Water Quality in the Duck Mountains and Surrounding Regions:

An assessment of current condition and historical trends

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Water Quality Management Section

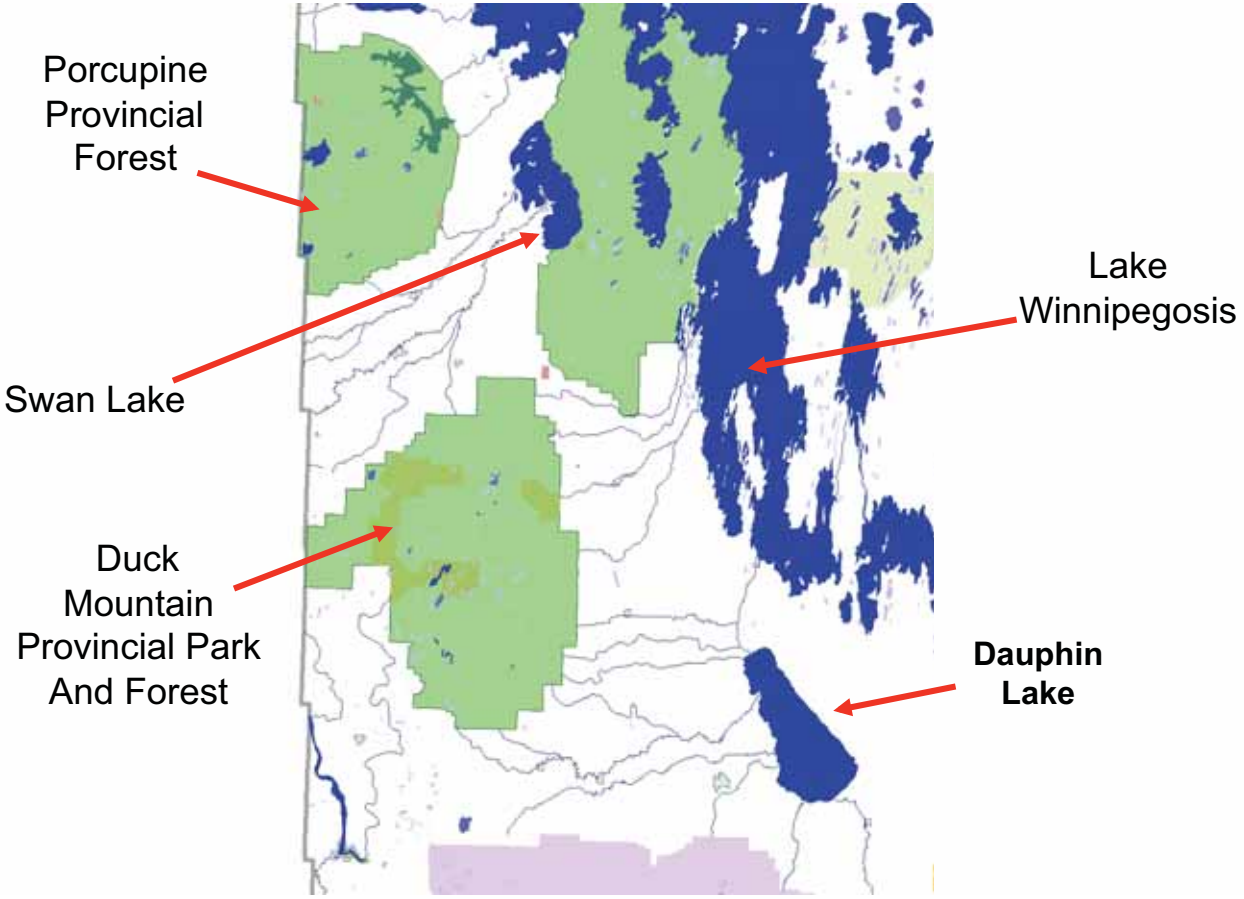
Manitoba Water Stewardship

Manitoba

Overview

- Background to Area of Study
- Evaluating Water Quality: The Basics
- Water quality and relationship to land use and climate pressures
- Water quality in the Duck Mountains and surrounding regions:
  - Trends in nutrient concentrations
  - Trends in Canadian Water Quality Index (CWQI)
  - Trends in biological condition using benthic macroinvertebrates
  - Current status of water quality → Manitoba Water Quality Standards, Objectives, and Guidelines (MWSOGs)

Background to Area of Study



Evaluating Water Quality: The Basics

- Questions:
  - Is water quality getting better or worse?
  - Is water quality good or bad?
- What is commonly measured?
  - 100 variables including:
    - Nutrients (phosphorus, nitrogen)
    - Pesticides
    - Metals
- Frequency
  - Dependent on the nature of the study
  - Long term provincial monitoring sites - quarterly

Evaluating Water Quality: The Basics

- Trend analysis – Has there been an increase or decrease in concentrations over time?
- Water Quality Index – Tool for simplifying the reporting of water quality data; much data, one value.
- Biological Condition (macroinvertebrates) – Allows evaluation of integrated set of conditions encountered by aquatic community over time.
- Comparison with objectives, standards, and guidelines – What is the current status of water quality?

CCME Water Quality Index

- Calculations based on:
  - **F1 (Scope)** - number of variables that are in exceedance
  - **F2 (Frequency)** - percentage of tests that are in exceedance
  - **F3 (Amplitude)** - amount or magnitude of exceedances

- Classifications:
  - **Excellent** - virtual absence of threat; pristine
  - **Good** - minor degree of threat or impairment; rare exceedances
  - **Fair** - occasionally threatened or impaired; sometimes depart from desirable
  - **Marginal** - frequently threatened or impaired; often depart from desirable
  - **Poor** - almost always threatened or impaired; usually depart from desirable

Biological Condition

- Site-specific and time-integrated evaluation of water quality
- Community metrics used to categorize sites as to biological condition
  - Taxa Richness
  - Dominant Taxon
  - EPT Index
  - EPT/Chironomidae Ratio
  - Hilsonhoff Biotic Index
  - Ration of Shredders/Total Count

Picture Sources: www.shef.ac.uk
www.aquatax.ca/trichoptera.html
www.ucmp/berkeley.edu/ephemeropter.html

Biological Condition

Nonimpaired	-Balanced trophic structure -Community structure is optimal for stream size and habitat quality
Slightly Impaired	-Community structure less than expected -Absence of some intolerant groups -Percent contribution of tolerant groups increases
Moderately Impaired	-Fewer species are present -Absence of most intolerant groups -Reduction in EPT index
Severely Impaired	- If higher numbers of organisms are present, dominated by one or two species.

Water quality and relationship to land use and climate pressures

- Artificial addition of nutrients to Manitoba watercourses and waterbodies can be related to land use:
  - Point Source (*e.g.*, industrial discharge, lagoon outflow)
  - Non-point Source (*e.g.*, runoff from fields, flow from damaged septic system)
- Climate pressures
  - Increased water flow with precipitation events → increase in runoff → increase in suspended material and nutrients

Water quality in the Duck Mountains and surrounding regions, Manitoba

- Valley River
- Mossy River
- North Duck River
- Swan River
- Woody River

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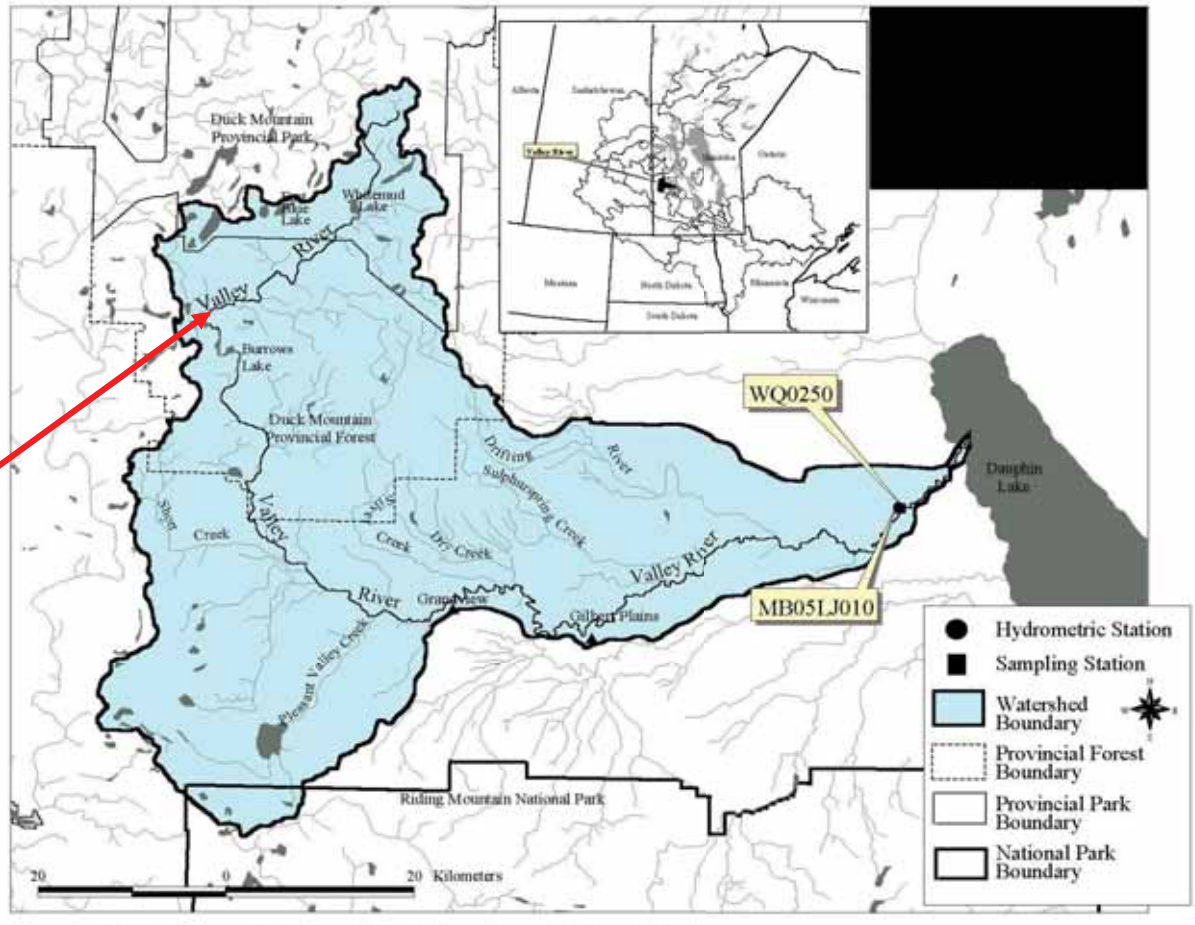
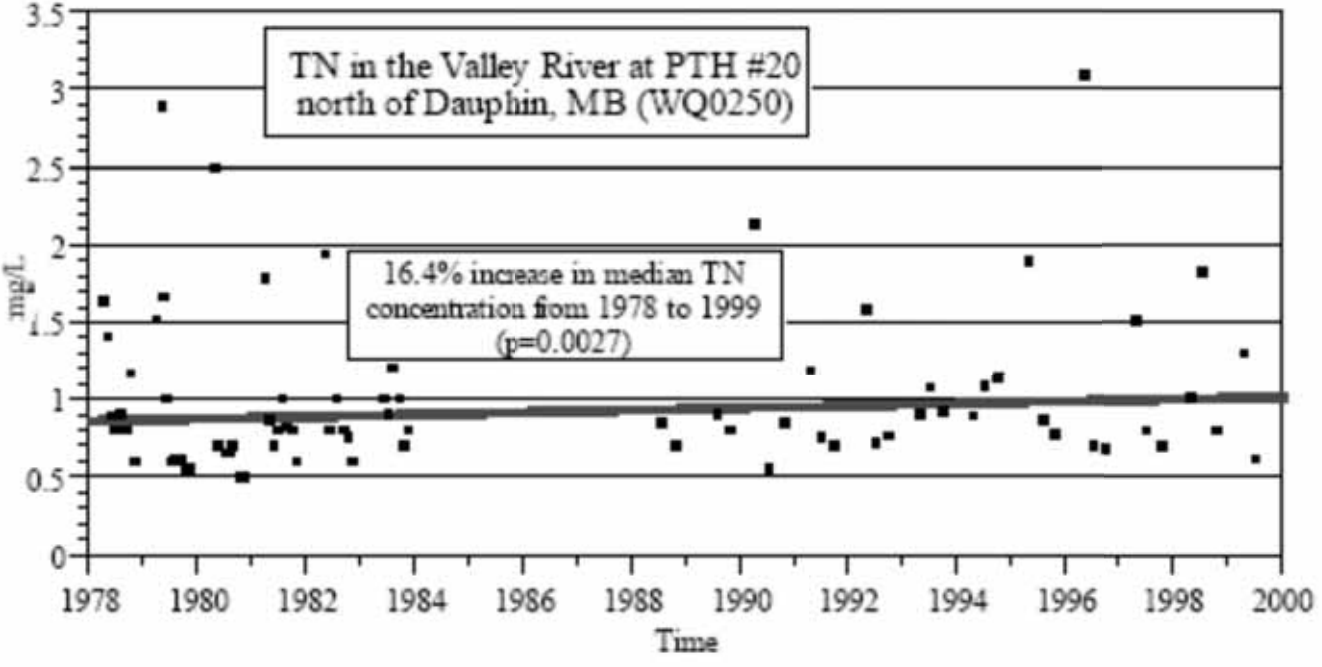
Valley River



