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SUMMARY OF WATER QUALITY SAMPLING

THE KENNEBECASIS RIVER CLASSIFICATION PROJECT

PREPARED BY:
Kennebecasis Watershed Restoration Committee
SPRING 2002

KENNEBECASIS
WATERSHED
RESTORATION
COMMITTEE

New Nouveau Brunswick

Your Environmental Trust Fund at Work!
Votre Fonds en fiducie pour l'Environnement au travail!

ACKNOWLEDGEMENTS

The Kennebecasis Watershed Restoration Committee would like to take this opportunity to acknowledge the contributions of numerous organizations and individuals who through their hard work and dedication made the 2000, 2001 season for this project a success.

The New Brunswick Environmental Trust Fund for providing the funding for the Water Classification Process (*Your Environmental Trust Fund Dollars at Work*).

The New Brunswick Department of Environment and Local Government, Outreach & Partnering Initiative: Jane Tims, Nelda Craig, Sheila Goucher, and John O'keefe, Colette Lemieux, Mathew Dickson

Volunteers: Austin Lewis, Brad Bernard, Charlie Polley, Danny Byers, Debbie Johnson, Del Munroe, Don Crothers, Doug Corbett, Greg McCullum, Jack Johnson, Jeff Johnson, Jim Olive, Lloyd Webb, Peter Ritchie, Rick Thorne, Sheryll Sackville, Terry Craig, Waymen Stevens, and Wayne Coates.

The Kennebecasis Watershed Restoration Committee members and staff.

Finally we would like to send a special thanks to all of the participants at the community meetings held within the sub-watersheds.

MISSION

The Kennebecasis Watershed Restoration Committee is a non-profit organization whose mission is to restore the Kennebecasis River Watershed back to a sustainable pristine ecosystem.

The Kennebecasis Watershed Restoration Committee's goals are to undertake strategic habitat restoration, educational and advisory initiatives, to promote public awareness and participation in the restoration of the Kennebecasis River Watershed.

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1.0 INTRODUCTION

In 2000, the Kennebecasis Watershed Restoration Committee (KWRC) started the first phases of the Water Classification program. The Department of Environment and Local Government (DELG) developed this program as a regulatory component of the *Clean Water Act* to help communities set goals for surface water quality, and to help achieve these water quality goals through the establishment of water quality standards, action planning and watershed management. Classification of the waterways is a simple step by step process for setting water quality goals that involves: Identifying and involving stakeholders; gathering water quality information; assembling land and water use information; setting goals for water quality and preparation and implementation of action plans. It is the purpose of this report to discuss the results of this water quality sampling effort, and historical water quality information for the area.

2.0 BACKGROUND

KWRC

The Kennebecasis Watershed Restoration is a non-profit organization whose mission is to restore the aquatic environment of the Kennebecasis River Watershed to historical conditions for fish and other aquatic, avian and terrestrial life. The Committee's goals are met through strategic habitat restoration, educational and advisory initiatives and promoting public awareness and participation in the restoration of the Kennebecasis River Watershed. The KWRC is composed of representatives from various provincial and federal departments, municipalities of the area, Soil and Crop Improvement Associations and local interest groups (Appendix A).

Strategic habitat restoration and enhancement activities are designed to promote aquatic health and water quality through improvements to the aquatic ecosystem in its entirety. The KWRC is committed to continuing restoration activities throughout the Kennebecasis Watershed in a concise and effective manner to reach the goal of a watershed with sustainable aquatic resources.

The KWRC has been orchestrating and implementing restoration activities within the Kennebecasis Watershed since 1994. The initiative began with a comprehensive habitat assessment of 285.5 km of stream studied through stream survey work, water quality sampling and stock assessment identifying concerns throughout the watershed. Based on the findings from this assessment, a prioritized list of impacted sites was compiled for the watershed to provide a clear direction for restoration efforts by the Committee.

Trout Creek was identified as one of the most heavily impacted of the significant tributaries to the Kennebecasis River and was of suitable size to provide an excellent test bed for restoration efforts. The smaller size of Trout Creek enabled the group to refine stream enhancement techniques, promote public participation and initiate an education and information campaign. The development of a stakeholder group for Trout Creek and the promotion of Best Management Practices (BMPs) and other educational initiatives for the community have heightened awareness of water quality and aquatic health issues for the area.

The restoration efforts on Trout Creek demonstrated that the techniques developed and applied have had a positive impact on the stream's health. The in-stream structures have shown dramatic results over the short period of time they have been installed. Annual ice generation has diminished remarkably, damage by annual flood events and erosion have been reduced and water quality and aquatic health have improved with significant narrowing and deepening of the channel. The re-establishment of riparian vegetation has provided a buffer for the watercourse, filtering out non point-source pollutants and providing shade to lower water temperatures. Riparian vegetation provides cover for aquatic species, habitat for avian and terrestrial species and is critical in stabilizing stream banks, reducing accelerated erosion. Restoration efforts have improved the over-all health of the system thus offering habitat for species associated with the ecosystem. Educational initiatives have provided knowledge for stakeholders to incorporate BMPs into their day to day activities.

In light of the success of the Trout Creek project, the committee has expanded restoration efforts to other tributaries of the Kennebecasis Watershed. We have placed approximately 165 digger logs and 177 rock sills in-stream and constructed 54 stable fording sites. Twenty-six kilometers of fencing have been erected and 73 600 trees and seedlings planted within riparian zones with the full cooperation, participation and in-kind support of the stakeholders of the watershed, particularly the farming community. Community and landowner involvement and awareness are essential components to our projects that will help to ensure the sustainability of the watershed for years to come.

These successes have not only had direct positive impacts on the landowners associated with the work, but also on the Village of Sussex Corner and the Town of Sussex. Both of these councils are in full support of the initiatives undertaken, particularly on Trout Creek, realizing they will be the benefactors of improved water quality and diminished flood and erosion damage due to ice generation on the system.

WATER CLASSIFICATION

The Water Classification program is the regulatory component of the Clean Water Act, and in essence gives watershed stakeholders an opportunity to set water quality standards for streams and rivers in their area. This program will not be discussed in great detail here, but in involves a number of steps towards the end product. These steps are all designed to understand the current water quality, land use, and stakeholder concerns in order to ultimately set water quality goals, and set in motion mechanisms to achieve them. The end result is a minimum baseline level of water quality throughout the watersheds, with more advanced objectives or goals reflective of the interests of the community.

