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# Water quality of the Canaan River, 1997, and its relationship to the water quality of Washademoak Lake.

**March 2001**

New Brunswick
Environment & Local Government

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**Acknowledgments**

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**Funding for the study on which this report is based was obtained by the Washademoak Environmentalists from the Environmental Trust Fund.**

**Summary**

Eight water quality surveys were conducted on the Canaan River and its tributaries between June 18 and November 11, 1997, by field officers of the New Brunswick Department of Environment and Local Government.

This purpose of these surveys was: to characterize the Canaan River water quality, in terms of the features of the watershed; to assess the effects of the Canaan River watershed conditions on the future of water quality of Washademoak Lake; and to provide baseline data of the Canaan River watershed prior to anticipated major highway and natural gas pipeline construction.

The water quality samples were analyzed for several chemical, physical, and bacterial parameters, including major ions, metals, dissolved oxygen, pH, and E.coli.

For the most part, the hardness of the water samples was very low (0 – 30 mg/l as Ca $CO_3$), with the exception of Station 3, which had some values in excess of 100 mg/l. Water temperatures were recorded on October 15 only. At that time, temperatures ranged from 9.5$^o$C to 11.5 $^o$C along the length of the Canaan. The pH was generally in the high six to low seven range, which is considered near neutral. The exception was Station 3, which had values over eight. Conductivity tended to be in the range of 100 µsie/cm, with the exception again at Station 3 which was in the range of 300 µsie/cm. In all cases, dissolved oxygen values were acceptable for aquatic life.

Parameter values were compared to a set of water quality guidelines. For most parameters, there was a low frequency and magnitude of guideline exceedences. Spatial, rainfall, and land use trends were, in general, absent with the exception of Station 3.

For the most part, the Canaan River system appears to be a relatively stable system, but did show changes after rainfall. Due to the highly erodable soils, future development in the watershed, particularly in the lower regions of the Canaan River, has the potential to release large quantities of sediment into the watercourse, which could, over time, have an impact on the water quality of Washademoak Lake.

It is recommended that Best Management Practices (BMP) be implemented to address many of the water quality issues in the Canaan River watershed. The BMP's should address such items as access road construction, ditch clearing, site clearing, stream/river buffers, manure disposal, residential septic systems, etc. The BMP's should be a community-based initiative involving many of the stakeholders in the region to ensure widespread acceptance and adherence.

Disposal of manure should be planned so it does not precede forecasted rain events. As well, appropriate methods should be implemented to minimize potential run-off from manure-spread fields. Technical information on manure management is available from the New Brunswick Department of Agriculture, Fisheries, and Aquaculture.

To help to ensure that bacteria contamination is not being caused by domestic septic systems, the systems should be checked frequently to ensure that they comply with current operation and maintenance practices.

The source of the elevated levels of *E.coli* bacteria throughout the Canaan River watershed, and particularly in the upper undeveloped portion of the watershed, remains unknown and should be studied further in an attempt to determine the source(s) and significance.

**Résumé**

Huit relevés sur la qualité de l'eau de la rivière Canaan et de ses tributaires ont été effectués entre le 18 juin et le 11 novembre 1997 par des agents du ministère de l'Environnement et des Gouvernements locaux du Nouveau-Brunswick.

Les buts de ces relevés étaient les suivants : décrire la qualité de l'eau de la rivière Canaan, en fonction des caractéristiques du bassin hydrographique; évaluer les effets de l'état du bassin hydrographique de la rivière Canaan sur l'avenir de la qualité de l'eau du lac Washademoak; et fournir des données de base sur le bassin hydrographique de la rivière Canaan avant d'importants travaux de construction routière et l'aménagement de gazoducs de gaz naturel.

Les échantillons d'eau ont été analysés pour plusieurs paramètres chimiques, physiques et bactériens, y compris les ions importants, les métaux, l'oxygène dissous, le pH, et le E.coli.

En général, la dureté des échantillons d'eau était très faible (0-30 mg/L en $CaCo_3$), à l'exception de la Station 3 où quelques valeurs dépassaient 100 mg/L. La température de l'eau a été prise le 15 octobre seulement. À ce moment-là, les températures sur toute la longueur de la Canaan variaient entre 9,5 °C à 11,5 °C. Le pH se situait généralement entre six et sept, ce qui est perçu comme une valeur presque neutre. L'exception est la Station 3, où les valeurs dépassaient huit. La conductivité avait tendance à se chiffrer à peu près à 100 usie/cm, à l'exception encore de la Station 3 dont les valeurs étaient environ de 300 usie/cm. En ce qui concerne les valeurs d'oxygène, dans tous les cas, elles étaient acceptables pour la vie aquatique.

Les valeurs des paramètres ont été comparées à un ensemble de recommandations pour la qualité de l'eau. Les valeurs de la plupart des autres paramètres dépassaient rarement les recommandations. Les dépassements, le cas échéant, étaient d'une très faible importance. Les tendances géographiques, de chutes de pluie et d'utilisation du sol étaient, en général, absentes, à l'exception de la Station 3.

En principe, le réseau fluvial Canaan semble relativement stable, mais quelques changements se sont manifestés après des chutes de pluie. En raison du sol très susceptible à l'érosion, l'aménagement dans le bassin hydrographique à l'avenir, notamment dans les régions plus basses de la rivière Canaan, pourrait entraîner des déversements de grandes quantités de sédiments dans le cours d'eau, qui au cours des années aurait des répercussions sur la qualité de l'eau du lac Washademoak.

Il est recommandé que des Méthodes de gestion optimales soient appliquées afin de traiter certains problèmes de qualité de l'eau dans le bassin hydrographique. Ces méthodes devraient régler certains aspects comme la construction de voies d'accès, le nettoyage des fossés et du terrain, les zones tampons des rivières et des ruisseaux, l'élimination du fumier, les systèmes de fosses septiques, etc. Les Méthodes de gestion

optimales devraient être utilisées à l'échelle communautaire et faire intervenir de nombreux intervenants de la région pour assurer l'acceptation et le respect en général des méthodes.

L'élimination du fumier ne devrait pas être effectuée avant des chutes de pluie. En outre, des méthodes convenables devront être mises en œuvre afin de diminuer le risque d'écoulement provenant des champs recouverts de fumier. Des renseignements techniques sur la gestion du fumier sont disponibles au ministère de l'Agriculture, des Pêches et de l'Aquaculture.

Il faut vérifier les systèmes de fosses septiques souvent afin d'assurer qu'ils sont conformes aux normes d'exploitation et d'entretien actuelles et qu'ils ne causent pas de contamination bactérienne.

La source des niveaux élevés de la bactérie E. coli dans le bassin hydrographique de la rivière Canaan, et plus précisément dans la partie supérieure non aménagée, reste inconnue. Ce problème devra être étudié de façon plus approfondie afin de déterminer la source et son importance.

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## Introduction

The Washademoak Lake – Canaan River watershed (Figure 1) is located on the western boundary of the Fundy Model Forest. The Canaan River watershed, which makes up approximately 68 percent of the total watershed, drains into Washademoak Lake, which in turn drains into the Saint John River.

In recent years, concerns have been expressed by a number of communities with respect to development – both residential and commercial – within the Canaan River watershed and its effect on the water quality of Washademoak Lake. Traditional land use in the watershed has changed considerably in the past fifty years, with many land parcels moving from family farms and small-scale woodlots to agribusiness and large scale industrial forest operations (Manley 1997). A considerable increase in the number of permanent and seasonal residences has occurred, particularly along the lakeshore, as well as associated recreational uses of both the land and the water.

A report entitled "Community–Based Investigation into the Current State and Functioning of the Washademoak Lake System and the Canaan River Watershed." (Manley 1997) discussed the water quality results of a study of Washademoak Lake in relation to the physical characteristics and activities (farming, forestry, roads, maintenance and building of residences) of its watershed. Work was begun in 1997 to determine the water quality of the Canaan River by means of a series of field collections and observations on the condition of its watershed. This study was intended to supply information that would permit the assessment of Canaan River conditions on the future of water quality in Washademoak Lake, of which the Canaan is the main tributary, and also to set a benchmark against which future changes in the Canaan watershed can be assessed.

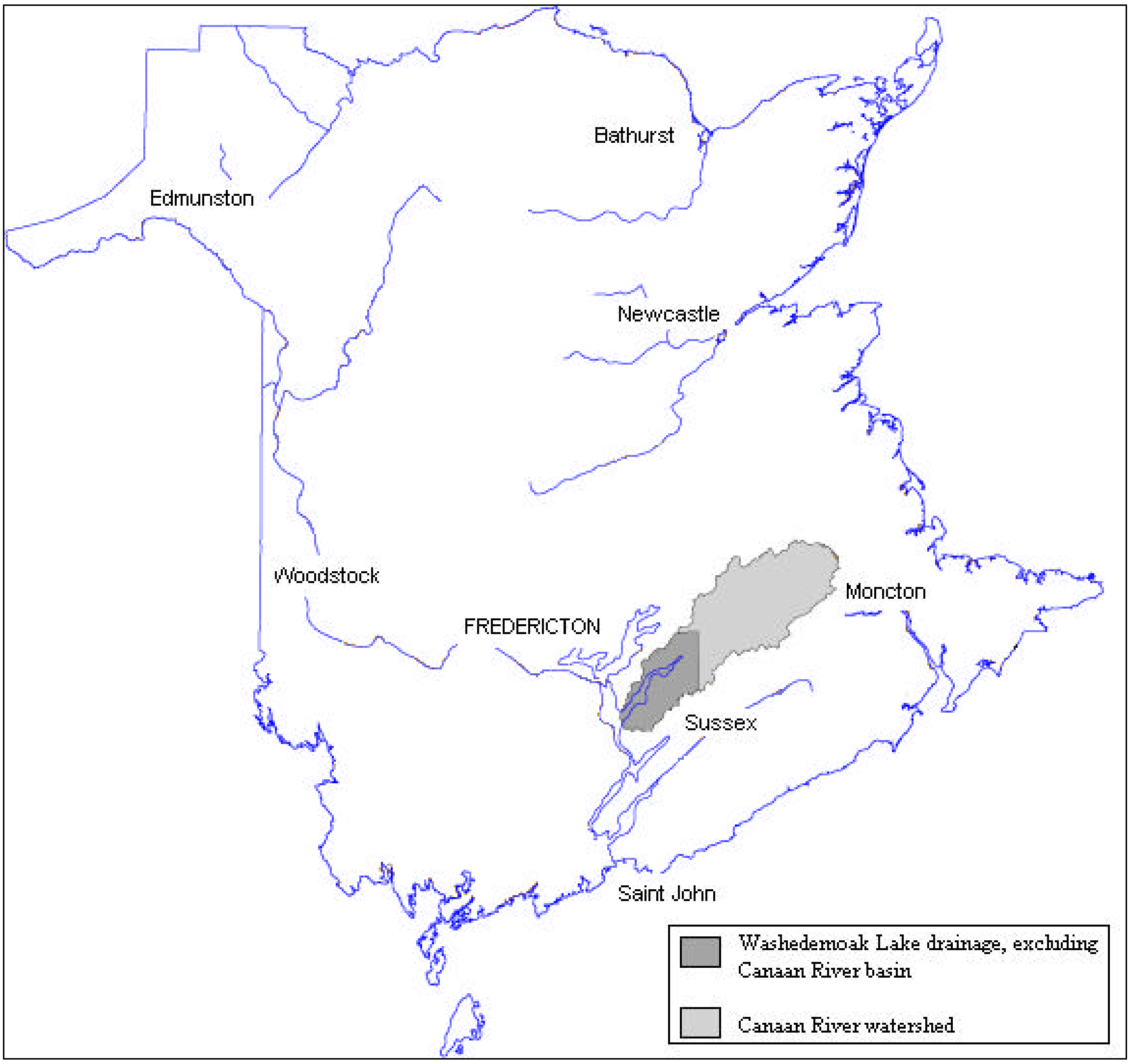
The objectives of this report are as follows:

1. To characterize the Canaan River water quality, in terms of the features of the watershed.

2. To assess the effects of the Canaan River watershed conditions on the future of water quality of Washademoak Lake.

3. To provide baseline data of the Canaan River watershed prior to anticipated major highway and pipeline works.

**Figure 1. General location of Washademoak Lake - Canaan River watershed (Manley 1997)**



## Canaan River Watershed

The Washademoak Lake – Canaan River watershed, located in southern New Brunswick, occupies an area of approximately 216 000 hectares (ha). The watershed is contained within Westmorland, Kings, and Queens Counties, with the majority of the area being in Queens County. This watershed is composed of twenty-five sub-watersheds (Figure 2).

The Canaan River watershed (defined as the portion of the watershed from the upper reaches of the Canaan River to its eventual drainage into Washademoak Lake) has an area of 148 000 ha or approximately 68 percent of the total watershed and includes 17 sub-watersheds that range in size from 2 200 ha to 26 000 ha.

## Ecological Land Classification of Washademoak Lake – Canaan River Watershed

Three of seven ecoregions are represented within the Washademoak Lake–Canaan River watershed (DNRE 1996 & Manley 1997).

The southern edge (approximately 10 percent) is represented by the Continental Lowlands. This ecoregion is characterized by a broad, rolling terrain, with elevations around 100 metres. Because the ecoregion is sheltered from the influences of the sea, which partially surrounds New Brunswick, the climate is more of a continental type than a maritime type, with warm summer temperatures and cold winter temperatures.

The southwestern portion (approximately 45 percent) is represented by the Grand Lake basin. The ecoregion is characterized by a low-lying trough around Grand Lake. Elevations range from approximately 150m in the northern portions to just above sea level along the Saint John River flood plain. Temperatures in the area are strongly regulated due to the large inland body of Grand Lake, which acts as a heat sink. This results in the area having the warmest climate in the province.

The northeastern portion (approximately 45 percent) is represented by the Eastern Lowlands. The ecoregion is characterized by generally flat to gently rolling terrain. Elevations tend to range from sea level in coastal areas, rise to heights of approximately 150m in central parts, and then recede again in the direction of the Grand Lake Basin. The climate of the Eastern Lowlands tends to be regulated by the surrounding ecoregions. As a result, the area has the lowest precipitation levels in New Brunswick. The warm, dry summers of the ecoregion have resulted in the area having a history of forest fires, which is reflected by the abundance of jack pine and black spruce, both of which are fire-adapted tree species.

The next higher ‘level of resolution’ in ecological land classifications are ecodistricts (DNRE 1996). An ecodistrict captures the broad landforms within areas of homogeneous climate represented by the ecoregions. Three ecodistricts are represented within the Washademoak Lake – Canaan River watershed: Salmon River, Grand Lake, and Anagance Ridge.

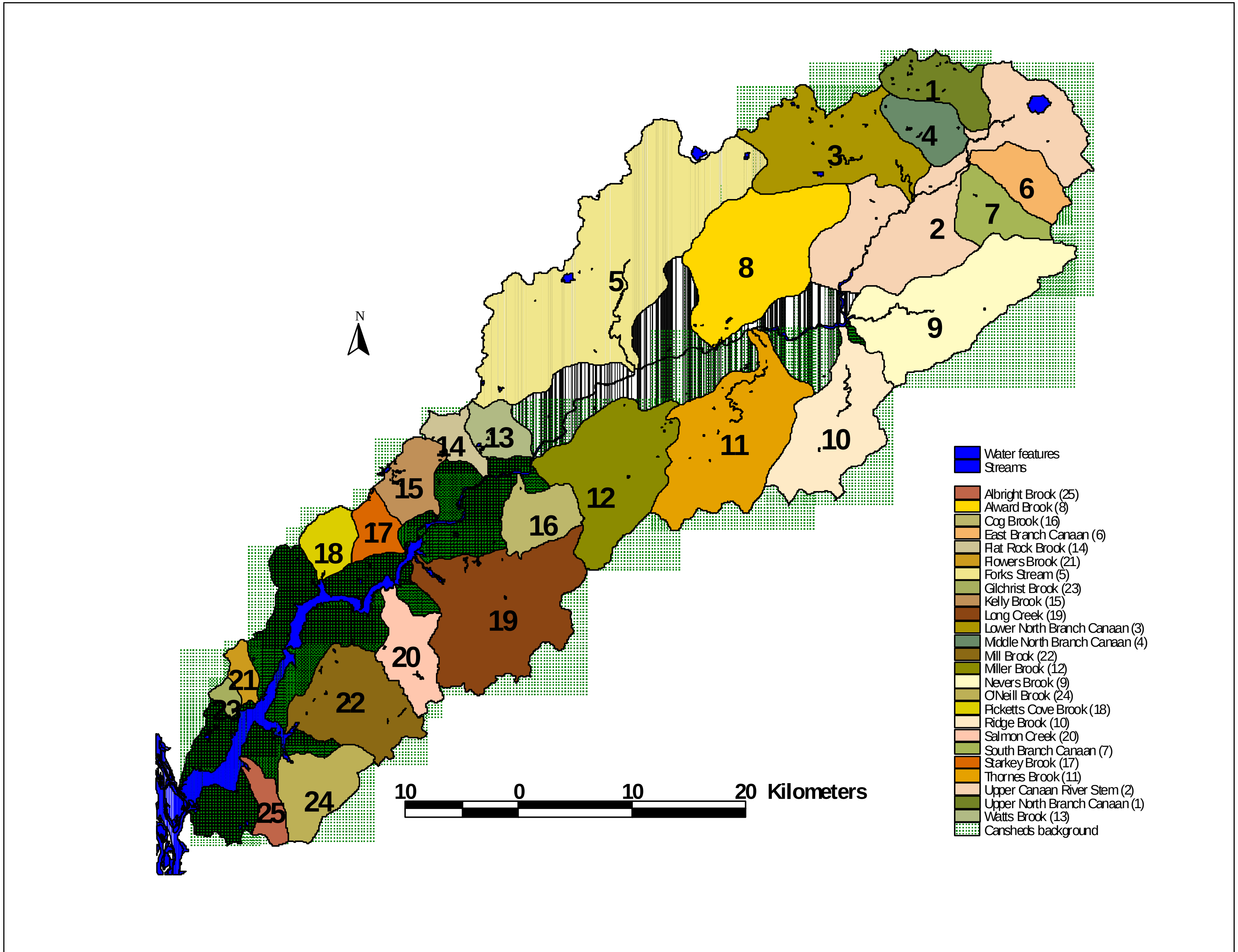
The northeastern portion of the Canaan River watershed is located within the Salmon River ecodistrict.  This ecodistrict contains soils that are poorly drained and of low inherent fertility.  Soils tend to consist of red, fine textured (clay loam) compact soil overlying Carboniferous grey and red sandstone, mudstone, and conglomerate bedrock.

The southwestern portion of the watershed is located within the Grand Lake ecodistrict. Soils within this ecodistrict are similar to those in the Salmon River ecodistrict, though they tend to be better drained and thus more fertile.  Bedrock is also similar.  These moderately fertile soils, particularly the well-drained slopes in the southwestern portion of the ecodistrict are in use for agriculture, mostly horticultural crops.

A small portion of the watershed, along its southern edge, is within the Anagance Ridge ecodistrict.  The bedrock consists of Carboniferous red conglomerate and sandstone, and a minor mudstone, overlain with deep, loam to sandy loam soils.  Because of the conglomerate bedrock, the soils may contain many gravel types.

The soils and underlying bedrock in all three ecodistricts, when exposed, tend to be highly erodable, which can lead to soil loss and stream sedimentation, particularly after heavy rain events.

**Figure 2. Sub-watersheds of Washademoak Lake - Canaan River drainage.**

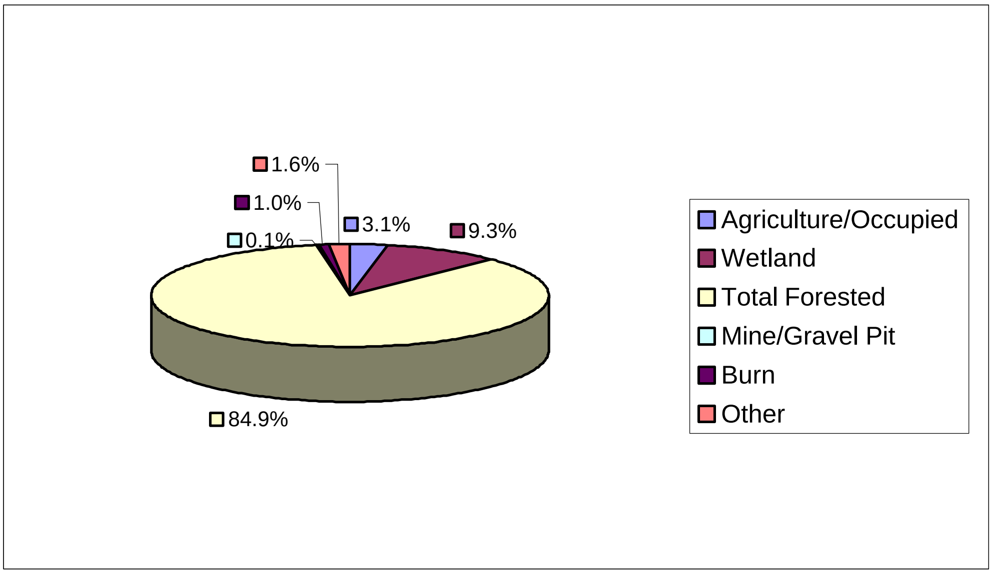


## Land use

Much of the land use within the watershed has shifted from family farms and small-scale woodlot activities to agribusiness and large-scale industrial forestry (Manley 1997). As well, areas closest to the water's edge have become greatly sought after for permanent and seasonal residences. This shift has also created an increase in recreational use within the watershed.

Forested land, including regenerating and recent cutover areas, covers approximately 85 percent of the total landbase of the Canaan River watershed. Agricultural and other 'occupied' lands, including residential and commercial properties, cover approximately 3 percent, and wetland approximately 9 percent (Figure 3).

**Figure 3. Land use, Canaan River watershed (148, 092 ha), 1997.**




Associated with the increase in forest activities and residential and commercial construction is an increase in the number of access roads being constructed. Access roads that are constructed using the highly erodible native soils of the watershed may greatly contribute to sediment release into the watercourses. This sediment release affects the colour, turbidity, and quantity of suspended solids, and hence affects water quality.

## Methods

Eleven sampling stations were established along the length of the Canaan River (Figure 4). Six of the sampling sites were located on the main stem of the Canaan River, while the remaining five were located on tributaries, near their confluence with the Canaan. Land use data for the Canaan River watershed were obtained from earlier work in the Washademoak Lake – Canaan River watershed (Manley 1997).

Eight water quality surveys were conducted between June 18 and November 11, 1997, by field officers of the New Brunswick Department of Environment and Local Government (NBDELG). The samples were collected according to established sampling protocols to ensure that they were representative of actual conditions. Of the surveys performed, four were considered post-precipitation event samples, which were originally intended to follow rain events with a total rainfall greater than 20 mm in a twenty-four hour period (Table 1). However, due to the dry summer and autumn conditions of 1997, two post-precipitation samples were taken when the total rainfall was less than 20 mm. For the rain event samples, field officers were informed of the occurrence of a 'rain event' by the New Brunswick Department of Natural Resources and Energy. Water samples from these events were collected within twenty-four hours of the field officers being advised of the event. It is important to note that field personnel had no way of knowing at which point in the run-off cycle samples were being collected. The rain event samples were collected on July 4, September 4, October 29, and November 11, 1997. In addition to the rain event samples, four to five baseline samples were collected during the above-mentioned period for the majority of the stations.

**Table 1. Canaan River watershed water quality sampling dates, 1997**

| Baseline sampling dates | Rain event sampling dates |
|---|---|
| 18 June | 04 July |
| 31 July | 04 September |
| 22 September | 29 October |
| 15 October | 11 November |

All samples collected were delivered to the NBDELG laboratory in Fredericton, for analysis of physical and chemical properties, and bacterial counts. The resulting data were compared to the guidelines found in Table 2.

The guidelines indicate protection levels. Values at or below the guideline do not pose any immediate threat, whereas those above the guidelines begin to have effects, which become more severe as the concentration increases to lethality (J. Choate, pers. comm).

The water quality was compared for baseline and rain event data. As well, land use data were viewed in relation to water quality results in an attempt to explain the reasons for water quality differences between sub-watersheds.

**Figure 4. Location of water quality sampling stations for Canaan River watershed.**

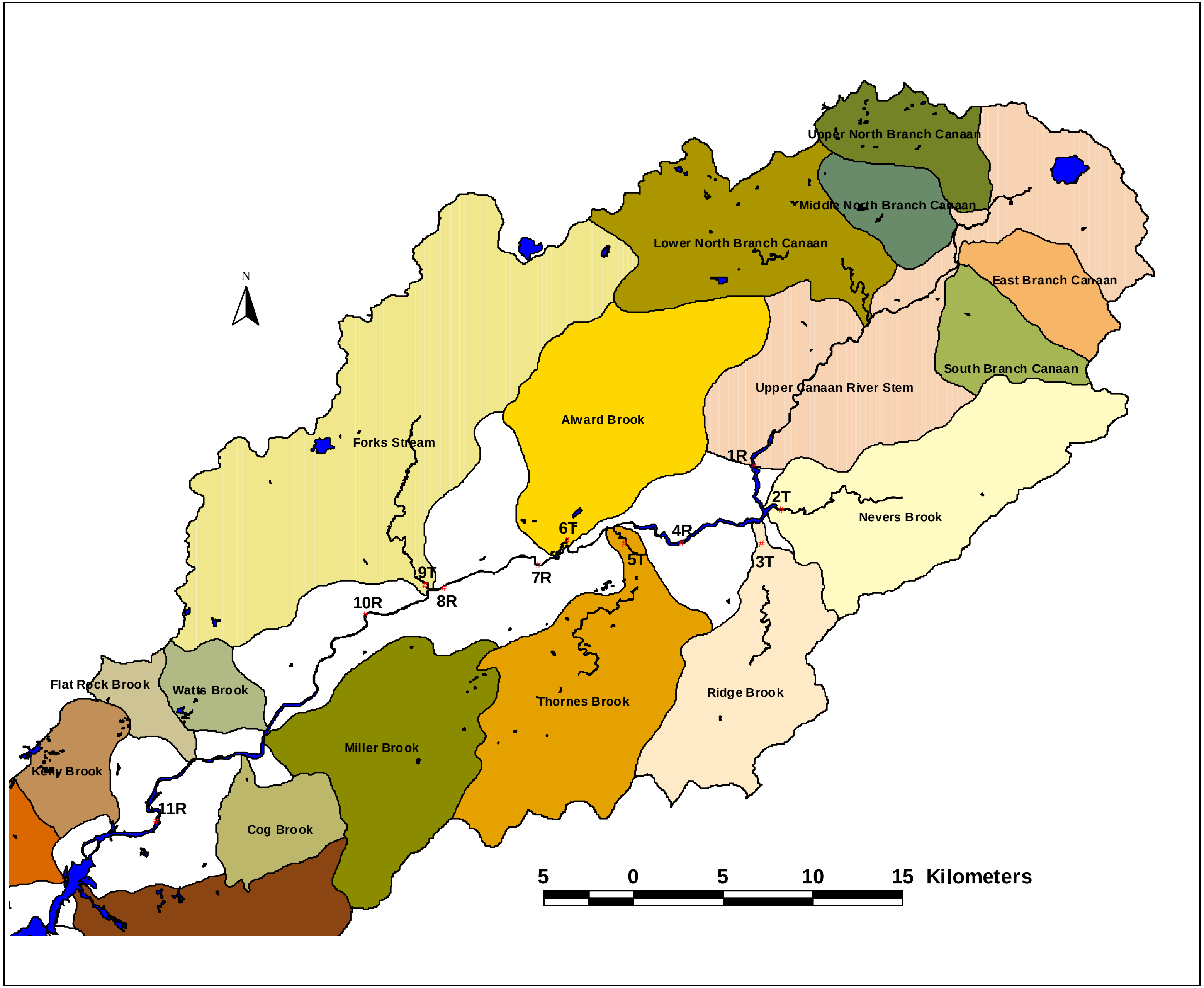


**Table 2. Water quality parameters measured in the Canaan River Watershed and guideline levels.**

| Parameter | Description | Guideline[1] | Comment |
|---|---|---|---|
| Aluminum (Al) | Third most abundant element in the earth's crust | Should not exceed 0.005 mg/L in waters with a pH of 6.5 or less; should not exceed 0.1 mg/L in waters with a pH of greater than 6.5 | Importance of pH to toxicity investigated only recently and significant gaps in knowledge remain |
| Grans Alkalinity (ALK-G) | Ability of water to neutralize an acid | | 2 – 10 mg/L indicates moderate sensitivity to acidification |
| Arsenic (As) | 53rd element in abundance in the earth's crust | 50 μg/L | Invertebrates are generally more sensitive to arsenic than adult fish |
| Calcium (Ca) | An alkaline-earth metal, along with magnesium is primarily responsible for the hardness of water | | Less than 15 mg/L is common in New Brunswick surface waters |
| Cadmium (Cd) | Usually present in water in trace quantities, highly toxic to humans and aquatic life | 0.2 μg/L in water with a hardness of 0 – 60 mg/L. 0.8 μg/L where hardness is 61 – 120 mg/L. | |
| Chloride (Cl) | Major inorganic ion, in high concentrations is partial cause of salty taste in water. | | |
| Colour (CLRA) | Colour imparted to water by natural minerals or vegetation. | 100 units for recreational use. | |
| Conductivity (COND) | Indicates waters ability to conduct an electrical current, can be used to estimate total dissolved solids. | | Normal range in NB fresh waters: 10 – 50 μsie/cm. |
| Copper (Cu) | Essential for plant and animal nutrition in small amounts. | 2.0 μg/L in waters with a hardness of 0 – 120 mg/L, 3.0 μg/L when hardness is 120 – 180 mg/L, and 4.0 μg/L when hardness is greater than 180 mg/L. | |
| Chromium (Cr) | A blue-white, hard, brittle metal. | 20 μg/L to protect fish, 2.0 μg/L to protect other aquatic life, including zooplankton and phytoplankton. | Generally present at low concentration in Canadian surface waters. |
| Fluoride (F) | 17th most abundant element in the earth's crust, a member of the halide family. | Drinking water guideline is 1.5 mg/L. | |

[1] Canadian Council of Ministers of the Environment. 1987. Canadian Water Quality Guidelines. Unless otherwise noted.

