# TOWN OF LUNENBURG COUNCIL MEETING MINUTES

## TUESDAY, JUNE 9, 2020 AT 2:00 P.M.

## VIA AUDIO/VIDEO CONFERENCE DURING COVID-19 PANDEMIC

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**PRESENT:** Mayor Rachel Bailey
Deputy Mayor John McGee
Councillor Joseph Carnevale (3:27 p.m. left the meeting)
Councillor Danny Croft
Councillor Ronnie Bachman
Councillor Peter Mosher
Councillor Matt Risser

**ALSO PRESENT:** Marc Belliveau, P. Eng., Consultant
Paul Bracken, Facilities Superintendent
Pat Burke, Q.C., Town Solicitor/Returning Officer
Lisa Dagley, CPA, CGA, Finance Director
Arthur MacDonald, Heritage Manager
Heather McCallum, Assistant Municipal Clerk
Bea Renton, Chief Administrative Officer
Ian Tillard, P. Eng., Town Engineer

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The Mayor called the meeting to order at 2:00 p.m. Her Worship expressed best wishes and congratulations for the Town's June 7, 267th birthday celebrations last week and the Heritage Property Recognition Awards presented to:

- Ironworks Distillery Inc., 2 Kempt Street;
- Travis Hiltz and Mary Anne Donovan, 80 Creighton Street;
- SMP Holdings Inc./Shane M. Pittman, 194 Montague Street;
- David R. Hirtle, 205 Pelham Street;
- Garth Turner, 12 King Street; and
- B2 Holdings Limited/Marilyn MacKay-Lyons and Brian MacKay-Lyons, 160 Montague Street.

She commented on the recent "Black Lives Matter" demonstrations in recognition of racial tragedies in Canada and the US.

1. Agenda

Motion: moved by Councillor Risser, seconded by Councillor Carnevale to approve the agenda. Motion carried.

2. May 26, 2020 Council meeting minutes

Motion: moved by Councillor Mosher, seconded by Councillor Croft to approve the May 26, 2020 Council meeting minutes. Motion carried.

3. Public Hearings and Presentations

Nil.

4. Correspondence

Nil.

5. Committee Meeting Minutes and Recommendations

a. General Government Committee June 3, 2020 meeting minutes

Motion: moved by Deputy Mayor McGee, seconded by Councillor Risser to approve the award of Town 2020/21 non-profit community grants in the amount of $18,115 (Schedule “A”).

Councillor Croft asked that his name be removed from the meeting minutes as he was not in attendance.

The motion was put and passed. Councillor Croft voted in the negative.

b. Audit Committee June 4, 2020 meeting minutes

These minutes were received for information.

c. Lunenburg County Seniors’ Safety Program May 2020 report

This report was received for information.

6. Unfinished Business

a. Corporate Services

- Proposed Property Tax Financing Program Policy **and** short term borrowing resolution for the Property Tax Financing Program

Motion: moved by Councillor Bachman, seconded by Councillor Carnevale to approve the Proposed Property Tax Financing Program Policy (Schedule “B”). Motion carried.

Motion: moved by Deputy Mayor McGee, seconded by Councillor Bachman to approve the short term operating loan resolution (Schedule “C”) to fund the Property Tax Financing Program in an amount not to exceed $1,800,000. Motion carried.

ii. Municipal and CSAP elections 2020 – Returning Officer report/resolutions regarding proposed Bylaw for alternative voting methods

The Town Solicitor/Returning Officer summarized his report and recommendations (Schedule "D") for Council. He said that the draft Alternative Voting Bylaw (Schedule "D") requires amendment in section 7B (1) by deleting the word "may" in the second line and inserting the word "shall" instead, plus inserting on each advance polling day in 7B(2).

Councillor Risser gave notice of motion of the proposed rescinding of Council's earlier paper ballot election process in view of the need for alternative voting as follows:

**WHEREAS**

1. Town Council passed the following motion on October 22, 2019:

   "Motion: moved by Councillor Risser, seconded by Councillor Carnevale that the Town of Lunenburg continue to use paper-only balloting for the 2020 municipal election. Motion carried.

2. The COVID-19 Pandemic has created potentially serious difficulties for holding a paper-balloting election,

I therefore give notice that I will, at the June 23, 2020 meeting of Council, be introducing (moving) a motion to rescind the aforesaid motion dated October 22, 2019.

Councillor Risser also gave notice of motion of the proposed Bylaw adoption as follows:

**WHEREAS** the COVID-19 pandemic will create significant challenges and risks associated with a paper balloting election,

I therefore give notice that I will, at the June 23, 2020 meeting of Council, be introducing (moving) a motion to give first reading of the Alternative Voting Bylaw attached hereto as Schedule "D" and as amended as noted above.

The Town Solicitor/Returning Officer was asked to comment on ways in which computer and phone voting can be protected against fraud. He advised that the e-voting supplier has system controls in place. Computers will be made available by the Town to vote at a prescribed polling station and election workers available to assist voters with e-voting and for those who may not have a personal smart phone or computer to cast their ballots.

iii. Blockhouse Hill development proposal of Richard Redmond, Redmond Properties/3007464 Nova Scotia Inc. staff report preparation – discussion

Council expressed their interest in developing these lands subject to a public procurement process. The Planning and Development Manager explained that staff have met with Mr. Redmond and clarified the current zoning which may require a comprehensive development district to coordinate the future development of the area. If the land is to be sold this would have to be done at fair market value unless there are some subsidized forms of housing development Council wishes to consider. Ideally, the Town's Project Lunenburg Comprehensive Community Plan and revised Municipal Planning Strategy, Land Use Bylaw and Subdivision Bylaws should be completed in advance. How the lands will be serviced with water and sewer and capacity of same with existing Town infrastructure must be considered as there may be capacity issues as mentioned in preliminary Project Lunenburg documents. The Planning and Development Manager's staff report will be completed in July for Council consideration and she will outline in it what tasks are needed to consider its potential sale and development, e.g., a survey, infrastructure analysis, etc.

b. Public Works Department

i. Source Water Protection Management Plan update - Consultant's report presentation and recommendations

Mr. Belliveau recapped his research to update the Plan noting that he checked Nova Scotia Environment Department documents and determined that nothing there required the Town to be amended. He also considered internal documents such as emergency contact procedures some of which had to be updated and are included in the revised Plan (Schedule "E"). There were some other documents in its appendix which were replaced with current versions.

He toured the watershed and recommends more Water Utility signage notifying people that it is a protected watershed. Signs were earlier ordered and will be installed by the Town Public Works Department. The Lunenburg and District Fire Department has done an overhead drone video of the watershed for viewing to assess current activities in the watershed.

Council asked about the potential expansion of the Town watershed boundary and regulations. Staff are asked to inquire of the Nova Scotia Environment Department and Legislative Office what the process would be to expand the watershed boundary to include the full natural watershed in a revised Provincial Regulation and report back to Council.

Motion: moved by Deputy Mayor McGee, seconded by Councillor Croft to approve the amendments in the revised Source Water Protection Plan (Schedule "E"). Motion carried.

Motion: Councillor Risser, seconded by Councillor Bachman that the other recommendations in the report (Schedule "E") also be incorporated in the updated Plan

and actioned by staff. An annual walk through the watershed for a visual inspection will also be conducted. Motion carried.

3:27 pm –Councillor Carnevale left the meeting. Council recessed until 3:40 p.m. when the meeting resumed.

i. Sidewalk and pot hole repair work update - staff report

The Town Engineer gave an overview of the mapping and detailed records management he developed with Public Works staff to prioritize this work which will be incorporated in the weekly work planner he has also created with the assistance of staff. Physical distancing and additional personal protective equipment procedures will be utilized during the pandemic so they can safely do this work (Schedule "F").

Council thanked staff for the preparation of the report and requested that Centennial Avenue near where it connects to Green Street be added to the pot hole repair list.

ii. April 2020 Water Utility and Wastewater treatment results and general information - staff report

The Town Engineer advised that all test results are within permitted levels. The Wastewater Treatment Plant aeration tanks are being retrofitted now and there is a temporary bypass with partially treated wastewater being discharged as permitted by senior governments (Schedule "G"). There are some parts delivery issues, but these are currently being resolved. Public notification of the temporary bypass has been given.

Council next considered agenda item #7. b. i.

7. New Business

a. Corporate Services

i. Lunenburg Academy school bell, handrail and signage project proposal – staff report

Deferred.

b. Public Works Department

i. Rotary Club Sign "Nova Scotia Strong" planter installation request – motion for Council approval to install without the requirement of a Development Permit pursuant to section 24.14 e., Land Use Bylaw

The Planning and Development Manager advised that with the permission of Council pursuant to the Land Use Bylaw section there is no need for a Development Permit for this sign request which is for general community support during the pandemic and recent tragedies in NS (Schedule "H").

Motion: moved by Councillor Croft, seconded by Councillor Risser that we approve the Rotary sign request (Schedule "H"), let staff determine the location and notify the Rotary with thanks that the sign will need to be removed by the end of the year. Motion carried.

8. Consideration of Council in camera meeting recommendation

   a. Lunenburg Heritage Society transfer of Lunenburg Heritage Bandstand to the Town of Lunenburg - resolution to approve (April 21 Council in camera)

Deferred.

9. Adjournment

Motion: moved by Councillor Croft, seconded by Councillor Risser to adjourn the meeting. Motion carried. Mayor Bailey voted against the motion.

The meeting was adjourned at 4:01 p.m.

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Bea Renton, CAO

| **Grants 2020/21** | | Schedule "A" |
|---|---|---|
| Account #01-2-19-5100 | 2020/21 Approved Grants | 2020/21 Notes |
| Bluenose 100 Committee<br>***pre-approved Jan.28, 2020*** | $5,000 | Funds for the Bluenose 100 Committee of $5,000 in the 2020/21 fiscal year and $5,000 of in-kind Town Services for the 2021/22 fiscal year when the celebration events will take place. |
| Curl for a Cause | $125 | Annual event which supports Fishermen's Memorial Hospital, no application but Town traditionally supports |
| Fishermen's Memorial Hospital - Golf Tournament | $100 | Annual event which supports Fishermen's Memorial Hospital, no application but Town traditionally supports |
| Lunenburg Community Christmas Dinner | $115 | The funds requested will cover the rental of the auditorium at the Town Fire Hall. ($100 + HST) |
| Lunenburg County Lifestyle Centre | $1,000 | Requesting municipal sponsorship towards hosting the 2020 Canadian Tire Para Hockey Cup Championships from December 5 to December 12, 2020. |
| Lunenburg Dog Park | $1,000 | The funds requested will be used to pay insurance costs and other yearly expenses. **In-kind** garbage collection. |
| Lunenburg Folk Harbour Society-Summer Concert Series | $2,500 | This grant will assist in providing funding for the bandstand concerts that are held on 10 Sundays, starting on July 5th and ending on September 13th. |
| Lunenburg Folk Harbour Society-Sponsorship | $1,000 | While the Lunenburg Folk Harbour Festival has been cancelled for August 2020, many of the Society's fixed costs of operation still remain, with significant loss in their traditional revenue. Revenue streams of ticket sales, sponsorships from local businesses, and rental opportunities have completely dried up, and yet they still have all of their operating and administrative costs to cover. Because of this, the Society is asking the Town of Lunenburg to consider supporting the Society during this time of need. |
| Lunenburg Grad Bursary | $500 | Bursary will be issued to a graduating high school student. |
| Lunenburg and District Swimming Pool | $1,500 | Support to operate and maintain their outdoor swimming pool. Even with Covid-19 restrictions they plan to provide jobs doing maintenance, renovation and repair of the pool and its facility. |
| Nova Scotia Sea School | $1,000 | The Sea School is seeking funding to assist in the structural long term repair and modification of the expedition vessels Dorothea and Elizabeth Hall. These 30' wooden sailboats, are over 20 years old and require improvements outside of regular maintenance to ensure they are meeting Transport Canada's Safety Regulations as commercial passenger vessels. |
| Safe Communities Lunenburg County | $1,275 | Designed to address a range of seniors' safety issues, to mitigate risk, to reduce incidences of elder abuse, and to foster effective helping relationships between seniors and police. |
| Society of St. Vincent de Paul | $1,000 | Funds will be utilized for any individual of the Town of Lunenburg who demonstrates genuine need. The society assists individuals who need temporary help with basic needs. |
| VON-Lunenburg County | $2,000 | To assist with expenses associated with providing transportation for seniors and those with medical concerns. The service provides drives for medical appointments, provides weekly drives for residents for dialysis, weekly transportation to run errands. The transportation program also is used to delivery frozen meals to residents of the Town. All grant money received from the Town of Lunenburg will be used to offset the cost of the transportation program offered for residents of the Town. |
| **Approvals June 3, 2020** | **$ 18,115** | |
| Budget for additional grant requests if required | $ 1,885 | |
| **Total 2020-21 Grant budget** | **$ 20,000** | |

Schedule "B"

# TOWN OF LUNENBURG PROCEDURAL POLICY #
# COVID-19 PANDEMIC PROPERTY TAX FINANCING PROGRAM

1. This Policy is entitled the "COVID-19 Pandemic Property Tax Financing Program Policy."

2. **Objective:**

**Town of Lunenburg** ("Municipality") is concerned about the health and safety of residents. Town of Lunenburg recognizes that facilitating the payment of property taxes in installments will better allow Nova Scotians to follow the public health directives endorsed by the Government of Nova Scotia. This Policy responds to that need by establishing a one-time property tax installment payment program (the "Program") for owners of residential and commercial properties negatively affected by the COVID-19 global pandemic.

3. **Authority:**

Sections 111 and 112 of the *Municipal Government Act* give Council the authority to provide for the payment of taxes by installments.

Section 113 of the *Municipal Government Act* allows Council to charge interest for non-payment of taxes when due, at a rate determined by policy.

4. **Scope:**

4.1 Residential - The following owners of residential property are eligible to participate in the Program:

4.1.1 An owner of a residential property that is the owner's primary residence, where the owner has experienced financial hardship through a significant reduction in income due to the State of Emergency declared by the Government of Nova Scotia in response to COVID-19, demonstrated through receipt of COVID-19 Provincial or COVID-19 Federal program assistance, or a Record of Employment (ROE) demonstrating layoff from employment after March 15, 2020;

4.1.2 An owner of a residential property where the owner was a registered Tourism Operator with Tourism Nova Scotia for the 2019 tourist season (excluding AirBNBs);

4.1.3 An owner of a residential property that is rented to one or more tenants, where the owner has experienced a significant reduction in rental income from the property due to the State of Emergency, demonstrated through the following:

4.1.3.1 The owner of a residential property that is rented must attest that the rental income for April 2020 and May 2020 is 30% less than rental incomes received in February 2020.

4.2 Commercial - The following owners of commercial property are eligible to participate in the Program:

4.2.1 An owner of a taxable commercial property where the property has a total taxable 2020 property assessment value equal to or less than $6,500,000 and where the owner's business or building located on the property has experienced financial hardship through loss of revenue related to the State of Emergency, demonstrated through the following:

a) In receipt of the Canada Emergency Wage Subsidy Benefit; or b) where the owner demonstrates a reduction in gross eligible revenue greater than or equal to 30 percent in the months of March, April and May 2020 as compared to the corresponding period in 2019. Eligible revenue includes selling goods, rendering services and other's use of services.

4.2.2 An owner of a taxable commercial property who has experienced financial hardship through loss of revenue related to the State of Emergency, regardless of the assessed value, where:

4.2.2.1 The owner of the property is a tourism operator registered under the *Tourist Accommodations Registration Act* and the property is used for tourist accommodations (e.g., hotels, motels, bed and breakfasts);

4.2.2.2 The owner of the property carries on the business of an automotive or leisure/recreational vehicle dealership on the property;

4.2.2.3 The owner of the property uses the property as a private or non-profit recreation facility (e.g., golf courses, indoor playgrounds, campgrounds, racing venues);

4.2.2.4 The owner of the property carries on a business on the property in the hospitality industry, including bars, cafes, and coffee shops;

4.2.2.5 The owner of the property carries on a business on the property in the service industry, including hairdressers, nail salons, gyms, tattoo parlours;

4.2.2.6 The owner of the property carries on a business on the property as a health care provider (including, but not limited to, dentists, naturopaths, chiropractors, physiotherapists, physicians and other doctors), where that business has been required to reduce hours as a result of the State of Emergency.

4.3 Exclusions: Regardless of sections 4.1 and 4.2 of this policy, the following are not eligible to participate in the Program:

4.3.1 Property owners who have not experienced financial hardship through loss of revenue related to the State of Emergency;

4.3.2 Property owners who have received compensation from Business Interruption Insurance towards the payment of property taxes;

4.3.3 Properties occupied by daycare centres in receipt of federal or provincial funding, or those in receipt of other emergency funding;

4.3.4 Properties used for landfill, pipeline, managed forest, parking, and commercial vacant land;

4.3.5 Properties for which there is an active tax agreement with the Municipality through legislation or bylaw;

4.3.6 All properties managed under payment-in lieu-programs.

4.4 General Requirements

4.4.1 Installments shall be payable by the person, company or other entity assessed for the property for the current fiscal year.

4.4.2 In order for taxes for a property to qualify for the Program, the taxes for the property must not be in arrears at the time of application.

4.5 Application

4.5.1 Property owners wishing to apply to participate in the Program for a property must complete and submit to the Municipality an application in the form attached as Schedule "A" to this policy as may be prescribed by the Chief Administrative Officer.

4.5.2 The application deadline to participate in the Program is **July 31, 2020**.

5. **Administration:**

5.1 Tax Installments

5.1.1 For applications meeting the Program criteria set out above, property tax payments normally due between May 1st, 2020 and September 1st, 2020 for approved properties may be paid in installments as follows.

5.1.2 For each property, Program participants will pay tax installments by pre-authorized payment as follows:

5.1.2.1 Payments of $25 per month for six months, payable on or before the last day of each month, commencing in August 2020.

5.1.2.2 Following these six months at $25 per month, monthly payments equal to 1/24th of the balance of the amount eligible for the Program plus interest as set out below. These monthly payments are payable on or before the last day of each month and continue for 24 months.

5.1.3 The rate of interest for the Program will be 1.35% per year.

5.1.4 Interest on amounts owing under the Program will be calculated commencing on the date the property tax payment is normally due and continuing until all installments have been paid.

5.2 Terms of the Program

5.2.1 The Treasurer, or their delegate, shall approve qualifying applicants.

5.2.2 Payments under the Program must remain in good standing with the Municipality throughout the duration of the Program.

5.2.3 Default in payment of an installment when due will result in the following:

5.2.3.1 The balance of outstanding taxes on the applicable property and interest will become immediately due and payable; and

5.2.3.2 The outstanding taxes and interest then owing will become subject to the municipality's regular rate of interest for overdue taxes 18% per annum, charged at 1.5% monthly.

5.2.4 All amounts owing and payable on the property tax account that are not included in the Program are due on their normal dates and any amounts not paid when due will be subject to the Municipality's regular rate of interest for overdue taxes of 18% per annum, charged at 1.5% monthly.

5.2.5 Payments received by the Municipality from a property owner will first be applied to any installments due under the Program, in priority to any other taxes or other amounts owing by the owner to the Municipality.

5.2.6 Tax Financing Agreement
Applicants approved for participation in the Program must enter into a Tax Financing Agreement with the Town of Lunenburg prior to the Tax Financing Plan applying to the Property Account.

## 6. Responsibilities:

6.1 Council will:

6.1.1 Monitor the implementation and administration of this policy and make any amendments required for the effective and efficient operation of the Program.

6.2 The Finance Director or designate will:

6.2.1 Be responsible for the administration and implementation of this policy and the Program; and

6.2.2 Identify necessary amendments to this policy in consultation with Council and managerial staff and make recommendations accordingly to Council.

## Schedule A

## Application for COVID-19 Pandemic Property Tax Financing Program

## Residential Property

Civic address of property: _____
Assessment Account Number (as it appears on your tax bill): _____

Name of owner (as it appears on your tax bill): _____
Mailing address (include civic number):_____
Phone number: _____
Email address: _____

**I declare that:**

a) I have not received compensation from business interruption insurance toward payment of property taxes in relation to the above property;
b) The property is not occupied by a daycare centre in receipt of federal or provincial funding or other emergency funding;
c) The property is not used for a landfill, pipeline, managed forest, or parking, and is not commercial vacant land;
d) There is no active tax agreement in place with the Municipality with respect to property taxes for the property through legislation or bylaw;
e) The property is not managed under a payment-in lieu-program.

**Complete one of I, II, or III below**

**I. Owner-occupied residence**

I also declare that:

a) I reside in the above property;
b) I have experienced financial hardship through due to a significant reduction in income as a result of the State of Emergency declared by the Province of Nova Scotia related to COVID-19; and
c) I am receiving federal or provincial financial assistance related to COVID-19 OR I was laid off from my employment after March 15, 2020.

Dated this __ day of _____, 2020.

_____
Signature of owner

Enclose: Documentation (email, letter, payment statement, or other) showing that you are in receipt of federal or provincial financial assistance related to COVID-19 OR enclose a Record of Employment indicating that you were laid-off from your employment after March 15, 2020.

**II. Registered tourism operator**

I also declare that:

a) I was a registered Tourism Operator with Tourism Nova Scotia for the 2019 tourist season with respect to the above property;
b) There is no current agreement in place with the Municipality regarding payment of property taxes;
c) I have experienced a significant reduction in income from the property as a result of the State of Emergency declared by the Province of Nova Scotia related to COVID-19; and
d) The property is not used as an AirBnB.

Dated this __ day of _____, 2020.

_____
Signature of owner

Enclose: Documentation showing registration as a Tourism Operator with Tourism Nova Scotia for the 2019 tourist season.

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**III. Rental residential property**

I also declare that:

a) I rent the above property to one or more residential tenants;
b) I have experienced a significant reduction in income from the property as a result of the State of Emergency declared by the Province of Nova Scotia related to COVID-19;
c) The owner of a residential property that is rented must attest that the rental income for April 2020 and May 2020 is 30% less than rental incomes received in February 2020.

Dated this __ day of _____, 2020.

_____
Signature of owner

Enclose: Proof of your residential property that is rented must attest that the rental income for April 2020 and May 2020 is 30% less than rental incomes received in February 2020.

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# Application for COVID-19 Pandemic Property Tax Financing Program

## Commercial Property

Civic address of property: _____
Assessment Account Number (as it appears on your tax bill): _____

Name of owner (as it appears on your tax bill): _____
Mailing address (include civic number):_____
Phone number: _____
Email address: _____

**I declare that:**

a) I have not received compensation from business interruption insurance toward payment of property taxes in relation to the above property;
b) The property is not occupied by a daycare centre in receipt of federal or provincial funding or other emergency funding;
c) The property is not used for a landfill, pipeline, managed forest, or parking, and is not commercial vacant land;
d) There is no active tax agreement in place with the Municipality with respect to property taxes for the property through legislation or bylaw;
e) The property is not managed under a payment-in lieu-program.

**Complete one of I *or* II below**

**I. I also declare that:**

a) I have experienced financial hardship through loss of revenue of my business or building located on the property as a result of the State of Emergency declared by the Province of Nova Scotia related to COVID-19;
b) The total taxable 2020 assessed value for the property is equal to or less than $6,500,000;
c) a) In receipt of the Canada Emergency Wage Subsidy Benefit; or b) where the owner demonstrates a reduction I gross eligible revenue greater than or equal to 30 percent in the months of March, April and May 2020 as compared to the corresponding period in 2019. Eligible revenue includes selling goods, rendering services and other's use of services.

Dated this __ day of _____, 2020.

_____
Signature of owner

Enclose: **Proof of** a) In receipt of the Canada Emergency Wage Subsidy Benefit; or b) documentation of a reduction in gross eligible revenue greater than or equal to 30 percent in the months of March, April and May 2020 as compared to the corresponding period in 2019. Eligible revenue includes selling goods, rendering services and other's use of services.

**II. I also declare that:**

a) I have experienced financial hardship through loss of revenue of my business or building located on the property as a result of the State of Emergency declared by the Province of Nova Scotia related to COVID-19;
b) The total taxable 2020 assessed value for the property is greater than **$6,500,00** but (*choose any of the following that apply*):
   ___ (i) I am a tourism operator registered with the *Tourist Accommodations Registration Act* and the property is used for tourist accommodations (e.g., hotels, motels, bed and breakfasts);
   ___ (ii) I carry on the business of an automotive or leisure/recreational vehicle dealership on the property;
   ___ (iii) I use the property as a private or non-profit recreation facility (e.g. golf course, indoor playground, campground, racing venue);
   ___ (iv) I carry on a business on the property in the hospitality industry (eg. bar, café, restaurant, coffee shop);
   ___ (v) I carry on a business on the property in the service industry (eg. hair salon, nail salon, gym, tattoo parlour);
   ___ (vi) I carry on a business on the property as a health care provider (eg. dentist, naturopath, chiropractor, physiotherapist, physician), and that business has been required to reduce hours as a result of the State of Emergency.

Dated this __ day of _____, 2020.

_____
Signature of owner

Schedule "C"

Document No:
Meeting: June 9, 2020
Circulate: Council, BR, LD
File: Budget 2020/21

# M E M O R A N D U M

**TO:** **TOWN COUNCIL**

**FROM:** **LISA DAGLEY, CPA, CGA, FINANCE DIRECTOR**

**DATE:** **JUNE 4, 2020**

**RE:** **SHORT TERM BORROWING RESOLUTION FOR THE PROPERTY TAX FINANCING PROGRAM**

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## 1. FACTS

At the May 26, 2020 Council Meeting Councillor Bachman gave notice of motion to adopt the draft COVID-19 Pandemic Property Tax Financing Program Policy at the June 9, 2020 Council meeting.

## 2. ISSUES AND OPTIONS ANALYSIS

To carry out this program the Town will need to access the provincial COVID-19 loan program for municipalities. The loan is available through the Municipal Finance Corporation (MFC) and municipal units will have six months to start repayment and three years to fully repay the loan. To access funds a borrowing resolution is required to be approved by Council and submitted to the Department of Municipal Affairs and Housing (DMAH) for their approval. The resolution is attached.

## 3. FINANCIAL IMPACT

The cost of borrowing under this program will be 1.1% and the policy allows for a 0.25% overhead charge, which will cover possible defaults and interest timing adjustments. Staff will work to structure the borrowing so the interest charges will be carried by taxpayers enrolled in the program.

The resolution is for the limit of our estimated Tax Financing Program. The approval process is expected to take several weeks which will be closer to our application due date of July 31, 2020. Before the release of the loan funds from the Municipal Finance Corporation, staff will be able to lower the amount of the borrowing if the entire amount is not required to carry out the Tax Financing Program.

DMHA have advised that this borrowing will not impact the Town's borrowing capacity.

## 4. STRATEGIC PLAN RELEVANCE

5) Operate the Town efficiently and effectively by:
C. Developing and updating Town bylaws, policies, procedures and plans.

## 5. RECOMMENDATION AND DRAFT MOTION

It is recommended that Council approve the Short-Term Operating Loan Resolution to fund the Property Tax Financing Program in an amount not to exceed $1,800,000 as per attached.

Acknowledged only by:

_____
Bea Renton
CAO

Attachment –
Short-Term Operating Loan Resolution

# NOVA SCOTIA MUNICIPAL FINANCE CORPORATION
# SHORT-TERM OPERATING LOAN
# RESOLUTION AS ADOPTED BY COUNCIL

**WHEREAS** the Municipal Finance Corporation is offering a temporary short-term operating loan to clients who are experiencing cash flow challenges for the 2020-21 fiscal year due to the impact of COVID-19; and,

**WHEREAS** in accordance with the policy of the Municipal Finance Corporation, the Council of Town of Lunenburg has deemed it necessary and expedient to seek approval from the Minister of Municipal Affairs and Housing to take part in this short-term operating loan program offered by the Municipal Finance Corporation; and

**WHEREAS** pursuant to Section 84 of the *Municipal Government Act*, a Municipality may borrow to cover the annual current expenditures to an amount not to exceed fifty per cent of the combined total of the taxes levied by the Municipality for the previous year and the amounts to be received by the provincial and federal governments; and

**WHEREAS** the summary amounts and descriptions of the cash flow impact of COVID-19 on the Municipality are contained in Schedules 'A' and 'B' (attached) to support analysis by the Department of Municipal Affairs and Housing and the Municipality shall provide officials from the Department of Municipal Affairs and Housing with reports and information deemed necessary to support this request;

**BE IT THEREFORE RESOLVED**

**THAT** subject to the approval of the Minister of Municipal Affairs and Housing, the Council of Town of Lunenburg borrow a sum or sums not exceeding One Million Eight Hundred Thousand Dollars ($1,800,000.00) for the purpose set out above; and,

**THAT** the sum be borrowed for a period not exceeding Thirty-Six (36) Months from the date of withdrawal from the Municipal Finance Corporation; and,

**THAT** the borrowing will be under the terms and conditions of the agreement as determined by the Municipal Finance Corporation.

**THIS IS TO CERTIFY** that the foregoing is a true copy of a resolution read and duly passed at a meeting of the Council held on the _____ day of _____ 2020.

**GIVEN** under the hands of the Clerk and under the seal of the Municipality this _____ day of _____ 2020.

_____
Clerk

** please ensure the impression of the common seal is clear and visible upon scanning*

**NOVA SCOTIA MUNICIPAL FINANCE CORPORATION**
**SHORT-TERM OPERATING LOAN**
**RESOLUTION AS ADOPTED BY COUNCIL**

**SCHEDULE 'A'**

**Summary Information**

Summary of basis for loan request i.e. ½ of estimated shortfall; remainder of estimated shortfall, or additional estimated shortfall

100% of estimated shortfall

Information regarding estimated shortfall

- Relevant factor used in the estimate

see assumptions used

- Source of relevant factor

NSFM

- Consideration of changes in previous factors

Nil

- Outline assumptions used

For Businesses: Hotel and accommodation=100%, Tourism sector, including seasonal tourism=100%, Restaurants, bars, coffee shops, cafes=100%, Health and para-health services (dentists, massage, physio, chiro, vet clinics)=100%, Hairdressers, nail salons, private gyms, tattoo parlors=100%, Craft beer/wine/spirits=30%, Non-profit organizations=20%, Other commercial businesses=35% Residential properties=30%

If applicable, updated estimated shortfall including changes in factors or assumptions

NA

**NOVA SCOTIA MUNICIPAL FINANCE CORPORATION**
**SHORT-TERM OPERATING LOAN**
**RESOLUTION AS ADOPTED BY COUNCIL**

## SCHEDULE 'B'

**Municipal Program Information**
** Please Note: if any of the items below do not apply to your Municipality, please indicate by writing "nil" or "does not apply" in the space provided*

- Interest rate anticipated to be charged by the municipality

1.35%

- Administration fee anticipated to be charged by the municipality

0.25%

- Anticipated term of program (i.e. 30 months)

30 months

- Anticipated lump sum payment or semi-annual payments

$300,000

- If there are any program variances, please note the variance and rationale *(for example, if the loan term or interest rate is different for property type)*

Nil

**Financial Information, please include with the submission of the resolution the following**

- Most recent non-consolidated financial statements available

OR

- If after Sept 30th, audited financial statements and Financial Information Return (FIR)

Schedule "D"

# Report to Council

To: Town of Lunenburg
From: Patrick A. Burke, Q.C., Town Solicitor
Re: Municipal Election 2020 – Voting
Date: June 2, 2020

1. The Town passed a Resolution on October 22, 2019 that the 2020 Election would be by paper balloting only.

2. Since that time, we have had the COVID-19 Pandemic which has created challenges in conducting all business activities.

3.
    a. Concern has been raised about the ability to conduct a paper-balloting election, from the perspective of adequately protecting any poll workers as well as voters.

    b. It may be difficult to obtain poll workers who are prepared to work in this environment. (If we need to have a mobile poll for Harbourview Haven and Fishermen's Memorial Hospital, we may have to get one of the nurses to be the DRO).

4. HRM has prepared a report dated April 14, 2020, (a copy of which is attached) which addresses many of the issues associated with electronic voting. Obviously, this decision is impacted by the geographical size of, and population in, their municipality.

5. HRM has recently conducted a by-election involving approximately 20,000 electors which was entirely electronic and telephone voting (alternative voting).

6. The Minister of Municipal Affairs has determined that the October 17, 2020 municipal election will be proceeding as scheduled.

7. It is submitted that alternative voting (and no paper ballots) is the safest method of conducting an election during this pandemic, particularly given that there may be a second wave outbreak in the Fall of 2020.

8. It is admitted that there are always risks of voter fraud with electronic voting (example – someone voting someone else's pin), but this must be balanced against the risks to the health of the public in trying to conduct an election with paper balloting during a Pandemic.

9. There will be costs associated with conducting an election of this nature:

    a. Help Desk Staffing

    It is anticipated that the alternative voting days would be 8 days long (October 10 – October 17 inclusive) and it is recommended that a person staff the Help Desk from 8:30 am – 4:30 pm during those 8 days (even though voting may occur 24 hours per day).

    b. Intelivote

    The cost of Intelivote is $1.25 per elector plus $1.20 for the letter and printing and postage which results in $2.45 per elector. We have under 1900 electors in the Town of Lunenburg.

    c. Auditor (IT Person)

    There will need to be an auditor who will audit the functions of the electronic voting. (For Example – the auditor will ensure that the voting cannot commence until the start of alternative voting days and will do various security checks on the system during the course of the election to ensure the integrity thereof).

    It is likely that a local IT person could perform this function. The cost is not known but would likely be at least $1500.00.

    d. Increased Costs for Returning Officer

    There will be an increased cost for the Returning Officer (with the amount to be determined).

    e. Increased Advertising Costs

    There will be increased advertising costs. (This could be at least $2000.00 as it is imperative that we ensure that the public is aware of the new voting system and accordingly, we should have substantial advertising, and circulars in the electric bills).

    f. Savings

    There will be some savings on DRO's and Poll Clerks as you would not likely have more than one poll (if any).

    Provided nevertheless, there will need to be a mobile poll for Harbourview Haven and the Hospital and that will likely mean that staff members will have to be appointed as DRO's and Poll Clerks and would circulate in the facility on Ordinary Polling Day with an IPad for those who are interested in voting.

g. Additional Hardware Costs

It may be necessary to have 3 or 4 IPads which will need to be used during the election. (These could likely be wiped clean and utilized by the new Councillors after the election).

I am enclosing herewith the following:

A. Notice of Motion to rescind the earlier Resolution concerning paper balloting;
B. The Resolution to rescind the Motion (which would be dealt with at the June 23, 2020 Council Meeting);
C. Report from Intelivote Systems Inc.
D. Draft Bylaw;
E. Notice of Motion to be given on June 9, 2020 for the June 23, 2020 Meeting; and
F. Resolution for the June 23, 2020 meeting to give first reading of the Bylaw.

[Once the Bylaw is passed (which is anticipated to take place in the July 28, 2020 Meeting), Council will need to pass a Resolution to proceed by electronic and telephone voting only].

All of which is respectfully submitted.

Patrick A. Burke, Q.C.

Town Solicitor

# HALIFAX

P.O. Box 1749
Halifax, Nova Scotia
B3J 3A5 Canada

**Item No. 8.1.3**
**Halifax Regional Council**
**April 14, 2020**

**TO:** Mayor Savage and Members of Halifax Regional Council

**SUBMITTED BY:** Original Signed by
Jacques Dubé, Chief Administrative Officer

**DATE:** March 19, 2020

**SUBJECT:** 2020 Municipal and CSAP Elections – election methods and Alternative voting dates

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## RECOMMENDATION REPORT

## ORIGIN

This report originates with staff. The Election Office has commenced planning for the 2020 Municipal and CSAP Elections (Election) and requires Council direction on the following to proceed with planning:

- Method of voting for the 2020 Municipal and CSAP Election
- Dates for the advance polling period for the 2020 Municipal and CSAP Election

Halifax Regional Council is required by resolution to address administrative matters under the *Municipal Elections Act* to conduct any election, including setting dates for alternative voting for the 2020 Municipal and CSAP Elections.

## LEGISLATIVE AUTHORITY

*Municipal Elections Act* (*MEA*), subsection 146A(1): "A council may by by-law authorize voters to vote by mail, electronically or by another voting method".

Bylaw A-400 , the *Alternative Voting By-law* clauses ©(d) and section 3, as follows:

© "alternative polling days" means any hours and dates fixed by a resolution of Council for alternative voting;

(d) "alternative voting" means voting by telephone or via the internet and includes a combination of telephone and internet voting;

3. (1) Subject to this by-law, alternative voting shall be permitted on alternative polling days.

(2) Council may, by resolution, provide that voting by a telephone and by a personal computing device shall be the only means of voting for an election.

**RECOMMENDATION ON PAGE 2**

## RECOMMENDATION

It is recommended that Halifax Regional Council:

1. Adopt Option 1 as outlined in Attachment A of this report and direct:

   (a) that use of a telephone and a personal computing device as the only method of voting to be used in the 2020 Municipal and CSAP Elections during alternative polling days, including during the advance polls; and

   (b) that paper ballot be used as the only method of voting on ordinary polling day.

2. Set the dates for alternative voting to commence on Tuesday, October 6, 2020 at 8:00 a.m. and run continuously through to Wednesday, October 14, 2020 at 7:00 p.m.

## BACKGROUND

### Methodology

Section 146A of the *MEA* provides Regional Council the option, by by-law, to select the method of voting.

Prior to the 2008 municipal election, Council did not have the ability to allow internet or telephone voting. Accordingly, the Municipality conducted the election using in-person paper ballots during two (2) days of advanced voting and on ordinary polling day (Election Day). After the amendments to the *MEA*, in 2007, following extensive discussion, Regional Council directed that electronic (internet & telephone voting) be introduced in the 2008 municipal and school board elections in the HRM.

A description of the voting methods and voter participation rates from previous regular municipal and school Board elections since 2008 is outlined in the table below:

| Election | Format | Voting Turnout |
|---|---|---|
| 2008 Municipal and School Board Election | • Electronic Voting available for 4 days prior to the beginning of the Advanced Poll<br>• In person advanced polls with traditional paper ballots conducted for two (2) advanced polling days with no reduction in the number of advanced in-person polls<br>• In person with traditional paper on Election Day | • 36.2% overall voter participation<br>• 28.4% of voters cast votes electronically |
| 2012 Municipal and School Board Election | • Electronic Voting only available through 13 days of advance polls<br>• In person paper ballots only available on election day<br>• 37.5% reduction in number of election day in-person polling locations from 2008 | • 36.93 % overall voter participation<br>• 60.18% of voters cast their vote electronically |

| Election | Format | Voting Turnout |
|---|---|---|
| 2016 Municipal and School Board Election | • Electronic voting available for advance period up to two days before Election Day.<br>• Paper and electronic voting available at the Advanced Polls.<br>• In person paper ballots only on election day. | • 33.62% Overall voter participation<br>• 61% of voters cast their vote electronically |
| 2019 Special Election – District 14 | • Electronic polling only for advance and Election Day. In-person polls were set up with e-voting kiosks and staff to assist voters. | • 22.5% overall voter participation<br>• 100% of voters cast their vote electronically. |

With appropriate implementation and electoral oversight, electronic voting has proven to be a well-received method of conducting municipal and school board elections in Nova Scotia and other provinces including Ontario.

### Alternative Voting Dates

The *MEA* requires that the first advanced poll to be either Thursday October 8, 2020 or Saturday October 10, 2020. On February 25th, 2020, Council delegated to the Returning Officer the authority to set the date of the first Advance polling date. The Returning Officer is intending to set the date of first Advance Poll to be Saturday, October 10th, 2020. The second Advance Poll is set by the *MEA* to be Tuesday, October 13th, 2020. The hours of the Advanced Polls are also set by the *MEA* to be noon to 8:00pm.

As set out in the recommendations, staff is recommending that Regional Council: (1) set the alternative voting period to commence Tuesday, October 6th, 2020 at 8:00am and run continuously through to Wednesday, October 14th, 2020 at 7:00pm, and (2) direct that internet and telephone voting be the only methods of voting during this period. Paper voting would be the only method of voting on election day (Saturday October 17, 2020).

## DISCUSSION

### Methodology

The Election Office has undertaken a review of the previous voting methods (as outlined above). Following that review several options for the voting approach and methods were considered in more detail.

In summary the options examined were:

1) To conduct the election in a manner similar to the 2012 model using electronic voting only for the advanced voting period and in person paper ballots only on election day.

2) To conduct the election in a manner similar to the 2019 special election using electronic voting only for advance voting and election day.

3) To conduct the election in a manner similar to the 2016 model using electronic voting during the advance voting period with paper ballots at the in-person polling locations on both advance voting days and election day.

A more detailed overview of the options is provided in Attachment A of this report. The option of continuing electronic voting through to election day was considered. This option is not presented as the size of the municipality and number of polling locations on election day substantially increases both the costs and risks associated with the conduct of the election as each polling station would need a computer and internet access. Instead, it is recommended that alternative voting (voting by telephone or a personal computing device) stop two days before election day.

In light of the review and analysis staff proposes that: Halifax Regional Council adopt Option 1, as outlined in Attachment A of this report, as the method of voting in the 2020 Municipal and CSAP Elections. This method utilizes voting by telephone or a personal computing device as the only method of voting during both advanced polling days. The method of voting on election day would be in-person with paper ballots.

This option is recommended as it provides access to the greatest number of voters and aligns closely with principles previously adopted by Regional Council regarding the conduct of elections which include:

- Security and auditability of the solution – the integrity of the voting process is paramount
- Aligning with NS regulatory requirements
- Increasing voter accessibility (all areas and all demographics in HRM)
- Aligning with experience in other jurisdictions
- Having broad public acceptance
- Providing value for money

Should Council wish to consider other alternatives, the Election Office has prepared several alternative approaches for delivering the election as provided for in Attachment A of this report. All options provided comply with the legislative requirements for conducting Municipal and CSAP Elections and are within the projected 2020 election budget.

**Alternative Voting Dates**

This report is before Regional Council to comply with the legislative requirements of the *Municipal Elections Act* regarding Municipal Elections.

Regional Council has passed By-law A-400 to permit internet and telephone voting. Specifically, clause 2(c) of the By-law states: (c) ""alternative polling days" means any hours and dates fixed by a resolution of Council for alternative voting".

It is recommended that Council set the internet and telephone voting to run continuously from Tuesday, October 6, 2020 at 8:00am and be kept open until Thursday, October 15, 2020 at 7:00pm. Paper ballots will be the only voting method offered on Election Day, which is Saturday October 17th, 2020.

## FINANCIAL IMPLICATIONS

There are no financial implications related to the recommendation. The municipal election operating budget (A125) is pending approval of the 2020/21 operating budget and if approved will have a withdrawal of $2.3 million from Q511, the Election Reserve. An additional $391,500 has been approved in the 2019/20 capital budget, also funded by Reserve.

## COMMUNITY ENGAGEMENT

The municipality completed a citizen engagement initiative in 2015 and 2016 with respect to elections. Where possible, input from the public will be referenced and incorporated in the planning process.

## ALTERNATIVES

### Methodology

Option 2:
Electronic voting for advance period, including locations, and on Election Day. No paper voting at all.

This was the model used for the 2019 Special Election in Lower Sackville.

Option 3:
Electronic voting for advance period.

Electronic and paper available at one polling location per district on two advance polling days.

Paper only on Election Day. This was the model used for the 2016 election.

### Alternative Voting Dates

Council may choose to establish dates other than those recommended.

## ATTACHMENT

Attachment 1 - Voting method options

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A copy of this report can be obtained online at halifax.ca or by contacting the Office of the Municipal Clerk at 902.490.4210.

Report Prepared by: Trish Smith, Elections Coordinator, 902-490-6810

ATTACHMENT 1

VOTING METHOD OPTIONS

| Option 1 | Description | Comments | Opportunities |
|---|---|---|---|
| | RECOMMENDED OPTION | | |
| Electronic Voting (voting by telephone and a personal computing device) only for advanced period (no paper ballots at locations) and paper only voting on Election Day.<br><br>This was done in 2012 | • Alternative voting available to electors remotely starting at during the advance voting period.<br><br>• Electronic voting kiosks available at one polling location per district on two dates during the advance voting period.<br><br>• Paper ballots only on election day. | • Advance period polling locations will be well staffed with election workers ready to assist electors.<br><br>• There will be a full staffing component for Election Day with paper ballots at multiple locations per polling division. (approximately 1400 workers for the entire election)<br><br>• Projected budget: $2.3 million (unchanged by voting method chosen) | • Offers a variety of voting options for electors.<br><br>• Municipal electors have familiarity with both paper and electronic voting methods and have used them.<br><br>• Electronic voting provides opportunity for those who may not otherwise be able, to cast their ballot independently using tools familiar to them.<br><br>• Recognizes challenges in hiring staff and requires a reduced number of staff during the advanced period by having one polling location per district. |

| Option 2 | Description | Comments | Opportunities |
|---|---|---|---|
| | ALTERNATIVE OPTION | | |
| Only electronic voting (voting by telephone and a personal computing device) for the advance polls and on. Election Day. No paper voting at all.<br><br>This was the model used for the 2019 Special Election in Lower Sackville. | • Electronic voting available to electors remotely during the advance voting period.<br><br>• Electronic voting kiosks available at one polling location per district on two dates during the advance voting period.<br><br>• Electronic voting kiosks only at all polling locations on Election Day. | • All polling locations, both advance and on Election Day, will be well staffed with election workers ready to assist electors.<br><br>• During the 2019 special election, staff supported electors throughout the voting process as needed.<br><br>• There will be a full staffing component for Election Day to assist electors at multiple locations per polling division. (approximately 1400 workers for the entire election)<br><br>• Projected budget: $2.3 million (unchanged by voting method chosen) | • Municipal voters have familiarity with electronic voting methods and have used them.<br><br>• Electronic voting provides opportunity for those who may not otherwise be able, to cast their ballot independently using tools familiar to them.<br><br>• Recognizes challenges in hiring staff and requires a reduced number of staff during the advanced period by having one polling location per district.<br><br>• Method facilitates a timely reporting of the results. |

| Option 3 | Description | Comments | Opportunities |
|---|---|---|---|
| | | ALTERNATIVE OPTION | |
| Electronic voting (voting by telephone and a personal computing device) for advance period.<br><br>Electronic and paper available at one polling location per district on two advance polling days.<br><br>Paper voting only on Election Day. | • Electronic voting available to electors remotely during the advance voting period.<br><br>• Electronic voting kiosks and paper ballots available at one polling location per district on two dates during the advance voting period.<br><br>• Paper ballots only on Election Day. | • This was the 2016 model.<br><br>• There will be a full staffing component for Election Day with paper ballots at multiple locations per polling division. (approximately 1400 workers for the entire election)<br><br>• Projected budget: $2.3 million (unchanged by voting method chosen) | • Offers a variety of voting options for electors.<br><br>• Municipal electors have familiarity with both electronic voting methods and paper ballots.<br><br>• Recognizes challenges in hiring staff and requires a reduced number of staff during the advanced period by having one polling location per district. |

# TOWN OF LUNENBURG
# ALTERNATIVE VOTING BY-LAW

**BE IT ENACTED** by the Council of the Town of Lunenburg, under the authority of Section 146A of the Municipal Elections Act, 1989 R.S.N.S. c. 300, as amended, as follows:

**Short Title**

1. This By-law shall be known as the "Alternative Voting By-law".

**Definitions**

2. In this by-law:

(a) "Act" means the Municipal Elections Act, 1989 R.S.N.S. c. 300, as amended;

(b) "advance poll" means the Tuesday immediately preceding ordinary polling day; and either

i. one other day fixed by the Council by resolution that is either Thursday, the ninth day before ordinary polling day, or Saturday the seventh day before ordinary polling day; or

ii. if Council has delegated its authority to fix a day to the Returning Officer, one other day fixed by the Returning Officer that is either Thursday, the ninth day before ordinary polling day, or Saturday the seventh day before ordinary polling day;

(c) "alternative polling days" means any hours and dates fixed by a resolution of Council for alternative voting;

(d) "alternative voting" means voting by telephone or via the internet and includes a combination of telephone and internet voting;

(e) "ballot box" means a computer database in the system where cast internet ballots and telephone ballots are put;

(f) "candidate" means a person who has been nominated as a candidate pursuant to the Act;

(g) "Council" means the Council of the municipality;

(h) "Deputy Returning Officer" means a person appointed under the Act to preside over a polling station;

(i) "Education Act" means the Education (CSAP) Act, S.N.S. 1995-1996 c. 1, as amended;

(j) "election" means an election held pursuant to the Act, including a school board election, special election and a plebiscite;

(k) "Election Officer" means an "election officer" under the Act;

(l) "elector" means a person:

i. qualified to vote pursuant to the Act and the Education (CSAP) Act; and

ii. entitled to vote for an election pursuant to section 7 of this by-law;

(m) "friend voter" means a friend who votes for an elector pursuant to section 9 of this by-law;

(n) "internet ballot" means an image of a ballot on a personal computing device including all the choices available to an elector and the spaces in which an elector marks a vote;

(o) "list of electors" means:

i. prior to the list of electors being completed and certified by the Returning Officer pursuant to section 50A of the Act, the list of electors that has been amended and corrected by the Returning Officer pursuant to subsections 2 and 3 of section 38 of the Act; or

ii. the list of electors that has been completed and certified by the Retuning Officer pursuant to section 50A of the Act;

(p) "municipality" means the Town of Lunenburg;

(q) "normal business hours" means the time between 8:30 am and 4:30 pm Monday through to and including Friday;

(r) "ordinary polling day" means the third Saturday in October in a regular election year and in the case of any other election means the Saturday fixed for the election;

(s) "PIN" means the Personal Identification Number issued to an elector for alternative voting on alternative polling days;

(t) "plebiscite" means a plebiscite directed to be held by the Council pursuant to section 53 of the Municipal Government Act;

(u) "proxy voter" means an elector who votes by a proxy pursuant to the Act;

(v) "regular election year" means 2016 and every fourth year thereafter;

(w) "rejected ballot" means an internet ballot or a telephone ballot that has not been marked for any candidate;

(x) "Returning Officer" means a Returning Officer appointed pursuant to the Act;

(y) "school board" means the Conseil scolaire acadien provincial as referred to in the Education (CSAP) Act;

(z) "seal" means to secure the ballot box and prevent internet and telephone ballots from being cast;

(aa) "special election" means a special election held pursuant to the Act, including a special election for a vacancy on a school board;

(bb) "system" means the technology, including software, that:

i. records and counts votes; and
ii. processes and stores the results of alternative voting during alternative polling days;

(cc) "System Elections Officer" means:

i. a person who maintains, monitors, or audits the system, and

ii. a person who has access to the system beyond the access necessary to vote by alternative voting.

(dd) "telephone ballot" means:

i. an audio set of instructions which describes the voting choices available to an elector; and

ii. the marking of a selection by an elector by depressing the number on a touch tone keypad;

**Alternative Voting Permitted**

3.

(1) Subject to this by-law, alternative voting shall be permitted on alternative polling days.

(2) Council may, by resolution, provide that voting by telephone and by a personal computing device shall be the only means of voting for an election.

**Notification of Electors**

4.

(1) The Returning Officer shall cause notice of alternative polling days to be published in a newspaper circulating in the municipality.

(2) The notice of alternative polling days shall:

(a) identify the alternative polling days for alternative voting; and

(b) inform the elector that telephone voting and internet voting is permitted during alternative polling days.

(3) The notice may include any other information the Returning Officer deems necessary.

**Form of Telephone and Internet Ballots**

5.

(1) A telephone ballot and internet ballot shall:

(a) identify the title "Election for Mayor" or "Election for Councillor" or "Election for School Board Member", as the case may be;

(b) identify the names or names by which they are commonly known of the candidates with given names followed by surnames, arranged alphabetically in order of their surnames and, where necessary, their given names, and

(c) warn the elector to "vote for one candidate only" or "vote for not more than (the number of candidates to be elected) candidates" as the case may be.

(2) No title, honour, decoration or degree shall be included with a candidate's name on an internet ballot or telephone ballot.

**Oath**

6. Any oath that is authorized or required shall be made:

(a) In the form specified by the procedures and forms, or

(b) If the form is not specified by the procedures and forms, in the form required by the Act.

**Electors**

7. No person shall vote by alternative voting unless:

(a) the person's name appears on the applicable list of electors; or

(b) the person is added to the applicable list of electors pursuant to section 36 of the Act or section 7A of the by-law.

7A (1) Notwithstanding sections 33 and 38 of the Act, in addition to section 36 of the Act, a person may apply for an amendment to any list of electors by telephone after the first notice of the preliminary lists of electors is given pursuant to section 34 of the Act and before the end of alternative polling days and such amendment may be made by a revising officer or the Returning Officer in accordance with subsection 2.

(2) Notwithstanding subsection 36(2) of the Act, an application by telephone to be added to any list of electors shall be sufficiently detailed to allow the revising officer or Returning Officer to determine whether the information can be verified from other sources available to the revising officer or Returning Officer and, if the revising officer or Returning Officer determines that this is not possible, then the applicant shall be required to personally appear, at the location and time determined by the revising officer or Returning Officer, and make an application accompanied by a declaration under oath administered by the revising officer or the Returning Officer of the facts that support the application.

**Polling Station for Alternative Voting**

7B (1) If Council decides that voting by a telephone and by a personal computing device are the only means of voting for an election, the Returning Officer may establish at least one polling station for alternative voting and each polling station established shall be equipped with at least one device that is capable of casting either an internet ballot or telephone ballot.

(2) Any polling station for alternative voting shall be:

(a) available for electors who are voting with friend voters and for any other electors; and

(b) open on ordinary polling day and such other days and times as decided by the Returning Officer.

(3) Despite s. 58(1) of the Act, the Returning Officer may appoint a Deputy Returning Officer and Poll Clerk for each polling station for alternative voting, but is not required to do so.

**Proxy Voting**

8. A proxy voter shall not vote for an elector by alternative voting.

**Friend Voting**

9.

(1) A friend voter shall only vote for an elector by alternative voting if:

(a) an elector is unable to vote because :

i. the elector is blind;

ii. the elector cannot read; or

iii. the elector has a physical disability that prevents him or her from voting by alternative voting.

(b) the elector and the friend appear, in person, before the Returning Officer or the Deputy Returning Officer and take the prescribed oaths.

(2) A candidate shall not act as a friend voter unless the elector is a child, grandchild, brother, sister, parent, grandparent, or spouse of the candidate.

(3) The elector shall take an oath in the form prescribed by the Act providing that he or she is incapable of voting without assistance.

(4) The friend of the elector shall take an oath in the prescribed form to this by-law that:

(a) the friend has not previously acted as a friend for any other elector in the election other than an elector who is a child, grandchild, brother, sister, parent, grandparent, or spouse of the friend of the elector;

(b) the friend will mark the ballot as requested by the elector; and

(c) the friend will keep secret the choice of the elector.

(5) Where the elector requests assistance, the Deputy Returning Officer or Returning Officer may act as a friend of the elector but shall not be required to take the oath referred to in subsections (1) and (4)

(6) The Returning Officer or Deputy Returning Officer or Poll Clerk shall enter in the poll book:

(a) the reason why the elector is unable to vote;

(b) the name of the friend; and

(c) the fact that the oaths were taken.

**System Elections Officer**

9A (1) A System Elections Officer shall have access to the system prior to the commencement of alternative voting to verify the count for each candidate is zero.

(2) Notwithstanding the day and time set for alternative voting, alternative voting shall not commence until the counts for each of the candidates is zero.

9B A System Elections Officer shall comply with the procedures and forms established by the Returning Officer pursuant to the subsection 146A (4) of the Act.

**Voting**

10.

(1) The system shall put internet ballots and telephone ballots cast by an elector in the ballot box.

(2) The system shall put spoiled ballots in the ballot box.

**Seal**

11.

(1) Where alternative voting closes before the close of the polls on ordinary polling day, the system shall seal the ballot box until after the close of the poll on ordinary polling day.

(2) The system shall seal the ballot box even where fewer than ten persons from any polling district voted for a candidate during alternative polling days.

**List of persons who voted**

12. Where alternative voting closes before the close of the polls on ordinary polling day, the system shall:

(a) generate a list of all electors who voted by alternative voting; and

(b) on the applicable list of electors cause a line to be drawn through the name of all the electors who voted during alternative polling days.

13.

(1) A printed and electronic copy of the lists under section 12 shall be delivered to the Returning Officer within 24 hours of the close of alternative voting.

(2) Where alternative voting closes at the close of the polls on ordinary polling day, the system shall generate a list of all electors who voted by alternative voting.

**Counting**

14.

(1) At the close of ordinary polling day, the system shall generate a count of the telephone ballots and internet ballots in the ballot box that were cast for each candidate during alternative polling days.

(2) In counting the votes that were cast for each candidate during alternative polling days, the system shall not count rejected ballots.

**Tallying of Rejected Ballots**

15. At the close of ordinary polling day, the system shall tally the number of rejected ballots that were cast during alternative polling days and the tally shall be delivered to the Returning Officer.

**Recount by System**

16. In the event of a recount, the system shall regenerate the election count and a printed copy of the regenerated count shall be given to the Returning Officer.

17. If the initial count and the regenerated count match, the regenerated count shall be the final count of the votes cast by alternative voting.

18.

(1) If the regenerated count and the initial count do not match, the Returning Officer shall:

a) direct one final count be regenerated by the system of the votes cast by alternative voting, and

b) attend while the final count is being regenerated.

(2) The regenerated final count pursuant to subsection (1) shall be the final count of the votes cast by alternative voting.

**Recount by Court**

19.

(1) For a recount, the judge shall only consider the final count by the system, as determined by section 17 or 18, of the total number of votes that were cast by alternative voting for each candidate.

(2) The final count by the system, as determined by section 17 or 18, of the total number of votes that were cast by alternative voting for each candidate shall be added to the judge's count of the number of votes for each candidate cast by non-alternative voting.

(3) For elections for which there is no voting by paper ballot, there shall be no recount by a judge.

**Secrecy**

20. An election officer and System Elections Officer shall maintain and aid in maintaining the secrecy of the voting.

21. Every person in attendance at a polling station, or at the counting of the votes, shall maintain and aid in maintaining the secrecy of the voting.

**Other Methods of Voting**

22.

(1) If voting via the Internet through the unsupervised use of a personal computing device is permitted during an election, voting shall be permitted by some other means on each alternative polling day.

(2) Council may, by resolution, provide that voting by telephone and by personal computing device shall be the only means of voting for an election.

**Severability**

23. If a court of competent jurisdiction should declare any section or part of a section of this by-law to be invalid, such section or part of a section shall not be construed as having persuaded or influenced Council to pass the remainder of the by-law and it is hereby declared that the remainder of the by-law shall be valid and shall remain in force.

**Prohibitions**

24. No person shall:

(a) use another person's PIN to vote or access the system unless the person is a friend voter;

(b) take, seize, or deprive an elector of his or her PIN; or

(c) sell, gift, transfer, assign or purchase a PIN.

25. No person shall:

(a) interfere or attempt to interfere with an elector who is casting an internet ballot or telephone ballot;

(b) interfere or attempt to interfere with alternative voting; or

(c) attempt to ascertain the name of the candidate for whom an elector is about to vote or has voted.

26. No person shall, at any time, communicate or attempt to communicate any information relating to the candidate for whom an elector has voted.

26A No

(a) candidate,
(b) recognized agent, or
(c) person acting on behalf of or in support of a candidate,

shall provide a person with a personal computing device or telephone for the purposes of casting an internet ballot or a telephone ballot.

**Offences and Penalty**

27. (1) A person who:

(a) violates any provision of this by-law; or
(b) makes a false statement in a declaration; or
(c) permits anything to be done in violation of any provision of this by-law;

is guilty of an offence.

(2) A person who contravenes subsection (1) of this section is guilty of an offence and is liable, on summary conviction, to a penalty of not less than five thousand dollars and not more than ten thousand dollars and in default of payment, to imprisonment for a term of two years less a day, or both.

(3) In determining a penalty under subsection (2), a judge shall take into account:

(a) the number of votes attempted to be interfered with;

(b) the number of votes interfered with; and

(c) any potential interference with the outcome of an election.

(4) Pursuant to section 146A of the Act:

(a) the limitation period for the prosecution of an offence under this by-law is two years from the later of the date of the commission of the offence and the date on which it was discovered that an offence had been committed; and

(b) The Remission of Penalties Act, 1989 SNS c. 397, as amended, does not apply to a pecuniary penalty imposed by this by-law.

RESOLUTION OF COUNCIL
OF THE TOWN OF LUNENBURG
NOTICE OF MOTION (June 9, 2020)

**WHEREAS**

1. Town Council passed the following motion on October 22, 2019:

   "Motion: moved by Councillor Risser, seconded by Councillor Carnevale that the Town of Lunenburg continue to use paper-only balloting for the 2020 municipal election. Motion carried."

2. The COVID-19 Pandemic has created potentially serious difficulties for holding a paper-balloting election,

I therefore give Notice that I will, at the June 23, 2020 meeting of Council, be introducing (moving) a motion to rescind the aforesaid motion dated October 22, 2019.

_____

Councillor

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RESOLUTION OF COUNCIL
OF THE TOWN OF LUNENBURG
MOTION TO RESCIND (June 23, 2020)

**WHEREAS**

1. Town Council passed the following motion on October 22, 2019:

   > "Motion: moved by Councillor Risser, seconded by Councillor Carnevale that the Town of Lunenburg continue to use paper-only balloting for the 2020 municipal election. Motion carried."

2. The COVID-19 Pandemic has created potentially serious difficulties for holding a paper-balloting election.

**BE IT RESOLVED THAT** the aforesaid motion dated October 22, 2019 requiring an election by paper-ballot in the 2020 Municipal Election, is hereby rescinded.

intelivote systems inc
202 Brownlow Avenue, Suite 900, Dartmouth, NS, B3B 1T5 Phone 1(888) 481-1156

Mr. Patrick Burke
Returning Officer – 2020 Municipal Election
Town of Lunenburg
28 King Street
Lunenburg, NS, B0J 2C0

Via Email: burkelaw@wolffhaus.com

May 28, 2020

Re: eVoting Services – Intelivote Systems Inc.

Dear Pat,

Thank you for reaching out to us regarding your potential online voting requirements. As the Canadian leader of evoting services, I am pleased to provide you with this quote and description of our services for electronic voting services for your 2020 Municipal and CSAP School Board voting requirements.

This document is provided to you based on preliminary information I have received from our recent communication, the HRM RFP that was issued and awarded to us, as well as some assumptions we have made based on previously conducting over 45 online Municipal and School Board elections and by-elections in Nova Scotia, and over 215 online Municipal and School Board elections and by-elections in Ontario.

Intelivote has assumed that part of your mandate may be to increase eligible elector participation in your election, reduce and/or contain voting costs and manage administrative efforts and costs associated with the conducting of a local election. I know our solution can address all these issues.

It has also become abundantly clear to many of the election officials we have communicated with, that the current Covid-19 situation has added a further series of issues to the safety and willingness of election workers to work elections that require dealing in close proximity with eligible electors who may be looking to cast a paper ballot at a polling location. Added to this, the uncertainty of a potential second wave of the disease possibly becoming an issue in the fall, seems to be the impetus for many councils and election officials to consider evoting and allowing their citizens the option to vote from the comfort and safety of their homes.

I have attached an overview of our services and a detailed breakdown of the evoting services provided and a fee structure for your municipality, as well as the cost for Intelivote to manage the mail-out, by first class Canada Post mail, of the voter instruction letter including Personal Identification Numbers (PINs) to your eligible electors.

Please do not hesitate to contact me via email or call me at 1-888-481-1156 if you have any questions.

Yours truly,

Dean Smith
President and Founder

## Electronic Voting (eVoting) - Solution Overview

Intelivote Systems Inc. (ISI) a Canadian owned and operated company, is the recognized Canadian leader in the successful implementation of eVoting; members casting their ballots using the Internet, wireless devices and mobile or land line telephones.

The Intelivote solution even provides a seamless integration of traditional in-person polling station voting and mail-in balloting, with an electronic voting solution which includes telephone and Internet voting. ISI's leadership position comes as a result of our extensive experience in conducting municipal, union, association, and political leadership elections in a secure and auditable fashion ensuring voter anonymity and ballot privacy.

Intelivote has delivered more eVoting events in Canada than all our competitors combined and in addition to our Canadian elections and events, we have gained international experience and credibility in the successful implementation of both Internet and telephone based voting applications used to deliver elections in the United States and the United Kingdom.

Intelivote understands that, in addition to other event requirements, event officials' mandate includes containing event costs, managing administrative time/effort, and providing overall management for the voting event. These requirements are among the key objectives and benefits available through the implementation of eVoting options.

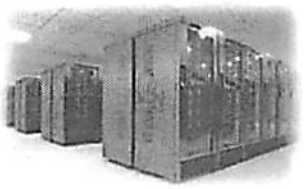
ISI's extensive subject matter expertise in Union, and Association Elections and voting events, Municipal Elections, and Political Party Leadership Elections, has resulted in a full suite of eVoting system modules that address the needs of both the event officials and members.

Intelivote does not sell its software; it is provided as a voting service. There is no additional software or hardware for clients to purchase to run a voting event using the Intelivote suite of modules. All the services are provided with our base service and all the modules are Internet enabled; secured by encryption, digital certificates and login IDs and passwords.

Voter anonymity, PIN security and event auditability are paramount in the design and delivery of the eVoting solutions ISI provides. In addition, the ability to import member information from clients' membership or eligible Member Lists, export updated member information and perform demographic and statistical analysis on voting activity, further demonstrates the flexibility of our voting solution.

The ability for authorized event officials to review information on particular aspects of the eVoting event as it progresses (member participation rates, etc.) provides increased visibility to those voting event metrics that can define a successful electronic voting event.

ISI maintains a hosted data centre environment in Halifax through Bell Canada, which also hosts some of the most sensitive government and financial applications running in Atlantic Canada. The full range of services we deliver, including high-speed high-bandwidth data capability, and scaleable IVR (telephone) port availability, further demonstrates our commitment to our ensuring an event with maximum performance, communications path diversity, application redundancy and high survivability.



ISI's project management capability, coupled with our established processes and procedures is delivered by a team of information systems professionals and electronic voting experts, providing clients with the best in-class Internet and telephone voting solution.

Our experience confirms that several other categories of electors; disabled electors, retirees, shift workers and electors travelling are positively impacted by offering electronic voting. It is clear that eVoting specifically and effectively addresses all their requirements while at the same time offering them a new degree of convenience and secrecy not offered in traditional balloting at a polling location.

The ability to cast your ballot using the telephone, in addition to the Internet, addresses another important social-economic issue often cited in Internet-only voting solutions. The fact that Internet enabled electors have a more ample opportunity to cast their ballot than those who do not have Internet service, has been defined as a form of "digital divide" between certain groups of citizens.

This demographic of electors who for various reasons, either are not comfortable with the technology, or cannot afford the technology (PC) and/or Internet service, or that the technology is not offered in their vicinity, are addressed by Intelivote's solution with the use of our telephone enabled voting. Typically, everyone has access to phone service, and this presents an equal opportunity to all electors. In municipal elections and union events conducted by Intelivote over the past several years, on average, up to 20% of eligible electors casting their ballot electronically used a phone to cast their vote, clearly confirming the value of this option. I expect this would be similar in your particular situation.

Intelivote has been proactive in accommodating persons with disabilities facilitating their comfort and participation when using eVoting services. Intelivote's solution is compliant with the guidelines as listed by the W3C technologies website principles which include organization, functionality and readability of information provided, as well as alternative ways of representing information (audio).

As traditional election costs continue to climb and municipal voting participation rates continue to drop, providing electors with choice in how they cast their ballot offers an opportunity to increase voter participation and selecting Intelivote as the service supplier provides our clients with the benefit of having one of Canada's most experienced providers

at your side during the entire voting period.

As noted earlier we are the Canadian leader in delivering eVoting services and **we are the only eVoting service organization with Federal Government security clearance for all our personnel, and our operations location.** This is in support of our selection as the supplier to the Federal Government of Canada for all the security clearance required eVoting performed by the Canadian Industrial Relations Board, and the Public Service Labour Relations Board.

In addition to having delivered the most Municipal Elections of all the service suppliers in Canada, our client list includes many of Canada's largest unions and associations and includes other organizations we have successfully delivered a variety of events that support their AGM's, executive and board elections, job action votes and agreement votes. A sample of our over 2,000 elections include services for these clients:

| | |
|---|---|
| • Ontario Municipal & School Board Elections - 215 Events | • Nova Scotia Municipal & School Board Elections – 45 Events |
| • Canada Industrial Relations Board (CIRB) – over 30 events | • State of Washington - Public Employment Relations Commission |
| • Newfoundland and Labrador Assoc. of Public and Private Employees (NAPE) | • Nova Scotia Gov. Employees Union - NSGEU - over 25 events |
| • New Brunswick Union of Public and Private Employees (NBPEA) | • Public Service Alliance of Canada – (PSAC) - over 20 events |
| • Public Service Labour Relations Board | • Nova Scotia Paramedics (IUOE) |
| • Nova Scotia Nurses Union | • Telecommunications Workers Union |
| • Elementary Teachers of Toronto (ETT) | • Canadian Flight Attendant Union |
| • Toronto Secondary Unit Teachers -TSU | • Manitoba Health Authority |
| • Unifor (numerous locals) | • Association of Cdn. Financial Officers |
| • Nurses Association of NB | • Teamsters Canada Rail Conference |
| • CUPE (numerous locals) | • Teamsters (numerous locals) |
| • IBEW (numerous locals) | • Canadian Merchant Services Guild |
| • Customs and Immigration Union (CIU) | • ACTRA |
| • Union of BC Performers | • Canada Actors Equity Assoc. (CAEA) |
| • Professional Association of Foreign Service Officers (PAFSO) | • United Steelworkers – USW (numerous locals) |
| • Association of Academic Staff University of Alberta (AASUA) | • Telecommunications Employees Association of Manitoba (TEAM) |
| • Canadian Broadcasting Corporation | • Doctors Nova Scotia |
| • Association of Municipal Clerks and Treasurers of Ontario (AMCTO) | • Confédération des syndicats nationaux (CSN) – numerous events |
| • Canadian Aboriginal and First Nations - over 15 events | • Canadian Political Leadership Elections (14) |
| • Alberta Labour Relations Board | • Ontario Labour Relations Board |

## Intelivote Modules

A series of modules are included in the Intelivote system that ensure all the key stakeholders in the eVoting process are provided with the information they require to perform their tasks in support of the event. These include:

- Auditor Module – provides support for an independent third party to formally audit the voting and availability of the system during the eVoting period.
- Ballot Review module – provides the opportunity for event officials to review the spelling and audio quality of information appearing on the eVoting ballots prior to the voting event starting.
- Chief Electoral Officer (CEO) module – provides an interactive monitoring and reporting capability to review the activity of the electors as the eVoting progresses.
- Voter Help module – provides assistance to electors who contact the HelpLine by allowing agents to review and query the status of a elector's activity. It is important to note that the agent can never see how a voter has cast their ballot.
- Voter Help Supervisor module – provides supervisory administration and management of the Voter HelpLine agents and their activities.
- Enumerator module – provides the event officials the opportunity to add eligible elector to the Electors List during a defined enumeration period.
- Deputy Returning Office (DRO) module – provides the DRO the capability to manage the electors appearing at a manual polling location by providing a capability to lookup electors, review their status within the eVoting system and strike them off the official list when a paper ballot is issued.
- Candidate module – offers candidates the opportunity to review and track elector's "attendance" whether they are using electronic voting or manual voting and assists them in "getting the vote out".
- Voter module – facilitates electors casting their ballots using either a phone or an Internet enabled device.

The opportunity to provide your electors with the option of electronic voting is an important step in the evolution of democracy and will give electors the convenience of "Choice" in the method of casting their ballot in your election. Intelivote Systems has the experience and has laid the groundwork to ensure that when this step is taken it will be placed on a firm foundation.