In order to make the Water Classification process manageable, the KWRC divided the Kennebecasis River Watershed up into five "Sub-watersheds": Upper Kennebecasis, Lower Kennebecasis, Smith's Creek, Trout Creek and Millstream River (Figure 1). This strategy allows the watershed to be assessed in a number of localized sections, respecting regional demographic and ecological differences between watersheds. Special conditions that may occur on a specific portion of the watershed can thus be characterized apart from other areas. This strategy also allows communities throughout the Kennebecasis Watershed to direct their efforts on a more defined section of the Kennebecasis Watershed. The KWRC felt that this method would

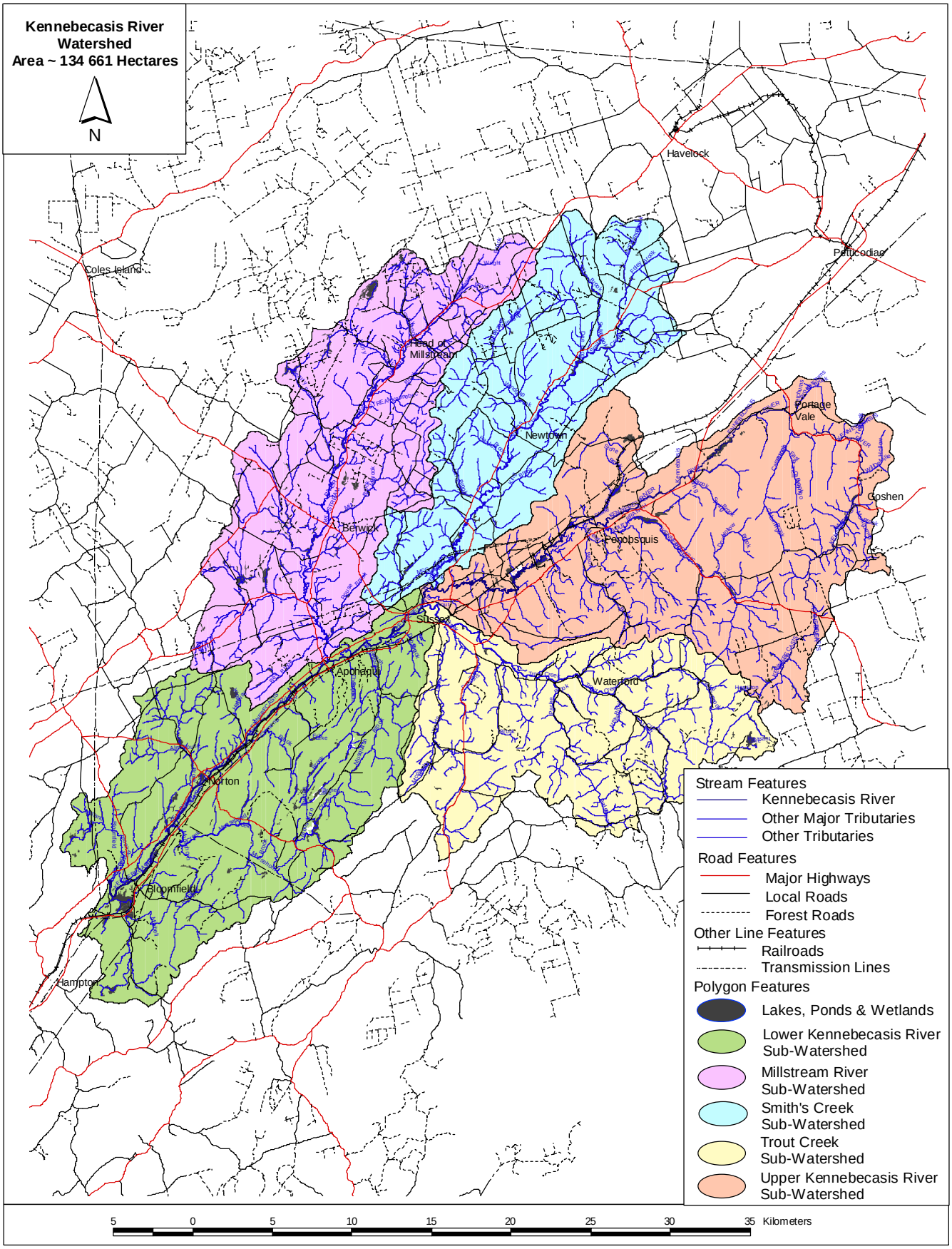

Figure 2. Map of the Kennebecasis River Watershed illustrating the five sub-catchments.

increase public participation and build a sense of ownership and stewardship for the Water Classification Process throughout the Kennebecasis Watershed as a whole (Appendix B).

Volunteers and staff of the KWRC collected water quality grab samples from 26 locations throughout the watershed during 2000. With assistance from the Fundy Model Forest, 14 additional sites were established in 2001, to clarify and add resolution to water quality issues. (Appendix C). Since the beginning of the water classification program, efforts have been made to assimilate all water quality information that may have been collected in the Kennebecasis system. The most significant information to come from this effort was the water quality results from a 1999 nutrient study by Erin Barry. The water quality data collected in the two field seasons, combine with historical data, was analyzed by sub-watershed to obtain a clearer picture of localized problems and contribute to identifying sources. The results can be compared to the historical water quality data to determine any changes within the watershed. This information provides a basis for making realistic decisions about the future of the watershed.

Water quality is determined by evaluating various chemical, biological, and physical parameters in a water sample or series of samples and comparing them to established standards and guidelines (Appendix D). These levels are determined by varying combinations of natural and human processes. If any substance is present at a concentration outside the suggested guidelines, negative effects may begin to occur. Negative effects can reach a point where the water is no longer suitable for a particular use. NBDELG compares water quality data with the limits that are found in the Canadian Environmental Quality Guidelines (CEQG) which includes guidelines for water, air, sediment, and soil.