Trends in Nitrogen – Valley River



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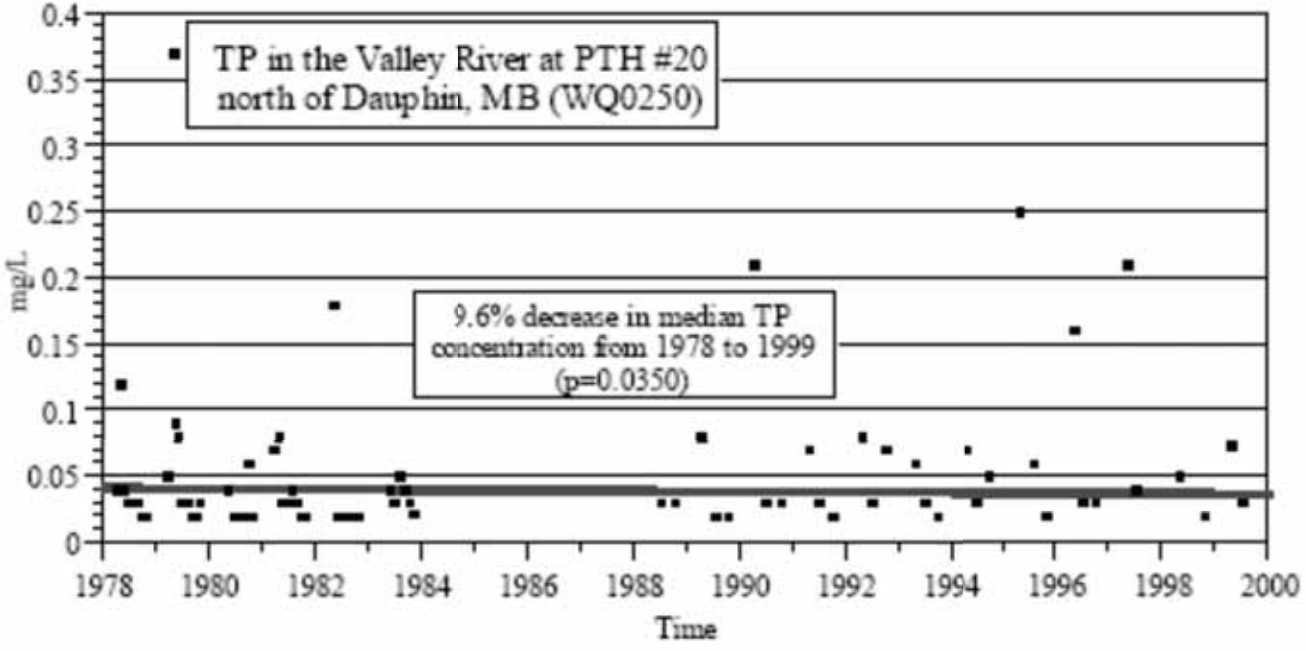

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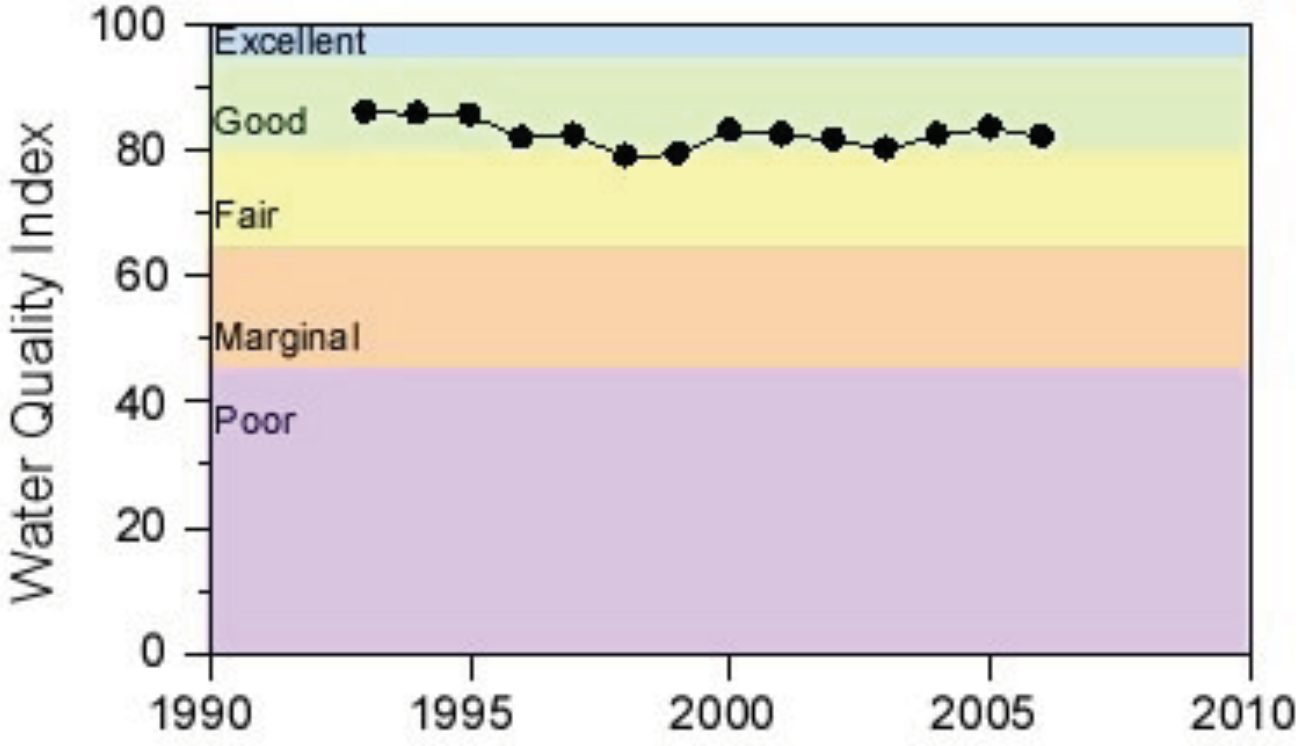
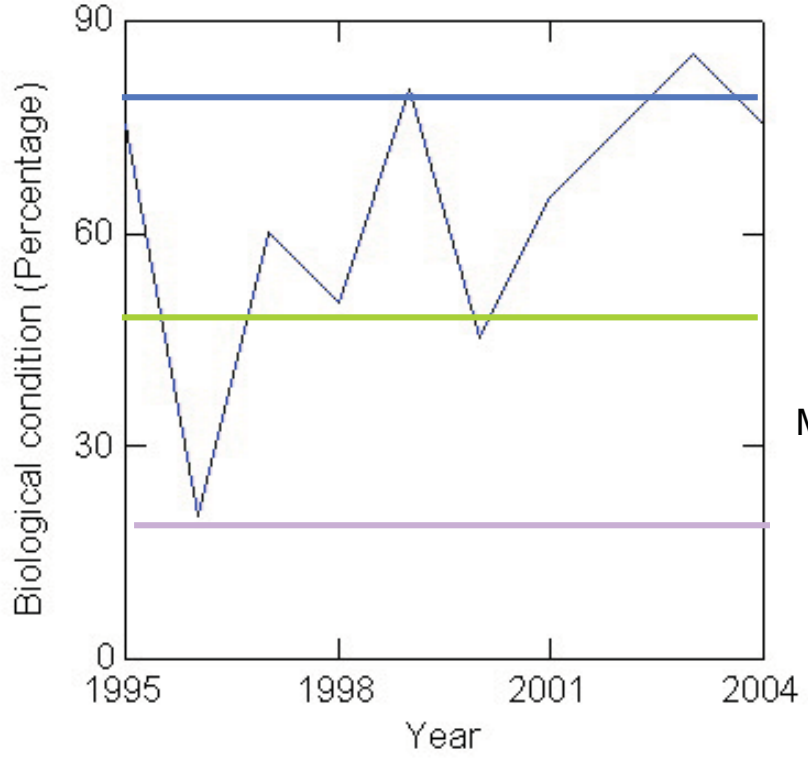
Valley River: Trends in CWQI (1993 – 2006)