## Electronic Voting – Services Table

There is a significant amount of flexibility in both the system capability and the methods by which an electronic vote can occur. Listed below are some of the most common features/services:

1. Voting will be enabled by implementation of the eVoting solution, (phone and Internet) allowing voting over a 7-12 (typically) day period, 24 hours a day.
2. The municipality will provide Voter Help Line services staffed by their personnel. Hours of operation will be determined by the municipality. Intelivote will train your staff to perform the service at no additional cost.
3. Creation and mail-out of the Personal Identification Numbers and Voter Instruction Letters by Canada Post required for electors to vote, will be provided based upon the Electors List provided by the client, through Elections Nova Scotia.
4. Internet and telephone voting are in English and French (if required).
5. All training for election personnel required to assist with the event.

**Services Pricing**

Pricing ± to be adjusted based on Eligible Electors once the Final Voters List is produced.

| Per Elector eVote Fee | Estimated # Eligible Members | Voter Letter Printing & Postage Rate |
|---|---|---|
| $1.25 | 1,850 | $1.20 |
| eVoting Costs Summary | | |
| Intelivote eVoting Solution | Electronic voting using the Internet and telephone, provided to the list of eligible electors. | $2,313 |
| Voter Instruction Letter | Cost of creation, production, supplies for producing and mailing the Voter Instruction Letter. This is based on a single page letter with black & white print and includes the cost of Canada Post postage for the mail-out. | $2,220 |
| | Total | $4,533 |

Applicable taxes are additional

Notes:

1. An Intelivote eVoting consultant/project manager is included in the services pricing and assigned to your event to assist and direct all aspects of your vote.

2. Training and support during the event are included in the price of the service.

## Base Services

| # | Base Fee Services Included | Description | Not Included |
|---|---|---|---|
| 1 | Multiple voting channels | Provides the elector with a choice of voting channel: internet, wireless device, and mobile or land line telephone. Includes the activities associated with the telecommunications setup for electronic voting; appropriate bandwidth; phone ports; website registration etc. | Elector equipment / hardware; equipment and internet connections for the Polling Stations (if required). |
| 2 | Voting event system setup | This eVoting system is fully configurable, facilitating a wide array of voting configuration options. All activity associated with configuring the event is included in the base service.<br>This includes such activities as: candidate or question assignment; race and candidate name recordings; elector list management; secure ID and password management; configuring and loading races/questions (i.e. type of race, sequence and presentation display). | |
| 3 | PIN management | Intelivote Systems will generate the PINs using the eligible elector population to determine the required PIN length and to determine the number of additional PINs required as spares. A unique PIN will be created for each eligible elector based on the file provided by the owner of the list.<br>In addition to the PIN, an eligible elector category is created and finally a file is produced suitable for production of voter instruction letters. | |
| 4 | Customization of voter instructions | Creation of the Voter Instruction Letter providing specific instructions on how to successfully use the electronic voting process. | |
| 5 | Customized welcome webpage | Generation of a customized webpage working with the client ensuring all legislative issues and association by-laws relating to voter notification are adequately addressed. | |
| 6 | Full enumeration capability | Provides the ability to add electors to the official electors list, assign the necessary categorization based on geography or local for example, and issue a PIN for voting purposes. | Equipment or hardware used by the returning officer or clerk. A standard PC with internet access is required. |

| # | Base Fee Services Included | Description | Not Included |
|---|---|---|---|
| 7 | Support module for Voter's HelpLine | The Voter HelpLine workers will have secure login access to the Voter HelpLine module. It provides a full set of features designed for agents to provide support to electors who may have questions regarding the event or issues relating to the elector profile, PINs, etc. | The Voter HelpLine Centre and the agents who staff it. Telecommunications costs for the Voter HelpLine. Equipment or hardware used by the staff. Standard PCs with internet access are required. |
| 8 | Event Official(s) management tools | The Event Officials will have a secure login which will allow for an up-to-the-minute view of critical eVoting data, required for the administration of the eVoting event. | Equipment or hardware used by the Event Official, standard PC with internet access is required. |
| 9 | Auditor control & management tools | The Auditor will have a secure login capability to audit the various processes as determined by the eVoting event authorities. They will have the capability to observe the voting event as it progresses, monitoring voting activity to the candidate level in a secure mode available only to them. | Equipment or hardware used by the Auditor. A standard PC with internet access is required. |
| 10 | Candidate 'Supporter Tracking' capability | Prior to and during the eVoting event, candidates will have the ability to identify their lists of supporters using a secure login in the Candidate module. During the voting period the candidate or approved designate can track the participation of supporters online. | Equipment or hardware used by the Candidate. A standard PC with internet access is required. |
| 11 | Reporting | A series of reports are available both during and after the voting event. These include vote results, audit reports, participation rate reports etc. | |
| 12 | Training | Training available on the features and use of the Auditor, CEO, Candidate, Enumeration, and Voter HelpLine modules. Training is normally provided via web training. | |
| 13 | Account Management | An experienced eVoting consultant, who assists with all aspects of the event and who is the single point-of-contact for the client. | |

Burke, Macdonald & Luczak

Patrick A. Burke Q.C. <burkelaw@wolffhaus.com>

# Intelivote information

1 message

**Dean Smith** <dean.smith@intelivote.com> Fri, May 29, 2020 at 12:39 AM
To: "burkelaw@wolffhaus.com" <burkelaw@wolffhaus.com>

Hi Pat;

As per your request attached please find an overview of Intelivote and some pricing information for the 2020 Municipal election for the Town of Lunenburg.

Please do not hesitate to contact me if you have any questions.

Regards

Dean

**Dean Smith | President and Founder**

**Intelivote Systems Inc.**

202 Brownlow Avenue, Suite 900

Dartmouth, NS, B3B 1T5

Office (902) 481-1156

Mobile (902) 471-1582

www.intelivote.com

**Intelivote eVoting Solution Overview and Quote -Lunenburg Town May 28 2020.pdf**
421K

RESOLUTION OF COUNCIL
OF THE TOWN OF LUNENBURG
NOTICE OF MOTION – BYLAW (June 9, 2020)

**WHEREAS** the COVID-19 Pandemic will create significant challenges and risks associated with a paper-balloting election,

I therefore give Notice that I will, at the June 23, 2020 meeting of Council, be introducing (moving) a motion to give first reading of the Alternative Voting Bylaw attached hereto as Schedule AVB.

_____

Councillor

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## Schedule AVB

## TOWN OF LUNENBURG
## ALTERNATIVE VOTING BY-LAW

**BE IT ENACTED** by the Council of the Town of Lunenburg, under the authority of Section 146A of the Municipal Elections Act, 1989 R.S.N.S. c. 300, as amended, as follows:

### Short Title

1. This By-law shall be known as the "Alternative Voting By-law".

### Definitions

2. In this by-law:

    (a) "Act" means the Municipal Elections Act, 1989 R.S.N.S. c. 300, as amended;

    (b) "advance poll" means the Tuesday immediately preceding ordinary polling day; and either

        i. one other day fixed by the Council by resolution that is either Thursday, the ninth day before ordinary polling day, or Saturday the seventh day before ordinary polling day; or

        ii. if Council has delegated its authority to fix a day to the Returning Officer, one other day fixed by the Returning Officer that is either Thursday, the ninth day before ordinary polling day, or Saturday the seventh day before ordinary polling day;

    (c) "alternative polling days" means any hours and dates fixed by a resolution of Council for alternative voting;

    (d) "alternative voting" means voting by telephone or via the internet and includes a combination of telephone and internet voting;

    (e) "ballot box" means a computer database in the system where cast internet ballots and telephone ballots are put;

    (f) "candidate" means a person who has been nominated as a candidate pursuant to the Act;

    (g) "Council" means the Council of the municipality;

    (h) "Deputy Returning Officer" means a person appointed under the Act to preside over a polling station;

    (i) "Education Act" means the Education (CSAP) Act, S.N.S. 1995-1996 c. 1, as amended;

(j) "election" means an election held pursuant to the Act, including a school board election, special election and a plebiscite;

(k) "Election Officer" means an "election officer" under the Act;

(l) "elector" means a person:

i. qualified to vote pursuant to the Act and the Education (CSAP) Act; and

ii. entitled to vote for an election pursuant to section 7 of this by-law;

(m) "friend voter" means a friend who votes for an elector pursuant to section 9 of this by-law;

(n) "internet ballot" means an image of a ballot on a personal computing device including all the choices available to an elector and the spaces in which an elector marks a vote;

(o) "list of electors" means:

i. prior to the list of electors being completed and certified by the Returning Officer pursuant to section 50A of the Act, the list of electors that has been amended and corrected by the Returning Officer pursuant to subsections 2 and 3 of section 38 of the Act; or

ii. the list of electors that has been completed and certified by the Retuning Officer pursuant to section 50A of the Act;

(p) "municipality" means the Town of Lunenburg;

(q) "normal business hours" means the time between 8:30 am and 4:30 pm Monday through to and including Friday;

(r) "ordinary polling day" means the third Saturday in October in a regular election year and in the case of any other election means the Saturday fixed for the election;

(s) "PIN" means the Personal Identification Number issued to an elector for alternative voting on alternative polling days;

(t) "plebiscite" means a plebiscite directed to be held by the Council pursuant to section 53 of the Municipal Government Act;

(u) "proxy voter" means an elector who votes by a proxy pursuant to the Act;

(v) "regular election year" means 2016 and every fourth year thereafter;

(w) "rejected ballot" means an internet ballot or a telephone ballot that has not been marked for any candidate;

(x) "Returning Officer" means a Returning Officer appointed pursuant to the Act;

(y) "school board" means the Conseil scolaire acadien provincial as referred to in the Education (CSAP) Act;

(z) "seal" means to secure the ballot box and prevent internet and telephone ballots from being cast;

(aa) "special election" means a special election held pursuant to the Act, including a special election for a vacancy on a school board;

(bb) "system" means the technology, including software, that:

i. records and counts votes; and
ii. processes and stores the results of alternative voting during alternative polling days;

(cc) "System Elections Officer" means:

i. a person who maintains, monitors, or audits the system, and

ii. a person who has access to the system beyond the access necessary to vote by alternative voting.

(dd) "telephone ballot" means:

i. an audio set of instructions which describes the voting choices available to an elector; and

ii. the marking of a selection by an elector by depressing the number on a touch tone keypad;

**Alternative Voting Permitted**

3.

(1) Subject to this by-law, alternative voting shall be permitted on alternative polling days.

(2) Council may, by resolution, provide that voting by telephone and by a personal computing device shall be the only means of voting for an election.

**Notification of Electors**

4.

(1) The Returning Officer shall cause notice of alternative polling days to be published in a newspaper circulating in the municipality.

(2) The notice of alternative polling days shall:

(a) identify the alternative polling days for alternative voting; and

(b) inform the elector that telephone voting and internet voting is permitted during alternative polling days.

(3) The notice may include any other information the Returning Officer deems necessary.

**Form of Telephone and Internet Ballots**

5.

(1) A telephone ballot and internet ballot shall:

(a) identify the title "Election for Mayor" or "Election for Councillor" or "Election for School Board Member", as the case may be;

(b) identify the names or names by which they are commonly known of the candidates with given names followed by surnames, arranged alphabetically in order of their surnames and, where necessary, their given names, and

(c) warn the elector to "vote for one candidate only" or "vote for not more than (the number of candidates to be elected) candidates" as the case may be.

(2) No title, honour, decoration or degree shall be included with a candidate's name on an internet ballot or telephone ballot.

**Oath**

6. Any oath that is authorized or required shall be made:

(a) In the form specified by the procedures and forms, or

(b) If the form is not specified by the procedures and forms, in the form required by the Act.

**Electors**

7. No person shall vote by alternative voting unless:

(a) the person's name appears on the applicable list of electors; or

(b) the person is added to the applicable list of electors pursuant to section 36 of the Act or section 7A of the by-law.

7A (1) Notwithstanding sections 33 and 38 of the Act, in addition to section 36 of the Act, a person may apply for an amendment to any list of electors by telephone after the first notice of the preliminary lists of electors is given pursuant to section 34 of the Act and before the end of alternative polling days and such amendment may be made by a revising officer or the Returning Officer in accordance with subsection 2.

(2) Notwithstanding subsection 36(2) of the Act, an application by telephone to be added to any list of electors shall be sufficiently detailed to allow the revising officer or Returning Officer to determine whether the information can be verified from other sources available to the revising officer or Returning Officer and, if the revising officer or Returning Officer determines that this is not possible, then the applicant shall be required to personally appear, at the location and time determined by the revising officer or Returning Officer, and make an application accompanied by a declaration under oath administered by the revising officer or the Returning Officer of the facts that support the application.

**Polling Station for Alternative Voting**

7B (1) If Council decides that voting by a telephone and by a personal computing device are the only means of voting for an election, the Returning Officer may establish at least one polling station for alternative voting and each polling station established shall be equipped with at least one device that is capable of casting either an internet ballot or telephone ballot.

(2) Any polling station for alternative voting shall be:

(a) available for electors who are voting with friend voters and for any other electors; and

(b) open on ordinary polling day and such other days and times as decided by the Returning Officer.

(3) Despite s. 58(1) of the Act, the Returning Officer may appoint a Deputy Returning Officer and Poll Clerk for each polling station for alternative voting, but is not required to do so.

**Proxy Voting**

8. A proxy voter shall not vote for an elector by alternative voting.

**Friend Voting**

9.

(1) A friend voter shall only vote for an elector by alternative voting if:

(a) an elector is unable to vote because :

i. the elector is blind;

ii. the elector cannot read; or

iii. the elector has a physical disability that prevents him or her from voting by alternative voting.

(b) the elector and the friend appear, in person, before the Returning Officer or the Deputy Returning Officer and take the prescribed oaths.

(2) A candidate shall not act as a friend voter unless the elector is a child, grandchild, brother, sister, parent, grandparent, or spouse of the candidate.

(3) The elector shall take an oath in the form prescribed by the Act providing that he or she is incapable of voting without assistance.

(4) The friend of the elector shall take an oath in the prescribed form to this by-law that:

(a) the friend has not previously acted as a friend for any other elector in the election other than an elector who is a child, grandchild, brother, sister, parent, grandparent, or spouse of the friend of the elector;

(b) the friend will mark the ballot as requested by the elector; and

(c) the friend will keep secret the choice of the elector.

(5) Where the elector requests assistance, the Deputy Returning Officer or Returning Officer may act as a friend of the elector but shall not be required to take the oath referred to in subsections (1) and (4)

(6) The Returning Officer or Deputy Returning Officer or Poll Clerk shall enter in the poll book:

(a) the reason why the elector is unable to vote;

(b) the name of the friend; and

(c) the fact that the oaths were taken.

**System Elections Officer**

9A (1) A System Elections Officer shall have access to the system prior to the commencement of alternative voting to verify the count for each candidate is zero.

(2) Notwithstanding the day and time set for alternative voting, alternative voting shall not commence until the counts for each of the candidates is zero.

9B A System Elections Officer shall comply with the procedures and forms established by the Returning Officer pursuant to the subsection 146A (4) of the Act.

**Voting**

10.

(1) The system shall put internet ballots and telephone ballots cast by an elector in the ballot box.

(2) The system shall put spoiled ballots in the ballot box.

**Seal**

11.

(1) Where alternative voting closes before the close of the polls on ordinary polling day, the system shall seal the ballot box until after the close of the poll on ordinary polling day.

(2) The system shall seal the ballot box even where fewer than ten persons from any polling district voted for a candidate during alternative polling days.

**List of persons who voted**

12. Where alternative voting closes before the close of the polls on ordinary polling day, the system shall:

(a) generate a list of all electors who voted by alternative voting; and

(b) on the applicable list of electors cause a line to be drawn through the name of all the electors who voted during alternative polling days.

13.

(1) A printed and electronic copy of the lists under section 12 shall be delivered to the Returning Officer within 24 hours of the close of alternative voting.

(2) Where alternative voting closes at the close of the polls on ordinary polling day, the system shall generate a list of all electors who voted by alternative voting.

**Counting**

14.

(1) At the close of ordinary polling day, the system shall generate a count of the telephone ballots and internet ballots in the ballot box that were cast for each candidate during alternative polling days.

(2) In counting the votes that were cast for each candidate during alternative polling days, the system shall not count rejected ballots.

**Tallying of Rejected Ballots**

15. At the close of ordinary polling day, the system shall tally the number of rejected ballots that were cast during alternative polling days and the tally shall be delivered to the Returning Officer.

**Recount by System**

16. In the event of a recount, the system shall regenerate the election count and a printed copy of the regenerated count shall be given to the Returning Officer.

17. If the initial count and the regenerated count match, the regenerated count shall be the final count of the votes cast by alternative voting.

18.

(1) If the regenerated count and the initial count do not match, the Returning Officer shall:

a) direct one final count be regenerated by the system of the votes cast by alternative voting, and

b) attend while the final count is being regenerated.

(2) The regenerated final count pursuant to subsection (1) shall be the final count of the votes cast by alternative voting.

**Recount by Court**

19.

(1) For a recount, the judge shall only consider the final count by the system, as determined by section 17 or 18, of the total number of votes that were cast by alternative voting for each candidate.

(2) The final count by the system, as determined by section 17 or 18, of the total number of votes that were cast by alternative voting for each candidate shall be added to the judge's count of the number of votes for each candidate cast by non-alternative voting.

(3) For elections for which there is no voting by paper ballot, there shall be no recount by a judge.

**Secrecy**

20. An election officer and System Elections Officer shall maintain and aid in maintaining the secrecy of the voting.

21. Every person in attendance at a polling station, or at the counting of the votes, shall maintain and aid in maintaining the secrecy of the voting.

**Other Methods of Voting**

22.

(1) If voting via the Internet through the unsupervised use of a personal computing device is permitted during an election, voting shall be permitted by some other means on each alternative polling day.

(2) Council may, by resolution, provide that voting by telephone and by personal computing device shall be the only means of voting for an election.

**Severability**

23. If a court of competent jurisdiction should declare any section or part of a section of this by-law to be invalid, such section or part of a section shall not be construed as having persuaded or influenced Council to pass the remainder of the by-law and it is hereby declared that the remainder of the by-law shall be valid and shall remain in force.

**Prohibitions**

24. No person shall:

(a) use another person's PIN to vote or access the system unless the person is a friend voter;

(b) take, seize, or deprive an elector of his or her PIN; or

(c) sell, gift, transfer, assign or purchase a PIN.

25. No person shall:

(a) interfere or attempt to interfere with an elector who is casting an internet ballot or telephone ballot;

(b) interfere or attempt to interfere with alternative voting; or

(c) attempt to ascertain the name of the candidate for whom an elector is about to vote or has voted.

26. No person shall, at any time, communicate or attempt to communicate any information relating to the candidate for whom an elector has voted.

26A No

(a) candidate,
(b) recognized agent, or
(c) person acting on behalf of or in support of a candidate,

shall provide a person with a personal computing device or telephone for the purposes of casting an internet ballot or a telephone ballot.

**Offences and Penalty**

27. (1) A person who:

(a) violates any provision of this by-law; or
(b) makes a false statement in a declaration; or
(c) permits anything to be done in violation of any provision of this by-law;

is guilty of an offence.

(2) A person who contravenes subsection (1) of this section is guilty of an offence and is liable, on summary conviction, to a penalty of not less than five thousand

dollars and not more than ten thousand dollars and in default of payment, to imprisonment for a term of two years less a day, or both.

(3) In determining a penalty under subsection (2), a judge shall take into account:

(a) the number of votes attempted to be interfered with;

(b) the number of votes interfered with; and

(c) any potential interference with the outcome of an election.

(4) Pursuant to section 146A of the Act:

(a) the limitation period for the prosecution of an offence under this by-law is two years from the later of the date of the commission of the offence and the date on which it was discovered that an offence had been committed; and

(b) The Remission of Penalties Act, 1989 SNS c. 397, as amended, does not apply to a pecuniary penalty imposed by this by-law.

RESOLUTION OF COUNCIL
OF THE TOWN OF LUNENBURG
FIRST READING OF BYLAW (June 23, 2020)

**WHEREAS** the COVID-19 Pandemic will create significant challenges and risks associated with a paper-balloting election,

**BE IT RESOLVED THAT** First Reading of the Alternative Voting Bylaw [attached hereto as Schedule AVB] is hereby given

**[BEA – Do we refer to the date of the 2nd and Final Reading and the Advertisement?]**

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## Schedule AVB

## TOWN OF LUNENBURG
## ALTERNATIVE VOTING BY-LAW

**BE IT ENACTED** by the Council of the Town of Lunenburg, under the authority of Section 146A of the Municipal Elections Act, 1989 R.S.N.S. c. 300, as amended, as follows:

### Short Title

1. This By-law shall be known as the "Alternative Voting By-law".

### Definitions

2. In this by-law:

    (a) "Act" means the Municipal Elections Act, 1989 R.S.N.S. c. 300, as amended;

    (b) "advance poll" means the Tuesday immediately preceding ordinary polling day; and either

        i. one other day fixed by the Council by resolution that is either Thursday, the ninth day before ordinary polling day, or Saturday the seventh day before ordinary polling day; or

        ii. if Council has delegated its authority to fix a day to the Returning Officer, one other day fixed by the Returning Officer that is either Thursday, the ninth day before ordinary polling day, or Saturday the seventh day before ordinary polling day;

    (c) "alternative polling days" means any hours and dates fixed by a resolution of Council for alternative voting;

    (d) "alternative voting" means voting by telephone or via the internet and includes a combination of telephone and internet voting;

    (e) "ballot box" means a computer database in the system where cast internet ballots and telephone ballots are put;

    (f) "candidate" means a person who has been nominated as a candidate pursuant to the Act;

    (g) "Council" means the Council of the municipality;

    (h) "Deputy Returning Officer" means a person appointed under the Act to preside over a polling station;

    (i) "Education Act" means the Education (CSAP) Act, S.N.S. 1995-1996 c. 1, as amended;

(j) "election" means an election held pursuant to the Act, including a school board election, special election and a plebiscite;

(k) "Election Officer" means an "election officer" under the Act;

(l) "elector" means a person:

i. qualified to vote pursuant to the Act and the Education (CSAP) Act; and

ii. entitled to vote for an election pursuant to section 7 of this by-law;

(m) "friend voter" means a friend who votes for an elector pursuant to section 9 of this by-law;

(n) "internet ballot" means an image of a ballot on a personal computing device including all the choices available to an elector and the spaces in which an elector marks a vote;

(o) "list of electors" means:

i. prior to the list of electors being completed and certified by the Returning Officer pursuant to section 50A of the Act, the list of electors that has been amended and corrected by the Returning Officer pursuant to subsections 2 and 3 of section 38 of the Act; or

ii. the list of electors that has been completed and certified by the Retuning Officer pursuant to section 50A of the Act;

(p) "municipality" means the Town of Lunenburg;

(q) "normal business hours" means the time between 8:30 am and 4:30 pm Monday through to and including Friday;

(r) "ordinary polling day" means the third Saturday in October in a regular election year and in the case of any other election means the Saturday fixed for the election;

(s) "PIN" means the Personal Identification Number issued to an elector for alternative voting on alternative polling days;

(t) "plebiscite" means a plebiscite directed to be held by the Council pursuant to section 53 of the Municipal Government Act;

(u) "proxy voter" means an elector who votes by a proxy pursuant to the Act;

(v) "regular election year" means 2016 and every fourth year thereafter;

(w) "rejected ballot" means an internet ballot or a telephone ballot that has not been marked for any candidate;

(x) "Returning Officer" means a Returning Officer appointed pursuant to the Act;

(y) "school board" means the Conseil scolaire acadien provincial as referred to in the Education (CSAP) Act;

(z) "seal" means to secure the ballot box and prevent internet and telephone ballots from being cast;

(aa) "special election" means a special election held pursuant to the Act, including a special election for a vacancy on a school board;

(bb) "system" means the technology, including software, that:

i. records and counts votes; and
ii. processes and stores the results of alternative voting during alternative polling days;

(cc) "System Elections Officer" means:

i. a person who maintains, monitors, or audits the system, and

ii. a person who has access to the system beyond the access necessary to vote by alternative voting.

(dd) "telephone ballot" means:

i. an audio set of instructions which describes the voting choices available to an elector; and

ii. the marking of a selection by an elector by depressing the number on a touch tone keypad;

**Alternative Voting Permitted**

3.

(1) Subject to this by-law, alternative voting shall be permitted on alternative polling days.

(2) Council may, by resolution, provide that voting by telephone and by a personal computing device shall be the only means of voting for an election.

**Notification of Electors**

4.

(1) The Returning Officer shall cause notice of alternative polling days to be published in a newspaper circulating in the municipality.

(2) The notice of alternative polling days shall:

(a) identify the alternative polling days for alternative voting; and

(b) inform the elector that telephone voting and internet voting is permitted during alternative polling days.

(3) The notice may include any other information the Returning Officer deems necessary.

**Form of Telephone and Internet Ballots**

5.

(1) A telephone ballot and internet ballot shall:

(a) identify the title "Election for Mayor" or "Election for Councillor" or "Election for School Board Member", as the case may be;

(b) identify the names or names by which they are commonly known of the candidates with given names followed by surnames, arranged alphabetically in order of their surnames and, where necessary, their given names, and

(c) warn the elector to "vote for one candidate only" or "vote for not more than (the number of candidates to be elected) candidates" as the case may be.

(2) No title, honour, decoration or degree shall be included with a candidate's name on an internet ballot or telephone ballot.

**Oath**

6. Any oath that is authorized or required shall be made:

(a) In the form specified by the procedures and forms, or

(b) If the form is not specified by the procedures and forms, in the form required by the Act.

**Electors**

7. No person shall vote by alternative voting unless:

(a) the person's name appears on the applicable list of electors; or

(b) the person is added to the applicable list of electors pursuant to section 36 of the Act or section 7A of the by-law.

7A (1) Notwithstanding sections 33 and 38 of the Act, in addition to section 36 of the Act, a person may apply for an amendment to any list of electors by telephone after the first notice of the preliminary lists of electors is given pursuant to section 34 of the Act and before the end of alternative polling days and such amendment may be made by a revising officer or the Returning Officer in accordance with subsection 2.

(2) Notwithstanding subsection 36(2) of the Act, an application by telephone to be added to any list of electors shall be sufficiently detailed to allow the revising officer or Returning Officer to determine whether the information can be verified from other sources available to the revising officer or Returning Officer and, if the revising officer or Returning Officer determines that this is not possible, then the applicant shall be required to personally appear, at the location and time determined by the revising officer or Returning Officer, and make an application accompanied by a declaration under oath administered by the revising officer or the Returning Officer of the facts that support the application.

**Polling Station for Alternative Voting**

7B (1) If Council decides that voting by a telephone and by a personal computing device are the only means of voting for an election, the Returning Officer may establish at least one polling station for alternative voting and each polling station established shall be equipped with at least one device that is capable of casting either an internet ballot or telephone ballot.

(2) Any polling station for alternative voting shall be:

(a) available for electors who are voting with friend voters and for any other electors; and

(b) open on ordinary polling day and such other days and times as decided by the Returning Officer.

(3) Despite s. 58(1) of the Act, the Returning Officer may appoint a Deputy Returning Officer and Poll Clerk for each polling station for alternative voting, but is not required to do so.

**Proxy Voting**

8. A proxy voter shall not vote for an elector by alternative voting.

**Friend Voting**

9.

(1) A friend voter shall only vote for an elector by alternative voting if:

(a) an elector is unable to vote because :

i. the elector is blind;

ii. the elector cannot read; or

iii. the elector has a physical disability that prevents him or her from voting by alternative voting.

(b) the elector and the friend appear, in person, before the Returning Officer or the Deputy Returning Officer and take the prescribed oaths.

(2) A candidate shall not act as a friend voter unless the elector is a child, grandchild, brother, sister, parent, grandparent, or spouse of the candidate.

(3) The elector shall take an oath in the form prescribed by the Act providing that he or she is incapable of voting without assistance.

(4) The friend of the elector shall take an oath in the prescribed form to this by-law that:

(a) the friend has not previously acted as a friend for any other elector in the election other than an elector who is a child, grandchild, brother, sister, parent, grandparent, or spouse of the friend of the elector;

(b) the friend will mark the ballot as requested by the elector; and

(c) the friend will keep secret the choice of the elector.

(5) Where the elector requests assistance, the Deputy Returning Officer or Returning Officer may act as a friend of the elector but shall not be required to take the oath referred to in subsections (1) and (4)

(6) The Returning Officer or Deputy Returning Officer or Poll Clerk shall enter in the poll book:

(a) the reason why the elector is unable to vote;

(b) the name of the friend; and

(c) the fact that the oaths were taken.

**System Elections Officer**

9A (1) A System Elections Officer shall have access to the system prior to the commencement of alternative voting to verify the count for each candidate is zero.

(2) Notwithstanding the day and time set for alternative voting, alternative voting shall not commence until the counts for each of the candidates is zero.

9B A System Elections Officer shall comply with the procedures and forms established by the Returning Officer pursuant to the subsection 146A (4) of the Act.

**Voting**

10.

(1) The system shall put internet ballots and telephone ballots cast by an elector in the ballot box.

(2) The system shall put spoiled ballots in the ballot box.

**Seal**

11.

(1) Where alternative voting closes before the close of the polls on ordinary polling day, the system shall seal the ballot box until after the close of the poll on ordinary polling day.

(2) The system shall seal the ballot box even where fewer than ten persons from any polling district voted for a candidate during alternative polling days.

**List of persons who voted**

12. Where alternative voting closes before the close of the polls on ordinary polling day, the system shall:

(a) generate a list of all electors who voted by alternative voting; and

(b) on the applicable list of electors cause a line to be drawn through the name of all the electors who voted during alternative polling days.

13.

(1) A printed and electronic copy of the lists under section 12 shall be delivered to the Returning Officer within 24 hours of the close of alternative voting.

(2) Where alternative voting closes at the close of the polls on ordinary polling day, the system shall generate a list of all electors who voted by alternative voting.

**Counting**

14.

(1) At the close of ordinary polling day, the system shall generate a count of the telephone ballots and internet ballots in the ballot box that were cast for each candidate during alternative polling days.

(2) In counting the votes that were cast for each candidate during alternative polling days, the system shall not count rejected ballots.

**Tallying of Rejected Ballots**

15. At the close of ordinary polling day, the system shall tally the number of rejected ballots that were cast during alternative polling days and the tally shall be delivered to the Returning Officer.

**Recount by System**

16. In the event of a recount, the system shall regenerate the election count and a printed copy of the regenerated count shall be given to the Returning Officer.

17. If the initial count and the regenerated count match, the regenerated count shall be the final count of the votes cast by alternative voting.

18.

(1) If the regenerated count and the initial count do not match, the Returning Officer shall:

a) direct one final count be regenerated by the system of the votes cast by alternative voting, and

b) attend while the final count is being regenerated.

(2) The regenerated final count pursuant to subsection (1) shall be the final count of the votes cast by alternative voting.

**Recount by Court**

19.

(1) For a recount, the judge shall only consider the final count by the system, as determined by section 17 or 18, of the total number of votes that were cast by alternative voting for each candidate.

(2) The final count by the system, as determined by section 17 or 18, of the total number of votes that were cast by alternative voting for each candidate shall be added to the judge's count of the number of votes for each candidate cast by non-alternative voting.

(3) For elections for which there is no voting by paper ballot, there shall be no recount by a judge.

**Secrecy**

20. An election officer and System Elections Officer shall maintain and aid in maintaining the secrecy of the voting.

21. Every person in attendance at a polling station, or at the counting of the votes, shall maintain and aid in maintaining the secrecy of the voting.

**Other Methods of Voting**

22.

(1) If voting via the Internet through the unsupervised use of a personal computing device is permitted during an election, voting shall be permitted by some other means on each alternative polling day.

(2) Council may, by resolution, provide that voting by telephone and by personal computing device shall be the only means of voting for an election.

**Severability**

23. If a court of competent jurisdiction should declare any section or part of a section of this by-law to be invalid, such section or part of a section shall not be construed as having persuaded or influenced Council to pass the remainder of the by-law and it is hereby declared that the remainder of the by-law shall be valid and shall remain in force.

**Prohibitions**

24. No person shall:

(a) use another person's PIN to vote or access the system unless the person is a friend voter;

(b) take, seize, or deprive an elector of his or her PIN; or

(c) sell, gift, transfer, assign or purchase a PIN.

25. No person shall:

(a) interfere or attempt to interfere with an elector who is casting an internet ballot or telephone ballot;

(b) interfere or attempt to interfere with alternative voting; or

(c) attempt to ascertain the name of the candidate for whom an elector is about to vote or has voted.

26. No person shall, at any time, communicate or attempt to communicate any information relating to the candidate for whom an elector has voted.

26A No
(a) candidate,
(b) recognized agent, or
(c) person acting on behalf of or in support of a candidate,

shall provide a person with a personal computing device or telephone for the purposes of casting an internet ballot or a telephone ballot.

**Offences and Penalty**

27. (1) A person who:

(a) violates any provision of this by-law; or
(b) makes a false statement in a declaration; or
(c) permits anything to be done in violation of any provision of this by-law;

is guilty of an offence.

(2) A person who contravenes subsection (1) of this section is guilty of an offence and is liable, on summary conviction, to a penalty of not less than five thousand

dollars and not more than ten thousand dollars and in default of payment, to imprisonment for a term of two years less a day, or both.

(3) In determining a penalty under subsection (2), a judge shall take into account:

(a) the number of votes attempted to be interfered with;

(b) the number of votes interfered with; and

(c) any potential interference with the outcome of an election.

(4) Pursuant to section 146A of the Act:

(a) the limitation period for the prosecution of an offence under this by-law is two years from the later of the date of the commission of the offence and the date on which it was discovered that an offence had been committed; and

(b) The Remission of Penalties Act, 1989 SNS c. 397, as amended, does not apply to a pecuniary penalty imposed by this by-law.

Schedule "E"

# Source Water Protection Management Plan Review

Prepared for Lunenburg Town Council

Prepared by Marc Belliveau

Date Submitted June 2020

# Introduction

The Town of Lunenburg ("Town") requires an Approval to Operate the Water Utility from the Provincial Government or more specifically from Nova Scotia Environment ("Department"). A Source Water Protection Management Plan was prepared under a previous Approval to Operate and submitted to the Department soon after it was completed on April 19, 2011. A new Approval to Operate was received by the Town in October 2019 and requires that after a Source Water Protection Management Plan has been implemented that the Plan must be reviewed and updated yearly and that any changes be documented in the Water Utilities yearly report submitted to the Department. This report will outline the issues reviewed in the Source Water Protection Management Plan complete with recommendations.

# Background Information

In October 2002, the province released "A Drinking Water Strategy for Nova Scotia", which provides the framework for managing drinking water supplies across the province. The following information is a summary of information contained in a brochure prepared by the Province "Developing a Municipal Source Water Protection Plan". The brochure describes a multiple barrier approach to clean, safe drinking water.

*Nova Scotia's multiple barrier approach has three lines of defence*:

*Keeping Clean Water Clean* - We must select the highest quality sources of water and protect these sources to prevent contamination.

*Making It Safe* - We must treat water to remove natural and man-made impurities.

*Proving It's Safe* - We must consistently monitor water quality and take swift, corrective action when deficiencies are identified. The success of these barriers relies on the involvement and vigilance of us all: government, business, landowners, public interest groups, and individual citizens.

The Drinking Water Strategy includes the following five (5) guides (or steps) prepared by the Provincial Government to assist municipalities in preparing a Source Water Protection Plan for a drinking water supply area. Steps 1, 2 and 3 were included in the Source Water Protection Management Plan. Some of items in Step 4 were included in the Source Water Protection Management Plan and others could be implemented by Town Council if they wanted a higher level of source water protection.

*Step 1 - Form a Source Water Protection Advisory Committee*
*Step 2 - Delineate the Source Water Protection Area Boundary*
*Step 3 - Identify Potential Contaminants and Assess Risks*

*Step 4 - Develop and Adopt a Source Water Protection Management Plan*

Step 4 lists the ABC's of source water protection which is often based on a combination of the most appropriate management practices for the source water supply area including:

(A)cquisition of land. The direct ownership of land in the source water supply area affords one of the highest levels of water quality protection.

(B)ylaws. Adopt or amend land-use bylaws or develop a new municipal planning strategy. These instruments allow regulation of land uses permitted in source water supply areas. You can find more information in the Department of Municipal Affairs Local Government Resource Handbook: Municipal Water Supply Watershed Planning Model, section 5.7.

(B)est Management Practices. Use best management practices and guidelines to manage activities that take place in the source water supply area.

(C)ontingency Plans. If there's a spill or other event that threatens the quality or quantity of the source water, a well-prepared contingency plan will allow continued protection of public health.

(D)esignation. The Environment Act allows for the designation of Protected Water Areas. Designation allows a water utility or municipality to regulate activities like swimming, fishing and logging within a delineated area. You can find more information in Nova Scotia Environment technical document, Designation of a Protected Water Area.

(E)ducation. Work with stakeholders in the source water supply area to teach them about drinking water and water resource stewardship.

*Step 5 - Monitor and Evaluate the Plan*

1) Develop a monitoring program and schedule

2) Continue to evaluate the effectiveness of the management plan

3) Develop a mechanism for the committee to respond to impairment or changes in water quality

4) Modify the plan if necessary

# Discussion

The following are the items considered during the review of the Source Water Protection Management Plan.

**Background Information Review**

All the Department background documents noted above were reviewed to ensure that no new information was required in the preparation or implementation of a Source Water Protection Management Plan. There were no new requirements noted during the review of these documents.

**Existing Source Water Protection Management Plan - General Review**

When the Source Water Protection Management Plan was prepared by the Source Water Protection Advisory Committee they were directed by the Department and followed the Department Guides noted above in the Background Information. The Source Water Protection Management Plan was well thought out by this committee and most of the information in the plan is still relevant. A separate more detailed review was carried out of the plan in a separate document in order to show the proposed changes.

**Existing Source Water Protection Management Plan – Call Out List Review**

In the current Source Water Protection Management Plan there is a Call Out List for a Boil Water or Contaminated Water Supply Advisory. This Call Out List would be used along with the advisories in the

event of an emergency. This list was outdated and has been replaced with the updated Water Utility Water Quality Emergency Notification Procedure which list who would be called in the event of an emergency.

**Existing Source Water Protection Management Plan – Appendix Review**

In the current Source Water Protection Management Plan there are sixteen appendices (Appendix "A" through Appendix "P"). To ensure the latest attachments are in the Plan a search was carried out to determine if any new updates were available. The majority of the appendices were up to date. Appendix "H" Nova Forest Alliance - Best Management Practices Manual was updated in 2012 and is attached to this report. Appendix "K" Wild Lowbush Blueberry IPM (Integrated Pest Management) Weed Management Guide was updated in 2017 and is attached to this report. A cleaner copy Appendix "O" Existing Land Use Plan Dares Lake latest revision December 2007 is attached to this report.

**Existing Source Water Protection Management Plan – Monitoring Program**

In the Evaluating and Monitoring Section of the Source Water Protection Management Plan the Town is required to monitor raw water quality. Raw water quality is to be tested and monitored to ensure there is no adverse water quality within the watershed. The Town has been testing raw water semi-annually but the test results have not been tabulated to verify that there is no adverse water quality within the watershed. A spreadsheet has been prepared with the Semi-Annual Raw Water Test Results between 2015 and 2019. There are few test results which appear somewhat inconsistent (highlighted in yellow) and should be monitored over the next few years. There is no concern in regards to these highlighted test results as they are not health-based parameters and do not exceed the aesthetic objective (AO) of the Guidelines for Canadian Drinking Water Quality.

**Watershed Signs**

A tour of the watershed was on carried out on February 24th. The only concern noted during the tour was the lack of "Protected Water Supply" signs along the unmaintained road located between Awalt Road and Big Lots Road along the western side of Dares Lake. Several signs should be installed along this road to ensure the public is aware that they are in the Towns water supply area. The Town has two types of signs (noted below) that are used to notify the public of the Towns water supply.



**Dares Lake Watershed Aerial Survey**

The Lunenburg and District Fire Department has a drone and in August 2019 they flew over the Dares Lake watershed and create a video recording for the Town. The recording is kept on file at the Water Treatment Plant. This is an excellent way of determining the condition of the watershed and to

determine if anyone is in violation of any of the restrictions included in the Dares Lake Protected Water Area Regulations made under subsection 106 (5) of the Environment Act.

# Recommendations

(1) The updated Water Utility Water Quality Emergency Notification Procedure must replace the outdated Call Out List in the Source Water Protection Management Plan.

(2) Replace Appendix H, Appendix K and Appendix O with the attached appendices in the Source Water Protection Management Plan.

(3) Continue to update the attached Semi-Annual Water Test Results spreadsheet yearly and verify that no adverse water quality is occurring in the watershed.

(4) Install more water supply signs along the unmaintained road located to the west side of Dares Lake.

(5) Continue to carry out a yearly aerial survey of the watershed in late fall or early spring when there are no leaves on the trees.

**Town of Lunenburg - Semi Annual Raw Water Test Results**

**Standard Water Analysis and Total Metals of Raw Water From Dares Lake**

| Parameter | Unit | G / S | RDL | 03/25/2015 | 09/22/2015 | 03/16/2016 | 09/20/2016 | 03/21/2017 | 09/26/2017 | 03/15/2018 | 10/10/2018 | 03/25/2019 | 09/25/2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **pH** | | 7.0-10.5 | | 6.39 | 6.47 | 6.25 | 6.36 | 6.27 | 6.41 | 6.32 | 6.48 | 6.68 | 6.37 |
| **Reactive Silica as SiO2** | mg/L | | 0.5 | 2.0 | | 1.1 | | 1.7 | | 1.8 | | 2.1 | |
| **Chloride** | mg/L | 250 AO | 1 | 6 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 |
| **Fluoride** | mg/L | 1.5 | 0.12 | <0.1 | <0.1 | <0.12 | <0.1 | <0.12 | <0.12 | <0.12 | <0.12 | <0.12 | <0.12 |
| **Sulphate** | mg/L | 500 AO | 2 | 3 | <2 | <2 | <2 | 2 | 2 | <2 | <2 | <2 | <2 |
| **Alkalinity** | mg/L | | 5 | <5 | | <5 | | <5 | | <5 | <5 | <5 | |
| **True Color** | TCU | 15 AO | 5 | 9 | <5 | 9 | <5 | <5 | <5 | 15 | 10 | 22 | <5 |
| **Turbidity** | NTU | 0.1-1 | 0.1 | 1.1 | 0.7 | 0.2 | 1.5 | 0.8 | 0.8 | 2.0 | 2.0 | 1.0 | 1.4 |
| **Electrical Conductivity** | umho/cm | | 1 | 30 | | 32 | | 28 | | 30 | | 34 | |
| **Nitrate + Nitrite as N** | mg/L | | 0.05 | 0.11 | | <0.05 | | <0.05 | | <0.05 | | <0.05 | |
| **Nitrate as N** | mg/L | 10 | 0.05 | 0.11 | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| **Nitrite as N** | mg/L | 1.0 | 0.05 | <0.05 | | <0.05 | | <0.05 | | <0.05 | | <0.05 | |
| **Ammonia as N** | mg/L | | 0.03 | <0.03 | | 0.13 | | 0.03 | | <0.03 | | <0.03 | |
| **Total Organic Carbon** | mg/L | | 0.5 | 2.3 | 2.7 | 2.4 | 2.1 | 3.0 | 2.4 | 3.0 | 2.4 | 2.6 | |
| **Ortho-Phosphate as P** | mg/L | | 0.01 | <0.01 | | <0.01 | | <0.01 | | 0.11 | | <0.01 | |
| **Total Sodium** | mg/L | 200 AO | 0.1 | 3.6 | 3.5 | 2.9 | 4.2 | 3.2 | 3.2 | 3.9 | 3.6 | 4.5 | 9.8 |
| **Total Potassium** | mg/L | | 0.1 | 0.2 | | 0.2 | | 0.2 | | 0.2 | | 0.2 | |
| **Total Calcium** | mg/L | | 0.1 | 1.0 | | 0.8 | | 1.0 | | 0.9 | | 1.0 | |
| **Total Magnesium** | mg/L | | 0.1 | 0.7 | | 0.5 | | 0.6 | | 0.6 | | 0.7 | |
| **Bicarb. Alkalinity (as CaCO3)** | mg/L | | 5 | <5 | | <5 | | <5 | | <5 | | <5 | |
| **Carb. Alkalinity (as CaCO3)** | mg/L | | 10 | <10 | | <10 | | <10 | | <10 | | <10 | |
| **Hydroxide** | mg/L | | 5 | <5 | | <5 | | <5 | | <5 | | <5 | |
| **Calculated TDS** | mg/L | 500 AO | 1 | 15 | | 9 | 30 | 12 | <5 | 11 | 60 | 12 | 20 |
| **Hardness** | mg/L | | | 5.4 | 5.2 | 4.1 | 5.6 | 5.0 | 4.7 | 4.7 | 5.0 | 5.4 | 4.6 |
| **Langelier Index (@20C)** | NA | | | -4.42 | -4.29 | -4.65 | -4.39 | -4.54 | -4.44 | -4.53 | -4.33 | -4.13 | -4.45 |
| **Langelier Index (@ 4C)** | NA | | | -4.74 | -4.61 | -4.97 | -4.71 | -4.86 | -4.76 | -4.85 | -4.65 | -4.45 | -4.77 |
| **Saturation pH (@ 20C)** | NA | | | 10.8 | 10.8 | 10.9 | 10.8 | 10.8 | 10.9 | 10.9 | 10.8 | 10.8 | 10.8 |
| **Saturation pH (@ 4C)** | NA | | | 11.1 | 11.1 | 11.2 | 11.1 | 11.1 | 11.2 | 11.2 | 11.1 | 11.1 | 11.1 |
| **Anion Sum** | me/L | | | 0.24 | | 0.11 | | 0.18 | | 0.14 | | 0.14 | |
| **Cation sum** | me/L | | | 0.28 | | 0.23 | | 0.25 | | 0.28 | | 0.32 | |
| **% Difference/ Ion Balance (NS)** | % | | | 7.2 | | 33.6 | | 15.4 | | 32.7 | | 38.5 | |
| **Total Aluminum** | ug/L | 100 AO | 5 | 34 | 17 | 22 | 12 | 22 | 11 | 52 | 42 | 50 | 30 |
| **Total Antimony** | ug/L | 6 | 2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| **Total Arsenic** | ug/L | 10 | 2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| **Total Barium** | ug/L | 1000 | 5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| **Total Beryllium** | ug/L | | 2 | <2 | | <2 | | <2 | | <2 | | <2 | |
| **Total Bismuth** | ug/L | | 2 | <2 | | <2 | | <2 | | <2 | | <2 | |
| **Total Boron** | ug/L | 5000 | 5 | 10 | <5 | 5 | 9 | 5 | 6 | 5 | <5 | 7 | 8 |
| **Total Cadmium** | ug/L | 5 | 0.017 | <0.017 | <0.3 | <0.017 | <0.3 | <0.017 | <0.3 | <0.017 | <0.3 | <0.09 | <0.3 |
| **Total Chromium** | ug/L | 50 | 1 | <1 | <2 | <1 | <2 | <1 | <2 | <1 | <2 | <1 | <2 |
| **Total Cobalt** | ug/L | | 1 | <1 | | <1 | | <1 | | <1 | | <1 | |
| **Total Copper** | ug/L | 1000 AO | 1 | 1 | <2 | <1 | 8 | <1 | <2 | <1 | <2 | <1 | 3 |
| **Total Iron** | ug/L | 300 AO | 50 | 78 | <50 | 59 | 55 | <50 | <50 | 73 | 80 | 81 | 94 |
| **Total Lead** | ug/L | 10 | 0.5 | <0.5 | <0.5 | <0.5 | 0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| **Total Manganese** | ug/L | 50 AO | 2 | 17 | 57 | 14 | 89 | 14 | 43 | 18 | 91 | 19 | 7 |
| **Total Molybdenum** | ug/L | | 2 | <2 | | <2 | | <2 | | <2 | | <2 | |
| **Total Nickel** | ug/L | | 2 | <2 | | <2 | | <2 | | <2 | | <2 | |
| **Total Phosphorous** | mg/L | | 0.02 | 0.03 | | <0.02 | | <0.02 | | <0.02 | | 0.02 | |
| **Total Selenium** | ug/L | 50 | 1 | <1 | <2 | <1 | <2 | <1 | <2 | <1 | <2 | <1 | <2 |
| **Total Silver** | ug/L | | 0.1 | <0.1 | | <0.1 | | <0.1 | | <0.1 | | <0.1 | |
| **Total Strontium** | ug/L | | 5 | 6 | | <5 | | 5 | | 6 | | 6 | |
| **Total Thallium** | ug/L | | 0.1 | <0.1 | | <0.1 | | <0.1 | | <0.1 | | <0.1 | |
| **Total Tin** | ug/L | | 2 | <2 | | <2 | | <2 | | <2 | | <2 | |
| **Total Titanium** | ug/L | | 2 | <2 | | <2 | | <2 | | <2 | | <2 | |
| **Total Uranium** | ug/L | 20 | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| **Total Vanadium** | ug/L | | 2 | <2 | | <2 | | <2 | | <2 | | <2 | |
| **Total Zinc** | ug/L | 5000 AO | 5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | 98 |

**Comments:**
RDL - Reported Detection Limit
G / S - Guideline / Standard

*Revised: May 29, 2020*

**Updates to the SWPMP Shown in Red**

# SOURCE WATER PROTECTION MANAGEMENT PLAN

# FOR THE TOWN OF LUNENBURG WATER UTILITY'S DARES LAKE WATERSHED

## Introduction

The Province of Nova Scotia introduced a Drinking Water Strategy in fall 2002. The Strategy was developed to ensure Nova Scotians enjoy high quality and safe drinking water. It is based on a multiple barrier approach which requires that source water be kept clean, potable water be treated to a higher standard making it safer to drink and that treated water be monitored to prove it's safe to drink. It also requires that all municipal water systems obtain new approvals to supply water to customers and this includes the construction of new water treatment plants or upgrades to existing plants to meet the higher standards. Operators of municipal water systems are required to prepare a Source Water Protection Plan with the involvement of stakeholders.

## History of the Water Utility

The Lunenburg Water and Electric Light, Heating and Power Company Limited was incorporated under Chapter 117 of the Nova Scotia Acts of 1888. In 1895 it acquired lands and water rights to construct and operate a commercial and residential water distribution system in and around Lunenburg. On August 22, 1896 the Lunenburg Board of Trade petitioned the Lunenburg Town Council to purchase the Company's waterworks system. Council agreed and offered $65,000, which the Company rejected. The Company eventually agreed to sell for $90,000 on November 15, 1902. Council borrowed an additional $15,000 to extend and upgrade the water system. A 700,000 gallon open reservoir was constructed near civic #524 Northwest Road at an elevation of 212 feet above sea level to provide additional storage and pressure within the distribution system.

In 1941, increasing commercial water demands required the installation of a booster pump on the main supply line. This served to maintain pressure at higher elevations. It was built along the Northwest highway between the open reservoir and the Town boundary. It was later converted to a chlorination facility in 1958.

Chlorine and lime feed equipment were installed in the main pumping station in 1965 to disinfect and increase the alkalinity of the water.

In 1968, a 750,000 gallon steel water tank was built on Hospital Hill Road in Garden Lots to provide additional storage within the distribution system and water required by High Liner Foods to meet their increased production requirements.

Flow proportional chlorine equipment was installed in 1990 and chlorine was added to the distribution system based on the water volume pumped to the Town.

The Utility's original water distribution system was primarily constructed of cast iron pipe. Since the 1970's the Utility has replaced these older cast iron pipes with cement

lined ductile iron (CLDI) and polyvinyl chloride (PVC) pipes to improve water quality and increase fire flows.

On June 10, 2009 Lunenburg Town Council awarded a $6.8 Million contract to Mid Valley Construction for the construction of a new water treatment plant and system upgrades to meet new Provincial Surface Water Treatment Standards. Improvements at the Water Utility pump house included three new pumps with variable speed drives to optimize energy use and a new roof. The new Water Treatment Plant uses membrane filtration with enhanced coagulation for organics removal and has a peak production rate of 5,400 cubic meters per day. Water is fed to the distribution system by gravity from a new reservoir, reducing energy use associated with treated water pumping. The membrane filtration recovers 95% of raw water flows, significantly reducing the daily volume of filtered organic materials for disposal when compared to conventional filtration. The filtered materials flow by gravity through pipes to the Town's Wastewater Treatment Plant for treatment.

A new glass lined bolted reservoir was constructed next to the Water Treatment Plant to replace an existing open reservoir. The new reservoir incorporates a central fixed volume chlorine contact tank and an outer ring for water storage requirements. The project also includes a remote chlorine monitoring and dosing station located at the existing Garden Lots standpipe at the far end of the distribution system.

## Dares Lake and the Town Water System

The intake pipe that draws water from Dares Lake is located approximately 300 feet from the shore on the eastern side of the lake. It is piped to the Water Utility's intake building and flows by gravity to the Water Utility's pump house located by the western shore of nearby Cantelope Lake. This raw water is next pumped to the Water Treatment Plant for micro filtration treatment. The treated water from the Plant is then stored in a glass lined steel reservoir where it flows by gravity in the Water Utility distribution system. Dares Lake has a stable yield of 10,800 cubic meters per day during a dry season.

The Water Utility currently supplies drinking water to approximately 1,100 residential customers and over 100 of these customers are located in Northwest, Lilydale and Garden Lots. There are approximately 200 commercial customers and ten of these customers are located in the Municipality of the District of Lunenburg (District). Fire hydrants are installed on the distribution system and provide fire protection to the District and the Town of Lunenburg. The Dares Lake water supply and distribution system is a valuable resource for residential and commercial customers in both municipalities.

The Town's current Water Treatment Plant was officially opened in September 2010. It is a vital component of the Town's capital assets meeting Provincial treatment standards to address customer needs for personal consumption, commercial and institutional operations, firefighting and other customer requirements. Maintaining the quality of water in Dares Lake is critical to the successful management of the Water Utility because if it were contaminated there would be a significant cost associated with finding another source of water. Business and residential customers would be severely inconvenienced if potable water was not available for everyday use.

## Dares Lake Watershed

In March 1972, 900 acres of land surrounding and including Dares Lake was designated as a protected water area under the Nova Scotia Water Act. The amount of land included in this designation represents approximately 3/4 of the total watershed area. Provincial Regulations were approved to protect the water supply against potentially harmful activities such as animal pasturing, fishing, boating, etc. that could negatively impact Dares Lake water quality. However, there are approximately 300 acres of land which are outside of the protected watershed, but are within the natural drainage area that have not been designated as a protected water area. The Town continues to explore various options to incorporate additional lands into the protected watershed.

The Source Water Protection Advisory Committee and Town Council reviewed the land within the natural drainage area of Dares Lake and put forth the following means of protecting this valuable resource and they have been included in this Plan. Town Council and Water Utility annually review these initiatives and update as required.

## Methodology of the Source Water Protection Plan

The most cost effective way to prevent drinking water from being contaminated is to protect the source of the water supply. The amount of fresh water available to municipalities is limited and the quality can be threatened by increased development and other human activity. Protecting the water supply will ensure good quality drinking water for residents and businesses in both the Municipality of Lunenburg and the Town of Lunenburg.

The Nova Scotia Department of Environment has developed guides for water utilities and municipalities to assist in preparing a Source Water Protection Plan. The following is a list of the guides available from the Province:

1. Form a Source Water Protection Advisory Committee.

2. Delineate a Source Water Protection area boundary.

3. Identify potential contaminants and assess risk.

4, Develop a Source Water Protection Management Plan.

5. Develop a monitoring program to evaluate the effectiveness of a Source Water Protection Plan.

These five guides were used by the Source Water Protection Advisory Committee in developing this Source Water Protection Management Plan.

## Formation of the Source Water Protection Advisory Committee

The Town of Lunenburg established a Source Water Protection Advisory Committee in fall 2005. A representative from the Nova Scotia Department of Environment reviewed the Provincial Drinking Water Strategy with the Committee and provided direction on the

structure and responsibilities of a Source Water Protection Advisory Committee.

The Source Water Protection Advisory Committee required representation from the land owners in the Dares Lake watershed. Therefore, a meeting was held with land owners on March 1, 2006 to explain why a Source Water Advisory Committee (Committee) was required and requested that they appoint two representatives to be active participants on the Committee. Two representatives were selected and attended Committee meetings. Committee Terms of Reference were developed by the Committee and approved by Town Council on June 15, 2006. A copy of the Committee's Terms of Reference is attached as Appendix "A" to this document.

## Delineation of the Source Water Protection Area Boundary

The Dares Lake watershed was originally surveyed by Mr. Errol Hebb and a plan prepared on March 27, 1971. This survey plan identified land around the Dares Lake watershed which was to be protected. This land was protected from certain activities after being designated as a protected area in March 1972. A copy of the Dares Lake Protected Water Area Regulations is attached in Appendix "B".

The protection of the watershed was reaffirmed in 2007 under the NS Environment Act. A copy of the reaffirmed Dares Lake Protected Water Area Designation is attached as Appendix "C". A copy of the reaffirmed Dares Lake Protection Water Area Regulations is attached as Appendix "D".

The Source Water Protection Advisory Committee determined that a detailed survey of the drainage boundary was required to identify all the land which drained towards Dares Lake. Richard Wentzell, a Forest Technician from Mahone Bay, was hired to conduct this survey and completed his work in May 2007. A copy of his survey plan is attached in Appendix "E".

## Risk Management Options

The Source Water Protection Advisory Committee discussed various methods to protect the watershed. The options listed below are provided in a guide prepared by the Nova Scotia Department of the Environment for the protection of water supplies.

A. **Acquisition of Land** - the direct ownership of land in the source water supply area affords one of the highest levels of water quality protection.

B. **By-laws** - adopt land-use bylaws or develop a new municipal planning strategy. These instruments allow regulation of land uses permitted in source water supply areas. You can find more information in the Service Nova Scotia and Municipal Relations Local Government Resource Handbook: Municipal Water Supply Watershed Planning Model, section 5.7.

C. **Best Management Practices** - use best management practices and guidelines to manage activities that take place in the source water supply

area.

D. **Contingency Plans** - if there's a spill or other event that threatens the quality or quantity of the source water, a well-prepared contingency plan will allow continued protection of public health.

E. **Designation** - the Environment Act allows for the designation of Protected Water Areas. Designation allows a water utility or municipality to regulate activities like swimming, fishing and logging within a delineated area.

F. **Education** - work with stakeholders in the source water supply area to teach them about drinking water and water resource stewardship. This Source Water Protection Management Plan is intended to educate the public about the importance of a public water supply. Signs have been posted around the watershed to ensure that the public is aware of Dares Lake being a public water supply.

## Watershed Activities and Potential Risk to Source Water Quality

The Source Water Protection Advisory Committee conducted a review of the following activities which could be a potential risk to water quality in Dares Lake. Each activity indicates how the watershed is to be protected to eliminate or reduce the risk of contaminating the water supply.

### 1. Forestry Operations

Forestry operations are to be conducted in accordance with the following documents or the latest revision.

a. Wildlife Habitat and Watercourse Protection Regulations made under Section 40 of the Forest Act, Appendix "F".
b. Best Management Practices / Forestry Planning in Municipal Drinking Water Supply Areas Nova Scotia dated September 29, 2005, Appendix "G".
c. Best Management Practices Manual as prepared by the Nova Forest Alliance, Appendix "H".

Landowners must comply with NS Department of Environment regulations with respect to the application of herbicides within the watershed.

### 2. Christmas Tree Cultivation and Harvesting

Best Management Practices for Christmas tree cultivation and harvesting must be followed when working in the watershed. Christmas tree cultivation and harvesting is to be conducted in accordance with the latest revision of the following documents.

a. Nova Scotia's Wildlife Habitat and Watercourse Regulations

(Appendix “I”), and

b. The Responsible Use of Herbicides in Nova Scotia Forests (Appendix “J”).

3. Blueberry Cultivation and Harvesting

Best Management Practices for blueberry cultivation and harvesting must be followed when working in the watershed. Blueberry cultivation and harvesting is to be conducted in accordance with the latest revision of the following document.

a. Wild Lowbush Blueberry IMP, Weed Management Guide as published by the Province of New Brunswick, Department of Agriculture, Fisheries and Aquaculture (Appendix “K”).

B. Lowbush Blueberry Fact Sheet from the Wild Blueberry Producers Association of Nova Scotia (Appendix “L”).

4. Roads

a. Any person who wants to use or alter a watercourse (creek, brook, stream, river, lake, pond, spring, lagoon or any other natural body of water) requires a Watercourse Alteration Approval from NSE in accordance with the Environment Act.

b. The Woodlot Roads Stream Crossing Guide prepared by Glen Brathwaite 1992 (Appendix “M”) is to be followed when constructing a wood lot road within the watershed.

c. Culverts on Awalt Road are to be maintained by Nova Scotia Transportation and Infrastructure Renewal.

5. Brooks, Streams and Watercourses Flowing into Dares Lake

Options should be evaluated in regard to mitigating any potential pollution sources near culverts/water crossings which flow towards Dares Lake.

6. Accidents and Spills

The accidental spill of any contaminant which may affect water quality even to a slight degree shall be cleaned up immediately and reported to the Town of Lunenburg as noted in the Contingency/Emergency Plan. Spills may also have to be reported to NSE as per the Emergency Spill Regulations (Appendix “N”).

7. Pesticides and herbicides

The current regulations for the Dares Lake watershed prohibit the use of insecticides or fertilizers that could affect water quality even to the slightest degree in Dares Lake. The use of pesticides within the Dares Lake watershed must comply with Pesticide Regulations made under section 84 of the Environment Act.

8. Recreation

Recreational activities are prohibited on or near the Dares Lake as per the Dares Lake Protected Water Area Regulations. Property owners who own land which abuts Dares Lake may request permission from the Town Engineer for some recreational activities. If it is deemed that the activity will not cause an adverse effect to the quality of water in Dares Lake the Town Engineer may grant permission for that activity to take place.

9. Agriculture Uses

a. Pasturing or grazing of cattle or livestock is prohibited in the Dares Lake protected watershed area and discouraged in the natural watershed area.
b. The application and storing of manure is prohibited in the Dares Lake protected watershed area and discouraged in the natural watershed area.
c. Farmers are encouraged to implement an Environmental Farm Plan (EFP) by contacting the Nova Scotia Federation of Agriculture for any farms located within the natural watershed area.

10. Development

The Dares Lake Protected Water Area Regulations state "... no houses, cottages, sheds, lean to's, hovels, barns, privies or any other structure housing persons or animals, either on a temporary or permanent basis may be erected within the prescribed area..." (Appendix "D").

The Source Water Protection Advisory Committee received and updated a plan identifying existing land uses within the watershed and a copy of the plan is attached as Appendix "O".

## CONTINGENCY / EMERGENCY PLAN

Water Utility and Water Supply Contacts

In the event of an emergency where water in Dares Lake is or may be contaminated as a result of a spill or release the Town Engineer or Public Works Superintendent must be contacted as soon as possible to determine the extent of the spill or release and to take appropriate action. Scotia Business is the dispatch service for the Town of Lunenburg Water Utility. Scotia Business will contact the Town Engineer or Public Works Superintendent during non-working hours. Contact numbers for Water Utility Managers are provided below and these numbers can be used during normal working hours (Monday to Friday between 8:00 am and 4:30 pm).

**Primary Contact Number** (24 hours a day / 7 days a week)

Water Utility Dispatch Service (902) 527-0150

**Secondary Contact Numbers** (during normal working hours)

Water Utility Managers

Town Engineer (902) 634-8992
Public Works Superintendent (902) 634-8992

Water Supply Information

The Dares Lake Water Supply is located in Northwest, Lunenburg County, Nova Scotia. The watershed (natural drainage area) is approximately 900 acres which surrounds and includes Dares Lake. The water intake (civic #763 Northwest Road, Route 324) is located on the eastern side of Dares Lake. The pump house (765 Northwest Road, Route 324) is where water is pumped into the distribution system. A map is attached as Appendix "Q" and identifies the location of Dares Lake.

Emergency Procedure

In the event of an emergency where the water supply has become contaminated the Town of Lunenburg Water Utility Water Quality Emergency Notification Procedure should be activated. This procedure is kept on file at the Water Treatment Plant and Town Hall. The first action to be taken by the Town Engineer or designate as the Water Utility Manager is to ensure all Water Utility pumps are turned off to prevent contaminated water from entering the distribution system. The Town Engineer will next contact the Regional Emergency Management Organization Manager, Town of Lunenburg Emergency Management Assistant Coordinator and Chief Administrative Officer as soon as is possible to advise of the emergency. The Town Engineer will next contact Nova Scotia Environment (NSE) and the Nova Scotia Medical Officer of Health (NSMOH) along with all the institutional and commercial customers whose contact information is included in the Water Utility Water Quality Emergency Notification Procedure.

The Town Engineer and Regional Emergency Management and Lunenburg Assistant Emergency Management Coordinators will work with the NSMOH and NSE in planning action required to protect Water Utility customers. The plan may include such measures as issuing a boil water advisory, radio, social media and other advertisements, posting of signs in the community and direct contact to institutional, conferring with institutional and commercial customers at a higher health risk due to water demands. A plan will be formulated to determine the source of the contamination and how to remove it from the watershed and distribution system. The plan will also address as necessary an alternate source of water for Water Utility customers be it by truck and/or bottles of water during the investigation, clean-up and testing the water supply prior to resuming normal use. The determination as to when the water supply is safe will be made by NSE and NSMOH in consultation with the Town Engineer.

In the event of a fire or contamination spill within the watershed the Fire Department is to be immediately contacted by calling 911 by whomever witnesses the fire or spill.

Contingency/Emergency Plan Annual Review

The Contingency/Emergency Plan should be reviewed on a yearly basis to ensure that information is up to date. It should also be reviewed after an emergency to determine if any updates are required.

## EVALUATION AND MONITORING

Evaluating and Updating the Plan

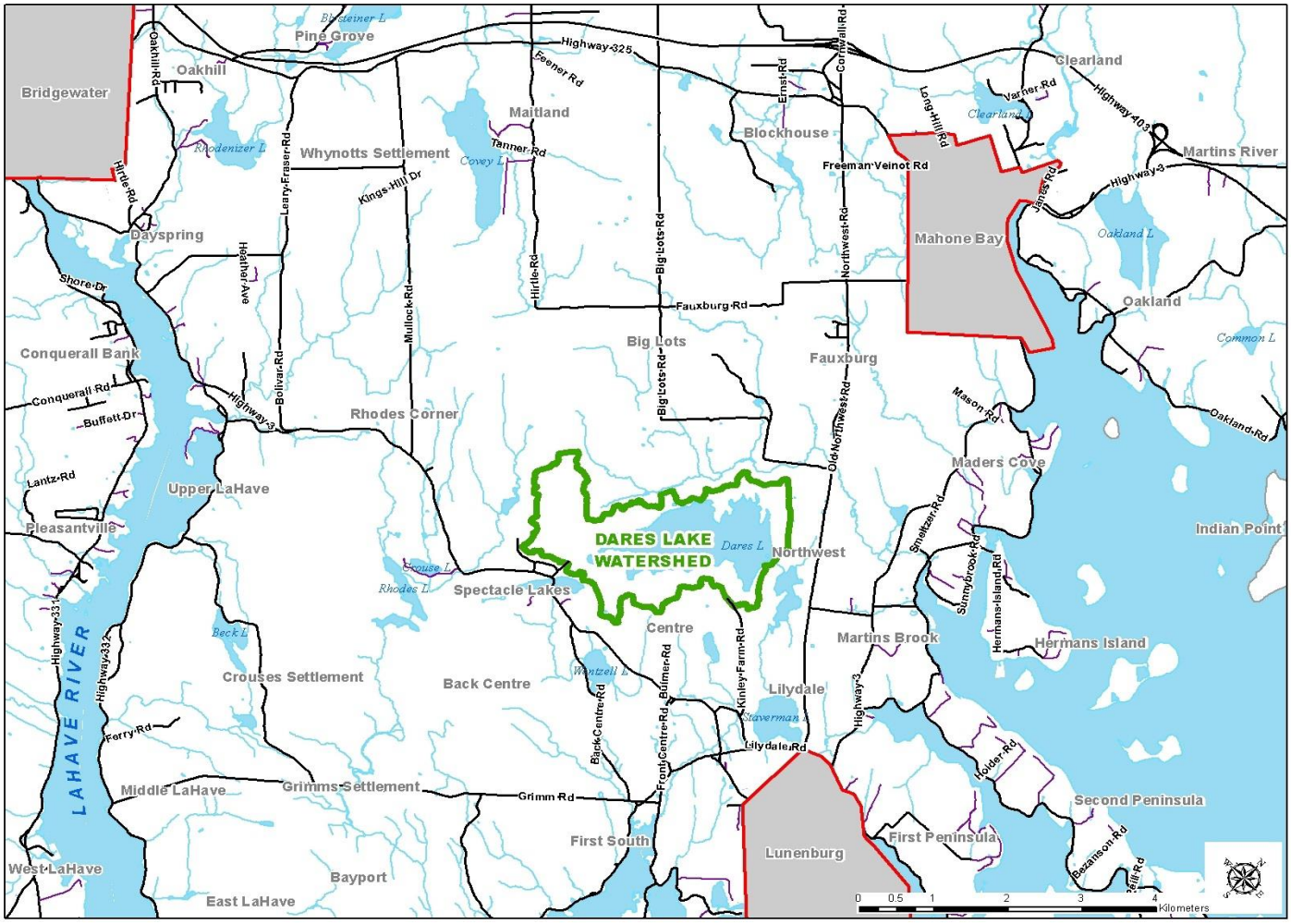
The Source Water Protection Management Plan will be annually reviewed by the Source Water Protection Advisory Committee if in effect or Council to determine if the Plan is achieving the desired results. If the Plan is not meeting the objectives of the Committee and/or Council as applicable then it should be updated to reflect changes required to protect the watershed.

Monitoring Program

Water quality in Dares Lake is monitored and tested by the Town's Water Utility. If raw water conditions change or are of concern to the Utility then action should be taken to address the issue(s) to ensure that there are no adverse water quality effects in the watershed. Raw water samples are tested two times per year for all parameters in the Guidelines for Canadian Drinking Water Quality and results compared to prior test results. Any results which indicated a change in raw water quality should be investigated to determine the source of the contaminant. Routine monitoring of the water supply is to be conducted in accordance with NSE's Guidelines for Monitoring Public Water Supplies (Appendix "P").

## TOWN OF LUNENBURG WATER UTILITY

LOCATION OF TOWN'S WATER SUPPLY DARES LAKE




**[Delete the following map and include as Appendix "Q" in the SWPMP]**

## TOWN OF LUNENBURG: WATER UTILITY

## BOIL WATER ADVISORY

**What to say to our customers**

Hi, my name is _____ and I work for the Town of Lunenburg and I've been asked to call you regarding a problem with the water supply in the Town of Lunenburg.

Water supplied to customers in the Town, Garden Lots and along the Northwest Highway has become contaminated and is unsafe and should not be used by customers without taking precautions. Customers are required to boil water for at least two minutes if it is to be used for drinking, making ice, preparing food, brushing teeth, or any other activity where the water may be consumed. Customers should continue to boil water until further notice.

The Town is working with the Nova Scotia Department of the Environment and the Medical Officer of Health in order to resolve the problem and will notify you when the problem's been corrected.

## TOWN OF LUNENBURG: WATER UTILITY

## CONTAMINATED WATER ADVISORY

**What to say to our customers**

Hi, my name is _____ and I work for the Town of Lunenburg and I've been asked to call you regarding a problem with the water supply in the Town of Lunenburg.