Spatial information has been collected to create visual products, to aid in understanding the topography, geology, soils, and vegetation cover in each of the five sub-watersheds (Appendix E). Several layers including roads, streams, land-use, etc. were used to create maps which help to explain water quality changes from the natural system and show where sources of pollutants may be.

3.0 DESCRIPTION OF THE STUDY AREA

The Kennebecasis River system has been and continues to be an important resource to the people of the southeastern area of New Brunswick. Kennebecasis is a Maliseet term that means “little snake”, a good description for the river whose watershed covers 134,660 hectares as it twists and turns from its head waters in Goshen to the head of tide at Bloomfield. The study area for this Water Classification Project undertaken by the KWRC on behalf of the NBDELG, focuses on 1833.91 km of streams from order classes ranging from 1 to 6 (Figure 2). Funding for the project is provided by the New Brunswick Environmental Trust Fund (ETF).

The mainstem of the Kennebecasis River is spread out over two counties, Kings and Albert, extending 103.35 km from its origin in Hamilton Lake to its confluence with the head of tide at Bloomfield. The Kennebecasis Watershed in made up of a number of significant tributaries including South Branch (17.89 km), Smith’s Creek (35.39 km), Trout Creek

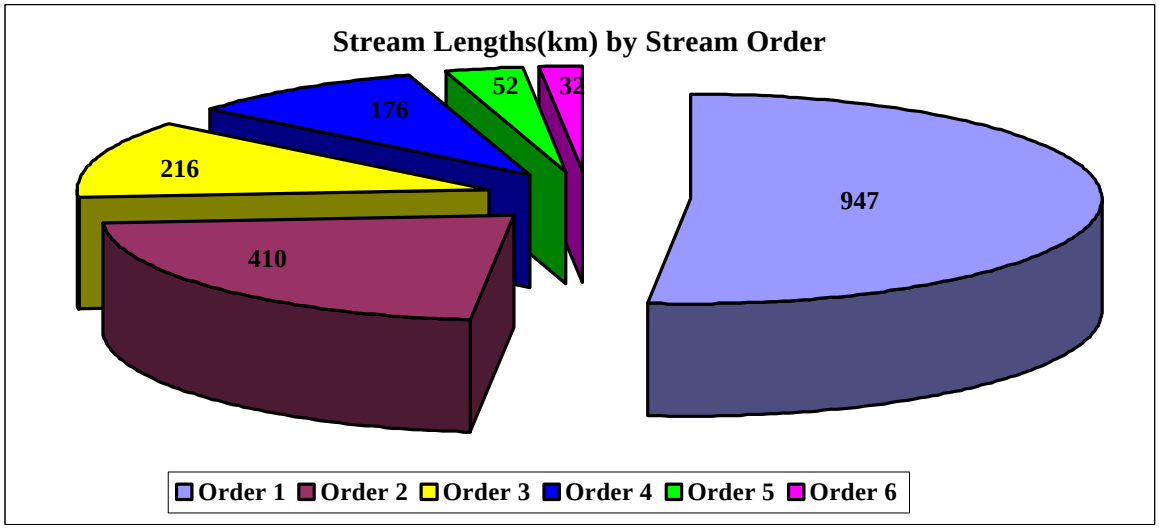

Figure 2. Total stream lengths by stream order for the Kennebecasis River Watershed

(26.75 km), Millstream River (45.52 km), and Moosehorn Creek (15.83 km) distributed throughout eight parishes from Elgin parish to Springfield parish.

ENVIRONMENTAL CONDITIONS

The Ecoregions of New Brunswick are delineated areas based on distinct differences in climate. Latitude, altitude, the channeling of prevailing winds over and around mountainous land masses, and proximity to the ocean and other large bodies of water are the primary influences on climate. These climatic influences are strongly correlated with vegetation patterns that exist within the province.

The Kennebecasis River Watershed is located in the Saint John River Basin. The majority of the watershed is located in the Continental Lowlands Ecoregion (93.6%) with the remainder in the Southern Uplands Ecoregion (6.3%) (Figure 3). The headwaters begin in the Southern Uplands Ecoregion, which is part of the unique Fundy plateau having elevations up to 500 m. This elevation creates a colder climate with forested ecosystems normally found in more northern latitudes. As the head waters drain into the Continental Lowlands Ecoregion, the climate becomes variable with warmer summer and colder winter temperatures and less precipitation than the adjacent Uplands Ecoregion. Generally, all of the tree species native to the Province can be found in this Ecoregion because of this broad range in climate and soil fertility.

The Kennebecasis River system plays a significant role in providing habitat for many species of birds, mammals and amphibians that use its banks, oxbows and backwaters for nesting and rearing of their offspring. This watershed is also the home to several different varieties of freshwater species of fish (Appendix F). Due to the physical and hydrological characteristics of the watershed, the Kennebecasis River and its tributaries have played a significant role in settlement, tourism, and commercial endeavors for the immediate and surrounding areas.

Through the years the Kennebecasis River System has been known for their recreational fishing opportunities especially in the pursuit of Salmonids such as Atlantic Salmon and Brook Trout. Recreational fishing continues to be vigorously pursued by many residents and non-residents alike (Creel Census 2000).

The Kennebecasis River and its tributaries meander through a collage of geological land types and anthropogenic land-uses including vast agricultural lands, industries, recreational areas and municipalities (i.e. Village of Sussex Corner, Apohaqui, Norton, Bloomfield and the town of Sussex). Approximately seventy-eight percent of the watershed consists of forested lands with seventeen percent consisting of agricultural and occupied lands (Figure 4). The Kennebecasis Watershed is the home to a variety of different activities that directly and indirectly affect water quality. Agricultural residential and other occupied lands directly influence the water quality of the watershed through cattle grazing, riparian vegetation removal and agricultural and municipal run-off. Residential areas such as Penobsquis, Sussex, Apohaqui, Norton and Bloomfield as well as rural residence dot the entire length of the Kennebecasis River and its tributaries. Industries such as a potash mine, saw mills, and fish hatcheries are littered throughout its reaches. Recreational industries including two golf courses are also found on the Kennebecasis tributaries.