Valley River – Trend in Biological Condition



Non Impaired (> 83 %)

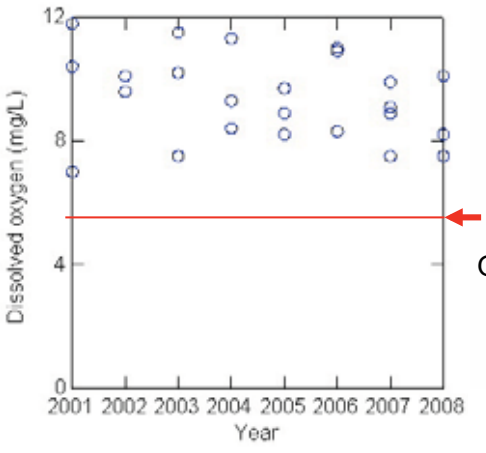
Slightly Impaired (54 – 79 %)

Moderately Impaired (21 – 50 %)

Severely Impaired (< 17 %)

Source: Hughes, 2009

Valley River - Current Conditions



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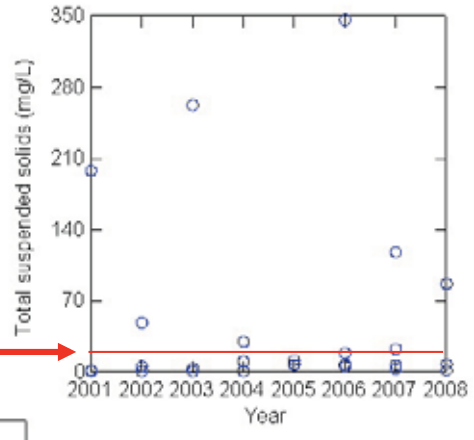

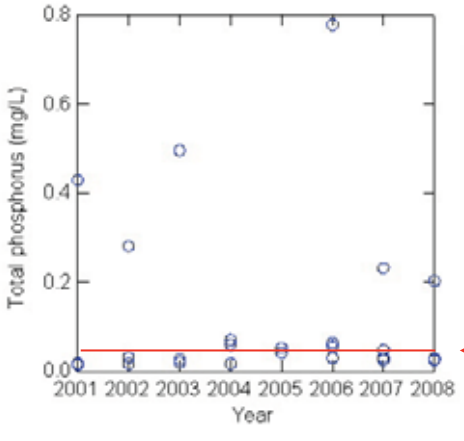

Manitoba Objective = 0.05 mg/L

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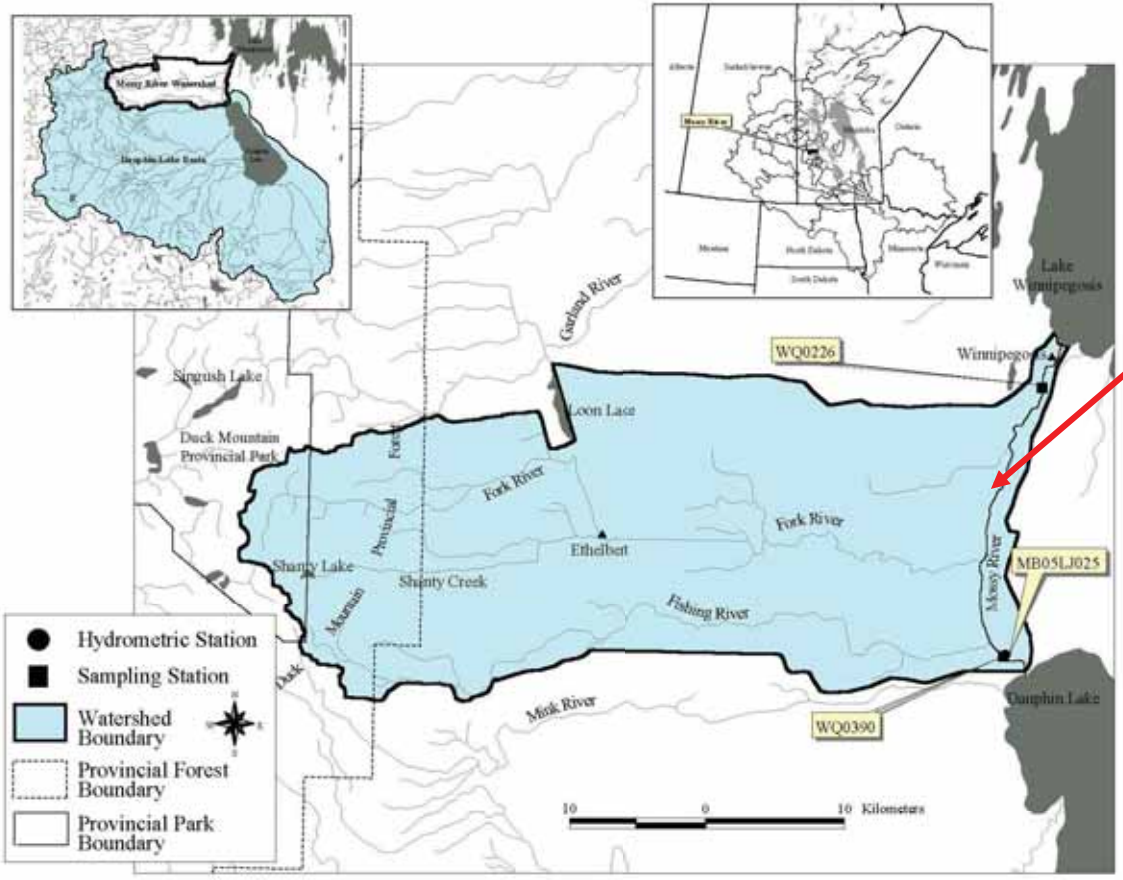
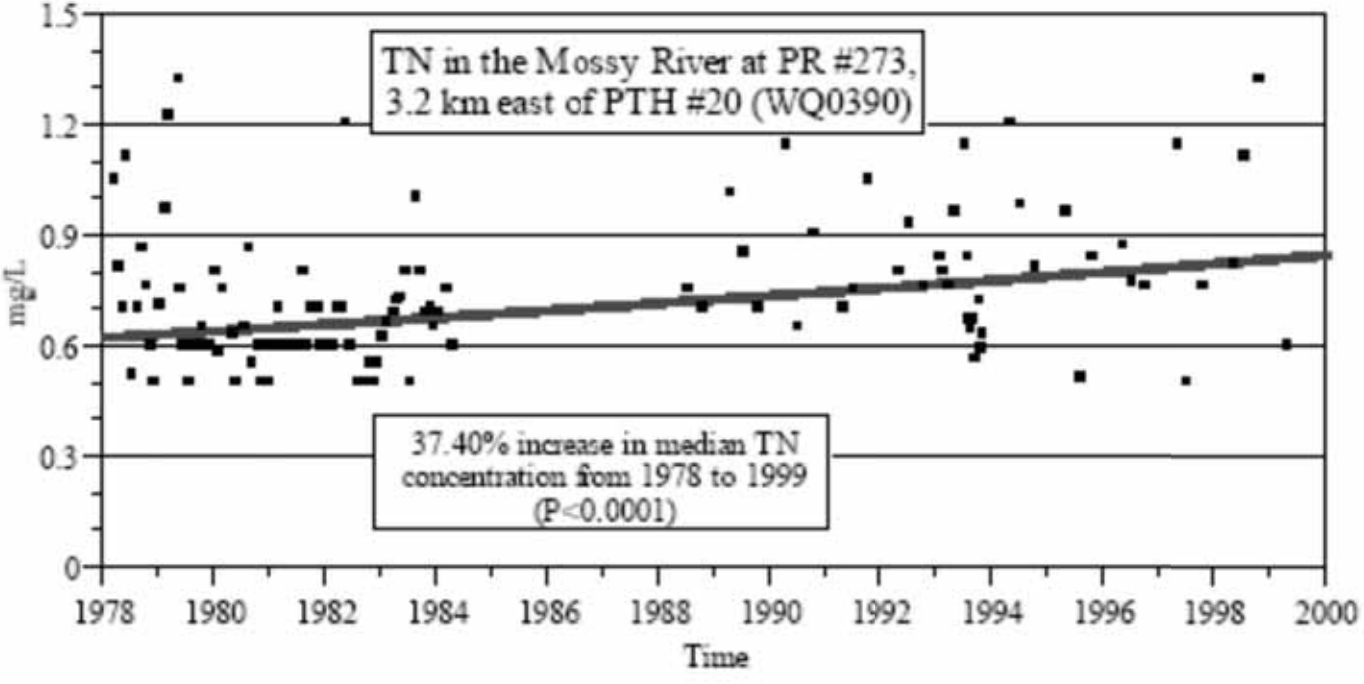


Mossy River

Trends in Nitrogen – Mossy River



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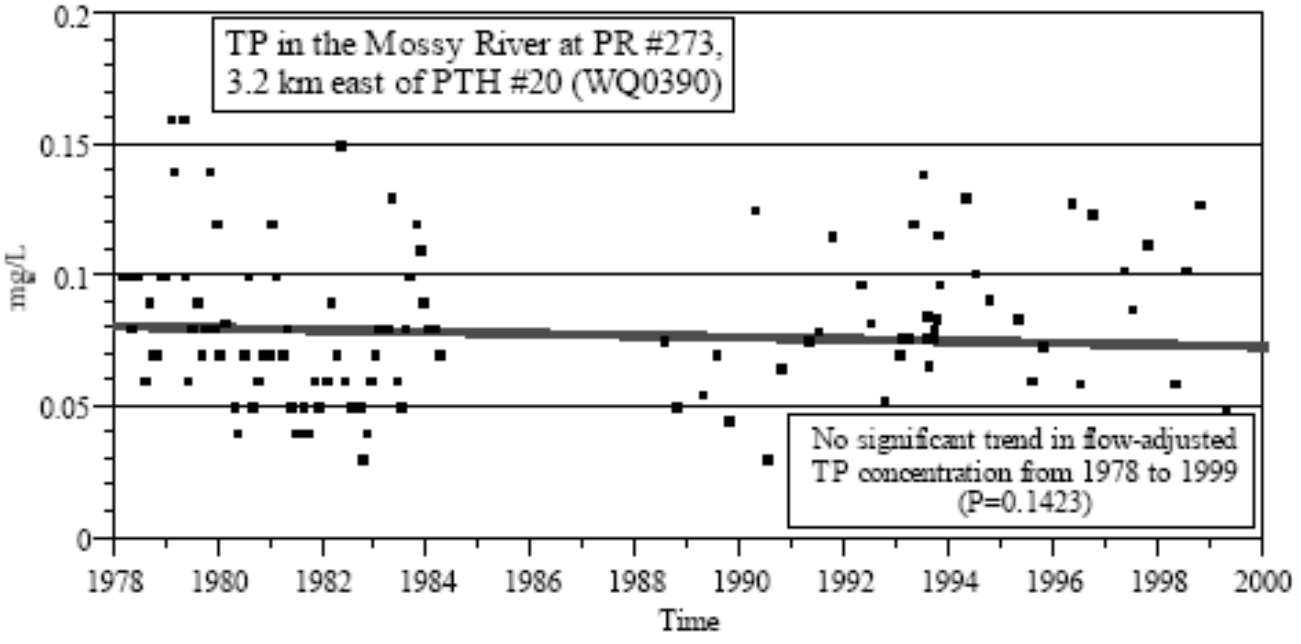