Water supplied to customers in the Town of Lunenburg, Garden Lots and along the Northwest Highway may have become contaminated and should be considered unsafe to drink. Water Utility customers are advised not to drink or use water supplied by the Town for any reason until further notice.

The Town is working with the Nova Scotia Department of the Environment and the Medical Officer of Health in order to resolve the problem and will notify you when the problem's been corrected.

# Source Water Management Plan for the Dares Lake Watershed

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# Appendices

*Revised: May 29, 2020*

# SOURCE WATER PROTECTION MANAGEMENT PLAN

# FOR THE TOWN OF LUNENBURG WATER UTILITY'S DARES LAKE WATERSHED

## Introduction

The Province of Nova Scotia introduced a Drinking Water Strategy in fall 2002. The Strategy was developed to ensure Nova Scotians enjoy high quality and safe drinking water. It is based on a multiple barrier approach which requires that source water be kept clean, potable water be treated to a higher standard making it safer to drink and that treated water be monitored to prove it's safe to drink. It also requires that all municipal water systems obtain new approvals to supply water to customers and this includes the construction of new water treatment plants or upgrades to existing plants to meet the higher standards. Operators of municipal water systems are required to prepare a Source Water Protection Plan with the involvement of stakeholders.

## History of the Water Utility

The Lunenburg Water and Electric Light, Heating and Power Company Limited was incorporated under Chapter 117 of the Nova Scotia Acts of 1888. In 1895 it acquired lands and water rights to construct and operate a commercial and residential water distribution system in and around Lunenburg. On August 22, 1896 the Lunenburg Board of Trade petitioned the Lunenburg Town Council to purchase the Company's waterworks system. Council agreed and offered $65,000, which the Company rejected. The Company eventually agreed to sell for $90,000 on November 15, 1902. Council borrowed an additional $15,000 to extend and upgrade the water system. A 700,000 gallons open reservoir was constructed near civic #524 Northwest Road at an elevation of 212 feet above sea level to provide additional storage and pressure within the distribution system.

In 1941, increasing commercial water demands required the installation of a booster pump on the main supply line. This served to maintain pressure at higher elevations. It was built along the Northwest highway between the open reservoir and the Town boundary. It was later converted to a chlorination facility in 1958.

Chlorine and lime feed equipment were installed in the main pumping station in 1965 to disinfect and increase the alkalinity of the water.

In 1968, a 750,000 gallon steel water tank was built on Hospital Hill Road in Garden Lots to provide additional storage within the distribution system and water required by High Liner Foods to meet their increased production requirements.

Flow proportional chlorine equipment was installed in 1990 and chlorine was added to the distribution system based on the water volume pumped to the Town.

The Utility's original water distribution system was primarily constructed of cast iron pipe. Since the 1970's the Utility has replaced these older cast iron pipes with cement lined ductile iron (CLDI) and polyvinyl chloride (PVC) pipes to improve water quality and

increase fire flows.

On June 10, 2009 Lunenburg Town Council awarded a $6.8 Million contract to Mid Valley Construction for the construction of a new water treatment plant and system upgrades to meet new Provincial Surface Water Treatment Standards. Improvements at the Water Utility pump house included three new pumps with variable speed drives to optimize energy use and a new roof. The new Water Treatment Plant uses membrane filtration with enhanced coagulation for organics removal and has a peak production rate of 5,400 cubic meters per day. Water is fed to the distribution system by gravity from a new reservoir, reducing energy use associated with treated water pumping. The membrane filtration recovers 95% of raw water flows, significantly reducing the daily volume of filtered organic materials for disposal when compared to conventional filtration. The filtered materials flow by gravity through pipes to the Town's Wastewater Treatment Plant for treatment.

A new glass lined bolted reservoir was constructed next to the Water Treatment Plant to replace an existing open reservoir. The new reservoir incorporates a central fixed volume chlorine contact tank and an outer ring for water storage requirements. The project also includes a remote chlorine monitoring and dosing station located at the existing Garden Lots standpipe at the far end of the distribution system.

## Dares Lake and the Town Water System

The intake pipe that draws water from Dares Lake is located approximately 300 feet from the shore on the eastern side of the lake. It is piped to the Water Utility's intake building and flows by gravity to the Water Utility's pump house located by the western shore of nearby Cantelope Lake. This raw water is next pumped to the Water Treatment Plant for micro filtration treatment. The treated water from the Plant is then stored in a glass lined steel reservoir where it flows by gravity in the Water Utility distribution system. Dares Lake has a stable yield of 10,800 cubic meters per day during a dry season.

The Water Utility currently supplies drinking water to approximately 1,100 residential customers and over 100 of these customers are located in Northwest, Lilydale and Garden Lots. There are approximately 200 commercial customers and ten of these customers are located in the Municipality of the District of Lunenburg (District). Fire hydrants are installed on the distribution system and provide fire protection to the District and the Town of Lunenburg. The Dares Lake water supply and distribution system is a valuable resource for residential and commercial customers in both municipalities.

The Town's current Water Treatment Plant was officially opened in September 2010. It is a vital component of the Town's capital assets meeting Provincial treatment standards to address customer needs for personal consumption, commercial and institutional operations, firefighting and other customer requirements. Maintaining the quality of water in Dares Lake is critical to the successful management of the Water Utility because if it were contaminated there would be a significant cost associated with finding another source of water. Business and residential customers would be severely inconvenienced if potable water was not available for everyday use.

## Dares Lake Watershed

In March 1972, 900 acres of land surrounding and including Dares Lake was designated as a protected water area under the Nova Scotia Water Act. The amount of land included in this designation represents approximately 3/4 of the total watershed area. Provincial Regulations were approved to protect the water supply against potentially harmful activities such as animal pasturing, fishing, boating, etc. that could negatively impact Dares Lake water quality. However, there are approximately 300 acres of land which are outside of the protected watershed, but are within the natural drainage area that have not been designated as a protected water area. The Town continues to explore various options to incorporate additional lands into the protected watershed.

The Source Water Protection Advisory Committee and Town Council reviewed the land within the natural drainage area of Dares Lake and put forth the following means of protecting this valuable resource and they have been included in this Plan. Town Council and Water Utility annually review these initiatives and update as required.

## Methodology of the Source Water Protection Plan

The most cost effective way to prevent drinking water from being contaminated is to protect the source of the water supply. The amount of fresh water available to municipalities is limited and the quality can be threatened by increased development and other human activity. Protecting the water supply will ensure good quality drinking water for residents and businesses in both the Municipality of Lunenburg and the Town of Lunenburg.

The Nova Scotia Department of Environment has developed guides for water utilities and municipalities to assist in preparing a Source Water Protection Plan. The following is a list of the guides available from the Province:

1. Form a Source Water Protection Advisory Committee.

2. Delineate a Source Water Protection area boundary.

3. Identify potential contaminants and assess risk.

4, Develop a Source Water Protection Management Plan.

5. Develop a monitoring program to evaluate the effectiveness of a Source Water Protection Plan.

These five guides were used by the Source Water Protection Advisory Committee in developing this Source Water Protection Management Plan.

## Formation of the Source Water Protection Advisory Committee

The Town of Lunenburg established a Source Water Protection Advisory Committee in fall 2005. A representative from the Nova Scotia Department of Environment reviewed

the Provincial Drinking Water Strategy with the Committee and provided direction on the structure and responsibilities of a Source Water Protection Advisory Committee.

The Source Water Protection Advisory Committee required representation from the land owners in the Dares Lake watershed. Therefore, a meeting was held with land owners on March 1, 2006 to explain why a Source Water Advisory Committee (Committee) was required and requested that they appoint two representatives to be active participants on the Committee. Two representatives were selected and attended Committee meetings. Committee Terms of Reference were developed by the Committee and approved by Town Council on June 15, 2006. A copy of the Committee's Terms of Reference is attached as Appendix "A" to this document.

## Delineation of the Source Water Protection Area Boundary

The Dares Lake watershed was originally surveyed by Mr. Errol Hebb and a plan prepared on March 27, 1971. This survey plan identified land around the Dares Lake watershed which was to be protected. This land was protected from certain activities after being designated as a protected area in March 1972. A copy of the Dares Lake Protected Water Area Regulations is attached in Appendix "B".

The protection of the watershed was reaffirmed in 2007 under the NS Environment Act. A copy of the reaffirmed Dares Lake Protected Water Area Designation is attached as Appendix "C". A copy of the reaffirmed Dares Lake Protection Water Area Regulations is attached as Appendix "D".

The Source Water Protection Advisory Committee determined that a detailed survey of the drainage boundary was required to identify all the land which drained towards Dares Lake. Richard Wentzell, a Forest Technician from Mahone Bay, was hired to conduct this survey and completed his work in May 2007. A copy of his survey plan is attached in Appendix "E".

## Risk Management Options

The Source Water Protection Advisory Committee discussed various methods to protect the watershed. The options listed below are provided in a guide prepared by the Nova Scotia Department of the Environment for the protection of water supplies.

A. **Acquisition of Land** - the direct ownership of land in the source water supply area affords one of the highest levels of water quality protection.

B. **By-laws** - adopt land-use bylaws or develop a new municipal planning strategy. These instruments allow regulation of land uses permitted in source water supply areas. You can find more information in the Service Nova Scotia and Municipal Relations Local Government Resource Handbook: Municipal Water Supply Watershed Planning Model, section 5.7.

C. **Best Management Practices** - use best management practices and

guidelines to manage activities that take place in the source water supply area.

D. **Contingency Plans** - if there's a spill or other event that threatens the quality or quantity of the source water, a well-prepared contingency plan will allow continued protection of public health.

E. **Designation** - the Environment Act allows for the designation of Protected Water Areas. Designation allows a water utility or municipality to regulate activities like swimming, fishing and logging within a delineated area.

F. **Education** - work with stakeholders in the source water supply area to teach them about drinking water and water resource stewardship. This Source Water Protection Management Plan is intended to educate the public about the importance of a public water supply. Signs have been posted around the watershed to ensure that the public is aware of Dares Lake being a public water supply.

## Watershed Activities and Potential Risk to Source Water Quality

The Source Water Protection Advisory Committee conducted a review of the following activities which could be a potential risk to water quality in Dares Lake. Each activity indicates how the watershed is to be protected to eliminate or reduce the risk of contaminating the water supply.

### 1. Forestry Operations

Forestry operations are to be conducted in accordance with the following documents or the latest revision.

a. Wildlife Habitat and Watercourse Protection Regulations made under Section 40 of the Forest Act, Appendix "F".
b. Best Management Practices / Forestry Planning in Municipal Drinking Water Supply Areas Nova Scotia dated September 29, 2005, Appendix "G".
c. Best Management Practices Manual as prepared by the Nova Forest Alliance, Appendix "H".

Landowners must comply with NS Department of Environment regulations with respect to the application of herbicides within the watershed.

### 2. Christmas Tree Cultivation and Harvesting

Best Management Practices for Christmas tree cultivation and harvesting must be followed when working in the watershed. Christmas tree cultivation and harvesting is to be conducted in accordance with the latest revision of the following documents.

a. Nova Scotia's Wildlife Habitat and Watercourse Regulations (Appendix "I"), and
b. The Responsible Use of Herbicides in Nova Scotia Forests (Appendix "J").

3. Blueberry Cultivation and Harvesting

Best Management Practices for blueberry cultivation and harvesting must be followed when working in the watershed. Blueberry cultivation and harvesting is to be conducted in accordance with the latest revision of the following document.

a. Wild Lowbush Blueberry IMP, Weed Management Guide as published by the Province of New Brunswick, Department of Agriculture, Fisheries and Aquaculture (Appendix "K").
B. Lowbush Blueberry Fact Sheet from the Wild Blueberry Producers Association of Nova Scotia (Appendix "L").

4. Roads

a. Any person who wants to use or alter a watercourse (creek, brook, stream, river, lake, pond, spring, lagoon or any other natural body of water) requires a Watercourse Alteration Approval from NSE in accordance with the Environment Act.
b. The Woodlot Roads Stream Crossing Guide prepared by Glen Brathwaite 1992 (Appendix "M") is to be followed when constructing a wood lot road within the watershed.
c. Culverts on Awalt Road are to be maintained by Nova Scotia Transportation and Infrastructure Renewal.

5. Brooks, Streams and Watercourses Flowing into Dares Lake

Options should be evaluated in regard to mitigating any potential pollution sources near culverts/water crossings which flow towards Dares Lake.

6. Accidents and Spills

The accidental spill of any contaminant which may affect water quality even to a slight degree shall be cleaned up immediately and reported to the Town of Lunenburg as noted in the Contingency/Emergency Plan. Spills may also have to be reported to NSE as per the Emergency Spill Regulations (Appendix "N").

7. Pesticides and herbicides

The current regulations for the Dares Lake watershed prohibit the use of insecticides or fertilizers that could affect water quality even to the slightest degree in Dares Lake. The use of pesticides within the Dares Lake watershed must comply with Pesticide Regulations made under section 84 of the Environment Act.

8. Recreation

Recreational activities are prohibited on or near the Dares Lake as per the Dares Lake Protected Water Area Regulations. Property owners who own land which abuts Dares Lake may request permission from the Town Engineer for some recreational activities. If it is deemed that the activity will not cause an adverse effect to the quality of water in Dares Lake the Town Engineer may grant permission for that activity to take place.

9. Agriculture Uses

a. Pasturing or grazing of cattle or livestock is prohibited in the Dares Lake protected watershed area and discouraged in the natural watershed area.
b. The application and storing of manure is prohibited in the Dares Lake protected watershed area and discouraged in the natural watershed area.
c. Farmers are encouraged to implement an Environmental Farm Plan (EFP) by contacting the Nova Scotia Federation of Agriculture for any farms located within the natural watershed area.

10. Development

The Dares Lake Protected Water Area Regulations state "... no houses, cottages, sheds, lean to's, hovels, barns, privies or any other structure housing persons or animals, either on a temporary or permanent basis may be erected within the prescribed area..." (Appendix "D").

The Source Water Protection Advisory Committee received and updated a plan identifying existing land uses within the watershed and a copy of the plan is attached as Appendix "O".

## CONTINGENCY / EMERGENCY PLAN

Water Utility and Water Supply Contacts

In the event of an emergency where water in Dares Lake is or may be contaminated as a result of a spill or release the Town Engineer or Public Works Superintendent must be contacted as soon as possible to determine the extent of the spill or release and to take appropriate action. Scotia Business is the dispatch service for the Town of Lunenburg Water Utility. Scotia Business will contact the Town Engineer or Public Works Superintendent during non-working hours. Contact numbers for Water Utility Managers are provided below and these numbers can be used during normal working hours (Monday to Friday between 8:00 am and 4:30 pm).

**Primary Contact Number** (24 hours a day / 7 days a week)

Water Utility Dispatch Service (902) 527-0150

**Secondary Contact Numbers** (during normal working hours)

Water Utility Managers

Town Engineer (902) 634-8992
Public Works Superintendent (902) 634-8992

Water Supply Information

The Dares Lake Water Supply is located in Northwest, Lunenburg County, Nova Scotia. The watershed (natural drainage area) is approximately 900 acres which surrounds and includes Dares Lake. The water intake (civic #763 Northwest Road, Route 324) is located on the eastern side of Dares Lake. The pump house (765 Northwest Road, Route 324) is where water is pumped into the distribution system. A map is attached as Appendix “Q”.

Emergency Procedure

In the event of an emergency where the water supply has become contaminated the Town of Lunenburg Water Utility Water Quality Emergency Notification Procedure should be activated. This procedure is kept on file at the Water Treatment Plant and Town Hall. The first action to be taken by the Town Engineer or designate as the Water Utility Manager is to ensure all Water Utility pumps are turned off to prevent contaminated water from entering the distribution system. The Town Engineer will next contact the Regional Emergency Management Organization Manager, Town of Lunenburg Emergency Management Assistant Coordinator and Chief Administrative Officer as soon as is possible to advise of the emergency. The Town Engineer will next contact Nova Scotia Environment (NSE) and the Nova Scotia Medical Officer of Health (NSMOH) along with all the institutional and commercial customers whose contact information is included in the Water Utility Water Quality Emergency Notification Procedure.

The Town Engineer and Regional Emergency Management and Lunenburg Assistant Emergency Management Coordinators will work with the NSMOH and NSE in planning action required to protect Water Utility customers. The plan may include such measures as issuing a boil water advisory, radio, social media and other advertisements, posting of signs in the community and direct contact to institutional, conferring with institutional and commercial customers at a higher health risk due to water demands. A plan will be formulated to determine the source of the contamination and how to remove it from the watershed and distribution system. The plan will also address as necessary an alternate source of water for Water Utility customers be it by truck and/or bottles of water during the investigation, clean-up and testing the water supply prior to resuming normal use. The determination as to when the water supply is safe will be made by NSE and NSMOH in consultation with the Town Engineer.

In the event of a fire or contamination spill within the watershed the Fire Department is to be immediately contacted by calling 911 by whomever witnesses the fire or spill.

Contingency/Emergency Plan Annual Review

The Contingency/Emergency Plan should be reviewed on a yearly basis to ensure that information is up to date. It should also be reviewed after an emergency to determine if any updates are required.

## EVALUATION AND MONITORING

Evaluating and Updating the Plan

The Source Water Protection Management Plan will be annually reviewed by the Source Water Protection Advisory Committee if in effect or Council to determine if the Plan is achieving the desired results. If the Plan is not meeting the objectives of the Committee and/or Council as applicable then it should be updated to reflect changes required to protect the watershed.

Monitoring Program

Water quality in Dares Lake is monitored and tested by the Town's Water Utility. If raw water conditions change or are of concern to the Utility then action should be taken to address the issue(s) to ensure that there are no adverse water quality effects in the watershed. Raw water samples are tested two times per year for all parameters in the Guidelines for Canadian Drinking Water Quality and results compared to prior test results. Any results which indicated a change in raw water quality should be investigated to determine the source of the contaminant. Routine monitoring of the water supply is to be conducted in accordance with NSE's Guidelines for Monitoring Public Water Supplies (Appendix "P").

Appendix "A"

# TOWN OF LUNENBURG WATER UTILITY
# SOURCE WATER PROTECTION ADVISORY COMMITTEE
# TERMS OF REFERENCE

## INTRODUCTION

The Town of Lunenburg's Source Water Protection Advisory Committee (SWPAC) will use these Terms of Reference to develop a Source Water Protection Plan for Dares Lake watershed. The Source Water Protection Plan will be used to protect water quality in Dares Lake and the customers that are supplied water by the Town's Water Utility. The Nova Scotia Department of Environment will provide guidance to the Advisory Committee in developing the Source Water Protection Plan.

## DARES LAKE WATERSHED

Dares Lake watershed is located approximately four (4) kilometers northwest of the Town of Lunenburg. The watershed is approximately 800 acres in area, of which 500 acres are prescribed as a protected area. The surface area of the lake is approximately 400 acres. The majority of land within the watershed is privately owned. The Town of Lunenburg owns approximately 70 acres of land within the watershed.

The protected area within the Dares Lake watershed was officially designated as a protected area in 1972 and published in the Royal Gazette on May 3, 1972. The watershed generally consists of raw forested land. No structures have been built in the watershed area.

## SOURCE WATER PROTECTION ADVISORY COMMITTEE PURPOSE

The primary purpose of the Advisory Committee is to ensure that safe drinking water is supplied to both businesses and residents within the Town of Lunenburg and the Municipality of the District of Lunenburg. The best method to ensure that the water supply does not get contaminated is to develop best management practices for activities within the watershed. This can be achieved by planning and working with all stakeholders who have an interest in the watershed and water supply.

## ROLE OF THE SOURCE WATER PROTECTION ADVISORY COMMITTEE

1. Provide a method for all stakeholders to get involved and share information on matters of watershed protection.

2. Develop best management practices for activities within the watershed. The plan may incorporate a range of available options, including

(1) Acquisition of Land
(2) By-laws (Planning Strategy and Land Use By-laws)
(3) Best Management Practices
(4) Contingency Plans
(5) Designation
(6) Education

3. Identify the boundary of the watershed area.

4. Identify the potential contaminants and assess risk.

5. Advise on forestry and other land use issues within the watershed.

6. Develop a Source Water Protection Management Plan which upon completion will be recommended to the Town of Lunenburg Town Council for approval.

## MEMBERSHIP

**Voting Members**

Two Members from Lunenburg Town
One Member from Municipality of the District of Lunenburg
Two Members from Dares Lake landowners
Town Engineer of the Town of Lunenburg

**Non - voting Members**

Town Planner of the Town of Lunenburg
Municipal Planner of the Municipality of the District of Lunenburg
Two employees from the Nova Scotia Department of Environment

## OPERATION OF THE SOURCE WATER ADVISORY COMMITTEE

1. Chairperson and Vice-Chairperson will be appointed by the Committee on or about the 1st of April each year.

2. Each member may appoint an alternate to attend meetings in their absence.

3. The Town of Lunenburg will prepare minutes for all meetings.

4. The Committee will attempt to resolve issues by a consensus of the members entitled to vote on issues. If a consensus cannot be reached then a vote shall be taken of which at least two thirds of the voting members will have to be in favor in order for a motion to pass. Three voting members will constitute a quorum.

5. The Chairperson shall act as spokesperson for the Committee.

6. Amending the Terms of Reference will require the approval of the Town of Lunenburg.

Appendix "B"

PPENDIX "B"

The Undersigned, the Minister charged with the administration of the Water Act, pursuant to Section 17 of the said Act hereby orders that the area of land in the County of Lunenburg, hereinafter described, which surrounds a source of water supply for the water works operated by the Town of Lunenburg, is now and hereafter designated as a Protected Water Area:

The Undersigned, pursuant to sub-section (2) of Section 17, does hereby order that with respect to the protected water area the following regulations will apply:

1. No Municipality or person shall discharge or deposit any material of any kind into or in any well, lake, river, pond, spring, stream, reservoir or other water or water course or on any shore or bank thereof or into or in any place that may cause pollution or impair the quality of the water in Dares Lake for domestic, commercial or industrial use.

2. No Municipal or private garbage or refuse may be disposed of within the prescribed watershed area, either by sanitary land fill, incineration or any other method.

3. No fishing, swimming, boating, camping, picnicking, snowmobiling or any other similar purpose will be permitted in or on the lake or in or on the prescribed area, unless it is for the express purpose of making surveys, taking water samples or any other use deemed necessary by the Town of Lunenburg for its' own use and benefit.

4. No houses, cottages, sheds, lean to's, hovels, barns, privies or any other structure housing persons or animals, either on a temporary or permanent basis may be erected within the prescribed area.

5. No grazing of cattle or livestock of any kind will be permitted within the prescribed watershed area.

6. Any land presently being used and maintained as "cultivated land" may continue to be used as such, providing precautions are taken to prevent runoff of excessive amounts of insecticides and fertilizers that could even to a slight degree affect the quality of the water in Dares Lake.

7. Logging or cutting of wood on so-called "woodlot areas" may continue providing:
   (a) Indiscriminate cutting is not permitted.
   (b) Good conservation and preventative land erosion practices are adhered to.
   (c) Persons carrying out the logging operation do not indiscriminately drain gas or oil from machinery, vehicles or hand machines on the ground where the residue could be washed into the lake.

DATED at Halifax, in the Province of Nova Scotia this 8th day of March A. D. 1972.

Appendix "C"

**Dares Lake Protected Water Area Designation**

**made under subsection 106(5) of the *Environment Act***

**S.N.S. 1994-95, c. 1**

**N.S. Reg. 259/2007 (March 8, 1972)**

Canada )

Province of Nova Scotia )

**In the Matter of** The *Water Act*, Chapter 335, of the Revised Statutes of Nova Scotia 1967, as amended by Chapter 64 of the Statutes of Nova Scotia 1968

- and -

**In the Matter** of A Protected Water Area

The Undersigned, the Minister charged with the administration of the *Water Act*, pursuant to Section 17 of the said Act hereby orders that the area of land in the County of Lunenburg, hereinafter described, which surrounds a source of water supply for the water works operated by the Town of Lunenburg, is now and hereafter designated as a Protected Water Area:

All and singular that certain parcel or tract of land and land covered by water situate lying and being at Northwest in the County of Lunenburg, Province of Nova Scotia, Canada, which can be more particularly described as follows:

Beginning at a point on the division line between properties of Michael Falkenham and Lottie M. Cantelope et al. on the Northeastern side of Dares Lake which said point is located Three Hundred Sixty feet (360.0') measured Northeastwardly along said division line from the mean high water mark of the Northeastern shore of Dares Lake;

Thence from said point so located South Eleven degrees three minutes Fifty-four seconds East (S 11°03'54" E) (Astronomic Meridian) over said property of Lottie M. Cantelope et al. One Thousand Three Hundred Ninety feet (1,390.0') more or less, to a point marked by a stake driven into the ground;

Thence South Thirty-six degrees Twenty-six minutes Fifty-four seconds East (S 36°26'54" E) over properties of Lottie M. Cantelope et al. and Benjamin Kaulback One Thousand Four Hundred Seven and Seventy-four one hundredths feet (1,407.74') more or less, to a point marked by a stake driven into the ground;

Thence South Forty degrees Fifty-four minutes Thirty seconds West (S 40°54'30" W) along the Southeastern boundary of property of Evans Parks and Ross Parks Eight Hundred Fifty and Ninety-eight one hundredths feet (850.98') more or less, to a point marked by a stake driven into the ground;

Thence North Fifty-nine degrees Thirty minutes West (N 59°30' W) over said property of Evans Parks and Ross Parks One Thousand One Hundred Sixty-two feet (1,162.0') more or less to a point marked by a stake driven into the ground;

Thence South Thirty-seven degrees Thirty-one minutes West (S 37°31' W) over properties of Evans Parks and Ross Parks and Heirs of the Estate of Forman Robar and Amiel Demone respectively Five Thousand Eleven and Ninety-four one hundredths feet (5,011.94') more or less, to a point marked by a stake driven into the ground;

Thence South Seventy-two degrees Thirty minutes West (S 72°30' W) over property of Carol W. Dares and Elmore Awalt respectively Two Thousand Five Hundred Fifty-two and Ninety-one one hundredths feet (2,552.91') more or less, to a point marked by a stake driven into the ground;

Thence North Twenty-two degrees Thirty minutes West (N 22°30' W) over property of Elmore Awalt Seven Hundred Fifteen and Sixty-two one hundredths feet (715.62') more or less, to a point marked by a stake driven into the ground;

Thence North Nine degrees Thirty-nine minutes West (N 09°39' W) over property of Elmore Awalt and Hugh Anderson respectively One Thousand Three Hundred Ninety-six feet (1, 396.0') more or less, to a point marked by a stake driven into the ground;

Thence North Seventeen degrees Four minutes East (N 17°04' E) over properties of Hugh Anderson, Lloyd Wentzell and Hazel Wentzell respectively Three Thousand Four Hundred Twenty Feet (3,420.0') more or less, to a point marked by a stake driven into the ground;

Thence North Twenty-seven degrees Thirty-five minutes East (N 27°35' E) over properties of Lloyd Wentzell and Hazel Wentzell, Olive E. Dorey and Aubrey Berringer respectively Four Thousand Two Hundred Seventy-nine and Seven one hundredths feet (4,279.07') more or less, to a point marked by a stake driven into the ground;

Thence North Fifty-three degrees Thirteen minutes Fifty-four seconds East (N 53°13'54" E) over property of Aubrey Berringer and along the division line between properties of Palmer Langille and Olive E. Dorey Seven Hundred Seventy-eight and Thirty-eight one hundredths feet (778.38') more or less, to a point marked by a stake driven into the ground;

Thence North Fifty-two degrees Six seconds East (N 52°00'06" E) along said division line One Hundred Fifty-seven and Seventy-seven one hundredths feet (157.77') more or less, to a point marked by a stake driven into the ground;

Thence North Fifty-two degrees Thirty-six minutes East (N 52°36' E) along said division line Three Hundred Ninety-five and Forty-nine one hundredths feet (395.49') more or less, to a point marked by a stake driven into the ground;

Thence North Fifty-four degrees Fifty-three minutes East (N 54°53' E) along said division line One Hundred Eighty-two and Twenty-eight one hundredths feet (182.28') more or less, to a point marked by a stake driven into the ground;

Thence North Fifty-three degrees Seventeen minutes East (N 53°17' E) along said division line Two Hundred Ninety-six and Forty-six one hundredths feet (296.46') more or less, to a point marked by a stake driven into the ground;

Thence South Thirty-five degrees Fifty-six minutes East (S 35°56' E) over properties of Olive E. Dorey, Michael Falkenham and Aubrey Berringer One Thousand Three Hundred Sixty-four and Thirty-eight one hundredths feet (1,364.38' more or less, to a point marked by a stake driven into the ground;

Thence South Forty-three degrees Thirty-six minutes forty-eight seconds East (S 43°36'48" E) over property of Aubrey Berringer Two Hundred Twenty-five and Forty-five one hundredths feet (225.45') more or less, to a point marked by a stake driven into the ground;

Thence South Forty degrees Ten minutes East (S 40°10' E) over properties of Aubrey Berringer, Alice Spidle, Muriel Nauss, Olive Dorey and Michael Falkenham respectively One Thousand Five Hundred Fifteen and Sixty-six one hundredths feet (1,515.66') more or less, to a point marked by a stake driven into the ground;

Thence South Eleven degrees Three minutes Fifty-four seconds East (S 11°03'54" E) over said property of Michael Falkenham Four Hundred Eighty feet (480.0') more or less, to the point marking the place of beginning, all bearings being astronomic.

The herein described lot of land and land covered by the waters of Dares Lake contains an approximate area of Nine Hundred and Seventy-one one hundredths acres (900.71 acs.) and is shown on a Plan of Survey showing Dares Lake and bordering properties at Northwest, Lunenburg Co., N.S. dated at Bridgewater, N. S. the 27th day of March, A. D., 1971 and approved by Errol B. Hebb, Nova Scotia Land Surveyor No. 7.

Dated at Halifax, in the Province of Nova Scotia this 8th day of March A. D. 1972.

*Glen M. Bagnell*

Minister Charged with the Administration of the *Water Act*

Appendix "D"

# Dares Lake Protected Water Area Regulations

**made under subsection 106(5) of the**

***Environment Act***

**S.N.S. 1994-95, c. 1**

**N.S. Reg. 260/2007 (March 8, 1972)**

(1) No Municipality or person shall discharge or deposit any material of any kind into or in any well, lake, river, pond, spring, stream, reservoir or other water or water course or on any shore or bank thereof or into or in any place that may cause pollution or impair the quality of the water in Dares Lake for domestic, commercial or industrial use.

(2) No Municipal or private garbage or refuse may be disposed of within the prescribed watershed area, either by sanitary land fill, incineration or any other method.

(3) No fishing, swimming, boating, camping, picnicking, snowmobiling or any other similar purpose will be permitted in or on the lake or in or on the prescribed area, unless it is for the express purpose of making surveys, taking water samples or any other use deemed necessary by the Town of Lunenburg for its own use and benefit.

(4) No houses, cottages, sheds, lean to's, hovels, barns, privies or any other structure housing persons or animals, either on a temporary or permanent basis may be erected within the prescribed area.

(5) No grazing of cattle or livestock of any kind will be permitted within the prescribed watershed area.

(6) Any land presently being used and maintained as "cultivated land" may continue to be used as such, providing precautions are taken to prevent runoff of excessive amounts of insecticides and fertilizers that could even to a slight degree affect the quality of the water in Dares Lake.

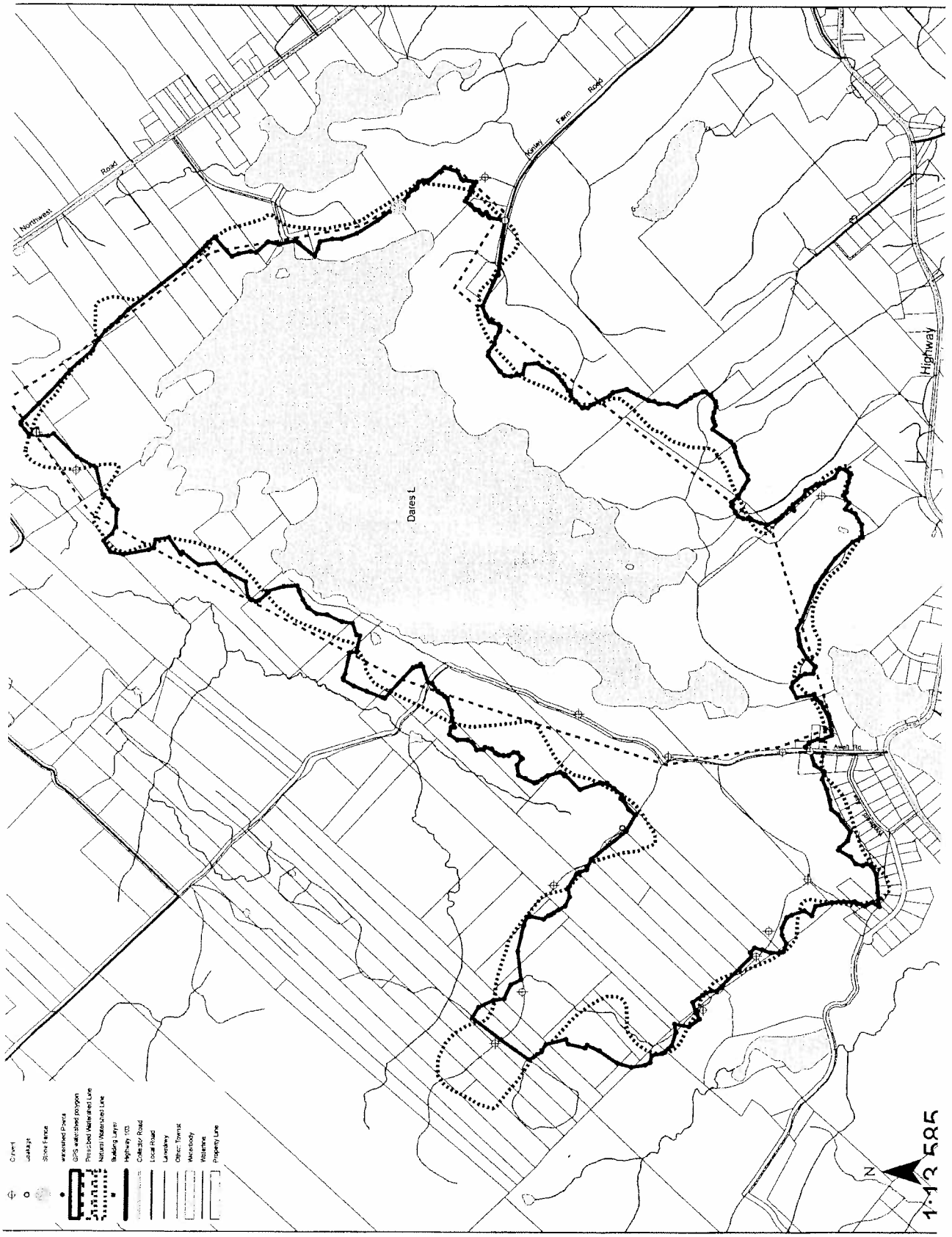
(7) Logging or cutting of wood on so-called "woodlot areas" may continue providing:

(a) Indiscriminate cutting is not permitted.

(b) Good conservation and preventative land erosion practices are adhered to.

(c) Persons carrying out the logging operation do not indiscriminately drain gas or oil from machinery, vehicles or hand machines on the ground where the residue could be washed into the lake.

Appendix "E"


Northwest
Road
Kinsey Farm
Road
Highway
Dares L
Awalt Rd
N
1:12,595
Cursor
Lookout
Snow Fence
watershed Points
GPS watershed polygon
Prescribed Watershed Line
Natural Watershed Line
Building Layer
Highway 100
Collector Road
Local Road
Laneway
Other Towns
Waterbody
Waterline
Property Line

# Lunenburg Watershed (Dares Lake)

## Establishing the Boundary

The Town of Lunenburg has been using Dares Lake as the towns water supply since 1895. I was hired by the Town in 2006 to establish the boundary for the watershed surrounding Dares Lake.

The criteria used to establish the boundary was very simple; any land that would allow water to drain into Dare's Lake would be considered "watershed lands". I started to establish the general locations and land search in January 2007. I spent time walking the alleged boundary and marked it with flags, as I determined the boundary. I planned much of the initial walking with times of peak water flow. With weather being unpredictable this can be difficult, however, this turned out to be very important, especially in the Spectacle Lake area and the south western side of Dare's Lake.

The points shown on the map were collected using a hand held GPS unit (Garmin Map76) and plotted on digital mapping. In addition to the boundary I have included culvert locations and a few points of interest in addition to the boundary.

The GPS readings (waypoints), give an area of the watershed as 1191 acres (482 hectares). A dot grid was used to estimate the area of the lake. My calculations give an area of the lake as 402 acres (162.5 hectares) 33.7% of the enclosed watershed area. The remaining 66.7% would be the lands that surround the lake.

The GPS data was collected on the following dates: April 26th , 27th ,28th , 30th, May1st and May 5th . All readings were taken in 2007.

373 waypoints were gathered during my final traverse of the watershed. I have broken the traverse into the following sections, with a brief description of each.

| Waypoints | Description |
|---|---|
| 1-2 | Abandoned field |
| 2-53 | Wooded areas with openings regeneration well established |
| **26** | Low area |
| **45** | Low area |
| 53-54 | Well established regeneration 8-12' mixed stand |

| | |
|---|---|
| 54-62 | Stand of thinned mature spruce |
| **56** | Low area |
| 62-66 | Openings with regeneration at differing stages |
| 68-71 | Christmas Tree lot |
| 71-82 | Thicket of coniferous trees - openings with differing stages of growth |
| 82-91 | Mature spruce with openings/road |
| **83-85** | Low area |
| 91 -95 | Blueberry cultivated lands |
| 96-115 | Road, mature spruce (some thinned) arriving at Awalt Road vicinity |
| 116-125 | Through "home properties" crossing Awalt Road<br>Note: This area may require more detailed research in times of heavy water flow |
| **123-125** | Low area |
| 121- 147 | Young immature growth - thick in places |
| 147-160 | Mature thinned spruce |
| 160-168 | Along a road and into the edge of a regenerated cut-over 4-10' naturally regenerated trees |
| 168- 173 | Patchy - Mature spruce, some deciduous trees regeneration established in openings - small areas with recent selection cuts |
| **173** | Low area |
| 173-188 | Mature with openings - recent selection cuts, spruce, hemlock & deciduous trees |
| 188-190 | Along a road in a Christmas Tree lot |
| 189-192 | Christmas Tree lot |
| 192-195 | Area with varying species and openings |
| 195-199 | Along a road |
| 199-213 | Through mature thinned spruce and road in places |
| **202-203** | Low area |
| 213-226 | Mature thinned spruce |

| | |
|---|---|
| 226-256 | Regenerated cut-over with 8-20' growth variety of species coniferous and deciduous |
| 256-313 | Variety of stand conditions- mostly spruce some areas thinned, however mostly natural growth |
| **259-260** | **Low area** |
| **281** | **Low area** |
| **303** | **Low area** |
| **307-309** | **Low area**<br>Note: This area flooded and drained into Martin's Brook during peak water flow |
| 314- 316 | Christmas Tree lot |
| 316-320 | Cultivated lands |
| 320-324 | Mature coniferous woods |
| 324-325 | Immature forest (home properties)<br>Note: Should be checked out in times of peak water flow |
| 325-332 | Field, forest openings, recent cutting<br>Note: I think a culvert/ditch could divert water to Cantelope lake from 324 to here, thereby reducing the area of the watershed |
| 332-334 | Field |
| 334-335 | Dam on Dare's Lake - brook leading to Pump House |
| 335-336 | Road from dam to Dare's Lake |
| 336-346 | Differing stages of over mature forested lands |
| 346-372 | Regenerated cut-over both coniferous and deciduous, thinned and natural. 8-20' |
| 372-373 | Road and field |
| 373-1 | Field |

| Culverts | Direction of flow |
|---|---|
| Culvert 1 | New culvert directing water to Martin's Brook |
| Culvert 2 | New culvert directing water to Dare's Lake |
| Culvert 3 | Culvert on Kinley Farm Road directing water to Cantelope Lake |
| Culvert 4 | Culvert on a logging road directing water to Dare's Lake |
| Culvert 5 | Culvert on home property leading to Spectacle Lakes |
| Culvert 6 | Culvert leading to Dare's Lake |
| Culvert 7 | Culvert leading to Dare's Lake - this has the largest volume of flow leading to Dare's Lake |
| Culvert 8 | Culvert leading water to Martin's Brook |
| Culvert 9 | Culvert directing water to Dare's Lake. I think this portion (189-195) could be diverted to Martin's Brook, with some excavating |
| Culvert 10 | Culvert outside the watershed boundary, directing water to Martin's Brook |
| Culvert 11 | Culvert directing water to Dare's Lake |
| Culvert 12 | Culvert directing water to Dare's Lake |
| Culvert 13 | Culvert directing water from a fire pond to Dorey's Marsh |
| Culvert 14 | Culvert directing water to Doreys Marsh |
| Culvert 15 | Culvert directing water to Dare's Lake |
| Old Culvert | Remains of an old culvert - water goes to Cantelope Lake |
| "Leakage" | It appears a culvert may have collapsed under the road. This leakage appears to be fed by a fire pond and leads to Martin's Brook |
| Stone wall/fence | At weigh-point 346 there are the remains of an old stone wall |
| | |

Note: Andrew Parks indicated to me that he **may** establish a home on the Parks property. He would like to place it to the north of waypoints 373-2. I think a minimal amount of ditching could easily divert any water in this area to culvert number 3.

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------- T O Alt(m) CommentW
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002 USER -- 20T 391313 4916505 Waypoint I E 57.1 26-APR-07 17:23W
003 USER -- 20T 391274 4916491 Waypoint I E 55.4 26-APR-07 17:26W
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006 USER -- 20T 391227 4916440 Waypoint I E 54.9 26-APR-07 17:30W
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CULVERT 14 -- 20T 388600 4915664 Waypoint I E 58.3 01-MAY-07 19:28W

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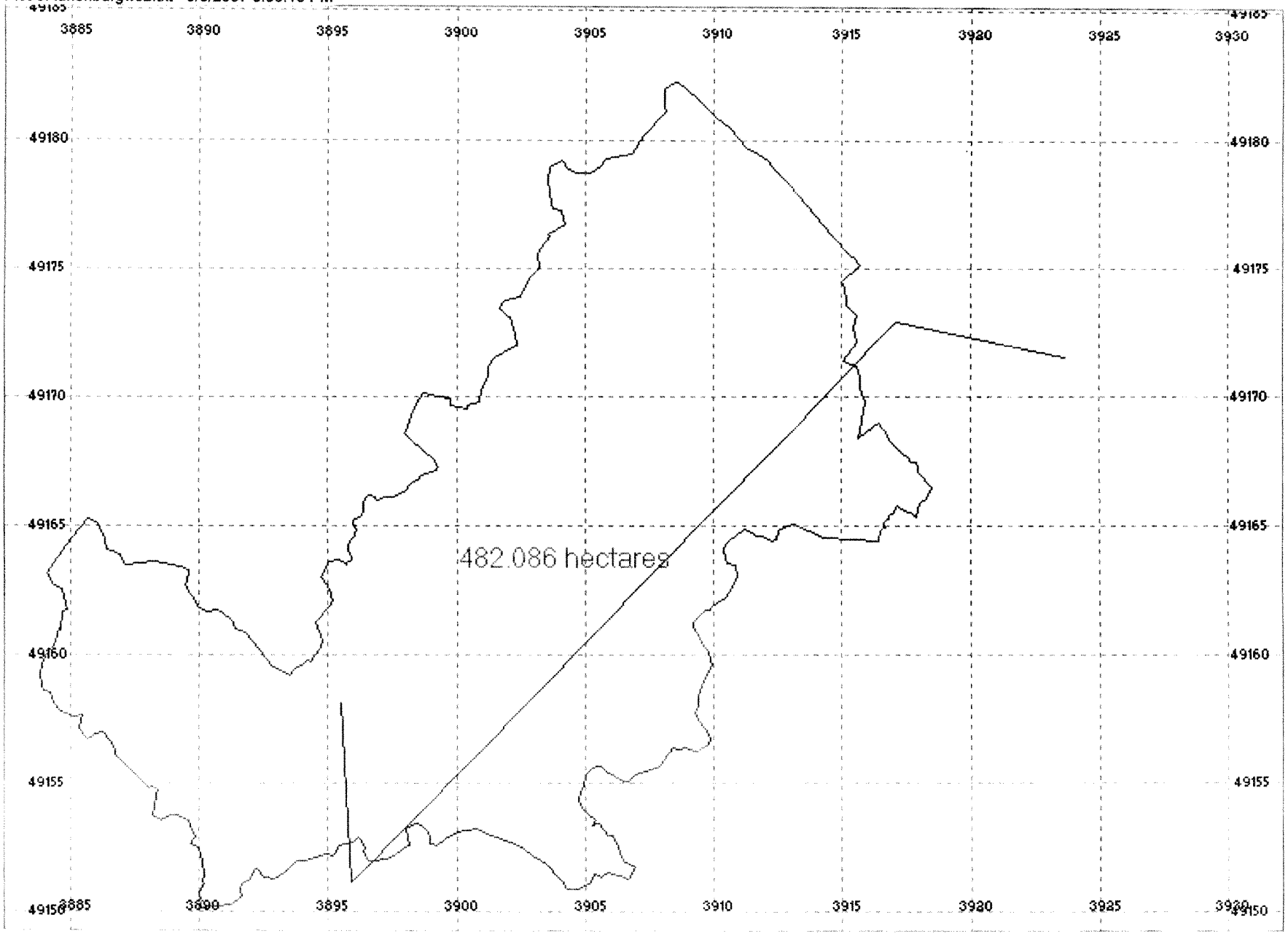


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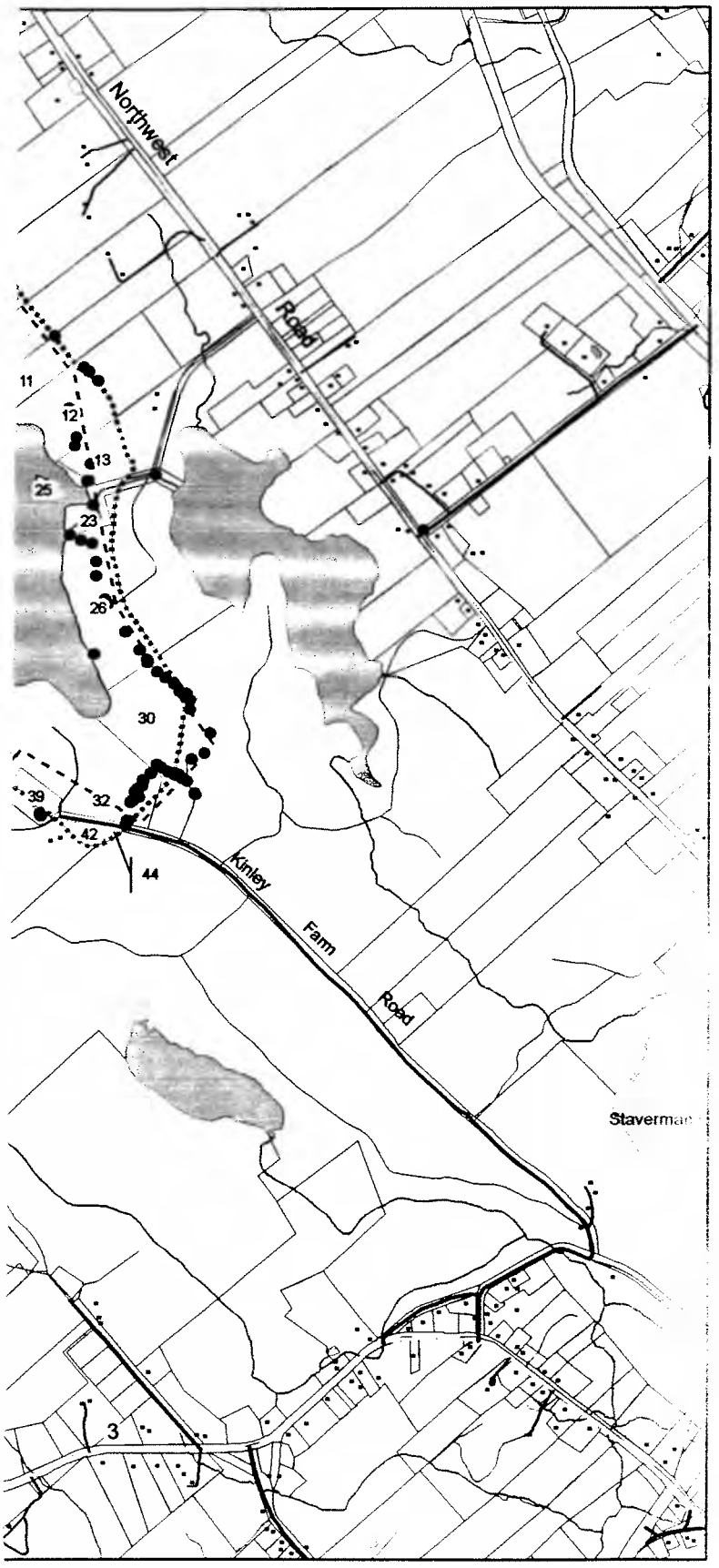
482.086 hectares


Northwest
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Kinley
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# Wildlife Habitat and Watercourses Protection Regulations

**made under Section 40 of the**
*Forests Act*
**R.S.N.S. 1989, c. 179**
**O.I.C. 2001-528 (November 15, 2001, effective January 14, 2002), N.S. Reg. 138/2001**
**as amended by O.I.C. 2002-609 (December 20, 2002), N.S. Reg. 166/2002**

**Citation**
**1** These regulations may be cited as the *Wildlife Habitat and Watercourses Protection Regulations*.

**Definitions**
**2** In these regulations

(a) "Act" means the *Forests Act*;

(b) "basal area" means the surface area of the cross-section of the trunks of the standing trees, measured at a height of 1.3 m from the ground;

(c) "bed" means that portion of a watercourse within a defined flow channel containing predominantly mud, silt, sand, gravel or rock;

(d) "forestry operator" means a person who harvests or permits the harvest of primary forest products or who conducts or permits a silviculture operation or related program on forest land and includes, but is not limited to

(i) an owner, occupier, lessee, or tenant of forest land, and

(ii) a producer or buyer of forest products, as defined in the Act,

and an agent, contractor or anyone otherwise acting on behalf of such a person;

(e) "harvest" means a forestry operation that removes primary forest products from an area of forest land, but does not include the removal of Christmas trees or a forestry operation whose primary purpose is to convert the land to a non-forestry use;
**Clause 2(e) amended: O.I.C. 2002-609, N.S. Reg. 166/2002.**

(f) "marsh" means an area of permanent standing or slow moving water that is vegetated in whole or in part with aquatic or hydrophytic plants;

(g) "special management zone" means an area of forest required to be established adjacent to a watercourse in accordance with Sections 5 and 6 to protect the watercourse and bordering wildlife habitat from the effects of forestry operations;

(h) "vehicle" means a vehicle propelled or driven otherwise than by muscular power, whether or not the vehicle is registered pursuant to the *Motor Vehicle Act*;

(i) "watercourse" means the bed and shore of a river, stream, lake, creek, pond, marsh, estuary or salt-water body that contains water for at least part of each year.

**Application**
**3** For greater certainty, these regulations apply only to persons carrying out forestry operations in a forest or on forest land.

**Legacy trees and habitat structure**
**4 (1)** On any harvest site comprising an area greater than 3 hectares of forest land, the forestry operator shall ensure that at least 10 living, or partially living, trees are left standing for each hectare of forest land cut.

(2) The trees required to be left standing pursuant to subsection (1) shall be

(a) in the same proportion by species as the forest stand being cut;

(b) as large as or larger than, in height and diameter, the average height and the average diameter, measured at a height of 1.3 m from the ground, of the trees within the forest stand being cut; and

(c) clumped together in accordance with the following:

(i) each clump shall contain no fewer than 30 trees,

(ii) there shall be at least one clump for each 8-hectare area, or part thereof, of forest land cut,

(iii) where there is more than one clump, clumps shall be situated no more than 200 m apart and at least 20 m but no more than 200 m from the edge of the forest stand being cut,

(iv) where there is one clump, it shall be situated at least 20 m but no more than 200 m from the edge of the forest stand being cut, and

(v) there shall be no harvesting of trees within any clump.

(3) Trees required to be left standing pursuant to subsection (1) shall not be removed before the next harvest.

(4) A forestry operator shall ensure that levels of snags and coarse woody debris on all harvested sites are similar to natural patterns to the fullest extent possible.

**Determining average width of watercourse**
**5** For the purposes of Sections 6 and 7, the average width of a watercourse shall be determined by measuring the width of the bed of the watercourse at 10 approximately equidistant locations extending along the entire portion of the watercourse situated within or adjacent to the forest land where a forestry operation is carried on, and taking the average of the measurements.

**Special management zones**

**6 (1)** Where the average width of a watercourse situated on or adjacent to forest land on which a forestry operation is carried on is equal to or greater than 50 cm, a forestry operator shall establish or ensure the establishment of a special management zone of at least 20 m in width along all boundaries of the watercourse.

**(2)** Where the land on which a special management zone is established pursuant to subsection (1) has an average slope within 20 m of a watercourse boundary of greater than 20%, the forestry operator shall increase the width of the special management zone by 1 m for each additional 2% of slope to a maximum of 60 m in width.

**(3)** No forestry operator shall within a special management zone

(a) permit the use of, use or operate a vehicle for forestry operations within 7 m of the watercourse;

(b) reduce the basal area of living trees to less than 20 $m^2$ per hectare; or

(c) create an opening in the dominant tree canopy larger than 15 m at its greatest dimension.

**(4)** Despite clause (3)(a), the operation of a vehicle for the purpose of watercourse crossings approved by the Department of Environment and Labour is permitted within a special management zone.

**Protection of watercourse less than 50 cm wide**

**7** Where the average width of a watercourse situated on or adjacent to forest land on which a forestry operation is carried on is less than 50 cm, no forestry operator shall permit the use of, use or operate a vehicle for forestry operations within 5 m of the watercourse, except for the purpose of watercourse crossings approved by the Department of Environment and Labour.

**Provisions applying to all watercourses**

**8** A forestry operator shall ensure that understory vegetation and non-commercial trees within 20 m of the edge of any watercourse are retained to the fullest extent possible.

**9** No forestry operator shall conduct any activity within 20 m of the edge of any watercourse that would result in sediment being deposited in the watercourse.

**Offence**

**10** Every person who does anything prohibited by these regulations or who fails to do anything required by these regulations is guilty of an offence.

Last updated: 24-03-2009

Appendix "G"

# Best Management Practices/Forest Planning in Municipal Drinking Water Supply Areas Nova Scotia

September 29, 2005

## Forestry Operations in Municipal Water Supply Areas

Forestry operations proposed in municipal water supply areas (MWSA) are subject to regulations and provisions in the Environment Act and any additional provisions or management strategies contained within municipal source water protection plans (SWPP). While the Forests Act and the Environment Act are administered under the provincial Departments of Natural Resources and Environment and Labour respectively, SWPP's are administered by the water utility operator or the municipality. As a matter of good business practice persons involved in forestry operations are expected to take every precaution to protect the environment, and respect local communities.

The objective of this pamphlet is to outline the various activities associated with the different stages of forest operations and explain how regulations under the Forests and Environment Acts work in concert with provisions in SWPP's to protect drinking water quality in MWSA's.

## Source Water Protection Planning

Every provincially approved municipal water utility in Nova Scotia must develop a plan to prevent contamination of the source water and keep it as clean as possible. These plans are called Source Water Protection Plans and are a condition of approval to operate the water utility. Source Water Protection Plans contain a range of management strategies that are designed to manage and minimize impacts from activities that can potentially impair water quality. Each municipal SWPP is unique to the source water supply area.

Management strategies may include specific regulations developed under section 106 of the Environment Act (*Designation of a Protected Water Area*). Regulations and other management strategies, such as best management practices, in a municipal source water protection plan may affect forestry activities. It is the responsibility of proponents planning to conduct forestry related activities to contact Nova Scotia Environment and Labour, and the local water utility operator, in order to find out if there are any additional constraints to activities they may undertake, and determine how SWPP management strategies may affect proposed forestry activities.

## Best Management Practice and Long Term Planning

In Nova Scotia, generally two types of approaches are taken to managing the forest when addressing environmental considerations. The most common approach is "Best Management Practices" that are designed to protect watercourses, forest attributes, maintain water quality and wildlife habitat. In this document, a table is provided that outlines a subset of the existing regulations and practices in Nova Scotia that contribute to the maintenance of water quality when undertaking forest operations within a municipal water supply area. The table is provided in Appendix "A" together with information on interpreting the table and sources for more detailed information.

A second approach that is complementary to the "Best Management Practices" involves sustainable long term forestry management planning. This approach provides greater assurance that water quality and quantity will be maintained or enhanced over the long term. This approach ensures measures for the long term maintenance of healthy vegetative cover on forest lands and may place limits on the overall amount of human-caused forest disturbance which should occur within specified time frames.

Sustainable long term forest management planning has been used in cooperation with water utilities where Crown, large land owners or Crown licensees have tenure. Such planning is often done in the context of broader planning for the entire tenure holding, but is more detailed within the municipal water supply area where maintenance of water quality and quantity has been identified as the priority objective. This approach will have limited value if the MWSA is small or there is not a lot of forest land. Fractured land holdings could make this approach complex and more difficult as the cohesive cooperation of many land owners may be needed. However, it should be of interest, particularly if there is a lot of forest land or the municipality has acquired land within the MWSA.

In long term planning, consideration is given to applying land classification and ecosystem management principles to resource management. Knowledge regarding natural forest disturbance regimes, the stages of forest development and the local ecology can assist to develop cutting patterns and practices. This is used to promote natural patterns of species, balanced age class distributions, promote natural forest stand development and stand structure and determine representative forests to serve as old forest habitats. A pamphlet entitled "Mapping Nova Scotia's Terrestrial EcoSystems" is available from the Department of Natural Resources which provides more explanation.

Consideration and analysis of underlying geology, soil stability, vegetative cover, disturbance regimes, frequency of natural and human-caused disturbances in the municipal water supply area is encouraged. Potential for future large scale catastrophic events should be given particular consideration and avoided, if possible, by appropriate interventions in forest development. For example, large tracts of forest land that are allowed to become over-mature in municipal water supply areas could potentially cause water quality problems such as sedimentation from uprooted trees or excessive amounts of decaying organic material. The likelihood of this type of event is influenced by site, exposure, forest stand conditions and forest tree species. Some combinations present very little risk while others present a very high risk. Experienced foresters can assist in assessing the risk.

Where it is determined that the risk is high or the conditions are such that an unstable forest is likely to develop over time, the implementation of forest treatment prescriptions from careful, knowledgeable based planning can reduce risks to water quality. Professionals specializing in ecosystem based management and silviculture and harvesting options can assist.

Once an analysis has been done, a plan should set out goals with a strategy to achieve the stated objectives. Enhanced forest management prescriptions, special practices or restrictions may be necessary on portions of watersheds where site specific sensitive conditions exist or to regulate the amount of disturbance occurring with defined time periods. Flexibility should be built into the plan to allow for measures to deal with unexpected large scale events such as hurricane, fire, insect infestation, and disease.

The plan should also contain measurable indicators that can be used to monitor and evaluate how the plan is progressing and whether adopted objectives and practices are being successfully implemented.

Appendix "B" briefly outlines a potential analysis, planning, implementation, inspection, monitoring and continual improvement process. Appendix "C" outlines examples of enhanced practices that may be adopted as a result of an analysis and planning exercise.

## Appendix "A"
## Summary of Existing Regulations and Practices that Contribute to Maintaining Water Quality

A summary table is provided to outline the most pertinent existing regulations and practices to assist a water utility when determining a suitable and reasonable suite of best forest management practices for a municipal water supply area. Due diligence on the part of woodlot owners refers to reasonable practices to mitigate or protect against potentially damaging actions or activities that are reasonably foreseeable.

### Interpreting the Table

Column 1
The first column is intended to summarize by major category type, the practices currently used in Nova Scotia to protect watercourses and watercourse habitat. These measures contribute to the maintenance and enhancement of water quality and quantity.

Column 2
The second column outlines applicable regulations, standards or guidelines. These include the *Wildlife Habitat and Watercourses Protection Regulations*, the *Fire Fighting Equipment Regulations* made under the *Forests Act*; the *Pesticide Regulations*, *Activities Designation Regulations* and *Protected Water Area Regulations* made under the *Environment Act*, 1994-95.

Notes: Nova Scotia Environment and Labour (NSEL) Pesticide Approvals for the application of a pesticide to a forest land site are made consistent with the *Pesticide Regulations*, specific provisions in any Designated Protected Water Area Regulation, and any site specific terms and conditions of approval deemed prudent by NSEL.

Column 3
The third column is considered by the forest industry as the standard in Nova Scotia. The Nova Forest Alliance has broad representation of parties with interest in forests and forestry and these parties cooperated in the development of the "Contractor and Operators Best Management Practices" publication.

Column 4
The fourth column is intended to record known applied enhanced practices used by operators on forest land tenures. This is not a comprehensive listing and the enhancements listed may only be practised at certain locations where deemed prudent to address site specific conditions such as municipal water supply areas or locations where soils are particularly sensitive to erosion.

| PRACTICES THAT MAINTAIN WATER QUALITY AND QUANTITY WITHIN NOVA SCOTIA FORESTS | | | |
|---|---|---|---|
| "✔" denotes Wildlife Habitat/Watercourses Protection Regulations, Pesticide Regulations, Designated Protected Water Area Regulations, watercourse alteration approvals and Pesticide Application Approvals.<br>"✔✔" denotes a tenure or industry standard that exceeds the Regulations<br>1 | Regulations<br>2 | Nova Forest Alliance (Contractors and Operators Best Management Practices)<br>3 | Crown or Industry Land Holdings (Selected Enhancements)<br>4 |
| **Riparian Zones (Special Management Zones)** | | | |

| | | | |
|---|---|---|---|
| a) Minimum width of 20 m (each side) applied to all watercourses 50 cm or greater - additional width dependant on slope of bank. | ✔ | | |
| b) On slopes greater than 20% add 1 metre of width for each additional 2% of slope to a maximum of 60m in width.<br><br>For slopes greater than 30 degrees go to the first regular break in slope that is more than five metres (16 feet) wide and establish the buffer strip at least five metres back from this break. | ✔ | ✔✔<br>(No. Max) | <br><br>✔✔ |
| c) Minimum width of 60 m for fish bearing streams (each side). | | | ✔✔ |
| d) Zone measurements are generally taken from the edge of the defined stream channel. When streams are bordered by grassy, intermittently flooded meadows, measure from the forest/meadow edge. | | | ✔✔ |
| e) Machine Exclusion Zones (MEZ)<br>- watercourse < 50 cm wide 5m MEZ and leave ground vegetation intact<br>- watercourse > 50 cm 7m MEZ<br>- watercourse > 50 cm 10m MEZ | ✔<br>✔ | <br><br>✔✔ | ✔✔<br>(high stumps) |
| f) Harvesting<br>- Maintain a minimum of $20m^2$/ha Basal Area * and leave wind firm trees.<br>- Do not allow woody debris from a forestry operation to enter a lake or stream and keep it out of areas that are periodically flooded.<br>- Do not create an opening in the dominant canopy larger than 15m.<br>- Do not create an opening larger than the height of the largest tree.<br>- Fueling and oiling machinery should be >30 m from a watercourse or bare mineral soil.<br>- Remove all garbage from the site and dispose of hazardous materials properly. | ✔<br><br><br>✔ | <br><br><br><br>✔✔<br>✔✔<br>✔✔ | <br>✔✔<br><br><br><br>✔✔<br>✔✔ |
| **Road Construction** | | | |
| a) Construct road approaches, stream crossings, temporary crossings and fire ponds in accordance with regulations, standards and guidelines ** | ✔ | ✔✔ | ✔✔ |
| b) Minimize rutting and soiled disturbance by processing at stump/using low ground pressure tires/avoid operating during excessively wet periods or operating when ground is frozen. | | | ✔✔ |

| | | | |
|---|---|---|---|
| c) Minimize road network and stream crossings. | | ✔✔ | ✔✔ |
| d) Use temporary crossings for forwarding wood where appropriate. | | ✔✔ | ✔✔ |
| e) Use trail orientation, berms and "take off" ditches to divert water flow from roads and trails into filtering areas or settling ponds. | | | ✔✔ |
| **Pesticides** | | | |
| a) Compliance with Pesticide Regulations | ✔ | | |
| b) Compliance with Designated Protected Water Area regulations. | ✔ | | |
| c) Compliance with Nova Scotia Environment and Labour Pesticide Application Approvals and applicator certification requirements. | ✔ | | |
| Fire | | | |
| a) Fire Fighting Equipment Regulations | ✔ | | |

* Cross section of the area occupied by trees/hectare at breast height.

* * Stream crossings are subject to Nova Scotia Environment and Labour approvals. Please contact the Department for further information. Also see "Woodlot Roads/Stream Crossings" - Cooperation Agreement for Forestry Development 1991-1995, N. S. Department of Natural Resources.

NOTES:

- For more details on the Wildlife Habitat and Watercourses Protection Regulations see www.gov.ns.ca/natr/forestry/strategy/wildl_hab - click on regulations.

- The most recent version of the Best Management Practices Manual for Contractors and Operators may be purchased from the Nova Forest Alliance. See website www.novaforestalliance.com to order publication (PDF) or E-mail info@novaforestalliance.com.

- For further information on General Pesticide Regulations see NSEL Pesticide Regulations: Section 84 NS Environment Act, 1994-95, available at: www.gov.ns.ca/just/regulations/regs/env6195.htm.

- For specific information on Pesticide Regulations for Designated Protected Water Areas (PWA) see NSEL Pesticide Regulations: Section 84, 1994-95, Part III, Subsection 21, available at: www.gov.ns.ca/just/regulations/regs/env6195.htm.

## Appendix "B"

### Potential Analysis, Planning, Implementation, Inspection, Monitoring and Continual Improvement Process

- Undertake Land Classification/Forest Ecosystem and Underlying Geology Analysis.
- Develop a 20-year plus management/tactical plan.
- Develop five year harvest and silviculture plans.
- Prepare a one year Annual Operating Plan.

Notes: Annual operating plans to contain harvest and silviculture prescriptions, rationale and any mitigating or special practices.

Annual operating plans should be consistent with Five Year Plans and the Five Year Plan consistent with the Long Term Plan.

- Develop long term and short term road plans consistent with the management/tactical plan.
- Source water protection committee to review forestry and road plans prior to implementation.
- Follow Wildlife Habitat/Watercourses Protection Regulations.
- Provide and maintain forest fire fighting equipment as per regulations made pursuant to Section 27 (4) of the Forests Act.
- Map any Special Management Zones determined necessary and exceeding the Provincial Wildlife Habitat/Watercourses Protection Regulations.
- Specify any cut size limitations and spacial distribution provisions.
- Specify any chemical application (pesticide and herbicide) restrictions exceeding the Provincial Pesticide Regulations.
- List the practices expected by major category, e.g. Roads, Harvest Operations, Extraction Trails, Special Management Zones, Fire Equipment, Oil Spills, Equipment Maintenance, Stream Crossings, Bridges and Culverts. (See examples in Appendix "C")
- Forest road construction and forest treatments should follow the road plan and the treatment prescriptions in the annual operating plans.
- Develop measurable indicators, check lists and inspection protocols to assist with monitoring and evaluation of adopted plans and practices.
- Source water protection committee should review annually, the results of monitoring and then evaluate and arrange for corrective action or improvements as deemed prudent or necessary to ensure the success of the Long Term Management/Tactical Plan.

## Appendix "C"

## Enhanced Practices that May Be Adopted

The following are examples of further enhanced practices frequently recommended within municipal water supply areas.

Roads

- Follow the long term and short term road plans approved by the Watershed or Wellfield Advisory Committee. Note: Reduce the overall road network, minimize stream crossings and the length and number of skid trails.
- Roads should be located wherever possible on grades less than 10%.
- There should be minimal road width and curve radius to reduce road erosion.
- Establish grass cover on slopes and ditches adjacent to roadways.

Stream Crossings/Bridges/Culverts

- Water turnouts should be used on all roads where they approach streams to divert storm runoff from roads onto the forest floor.
- Roads should be gravelled where they approach streams with clean gravel.
- Road crossings should be placed at the narrowest section of the stream where stable approaches are available. The approaches and structure should be at right angles to the stream. This reduces sedimentation occurrence.
- Streams should be assessed for bridge or culvert installation and properly sized for peak flows. Failure to do so may result in frequent washouts and sedimentation.
- Open bottom culverts should be used when possible and properly set for fish passage. There is less washout with open bottom culverts. Open bottom culverts can usually be installed with less disturbance to the stream bottom.
- Bridge and culvert placement should create as little disturbance as possible.

Harvest Operations

- Pre-treatment conditions should be recorded.
- Follow operating plan prescriptions.
- Ribbon off stream buffers, special management zones, environmentally sensitive areas and any culturally significant areas.
- Meet or exceed regulations.
- Consider options to save or secure natural regeneration in harvesting applications.
- Operate machines in a manner to minimize impacts to soil, regeneration and understory.
- Time operations in sensitive areas to summer when ground is dry or in winter when ground is frozen or protected by snow cover.
- Keep machinery out of watercourses. Temporary bridges must be removed when the operation is completed.

- Keep debris out of waterways, recreational trails, roads, neighbouring immature stands, boundary lines and ribboned non cut areas.

- All garbage must be removed from the site and all hazardous substances properly disposed of outside the watershed.

- Forest debris should be left on the forest floor after harvesting.

- Portable toilet facilities should be used.

Equipment Maintenance/Oil Spills

- Power saws should be used according to the following practices:
  - Use vegetable-based oil to lubricate chains.
  - Store fuel in approved containers and labelled clearly.
  - Remove fuel containers from the site when work shift is over.
  - Fuel power saws over a spill pad and keep all fuels on the spill pad.
  - Use fire retardant pouches with each saw.

- Use of machinery should follow these precautions:
  - Vegetable-based oil should be used to lubricate chains.
  - Machines should be kept clean and leak-free.
  - Machines should be equipped with industry approved fire extinguishers.
  - Machines should carry a spill kit.

- Fuel tanks for machinery should be clean, leak-free, have a locking device, a no-drip nozzle, used with a spill kit, and should be stored on mineral soil as far away as possible from watercourses (at least 100 metres or 330 feet).

- No fuel or oil should be stored within the boundaries of the watershed or stored in approved areas.

- Refuelling should take place on spill pads outside of all buffer zones.

- All fuel leaks over five litres should be reported to the Water Utility and Nova Scotia Environment and Labour within one hour.

- Fire extinguishers should be available during all harvesting operations and should also meet required specifications.

- All trucks with loaders should have remote engine shut down.

- All trucks with loaders should have a hydraulic tank float switch.

Special Management Zones

- Zones may be enhanced beyond the regulations at specified locations, in cooperation with landowners, particularly the main water supply bodies and those close to the point of intake. Examples include enhanced machine exclusion zones, greater amounts of living trees to be retained in harvesting operations, no cut zones and limits on size of openings within a special management zone that can be created.

Harvesting

- Limits on clearcut size, distribution of cuts and amount of harvest area within specified time frames are sometimes negotiated with landowners.

Fire Fighting Equipment

- Persons in charge of an operation or activity conducted in the woods or within 305 metres (1,000 feet) of the woods during the fire season are required by regulation under the Forest Act to provide and maintain fire fighting equipment. Further details may be obtained from the Department of Natural Resources.

