▶ Typical monitored values are well in excess of guidelines upstream of Winnipeg
 - ◆ **Nitrogen**
 - ▶ Tier 2 substance, Objective
 - ▶ Nitrite+Nitrate not to exceed 10 mg/L as N
 - ▶ Ammonia (NH₃), varies, toxicity related
 - ▶ No limit at this time for Total Nitrogen

Nutrient Characterization

Lake Winnipeg Watersheds



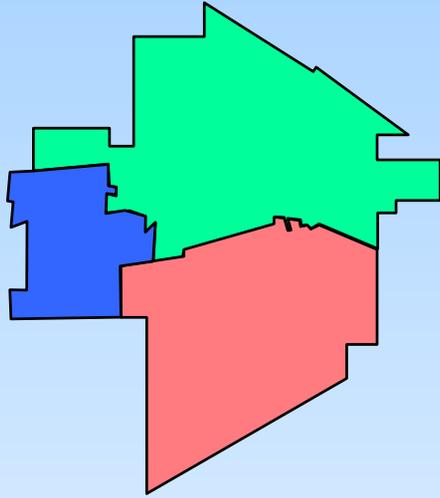
Nutrient Characterization

Monitored Water Quality

- Nitrogen & Phosphorus
- City of Winnipeg has collected and analyzed considerable amount of data related to:
 - ➔ River water quality
 - ➔ Wastewater Treatment Plants
 - ➔ Urban Loadings
 - Continuous Dry Weather (treatment plants)
 - Intermittent Wet Weather (CSOs and Land Drainage)



Nutrient Characterization



Monitored wastewater concentrations



Total Phosphorus Influent: (mg/L)	<i>3.1 to 8.9</i> Average: 6.0	<i>3.2 to 12.2</i> Average: 6.4	<i>3.3 to 7.6</i> Average: 5.8
Total Phosphorus Effluent: (mg/L)	<i>1.6 to 5.8</i> Average: 3.2	<i>1.7 to 6.4</i> Average: 3.7	<i>2.1 to 5.9</i> Average: 3.2
Total Nitrogen Influent: (mg/L)	<i>20.2 to 60.2</i> Average: 42.6	<i>17.9 to 59.4</i> Average: 37.5	<i>23.1 to 43.6</i> Average: 33.9
Total Nitrogen Effluent: (mg/L)	<i>13.1 to 43.2</i> Average: 31.9	<i>14.9 to 38.02</i> Average: 26.4	<i>6.4 to 34.5</i> Average: 19.9

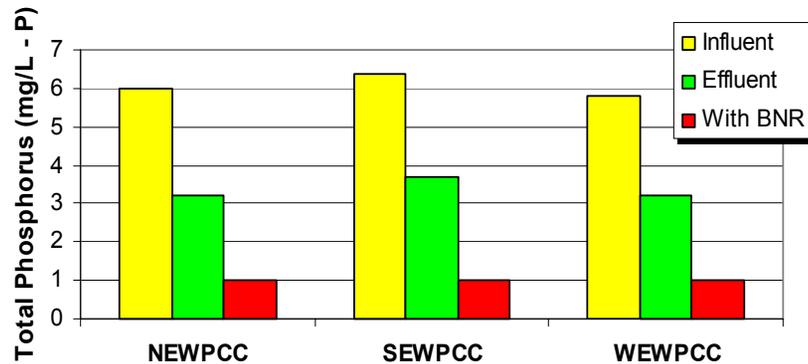
Nutrient Characterization

Nutrient Management Options for Winnipeg

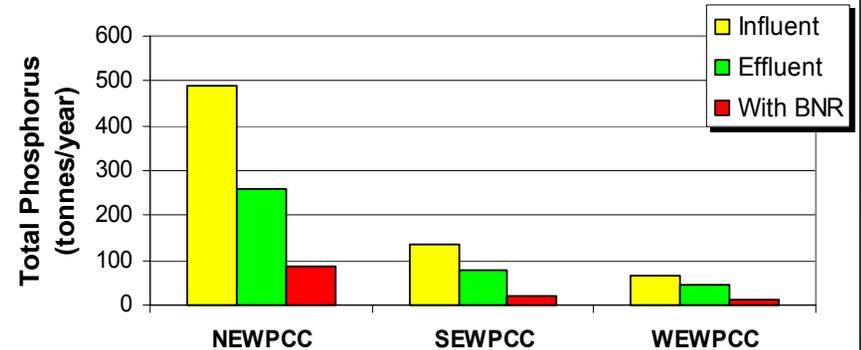
- **Biological Nutrient Removal (BNR)**
- **Final effluent quality at Wastewater Treatment Plants**
 - **Total Nitrogen 10 mg/L**
 - **Total Phosphorus 1 mg/L**
- **Total estimated capital cost to implement BNR at all three plants**
 - **\$ 181 Million**