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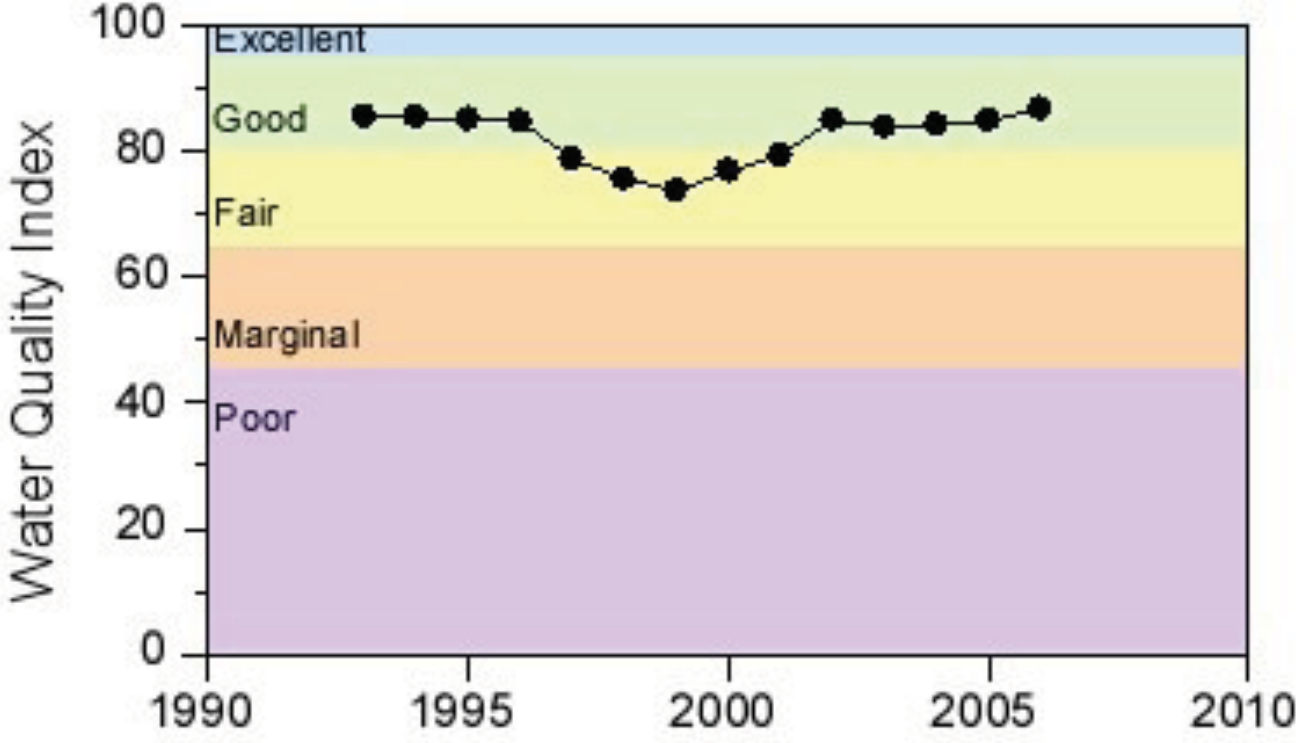

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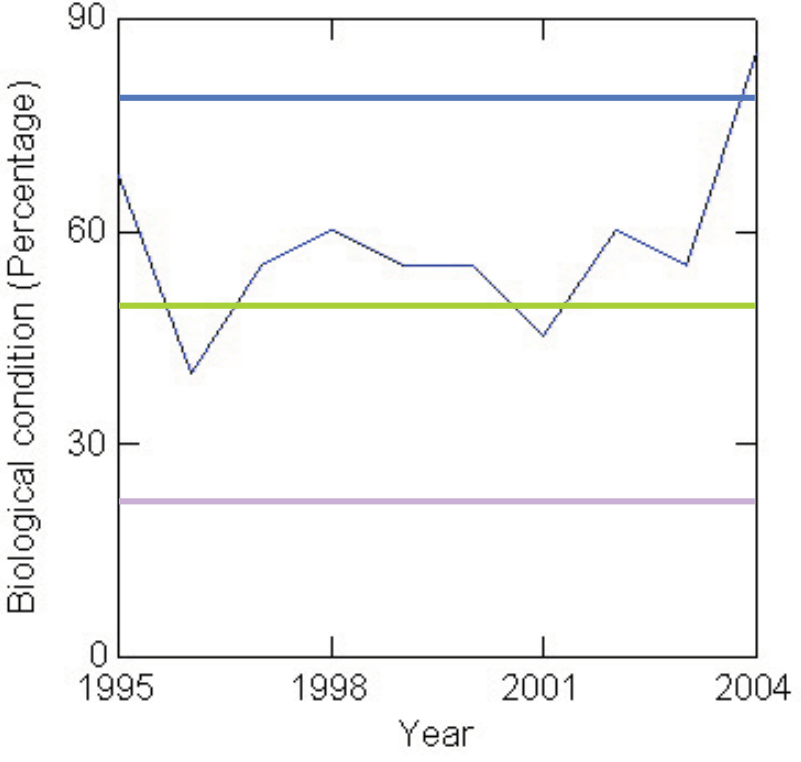

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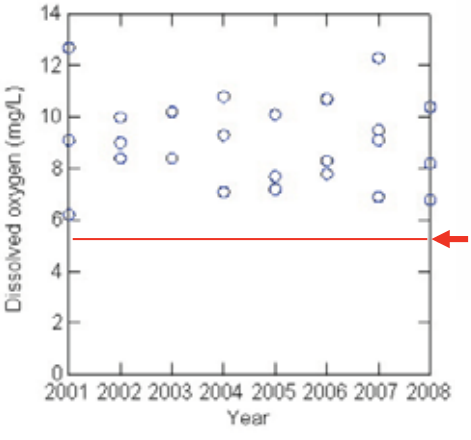

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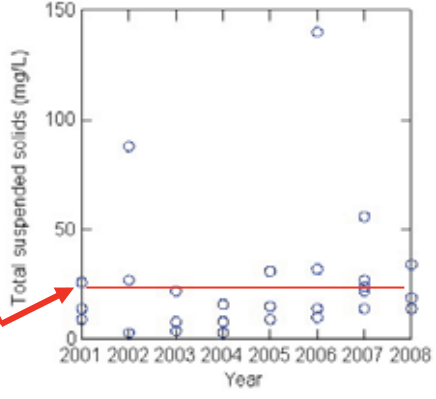