**Table 2. (continued).**

| Parameter | Description | Guideline[3] | Comment |
| --- | --- | --- | --- |
| Iron (Fe) | Fourth most abundant element in the earth's crust | Should not exceed 0.3 mg/L. | |
| Hardness (HARD) | Principally determined by the sum of calcium and magnesium. | | 0-30 mg/L : very soft<br>31-60 mg/L: soft<br>61-120 mg/L: moderately soft<br>121-180 mg/L: hard<br>>180 mg/L: very hard |
| Potassium (K) | Alkali metal, essential for plant and animal nutrition. | | Seldom 20 mg/L in natural surface waters, generally less than 10 mg/L. |
| Magnesium (Mg) | An alkaline-earth metal, one of the two main components of hardness. | Less than 50 mg/L recommended for drinking water. | |
| Manganese (Mn) | Often found in association with iron. | | Tolerance values for freshwater aquatic life are reported to range from 1.5 to 1000 mg/L. |
| Sodium (Na) | Major inorganic ion, in high concentrations and in combination with chloride can cause salty taste in water. | 20 mg/L in drinking water of individuals on sodium restricted diets. | |
| Total Ammonia ($NH_3T$) | Reduced inorganic form of nitrogen. | Varies with temperature and pH; at pH of 6.75 and temperature of 15$^o$C, guideline is 2.2 mg/L. | |
| Total Kjeldahl Nitrogen (TKN) | Sum of both ammonia and organic nitrogen. | | 0.1 to 0.5 mg/L is normal environmental range. |
| Nitrate & Nitrite (NOx) | Inorganic form of nitrogen, major nutrient for aquatic vegetation. | Less than 10 mg/L in drinking water. | Greater than 5 mg/L may reflect unsanitary conditions. |
| Nickel (Ni) | Silver-grey metal, ductile, malleable, and tough. | 25 μg/L at hardness 0-60 mg/L<br>65 μg/L at hardness 60-120 mg/L<br>110 μg/L at hardness 120-180 mg/L<br>150 μg/L at hardness >180 mg/L | |
| Lead (Pb) | Ubiquitous in the natural environment | Should not exceed 1.0 μg/L in waters with a hardness of 0-60 mg/L | |
| pH (pH) | Index of hydrogen ion concentration, 7 indicates neutral, less than 7 acidic, greater than 7 alkaline. | 6.5 – 9.0 | |
| Sulfate ($SO_4$) | Oxidized form of sulfur. | Less than 150 mg/L for drinking water. | |
| Suspended Solids (SS) | A measure of material suspended in the water column. | Should not exceed 10 mg/L. | |

**Table 2. (continued).**

| Parameter | Description | Guideline[3] | Comment |
|---|---|---|---|
| Total Organic Carbon (TOC) | Carbon is required for biological processes, decomposition of carbon compounds removes oxygen from water. | 15 mg/L (represents the upper end of values detected in natural surface waters in NB). | Greater than 15 mg/L may reflect unsanitary conditions. |
| Total Phosphorus (TP) | Essential plant nutrient may stimulate algal growth. | 0.02 mg/L average for ice-free period in lakes to avoid nuisance concentrations of algae (0.01 mg/L provides a high level of protection); less than 0.03 mg/L for rivers and streams.[1] | Index of maximum concentrations is: 0.10 mg/L in flowing water, 0.05 mg/L for water flowing into lakes and reservoirs and 0.025 mg/L in lakes and reservoirs. |
| Turbidity (TURB) | Optical measure of suspended particles in water. | For recreational use should not increase by more than 5.0 NTU (nephelometric turbidity units) over natural turbidity when turbidity is low (<50 NTU). | Noted any results exceeding 10.0 NTU, as increases could not be determined. |
| Zinc (Zn) | Essential for plants and animals, relatively non-toxic to humans but toxic to aquatic organisms. | Should not exceed 30.0 μg/L. | |
| Dissolved Oxygen (DO) | Necessary for respiration in aerobic organisms. | Should be no less than 5.0 mg/L for protection of fish. | |
| Fecal Coliform Bacteria (FC) | A group of bacteria found in the intestines of humans and warm blooded animals and present in their feces. | For body contact recreation, geometric mean of at least 5 samples taken over a 30 day period should be less than 200 / 100 ml. | For report, FC bacteria were used a water quality indicators and results exceeding 200 / 100 ml were noted instead of using geometric mean. |
| *Escherichia coli* (*E.coli*) | A bacterium formed in the intestines of humans and warm blooded animals and present in their feces. | For body contact recreation, geometric mean of at least 5 samples taken over a 30 day period should be less than 200 / 100 ml. | For report, *E.coli* bacteria were used a water quality indicators and results exceeding 200 / 100 ml were noted instead of using geometric mean. |
| Temperature (TEMP) | Affects physical, biological, and chemical processes in the aquatic environment. | The natural thermal regime should not be altered so as to impair the quality of the natural environment. The diversity, distribution and abundance of plant and animal life should not be significantly changed.[4] | Optimum temperature for brook trout are between 15 and 20 $^{o}$C.[2] |

[1] Ontario Ministry of Environment and Energy (1994)
[2] International Technical Advisory Subcommittee on Water Quality in the Saint John river (1980)

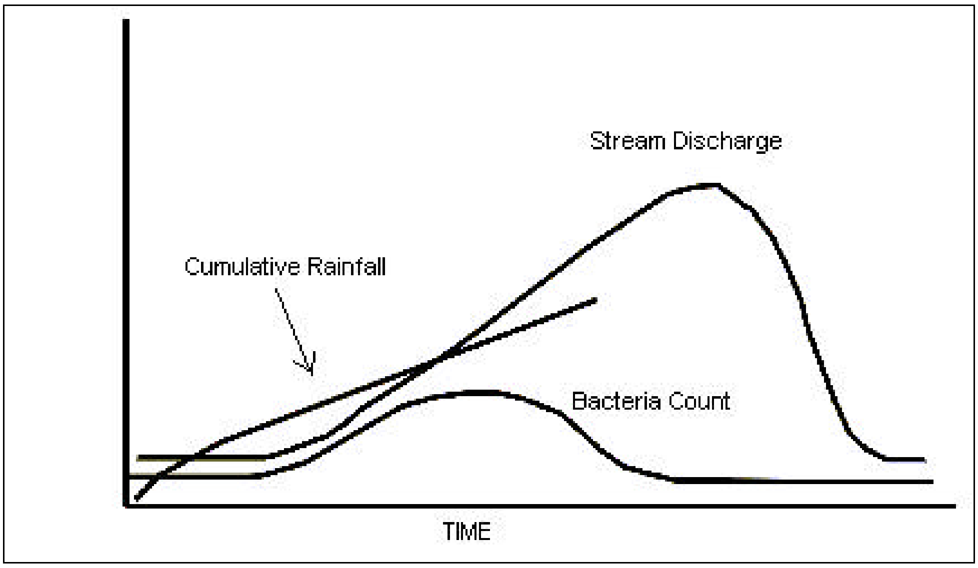
**Results**

Duplicate samples were collected and analyzed to ensure reproducibility. For the physical and chemical parameters, this was done on July 4 at stations 10 and 11. For the bacteria, four samples were usually collected and analyzed for each station during each sampling date.

Results for duplicate samples were similar for most parameters, providing some indication that the data were reliable (Table 3). Greater variations were noted for duplicate copper and iron results, indicating that the results for these two parameters may be less reliable. As expected, there was considerable variation in replicate bacteria samples (Table 4), however large variations for total coliform only occurred in one instance and for *E.coli* in two instances. All replicate fecal coliform results showed reasonable agreement.

As mentioned previously, field personnel were unable to determine the stage of the runoff cycle at the time of sampling. Since water quality may change a great deal over the course of a rainfall event (Figure 5), caution must be exercised when interpreting data, particularly when comparing results for specific stations and / or dates. Thus, conclusions drawn from the data must be tempered by the fact that measurements could have been much different had the samples been taken at another time. This is less of a problem when measuring baseline conditions.

**Figure 5. Hypothetical relationship between discharge, rainfall, and bacteria concentration (NBDELG, report in preparation).**




**General water quality**

For the most part, the hardness of the water samples was very low (0 – 30 mg/l as Ca $CO_3$), with the exception of Station 3, which had some values in excess of 100 mg/l. Water temperatures were recorded on October 15 only. At that time, temperatures ranged from 9.5$^{o}$C to 11.5 $^{o}$C along the length of the Canaan. The pH was generally in the high six to low seven range, which is considered near neutral. The exception was Station 3, which had values over eight. Conductivity tended to be in the range of 100 µsie/cm, with the exception again at Station 3 which was in the range of 300 µsie/cm.

Provided in Tables 3 and 4 are the laboratory results for the individual measurements of all chemical, physical, and bacterial parameters for both baseline and event sampling, while Tables 5 and 6 provide summary statistics (mean, median, and standard deviation) of the parameters measurements.

The frequency distribution of the parameters in comparison to the guidelines in Table 2 are shown in Table 7. Ammonia, arsenic, cadmium, fluoride, magnesium, nickel, nitrite, nitrite-nitrate (NOx), and sulfate values were all less than the prescribed protection guidelines. Many of these parameters had values that fell below established laboratory detection limits, and were of no consequence.

Dissolved oxygen was acceptable in all cases.

Thirty-five percent of the chromium results were below detection. Sixty-one percent were below the 2.0 µg/l guideline, while the remaining four percent slightly exceeded the guideline (Station 3). The maximum chromium value was 3.6 µg/l (Station 3), which is higher than the guideline for the protection of all aquatic life (2.0 µg/l), but well below the second guideline of 20 µg/l established for the protection of freshwater fish.

Ninety-nine percent of the copper values were below the 2.0 µg/l guideline, while the remaining one percent slightly exceeded the guideline (Station 11).

Ninety-eight percent of the lead values fell below the 1.0 µg/l guideline. The remaining two percent slightly exceeded the guideline (Stations 1 and 3). The maximum value recorded was 2.4 µg/l (Station 3).

Ninety-nine percent of the zinc results were below the 0.03 mg/l guideline, while one percent slightly exceeded the guideline (Station 10).

Seventy-three percent (58 of 80) of the samples tested for aluminum concentrations exceeded the 100 µg/l guideline (all stations but Station 7). Of the samples exceeding the guideline, forty-one percent (24 of 58) had concentrations between 100 and 200 µg/l; thirty-one percent (18 of 58) were between 200 and 300 µg/l, while the remaining twenty-eight percent (16 of 58) were in excess of 300 µg/l.

Eighty-five percent (68 of 80) of the samples tested for iron concentration exceeded the 0.3 mg/l guideline (all stations). Of the samples exceeding the guideline, twenty-one percent (14 of 68) slightly exceeded the guideline (greater than 0.3 mg/l, but less than 0.5 mg/l), seventy-three percent (50 of 68) were between 0.51 mg/l and 1.0 mg/l, while the remaining six percent (4 of 68) were in excess of 1.0 mg/l.

For the most part, all metals were below guidelines, with the exception of aluminum and iron. The values for aluminum and iron, though exceeding the guidelines, exhibit similar characteristics to other surface waters in New Brunswick (J. Choate, per comm).

Nine percent of the pH readings were below the guideline range of 6.5 to 9.5 (Stations 1, 6, and 9). The lowest result was 5.62 (Station 6). Although slightly acidic waters are not, in themselves, necessarily harmful to aquatic biota, the effect they may have on other parameters are a source of concern, e.g. when the pH of water decreases, the toxicity of aluminum to aquatic life increases. However, the low incidence of values that were less than the guidelines is probably of little concern.

Ninety-four percent of the total phosphorous values were less than the 0.03 mg/l guideline value, while the remaining six percent were slightly in excess of the guideline (Stations 1, 3, 4, and 9). The maximum value recorded was 0.12 mg/l (Station 3).

New Brunswick waters usually have low concentrations of total organic carbon (TOC) (less than 15 mg/l). Of the 78 samples tested for TOC, 29 (37 percent) were in excess of 15 mg/l (all but Stations 5 and 7), with the maximum value being 23 mg/l (Station 12).

Thirty-four percent (27 of 80 samples) of samples exceeded the recreational guideline for colour (all but Stations 5 and 7) (Figures 6 – 11). Of the samples exceeding the guideline, eighty-one percent (22 samples) had values between 100 and 200 TCU, while the remaining nineteen percent (5 samples) were in excess of 200 TCU (Stations 1, 9, and 10).

Fifteen percent (12 of 80) of the samples measured for suspended solids exceeded the 10 mg/l guideline (all but Stations 6, 7, and 9) (Figures 12 - 17). Of these 12 samples, 8 (67 percent) had concentrations between 21 and 30 mg/l, while the remaining 4 (33 percent) were in excess of 40 mg/l. The maximum value recorded was 150 mg/l (Station 3).

Ninety-six percent of turbidity values were below the 10 Nephelometric turbidity unit (NTU) guideline (Figures 18 – 23), while the remaining four percent were slightly above, with the maximum value being 21.2 NTU (Stations 1, 3, and 6).

*Escherichia coli* (*E.coli*) and fecal coliform bacteria do not directly affect aquatic biota, but indicate the degree of contamination by animal and or human waste, and are important from a public health standpoint. Significant levels of bacteria (fecal coliform and *E.coli*) were present at various locations and times. The guideline used was 200 counts per 100 ml for both *E.coli* and fecal coliform (Table 2). Twenty-eight percent (19 of 69) of the samples tested for *E.coli* exceeded the guideline (all stations but 7, 9, and 11) (Figures 24 – 29). Of these 19 samples, 10 (53 percent) had counts in excess of 1000 per 100 ml, with the maximum value being greater than 2419 counts per 100 ml (Stations 3 and 10) . Nineteen percent (13 of 69) of fecal coliform measurements were in excess of the guideline (all stations but 7, 9, and 11) (Figures 30 – 35). Of the 13 samples, the maximum measurement recorded was 344 counts per 100 ml (Station 6).

The low frequency and magnitude of exceedences of the guidelines indicate that the Canaan River system is generally suited to aquatic life. Occasional exceedences of bacteria guideline values may indicate some impairment of the Canaan River system for recreational use. Some of the exceedences in the guidelines were due to rainfall events and land use, which will be discussed in other sections.

### Spatial Trends

Median conductivity and turbidity measured on the main river during baseline conditions were used to indicate the overall change in water quality along the length of the Canaan River (Figures 36 and 37). Median conductivity remained somewhat constant along the length of the Canaan, though the values at Stations 3, 4, and 7 were higher than the others (Table 5). Median turbidity values remained relatively constant throughout the mainstem. Perusal of data for other parameters also indicated relatively constant conditions.

Water quality at Station 3 differed from the other stations both on the main river and tributaries. Hardness, alkalinity, conductivity, fluoride, sulfate, and pH were noticeably higher than at any of the other stations (Tables 3 and 5). Station 3 is influenced by a large percentage of agricultural and occupied land (twenty five percent) in its drainage (Figure 37), which may account for the high levels of bacteria which were also recorded (Table 4 and 6). As well, one of the main geological features of the area is a large limestone deposit, which supports a quarry operation at a commercial level. This probably had a noticeable effect on the hardness, alkalinity, and pH. Additionally, the village of Havelock, which is the most populated community within the Canaan River watershed is located within the drainage area represented by Station 3.

Station 11, at Canaan Rapids, is the most downstream station on the Canaan. Values recorded at Station 11 were generally consistent with those recorded at the mainstream stations along the length of the Canaan (Table 3 and 4). This station has been used in the past for water quality sampling. Most recently, data for this station were used in a study which resulted in a report: “Community–Based Investigation into the Current State and Functioning of the Washademoak Lake System and the Canaan River Watershed.” (Manley 1997). Comparison of the Station 11 baseline values with the results for July to October 1996 showed little difference between the two years (Table 3).

### Effects of Rainfall and Surface Runoff on Water Quality

Some parameter values showed major increases following rain events, while others declined.

Major rainfall events (>20 mm) were recorded at a weather observation station at Alward Brook on July 4 (~ 38mm) and September 4 (~ 22mm) (Table 8). A perusal of the water quality data indicated that several parameters were near or below detection regardless of rainfall, and they were not considered further.

Of the remaining parameters, conductivity, hardness, and pH tended to decrease following a rain event, while others tended to increase (Table 9). Colour, suspended solids, turbidity, fecal coliform, and, notably, *E.coli* often increased to the point of exceeding the guidelines (Figures 6 – 35). It is likely that the decreases resulted from dilution of the groundwater component of the stream flow by surface water which contained less dissolved matter and was also probably lower in pH than the groundwater. The acidity of the rain may have also contributed to the decline in pH. It is probable that the increases resulted from overland flow transporting significant amounts of soil, organic matter, and bacteria to the watercourse early in the event, before dilution could reduce concentrations (Figure 4).

Colour, suspended solids, and turbidity tended to increase dramatically following the July 4 rain event, but changes for the September 4 event were not as dramatic. The reasons for this difference are not known.

Bacteria were not measured on July 4 due to logistical problems of getting samples to the laboratory within the specified time period. In general, bacteria (*E.coli* and fecal coliform) showed the largest increase on September 4, with lesser increases noted on September 22 and October 29 (Figures 24 – 35). The latter two increases were likely due to rainfall that occurred prior to sampling, but was not in sufficiently large amounts to be considered rainfall events (Table 8). *E.coli* values were, at times, in excess of the guideline, exceeding it by up to twelve times (Figures 24 to 29). *E.coli* measurements had an upper detection limit of 2419 counts per 100 ml of water. Values that exceeded this limit were recorded as greater than 2419 counts per 100 ml. For this reason, the actual maximum bacteria count is not known.

This increase may be attributable to manure spreading on agricultural fields in late summer to late autumn. Prior to the September 4 sample, approximately 23 mm of rain fell in the watershed area. If manure spreading occurred prior to this rain event, it is reasonable to expect that the *E.coli* bacteria would be transported into the watercourse.

Unlike the other stations, Station 11 did not show a large increase in *E.coli* and fecal coliform following the September 4 rain event (Figures 24 – 35). This may have been attributable to a combination of dilution and die-off. Station 9, likewise, did not exhibit an increase after rainfall. Immediately upstream of Station 11 was a large, seasonal trailer park / campground. The grounds were essentially a wide-open, grassy field that was cleared to the water's edge. This large area may have contributed to the sedimentation of the Canaan River, as overland flow may have transported loose soil particles into the water course, which would otherwise be trapped by vegetation had a riparian strip been established. Additionally, the park collected its domestic waste in an aerated waste pond. If the pipe network or the waste pond had undetected deficiencies, contamination of the Canaan by human waste was possible. However, water quality measured at this station was generally good, which would indicate that the campground had little effect on the parameter values.

Conductivity tended to decrease after rainfall. The largest decreases occurred at Stations 1 and 3 (Table 8), where declines of approximately 60µsie/cm and 700 µsie/cm were recorded for Station 1 on July 4 and September 4, respectively. Reductions of 200 µsie/cm and 100 µsie/cm were noted for Station 3. The other stations saw decreases of approximately 2 µsie/cm to 50 µsie/cm. Hardness showed the same general pattern as conductivity. Similarly, pH showed the same general pattern, though a large change also occurred at Station 6 on July 4.

Aluminum, iron, and manganese all tended to increase following rainfall events (Table 8). These metals are found naturally as a component of the soil and may be transported to a watercourse by surface runoff. Because they are a component of the soil, they also tend to show up with increases in suspended solids.

Nitrogen (as NOx) and total phosphorous tended to increase following rain events. These increases could have resulted from agricultural and forestry activities, faulty individual sewage treatment systems, and other land use practices. Total organic carbon also generally increased following rainfall due to surface runoff carrying organic matter to watercourses.

**Water quality in relation to land use**

Land use data for the sampling station drainage area are given in Figures 38 – 45 and Tables 10 and 11.

The data indicated that Station 3 differed from all other stations. Values for hardness, alkalinity, chloride, and conductivity increased at Station 3 (Table 3). These increases were probably related to the limestone bedrock in the area. The hardness, alkalinity, and conductivity suggest a higher pH, which was the case at this station.

The increased sulfate ($SO_4$) measured for Station 3 was also likely related to the type of bedrock in the area. Similarly, the low occurrence of aluminum and iron was probably related to the localized soil and bedrock conditions of the sub-watershed.

Chromium is known to be used in explosives and some fertilizers (CCME 1987), and therefore could have resulted from either agricultural and or mining activities in the area. In addition to the quarry activities, the drainage for this station contained the greatest portion of agricultural and occupied lands of any of the sub-drainages in the watershed (Table 11 and Figure 40).

Low colour values for Station 3 were likely due to low iron content and lesser leaching of organics due to higher pH. Additionally, organic carbon (TOC) values were also probably lower due to a lesser rate of leaching.

Baseline phosphorous and turbidity values were generally low. Phosphorous values, after rain events, increased to a greater extent at Station 3 than at the other stations. This may have resulted from higher amounts of agricultural and occupied lands in this sub-watershed (Table 11 and Figure 40).

Because of a high percentage of agricultural and occupied land at Station 3, turbidity would also be expected to increase significantly. However, turbidity did not show the same increase after a rain event when compared to the other stations. The reason for this is not known.

Aluminum, colour, iron, and organic carbon results for Station 5 were similar to those at Station 3. However, the results for the other chemical and physical parameters were more similar to the remaining stations. Land use in the drainage for this station was considerably different from Station 3 (Figures 38 and 42). The greatest difference was in agriculture and occupied land which only made up four percent (approximately 525 hectares) of the drainage as opposed to twenty-five percent (approximately 2200 hectares) for Station 3 (Table 11). The two subwatersheds are adjacent to each other, and possibly some of the similarities in water quality were related to certain commonalties in soil and bedrock.

Stations 1, 6, and 9 all had lower hardness, alkalinity, and pH values than the remaining stations. The wetland percentages in the drainage of these stations were all much higher than those for the other stations, with values of seventeen, eight, and eight percent, respectively (Table 11 and Figures 38, 43, and 46). Most of the wetlands in these areas are acidic bogs (J. Choate per comm), which would explain the reduced values for these three parameters. The remaining six stations had values similar to each other, which would indicate that they represent normal conditions.

Compared to total coliform and fecal coliform, *E.coli* measurements are considered the best indicator of fecal contamination.

Recognizing the high degree of variability that can occur in bacteria populations, baseline values for *E.coli* were judged essentially similar at all stations. *E.coli* values were elevated at Stations 3 and 6 for the June 18 samples (Table 4), however, no significant prior rainfall took place and subsequent values during baseline periods were low. Thus, these higher values do not indicate a continuous bacteria source.

Major increases in *E.coli* occurred on September 4 (~22 mm of rain on the previous day). All *E.coli* measurements exceeded 1000 counts/100 ml except at Stations 9 and 11, which, as previously mentioned, did not show significant increases. Most of the high values were in the range of 1000 to 2000 counts/100 ml, but at Station 3 and 10 the values exceeded 2419 counts/100 ml. The increase at Station 3 can be explained by the high percentage of agricultural and occupied land. The reason for the high counts at Station 10 is not known. However, the increase on October 29 (prior rainfall amount is not known) at Station 10 was similar to the other stations.

The increase at Station 3 was again greater than at the other stations on October 29, indicating a greater likelihood of an actual difference at this station. Thus, rainfall is considered to have a greater effect on Station 3 than on the others.

The increased bacterial counts at Station 1 were unexpected since the drainage area represented by this station has little development with only 0.2 percent of the land area classified as agricultural and occupied (Table 11). The cause of this is unknown and could be the subject of further investigation. Baseline bacteria values were as expected for a relatively undeveloped area.

Two regressions were done to determine whether the *E.coli* counts for September 4 were related to the percent of agricultural land in each sub basin. For the first regression, all of the *E.coli* data were used. Data for Station 3 were removed before calculating the second regression due to the large percentage of agricultural land (twenty-five percent) in the sub basin compared to the others. Both regressions (Figures 49 and 50) showed weak linear trends ($R^2$ of 0.26 and 0.23, respectively), suggesting that the area of agricultural land influenced the degree of *E.coli* bacteria contamination. Had more samples been collected, a stronger relationship might have been detected. Moreover, a stronger trend might have been indicated if information on the location and type of agriculture and land use practices were available and could have been incorporated into a multiple regression.

The highest suspended sediment value (150 mg/l) was recorded at Station 3 following the July 4 rain event. The increase was approximately 100 times normal baseline values. Given the high percentage of agricultural land (Figure 40), as well as soils that are highly susceptible to erosion, this result is not surprising. However, Station 3 drains a relatively small area (~ 8600 hectare), which may explain the lack of significant effect on the downstream stations – Station 4 had a suspended solids value of 60 mg/l, while further downstream at Station 8 the value was 20 mg/l. Had Station 3 drained a larger area, a greater downstream effect could be expected.