Appendix "H"

# NOVA FOREST ALLIANCE

# CONTRACTORS & OPERATORS
# BEST MANAGEMENT PRACTICES MANUAL
# MARCH, 2012

Adopted by

Forest Products Association of Nova Scotia

*The nature of our business is growing.*

BMP CONTRACTOR

## *A Contractors Code of Practice*

I will conduct forest operations in accordance with a mutually developed woodlot operations plan that recognizes landowner objectives and ecological values.

I will plan and operate in a manner designed to protect biodiversity.

I will conduct harvesting operations to facilitate forest renewal.

I will construct forest roads in a manner that minimizes impact on the environment.

I will operate with due diligence for the health and safety of employees and the public.

I will promote public awareness of sustainable forest management and respond to public concerns about forest practices in a sensitive and progressive manner.

I will participate with the Nova Forest Alliance in monitoring and evaluating my compliance with these principles.

| | |
|---|---|
| _____ | _____ |
| Contractor | Chair, Nova Forest Alliance |

# TABLE OF CONTENTS

# INTRODUCTION

Welcome to the latest edition of the Nova Forest Alliance Best Management Practices (BMP) Manual. It was prepared through the diligent efforts of a number of individuals and organizations that work together to improve forestry practices in Nova Scotia. The manual is the basis for training sessions offered by the Forestry Safety Society of Nova Scotia.

Many of the fundamental procedures and practices remain unchanged from the 2007 edition of the manual. The format has been improved so that information may be found more easily. Good forestry is a process of continuous improvement, and this manual sets the bar a little higher for practitioners of forest management in the province.

The manual is intended to be a reference that can be kept handy at the job site. It is the product of more than a decade of collaboration and revision. We hope that it will be used by all contractors and woodlot owners who wish to operate safely, efficiently and with respect for the environment.

Nearly three-quarters of Nova Scotia's forest land is under private ownership. Of paramount importance are the landowners' visions for the future of their properties. This manual suggests effective ways of working with woodlot owners to achieve their objectives. Other sections describe procedures that are valuable in recognizing significant wildlife habitat, the proper construction and maintenance of woodlot roads, safe handling and storage of fuel and oils, and harvesting methods that require ecological consideration of each forest site.

An increasing public scrutiny of forest practices and greater demand for products from well-managed forests indicates that a multitude of techniques must be used in managing forests. This manual lays a foundation for procedures that most woodlot owners and forest contractors implement on a regular basis.

With ever-increasing demands on Nova Scotia's forests to provide ecological and economic values to society, woodlot owners and contractors must exhibit – by practice – a progressive approach towards sustainable forest management.

We hope that this manual lays the groundwork for efficient and effective harvesting of wood fiber, respect for wildlife habitat and the prudent renewal of our forest resources. We recognize that this manual is a work in progress and welcome your feedback. Please feel free to contact us should you have any comments or suggestions for improvement.

Yours sincerely,

Nova Forest Alliance BMP Working Group

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Canadian Institute of Forestry Nova Scotia Section
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# FOREST PRODUCTS ASSOCIATION OF NOVA SCOTIA

The Forest Products Association of Nova Scotia (FPANS) is adopting this Best Management Practices Manual as a tool to help its members follow the seven Principles of Forest Stewardship for Nova Scotia.

Our forest industry directly supports 13,000 jobs and indirectly provides employment to an additional 10,000 Nova Scotians each year. The forest is a complex resource that we all must treat with great respect. Through the use of this manual the Forest Products Association of Nova Scotia endeavors to ensure our industry continues to thrive by managing this complex resource in a sustainable fashion.

As the forest industry we also recognize our responsibility to work with landowners, maintain clean water, provide opportunities for forest recreation, and to enhance our natural, biodiverse, Acadian Forest landscape. Following the Best Management Practices detailed throughout this manual will ensure contractors, woodlot owners and industry members are contributing to the sustainable use of our forest resource while maintaining our environment and contributing to our social needs.

By adopting, distributing and providing training on this Best Management Practices manual the Forest Products Association of Nova Scotia intends to:

1. Provide a better understanding of the Principles of Forest Stewardship.

2. Increase awareness of some measure of sustainability.

3. Demonstrate a commitment to fulfilling the Principles of Forest Stewardship by members of FPANS.

4. Provide consistency in the way all FPANS members understand and apply the Principles.

## *Principles of Forest Stewardship in Nova Scotia*

### Forest Products Association of Nova Scotia

1. Forest operation will be conducted in accordance with an operations management plan for the property which identifies environmental protection and forest conservation measures.

2. Forest planning and operations will be conducted in accordance with the Wildlife Habitat and Watercourse Protection Regulations for Nova Scotia which are designed to sustain forest biodiversity and wildlife habitat.

3. Harvesting operations will be designed to facilitate forest renewal either by natural regeneration or planting.

4. Forest roads will be constructed in accordance with the Standards of the Nova Scotia Department of the Environment.

5. The health and safety of employees and the public will not be compromised by any forest practice.

6. Through the Forest Products Association of Nova Scotia, public awareness and information on Nova Scotia forests will be promoted. Members will cooperate with the Association in responding to public concerns about forest practices in a sensitive and progressive manner.

7. Private landowners have the right to manage their individual forest properties in accordance with their own objectives, while meeting or exceeding government standards for environmental protection and forest conservation.

# DEVELOPING LANDOWNER AGREEMENTS: BEST MANAGEMENT PRACTICES

## MAKING CONTACT WITH THE LANDOWNER

Making contact with the landowner is the critical first step. First impressions are important and contractors need to approach landowners with honesty and professionalism. Your first step is to prepare thoroughly before meeting the landowner.

FPANS Stewardship Principles 6 & 7

## PREPARING FOR THE INTERVIEW

### STANDARD PRACTICES

- Prepare yourself mentally for the interview. Think about the landowner's point of view and what kind of reassurances and information they may want of you.
- Remember you need to take time to get to know the landowner. Try to establish a rapport. The best way to do this is by asking questions.
- Have some information about yourself. This can be written material such as pamphlets about your company, business cards, photos of past operations or just information you can tell the landowner. The idea is to show professionalism, not to brag.
- It is helpful to have information on the property on which you want to work. Things such as aerial photographs, property maps and woodlot size can be helpful when talking to landowners. You must use your judgment on when it is appropriate to use this information. Some landowners may feel you are checking up on them if you bring out the information too soon.
- Have a working knowledge of the area where you are operating, this could include topics such as: species-at-risk, invasive exotic species, and significant wildlife habitat.
- You may want to have some information on current silviculture programs. Pamphlets are available for most programs. This is helpful even if you do not plan on doing silviculture work yourself. It demonstrates that you are committed to more than just cutting down trees.
- Allow time to walk the woodlot or portion of the woodlot with the owner.

### ENHANCED PRACTICES

- Bring the landowner to other sites where you have worked to show the quality of your work.
- Show landowners examples of other uses of the forest on their land – for example, a sugar bush or recreational trails.

- Develop a portfolio with photographs of previous work on other woodlots.

## OWNER'S OBJECTIVES AND EXPECTATIONS

### STANDARD PRACTICES

It is important to remember that landowners have the right to manage their property according to their own objectives while meeting or exceeding government regulations. Contractors need to take the time early in the process to determine what those objectives are.

- Asking questions is one of the most important approaches to determining the landowner's objectives and values for their woodlot. Values could include cultural, ecological and geologically important features. Objectives that may be important to landowners include: timber production, income generation, appearance, protection of old growth, wildlife, biodiversity, heritage values such as burial grounds and old farm sites, traditional travel routes, and recreational values such as walking, snowmobiling or having a camp.

- Suggest other forest management alternatives with respect to harvesting, silviculture and the potential for non-timber forest products.

### ENHANCED PRACTICES

- Complete a survey or questionnaire to assist in determining the landowner values and/or objectives for the woodlot.

## PROPOSED OPERATION PLAN

If you plan to perform a forestry operation on a particular woodlot, you likely have in your mind a rough plan of where you are going to work and how you are going to go about it. This is taken a step further in an operation plan by putting it on paper. An operation plan may be very simple, consisting of a single piece of paper showing the location of the proposed operation and legend. For larger undertakings it may be more complex. Basically, an operation plan outlines what you intend to do, and:

- Demonstrates accountability and responsibility.

- Shows due diligence.

- Reduces misunderstandings.

- Demonstrates a professional image.

- Helps ensure quality work.

## WOODLOT ASSESSMENT (INVENTORY)

An operation plan begins with determining what is on the woodlot. This will help determine what can be done to meet the landowner's objectives. An assessment should include a number of actions:

### STANDARD PRACTICES

- Conduct an inventory of forest products present on the site. The woodlot condition and the landowner requirements will determine what this inventory will consist of. The inventory may be a formal technical cruise or it may be a less formal descriptive type cruise.
- Identify all watercourses including springs, brooks, rivers, streams, ponds and lakes.
- Record observations of wildlife and habitat such as nests and dens.
- Assess other items important in designing the operation such as: soft or wet ground, wetlands and areas of human interest such as old farm sites or graveyards.
- Identify special management areas such as old growth forests, unique or endangered plants or areas with significant wildlife habitat such as deer wintering areas.
- Identify opportunities to pursue work with other landowners/contractors in the area to discuss broader landscape objectives.
- Identify areas with potential opportunities for afforestation, including: old fields/pastures, abandoned roads/landings, and pits/quarries.
- Identify the potential for prescriptions other than clearcutting.

### ENHANCED PRACTICES

- Conduct assessment of broader woodlot values (i.e. non-timber) in consultation with a forestry professional.
- Inventory assessment should document any observed invasive exotic plant or animal species. Consult with DNR if necessary.
- Complete Landowner Decision Support Tool.

## PUTTING THE PLAN TOGETHER

The operation plan should include a description of the proposed operations and their location on a map. In finalizing the plan it will be important to re-examine landowner objectives to determine if all of them are met. The plan at this point may have to be revised if not all objectives can be met.

The plan should also include the following items:

### STANDARD PRACTICES

- Landowner objectives where applicable.
- A map outlining boundary lines and areas of operation.
- A description of the vegetation present on the area of operation including tree species and size.
- Area to be harvested, harvest prescription and the harvesting method and system to be used.
- Special management areas, wildlife clumps, sensitive or unique areas, recreational trails and graveyards.
- Watercourses and wetlands.
- The number of clumps, wildlife trees and Coarse Woody Debris (CWD) to remain after harvest.
- Stream crossings required and the methods for crossing the stream.

### ENHANCED PRACTICES

The operation plan includes in addition to the above:

- Forest stand characteristics from the timber cruise such as stand age, stand health, site quality, stand volume and timber quality.
- Results of consultations with forestry professionals such as the potential for alternative treatments.
- Forest Inventory data; this can be in the form of a table.
- A general description of the type of prescription to be applied, where applicable (e.g. shelterwood, thinning, etc.).
- Potential locations for clumps, corridors, etc. detailed on an operating plan map.

## NEGOTIATIONS WITH THE LANDOWNER

Negotiations begin with doing your homework. A proposed operation plan for the landowner to review demonstrates professionalism and responsibility. For example, a great deal of information can be conveyed on a map which can be easily understood by many people. You may also want to include the results of the timber inventory. This could be total volume by product and/or species.

### STANDARD PRACTICES

- Go through the proposed operation with the landowner by showing what you plan to do.
- Explain the timing, type of operation, the boundaries of the operation and how you plan to do it.
- Make sure you explain how your proposed operation will help them meet their objectives.
- Detail any areas that will not be cut and why (e.g. around hawk nests, sensitive areas or stream buffers).
- Agree on the financial arrangements.
- Be prepared to revise the operation plan to reflect the landowner's thoughts.

### ENHANCED PRACTICES

- Visit the operation area with the landowner to review the operation plan.

## HELPFUL HINTS ON FINANCIAL ARRANGEMENTS

- The best method of payment for both the contractor and landowner must be decided. If the landowner has not talked to an accountant, you should advise them to do so before finalizing an agreement.
- Two common methods of payment are lump sum (a complete payment based on what the contractor believes the timber is worth) or piece rate (payment is made as the timber is scaled). Each method has different implications under current tax laws. Type of payments can have impacts for contractors as well. For example, lump sum payments may affect cash flow. All these aspects must be considered when negotiating with an owner and you may be able to offer several options.
- If the agreed arrangement is a piece rate payment, you will have to determine what scale will be used for payment. This could be roadside scale or mill scale. In the case of mill scale it is best to provide the owner with copies of all mill scale receipts.
- The Landowners may require some or all of the following items:

- Liability insurance.
- Clear beginning and end dates of the harvest.
- A specific season of harvest.

## AGREEMENT WITH THE LANDOWNER

Any agreement between people or companies should include a contract or lease. This will help protect both you and the landowner and will help avoid future misunderstandings. Contractors should consult a lawyer to develop an agreement that meets their needs.

### STANDARD PRACTICES

- Reference to the Operation or woodlot management plan, if applicable, or a description or map of the area of operation.
- Requirement to adhere to fire regulations.
- Method and terms of payment.
- Liability issues.
- Cancellation/termination conditions.
- Wildlife and environmental protection.
- Road construction, maintenance and upgrading.
- Timing of operation.
- Definition of merchantable timber and minimum stump heights.

- Reference to applicable laws such as Wildlife Habitat and Water Course Protection Regulations, Occupational Health and Safety Act, Workers Compensation Act, Forest Act, Wildlife Act, Water Resources Protection Act and Endangered Species Act.
- Workers Compensation Clearance letter.
- Verify that landowner has clear title.
- Binding of agreement to executors and heirs of the property in case something should happen to the landowner.
- Extension of operation timing due to unforeseeable acts.
- Provision for or against assignment of contract.

### ENHANCED PRACTICES

- In addition to providing a contract with all of the above listed items, the contract should be registered with a lawyer to provide additional protection to both parties.

- Provide a performance bond to the landowner (if requested).

## HELPFUL HINTS

Once you have an agreement with the landowner, your communications should not stop there. It is a courtesy that pays off in trust, to keep landowners informed of the progress of the operation. You may want to send a notice to the landowner a week before you actually start. You may also want to send a notice a week before you finish. Keep a paper trail of your activities for that woodlot, particularly mill scale receipts. You may not plan on using the information but it pays off to keep a paper record.

# ROAD CONSTRUCTION: BEST MANAGEMENT PRACTICES

Roads have a major impact on a forested area including impacts on watercourses, drainage, access, wildlife habitat, soil erosion and the visual aesthetics of an area. Roads can enhance the benefits from the forest if constructed properly. Roads essentially take land out of forest production; as a result, careful consideration should be given to their location and requirements. Investing now in a well planned and constructed road will reduce long term maintenance costs and environmental impacts. The following outlines some best management practices that contractors can follow in order to provide the highest quality service to their customers in the design and construction of an access road.

## GETTING STARTED - PLANNING AND LAYOUT

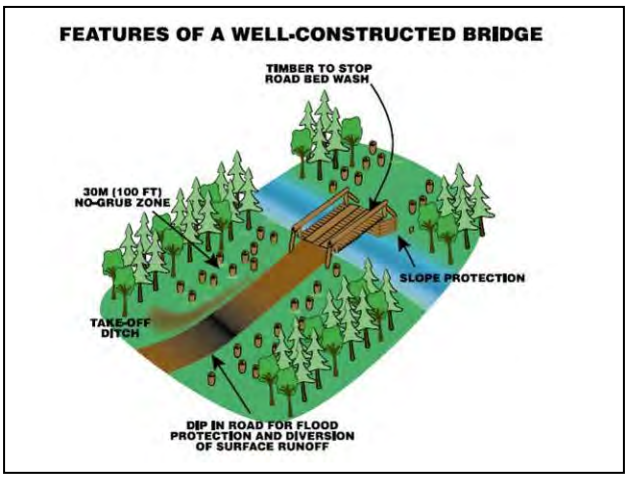
FPANS Stewardship Principle 4

### STANDARD PRACTICES

- Owner objectives must be identified and considered.
- The potential for multiple use of the road should be identified.
- Information should be gathered on the area such as topographic information, stream locations, special management features, soil types and drainage.
- Locate roads on stable ground (such as low slopes and high ground).
- Avoid river valleys, steep slopes, swamps and rock ledges, fragile areas (e.g. thin sandy soils) and sensitive areas (e.g. marshes, deer wintering areas, hawk nests).
- Minimize impact on watercourses by reducing the number of crossings and locate the road as far away from watercourses as possible.
- Prepare a preliminary sketch of the road location.

- Adjust road location to reflect site conditions.
- Complete a final sketch of the road location noting special features (i.e. watercourse crossings, landings, etc.).
- Flag and review road location with landowner and reach an agreement.
- Apply for and receive permits and applications (i.e. NS Environment approval for installation of a bridge or culvert and DOT road access permits).

- Any work that disturbs a watercourse or wetland requires a permit from NS Environment and work must be carried out or supervised by a person certified by NS Environment as a Recognized Individual who has completed the NS Watercourse Alteration Certification training.
- In-stream work is only allowed between June 1st and September 30th.
- Temporary bridges may be installed year-round, but must have a permit.




### ENHANCED PRACTICES

- Consider the sight distance for landscape/aesthetic values.
- Road construction staff should be trained/equipped to implement best management practices (e.g. erosion Control, grading).
- Narrow the road corridor to 10 meters in width with a 30 meter no grub zone on either side of watercourse.
- Seeding – Erosion Control.

## APPLYING ROAD CONSTRUCTION TOOLS AND TECHNIQUES

### STANDARD PRACTICES

- Use standard accepted road construction practices and follow all regulations and policies (i.e. woodlot roads/stream crossings, endangered species legislation, wetland conservation policy).
- Ensure road is built with proper erosion control.
- Fuel and oil machinery must be more than 30m away from a watercourse on bare mineral soil.
- Dispose of used oil properly through a used oil recycle facility. Information is available through your fuel and oil supplier.
- Avoid having water running in a ditch for greater than 300m to minimize erosion.
- Use cross culverts to avoid blocking natural drainage.

- Use ditches or culverts to direct drainage through vegetation filters and not directly into streams.

- Construct stream crossings with the first priority placed on minimizing impacts on the aquatic ecosystem, including NS Environment water crossing regulations.

- Apply road construction practices that exceed minimum regulations, such as crossing at the narrowest part and at right angles to the stream, crossing at locations with stable soil and without steep sides and crossing where the stream is running relatively straight.

- Bridges must be constructed to the conditions in your permit and the NS Environment regulations.

### ENHANCED PRACTICES

- Seed roadsides or use brush mats.

- Use advanced construction techniques such as the use of a rock apron at the culvert outlet.

- Document the work with digital photography.

- Prepare an annual inspection and maintenance plan for your roads and water crossings.

- Post appropriate signage to indicate location of bridges and gates.

## HELPFUL HINT

Avoid using the road excessively during wet weather. This can damage the road and create erosion/sedimentation problems, especially in areas with steep slopes.

## TEMPORARY STREAM CROSSINGS FOR FORWARDING WOOD

### STANDARD PRACTICES

- Temporary stream crossings require a permit from NS Environment. Application must be accompanied by a best management practices document that includes:
  - Bridge design diagram.
  - Erosion and sedimentation control measures.
  - Method of bank stabilization at approaches.
  - Location map (1:50,000 topographic map).
  - Contact information of landowner.
  - Timing and type of harvest operation.

- Use brush mats or logs at ends of crossing.
- Cross at right angles to stream.
- Do not put crossing structure in stream.
- A copy of the permit must remain on-site during operations.
- Remove temporary crossing after operation, and within the specified time limits stated in the permit.
- Stabilize the approaches to the bridge location after removal.
- No silt should enter the stream.

**ENHANCED PRACTICES**

- Construct a portable solid-bottom bridge that can be re-used from site to site.
- Document installation and removal procedure with digital photography for record-keeping and to be used in future permit applications.

Practice set-up of a temporary watercourse crossing using bunk logs and fabricated runners.

# WILDLIFE HABITAT: BEST MANAGEMENT PRACTICES

FPANS Stewardship Principle 2

Wildlife is an important forest value. Wildlife habitat can be defined as an area characterized by a distinct assemblage of landforms, aquatic forms, vegetation, soil and moisture regimes that are considered to be important for a variety of selected wildlife species. Forest operations can either enhance wildlife habitat, detract from it, or maintain the status quo. It is important to consider wildlife aspects at both the woodlot level as well as on adjacent woodlots. One extremely important aspect to consider is species at risk which is governed by both federal and provincial legislation. The Nova Scotia Department of Natural Resources and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) maintains a list of species that are considered to be vulnerable and therefore may need special conservation measures to be implemented.

## WILDLIFE HABITAT PLANNING

Adequate information should be available in order to integrate wildlife considerations into forest operations. For example, the following should be considered in the design of any forest operation:

### STANDARD PRACTICES

- Have a working knowledge of the species at risk (SAR) in your area of operation
  - Key factors include:
    - Habitat requirements.
    - Applicable legislation.
    - Operational restrictions.
  - Options for researching SAR information include:
    - Contacting regional DNR wildlife biologist (see phone listings in Resources section).
    - Consult relevant websites (as listed in Resources section).
  - Document SAR research actions.
  - Operation plan shall include specific SAR protection measures.

- Significant wildlife habitat features should be located on the property and their impact on the operation considered. Significant wildlife habitat features could include:
  - Active nesting sites.
  - Deer wintering areas.
  - Watercourses.
  - Large diameter snags.

- The landowner's objectives for wildlife habitat should be identified and incorporated into the operation plan.

- Forest workers should be trained to apply best management practices in wildlife habitat.

### ENHANCED PRACTICES

- Landscape level issues should be considered in the design of the forest operation. For example adjacent woodlot harvests could have an impact on cut size, the need for clumps and corridors.

- Late successional Acadian forests offer unique wildlife habitat and should be left intact for biodiversity.

## APPLYING TOOLS AND TECHNIQUES FOR WILDLIFE HABITAT

### DEVELOPING A VARIETY OF FOREST HABITATS - HARVEST DESIGN:

### STANDARD PRACTICES

- Harvest prescriptions should promote a variety of age classes, tree species and vegetation types.

- If the prescription is clearcut, areas should not exceed 50 hectares (125 acres) except in the case of salvage as a result of blowdown, insect and disease damage, or fire.

- In cuts exceeding 50 hectares, wildlife corridors 50 metres in width should be used to join uncut areas.

- If cutting next to an old cut, wait until regeneration is at least 2m tall to avoid creating cuts that exceed 50 hectares (125 acres).

- Blocks should follow stand or landform edges to create irregular cut boundaries.

- Trees within the corridors can be selectively cut, ensuring that a minimum of 20 m2/ha of basal area is left at all times.

- Leave live wind-firm trees and snags within the corridors.

- Corridors should be located to include a variety of wildlife habitat features.

The BEST corridors provide a variety of cover including:

* shrubs
* dense young softwoods
* low lying areas
* mixture of mature hardwood and softwood trees

### ENHANCED PRACTICES

- Harvest prescriptions will promote a variety of age classes, tree species and vegetation types.

## PROTECTING AQUATIC ECOSYSTEMS

When forests are harvested adjacent to watercourses, special management zones (SMZ's) should be established along each side to leave enough vegetation for stream protection and to maintain a rich wildlife community. An ideal buffer zone involves minimal disturbance within 20 metres of the watercourse.

### STANDARD PRACTICES

- Refer to the Nova Scotia Wildlife Habitat and Watercourse Protection Regulations and the Nova Scotia Wetland Conservation Policy prior to harvesting.

### WATERCOURSE PROTECTION

**Watercourses less than 50 cm in width.**

- Vehicles cannot be operated within 5m of the watercourse.
- Ground vegetation and non-commercial trees must be left intact within the SMZ.

**Watercourses 50 cm and greater in width**.

- Vehicles cannot be operated within 7m of the watercourse.
- Increased buffer width is required if slopes within the SMZ are greater than 20%. Add one metre of buffer width for each additional 2% in slope.
- Trees within the buffer zone may be selectively cut leaving a minimum of 20 m2/ha of basal area.
- No opening larger than 15m in the dominant tree canopy can be created.
- To reduce blowdown leave green wind-firm trees within the SMZ.

### WETLAND CONSERVATION

- Any areas that potentially could be classified as wetlands under the Nova Scotia Wetland Conservation Policy, which could include wooded swamp, should have further consultation by a qualified wetland specialist.

### ENHANCED PRACTICE

- The BEST buffer is the widest buffer possible.

## PROVIDING WILDLIFE CLUMPS, SNAGS AND CAVITY TREES

At least one third of Nova Scotia's wildlife use snags and cavity trees for habitat. The following practices should be considered to protect this habitat in harvest areas:

### STANDARD PRACTICES

- Refer to the Nova Scotia Wildlife Habitat and Watercourse Protection Regulations prior to harvesting.
- Leave snags and cavity trees within clumps.
- Any cut greater than 3 ha of forest land must have at least one wildlife clump.
- Cuts greater than 8 ha in size require additional clumps, relative to the size of the cut (refer to Regulations).
- Each clump shall contain at least 30 trees.

**A good clump includes:**

*A cavity tree with a dbh > 30 cm, with woodpecker holes, living or dead
*Average tree diameters and species mix representative of the original stand
*At least 10% dead trees
*At least 0.02 ha (10 m x 20 m)

- The trees left standing shall be in the same proportion by species, height and diameter as the forest stand being cut.
- Where there is one clump, it shall be situated at least 20 m but no more than 200 m from the edge of the forest stand being cut.
- Where there are additional clumps, they shall be situated no closer than 20 m apart, and no further than 200 m apart. The clumps must be no more than 200 m from the edge of the forest stand being cut.
- There shall be no harvesting of trees within a clump.

### Coarse-Woody Debris

- Leave snags and woody debris scattered evenly across the site.
- Ensure that levels of snags and coarse woody debris are similar to natural patterns to the fullest extent possible.

## PROTECTING SIGNIFICANT WILDLIFE HABITAT:

Some forests contain special characteristics that make them more important to wildlife species than other areas. These areas are referred to as significant wildlife habitat, and they may contain any or all of the following:

- A site that is unique within the province.
- Provides habitat for species at risk.
- Is used by unusually large concentrations of wildlife.

Some examples of these sites that may be encountered are:

**Deer Wintering Areas**

- Provide thermal and snow cover for deer.
- Typically mature conifers on south/southwest slopes.
- Look for heavy browse & lots of tracks.

**Raptor/Heron Nests**

- Look for large nest structures in trees.
- Normally occupied and sensitive to disturbance between March and mid July.

Local interest groups and the Nova Scotia Department of Natural Resources have gathered information on these sites and have created wildlife habitat maps. Contact the Department of Natural Resources prior to operations to determine if there is any significant wildlife habitat areas present on the woodlot.

# HARVESTING: BEST MANAGEMENT PRACTICES

## HARVESTING CONSIDERATIONS

Harvesting is a forest practice that can have a significant impact on the environment. Forest harvesting operations can be designed to benefit environmental, economic and social values. However, improperly designed and implemented harvest operations can have negative effects on the landscape. The following best management practices will contribute to sustainable forest management.

## GETTING THE PRESCRIPTION RIGHT - FOR THE FOREST AND THE LANDOWNER

The first step in setting a prescription for a woodlot is to determine the landowner's objectives. This step guides the decision-making process from which prescriptions are developed. Some prescriptions may favor one objective over the other, but the ultimate decision rests with the landowner.
A variety of objectives (including recreation, preserving old growth, wildlife habitat conservation and fibre production) can be met by implementing the appropriate prescriptions.

FPANS Stewardship Principles 1 & 3

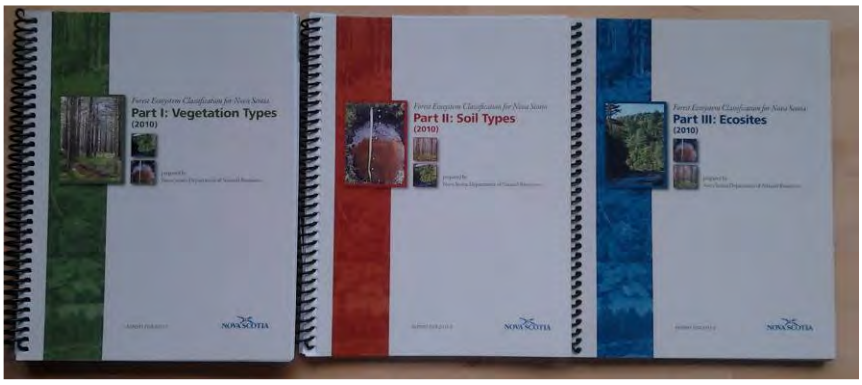
Financial assistance may be available and contractors are encouraged to refer to the Nova Scotia Forest Sustainability Regulations for further information.

Getting the prescription right involves collecting relevant data about the forest to assist in determining appropriate prescriptions. With this information, the landowner can make an educated decision as to which prescription is most appropriate to meet their objectives.

The "Getting the Prescription Right for the Landowner - Decision Support Tool" is a useful tool to aid contractors in identifying suitable options and provides documentation on the decision-making process.

### DETERMINING THE FOREST TYPE AND STRUCTURE

In order to determine the range of viable prescriptions possible on a woodlot, an assessment of the forest type and structure is necessary. This assessment should be conducted as part of the development of the operation plan and should include the following items:




• Soil type – texture, drainage and site quality.

• Description of the major tree and plant species present on the site.

• Stand characteristics such as age, health, tree size, density and growth rate.

• Stand history – determine if any previous treatments have been done.

• Terrain – slope and obstacles to equipment.

• Presence of advanced regeneration.

• Potential for high value products such as veneer or sawlogs.

NOVA FOREST ALLIANCE

# Field Assessment Form

BMP CONTRACTOR

Best Management Practices

Getting the Prescription Right for the Landowner - Decision Support Tool

Forest management has a significant impact on the environment. Choosing the best management option depends on many factors including: landowner objectives, stand type and condition, non-timber values, and economic and operating conditions.

A good forest management prescription will help to address your goals as a woodlot owner as well as consider the health of the future forest.

This tool:

- Is to be used by a forester, forest technologist or forest contractor in consultation with the landowner.
- Is based on the premise that collectively we are striving towards maintaining forest types that are consistent with the Acadian Forest Region.
- Assesses various values or aspects of the stand being considered for timber harvest and then evaluates a series of harvest options in terms of whether they will contribute positively or negatively to that particular value.
- Does not make a recommendation or a final decision. It does, however, identify suitable options and provides documentation on the decision-making process. It can be extremely helpful in explaining harvest decisions to family members, neighbours or concerned community members who may not fully understand why a specific prescription has been chosen.

Planning your forest management options properly will contribute to the future health and productivity of your woodlot and ensure that you will be able to continue to enjoy your forest for the many values it provides.

Two useful references supporting this tool are Nova Forest Alliance's:

***Contractors and Operators Best Management Practices Manual***
and
***Forest Ecosystem Classification of Nova Scotia's Model Forest Guide***

| IDENTIFYING THE MANAGEMENT AREA - STAND # | |
|---|---|
| Woodlot Owner Name | Forester/Technologist/Contractor Name |
| Woodlot Location<br>PID # | Date Completed |
| Approximate Stand Area | Prescription |
| Forester/Technologist/Contractor Signature | Date |
| Landowner Signature | Date |

Natural Resources Canada / Ressources naturelles Canada

Canada

**Landowner Objectives for Stand: The following diagram illustrates potential landowner objectives for a stand.**

| PRESCRIPTION OBJECTIVE | Alternative treatments to achieve prescription objectives | | |
|---|---|---|---|
| | Heavy Removal 100% to 80% of Merchantable Volume | Moderate Removal 60% to 40% of Merchantable Volume | Light Removal Less than 40%* of Merchantable Volume |
| Promotion of Regeneration | Clearcut<br>Overstory Removal<br>Seedtree | Shelterwood<br>Strip/Patch Cut | Selection Cut<br>Commercial Thinning<br>Crop Tree Release |
| Promotion of Existing Tree Quality | n/a | n/a | Selection Cut<br>Commercial Thinning<br>Crop Tree Release |
| Maintenance of Forest Cover | n/a | Shelterwood<br>Strip/Patch Cut | Selection Cut<br>Commercial Thinning<br>Crop Tree Release |

* 30% in moderate or higher exposure

Landowner Objectives/Issues to be Considered:

_____

_____

_____

_____

**PART 1 STAND ASSESSMENT -** This section provides a brief description of the stand including the trees to be harvested (merchantable) and the younger trees that may be growing beneath (regeneration). To complete this section the user needs to traverse the stand area to get a feel for the stand characteristics.

**MERCHANTABLE PORTION - (Please circle or write in appropriate response)**

| | | | | | |
|---|---|---|---|---|---|
| 1 | Forest Ecosystem Classification units.<br>(Determine which ecosystem units describe the stand. Each unit is associated with management interpretations which should be reviewed to aid further stand assessment and decision making. See FEC Guide) | Vegetation Type | | Soil Type | |
| | | | | | |
| 2 | Does the stand contain trees of similar ages? OR<br><br>Does the stand contain trees of different ages? Please circle | Evenaged<br><br>Unevenaged | | | |
| | | **Long-lived Species** | | **Short-lived Species** | |
| 3 | What is the stand's merchantable species composition?<br><br>(Rate scoring on the largest % of species) | Species 1 | Species 2 | Species 3 | Species 4 |
| | | | | | |
| | | % | % | % | % |
| 4 | Is the current stand volume increasing, staying constant or decreasing? | increase constant decrease | | increase constant decrease | |
| 5 | Is there evidence of insect or disease damage? | none insect disease | | none insect disease | |
| 6 | Is there evidence of physical damage? | none blowdown frost<br>broken tops salt | | none blowdown frost<br>broken tops salt | |
| 7 | Does this stand have old growth/climax characteristics? (For reference see NSDNR's *Interim Old Forest Policy*) | yes no | | | |

**Landowner Objectives for Stand: The following diagram illustrates potential landowner objectives for a stand.**

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Landowner Objectives/Issues to be Considered:

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| | | | | | |
| 2 | Does the stand contain trees of similar ages? OR<br><br>Does the stand contain trees of different ages? Please circle | Evenaged<br><br>Unevenaged | | | |
| | | **Long-lived Species** | | **Short-lived Species** | |
| 3 | What is the stand's merchantable species composition?<br><br>(Rate scoring on the largest % of species) | Species 1 | Species 2 | Species 3 | Species 4 |
| | | | | | |
| | | % | % | % | % |
| 4 | Is the current stand volume increasing, staying constant or decreasing? | increase / constant / decrease | | increase / constant / decrease | |
| 5 | Is there evidence of insect or disease damage? | none insect disease | | none insect disease | |
| 6 | Is there evidence of physical damage? | none blowdown frost<br>broken tops salt | | none blowdown frost<br>broken tops salt | |
| 7 | Does this stand have old growth/climax characteristics? (For reference see NSDNR's *Interim Old Forest Policy*) | yes no | | | |

| | | | | | |
|---|---|---|---|---|---|
| 8 | Are there any special tree species present? Specify | | | | |
| 9 | Slope | relatively flat moderate steep | | | |
| 10 | Aspect/Wind Exposure | north east south west<br>very exposed moderately exposed protected | | | |
| REGENERATION PORTION | | Species 1 | Species 2 | Species 3 | Species 4 |
| 11 | Is there sufficient established and desirable regeneration to restock the site? List by species. | | | | |
| | | % | % | % | % |
| 12 | Is a desirable seed source available? | yes no | | | |
| **PART 2 NON-TIMBER ASSESSMENT** - This section will assist the user in determing if there are any non-timber factors that could influence the choice of harvest method. Generally this will include factors **within the site or in the surrounding area.** Each of the features identified on the site should be circled to provide a record of what has been considered. | | | | | |
| 13 | Are there any features within or adjacent to the stand? | dwelling boundary line well (water supply)<br>valued viewscape no significant features other(specify) | | | |
| 14 | Are there any features of cultural/heritage/archeological significance? | old foundation stone walls burial site aboriginal site<br>no features other | | | |
| 15 | Are there recreational features in use? | trails campsite/picnic fishing recreational access<br>wildlife viewing tree stand no features other | | | |
| 16 | What water resource issues need to be considered? | watercourse lake pond water table no features<br>other | | | |
| 17 | Wildlife habitat issues<br>eg. any habitat defined as critical or desired by landowner | nesting area deer wintering area cavity trees<br>wetland no features coarse woody debris other | | | |
| 18 | Are any non-timber forest products present? List | | | | |
| **PART 3 Scoring of Harvest Prescriptions - this section enables the user to score the harvest prescriptions based on their ability to accomodate stand, non timber, economic and operating conditions.** | | | | | |

In part 3, the user rates each of the harvesting options against the Part 1 - Stand Assessment and the Part 2 - Non-Timber Assessment to determine the extent to which the harvest option will have a negative, positive or neutral impact .

**Interpreting the rankings:**

For each of the treatments the rankings should be totaled. The score only provides a relative weighting of one prescription against the other.

In other words, if shelterwood harvest scores a +6 and clearcut a +4 then the shelterwood harvest has the greater potential to address the stand development parameters outlined in the decision key. It could therefore be considered as a more suitable prescription than the clearcut option.

The objective of the scoring is to provide a list of prescriptions which the landowner and contractor can discuss and finalize based on landowner objectives and contractor constraints.

## SILVICULTURE TREATMENT/HARVEST OPTIONS

Nova Scotia is part of the Acadian Forest Region. The natural Acadian forest is characterized by stands of trees having various sizes, ages, and mixtures of species. Late successional species including red spruce, white pine, hemlock, sugar maple and yellow birch predominate.

Land use practices over the past four hundred years have altered forest development in Nova Scotia. Many forest stands are now even aged and contain more early successional tree species including balsam fir, white spruce, larch, red maple, white birch, and poplar.

This section contains a brief description of various harvesting prescriptions, and the appropriate forest conditions for their application.

The following prescriptions are listed by the age class structure that they tend to create. For more information on the following prescriptions, there are several resources listed in the background information section.

The age class structure of a stand refers to the relative ages of the trees making up the stand. *Even-aged* stands generally result from stands composed of trees that began growing at about the same time. *Uneven-aged* stands refer to stands that have trees of various ages from juvenile to mature present on the same site.

## EVEN-AGED

### CLEARCUT SYSTEM

Clearcutting can be used to prepare a site for the establishment of a new even aged stand. Regeneration can be achieved naturally by sprouting and seeding or by artificial means such as planting or direct seeding. This system is most applicable in stands dominated by shorter lived, lower value species such as white spruce, fir and the intolerant hardwoods. If applied in forests with longer lived species such as red spruce, cut sizes can be reduced to allow for natural seeding from adjacent stands.

Two variations on this prescription are possible in the Acadian forest – strip cutting and patch cutting. These variations will tend to decrease the cut size, promote better natural regeneration and favor some wildlife species.

### SEED TREE SYSTEM

This system promotes natural regeneration of a site by leaving a number of trees standing, ranging from 15 to 35 per hectare. They should be good quality and wind-firm to provide seed for the next crop. The seed trees may be harvested after the stand has been regenerated if this can

be accomplished without damaging the natural regeneration. This system can be applied in stands that contain dominant white pine, yellow birch, white ash and sugar maple.

### SHELTERWOOD SYSTEM

Shelterwood harvesting involves the removal of the overstory in several stages over a few years. The new stand is established under the cover of the existing forest. This treatment is most applicable where low light conditions and cool temperatures are required for regeneration of the forest. Sites where shelterwood is an applicable prescription generally have tight crown closure with little advanced regeneration and can be composed of shade-tolerant species such as white pine, red spruce, Eastern hemlock, sugar maple and yellow birch.

## UNEVEN-AGED

### THE SELECTION SYSTEM

The selection system is used where the primary goal is to restore or maintain the structure and composition of the Acadian Forest Region. The objective is to retain forest cover, improve overall stand quality and maintain an uneven-aged stand condition with natural regeneration of shade-tolerant tree species. Tree removal is typically done at regular intervals of 5 to 20 years and involves the removal of individual trees or small groups of trees. This system simulates one of the natural disturbance patterns present in the Acadian forest where old mature trees would die or blow down and would be replaced by younger trees.

Two types of selection harvesting commonly used are single tree or group selection.

### SINGLE TREE SELECTION

This treatment focuses on the removal of individual trees from the stand at regular intervals. The resulting stand will be composed of trees with a range of ages and sizes, although this can take several entries to accomplish.

### GROUP SELECTION

The objective of this treatment is to create small gaps where natural regeneration of shade-tolerant tree species can become established. To accomplish this, canopy openings should not exceed twice the average stand height. Group selection can be used to create an uneven-

aged forest, or to maintain a forest that is already in an uneven-aged condition.

### MAKING THE DECISION

The ultimate decision on what to do with the forest rests with the landowner, however it is a good practice for the contractor to present the landowner with several prescriptions that could address their objectives and recognize the values present in their forest.

Once the landowner has considered possible harvesting options and selected an appropriate treatment, it is important to carefully plan the harvest. The following practices apply to all harvesting systems.

# PLANNING THE HARVEST

## STANDARD PRACTICES

- Harvest planning should consider wildlife habitat, aquatic ecosystems, and the provision of snags and downed woody material. See Wildlife Habitat BMP's.
- The harvest prescription selected should consider landowner objectives, natural disturbance patterns and stand specific conditions.
- The area to be harvested should be identified on the ground and flagged.
- Special Management Zones should be identified and flagged.
- Harvesting operations should be planned with consideration for natural regeneration, taking care to protect advanced regeneration when present.
- Wood extraction trails should be located to minimize environmental impact.
- Harvesting should maximize the production of high value products while minimizing waste, within market constraints.
- Consider harvest timing to accommodate environmental conditions and markets.
- Location of extraction trails, landings, and crossings should be planned to minimize impact on watercourses.
- Locations for piling wood should be identified and should consider local hazards and constraints (for example power lines, traffic flows, right of ways and other uses for the area).
- Where selection cuts are prescribed, advance marking of at least some of the trees should be considered.
- Consider impacts of harvesting on viewscapes and other landowners.

## ENHANCED PRACTICES

- Locate harvest boundaries along naturally occurring features (stand types, topography).
- Consult a Depth to Water Table (wet areas) Map to determine potentially sensitive areas.
- Inform adjacent landowners of pending harvest operations.
- Consult the Nova Scotia Forest Ecosystem Classification guide to determine soil characteristics of the site when considering the harvesting of forest products, including: boles, slash, limbs and tops.

## HARVESTING OPERATIONS

### STANDARD PRACTICES

- Implement operations plan as written.
- Be aware of and follow Nova Scotia Occupational Health and Safety Regulations on all harvesting sites.
- Be aware of and follow Fire Protection Regulations for fire prevention during fire season.
- Avoid rutting by keeping machinery away from soft or wet ground and using brush matting where required.
- Remove all garbage from the site and properly dispose of hazardous materials (including petroleum products).
- Optimize utilization by minimizing stump height and processing trees to acceptable minimum top size.
- Use caution and proper procedures in the handling and storage of harmful substances.
- Keep all boundaries, roads and recreational trails free of debris.
- Never allow machinery or debris to enter a watercourse.
- Avoid operating during excessively wet periods to minimize rutting, soil compaction and erosion.
- Avoid damaging advanced regeneration.
- Avoid damaging roads, culverts and ditches with forwarding and harvesting machinery.
- Refuel and service machinery at least 30 metres away from a watercourse and on bare mineral soil.
- Repair damage done to forwarder/skid trails and access roads.

## POST HARVEST ACTIVITIES

### STANDARD PRACTICES

- Record information on volume harvested.
- Complete self performance checklist.
- Repair any damage to roads and environment.
- Ensure that landowner is satisfied with the operation.
- Ensure all roadside wood is promptly removed from site.
- Supply owner with final sketch or GPS map of harvest area and outline process for ensuring regeneration occurs, including the re-vegetation of landings.
- Contractor should supply the landowner with a list of silviculture contractors that can provide reforestation services.

### ENHANCED PRACTICES

- The contractor should ensure the harvested site has a regeneration survey completed within 3 years and arrange for the appropriate silviculture treatment to ensure optimum reforestation.
- Practice due diligence by taking digital photographs of pre/post site and road conditions.
- Recommend contacts for follow-up silviculture treatments.

# ENSURING A SAFE OPERATION: BEST MANAGEMENT PRACTICES

Nova Scotia's Occupational Health and Safety Act provides for the promotion, co-ordination, administration and enforcement of occupational safety and health. Occupational health and safety involves five essential elements:

- Prevention
- Internal responsibility
- External support (training)
- Enforcement (monitoring)
- Response to changing needs (updating procedures)

FPANS Stewardship Principle 5

Forest operations raise unique challenges for contractors and operators. The nature of forest work, the variation in environmental conditions and stand conditions, coupled with the use of mechanized equipment can create dangerous work situations for both the contractor as well as visitors to the site. The following practices are considered mandatory and are described more fully in the latest edition of "Forest Professional."

### STANDARD PRACTICES

- Personal protective equipment (PPE) appropriate to the operation must be worn by the forest worker. Equipment must be approved as outlined in the "Forest Professional" and be kept in good repair.

- Develop a procedure and record keeping system for competency training for all employees.

- Contractors must understand and conduct operations in accordance with the Nova Scotia Occupational Health and Safety Act and regulations, codes of practice and other applicable acts and/or regulations.

- Contractors must undertake periodic visual checks of any employee working under hazardous conditions (including working alone) and develop effective policies and procedures to address the risk.

- First aid supplies and services must be made available as required by Occupational Health and Safety regulations, including a valid remote location plan.

- Safe operating practices must be adhered to for the operation of equipment used in a forest operation. Some examples might include:
  - Forwarding wood on steep slopes
  - Chainsaw operation, etc.

- Harvesting and road construction practices must be used as outlined in the latest edition of the "Forest Professional".

## ENHANCED PRACTICES

- Each contractor should have an Occupational Health and Safety Program in place.
- Contractors should participate in third-party audits of their Occupational Health and Safety Program.
- Job sites should be posted to indicate that work is in progress.

## FUEL AND OIL STORAGE AND HANDLING

Storing, using and transporting petroleum products is a responsibility that all contractors and their employees must consider as a significant requirement of their jobs. Any amount of spilled or released petroleum product has the potential to contaminate surrounding soils if not properly contained and disposed of in an approved manner. If these products penetrate ground water they can travel for hundreds of meters affecting household water supplies, destroying wildlife and habitat.

The following are basic conditions contractors and/or employees must be aware of to reduce the risk of an adverse environmental incident:

### STANDARD PRACTICE

- Applicable legal requirements will be met or exceeded as per regulations when working with controlled products.
- Develop and implement an Emergency Response Plan that includes training and drills for expected emergencies and includes proper use of spill kits and their disposal.
- Any movement of a fuel tank over 450 litres on a site will be done by a person with current Transportation of Dangerous Goods (TDG) training.
- A method for disposal of used fuel and oils in accordance with provincial regulations is to be used and documented.
- Every effort must be made to ensure spill kits are restocked after use.
- Perform and document monthly visual inspections of storage tanks.

### ENHANCED PRACTICE

- Where possible, environmentally friendly products will be substituted for more hazardous fuels and oil.
- Install automatic shut-off valves on hydraulic equipment.

## FUELING AND LOCATION OF STORAGE TANKS AND FACILITIES

### STANDARD PRACTICE

- Off road fueling, fuel storage sites and facilities will be on reasonably level ground, free of large rocks or exposed bedrock, and will be located at least 30 metres from any defined watercourse, wetland, pond, or lake.

- Fuel may be stored and transported in a small means of containment (less than 450 litres – slip tanks) providing that the means of containment is designed, filled, closed, secured, and maintained to ensure that there will be no accidental release of the product during transport.

- Fuel being stored and transported in a means of containment greater than 450 litres must meet the requirements of section 5.12 of the Transportation of Dangerous Goods Act and Regulations.

- All fuel tanks must have proper TDG and WHMIS placards.

- Each operation will be equipped with a large spill kit. Each machine will have a supply of absorbent material.

- When being moved on a public highway, a tank must be properly mounted on a licensed and inspected trailer.

- Ensure lube oil, grease, antifreeze and other controlled products are kept inside a secure and locked structure when no one is on site.

### ENHANCED PRACTICES

- Each machine must have access to an adequate supply of absorbent material for spills.

- Each fuelling location should have a "Plug & Dyke" kit.

## FUEL STORAGE TANKS AND PUMPS CHECKLIST

Contractors/employees will make routine checks/inspections of the following items on fuel storage tanks and pumps:

- All transportation tanks must be secured to the truck or trailer.

- Pumps, discharge hoses and drain plugs are well maintained and kept free of leaks.

- Ensure nozzle is in place and in good repair on automatic shut-off nozzles. When refueling, an operator must be at the nozzle at all times, regardless of the type of nozzle, except when using a hand pump.

- All fuel discharge hoses must have a nozzle.
- All hand pumps must be equipped with automatic shut-off nozzles.
- All pumps are fitted with a secure and sturdy locking mechanism and are kept locked when not in use.
- Electrical leads to the fuel pump must be well maintained with no breaks in the wire insulation and be properly connected to the power source.
- Gravity flow pumps should not be used in any situation.

## HYDRAULIC OIL SYSTEMS

Contractors/employees will check and ensure that the hydraulic systems on all forestry equipment are well maintained and controls are in place when lines are disconnected for repairs. Proper procedures must be followed to minimize loss of hydraulic oil into the environment.

## OIL SPILLAGE DURING SERVICE AND REPAIRS

Every effort will be made to prevent the loss of fuel, motor oil, hydraulic oil, gear oil, and other deleterious material into the environment through the collection of these fluids during service and repairs. When a small amount of fluid spillage is unavoidable an oil proof barrier in combination with oil absorbing material will be used to prevent soil and water contamination.

## ENVIRONMENTAL EMERGENCY NUMBER - 1-800-565-1633

A spill of more than 100 liters (22 gal) will be reported to the Nova Scotia Environment.

Judgement must be exercised when reporting spills lower than the stated amounts. (i.e. spills on or near drinking water sources or other sensitive areas should be reported regardless of the amount).

# PERFORMANCE MONITORING: BEST MANAGEMENT PRACTICES

Performance should be continuously monitored and adjusted in order to ensure that best management practices are being adhered to and that established objectives are being met. A system of recording performance is useful. It provides the contractor with a tool to assist them in completing a thorough performance review as well as documentation which can be supplied to wood purchasers or landowners to illustrate compliance with best management practices.

The following checklists will make it easy for the contractor to determine if the operation meets best management practices and to identify where improvements are required.

### STANDARD PRACTICES

- It is recommended that the contractor complete the checklist at three stages of operation:

    1. Before the operation starts.
    2. During the operation.
    3. Post operation.

- Only those practices that are relevant to the operation need be assessed. This program will enable the contractor to identify practices or areas which need improvement early in the operation.

### ENHANCED PRACTICES

- Provide landowner with completed checklists.

- Maintain paper copy for future reference and provision to wood purchasers.

# BUSINESS: BEST MANAGEMENT PRACTICES

Whether you are a contractor or landowner operating on your own land, you are a small business. The success of your business is dependent upon management of your operation and/or woodlot. The management aspect is as important as the operation and repair of your equipment.

### STANDARD PRACTICES

- Develop a business plan that provides direction over the short term and long term for your business. The plan should include revenue, expenses and annual cash flow as well as a 3 to 5 year forecast. Equipment replacement plans should be reviewed and updated annually.

- Consult an accountant to ensure that your books are properly set up and provide the information you will need to manage your business.

- Develop a record keeping system that provides you the information to manage your business such as equipment maintenance and repair, parts inventory, wood sold and wood inventory on landing, production, operating costs, staff expenses, training, and your safety program.

- Track operating costs at least monthly to ensure you have a good understanding of your per unit costs and the factors that affect them.

- Use contracts for operations such as stumpage purchases, silviculture work and road building.

- When negotiating contracts or selling forest products, you have to know all your costs, including capital, operating expenses, payroll, taxes, insurances, overhead and a reasonable rate of return.

- Have a human resource plan that identifies staffing needs, recruitment, training, retention and dismissal.

- Have adequate insurances such as liability, equipment, vehicle and Workers Compensation to protect yourself and your business. Landowners should require proof of adequate insurance.

- Stay current on forest products markets, specifications and prices and be prepared to respond to changes in the market place.

- Be registered as applicable with appropriate government agencies such as Revenue Canada, Joint Stocks, WCB.

- Join and participate in an appropriate professional organization(s).

## ENHANCED PRACTICES

- Research emerging technologies to assist in managing your business such as GIS/GPS, various operational software that optimizes production.
- Research emerging forest products markets.
- Participate in continuing education programs.
- Encourage employees to participate in an appropriate professional organization(s).

# SELF PERFORMANCE CHECKLISTS

## DEVELOPING LANDOWNER AGREEMENTS: BEST MANAGEMENT PRACTICES

### BEFORE MEETING THE LANDOWNER:

| | Standard | Enhanced |
|---|---|---|
| • Information gathered on the woodlot; maps, air photos etc. | ☐ | |
| • Information provided to landowner on forest operations | ☐ | |
| • Portfolio made available with photographs of previous work | | ☐ |

### DISCUSSED DURING THE LANDOWNER INTERVIEW:

| | Standard | Enhanced |
|---|---|---|
| • Landowner's objectives | ☐ | |
| • Forest management alternatives – harvesting, silviculture, non-timber | ☐ | |
| • Survey to determine landowner objectives administered | | ☐ |

### WOODLOT ASSESSMENT

| | Standard | Enhanced |
|---|---|---|
| • Inventory of forest products | ☐ | |
| • Observations of wildlife and habitat recorded | ☐ | |
| • Watercourses identified | ☐ | |
| • Other operating constraints identified (areas of human interest, etc.) | ☐ | |
| • Special Management Areas identified (i.e. significant habitat, old growth, endangered plants, designated wetlands etc.) | ☐ | |
| • Opportunities to work together with other landowners identified | ☐ | |
| • Assessment of broader woodlot values conducted | | ☐ |
| • Document any observed invasive exotic plant or animal species | | ☐ |
| • Potential for prescriptions other than clearcutting identified | | ☐ |
| • Completed Landowner – Decision Support Tool | | ☐ |

**OPERATION PLAN INCLUDES**

| | Standard | Enhanced |
|---|---|---|
| • Landowner objectives | ☐ | |
| • A map showing boundary line and areas of operation | ☐ | |
| • Description of vegetation on areas of operation (tree species and size) | ☐ | |
| • Area to be treated, prescription, method and system to be used | ☐ | |
| • Special management areas identified | ☐ | |
| • Watercourses and wetlands identified | ☐ | |
| • Forest/Wildlife requirements identified | ☐ | |
| • Stream crossings and method of crossing noted | ☐ | |
| • Forest stand characteristics from inventory | | ☐ |
| • Consultations with forestry professional to assist in development of plan | | ☐ |
| • Forest inventory data included | | ☐ |
| • Brief description of prescription type | | ☐ |
| • Potential locations of wildlife management features | | ☐ |

**NEGOTIATION AND AGREEMENT WITH LANDOWNER**

| | Standard | Enhanced |
|---|---|---|
| • Operation plan reviewed with the landowner | ☐ | |
| • Method of payment agreed upon | ☐ | |
| • Revisions incorporated to meet landowner needs | ☐ | |
| • Visit area(s) of operation with landowner | | ☐ |
| • Provide landowner with contract or lease | | ☐ |
| • Register contract with lawyer | | ☐ |
| • Provide performance bond | | ☐ |

## ROAD CONSTRUCTION: BEST MANAGEMENT PRACTICES

### PLANNING AND LAYOUT

| | Standard | Enhanced |
|---|---|---|
| • Owner objectives and approval of road location determined | ☐ | |
| • Fragile/sensitive areas avoided | ☐ | |
| • All required permits in place | ☐ | |
| • Sight distance/aesthetics considered | | ☐ |

### CONSTRUCTION

| | Standard | Enhanced |
|---|---|---|
| • Ditches/culverts adequate – road well drained | ☐ | |
| • Erosion control has been implemented | ☐ | |
| • Site clean of garbage and machinery | ☐ | |
| • Road sides seeded or brush mats installed | | ☐ |
| • Document work with digital photography | | ☐ |
| • Annual inspection and maintenance plan | | ☐ |
| • Watercourse alteration certified | | ☐ |

### TEMPORARY STREAM CROSSINGS

| | Standard | Enhanced |
|---|---|---|
| • Installed in accordance with guidelines | ☐ | |
| • Removed the temporary crossing | ☐ | |

## WILDLIFE HABITAT: BEST MANAGEMENT PRACTICES

| | Standard | Enhanced |
|---|---|---|
| • Working knowledge of species at risk | ☐ | |
| • Document species at risk research actions | ☐ | |
| • Species at risk protection measures included in plan | ☐ | |
| • Wildlife features identified and considered | ☐ | |
| • Landowner objectives considered | ☐ | |
| • Landscape level issues considered | | ☐ |
| • Late successional Acadian forest left intact | | ☐ |

### DEVELOPING A VARIETY OF FOREST HABITATS – HARVEST DESIGN

| | Standard | Enhanced |
|---|---|---|
| • Harvest prescription appropriate | ☐ | |
| • Harvest area less than 50 ha. | ☐ | |
| • Corridors installed where required | ☐ | |
| • Wind-firm trees and snags left within corridors | ☐ | |
| • Special management areas addressed | ☐ | |
| • Blocks –irregular shaped to increase edge habitat | ☐ | |
| • NS Wildlife Habitat and Watercourse Protection Regulations followed | ☐ | |
| • Harvest prescriptions to promote a variety of age classes, tree species and vegetation types | | ☐ |
| • Widest buffer possible left | | ☐ |

## HARVESTING BEST MANAGEMENT PRACTICES

### HARVESTING OPERATIONS

| | Standard | Enhanced |
|---|---|---|
| • Followed operations plan | ☐ | |
| • Followed NS Occupational Health and Safety regulations | ☐ | |
| • Followed Fire Protection Regulations | ☐ | |
| • Avoided rutting | ☐ | |
| • Proper procedure followed in handling and storage of harmful substances | ☐ | |
| • Garbage/equipment removed from site | ☐ | |
| • Avoided damaging advanced regeneration | ☐ | |
| • Repaired damaged trails and roads | ☐ | |

### POST HARVEST ACTIVITIES

| | |
|---|---|
| • Harvested volume recorded | ☐ |
| • Self performance checklist completed | ☐ |
| • Damaged roads and environment repaired | ☐ |
| • Landowner satisfaction verified | ☐ |
| • Roadside wood removed | ☐ |

| | | |
|---|---|---|
| • Provided GPS map of harvested area with outline process for regeneration | ☐ | |
| • Provided list of silviculture contractors | ☐ | |
| • Ensure a regeneration survey is completed | | ☐ |
| • Pre/post site and road conditions photos taken | | ☐ |
| • Follow-up silviculture treatments contacts supplied | | ☐ |

## ENSURING A SAFE OPERATION

| | Standard | Enhanced |
|---|---|---|
| • Personal protective equipment worn and kept in good repair | ☐ | |
| • Employee competency training procedures and record keeping system developed | ☐ | |
| • NS Occupational Health and Safety Act and other applicable act/regulations followed | ☐ | |
| • Performed visual checks on employees at risk and developed policies and procedures to address the risk | ☐ | |
| • Followed the practices of the latest edition of the "Forest Professional" | ☐ | |
| • Occupational Health and Safety program in place | | ☐ |
| • Participated in third-party audits | | ☐ |
| • Posted work in progress on job sites | | ☐ |

## FUEL AND OIL STORAGE AND HANDLING

| | Standard | Enhanced |
|---|---|---|
| • Met applicable legal requirements | ☐ | |
| • Developed and implemented an Emergency Response Plan | ☐ | |
| • Used fuel and oils recorded and disposed of in accordance with provincial regulations | ☐ | |
| • Spill kits must have sufficient supplies to accommodate size of operation | ☐ | |
| • Environmentally friendly products used | | ☐ |
| • Automatic shut-off valves installed | | ☐ |

## FUELING AND LOCATION OF STORAGE TANKS AND FACILITIES

| | Standard | Enhanced |
|---|---|---|
| • Not closer than 30m from any defined watercourse | ☐ | |
| • Met requirements of the Transportation of Dangerous Goods Act and Regulations | ☐ | |
| • Proper TDG and WHMIS placards | ☐ | |
| • Tanks properly mounted on a licensed and inspected trailer | ☐ | |
| • Stored products locked in structure when no one is on site | ☐ | |
| • Machines have absorbent material for spills | | ☐ |
| • Fueling locations have a "Plug & Dyke" kit | | ☐ |

## FUEL STORAGE TANKS AND PUMPS

| | Standard | Enhanced |
|---|---|---|
| • Transportation tanks secured | ☐ | |
| • Pumps, discharge hoses and drain plugs maintained with no leaks | ☐ | |
| • Nozzles kept in good repair | ☐ | |
| • Fuel discharge hoses have nozzles | ☐ | |
| • Hand pumps equipped with automatic nozzles | ☐ | |
| • Pumps locked when not in use | ☐ | |
| • Electrical leads to fuel pump maintained | ☐ | |
| • Gravity flow pumps not used | ☐ | |

## ADDITIONAL RESOURCES

**Nova Forest Alliance -** www.novaforestalliance.com

- At a Glance: A Guide to Identifying and Managing Nova Scotia Hardwoods
- Forest Ecosystem Classification of Nova Scotia's Model Forest
- Woodlot Info Shop Website – www.woodlotinfoshop.ca

**Woodlot Management Home Study Program - Nova Scotia Department of Natural Resources -** http://www.gov.ns.ca/natr/education/woodlot/

- Introduction – Getting More from Your Woodlot
- Principles of Forest Stewardship
- Introduction to Silviculture (Module 1)
- Harvesting Systems (Module 2)
- Thinning for Value (Module 3)
- Wildlife and Forestry (Module 4)
- Stand Establishment (Module 5)
- Chain Saw Use and Safety (Module 6)
- Woodlot Ecology (Module 7)
- Wood Utilization & Technology (Module 8)
- Woodlot Recreation (Module 9)
- Managing Woodlot Finances: Planning and Investment Guide (Module 10A)
- Managing Woodlot Finances: Income Tax and Estate Planning Guide (Module 10B)
- Roads and Trails: Planning it Right from the Start (Module 11)
- Small Scale Harvesting Equipment – What's Right For You? (Module 12)
- Non Timber Forest Products: Growing Opportunities (Module 13)

**Nova Scotia Forest Practices Pamphlets - Nova Scotia Department of Natural Resources**

- Your Forest Management Plan (Pamphlet 1)
- Building Woodland Roads (Pamphlet 2)
- Forest Surveys and Boundary Lines (Pamphlet 3)
- Safe Felling (Pamphlet 9)
- Safety From Stump to Roadside (Pamphlet 10)
- Harvesting Systems Clearcut Method (Pamphlet 13)
- Harvesting Systems Selection Method (Pamphlet 14)
- Harvesting Systems Seed Tree Method (Pamphlet 15)
- Harvesting Systems Release Cutting (Pamphlet 16)

**Nova Scotia Department of Natural Resources**

- Integrated Resource Management Pamphlet and Video
- Selling Standing Timber
- Forest Sustainability Regulations – Information leaflet FOR-3
- Woodlot Roads/Stream Crossing Manual

- Forestry/Wildlife Guidelines
- More Wildlife on Your Woodlot
- Forestry Field Handbook
- Hardwood Thinning Manual
- Shelterwood Harvesting Manual
- Merchantable Thinning Manual - Softwoods

Logging for Wildlife – *Nova Scotia Forestry Association*

A True Picture – Taking Inventory of Your Woodlot – *Eastern Ontario Model Forest*

The SFM Essentials – An Introduction to the Sustainable Forest Management Standards – *Canadian Standards Association*

The Forest Professional – Guidelines for the Stewards of Tomorrow's Forests – Occupational Health and Safety Division – *Nova Scotia Department of Labour*

Registered Professional Foresters Association of Nova Scotia – www.rpfans.ca

Forest Products Association of Nova Scotia – www.fpans.ca

Nova Scotia Forest Technicians Association – www.nsfta.ca

Canadian Institute of Forestry – Nova Scotia Section - http://www.cif-ifc.org/site/nova_scotia

Green Pages Directory – DvL Publishing – www.countrymagazines.com/greenpages.shtml

## LIST OF LEGAL REQUIREMENTS

### PROVINCIAL LEGISLATION

- Occupational Health and Safety Act
  - Occupational Health and Safety First Aid
  - Occupational Safety General
  - Workplace Hazardous Materials Information System
  - Occupational Health (enforced under this act)

- Dangerous Goods Transportation Act
  - Dangerous Goods Transportation

- Endangered Species Act
  - Species at Risk List

- Environment Act
  - Activities Designation
  - Approvals Procedure
  - Dangerous Goods Management
  - Emergency Spill
  - Environmental Assessment
  - Motive Fuel and Oil Approval
  - NS Environmental Assessment Board
  - On-site Sewage Disposal Systems
  - PCB Management
  - Pesticide
  - Petroleum Management
  - Protected Water Areas
  - Used Oil
  - Solid Waste-Resource Management
  - Sulphide Bearing Material Disposal
  - Water and Wastewater Facility

- Forests Act
  - Forest Fire Protection
  - Forest Sustainability
  - Registration and Statistical Returns
  - Wildlife Habitat and Watercourse Protection

- Labour Standards Code
  - General Labour Standards Code
  - Minimum Wage Order
    - General
    - Logging and Forest Operations

- Land Registration Act
  - Land Registration General

- Off-highway Vehicles Act
  - Off-Highway Vehicles Trails Designation
  - Off-highway Vehicle Infrastructure Fund
  - Off-highway Vehicle Insurance
  - Off-highway Vehicles Closed Courses
  - Off-highway Vehicles Designated Trails and Trail Permits
  - Off-highway Vehicles Fees
  - Off-highway Vehicles General
  - Off-highway Vehicles Safety and Training
  - Off-highway Vehicles Vulnerable Areas Licensing

- Special Places Protection Act
  - See Site Specific Designations and Regulations

- Wilderness Areas Protection Act

- Wildlife Act
  - General Wildlife
  - Wildlife Management Area

- Workers' Compensation Act
  - Workers' Compensation General

**FEDERAL LEGISLATION**

- Canada Labour Code
  - Canada Occupational Health and Safety

- Canadian Environmental Assessment Act
  - Comprehensive Study List
  - Exclusion List
  - Inclusion List

- Canadian Environmental Protection Act
  - Environmental Emergency

- Canada Wildlife Act
  - Wildlife Area

- Fisheries Act

- Forestry Act

- Timber Regulations

- Migratory Bird Convention Act
  - Migratory Birds
  - Migratory Bird Sanctuary

- National Fire Code

- Navigable Waters Protection Act
  - Navigable Waters Works

- Pest Control Products Act
  - Pest Control Products

- Plant Protection Act

- Species at Risk Act

- Transportation of Dangerous Goods Act
  - Transportation of Dangerous Goods

## USEFUL PHONE NUMBERS

Association for Sustainable Forestry 902-895-1179

Canadian Forest Service – Atlantic Forestry Centre – Fredericton 506-452-3500

Christmas Tree Council of Nova Scotia 902-895-6914

Department of Fisheries and Oceans 1-800-782-3058

Environment Canada - Environmental Protection Branch 902-426-7231

Forest Products Association of Nova Scotia 902-895-1179

Forest Safety Society of Nova Scotia 902-895-1107

Nova Forest Alliance 902-639-2921

Nova Scotia Department of Fisheries and Aquaculture Inland Fisheries 902-485-5056

**Nova Scotia Department of Natural Resources**
Central Region 902-893-5631
Eastern Region 902-563-3370
Western Region 902-527-5984

**Nova Scotia Environment and Labour**
Environmental Monitoring and Compliance Toll Free: 1-877-936-8476
Labour Standards Toll Free: 1-888-315-0110
Occupational Health and Safety Toll Free: 1-800-952-2687

Nova Scotia Forestry Association 902-895-1179

Sustainable Forestry Initiative 1-800-631-3657 (to report noncompliant forestry operations with regards to sustainable forestry)

**Emergency Numbers**
Fuel Spill Emergency 1-800-565-1633
Medical Emergency – 911
Forest Fire or Game Infraction Reporting 1-800-565-2224

Schedule "I"

**Q.** ***How is the width of a stream measured?***

**A.** Measure the width of the bed of the stream, which is the portion of the stream containing mud, silt, sand, gravel or rock covered by water for at least part of the year. Take a measurement at ten equidistant locations along the stream where it is adjacent to the proposed harvest area, then calculate the average of those measurements to determine the average width.

**Q.** ***Can you harvest trees in Special Management Zones?***

**A.** Yes, but you must leave a standing basal area (see next question) of at least 20 metres²/ hectare (87 feet²/acre) and not create an opening in the dominant canopy larger than 15 metres (48 feet). It is recommended that the most windfirm trees (ie. hardwood, pine, hemlock, and healthy red spruce) be favoured as the trees to remain standing in the Special Management Zones.

**Q.** ***How can I determine "Basal Area"?***

**A.** Basal area is the surface area of the cross section of the trunks of trees left standing, measured at a height of 1.3 metres (4.3 feet) from the ground. Usually measured in square feet per acre or square meters per hectare, the number can be estimated using a prism or relascope. For assistance contact a local N. S. Department of Natural Resources office.

**Q.** ***What are the best trees to leave as legacy trees in wildlife clumps?***

**A.** Large diameter trees are the best, as are those that will last a long time, such as hardwoods and hemlock. Most tree species are suitable. Living trees with dead tops, broken limbs or showing the first signs of decay will provide cavities for a long time. Try selecting a good cavity tree to use as the center of the clump. Leave enough standing trees around it to provide at least the minimum number of required trees per clump. Continue this procedure until there are at least the minimum number of clumps required for the harvest area. This allows the best candidate cavity trees to be kept and governs how the clumps are distributed.

**Q.** ***What happens if I do not follow these Regulations?***

**A.** You would be guilty of an offense and subject to a significant penalty.

**Q.** ***Where can I get more information?***

**A.** For more details, please read the regulations available from a N.S. Department of Natural Resources office.

or visit our website at:
www.gov.ns.ca/natr/forestry/strategy

NOVA SCOTIA
Natural Resources

02/2002

# NOVA SCOTIA'S WILDLIFE HABITAT AND WATERCOURSES PROTECTION REGULATIONS

Information Circular
WDL-7

habitat, to ensure Nova Scotian forests will have a diversity of wildlife species in the future.

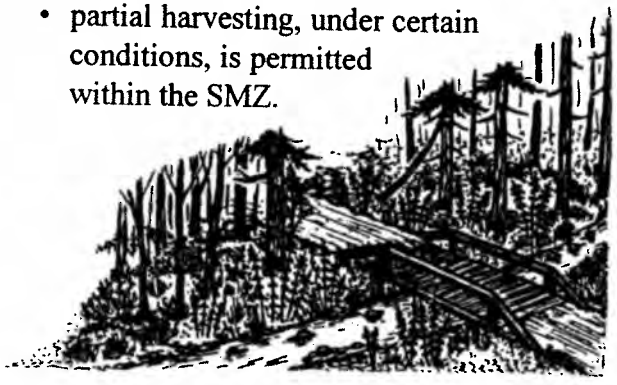
On January 14, 2002 these Regulations became law and must be followed when forest harvesting takes place on any woodland in Nova Scotia.

**There are 3 techniques that must be followed when harvesting forest land:**

**1. Leaving Buffer Strips Along Watercourses**

The area next to a watercourse provides food and shelter for many species of wildlife. When harvesting adjacent to a watercourse 50 centimetres (20 inches) or more in width:

- leave at least a 20 metre (66 feet) wide strip, called a Special Management Zone (SMZ), along each edge of the watercourse.
- partial harvesting, under certain conditions, is permitted within the SMZ.