WATER QUALITY CONCERNS IN THE WATERSHED

Before the water classification program began, water quality concerns in the watershed were typical of those in other agriculturally dominated watersheds. This program brought to the forefront other points that will be discussed with the data, but concerns regarding water temperature, dissolved oxygen, phosphorus, nitrogen, and E. coli were issues that were historically of high priority to the committee. Limited water quality sampling for other studies and numerous water temperature investigations had raised awareness to these water quality problems, with restoration work focussed at addressing them. We also anticipated water quality impairments originating from rural development and industry, but until now, had few numbers to compliment our concerns.

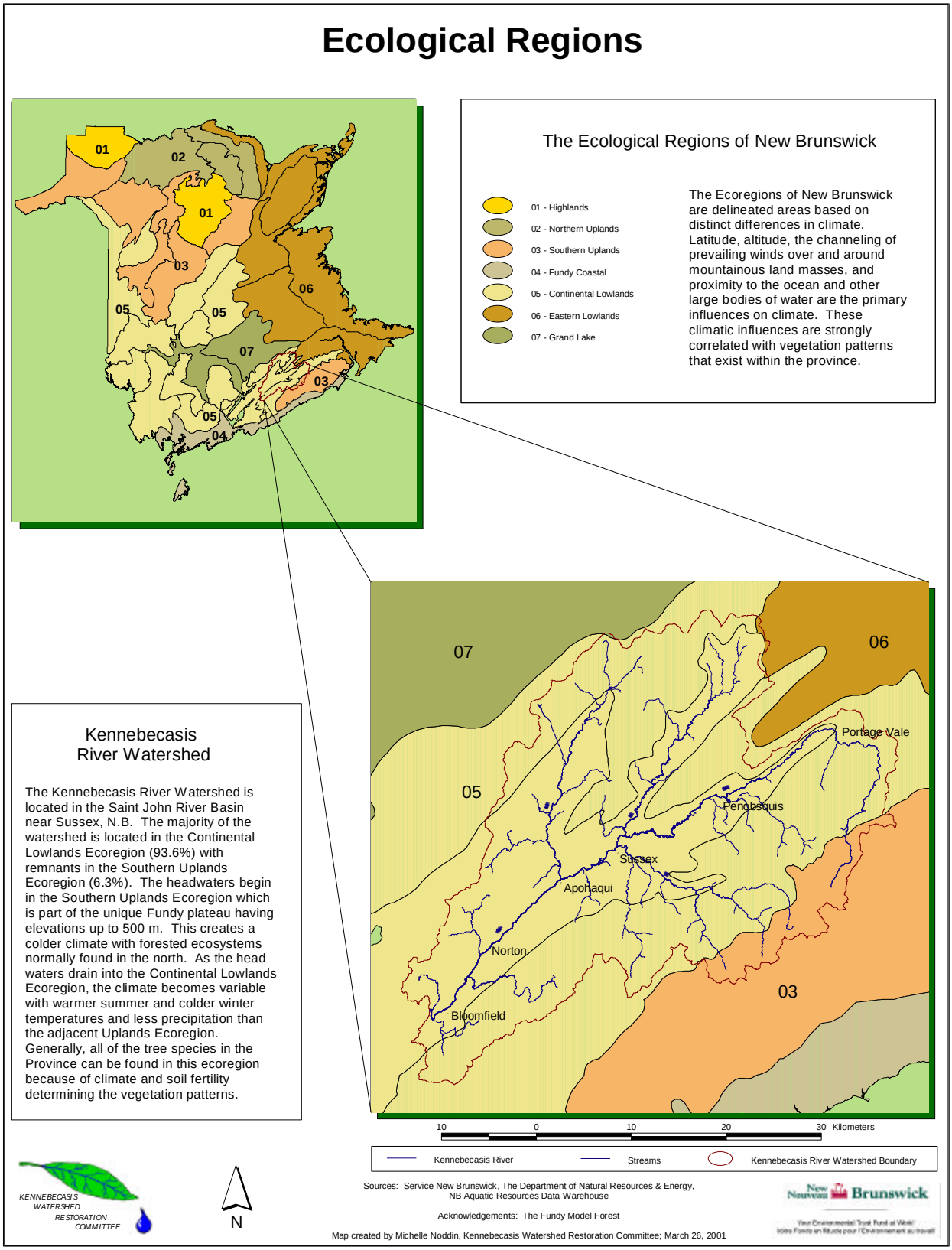

Figure 3. Ecological land classification map of the Kennebecasis River Watershed.