**Figure 6. Colour values for all sampling stations, 18-June – 31-July, Canaan River and tributaries, 1997.**

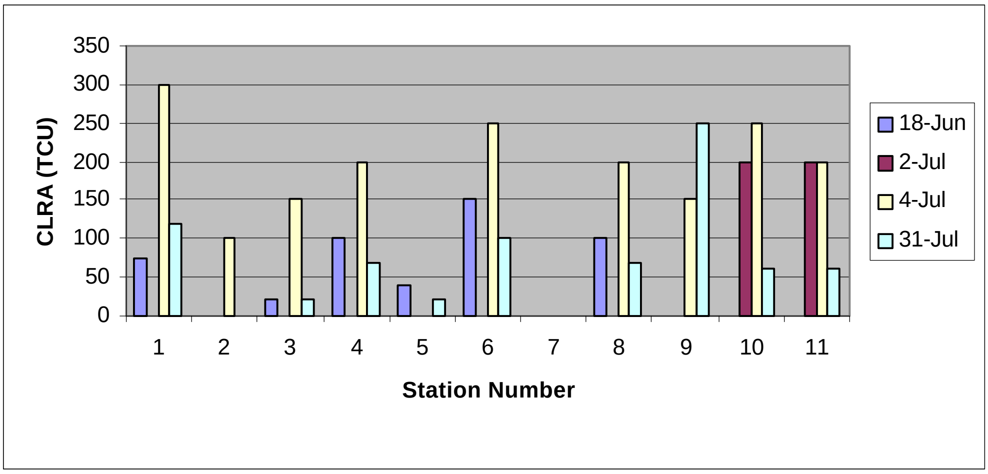



**Figure 7. Colour values for all sampling stations, 04-Sept – 11-Nov, Canaan River and tributaries, 1997.**

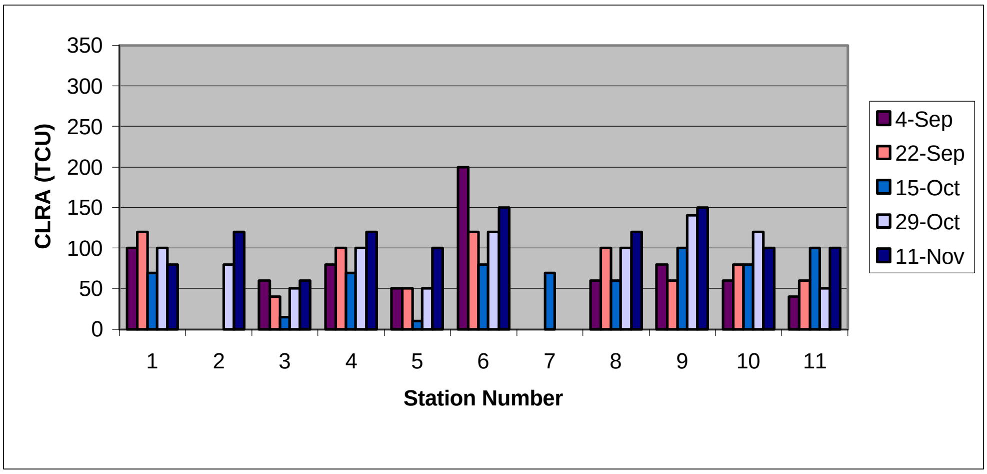



**Figure 8. Colour values for each sampling date, Stn 1 – 3, Canaan River and tributaries, 1997.**

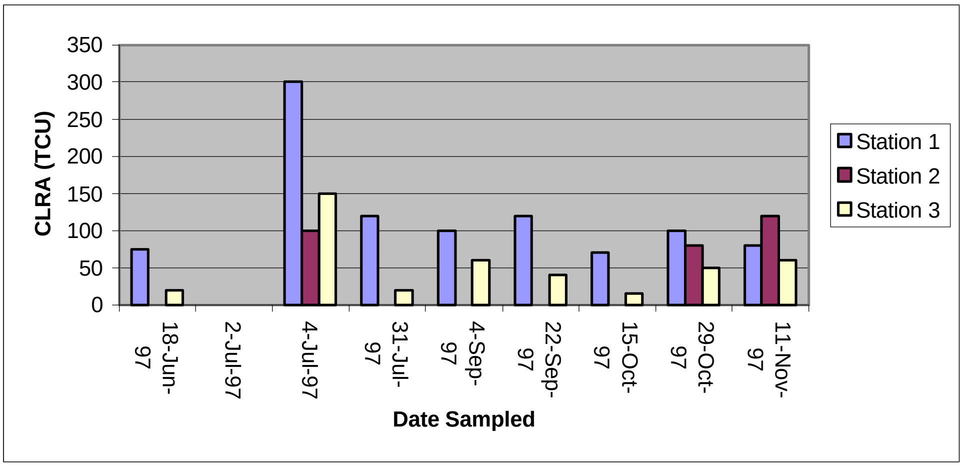


**Figure 9. Colour values for each sampling date, Stn 4 – 6, Canaan River and tributaries, 1997.**

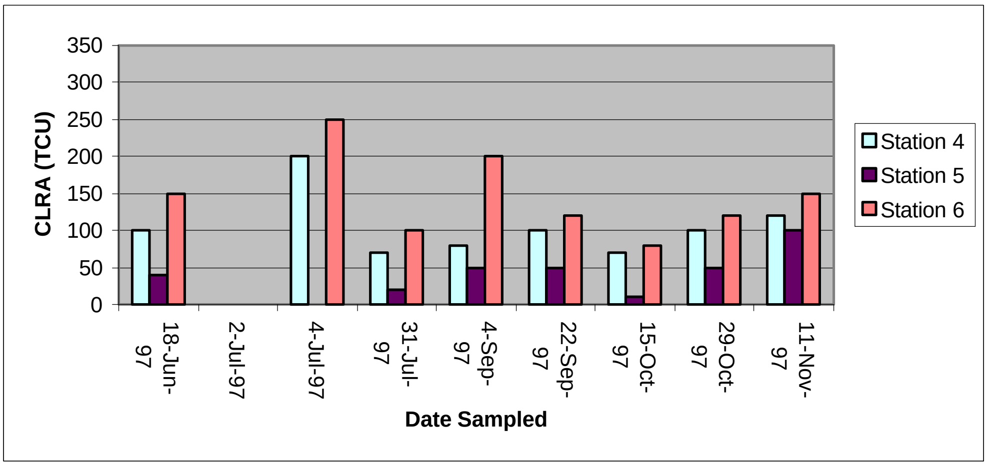



**Figure 10. Colour values for each sampling date, Stn 7 – 9, Canaan River and tributaries, 1997.**

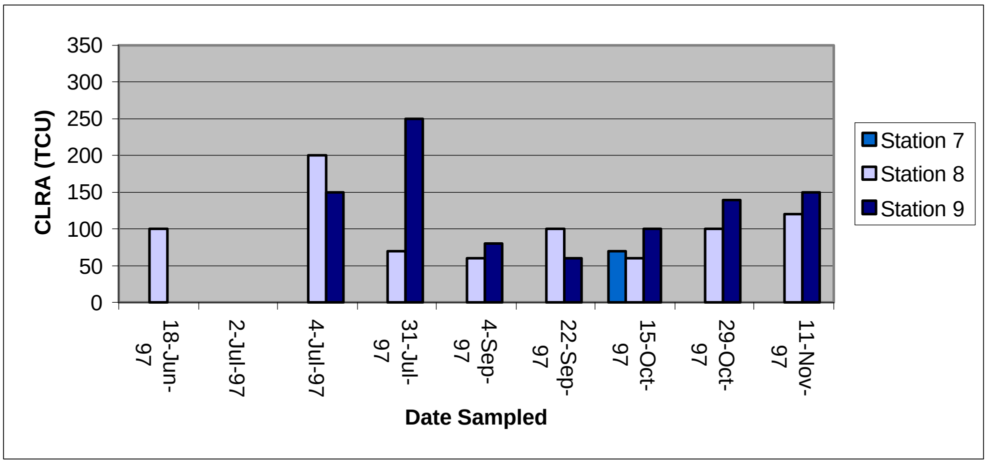



**Figure 11. Colour values for each sampling date, Stn 10 – 11, Canaan River and tributaries, 1997.**

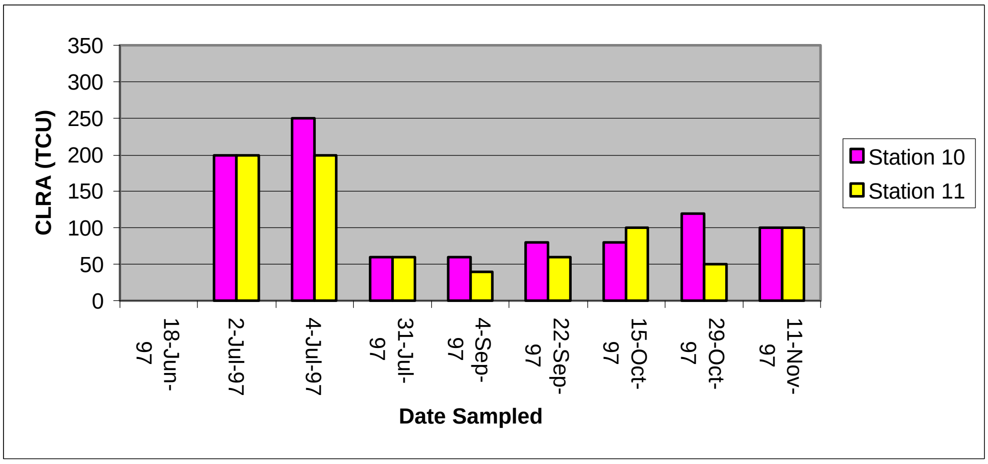


**Figure 12. Suspended solid values for all sampling stations, 18-June – 31- July, Canaan River and tributaries, 1997.**

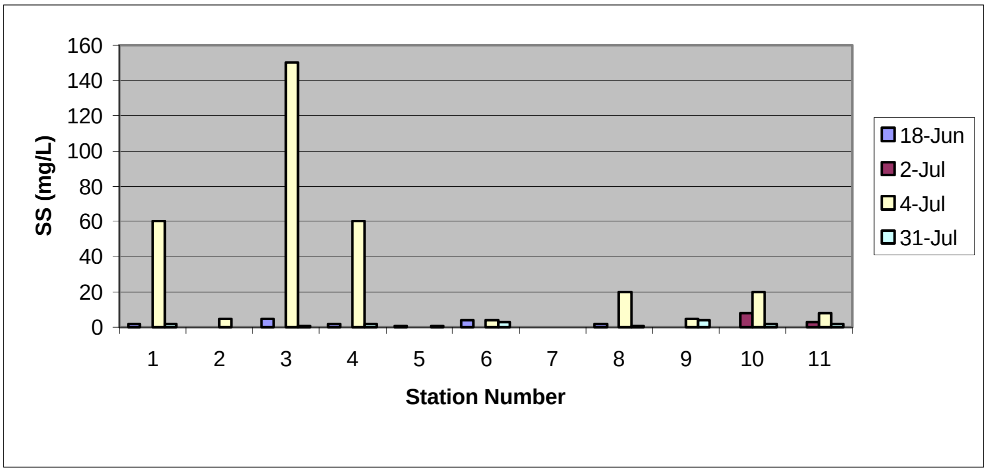



**Figure 13. Suspended solid values for all sampling stations, 04-Sept. – 11-Nov, Canaan River and tributaries, 1997.**

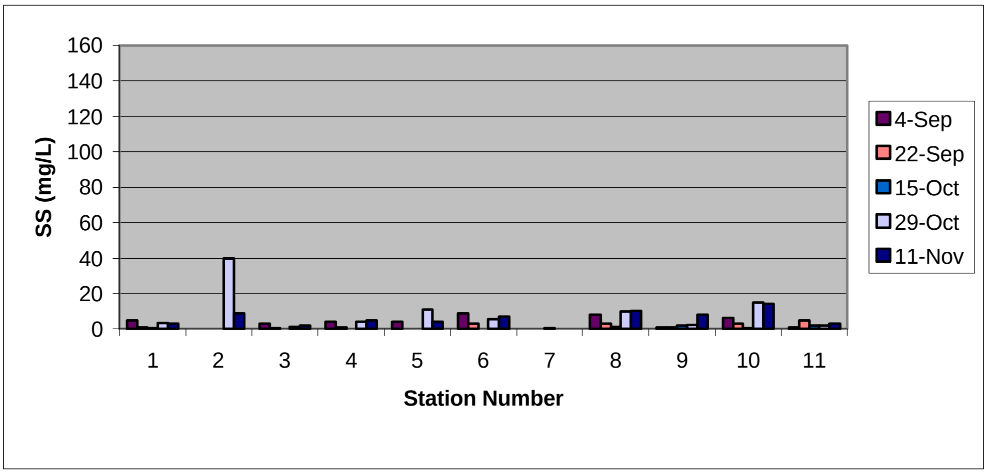



**Figure 14. Suspended solid values for each sampling date, Stn 1 – 3, Canaan River and tributaries, 1997.**

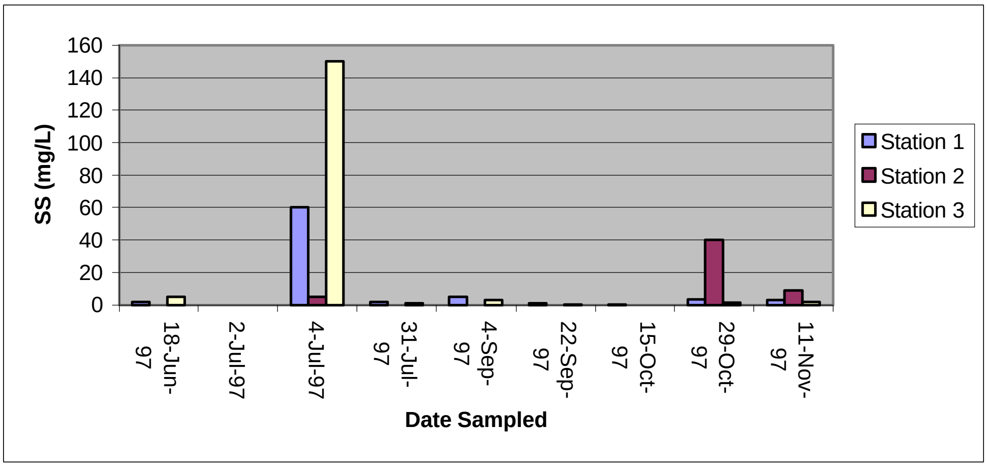


**Figure 15. Suspended solid values for each sampling date, Stn 4 – 6, Canaan River and tributaries, 1997.**

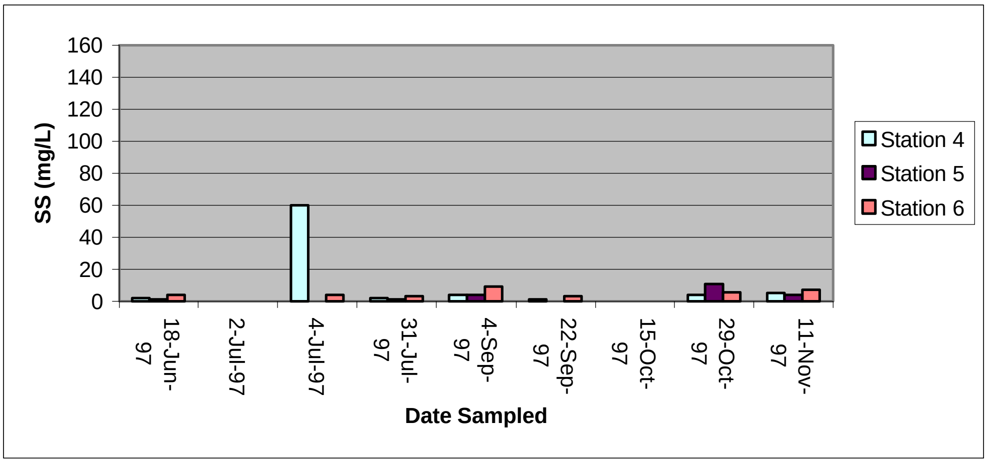



**Figure 16. Suspended solid values for each sampling date, Stn 7 – 9, Canaan River and tributaries, 1997.**

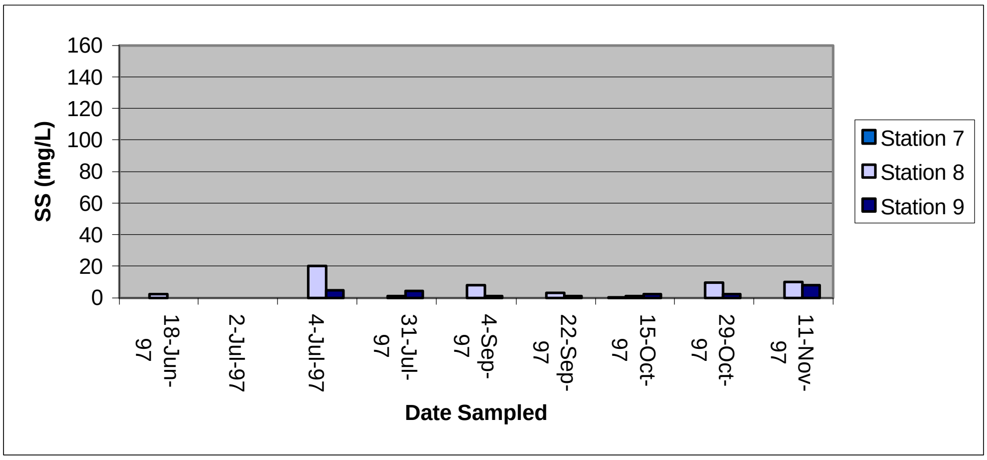



**Figure 17. Suspended solid values for each sampling date, Stn 10 – 11, Canaan River and tributaries, 1997.**

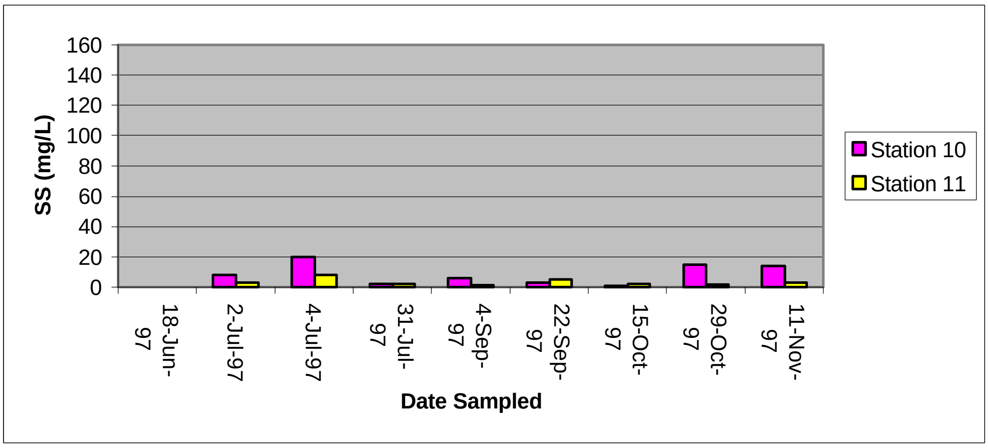


**Figure 18. Turbidity values all sampling stations, 18-June – 31- July, Canaan River and tributaries, 1997.**

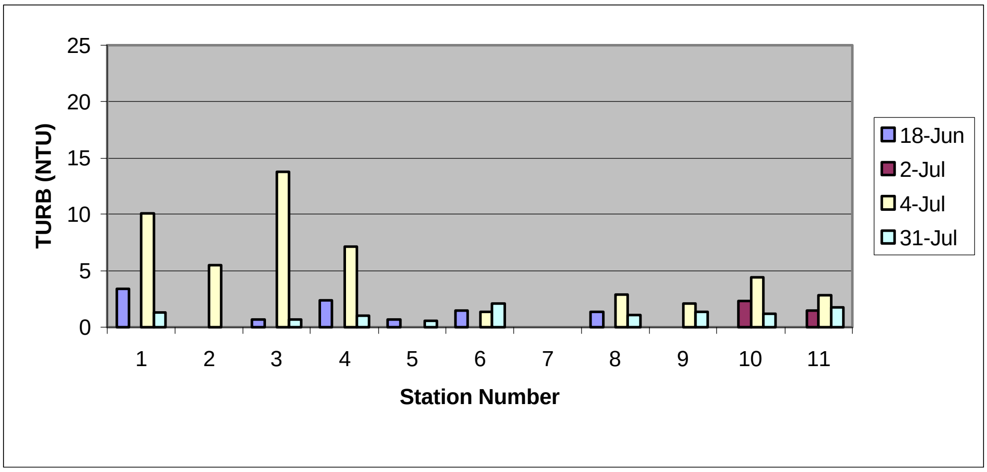



**Figure 19. Turbidity values for all sampling stations, 04-Sept – 11-Nov, Canaan River and tributaries, 1997.**

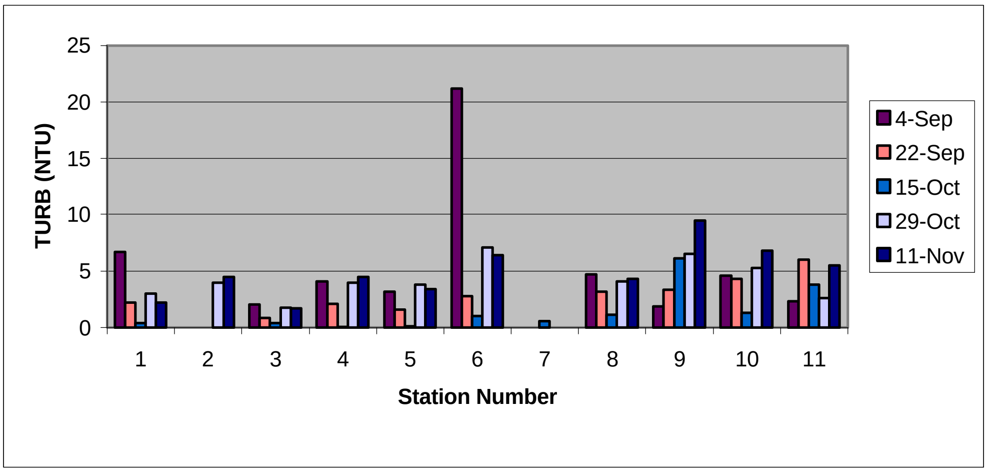



**Figure 20. Turbidity values for each sampling date, Stn 1 – 3, Canaan River and tributaries, 1997.**

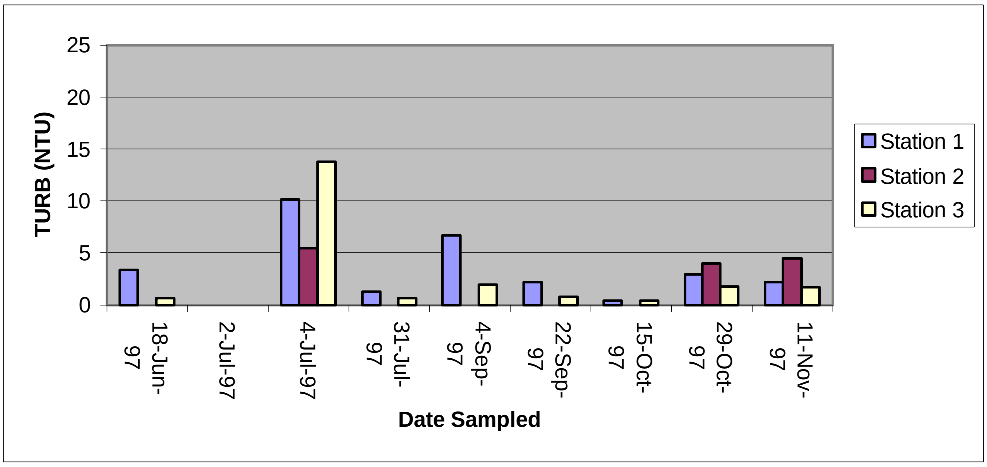


Figure 21. Turbidity values for each sampling date, Stn 4 – 6, Canaan River and tributaries, 1997.

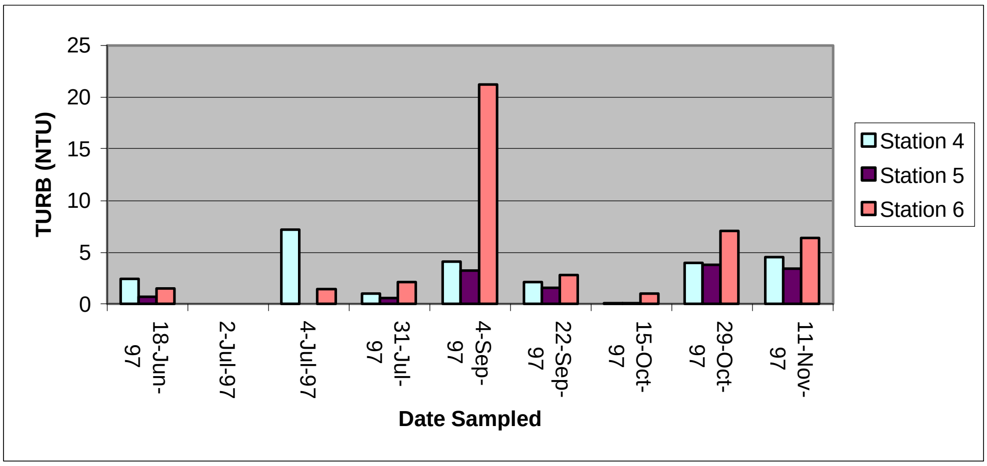



Figure 22. Turbidity values for each sampling date, Stn 7 – 9, Canaan River and tributaries, 1997.

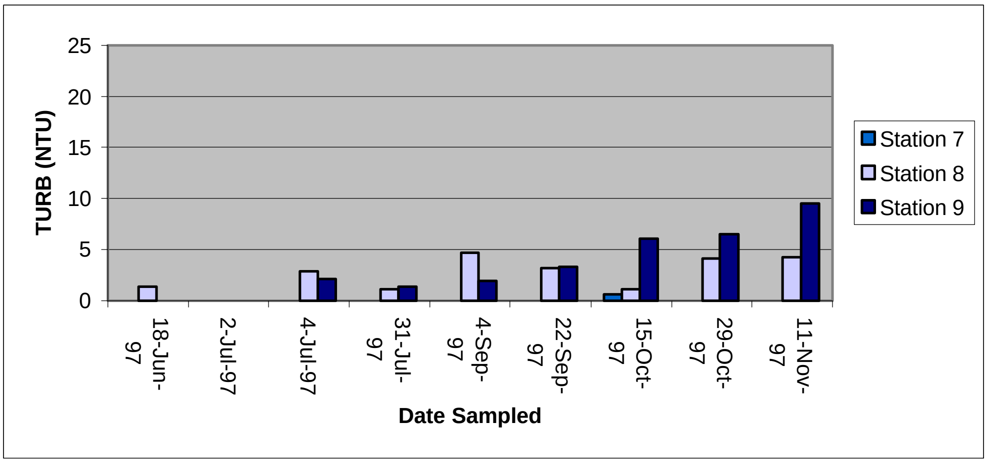



Figure 23. Turbidity values for each sampling date, Stn 10 – 11, Canaan River and tributaries, 1997.

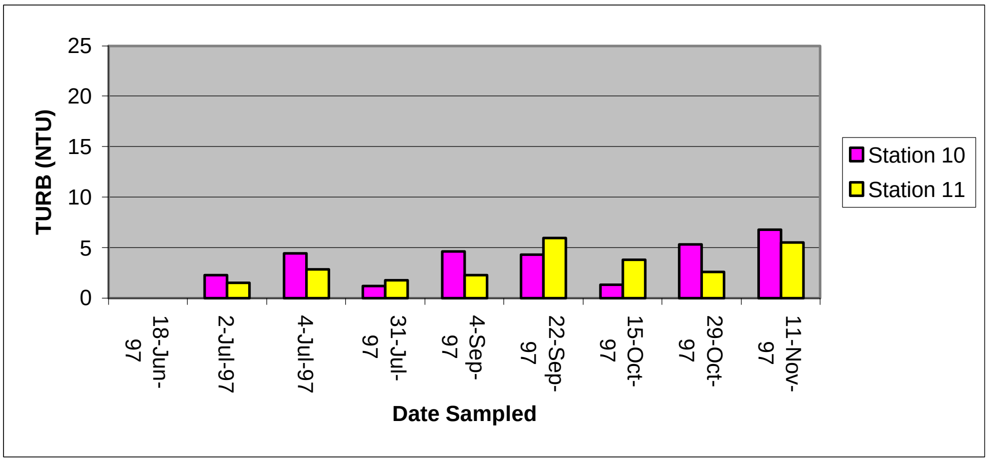


**Figure 24.** ***E.coli*** **counts for all sampling stations, 18-June – 31- July, Canaan River and tributaries, 1997.**

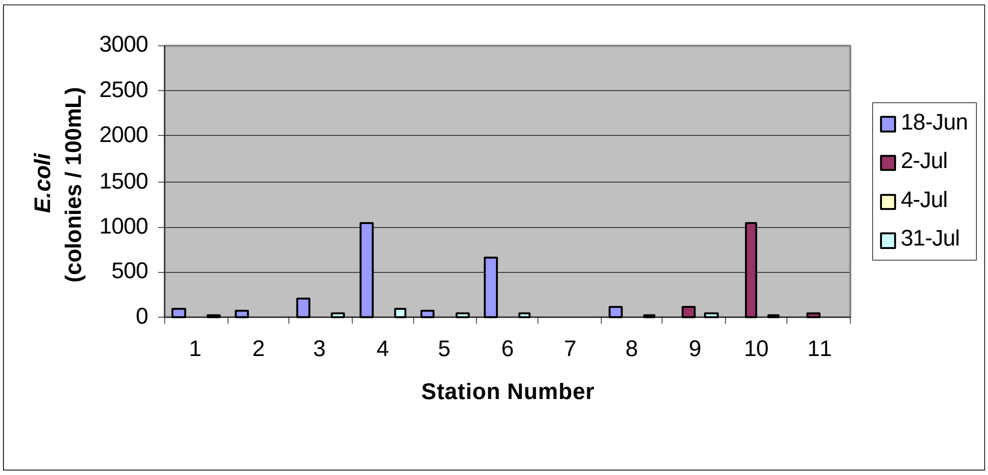



**Figure 25.** ***E.coli*** **counts for all sampling stations, 04-Sept – 11-Nov, Canaan River and tributaries, 1997.**

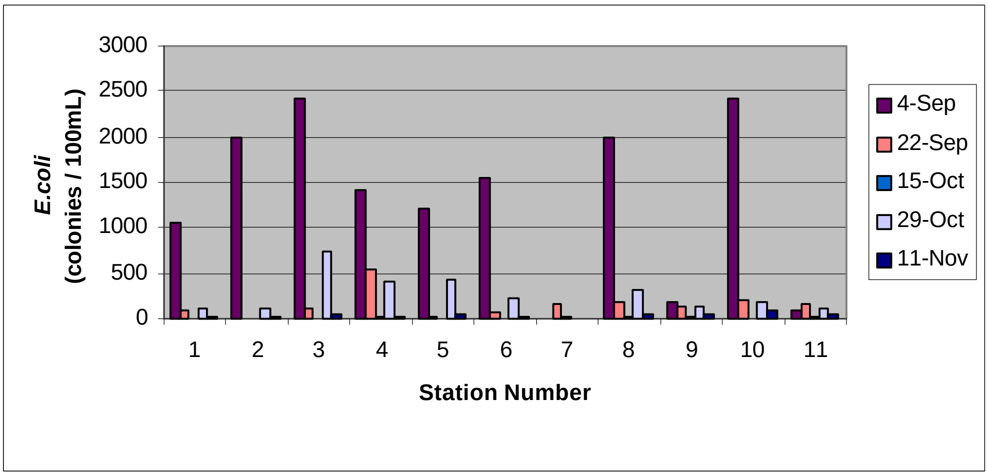



**Figure 26.** ***E.coli*** **counts for each sampling date, Stn 1 – 3, Canaan River and tributaries, 1997.**

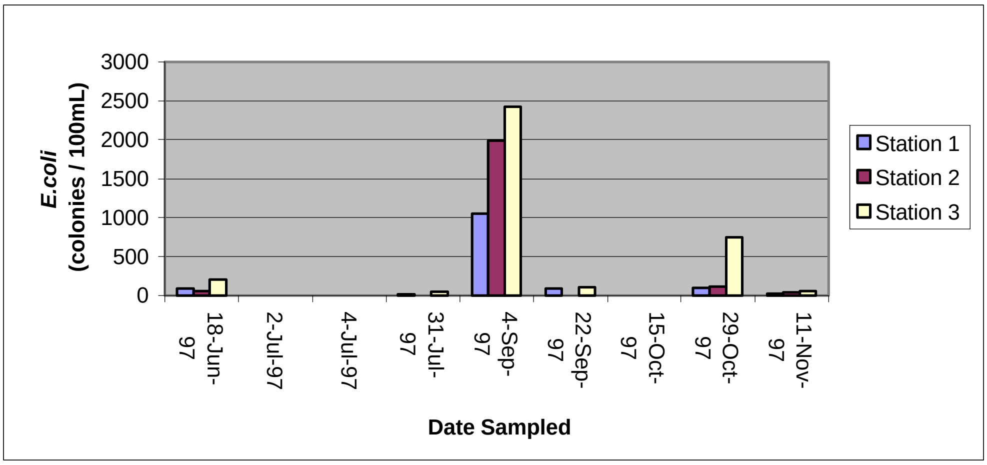


Figure 27. ***E.coli*** **counts for each sampling date, Stn 4 – 6, Canaan River and tributaries, 1997.**