Nutrient Characterization

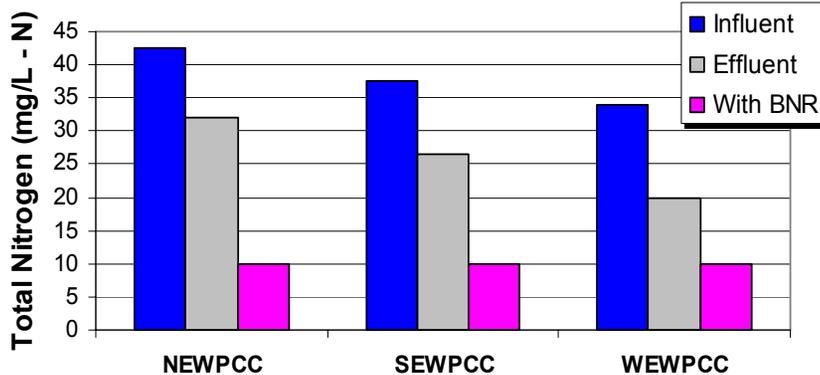
**Average Phosphorus Concentration
Winnipeg's Wastewater Treatment Plants**



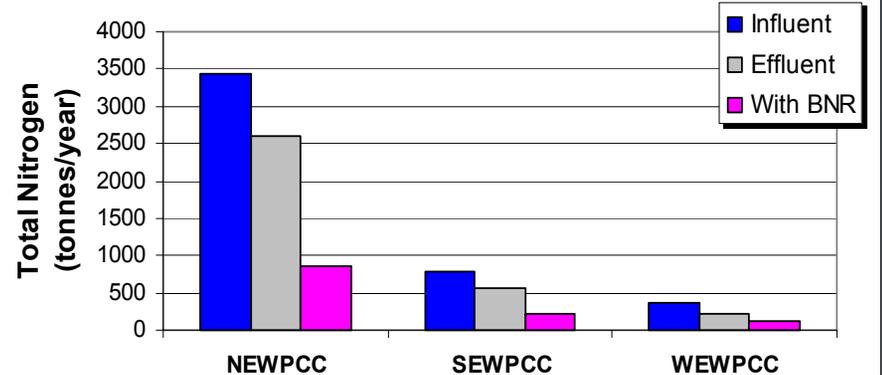
**Total Annual Phosphorus Discharges From
Winnipeg's Wastewater Treatment Plants**



**Average Nitrogen Concentration
Winnipeg's Wastewater Treatment Plants**



**Total Annual Nitrogen Discharges From
Winnipeg's Wastewater Treatment Plants**



Nutrient Characterization

Estimated** Nutrient Loading to Lake Winnipeg

	Total N tonne/year		Total P tonne/year	
	Province's Estimates	Province's Estimates w/BNR at WPCCs	Province's Estimates	Province's Estimates w/BNR at WPCCs
Red River w/o Winnipeg	29,118	29,118	4,490	4,490
Winnipeg River	16,817	16,817	788	788
Saskatchewan River	7,807	7,807	307	307
Dauphin River	3,294	3,294	50	50
Brokenhead River	232	232	12	12
Atmospheric Loads	9,500	9,500	475	475
Winnipeg (WPCC,s CSOs, LDS)	3,647	1,461	414	154
Totals (tonnes/year)	70,415	68,229	6,536	6,276
Winnipeg's Percent Contribution	5.2%	2.1%	6.3%	2.5%
Reduction (tonnes/year)	-	2,186	-	260