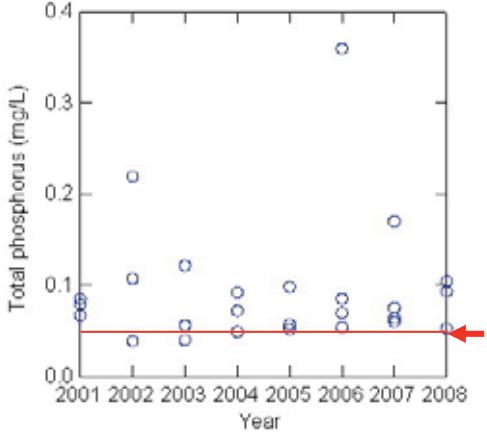

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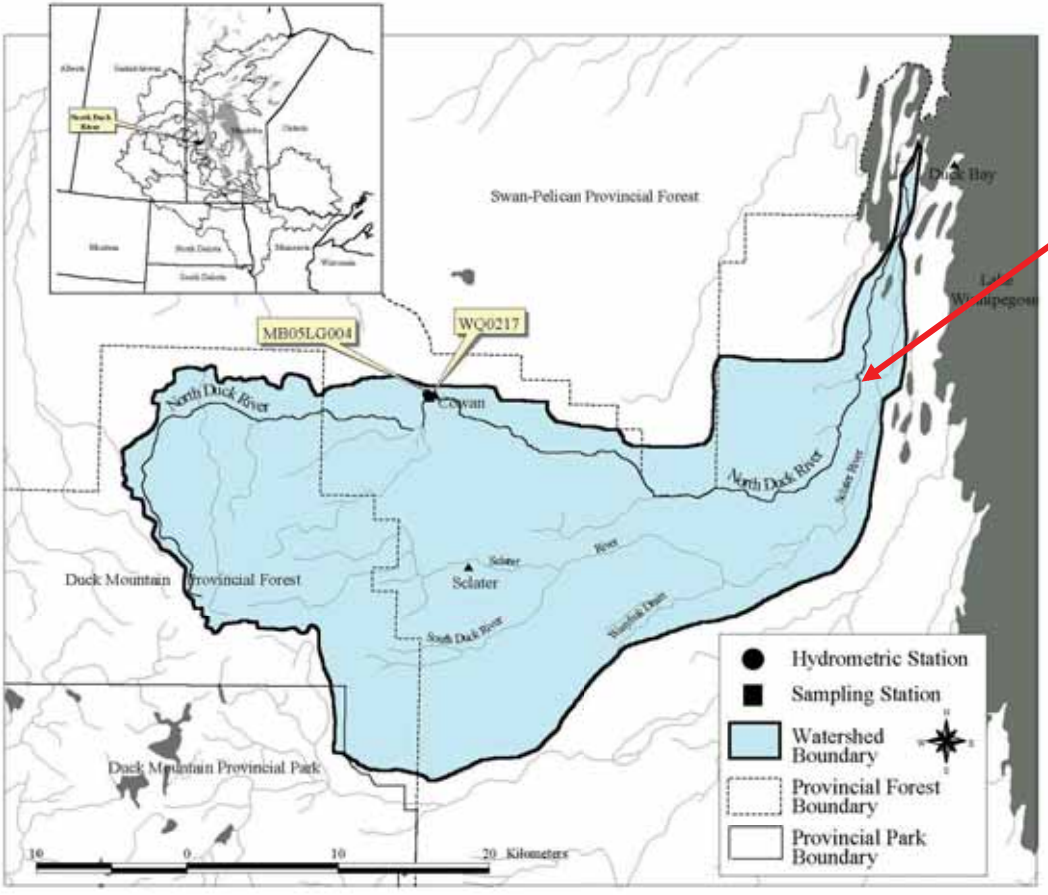
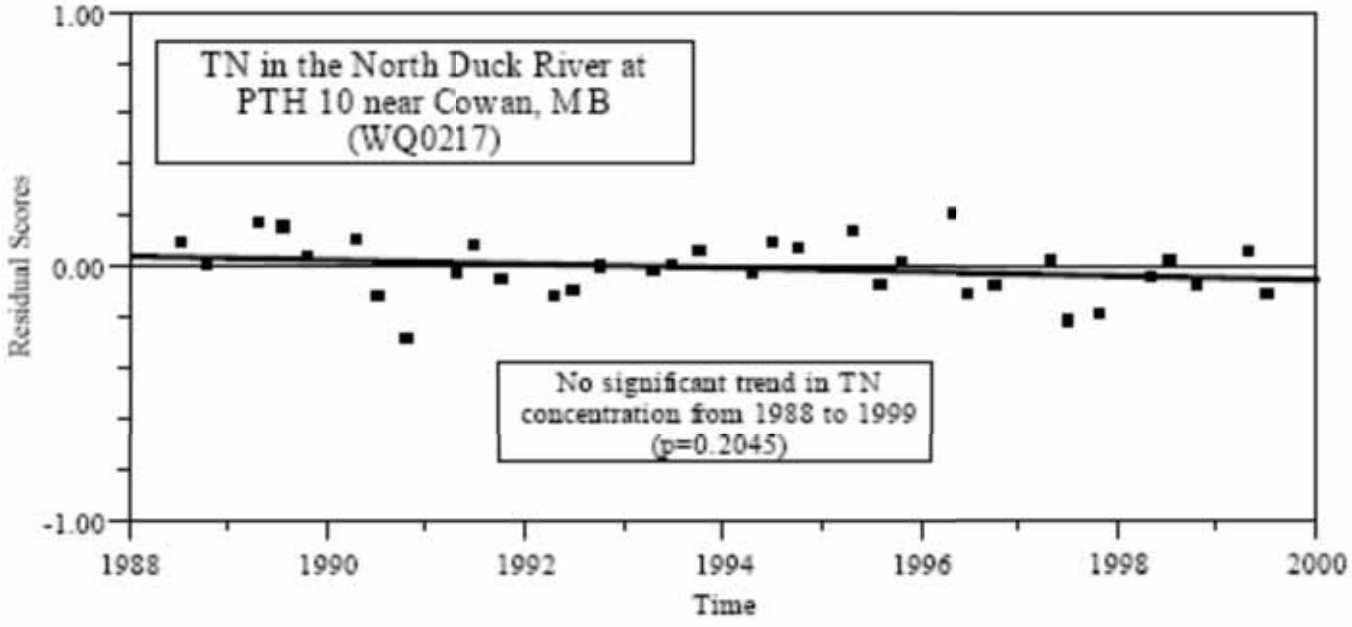


North Duck River

Trends in Nitrogen – North Duck River



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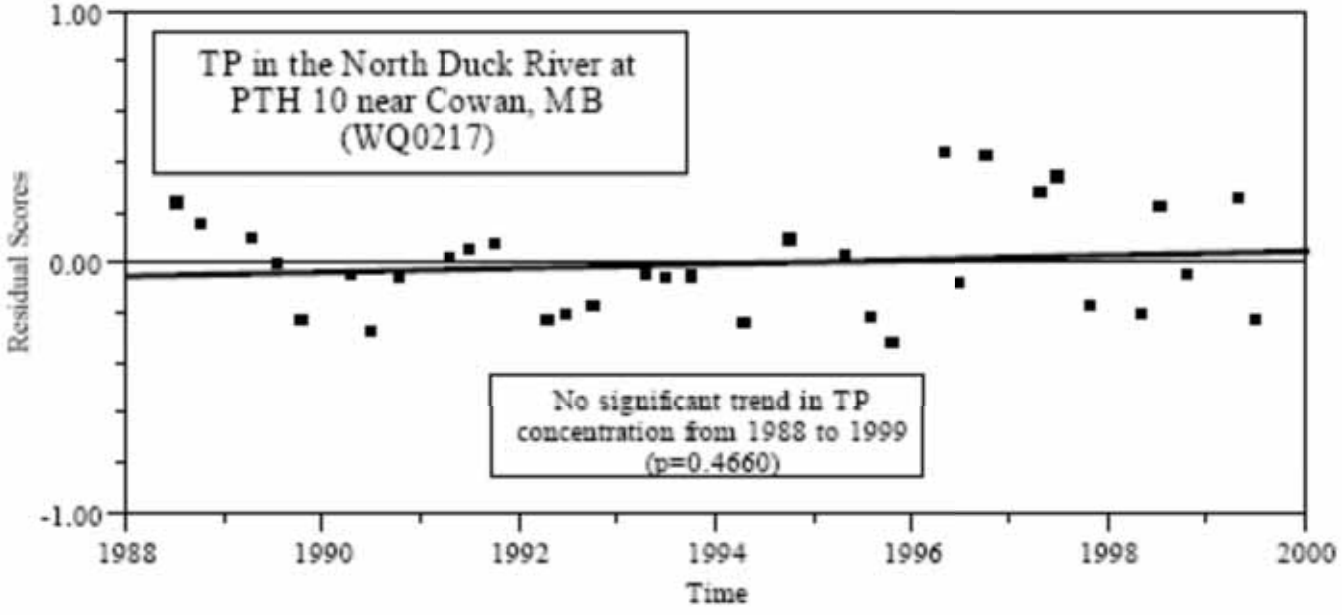

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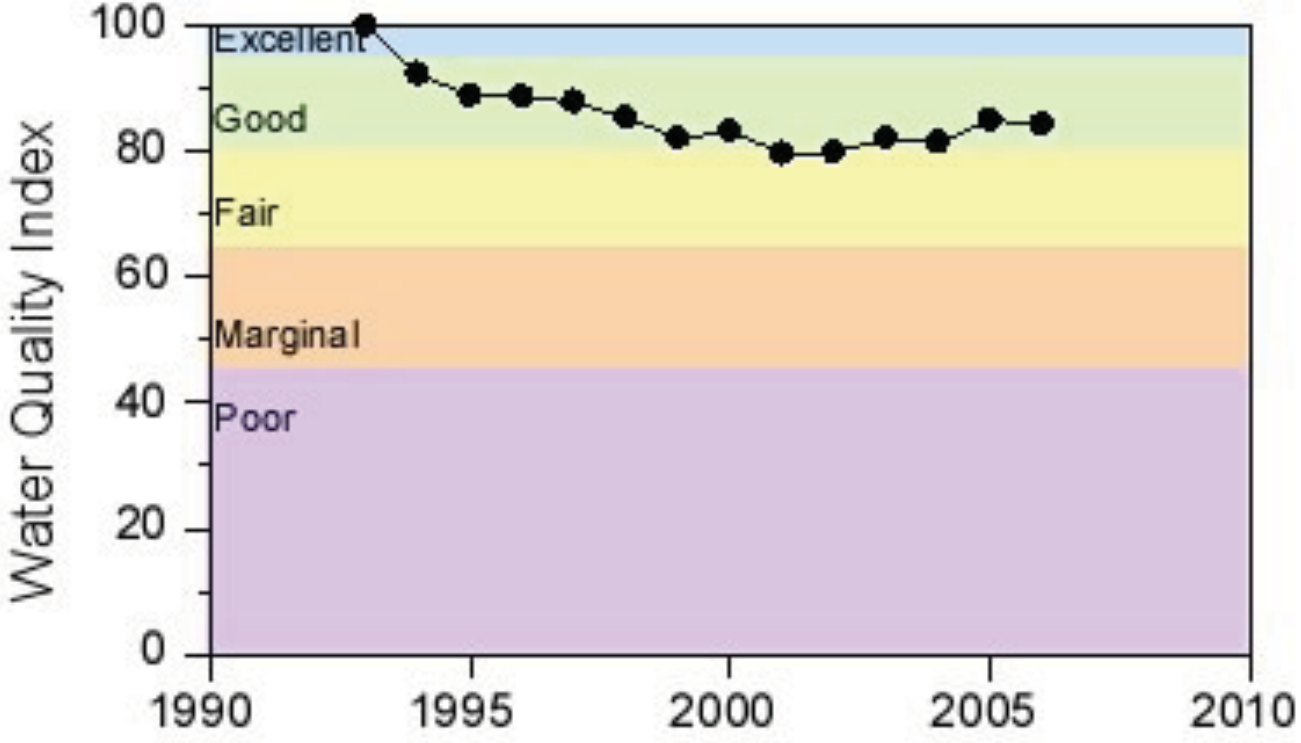

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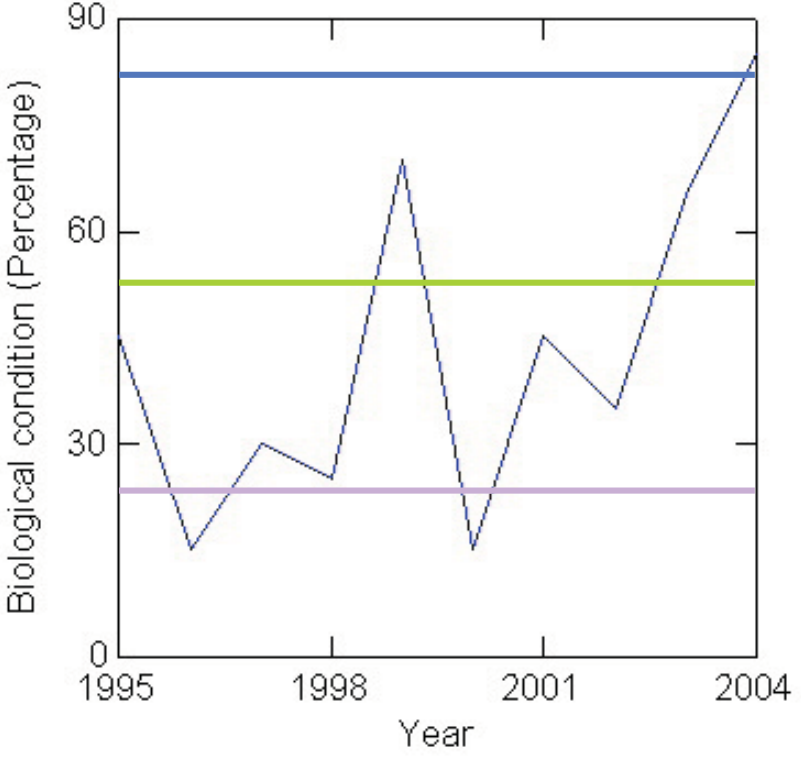