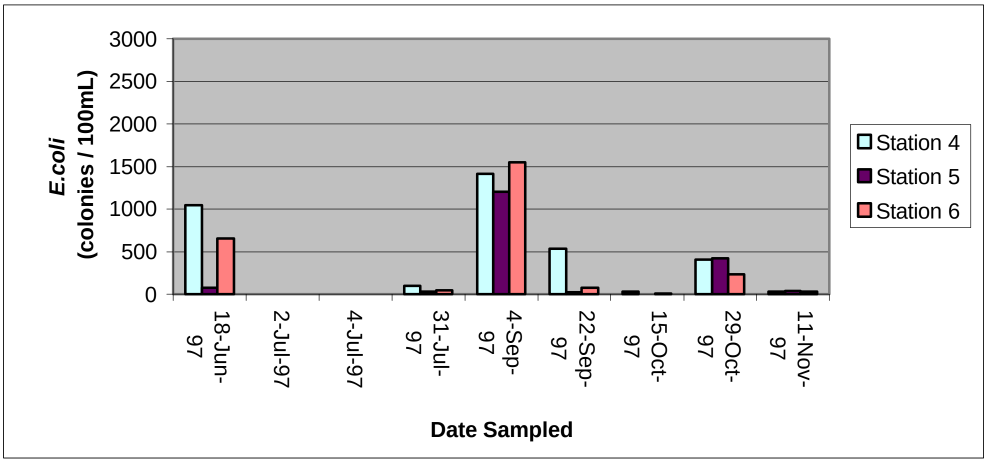



**Figure 28.** ***E.coli*** **counts for each sampling date, Stn 7 – 9, Canaan River and tributaries, 1997.**

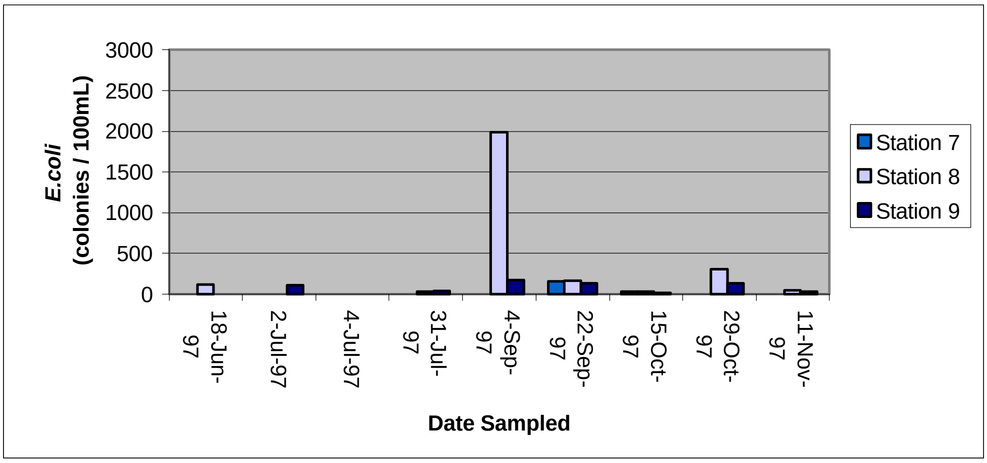



**Figure 29.** ***E.coli*** **counts for each sampling date, Stn 10 – 11, Canaan River and tributaries, 1997.**

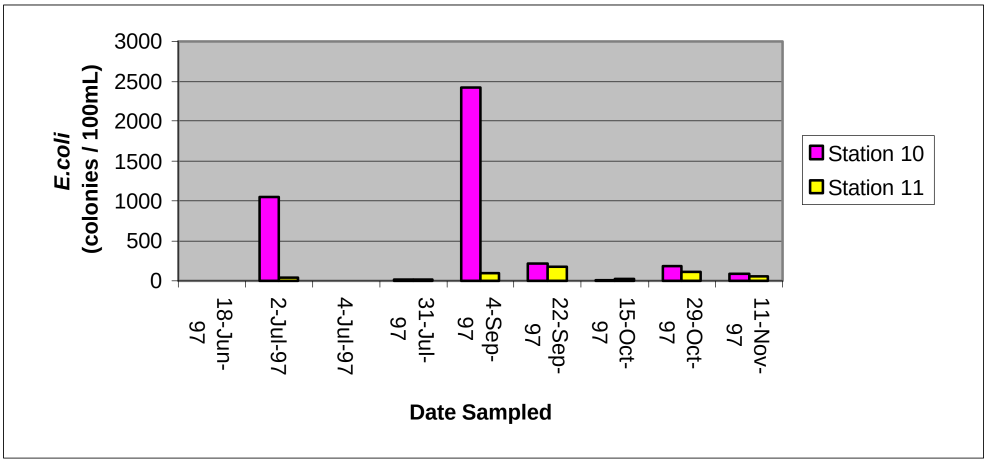


**Figure 30. Fecal Coliform counts for all sampling stations, 18-June – 31-July, Canaan River and tributaries, 1997.**

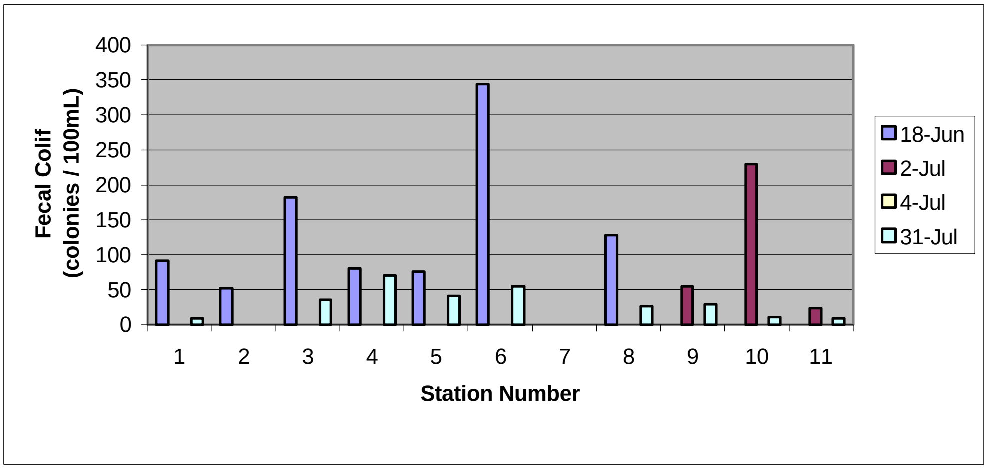



**Figure 31. Fecal Coliform counts for all sampling stations, 04-Sept – 11-Nov, Canaan River and tributaries, 1997.**

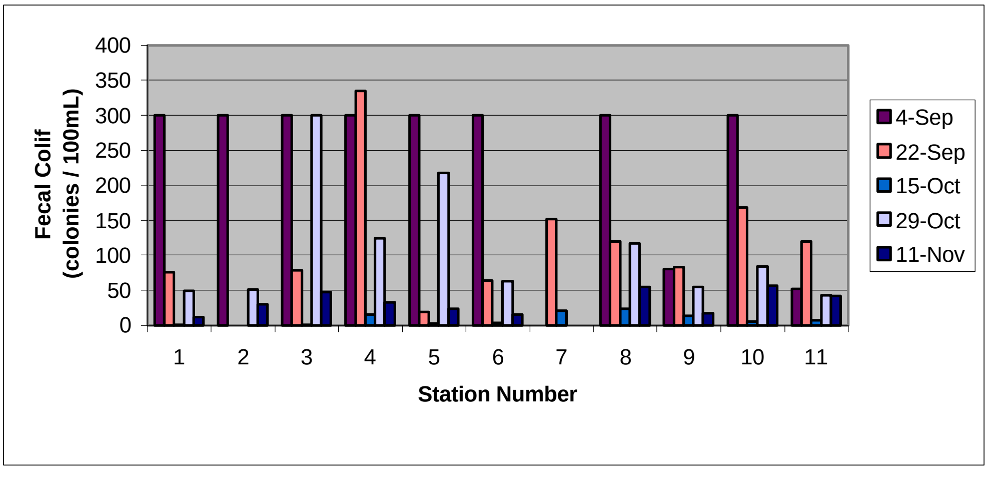



**Figure 32. Fecal coliform counts for each sampling date, Stn 1 – 3, Canaan River and tributaries, 1997.**

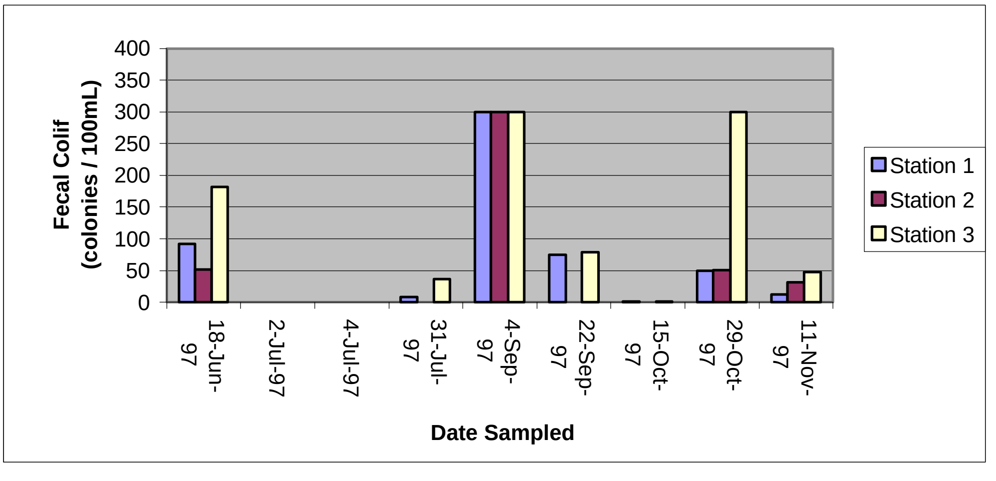


**Figure 33. Fecal coliform counts for each sampling date, Stn 4 – 6, Canaan River and tributaries, 1997.**

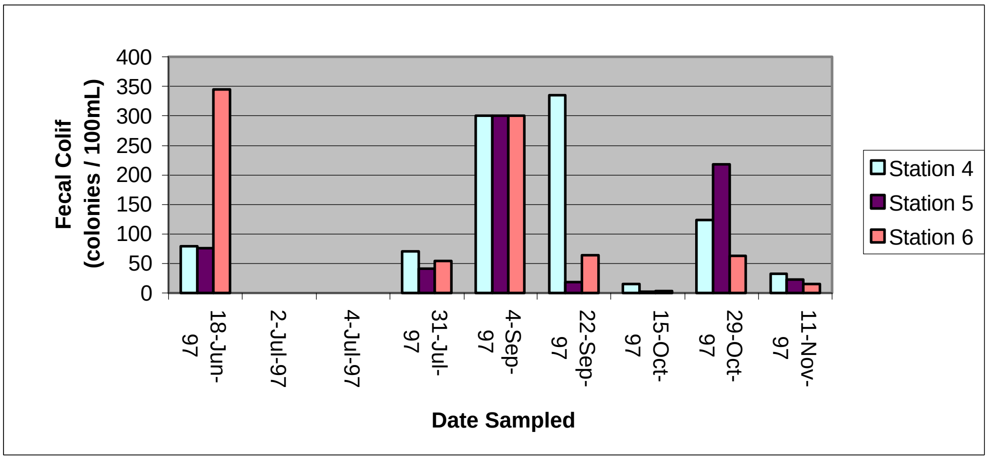



**Figure 34. Fecal coliform counts for each sampling date, Stn 7 – 9, Canaan River and tributaries, 1997.**

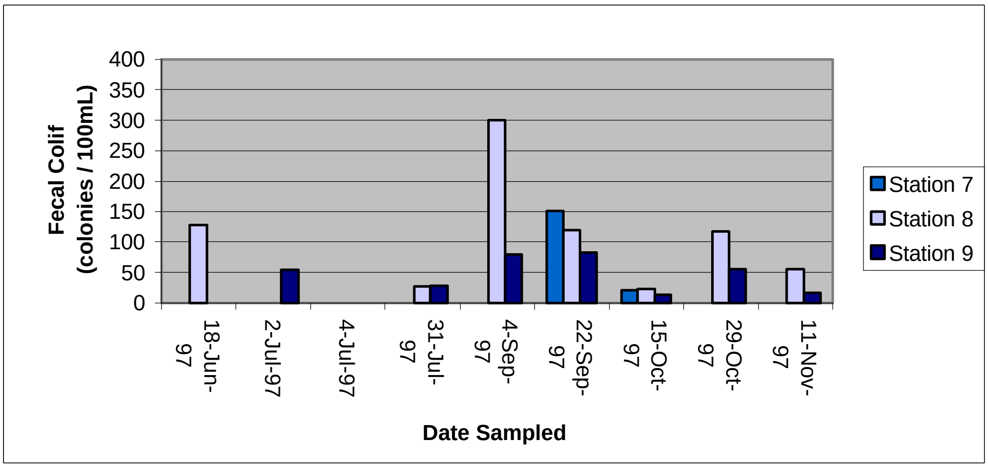



**Figure 35. Fecal coliform counts for each sampling date, Stn 10 – 11, Canaan River and tributaries, 1997.**

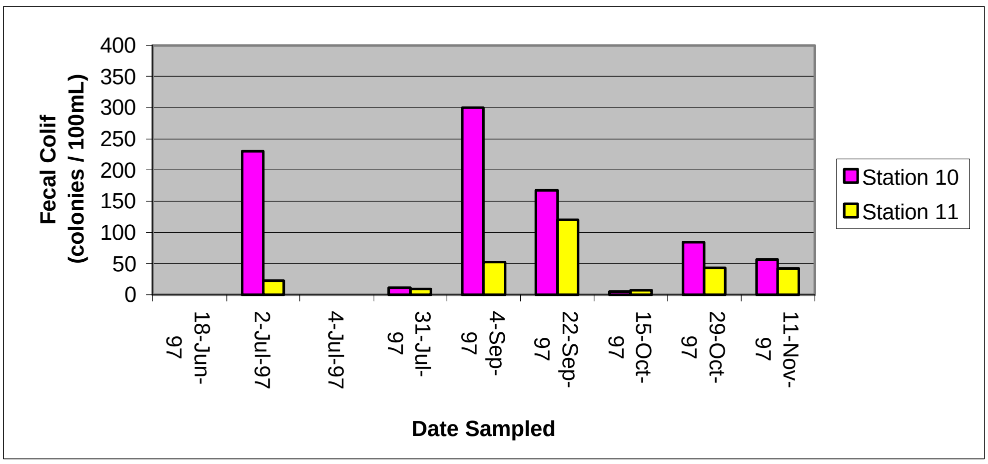


**Figure 36. Mainstream median conductivity values for baseline samples, Canaan River and tributaries, 1997.**

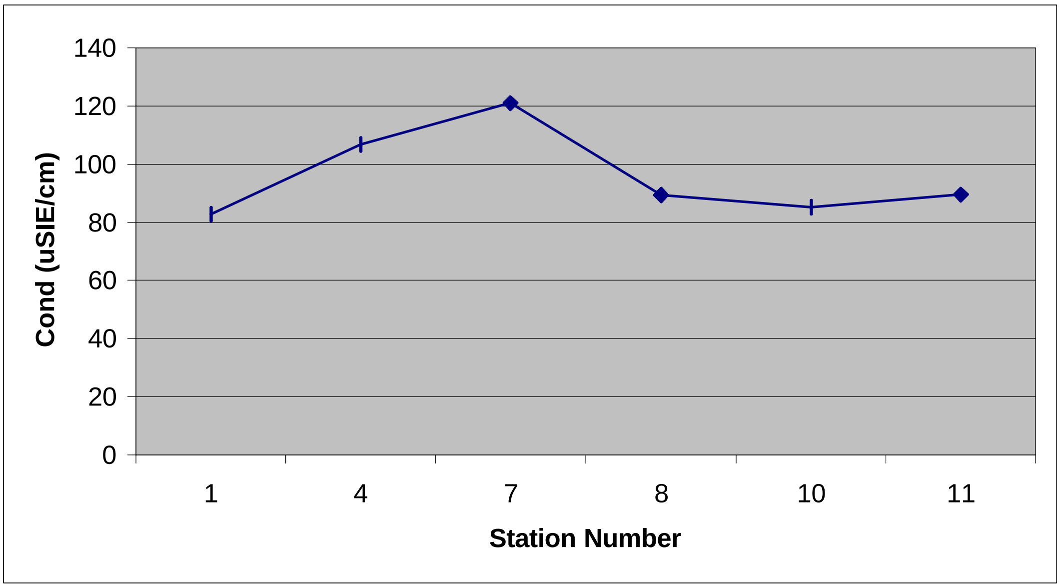



**Figure 37. Mainstream median turbidity values for baseline samples, Canaan River and tributaries, 1997.**

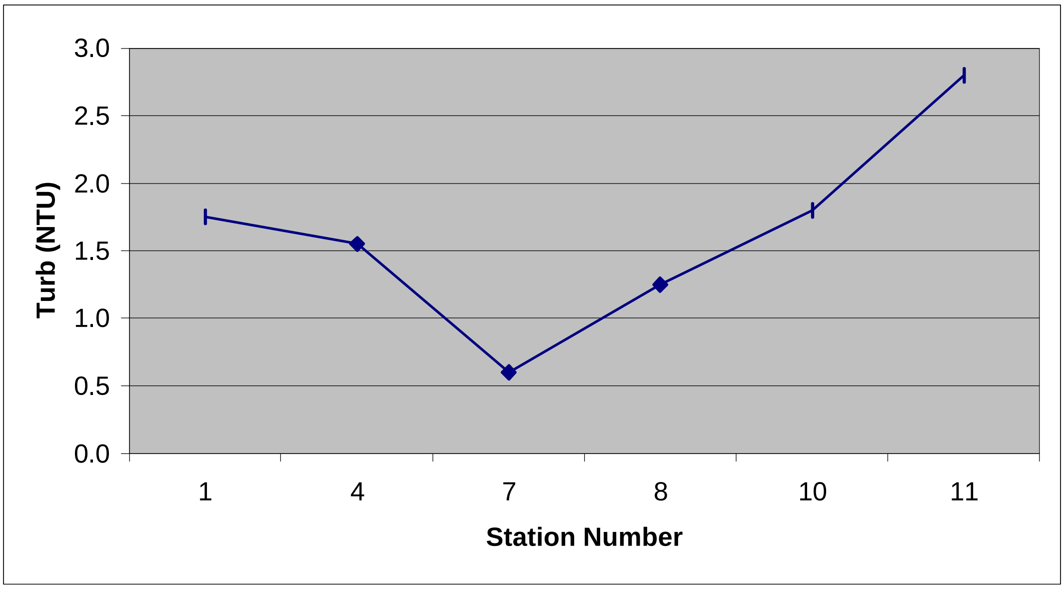


**Figure 38. Land use for Station 1 drainage area (41 436 ha), Canaan River and tributaries (from Manley 1997).**

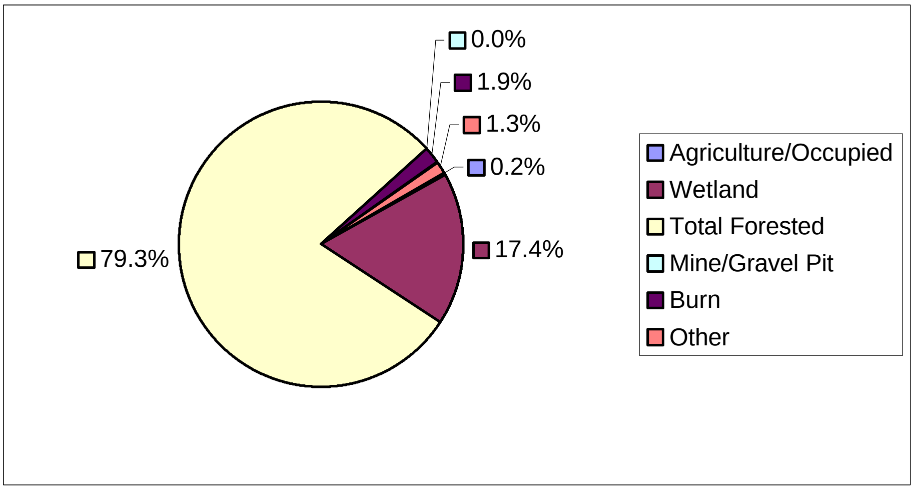



**Figure 39. Land use for Station 2 drainage area (12 304 ha) , Canaan River and tributaries (from Manley 1997).**

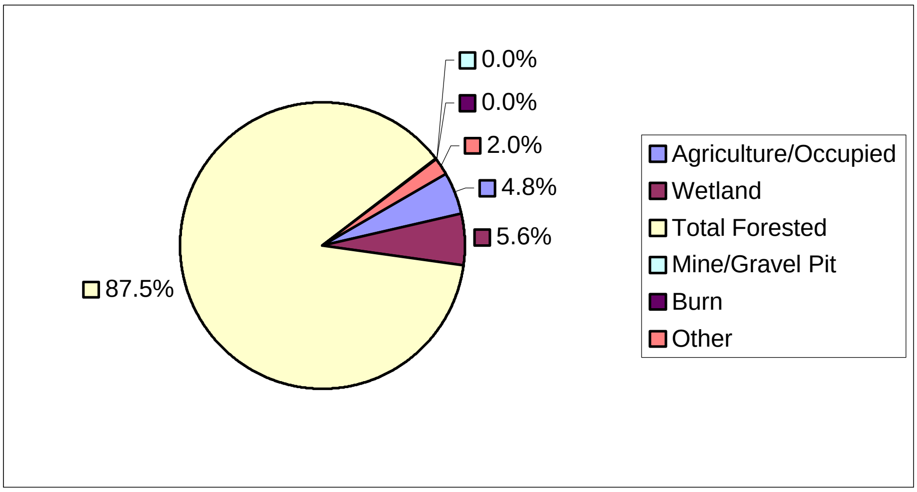



**Figure 40. Land use for Station 3 drainage area (8 613 ha) , Canaan River and tributaries (from Manley 1997).**

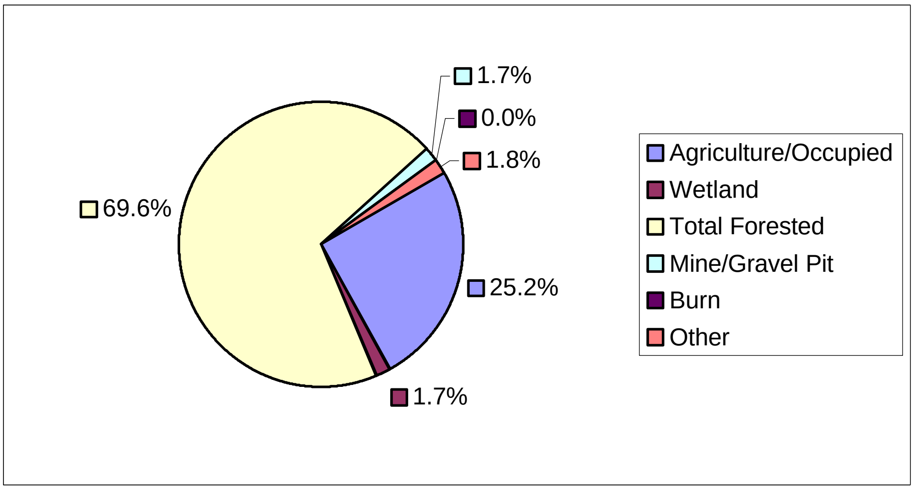


**Figure 41. Land use for Station 4 drainage area (62 254 ha) , Canaan River and tributaries (from Manley 1997).**

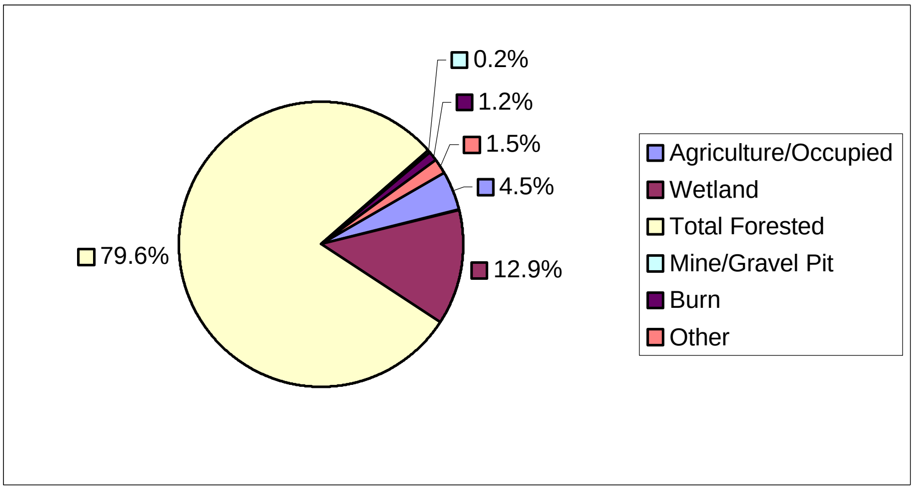



**Figure 42. Land use for Station 5 drainage area (12 402 ha) , Canaan River and tributaries (from Manley 1997).**

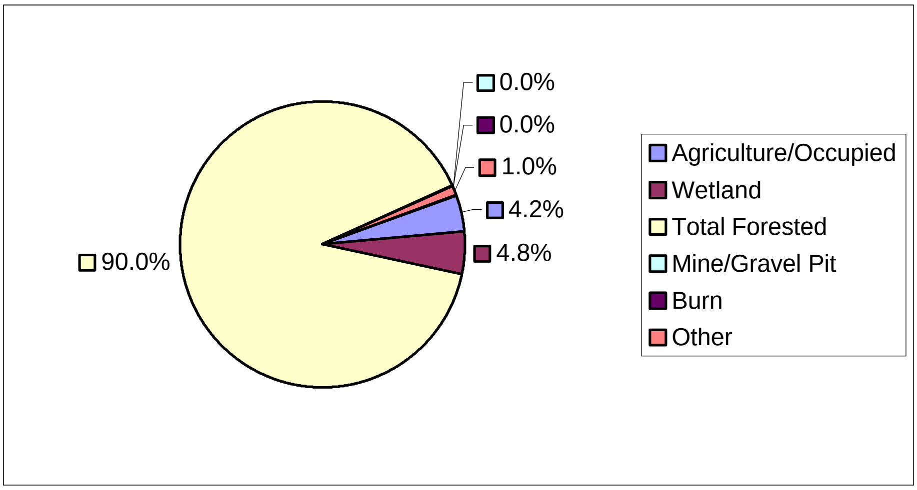



**Figure 43. Land use for Station 6 drainage area (12 357 ha) , Canaan River and tributaries (from Manley 1997).**

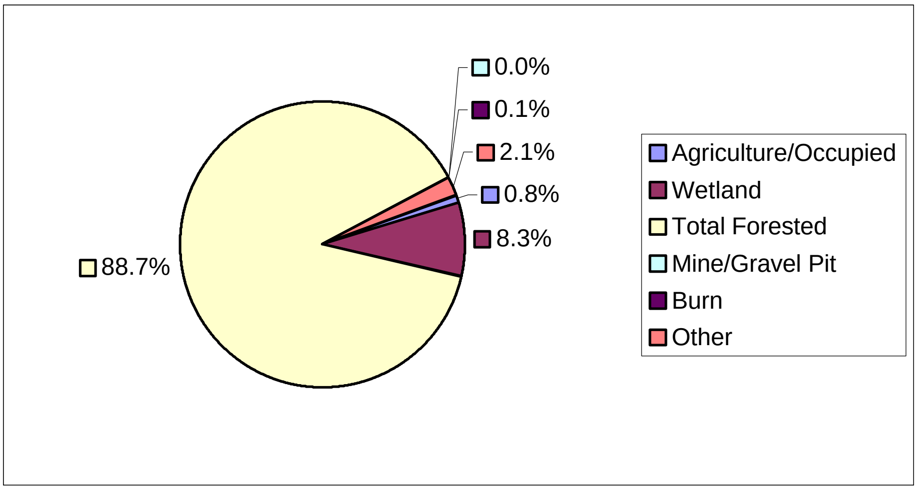


Figure 44. Land use for Station 7 drainage area (87 014 ha) , Canaan River and tributaries (from Manley 1997).

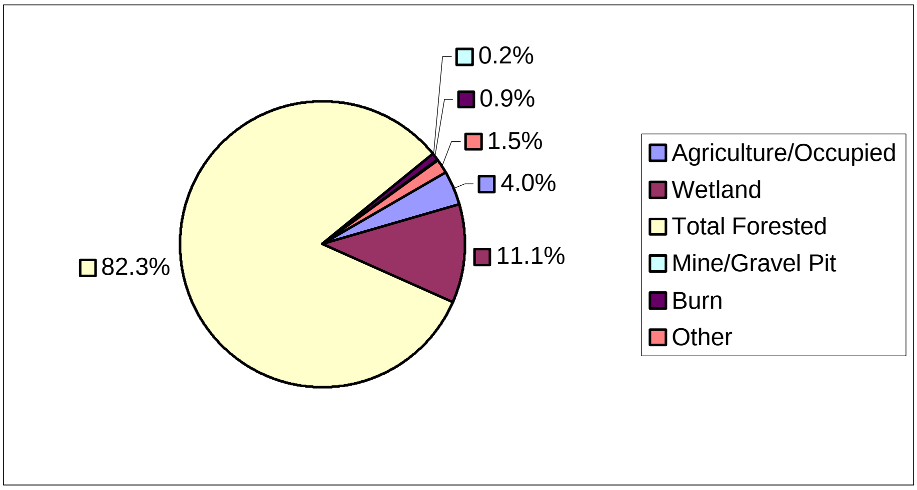



Figure 45. Land use for Station 8 drainage area (87 014 ha) , Canaan River and tributaries (from Manley 1997).

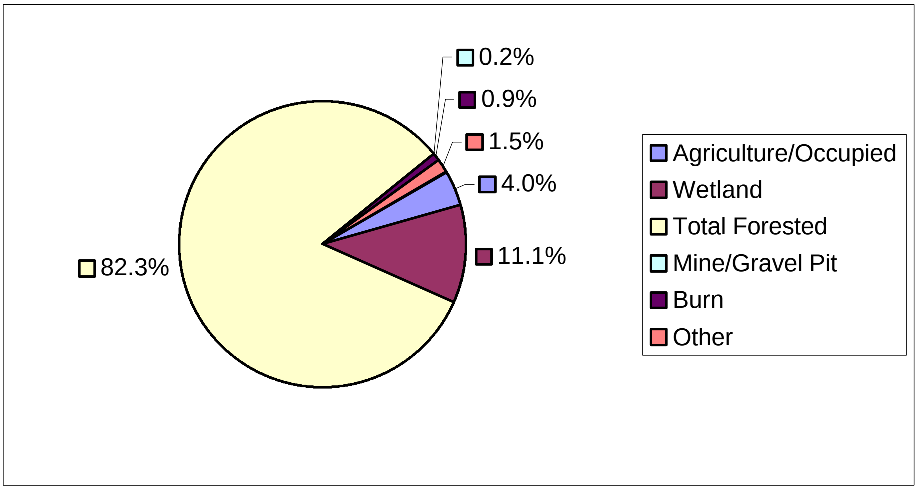



Figure 46. Land use for Station 9 drainage area (26 288 ha) , Canaan River and tributaries (from Manley 1997).

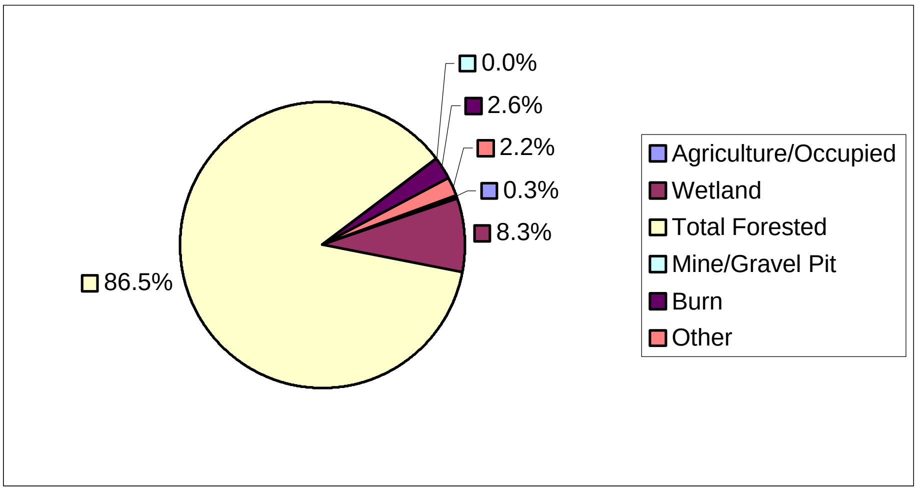


Figure 47. Land use for Station 10 drainage area (113 302 ha) , Canaan River and tributaries (from Manley 1997).

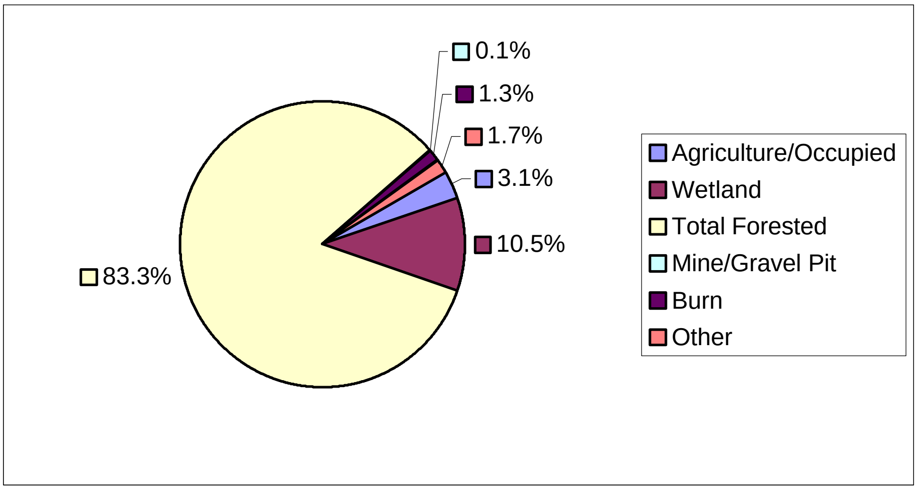



Figure 48. Land use for Station 11 drainage area (131 109 ha) , Canaan River and tributaries (from Manley 1997).

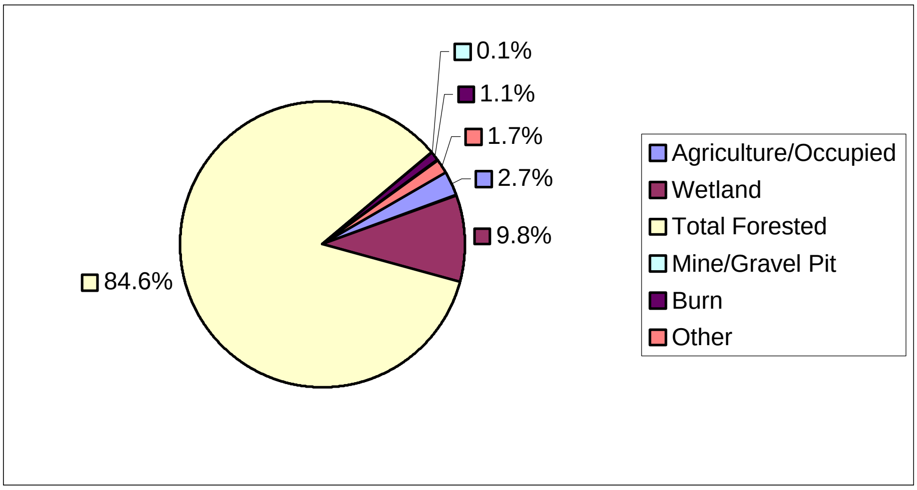


**Figure 49.** ***E.coli*** **counts v. percent agricultural land for September 4, 1997 samples (for all stations sampled) , Canaan River and tributaries 1997.**

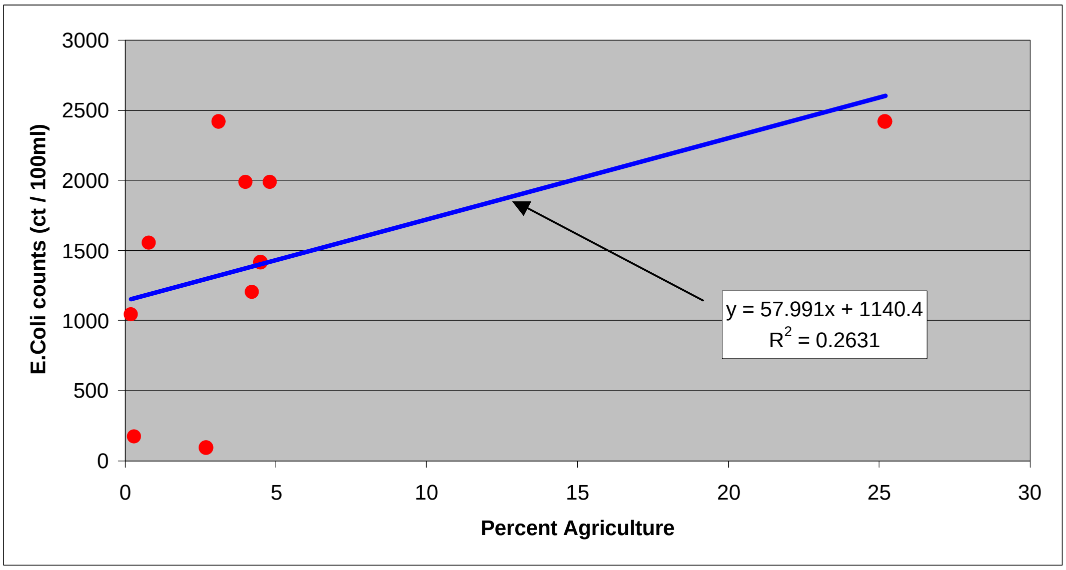



**Figure 50.** ***E.coli*** **counts v. percent agricultural land for September 4, 1997 samples (not including Station 3) , Canaan River and tributaries 1997.**