Many species of animals and birds require openings or cavities in standing trees for nesting and shelter. When harvesting any area larger than 3 hectares (7.4 acres):

- leave at least 10 living trees standing (future cavity trees) for each hectare harvested.
- leave these trees in clumps, with a minimum of 30 trees per clump.
- for information regarding the number of clumps required, their composition and their location, see www.gov.ns.ca/natr/forestry/strategy.

**3. Leaving Coarse Woody Debris**

Standing dead trees, fallen trees and large branches, and rotting logs are important habitat for many species of wildlife, and when decomposed, they are a source of nutrients for the next forest. When harvesting:

- leave standing dead trees and as much large woody debris on the harvested area as possible.

For more details on the Wildlife Habitat and Watercourses Protection regulations, visit www.gov.ns.ca/natr/forestry/strategy or contact your local N. S. Department of Natural Resources office.

## ABOUT THE WILDLIFE HABITAT AND WATERCOURSES PROTECTION REGULATIONS

**Q.** ***Why are there no restrictions on clearcutting in the Regulations?***

**A.** All forest harvesting methods change wildlife habitat. Some species prefer openings while others prefer forest cover. Clearcutting is the predominant method of harvesting used for a variety of legitimate reasons including the characteristics of our forests, economics and the size of area being harvested. Other methods such as selection and shelterwood harvesting are used where they suit the management objectives of the landowner and the forest being managed.

**Q.** ***Why must there be controls on what I can do on my land?***

**A.** Harvesting has a major impact on the habitat of wildlife (plants and animals) and on water quality. After consulting with the public, forest industry, environmental groups, foresters, and biologists, these new regulations provide the minimum standards that most parties agreed are necessary to protect the integrity of areas along defined watercourses.

Schedule "J"

## Who regulates herbicide use in Nova Scotia?

Application of a herbicide on forest land in Nova Scotia requires approval by the Nova Scotia Department of Environment and Labour (NSDEL). All applications must adhere to the terms and conditions contained in their approval.

NSDEL sets "No-spray" set back zones to protect water supplies, watercourses, wetland areas and dwellings. They also stipulate public notification requirements, such as, applicators must notify residents of any dwelling within 500 m of the site that a herbicide application will be taking place.

Registered applicators must have successfully completed training and have been certified after passing a provincial exam. NSDEL has strict policies and procedures that certified herbicide applicators must follow when working on forest lands.

See the Nova Scotia Department of Environment and Labour website for more information:
http:www.gov.ns.ca/enla/services.htm

## How do we know that the herbicide is reaching and staying within the treatment area?

Aerial applicators use global positioning technology and sophisticated computerized spray equipment thats controls droplet size, to ensure precise delivery of the herbicide. Prior to and during a spray operation, weather is closely monitored and the herbicide is applied only during low wind conditions as specified in the Approval from the Nova Scotia Department of Environment and Labour. Observations, post treatment by DNR staff, of the line on the ground between areas receiving and not receiving treatment is typically found to about one metre width.

The decision to use herbicides is never taken lightly. It is based on a careful analysis of the site and the species found, the selection of a thoroughly tested and understood product, and the skill of trained operators using modern technology to produce accurate and successful results. Herbicide use is one of the tools available to resource managers as they seek to enhance tree growth while ensuring the benefits from other forest values remain for present and future generations to enjoy.

For more information on forestry and forest management in Nova Scotia visit the Department of Natural Resources website:
http://www.gov.ns.ca/natr

NOVA SCOTIA
Natural Resources
Information Circular FOR - 4
May 2006
05-23-08/5000

# The Responsible Use of Herbicides in Nova Scotia Forests

## Science, Safety and Sustainability

Scotia's forest industry generates $150 million in direct and indirect taxes. As a major employer in many rural communities, the industry provides direct and indirect employment for more than 17,000 people.

Nova Scotia's forests must be able to regenerate and grow quickly to meet the growing demand for forest products and sustain the economic, social, and environmental benefits we value. Forest managers develop harvesting plans and post harvest treatments to manage healthy, diverse and productive forest stands. These plans include measures such as maintaining species representative of the original forest, and site specific silviculture treatments. Planning includes monitoring regeneration vigour, selecting appropriate planting stock and selective vegetation management programs.

To aid forest managers in the selection of appropriate harvest plans and silviculture treatments, a forest management Code of Practice has been introduced in Nova Scotia. As well, a guidebook on forest ecosystem management will be introduced to further assist forest managers in meeting biodiversity goals on Crown land forests. These will serve as guides for private woodlot managers as well.

## Is vegetation management necessary?

Vegetation management is necessary to ensure that sufficient areas of Nova Scotia's forests are quickly restocked with commercial tree species to meet our wood supply needs without compomising forest sustainability. It is an accepted silviculture treatment and an integral part of todays' forest management strategy.

Vegetation management ensures trees receive adequate sunlight and have sufficient growing space to achieve optimum growth and development. Tree seedlings on some sites, whether natural

from other vegetation.

## How are herbicides used?

The methods used in forestry are similar to those used to keep agricultural crops free of weeds by applying a herbicide or physically removing or cutting away competing vegetation. In many forest stands, cutting competing vegetation is time consuming, difficult, and expensive work and nearly always results in multiple stems replacing the initial plant. In other cases competing herbaceous plants,(ferns, raspberries, etc.) cannot be controlled by cutting.

*Following cutting many competing species sprout new stems from the stumps or roots. Root systems are not affected by cutting the stems.*

the life of the stand (usually 40 to 60 years). When needed, small amounts of approved herbicides are applied to sites to help seedlings become established. They offer a cost effective, efficient, and safe means of controlling competing vegetation. The use of herbicides is done in accordance with all regulatory requirements.

## What are the main herbicides used in Nova Scotia forests?

The most predominately used herbicides are glyphosate-based products including: Forza™, Vantage Forestry™ and Vision™. Glyphosate is commonly used in agricultural crop production and domestic home and garden use for weed control. Forest use of herbicides accounts for less than one per cent of the total annual pesticide sold in Canada. In Nova Scotia, herbicides have been used successfully in forests for several decades.

## Are herbicides safe?

Only herbicides registered by the Canadian Pest Management Regulatory Agency (PMRA) are approved for use in the forest industry. Prior to registering a herbicide the PMRA (a Division of Health Canada) reviews toxicological, environmental, chemical and efficacy studies to ensure product safety and performance. For further information visit the PMRA website at http:www.pmra-arla.gc.ca or call the PMRA Info Service at 1-800-267-6315.

Glyphosate products act on a metabolic process found only in plants. They have a high degree of human safety when used according to label directions and have been demonstrated to have low toxicity to insects, mammals, birds and fish. There is no known risk associated with eating the meat of game animals that have been feeding in treated areas.

Schedule "K"

Wild Blueberry Fact Sheet C.4.2.0

# Wild Blueberry IPM

# Weed Management Guide

**Recommendations in this Guide are given for general information only. All herbicides used must be applied in accordance with label directions. The New Brunswick Department of Agriculture, Aquaculture and Fisheries by printing this publication does not offer any warranty or guarantee and does not assume liability for crop loss, animal loss, health, safety, or environmental hazards caused by the listed herbicides or practices. Trade names used in this Guide are given as a convenience to producers and are neither an endorsement of the product nor a suggestion that similar not mentioned products are not as effective.**

Revised 2017

Agriculture, Aquaculture and Fisheries

# Table of Contents

# Introduction

The weed flora in wild blueberry fields is unique compared to that found in other agricultural fields. Producers manage a native perennial crop that grows in low pH soils without associated tillage or cultivation. Weeds which prefer this habitat thrive if not controlled. Weeds can shade and compete with the crop, reduce bud/flower production and yield, reduce quality and can interfere with harvesting. The origin of a field often determines the weed flora. Fields developed from abandoned hayfields or pastures typically have a large number of grasses and herbaceous perennial weeds. Fields developed from woodland often have plants commonly associated with the woodland undergrowth such as bunchberry, ferns, lambkill, rhodora, and other woody plants and shrubs.

A weed survey conducted in the year 2000 recorded more than 250 species in blueberry fields, compared to only 115 species in a 1985 survey. The number of many of the traditional woody weeds has decreased due to herbicide use, but this has been off-set by greater numbers of herbaceous annuals and perennials. Not all non-traditional species are considered as significant weed problems but some, like lamb's quarters and herbicide resistant fescue grasses, have the potential of becoming major problems. This change in weedy vegetation resulted from herbicide use, especially hexazinone (Velpar/Pronone). Other contributing factors have been changes in production practices that allow weeds to spread and thrive, such as the increased use of fertilizers, increased use of mowing instead of burning for pruning and the use of mechanical harvesters and other equipment that spreads weeds. In the future, growers can expect an increasingly diverse weed flora. It is important to understand the activity and limitations of available weed control options and to use herbicides in conjunction with other practices to manage weeds.

A blueberry weed management program should follow the principles of Integrated Pest Management (IPM). IPM is a pest management strategy that integrates preventive, cultural, mechanical, biological and chemical control methods to achieve a sustainable production system that balances economic, health and environmental concerns. IPM is based on dynamic principles rather than a definitive set of rules and can vary from farm-to-farm or even from field-to-field. A weed management program that follows the principles and practices of IPM is often referred to as an integrated weed management (IWM) program.

# Components of an Integrated Weed Management Program

## *I. Weed Identification and Biology*

When planning a weed management program, blueberry producers must first be able to identify the weeds present in each of their fields. Most weed guides do not include many of the important blueberry weeds. The New Brunswick Department of Agriculture, Aquaculture and Fisheries maintains an integrated pest management (IPM) image bank on the www.gnb.ca/agriculture website, available directly here. This site contains images of diseases, insects, weeds and other disorders affecting New Brunswick's blueberry crop. Most images are available in both low and high resolution and the site is completely bilingual. The site can be accessed by three different methods: 1) the Browse feature where a pest category and/or crop can be selected to find the appropriate images, 2) the Search feature using a key word search or 3) the Complete Listing showing all images in the bank. Clients with slower Internet connections should only select lower resolution images to avoid long download times. Other excellent illustrated publications for identification of blueberry weeds are: Weeds of Eastern Canadian Blueberry Fields by M.G. Sampson, K.V. McCully and D.L. Sampson. NSAC Bookstore, Truro, N.S. 229 pp or Guide d'identification Alliés et Ennemis du Bleuet Nain, by È-C. Desjardins and R. Néron, Centre de Référence en Agriculture et Agroalimentaire du Québec.

Knowing how plants are classified or grouped helps to understand similarities and differences between them. An understanding of the life cycle and the reproductive strategy of weeds is needed in order to use the best approach to their control. Based on life cycle, weeds within wild blueberry fields can be categorized as annuals, biennials or perennials.

### *A) Annuals*

Annuals are becoming increasingly common in blueberry fields. Annuals reproduce only by seed and complete their life cycle in less than one year. They grow rapidly, produce large amounts of seed and may require control in both the sprout and crop year. Control methods must focus on preventing annuals from producing and spreading seed. Most annuals found in wild blueberry fields are summer annuals that germinate in the spring, produce flowers and seed and die in late summer or fall. These include such weeds as lamb's quarters, hemp-nettle, cow wheat and witch grass. There are also a few winter annuals found in blueberry fields. Winter annuals germinate in the fall and then over-winter in a seedling or rosette stage. They produce flowers and seeds the following summer and then die. Winter annuals include such weeds as common chickweed and Canada fleabane.

### *B) Biennials*

Biennials complete their life cycle in two years. They produce a low-growing rosette of basal leaves with a taproot that over-winters. Biennials 'bolt' to produce a flowering stalk, set seed and die in the second year. Examples include yellow evening-primrose, wild carrot and meadow goat's-beard. Biennials are also becoming increasingly common.

### *C) Perennials*

Perennial weeds are the most common in blueberry fields and generally more difficult to control. They live for more than two years and can be either herbaceous or woody. Perennial weeds may reproduce primarily by seed (daisy); by both seed and vegetative means (sheep sorrel); or primarily by vegetative means (bunchberry). Many perennial weeds grow in the same manner as the blueberry plant. Therefore, some of the production practices that promote blueberry growth (like pruning) also promote the growth of these weeds. Perennials which are low growing and spread vegetatively by interconnected underground root systems are the most difficult to control and cannot be controlled by hand-weeding. Some perennials can be controlled with selective or non selective herbicides, but for many, there are no satisfactory controls.

Annuals, biennials and perennials can be grouped in other ways. Flowering plants can be broadly classified as dicots (broadleaves) and monocots. There are also primitive plants that do not produce flowers. Plants can also be grouped into herbaceous (non-woody) and woody species.

### *1) Flowering Plants*

Flowering plants produce seed and can be divided into broadleaved species or dicots (with two seed leaves) and monocots (with one seed leaf). Dicot leaves have a branching network of veins and flowers with petals, although these can be inconspicuous, as shown by alders or lamb's quarters. Monocots have leaves with parallel veins. With the exception of lilies and related plants, monocots have flowering heads of many small, reduced flowers (or florets) without petals that produce a single seed. Monocots include grasses, that are annuals or perennials with jointed stems that are usually hollow and round in cross section; sedges, which are usually perennial plants that form tussocks with leaves that are V-shaped and stems that are triangular in cross section; and rushes, that are annuals and perennials with tussocks of needle-like leaves that are round, jointless and filled with a whitish pith in cross section.

### *2) Non-flowering Plants*

There are also primitive, non-flowering plants that reproduce by microscopic spores that include ferns, horsetails and mosses. Ferns, with stalks and fronds, and horsetails, with narrow leaves in whorls at joints of hollow stems, both spread by underground rhizomes and are difficult to control. Mosses are tolerant to most herbicides but may be suppressed by fire.

## *II. Scouting and Weed Mapping*

Scouting and proper weed identification are the foundation of any integrated weed management program. Scouting involves walking fields in a pattern (e.g. "W" pattern) thereby allowing monitoring for potential weed problems over the entire field. Scouting provides an opportunity to evaluate weed control programs and to look for any herbicide injury. Scouting also provides an opportunity to identify and target new invasive weed species that have the potential to become serious weed problems in the future. Scouting results can be compiled into weed maps to highlight the locations of different weed species. Mapping for weeds from year-to-year is helpful in monitoring changes in weed species, weed densities, distribution, as well as providing an opportunity to plan your future weed control strategy. The management strategy must target the dominant weeds and prevent the spread of others.

The following should be documented when scouting and mapping:

- the weed species and its life cycle (annual, biennial, perennial);
- the size or growth stage of the weed (seedling, small, medium, large, flowering, seed formed, seed dropped);
- the density of the weed (counts or categorize as low, medium, high);
- the distribution (uncommon, scattered throughout, a few patches, numerous patches, common throughout; or estimate the percent blueberry field covered per weed species);
- the location of the weed infestations on a field map;
- the date of scouting.

Weed scouting in sprout fields should be done:

a) just before blueberry emergence to monitor for bunchberry presence and growth stage;
b) soon after blueberry emergence to monitor for potential grass problems;
c) late June - early July for weeds growing above the blueberry plants that would be susceptible to wiping treatments;
d) late summer-early fall for wiping and evaluating the current year's weed control program and also for planning next year's weed control program.

Weed scouting in crop fields should be done:

a) before blueberry buds swell to determine if Velpar or Callisto applications are required;
b) mid-May to mid-June to scout for grasses;
c) mid-July to harvest to determine presence, densities and location of weeds for fall treatments or next year's weed control program.

Special note should be made of weeds that appear to be increasing significantly in distribution and density or any new weeds. For example, burnweed has been noted in greater abundance in many New Brunswick fields. Weeds which may be undesirable for reasons other than competition should also be noted. Examples include weeds flowering during pollination, weeds known as alternate hosts for insects or diseases, or weeds which can interfere with harvesting.

## *III. Weed Thresholds and Action Levels*

Weed thresholds have not been determined for New Brunswick blueberry fields. As a result, the decision to target a weed for control must be based on knowledge of the weed within your farming

system. From a strictly economic perspective, there is no reason to apply control measures unless the weed population inflicts crop damage greater than the cost of the control measure. To make knowledgeable decisions, growers must scout and monitor their fields and continuously observe weeds and evaluate their effect on the crop. Decisions to control weeds may be made even when the cost of control is greater than the losses resulting from weed competition. For example, weeds may have to be controlled despite low densities when they interfere with harvest, act as alternate hosts for insect pests or diseases, attract bees during pollination, or if they have a high potential to cause future problems if not controlled.

## *IV. Control Methods*

With the information gathered through scouting and the knowledge about the weeds present in your fields, you can make the decision as to whether or not a weed should be targeted for control. If action is warranted, it is important to choose the methods that optimize costs and effectiveness, while minimizing potentially adverse effects. The most economical and effective blueberry weed management programs combine preventive, biological, cultural, mechanical and chemical practices within an integrated system.

### *A) Preventive*

Preventive weed control includes all practices that prevent the introduction and spread of weeds into a blueberry field. It is important to be aware of activities which can introduce new weeds and try to prevent the weeds from being introduced. This will help minimize the build-up and spread of new weed introductions.

An important preventive practice is to clean equipment between fields. This is important as weed seeds and other plant parts can attach to equipment and soil and be transported by farm equipment. This is a particular problem with mowers, wipers and harvesters. Recent wild blueberry research has determined that 200,000 to 400,000 weed seeds could be found on individual blueberry harvesters. All equipment, including tractors, land levelling equipment and berry boxes, should be cleaned. Seed dispersal within and between fields can be limited by avoiding equipment operation though dense weed patches during peak periods of seed drop.

Limiting seed production will also help prevent weeds from spreading. Keeping weeds under control in ditches, field edges, and roadsides can minimize the introduction of new problem weeds. Weeds can also be introduced into blueberry fields through the use of weedy straw used for burning. It is critical that growers obtain as weed-free straw as possible. Purchase straw from a reputable source and, if possible, visit the grain field before harvest to check for weeds.

### *B) Cultural*

Cultural practices that encourage a vigorous, dense and healthy crop help to reduce weed pressures as a result of less bare ground being exposed. The use of wood chips, sawdust or bark mulch can reduce weed problems and encourage clone expansion into bare areas. Bare areas can also be planted with blueberry plants to increase crop cover. The presence of some grasses, especially in bare spots, reduces invasion of broadleaved weeds and encourages blueberry expansion.

### *C) Fertility*

Wild blueberries are adapted to grow and produce a crop on soil that is considered, by most agricultural specialists, to be poor in fertility. Plants have a requirement for nutrients from the soil (nitrogen, phosphorus and potassium, among others). Blueberries have a number of adaptations which allow them to thrive in this environment. Weeds are generally better adapted to respond to applied fertilizer than are blueberries. Excessive fertilizer rates that promote weed growth and

vigour should be avoided. Proper fertilizer rates should coincide with adequate weed control to maximize the benefit from each of these inputs. A reliable tool to determine fertility levels is leaf tissue analysis, outlined in this fact sheet.

Blueberries are adapted to a low pH environment, with a relatively low pH near 4 to 4.5. Many weeds, especially annuals and grass species, are not adapted to these conditions. More forest-type species, like lambkill and bunchberry, will not be affected by lowering the pH of the soil. Sulphur application can reduce the availability of soil nutrients for the weeds but allows the blueberries to grow because they are well adapted to acid soil. Approximately 112 kg/ha (100 lb/acre) of sulphur is required for a reduction of 0.1 pH unit. Do not apply more than 1120 kg/ha (1000 lb/ac) of sulphur in any given year. Application should not occur when the ground is saturated or injury to blueberries could result. Change in pH may take several years to be completed, with limited results soon after application.

### *D) Biological*

Biological weed control is the deliberate use of highly selective enemies to reduce the population of a target weed to an acceptable level. In Atlantic Canada, there have been releases of either insects or pathogens against some weed species, including St. John's wort, Canada thistle, perennial sowthistle and toadflax. Biological control is generally most effective on introduced, non-native species in relatively undisturbed, pesticide-free agricultural habitats like pastures and rangelands. Naturally occurring disease epidemics have been observed for St. John's wort and bracken fern in blueberry fields, giving significant control in some years. The use of insecticides and fungicides as production practices within blueberry fields also makes the use of insects and pathogens as biological control agents more challenging. The prospect for biological weed control in wild blueberry is limited.

### *E) Mechanical*

Mechanical methods of weed control include such practices as hand-pulling, pruning (mowing/burn) and clipping.

#### *1. Hand-pulling*

Hand-pulling is one of the oldest methods of weed control and is most effective against annuals, biennials and perennial seedlings. Established perennials can only be controlled effectively if the entire root system is removed. This is not possible, in most instances, although hand-pulling perennials can be effective in preventing seed production. If fields have both flowering and non-flowering weeds, flowering weeds should be removed first in order to prevent seed formation. It is also important to remove pulled weeds from the field, as many can still produce viable seed when lying on the soil surface. Hand-pulling is easier when the soil is wet.

#### *2. Pruning (mow/burn)*

The main purpose of pruning is to rejuvenate blueberry plants but it also aids in control of some weeds. Burning will control coniferous species and some shallow rooted grasses. The top growth of many woody and herbaceous perennials is generally killed by burning but underground parts re-sprout. Burning also reduces the return of many weed seeds from mature plants to the soil, and will kill many of the weed seeds present near the soil surface. Unfortunately, most burning operations provide only partial or erratic control results. Mowing as a pruning method may give some short-term suppression of perennial weeds and is generally not recommended as the sole method of control. Weeds must be mowed or cut several times during the season to ensure suppression. Species such as maple, birch and willow should be cut back to the ground level. Regrowth from the roots is common and frequently results in additional cuttings. Burning or

mowing alone may promote growth of many perennial weeds with extensive underground root systems by releasing apical dominance.

***3. Selective mid-season clipping***

Clipping the tops off weeds before seeds ripen prevents seed formation and helps reduce future weed problems. Clipping of species in June, July and August for a few seasons may help suppress weeds to acceptable levels. Clipping weeds every mid-summer has also been found to help control or suppress bracken fern, bayberry, *Prunus* spp., wild rose, and other weeds. Bracken fern should be cut just as the fronds unfold, at least two times, at four-to-six week intervals. Flowering weeds should be clipped before weeds which have not yet flowered. For weeds growing above the blueberry canopy, selective clipping can be performed with “whipper-snippers” or other similar equipment. Alternatively, non-woody weeds can be clipped through whipping. Hand clippers can also be used to target individual low growing weeds, such as sweet fern or lambkill. Clipping is labour intensive and does not generally result in permanent control.

### *F) Chemical*

The use of herbicides to control weeds in blueberry fields is an important component of an integrated weed management program. Herbicides must be used responsibly and judiciously and as just one component within an overall program. Herbicides cannot be used as a cure-all for poor management. No single herbicide or combination of herbicides will control every weed within a blueberry field. Furthermore, excessive weed control that results in long-term bare ground should be avoided as this practice leads to soil erosion and impairs blueberry clone expansion.

Herbicides used within blueberry fields are either selective or nonselective. Following labelled rates and recommendations, selective herbicides control specific weeds without significantly injuring blueberry plants. Some selective herbicides (e.g. Velpar) are only safe to use at prescribed rates and times of application. If excessive rates are applied they are no longer selective and can cause severe crop injury. Nonselective herbicides kill both weeds and crop plants (e.g. glyphosate) and therefore caution must be exercised when applying them. Blueberry herbicides are applied either pre-emergence (applied before any blueberry plant or weed foliage emerges); or post emergence (applied after blueberry plant and weed foliage has emerged). Pre-emergence herbicides provide residual control, whereas post emergence treatments provide little or no residual control. To keep fields relatively clean, growers need both a “base program” and a “clean-up program”. The base program refers to the primary method relied on to control most weeds. For blueberry growers, Velpar is relied on most frequently to provide this base level of weed control. The clean-up program relies on herbicides such as Callisto, Ultim, Venture L, Poast Ultra, Spartan, Roundup, Lontrel or Banvel II to target specific weeds that escape the base program.

Even when label instructions are followed, not all weeds will be controlled. Each herbicide controls only specific weed species, and if timing and rates are not followed, control may be poor. In addition, other factors can also reduce weed control. For example, if heavy rains follow pre-emergence applications on sandy soils, some herbicides may leach away from the weed seed germination zone. Likewise for post emergence herbicides, if rain-free periods are not respected, control can be reduced. A pre-emergence herbicide may not be effective if labelled weeds have emerged before herbicide application. If emerged weeds are too large, control with post emergence herbicides will be reduced. Control from herbicides can also be reduced if weeds are under stress. For example, drought stress can cause weeds to form thicker layers of wax on leaf surfaces, thereby reducing herbicide uptake.

# Herbicide Use

## 1. Methods of Application

There are several methods of applying herbicides, depending on the properties of the herbicide and target weed. The label gives detailed instructions on mixing and application of each product and should be carefully followed to ensure applications are safe and effective. The following gives general information on methods of applying the approved herbicides discussed in Notes on Herbicides Registered for Use in Wild Blueberry.

### A) Overall Broadcast Spray

Overall broadcast spraying involves the use of boom sprayers to apply herbicides uniformly over entire fields or large areas. An overall broadcast spray is recommended for treating areas with a uniform rate of herbicide, such as pre-emergence applications of Velpar in the spring of the sprout year. Broadcast applications can also be made to large infestations of some species, such as sweet fern or lambkill, to treat them in the fall of the crop year with Banvel II. Pronone 10G can also be applied as a broadcast treatment by using a granular applicator such as a Vicon spreader. To apply the herbicides at the recommended rate, the equipment must be calibrated and in proper working order. Avoid irregular spray applications by using flagging tape, foam markers, appropriate dyes or GPS systems as guides.

### B) Directed Spot Sprays

The objective of directed spot spraying is to apply herbicides to the weed foliage while avoiding contact with the blueberry foliage. Spot sprays are applied with either backpack or handheld sprayers or by operating a handgun from a line connected to a tractor-mounted sprayer. Depending on the product used and the time of application, blueberry plants can be injured or killed if the foliage is sprayed. Applications are often made in the summer of the sprout year, and can result in crop injury. Many species such as alders, sweet-fern, bayberry, lambkill and blackberry retain their leaves in a viable condition longer than the harvested blueberries. Treatment in the fall after blueberry leaf drop helps to reduce the potential for crop injury.

Herbicide applications to fully expanded leaves of brush species can be useful where there are limited numbers of escaped brush species. Unless otherwise stated on the label, applications should be limited to bushes that are less than 2 meters in height. If higher, they should be cut and the regrowth treated. Coverage should be uniform and thorough to wet all leaves and stems. Mix with water only and spray until wet, but avoid spraying to the point there would be runoff. Extreme caution must be used with any non-selective herbicide. Any spray contacting blueberry plants can cause severe injury or death. Applications made to actively growing bushes will be the most effective when there are good growing conditions and adequate soil moisture. Foliar applications are generally the most effective just after full leaf expansion in late spring or early summer. If foliage remains green and in good condition on some species (e.g. alders, bayberry, sweet-fern, willows and others), effective applications can also be made in early fall after harvest. There may be less herbicide injury to blueberry plants if applications are made after blueberry foliage has turned red and begun to drop, but careful application is still required.

### C) Roller and Wiper Applications

There are several roller-type applicators now available, including several tractor-mounted models and small one-man portable machines for use in small fields. The herbicide is slowly delivered to an absorbent covered drum that wipes and transfers herbicide to the foliage of tall weeds. In order to improve coverage, most rollers must be operated relatively slowly. Wipers are also available that do not have a rotating drum. Wiping in two directions improves coverage and results in better

control. Do not wipe in a second direction until the herbicide from the first pass has dried. Wiping and rolling methods can be used where weeds are taller than the blueberry plants. A commercially available “hockey-stick” applicator has been used effectively for applying Roundup and similar products within small areas.

### *D) Stump Treatments*

A stump treatment is a safe and effective way of controlling bushes and small trees. Stump treatments involve herbicide applications to tree stumps that were recently cut, thereby causing the stumps to decay faster. 2,4-D (low volatile ester formulation) or Garlon in oil can be either sprayed or painted onto freshly cut stumps and exposed roots. Best results are usually obtained on stumps 5 cm across or larger (refer to individual labels). All exposed bark, roots, and cut surfaces should be wet thoroughly either by painting or spraying. Most of the stump treatments will control crown suckering species, like birches, maples and pin cherries, but there may be regrowth of species that sucker from lateral roots, like poplars. Many woody weeds are affected by these treatments, and on certain species, stump treatments are more effective than foliage applications.

Stump treatments can be applied any time of the year, including the winter months as long as snow or water does not prevent application. Trash from brush cutting operations such as sawdust, leaves, branches, etc. should also be removed from the base of the stumps before treating. Unless otherwise stated, applications should be made to freshly cut stumps. For old stumps, it is best to drill several holes or split the stump with a wedge before applying the treatment. Care must be taken to ensure that all cut stems in a clump have been treated or regrowth can result. Dye can also be added to the mixture to help ensure all exposed surfaces of the stump have been treated, and stumps do not get retreated or skipped.

Unless otherwise stated on the label, the herbicides used as stump treatments should be applied in vegetable or mineral oil to help penetrate the exposed bark and cut surfaces. If regrowth appears it should be treated with an appropriate herbicide. Note that 2,4-D alone, glyphosate and Garlon are registered for general weed control and used in preparing land for blueberry production. These products are not registered for use in producing blueberry fields and can cause crop damage if applied directly to actively growing blueberry plants. Crop damage can be minimized by careful application.

### *E) Basal Bark Treatments*

Many shrubs and small trees (up to 15 cm diameter) can be controlled by spraying or wiping the basal parts of their stems or tree trunks from the soil level up to a height of 50 cm or as recommended on the label. Basal bark treatments are advantageous because the entire shrub or tree does not require spraying. Treatments are applied in vegetable or mineral oil as recommended on the label. Use a nozzle that forms a very narrow band or stream when spraying basal bark treatments. Low volatile esters of 2,4-D or Garlon in oil can also be used for basal bark treatments. Old or rough bark requires more volume than young or smooth bark. Treatments can be applied any time of the year except when snow or water prevents application to the lower trunk and exposed roots.

## *2. Sprayer Calibration*

Calibrating the sprayer regularly is extremely important. Broadcast herbicide applications should be made with an accurately calibrated boom sprayer. Blueberry plants can be injured if too much herbicide is applied. Backpack and air-blast sprayers should not be used for broadcast herbicide applications as coverage and distribution will not be uniform. Complete directions on sprayer calibration and calculating the amount of herbicide required can be found in the New Brunswick

Department of Agriculture, Aquaculture and Fisheries's Sprayer Calibration Fact Sheet (C.1.2.0) or in the Guide to Weed Control (Publication 75) from the Ontario Ministry of Agriculture and Food (available here). Calibration of fertilizer spreaders for Pronone 10G application is equally important, with more information found in this fact sheet: C.4.4.0.

The boom should be adjusted to the appropriate height above the target, either the ground for pre-emergence applications or the weed canopy for post emergence applications. The sprayer must be set up and operated to provide the correct amount of spray overlap. Overlap within a boom swath depends on both nozzle spacing and boom height. Overlap between boom swaths can result in a double application and crop injury. GPS systems and various boom-end marking systems (foam markers) can be used to mark the outer edge of the swath pass.

Herbicides are usually applied with flat fan nozzles. Nozzles such as the Delevan Raindrop nozzles or the air induction (venturi) type nozzles are effective. Cone-type nozzles are not recommended as spray pattern and distribution are poor at the lower pressures required for herbicide applications. Sprayer pressure should not exceed 276 kPa (40 psi) for herbicide applications unless otherwise recommended by the equipment manufacturer.

## *3. Best Management Practices*

Blueberry growers can respond to the public's concern for the environment in a proactive manner through the adoption of Best Management Practices (BMP). Best Management Practices are recommendations and guidelines to help growers make sound environmental decisions in their farming operation. They are a combination of management, cultural, and structural practices that are considered effective and economical in reducing environmental impacts. They provide opportunities for growers to evaluate and choose the best management practices that are most appropriate for their own operation. Many of the production and management activities that blueberry growers practice influence not just themselves but their neighbours and community. Anything that can be achieved to prevent environmental pressures will make both the grower's operation and the blueberry industry more sustainable.

It is important that growers identify problem areas within their operation and select and implement the appropriate changes. Examples of Best Management Practices include:

- scouting fields and spray only when and where necessary
- making sure your sprayer or spreader is calibrated properly and accurately
- matching appropriate herbicide rates with soil type
- not mixing or loading near water, bringing the water to the sprayer
- not applying herbicides to rock formations and exposed ledges as they may provide a direct channel to groundwater
- avoiding spraying if heavy rainfall or winds are forecast
- using an anti-backflow device when filling sprayers from a water source to prevent contamination from backflow
- leaving an untreated vegetation strip near any water sources to act as a buffer and filter
- reading and following all instructions as stated on the labels

The use of hexazinone (Velpar DF, Pronone 10G) has been associated with groundwater contamination and soil erosion. A fact sheet, Best Management Practices for Hexazinone (C.4.5.0), has been prepared to help minimize these problems. It is important that these instructions be followed to safeguard the use of this herbicide.

## *4. Tank Mixing*

A tank mix of a pest control product occurs when two or more products are applied at the same time through the same set of nozzles. Tank mixes can be mixtures of the same product type (herbicide + herbicide) or of different types (for example, herbicide + fungicide). Tank mixing provides benefits to producers by broadening the spectrum of pests controlled, helping to manage pest resistance and reducing application time and costs. Products may not be suitable for tank mixing due to physical incompatibility, increased risk of crop injury or decreased pesticide performance.

Some pesticide labels provide specific recommendations and instructions for applying products as tank mixes. These tank mixes have been evaluated for performance and safety. When using a labelled tank mix, follow all directions included on the product label. If a tank mix does not appear on a product label, producers can apply unlabelled tank mixes for registered products, provided that these six conditions are met:

a) All products are registered for use on the crop;
b) The tank mix only includes an adjuvant when specifically required by one of the tank mix partner labels. If an adjuvant is not required on the label of any tank mix partner, then no adjuvant may be added to the tank mix;
c) The stage of application for the crop and all pests for all products must overlap. The pests and crop must all be in an appropriate stage for application for all products in the tank mix;
d) All label directions are followed, including the use of the most restrictive buffer zone, personal protective equipment, restricted entry interval etc.;
e) Tank mixing is not excluded on any of the product labels. Some pesticide labels specifically prohibit mixing with other products;
f) Applying the products together provides a value to the end user, either through increased pest control spectrum, reduced application time/costs or resistance management.

Anyone who recommends or applies an unregistered tank mix does so at their own risk and liability. More information on the use of unlabelled tank mixes can be found in these documents: Memo – Use of Unlabelled Tank Mixes or Frequently Asked Questions.

Before tank mixing any pesticides, it is very important to test the compatibility of the products. When certain pesticides are mixed, they may gel or form a precipitate, either of which will be difficult to clean out of spray equipment. An easy method to test compatibility is a jar test. Before beginning the jar test, make sure to wear the appropriate personal protective equipment. Add water to a small jar or container, then add small amounts of the pesticides you are interested in mixing, in the order and ratios in which you plan to apply the products. Cover the jar and shake it vigorously, then leave it to settle for 15 minutes. If the mixture is smooth and free of clumps, the products should be physically compatible. If the jar feels warmer, or if there is any clumping or particles that do not disappear after additional shaking, the products are not compatible and should not be tank mixed. The jar test only evaluates physical compatibility. A tank mix may be physically compatible but may still cause crop injury or decreased pest control.

Tank mixing may reduce the margin of crop safety. The potential risks associated with tank mixes may be reduced if the products are applied using the correct rates, under ideal environmental conditions and at the proper growth stages. Follow the application recommendations on all product labels closely, with special attention to the environmental conditions associated with crop injury. Avoid tank mix application during stress or when environmental conditions may create stress conditions in the future, like periods of drought or heavy rains. Adding multiple products (more than two) and pesticide types may increase crop injury risk.

The weeds, crop and other pests targeted with the tank mix treatment must all be in the proper stage for each tank mix partner. Applying a control too early or too late for a given pest could decrease the level of control and not provide the desired economic benefit for the crop. In some cases, applying the proposed tank mix as two separate treatments, timed according to the proper pest stage, will provide an economic benefit greater than the costs saved by only having one sprayer pass.

Some pesticide formulations, like Venture L, have surfactants built-in with the pesticide. Others, like Poast Ultra, require additional surfactant to be added. When tank mixing pesticides, adding two surfactants will increase the risk of crop injury. If both pesticides require a surfactant, consider adding only a single surfactant and do not 'double-up' the surfactant applied to the crop.

When applying pre-emergent herbicides, tank mixing generally decreases the margin of crop safety for emerged blueberry sprouts. To reduce crop injury risk, ensure any pre-emergent herbicide applications are made well in advance of the expected blueberry plant emergence in the spring.

Consider using higher water volumes when tank mixing. More water will allow for better product dilution and mixing, which is very important when using dry herbicide formulations. Higher water volumes will also improve product coverage and may help improve pest control.

Follow all mixing instructions on the product label. When the label does not provide mixing instructions, pesticides may be mixed in the following manner. Fill the spray tank ½ full with water and start agitation. Add in the different formulations in the order below, allowing time for complete mixing and dispersion of each product.

1) Dissolvable Packs (WSP)
2) Wettable Powder (WP, W)
3) Water-Dispersible Granules and Dry Flowables (WDG, DF)

Maintain agitation and fill the spray tank to ¾ of the final water volume, then add:

4) Water-based Solutions (S, L, SC, F)
5) Emulsifiable Concentrates (EC, E)
6) Spray Adjuvants (surfactants, fertilizers)

Finish filling the tank and maintain agitation throughout the entire spraying procedure.

## Notes on Herbicides Registered for Use on Wild Blueberry

Herbicide label information overrides any discrepancies between information presented in this guide and the label. Herbicides are presented in alphabetical order and rates are given in kilograms or litres of commercial product. Additional information on weed susceptibility, herbicide use and toxicity are given in tables that follow.

### *1. Authority 480 (sulfentrazone)*

Authority is a selective, soil applied herbicide for the control of wild buckwheat, lambs quarters, pigweed and other broadleaf weeds. Under research conditions, sheep sorrel was suppressed following Authority application. Authority may be applied as a broadcast spray. Applications should be made to dormant blueberry plants and only once in a two year period. Research evaluations were made either in the late fall of the crop year following mowing and blueberry leaf drop or in the early spring of the sprout year before blueberry emergence. Applications to blueberry plants with emerged growth are not recommended due to leaf burning and possible stand loss.

Use 0.22 to 0.29 L/ha (0.09-0.12 L/ac) of Authority per application, depending on soil organic matter and texture. Use the higher rates within the rate range for soils with pH less than 7.0 and organic matter greater than 3%. Do not use on coarse soils classified as sand which have less than 1% organic matter. Do not apply in fine textured soils with less than 1.5% organic matter. Do not apply in any type of soils with an organic matter content greater than 6%. Do not use on soils with a pH of 7.8 or greater. Refer to the product label for specific rate recommendations and weeds controlled.

Apply in a minimum water volume of 100 L per hectare. Do not apply to saturated soils. When soils are wet, do not apply if heavy rainfall is expected within 24 hours. Do not apply to frozen soil.

Authority is taken up by plant roots and shoots. Moisture is required to activate the herbicide in the soil. Adequate moisture of at least 18 mm is required within 14 days after application for optimal control. If adequate rainfall is not received in a timely fashion, irrigate with a minimum of 18 mm of water. When activating moisture is delayed, a reduced level of weed control may occur.

Authority is persistent in the soil. The total amount available in any given soil is determined by the interaction of soil type (mainly clay content), percent organic matter, soil pH, soil moisture and application rate. Both clay and organic matter bind Authority, making it less available to plants. As soil pH increases, availability of Authority in the soil increases. Irrigation with highly alkaline water (pH above 7.5) may increase the amount of Authority available in soil solution and may cause an adverse crop response. Residual weed control may be reduced when the herbicide is applied where heavy crop residue exists (such as leaves, straw and /or weeds).

Apply no more than 0.292 L/ha of Authority per season in a single field. Do not continually apply Authority to the same field for multiple seasons. Do not apply Authority to fields treated in the previous year (only apply Authority in one field season over a two year period). Authority may leach through the soil and into the water table, especially in sandy soils or in areas where the depth to the water table is shallow. Only apply one treatment of a Group 14 soil-residual herbicide per season to avoid crop injury and/or soil residual issues. Soil residual Group 14 herbicides include Authority and Chateau.

### *2. Callisto 480 SC (mesotrione)*

Callisto is a selective broadleaf herbicide for the control of labelled weeds in the sprout or crop year of wild blueberry production. Callisto has both pre-emergent (soil) and post-emergent (leaf) activity. Callisto can be broadcast using ground application, once per year, over the top of the blueberries. Within the cropping season, applications must be made prebloom to the crop. Treated areas cannot be harvested within 60 days of application. Apply in 100-200 L water per hectare with a spray pressure of 206-300 kPa. Two application timings are registered; however, most grower experience indicates improved weed control from post-emergent use.

**Pre-emergent:** Up to the 2 leaf weed stage, apply 0.3 L Callisto/ha. No surfactant is required.

**Post-emergent:** Up to the 8 leaf weed stage, apply 0.3 L Callisto/ha. A non-ionic surfactant, Agral 90, must be added at 0.2% v/v (2 L Agral 90 per 1000 L spray solution).

In susceptible plants, herbicide activity results in bleaching symptoms, followed by plant death. Bleaching typically begins in leaf foliage and at growing points 3-5 days after application, with weed death 2-3 weeks later. Although weed competition is quickly halted, visual symptoms of dying weeds (discolouration) may take up to 2 weeks to appear, depending on the weed species and growing conditions. The bleaching symptom may be noted on less susceptible plants (like tree species) but may not result in plant death. For best results, apply Callisto to actively growing weeds. Weeds that emerge after an application may be controlled when they absorb the herbicide

from the soil provided there is sufficient moisture for uptake. When applied post emergent, thorough coverage of emerged weeds is essential for effective control. Under unfavourable conditions, such as drought, heat, flooding or prolonged cool temperatures, adequate control may not be achieved and re-growth may occur. Active weed growth is required for optimal herbicide activity.

Temporary crop injury (bleaching) may occur if applications are made under extreme weather conditions or when the crop is under stress. Blueberry growers have observed more crop injury when applications are made under hot and/or humid conditions or when the crop is stressed from flooding. The injury is most visible where excessive rates have been applied, such as sprayer overlaps. If heavy rain is expected within 48 hours, application should be delayed. For improved crop safety, make applications under cooler conditions (early morning or evening) or when daytime temperatures are below 21 $^{o}$C. Do not make a foliar post-emergent application of any organophosphate or carbamate insecticide within 7 days before or 7 days after Callisto application or severe crop injury may occur. No tank-mixes with Callisto are currently registered for use in wild blueberry. There is an increased potential for crop injury when extra surfactant is added. The use of high surfactant rates or non-labelled surfactants has caused leaf burning to the crop.

In wild blueberry production, mid-June applications have provided the most consistent weed control. This product has a more limited control spectrum than hexazinone (Velpar/Pronone) and is best used to supplement current weed control practices. Improved weed control has been shown when a hexazinone application is followed with a Callisto application post-emergence, especially on difficult to control weeds like goldenrod species. More information on the use of Callisto in wild blueberry is available in this fact sheet (C.4.6.0).

## *3. Casoron G-4 (dichlobenil)*

Casoron is a soil-active herbicide that controls broadleaved and grassy weeds at germination and growth initiation. Casoron G-4 is a ready to use granular product. It can be spread on the soil surface by hand, using small hand-held or backpack equipment or by tractor mounted spreaders. Do not apply more than 20 kg product/day when using small handheld equipment. Do not apply more than 75 kg product/day if using push-type granular spreaders. Casoron is volatile and should be applied when the air temperature is less than 15 $^{o}$C. Water is necessary to move the product into the soil. Soils should be moist after application to activate the product. Avoid application if heavy rain is expected.

Apply at a rate of 110-175 kg/ha (40-70 kg/ac) during the dormant period of the blueberry crop, typically late fall or early winter. Use the high rate for grasses and to control tough perennial weeds when entering the sprout (vegetative) year and the low rate for annual weeds or when entering the crop (fruiting) year. The preharvest interval is 100 days. This herbicide has not been frequently used by the blueberry industry. As a result, the weed spectrum controlled is not well documented.

## *4. Chateau (flumioxazin)*

Chateau is a pre-emergence herbicide used for suppression of hair-cap moss and control of selected grass and broadleaf weeds. All applications should be made to dormant wild blueberries in the sprout year (spring and/or fall) or as a dormant post harvest (fall). Ideally, applications should be made in the late fall of the crop year, following crop pruning or complete blueberry leaf drop. Unacceptable crop injury, including yield loss, can occur if Chateau comes into contact with non-dormant blueberry plant parts, including green leaves or green bark. Research trials have shown extensive crop injury when Chateau is applied to non-dormant blueberry plants.

The application rate is dependent on soil texture and weed target. To suppress hair-cap moss apply 280 g/ha on coarse-textured soils or 420 g/ha on medium-textured soils. A lower rate is registered for control of lamb's quarters and other labelled annual weeds. Apply 140 g/ha on coarse soil and 210 g/ha on medium textured soils when controlling annual weeds (as listed on the label). Do not apply Chateau on soils with greater than 5% organic matter (OM) or on fine-textured soils like clay. A second application may be applied if required for weed control for a maximum of two applications per year. The second application must not occur until 30 days following the first application when the blueberry plants remain dormant.

Control is most effective when applied to clean, weed-free soil surfaces. Apply in adequate water volume to ensure thorough coverage. For residual weed control, moisture is required to activate the herbicide in the soil. Dry conditions following application may reduce effectiveness. Crop injury may occur from applications made to poorly drained soils or applications made under cool, wet conditions. Spray equipment must be thoroughly cleaned after Chateau use to ensure that herbicide residue in the sprayer does not harm the crop when the sprayer is next used. Only apply one treatment of a Group 14 soil-residual herbicide per season to avoid crop injury and/or soil residual issues. Soil residual Group 14 herbicides include Authority and Chateau.

## *5. Dicamba (Banvel II, Hawkeye, Oracle)*

Dicamba is the active ingredient found in Banvel II, Hawkeye and Oracle herbicides, formulated at 480 g dicamba per litre. Other formulations and concentrations may be available. These non-selective broadleaf herbicides, when applied to the foliage, are absorbed by the leaf and translocated throughout the plant. Dicamba can be applied alone or in combination with 2,4-D L.V. (low volatile) ester as either an overall broadcast or spot spray. Dicamba or dicamba plus 2,4-D L.V. ester can cause serious damage to lowbush blueberries if applied directly on actively growing blueberry plants, or if applied improperly.

### *Broadcast application*

Application must be made in the fall of the fruiting year when the weeds are moderately green but after **90%** of the blueberry plants have dropped their leaves. Two application rates are registered.

**1. Dicamba alone.** For control of lambkill and suppression of sweet fern, apply Banvel II (480 g/L), Hawkeye (480 g/L) or Oracle (480 g/L) at a rate of 4.6 to 7.1 L/ha (1.9 to 2.9 L/acre).

**2. Dicamba + 2,4-D L.V. ester.** For additional control of broadleaf weeds, Banvel II, Hawkeye or Oracle may be mixed with 2,4-D L.V. ester (600 g/L) and applied in the fall of the crop year. Apply Banvel II, Hawkeye or Oracle at 2.3 L/ha (0.93 L/acre) with 2,4-D L.V. ester (600 g/L) at 5.7 L/ha (2.3 L/acre).

Many different formulations of dicamba may be available. For formulations of dicamba other than 480 g/L, follow label directions for the amount of product to apply.

If possible, fall pruning should be carried out 4 to 5 weeks after spraying. In New Brunswick research, there was no change in weed control or crop injury when mowing was carried out 2 to 3 weeks after application. If spring pruning is planned, it should be done as early as possible to reduce the chance of injury to the blueberry plants by this herbicide. Dicamba should be applied in 550 L of water per hectare. Blueberry tolerance decreases with the use of lower water volumes. Rainfall within 4 hours of application may reduce effectiveness. Significant delays in emergence have been observed in the spring following a fall application, particularly where mowing has replaced burning. A longer delay of emergence and a lower blueberry plant density have been observed if mowing height is not adequate. Proper sprayer calibration and agitation in the spray

tank is essential to avoid crop injury. When working with these herbicides, growers should experiment on a small area for the first time until they become familiar with broadcast applications.

### *Spot spray application*

During site preparation, dicamba can be applied as a spot spray to control Velpar resistant weeds such as maple, alders, willows and honeysuckle. Apply 2.1 L of dicamba per 1000 L of water. Contact with actively growing blueberry plants must be avoided or severe injury or death will result.

## *6. Garlon (triclopyr)*

On newly cleared sites, Garlon can be used to control alder, ash, birch, poplar, pin cherry, maples, and other woody species. Some species (e.g. red maple and choke cherry), are more difficult to control and may require re-treatment the following year. Two formulations of Garlon are available for use. Garlon XRT should be mixed with oil, either vegetable or mineral oil, where 13 to 19 L of Garlon XRT is added to enough oil to make 100 L of spray mixture. Garlon RTU is ready to use and does not require any additional oil before treatment. Apply either formulation using a knapsack or backpack sprayer with a flat fan or solid cone nozzle, or with a wick attachment. Low pump pressures of 70 to 210 kPa are recommended. Blueberry plants are very sensitive and may be killed if Garlon comes in contact with the plants. Only one application per year is permitted. Rainfall within 2 hours of application may reduce effectiveness.

Garlon is registered for the control of woody weed species during field site preparation as either a basal bark or stump treatment. For basal bark application, spray the basal or lower 30 cm of trunks up to 15 cm in diameter as well as to any roots that may be exposed. To control re-sprouting of cut stumps of woody species, all exposed bark, roots and cut surfaces should be wet thoroughly either by painting or spraying. This solution can also be applied to the base of suckers or saplings with a small brush for effective control of many species. All surfaces should be coated, including individual stems when applying to clumps of trees.

## *7. Glyphosate (Roundup, etc.)*

There are a number of commercial products currently registered for use in wild blueberry that contain the active ingredient glyphosate. These include Roundup, Roundup WeatherMax, Touchdown, Credit, Vantage, Factor, Sharpshooter and Glyfos with several formulations for each commercial product. Although glyphosate is common to each of these products, the salt formulation and surfactants present in these products may vary. In addition, the application rate and rain-fast period can differ for each type of product. Differences in weed control between these products are generally considered minimal by many weed scientists. Consult the label for additional information on the use of individual glyphosate products.

Glyphosate is effective against most broad leaved species including maple, beech and ash. Glyphosate is absorbed into the foliage and translocated throughout the plant, killing both above and below ground growing points. It is generally most effective when applied in June through August to fully expanded and actively growing foliage. To be effective, application must be made immediately after cutting the plant if used as a cut stump treatment. It is not effective as a bark treatment as it does not readily penetrate bark. Glyphosate will not have any activity on conifer species. Glyphosate has no activity when applied to the soil and provides no residual weed control.

Glyphosate can only be used in blueberry fields if it is selectively applied to the weed foliage. Glyphosate has a role in the preparation of fields for blueberry production and also as a spot or wiper treatment in established fields. Glyphosate can be applied selectively, either as a directed spot spray or as a wiping treatment. Blueberry plants are very sensitive to glyphosate treatments and contact will result in blueberry plant injury or death. Rainfall within 1 to 6 hours may reduce

effectiveness, depending on the commercial product used. Glyphosate, mixed and applied in hard water, is known to result in reduced weed control. For optimal results, glyphosate should therefore be applied in soft water. The addition of ammonium sulfate to hard water can counteract the negative action of the hard water and improve weed control.

### *Spot Spray*

Apply as 1% to 2% solution of 356 g acid equivalent per litre of glyphosate (356 g.a.e./L – Roundup Original formulation). A 2% solution is equivalent to 2L of product in 98L of water. For Roundup WeatherMax, apply as 0.67% to 1.34 % solution. A 0.67% solution is equal to 670 mL of product with enough water to make a 100 L solution and a 1.34% solution is equal to 1.34L of product with enough water to make a 100 L solution. The mixture should be applied to the foliage of woody weeds in the sprout year. Ensure uniform coverage and apply enough product to wet the leaves but not to the point of runoff.

### *Roller and Wiper Treatments*

The use of glyphosate in rollers or wipers is an effective way to control weeds growing above the blueberry plants. The roller or wiper should touch the weeds at a minimum 5 cm above the blueberry canopy, ideally 15 cm above the crop. Care must be taken to avoid dripping the product from the application equipment onto the blueberry crop. For roller applicators, prepare a 5 to 10% solution by mixing 0.5 L to 1.0 L of 356 g.a.e./L herbicide with enough water to make 10 L of solution. For Roundup WeatherMax, prepare a 3.3-6.7% solution (0.33 to 0.67 L with enough water to make 10 L of solution). Roller speed should be maintained at 50 to 150 rpm. For wick or other wiper applicators, mix 1L of herbicide with 2L of water to prepare a 33% solution. For Roundup WeatherMax, mix a 22% solution (0.57 L in 2 L of water). Not all glyphosate products are registered for use in rollers or wipers and rates may vary between products. Please consult the glyphosate label for more specific information before using in this manner.

### *Fall Roundup WeatherMax Use for Lambkill Control*

This herbicide treatment pattern for Roundup WeatherMAX is only registered within newly cleared wild blueberry production. There still is a risk of crop injury when using this treatment, although this potential risk is better tolerated during early production years. Crop safety of this application pattern in mature fields was not evaluated and use in mature fields cannot be recommended at this time. Grower experience has shown better results in fields that have been managed for one or two cycles, as compared to applications made to fields just starting the land clearing process. The current recommendation is to only apply glyphosate to fields that have experienced a commercial harvest because weed control is improved and there is less risk of injury to blueberry plants. Other glyphosate formulations can still be used in wild blueberries as spot or wiping treatments in established fields but are not recommended for a late fall application for lambkill control. These glyphosate formulations were not tested using this application pattern and cannot be recommended at this time.

As the correct application conditions are a balance between the stage of development of the lambkill and blueberry plants, potential treatment areas should be monitored closely in the fall. Since harvesting the crop places stress on the blueberry plants and contributes to early leaf drop, any treatment areas should be harvested in the year of application. Applications should be made in the fall before pruning the field, when blueberry plants have 95% leaf drop. The typical timing in research evaluations was late October or November.

Apply Roundup WeatherMAX at 1.67 litres per hectare in 200-300 litres per hectare of clean water using a boom applicator. Do not add adjuvant to the spray mixture. Treat only areas of the field which have lambkill present. Do not prune for at least 14 days after application. All fields treated

with Roundup WeatherMAX must be pruned post treatment in the fall or pruned the following spring before May 15th. Any delay in pruning in the spring can decrease the level of weed control. Pruning as close as possible to the ground is recommended to improve weed control and to limit injury to blueberry plants.

Only one application of glyphosate is registered in a typical cropping cycle (2 year rotation). As a general precaution, only apply fall glyphosate once within two cropping cycles. One glyphosate application, if made under the proper application conditions, generally provides a very high level of lambkill control and follow-up lambkill control treatments are usually not required. More information on the use of glyphosate to control lambkill is available in this fact sheet (C.4.7.0).

## 8. Ignite SN Herbicide (glufosinate)

Ignite is a non-selective herbicide used for the burn-down of annual and perennial weeds. Ignite may be applied with ground (boom) spray equipment, high volume orchard spray guns or hand-held pump-type and backpack sprayers. The addition of an anti-foaming agent may reduce foaming, especially when using soft water.

Weeds that emerge after application will not be controlled. Apply to actively growing weeds. Speed of weed control is influenced by environmental factors. At low temperatures (below 10 $^{o}$C), poor moisture and low humidity conditions, the speed of action may be reduced. Use higher rates when weed growth is dense, when weeds are mature or when environmental conditions are cool or dry. Do not make more than 2 applications of Ignite per year. Do not apply more than 6.7 L/ha total product in one season.

Avoid contact of Ignite spray, drift or mist with green bark, stems, or foliage, as this contact may injure the plants. Only sprouts with mature brown bark should be sprayed. Alternatively, blueberry plants could be pruned before application. Contact of Ignite with parts of plants other than mature brown bark can result in serious damage.

### *Broadcast application*

Broadcast application must be made to dormant lowbush blueberry plants. Field must be entering into the sprout (vegetative) year in the season following application. Broadcast application can be made after blueberry leaf drop in the late fall of the cropping season but before blueberry sprout emergence in the spring following pruning.

Apply Ignite at 2.7-5 L/ha for the control of annual grasses, broadleaf weeds and suppression of perennial weeds. Apply in a minimum of 110 L/ha of water and ensure uniform, thorough coverage. Ignite may be tank mixed with Sinbar WDG or Velpar DF for control of weeds listed on the respective labels, including control or improved control of hawkweed, sheep sorrel and many annual and perennial grasses. Do not apply a tank mixture of Ignite + Sinbar or Ignite + Velpar more often than once per year.

### *Spot application*

Mix Ignite at 27-50 mL of product per 10 litres of spray solution for the control of annual grasses and broadleaf weeds. Ten litres of spray solution should be used over an area of 100 m$^2$. Provide thorough coverage of the weeds, but not to the poing that the product ‘runs off’ the leaves. Use as a directed spray if sprouts have emerged. Avoid contact of Ignite spray, drift or mist with green bark, stems, or foliage, as injury may occur to plants. Repeat treatments may be necessary to control new germination of annual weeds. Do not make more than 2 applications of Ignite per year.

## 9. Kerb SC (propyzamide)

Kerb is a soil active herbicide that will control or suppress many perennial grasses, including Venture L and Velpar-tolerant fescues. It does not control poverty oat grass or woody species. It has little activity on broadleaved species, but has shown activity on sheep sorrel. Kerb is registered for use at 4.1 to 5.6 L/ha (1.7 to 2.3 L/acre) in late October and November of either the sprout or crop year. Application should be made in 300-500 L water per hectare. Applications should be made when the ground is cool but before it freezes. Rainfall is required to move Kerb into the soil where it is active. Herbicide losses are greatest when applications are made to frozen ground or when soil temperatures are high (greater than 10 $^{o}$C). Weed control is best when the soil moisture level is high and soil temperatures are cool. Lowbush blueberry is very tolerant to Kerb. Variability in weed control has been found with this product, mainly attributed to poor weather at application (e.g. too dry, too warm, frozen ground).

## 10. Lontrel 360 EC (clopyralid)

For the control of tufted vetch apply Lontrel 360 in late spring of the sprout year when tufted vetch is in the early flowering stage. Lontrel 360 generally gives excellent control of established tufted vetch but it gives no control of seedlings that emerge after application. Research evaluations have shown control of hawkweed in both early and late spring sprout year applications, either before blueberry emergence or later in June of the sprout year. Early application provides a longer period of weed control and will prevent seed production. Often there are no obvious visible crop injury symptoms following application, but there may be a reduction in bloom and blueberry canopy the following crop year, particularly if late applications, which can interfere with the developing fruit bud, were made. Applications in July and August have resulted in blueberry yield loss. In extreme cases, there may be malformations of the blossoms. **Lontrel 360 should never be applied in fruiting blueberry fields.**

Only one application per year is permitted. Small infestations can be treated with backpack or hand-gun applicators; larger infestations can be treated with a calibrated boom sprayer. Applications should only be made to areas infested with vetch. Application to the crop should be avoided as much as possible. When using a hand gun or backpack sprayer to treat small infestations, apply Lontrel 360 herbicide at a rate of 42 ml per 1000 m$^2$ area in 200 L of water. When applying with a boom sprayer to treat larger infestations, apply 420 ml per hectare (2.5 acres) in 150 to 200 L of water.

## 11. Option 2.25 OD + UAN (foramsulfuron)

Option is registered for use in the spring of the sprout year when the targeted weeds are at the appropriate leaf stage. This herbicide will control mainly grasses in wild blueberry, including quackgrass (3-6 leaf stage), witchgrass (2-4 leaf stage) and suppress fescues (1-6 leaf stage of fine-leaf sheep fescue, sheep fescue, red fescue and tall fescue). Timing of application is very important for fescue control. The appropriate stage can vary from field to field and season to season, but typically occurs after blueberry emergence in the sprout year, but before seedhead emergence of the fescue. This timing is earlier than the typical post-emergent grass timing in wild blueberry, so proper scouting and staging is required for best results. In research evaluations for wild blueberry, Option has controlled ticklegrass and suppressed poverty oatgrass. Only a few broadleaf weeds may be controlled, including lamb's quarters and redroot pigweed. For best results, apply to emerged, young, actively growing weeds. Option will have an effect on more mature weeds, but the speed of activity and level of control will be reduced.

Apply Option at 1.56 L/ha. Option must be applied with a spray-grade liquid nitrogen fertilizer, such as 28% UAN, at a rate of 2.5 L/ha. Grassy weed control will be decreased if the fertilizer is not

used. Apply in a minimum of 150 L water per hectare and at a pressure of 175 – 275 kPa. The use of 80° or 110° flat fan nozzles is highly recommended for optimum spray coverage and canopy penetration. Use 50 mesh filter screens or larger. Do not apply Option to any field more than once per year. Apply by ground application only.

The speed of action of Option is influenced by environmental factors. Weed growth typically stops within 1-3 days following application. Warm, moist conditions promote the activity of herbicide action. Typically, the weeds will turn yellow, usually in 5-10 days. Under cool and/or dry conditions, activity may be reduced or delayed. Weed control may also be reduced if application is made when weeds are covered by dust or in the presence of heavy dew, fog or mist/rain. Option works primarily as a contact herbicide with limited soil residual activity. Uniform spray coverage is important to achieve consistent weed control. Control may be reduced if the blueberry canopy has closed over the weeds, intercepting the spray.

## *12. Poast Ultra + Merge (sethoxydim)*

Poast Ultra can be applied broadcast in the late spring of both the sprout and fruiting year for post emergent control or suppression of certain annual and perennial grasses. Poast Ultra is a contact and a systemic herbicide. Uptake into the plant is primarily through its leaves. Thorough coverage of the foliage is important for consistent grass control. Degree of control will depend on the level of susceptibility to the herbicide and the rate applied. Once treated, susceptible grasses that were actively growing prior to treatment stop growing and undergo a burn-back. Colour changes first to a yellow, then purple and finally a brown colour. The time required for complete control is normally 7 to 21 days following treatment, depending on growing conditions and crop competition.

Control of quackgrass (and other perennial grasses) happens more slowly than control of annual grasses. Poast Ultra is translocated through the quackgrass plant to the rhizomes and kills actively growing rhizome buds, as well as above ground vegetation. Dormant rhizome buds will remain unaffected by the spray and regrowth can occur from these buds. When Poast Ultra is applied according to label directions, the regrowth of the quack grass will not be significant until 6-8 weeks after treatment, depending on growing conditions and crop competition.

Apply 0.47 L/ha Poast Ultra plus 1 L/ha Merge post emergence for the control of annual grasses at the 1 to 6 leaf stage (witch grass and fall panicum) and for ticklegrass control. Apply 1.1 L/ha Poast Ultra plus 1-2 L/ha Merge for the suppression of quackgrass, poverty oat grass, blue grasses and other perennial grasses. Apply when perennial grasses have 10 cm of new leaf growth – usually in late May or early June. These applications are useful in some grass-infested fields during the crop year to increase harvest efficiency. Assist Oil Concentrate can be substituted for Merge Adjuvant at the same rates. Poast Ultra should be applied in 100 to 200 L water per hectare. Blueberry plants are very tolerant to Poast Ultra, even during bloom.

Most effective control is achieved when application is made at the 2 to 5 leaf stage when annual grasses are small and actively growing, soil moisture is good, and the crop is small enough to permit thorough spray coverage. Applications made to grasses greater than 20 cm in height or grasses that have reached the heading stage will not give adequate control or suppression. When grasses are stressed due to drought, flooding, hot or prolonged cool temperatures (15°C or less), control can be reduced or delayed since grasses are not actively growing. Grass escapes or re-tillering may occur under prolonged stress conditions or low fertility. Do not make applications to grasses stressed longer than 20 days due to lack of moisture, as unsatisfactory control can result. If stress conditions exist at the time of application and have existed for less than 20 days, then use the higher recommended rates of Poast Ultra.

Rainfall within one hour of application may reduce the effectiveness of the spray. This product does not provide residual control. The preharvest interval is 15 days. Poast Ultra does not control rush, sedge or broadleaf weeds. Do not mix or apply Poast Ultra with any other additive, pesticide or fertilizer unless recommended on the label. Allow 4 days between application of Poast Ultra and any other chemical.

## 13. Princep Nine-T (simazine)

Princep Nine-T (1.5 to 2.0 kg/ha; 0.6 to 0.8 kg/acre) is registered for use in lowbush blueberries. This herbicide should be applied in a minimum water volume of 300 L/ha. This herbicide has not been frequently used within the blueberry industry. As a result, the weed spectrum controlled is not well documented. Woody weeds and most established perennial species will not be controlled with simazine. Princep Nine-T can be applied in late fall or early spring when blueberries are still dormant. Only one application is permitted per season. Apply the lower rates on coarse sandy soil and the higher rates on clay soils and soils high in organic matter. Rainfall is required to activate simazine. Crops must not be harvested within 60 days of application.

## 14. Sinbar WDG (terbacil)

Sinbar is recommended for grass and hay-scented fern control, but is also effective against lamb's quarters and other annual broadleaf weeds. Sinbar is residual and provides control of many later germinating weeds. It is not recommended to continuously apply Sinbar as this may promote the growth of tolerant broadleaf weeds, such as goldenrods, sheep-sorrel and asters. Apply Sinbar at 1.5 to 2.5 kg/ha (0.6 to 1 kg/acre) in the spring of the sprout year, after the pruning operation, but before new blueberry shoots emerge. Later applications may cause crop injury. Sinbar can be applied in late fall of the crop or sprout years when blueberry plants are dormant. Apply the lower rates on coarse sandy soil and the higher rates on clay soils and soils high in organic matter. Use a minimum of 200 L water per hectare. Agitation of the product in the spray tank is essential to ensure proper mixing and to avoid application issues. Apply Sinbar within 24 hours of mixing as product degradation may result. Moisture within 2 weeks of application is required to activate Sinbar. Do not tank mix with Venture. Do not apply Sinbar within the two weeks before or after an application of Venture or crop injury may result.

## 15. Spartan + Agral 90 (tribenuron methyl)

### Broadcast applications for bunchberry control

Spartan is a post emergent herbicide that must be absorbed through emerged weed foliage to be effective. Proper application timing is critical with this herbicide and will directly influence the level of bunchberry control and crop injury. For bunchberry control, apply Spartan at 40 g/ha (16 g/acre) with 0.2%v/v Agral (200 mL per 100 L water) in 150 to 250 L water per hectare. Add Agral 90 after Spartan is well mixed and in suspension. Spartan may degrade in water and should be applied on the day it is mixed. Disperse the granules in a small amount of water before adding them to the spray tank to ensure the herbicide is thoroughly in suspension. Only one application per year is permitted. Rainfall within 4 to 6 hours after application may also reduce control.

In the year following Spartan application, some bunchberry regrowth can be expected, but densities will be much lower than pre-treatment levels. It may be necessary to use Spartan in following sprout years to maintain bunchberry control levels. When used in the manner described below, Spartan has generally resulted in 70 to 90% control of bunchberry with minimal effect on the crop. Two distinct application timings are registered, with more information available in this fact sheet (C.4.3.0). The fall timing has shown increased and easier weed control with a wider application window and should be the preferred method of treatment.

### *i) Spring, sprout year application*

This is the original application window registered on the Spartan label. For best results, applications should be made when the majority of the emerged bunchberry plant leaves have unfolded to form a 45 degree angle, but no later than when the first white blossoms are visible on the most advanced plants. Bunchberry plants generally turn pinkish red to yellow following spraying but may take weeks to die down. If Spartan applications are made too late, bunchberry plants turn red and remain so for the entire season and reduced control can be expected. If Spartan is applied too early, bunchberry regrowth can be expected later in the season.

Spartan should also be applied before blueberry sprout regrowth exceeds 2 cm in height. Some stem height reduction, with yellowing and reddening of the blueberry leaves, might be observed for 6 to 8 weeks after application. This is more likely to occur if there have been prolonged cool temperatures or wide fluctuations in day and night temperatures just prior to or soon after treatment. Blueberry plants, however, recover and fruit bud numbers and potential yields are not generally affected. Recommended fertilizer applications before or after Spartan applications may be beneficial. Applications made at later stages of blueberry development or applications in spring-burnt fields are not recommended due to potential crop injury and potential yield reductions.

### *ii) Fall, crop year application*

A fall application timing, evaluated through research conducted in New Brunswick, has been accepted for registration. This timing occurs one to four weeks after the completion of the blueberry crop harvest. Typically, this application would occur in September of the crop year. There are no restrictions on crop stage, although application should be made while bunchberry has active growth. Reddening of bunchberry may occur after harvest, especially in mechanically harvested areas. No effect of harvest type, either hand or mechanical harvest, was found in research trials. Higher levels of weed control in sprout year evaluations were noted following fall applications, as well as decreased visual crop injury as compared to typical spring Spartan applications. However, no difference in blueberry yield was measured between the spring and fall application timings in research trials.

### *Spot applications*

Spartan can be used as a directed spot spray with a backpack sprayer or handgun to control alders, bracken fern, wild rose and yellow loosestrife. Mix 2.5 g of Spartan plus 20 mL Agral 90 for every 10 L of water and spray to thoroughly wet the foliage. Apply only during the summer of the sprout year when the foliage is fully expanded. Alders and wild rose can be controlled with early fall applications as they retain their leaves longer. Bracken fern shows few symptoms after application but control the following year is excellent. Foliage of the other species turns yellow or red and the stem terminals die soon after application. Control of vetch, poplars, willows, goldenrods and fly honeysuckle has been erratic and others like chokepear, bayberry, black bulrush, sweet fern, and birch, are resistant. Blueberries growing among treated weeds generally show few symptoms. However, when the crop is sprayed directly, it may be stunted, with reduced bloom and yield. Spartan may degrade in water and should be applied the same day it is mixed.

## *16. Ultim 75 DF + Agral 90 (nicosulfuron/rimsulfuron)*

Ultim is a post-emergent herbicide registered for use with two distinct application methods in wild blueberries, discussed below. Ultim is a contact herbicide and will not provide residual control of grass or broadleaf weed seedlings that may germinate after application.

When mixing the product, disperse the granules in a small amount of water before adding them to the spray tank to ensure the herbicide is thoroughly in suspension. Add the surfactant after Ultim is well mixed and in suspension. Ultim 75 DF should always be applied with a recommended non-ionic surfatant (equivalent to 2 L per 1000 L water or 200 mL per 100 L water). Ultim spray solutions should be used within 24 hours of mixing or product degradation may occur. Mix no more than can be used in one day. Rainfall within 2 to 4 hours after application may reduce Ultim effectiveness. Do not apply within 14 months of harvest.

### *Broadcast applications*

For control of quackgrass, annual grasses and redroot pigweed, plus suppression of poverty oatgrass, ticklegrass and black bulrush, apply one water soluble bag of Ultim (33.7 grams/ha) with a recommended non-ionic surfactant (Citowett Plus, Agral 90 or Ag-Surf) at 2.0 litres per 1,000 litres of spray solution (0.2% v/v). Apply within a minimum of 140 L water per hectare. Apply with ground equipment only. Make only one application per growing season

Apply Ultim when annual grasses have 1-6 leaves (up to early tillering) and perennial grasses have 3-6 leaves. Application must be made in the spring of the sprout year (non-bearing year) Stunting and yield losses may occur if blueberry plants are contacted by the spray. Increased crop safety will occur when applications are made before blueberry emergence.

Ultim may be tank mixed with Velpar or Sinbar to control annual grasses, quackgrass and many broadleaf weeds. Follow the recommended rates and timings outlined on the Velpar or Sinbar labels. Application must be made in the spring of the sprout year (non-bearing year) before blueberry crop emergence, or severe crop injury may result to emerged plants. Consult the tank mix partner label for additional application instructions and use precautions.