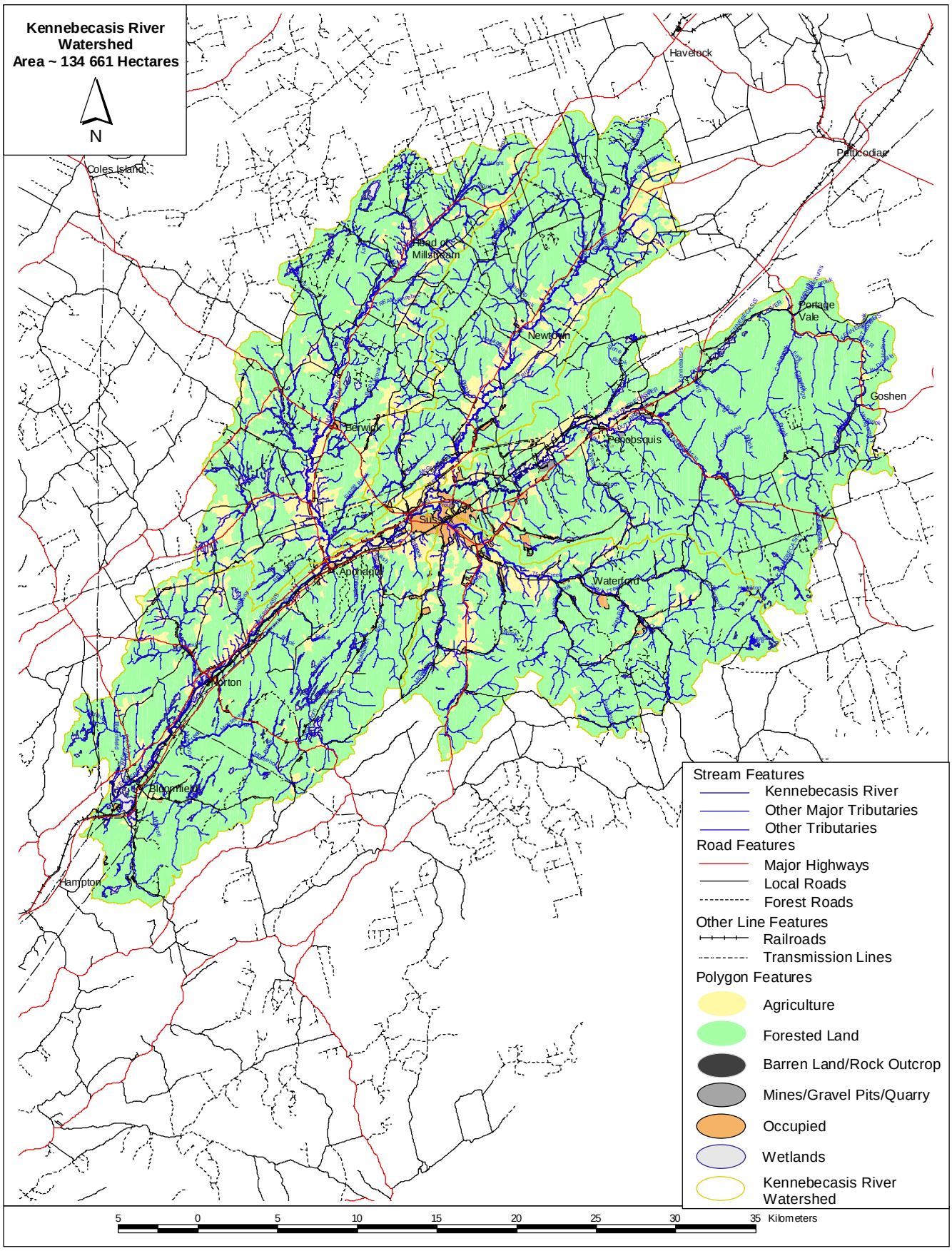

Figure 4. Landuse/Cover Type map of the Kennebecasis River Watershed.

4.0 Water Quality Sampling

On average, thirty-six parameters were assessed for roughly 370 water quality samples taken at 40 sampling sites on the Kennebecasis Watershed for the Water Classification Project in 2000, 2001 (Figure 5, Appendix G). Dissolved Oxygen (DO) was measured using the OxyGuard Handy Gamma from OxyGuard International A/S Blokken 59. Water temperatures were taken using a Digital Indoor/Outdoor Thermometer from InterTAN. Through consultation with NBDELG staff, five of the original sampling sites were changed after the first round of sampling in July 2000. This decision was made to better capture and spatially assess the water quality "picture" throughout the whole watershed with the resources available. Water quality sampling was conducted by volunteers, KWRC and NBDELG staff. The first sampling of the system took place on July 19th for 2000, and June 28 shortly after the initiation of the project.

Water samples were taken as per NBDELG sampling standards. For consistency, NBDELG staff held an information session for volunteers and staff on the proper techniques and procedures for sampling, transportation, and storage for water quality sampling. For accuracy only standard sterile water sample bottles were utilized for sampling. The samples were immediately placed in coolers to retard any degradation of the samples while being transported to the NBDELG lab in Fredericton, New Brunswick. Appropriate water quality sampling procedures were followed to ensure that no undue contamination would occur to the samples and that they could be delivered to the lab within 24 hours of the sampling period.

Appendix G shows all sampling dates for samples taken by volunteers, KWRC staff, and DELG personnel during site visits, and work related to Benthic Macroinvertebrate sampling. Within these samples are periodic duplicate samples taken for quality control purposes, ensuring the soundness of sampling techniques and handling procedures (Table 3).

MAJOR ISSUES AND FINDINGS

As anticipated, many problems in the watershed are related to factors known to be influenced by agricultural practices. Indeed, there were few major surprises when the data were analyzed. In keeping with past studies, heightened water temperature seemed to be a ubiquitous problem, requiring the broad scale application of well understood restoration activities. Heightened E. coli levels were clearly evident throughout the watershed, with some bacterial signatures suggesting point sources, and others broad non-point sources. Consistent with the findings of Barry (1999), phosphorus was found to be elevated above background levels in many waterways. Other issues were found on a more local level, and will be discussed individually by watershed.