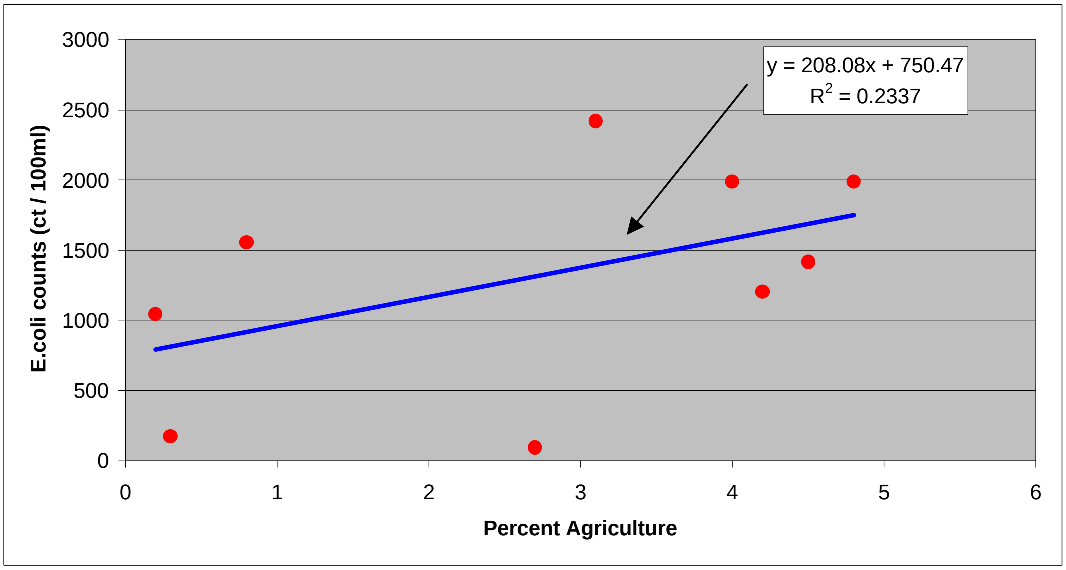


**Table 3. Water quality results (physical and chemical), Canaan River and tributaries, 1997.**

| DOE Station No. | Station No. | Date Sampled | HARD mg/L | NO3 mg/L | Al-XGF ug/L | ALK-G mg/L | As-XGF ug/L | Ca-D mg/L | Cd-XGF ug/L | Cl-IC mg/L | CLRA TCU | COND USIE/CM | Cr-XGF ug/L | Cu-XGF ug/L | DO mg/L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 18-Jun-97 | 39.00 | 0.00 | 125.00 | 26.10 | < 1.0 | 14.30 | < 0.1 | 6.31 | 75.00 | 106.00 | 1.40 | < 0.5 | |
| River | | 4-Jul-97 | 21.50 | 0.08 | 525.00 | 14.70 | < 1.0 | 7.80 | < 0.1 | 2.54 | 300.00 | 47.60 | 0.90 | 0.80 | |
| | | 31-Jul-97 | 12.10 | 0.00 | 153.00 | 12.20 | < 1.0 | 3.70 | < 0.1 | 1.90 | 120.00 | 737.00 | 0.90 | < 0.5 | |
| | | 4-Sep-97 | 15.30 | 0.03 | 260.00 | 12.00 | < 1.0 | 4.80 | < 0.1 | 1.76 | 100.00 | 46.90 | < 0.5 | < 0.5 | |
| | | 22-Sep-97 | 12.90 | 0.00 | 316.00 | 6.41 | < 1.0 | 4.00 | < 0.1 | 2.31 | 120.00 | 38.20 | 0.90 | < 0.5 | |
| | | 15-Oct-97 | 19.80 | 0.00 | 78.40 | 19.10 | < 1.0 | 6.30 | < 0.1 | 2.81 | 70.00 | 59.60 | < 0.5 | < 0.5 | |
| | | 29-Oct-97 | 16.00 | 0.00 | 128.00 | 14.80 | < 1.0 | 5.10 | < 0.1 | 2.70 | 100.00 | 53.70 | 0.60 | < 0.5 | |
| | | 11-Nov-97 | 10.60 | 0.05 | 314.00 | 2.78 | < 1.0 | 3.10 | < 0.1 | 2.49 | 80.00 | 33.20 | < 0.5 | < 0.5 | |
| 00BR01AP0206 | 2 | 4-Jul-97 | 19.90 | 0.32 | 245.00 | 15.20 | < 1.0 | 7.00 | < 0.1 | 4.78 | 100.00 | 72.50 | < 0.5 | < 0.5 | |
| Tributary | | 29-Oct-97 | 24.30 | 0.07 | 138.00 | 20.10 | < 1.0 | 8.40 | < 0.1 | 9.09 | 80.00 | 86.00 | 1.00 | < 0.5 | |
| | | 11-Nov-97 | 15.50 | 0.13 | 388.00 | 6.07 | < 1.0 | 5.20 | < 0.1 | 4.66 | 120.00 | 50.40 | < 0.5 | < 0.5 | |
| 00BR01AP0205 | 3 | 18-Jun-97 | 127.60 | 0.16 | 72.80 | 66.40 | < 1.0 | 48.80 | < 0.1 | 10.90 | 20.00 | 279.00 | 2.00 | < 0.5 | |
| Tributary | | 4-Jul-97 | 30.90 | 0.20 | 1870.00 | 23.80 | < 1.0 | 11.40 | < 0.1 | 3.17 | 150.00 | 70.30 | 1.20 | 1.30 | |
| | | 31-Jul-97 | 145.90 | 0.16 | 33.70 | 81.00 | < 1.0 | 55.80 | < 0.1 | 13.10 | 20.00 | 342.00 | 3.60 | < 0.5 | |
| | | 4-Sep-97 | 97.80 | 0.48 | 118.00 | 49.00 | < 1.0 | 37.20 | < 0.1 | 10.20 | 60.00 | 235.00 | < 0.5 | < 0.5 | |
| | | 22-Sep-97 | 106.90 | 0.04 | 53.10 | 61.00 | < 1.0 | 40.62 | < 0.1 | 12.00 | 40.00 | 265.00 | 2.10 | < 0.5 | |
| | | 15-Oct-97 | 195.00 | 0.00 | 6.50 | 82.50 | < 1.0 | 74.80 | < 0.1 | 16.20 | 15.00 | 401.00 | 1.10 | < 0.5 | 14.00 |
| | | 29-Oct-97 | 106.10 | 0.44 | 72.20 | 53.60 | < 1.0 | 40.20 | < 0.1 | 15.20 | 50.00 | 263.00 | 2.60 | < 0.5 | |
| | | 11-Nov-97 | 98.50 | 0.31 | 136.00 | 51.00 | < 1.0 | 37.30 | < 0.1 | 11.60 | 60.00 | 224.00 | 1.40 | < 0.5 | |
| 00BR01AP0175 | 4 | 18-Jun-97 | 32.60 | 0.00 | 121.00 | 23.70 | < 1.0 | 11.90 | < 0.1 | 3.85 | 100.00 | 93.70 | 1.10 | < 0.5 | |
| River | | 4-Jul-97 | 25.80 | 0.06 | 381.00 | 19.70 | < 1.0 | 9.50 | < 0.1 | 3.83 | 200.00 | 66.20 | 1.00 | 0.70 | |
| | | 31-Jul-97 | 40.30 | 0.00 | 124.00 | 25.80 | < 1.0 | 14.50 | < 0.1 | 9.71 | 70.00 | 120.00 | 1.70 | 0.70 | |
| | | 4-Sep-97 | 30.70 | 0.13 | 173.00 | 20.40 | < 1.0 | 10.80 | < 0.1 | 3.63 | 80.00 | 85.70 | < 0.5 | < 0.5 | |
| | | 22-Sep-97 | 24.90 | 0.00 | 206.00 | 14.70 | < 1.0 | 8.40 | < 0.1 | 9.18 | 100.00 | 86.20 | < 0.5 | 1.70 | |
| | | 15-Oct-97 | 57.30 | 0.00 | 64.80 | 32.00 | < 1.0 | 20.80 | < 0.1 | 9.54 | 70.00 | 150.00 | < 0.5 | < 0.5 | 11.80 |
| | | 29-Oct-97 | 34.60 | 0.01 | 253.00 | 23.50 | < 1.0 | 12.20 | < 0.1 | 6.95 | 100.00 | 98.00 | 1.20 | < 0.5 | |
| | | 11-Nov-97 | 19.50 | 0.07 | 388.00 | 7.17 | < 1.0 | 6.50 | < 0.1 | 3.95 | 120.00 | 51.70 | < 0.5 | < 0.5 | |
| 00BR01AP0204 | 5 | 18-Jun-97 | 23.00 | 0.00 | 48.20 | 22.20 | < 1.0 | 7.90 | < 0.1 | 2.31 | 40.00 | 59.90 | 0.90 | < 0.5 | |
| Tributary | | 31-Jul-97 | 28.70 | 0.00 | 46.90 | 28.10 | < 1.0 | 10.00 | < 0.1 | 3.11 | 20.00 | 74.70 | 1.30 | 0.60 | |
| | | 4-Sep-97 | 26.00 | 0.36 | 133.00 | 16.50 | < 1.0 | 9.10 | < 0.1 | 3.11 | 50.00 | 71.90 | 0.60 | < 0.5 | |
| | | 22-Sep-97 | 21.10 | 0.00 | 103.00 | 16.30 | < 1.0 | 7.21 | < 0.1 | 2.82 | 50.00 | 64.80 | < 0.5 | < 0.5 | |
| | | 15-Oct-97 | 32.10 | 0.00 | 14.40 | 28.30 | < 1.0 | 11.20 | < 0.1 | 4.14 | 10.00 | 82.60 | < 0.5 | < 0.5 | |
| | | 29-Oct-97 | 32.50 | 0.23 | 137.00 | 22.60 | < 1.0 | 11.20 | < 0.1 | 6.53 | 50.00 | 83.20 | 1.20 | < 0.5 | |
| | | 11-Nov-97 | 22.00 | 0.19 | 276.00 | 10.30 | < 1.0 | 7.50 | < 0.1 | 3.49 | 100.00 | 55.90 | < 0.5 | < 0.5 | |
| 00BR01AP0203 | 6 | 18-Jun-97 | 6.60 | 0.00 | 184.00 | 8.29 | < 1.0 | 2.00 | < 0.1 | 2.96 | 150.00 | 34.60 | 0.60 | < 0.5 | |
| River | | 4-Jul-97 | 5.90 | 0.00 | 242.00 | 3.01 | < 1.0 | 1.70 | < 0.1 | 2.02 | 250.00 | 21.30 | 0.60 | < 0.5 | |
| | | 31-Jul-97 | 8.10 | 0.00 | 234.00 | 7.57 | < 1.0 | 2.40 | < 0.1 | 2.96 | 100.00 | 36.00 | 0.80 | < 0.5 | |
| | | 4-Sep-97 | 9.20 | 0.01 | 271.00 | 11.80 | < 1.0 | 2.70 | < 0.1 | 2.32 | 200.00 | 46.20 | 0.60 | 1.00 | |
| | | 22-Sep-97 | 8.90 | 0.00 | 278.00 | 3.85 | < 1.0 | 2.63 | < 0.1 | 2.32 | 120.00 | 34.60 | < 0.5 | < 0.5 | |
| | | 15-Oct-97 | 11.90 | 0.00 | 109.00 | 12.40 | < 1.0 | 3.60 | < 0.1 | 4.04 | 80.00 | 52.60 | < 0.5 | < 0.5 | 11.60 |
| | | 29-Oct-97 | 10.90 | 0.00 | 161.00 | 8.47 | < 1.0 | 3.20 | < 0.1 | 3.05 | 120.00 | 43.70 | 0.80 | < 0.5 | |
| | | 11-Nov-97 | 8.90 | 0.03 | 400.00 | 2.14 | < 1.0 | 2.40 | < 0.1 | 2.48 | 150.00 | 32.80 | < 0.5 | < 0.5 | |

**Table 3 (continued)**

| DOE Station No. | Station No. | Date Sampled | F mg/L | Fe-X mg/L | K mg/L | Mg-D mg/L | Mn-X mg/L | Na mg/L | NH3T mg/L | Ni-X mg/L | NO2D mg/L | NOX mg/L | Pb-XGF ug/L | PH pH | SO4-IC mg/L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 18-Jun-97 | < 0.1 | 0.48 | 0.50 | 0.80 | 0.03 | 4.70 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.67 | 15.50 |
| River | | 4-Jul-97 | < 0.1 | 0.68 | 0.56 | 0.50 | 0.11 | 2.30 | 0.13 | < 0.01 | < 0.05 | 0.13 | 1.10 | 6.87 | 4.59 |
| | | 31-Jul-97 | < 0.1 | 0.68 | 0.25 | 0.70 | 0.02 | 3.90 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.06 | 2.50 |
| | | 4-Sep-97 | < 0.1 | 0.62 | 0.46 | 0.80 | 0.05 | 3.20 | < 0.01 | < 0.01 | < 0.05 | 0.08 | < 1.0 | 7.12 | 4.37 |
| | | 22-Sep-97 | < 0.1 | 0.66 | 0.32 | 0.70 | 0.04 | 2.89 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.62 | 5.54 |
| | | 15-Oct-97 | < 0.1 | 0.43 | 0.28 | 1.00 | 0.01 | 5.80 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.55 | 3.49 |
| | | 29-Oct-97 | < 0.1 | 0.50 | 0.44 | 0.80 | 0.04 | 3.90 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.23 | 3.50 |
| | | 11-Nov-97 | < 0.1 | 0.66 | 0.26 | 0.70 | 0.08 | 2.30 | 0.01 | < 0.01 | < 0.05 | 0.10 | < 1.0 | 5.76 | 3.61 |
| 00BR01AP0206 | 2 | 4-Jul-97 | < 0.1 | 0.64 | 0.70 | 0.60 | 0.04 | 4.80 | < 0.01 | < 0.01 | < 0.05 | 0.37 | < 1.0 | 7.16 | 7.82 |
| Tributary | | 29-Oct-97 | < 0.1 | 0.59 | 0.72 | 0.80 | 0.04 | 7.20 | < 0.01 | < 0.01 | < 0.05 | 0.12 | < 1.0 | 7.29 | 4.44 |
| | | 11-Nov-97 | < 0.1 | 0.61 | 0.52 | 0.60 | 0.03 | 3.70 | 0.01 | < 0.01 | < 0.05 | 0.18 | < 1.0 | 6.52 | 4.66 |
| 00BR01AP0205 | 3 | 18-Jun-97 | 0.15 | 0.12 | 0.90 | 1.40 | 0.04 | 6.70 | < 0.01 | < 0.01 | < 0.05 | 0.21 | < 1.0 | 8.27 | 55.80 |
| Tributary | | 4-Jul-97 | < 0.1 | 0.46 | 1.09 | 0.60 | 0.20 | 2.40 | 0.06 | < 0.01 | < 0.05 | 0.25 | 2.40 | 7.02 | 7.73 |
| | | 31-Jul-97 | 0.18 | 0.04 | 1.06 | 1.60 | 0.02 | 7.80 | 0.02 | < 0.01 | < 0.05 | 0.21 | < 1.0 | 8.19 | 69.90 |
| | | 4-Sep-97 | 0.14 | 0.17 | 1.32 | 1.20 | 0.02 | 5.90 | < 0.01 | < 0.01 | < 0.05 | 0.53 | < 1.0 | 7.73 | 41.90 |
| | | 22-Sep-97 | 0.16 | 0.08 | 1.50 | 1.34 | 0.01 | 7.26 | 0.01 | < 0.01 | < 0.05 | 0.09 | < 1.0 | 8.27 | 49.90 |
| | | 15-Oct-97 | 0.23 | 0.01 | 1.03 | 2.00 | 0.01 | 9.40 | 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 8.72 | 102.00 |
| | | 29-Oct-97 | 0.15 | 0.14 | 1.81 | 1.40 | 0.02 | 7.60 | < 0.01 | < 0.01 | < 0.05 | 0.49 | < 1.0 | 7.92 | 43.90 |
| | | 11-Nov-97 | 0.13 | 0.16 | 1.24 | 1.30 | 0.01 | 6.20 | < 0.01 | < 0.01 | < 0.05 | 0.36 | < 1.0 | 7.90 | 38.90 |
| 00BR01AP0175 | 4 | 18-Jun-97 | < 0.1 | 0.49 | 0.41 | 0.70 | 0.03 | 4.00 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.74 | 14.00 |
| River | | 4-Jul-97 | < 0.1 | 0.55 | 0.66 | 0.50 | 0.10 | 2.70 | 0.13 | < 0.01 | < 0.05 | 0.11 | < 1.0 | 7.25 | 8.69 |
| | | 31-Jul-97 | < 0.1 | 0.48 | 0.53 | 1.00 | 0.05 | 7.00 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.48 | 14.50 |
| | | 4-Sep-97 | < 0.1 | 0.55 | 0.63 | 0.90 | 0.04 | 4.80 | 0.04 | < 0.01 | < 0.05 | 0.18 | < 1.0 | 7.38 | 7.83 |
| | | 22-Sep-97 | < 0.1 | 0.50 | 0.55 | 0.95 | 0.03 | 5.99 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.19 | 9.26 |
| | | 15-Oct-97 | < 0.1 | 0.31 | 0.54 | 1.30 | 0.04 | 11.00 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.70 | 22.30 |
| | | 29-Oct-97 | < 0.1 | 0.54 | 0.83 | 1.00 | 0.06 | 5.60 | < 0.01 | < 0.01 | < 0.05 | 0.06 | < 1.0 | 7.52 | 11.30 |
| | | 11-Nov-97 | < 0.1 | 0.72 | 0.47 | 0.80 | 0.05 | 3.00 | 0.01 | < 0.01 | < 0.05 | 0.12 | < 1.0 | 6.70 | 8.25 |
| 00BR01AP0204 | 5 | 18-Jun-97 | < 0.1 | 0.20 | 0.44 | 0.80 | 0.02 | 2.50 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.67 | 3.07 |
| Tributary | | 31-Jul-97 | < 0.1 | 0.15 | 0.43 | 0.90 | 0.04 | 3.10 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.57 | 3.26 |
| | | 4-Sep-97 | < 0.1 | 0.26 | 0.61 | 0.80 | 0.03 | 2.30 | < 0.01 | < 0.01 | < 0.05 | 0.41 | < 1.0 | 7.28 | 8.71 |
| | | 22-Sep-97 | < 0.1 | 0.24 | 0.59 | 0.75 | 0.02 | 2.44 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.37 | 7.95 |
| | | 15-Oct-97 | < 0.1 | 0.07 | 0.41 | 1.00 | 0.01 | 3.60 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.69 | 3.95 |
| | | 29-Oct-97 | < 0.1 | 0.32 | 1.02 | 1.10 | 0.03 | 3.20 | < 0.01 | < 0.01 | < 0.05 | 0.28 | < 1.0 | 7.48 | 6.85 |
| | | 11-Nov-97 | < 0.1 | 0.37 | 0.63 | 0.80 | 0.02 | 2.20 | < 0.01 | < 0.01 | < 0.05 | 0.24 | < 1.0 | 7.03 | 8.15 |
| 00BR01AP0203 | 6 | 18-Jun-97 | < 0.1 | 0.80 | 0.32 | 0.40 | 0.02 | 4.60 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.02 | 2.20 |
| River | | 4-Jul-97 | < 0.1 | 1.25 | 0.16 | 0.40 | 0.05 | 2.60 | 0.04 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 5.81 | 1.36 |
| | | 31-Jul-97 | < 0.1 | 1.20 | 0.29 | 0.50 | 0.03 | 4.20 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.81 | 2.16 |
| | | 4-Sep-97 | < 0.1 | 0.76 | 0.43 | 0.60 | 0.02 | 5.00 | < 0.01 | < 0.01 | < 0.05 | 0.06 | < 1.0 | 6.97 | 3.70 |
| | | 22-Sep-97 | < 0.1 | 0.68 | 0.43 | 0.57 | 0.04 | 3.12 | 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.29 | 6.11 |
| | | 15-Oct-97 | < 0.1 | 0.64 | 0.33 | 0.70 | 0.01 | 6.90 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.11 | 2.75 |
| | | 29-Oct-97 | < 0.1 | 0.69 | 0.67 | 0.70 | 0.04 | 4.20 | 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.97 | 3.07 |
| | | 11-Nov-97 | < 0.1 | 0.86 | 0.45 | 0.70 | 0.07 | 2.20 | 0.02 | < 0.01 | < 0.05 | 0.08 | < 1.0 | 5.62 | 4.18 |

**Table 3 (continued)**

| DOE Station No. | Station No. | Date Sampled | SS mg/L | TDS mg/L | TEMP degrees C | TKN mg/L | TOC mg/L | TP-L mg/L | TURB NTU | ZN-X mg/L |
|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 18-Jun-97 | 2.00 | | | 0.32 | 11.30 | 0.011 | 3.40 | 0.014 |
| River | | 4-Jul-97 | 60.00 | | | 0.90 | 19.00 | 0.059 | 10.10 | 0.020 |
| | | 31-Jul-97 | 2.00 | | | 0.20 | 16.20 | 0.010 | 1.30 | < 0.01 |
| | | 4-Sep-97 | 5.00 | | | 0.48 | 15.40 | 0.017 | 6.70 | < 0.01 |
| | | 22-Sep-97 | 1.00 | | | 0.56 | 22.00 | 0.008 | 2.20 | < 0.01 |
| | | 15-Oct-97 | 0.40 | | | 0.28 | 12.00 | 0.005 | 0.40 | < 0.01 |
| | | 29-Oct-97 | 3.50 | | | 0.36 | 12.60 | 0.011 | 3.00 | < 0.01 |
| | | 11-Nov-97 | 3.00 | | | 0.54 | 20.90 | 0.008 | 2.20 | < 0.01 |
| 00BR01AP0206 | 2 | 4-Jul-97 | 5.00 | | | 0.53 | 16.30 | 0.022 | 5.50 | < 0.01 |
| Tributary | | 29-Oct-97 | 40.00 | | | 0.42 | 14.20 | 0.014 | 4.00 | < 0.01 |
| | | 11-Nov-97 | 9.00 | | | 0.57 | 19.80 | 0.012 | 4.50 | < 0.01 |
| 00BR01AP0205 | 3 | 18-Jun-97 | 5.00 | | | 0.22 | 4.30 | 0.014 | 0.70 | < 0.01 |
| Tributary | | 4-Jul-97 | 150.00 | | | 1.47 | 17.00 | 0.120 | 13.80 | < 0.01 |
| | | 31-Jul-97 | 1.00 | | | 0.20 | 4.20 | 0.005 | 0.70 | 0.017 |
| | | 4-Sep-97 | 3.00 | | | 0.61 | 12.50 | 0.031 | 2.00 | < 0.01 |
| | | 22-Sep-97 | 0.30 | | | 0.41 | 8.90 | 0.005 | 0.80 | < 0.01 |
| | | 15-Oct-97 | 0.10 | | 11.00 | 0.20 | 2.70 | 0.005 | 0.40 | < 0.01 |
| | | 29-Oct-97 | 1.30 | | | 0.48 | 10.70 | 0.017 | 1.80 | < 0.01 |
| | | 11-Nov-97 | 2.00 | | | 0.50 | 11.80 | 0.009 | 1.70 | < 0.01 |
| 00BR01AP0175 | 4 | 18-Jun-97 | 2.00 | | | 0.26 | 11.40 | 0.011 | 2.40 | < 0.01 |
| River | | 4-Jul-97 | 60.00 | | | 0.81 | 17.20 | 0.049 | 7.20 | < 0.01 |
| | | 31-Jul-97 | 2.00 | | | 0.40 | 12.50 | 0.007 | 1.00 | < 0.01 |
| | | 4-Sep-97 | 4.00 | | | 0.40 | 12.40 | 0.016 | 4.10 | < 0.01 |
| | | 22-Sep-97 | 1.00 | | | 0.58 | 18.20 | 0.009 | 2.10 | < 0.01 |
| | | 15-Oct-97 | 0.00 | | 11.50 | 0.29 | 9.60 | 0.005 | 0.07 | < 0.01 |
| | | 29-Oct-97 | 4.00 | | | 0.41 | 11.30 | 0.012 | 4.00 | < 0.01 |
| | | 11-Nov-97 | 5.00 | | | 0.47 | 18.00 | 0.010 | 4.50 | < 0.01 |
| 00BR01AP0204 | 5 | 18-Jun-97 | 1.00 | | | 0.25 | 6.00 | 0.005 | 0.70 | 0.016 |
| Tributary | | 31-Jul-97 | 1.00 | | | 0.20 | 4.80 | 0.005 | 0.60 | 0.014 |
| | | 4-Sep-97 | 4.00 | | | 0.44 | 10.60 | 0.017 | 3.20 | < 0.01 |
| | | 22-Sep-97 | 0.00 | | | 0.36 | 10.60 | 0.005 | 1.60 | < 0.01 |
| | | 15-Oct-97 | 0.00 | | | 0.20 | 3.90 | 0.005 | 0.10 | < 0.01 |
| | | 29-Oct-97 | 11.00 | | | 0.40 | 8.20 | 0.015 | 3.80 | < 0.01 |
| | | 11-Nov-97 | 4.00 | | | 0.44 | 13.50 | 0.010 | 3.40 | < 0.01 |
| 00BR01AP0203 | 6 | 18-Jun-97 | 4.00 | | | 0.36 | 15.40 | 0.013 | 1.50 | < 0.01 |
| River | | 4-Jul-97 | 4.00 | | | 0.45 | 22.80 | 0.009 | 1.40 | < 0.01 |
| | | 31-Jul-97 | 3.00 | | | 0.42 | 16.80 | 0.013 | 2.10 | < 0.01 |
| | | 4-Sep-97 | 9.00 | | | 0.41 | 12.10 | 0.017 | 21.20 | < 0.01 |
| | | 22-Sep-97 | 3.00 | | | 0.46 | 19.30 | 0.008 | 2.80 | < 0.01 |
| | | 15-Oct-97 | 0.00 | | 10.00 | 0.31 | 11.80 | 0.005 | 1.00 | < 0.01 |
| | | 29-Oct-97 | 5.40 | | | 0.39 | 14.00 | 0.014 | 7.10 | 0.012 |
| | | 11-Nov-97 | 7.00 | | | 0.46 | 18.60 | 0.010 | 6.40 | < 0.01 |

**Table 3 (continued)**

| DOE Station No. | Station No. | Date Sampled | HARD mg/L | NO3 mg/L | Al-XGF ug/L | ALK-G mg/L | As-XGF ug/L | Ca-D mg/L | Cd-XGF ug/L | Cl-IC mg/L | CLRA TCU | COND USIE/CM | Cr-XGF ug/L | Cu-XGF ug/L | DO mg/L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0211 | 7 | 15-Oct-97 | 45.70 | 0.00 | 61.00 | 26.90 | < 1.0 | 16.50 | < 0.1 | 8.09 | 70.00 | 121.00 | < 0.5 | < 0.5 | 11.70 |
| 00BR01AP0176 | 8 | 18-Jun-97 | 33.20 | 0.00 | 98.90 | 22.40 | < 1.0 | 11.80 | < 0.1 | 6.46 | 100.00 | 88.00 | 1.10 | < 0.5 | |
| River | | 4-Jul-97 | 15.30 | 0.00 | 261.00 | 10.90 | < 1.0 | 5.30 | < 0.1 | 3.03 | 200.00 | 40.40 | 0.60 | < 0.5 | |
| | | 31-Jul-97 | 21.40 | 0.00 | 103.00 | 21.90 | < 1.0 | 11.10 | < 0.1 | 6.62 | 70.00 | 90.70 | 1.10 | < 0.5 | |
| | | 4-Sep-97 | 36.70 | 0.24 | 200.00 | 24.00 | < 1.0 | 13.20 | < 0.1 | 6.55 | 60.00 | 109.00 | < 0.5 | < 0.5 | |
| | | 22-Sep-97 | 20.00 | 0.00 | 218.00 | 12.40 | < 1.0 | 6.78 | < 0.1 | 5.46 | 100.00 | 61.20 | 0.70 | < 0.5 | |
| | | 15-Oct-97 | 39.00 | 0.00 | 95.40 | 25.00 | < 1.0 | 13.80 | < 0.1 | 8.39 | 60.00 | 114.00 | < 0.5 | < 0.5 | 11.30 |
| | | 29-Oct-97 | 32.30 | 0.00 | 136.00 | 22.20 | < 1.0 | 11.30 | < 0.1 | 7.16 | 100.00 | 95.70 | 1.20 | < 0.5 | |
| | | 11-Nov-97 | 17.80 | 0.07 | 311.00 | 7.56 | < 1.0 | 5.80 | < 0.1 | 4.33 | 120.00 | 53.50 | < 0.5 | < 0.5 | |
| 00BR01AP0177 | 9 | 4-Jul-97 | 8.30 | 0.00 | 321.00 | 4.12 | 1.90 | 2.50 | < 0.1 | 3.21 | 150.00 | 30.20 | 0.60 | < 0.5 | |
| Tributary | | 31-Jul-97 | 7.30 | 0.00 | 263.00 | 3.76 | < 1.0 | 2.10 | < 0.1 | 1.10 | 250.00 | 19.90 | 0.80 | < 0.5 | |
| | | 4-Sep-97 | 10.90 | 0.00 | 172.00 | 11.40 | < 1.0 | 3.20 | < 0.1 | 2.94 | 80.00 | 45.10 | 0.80 | < 0.5 | |
| | | 22-Sep-97 | 13.80 | 0.00 | 92.90 | 18.80 | < 1.0 | 4.20 | < 0.1 | 3.45 | 60.00 | 62.50 | < 0.5 | < 0.5 | |
| | | 15-Oct-97 | 11.60 | 0.00 | 198.00 | 9.90 | < 1.0 | 3.49 | < 0.1 | 2.64 | 100.00 | 47.10 | 0.80 | 0.60 | |
| | | 29-Oct-97 | 15.90 | 0.00 | 180.00 | 14.40 | < 1.0 | 4.90 | < 0.1 | 3.20 | 140.00 | 55.30 | 0.70 | < 0.5 | |
| | | 11-Nov-97 | 12.20 | 0.05 | 450.00 | 3.17 | < 1.0 | 3.40 | < 0.1 | 2.44 | 150.00 | 36.80 | < 0.5 | < 0.5 | |
| 00BR01AP0208 | 10 | 2-Jul-97 | 17.70 | 0.01 | 312.00 | 10.60 | 1.80 | 6.10 | < 0.1 | 2.56 | 200.00 | 43.80 | 0.60 | 0.90 | |
| River | | 4-Jul-97 | 14.70 | 0.00 | 316.00 | 9.04 | < 1.0 | 4.90 | < 0.1 | 6.87 | 250.00 | 46.20 | 0.70 | 0.60 | |
| | | 4-Jul-97 | 16.00 | 0.00 | 326.00 | 10.60 | < 1.0 | 5.40 | < 0.1 | 6.39 | 250.00 | 47.00 | 0.80 | 0.60 | |
| | | 31-Jul-97 | 30.40 | 0.00 | 97.60 | 21.50 | < 1.0 | 10.70 | < 0.1 | 6.60 | 60.00 | 90.50 | 1.10 | < 0.5 | |
| | | 4-Sep-97 | 46.30 | 0.34 | 175.00 | 26.40 | < 1.0 | 16.90 | < 0.1 | 7.89 | 60.00 | 127.00 | 0.70 | < 0.5 | |
| | | 22-Sep-97 | 25.50 | 0.00 | 171.00 | 16.70 | < 1.0 | 8.71 | < 0.1 | 6.46 | 80.00 | 80.00 | 0.80 | < 0.5 | |
| | | 15-Oct-97 | 39.10 | 0.00 | 73.10 | 23.90 | < 1.0 | 13.70 | < 0.1 | 8.85 | 80.00 | 110.00 | < 0.5 | < 0.5 | 12.20 |
| | | 29-Oct-97 | 38.50 | 0.06 | 183.00 | 24.70 | < 1.0 | 13.60 | < 0.1 | 7.91 | 120.00 | 109.00 | 1.20 | < 0.5 | |
| | | 11-Nov-97 | 20.70 | 0.07 | 432.00 | 8.46 | < 1.0 | 6.80 | < 0.1 | 3.86 | 100.00 | 56.50 | 0.80 | < 0.5 | |
| 00BR01AP0195 | 11 | 14-Jul-96 | 12.70 | | 419.00 | 7.30 | | 4.32 | < 0.1 | 2.54 | 150.00 | 40.10 | | 1.60 | |
| River | | 3-Sep-96 | 40.60 | | 61.70 | 25.50 | | 14.10 | < 0.1 | 6.69 | 50.00 | 116.00 | | 1.00 | |
| | | 10-Sep-96 | 42.30 | | 49.10 | 27.30 | | 14.80 | < 0.1 | 7.85 | 40.00 | 122.10 | | 3.60 | |
| | | 10-Oct-96 | 14.20 | | 137.00 | 11.50 | | 4.91 | < 0.1 | 5.16 | 100.00 | 62.70 | < 0.5 | < 0.5 | |
| | | 2-Jul-97 | 13.50 | 0.00 | 279.00 | 7.32 | 1.80 | 4.40 | < 0.1 | 2.53 | 200.00 | 36.40 | 1.20 | 1.70 | |
| | | 4-Jul-97 | 12.80 | 0.00 | 230.00 | 8.64 | < 1.0 | 4.30 | < 0.1 | 2.72 | 200.00 | 34.80 | 0.60 | 0.60 | |
| | | 4-Jul-97 | 15.20 | 0.00 | 226.00 | 9.22 | < 1.0 | 5.10 | < 0.1 | 2.08 | 200.00 | 33.80 | 0.70 | 1.50 | |
| | | 31-Jul-97 | 31.10 | 0.00 | 99.90 | 21.00 | < 1.0 | 10.80 | < 0.1 | 7.59 | 60.00 | 94.20 | 1.40 | < 0.5 | |
| | | 4-Sep-97 | 43.10 | 0.00 | 52.80 | 28.80 | < 1.0 | 15.10 | < 0.1 | 9.52 | 40.00 | 129.00 | < 0.5 | < 0.5 | |
| | | 22-Sep-97 | 26.20 | 0.00 | 201.00 | 17.80 | < 1.0 | 8.78 | < 0.1 | 8.08 | 60.00 | 88.50 | 0.90 | < 0.5 | |
| | | 15-Oct-97 | 28.30 | 0.00 | 78.50 | 20.10 | < 1.0 | 9.70 | < 0.1 | 7.38 | 100.00 | 90.80 | < 0.5 | < 0.5 | 11.40 |
| | | 29-Oct-97 | 38.60 | 0.00 | 61.00 | 25.90 | < 1.0 | 13.50 | < 0.1 | 10.20 | 50.00 | 118.00 | 1.00 | < 0.5 | |
| | | 11-Nov-97 | 18.00 | 0.01 | 275.00 | 8.38 | < 1.0 | 5.90 | < 0.1 | 6.84 | 100.00 | 58.20 | < 0.5 | < 0.5 | |