### *Spot applications for black bulrush*

For control of black bulrush, apply Ultim 75 DF plus Agral 90 in June of the sprout year. Apply when the first flower heads begin to emerge from the bulrush tussock. Ultim 75 DF should be applied as a directed spot spray to thoroughly wet bulrush foliage. Control may be erratic or unsatisfactory from later applications or if the bulrush is under stress. Stunting and yield loss may occur when blueberry plants are sprayed directly, but with careful application, injury is minimal to those plants growing among the bulrush. Ultim 75 DF is pre-packaged in water soluble bags containing 33.7 g commercial product, or enough to mix 800 L of spray solution. This is equivalent to 4.2 g per 100 L of spray solution. Apply with 0.2% Agral 90 surfactant (equivalent to 200 mL per 100 L water).

## *17. Velpar DF and Pronone 10G (hexazinone)*

### *A. Formulations*

Two commercial formulations containing the active ingredient hexazinone are available: Velpar DF, a 75% dry flowable granule that is mixed with water and Pronone 10G, a 10% solid granule. Velpar DF and Pronone 10G are pre-emergence residual herbicides applied for the control of many grasses, broadleaf weeds, and woody weeds. More information on the hexazinone formulations is available in this fact sheet (C.4.1.0).

Pronone 10G consists of clay granules impregnated with the herbicide. Following rainfall, the herbicide is released by leaching. Pronone 10G is approved only for sprout year applications and is applied with a calibrated fertilizer spreader, such as the Vicon spreader, and not a conventional pesticide sprayer. Calibration information on the Vicon spreader is available here (C.4.4.0). Patchy crop injury or control indicates uneven distribution of granules. Control may therefore be poor during dry weather, but gradual release may prolong and improve control of some species.

If blueberry sprouts or leaves have emerged, the risk of crop injury is much less from Pronone 10G applications than from liquid sprays of Velpar DF. However, herbaceous weed control is generally better with pre-emergence applications of Velpar DF than with Pronone 10G. When using Velpar DF, follow label instructions to ensure the dry flowable granules completely disperse in the spray tank before application.

### *B. Sprout year applications*

Velpar DF is registered for use in the sprout year at 1.92 to 2.56 kg/ha (0.78 to 1.0 kg/acre) and Pronone 10G at 14 to 20 kg/ha (5.7 to 8.0 kg/acre). The high rate is recommended for use in weedy or new fields to control common herbaceous and woody weeds. The low rate is recommended for maintenance weed control in relatively clean fields. Applications should be made in the spring after the pruning operation, but before new sprouts or leaves emerge. Apply Velpar DF in at least 200 litres of water per hectare. Agitation of Velpar DF in the spray tank is essential to ensure proper mixing and to avoid application issues. Do not apply to extremely sandy or gravely soils or where the terrain does not permit even and accurate application.

On mature, well-established fields, it is suggested that growers experiment with different hexazinone rates in order to determine the minimal effective rate for the weed types present. In some instances, it may be feasible to even skip hexazinone applications or just treat known problem areas. For growers who are concerned that unmanageable weed populations may result if hexazinone applications are skipped, it is suggested that only a small area of their field be left untreated. If weed levels in the area are acceptable, then the untreated area could be expanded the following cycle.

Crop tolerance to Velpar DF is generally the greatest and weed control the best when applications are made soon after pruning but before new blueberry sprout emergence or new leaf growth. Best results occur when the herbicide is present in the root zone during active growth of the target weeds. There is no difference in tolerance between mowed and burned blueberry plants. Applications made after the foliage has emerged can cause serious leaf burn. Crop injury has consistently been associated with late applications. However, blueberry plants on sandy or shallow soils, or those weakened by heavy weed competition or frost heaving, may be more prone to hexazinone injury than those in vigorous stands.

Hexazinone is principally a soil acting herbicide that is leached by rain into the root zone. Herbicide activity is affected by too little or too much rainfall and by soil texture. Lower rates are used on light textured soils and higher rates are used on heavier soils and in high organic matter soils. Hexazinone is very water soluble and subject to leaching and lateral movement. Therefore, do not apply to gravely soils or on steep slopes or to roadways or other areas subject to erosion in the absence of plant cover. Follow Best Management Practices to minimize the risk of contaminating water sources, as outlined here (C.4.5.0).

Experience has shown that blueberry rhizomes do not colonize ground kept bare by repeated hexazinone use. Hexazinone is an important tool in developing blueberry fields and managing weeds, but over-use that results in bare ground may lead to soil erosion and prevent clone expansion.

### *C. Velpar DF in the fruiting year*

Velpar can be applied in the early spring of the crop year, although the risk of crop injury is high when applied at this time. When the crop contains weed species that could affect its development or harvest efficiency, an application of 1.3 kg/ha (0.53 kg/acre) Velpar can be made. It is recommended that this treatment be applied only to those areas of the field where weed density will cause yield losses or harvesting problems. This treatment will control or suppress most

goldenrods, asters, sheep sorrel, some annual broadleaved weeds and most grasses that have not developed hexazinone tolerance. Timing of application is critical. Applications should be made no later than the early bloom stage before the flower buds separate and show the white floral tube. This corresponds to when the bud scales are separating or the F1 and F2 developmental stages as described in the Monolinia blight control fact sheet (C.3.1.0). This stage generally occurs no later than mid May. Later applications can result in serious crop injury and much reduced yield. This treatment should only be used on soils with a well-developed organic layer and should not be used on sandy or gravely soils. Crop injury is strongly influenced by soil and environmental conditions. Velpar application in the crop year should only be used as a rescue treatment for severe weed infestations. Growers should evaluate alternative weed control options before using Velpar applications in the crop year.

### *D. Response of weeds to hexazinone*

Repeated hexazinone use has led to many changes in the weed flora of blueberry fields. It is now difficult to predict the response of some species to hexazinone. The susceptible/tolerant ratings of common weed species in Table 1 are based on trials in fields with little or no previous exposure to hexazinone and may be most applicable to new fields. The susceptibility of some species has changed with long-term exposure to hexazinone (or reduced rates) in the following ways:

**Incomplete control.** Majority of seedlings and immature plants may be killed but mature plants recover from initial injury and reproduce, especially in the fruiting year. Examples of weeds which show incomplete control include many perennial herbaceous species, like black bulrush, black knapweed, St. John's wort, goldenrods, vetch, ferns, and others. The level of weeds which exhibit incomplete control increases as growers decrease the herbicide rate, as shown by the increase in sheep sorrel and narrow-leaved goldenrod in fields which have used reduced hexazinone rates.

**Inherent tolerance.** Like the blueberry plant, many other plant species are tolerant to labelled rates of hexazinone, e.g. bunchberry, bayberry, chokeberry, yellow loosestrife, lilies and orchids, and others. Some 'new' weeds like goat's-beard and sow-thistle appear to have inherent hexazinone tolerance.

**Developed tolerance.** Many native grasses have developed hexazinone tolerant populations with repeated exposure, as have some annual ones like witch grass. There is no evidence that populations of herbaceous broadleaved weeds have developed tolerance, or if the decreased control of some woody weed species (e.g. wild rose, bristly arilia, blackberry) results from decreased rates of herbicide or increased tolerance.

**Germination patterns.** Although residual, hexazinone may only provide several months of weed control. Many weed species germinate and establish later, like witch grass, chickweeds and others. Annual weeds germinate in both the sprout and fruiting year. When plants like lamb's quarters, witch grass, and hemp-nettle germinate in the crop year, control by sprout-year hexazinone is not achieved. Observing emergence patterns can help determine why some weed species are not controlled.

It is clear that many weed problems cannot be solved with hexazinone use. Growers must adapt their control strategy to control these escaping species.

## *18. Venture L (fluazifop-p-butyl)*

Venture L can be applied broadcast in the late spring of both the sprout and fruiting year for post emergent control or suppression of certain annual and perennial grasses. Degree of control will depend upon their level of susceptibility to the herbicide and the rates applied. Susceptible annual grasses like witch grass or native perennials like ticklegrass (rough hair grass) can be controlled

with Venture L, but many native grasses, like poverty oat grass and blue grasses, are more tolerant and are only suppressed. Suppressed grasses are severely stunted and flowering and vigour is greatly reduced for at least one season. The presence of these suppressed species, particularly in bare areas of blueberry fields, is beneficial and may enhance expansion of blueberry clones and reduce soil erosion. Other grasses, however, are highly tolerant.

Apply 1 L/ha (0.4 L/acre) Venture L post emergence for control of annual grasses at the 2 to 5 leaf stage (e.g. witch grass and fall panicum) and for tickle grass suppression. Apply 2 L/ha (0.8 L/acre) Venture L for the suppression of quack grass, poverty oat grass, blue grasses and other perennial grasses. Apply when perennial grasses have 10 cm of new leaf growth, usually in late May or early June. These applications are useful in some grass-infested fields during the crop year to increase harvest efficiency. When applications are made to grasses greater than 20 cm in height or grasses that have reached the heading stage, the grasses will not be adequately controlled or suppressed. Venture L should be applied in 100 to 200 L of water per hectare. Blueberry plants are very tolerant to Venture L, even during bloom. Venture L requires a minimum 2 hour rain-free period after application and has no activity in the soil. The preharvest interval is 60 days. Venture L does not control rushes, sedges nor any broad-leaved weeds.

## Notes on Herbicide Tables

Information provided in the following tables are provided to facilitate choosing the best treatment and are not a guarantee of performance. Producers should refer to the product label for more specific information. Factors such as weather, stage of growth, herbicide rate and difference in tolerance among plant populations can influence the information presented. Selective treatments can be applied with little risk of crop injury, provided label directions are followed. Non-selective herbicide treatments must be applied only to the weeds as blueberry plants that come in contact with the herbicide spray may be injured or killed.

## Table 1. Herbicide Effect on Common Blueberry Field Weeds

| Ratings<br>s - susceptible<br>t - tolerant<br>sd - suppressed<br>v - variable<br>n/a - not applicable<br>A - Annual<br>P - Perennial | Life Cycle | Pre-Emergence | | | | | Post Emergence | | | | | Spot Treatments | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Authority | Chateau | Kerb | Sinbar | Velpar/Pronone | Callisto | Option | Poast Ultra | Ultim | Venture | Casoron | dicamba | Glyphosate | Garlon | Lontrel | Spartan |
| **Grass Type Weeds** | | | | | | | | | | | | | | | | | |
| Black bulrush | P | | | t | t | v | sd | | t | s | t | sd | t | s | | t | t |
| Browntop | P | | | | s | s | t | | s | | s | | t | v | t | t | t |
| Canada blue grass | P | | | | s | s | t | sd | sd | v | sd | | t | v | t | t | t |
| Fescue (*Festuca sp*) | P | | | s | v | v(3) | t | sd | t | v | t | | t | v | t | t | t |
| Kentucky blue grass | P | | | | | s(3) | t | | sd | | sd | | t | v | t | t | t |
| Mexican muhly grass | P | | | | sd | v(3) | t | | sd | | sd | | t | v | t | t | t |
| Poverty oat grass | P | | | t | s | s(3) | t | sd | sd | sd | sd | | t | v | t | t | t |
| Quack grass | P | | | v | sd | sd | t | s | sd | sd | sd | sd | t | v | t | t | t |
| Tickle grass (Rough hair) | P | | | | s | s(3) | t | s | s | sd | s | | t | v | t | t | t |
| Rush Species | P | | | | | v | v | | t | | t | sd | | | | | |
| Witch grass | A | | | | s | v(3) | t | s | s | s | s | | t | v | t | t | t |
| **Herbaceous Broadleaf** | | | | | | | | | | | | | | | | | |
| Asters | P | | | t | t | v | v | | t | | t | s | s | s | | v | v |
| Bunchberry | P | | | t | t | t | t | | t | v | t | | | n/a | | t | s(1) |
| Burnweed | A | | | | | v | s | | t | | t | | | s | | sd | |
| Cinquefoil (Rough, 5-finger) | P | | | | s | v | v | | t | v | t | | | n/a | | | v |
| Cow wheat | A | | | | | v | s | | t | t | t | | | n/a | | | |
| Fireweed | P | | | | s | s | sd | | t | | t | | | s | | | |
| Goldenrods | P | | | t | t | v | sd | | t | sd | t | | s(1) | s | | v | v |
| Hawkweed | P | | | | sd | v | t | v | t | sd | t | | | n/a | | s | |
| Lamb's quarters | A | s | s | | s | v | s | s | t | sd | t | s | s | s | | t | |
| Old field toadflax | A,P | | | | | | sd | | t | | t | | | n/a | | t | |
| Ox-eye daisy | P | | | | t | s | | | t | | t | | s | s | | v | |
| Sheep sorrel | A,P | sd | | sd | t | v(3) | t | v | t | v | t | sd | s | n/a | | v | |
| Spreading dogbane | P | | | | t | t | v | v | t | v | t | v | s | s | s | t | t |
| St. John's wort | P | | | t | t | t | v | | t | t | t | | s | s | | t | t |
| Vetch | P | | | t | t | v | sd | | t | sd | t | v | s | v | | s | v |
| Wild lily of the valley | P | | | | t | t | | | t | t | t | | | n/a | | t | t |
| Yellow loosestrife | P | | | | t | t | v | | t | t | t | v | s | s | | t | s |
| **Woody Weeds** | | | | | | | | | | | | | | | | | |
| Alder | P | | | t | t | t | t | | t | t | t | | s | s | s | t | s |
| Barrenberry | P | | | t | t | t | v | | t | t | t | | s | s | | t | t |
| Birch | P | | | t | t | s | v | | t | t | t | | s | s | s | t | t |
| Cherry (*Prunus* spp) | P | | | t | t | t | t | | t | t | t | | s | s | v | t | |
| Huckleberry | P | | | t | t | t | t | | t | t | t | | t | s | t | t | t |
| Lambkill | P | | | t | t | s(1) | t | | t | t | t | | s | v | v | t | t |
| Maple | P | | | t | t | t | t | | t | t | t | | | s | s(2) | t | sd |
| Poplar | P | | | t | t | v | v | | t | t | t | | s | s | s | t | v |
| Rhodora | P | | | t | t | s(1) | t | | t | t | t | | sd | v | v | t | t |
| Wild rose | P | | | t | t | t | v | | t | t | t | | s | v | s | t | s |
| Willow | P | | | t | t | | v | | t | t | t | | | v | s | t | v |
| **Non-flowering Plants** | | | | | | | | | | | | | | | | | |
| Bracken fern | P | | | | t | v | s(1) | | t | t | t | s | | s | | t | s |
| Hair-cap moss | P | | s(1) | t | t | t | t | | t | t | t | | t | t | t | t | t |
| Sweet fern | P | | | t | t | t | | | t | t | t | | s | v | | t | t |

(1) may require additional applications in following cycles for satisfactory control
(2) Red maple requires high rate and possible re-treatment (3) Herbicide Resistant species suspected

| Table 2. Herbicides Registered for Broadcast Application | | | | | | |
|---|---|---|---|---|---|---|
| Active Ingredient | Product | Product Rate | | Water Volume | Pre Harvest Interval (Days) | Application Timing (see label for additional information/precautions) |
| | | kg or L / ha | kg or L / ac | | | |
| **Pre-emergent, before blueberry growth (Early Spring)** | | | | | | |
| glufosinate | Ignite SN | 2.7-5 L/ha | 1.1-2 L/ac | Min 110 L/ha (10 gal/ac) | Non crop year | Dormant spray, after blueberry leaf drop in crop season but before blueberry sprout emergence in the sprout year. |
| hexazinone | Pronone 10G<br>Velpar DF | 14-20 kg/ha<br>1.92-2.56 kg/ha | 5.7-8.1 kg/ac<br>0.78-1.0 kg/ac | Min 200 L/ha (18 gal/ac) | None available | Spring of sprout year, before new blueberry plant growth emerges. |
| sulfentrazone | Authority 480 | 0.22-0.29 L/ha | 0.09-0.12 L/ac | Min 100 L/ha (9 gal/ac) | Non crop year | Dormant spray, after blueberry leaf drop in crop season but before blueberry sprout emergence in the sprout year. |
| terbacil | Sinbar WDG | 1.5-2.5 kg/ha | 0.6-1.0 kg/ac | Min 200 L/ha (18 gal/ac) | None available | Spring of sprout year, before new blueberry plant growth emerges or late fall, when dormant. |
| **Post-emergent, after blueberry growth (Late Spring/Summer)** | | | | | | |
| fluazifop-p-butyl | Venture L | 1-2 L/ha | 0.4-0.8 L/ac | 100-200 L/ha (9-18 gal/ac) | 60 fruit, 420 sprout | Late spring, sprout and fruiting year, control of grasses only. Low rate for annual grass control. |
| foramsulfuron | Option 2.25 OD | 1.56 L/ha + 2.5 L/ha UAN | 0.63 L/ac + 1 L/ac UAN | Min 150 L/ha (13 gal/ac) | None available | Sprout year only. One application per season after blueberry emergence. |
| mesotrione | Callisto 480 SC + Agral 90 | 0.3 L/ha + 200 ml Agral 90 per 100 L water | 0.12 L/ac + 200 ml Agral 90 per 100 L water | 100-200 L/ha (9-18 gal/ac) | 60 | Late spring of sprout or crop year, prebloom. Apply up to 8 leaf weed stage. Can be applied before weed emergence. One application per season. |
| nicosulfuron/ rimsulfuron | Ultim 75 DF + Agral 90 | 33.7 g/ha + 200 ml NIS per 100 L water | 13.6 g/ac + 200 ml NIS per 100 L water | Min 140 L/ha (12 gal/ac) | 14 months | Apply with approved surfactant. Crop stunting may occur when applied later in season. One application per season. |
| sethoxydim | Poast Ultra + Merge or Assist | 0.47-1.1 L/ha + 1-2 L/ha Merge or Assist | 0.19-0.45 L/ac + 0.4-0.8 L/ac Merge or Assist | 100-200 L/ha (9-18 gal/ac) | 15 | Late spring, sprout and fruiting year, control of grasses only. Low rate for annual grass control. |
| **Dormant application (Late Fall)** | | | | | | |
| dicamba | Banvel II/Hawkeye Oracle | 4.6-7.1 L/ha | 1.9-2.9 L/ac | 550 L/ha (50 gal/ac) | None available | Fall of fruiting year after 90% blueberry plant leaf drop. Change rate for other formulations. |
| dicamba + 2,4-D ester | Banvel II/Oracle + 2,4-D LV ester 600 | 2.3 L/ha + 5.7 L/ha | 0.93 L/ac + 2.3 L/ac | 550 L/ha (50 gal/ac) | None available | Fall of fruiting year after 90% blueberry plant leaf drop. Only use low volatile formulations of 2,4-D ester. |
| flumioxazin | Chateau WDG | Suppress Moss: 0.28-0.42 kg/ha | Suppress Moss: 0.11-0.17 kg/ac | Min 100 L/ha (9 gal/ac) | None available | Apply to dormant blueberry, ideally late fall of crop year after pruning. |
| glyphosate | Roundup Weathermax | 1.67 L/ha | 0.68 L/ac | 200-300 L/ha (18-27 gal/ac) | None available | Newly cleared land only. Fall of fruiting year after 95% blueberry plant leaf drop. Must prune after treatment. |
| propyzamide | Kerb SC | 4.1-5.6 L/ha | 1.7-2.3 L/ac | 300-500 L/ha (27-45 gal/ac) | None available | Late fall of fruiting or sprout year, after blueberry plant defoliation. Best results when soil temperatures are low, but above freezing and soil moisture is high. |

| Table 3. Herbicides Registered for Spot Application | | | | | |
|---|---|---|---|---|---|
| **Active Ingredient** | **Product** | **Type of Application** | **Herbicide Mixture (g or L product)** | **Pre Harvest Interval** | **Application Timing (see label for additional information)** |
| **Selective spot herbicide treatments** | | | | | |
| clopyralid | Lontrel 360 | Spot spray | Spot: 42 ml in 200 L water, treat 1000 $m^2$<br>Boom: 420 ml/ha in 150-200 L | 10 months | Sprout year – June or when tufted vetch is early bloom. Later applications may result in yield reductions the following year. |
| dichlobenil | Casoron 4G | Granular | 110-175 kg/ha (40-70 kg/ac) spread directly on soil | 100 days | Apply during dormant period (late fall). Do not apply above 15 °C. Low rate for crop year. |
| glufosinate | Ignite SN | Spot spray | 27-50 ml in 10 L spray solution | Non crop year | Directed spray if sprouts have emerged. Two applications may be needed, 6.7 L/ha maximum. |
| nicosulfuron/ rimsulfuron | Ultim 75 DF + Agral 90 | Spot spray | Spot: 4.2 g plus 200 ml Agral 90 per 100 L water | 14 months | Early summer of sprout year - black bulrush. |
| tribenuron methyl | Spartan + Agral 90 | Spot spray | 2.5 g in 10 L water plus 20 ml Agral 90 per 10 L water | None available | Summer or early fall of sprout year. Varies with weed targeted. |
| | | Bunchberry | 40 g/ha + 0.2% v/v Agral 90 (20 ml Agral 90 per 10 L water); Spray in 150-250 L water/ha | None available | **Spring sprout year:** Bunchberry leaves unfolded at a 45 degree angle, before blueberry re-growth more than 2 cm. **Late summer fruiting year:** apply 1-4 weeks after blueberry harvest. |
| **Non-selective spot and wiper herbicide treatments** | | | | | |
| 2,4-D LV ester | Numerous trade names | Spot spray | Consult individual labels | None available | Site preparation, non crop. |
| dicamba | Banvel II / Hawkeye Oracle | Spot spray | 2.1 L per 1000 L water | None available | Site preparation – brush control. |
| glyphosate | Roundup Original, Roundup Weathermax, Touchdown Total, Factor, Factor 540, Credit, Credit Plus, Glyfos, Vantage Plus MAX, Polaris, Traxion and others | Spot spray | 1-2 % solution<br>Roundup Weathermax: 0.67 to 1.34 % solution | Non crop year | Site preparation, sprout year, after harvest. |
| | | Roller | 5 to 10 % solution<br>Roundup Weathermax: 3.3–6.7 % solution | Non crop year | |
| | | Wiper | 33 % solution<br>Roundup Weathermax: 22% solution | Non crop year | |
| triclopyr | Garlon | Spot spray or wiper | 13 – 19 % solution in mineral or vegetable oil for Garlon XRT; No mixing for Garlon RTU | None available | Site preparation, one application per year. |

**Pre Harvest Interval (PHI):** The minimum number of days between the last application of the pesticide and harvest. **Label Information:** Information listed in this guide is provided to growers as a convenience. Pesticides must be applied according to label directions. Please refer to the product label before application and for more information on each product. Label information overrides any discrepancies between information presented in this guide and the label. Label information can be found at the Health Canada Pesticide Label Search, available on-line.

## Table 4. Additional Information for Herbicides Used on Wild Blueberry

| Active Ingredient | Product | Group | Hazard | Protection Equipment | Buffer Zone (metres) | | Restrictions (hours) | | Herbicide Activity | | Leaching Potential | Bee Toxicity | Winter Storage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Water <1m | Terrestrial Habitat | Rain-free Period | Re-Entry Interval | Foliar | Soil | | | |
| 2,4-D | 2,4-D | 4 | Warning | d f g j | 1 | 2 | 2 | 12 | yes | no | moderate | low | C |
| clopyralid | Lontrel | 4 | Caution | a f j | - | 2 | 4 | 12 | yes | no | low to moderate | low | B |
| dicamba | Banvel II /Oracle | 4 | Warning | d f | 1 | 15 | 4 | 12 | yes | limited | very high | low | B |
| dichlobenil | Casoron | 20 | Caution | a f g | - | - | - | 12 | no | yes | low | low | C |
| fluazifop-p-butyl | Venture | 1 | Caution | d f h j | 1 | 2 | 2 | 12 | yes | no | very low | low | B |
| flumioxazin | Chateau | 14 | Caution | d f g j m | 5 | 25 | 0 | 12 | limited | yes | low | low | C |
| foramsulfuron | Option | 2 | Caution | a f g | 1 | 3 | 2 | 12 | yes | limited | low | low | C |
| glufosinate | Ignite | 10 | Warning | a f j m | 1 | 1 | 4 | 12 | yes | no | high | low | A |
| glyphosate | Various | 9 | Caution | a f j | 15 | 15 | 1-6 | 12 | yes | no | extremely low | low | B |
| hexazinone | Pronone | 5 | Warning | b f | 50 | - | 0 | 48 | no | yes | very high | low | C |
| hexazinone | Velpar | 5 | Caution | a f j | 1 | 5 | 0 | 48 | limited | yes | very high | low | C |
| mesotrione | Callisto | 27 | Caution | a f j | 1 | 4 | 3 | 12 | yes | yes | low | low | B |
| nicosulfuron/ rimsulfuron | Ultim | 2 | Warning | a f h | 1 | 5 | 2-4 | 12 | yes | no | high | low | C |
| propyzamide | Kerb | 15 | Caution | d f h | - | 10 | 0 | 24 | no | yes | low | low | A |
| sethoxydim | Poast Ultra | 1 | Caution | d f h j | 1 | 2 | 1 | 12 | yes | no | low | low | B |
| simazine | Princep Nine-T | 5 | Warning | d f h j | 1 | 5 | 0 | 12 | no | yes | high | low | C |
| sulfentrazone | Authority | 14 | Caution | a f g | 1 | 10 | - | 12 | limited | yes | high | low | B |
| terbacil | Sinbar | 5 | Caution | a g j | 10 | 35 | 0 | 12 | limited | yes | very high | low | C |
| tribenuron-methyl | Spartan | 2 | Warning | a f j | 1 | 10 | 4-6 | 12 | yes | no | moderate | low | C |
| triclopyr | Garlon | 4 | Caution | d f h j | - | - | 2 | 12 | yes | no | low | low | B |

**Protection Equipment:** **a** - long-sleeved shirt and long pants, **b** - coveralls or disposable spray suit, **d** - coveralls or disposable spray suit over long sleeved shirt and pants, **e** - waterproof gloves, **f** - chemically-resistant gloves, **g** - shoes plus socks, **h** - chemically resistant footwear plus socks, **j** - protective eye wear, **l** - chemically resistant head gear for overhead application, **m** - approved respirator, **n** - chemical-resistant spray suit. **Winter Storage:** Winter storage requirement codes are: **A** - Do not allow to freeze, **B** - Preferably should not freeze. If frozen, return to original state by allowing product to warm to 10-20$^{0}$C and agitate thoroughly before use, **C** - Not usually damaged by freezing. Store in cool dry place.

## Pesticide Emergency Information

### Poison Control Centres

| | |
|---|---|
| New Brunswick | Dial 911, ask for Poison Information |
| Newfoundland | Dr. Charles A. Janeway Child Healthcare Centre, St. John's (709) 722-1110 |
| Nova Scotia<br>Prince Edward Island | The Izaak Walton Killam Hospital for Children, Halifax 1-800-565-8161 |

### Environmental Pesticide Spill

| | |
|---|---|
| New Brunswick<br>Prince Edward Island<br>Nova Scotia | 1-800-565-1633 |
| Newfoundland | 1-800-563-9089 |

### PMRA Websites

**Pesticide Label Search**

http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php

**Drift Mitigation**

Buffer Zone Calculator Link

## Helpful Conversions

### Units

| |
|---|
| kPa x 0.14 = pounds per square inch |
| hectares x 2.47 = acres |
| kilograms x 2.2 = pounds |
| 1000 grams (g) = 1 kilogram (kg) |
| millilitres x 0.035 = fluid ounces |
| litres x 35 = fluid ounces |
| litres x 0.22 = imperial gallons |
| 1000 millilitres (mL) = 1 Litre (L) |
| °F = (°C x 9/5) + 32 |
| °C = (°F-32) x 5/9 |
| miles per hour x 1.61 = km per hour |
| 5 mL = 1 tsp |

### Volume per Area

| |
|---|
| kg per ha x 0.89 = pounds per ac |
| kg per ha x 0.40 = kilograms per ac |
| g per ha x 0.015 = ounces per ac |
| tonnes per ha x 0.45 = tons per ac |
| L per ha x 0.40 = litres per ac |
| L per ha x 0.09 = gallons per ac |
| L per ha x 14.17 = fluid ounces per ac |
| L per ha x 0.71 = pints per acre |
| mL per ha x 0.015 = fl. ounces per ac |
| L per ha x 0.11 = US gallons per ac |
| L per ha x 0.86 = US pints per ac |

## Abbreviations

### Formulation

| | |
|---|---|
| DF | Dry flowable |
| EC,E | Emulsifiable concentrate |
| F | Flowable |
| G | Granular |
| L | Liquid |
| LV | Low Volatile |
| SC | Suspension concentrate |
| Sn | Solution |
| SP | Soluble Powder |
| WDG | Water Dispersible Granule |
| WP,W | Wettable Powder |
| WSP | Water Soluble Pouches |

### Measurements

| | |
|---|---|
| ac | acre |
| g | gram |
| g.a.e. | grams acid equivalent |
| ha | hectare |
| kg | kilogram |
| kPa | kilopascal |
| L | litre |
| m | metre |
| mL | millilitre |
| psi | pounds per square inch |
| % v/v | percent volume to volume |

### Personal Protection Equipment

**Gloves**

**e** - waterproof gloves **f** - chemical resistant gloves

**Head and Lung**

**j** - eye protection, application **m** - approved respirator

**l** - chemically resistant headgear for overhead application

**Clothes**

**a** - long-sleeved shirt/pants **b** - coveralls or disposable spray suit

**d** - coveralls or disposable spray suit over long sleeved shirt/pants

**n** - chemical-resistant spray suit

**Footwear**

**g** - shoes plus socks **h** - chemically resistant footwear plus socks

**Herbicide Activity: Foliar** – Indicates whether or not susceptible weeds will be controlled by herbicide contact with above ground plant tissue (leaves). **Soil** – Indicates whether or not late emerging susceptible weeds will be controlled for some time after application by residual herbicide activity as they germinate from the soil.

**Group:** Weed Science Society of America's nationally accepted grouping of herbicides based on site of action.

**Bee Toxicity:** Degree of toxicity to honey bees. If possible, all pesticide applications should be avoided during times of bee activity within fields, such as mid-day during bloom periods.

**Hazard:** The signal words Danger, Warning and Caution appear on the pesticide label and indicate the level of hazard associated with handling or using the product. Products bearing the signal word **Danger** have an extreme or high hazard rating. Products labeled **Warning** have a moderate hazard rating and a **Caution** warning is associated with a low level of hazard. The degree of hazard may be due to toxicity, flammability, explosiveness or corrosiveness.

**Buffer Zones:** Distance between the closest point of direct pesticide application and the nearest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas and shrublands) and sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands). Water < 1m refers to wet areas with less than 1 meter of water depth. All buffer zones are for boom sprayers unless indicated. A buffer zone calculator is available here.

**Rain-free Period:** The recommended minimum time in hours between pesticide application and rain. If rain occurs during the rain-free period, pest control may be significantly reduced.

**Restricted-Entry Interval (REI):** The minimum time in hours before you can enter a field that has been treated with the pesticide.

**Leaching Potential:** The potential for a pesticide to be leached or carried by surface run-off is determined by characteristics of both the pesticide and the field. Surface slope, proximity to surface water, low organic matter content, depth to aquifer and heavy rainfall are some of the factors which lead to run-off and leaching problems when combined with pesticides of a moderate to high leaching potential.

Schedule "L"

# Lowbush Blueberry Fact Sheet

# Blueberry Grower's Code Of Practice For Pest Management

## "A Growers Guide"

## Wild Blueberry Growers Association of Nova Scotia

In the year 1970, a group of active blueberry growers working with representatives from the Nova Scotia Department of Agriculture and Marketing formed an organization and aptly named it "Blueberry Producers Association of Nova Scotia". The organization of this group did not take place overnight. Already two attempts at organizing had collapsed. With months of preparation, this new organization was formed and over the years has grown and developed into one of the strongest commodity organizations in Nova Scotia.

The Association has advised government on many policies affecting the industry, been active in promotional programs, and lead in support of innovative technology. During this time blueberries, in terms of acreage and exports, have become the most important horticultural crop in the province.

As we move towards the twenty-first century, one of our areas of concern is the environment. Blueberries are one of the most environmentally friendly food crops produced and we are proud to initiate this publication, *Blueberry Grower's Code of Practice For Pest Management*. Common sense is the guide for using pesticides to grow blueberries. Our goal is to promote greater use of common sense by everyone involved in the industry.

## Introduction

Pesticides are best employed within a strategy of integrated pest management (IPM). IPM depends on detailed knowledge of pest and crop biology and combines natural control for pests with synthetic pesticides. Pesticides can help to attain sustainable development of the blueberry industry.

The wild Blueberry Producers Association of Nova Scotia recognizes the importance of pesticides as components of IPM. Pesticides must be registered by the federal government. The registration process involves a rigorous review of data on the products toxicity, environmental impact and degradation. Pest control products can be used safely and have no long term impact on the environment when used according to label directions! The Association developed this Grower's Guide to assist producers in improving management of pesticides within the industry.

The Association identified six concepts that are crucial to responsible use of pest control products. The philosophy of each concept should be incorporated into all decisions regarding pest management and pesticide use. These concepts are:

1. Integrated Pest Management
2. Application Technology
3. Protection of Environmentally Sensitive Zones
4. Effective Storage, Cleaning and Container Disposal
5. Applicator Safety
6. Public Information and Good Neighbor Policy

Producers can use the Guide to evaluate their own practices, identify areas for improvement and further training.

Following the Guide will allow growers to maximize value of their pesticide inputs, protect the environment, and more effectively communicate with the general public the benefits and risks of pesticide use in blueberry production.

## Integrated Pest Management

IPM involves a "whole system" approach to producing a crop of blueberries and managing the associated plants, insects, disease organisms and vertebrates. IPM strives to maintain a balanced ecosystem of plants, animals and microorganisms while maintaining sufficient crop production to ensure a profitable enterprise for the grower. These concepts can be applied to controlling vegetation, insects or diseases.

IPM utilizes all possible tools and techniques to manage a pest population in an economical and environmentally safe way. Monitoring or scouting the crop to determine levels of pests and natural controls is essential. This information is used to determine appropriate pest management techniques.

## IPM Requires

1. **correct identification** of both pests and beneficial organisms such as parasitic wasps, which help control span worms and leaf tiers,
2. **knowledge of pest biology**, so treatments can be applied at the most effective time,
3. ongoing **monitoring of pests**, usually on a weekly or bi- weekly basis,
4. application of an **economic threshold level or tolerance**, *ie*, the level of pest activity at which a treatment must be applied to prevent unacceptable crop losses from occurring,
5. application of a **treatment when pest populations exceed threshold levels**. This may consist of a pesticide, a biological control, physical controls such as cutting weeds or cultural controls such as plant nutrition.

Pesticides are only applied when pest populations exceed established levels or tolerances known to result in unacceptable crop loss. Accurate identification of weeds, insects and diseases is essential to IPM; growers should familiarize themselves with the major pest problems. Natural pest controls are used whenever possible. Pesticides are selected to minimize possible adverse affects and are used to augment naturally occurring controls when possible. In many years beneficial insects and other naturally occurring phenomena such as weather conditions may prevent pest populations from reaching levels that would warrant use of pesticides.

## Application Technology

Pesticide use in IPM assumes accurate application of a recommended rate to a defined target. Accurate application requires determining the volume of spray or dry product delivered by equipment over a specified unit of land - usually an acre or hectare. This process of determining delivery volumes is known as calibration. Calibration of equipment is crucial for the economic well-being of the farm as well as ensuring environmental integrity. Pesticides are expensive! Excessive use through inaccurately calibrated equipment may lead to crop injury, residues that will prevent sale of the crop and loss of operating capital.

Spray droplet size is an important consideration to maximize efficient dispersal and deposition of pesticide on the target. Herbicides are usually more effective with relatively large droplet sizes, while insecticides are usually more effective when applied as mist size droplets. Choosing the correct spray and application pressure will ensure generation of the appropriate droplet size. Farm machinery dealers, private consultants, IPM and machinery engineering specialists with NSDAM can provide assistance.

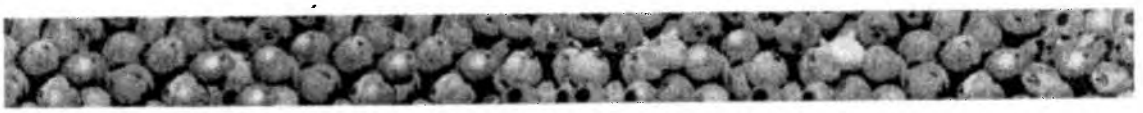
Weather conditions and terrain are factors that will also influence equipment and droplet size choices. The larger droplet sizes that should be used with herbicides are less vulnerable to off-site movement as a result of wind and air currents. Granular applicators are particularly suited to rough terrain. Spot treatments with back-pack sprayers or "wipers" are appropriate to control pest populations confined to small areas.

## Protection of Environmentally Sensitive Zones

Pesticides are safe and effective tools in pest management when used according to label directions. Product labels specify use procedures and practices that will mitigate against adverse environmental effects. Users are legally required to adhere to label requirements! Failure to do so may seriously damage the environment and result in prosecution of the offender.

Contamination of ground and surface water supplies is perhaps the greatest environmental concern relative to use of pesticides. Products that are highly soluble in water and slow to degrade are more risky than products that are of low water solubility and degrade quickly. Research has shown that most contamination occurs as a result of accidents and carelessness; *ie* spills of concentrated pesticides into or near wells or bodies of water or spraying over open wells. The implication is that risk of water contamination can be minimized by taking extra precautions to ensure that spills and over-sprays do not occur. Maintenance of an appropriate width unsprayed buffer zone between treated areas and bodies of water will prevent pollution of streams and ponds.

Products that are highly soluble in water may wash down-hill and accumulate at the bottom, harming sensitive terrestrial or aquatic life found there. For this reason highly soluble pesticides should not be used on steep terrain.



Hilly fields in early stages of development may be especially vulnerable to erosion. Herbicides remove most weedy vegetation, leaving the soil bare in areas where blueberries have not completely filled in. Heavy rainfall may then wash top soil away causing exposure of sub-soil and siltation of streams. Once top soil is gone the crop may never establish in these areas. Therefore, herbicides should be used carefully in developing fields so as to maintain some grass or weedy vegetation in areas where the crop had not yet spread. Grassed waterways should be considered on particularly sloped fields.

Consider developing buffer zones of unmanaged vegetation around sensitive areas like streams and swamps or near potable water supplies. In some instances buffer zones are legally required, either by Federal or provincial law. Always consult the product label!

Understanding properties, such as toxicity, water solubility and persistence of the product is essential to assure correct use. Growers must ensure that label instruction relative to precautions and setbacks from sensitive areas are followed.

## Effective Storage, Cleaning and Container Disposal

Many accidents with pesticides occur not in application, but in storage. Children and adults can inadvertently contact chemical containers and spilled concentrate when pesticides are improperly handled and stored. Children have been known to confuse pesticides with food products and consume them, when they were not stored in their original container.

Just as medicines should be kept under lock and key, so too should stored pesticides. Special storage rooms or cabinets which can be locked are mandatory. Ventilation of storage units is advisable to prevent the buildup of potentially toxic fumes. Pesticides should be stored in their original containers. Check all containers periodically for leaks. If leaks have occurred take measures to prevent additional leakage and use an absorbent material to soak-up the spilled product. Check with the Department of the Environment (NSDOE) or the manufacturer to determine how to clean up leaked material or dispose of unusable product.

Pesticide storage areas should be posted. Local fire departments should be notified when large quantities are being stored on farm. Build storages of non-combustible or fire retardant materials. Keep safety equipment and a fire extinguisher close by. Absorbant material like dry peat moss should be on hand in case of a spill or leakage.

On-farm storage for private use can be very safe with the application of common sense. The first step is to store as little as possible. Try to buy only enough pesticide to cover your land base requiring treatment. Knowledge of label rates and land measurement is necessary for this. Vendors can assist in the process of determining pesticide volumes required for a treatment.

Retail or wholesale storages are regulated under the provincial Pest Control Products Act and must meet specifications outlined in the Regulations.

Cleanup and proper disposal of application equipment and containers is essential for economic reasons and to ensure environmental integrity. Equipment should be thoroughly cleaned with large volumes of water. The rinsate should be sprayed-out over a large land area, preferably the same area treated with the pesticide in the first place. For instructions regarding decontamination of equipment when used with specific products, consult the label.

Product containers should be flushed with a spray of water and shaken vigorously a minimum of three times, This is commonly referred to as "triple-rinsing". Jet-rinsers, available from most farm chemical outlets, can be attached to the by-pass line of the sprayer and provide a very effective and efficient means for triple-rinsing. Rinsate from triple-rinsing is disposed of by adding it to the spray tank as the applications mix is being prepared.

Research has shown that the short time taken in triple-rinsing containers is much more than paid for the by product saved. Knowing that containers are clean and do not pose a health or environmental hazard will give peace of mind and a clear conscience!

Rinsed containers should be punctured to prevent re-use. Clean, dry containers can be taken to a recycling depot.

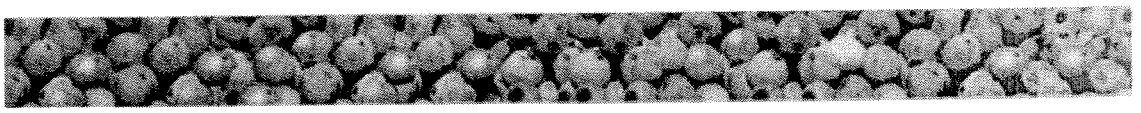
## Applicator Safety

Pesticide labels all carry information regarding necessary safety precautions to be taken by applicators to minimize their exposure and risk of injury. Depending upon the toxicity (ability to poison) of the individual pesticide, differing levels of personal protection are recommended. Minimum personal protective equipment that should always be used when handling concentrates would include safety goggles, coveralls, nitrile rubber gloves and apron. Coveralls over regular clothes are a good idea for applicators. Disposable coveralls are available; however, if non-disposable clothing is used, remember to wash it in a separate cycle from the family wash. Product labels will stipulate wearing a respirator and chemical resistant clothing when necessary.

Growers must be able to recognize and respond to label safety precautions. Additional sources of information of safe use might include NSDAM specialists, technical sales representatives and staff of NSDOE.

Two facts worthy of remembering are:

1. Greatest risk of exposure occurs during handling of concentrated pesticides while measuring, mixing and filling sprayers.



2. Pesticide enters the body more readily through the skin(hands, arms, neck and face are at greatest risk) than by any means other than intentional or accidental consumption.

The Crop Protection Institute has designated sprayer filling stations as *Rubber Glove Zones*, where rubber gloves, protective coveralls, aprons and eye protection should always be worn.

## Public Information and Good Neighbour Policy

A critical consideration for pesticide applications is public acceptance and understanding of the objectives of pesticide use.

Growers must recognize that neighbours, and individuals with right-of-way passage through their land, have a right to know what pesticides might be utilized in close proximity to them, and the risks of such usage. With certain applications, such as aerial, a public notification process is legally required.

If there is risk of chemical trespass (pesticide movement) to a neighbor's property it is wise to establish suitable buffer zones wherein no pesticide application takes place. Width of buffer zones will vary depending upon the product and application technology used. Staff of NSDOE or NSDAM may be helpful in suggesting appropriate buffer zones.

Formalized notification measures are counter-productive to IPM. Pest management situations often change quickly. A rapid response to a pest crisis may mean that less pesticide will be used than if the response is delayed. Therefore, use a notification procedure at the beginning of the crop protection season that will accommodate all possible outcomes.

Develop a list of potential treatments detailing product to be used, possible time span of usage, reason for usage, reentry intervals and relevant information as to the risk involved with exposure. The Association recommends approaching neighbors, individuals in close proximity or with access to your property, well in advance of the pesticide application season. Explain the products that might be used, their purpose, and the approximate time of year use might occur. This is not to say that any particular application will actually occur. But at least both parties will understand during which periods of the year pesticide applications are probable. By doing this it will be easier to work out a system of notification that is practical and a shared responsibility.

Be prepared to provide as much prior notification as possible. Perhaps a phone call will suffice. Signage at entry points to fields is a final effort to warn potential visitors of pesticide work recently done, in progress or about to happen. However, signs should not be left up indefinitely! Good communication will help prevent unnecessary problems.

## Conclusion

The Grower's Guide presented 6 major concepts.

1. Integrated Pest Management
2. Application Technology
3. Protection of Environmentally Sensitive Zones
4. Effective Storage, Cleaning and Container Disposal
5. Applicator Safety
6. Public Information and Good Neighbor Policy

Adoption of these concepts should be a goal for every WBPANS member. These concepts will assist growers to be safe, cost effective and more fully sustainable. Knowledge and skill are fundamental to IPM and good pesticide management. All growers are encouraged to participate in pesticide applicator courses and training that deals with blueberry production and pest management.


## Acknowledgements

The draft Code of Practice for Pest Management prepared by the Nova Scotia Christmas Tree Council inspired and formed a framework for this material. Other sources of information included bulletins published by the Crop Protection Institute and NSDAM



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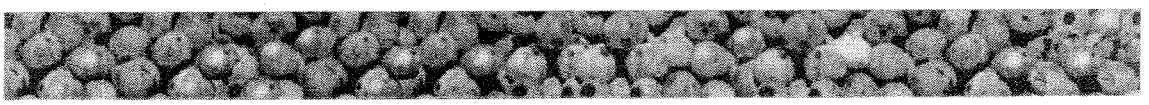
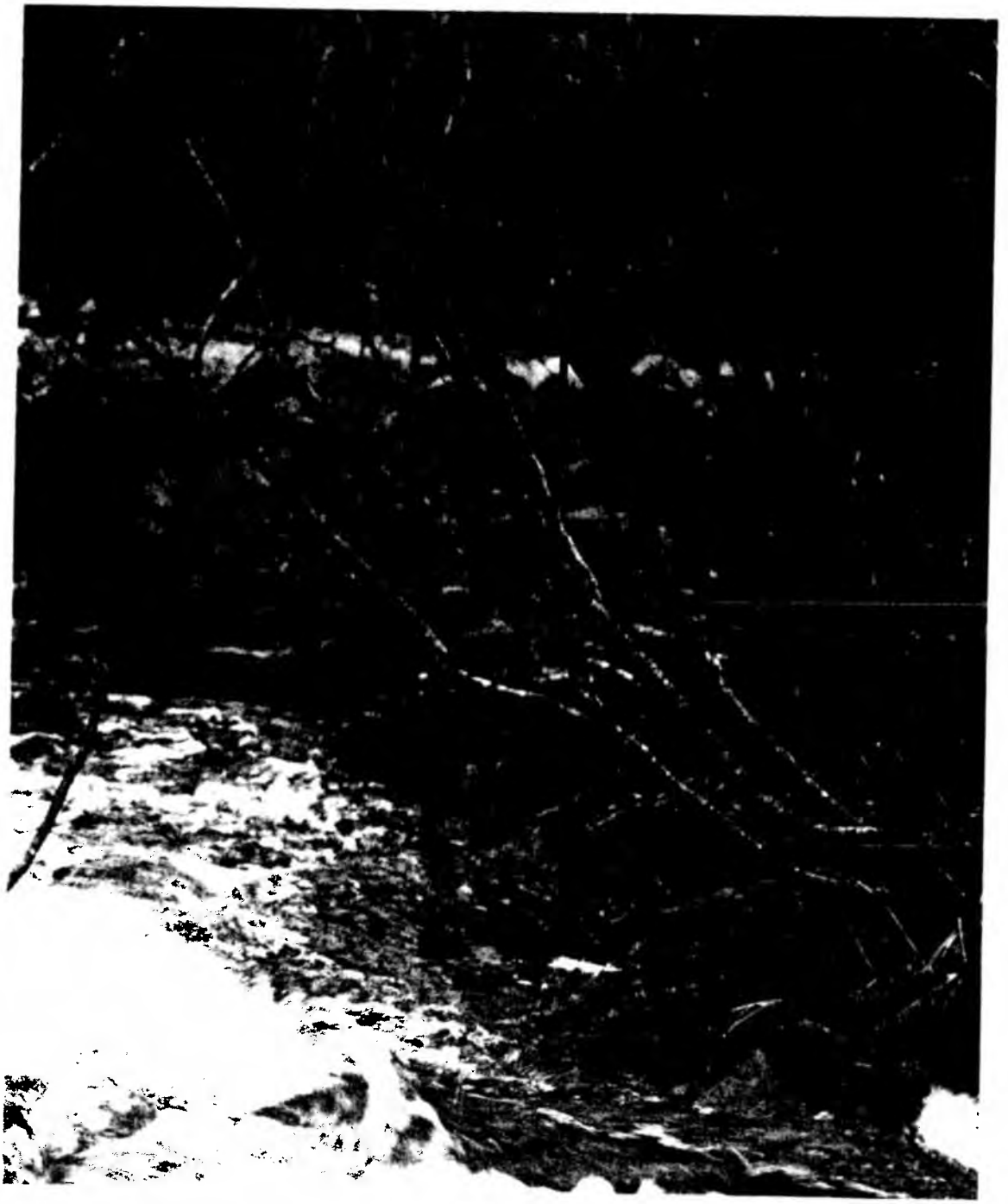


Schedule "M"

# COOPERATION AGREEMENT FOR FORESTRY DEVELOPMENT 1991-1995



nadâ

Nova Scotia

Appendix M

# woodlot roads
# stream crossings

Glen C. Brathwaite, P. Eng.
1992

Canada

Nova Scotia

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*Illustrations:*
Gerald Gloade

# Index

# Introduction

Road construction has a major impact on soils, drainage and the forest ecosystem. The construction of roads, not wood harvesting, has proven to be the major cause of soil erosion and stream siltation in forest operations. Research has shown that much of the siltation in streams is the result of poorly selected and installed stream crossings. Siltation can ruin fish habitat and water quality, and measures must be taken to prevent it.

Forest Management programs are being used to guarantee an adequate supply of wood fibre in future years. These programs have resulted in the increase of road construction activities on woodlots. Good construction practices must be followed to reduce the negative impact associated with stream crossing installations on these roads.

This booklet will assist woodlot owners and operators by addressing the problems that may be encountered with stream crossings and recommending solutions. It describes selecting, locating and constructing stream crossings to help eliminate siltation. This will help ensure the protection of fish habitat and water quality in forest streams.

# 1.0 Selecting A Site

A stream crossing may be a culvert or a bridge. A culvert is an enclosed channel serving as a continuation of, and a substitute for, an open channel where that channel meets an artificial barrier (e.g., road embankment). In contrast, a bridge serves as a part of the road and is a definite link in a roadway surface. (Fig. 1)

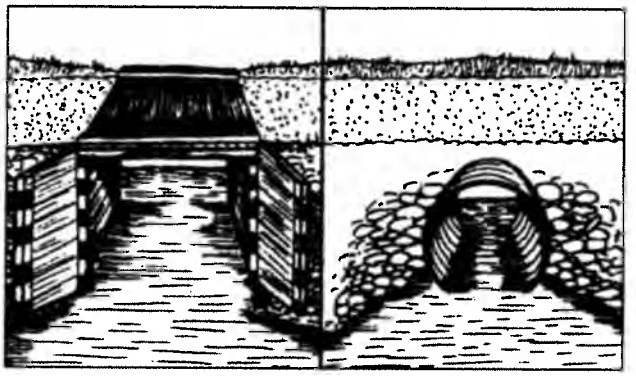


Fig. 1 Bridge Culvert

A stream is continually changing its channel, straightening or bending, scouring itself deeper, or depositing silt.

Because the crossing is a fixed link in a stream which can and often will change its location, good engineering is needed. In Nova Scotia, approval is required from the Department of the Environment before a stream crossing can be built. Engineering input at the planning stage will help in obtaining this approval.

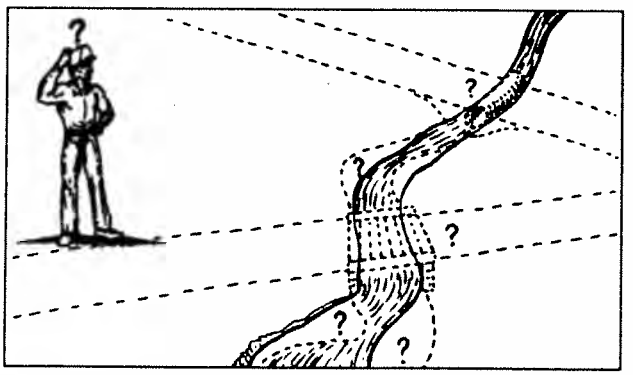



Fig. 2 Selecting a streram crossing requires good engineering.

## 1.1 Principles of Location

**The first principle of locating a stream crossing is to provide a direct entrance and exit for water flow. Any abrupt change in the direction of water flow before or after the crossing may cause damage and create an opportunity for future washout and siltation.**

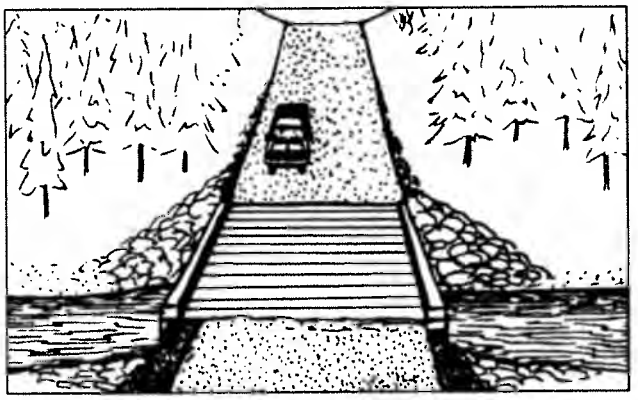


Fig. 3 Stream should enter and exit in a straight line.

**The second principle is to prevent the stream from changing course immediately before it enters or immediately after it exits the structure. Otherwise, the structure may become inadequate, causing excessive scouring or ponding which can result in damage to, or washout of the structure. Such damage means expensive maintenance or replacement costs, not to mention the accompanying siltation.**

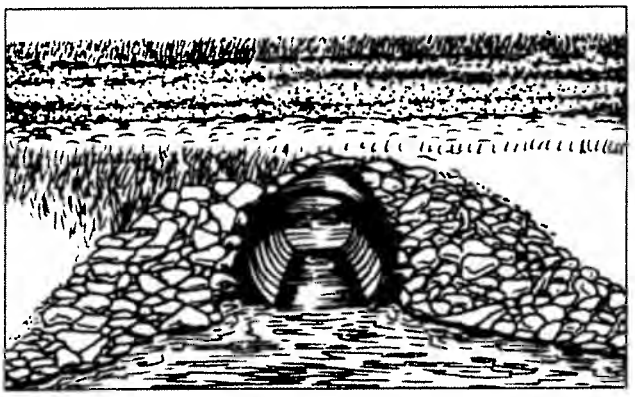


Fig. 4 Entrance and exit must be protected against erosion.

Other factors to consider when selecting a stream crossing are: type of structure, area and shape of stream, grade of stream channel, and treatment of inlet and outlet of the structure.

## 1.2 Characteristics of a Good Crossing

The factors that make a good crossing should be considered when selecting a possible site:

1. The crossing causes no unnecessary or excessive flooding or erosion damage;
2. The structure allows debris to flow through without any drastic change in water flow pattern above or below the structure;
3. The structure should be designed to handle storm runoff increases that could result from land clearing, land development or other change in land use;
4. The structure should be built economically, but large enough to handle peak runoff, structurally sound, and easy to maintain;
5. The outlet should be protected to prevent undermining or washout;
6. Connecting structures at the inlet and outlet should properly handle water, bed load, and floating debris at all stages of flow;
7. The structure must be positioned to allow easy entrance and a fast get-away of water flow;
8. The structure should be installed to function properly after the embankment has settled;
9. Where necessary, entrance structures should be used to screen out materials which will cause blockage and reduce water handling capacity of the structure.

**The preferred type of stream crossing structures are bridges and box culverts. They allow stream velocity to remain undisturbed and reduce the risk of obstruction caused by beavers. Round culverts result in increased water velocity that restrict fish passage through the structure and cause scouring at the outlet.**

## 1.3 Using Aerial Photographs & Maps

Various types of aerial photography and maps can be used to investigate sites for stream crossings. The most popular aerial photography available in Nova Scotia is the Vertical Colour Forest Resource Photography, flown at a scale of 1:10,000 and used primarily for forest inventory purposes.

Fig. 5 Stereo-pairs viewed with the aid of a stereoscope.

The photography is flown along planned flight lines to give a 60 per cent overlap of successive photographs and a 15 per cent overlap between adjacent flight lines. When two adjoining photographs are viewed with the aid of a stereoscope, a three dimensional model of the area can be seen.

**The Photo Model allows the viewer to study large land areas.** Topography, drainage pattern, vegetation, soil types and terrain can be examined and tentative stream crossing sites selected for more detailed studies and final selection in the field.

A number of maps are available for preliminary selection of stream crossings. For determining and calculating drainage areas the 1:50,000 National Topographic Series (NTS) maps are useful. Another very useful map is the Orthophoto Series Maps at a scale of 1:10,000 (Fig. 6). The Orthophoto Maps are made from aerial photographs corrected for distortion and scale.

ig. 6 Orthophoto Map.

## 1.4 Alignment

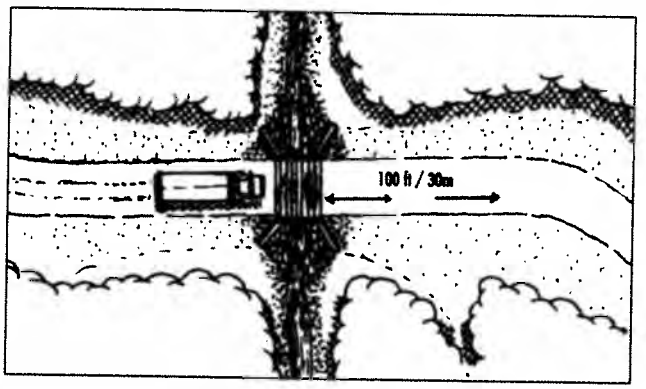



Fig. 7 Stream alignment.

**Choose a site where the stream bed is straight and narrow.** Such sites indicate the stream is stable and will offer the best chances of a solid base. Avoid selecting a site on or near a meander. Meanders indicate the stream bed is shifting and possibly soft based.

A recommended 100 feet (30 m) straight road approach should be provided on either side of a bridge. This makes it easier for tractor trailers to navigate the structure.

## 1.5 Grade

When locating and installing pipe culverts, the natural grade or slope of the stream must be maintained.

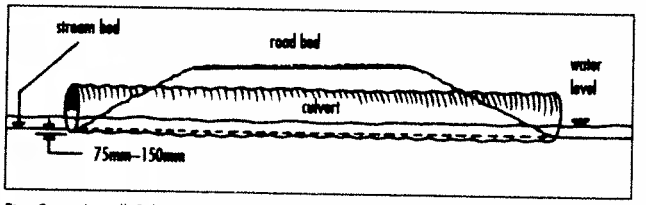



Fig. 8 Install Culvert 75 mm to 150 mm below the stream bed.

Setting the pipe 3 to 6 inches (75 mm to 150 mm) into the stream bed (Fig. 8) will maintain enough water in the bottom of the pipe at low flow to allow fish movement. Setting the pipe too low can cause it to become partially blocked with sediment. Setting too high can cause ponding. Avoid using pipes larger than 48 inches (1200 mm) in diameter. They are more difficult to install, and stream bed scouring and bank erosion is more likely. When using pipes greater than 48 inches (1200 mm), install them properly protecting against erosion and scouring. (Section 5.0)

# 2.0 Rainfall Runoff

Precipitation in its various forms – rain, snow, sleet or hail, is recorded as rainfall. Very intense rainfall usually occurs during storms and can result in property damage.

## 2.1 Hydrologic Cycle

Water is evaporated into the atmosphere and is transported over land where it condenses and falls as rain. Some of this rain is absorbed into the soil, some is intercepted by plants and animals, and some evaporates into the atmosphere. The remainder collects and flows along the earth's surface as runoff. Runoff flows into streams and rivers and will eventually find its way to lakes and oceans where it again evaporates into the atmosphere. This cycle (Fig. 9) known as the "Hydrologic Cycle" is repeated time after time.

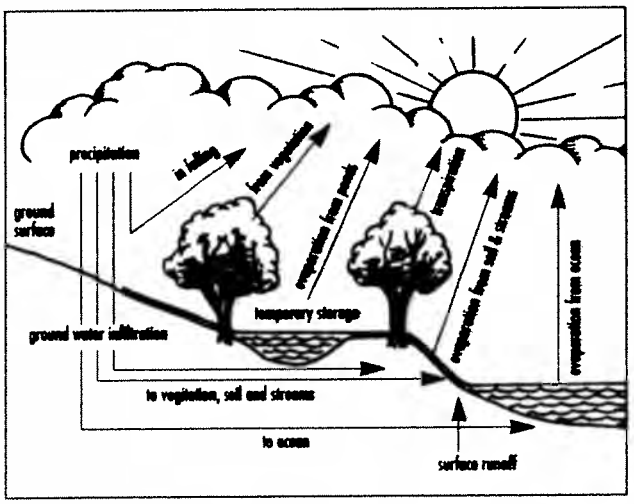



Fig. 9 The Hydrologic Cycle.

The quantity of water in the hydrologic cycle is nearly constant. Abnormally low precipitation in one area of the world is offset somewhere else by above normal precipitation. Rainfall is influenced by climate, soil and topography in an infinite variety of ways.

## 2.2 Peak Flow

**Runoff occurs when water saturates the ground surface and exceeds the rate of evaporation.**

Peak flow or maximum runoff usually occurs during the spring when melting snow creates saturated soil conditions and some runoff prior to a heavy rainfall. Records also show peak flow occurring in other seasons, the result of large rainfalls.

Peak flow can be increased by activities such as clearcutting, soil compaction by heavy equipment, land development and the creation of impermeable areas such as parking lots and buildings, and by filling depressions when land is cleared and levelled for development or agricultural purposes.

## 2.3 Estimating Peak Flow

A number of factors must be considered before an estimate of real storm runoff can be made.
(a) size of watershed
(b) slope of watershed
(c) type of vegetation
(d) type of soils
(e) intensity of rainfall
(f) number & size of natural reservoirs (lakes, swamps, etc.)

**(a) Size of Watershed:** The affective area contributing to the flood peak is the watershed area. This will be the land area draining to the crossing structure, and can be determined from a contour map. The area may be outlined by drawing a line along the height of land upstream from the crossing, and ending at the crossing, as shown in Fig. 10.

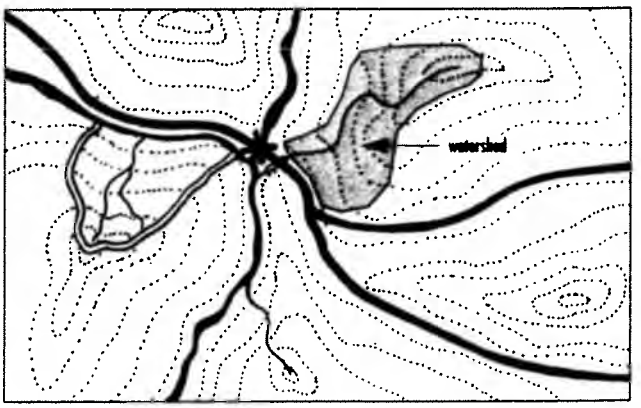



Fig. 10 Watershed Area

**(b) Slope of Watershed:** The average slope of the land within the watershed and the slope of the stream may be determined from a topographical map of the watershed. Storm runoff along steep slopes contributes a larger volume more quickly to the peak flow.

**(c) Vegetation:** Vegetation will intercept rainfall and increase evaporation. The roots of plants increase the porosity of the soil and obstruct the flow of runoff. Vegetation or ground cover will reduce the amount of runoff and in turn reduce the peak flow.

**(d) Type of Soils:** Some rainfall flows along the surface of the earth and some soaks into the soil. Impermeable soils will allow little or no infiltration. Runoff will therefore be higher on silts and clays and in soils where bedrock is exposed or covered with a thin layer of soil.

**(e) Intensity of Rainfall:** A long continuous storm of moderately heavy intensity over a large area may cause greater runoff than a more intense storm for a short period over only a portion of the drainage area. Intensity defines the quantity of the rainfall over time. *See Appendix "A".*

**(f) Number & Size of Natural Reservoirs:** Lakes, swamps and depressions in the watershed act as buffers and control the peak storm runoff. Some depressions don't allow drainage away from them and will reduce the quantity of runoff reaching the stream channel. Large lakes and swamps provide a large surface area for evaporation and runoff entering them can be evaporated before flowing into the stream and river system.

There are generally three methods of determining peak runoff for watershed areas:

1. Inspecting the high water mark in existing structures and along stream banks.

2. Runoff calculations relating drainage, area and the size of stream crossing.

3. Making and collecting actual flow measurements over a period of years.

Contact the local Department of Natural Resources office for help in sizing the crossing.

# 3.0 Bridge or Culvert

In most cases, the size of the stream will dictate the selection of the structure. Some other factors which influence the selection are environmental considerations, the passage of fish through the structure, beaver damage, and possible property damage caused by upstream flooding.

Environmental factors and fish passage encourages the choice of a bridge or box culvert installation. These structures cause less environmental damage both during and after construction.

In some situations the physical characteristics of a crossing make it more economical to install a pipe culvert. In these cases, precautions should be taken to reduce environmental damage and provide good fish passage. (Fig. 11)

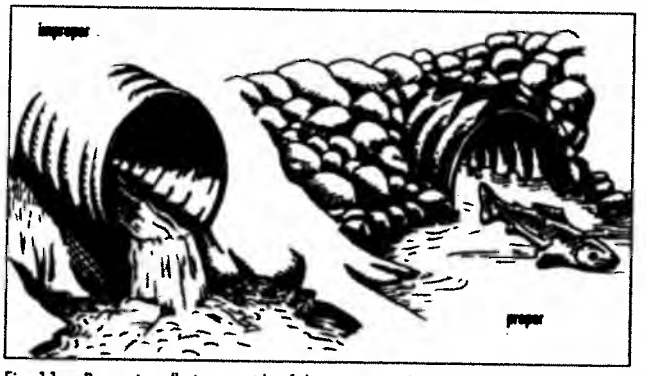


Fig. 11 Proper installation provides fish passage and reduces environmental damage.

## 3.1 Size of Opening

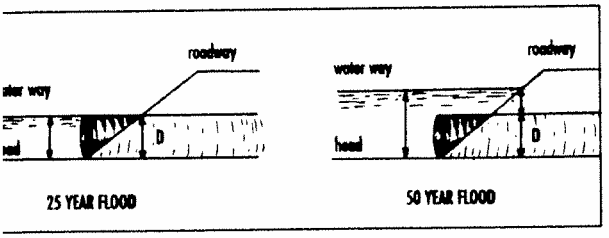
When sizing a stream crossing structure, factors such as ponding, sedimentation, debris and variable stream conditions must be considered if the structure is expected to function properly.

For woodland management roads, design of culverts should be based on a 25-year flood, where the flood water will rise a full culvert diameter at the entrance, and a 50-year flood using available head above the entrance (Fig. 12). This design would give a risk of two per cent for a storm exceeding the culvert capacity in any one year.

e will be established by the volume of water to be passed ough the culvert. The required opening can be calculated ng hydraulic formulae. A good rule of thumb is to allow a e square foot opening for every 10 cubic feet per second FS) (0.3 $m^3$/sec) of runoff.

**ılverts for woodlot roads may be designed discharge:**

**)A 25-year flood without static head at the entrance.**
**)A 50-year flood utilizing the available head at the entrance; the head is a maximum of 1.5 diameters of the culvert used.**




. 12 Criteria for Balanced Design

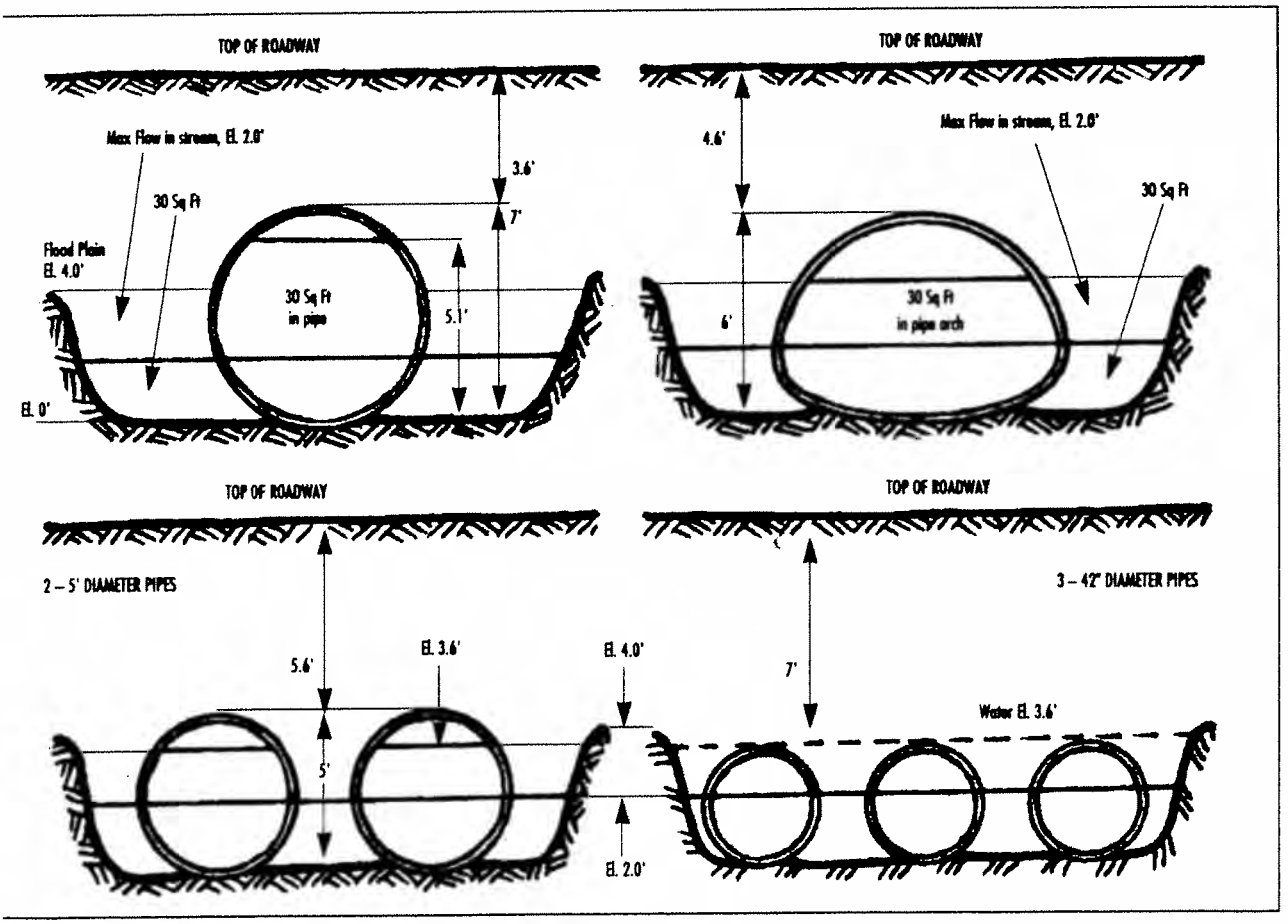
## 3.2 Choice of Structure

The choice of stream crossing structures should be based on the size of the stream (Quantity of Flow) and site conditions.

Normally, pipe culverts may be used for stream crossings requiring a pipe diameter of 48 inches (1200 cm) or less. For larger sizes, it is usually more economical to use a box culvert or timber bridge. Bridges are normally used for streams that are wider than 8 feet (2.4 m).