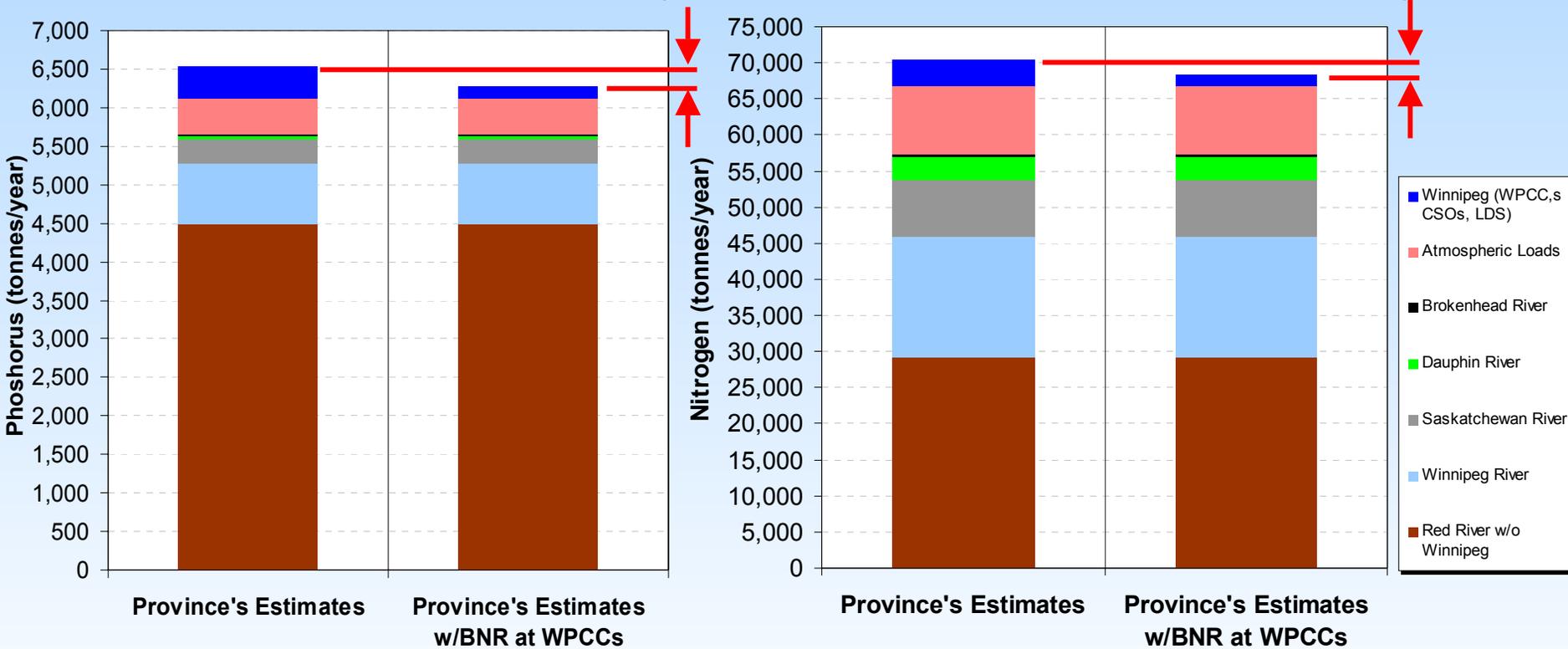
** Source: Manitoba Conservation, Nov 2002: "A Preliminary Estimate of Total Nitrogen and Total Phosphorus Loading to Streams in Manitoba, Canada".

Nutrient Characterization

Nutrient Removal at All Winnipeg WPCCs \$181 Million

**3.8 % Reduction
260 tonnes/year**

**3.1 % Reduction
2200 tonnes/year**



Nutrient Characterization

Overall strategy needed

● Complex Issue

- What are the problems?....Lakes? Rivers?
- What are the costs and benefits?
- What nutrient needs to be managed?
 - Nitrogen and/or Phosphorus?
- How to address point and non-point sources?
 - Must be fair and effective
- All are under study to be resolved

Nutrient Characterization

Overall strategy needed

● **Complex Issue**

- ◆ **Basin-wide issue involving multiple stakeholders**
- ◆ **MB Conservation has initiated such a study**
- ◆ **Winnipeg has a vested environmental and financial interest in the issues**
- ◆ **Winnipeg looking to participating in development of nutrient management strategy for Manitoba**

Nutrient Characterization

City's Recommendation:

● **Nutrients in Effluent Discharges**

◆ **City recommends that limits for Nitrogen and Phosphorus not be established until:**

- ▶ **Province completes basin-wide Nutrient Management Study: and**
- ▶ **Conducted stakeholder and public consultations.**