# Annapolis River Guardians
# Summary of 2004 Water Quality Monitoring Results

Prepared by Clean Annapolis River Project, March 2005

## Introduction

The Annapolis River Guardians is a volunteer-based water-quality monitoring program, which has been active since 1992. Since its inception, the program has involved approximately 90 volunteers in the collection and analysis of over 3400 water samples. This newsletter presents a summary of the 2004 River Guardians monitoring report. The full report can be found at ***www.annapolisriver.ca***

The Annapolis River Guardians is operated by the Clean Annapolis River Project (CARP). CARP is a charitable, community-owned corporation created to work with the community and interested organizations to foster the conservation, restoration and sustainable use of the freshwater and marine ecosystems of Nova Scotia's Annapolis River and its watershed.

## Program Objectives

The Annapolis River Guardians program has four objectives:

- To establish and support a regular observation system which will provide an early warning of environmental problems.
- To provide a long term record of the river's health.
- To develop interest in the Annapolis River and community stewardship to ensure a viable resource for future generations.
- To provide a knowledgeable group of local individuals who can promote the preservation, rehabilitation, and use of these aquatic resources in the future.

## Overview of 2004 Monitoring Season

The 2004 monitoring season commenced on May 2 and concluded on November 17. Samples were collected fortnightly, with over 350 samples being collected for analysis during the season. Samples were analysed for a variety of parameters, including fecal coliform bacteria, dissolved oxygen, temperature, and nitrates.

Samples were collected from the main road bridges across the Annapolis River at Aylesford, Kingston, Wilmot, Middleton, Lawrencetown, Paradise and Bridgetown. As well, additional monitoring was conducted on the following tributaries: Moose River, Round Hill River, Black River, Fales River, Nictaux River and South Annapolis River.

## Monitoring Results

The 2004 monitoring results have been summarised below, to address three common questions:

- How can the water be used?
- Is the water safe for swimming?
- Will the water support fishing?

### Question 1

### Was the water in the Annapolis River during 2004 acceptable for food crop irrigation?

The Canadian Council for Ministers of the Environment (CCME) have set a number of criteria for water used to irrigate food crops. One of the most important criteria relates to the bacterial quality of water.

Fecal coliform bacteria originate from the intestinal tract of warm-blooded animals, including humans. Most are not harmful themselves, but can indicate the occurrence of disease-causing bacteria, viruses, protozoa and other parasites. It is easier to sample for fecal coliform bacteria rather than the other harmful organisms. Fecal coliform contamination in the river can originate from a variety of sources, including inadequate or malfunctioning municipal sewage treatment plants, faulty domestic septic systems, or livestock manure entering water courses.

The CCME tentative guideline for water used to irrigate food crops is 100 fecal coliforms per 100 ml of water. Figure 1 presents the percentage of water samples collected in 2004 where bacteria levels exceeded 100 fecal coliforms per 100 ml.

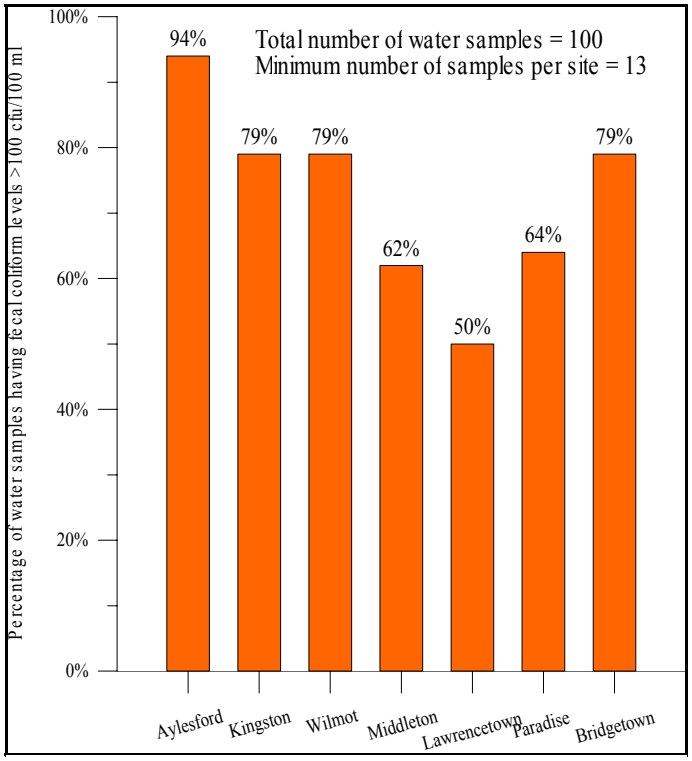


Figure 1: Percentage of water samples collected in 2004 where bacteria levels exceeded 100 fecal coliforms per 100 ml.