**Table 3 (continued)**

| DOE Station No. | Station No. | Date Sampled | F mg/L | Fe-X mg/L | K mg/L | Mg-D mg/L | Mn-X mg/L | Na mg/L | NH3T mg/L | Ni-X mg/L | NO2D mg/L | NOX mg/L | Pb-XGF ug/L | PH pH | SO4-IC mg/L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0211 | 7 | 15-Oct-97 | < 0.1 | 0.37 | 0.45 | 1.10 | 0.02 | 6.60 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.57 | 2.13 |
| 00BR01AP0176 | 8 | 18-Jun-97 | < 0.1 | 0.50 | 0.47 | 0.90 | 0.03 | 4.90 | 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.55 | 11.50 |
| River | | 4-Jul-97 | < 0.1 | 0.62 | 0.27 | 0.50 | 0.07 | 2.60 | 0.17 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.98 | 3.86 |
| | | 31-Jul-97 | < 0.1 | 0.55 | 0.43 | 0.90 | 0.03 | 5.10 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.32 | 11.40 |
| | | 4-Sep-97 | < 0.1 | 0.53 | 0.78 | 0.90 | 0.09 | 5.20 | < 0.01 | < 0.01 | < 0.05 | 0.29 | < 1.0 | 7.34 | 14.10 |
| | | 22-Sep-97 | < 0.1 | 0.63 | 0.50 | 0.75 | 0.05 | 3.85 | 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.06 | 8.34 |
| | | 15-Oct-97 | < 0.1 | 0.55 | 0.47 | 1.10 | 0.02 | 6.20 | 0.03 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.56 | 4.01 |
| | | 29-Oct-97 | 0.11 | 0.73 | 0.82 | 1.00 | 0.09 | 5.60 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.45 | 11.30 |
| | | 11-Nov-97 | < 0.1 | 0.65 | 0.48 | 0.80 | 0.04 | 3.00 | 0.02 | < 0.01 | < 0.05 | 0.12 | < 1.0 | 6.71 | 8.17 |
| 00BR01AP0177 | 9 | 4-Jul-97 | < 0.1 | 1.00 | 0.21 | 0.50 | 0.06 | 3.20 | 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.16 | 2.09 |
| Tributary | | 31-Jul-97 | < 0.1 | 1.08 | 0.18 | 0.50 | 0.05 | 1.90 | 0.03 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.18 | 1.89 |
| | | 4-Sep-97 | < 0.1 | 0.98 | 0.35 | 0.70 | 0.03 | 4.90 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.10 | 3.54 |
| | | 22-Sep-97 | 0.12 | 0.52 | 0.39 | 0.80 | 0.02 | 6.20 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.40 | 4.34 |
| | | 15-Oct-97 | < 0.1 | 0.69 | 0.52 | 0.70 | 0.02 | 4.45 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.14 | 6.88 |
| | | 29-Oct-97 | < 0.1 | 0.75 | 0.67 | 0.90 | 0.04 | 5.10 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.29 | 4.32 |
| | | 11-Nov-97 | < 0.1 | 0.98 | 0.48 | 0.90 | 0.09 | 2.50 | 0.02 | < 0.01 | < 0.05 | 0.10 | < 1.0 | 6.17 | 7.18 |
| 00BR01AP0208 | 10 | 2-Jul-97 | < 0.1 | 0.77 | 0.38 | 0.60 | 0.05 | 2.60 | 0.01 | < 0.01 | < 0.05 | 0.06 | < 1.0 | 6.85 | 4.04 |
| River | | 4-Jul-97 | < 0.1 | 1.02 | 0.25 | 0.60 | 0.07 | 5.70 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.74 | 3.39 |
| | | 4-Jul-97 | < 0.1 | 0.78 | 0.26 | 0.60 | 0.07 | 4.80 | | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.91 | 3.45 |
| | | 31-Jul-97 | < 0.1 | 0.52 | 0.48 | 0.90 | 0.03 | 5.40 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.41 | 11.80 |
| | | 4-Sep-97 | < 0.1 | 0.47 | 0.96 | 1.00 | 0.07 | 5.80 | < 0.01 | < 0.01 | < 0.05 | 0.39 | < 1.0 | 7.47 | 17.40 |
| | | 22-Sep-97 | < 0.1 | 0.66 | 0.66 | 0.92 | 0.05 | 5.17 | 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.30 | 10.00 |
| | | 15-Oct-97 | < 0.1 | 0.53 | 0.46 | 1.20 | 0.03 | 6.90 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.50 | 13.20 |
| | | 29-Oct-97 | < 0.1 | 0.62 | 0.69 | 1.10 | 0.07 | 6.50 | < 0.01 | < 0.01 | < 0.05 | 0.11 | < 1.0 | 7.44 | 13.30 |
| | | 11-Nov-97 | < 0.1 | 0.80 | 0.64 | 0.90 | 0.08 | 3.30 | 0.01 | < 0.01 | < 0.05 | 0.12 | < 1.0 | 6.78 | 8.74 |
| 00BR01AP0195 | 11 | 14-Jul-96 | | 0.79 | 0.34 | 0.46 | 0.07 | 2.79 | < 0.01 | < 0.01 | | < 0.05 | < 1.0 | 6.52 | 2.54 |
| River | | 3-Sep-96 | | 0.55 | 0.59 | 1.31 | 0.09 | 6.78 | < 0.01 | < 0.01 | | < 0.05 | < 1.0 | 7.56 | 12.70 |
| | | 10-Sep-96 | | 0.61 | 0.58 | 1.30 | 0.11 | 6.90 | 0.02 | < 0.01 | | < 0.05 | < 1.0 | 7.31 | 14.40 |
| | | 10-Oct-96 | | 0.31 | 0.35 | 0.48 | 0.03 | 3.52 | < 0.01 | < 0.01 | | < 0.05 | < 1.0 | 6.88 | 5.85 |
| | | 2-Jul-97 | < 0.1 | 0.72 | 0.38 | 0.60 | 0.08 | 2.60 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.60 | 3.08 |
| | | 4-Jul-97 | < 0.1 | 0.65 | 0.26 | 0.50 | 0.06 | 2.50 | 0.11 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.73 | 3.28 |
| | | 4-Jul-97 | < 0.1 | 0.71 | 0.41 | 0.60 | 0.07 | 2.40 | | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.82 | 3.17 |
| | | 31-Jul-97 | < 0.1 | 0.62 | 0.46 | 1.00 | 0.07 | 5.40 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.37 | 11.30 |
| | | 4-Sep-97 | < 0.1 | 0.31 | 0.52 | 1.30 | 0.05 | 7.50 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.65 | 14.90 |
| | | 22-Sep-97 | < 0.1 | 0.59 | 0.79 | 1.04 | 0.07 | 6.07 | 0.02 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.36 | 10.30 |
| | | 15-Oct-97 | 0.13 | 0.53 | 0.41 | 1.00 | 0.04 | 5.00 | 0.07 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.35 | 11.20 |
| | | 29-Oct-97 | < 0.1 | 0.39 | 0.51 | 1.20 | 0.03 | 7.80 | < 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 7.50 | 13.10 |
| | | 11-Nov-97 | < 0.1 | 0.58 | 0.41 | 0.80 | 0.03 | 4.40 | 0.01 | < 0.01 | < 0.05 | < 0.05 | < 1.0 | 6.82 | 8.14 |

**Table 3 (continued)**

| DOE Station No. | Station No. | Date Sampled | SS mg/L | TDS mg/L | TEMP degrees C | TKN mg/L | TOC mg/L | TP-L mg/L | TURB NTU | ZN-X mg/L |
|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0211 | 7 | 15-Oct-97 | 0.20 | | 9.50 | 0.28 | 9.10 | 0.005 | 0.60 | < 0.01 |
| 00BR01AP0176 | 8 | 18-Jun-97 | 2.00 | | | 0.28 | 10.20 | 0.008 | 1.40 | < 0.01 |
| River | | 4-Jul-97 | 20.00 | | | 0.49 | 19.00 | 0.018 | 2.90 | 0.021 |
| | | 31-Jul-97 | 1.00 | | | 0.27 | 11.30 | 0.007 | 1.10 | 0.029 |
| | | 4-Sep-97 | 8.00 | | | 0.43 | 10.60 | 0.021 | 4.70 | < 0.01 |
| | | 22-Sep-97 | 3.00 | | | 0.51 | 17.20 | 0.009 | 3.20 | < 0.01 |
| | | 15-Oct-97 | 1.20 | | 9.50 | 0.26 | 8.80 | 0.005 | 1.10 | < 0.01 |
| | | 29-Oct-97 | 9.70 | | | 0.38 | 10.20 | 0.016 | 4.10 | < 0.01 |
| | | 11-Nov-97 | 10.00 | | | 0.60 | 16.70 | 0.013 | 4.30 | 0.015 |
| 00BR01AP0177 | 9 | 4-Jul-97 | 5.00 | | | 0.45 | 20.90 | 0.012 | 2.10 | < 0.01 |
| Tributary | | 31-Jul-97 | 4.00 | | | 0.44 | 22.20 | 0.090 | 1.40 | < 0.01 |
| | | 4-Sep-97 | 1.00 | | | 0.42 | 12.50 | 0.015 | 1.90 | < 0.01 |
| | | 22-Sep-97 | 1.00 | | | 0.24 | 7.50 | 0.011 | 3.30 | < 0.01 |
| | | 15-Oct-97 | 2.00 | | | 0.48 | 14.20 | 0.011 | 6.10 | < 0.01 |
| | | 29-Oct-97 | 2.40 | | | 0.34 | 12.50 | 0.016 | 6.50 | 0.027 |
| | | 11-Nov-97 | 8.00 | | | 0.48 | 17.80 | 0.015 | 9.50 | 0.019 |
| 00BR01AP0208 | 10 | 2-Jul-97 | 8.00 | | | 0.48 | 19.50 | 0.014 | 2.30 | 0.052 |
| River | | 4-Jul-97 | 20.00 | | | 0.49 | 19.60 | 0.018 | 4.90 | < 0.01 |
| | | 4-Jul-97 | 20.00 | | | | | | 4.00 | 0.014 |
| | | 31-Jul-97 | 2.00 | | | 0.24 | 10.40 | 0.007 | 1.20 | < 0.01 |
| | | 4-Sep-97 | 6.00 | | | 0.42 | 10.10 | 0.019 | 4.60 | < 0.01 |
| | | 22-Sep-97 | 3.00 | | | 0.42 | 13.60 | 0.009 | 4.30 | < 0.01 |
| | | 15-Oct-97 | 0.60 | | 9.50 | 0.33 | 9.80 | 0.005 | 1.30 | < 0.01 |
| | | 29-Oct-97 | 15.00 | | | 0.56 | 9.60 | 0.028 | 5.30 | < 0.01 |
| | | 11-Nov-97 | 14.00 | | | 0.51 | 16.80 | 0.015 | 6.80 | < 0.01 |
| 00BR01AP0195 | 11 | 14-Jul-96 | 4.00 | 70.00 | | 0.46 | 21.00 | 0.016 | 3.20 | < 0.01 |
| River | | 3-Sep-96 | 4.00 | 80.00 | | 0.28 | 6.60 | 0.009 | 3.30 | < 0.01 |
| | | 10-Sep-96 | 20.00 | 80.00 | | 0.29 | 5.40 | 0.006 | 4.30 | < 0.01 |
| | | 10-Oct-96 | 4.00 | 70.00 | | 0.38 | 15.20 | 0.012 | 5.70 | < 0.01 |
| | | 2-Jul-97 | 3.00 | | | 0.52 | 19.40 | 0.009 | 1.50 | 0.011 |
| | | 4-Jul-97 | 7.00 | | | 0.49 | 19.60 | 0.014 | 2.70 | 0.013 |
| | | 4-Jul-97 | 9.00 | | | | | | 3.00 | 0.017 |
| | | 31-Jul-97 | 2.00 | | | 0.26 | 10.10 | 0.006 | 1.80 | < 0.01 |
| | | 4-Sep-97 | 1.00 | | | 0.22 | 5.10 | 0.005 | 2.30 | < 0.01 |
| | | 22-Sep-97 | 5.00 | | | 0.54 | 11.40 | 0.009 | 6.00 | < 0.01 |
| | | 15-Oct-97 | 2.00 | | 11.00 | 0.34 | 10.50 | 0.008 | 3.80 | < 0.01 |
| | | 29-Oct-97 | 1.90 | | | 0.25 | 7.10 | 0.010 | 2.60 | < 0.01 |
| | | 11-Nov-97 | 3.00 | | | 0.42 | 14.10 | 0.010 | 5.50 | < 0.01 |

**Table 4. Bacterial results, Canaan River and tributaries, 1997.**

| | | | Total Coliform (count/100mL) | | | | E.coli (count/100mL) | | | | Fecal coliform (count/100mL | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DOE Station No. | Station No. | Date Sampled | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 00BR01AP0209 | 1 | 18-Jun-97 | 1733 | | | | 77 | 105 | | | 84 | 100 | | |
| | | 31-Jul-97 | 1414 | 1300 | | | 14 | 9 | | | 8 | 9 | | |
| | | 4-Sep-97 | > 2419 | | | | 1046 | | | | 300 | | | |
| | | 22-Sep-97 | 1986 | > 2419 | > 2419 | 1986 | 86 | 66 | 119 | 93 | 85 | 66 | 80 | 70 |
| | | 15-Oct-97 | 205 | 142 | | | 1 | 1 | | | 1 | 1 | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 108 | 75 | 102 | 119 | 50 | 53 | 47 | 46 |
| | | 11-Nov-97 | > 2419 | > 2419 | 1986 | | 25 | 23 | 20 | | 9 | 14 | 13 | |
| 00BR01AP0206 | 2 | 18-Jun-97 | 1733 | 770 | | | 63 | 55 | | | 48 | 56 | | |
| | | 4-Sep-97 | > 2419 | | | | 1986 | | | | 300 | | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 124 | 86 | 132 | 105 | 53 | 50 | 52 | 50 |
| | | 11-Nov-97 | > 2419 | > 2419 | > 2419 | | 33 | 35 | 31 | | 28 | 34 | 30 | |
| 00BR01AP0205 | 3 | 18-Jun-97 | 1986 | 1733 | | | 219 | 192 | | | 200 | 164 | | |
| | | 31-Jul-97 | > 2419 | > 2419 | | | 41 | 58 | | | 32 | 40 | | |
| | | 4-Sep-97 | > 2419 | | | | > 2419 | | | | 300 | | | |
| | | 22-Sep-97 | 1986 | 1986 | 1986 | 1986 | 99 | 124 | 99 | 91 | 86 | 70 | 72 | 85 |
| | | 15-Oct-97 | 205 | 275 | | | 2 | 4 | | | 1 | 1 | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 921 | 770 | 687 | 613 | 300 | 300 | 300 | 300 |
| | | 11-Nov-97 | > 2419 | 1553 | > 2419 | | 50 | 43 | 67 | | 49 | 54 | 40 | |
| 00BR01AP0175 | 4 | 18-Jun-97 | 1533 | 1986 | | | 104 | 1986 | | | 58 | 102 | | |
| | | 31-Jul-97 | > 2419 | 1011 | | | 111 | 82 | | | 70 | 71 | | |
| | | 4-Sep-97 | > 2419 | | | | 1414 | | | | 300 | | | |
| | | 22-Sep-97 | > 2419 | > 2419 | > 2419 | > 2419 | 435 | 345 | 816 | 548 | 300 | 320 | 380 | 340 |
| | | 15-Oct-97 | 365 | 365 | | | 26 | 20 | | | 17 | 14 | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 210 | 602 | 299 | 491 | 114 | 121 | 134 | 128 |
| | | 11-Nov-97 | > 2419 | > 2419 | 1011 | | 33 | 28 | 29 | | 34 | 30 | 33 | |
| 00BR01AP0204 | 5 | 18-Jun-97 | 1986 | 1733 | | | 61 | 88 | | | 83 | 69 | | |
| | | 31-Jul-97 | 1553 | > 2419 | | | 29 | 41 | | | 42 | 40 | | |
| | | 4-Sep-97 | > 2419 | | | | 1203 | | | | 300 | | | |
| | | 22-Sep-97 | 1046 | 1533 | 980 | 1046 | 16 | 17 | 20 | 32 | 14 | 27 | 21 | 12 |
| | | 15-Oct-97 | 249 | 261 | | | 3 | 3 | | | | 2 | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 411 | 517 | 344 | 411 | 256 | 192 | 184 | 238 |
| | | 11-Nov-97 | 1553 | 1986 | 1414 | | 35 | 40 | 32 | | 30 | 22 | 18 | |
| 00BR01AP0203 | 6 | 18-Jun-97 | > 2419 | > 2419 | | | 613 | 686 | | | 352 | 336 | | |
| | | 31-Jul-97 | > 2419 | > 2419 | | | 41 | 46 | | | 54 | 55 | | |
| | | 4-Sep-97 | > 2419 | | | | 1553 | | | | 300 | | | |
| | | 22-Sep-97 | 1553 | 1733 | 1553 | 1733 | 87 | 71 | 71 | 70 | 44 | 86 | 65 | 60 |
| | | 15-Oct-97 | 649 | 816 | | | 3 | 5 | | | 5 | 2 | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 248 | 293 | 144 | 228 | 65 | 59 | 66 | 62 |
| | | 11-Nov-97 | 1986 | > 2419 | > 2419 | | 26 | 33 | 27 | | 13 | 14 | 19 | |

**Table 4. (continued)**

| | | | Total Coliform | | | | E.coli | | | | Fecal | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (count/100mL) | | | | (count/100mL) | | | | (count/100mL | | | |
| DOE Station No. | Station No. | Date Sampled | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 00BR01AP0211 | 7 | 22-Sep-97 | > 2419 | > 2419 | > 2419 | > 2419 | 172 | 130 | 178 | 162 | 140 | 134 | 156 | 176 |
| | | 15-Oct-97 | 387 | 365 | | | 29 | 37 | | | 23 | 19 | | |
| 00BR01AP0176 | 8 | 18-Jun-97 | 1414 | 1553 | | | 99 | 127 | | | 133 | 123 | | |
| | | 31-Jul-97 | 1300 | 1300 | | | 23 | 31 | | | 30 | 23 | | |
| | | 4-Sep-97 | > 2419 | | | | 1986 | | | | 300 | | | |
| | | 22-Sep-97 | > 2419 | > 2419 | > 2419 | > 2419 | 178 | 228 | 132 | 140 | 120 | 140 | 97 | 120 |
| | | 15-Oct-97 | 488 | 488 | | | 28 | 33 | | | 19 | 27 | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 525 | 184 | 299 | 210 | 130 | 118 | 100 | 121 |
| | | 11-Nov-97 | > 2419 | 1011 | 1011 | | 54 | 50 | 41 | | 64 | 50 | 52 | |
| 00BR01AP0177 | 9 | 2-Jul-97 | > 2419 | > 2419 | | | 126 | 91 | | | 57 | 52 | | |
| | | 31-Jul-97 | 1414 | 1986 | | | 40 | 36 | | | 38 | 19 | | |
| | | 4-Sep-97 | > 2419 | | | | 173 | | | | 80 | | | |
| | | 22-Sep-97 | 1986 | 1733 | 1986 | 1733 | 107 | 186 | 114 | 124 | 60 | 92 | 67 | 112 |
| | | 15-Oct-97 | 326 | 231 | | | 16 | 8 | | | 19 | 8 | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 115 | 96 | 203 | 131 | 50 | 63 | 52 | 57 |
| | | 11-Nov-97 | 1733 | 1986 | > 2419 | | 28 | 39 | 38 | | 18 | 22 | 12 | |
| 00BR01AP0208 | 10 | 2-Jul-97 | > 2419 | > 2419 | | | | 1046 | | | 212 | 248 | | |
| | | 31-Jul-97 | 980 | 921 | | | 12 | 12 | | | 13 | 9 | | |
| | | 4-Sep-97 | > 2419 | | | | > 2419 | | | | 300 | | | |
| | | 22-Sep-97 | > 2419 | > 2419 | > 2419 | > 2419 | 210 | 179 | 166 | 291 | 200 | 154 | 176 | 141 |
| | | 15-Oct-97 | 387 | 435 | | | 10 | 9 | | | 5 | 6 | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 205 | 157 | 210 | 172 | 76 | 80 | 88 | 92 |
| | | 11-Nov-97 | > 2419 | > 2419 | > 2419 | | 88 | 105 | 56 | | 58 | 51 | 60 | |
| 00BR01AP0195 | 11 | 2-Jul-97 | > 2419 | > 2419 | | | 40 | 44 | | | 18 | 28 | | |
| | | 31-Jul-97 | 547 | 649 | | | 11 | 10 | | | 9 | 9 | | |
| | | 4-Sep-97 | > 2419 | | | | 93 | | | | 52 | | | |
| | | 22-Sep-97 | > 2419 | > 2419 | > 2419 | > 2419 | 125 | 185 | 173 | 186 | 92 | 118 | 116 | 154 |
| | | 15-Oct-97 | 517 | 649 | | | 22 | 16 | | | 7 | 7 | | |
| | | 29-Oct-97 | > 2419 | > 2419 | > 2419 | > 2419 | 76 | 74 | 82 | 203 | 40 | 41 | 45 | 46 |
| | | 11-Nov-97 | > 2419 | 1733 | > 2419 | | 68 | 58 | 39 | | 40 | 44 | 42 | |

**Table 5. Summary statistics for chemical and physical parameters, grouped by baseline and post rainfall results, Canaan River and tributaries, 1997.**

## Baseline results

| DOE Station No. | Station No. | Number of observations | | HARD mg/L | Al-XGF ug/L | ALK-G mg/L | Ca-D mg/L | Cl-IC mg/L | CLRA TCU | COND USIE/CM | Cr-XGF ug/L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 4 | Mean | 20.95 | 168.10 | 15.95 | 7.08 | 3.33 | 96.25 | 235.20 | 0.925 |
| | | | St. Dev. | 12.52 | 103.29 | 8.52 | 4.95 | 2.02 | 27.50 | 335.73 | 0.369 |
| | | | Median | 16.35 | 139.00 | 15.65 | 5.15 | 2.56 | 97.50 | 82.80 | 0.900 |
| 00BR01AP0206 | 2 | 0 | Mean | | | | | | | | |
| | | | St. Dev. | not sampled as baseline | | | | | | | |
| | | | Median | | | | | | | | |
| 00BR01AP0205 | 3 | 4 | Mean | 143.85 | 41.53 | 72.73 | 55.01 | 13.05 | 23.75 | 321.75 | 2.200 |
| | | | St. Dev. | 37.64 | 28.28 | 10.67 | 14.58 | 2.28 | 11.09 | 62.55 | 1.036 |
| | | | Median | 136.75 | 43.40 | 73.70 | 52.30 | 12.55 | 20.00 | 310.50 | 2.050 |
| 00BR01AP0175 | 4 | 4 | Mean | 38.78 | 128.95 | 24.05 | 13.90 | 8.07 | 85.00 | 112.48 | 0.950 |
| | | | St. Dev. | 13.86 | 58.14 | 7.16 | 5.24 | 2.82 | 17.32 | 28.91 | 0.574 |
| | | | Median | 36.45 | 122.50 | 24.75 | 13.20 | 9.36 | 85.00 | 106.85 | 0.800 |
| 00BR01AP0204 | 5 | 4 | Mean | 26.23 | 53.13 | 23.73 | 9.08 | 3.10 | 30.00 | 70.50 | 0.800 |
| | | | St. Dev. | 5.08 | 36.74 | 5.70 | 1.85 | 0.77 | 18.26 | 10.15 | 0.383 |
| | | | Median | 25.85 | 47.55 | 25.15 | 8.95 | 2.97 | 30.00 | 69.75 | 0.700 |
| 00BR01AP0203 | 6 | 4 | Mean | 8.88 | 201.25 | 8.03 | 2.66 | 3.07 | 112.50 | 39.45 | 0.600 |
| | | | St. Dev. | 2.23 | 72.50 | 3.50 | 0.68 | 0.71 | 29.86 | 8.79 | 0.141 |
| | | | Median | 8.50 | 209.00 | 7.93 | 2.52 | 2.96 | 110.00 | 35.30 | 0.550 |
| 00BR01AP0211 | 7 | 1 | Mean | 45.70 | 61.00 | 26.90 | 16.50 | 8.09 | 70.00 | 121.00 | 0.500 |
| | | | St. Dev. | | | | | | | | |
| | | | Median | 45.70 | 61.00 | 26.90 | 16.50 | 8.09 | 70.00 | 121.00 | 0.500 |
| 00BR01AP0176 | 8 | 4 | Mean | 28.40 | 128.83 | 20.43 | 10.87 | 6.73 | 82.50 | 88.48 | 0.850 |
| | | | St. Dev. | 9.22 | 59.53 | 5.52 | 2.96 | 1.22 | 20.62 | 21.61 | 0.300 |
| | | | Median | 27.30 | 100.95 | 22.15 | 11.45 | 6.54 | 85.00 | 89.35 | 0.900 |
| 00BR01AP0177 | 9 | 3 | Mean | 10.90 | 184.63 | 10.82 | 3.26 | 2.40 | 136.67 | 43.17 | 0.700 |
| | | | St. Dev. | 3.31 | 85.83 | 7.56 | 1.07 | 1.19 | 100.17 | 21.57 | 0.173 |
| | | | Median | 11.60 | 198.00 | 9.90 | 3.49 | 2.64 | 100.00 | 47.10 | 0.800 |
| 00BR01AP0208 | 10 | 4 | Mean | 28.18 | 163.43 | 18.18 | 9.80 | 6.12 | 105.00 | 81.08 | 0.750 |
| | | | St. Dev. | 8.97 | 107.43 | 5.87 | 3.21 | 2.61 | 64.03 | 27.79 | 0.265 |
| | | | Median | 27.95 | 134.30 | 19.10 | 9.71 | 6.53 | 80.00 | 85.25 | 0.700 |
| 00BR01AP0195 | 11 | 4 | Mean | 24.78 | 164.60 | 16.56 | 8.42 | 6.40 | 105.00 | 77.48 | 1.000 |
| | | | St. Dev. | 7.78 | 93.12 | 6.30 | 2.80 | 2.59 | 66.08 | 27.48 | 0.392 |
| | | | Median | 27.25 | 150.45 | 18.95 | 9.24 | 7.49 | 80.00 | 89.65 | 1.050 |

**Baseline results**

| DOE Station | Station No. | Number of observations | | DO mg/L | Fe-X mg/L | K mg/L | Mg-D mg/L | Mn-X mg/L | Na mg/L | NH3T mg/L | pH pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP02 | 1 | 4 | Mean | | 0.562 | 0.338 | 0.800 | 0.025 | 4.32 | 0.017 | 7.23 |
| | | | St. Dev. | | 0.125 | 0.109 | 0.141 | 0.014 | 1.23 | 0.005 | 0.48 |
| | | | Median | | 0.567 | 0.302 | 0.750 | 0.025 | 4.30 | 0.018 | 7.31 |
| 00BR01AP02 | 2 | 0 | Mean | | | | | | | | |
| | | | St. Dev. | | | | | not sampled as baseline | | | |
| | | | Median | | | | | | | | |
| 00BR01AP02 | 3 | 4 | Mean | 14.0 | 0.060 | 1.122 | 1.585 | 0.021 | 7.79 | 0.013 | 8.36 |
| | | | St. Dev. | | 0.046 | 0.262 | 0.298 | 0.014 | 1.16 | 0.003 | 0.24 |
| | | | Median | 14.0 | 0.058 | 1.045 | 1.500 | 0.018 | 7.53 | 0.012 | 8.27 |
| 00BR01AP01 | 4 | 4 | Mean | 11.8 | 0.445 | 0.509 | 0.988 | 0.037 | 7.00 | 0.015 | 7.53 |
| | | | St. Dev. | | 0.093 | 0.064 | 0.246 | 0.010 | 2.95 | 0.006 | 0.25 |
| | | | Median | 11.8 | 0.487 | 0.537 | 0.975 | 0.039 | 6.50 | 0.015 | 7.59 |
| 00BR01AP02 | 5 | 4 | Mean | | 0.163 | 0.466 | 0.863 | 0.023 | 2.91 | 0.010 | 7.58 |
| | | | St. Dev. | | 0.075 | 0.082 | 0.111 | 0.011 | 0.55 | 0.000 | 0.15 |
| | | | Median | | 0.172 | 0.435 | 0.850 | 0.022 | 2.80 | 0.010 | 7.62 |
| 00BR01AP02 | 6 | 4 | Mean | 11.6 | 0.828 | 0.340 | 0.543 | 0.025 | 4.71 | 0.012 | 6.81 |
| | | | St. Dev. | | 0.254 | 0.061 | 0.126 | 0.011 | 1.59 | 0.002 | 0.37 |
| | | | Median | 11.6 | 0.740 | 0.322 | 0.535 | 0.026 | 4.40 | 0.011 | 6.92 |
| 00BR01AP02 | 7 | 1 | Mean | 11.7 | 0.372 | 0.452 | 1.100 | 0.018 | 6.60 | 0.015 | 7.57 |
| | | | St. Dev. | | | | | | | | |
| | | | Median | 11.7 | 0.372 | 0.452 | 1.100 | 0.018 | 6.60 | 0.015 | 7.57 |
| 00BR01AP01 | 8 | 4 | Mean | 11.3 | 0.558 | 0.471 | 0.913 | 0.031 | 5.01 | 0.017 | 7.37 |
| | | | St. Dev. | | 0.053 | 0.029 | 0.144 | 0.011 | 0.96 | 0.010 | 0.24 |
| | | | Median | 11.3 | 0.549 | 0.474 | 0.900 | 0.031 | 5.00 | 0.013 | 7.44 |
| 00BR01AP01 | 9 | 3 | Mean | | 0.765 | 0.363 | 0.667 | 0.032 | 4.18 | 0.015 | 6.91 |
| | | | St. Dev. | | 0.286 | 0.171 | 0.153 | 0.016 | 2.16 | 0.009 | 0.64 |
| | | | Median | | 0.690 | 0.393 | 0.700 | 0.024 | 4.45 | 0.010 | 7.14 |
| 00BR01AP02 | 10 | 4 | Mean | 12.2 | 0.620 | 0.494 | 0.905 | 0.042 | 5.02 | 0.014 | 7.27 |
| | | | St. Dev. | | 0.117 | 0.120 | 0.245 | 0.013 | 1.78 | 0.007 | 0.29 |
| | | | Median | 12.2 | 0.594 | 0.470 | 0.910 | 0.042 | 5.29 | 0.011 | 7.36 |
| 00BR01AP01 | 11 | 4 | Mean | 11.4 | 0.617 | 0.507 | 0.910 | 0.067 | 4.77 | 0.030 | 7.17 |
| | | | St. Dev. | | 0.080 | 0.189 | 0.208 | 0.018 | 1.51 | 0.027 | 0.38 |
| | | | Median | 11.4 | 0.606 | 0.433 | 1.000 | 0.072 | 5.20 | 0.020 | 7.36 |