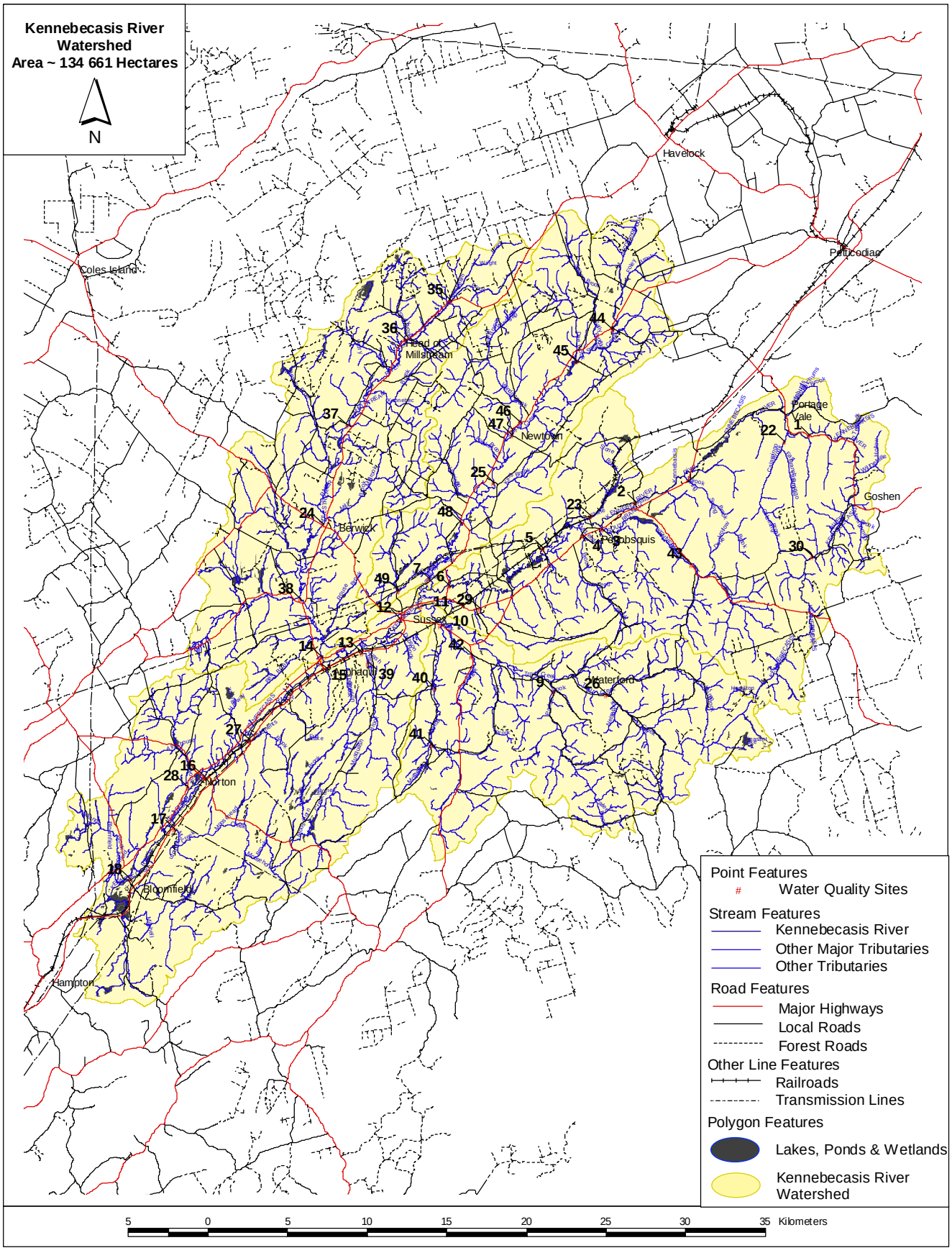

Figure 5. Water quality sites for the Kennebecasis River Watershed for year 2000.

UPPER KENNEBECASIS RIVER SUB-WATERSHED

189 water quality samples were taken at ten sampling sites in the Upper Kennebecasis River Sub-watershed (UKSW) during the 2000-2001 sampling seasons, combined with 18 samples taken during the nutrient study (Figure 6). The metal Aluminum (Al) was elevated in 17 of the 207 samples with an average value for the sub-watershed of 0.045mg/l. The suggested level by the Canadian Water Quality Guidelines (CWQG) is 0.1mg/l.

Six samples, all on Millpond Brook, had Arsenic (As) levels with elevated values above background but well within the CWQG of 5.0µg/l.

Most sample sites, at one point or another, produced samples with calcium levels in excess of 15mg/L, the accepted norm for surface water.

37 samples were observed to exceed the CWQG recommended levels for Chromium (CR) of 2.0µg/l.

47 readings were taken for Dissolved Oxygen (DO) over the two years and ten sampling sites. Of the readings taken nine were observed to be below the 9.5mg/l for cold water biota for early life stages, none of which dropped below the recommended level for other life stages for cold water biota of 6.5mg/l.

137 samples were taken for E.coli levels, 61 of which had levels in excess of 50MPN, roughly the upper limit for background levels. The highest recorded value on this sub-watershed was 2000MPN (Figure 7).

Ten samples, nine coming from Millpond Brook had Fluoride (F) levels elevated above background levels, but not in excess of the 1.0mg/l guideline.

Nine samples were observed to have elevated Iron (Fe) levels above the 0.3mg/l guideline for surface water.

The average hardness for the Upper Kennebecasis Sub-watershed was found to be 55.78mg/l, including samples from Millpond Brook, but 40mg/L excluding these atypical samples. These value represents a soft water condition.

PH levels for this sub-watershed had an average value of 7.67. This value is representative of a healthy system with a pH range for surface water by the CWQG of 6.5pH-9.0pH.