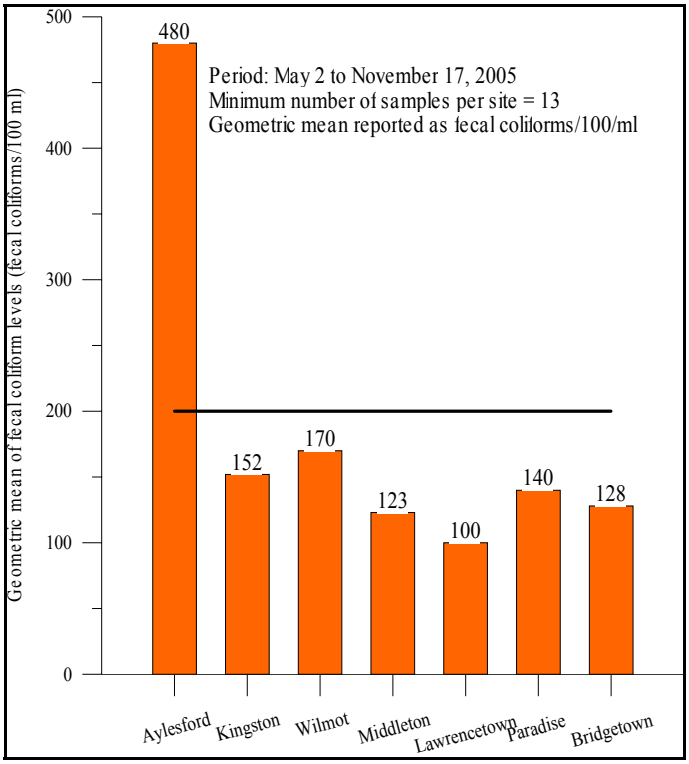


Figure 2: Geometric mean of 2004 fecal coliform results.

From the above graph, it is evident that over much of the Annapolis River during 2004, the water was unacceptable for food-crop irrigation purposes.

## Question 2

### Was the water in the Annapolis River during 2004 safe for swimming and water contact recreation?

The CCME has set the following bacterial guideline for recreational water quality: '*The geometric mean of not less than 5 samples taken over a 30 day period should be less than 200 fecal coliforms per 100 ml. Re-sampling should be performed when any sample exceeds 400 fecal coliforms per 100 ml*'.

As noted above, the Annapolis River Guardians collect samples every two weeks, approximately twice per month. Although this sample frequency is less than that recommended by the CCME, the monitoring occurs over a longer period (May to November), with approximately 13 samples being collected at each site. Figure 2 presents the geometric mean of fecal coliform results for each of the monitoring locations, over the May to November season.

From Figure 2, it is evident that for all sites except Aylesford, the geometric mean of fecal coliform results was below the CCME guideline during 2004. While the monitoring program used by the Annapolis River Guardians does not exactly follow that suggested by the CCME, it is felt that the information presented in Figure 2 provides a useful indication of water quality in the Annapolis River. It should be noted that all sites had some results above 200 fecal coliforms per 100 ml during 2004.

## Question 3

### Was the water quality of the Annapolis River during 2004 impairing freshwater aquatic life (e.g. trout and salmon)?

The CCME have established a number of guidelines for water quality to protect freshwater aquatic life. During 2004, the Annapolis River Guardians collected and analyzed water samples for a number of these, including dissolved oxygen, temperature, nitrates and pH.

Dissolved Oxygen

Dissolved oxygen (DO) is a widely used and important general indicator of the health of a river system. Dissolved oxygen is essential for the maintenance of healthy rivers and lakes. A sudden drop in dissolved oxygen levels can indicate an influx of some type of organic material into the river system.