**Table 5. (continued)**

## Baseline results

| DOE Station No. | Station No. | Number of observations | | SO4-IC mg/L | SS mg/L | TKN mg/L | TOC mg/L | TP-L mg/L | TURB NTU |
|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 4 | Mean | 6.76 | 1.35 | 0.340 | 15.38 | 0.009 | 1.83 |
| | | | St. Dev. | 5.96 | 0.79 | 0.155 | 4.92 | 0.003 | 1.28 |
| | | | Median | 4.52 | 1.50 | 0.300 | 14.10 | 0.009 | 1.75 |
| 00BR01AP0206 | 2 | 0 | Mean | | | | | | |
| | | | St. Dev. | | | | | | |
| | | | Median | | | | | | |
| 00BR01AP0205 | 3 | 4 | Mean | 69.40 | 1.60 | 0.258 | 5.03 | 0.007 | 0.65 |
| | | | St. Dev. | 23.30 | 2.30 | 0.102 | 2.68 | 0.005 | 0.17 |
| | | | Median | 62.85 | 0.65 | 0.210 | 4.25 | 0.005 | 0.70 |
| 00BR01AP0175 | 4 | 4 | Mean | 15.02 | 1.25 | 0.383 | 12.93 | 0.008 | 1.39 |
| | | | St. Dev. | 5.40 | 0.96 | 0.145 | 3.71 | 0.003 | 1.07 |
| | | | Median | 14.25 | 1.50 | 0.345 | 11.95 | 0.008 | 1.55 |
| 00BR01AP0204 | 5 | 4 | Mean | 4.56 | 0.50 | 0.253 | 6.33 | 0.005 | 0.75 |
| | | | St. Dev. | 2.29 | 0.58 | 0.075 | 2.98 | 0.000 | 0.62 |
| | | | Median | 3.61 | 0.50 | 0.225 | 5.40 | 0.005 | 0.65 |
| 00BR01AP0203 | 6 | 4 | Mean | 3.31 | 2.50 | 0.388 | 15.83 | 0.010 | 1.85 |
| | | | St. Dev. | 1.89 | 1.73 | 0.066 | 3.13 | 0.004 | 0.78 |
| | | | Median | 2.48 | 3.00 | 0.390 | 16.10 | 0.011 | 1.80 |
| 00BR01AP0211 | 7 | 1 | Mean | 2.13 | 0.20 | 0.280 | 9.10 | 0.005 | 0.60 |
| | | | St. Dev. | | | | | | |
| | | | Median | 2.13 | 0.20 | 0.280 | 9.10 | 0.005 | 0.60 |
| 00BR01AP0176 | 8 | 4 | Mean | 8.81 | 1.80 | 0.330 | 11.88 | 0.007 | 1.70 |
| | | | St. Dev. | 3.52 | 0.91 | 0.120 | 3.69 | 0.002 | 1.01 |
| | | | Median | 9.87 | 1.60 | 0.275 | 10.75 | 0.008 | 1.25 |
| 00BR01AP0177 | 9 | 3 | Mean | 4.37 | 2.33 | 0.387 | 14.63 | 0.037 | 3.60 |
| | | | St. Dev. | 2.50 | 1.53 | 0.129 | 7.36 | 0.046 | 2.36 |
| | | | Median | 4.34 | 2.00 | 0.440 | 14.20 | 0.011 | 3.30 |
| 00BR01AP0208 | 10 | 4 | Mean | 9.76 | 3.40 | 0.368 | 13.33 | 0.009 | 2.28 |
| | | | St. Dev. | 4.03 | 3.22 | 0.105 | 4.44 | 0.004 | 1.44 |
| | | | Median | 10.90 | 2.50 | 0.375 | 12.00 | 0.008 | 1.80 |
| 00BR01AP0195 | 11 | 4 | Mean | 8.97 | 3.00 | 0.415 | 12.85 | 0.008 | 3.28 |
| | | | St. Dev. | 3.95 | 1.41 | 0.137 | 4.40 | 0.001 | 2.08 |
| | | | Median | 10.75 | 2.50 | 0.430 | 10.95 | 0.009 | 2.80 |

**Table 5. (continued)**

## Post rainfall

| DOE Station No. | Station No. | Number of observations | | HARD mg/L | Al-XGF ug/L | ALK-G mg/L | Ca-D mg/L | Cl-IC mg/L | CLRA TCU | COND USIE/CM | Cr-XGF ug/L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 4 | Mean | 15.85 | 306.75 | 11.07 | 5.20 | 2.37 | 145.00 | 45.35 | 0.625 |
| | | | St. Dev. | 4.47 | 165.15 | 5.68 | 1.94 | 0.42 | 103.76 | 8.66 | 0.189 |
| | | | Median | 15.65 | 287.00 | 13.35 | 4.95 | 2.52 | 100.00 | 47.25 | 0.550 |
| 00BR01AP0206 | 2 | 3 | Mean | 19.90 | 257.00 | 13.79 | 6.87 | 6.18 | 100.00 | 69.63 | 0.667 |
| | | | St. Dev. | 4.40 | 125.43 | 7.12 | 1.60 | 2.52 | 20.00 | 17.97 | 0.289 |
| | | | Median | 19.90 | 245.00 | 15.20 | 7.00 | 4.78 | 100.00 | 72.50 | 0.500 |
| 00BR01AP0205 | 3 | 4 | Mean | 83.33 | 549.05 | 44.35 | 31.53 | 10.04 | 80.00 | 198.08 | 1.425 |
| | | | St. Dev. | 35.15 | 881.04 | 13.83 | 13.49 | 5.04 | 46.90 | 86.75 | 0.873 |
| | | | Median | 98.15 | 127.00 | 50.00 | 37.25 | 10.90 | 60.00 | 229.50 | 1.300 |
| 00BR01AP0175 | 4 | 4 | Mean | 27.65 | 298.75 | 17.69 | 9.75 | 4.59 | 125.00 | 75.40 | 0.800 |
| | | | St. Dev. | 6.52 | 104.30 | 7.21 | 2.43 | 1.58 | 52.60 | 20.52 | 0.356 |
| | | | Median | 28.25 | 317.00 | 20.05 | 10.15 | 3.89 | 110.00 | 75.95 | 0.750 |
| 00BR01AP0204 | 5 | 3 | Mean | 26.83 | 182.00 | 16.47 | 9.27 | 4.38 | 66.67 | 70.33 | 0.767 |
| | | | St. Dev. | 5.30 | 81.43 | 6.15 | 1.86 | 1.87 | 28.87 | 13.72 | 0.379 |
| | | | Median | 26.00 | 137.00 | 16.50 | 9.10 | 3.49 | 50.00 | 71.90 | 0.600 |
| 00BR01AP0203 | 6 | 4 | Mean | 8.73 | 268.50 | 6.36 | 2.50 | 2.47 | 180.00 | 36.00 | 0.625 |
| | | | St. Dev. | 2.08 | 99.26 | 4.59 | 0.63 | 0.43 | 57.15 | 11.40 | 0.126 |
| | | | Median | 9.05 | 256.50 | 5.74 | 2.55 | 2.40 | 175.00 | 38.25 | 0.600 |
| 00BR01AP0211 | 7 | 0 | Mean | | | | | | | | |
| | | | St. Dev. | | | not sampled after rain event | | | | | |
| | | | Median | | | | | | | | |
| 00BR01AP0176 | 8 | 4 | Mean | 25.53 | 227.00 | 16.17 | 8.90 | 5.27 | 120.00 | 74.65 | 0.700 |
| | | | St. Dev. | 10.57 | 75.77 | 8.16 | 3.95 | 1.92 | 58.88 | 32.88 | 0.337 |
| | | | Median | 25.05 | 230.50 | 16.55 | 8.55 | 5.44 | 110.00 | 74.60 | 0.550 |
| 00BR01AP0177 | 9 | 4 | Mean | 11.83 | 280.75 | 8.27 | 3.50 | 2.95 | 130.00 | 41.85 | 0.650 |
| | | | St. Dev. | 3.16 | 131.96 | 5.50 | 1.01 | 0.36 | 33.67 | 10.84 | 0.129 |
| | | | Median | 11.55 | 250.50 | 7.76 | 3.30 | 3.07 | 145.00 | 40.95 | 0.650 |
| 00BR01AP0208 | 10 | 5 | Mean | 27.24 | 286.40 | 15.84 | 9.52 | 6.58 | 156.00 | 77.14 | 0.840 |
| | | | St. Dev. | 14.29 | 108.10 | 8.92 | 5.40 | 1.66 | 88.49 | 38.06 | 0.207 |
| | | | Median | 20.70 | 316.00 | 10.60 | 6.80 | 6.87 | 120.00 | 56.50 | 0.800 |
| 00BR01AP0195 | 11 | 5 | Mean | 25.54 | 168.96 | 16.19 | 8.78 | 6.27 | 118.00 | 74.76 | 0.660 |
| | | | St. Dev. | 14.19 | 104.13 | 10.25 | 5.10 | 3.76 | 78.23 | 45.72 | 0.207 |
| | | | Median | 18.00 | 226.00 | 9.22 | 5.90 | 6.84 | 100.00 | 58.20 | 0.600 |

**Table 5. (continued)**

**Post rainfall event results**

| DOE Station No. | Station No. | Number of observations | | DO mg/L | Fe-X mg/L | K mg/L | Mg-D mg/L | Mn-X mg/L | Na mg/L | NH3T mg/L | pH pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 4 | Mean | | 0.615 | 0.430 | 0.700 | 0.071 | 2.93 | 0.041 | 6.75 |
| | | | St. Dev. | | 0.082 | 0.125 | 0.141 | 0.035 | 0.78 | 0.060 | 0.67 |
| | | | Median | | 0.640 | 0.448 | 0.750 | 0.067 | 2.75 | 0.012 | 7.00 |
| 00BR01AP0206 | 2 | 3 | Mean | | 0.612 | 0.647 | 0.667 | 0.035 | 5.23 | 0.011 | 6.99 |
| | | | St. Dev. | | 0.029 | 0.110 | 0.115 | 0.002 | 1.79 | 0.002 | 0.41 |
| | | | Median | | 0.605 | 0.697 | 0.600 | 0.036 | 4.80 | 0.010 | 7.16 |
| 00BR01AP0205 | 3 | 4 | Mean | | 0.228 | 1.365 | 1.125 | 0.061 | 5.53 | 0.023 | 7.64 |
| | | | St. Dev. | | 0.152 | 0.312 | 0.359 | 0.089 | 2.21 | 0.026 | 0.42 |
| | | | Median | | 0.161 | 1.280 | 1.250 | 0.019 | 6.05 | 0.010 | 7.82 |
| 00BR01AP0175 | 4 | 4 | Mean | | 0.586 | 0.647 | 0.800 | 0.064 | 4.03 | 0.049 | 7.21 |
| | | | St. Dev. | | 0.087 | 0.150 | 0.216 | 0.026 | 1.40 | 0.057 | 0.36 |
| | | | Median | | 0.546 | 0.643 | 0.850 | 0.055 | 3.90 | 0.027 | 7.32 |
| 00BR01AP0204 | 5 | 3 | Mean | | 0.320 | 0.755 | 0.900 | 0.024 | 2.57 | 0.010 | 7.26 |
| | | | St. Dev. | | 0.055 | 0.230 | 0.173 | 0.007 | 0.55 | 0.000 | 0.23 |
| | | | Median | | 0.323 | 0.630 | 0.800 | 0.025 | 2.30 | 0.010 | 7.28 |
| 00BR01AP0203 | 6 | 4 | Mean | | 0.889 | 0.427 | 0.600 | 0.045 | 3.50 | 0.018 | 6.34 |
| | | | St. Dev. | | 0.253 | 0.207 | 0.141 | 0.021 | 1.32 | 0.012 | 0.73 |
| | | | Median | | 0.806 | 0.438 | 0.650 | 0.043 | 3.40 | 0.013 | 6.39 |
| 00BR01AP0211 | 7 | 0 | Mean | | | | | | | | |
| | | | St. Dev. | | | | | not sampled after rain event | | | |
| | | | Median | | | | | | | | |
| 00BR01AP0176 | 8 | 4 | Mean | | 0.631 | 0.585 | 0.800 | 0.070 | 4.10 | 0.053 | 7.12 |
| | | | St. Dev. | | 0.083 | 0.259 | 0.216 | 0.021 | 1.52 | 0.075 | 0.34 |
| | | | Median | | 0.633 | 0.626 | 0.850 | 0.077 | 4.10 | 0.018 | 7.16 |
| 00BR01AP0177 | 9 | 4 | Mean | | 0.929 | 0.428 | 0.750 | 0.054 | 3.93 | 0.012 | 6.68 |
| | | | St. Dev. | | 0.121 | 0.193 | 0.191 | 0.024 | 1.28 | 0.003 | 0.60 |
| | | | Median | | 0.983 | 0.415 | 0.800 | 0.050 | 4.05 | 0.012 | 6.64 |
| 00BR01AP0208 | 10 | 5 | Mean | | 0.739 | 0.560 | 0.840 | 0.072 | 5.22 | 0.014 | 7.07 |
| | | | St. Dev. | | 0.206 | 0.302 | 0.230 | 0.006 | 1.23 | 0.007 | 0.36 |
| | | | Median | | 0.782 | 0.640 | 0.900 | 0.071 | 5.70 | 0.012 | 6.91 |
| 00BR01AP0195 | 11 | 5 | Mean | | 0.529 | 0.423 | 0.880 | 0.046 | 4.92 | 0.037 | 7.10 |
| | | | St. Dev. | | 0.172 | 0.105 | 0.356 | 0.017 | 2.62 | 0.052 | 0.43 |
| | | | Median | | 0.576 | 0.414 | 0.800 | 0.045 | 4.40 | 0.012 | 6.82 |

**Table 5. (continued)**

**Post rainfall**

| DOE Station No. | Station No. | Number of observations | | SO4-IC mg/L | SS mg/L | TKN mg/L | TOC mg/L | TP-L mg/L | TURB NTU |
|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 4 | Mean | 4.02 | 17.88 | 0.570 | 16.98 | 0.024 | 5.50 |
| | | | St. Dev. | 0.54 | 28.10 | 0.232 | 3.70 | 0.024 | 3.64 |
| | | | Median | 3.99 | 4.25 | 0.510 | 17.20 | 0.014 | 4.85 |
| 00BR01AP0206 | 2 | 3 | Mean | 5.64 | 18.00 | 0.507 | 16.77 | 0.016 | 4.67 |
| | | | St. Dev. | 1.89 | 19.16 | 0.078 | 2.83 | 0.005 | 0.76 |
| | | | Median | 4.66 | 9.00 | 0.530 | 16.30 | 0.014 | 4.50 |
| 00BR01AP0205 | 3 | 4 | Mean | 33.11 | 39.08 | 0.765 | 13.00 | 0.044 | 4.83 |
| | | | St. Dev. | 17.04 | 73.95 | 0.473 | 2.77 | 0.051 | 5.98 |
| | | | Median | 40.40 | 2.50 | 0.555 | 12.15 | 0.024 | 1.90 |
| 00BR01AP0175 | 4 | 4 | Mean | 9.02 | 18.25 | 0.523 | 14.73 | 0.022 | 4.95 |
| | | | St. Dev. | 1.56 | 27.84 | 0.194 | 3.37 | 0.018 | 1.52 |
| | | | Median | 8.47 | 4.50 | 0.440 | 14.80 | 0.014 | 4.30 |
| 00BR01AP0204 | 5 | 3 | Mean | 7.90 | 6.33 | 0.427 | 10.77 | 0.014 | 3.47 |
| | | | St. Dev. | 0.95 | 4.04 | 0.023 | 2.65 | 0.004 | 0.31 |
| | | | Median | 8.15 | 4.00 | 0.440 | 10.60 | 0.015 | 3.40 |
| 00BR01AP0203 | 6 | 4 | Mean | 3.08 | 6.35 | 0.428 | 16.88 | 0.013 | 9.03 |
| | | | St. Dev. | 1.23 | 2.15 | 0.033 | 4.80 | 0.004 | 8.50 |
| | | | Median | 3.39 | 6.20 | 0.430 | 16.30 | 0.012 | 6.75 |
| 00BR01AP0211 | 7 | 0 | Mean | | | | | | |
| | | | St. Dev. | | | | | | |
| | | | Median | | | | | | |
| 00BR01AP0176 | 8 | 4 | Mean | 9.36 | 11.93 | 0.475 | 14.13 | 0.017 | 4.00 |
| | | | St. Dev. | 4.39 | 5.45 | 0.095 | 4.41 | 0.003 | 0.77 |
| | | | Median | 9.74 | 9.85 | 0.460 | 13.65 | 0.017 | 4.20 |
| 00BR01AP0177 | 9 | 4 | Mean | 4.28 | 4.10 | 0.423 | 15.93 | 0.015 | 5.00 |
| | | | St. Dev. | 2.14 | 3.08 | 0.060 | 4.15 | 0.002 | 3.68 |
| | | | Median | 3.93 | 3.70 | 0.435 | 15.15 | 0.015 | 4.30 |
| 00BR01AP0208 | 10 | 5 | Mean | 9.26 | 15.00 | 0.495 | 14.03 | 0.020 | 5.12 |
| | | | St. Dev. | 6.15 | 5.74 | 0.058 | 4.96 | 0.006 | 1.05 |
| | | | Median | 8.74 | 15.00 | 0.500 | 13.45 | 0.019 | 4.90 |
| 00BR01AP0195 | 11 | 5 | Mean | 8.52 | 4.38 | 0.345 | 11.48 | 0.010 | 3.22 |
| | | | St. Dev. | 5.43 | 3.45 | 0.131 | 6.65 | 0.004 | 1.30 |
| | | | Median | 8.14 | 3.00 | 0.335 | 10.60 | 0.010 | 2.70 |

**Table 6. Summary statistics for bacteria, grouped by baseline and post rainfall results, Canaan River and tributaries, 1997.**

| **Baseline results** | | | | Total | | | *E.coli* | | | | | | Fecal Coliform |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (count/100mL) | | | | (count/100mL) | | | | (count/100mL) | | |
| | | | | | | | | | | | | | |
| DOE Station No. | Station No. | No. obs | Mean | St. Dev | Median | No. obs | Mean | St. Dev | Median | No. obs | Mean | St. Dev | Median |
| 00BR01AP0209 | 1 | 9 | 1366 | 93.8 | 1366 | 10 | 48 | 11.3 | 48 | 10 | 44 | 5.2 | 44 |
| 00BR01AP0206 | 2 | 2 | 1251 | 680.9 | 1251 | 2 | 59 | 5.7 | 59 | 2 | 52 | 5.7 | 52 |
| 00BR01AP0205 | 3 | 10 | 1626 | 57.1 | 1626 | 10 | 90 | 11.7 | 89 | 10 | 74 | 9.9 | 74 |
| 00BR01AP0175 | 4 | 10 | 1565 | 329.0 | 1564 | 10 | 425 | 390.0 | 414 | 10 | 125 | 17.0 | 124 |
| 00BR01AP0204 | 5 | 10 | 1313 | 264.0 | 1286 | 10 | 33 | 8.7 | 32 | 9 | 34 | 4.5 | 34 |
| 00BR01AP0203 | 6 | 10 | 1803 | 55.5 | 1803 | 10 | 192 | 16.2 | 192 | 10 | 116 | 7.9 | 116 |
| 00BR01AP0211 | 7 | 6 | 1397 | 7.8 | 1397 | 6 | 96 | 13.5 | 100 | 6 | 86 | 10.8 | 84 |
| 00BR01AP0176 | 8 | 10 | 1423 | 24.6 | 1422 | 10 | 85 | 18.2 | 82 | 10 | 74 | 8.8 | 74 |
| 00BR01AP0177 | 9 | 10 | 1564 | 154.4 | 1564 | 10 | 72 | 17.4 | 69 | 10 | 45 | 12.2 | 44 |
| 00BR01AP0208 | 10 | 10 | 1550 | 18.9 | 1549 | 9 | 319 | 14.2 | 315 | 10 | 104 | 13.7 | 103 |
| 00BR01AP0195 | 11 | 10 | 1505 | 41.4 | 1504 | 10 | 59 | 9.1 | 62 | 10 | 40 | 8.2 | 39 |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| **Event results** | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| DOE Station No. | Station No. | No. obs | Mean | St. Dev | Median | No. obs | Mean | St. Dev | Median | No. obs | Mean | St. Dev | Median |
| 00BR01AP0209 | 1 | 8 | 2371 | 83.3 | 2419 | 8 | 390 | 7.1 | 391 | 8 | 120 | 1.9 | 120 |
| 00BR01AP0206 | 2 | 8 | 2419 | 0.0 | 2419 | 8 | 710 | 7.5 | 711 | 8 | 127 | 1.5 | 127 |
| 00BR01AP0205 | 3 | 8 | 2323 | 166.7 | 2419 | 8 | 1073 | 48.2 | 1066 | 8 | 216 | 2.4 | 216 |
| 00BR01AP0175 | 4 | 8 | 2263 | 271.0 | 2419 | 8 | 615 | 60.3 | 613 | 8 | 152 | 3.6 | 152 |
| 00BR01AP0204 | 5 | 8 | 2163 | 99.4 | 2130 | 8 | 553 | 25.2 | 550 | 8 | 180 | 13.7 | 179 |
| 00BR01AP0203 | 6 | 8 | 2371 | 83.3 | 2419 | 8 | 603 | 22.1 | 606 | 8 | 126 | 2.1 | 126 |
| 00BR01AP0211 | 7 | | Not sampled as post rainfall | | | | | | | | | | |
| 00BR01AP0176 | 8 | 8 | 2106 | 271.0 | 1950 | 8 | 780 | 53.9 | 763 | 8 | 157 | 6.7 | 157 |
| 00BR01AP0177 | 9 | 8 | 2295 | 115.6 | 2275 | 8 | 115 | 17.6 | 111 | 8 | 51 | 3.6 | 51 |
| 00BR01AP0208 | 10 | 8 | 2419 | 0.0 | 2419 | 8 | 896 | 16.8 | 898 | 8 | 147 | 4.0 | 147 |
| 00BR01AP0195 | 11 | 8 | 2343 | 132.0 | 2419 | 8 | 86 | 25.9 | 77 | 8 | 46 | 1.6 | 46 |

**Table 7. Frequency distribution of results for parameters with guidelines, Canaan River and tributaries, 1997.**

| **Ammonia (guideline 2.2 mg/L)** | | **Arsenic (guideline 50 µg/L)** | |
|---|---|---|---|
| mg/L | No. of values | µg/L | No. of values |
| **>0.2**[1] | **0** | **>50** | **0** |
| 0.01 – 0.2 | 41 | 5 – 50 | 0 |
| < 0.01 detection limit | 37 | >1 – 5 | 3 |
| | 78 | < 1.0 detection limit | 73 |
| | | | 80 |
| **Cadmium (guideline 0.2 µg/L)** | | **Fluoride (guideline 1.5 mg/L)** | |
| µg/L | No. of values | mg/L | No. of values |
| **>0.2** | **0** | **>1.5** | **0** |
| 0.1 – 0.2 | 0 | 0.1 – 1.5 | 10 |
| < 1.0 detection limit | 80 | < 0.1 detection limit | 66 |
| | 80 | | 76 |
| **Magnesium (guideline 50 mg/L)** | | **Nickel (guideline 0.025 mg/L)** | |
| mg/L | No. of values | mg/L | No. of values |
| **>50** | **0** | **>1.0 – 0.025** | **0** |
| 2.6 – 50 | 0 | < 0.01 detection limit | 80 |
| 1.0 – 2.5 | 25 | | 80 |
| 0 – 1.0 | 55 | | |
| | 80 | | |
| **Nitrite (guideline 0.06 mg/L)** | | **Nitrite - Nitrate (guideline 10 mg/L)** | |
| mg/L | No. of values | mg/L | No. of values |
| **>0.06** | **0** | **>1.0** | **0** |
| < 0.05 detection limit | 76 | 0.05 – 1.0 | 30 |
| | 76 | < 0.05 detection limit | 50 |
| | | | 80 |

[1] Values and numbers of values in bold typeface are those that exceeded the water quality guidelines.

**Table 7. (continued)**

| **Sulfate (guideline 150 mg/L)** | | **Dissolved Oxygen (guideline >6.5 mg/L)** | |
|---|---|---|---|
| mg/L | No. of values | mg/L | No. of values |
| **>150** | **0** | >6.5 | 13 |
| 100 – 150 | 1 | **<6.5** | **0** |
| 50 – 100 | 2 | | 13 |
| <50 | 77 | | |
| | 80 | | |
| **Chromium (guidelines 2.0 & 20 µg/L)** | | **Copper (guideline 2.0 µg/L)** | |
| µg/L | No. of values | µg/L | No. of values |
| **5.0 – 20.0** | **0** | **>5.0** | **0** |
| **2.0 – 5.0** | **3** | **2.1 – 2.5** | **1** |
| 0.5 – 2.0 | 47 | 0.5 – 2.0 | 16 |
| < 0.5 detection limit | 27 | < 0.5 detection limit | 63 |
| | 80 | | 79 |
| **Lead (guideline 1.0 µg/L)** | | **Zinc (guideline 0.03 mg/L)** | |
| µg/L | No. of values | mg/L | No. of values |
| **1.6 – 2.5** | **1** | **>0.03** | **1** |
| **1.0 – 1.5** | **1** | 0.01 – 0.03 | 15 |
| < 1.0 detection limit | 78 | < 0.01 detection limit | 64 |
| | 80 | | 80 |
| **Aluminum (guideline 5.0 µg/L, 100.0 µg/L when pH>6.5)** | | **Iron (guideline 0.3 mg/L)** | |
| µg/L | No. of values | mg/L | No. of values |
| **>300** | **16** | **>1.0** | **4** |
| **200 – 300** | **18** | **0.51 – 1.0** | **50** |
| **100 – 200** | **24** | **0.3 – 0.5** | **14** |
| <100 | 22 | <0.3 | 12 |
| | 80 | | 80 |

**Table 7. (continued)**

| **pH (guideline 6.5 to 9.5)** | |
|---|---|
| pH | No. of values |
| **>9.5** | **0** |
| 6.5 – 9.5 | 74 |
| **<6.5** | **6** |
| | 80 |

| **Total Phosphorous (guideline 0.03 mg/L)** | |
|---|---|
| mg/L | No. of values |
| **>0.03** | **5** |
| <0.03 | 73 |
| | 78 |

| **Total Organic Carbon (>15 mg/L *may* reflect unsanitary conditions)** | |
|---|---|
| mg/L | No. of values |
| **>15** | **29** |
| <15 | 49 |
| | 78 |

| **Colour (guideline 100 TCU)** | |
|---|---|
| TCU | No. of values |
| **>200** | **5** |
| **101 – 200** | **22** |
| <100 | 53 |
| | 80 |

| **Suspended Solids (guideline 10 mg/L)** | |
|---|---|
| mg/L | No. of values |
| **>40** | **4** |
| **31 – 40** | **0** |
| **21 – 30** | **8** |
| 10 – 20 | 0 |
| <10 | 68 |
| | 80 |

| **Turbidity (guideline 10.0 NTU)** | |
|---|---|
| NTU | No. of values |
| **>10.0** | **3** |
| <10.0 | 77 |
| | 80 |

| ***E.coli* (guideline 200/100ml)[1]** | |
|---|---|
| counts/100ml | No. of values |
| **>2000** | **2** |
| **1501 – 2000** | **3** |
| **1001 – 1500** | **5** |
| **501 – 1000** | **3** |
| **200 – 500** | **6** |
| <200 | 50 |
| | 69 |

| **Fecal Coliform (guideline 200/100ml) [2]** | |
|---|---|
| counts/100ml | No. of values |
| **>350** | **0** |
| **200 – 350** | **13** |
| <200 | 56 |
| | 69 |

[1] Values for each date and site were averaged prior to determining the frequency distribution. Between 2 and 4 samples were collected per site on each sampling date.