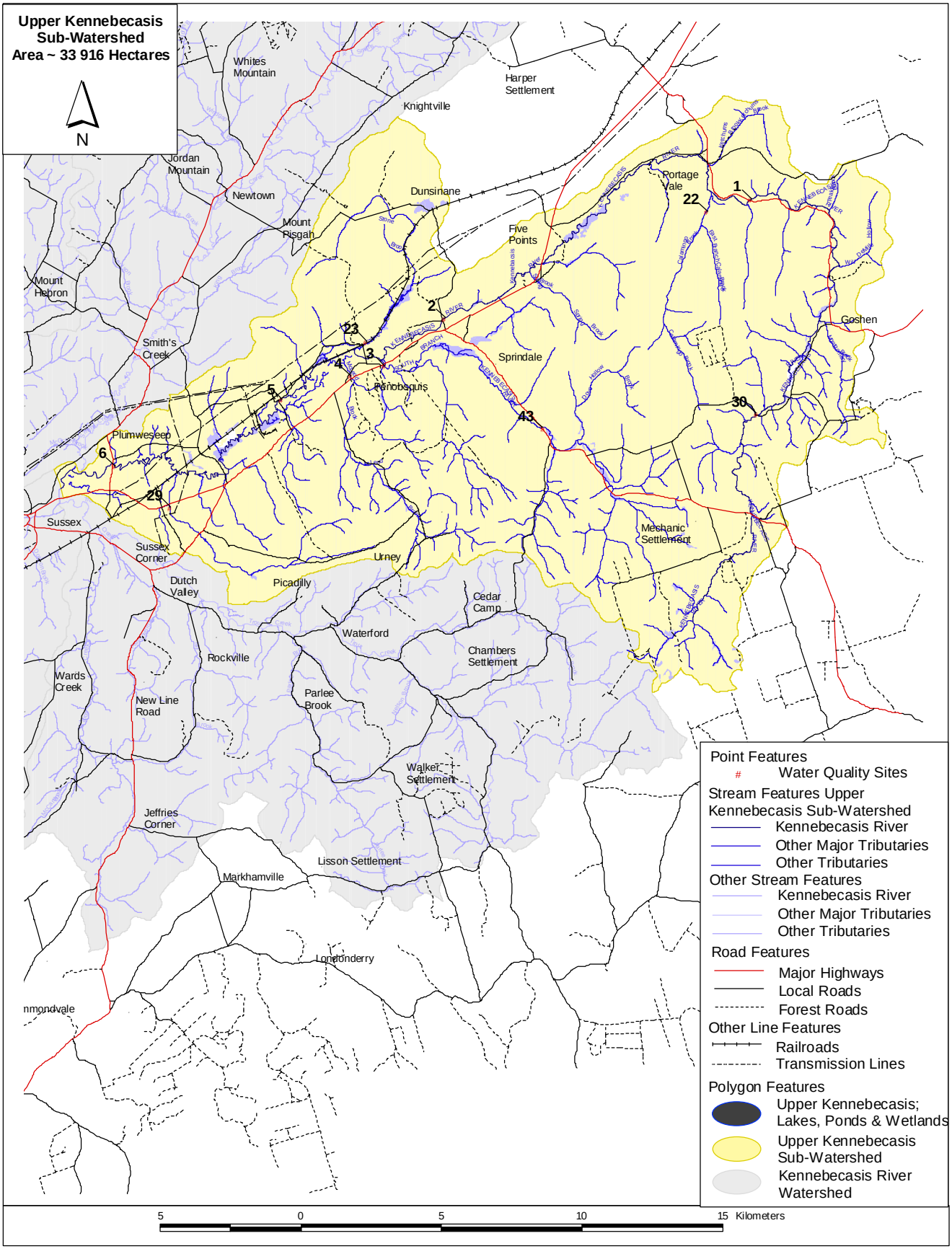

Figure 6. Upper Kennebecasis River Sub-watershed water quality sampling sites for year 2000, 2001.

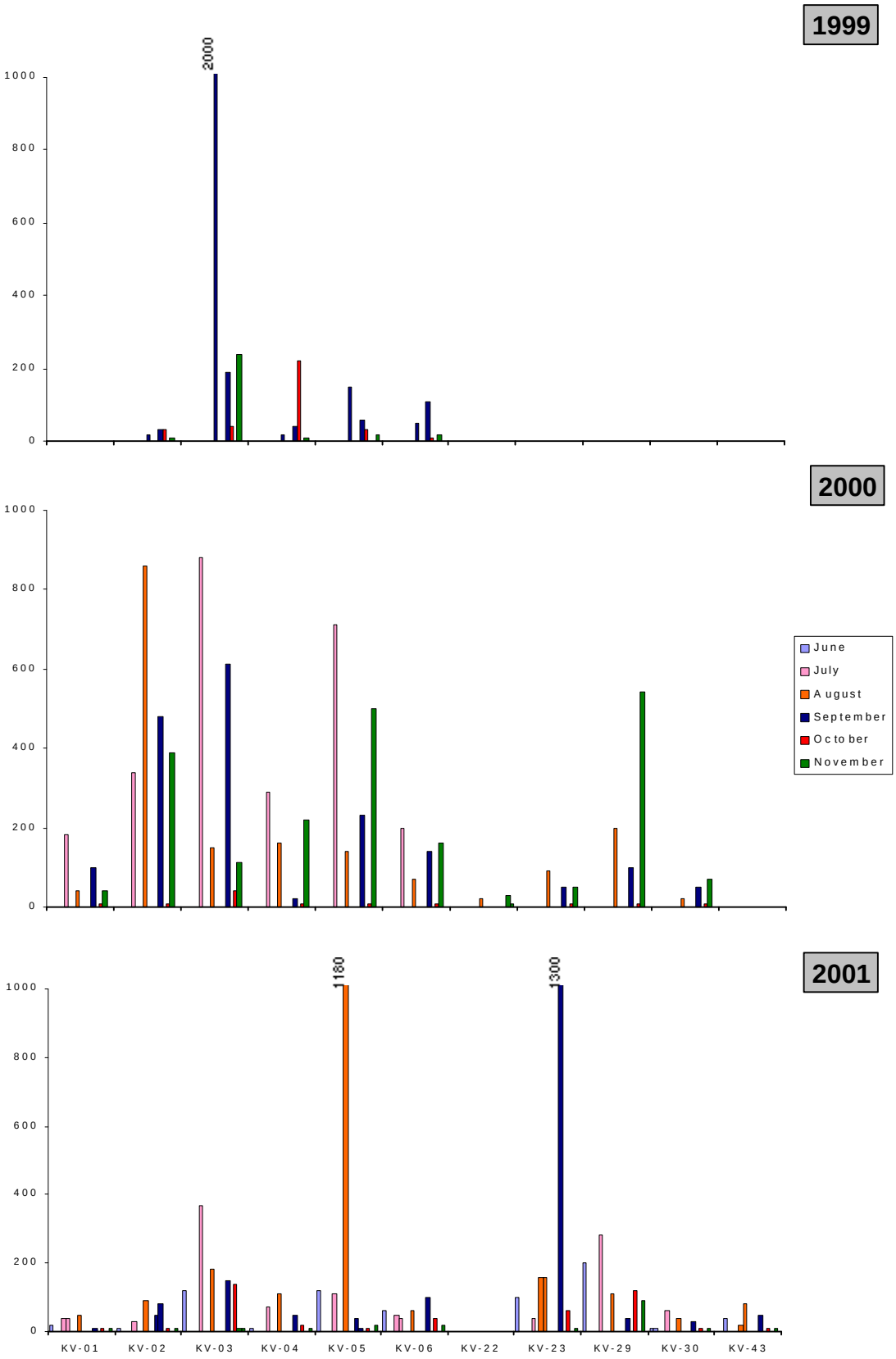

Figure 7. Graphs illustrating monthly E. coli values (MPN/100ml) by sampling station for 1999, 2000, and 2001.

61 temperature readings were taken over this sub-watershed for the five-month sampling period (Figure 8). The average temperature recorded for July and August was 16.5°C with the maximum value of 25.5°C.

16 samples of the 136 taken exceeded the Total Kjeldahl Nitrogen (TKN) guideline level of 0.5mg/l.