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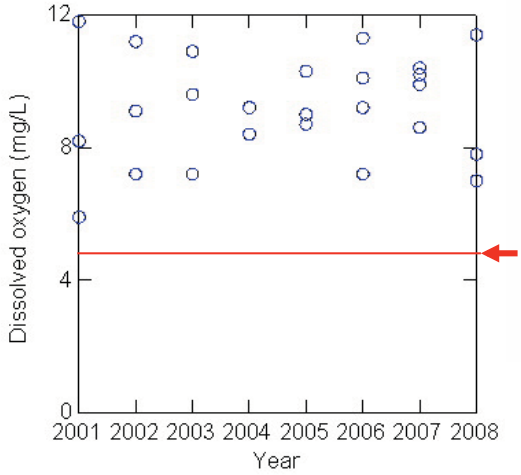

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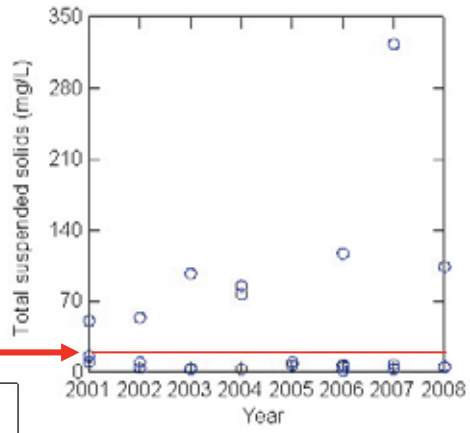

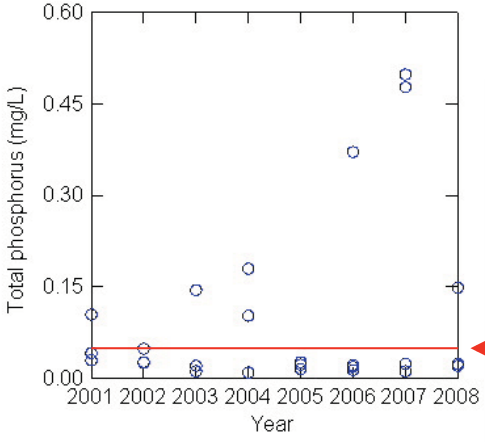

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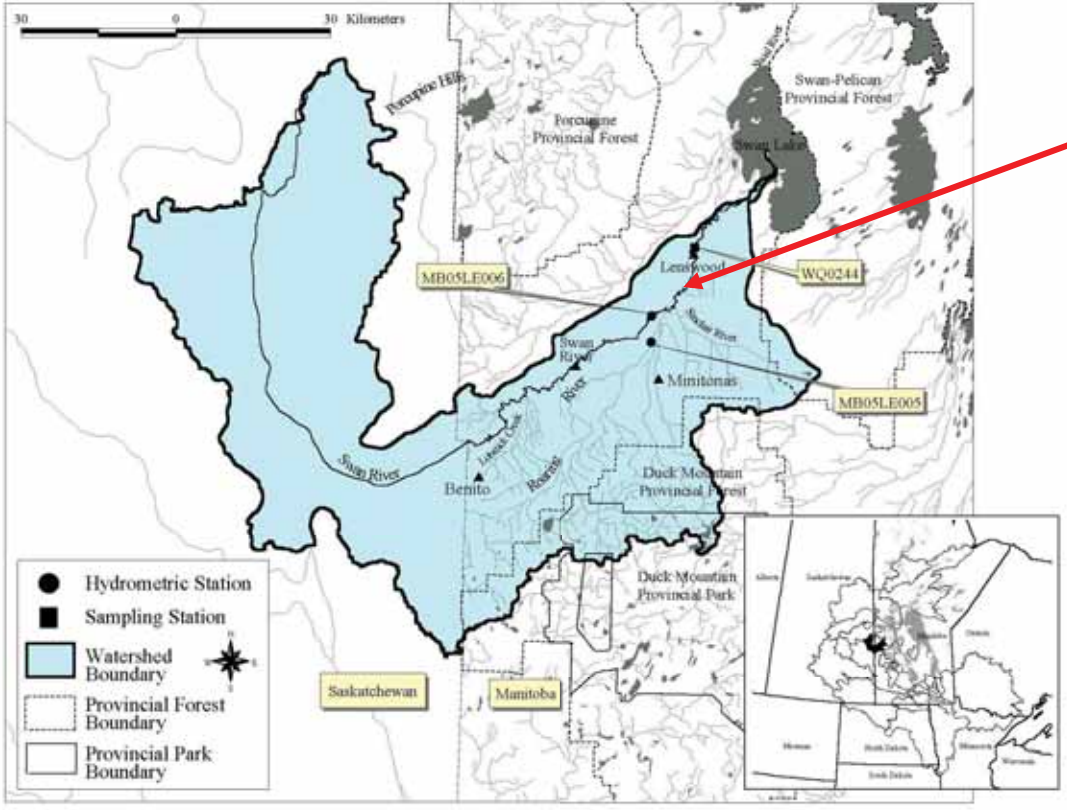

Swan River

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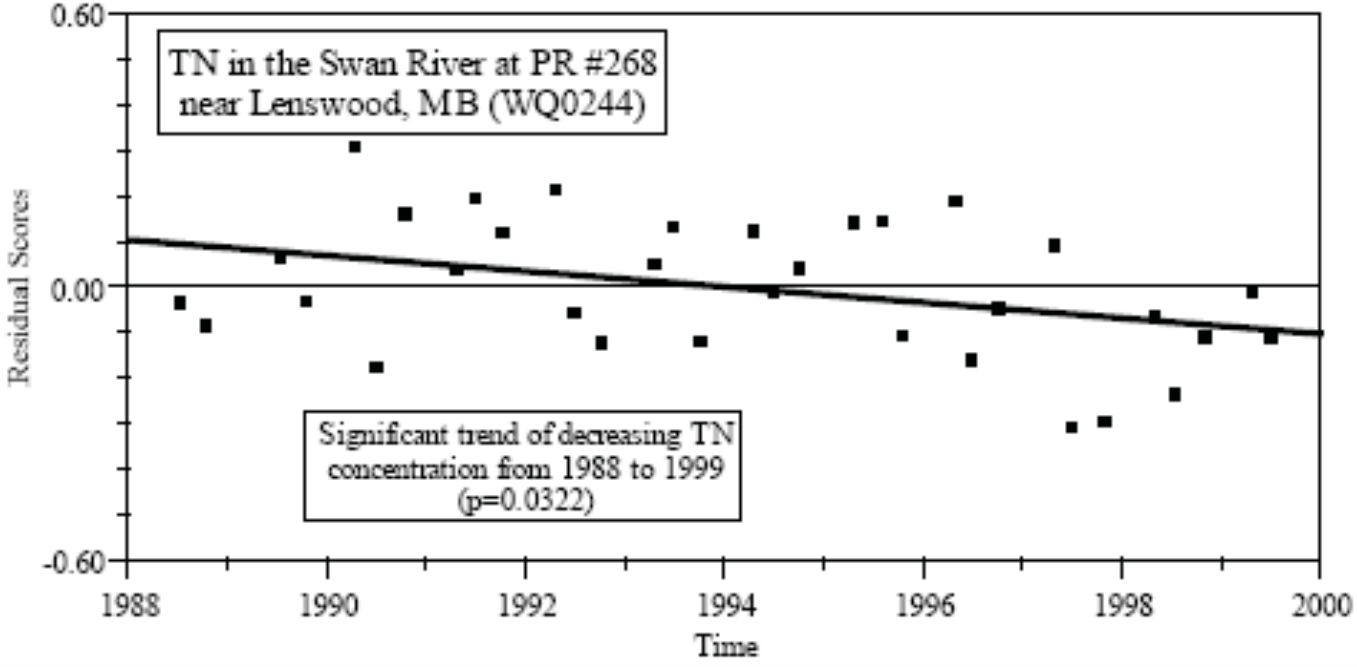

Source: Jones and Armstrong, 2001

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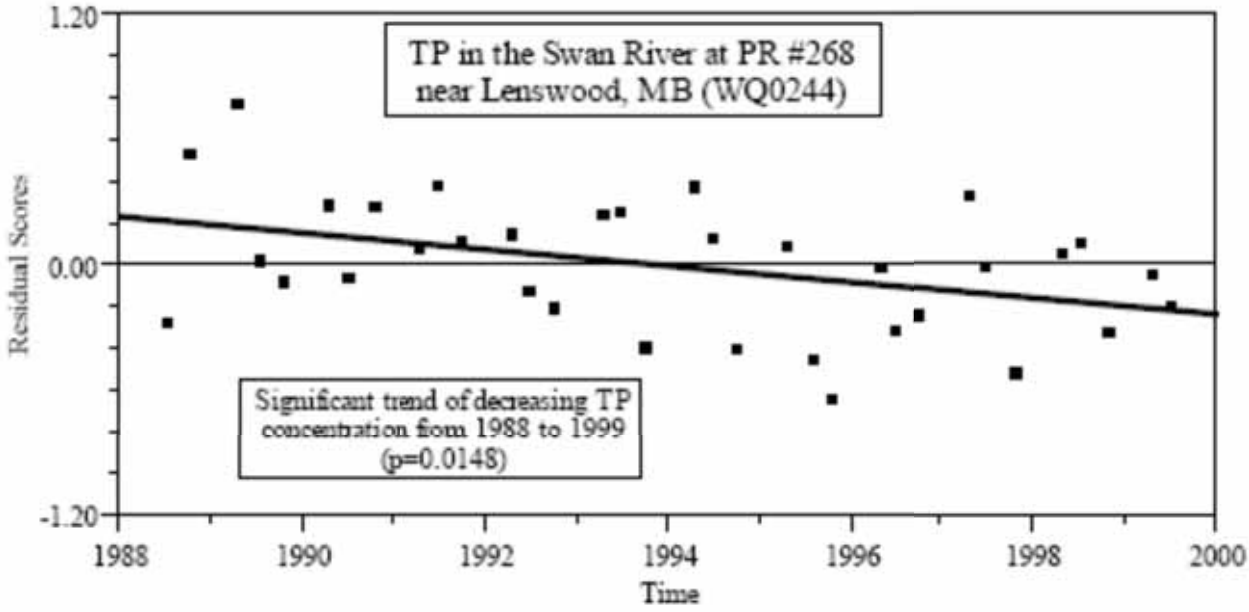