The CCME guideline for the Protection of Freshwater Aquatic Life for Dissolved Oxygen is 5.5 mg/L. Only two of the seventy-five water samples analyzed by the Annapolis River Guardians had dissolved oxygen levels below this guideline (Paradise, August 8, 4.20 mg/L and Bridgetown, September 6, 4.80 mg/L).

## Temperature

Water temperature, like dissolved oxygen, serves as a broad indicator of water quality. The temperature of water has a direct bearing on the aquatic species present and their abundance. For example, trout and salmon species experience stress at water temperatures in excess of 20ºC, with lethality occurring with prolonged exposures to temperatures over 24ºC.

Figure 3 presents the mean summer water temperature along the main Annapolis River in 2004. Of the 34 temperature measurements recorded during the months of July, August and September, approximately one-third exceeded 20ºC. The maximum temperature observed was 23.5ºC, recorded at Middleton on August 22. There are many factors that can lead to increased water temperatures. These include loss of riparian buffers and trees which shade water courses, land use changes, and climate change.

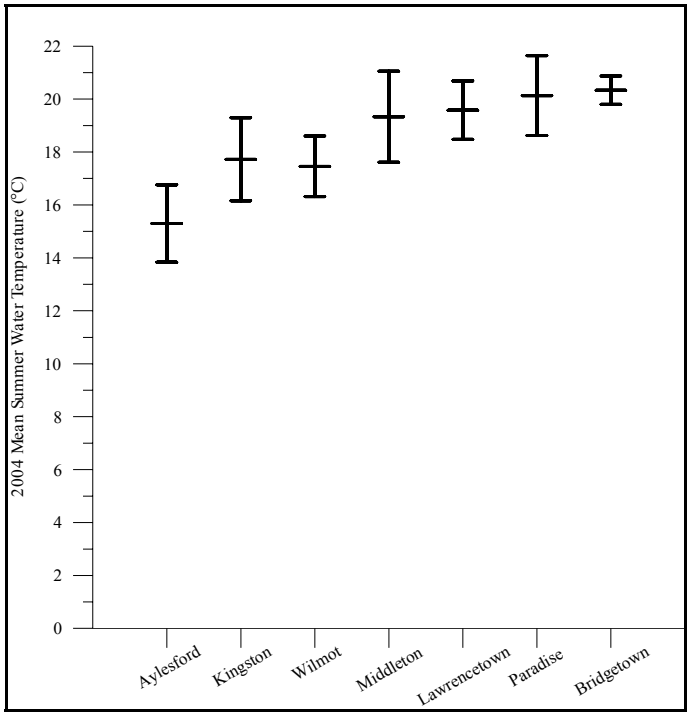


Figure 3: Mean summer water temperature by site, 2004 (showing standard error of the mean)

## Nitrates

Elevated levels of nitrate in aquatic systems can originate from a variety of sources, including municipal wastewater, the use of chemical fertilizers and manure on agricultural land, industry, and atmospheric deposition. The CCME guideline for the protection of freshwater aquatic life for nitrate-N is 13 mg/L. The 2004 nitrate monitoring results, with standard error of the mean, are presented in Figure 4.

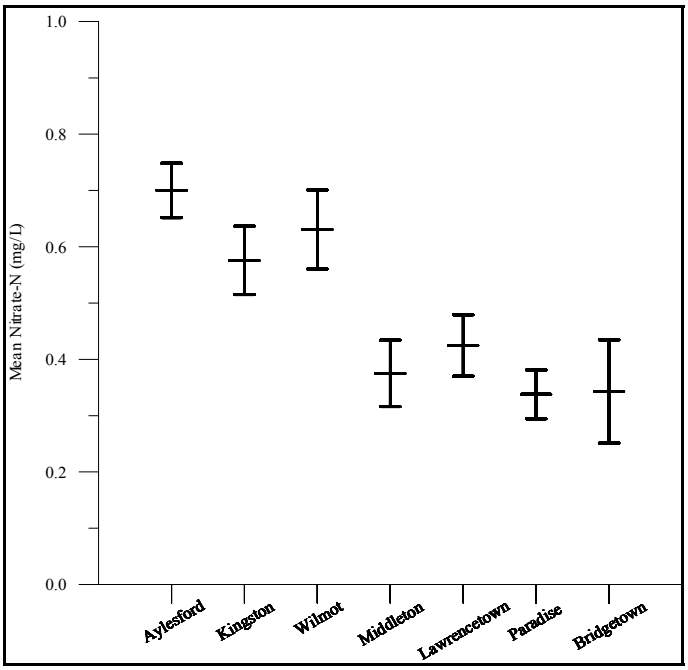


Figure 4: Mean Nitrate-N by Site, 2004 (showing standard error of the mean)