Special site conditions can make it more feasible to use large pipes. Technical assistance should be obtained for installing these, otherwise serious damage may occur.

Flood damage may result if water is forced to pond behind a culvert. This problem is critical in areas where the upstream elevation changes very little over a long distance. Forcing water to pond 2 or 3 feet (0.6 or 1 m) above the normal flood height can cause extensive flooding and property damage over a large area. In such cases a multiple pipe installation could be used to provide the required cross-section area or a bridge may be necessary. Figure 13 shows how pipe arches or multiple pipes may be used to reduce flood height.




. 13 Pipe arch or multiple pipes used to reduce flood height.

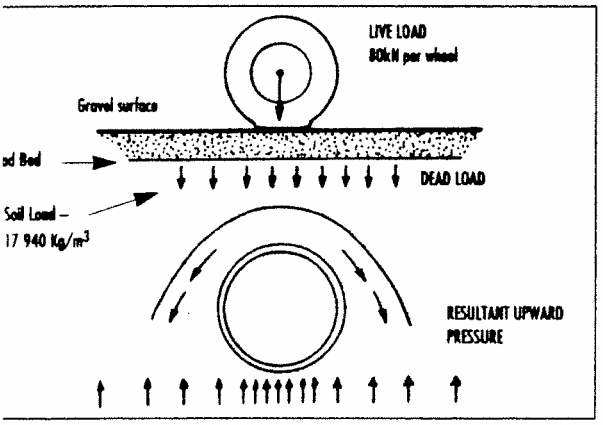
# .0 Flexible Pipe Culverts

ılverts are made from a variety of materials and are ıilable in many shapes and sizes. Since the culvert is engineering structure, choose a design of the correct ckness and strength so the pipe will function properly der normal use.

ıere are basically two types of pipe culverts in use: solid and xible. The flexible pipe is corrugated and used extensively.

## 1 Soil Arch

ɔrrugated pipes are a flexible design and when placed in an ıbankment, are able to transfer a portion of their loading to : surrounding soil embankment (Fig. 14). The soil will ry as much as 40 per cent of the pipe loading. **Soil around ɔipe culvert should be well graded, pit-run granular il and should be compacted around the pipe.** ***See ɣpendix "B".***




14 Soil-Arch, load partially carried by surrounding soil.

# 5.0 Culvert Installation (Flexible Pipe)

The pipe culvert is designed to flex under load, and to build up side support in the surrounding soil backfill. The pipe culvert depends on the selection, placement and compaction of soil backfill and will determine how evenly load pressures are distributed. Section 8.0 explains the environmental protection required when installing a culvert.

## 5.1 Foundation

**For best performance and service life, the culvert must be installed on foundation material that will evenly distribute the load to the sub-soil.** The foundation must maintain grade and elevation of the culvert and prevent excessive stresses in the pipe structure due to localized concentration of pressures. Avoid having large rocks or boulders placed next to or under the pipe culvert.

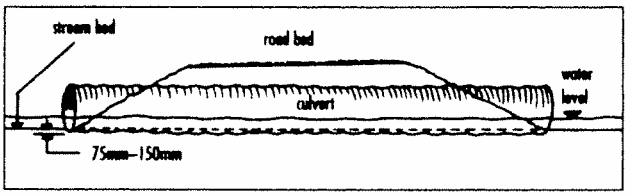



Fig. 15 Match culvert to stream grade.

The foundation material should be investigated prior to culvert installation. Muck, muskeg, peat, bedrock and rock ledge provide poor support for a culvert, and must be removed and replaced with suitable material. Avoid excessive excavation in these soil conditions whenever possible.

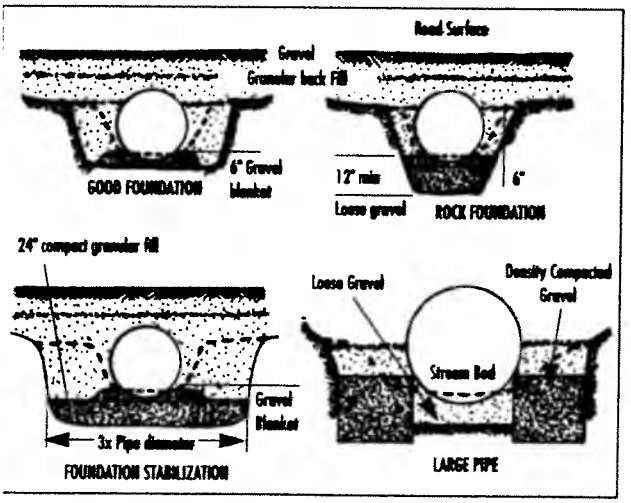
The type of foundation soil can be determined by inserting a metal rod or bar into the foundation (Fig. 16). The resistance to penetration will provide a good basis for assessing the soil conditions. A more accurate method will involve soil testing.

Fig. 16 Use a rod to assess foundation conditions.

## 5.2 Bedding

A bedding blanket of loose gravel should be used to provide uniform and continuous support for a culvert. A relatively thin mat, 6 to 12 inches (15 - 30 cm) thick, of well graded loose granular material will provide satisfactory support. In soft foundation material it may be necessary to use 24 inches (60 cm) or more of bedding to provide uniform support. **In-stream work should be done in the dry with the aid of a coffer dam and a diversion ditch. Refer to Section 8.0 before installing.**

In non-uniform or poor bearing foundation material, remove the foundation material and replace it with granular fill. The excavation should be at least three times the diameter (3xD) of the culvert in width. The depth of the excavation will depend on the bearing capacity of the soil in the foundation. The excavation can vary from a depth of 12 inches (30 cm) minimum, to 0.75xD in rocks or unyielding foundation, and 24 inches (61 cm) in soft foundation. In soft foundations, the excavation should be deep enough to equalize the upward pressure in the soil and the downward pressure of the backfill, culvert and road embankment above. A separation material such as a brush mat or geotextile fabric should be used over the foundation material before the granular bedding is placed on soft foundation, especially where high ground water is present. Fig. 17 shows how various foundation conditions are handled.




ig. 17 Bedding on foundation material.

## 5.3 Camber

After construction, a roadbed will go through a period of settlement. Pipe culverts installed in the embankment will settle along with the embankment material. Because of the larger volume of fill near the center line of the embankment, settlement will be greater at the center of the roadbed.

Culverts installed improperly along a flat grade will sag at the middle. The sag will often collect sediment or retain water reducing the flow capacity of the pipe. **All culverts, especially those at stream crossings, should be cambered slightly during installation.** Cambering (Fig. 19) raises the pipe slightly at the middle without restricting flow. This is achieved by placing the bedding blanket for the upstream half of the pipe on a flat grade, and the downstream half on a slightly steeper than normal grade. The pipe will settle to the desired slope after the embankment has consolidated.

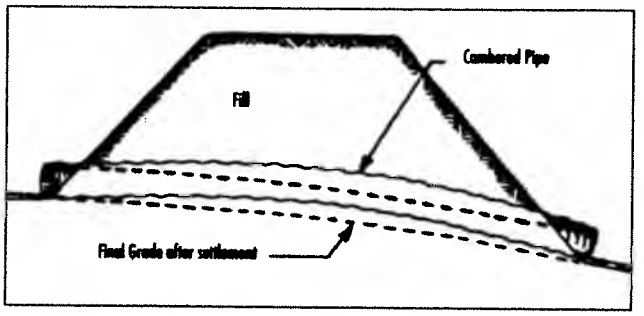



Fig. 18 Camber pipe under fill.

The amount of camber is based on soil conditions of the fill and foundation material. Some materials will settle more than others. The amount of camber should be determined for each site. A good rule-of-thumb is to provide a camber equivalent to 1 per cent of the pipe length. This estimate will usually be adequate in fair to good mineral soil.

For example, if a pipe culvert is 30 feet (9 m) long, the camber should be 30 x (1/100) = 0.3 feet or about 4 inches (10 cm). This applies to installations in good road building material.

## 5.4 Pipe Length

Length of the pipe for a culvert depends on roadbed width, height of road embankment and skew angle, the angle between the road and stream alignment. See Fig. 19.

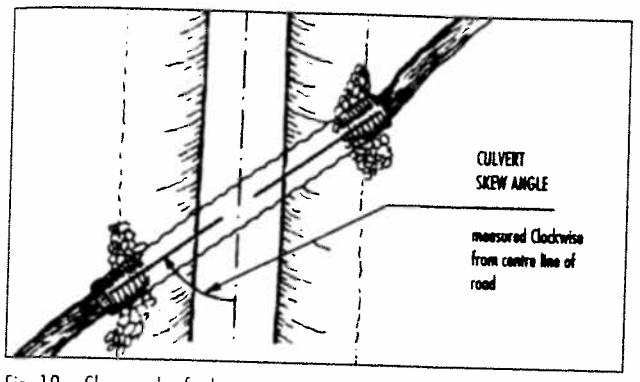
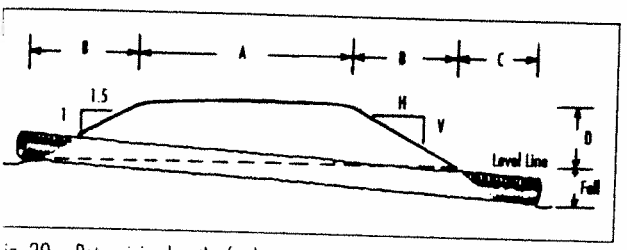



Fig. 19 Skew angle of culvert.

To ensure the end of the culvert protrudes from the embankment, 12 inches (30 cm) should be added to the calculated length. This is included in the following formula.




ig. 20 Determining length of culvert.

The length of culvert, L required as shown in Figure 21, is

**= A + 2B + C + 1 (feet)**

here L = Length of Culvert (feet)
A = Road Width, feet
B = (Side slope ratio) x (fill depth, D)
C = (Side slope ratio) x (fall, E)
D = Depth of fill in embankment at centerline of roadway
E = Fall or (Stream Gradient x (A + 2B))

***ample:*** Find length of culvert required for stream crossing ere road width is 15 feet, fill depth is 4 feet, side slope is 1/2:1 and stream grade is 4 per cent.

:15 ft.; B=1.5 x 4 = 6 ft.; C=1.5 x 0.04 x (15+12)=1.62 ft.

:n, L = A + 2B + C + 1
= 15 + (2x6) + 1.62+1 = 29.62 ft.
The culvert should be 30 feet in length.

The length of the culvert can first be determined as for installation normal to road. The skew angle is then applied to the normal length to determine the skew length.

A correction must also be made to adjust the length of the pipe, depending on size of the diameter. In this case the length is:

**Ls = Ln x (1/cos ø) + D Tan ø**

Where Ls = Skewed Length
Ln = Normal Length (perpendicular to center line)
ø = Skew Angle
D = Culvert Diameter

**The length of the culvert can be reduced if the ends are rip-rapped or if headwalls are used to protect the ends. (Section 8.5)**

## 5.5 Structural Backfill

Backfill should be well graded material (Appendix "B") capable of supporting load. A well graded pit-run gravel with a diameter less than 2 inches (5 cm) is excellent backfill material. Cohesive type materials such as clays can also be used if careful attention is given to compaction. Very fine granular materials, such as sand and silts should be avoided. Fine material may filter into the pipe, especially where ground water is high. Also, water can filter through these fine materials and flow along the length of the pipe causing the movement of these materials, resulting in washouts.

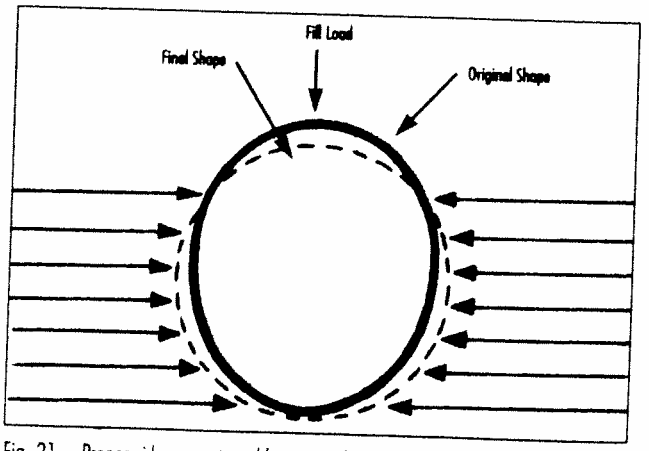



Fig. 21 Proper side support enables pipe culvert to carry load.

## 5.5.1 Placing Backfill

Place backfill equally on either side of the culvert. The fill should also extend at least one diameter from the face of the culvert. Material should be spread evenly in layers, 6 to 9 inches (15-23 cm) in thickness and compacted lightly, as shown in Fig. 22. Uniform compaction is essential to ensure equal distribution of pressures between culvert and soil. Place backfill in this manner until the culvert is covered. Continue placing backfill in layers and compact to road grade. Never push material under the pipe and raise it above the stream grade when starting placement of the backfill.

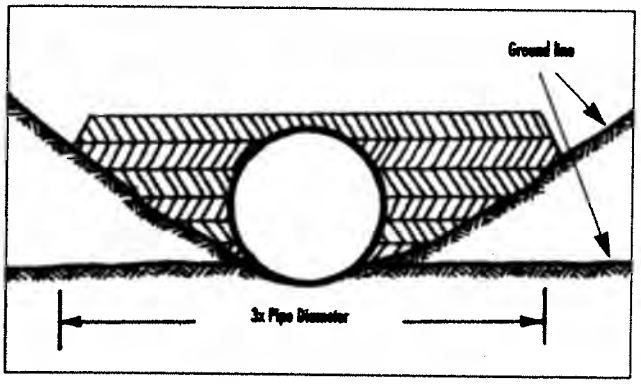



Fig. 22 Uniformly placed backfill around culvert.

**Take special care to tamp backfill along the haunches (Fig. 23), the crevices formed where the pipe meets the bedding.** The greatest stresses in a pipe arch are set up along the haunches.

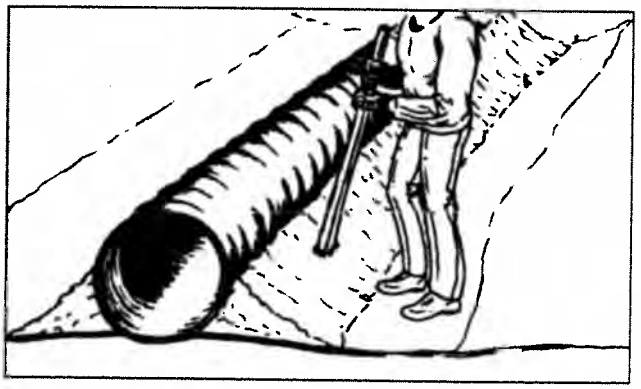


Fig. 23 Tamping under pipe haunches.

For Pipe Arches, first cover entirely with an envelope of backfill at the middle of the pipe. Placed and compacted in layers, this material will maintain the shape of the Pipe Arch and will prevent the tendency of the arch to "peak up", see Fig. 24.

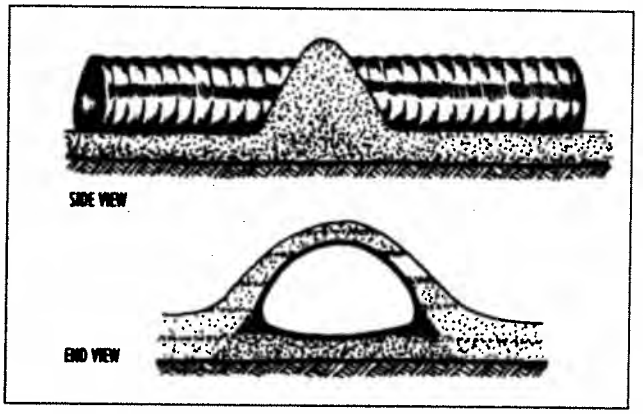



Fig. 24 Backfilling Pipe Arch.

Then place fill from the top of the arch and extend it towards each end of the culvert. Place fill evenly to ensure equal distribution on both sides of the pipe. Spread fill in layers and compact as before. The fill will help the pipe to retain its shape.

## 5.6 Compaction

Purchasing mechanical tamping equipment is very costly and although rental is possible, mechanical tampers may be inconvenient for site conditions. In most cases, you can do the tamping required around a culvert with easily made hand tampers. A typical hand tamper can be a simple length of 2x4 inches (38 x 89 cm); which is ideal for tamping the haunches of culverts. Hand tampers for horizontal layers should have a tamping face no greater than 6 x 6 inches (15 x 15 cm) and should weigh about 20 lbs. (9 kg).

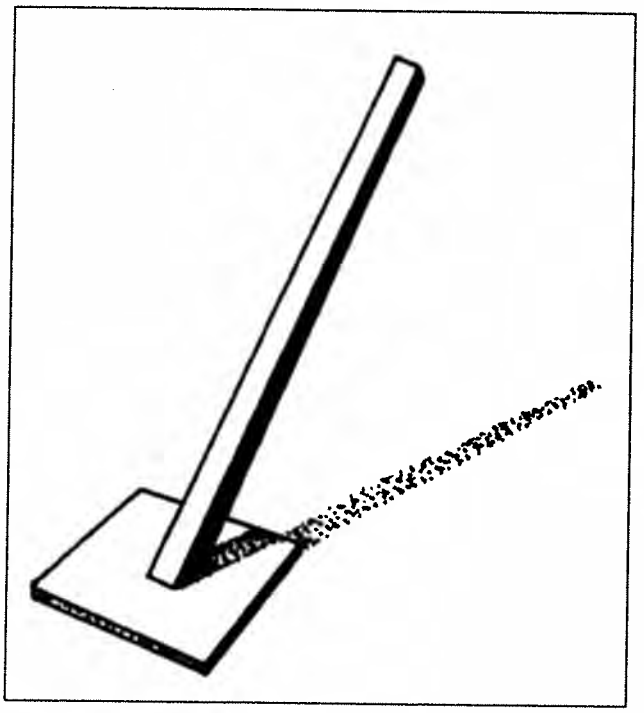


Fig. 25 Hand Tamper for compacting horizontal layers.

When mechanical tampers are used, ensure there is even compaction over the entire area. Working too near the structure should be avoided, since the tamper could damage the structure or cause the pipe to shift, lift or peak up.

When using rollers, compact the fill adjacent to the structure with a hand tamper and operate the rollers parallel to the pipe. A vibrating roller should be kept well away from the pipe.

## 5.7 Structural Protection

Construction equipment moving over a newly installed culvert of a new road can easily damage the culvert. The road embankment is not well compacted and settlement may not be complete enough to prevent equipment from punching through the road bed.

To prevent damage, add at least 2 feet (61 cm) of fill over culverts before construction equipment is allowed to travel over them. Failure to take this precaution will result in culverts being crushed or partially damaged. Replacement will be required after only a few years use.

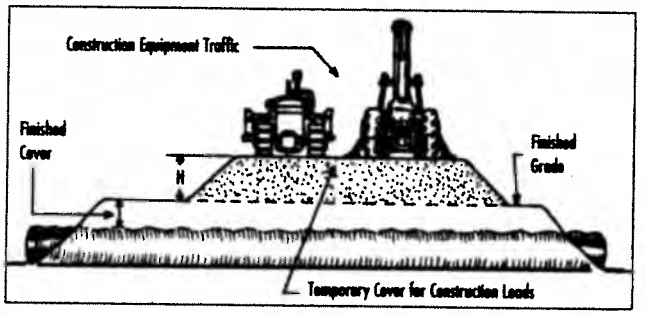



Fig. 26 Culvert Protection

## 5.8 Multiple Culverts

You may need to install more than one culvert in parallel at a stream crossing. Upstream flooding may limit the height of ponding water behind the culvert. The selection and installation of multiple pipes should be made carefully as there is greater risk of washouts. (If possible install a bridge or box culvert.)

Set the culverts at least 3 feet (1 m) apart to allow for good compaction between the pipes. Compaction is important in preventing washout. Set one culvert with its grade lower than the others to allow flow to concentrate in that pipe at low water flow. (Fig. 27) This will ensure ease of fish passage through the pipe. The embankment should be well protected with rip-rap to prevent erosion and possible washout. Rip-rap should also be used to protect the stream bed from scouring. (Table 8.1)

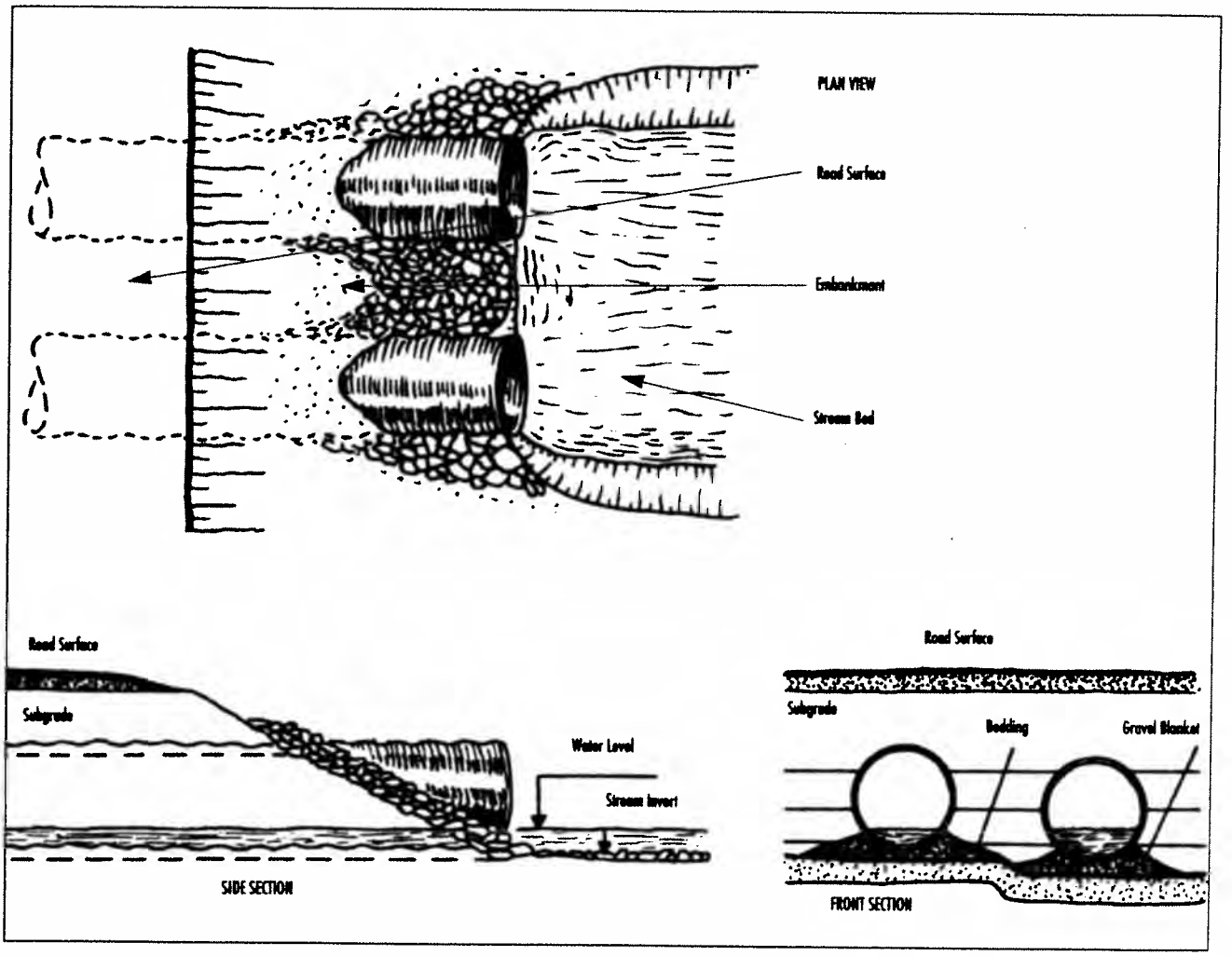



Fig. 28 Multiple Culvert Installation

# 6.0 Bridges and Box Culverts

Materials frequently used in the construction of bridges and box culverts are timber, steel, concrete or a combination thereof.

The design of bridges and box culverts is governed by codes which are meant to protect the public. The design must provide for a safe, reliable structure which is practical and economical to construct and maintain over its anticipated life span.

## 6.1 Design Code

The code in use by the Department of Natural Resources in Nova Scotia is the National Standards of Canada Code CAN/CSA-S6-88, Design of Highway Bridges. This code, prepared by the Canadian Standards Association, provides structural engineering guidelines for the design of bridges and other similar structures in timber, concrete and steel.

## 6.2 Loading

Bridge structures must be designed for all loads and load effects that they may be expected to carry. These loads and load effects may include:
(a) Dead Loads
(b) Live Loads
(c) Other Loads and Load Effects

**(a) Dead loads** refer to the permanent loading caused by the weight of the structure itself and all permanent attachments, such as the deck, stringers, and other parts.

**(b) Live loads** consist of the applied moving load due to vehicles and pedestrians. In the case of forest road bridges, the live load will be a tractor-trailer loaded with wood fibre.

**(c) Other loads and load effects** result from wind, ice, snow, earthquakes, temperature change, and settlement. The Design Code specifies how loads and load effects are to be considered in the design of the bridge structure.

## 6.3 Stringer Size

The size of bridge stringers varies with the length of span. The dead load of the bridge deck and stringers and all applied loads and load effects cause stresses in the stringers. The stringer must be strong enough to resist these stresses which are expressed as:
(a) Bending
(b) Shear
(c) Bearing and
(d) Buckling

### 6.3.1 Bending

When the deck of a bridge is loaded, the stringers will bend under the load causing stress in the stringer material. If the unit stress exceeds the unit stress resistance of the material, the stringers will break, resulting in the collapse of the bridge.

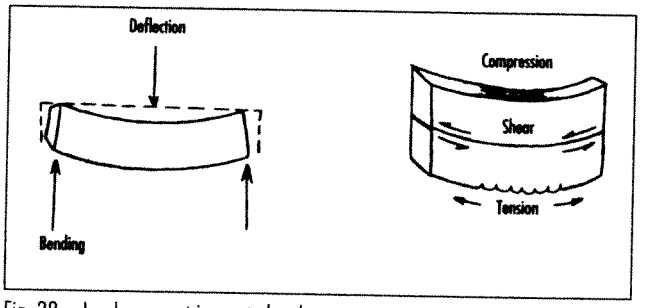



Fig. 28 Load causes stringers to bend.

Timber is often used in bridge construction for woodlot roads. All timber used in bridge construction must be visually stress graded in conformation with the National Lumber Grading Association (NLGA) Standard Grading Rules for Canadian Lumber. The allowable stresses will change with species or species group and with the specific grade of lumber. Substitution of species, species group or grade must be done only at the instruction of the design engineer.

### 6.3.2 Shear

A farmer when mowing hay is often stopped when a rock caught in the mower causes the shear-pin to break. On inspection, the pin appears to be sliced through by a knife. This happens when the shaft driving the mower is suddenly stopped, and the fly-wheel providing the power continues to move. The external forces acting on the pin at the plane of failure is called shear.

Similar forces are set up in the bridge stringers when a load is moved across its deck (see Fig. 29). The stringer must be strong enough to resist the shear at its supports.

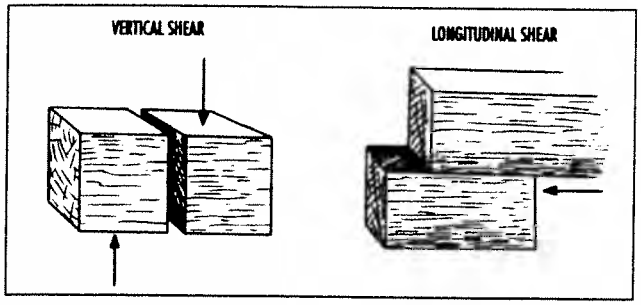



Fig. 29 Shear at plane segment.

### 6.3.3 Bearing

The contact area between the stringer and the abutment is called the loaded or bearing area. There is also a bearing area between the abutment and the soil. A stringer must not be crushable under the applied load.

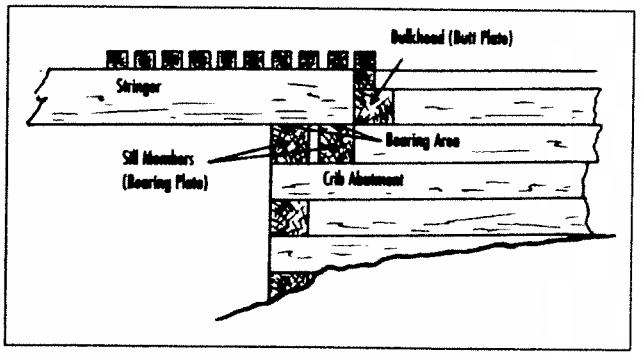



Fig. 30 Bearing area of stringer.

### 6.3.4 Buckling

When the depth of a beam exceeds its breadth, lateral supports are required at the points of bearing to prevent torsional rotation. If a stringer is very long, it may require lateral support at a number of points along its length to prevent rotation.

## 6.4 Abutment & Wing Walls

The abutments are designed to support the load of the structure plus all superimposed loads, including live load. The design must also consider resistance to overturning and sliding, and forces caused by ice floes, earthquake and hydrostatic pressure.

## 6.5 Deck

**The deck must be rigid enough to distribute the weight of the vehicle and its load to all stringers. Each deck timber must be able to carry the total weight of a loaded truck wheel.**

Woodlot road bridge decks are usually one lane width, 14 to 16 feet (4.3-4.8 m). Under normal conditions, deck timbers are 4 inches (100 mm) thick. Wheel runs are placed on the deck to protect the deck timbers from wear. Wheel runs also help distribute the truck load over the entire deck.

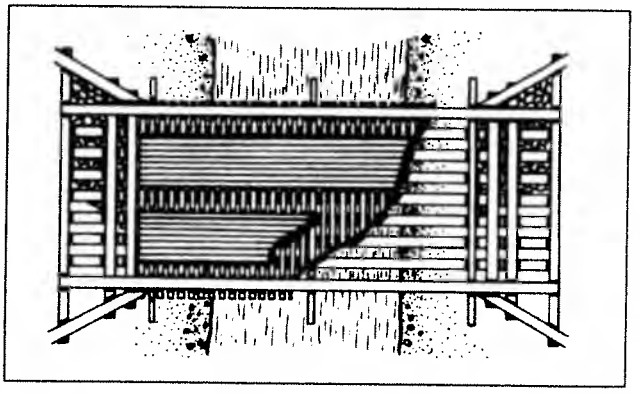


Fig. 31 Bridge Deck., Plan view

# 7.0 Bridge And Box Culvert Installation

Bridges and box culverts require careful installation according to the designer's specifications. Failure to adhere to guidelines can nullify the safety and versatility of the design.

Box culverts are generally used on streams that would require round culverts with diameter over 48 inches (1200 mm). The equivalent timber structure is often cheaper to install than large diameter round culverts.

Timber bridges are the popular choice for woodlot roads, and are used for spans 10 feet (3 m) and larger. Timber has been used for spans of 45 feet (14 m), but the cost of installation rises with span length because of increased stringer cost. Refer to Section 8.0 before starting installation.

## 7.1 Alignment and Grade

Since a bridge deck is part of the roadway, proper alignment and grade between the bridge and road approaches is necessary. Although it is best to have a road alignment intersect a stream at right angles, the roadway may intersect the stream at a skew angle. In either case, the bridge abutments must be aligned parallel to the stream banks. This may result in the abutments being staggered to match the road alignment.

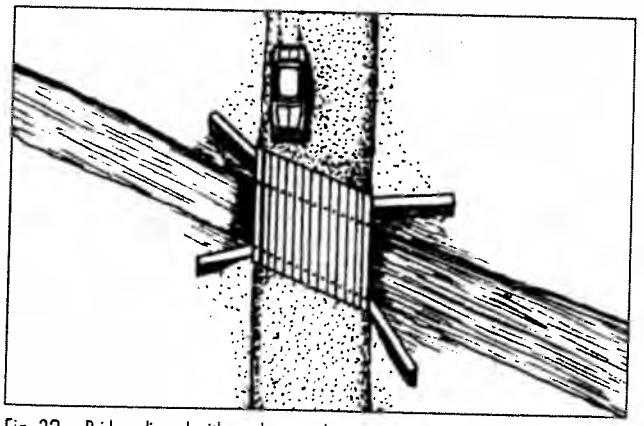


Fig. 32 Bridge aligned with roadway and stream.

A straight approach of 100 feet (30 m) minimum on either side of the bridge is recommended. This will allow vehicles, especially tractor trailers, to approach the bridge in a straight line.

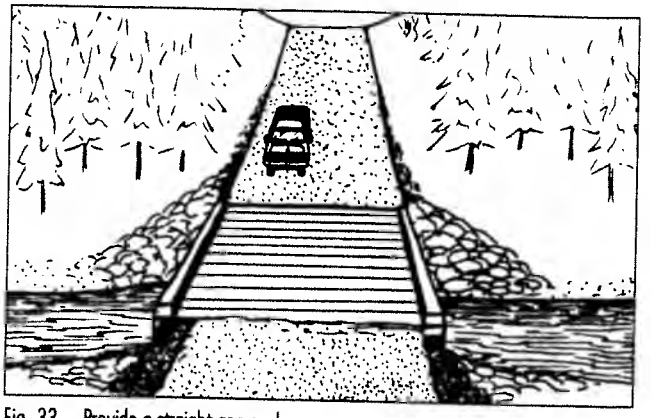


Fig. 33 Provide a straight approach.

**Where possible, the grade of the bridge should be higher than the road grade. This allows flood water to cross the road under extreme flood conditions, rather than cause damage to the bridge.**

## 7.2 Foundation

Foundation material must provide good support for the bridge abutments. In poor soil conditions, it may be necessary to increase the base area of the abutments to reduce the unit load on the foundation material. In very soft conditions, especially in areas where the ground water is high, poor foundation material can be excavated to a depth of 24 to 36 inches (60 - 90 cm) and be replaced with well graded pit run gravel or rock. Use a separation layer such as geotextile fabric before placing the gravel. Gabion mats can also be used as a base for timber abutments or for the total construction of abutments.

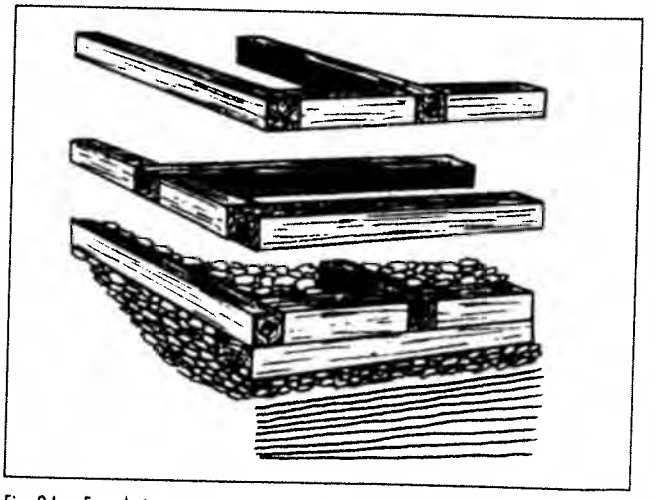


Fig. 34 Foundation

Scour damage or undercutting caused by flood water is the most common damage occurring at a bridge abutment. Where scouring may occur, the abutment should be extended at least 12 inches (30 cm) below the stream bed to provide protection. Wing walls should also start below the stream bed.

Abutments are man-made restrictions, or a bottle neck in a stream bed, that may cause flow velocity to increase and cause soil erosion. Care must, therefore, be taken to protect the stream banks near the structure. The structure will produce eddies next to the embankment which can cause soil erosion. Constructing the abutment behind the natural stream bank will negate this problem.

## 7.3 Bedding

At most abutments excavation will be needed to imbed the abutment in the foundation material below the bottom of the stream bed. To prevent siltation in the stream a coffer dam (Fig. 36 & 42), should be used during excavation. The excavated area should be levelled and a gravel blanket used to provide a level working surface for starting the crib work.

In bedrock, a bed can be made with concrete or timbers to provide a level footing for the crib. A sloping surface can be levelled by cutting and keying the footing into the rock to resist movement.

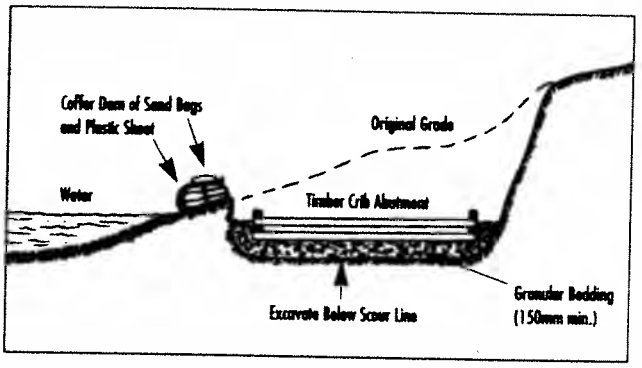



Fig. 35 Bedding and Timber Crib Abutment

## 7.4 Abutments

Abutments support their own weight, their share of the dead load and live load of the bridge, and the horizontal pressure of the earth backfill behind them.

The combined loads on the abutments can cause uplift at the face of the abutments, which will result in instability and possible collapse of the bridge.

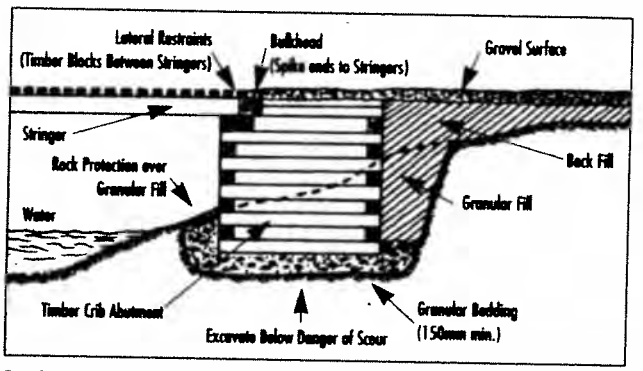



Fig. 36 Typical Timber Crib Abutment

A level footing will provide a good base for the cribs. The cribs are fastened together with drift-pins. After about 3 feet (1 m) of construction the rock backfill is started. This will help to maintain even packing of backfill throughout the construction of the cribs. See Appendix "C".

A sill is constructed at the top of the cribs to support the stringers. A butt plate should also be used to prevent the stringers from sliding over the sills. Sills are normally 18 inches (460 mm) wide, but should be constructed according to the bridge plan.

The crib can either have an open or closed face construction. When an open face is used, the rock backfill should be larger than the open space between the crib timbers. A close face construction should be used where ice floes may damage the abutments.

## 7.5 Stringers

For spans over 30 feet (9 m), the cost of timber stringers increase dramatically so they are used only in special cases. Hemlock, tamarack, and Douglas fir are the preferred species for stringers, but other species such as eastern fir, spruce, Jack pine, lodgepole pine and ponderosa pine can be used.

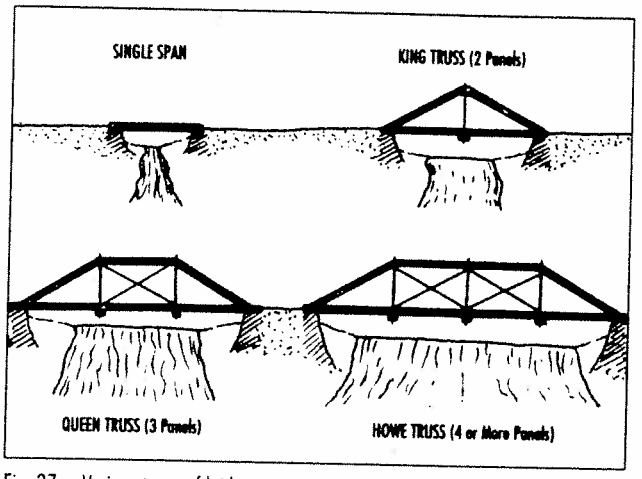



Fig. 37 Various types of bridge construction on woodlot roads.

Stringers should be placed parallel to the center line of the roadway and should extend 18 inches (45 cm) on to the sill plates. The span will be measured along the stringer from abutment face to abutment face, and should not be longer than the specified design length of span. Place diaphragms at the ends of the stringers to prevent rotation about their longitudinal axes. Stringers are equally spaced across the width of the bridge, normally with eight stringers to a 16 foot (5 m) wide timber bridge.

## 7.6 Deck

The deck timbers are equally spaced along the stringers, with equal overhang beyond the outside stringers as shown in Fig. 38. Rough sawn lumber can be used, but should be pressure treated. Deck timbers should be attached to each stringer with galvanized spikes which should extend into the stringers by at least 3 inches (76 mm). Sawn decking less than 4 inches (100 mm) thick is not recommended.

Use wheel runs over the deck timbers to protect the deck from wear and also to assist in distributing the load over the entire deck. Material 3 inches (75 mm) thick is recommended for wheel runs.

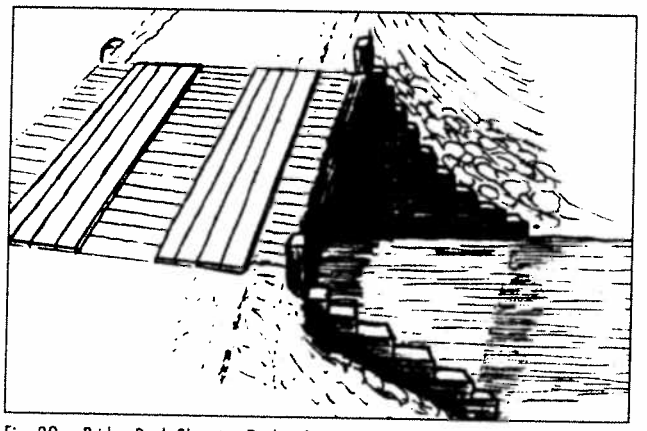


Fig. 38 Bridge Deck Showing Timber Spacing.

## 7.7 Backfill

Abutments should be backfilled with rock. The rock should be larger than the opening between the crib members where an open faced crib is used. For a closed face abutment, smaller rock can be included to fill the spaces between the larger rocks.

**Sand or silt should not be used for backfilling bridge abutments.** Even with a closed face arrangement, water can cause the backfill to be washed out from under the abutment during flood conditions, and cause bridge damage.

# 7.8 Box Culverts

The basic structure of a box culvert is very similar to that of a bridge (see Fig. 39). The sidewalls can be considered abutment faces without the wing walls.

This design provides for tie-backs into the embankment from the side walls, similar to a bridge abutment. The approach to construction should be similar to that for a bridge. Backfill used around the tie-backs should be granular and well packed to provide a counter-balance for the side walls.

In soft foundation conditions, a footing should be provided for the sidewall. In places where scouring is likely, the use of wing-walls is preferred.

Provisions are made for covering the deck with granular backfill. The length of the culvert will depend on the amount of fill cover over the deck. Cautions should be taken against scouring and siltation at the toe of the embankment.

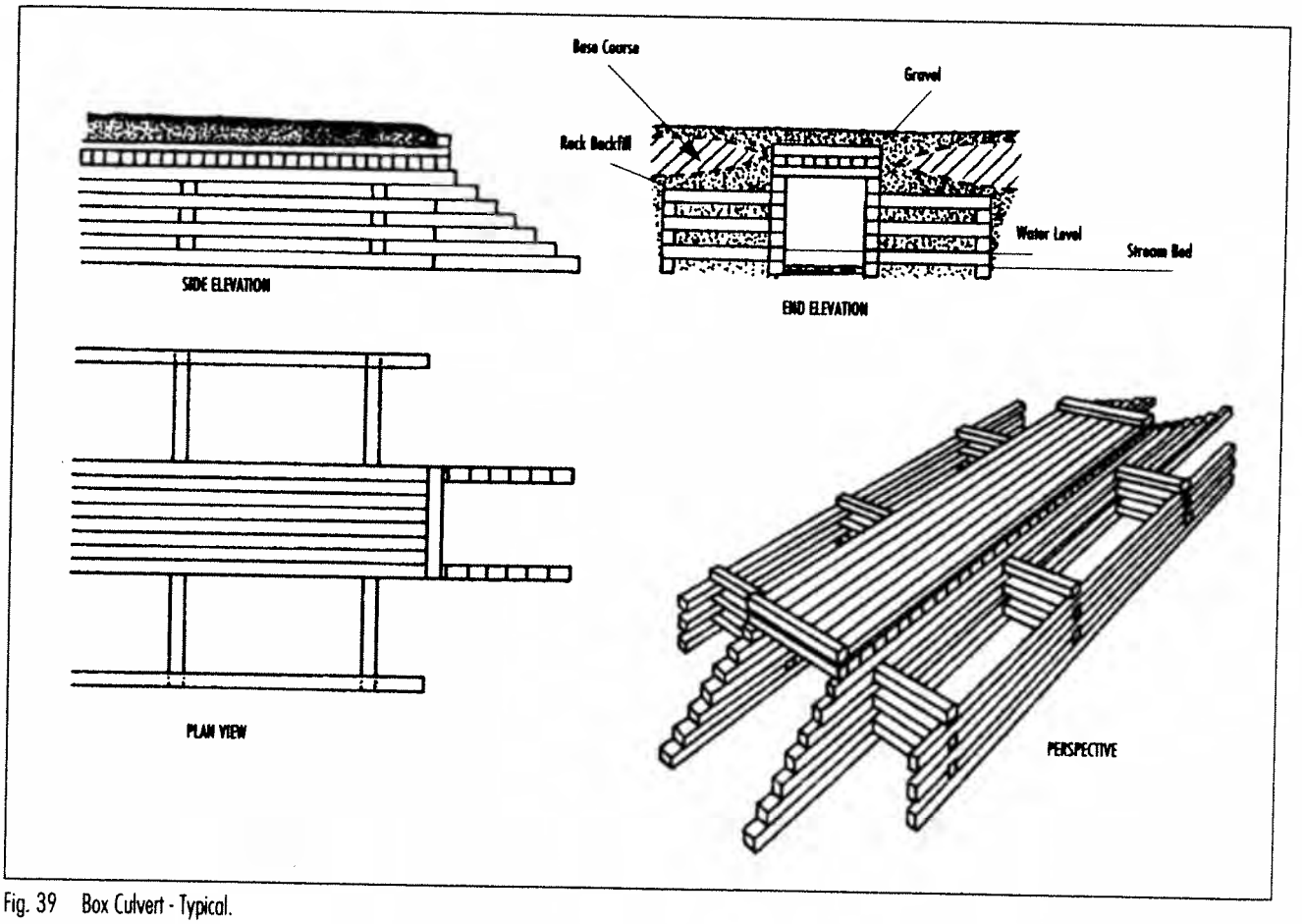



Fig. 39 Box Culvert - Typical.

# 7.9 Temporary Crossings

Fording streams should be avoided because of the damage that can be caused to the stream bed and banks.

In cases where it is necessary to cross a stream, but the construction of a permanent road is not feasible, a portable bridge or temporary structure may be used.

A permit may be required, therefore, the Department of the Environment should be contacted.

The temporary structure can be made of logs fastened together and placed on a mud sill constructed behind the stream banks. (See Fig. 40). Manufactured reusable structures are also available.

The approaches to the structure should be protected with gravel or a brush mat. Precautions should be taken to prevent erosion and siltation.

Temporary crossings should be used during low stream flow and should be removed immediately after access is no longer required. When the structure is removed, repair wheel ruts and any other damage that may cause siltation in the stream.

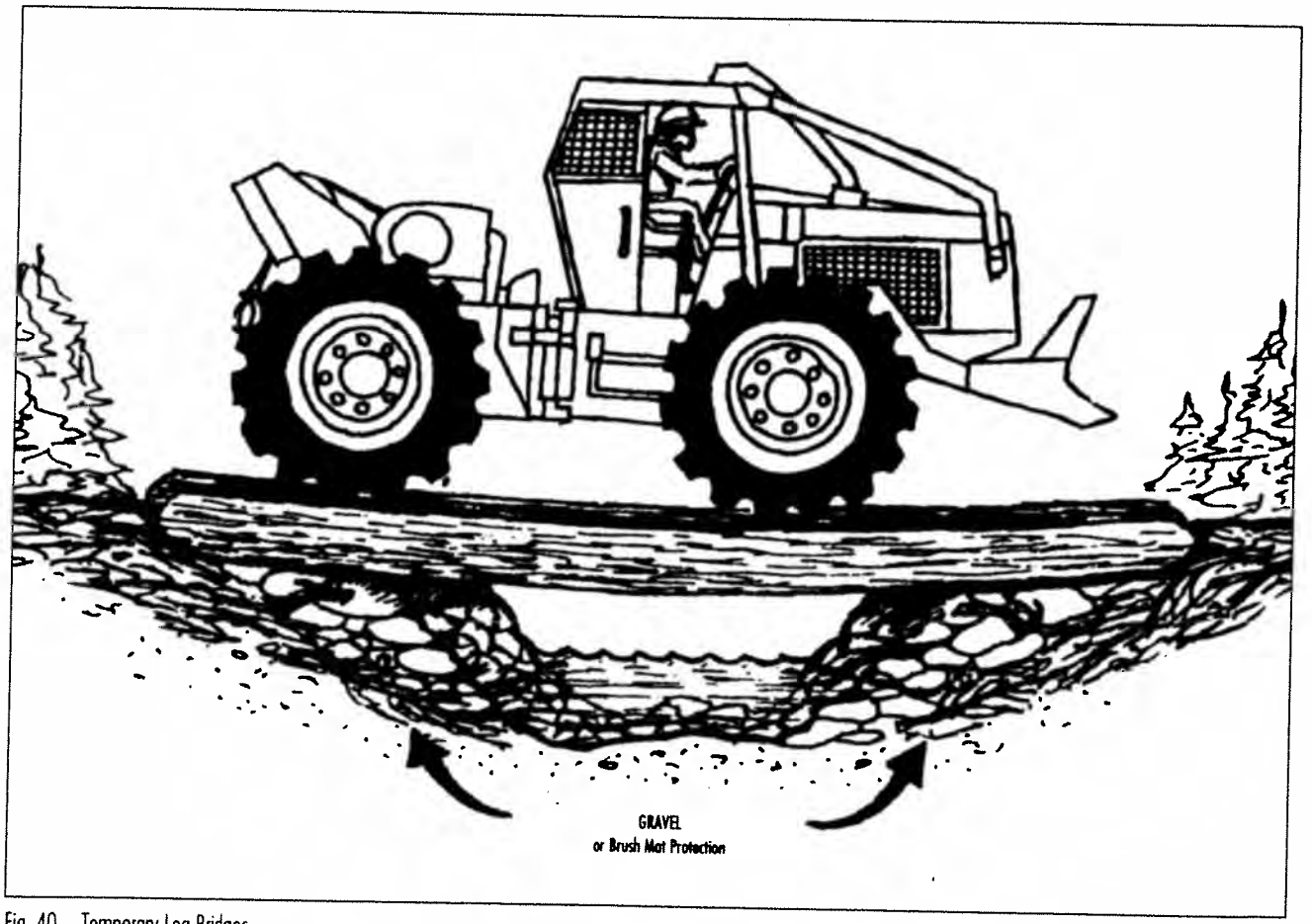



Fig. 40 Temporary Log Bridges

# 8.0 Environmental Protection

Contractors should be aware of the effects road construction has on the forest environment. Steps should be taken to minimize the impact of woodlot roads construction on streams. The effect of erosion and siltation is two-fold. Firstly, it causes stream pollution, destroying fish habitat and reducing water quality. Secondly, it causes road damage which results in high maintenance costs. **The booklet "Environmental Standards for the Construction of Forest Roads and Fire Ponds in Nova Scotia" published by the Department of the Environment should be read and carefully followed.**

## 8.1 No-Grub Zone

All grubbing activity should be stopped a minimum of 100 feet (30 m) from the banks of a stream. On smaller watercourses, grubbing should be stopped far enough back to allow silt to settle out of run-off water before it can enter the watercourse.

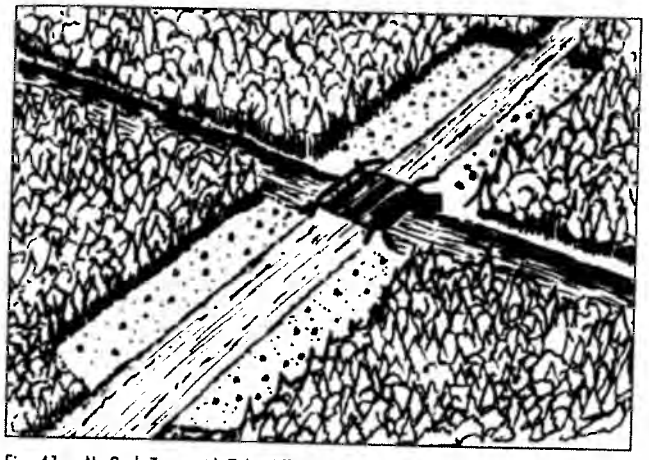


Fig. 41 No-Grub Zone with Take Off Ditches.
30m (100ft) should be clear on each side of the stream crossing.

Take-off ditches must be constructed at the beginning of the no-grub zone. Take-off ditches move storm water away from the road and deposit it onto the forest floor where silt may be filtered out before the water reaches a stream.

## 8.2 Coffer Dams & Stream Diversions

A coffer dam is a watertight temporary structure used in a waterway to separate the water from a work area. Coffer dams should be used to prevent silting in waterways when construction work such as building bridge abutments and culvert installation must be done in the stream bed when water is present.

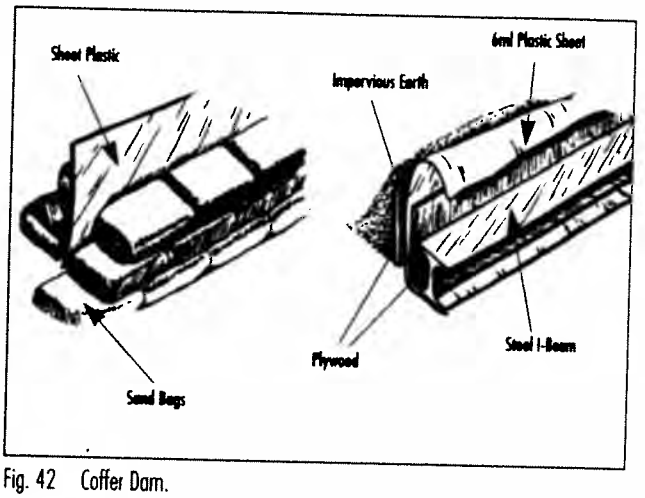



Fig. 42 Coffer Dam.

Coffer dams are to be constructed of erosion resistant material. Generally, a combination of plastic and sandbags or plastic and plywood is used. Streambed material is not to be used for constructing coffer dams.

When the coffer dam is in place, the work area is pumped dry. Any water pumped from the work area should be directed into a sediment basin or over the forest floor so the water does not re-enter the stream unfiltered.

Coffer dams should be constructed so that no more than two-thirds of the normal stream flow is cut off. In cases where it is necessary to restrict a larger area, a stream diversion should be considered.

**A permit must be obtained from the Nova Scotia Department of the Environment before a stream diversion is made.**

Start excavation for the diversion ditch downstream. Continue upstream leaving an earth plug between the stream and the head of the diversion ditch. The ditch must then be lined with a plastic sheet to prevent erosion. The plastic sheet should be pegged along the edge of the diversion ditch, and stones and gravel placed on the plastic along the ditch to reduce the speed of the water. Enough plastic should be left at the head of the ditch to cover the exposed earth after the earth-plug is removed. The ditch should be large enough to carry at least one-third of the water flow in the stream, but should normally match the natural channel width and depth.

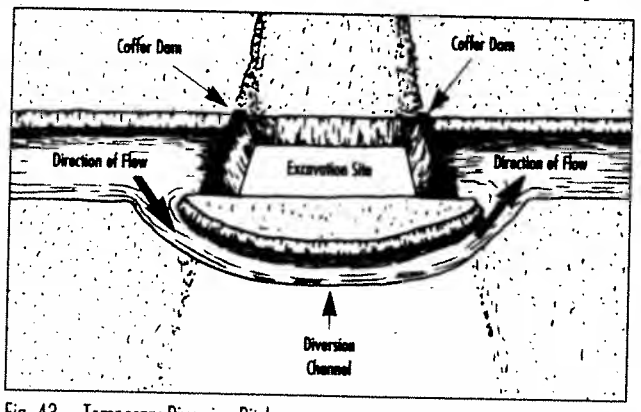



Fig. 43 Temporary Diversion Ditch.

Coffer dams are used with a temporary diversion ditch to restrict water movement into the work area. After the work is completed and measures have been taken to prevent soil erosion, the water is diverted back to the stream by removing the coffer dam and plugging the diversion ditch. All material imported for the construction of the coffer dam must be removed from the stream after the work is complete.

## 8.3 Fish Passage

Fish depend on streams for spawning and rearing as well as for food and nutrients. Research has shown that fish use small streams and intermittent streams more than larger streams for spawning. If their movement from larger streams to smaller streams is restricted by poorly installed culverts, debris and dams, the most productive fish spawning areas will be lost.

It is important to ensure that a large enough volume of water is present in culverts at low water flow to allow fish to move through these structures and upstream to spawning areas. Also, all debris and other material that will block water flow should be removed after a construction job is completed. All streams should be left in good condition, and disturbance caused by construction should be kept to a minimum.

## 8.4 Stream Bed and Bank

Sudden increases in velocity in the water flow result in eddie currents which can cause erosion. The increase in speed of water through pipe culverts causes scouring along the stream bed. This is noticeable at the outlet end of a pipe culvert if no stream bed protection is provided. (Fig. 44)

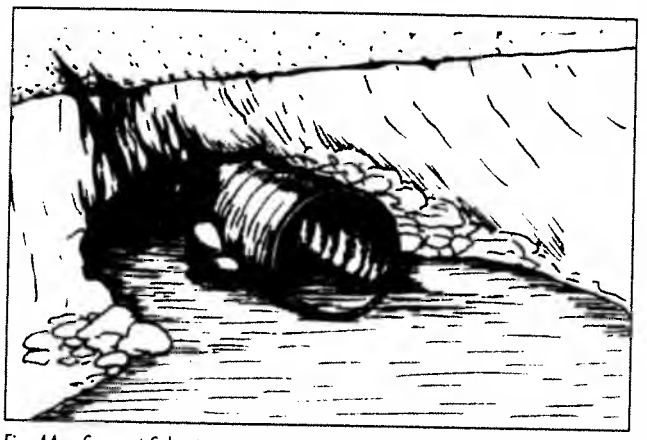


Fig. 44 Scour at Culvert

A rock apron should be placed, at the outlet end of the culvert structure, along the stream bed. The rock should be at least 6 inches (15 cm) in diameter and should extend downstream relative to the diameter of the culvert as shown in Table 8.1. The length of rock protection should be 4.5 to 6 times the diameter of a pipe culvert, or about the same as the width of a box culvert.

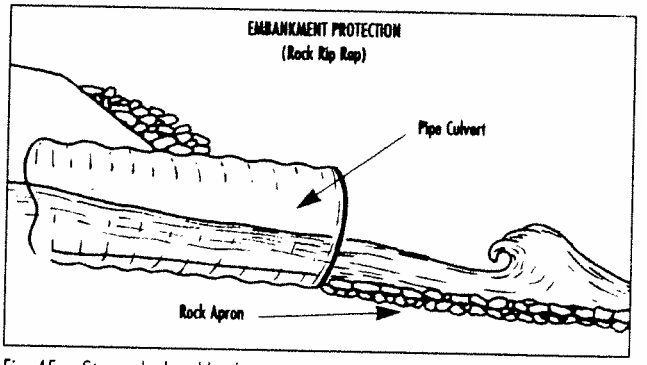



Fig. 45 Stream bed and bank protection using rip-rap.

Table 8.1 Culvert Outlet Protection

| Culvert Diameter | Length of Rock Apron | Apron Thickness |
|---|---|---|
| 18 ins. (450 mm) | 7 ft. (2.1 m) | 12 ins. (300 mm) |
| 24 600 | 9 2.7 | 12 ins. (300 mm) |
| 30 760 | 11 3.3 | 12 ins. (300 mm) |
| 36 900 | 13 4.0 | 12 ins. (300 mm) |
| 48 1200 | 18 5.5 | 12 ins. (300 mm) |

To protect stream banks, the rock should extend up their sides. For bridge structures, it is more important to protect the fill embankment. Rock can be placed along the fill embankment from the toe of the slope to above the expected flood water level for protection. Where the soil is sandy or highly erodible, use geotextile fabric to provide a protective blanket and separation layer over the bank and bed before the rock is placed. Large boulders used for rip-rap provide little or no protection if the spaces between them are not filled with smaller rocks. **Grass seed can be planted along the slopes of the fill embankment to reduce erosion.**

## 8.5 End Treatment of Culverts

Culverts can be made to work better by the treatment utilized at their ends. In most cases, culverts are installed with their ends projecting from the fill. Greatly improved water handling capacity can be made by constructing headwalls around the ends of the culvert. A headwall is a vertical wall around the end of the culvert and extending back into the slopes of the road embankment. Headwalls are similar to wingwalls, but extend parallel to the road alignment. Headwalls also allow for the use of shorter culverts.

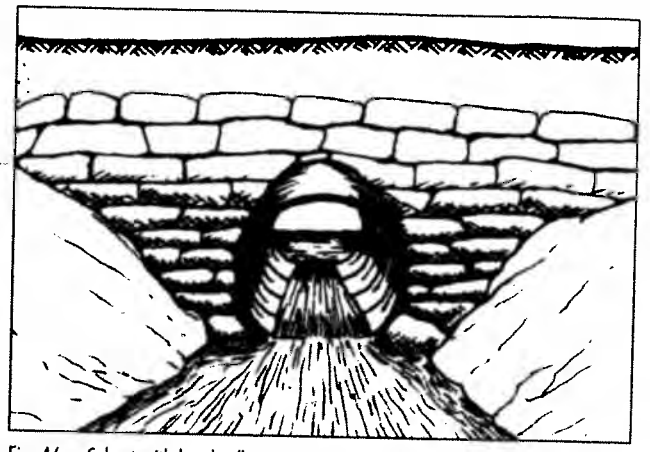


Fig. 46 Culvert with headwalls.

Wingwalls can also be constructed around the ends of culverts, and are considered a better method of end treatments than headwalls, since they facilitate better flow through the culvert.

The culvert ends can also be bevelled to conform to the fill slope. This type of treatment is often used on highway pipe culverts. Headwalls are used more often for concrete box culverts on highway roads.

## 8.6 Debris Control

One major problem with any culvert is the possibility of debris blocking the entrance during floods. If this occurs, water will flow over the embankment and can cause road damage or wash out the structure.

Larger culverts and more expensive installations can be protected by screens built at or near the culvert entrance. These screens should be easy to clear and be reasonably self-cleaning during periods of easy flow.

## 8.7 Beaver Damage

Many a forest road maintenance foreman is faced with the endless task of cleaning culverts and stream crossings plugged with a maze of sticks, leaves, and mud placed by one of the most tenacious animals known to man, the beaver. The plugged crossing will often cause water to flow over the embankment. This results in road damage and often the loss of the structure itself. Mere cleaning is not the answer, since the material is often replaced overnight.

Many methods have been used to dissuade the beaver without much success. One method that often works is the construction of an upstream barrier around the entrance of the culvert against which the beaver can build a dam far enough upstream not to cause blockage. (Fig. 47)

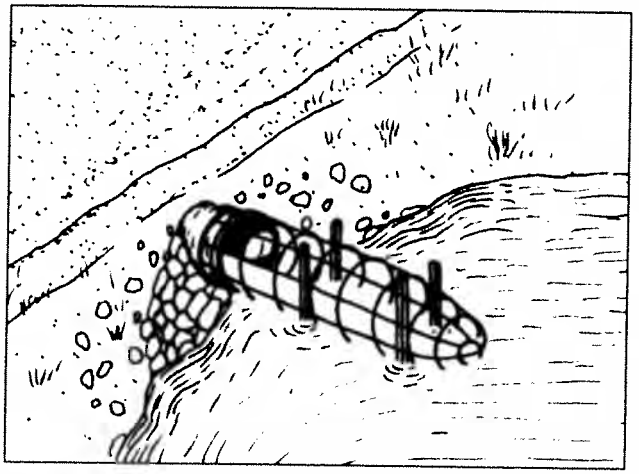


Fig. 47 Typical Beaver Barrier

Another interesting method is the use of a battery operated electric fencer and vertical control wires placed across the entrance of the culvert to discourage the beaver. This method usually takes about a week before the beaver leaves, but the wires should be left in place after the fencer is disconnected. (Fig. 48).

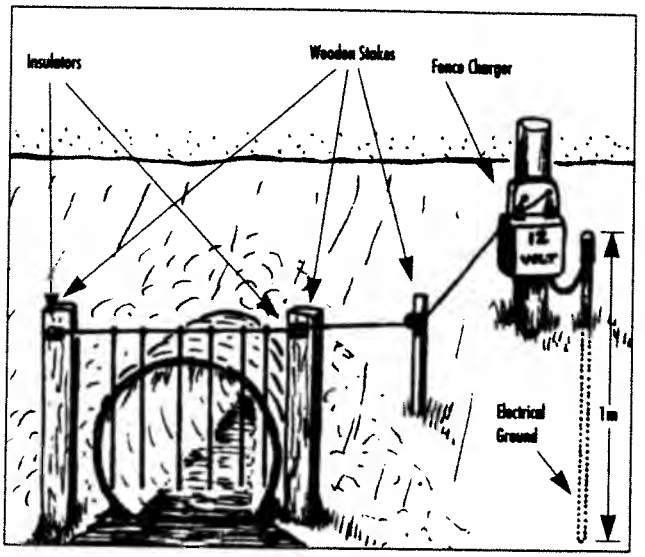



Fig. 48 Electric Beaver Repelling Device for Protecting Culvert Entrance.

Make sure the fencer is well grounded. A grounding rod or metal pipe at least 3 feet (1 m) long is recommended.

# Glossary

**Axis** .....A real or imaginary line about which a body rotates; the line around which the parts of a thing or system are symmetrical or evenly arranged.

**Backfill** .....Earth or other material used to replace material removed during construction or material placed between an old structure and a new lining.

**Bearing Capacity**.....The ability to support a certain load or pressure without failure or deformation.

**Bed Load** .....Sediment in the flow that moves by rolling, sliding or skipping along the stream bed, and is essentially in contact with the stream bed.

**Brush mat**.....A mat made of brush and tree branches used under a road embankment, a separation layer made of brush and branches.

**Dead Load**.....The weight of the materials and attachments such as the embankment and pavement over a culvert or the stringers and deck material of a bridge.

**Density**.....The mass per unit volume of a substance; the quality or condition of being packed tightly together.

**Diaphragm** .....A separating member used between bridge stringers to prevent them from twisting or rotating around their length.

**Embankment**.....A bank of earth used to hold up a road.

**Erosion**.....The detachment of soil particles by the action of water, wind or temperature.

**Flex**.....To bend without breaking.

**Foundation**.....The base or lowest part of a structure.

**Frequency**.....The number of times an event, or activity is repeated in a given period of time.

**Gabion mat** .....A basket made of steel wire mesh and filled with rock to form a mat.

**Geotextile**.....A woven or nonwoven engineering fabric used as a separation layer between soils or as a filter for removing sediment from flowing water.

**Grade** .....The degree of rise or fall of a slope, as of a road or stream.

**Intensity**.....The relative strength or magnitude, as the amount of rainfall over a period of time.

**In the dry**.....Separated from water as on dry land, free from water.

**Lateral support**...Support along the sides.

**Live Load**.....The weight of any moving load or impact, as traffic moving over a bridge or road.

**Longitudinal** .....Running or placed lengthwise, end to end.

**Meander** .....To take a winding course, as a winding stream.

**Normal**.....At right-angle to a given line or perpendicular to a given line or surface.

**Peak Flow**.....Maximum flow, as a river at flood.

**Ponding**.....Water setting in small bodies or pools along the ditch of a road.

**Rip-Rap**.....Large rocks, cobble or boulders placed in or around a watercourse to prevent moving water from eroding soil.

**Run-off**.....The portion of precipitation on a drainage area that runs along the surface of the ground and is discharged in streams and waterways.

**Saturation**.....When water is thoroughly soaked into the soil.

**Scouring**.....The erosion of soil caused by running water, as the banks and bed of a stream channel at the outlet end of a culvert.

**Tie-Backs**.....Anchor timbers for securing the sidewalls of a culvert to the embankment.

**Torsional Rotation**.....Twisting or rotation about the longitudinal axis or length, as in a stringer twisting about its length.

**Unit load**.....The load per unit area such as pounds per square foot.

**Vertical Photographs**.....Photographs usually taken from a plane, where the camera is held in a vertical or nearly vertical position.

**Washout**.....The failure of a culvert, bridge, embankment or other structure resulting from the action of flowing water.

**Wing-Wall**.....A protective wall constructed at a bridge abutment and extending into and supporting the embankment.

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# Appendix A

## Rainfall Intensity

The Atmospheric Environment Services (AES) of Environment Canada is the principal source of meteorological data in Canada. Information collected from a network of observation stations throughout Canada is used to compile rainfall intensity - duration - frequency data which is used in calculating design discharge.

## Typical Rainfall Intensity - Duration - Frequency Curves

The period of return simply defines the peak discharge that will occur, on the average, once in say 10 or 25 years. To be more meaningful, the probability of a storm occurring in any one year may be expressed as reciprocal of the return period. For example, a 25 year storm has a probability of 1/25 or 4 per cent chance of occurring in any one year.

# Appendix B

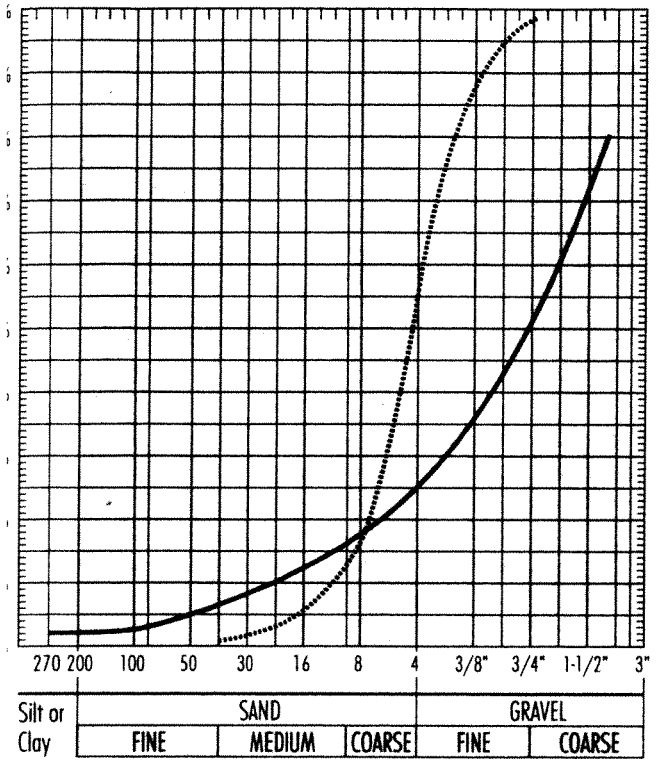
## Well Graded Gravel

Gradation refers to the various sizes a soil may be separated into by the use of a series of sieves. In the Unified Soil Classification System, four soil fractions are recognized to distinguish the size range of soils. These are cobbles, gravel, sand and fines.

| Component | Size Range |
|---|---|
| COBBLES | Larger than 75mm (3 in.) |
| GRAVEL | 75mm (3 in.) to 4.75mm (No. 4 Seive) |
| *Coarse Gravel* | 75mm (3 in.) to 19mm (3/4 in.) |
| *Fine Gravel* | 19mm (3/4 in.) to 4.75mm (No. 4 Seive) |
| SAND | 4.75mm (No. 4) to 75um (No. 200) |
| *Coarse Sand* | 4.75mm (No. 4) to 2.0mm (No. 10) |
| *Fine Sand* | 2.0um (No. 4) to 425um (No. 200) |
| FINES (Silt or Clay) | Smaller than 75um (No. 200) |

Gravel may be defined as well graded or poorly graded. This refers to the relative gradation of the gravel. Well graded, defines a gravel that has various grain sizes in an amount that will fit together with the least amount of air voids between particles, and have little or no non-plastic fines (less than 5 per cent passing the No. 200 sieve). The present fines must not noticeably change the strength properties of the gravel.