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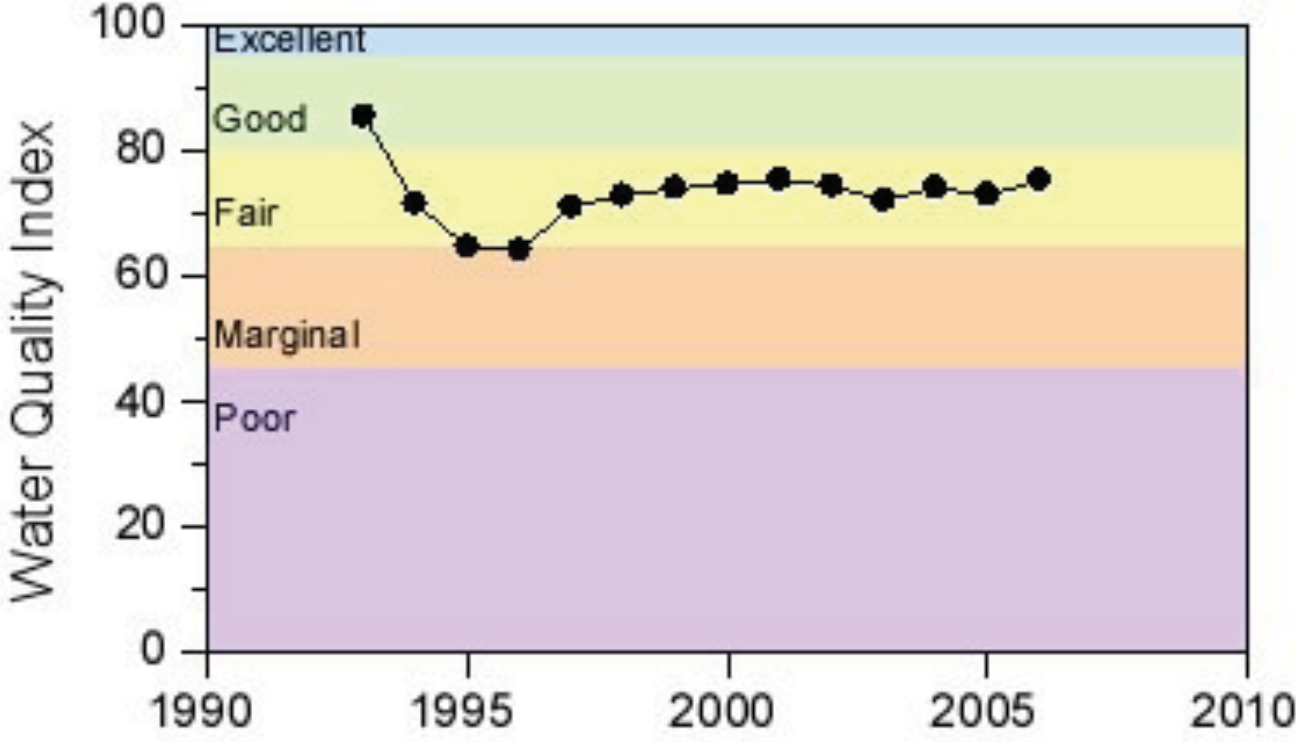
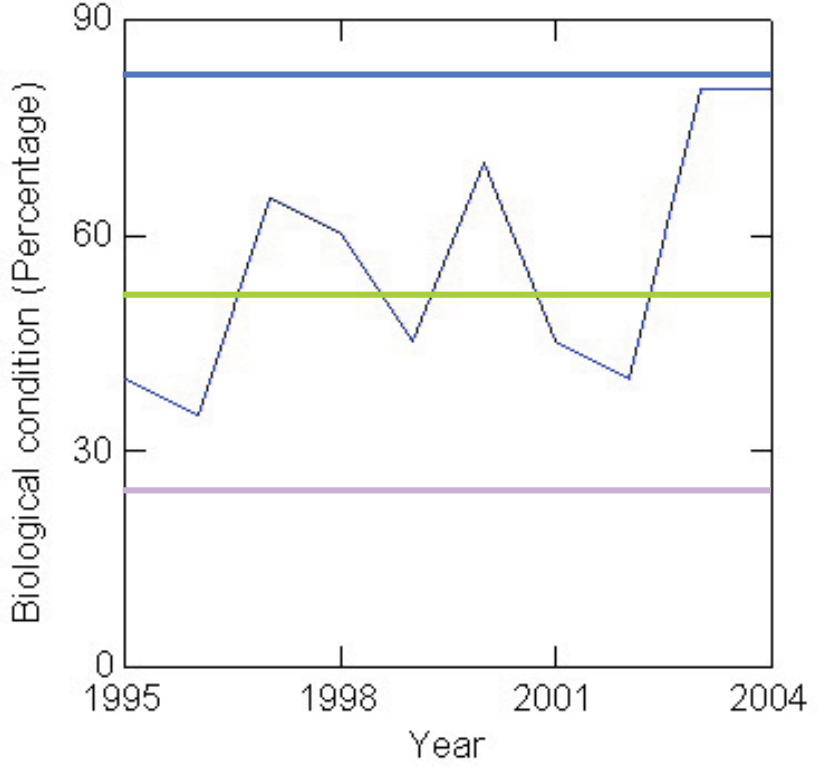


Swan River – Trend in Biological Condition



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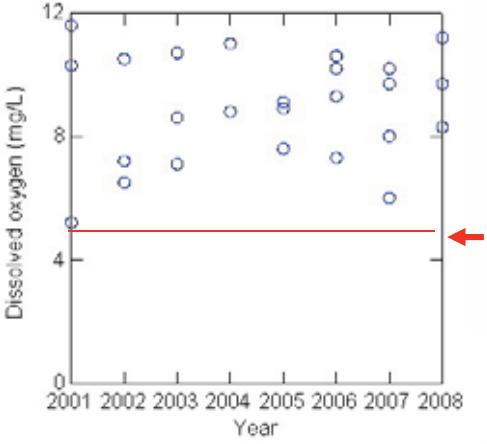

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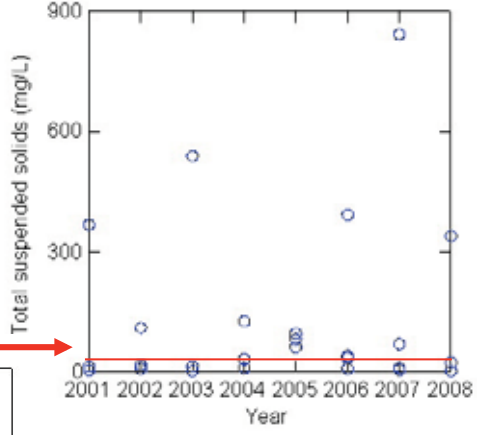

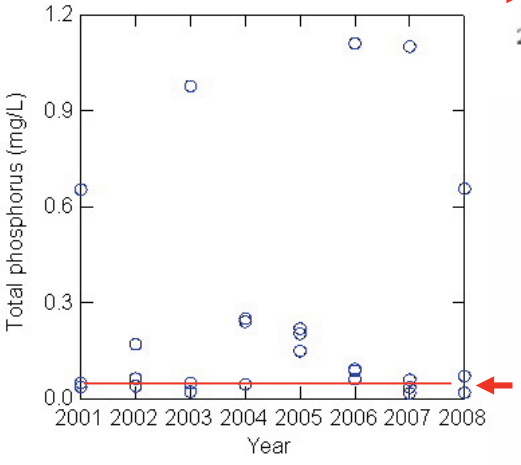

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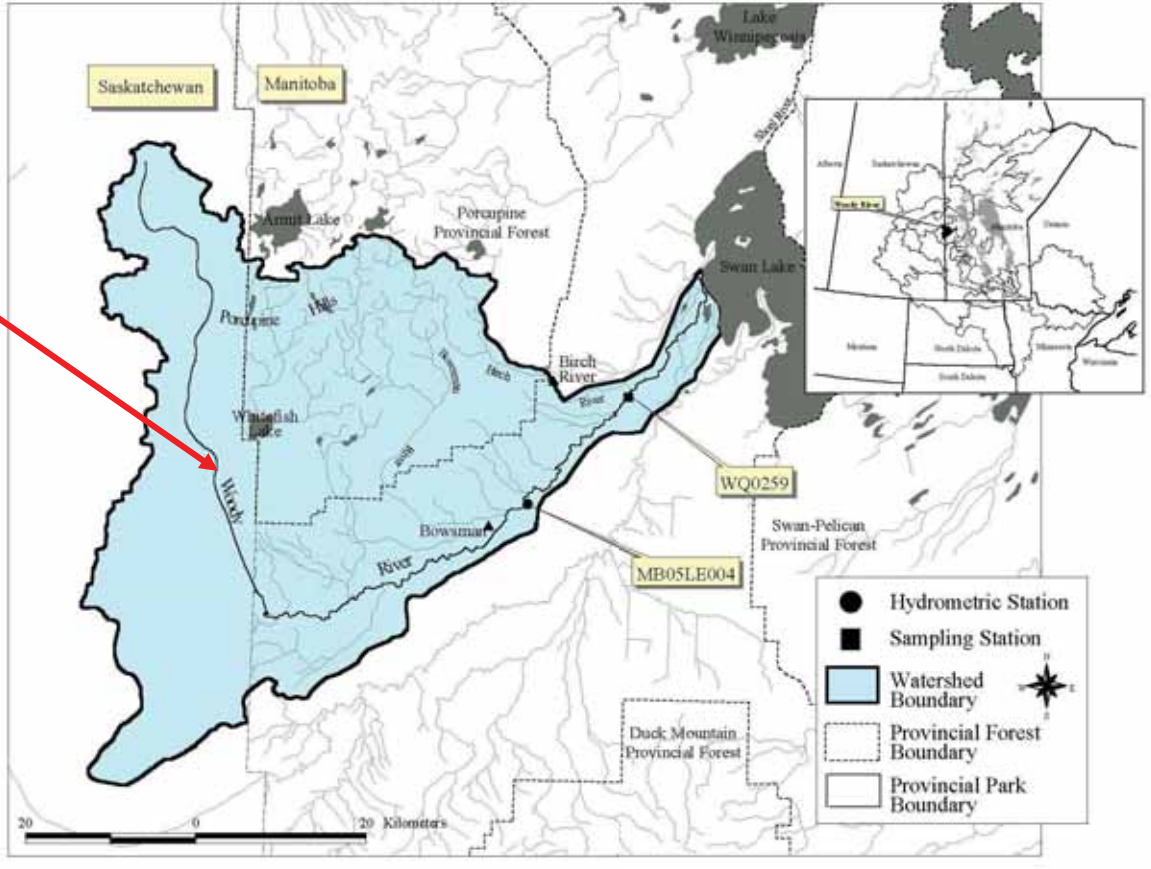
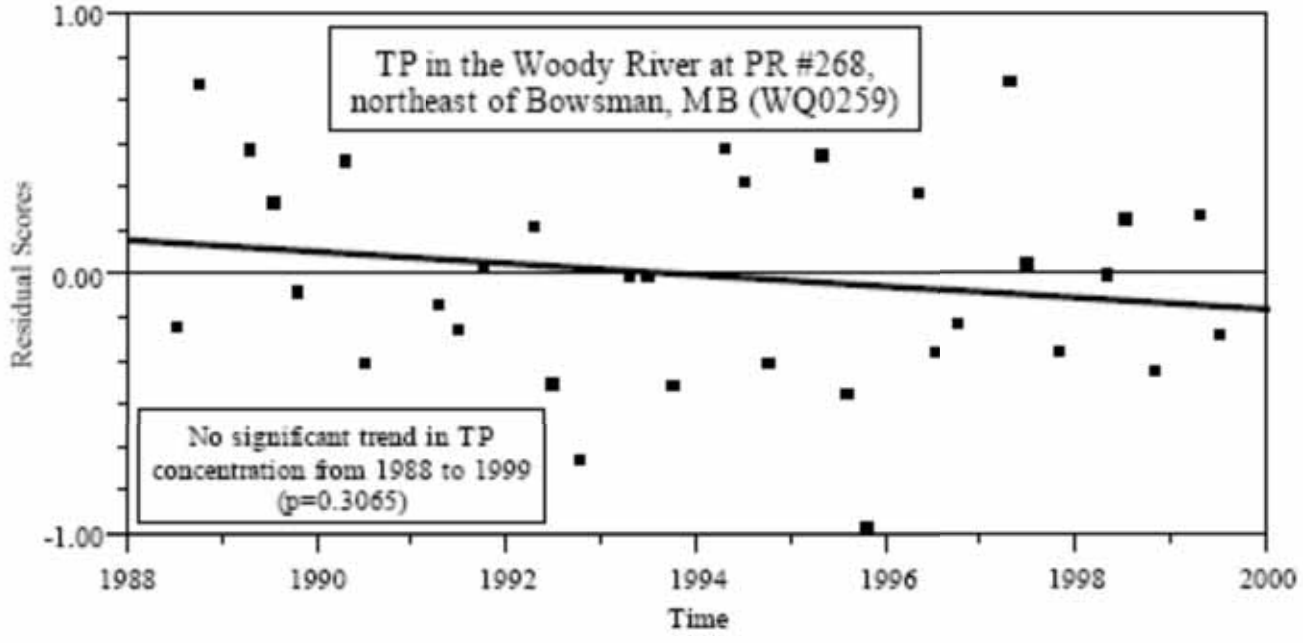
Woody River