During the sampling periods, six samples for Total Phosphorus (TP-L) exceeded the maximum suggested limits of 0.03 mg/l by other jurisdictions during the sampling period. Four of the six elevated samples occurred in the month of November during high water and rain event conditions. The suggested background levels of TP-L for the Kennebecasis River is 0.01mg/l (Barry 2000), with 38 of the samples exceeding this level.

LOWER KENNEBECASIS RIVER SUB-WATERSHED

Ninety-two water quality samples were taken at nine sampling sites on the Lower Kennebecasis Sub-watershed (LKSW) during the 2000-2001 sampling seasons, combined with 61 samples from the nutrient study (Figure 9). Nineteen of these samples had elevated levels for Aluminum (Al).

Eleven samples contained Arsenic (As) levels above background in the LKSW. These results, though above trace levels, were within the CWQG.

Eighty-five samples out of ninety-two taken on the LKSW indicated levels of Calcium (Ca) above 15mg/l, the typical norm for surface waters.

Dissolved Oxygen readings were taken twenty three times during the sampling period on the LKSW. All readings but one exceeded minimum standards for early life stages for cold water biota of 9.5mg/l.

One hundred and fifteen samples were taken for E.coli in the LKSW, of these all but 41 indicated highly elevated numbers with two readings at 24190 MPN (Figure 10).

Seventeen samples taken in the LKSW indicated elevated Fluoride (F) levels above background, but were below guideline maximums of 1.0mg/l.

Eight of thirty-eight samples indicated elevated levels of Iron (Fe) above the 0.3mg/l CWQG limits for surface water.

The average hardness of the surface water in the LKSW was 58, indicating a soft water condition.

The pH levels for the LKSW were consistent to the UKSW with an average pH level of 7.88.

Thirty-seven readings for water temperature were taken throughout the LKSW. Fifteen readings, during the months of June to August exceeded there recommended limits of 12°C-14°C with an average value for these two months of 21.5°C (Figure 11).

Nineteen of the 105 samples taken exceeded the normal limits of 0.5mg/l for TKN, with most of these recorded during high water conditions later in or after the growing season.

Thirteen samples were recorded with levels in excess of the recommended level for Total Organic Carbon (TOC; <10mg/l) for excellent water conditions.

Total Phosphorous (TP-L) levels in the LKSW were elevated (>0.03mg/L) in 46 of 155 samples. One hundred twenty-four samples exceeded 0.01mg/l, considered background levels for TP-L.

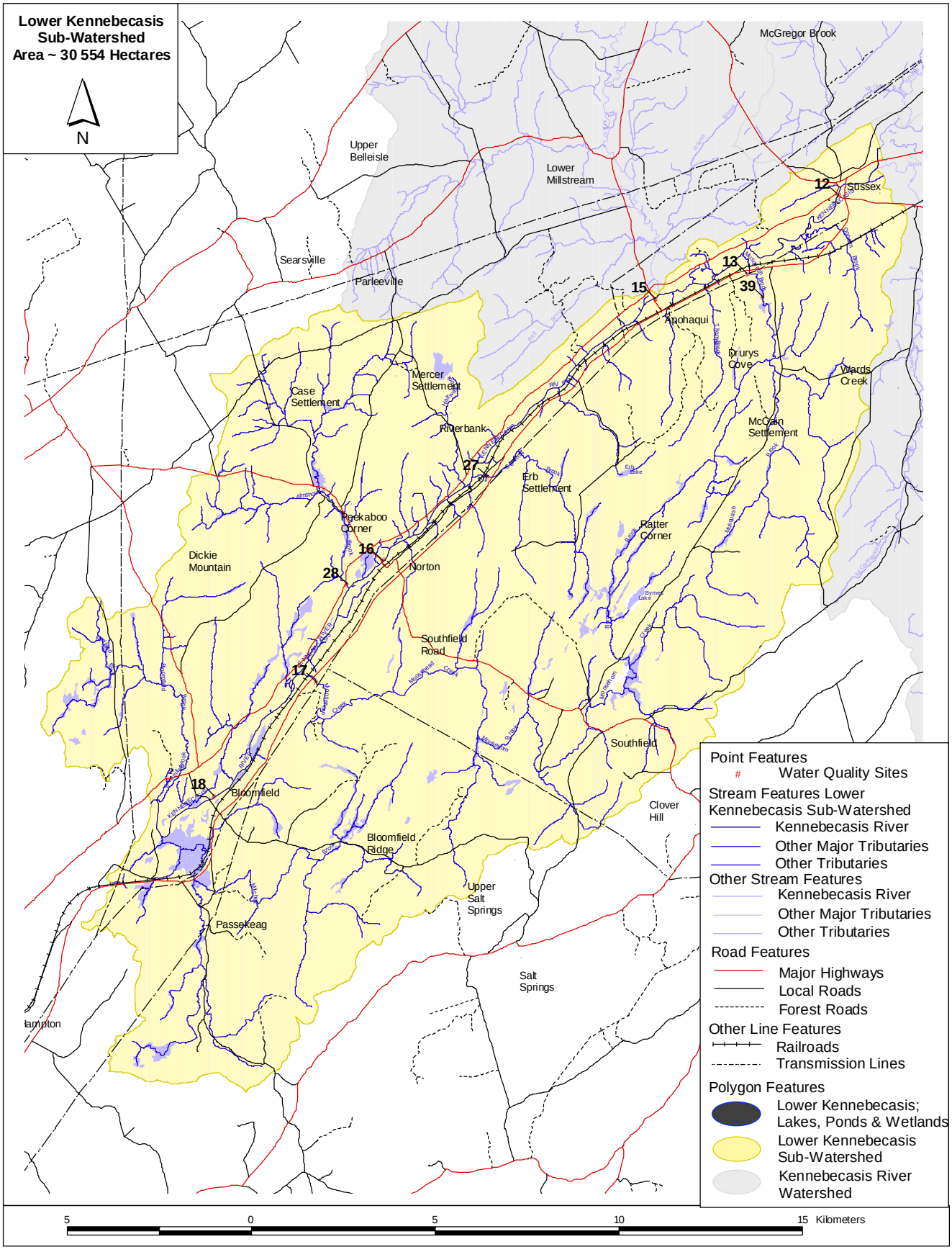

Figure 8. Lower Kennebecasis River Sub-watershed water quality sampling sites for year 2000, 2001.