Aylesford had the highest levels of nitrate-N in 2004, ranging from 0.43 to 1.26 mg/L. Figure 4 shows the mean nitrate-N values for 2004, with the standard error of the mean. The upper river sites (Aylesford, Kingston, Wilmot) have the highest nitrate-N levels, followed by lower river sites (Middleton, Lawrencetown, Paradise, Bridgetown).

The decrease in nitrate-N concentrations between the Wilmot and Middleton sites suggests dilution caused by an input of low nitrate-N water from a tributary. The Nictaux River enters the mainstem between these two sites. The 2004 SWIM data showed its nitrate-N contributions to be low to moderate relative to other major tributaries monitored.

pH

pH is a measure of the acidic/basic nature of water and is determined by measuring the concentration on the hydrogen ion ($H^+$). It is expressed on a logarithmic scale from 0 to 14, zero being the most acidic. To ensure the protection of freshwater aquatic life, the CCME has recommended that pH levels should not vary beyond 6.5 to 9.0.

Table 1: Mean pH values at each River Guardian monitoring

| Site | pH | Site | pH |
|---|---|---|---|
| Aylesford | 6.90 | Lawrencetown | 6.88 |
| Kingston | 7.02 | Paradise | 7.03 |
| Wilmot | 7.04 | Bridgetown | 6.95 |
| Middleton | 6.91 | | |

Table 1 shows that pH values all along the Annapolis River are generally very good. Portions of the Annapolis watershed are underlain by the Torbrook formation, a geological formation containing limestone. This formation buffers the Annapolis River from the harmful effects of acid rain, which has caused the acidification of many other rivers in Nova Scotia.

## Conclusion and Overall Assessment

From the monitoring conducted by the Annapolis River Guardians during 2004, dissolved oxygen, nitrate and pH values on the Annapolis River are generally within the CCME guidelines for the protection of freshwater aquatic life. Water temperatures during the summer months exceed 20ºC though, which is known to cause stress to cold water fish such as trout and salmon.

Fecal coliform bacteria continued to be a cause for concern during 2004. Over much of the river, water was unacceptable for food crop irrigation purposes. With the exception of Aylesford, the geometric mean of fecal coliform levels was below the guideline for water contact recreation.

## What Can Be Done To Improve Water Quality?

Summer water temperatures can be reduced by:

- Protection and enhancing riparian (stream-side) habits.
- Planting shade trees along watercourses.

Fecal coliform levels can be reduced by:

- Ensuring domestic septic systems are maintained and pumped out regularly
- Preventing manure from entering watercourses, such as by fencing cattle out of streams
- Ensuring the municipal sewage treatment plants operate properly.

## Acknowledgements

The Annapolis River Guardians is a volunteer-based program. Without the dedication of the volunteers, the program would not be the success that it is. We would therefore like to extend our thanks to the volunteers who contributed their time and energy during the 2004 season. The volunteers included:

Bill Faye
David and Heide Cogswell
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Christine Attard
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Peter and Wendy McLean
Claire Diggins
Paul Baker

The success of the River Guardians program is in part due to its approach of bringing together a variety of stakeholders who have an interest in the health of the Annapolis River. We would like to thank the following partners who have worked with us to deliver the Annapolis River Guardians program:

- Environment Canada
- NS Dept. of Environment and Labour
- Acadia University
- Acadia Centre for Estuarine Research
- Synova Diagnostics Inc.
- Human Resources Development Canada

## Further Information

This newsletter presents a summary of the 2004 Annapolis River Guardians Report. All monitoring results are available in an on-line web searchable database at ***www.fundybay.com*** If you have any questions about the material presented in this newsletter, require further monitoring details, or would like a presentation on these results to your group or organisation, please contact:

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