Trends in Phosphorus – Woody River



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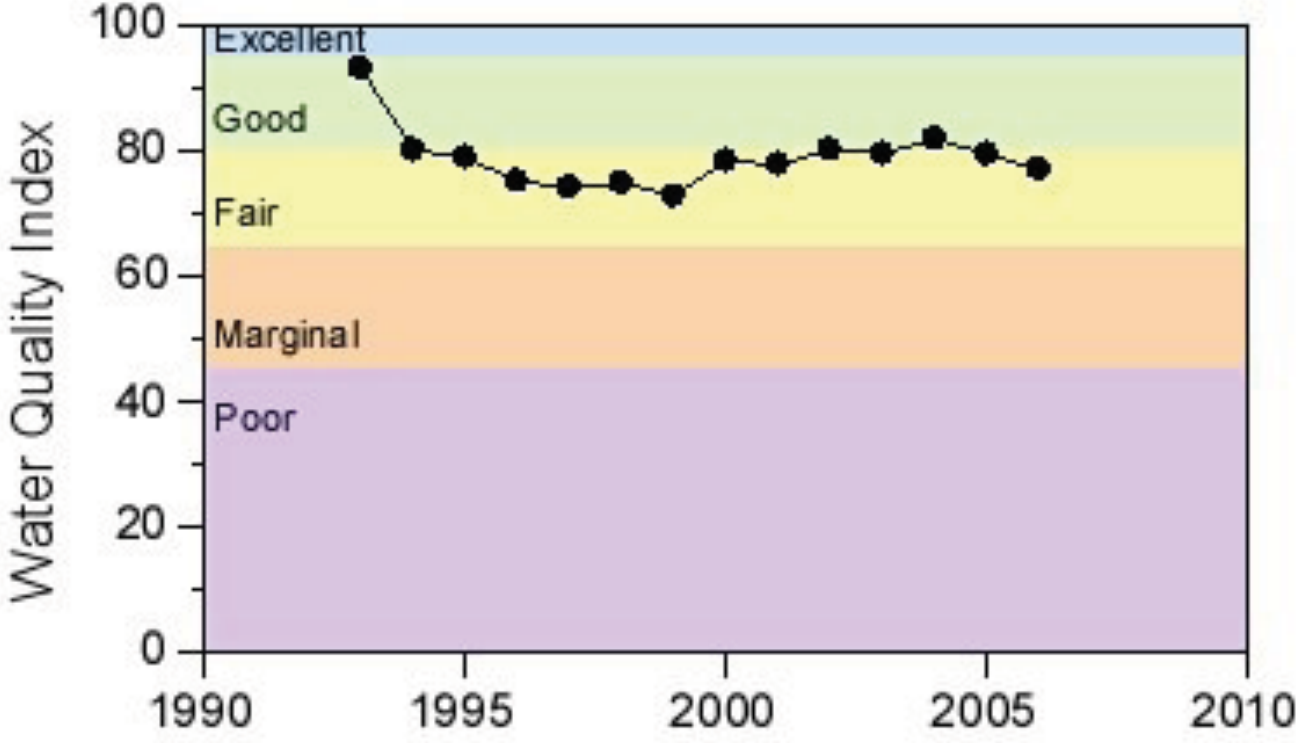

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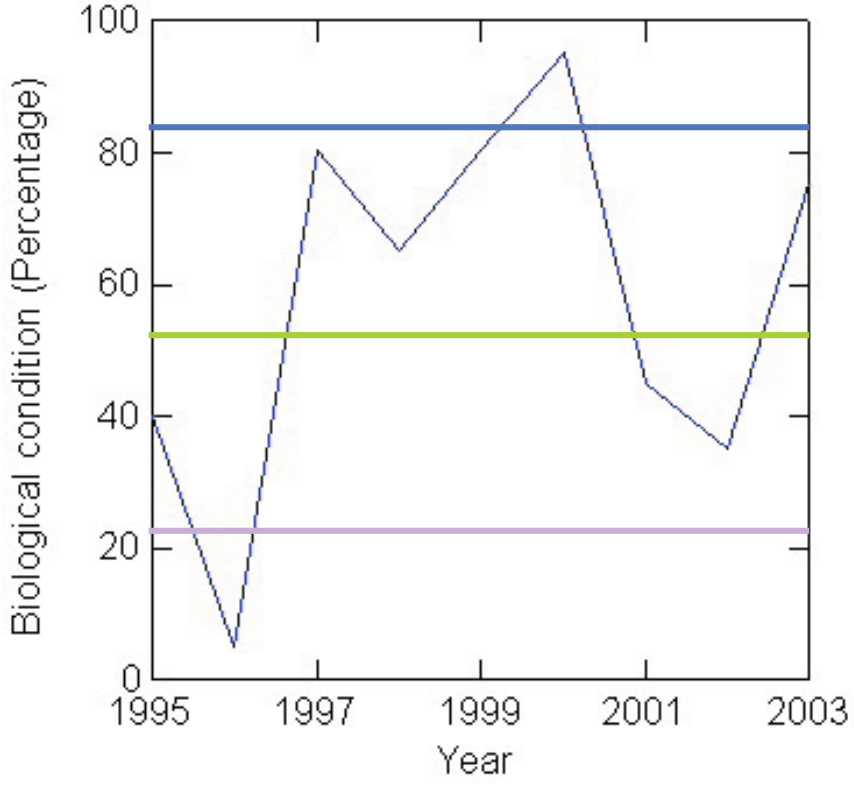

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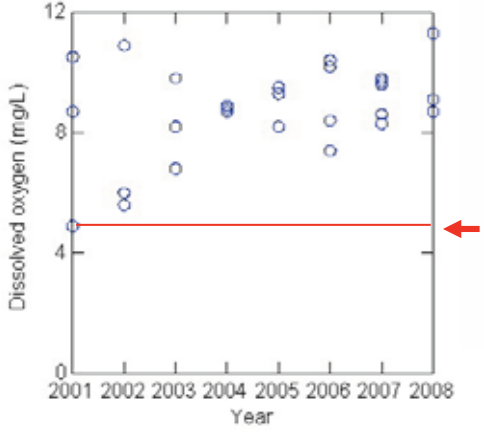

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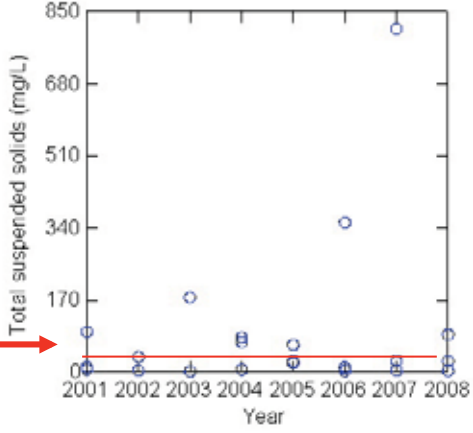

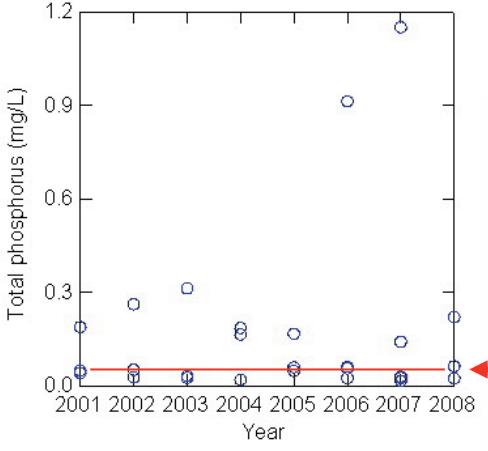

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Summary

	Valley	Mossy	North Duck	Swan	Woody
Nitrogen	↑	↑	**0**	**0**	N/A
Phosphorus	↓	**0**	**0**	↓	**0**
CWQI	Good	Fair/Good	Fair/Good	Good/Fair	Good/Fair
BCI	Slight Impairment	No impairment	No impairment	No impairment	Slight Impairment
O_2	Above Objective	Above Objective	Above Objective	Above Objective	Above Objective
TP TSS	Some	Several	Some	Several	Several

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Thank You