**Table 8. Rainfall recorded at the New Brunswick Department of Natural Resources and Energy station at Alward Brook, during the 1997 forest fire season.**

| Date | Rainfall (mm) | Date | Rainfall (mm) | Date | Rainfall (mm) |
|---|---|---|---|---|---|
| 04 04 | 0.00 | 15 05 | 1.52 | 25 06 | 33.78 |
| 05 04 | 0.00 | 16 05 | 10.16 | 26 06 | 9.15 |
| 06 04 | 7.10 | 17 05 | 3.29 | 27 06 | 2.28 |
| 07 04 | 4.56 | 18 05 | 0.00 | 28 06 | 0.00 |
| 08 04 | 0.00 | 19 05 | 0.00 | 29 06 | 0.00 |
| 09 04 | 0.00 | 20 05 | 3.55 | 30 06 | 0.00 |
| 10 04 | 0.00 | 21 05 | 2.53 | 01 07 | 4.06 |
| 11 04 | 0.00 | 22 05 | 3.56 | 02 07 | 0.00 |
| 12 04 | 0.00 | 23 05 | 4.04 | 03 07 | 38.10 |
| 13 04 | 0.00 | 24 05 | 0.25 | 04 07 | 15.24 |
| 14 04 | 11.42 | 25 05 | 2.79 | 05 07 | 0.00 |
| 15 04 | 0.50 | 26 05 | 10.15 | 06 07 | 0.00 |
| 16 04 | 0.00 | 27 05 | 0.50 | 07 07 | 0.00 |
| 17 04 | 0.00 | 28 05 | 0.00 | 08 07 | 6.10 |
| 18 04 | 0.00 | 29 05 | 0.00 | 09 07 | 8.89 |
| 19 04 | 0.00 | 30 05 | 0.00 | 10 07 | 0.00 |
| 20 04 | 0.00 | 31 05 | 5.08 | 11 07 | 0.00 |
| 21 04 | 0.00 | 01 06 | 5.08 | 12 07 | 0.00 |
| 22 04 | 0.00 | 02 06 | 0.00 | 13 07 | 0.00 |
| 23 04 | 5.06 | 03 06 | 0.00 | 14 07 | 0.00 |
| 24 04 | 0.00 | 04 06 | 0.00 | 15 07 | 0.00 |
| 25 04 | 1.01 | 05 06 | 0.25 | 16 07 | 0.00 |
| 26 04 | 0.00 | 06 06 | 6.33 | 17 07 | 8.13 |
| 27 04 | 0.00 | 07 06 | 0.00 | 18 07 | 0.50 |
| 28 04 | 0.00 | 08 06 | 0.00 | 19 07 | 1.02 |
| 29 04 | 16.25 | 09 06 | 0.00 | 20 07 | 0.00 |
| 30 04 | 12.95 | 10 06 | 0.00 | 21 07 | 0.00 |
| 01 05 | 0.00 | 11 06 | 1.52 | 22 07 | 0.00 |
| 02 05 | 4.06 | 12 06 | 0.00 | 23 07 | 0.00 |
| 03 05 | 0.00 | 13 06 | 3.04 | 24 07 | 0.00 |
| 04 05 | 9.39 | 14 06 | 0.25 | 25 07 | 0.00 |
| 05 05 | 0.00 | 15 06 | 0.51 | 26 07 | 0.00 |
| 06 05 | 0.00 | 16 06 | 0.00 | 27 07 | 0.00 |
| 07 05 | 8.13 | 17 06 | 2.54 | 28 07 | 0.00 |
| 08 05 | 0.25 | 18 06 | 9.39 | 29 07 | 9.65 |
| 09 05 | 3.29 | 19 06 | 13.46 | 30 07 | 0.50 |
| 10 05 | 0.00 | 20 06 | 0.76 | 31 07 | 0.00 |
| 11 05 | 0.25 | 21 06 | 0.00 | 01 08 | 0.00 |
| 12 05 | 0.50 | 22 06 | 5.06 | 02 08 | 0.00 |
| 13 05 | 0.00 | 23 06 | 23.11 | 03 08 | 0.00 |
| 14 05 | 10.15 | 24 06 | 0.00 | 04 08 | 0.00 |

**Table 8. (continued)**

| Date | Rainfall (mm) | Date | Rainfall (mm) | Date | Rainfall (mm) |
|---|---|---|---|---|---|
| 05 08 | 11.43 | 27 08 | 0.00 | 18 09 | 1.02 |
| 06 08 | 1.77 | 28 08 | 0.00 | 19 09 | 0.25 |
| 07 08 | 0.00 | 29 08 | 0.00 | 20 09 | 6.09 |
| 08 08 | 0.00 | 30 08 | 0.25 | 21 09 | 18.54 |
| 09 08 | 0.00 | 31 08 | 0.00 | 22 09 | 0.00 |
| 10 08 | 2.78 | 01 09 | 0.00 | 23 09 | 2.03 |
| 11 08 | 0.00 | 02 09 | 0.25 | 24 09 | 5.83 |
| 12 08 | 3.56 | 03 09 | 22.86 | 25 09 | 0.00 |
| 13 08 | 0.00 | 04 09 | 7.36 | 26 09 | 0.50 |
| 14 08 | 8.36 | 05 09 | 0.00 | 27 09 | 3.30 |
| 15 08 | 0.25 | 06 09 | 0.00 | 28 09 | 0.00 |
| 16 08 | 8.87 | 07 09 | 0.00 | 29 09 | 0.00 |
| 17 08 | 2.03 | 08 09 | 1.77 | 30 09 | 6.08 |
| 18 08 | 0.00 | 09 09 | 1.53 | 01 10 | 0.25 |
| 19 08 | 0.51 | 10 09 | 17.00 | 02 10 | 0.25 |
| 20 08 | 0.50 | 11 09 | 0.00 | 03 10 | 0.00 |
| 21 08 | 0.00 | 12 09 | 0.00 | 04 10 | 0.00 |
| 22 08 | 0.00 | 13 09 | 2.79 | 05 10 | 0.00 |
| 23 08 | 2.27 | 14 09 | 0.00 | 06 10 | 3.04 |
| 24 08 | 0.25 | 15 09 | 0.00 | 07 10 | 0.00 |
| 25 08 | 5.84 | 16 09 | 0.00 | 08 10 | 0.00 |
| 26 08 | 0.00 | 17 09 | 0.00 | | |

**Table 9. Comparison of baseline and post rainfall values for selected parameters, Canaan River and tributaries, 1997.**

| DOE Station No. | Station | Date Sampled | HARD mg/L | | AlXGF ug/L | | CLRA TCU | | COND USIE/CM | | CrXGF ug/L | | CuXGF ug/L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 18-Jun-97 | 39.0 | | 125.0 | | 75 | | 106.0 | | 1.4 | | 0.5 |
| | **1** | **4-Jul-97** | **21.5** | **D** | **525.0** | **U** | **300** | **U** | **47.6** | **D** | **0.9** | **D** | **0.8** |
| | 1 | 31-Jul-97 | 12.1 | | 153.0 | | 120 | | 737.0 | | 0.9 | | 0.5 |
| | **1** | **4-Sep-97** | **15.3** | **U** | **260.0** | **U** | **100** | **D** | **46.9** | **D** | **0.5** | **D** | **0.5** |
| 00BR01AP0206 | **2** | **4-Jul-97** | **19.9** | | **245.0** | | **100** | | **72.5** | | **0.5** | | **0.5** |
| 00BR01AP0205 | 3 | 18-Jun-97 | 127.6 | | 72.8 | | 20 | | 279.0 | | 2.0 | | 0.5 |
| | **3** | **4-Jul-97** | **30.9** | **D** | **1870.0** | **U** | **150** | **U** | **70.3** | **D** | **1.2** | **D** | **1.3** |
| | 3 | 31-Jul-97 | 145.9 | | 33.7 | | 20 | | 342.0 | | 3.6 | | 0.5 |
| | **3** | **4-Sep-97** | **97.8** | **D** | **118.0** | **U** | **60** | **U** | **235.0** | **D** | **0.5** | **D** | **0.5** |
| 00BR01AP0175 | 4 | 18-Jun-97 | 32.6 | | 121.0 | | 100 | | 93.7 | | 1.1 | | 0.5 |
| | **4** | **4-Jul-97** | **25.8** | **D** | **381.0** | **U** | **200** | **U** | **66.2** | **D** | **1.0** | **D** | **0.7** |
| | 4 | 31-Jul-97 | 40.3 | | 124.0 | | 70 | | 120.0 | | 1.7 | | 0.7 |
| | **4** | **4-Sep-97** | **30.7** | **D** | **173.0** | **U** | **80** | **U** | **85.7** | **D** | **0.5** | **D** | **0.5** |
| 00BR01AP0204 | 5 | 18-Jun-97 | 23.0 | | 48.2 | | 40 | | 59.9 | | 0.9 | | 0.5 |
| | 5 | 31-Jul-97 | 28.7 | | 46.9 | | 20 | | 74.7 | | 1.3 | | 0.6 |
| | **5** | **4-Sep-97** | **26.0** | **D** | **133.0** | **U** | **50** | **U** | **71.9** | **D** | **0.6** | **D** | **0.5** |
| 00BR01AP0203 | 6 | 18-Jun-97 | 6.6 | | 184.0 | | 150 | | 34.6 | | 0.6 | | 0.5 |
| | **6** | **4-Jul-97** | **5.9** | **D** | **242.0** | **U** | **250** | **U** | **21.3** | **D** | **0.6** | **D** | **0.5** |
| | 6 | 31-Jul-97 | 8.1 | | 234.0 | | 100 | | 36.0 | | 0.8 | | 0.5 |
| | **6** | **4-Sep-97** | **9.2** | **U** | **271.0** | **U** | **200** | **U** | **46.2** | **U** | **0.6** | **D** | **1.0** |
| 00BR01AP0211 | 7 | 15-Oct-97 | 45.7 | | 61.0 | | 70 | | 121.0 | | 0.5 | | 0.5 |
| 00BR01AP0176 | 8 | 18-Jun-97 | 33.2 | | 98.9 | | 100 | | 88.0 | | 1.1 | | 0.5 |
| River | **8** | **4-Jul-97** | **15.3** | **D** | **261.0** | **U** | **200** | **U** | **40.4** | **D** | **0.6** | **D** | **0.5** |
| | 8 | 31-Jul-97 | 21.4 | | 103.0 | | 70 | | 90.7 | | 1.1 | | 0.5 |
| | **8** | **4-Sep-97** | **36.7** | **U** | **200.0** | **U** | **60** | **D** | **109.0** | **U** | **0.5** | **D** | **0.5** |
| 00BR01AP0177 | **9** | **4-Jul-97** | **8.3** | | **321.0** | | **150** | | **30.2** | | **0.6** | | **0.5** |
| | **9** | **31-Jul-97** | **7.3** | | **263.0** | | **250** | | **19.9** | | **0.8** | | **0.5** |
| 00BR01AP0208 | 10 | 2-Jul-97 | 17.7 | | 312.0 | | 200 | | 43.8 | | 0.6 | | 0.9 |
| | **10** | **4-Jul-97** | **14.7** | **D** | **316.0** | **U** | **250** | **U** | **46.2** | **U** | **0.7** | **U** | **0.6** |
| | **10** | **4-Jul-97** | **16.0** | | **326.0** | | **250** | | **47.0** | | **0.8** | | **0.6** |
| | 10 | 31-Jul-97 | 30.4 | | 97.6 | | 60 | | 90.5 | | 1.1 | | 0.5 |
| | **10** | **4-Sep-97** | **46.3** | **U** | **175.0** | **U** | **60** | **D** | **127.0** | **U** | **0.7** | **D** | **0.5** |
| 00BR01AP0195 | 11 | 2-Jul-97 | 13.5 | | 279.0 | | 200 | | 36.4 | | 1.2 | | 1.7 |
| | **11** | **4-Jul-97** | **12.8** | **D** | **230.0** | **D** | **200** | **D** | **34.8** | **D** | **0.6** | **D** | **0.6** |
| | **11** | **4-Jul-97** | **15.2** | | **226.0** | | **200** | | **33.8** | | **0.7** | | **1.5** |
| | 11 | 31-Jul-97 | 31.1 | | 99.9 | | 60 | | 94.2 | | 1.4 | | 0.5 |
| | **11** | **4-Sep-97** | **43.1** | **U** | **52.8** | **D** | **40** | **D** | **129.0** | **U** | **0.5** | **D** | **0.5** |

*Bold typeface values represent post rainfall

* **U** = shift upwards following rain event

* **D** = shift downwards following rain event

**Table 9 (continued)**

| DOE Station No. | Station No. | Date Sampled | pH<br>pH | | SO4-IC<br>mg/L | | SS<br>mg/L | | TOC<br>mg/L | | TP-L<br>mg/L | | TURB<br>NTU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00BR01AP0209 | 1 | 18-Jun-97 | 7.67 | | 15.50 | | 2.0 | | 11.3 | | 0.011 | | 3.40 |
| | 1 | 4-Jul-97 | 6.87 | D | 4.59 | D | 60.0 | U | 19.0 | U | 0.059 | U | 10.10 |
| | 1 | 31-Jul-97 | 7.06 | | 2.50 | | 2.0 | | 16.2 | | 0.010 | | 1.30 |
| | 1 | 4-Sep-97 | 7.12 | U | 4.37 | U | 5.0 | U | 15.4 | D | 0.017 | U | 6.70 |
| 00BR01AP0206 | 2 | 4-Jul-97 | 7.16 | | 7.82 | | 5.0 | | 16.3 | | 0.022 | | 5.50 |
| 00BR01AP0205 | 3 | 18-Jun-97 | 8.27 | | 55.80 | | 5.0 | | 4.3 | | 0.014 | | 0.70 |
| | 3 | 4-Jul-97 | 7.02 | D | 7.73 | D | 150.0 | U | 17.0 | U | 0.120 | U | 13.80 |
| | 3 | 31-Jul-97 | 8.19 | | 69.90 | | 1.0 | | 4.2 | | 0.005 | | 0.70 |
| | 3 | 4-Sep-97 | 7.73 | D | 41.90 | D | 3.0 | U | 12.5 | U | 0.031 | U | 2.00 |
| 00BR01AP0175 | 4 | 18-Jun-97 | 7.74 | | 14.00 | | 2.0 | | 11.4 | | 0.011 | | 2.40 |
| | 4 | 4-Jul-97 | 7.25 | D | 8.69 | D | 60.0 | U | 17.2 | U | 0.049 | U | 7.20 |
| | 4 | 31-Jul-97 | 7.48 | | 14.50 | | 2.0 | | 12.5 | | 0.007 | | 1.00 |
| | 4 | 4-Sep-97 | 7.38 | D | 7.83 | D | 4.0 | U | 12.4 | D | 0.016 | U | 4.10 |
| 00BR01AP0204 | 5 | 18-Jun-97 | 7.67 | | 3.07 | | 1.0 | | 6.0 | | 0.005 | | 0.70 |
| | 5 | 31-Jul-97 | 7.57 | | 3.26 | | 1.0 | | 4.8 | | 0.005 | | 0.60 |
| | 5 | 4-Sep-97 | 7.28 | D | 8.71 | U | 4.0 | U | 10.6 | U | 0.017 | U | 3.20 |
| 00BR01AP0203 | 6 | 18-Jun-97 | 7.02 | | 2.20 | | 4.0 | | 15.4 | | 0.013 | | 1.50 |
| | 6 | 4-Jul-97 | 5.81 | D | 1.36 | D | 4.0 | D | 22.8 | U | 0.009 | D | 1.40 |
| | 6 | 31-Jul-97 | 6.81 | | 2.16 | | 3.0 | | 16.8 | | 0.013 | | 2.10 |
| | 6 | 4-Sep-97 | 6.97 | U | 3.70 | U | 9.0 | U | 12.1 | D | 0.017 | U | 21.20 |
| 00BR01AP0211 | 7 | 15-Oct-97 | 7.57 | | 2.13 | | 0.2 | | 9.1 | | 0.005 | | 0.60 |
| 00BR01AP0176 | 8 | 18-Jun-97 | 7.55 | | 11.50 | | 2.0 | | 10.2 | | 0.008 | | 1.40 |
| River | 8 | 4-Jul-97 | 6.98 | D | 3.86 | D | 20.0 | U | 19.0 | U | 0.018 | U | 2.90 |
| | 8 | 31-Jul-97 | 7.32 | | 11.40 | | 1.0 | | 11.3 | | 0.007 | | 1.10 |
| | 8 | 4-Sep-97 | 7.34 | U | 14.10 | U | 8.0 | U | 10.6 | D | 0.021 | U | 4.70 |
| 00BR01AP0177 | 9 | 4-Jul-97 | 6.16 | | 2.09 | | 5.0 | | 20.9 | | 0.012 | | 2.10 |
| | 9 | 31-Jul-97 | 6.18 | | 1.89 | | 4.0 | | 22.2 | | 0.090 | | 1.40 |
| 00BR01AP0208 | 10 | 2-Jul-97 | 6.85 | | 4.04 | | 8.0 | | 19.5 | | 0.014 | | 2.30 |
| | 10 | 4-Jul-97 | 6.74 | D | 3.39 | D | 20.0 | U | 19.6 | U | 0.018 | U | 4.90 |
| | 10 | 4-Jul-97 | 6.91 | | 3.45 | | 20.0 | | | | | | 4.00 |
| | 10 | 31-Jul-97 | 7.41 | | 11.80 | | 2.0 | | 10.4 | | 0.007 | | 1.20 |
| | 10 | 4-Sep-97 | 7.47 | U | 17.40 | U | 6.0 | U | 10.1 | D | 0.019 | U | 4.60 |
| 00BR01AP0195 | 11 | 2-Jul-97 | 6.60 | | 3.08 | | 3.0 | | 19.4 | | 0.009 | | 1.50 |
| | 11 | 4-Jul-97 | 6.73 | U | 3.28 | U | 7.0 | U | 19.6 | U | 0.014 | U | 2.70 |
| | 11 | 4-Jul-97 | 6.82 | | 3.17 | | 9.0 | | | | | | 3.00 |
| | 11 | 31-Jul-97 | 7.37 | | 11.30 | | 2.0 | | 10.1 | | 0.006 | | 1.80 |
| | 11 | 4-Sep-97 | 7.65 | U | 14.90 | U | 1.0 | D | 5.1 | D | 0.005 | D | 2.30 |

**Table 10. Location and effective drainage area for sampling stations, Canaan River and tributaries, 1997.**

| Station No. | NBDOE Reference No. | General Location | Effective drainage area (ha) |
|---|---|---|---|
| 1R | 00BR01AP0209 | On mainstream of the Canaan River, at lower end of 'Upper Canaan River Stem' sub-watershed – water quality is influenced by the six upper sub-watersheds. | 41,437 |
| 2T | 00BR01AP0206 | On Nevers Brook, near confluence with Canaan River – water quality is influenced by the Nevers Brook watershed. | 12,303 |
| 3T | 00BR01AP0205 | On Ridge Brook, near confluence with Canaan River – water quality is influenced by the Ridge Brook watershed. | 8,613 |
| 4R | 00BR01AP0175 | On mainstream of the Canaan River where it crosses NB Route 112, near Route 885. | 62,254 |
| 5T | 00BR01AP0204 | On Thorne Brook, near confluence with Canaan River – water quality is influenced by the Thorne Brook watershed. | 12,04 |
| 6T | 00BR01AP0203 | On Alward Brook, near confluence with Canaan River – water quality is influenced by the Alward Brook watershed. | 12,356 |
| 7R | 00BR01AP0211 | On mainstream of the Canaan River, located downstream of the confluence of the Alward Brook watershed | 87,013 |
| 8R | 00BR01AP0176 | On mainstream of the Canaan River, located above the confluence of the Forks Stream watershed. | 90,000 |
| 9T | 00BR01AP0177 | On Forks Brook, near confluence with Canaan River – water quality is influenced by the Forks Brook watershed. | 26,287 |
| 10R | 00BR01AP0208 | On mainstream of the Canaan River, downstream from Forks Brook confluence – influenced by entire upper portion of the watershed. | 113,301 |
| 11R | 00BR01AP0195 | On mainstream of the Canaan River at Canaan Rapids, near the confluence to Washademoak Lake – influenced by entire Canaan River watershed. This site was used in the 1996 Washademoak Lake report. | 140,000 |

**Table 11. Landuse in the Canaan River Watershed (Manley 1997).**

| | Miller Brook | | Thornes Brook | | Ridge Brook | | Nevers Brook | | Alward Brook | | Forks Stream | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (10589.7 ha) | | (12402.4 ha) | | (8613.2 ha) | | (12303.5 ha) | | (12356.9 ha) | | (26287.9 ha) | |
| | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed |
| Agriculture/ Occupied | 5.7 | 0.1 | 525.1 | 4.2 | 2173 | 25.2 | 590.2 | 4.8 | 95.1 | 0.8 | 87.4 | 0.3 |
| Wetland | 614.4 | 5.8 | 594.3 | 4.8 | 147.2 | 1.7 | 693.3 | 5.6 | 1029.8 | 8.3 | 2188.7 | 8.3 |
| Plantation/Thinned | 2434.1 | 23.0 | 2744.7 | 22.1 | 496 | 5.8 | 1217.7 | 9.9 | 610.3 | 4.9 | 3247.6 | 12.4 |
| Recent Cutover /Regeneration | 639.1 | 6.0 | 405.1 | 3.3 | 411.3 | 4.8 | 2950.9 | 24.0 | 3709.7 | 30.0 | 6714.2 | 25.5 |
| Sapling/Young | 1060 | 10.0 | 2566.2 | 20.7 | 1640.9 | 19.1 | 1520.6 | 12.4 | 207.1 | 1.7 | 2767.6 | 10.5 |
| Intolerant Hardwood | 1466 | 13.8 | 1337.1 | 10.8 | 789.2 | 9.2 | 276.5 | 2.2 | 428.3 | 3.5 | 484.8 | 1.8 |
| Mixedwood | 2513.4 | 23.7 | 2208.6 | 17.8 | 1448.4 | 16.8 | 1759.4 | 14.3 | 1001.8 | 8.1 | 2066.8 | 7.9 |
| Softwood | 1338.3 | 12.6 | 1073.6 | 8.7 | 1037.5 | 12.0 | 2900 | 23.6 | 3643.3 | 29.5 | 5504.6 | 20.9 |
| Pine | 81.4 | 0.8 | 46.1 | 0.4 | 3 | 0.0 | 60 | 0.5 | 928.6 | 7.5 | 954 | 3.6 |
| Tolerant hardwood | 277.7 | 2.6 | 775.9 | 6.3 | 163 | 1.9 | 82.6 | 0.7 | 431.2 | 3.5 | 998.5 | 3.8 |
| Mine/Gravel Pit | 0.5 | 0.0 | 0.5 | 0.0 | 144.1 | 1.7 | 1 | 0.0 | 0 | 0.0 | 2.1 | 0.0 |
| Burn | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 11.4 | 0.1 | 685.2 | 2.6 |
| Other | 159.4 | 1.5 | 125.2 | 1.0 | 153.4 | 1.8 | 251.4 | 2.0 | 260.3 | 2.1 | 586.4 | 2.2 |

**Table 11. (continued)**

| Watts Brook | | Flat Rock Brook | | Kelly Brook | | Long Creek | | Cog Brook | | South Branch Canaan River | | East Branch Canaan River | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (2242.8 ha) | | (1644.9 ha) | | (3055.9 ha) | | (13827.3 ha) | | (3330.5 ha) | | (3402.0 ha) | | (3284.7 ha) | |
| Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed |
| 4.9 | 0.2 | 0 | 0.0 | 32.5 | 1.1 | 1063.6 | 7.7 | 0 | 0.0 | 1.2 | 0.0 | 0 | 0.0 |
| 63.7 | 2.8 | 37.8 | 2.3 | 229.9 | 7.5 | 619.3 | 4.5 | 288.5 | 8.7 | 198.4 | 5.8 | 350.7 | 10.7 |
| 523.2 | 23.3 | 417.6 | 25.4 | 45.6 | 1.5 | 921.1 | 6.7 | 789.6 | 23.7 | 621.3 | 18.3 | 130.2 | 4.0 |
| 430.6 | 19.2 | 260.6 | 15.8 | 349 | 11.4 | 642.8 | 4.6 | 253.3 | 7.6 | 1283.3 | 37.7 | 1482.2 | 45.1 |
| 346.2 | 15.4 | 193 | 11.7 | 295.4 | 9.7 | 3009.6 | 21.8 | 443.2 | 13.3 | 95 | 2.8 | 21.5 | 0.7 |
| 33.7 | 1.5 | 46.9 | 2.9 | 584.5 | 19.1 | 1216.1 | 8.8 | 572 | 17.2 | 7.3 | 0.2 | 52.3 | 1.6 |
| 231.2 | 10.3 | 240.9 | 14.6 | 555.7 | 18.2 | 3367.1 | 24.4 | 503 | 15.1 | 167.9 | 4.9 | 199.7 | 6.1 |
| 419.3 | 18.7 | 295.5 | 18.0 | 532.7 | 17.4 | 1364 | 9.9 | 374.4 | 11.2 | 848.5 | 24.9 | 904.2 | 27.5 |
| 45.6 | 2.0 | 10.2 | 0.6 | 51.6 | 1.7 | 22.2 | 0.2 | 56.6 | 1.7 | 65.3 | 1.9 | 73.4 | 2.2 |
| 108.3 | 4.8 | 119.1 | 7.2 | 310.7 | 10.2 | 1422.4 | 10.3 | 6.1 | 0.2 | 55.4 | 1.6 | 13.2 | 0.4 |
| 5.2 | 0.2 | 0 | 0.0 | 0 | 0.0 | 7.7 | 0.1 | 0 | 0.0 | 1 | 0.0 | 0 | 0.0 |
| 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| 31 | 1.4 | 23.3 | 1.4 | 68.4 | 2.2 | 171.3 | 1.2 | 43.7 | 1.3 | 57.5 | 1.7 | 57.4 | 1.7 |

**Table 11. (continued)**

| Upper North Branch Canaan (3844.5 ha) | | Middle North Branch Canaan (3021.0 ha) | | Lower North Branch Canaan (10233.2 ha) | | Canaan Stream (Upper) (17652.2 ha) | | Canaan River Watershed Total (148092.6 ha) | |
|---|---|---|---|---|---|---|---|---|---|
| Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed | Area (ha) | % of Watershed |
| 0 | 0.0 | 0 | 0.0 | 1.8 | 0.0 | 62.9 | 0.4 | 4643.4 | 3.1 |
| 1235.1 | 32.1 | 655.5 | 21.7 | 2660.7 | 26.0 | 2099.2 | 11.9 | 13706.5 | 9.3 |
| 37.6 | 1.0 | 0 | 0.0 | 95 | 0.9 | 1337.7 | 7.6 | 15669.3 | 10.6 |
| 171.2 | 4.5 | 499.3 | 16.5 | 1088.5 | 10.6 | 7450.7 | 42.2 | 28741.8 | 19.4 |
| 1049.3 | 27.3 | 521.5 | 17.3 | 1690.3 | 16.5 | 313.5 | 1.8 | 17740.9 | 12.0 |
| 265.8 | 6.9 | 317.5 | 10.5 | 443.6 | 4.3 | 350.8 | 2.0 | 8672.4 | 5.9 |
| 108 | 2.8 | 156.3 | 5.2 | 219.7 | 2.1 | 861.5 | 4.9 | 17609.4 | 11.9 |
| 581 | 15.1 | 740.3 | 24.5 | 2832.8 | 27.7 | 4054.7 | 23.0 | 28444.7 | 19.2 |
| 311.1 | 8.1 | 63.5 | 2.1 | 269.6 | 2.6 | 532.6 | 3.0 | 3574.8 | 2.4 |
| 74.9 | 1.9 | 38.4 | 1.3 | 72.2 | 0.7 | 272.5 | 1.5 | 5222.1 | 3.5 |
| 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 162.1 | 0.1 |
| 0 | 0.0 | 0 | 0.0 | 775.8 | 7.6 | 0 | 0.0 | 1472.4 | 1.0 |
| 10.5 | 0.3 | 28.4 | 0.9 | 81.5 | 0.8 | 316.2 | 1.8 | 2425.3 | 1.6 |

**Discussion**

The land use practices and geological features of the Canaan River watershed lend themselves to many potential sources of sedimentation, and in turn may result in an increase in water colour and turbidity. The poorly drained loam soils of the watershed are very susceptible to erosion. The lower ends of many of the tributaries tend to have gentle horizontal and vertical gradients, with many grassy bends that appear to have the ability to trap sediment before it enters the Canaan. Observations made on November 30, 2000, further strengthened this belief. At that time, sediment was noticed entering Kelly Brook and was very apparent throughout the lower portion of the brook, until it encountered the gentle, grassy bends, approximately four-hundred meters upstream of its confluence with the Canaan River, after which the discharge into the Canaan appeared to be free of sediment. If the sediment was in fact being trapped in the grasses, it can be expected that under spring surcharge conditions, most of the trapped sediment will be transported into the mainstream of the Canaan, where it may be deposited on the bed of the Canaan River, or may find its way into Washademoak Lake. In either case, brown appearance due to soil particles in suspension throughout the system could be expected.

Non-point sources of sedimentation include exposed stream banks, gravel access roads, ditch clearing, residential and commercial construction sites, agricultural fields, and forestry operations.

As previously mentioned *E.coli* counts increased dramatically on September 4. Abnormally high values were seen over the entire Canaan River system, with the exception of Station 7 (no sample recorded), 9, and 11. Increased levels of *E.coli* could be expected at stations that drained large areas of agricultural land due to the common practice of manure spreading, which typically occurs in late summer and early autumn. However, this does not explain why the increase was seen at most points along the Canaan River. It is possible that elevated *E.coli* values resulted from a few residential septic systems that were out of compliance, resulting in human waste entering the watercourse, and suggests a need for further investigation. Other possible sources of bacteria contamination include beaver colonies and the droppings of other warm blooded animals.

**Conclusions and Recommendations**

The water quality of the Canaan River system may be characterized as having low hardness (0 to 30 mg/l as Ca $CO_3$). The pH tended to be near neutral, although moderately acidic conditions did exist on occasion. Further exception was Station 3 where pH was typically above 8.0. High *E.coli* and fecal coliform bacteria levels were measured at many of the stations following a rain event. Elevated levels of aluminum and iron were found in most samples, however, due to naturally high levels of metals in New Brunswick soils, the values are not considered abnormal. Values for suspended solids were at times high, particularly following major precipitation events. Corresponding with the precipitation events, was an increase in colour and turbidity values.

Arsenic, ammonia, cadmium, fluoride, nickel, nitrite, nitrite-nitrate (NOx), magnesium, and sulfate values were all less than the protection guidelines. Dissolved oxygen concentrations were acceptable. Values for copper, lead, total phosphorous, turbidity, and zinc, were less than the guidelines, though, some slightly elevated values were noted.

For the most part, the Canaan River system appears to be a relatively stable system, but did show changes after rainfall. Due to the highly erodable soils, future development in the watershed, particularly in the lower regions of the Canaan River, has the potential to release large quantities of sediment into the watercourse, which could, over time, have an impact on the water quality of Washademoak Lake.

It is recommended that Best Management Practices (BMP) be implemented to address many of the water quality issues in the Canaan River watershed. The BMP's should address such items as access road construction, ditch clearing, site clearing, stream/river buffers, manure disposal, residential septic systems, etc. The BMP's should be a community-based initiative involving many of the stakeholders in the region to ensure widespread acceptance and adherence.

Disposal of manure should be planned so it does not precede forecasted rain events. As well, appropriate methods should be implemented to minimize potential run-off from manure-spread fields. Technical information on manure management is available from the New Brunswick Department of Agriculture, Fisheries, and Aquaculture.

To help to ensure that bacteria contamination is not being caused by domestic septic systems, the systems should be checked frequently to ensure that they comply with current operation and maintenance practices.

The source of the elevated levels of *E.coli* bacteria throughout the Canaan River watershed, and particularly in the upper undeveloped portion of the watershed, remains unknown and should be studied further in an attempt to determine the source(s) and significance.

Since the data collection phase of this project, the Canaan River – Washademoak Lake system has seen the development of a high density hog farm, an increase in forest harvesting activities, a natural gas pipeline crossing, and a major four-lane highway project that has many water crossings. The cumulative affect that these activities will have on the water quality of the Washademoak Lake – Canaan River system has yet to be determined, and should be monitored. Monitoring will allow for changes in water quality to be assessed and, if possible, for procedures to be implemented to reduce the impact.

This study provides a first look at the water quality conditions of the Canaan River watershed, and has resulted in a benchmark data set that can be used to compare with future water quality measurements in the watershed. Future development in the Washademoak Lake – Canaan River watershed has the potential to negatively impact water quality. Future study of water quality in the watershed is required to detect trends in water quality and any impacts of human related activities.

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## ADDENDUM

### Overview of Linear Construction Projects in relation to Canaan River and Washademoak Lake

The following information is pertinent to the report on Water Quality of the Canaan River, 1997, and its relationship to the water quality of Washademoak Lake. Two linear construction projects have passed through the areas described in the report. These include the Maritimes and Northeast Pipeline and the Fredericton to Moncton Highway.

Both projects received extensive environmental planning and regulatory input prior to construction. The proponents of both projects had numerous commitments with respect to environmental matters and reporting procedures as indicated in a series of documents such as environmental protection plans, management plans and contingency plans. Additionally, numerous conditions were imposed upon the proponents with respect to environmental performance. As well, there was a significant amount of regulatory, internal and third party monitoring or inspection. The premise or goal throughout the planning, construction and post-construction or clean-up phases was to minimize potential negative impacts on the environment. While there have been, and continue to be, issues that need to be addressed, it is not possible at this point in time to determine if there have been negative impacts.

<u>M&NP Mainline Overview</u>

The Maritimes and Northeast Pipeline Project (Mainline) is a 1048 km underground natural gas transmission pipeline designed to transport Sable Natural Gas from processing facilities in Goldboro, NS, to markets in eastern Canada and the New England states before interconnecting with the North American pipeline grid near Dracut, Massachusetts. The terrestrial portion is 565km of 30" diameter steel pipeline (328 km in NB and 237 km in NS). Clearing of the Right of Way was accomplished in late 1998 and early 1999 with physical construction taking place in 1999.

The project involved many different issues from an environmental point of view. Of particular concern were watercourses and associated aquatic resources. In New Brunswick, a dry or isolated construction method was used for 175 watercourse crossings. Wet crossing techniques were used in two instances, and horizontal directional drills were used for three crossings. In addition, at least 56 wetlands including areas with imperfectly drained soils were crossed. The pipeline crossed four counties. The watersheds crossed in the Canaan-Washademoak area included those for Forks Stream, Alward Brook and Canaan River.

FMHP Overview

This project involves the construction of approximately 195km of divided four lane highway between Fredericton and Moncton. This includes a 5 km fill across the Grand Lake Meadows, five major watercourse crossings, 180 regular watercourse crossings (30 of them in salmonid habitat), as well as several recreational trails, grade separation structures, resource access roads and military access roads.

The watersheds crossed in the Canaan-Washademoak drainage include Jonah Brook, Picketts Cove Brook, Starky Brook, Kelly Brook and Canaan River. The majority of construction was undertaken in 1999 and 2000.

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