**Typical Example of Well Graded Gravel (GW)**
in Percent Finer by Weight




**Curve 1:**
Pit Run Gravel; Nonplastic; Well-Graded; Small Percentage of Fines.

**Curve 2:**
Sandy Gravel; Nonplastic; No Fines.
(Curve is about the steepest one that will meet the criteria for GW Group.)

The above curves can be expressed as percentage by weight passing a particular size sieve as follows:

| Sieve Size | Percentage Finer By Weight |
|---|---|
| 3 inches | 100 % |
| 1 1/2 inches | 67 to 100 % |
| 3/4 inch | 50 to 95 % |
| 3/8 inch | 35 to 82 % |
| No. 4 | 25 to 55 % |
| No. 10 | 12 to 16 % |
| No. 100 | 0 to 4 % |
| No. 200 | 0 to 3 % |

# Appendix C

## Assembly of Timber Bridges by Terry Amirault, P.Eng.

### Before starting:

1. Has an environmental permit been issued by the Department of the Environment?
2. Are there stipulations, restrictions outlined on the permit?
3 Is the contractor aware of Environmental Guidelines?
4. What equipment, tools will be needed?
5. Is the site readily accessible by truck, porter, skidder, backhoe?
6. Have the materials been ordered? Are they available locally? Immediately?
7. How will the construction be completed? In what order? Both abutments at same time? How will machinery, materials, reach far side?
8. Where will backfill material (rock) come from?

### On-Site Planning:

1. Materials should be loaded and/or stockpiled on-site in order of use, e.g., crib material before decking.
2. Exact bridge location should be determined and abutment locations staked.
3. Decide on appropriate erosion control measures if needed. (Section 8.0)
4. Plan on building far side abutment first — this will give you additional flexibility.

### Preparing Base for Abutments:

1. Use a backhoe/excavator to remove all organic and/or unsuitable material such as low bearing capacity soils from the area where abutment will be constructed.
2. If site is swampy, some coarse rock may be required to fill hole created by removal of the unsuitable material. (Section 7.3)
3. If part of excavation will be in the streambed area, provisions should be made to control damage to fish habitat, i.e., cofferdam, straw bales, silt curtain. (Section 8.2)
4. Allow for working space around crib abutment (excavate an area larger than the abutment).
5. Make sure base is as even and level as possible. Abutments built on solid rocks will probably need shims to level first layer. (Section 7.3)

## Crib Construction:

### STEP 1.

Place bottom face stretcher (key timber) and bottom back stretchers (1, 2 or 3 pieces depending on length available) parallel, at desired spacing and such that back stretchers extend past both ends of stretcher in equal amounts (Fig. C1). If pieces are not level, shim or excavate base to adjust the timbers.

### STEP 2.

On top of initial pieces place the first two wingwall pieces and the two headers and pin these with 14" x 5/8" diameter pins (for 8" x 8" timber). One pin is to be placed at each connection. Holes, 9/16" in diameter, shall be drilled through the top layer and 6" into the second layer to accept the pins (Fig. C1).

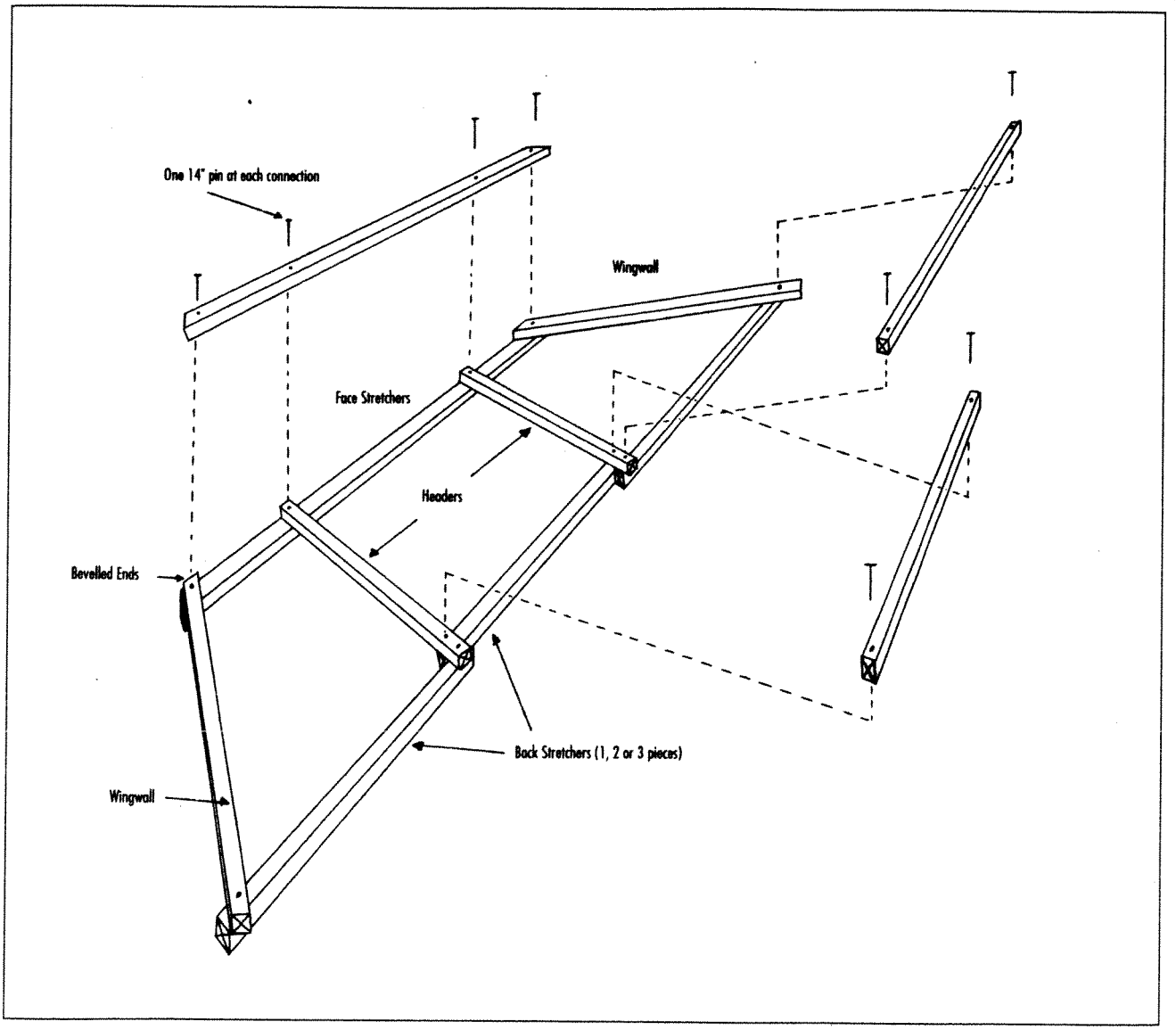



Fig. C1 First layers of Crib

**STEP 3.**
Steps 1 & 2 are repeated until desired height is reached (Fig. C2). Corners between face stretches and wingwalls should be bevelled. Other junctions may be left with square butts. All field sawn ends are to be treated with suitable preservative.

**STEP 4.**
Two bearing plates 8" x 8" are pinned to the top layer of the wingwalls and headers. Second bearing plate is longer than first to account for angle between wingwall and crib face (Fig. C2).

**STEP 5.**
Blocking pieces are added to top of headers and wingwalls, immediately behind rear bearing plate (Fig. C2). Each blocking piece is pinned with two fasteners and will be used to support the butt plates and the final layers of wingwall.

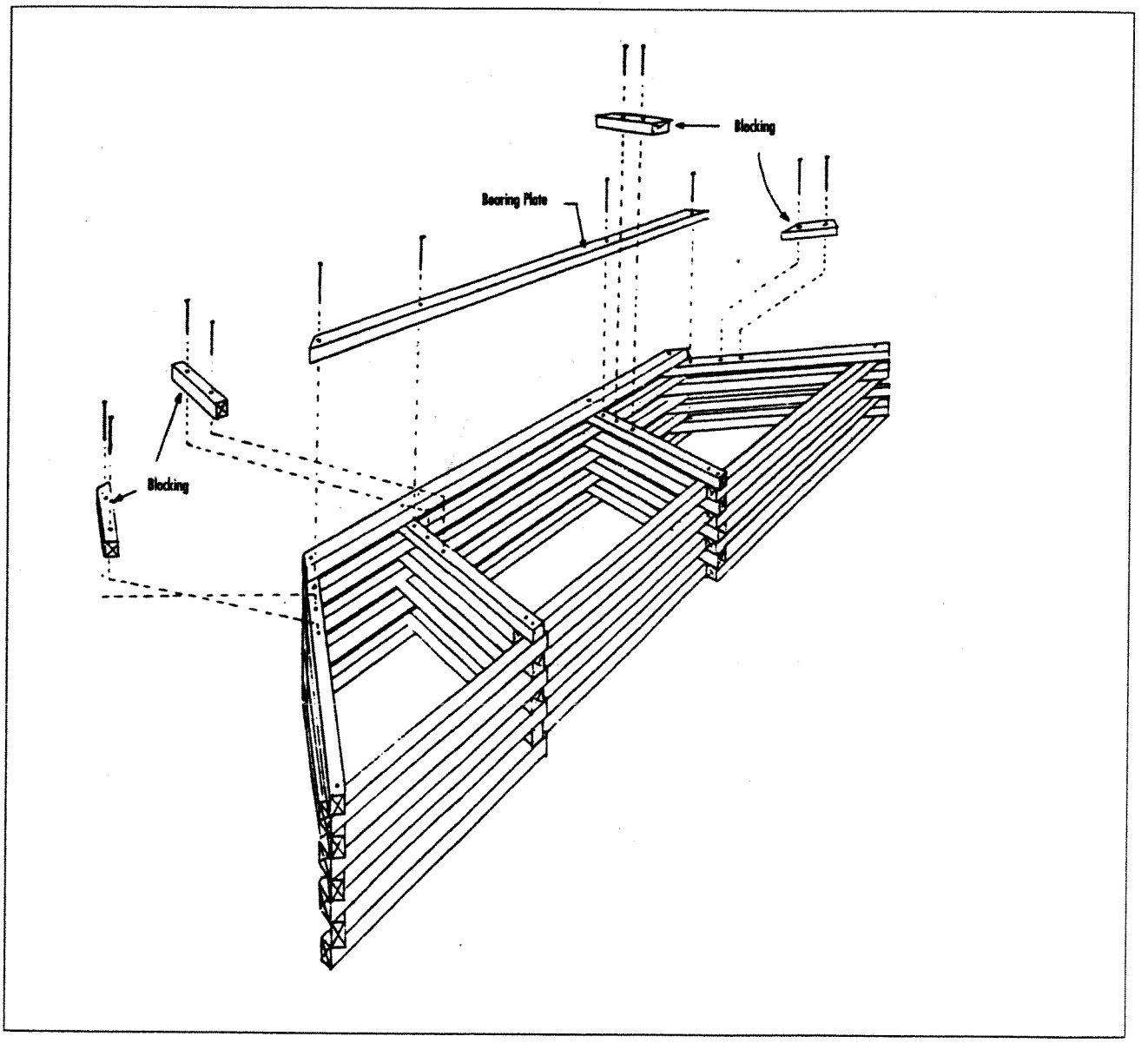



Fig. C2 Installation of Blocking Plates

**STEP 6.**
Stringers are placed with ends on the two bearing plates, at the specified spacing (Fig. C3). (See table for stringer sizes, species, and spacing.) Large stringers will require mechanical equipment, boom-truck, grapple loader, backhoe) to lift them in place.

**STEP 7.**
Each stringer is pinned to the bearing plates through predrilled holes and with fastener extending through the stringer and the plates.

**STEP 8.**
Attach two 4" x 8" butt plates to ends of the stringers. Nail both butt plates to each stringer with 10" spikes (Fig. C3). These butt plates serve two purposes. They restrain the stringers and they prevent the roadway backfill from falling into the stream.

**STEP 9.**
Remaining wingwall pieces are fastened to the blocking pieces (Fig. C3).

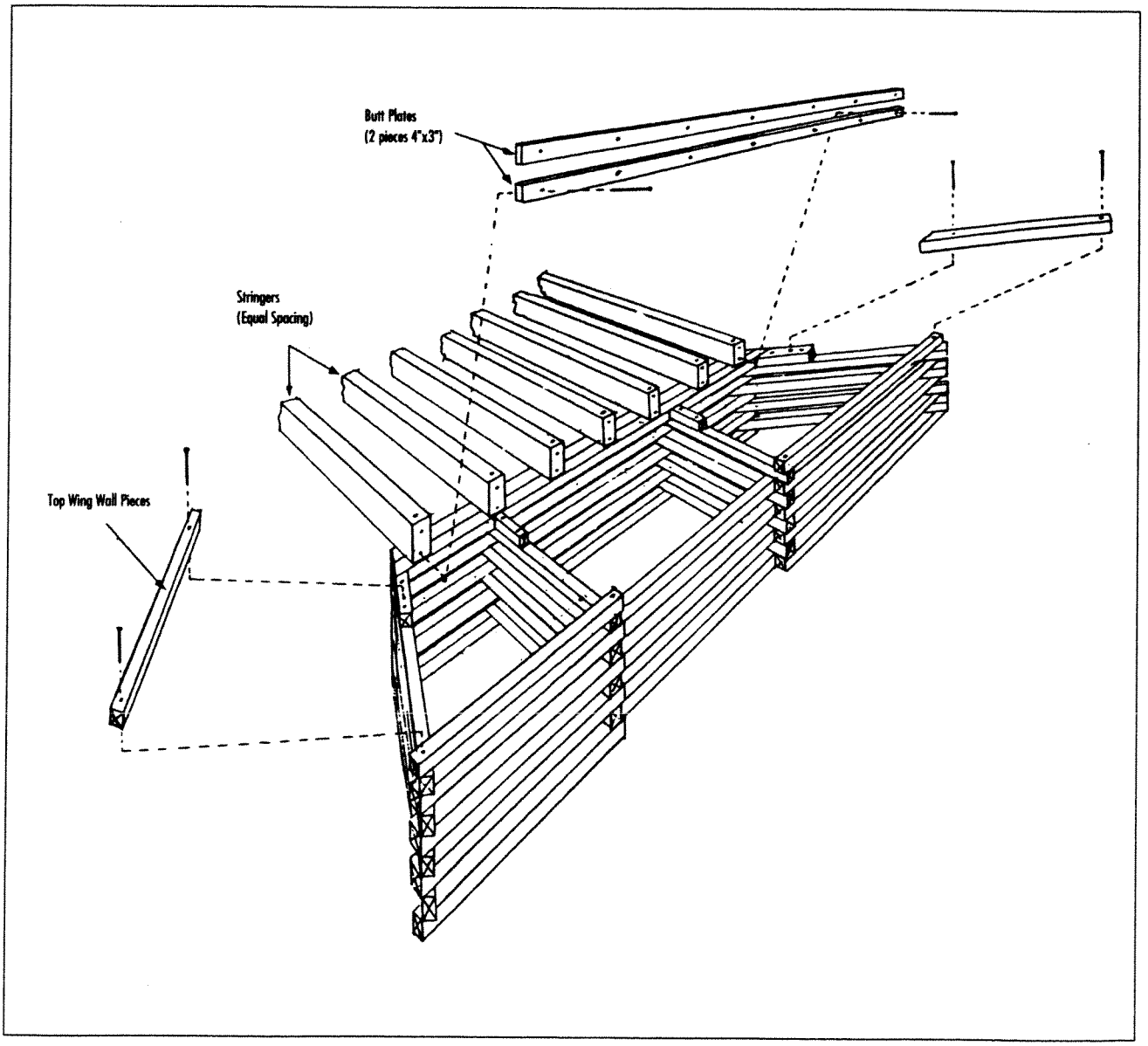



Fig. C3 Placing Stringers and Butt Plates

**STEP 10. (Optional)**
If crib is to be filled with fine backfill material instead of rock, crib should be lined on front face and wingwalls with 2" x 6" planks placed in an upright position on the inside of the crib. These will block all openings between crib layers, preventing the backfill from being washed away. Note: When fine material is used for backfill, crib abutment should be set far enough below surrounding grade to prevent stream flows from washing backfill from the underside of the crib.

**STEP 11.**
Abutment(s) may be backfilled either before or after bridge deck is placed. If backfill material is to be trucked in, near side abutment should be filled first, then deck put in place, then truck slowly backed over bridge and fill dumped into far abutment. Abutment can also be filled as the abutments are built. If front of crib is to be protected with rip rap stone, these should be put in place before bridge deck is installed.

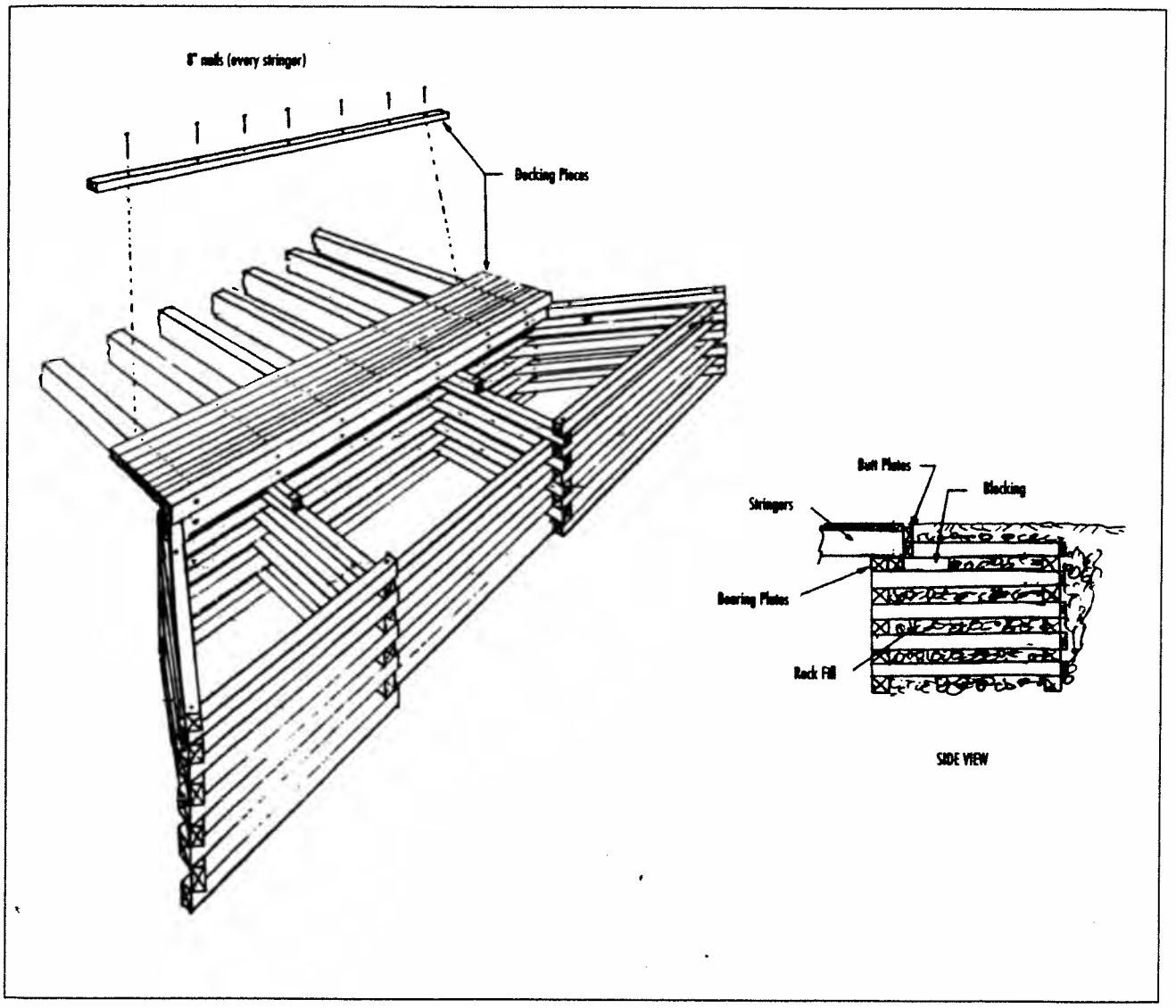



Fig. C4 Decking

**STEP 12.**
Nail decking pieces to each stringer with 8" nails. Decking pieces should be one piece, if possible.

**STEP 13.**
Install tire guard and blocking and guard rails if required.

**STEP 14.**
Nail running surface to bridge deck.

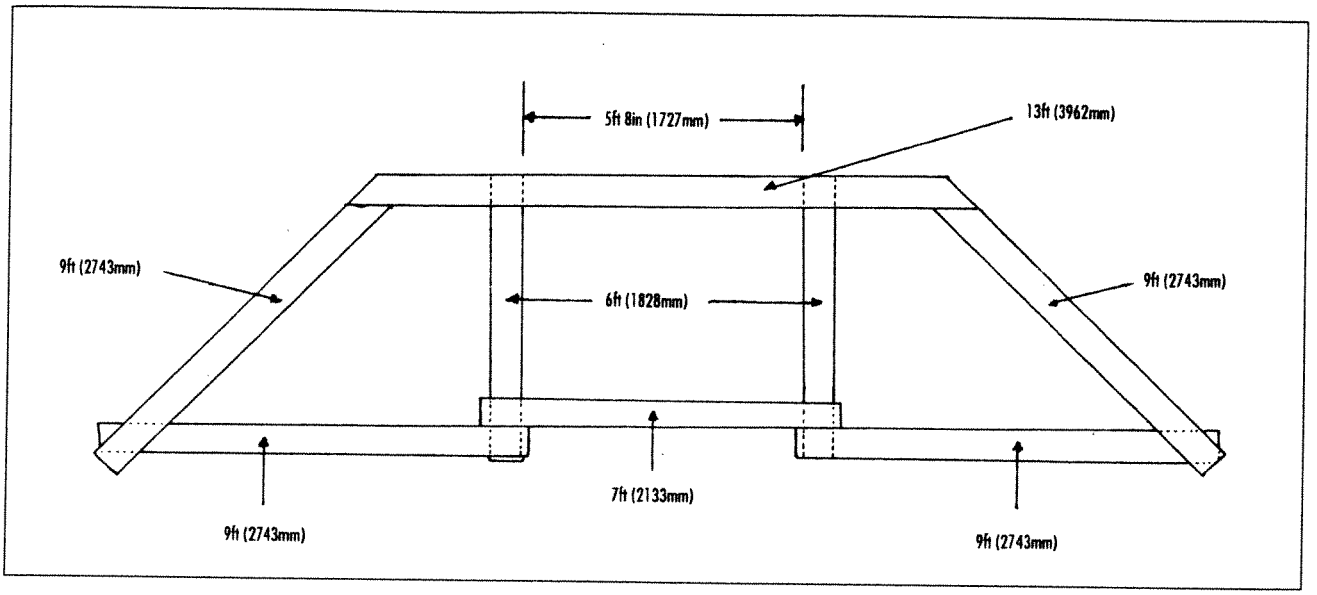



Fig. C5 Crib Dimensions

# Further Reading

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# Emergency Spill Regulations

**made under Sections 74, 136, and 171 of the**
***Environment Act***
**S.N.S. 1994-95, c. 1**
**Order in Council 95-298 (April 11, 1995), N.S. Reg. 59/95**

## Citation

**1** These regulations may be cited as the "Emergency Spill Regulations".

## Definitions

**2** In these regulations

**(a)** "Act" means the Environment Act;

**(b)** "Administrator" means a person appointed by the Minister pursuant to Section 3 to administer these regulations, and includes an acting Administrator;

**(c)** "C.C.M.E." means the Canadian Council of Ministers of the Environment;

**(d)** "contaminant" means a substance that causes or may cause an adverse effect;

**(e)** "Department" means the Department of Environment and Labour;

**(f)** "emergency responder" means a person appointed pursuant to Section 9 for the purpose of responding to and managing an environmental emergency;

**(g)** "environmental emergency" means an emergency situation in which there is a release or an impending release of a contaminant in such quantities that mitigation of the release is beyond the capability of the person responsible because the person responsible lacks the resources, is unknown, or is otherwise unwilling or unable to control and manage the release;

**(h)** "environmental emergency area" means a property, habitat, land, watercourse or other area which has been affected or is likely to be affected during an environmental emergency;

**(i)** "Minister" means the Minister of Environment and Labour;

**(j)** "process tank" means any tank which forms an integral part of a manufacturing process;

**(k)** "release" means to spill, discharge, dispose of, spray, inject, inoculate, abandon, deposit, leak,

seep, pour, emit, empty, throw, dump, place or exhaust;

**(l)** "remediate" means to clean up land which is impacted by the release of a contaminant to a level required by the Minister;

**(m)** "spill" means a release of a substance

(i) into the environment,

(ii) from or out of an approved containment system, structure, aircraft, vehicle, vessel, process tank, pipeline, or other container,

(iii) that is abnormal in quantity or quality in light of all the circumstances of the release, or

(iv) in excess of an amount specified in these regulations or an approval.

**Administrator**

**3** The Minister may appoint an Administrator to administer these regulations.

**Application**

**4 (1)** These regulations apply to an environmental emergency, an unauthorized release or an impending unauthorized release of a contaminant including an environmental emergency, an unauthorized release or impending unauthorized release on lands owned or claimed by Her Majesty in the Right of Canada.

**(2)** A release is deemed to be an unauthorized release or an impending unauthorized release if the release is prohibited by the Act or regulations made pursuant to the Act or exceeds or does not comply with what is authorized by the Act or regulations made pursuant to the Act.

**(3)** The reporting requirements prescribed in these regulations do not apply

**(a)** to a release that is permitted in an approval issued under the Act; or

**(b)** where a reporting requirement for the release is described in an approval issued under the Act.

**Designated contaminants**

**5** A contaminant listed in Column 3 of Schedule "A" is designated a contaminant under these regulations.

**Duty to report the release of a contaminant**

**6** A person responsible under Section 69 of the Act shall forthwith report an unauthorized release of a contaminant listed in Column 3 of Schedule "A" in quantities greater than those listed in Column 4 of Schedule "A" as soon as that person knows of the unauthorized release.

**Verbal reporting requirements**

**7 (1)** A person reporting an unauthorized release under Section 6 shall notify the Department by contacting the environmental emergencies reporting centre by telephone at (902) 426-6030 or at 1-800-565-1633.

**(2)** No person shall make a false report of an unauthorized release.

**(3)** No person shall refuse to provide information required under these regulations.

**Written reporting requirement**

**8** An Administrator may request in writing that a person responsible under Section 69 of the Act submit a written report to the Administrator within a specified time period after an unauthorized release outlining the actions taken

**(a)** to identify the cause of the release;

**(b)** to assess the adequacy of the response to the release by the person responsible under Section 69 of the Act or any other person or agency involved in the response;

**(c)** to remediate any lands upon which by the unauthorized release has an impact;

**(d)** to dispose of the contaminant; and

**(e)** to prevent a reoccurrence of the unauthorized release.

**Training for emergency responders**

**9 (1)** The following persons may apply to be appointed by the Minister or an Administrator as an emergency responder under these regulations:

**(a)** fire service personnel of a village, town, city or municipality in Nova Scotia, and

**(b)** police service personnel of a village, town, city or municipality in Nova Scotia.

**(2)** Upon a person having successfully completed the requirements of a national certification program for emergency responders, the Minister or the Administrator may appoint that person as an emergency responder.

**(3)** A village, town, city or municipality described in subsection (1) shall determine whether a person who wishes to be appointed as an emergency responder has successfully completed the requirements referred to in subsection (2) and provide the name of the person to the Administrator.

**Powers of an emergency responder during an environmental emergency**

**10 (1)** Pursuant to Section 72 of the Act, during an environmental emergency an emergency responder may do the following:

**(a)** restrict entry of any person into an environmental emergency area;

**(b)** control traffic in the vicinity of the environmental emergency area;

**(c)** determine unsafe areas;

**(d)** enter any land or building within the environmental emergency area, excluding a private dwelling, without a warrant;

**(e)** authorize entry by any person into any building or on any land within the environmental

emergency area, excluding a private dwelling, without a warrant by any person; and

**(f)** take such action the emergency responder considers necessary to contain, control, and manage the release, including the construction of any works.

**(2)** No person shall

**(a)** hinder or obstruct an emergency responder in the lawful performance of the emergency responder's duties;

**(b)** furnish any emergency responder with false information; or

**(c)** refuse to furnish any emergency responder with information respecting an environmental emergency.

**Emergency order**

**11 (1)** Pursuant to Section 128 of the Act, the Administrator or an emergency responder may issue a verbal or written order to a person to take any emergency actions listed in Section 10 to contain, control, or manage an unauthorized release or an impending unauthorized release.

**(2)** An order issued under subsection (1) shall lapse 72 hours after issuance unless it is ratified and confirmed in writing by the Minister.

**(3)** The Minister may at any time revoke an order made by the Administrator or an emergency responder pursuant to these regulations.

**Powers of the Minister/Administrator**

**12 (1)** Pursuant to Section 128 of the Act, during and after an environmental emergency or an unauthorized release, the Minister or the Administrator may order the person responsible for the environmental emergency or the unauthorized release to

**(a)** take any action required to dispose of the contaminant which has been released;

**(b)** remediate any lands impacted by the release; and

**(c)** do all things necessary to repair any injury or damage directly or indirectly caused by or resulting from the release.

**(2)** The Administrator may determine the size of an environmental emergency area and identify the area on the ground.

**(3)** The Administrator may determine when an environmental emergency is finished.

**(4)** If the person responsible for an environmental emergency or an unauthorized release fails to comply with an order issued pursuant to subsection (1), the Minister or the Administrator may take any action required to remediate any lands or waters impacted by the release or repair any injury or damage directly or indirectly caused by or resulting from the release.

**Recovery of costs**

**13 (1)** Pursuant to Section 169 of the Act, the Minister may recover any reasonable costs,

expenses, or charges supported by proper receipts that are incurred by the Minister, the Administrator or emergency responders while acting under the Act or these regulations

**(a)** by issuing an order against the person responsible for the environmental emergency, the unauthorized release or the impending unauthorized release for a claim less than $5000; or

**(b)** by taking an action against the person responsible for the environmental emergency, the unauthorized release or the impending unauthorized release in a court of competent jurisdiction for a claim greater than $5000.

**(2)** If the person described in clause (1)(a) fails to pay, the Minister or the Administrator may file the order with the prothonotary of the Supreme Court and it shall have the same effect as an order filed under subsection 132(7) of the Act.

**Effective date**

**14** These regulations shall come into effect on, from and after April 11, 1995.

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**Schedule "A" - Spill Report Requirements**

| Column 1<br>Item No. | Column 2<br>TDGA Class | Column 3<br>Description of Contaminant | Column 4<br>Amount Spilled |
|---|---|---|---|
| 1. | 1 | Explosives | any amount |
| 2. | 2.1 | Compressed gas (flammable) | 100 L |
| 3. | 2.2 | Compressed gas (non-corrosive, non-flammable) | 100 L |
| 4. | 2.3 | Compressed gas (toxic) | any amount |
| 5. | 2.4 | Compressed gas (corrosive) | any amount |
| 6. | 3 | Flammable liquids | 100 L |
| 7. | 4.1 | Flammable solids | 25 kg |
| 8. | 4.2 | Spontaneously combustible solids | 25 kg |
| 9. | 4.3 | Water reactant solids | 25 kg |
| 10. | 5.1 | Oxidizing substances | 50 L or 50 kg |
| 11. | 5.2 | Organic peroxides | 1 L or 1 kg |
| 12. | 6.1 | Poisonous substances | 5 L or 5 kg |
| 13. | 6.2 | Infectious substances | any amount |
| 14. | 7 | Radioactive substances | any amount |
| 15. | 8 | Corrosive substances | 5 L or 5 kg |
| 16. | 9.1 (in part) | Miscellaneous products or substances, excluding PCB mixtures | 50 L or 50 kg |
| 17. | 9.1 (in part) | PCB mixtures of 50 or more parts per million | 0.5 L or 0.5 kg |
| 18. | 9.2 | Environmentally hazardous substances | 1 L or 1 kg |
| 19. | 9.3 | Dangerous wastes | 5 L or 5 kg |
| 20. | none | Asbestos waste as defined in the Asbestos Waste Management Regulations | 50 kg |
| 21. | none | Used oil as defined in the Used Oil | 100 L |

| | | | |
|---|---|---|---|
| | | Regulations | |
| 22. | none | Contaminated used oil as defined in the Used Oil Regulations | 5 L |
| 23. | none | A pesticide in concentrated form | 5 L or 5 kg |
| 24. | none | A pesticide [in] diluted form | 70 L |
| 25. | none | Unauthorized sewage discharge into fresh water or sensitive marine water | 100 L |
| 26. | none | Ozone depleting substances as defined in the Ozone Layer Protection Regulations | 25 kg |

Last updated: 20-03-2009

## Land Use

- RSSIDE - Residential Single Unit Dwelling Detached
- AG - Agriculture
- AGSBHA - Agriculture - Site Based - Housing Animals
- AGLBLT - Agriculture Land Based Long Term Cropping System
- MAPRWP - Manufacturing - Processing - Water Purification
- PLWA - Protected & Limited Use - Watershed
- ITVAMI - In Transition Vacant Mining
- ITVAAG - In Transition Vacant Agriculture
- ITVARC - In Transition Vacant Recreation, Culture & Entertainment
- Fire Pond
- Forestry Silviculture Treatment
- FOforestry

- Building Point
- 2007 Natural Watershed Boundary
- Prescibed Watershed Line
- Collector Road
- Local Road
- Non-addressed roads
- swamp
- Tree Line
- Building outline
- Utility
- Waterline
- Waterbody
- Property Line

**2007 Natural Watershed Boundary**
**Area: 482.6 ha (1192.7 ac)**
**Prescribed Watershed Boundary**
**Area: 364.5 ha (900.7 ac)**
(The area of the watershed boundaries were calculated using the Municiaplity's Geographic Information System. The calculation of the watershed area includes all land and water features within the polygon shown on the map, including lakes, rivers and roads)

N W E S

Revised: December, 2007
Municipality of the District of Lunenburg, Planning Department
C:\Data\Projects\Planning2007\DaresLake\
DaresLake_LU11x17_nov2007.mxd

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Schedule "O"

**Dares Lake Area:**
**164.3 ha (406 ac)**

Northwest Rd
Kinley Farm Rd
Bulmer Rd
Highway 3
Windward Ave
Edgemount Rd
Avail Rd
O'Brien Rd

Schedule "P"

# Guidelines for Monitoring Public Drinking Water Supplies

NOVA SCOTIA

Environment and Labour

| | |
|---|---|
| Approval Date: December 12, 2005 | Effective Date: December 12, 2005 |
| Approved By: William Lahey | |
| **Version Control:** | Replaces the October 1, 2000 version as amended July 15, 2003 |

## Table of Contents

# GUIDELINES FOR MONITORING PUBLIC DRINKING WATER SUPPLIES

## 1.0 Preface

## 1.1 Purpose

The purpose of these guidelines is to assist an owner of a public drinking water supply with developing and implementing an acceptable water quality monitoring program. These guidelines reflect the minimum requirements under the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* made pursuant to the *Environment Act*.

The objective is to ensure that consumers of water provided by a public drinking water supply in Nova Scotia have safe drinking water. Systematic water quality monitoring and immediate notification and corrective action are essential elements to a comprehensive water supply protection program.

All owners of public drinking water supplies must use these guidelines to develop and implement a water quality monitoring program that supports the maintenance and optimization of water system operations.

## 1.2 Authority

***Regular Testing*** - Section 33 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* requires an owner of a public drinking water supply to regularly monitor drinking water quality for the parameters listed in the *Guidelines for Monitoring Public Drinking Water Supplies,* as well as other substances as may be required by the Minister or an Administrator. Samples are to be collected in the manner and with the frequency set out in the *Guidelines for Monitoring Public Drinking Water Supplies* or as required by the Minister or an Administrator.

Drinking water quality testing is to be completed by approved laboratories in accordance with the Policy for the Accreditation of Laboratories.

***Immediate Notification and Corrective Action*** - Section 34 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* requires an owner of a public drinking water supply to:

- notify the department immediately upon becoming aware of not meeting health-related drinking water quality criteria; and

- take corrective action as set out in the *Guidelines for Monitoring Public Drinking Water Supplies* or as may be required by the Minister or Administrator.

***Provision of Safe Drinking Water*** - Section 35 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* requires that an owner of a public drinking water supply ensure that the microbiological, physical and chemical characteristics of a public drinking water supply do not exceed the maximum acceptable concentration (MAC) or interim maximum acceptable concentration (IMAC) for substances listed in the most recent version of Health Canada's *Guidelines for Canadian Drinking Water Quality*, as amended from time to time.

## 1.3 Application

These guidelines apply to a public drinking water supply as defined herein and include municipal, commercial, industrial, institutional, and privately owned water supplies. **It should be noted that these guidelines are considered to be minimum requirements under the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* and any conditions to an operating approval that the facility has or may require will always take precedence.**

## 2.0 Definitions

*Public Drinking Water Supply* (water supply) means a water supply system, including any source, intake, treatment, storage, transmission or distribution, that is intended to provide the public with potable, piped water and that:
i) has at least 15 service connections; or
ii) regularly serves 25 or more persons per day at least 60 days of the year.

*Owner* means a person who owns, operates or maintains a public drinking water supply.

*Safe Drinking Water* means water that meets the health-related criteria for substances specified in the most recent version of Health Canada's *Guidelines for Canadian Drinking Water Quality*, as amended from time to time.

*Water Quality Committee* means an ad hoc committee appointed at the discretion of Nova Scotia Environment and Labour (NSEL) or the Medical Officer of Health (MOH) to investigate water quality deficiencies that require a boil water advisory. In addition to representatives from NSEL and the MOH, the committee may include an owner, a representative from a water quality laboratory and other experts as required.

*Approved Water Supply* means a public drinking water supply that holds a municipal water works approval issued under the *Activities Designation Regulations* made pursuant to the *Environment Act* for the collection, production, treatment, storage, supply or distribution of potable, piped water to the public.

*Registered Water Supply* means a public drinking water supply that holds a registration with NSEL under the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* made pursuant to the *Environment Act* for the collection, production, treatment, storage, supply or distribution of potable, piped water to the public. Examples of registered water supplies include: trailer parks, apartment buildings, rural developments, schools, day cares, nursing homes, industrial or commercial buildings, eating establishments, fixed roof accommodations, recreational facilities, campgrounds, etc. that are not connected to a municipal water works.

*Maximum acceptable concentration* means the health-related criteria specified for substances in the *Guidelines for Canadian Drinking Water Quality*, which when present above the set concentration have known or suspected adverse health effects.

*Interim maximum acceptable concentration* means the health-related criteria specified for substances in the *Guidelines for Canadian Drinking Water Quality*, which when present above the set concentration may have adverse health effects but there is insufficient toxicological data to set a maximum acceptable concentration.

## 3.0 Roles and Responsibilities

### 3.1 Public Drinking Water Supply Owner

An owner is responsible for delivering safe drinking water to the consumer. This responsibility includes routine monitoring of the public drinking water supply, informing the consumer and Nova Scotia Environment and Labour (NSEL) if water quality fails to meet the health-related criteria set out in the *Guidelines for Canadian Drinking Water Quality* and for correcting any deficiencies that may result. The owner is also responsible for contacting NSEL as soon as he/she becomes aware of any problem that may result in unsafe water being supplied to the consumer such as equipment failure and/or malfunction. The owner shall have contingency plans in place to deal with poor water quality, major fluctuations in system flow and/or pressure, or a prolonged interruption in the supply of water.

Owners of public drinking water supplies should refer to the appropriate section of these Guidelines, namely:

- Approved Water Supply - Section 4
- Registered Water Supply - Section 5

## 3.2 Nova Scotia Environment and Labour

Nova Scotia Environment and Labour (NSEL) has been designated as the lead agency to take such measures as are reasonable to provide access to safe, adequate and reliable public water supplies (*Environment Act*, Section 104(c)). To carry out this mandate, NSEL issues approvals to construct and operate water distribution and water treatment facilities, classifies facilities, requires certified operators, registers public drinking water supplies, audits facilities and ensures water quality monitoring programs are carried out and appropriate action is taken to address any problems that may arise. When a public drinking water supply owner fails to notify consumers that a public health risk exists, NSEL will cause a public notification to be issued, including the issuance of boil water advisories. NSEL may assist with non-routine or site-specific monitoring.

## 3.3 Medical Officer of Health (MOH)

The MOH provides advice to the Minister of Health, the Minister of Environment and Labour, the owner, NSEL and the public regarding public health concerns associated with drinking water supplies. The MOH may issue orders to protect public health, including the issuance of boil water advisories.

## 3.4 Water Quality Laboratory (Lab)

The lab conducts analyses of samples following procedures defined in the latest edition of *Standard Methods for the Examination of Water and Wastewater*, published jointly by the American Public Health Association, the American Water Works Association and the Water Environment Federation, or an alternative method acceptable to NSEL. The lab also participates in quality control, quality assurance and accreditation programs, as required, to ensure accurate results. All sample analyses are to be performed by a laboratory acceptable to NSEL.

The lab, when analysing water samples from a public drinking water supply, is responsible to immediately notify the water supply owner and NSEL of any sample results indicating the presence of coliforms.

## 4.0 Approved Water Supplies

The following sections apply to public drinking water supplies that hold a municipal water works approval issued under the *Activities Designation Regulations* made pursuant to the *Environment Act* for the collection, production, treatment, storage, supply or distribution of potable, piped water to the public (i.e. approved water supplies).

## 4.1 Routine Monitoring for Microbiological Quality

### 4.1.1 Parameters

An owner shall monitor all public drinking water supplies for total coliform and *Escherichia coli (E. coli)* bacteria. Coliform bacteria (total or *E. coli*) are indicator organisms used to determine the efficiency of treatment and the integrity of the water works system. They are surrogates for less abundant and more difficult to detect human pathogens. *E. coli* bacteria is a sub-group of total coliform bacteria and is used as a screen for fecal contamination. Thus, the presence of coliform organisms in treated water indicates that barriers are ineffective and there is an increased chance for waterborne pathogens to follow the same pathway. However, the absence of coliforms does not guarantee safe water and the presence of coliforms does not necessarily indicate an immediate hazard. Generally, the presence of total coliform indicates that treatment is not effective or that there is a secondary contamination in the water works system such as from a cross connection or biofilm growth or accumulation. The presence of *E. coli* indicates ineffective treatment and recent fecal contamination.

An owner shall ensure that all samples collected for routine bacteriological monitoring are tested for the presence of total coliform and *E. coli* organisms using methods listed in the latest edition of *Standard Methods for the Examination of Water and Wastewater.* It is recommended that the samples be analysed using the presence/absence (P/A) method that permits both total coliform and *E. coli* organisms to be determined simultaneously.

### 4.1.2 Sample Frequency, Number and Location

An owner of an approved water supply shall sample the public drinking water supply routinely. The minimum number of bacteriological samples an owner shall collect

from a public drinking supply water is set out in the most recent version of the *Guidelines for Canadian Drinking Water Quality* and shown in the following table:

| Population Served | Minimum Number of Samples per Month |
|---|---|
| Up to 5,000 | 4 |
| 5,000 to 90,000 | 1 per 1,000 persons |
| More than 90,000 | 90 + (1 per 10,000 persons) |

In many cases the number of samples necessary to obtain an accurate representation of a water works system will exceed these minimums. Sampling frequency from the system shall be at least weekly.

The sampling locations shall be chosen to be representative of the water works system and include central and peripheral locations. Buildings with prolonged periods of low or no use of water should be avoided as sampling locations.

For systems using surface water supplies, at least one water sample per week shall be collected from the point where the treated water enters the water works system.

NSEL may alter the frequencies, locations, numbers and parameters to be monitored depending on local conditions, analytical results or changes to the *Guidelines for Canadian Drinking Water Quality*.

### 4.1.3 Sample Collection and Preservation

All samples shall be collected and transported according to the standard procedures outlined in APPENDIX A.

### 4.1.4 Reporting of Sample Results

1) An owner shall ensure that results of all routine samples collected are sent from the lab to the owner. An owner shall record summaries of routine sample results in a uniform manner and make them available to NSEL upon request. The owner shall maintain records of sample results, including the original lab records, for a minimum of two years from the collection date.

2) Whenever the presence of coliforms is detected (total or *E. coli*), the lab shall immediately notify the water supply owner and NSEL and forward the results

to NSEL. The owner shall also immediately notify NSEL and forward the results to NSEL immediately after they receive the results from the lab. Receipt of any results sent electronically must be confirmed by telephone. If the local NSEL office cannot be contacted for any reason, the environmental emergencies number is to be called at 1-800-565-1633.

3) Upon receipt of sample results indicating the presence of coliforms (total or *E. coli*), the owner shall comply with Section 4.4 of this Guideline, "Corrective Actions to be Taken When Bacteria Are Present". Depending on the particular circumstances, advice may be sought from NSEL.

4) If the results indicate deficiencies that require a boil water advisory (see Section 4.5), the owner shall notify and work cooperatively with NSEL and the MOH. NSEL and the MOH may appoint a water quality committee to investigate the problem.

### 4.1.5 Re-sampling Procedure

The owner shall re-sample all locations showing coliforms present immediately upon receiving the results. Depending on the circumstances, NSEL may require that the owner collect additional samples throughout the water works system. The owner shall make arrangements with the lab to ensure the samples are analysed when received.

All re-samples shall be analysed by the P/A method (e.g. Colilert™, Colisure™, etc.) for a 24-28 hour result to confirm the presence of coliforms (total or *E. coli*).

### 4.1.6 Compliance

An owner shall ensure that the drinking water meets the bacteriological quality requirements as set out in the *Guidelines for Canadian Drinking Water Quality*.

Currently, the *Guidelines for Canadian Drinking Water Quality* require that:

> *The maximum acceptable concentration (MAC) for the bacteriological quality of approved water supplies is no coliforms detectable per 100 mL.*

However, because coliforms are not uniformly distributed in water and are subject to considerable variations in public health significance, this MAC will be applied in Nova Scotia as outlined in Section 4.4.

Section 4.4 outlines the corrective actions to be taken by the owner when coliform bacteria are present. When a boil water advisory is necessary (see Section 4.5), the owner shall comply with Section 4.6.

## 4.2 Routine Monitoring for Chemical and Physical Quality

### 4.2.1 Parameters

The owner shall monitor for general chemical and physical quality. The minimum parameters to be monitored are shown in the following table and include inorganic and physical parameters with recommended limits in the *Guidelines for Canadian Drinking Water Quality* and some with no guidelines at the present time. These parameters are included in standard general chemical analysis and metal scan packages available at most labs.

**The following parameters are considered to be minimum requirements and any conditions to an operating approval that the facility has or may require will always take precedence. NSEL may require additional parameters to be monitored as part of an approval to operate.**

| | | |
|---|---|---|
| Alkalinity | Colour | Potassium |
| Aluminum | Conductivity | Selenium |
| Ammonia | Copper | Sodium |
| Antimony | Fluoride | Sulphate |
| Arsenic | Hardness | Total Dissolved Solids |
| Barium | Iron | Total Organic Carbon |
| Boron | Lead | Turbidity |
| Cadmium | Magnesium | Uranium |
| Calcium | Manganese | Zinc |
| Chloride | Nitrate | |
| Chromium | pH | |

### 4.2.2 Sample Frequency, Number and Location

An owner of an approved water supply shall monitor a surface water supply at least annually or a groundwater supply at least once every two years. On each occasion two samples shall be collected, one sample from the raw water source and one sample from a point after treatment. The same sample points shall be used each year.

In many cases the number of samples necessary to obtain an accurate representation of a water works system will exceed these minimums. The sampling locations shall be chosen to be representative of the water works system and include central and peripheral locations.

If there is reason to suspect the presence of other substances not listed in the table in Section 4.2.1 in a public drinking water supply, an owner shall monitor for these substances to ensure that their concentrations are below acceptable limits.

NSEL may alter the frequencies, locations, numbers and parameters to be monitored depending on local conditions, analytical results or changes to the *Guidelines for Canadian Drinking Water Quality* pursuant to Section 33 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations.*

### 4.2.3 Sample Collection and Preservation

An owner shall collect and transport samples according to the standard procedures outlined in APPENDIX B.

### 4.2.4 Reporting of Sample Results

1) An owner shall ensure that the results of samples for chemical and physical quality are sent from the lab to the owner. An owner shall record summaries of routine sample results in a uniform manner and make the results available to NSEL upon request. The owner shall maintain records of sample results for a minimum of ten years from the collection date.

2) Upon receipt of results that indicate that a Maximum Acceptable Concentration (MAC) or an Interim Maximum Acceptable Concentration (IMAC) has been exceeded, the owner shall immediately notify NSEL and forward the results to NSEL. Receipt of any results sent electronically must be confirmed by telephone.

3) Where a MAC or IMAC is exceeded, the owner shall comply with Section 4.2.5 of this Guideline, "Re-sampling Procedure". Depending on the particular circumstances, advice may be sought from NSEL.

### 4.2.5 Re-sampling Procedure

Where results indicate that a Maximum Acceptable Concentration (MAC) or an Interim Maximum Acceptable Concentration (IMAC) has been exceeded, the owner

shall collect a confirmation re-sample for that parameter as soon as possible after the initial results are received.

If the confirmation re-sample indicates that the MAC or IMAC is exceeded for the parameter of concern, the owner shall comply with Section 4.2.6 of this Guideline, "Compliance". Depending on the particular circumstances, advice may be sought from NSEL.

If the confirmation re-sample indicates that the MAC or IMAC is not exceeded for the parameter of concern, NSEL may require that additional samples be taken to further evaluate the need for compliance pursuant to Section 33 (2) of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations*.

### 4.2.6 Compliance

Any public drinking water supply in which the level of a substance is confirmed to exceed a Maximum Acceptable Concentration (MAC) or an Interim Maximum Acceptable Concentration (IMAC) is considered to be out of compliance with the health-related criteria specified in the most recent version of the *Guidelines for Canadian Drinking Water Quality*. The water supply owner, in consultation with NSEL, shall develop an action plan for addressing such non-compliance issues.

The action plan shall:

1) determine why the water exceeds the MAC or IMAC;

2) select a corrective action(s) to remove the source of contamination, provide treatment or switch to an acceptable alternate potable water supply;

3) provide a schedule for implementation of the corrective action(s) for meeting the MAC or IMAC.

After completing the corrective action(s), a water sample must be collected to demonstrate that the corrective action(s) has successfully reduced the concentration to below the MAC or IMAC given in most recent version of the *Guidelines for Canadian Drinking Water Quality*.

The action plan shall be prepared and submitted to NSEL within 30 calendar days from when the water supply owner confirmed the MAC or IMAC exceedance.

NSEL will communicate with the MOH during this process.

## 4.3 Daily Operational Monitoring

### 4.3.1 Disinfection Residual

An owner using a disinfection system shall monitor daily for disinfection residual. A disinfection residual should be continuously maintained throughout the entire water works system. Where a chlorine disinfection system is being used, the goal for a free chlorine residual at distant points in a water works system should be a minimum 0.2 mg/L. Higher chlorine residuals may be required by NSEL depending on other characteristics of the system but should not exceed 4.0 mg/L at any time.

Daily disinfection residuals should be recorded in a uniform manner and made available to NSEL upon request.

> All municipal water supplies shall be disinfected. In addition, NSEL has established minimum treatment requirements for all municipal supplies derived from surface water sources, groundwater under the direct influence of surface water and secure groundwater sources. Treatment requirements are available on the web at: www.gov.ns.ca/enla/water/municipalwaterapprovals.asp.

### 4.3.2 Turbidity

An owner using chemically-assisted filtration shall measure source and treated water turbidity at least once per day. An owner shall record daily turbidity measurements in a uniform manner and make them available to NSEL upon request.

### 4.3.3 Fluoride

An owner using fluoridation shall monitor daily for fluoride concentrations at a representative location within the water works system. At no time should fluoride concentrations exceed 1.5 mg/L with an optimum range between 0.8 and 1.0 mg/L. An owner shall record daily fluoride measurements in a uniform manner and make them available to NSEL upon request.

### 4.3.4 Approval to Operate

Any conditions to an operating approval that the water works system has or may require will always take precedence over the above requirements.

## 4.4 Corrective Actions to be Taken When Bacteria Are Present

### 4.4.1 Immediate Notification

An owner of an approved water supply shall contact NSEL immediately upon receipt of any sample result indicating the presence of total coliform or *E. coli*. If the local NSEL office cannot be contacted for any reason, the environmental emergencies number is to be called 1-800-565-1633.

When corrective action is to involve increased sampling (re-sampling) and/or weekend or public holiday monitoring, the lab is to be notified immediately.

### 4.4.2 With Total Coliform Present, *E. coli* Absent

Where total coliform are present in the absence of *E. coli*, the owner shall:

1) Immediately notify NSEL.
2) Re-sample at least the total coliform positive locations immediately.
3) Check disinfection residual:
   a) if there is inadequate residual throughout the system, increase disinfection;
   b) if there is no, or very low, disinfection residual at distant ends of the system, increase disinfection and flush water mains if necessary.

If the presence of total coliform is confirmed, the owner shall immediately begin an investigation to explain the presence of total coliform in the distribution system. NSEL, the MOH and the owner shall consider, on a case-by-case basis, one or more of the following actions to be included in the investigation:

1) Evaluate the effectiveness of treatment and the treatment plant:
   - determine if the disinfection equipment is working properly;
   - collect additional samples(s) of water leaving the treatment plant to see if it is properly disinfected (dosage/contact time);
   - analyse turbidity of water entering the water works system;
   - test for heterotrophic plate counts of raw and treated water and stressed coliform.
2) Evaluate the integrity of the water works system:
   - determine if water quality has deteriorated due to cross-connections, repairs, construction, loss of pressure, etc.;
   - collect additional samples to better characterize distribution system water quality.

3) Enumerate coliforms in samples to assess degree of contamination and possible point of entry.
4) Determine the species of coliforms retrieved from the water works system.
5) Request the MOH to survey doctor offices, hospital laboratories, etc. for increase in the incidence of waterborne gastrointestinal illness.
6) Review past history of the system and possibility of biofilm episode (see APPENDIX C).

A boil water advisory will be initiated at any time, in accordance with Section 4.6, if:

1) The owner is unable or unwilling to conduct the investigation.
2) The owner is unable or unwilling to take corrective action to remediate the cause of the positive samples.
3) The investigation indicates a problem that results in a threat to public health.
4) Any other circumstance in which it is believed that public health may be at risk from the water supply.

### 4.4.3 With *E. coli* Present

Where *E. coli* is present in any sample, the owner shall immediately notify NSEL. NSEL will notify the MOH. If the local NSEL office cannot be contacted for any reason, the environmental emergencies number is to be called at 1-800-565-1633.

The owner shall immediately initiate a boil water advisory, in accordance with Section 4.6, and immediately begin an investigation to explain the presence of *E. coli* in the distribution system. NSEL, the MOH and the owner shall consider, on a case-by-case basis, one or more of the following actions to be included in the investigation:

1) Resample at least the positive locations immediately.
2) Check disinfection residual:
   a) if there is inadequate residual throughout the system, increase disinfection;
   b) if there is no, or very low, disinfection residual at distant ends of the system, increase disinfection and flush water mains if necessary.
3) Evaluate the effectiveness of treatment and the treatment plant:
   - determine if the disinfection equipment is working properly;
   - collect additional samples(s) of water leaving the treatment plant to see if it is properly disinfected (dosage/contact time);
   - analyse turbidity of water entering the water works system;

- test for heterotrophic plate counts of raw and treated water and stressed coliform.

4) Evaluate integrity of the water works system:
   - determine if water quality has deteriorated due to cross-connections, repairs, construction, loss of pressure, etc.;
   - collect additional samples to better characterize distribution system water quality.
5) Enumerate coliforms in samples to assess degree of contamination and possible point of entry.
6) Consider further microbiological analysis of samples from the water works system.
7) Request the MOH to survey doctor offices, hospital laboratories, etc. for increase in the incidence of waterborne gastrointestinal illness.
8) Review past history of the system and possibility of biofilm episode (see APPENDIX C).

## 4.5 Boil Water Advisories

### 4.5.1 Deficiencies That Require a Boil Water Advisory

Deficiencies that require a boil water advisory include:

1) Fecal contamination of drinking water evidenced by sample results indicating the presence of *E. coli*.
2) Lack of disinfection or failure of key water treatment process.
3) Use of emergency water supply from an unchlorinated or inadequately chlorinated source.
4) Other circumstances which in the opinion of NSEL or the MOH constitutes a risk to public health (e.g. *Giardia*, *Cryptosporidium* contamination, etc.).
5) Evidence of an outbreak of waterborne illness as determined by the MOH (the risk to young children, elderly and immuno-compromised people should be considered in a decision).
6) A serious incident of raw water contamination.

Depending on the particular circumstances, advice may be sought from NSEL.

### 4.5.2 Deficiencies That May Require a Boil Water Advisory

Deficiencies that may require a boil water advisory include, but are not limited to:

1) Water that does not meet the *Guidelines for Canadian Drinking Water Quality* requirements for total coliform.
2) Suspected cross-connection or negative pressure.
3) Indicators of poor water quality such as ineffective disinfection due to high turbidity, high chlorine demand, etc. evidenced by sample results indicating the presence of total coliform in the water leaving the treatment plant and generally poor bacteriological water quality.

Depending on the particular circumstances, advice may be sought from NSEL.

## 4.6 Boil Water Advisory Protocol and Communication Plan

### 4.6.1 Initiating the Boil Water Advisory

Where one or more of the conditions described in Section 4.5.1 exists, the owner shall initiate the boil water advisory and contact NSEL immediately.

Where one or more of the conditions described in Section 4.5.2 exists, the owner may initiate the boil water advisory after consultation with NSEL.

In the event that NSEL or the MOH is aware of a potential serious health risk, NSEL will advise the water supply owner to initiate the boil water advisory.

When a boil water advisory is to be initiated, the owner shall provide a communication plan to NSEL for approval in accordance with Section 4.6.2. NSEL may approve or modify the plan depending on the seriousness of the event.

During the boil water advisory there should be frequent communication between NSEL, the MOH and the owner.

### 4.6.2 Procedure for Notification of Boil Water Advisory

1) The owner will inform consumers in a manner and frequency acceptable to NSEL and the MOH.
2) If the owner fails to notify the consumers, NSEL or the MOH will take appropriate steps to notify consumers.

The boil water advisory must be effectively communicated to the public. Consideration is to be given to placing the advisory in daily newspapers and in all other print media in the area. Local radio and television stations should be requested to broadcast the advisory on a frequent basis. All methods of

communication to the public are to be maintained throughout the duration of the advisory being in effect. In the case of an immediate serious public health threat other methods of notification, such as door-to-door and installation of signage, may be necessary.

### 4.6.3 Suggested Wording for Boil Water Advisory

"Due to water quality problems and the possibility of unsafe water, consumers are advised to boil all water for at least 1 minute before drinking, preparing infant formulas, preparing juices and ice cubes, washing fruits and vegetables, cooking, dental hygiene or any other activity requiring human consumption. This is to be done until further notice". (See APPENDIX D for recommended press release).

### 4.6.4 Follow up Communication Plan for Boil Water Advisory

After a boil water advisory has been issued, the owner shall keep the general public informed about the status of the advisory. A telephone hot line may be put in place by the owner during the boil water advisory. The hot line should be staffed for extended hours as needed.

Some businesses, institutions, manufacturing plants or health care facilities may have to take additional precautions during a boil water advisory. There may be circumstances where these facilities should be contacted as part of the owner's communication plan to assure compliance with these precautions.

### 4.6.5 Instructions for Boiling and Disinfecting Tap Water

During an advisory it is essential that all water to be used for the following activities be boiled:

1) drinking;
2) preparing infant formulas;
3) preparing juices and ice cubes;
4) washing fruits and vegetables;
5) cooking; or
6) dental hygiene.

Detailed instructions for boiling and disinfecting tap water during a boil water advisory are included in APPENDIX E. Instructions for businesses, institutions, manufacturing plants or health care facilities that may have special requirements when a boil water advisory is in effect are provided in APPENDIX F.

### 4.6.6 Removing the Boil Water Advisory

The boil water advisory will be removed by NSEL, in consultation with the MOH and the owner. Under normal circumstances the boil water advisory will be removed when:

a) the *Guidelines for Canadian Drinking Water Quality* for bacteriological quality are met for 2 consecutive sets of samples separated by a minimum of 24 hours; and

b) the deficiencies which led to the boil water advisory are corrected; and

c) sufficient finished water displacement has occurred in the water works system to eliminate potentially contaminated water.

## 5.0 Registered Water Supplies

The following sections apply to public drinking water supplies that hold a registration with NSEL under the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* made pursuant to the *Environment Act* for the collection, production, treatment, storage, supply or distribution of potable, piped water to the public (i.e. registered water supplies).

## 5.1 Routine Monitoring for Microbiological Quality

### 5.1.1 Parameters

An owner shall monitor all public drinking water supplies for total coliform and *Escherichia coli (E. coli)* bacteria. Coliform bacteria (total or *E. coli*) are indicator organisms used to determine if drinking water is of good quality and free of microbial pathogens that can cause disease. Coliform bacteria are found in soil and in the intestines of warm-blooded animals, including humans. Monitoring for total coliform and *E. coli* bacteria therefore provides an indication of the degree of pollution impacting a drinking water supply source and its sanitary condition.

The presence of *E. coli* indicates that the source has been impacted by recent fecal contamination and therefore the water is unsafe to drink. The presence of total coliform in a non-disinfected well means that the well is prone to surface water infiltration and is therefore at risk of fecal contamination. The presence of total coliform in a disinfected system means the disinfection process has failed or has been overwhelmed. In the latter two cases, the water is considered unsafe to drink until the situation is remediated.

It is important to note that the absence of coliform bacteria does not guarantee safe water. Regular testing is required to check the safety of the water supply. Sampling should be carried out when the risk of contamination is greatest, such as during spring thaw, extended periods of heavy rain or drought, after lengthy periods of non-use or if the owner suspects any changes to the water quality.

An owner shall ensure that all samples collected for routine bacteriological monitoring are tested for the presence of total coliform and *E. coli* organisms using methods listed in the latest edition of *Standard Methods for the Examination of Water and Wastewater*. It is recommended that the samples be analysed using the

presence/absence (P/A) method that permits both total coliform and *E. coli* organisms to be determined simultaneously.

### 5.1.2 Sample Frequency, Number and Location

An owner of a registered water supply shall sample the water supply quarterly for microbiological quality. Where a water supply is not in operation year round, at least one of the samples is to be collected prior to start up.

NSEL may alter the frequencies, locations, numbers and parameters to be monitored depending on local conditions, analytical results or changes to the *Guidelines for Canadian Drinking Water Quality*.

### 5.1.3 Sample Collection and Preservation

All samples shall be collected and transported according to the standard procedures outlined in APPENDIX A.

The owner shall record the water supply registration number on the lab form when submitting all samples for microbiological quality analyses.

### 5.1.4 Reporting of Sample Results

1) An owner shall ensure that results of all routine samples collected are sent from the lab to the owner. The owner shall maintain records of sample results, including the original lab records, for a minimum of two years from the collection date. An owner shall make sample results available to NSEL upon request.

2) Whenever the presence of coliforms is detected (total or *E. coli*), the lab shall immediately notify the water supply owner and NSEL and forward the results to NSEL. The owner shall also immediately notify NSEL and forward the results to NSEL immediately after they receive the results from the lab. Receipt of any results sent electronically must be confirmed by telephone. If the local NSEL office cannot be contacted for any reason, the environmental emergencies number is to be called at 1-800-565-1633.

3) Upon receipt of sample results indicating the presence of coliforms (total or *E. coli*), the owner shall comply with Section 5.4 of this Guideline, "Corrective Actions to be Taken When Bacteria Are Present". Depending on the particular circumstances, advice may be sought from NSEL.

### 5.1.5 Compliance

An owner shall ensure that the drinking water meets the bacteriological quality requirements as set out in the *Guidelines for Canadian Drinking Water Quality*.

Currently, the *Guidelines for Canadian Drinking Water Quality* require that:

> *The maximum acceptable concentration (MAC) for the bacteriological quality of registered water supplies is no coliforms detectable per 100 mL.*

For clarity, this means that no sample should contain *E. coli* or other coliform bacteria. This MAC will be applied in Nova Scotia as outlined in Section 5.4.

Section 5.4 outlines the corrective actions to be taken by the owner when coliform bacteria are present. When a boil water advisory is necessary (see Section 5.5), the owner shall comply with Section 5.6.

## 5.2 Routine Monitoring for Chemical and Physical Quality

### 5.2.1 Parameters

The owner shall monitor for general chemical and physical quality. The minimum parameters to be monitored are shown in the following table and include inorganic and physical parameters with recommended limits in the *Guidelines for Canadian Drinking Water Quality* and some with no guidelines at the present time. These parameters are included in standard general chemical analysis and metal scan packages available at most labs.

**The following parameters are considered to be minimum requirements. NSEL may require additional parameters to be monitored.**

| | | |
|---|---|---|
| Alkalinity | Colour | Potassium |
| Aluminum | Conductivity | Selenium |
| Ammonia | Copper | Sodium |
| Antimony | Fluoride | Sulphate |
| Arsenic | Hardness | Total Dissolved Solids |
| Barium | Iron | Total Organic Carbon |
| Boron | Lead | Turbidity |
| Cadmium | Magnesium | Uranium |
| Calcium | Manganese | Zinc |
| Chloride | Nitrate | |
| Chromium | pH | |

### 5.2.2 Sample Frequency, Number and Location

An owner of a registered water supply shall monitor a surface water supply at least annually or a groundwater supply at least once every two years. If a treatment device is in place to remove any chemical or physical substances, two samples shall be collected, one sample from the raw water source and one sample from a point after treatment. The sampling locations shall be chosen to be representative of the system and the same sample points shall be used when sampling.

In many cases it may be necessary to sample more frequently to obtain an accurate representation of the registered water supply.

If there is reason to suspect the presence of other substances not listed in the table in Section 5.2.1 in a public drinking water supply, an owner shall monitor for these substances to ensure that their concentrations are below the acceptable limits.

NSEL may alter the frequencies, locations, numbers and parameters to be monitored depending on local conditions, analytical results or changes to the *Guidelines for Canadian Drinking Water Quality* pursuant to Section 33 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations*.

### 5.2.3 Sample Collection and Preservation

An owner shall collect and transport samples according to the standard procedures outlined in APPENDIX B.

The owner shall record the water supply registration number on the lab form when submitting all samples for chemical and physical quality analyses.

### 5.2.4 Reporting of Sample Results

1) An owner shall ensure that the results of samples for chemical and physical quality are sent from the lab to the owner. The owner shall maintain records of sample results for a minimum of ten years from the collection date. An owner shall make sample results available to NSEL upon request.

2) Upon receipt of results that indicate a Maximum Acceptable Concentration (MAC) or an Interim Maximum Acceptable Concentration (IMAC) has been exceeded, the owner shall immediately notify NSEL and forward the results to NSEL. Receipt of any results sent electronically must be confirmed by telephone.

3) Where a MAC or IMAC is exceeded, the owner shall comply with Section 5.2.5 of this Guideline, "Re-sampling Procedure". Depending on the particular circumstances, advice may be sought from NSEL.

### 5.2.5 Re-sampling Procedure

Where results indicate that a Maximum Acceptable Concentration (MAC) or an Interim Maximum Acceptable Concentration (IMAC) has been exceeded, the owner shall collect a confirmation re-sample for that parameter as soon as possible after the initial results are received.

If the confirmation re-sample indicates that the MAC or IMAC is exceeded for the parameter of concern, the owner shall comply with Section 5.2.6 of this Guideline, "Compliance". Depending on the particular circumstances, advice may be sought from NSEL.

If the confirmation re-sample indicates that the MAC or IMAC is not exceeded for the parameter of concern, NSEL may require that additional samples be taken to further evaluate the need for compliance pursuant to Section 33(2) of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations*.

### 5.2.6 Compliance

Any public drinking water supply in which the level of a substance is confirmed to exceed a Maximum Acceptable Concentration (MAC) or an Interim Maximum Acceptable Concentration (IMAC) is considered to be out of compliance with the health-related criteria specified in the most recent version of the *Guidelines for Canadian Drinking Water Quality*. The water supply owner, in consultation with NSEL, shall develop an action plan for addressing such non-compliance issues.

The action plan shall:

1) determine why the water exceeds the MAC or IMAC;

2) select a corrective action(s) to remove the source of contamination, provide treatment or switch to an acceptable alternate potable water supply;

3) provide a schedule for implementation of the corrective action(s) for meeting the MAC or IMAC.

After completing the corrective action(s), a water sample must be collected to demonstrate that the corrective action(s) has successfully reduced the concentration to below the MAC or IMAC given in the most recent version of the *Guidelines for Canadian Drinking Water Quality*.

The action plan shall be prepared by a qualified professional, complete with a schedule for implementation of the corrective measures and copies of any water quality results. The action plan shall be submitted to NSEL within 30 calendar days from when the water supply is confirmed to exceed the health-related criteria (i.e. MAC or IMAC).

The proposed action plan must be acceptable to NSEL. The acceptance of the proposed action plan does not preclude the owner from having to take additional corrective measures if the proposed action plan is unsuccessful at remediating the problem or from having to submit a revised or new action plan.

Qualified professionals may include licensed hydrogeolgoists, licensed engineers, or water treatment specialists.

NSEL will communicate with the MOH during this process.

Where a treatment device is installed to remove any chemical or physical substances, Section 5.2.2 of the *Guidelines for Monitoring Public Drinking Water Supplies* requires that two samples be collected when sampling, one sample from the raw water source and one sample from a point after treatment. The requirement to test the raw and treated water does not apply to groundwater supplies that only disinfect to meet bacteriological guidelines.

## 5.3 Daily Operational Monitoring

### 5.3.1 Disinfection Residual

An owner using a disinfection system shall monitor daily for disinfection residual. Where a chlorine disinfection system is being used, the goal for free chlorine residual should be a minimum 0.2 mg/L at the furthest tap in the system. Higher chlorine residuals may be required by NSEL depending on other characteristics of the system but should not exceed 4 mg/L at any time.

Daily disinfection residuals should be recorded in a uniform manner and made available to NSEL upon request.

## 5.4 Corrective Actions to be Taken When Bacteria Are Present

### 5.4.1 Immediate Notification

An owner of a registered water supply shall contact NSEL immediately upon receipt of any sample results indicating the presence of total coliform or *E. coli*. If the local NSEL office cannot be contacted for any reason, the environmental emergencies number is to be called at 1-800-565-1633.

### 5.4.2 Dug and Drilled Well Water Sources

Where total coliform or *E. coli* are present, the owner shall:

1) Immediately notify NSEL.
2) Immediately initiate a boil water advisory, in accordance with Section 5.6, or seek an acceptable alternate potable water supply until satisfactory bacteriological quality is restored.
3) Immediately re-sample the supply.

NSEL will respond within 24 hours. Based on this response, the following protocol will apply.

#### 5.4.2.1 No Obvious Signs of Well Construction Problems

Where there are no obvious signs of well construction problems and the re-sample result confirms the presence of total coliform or *E. coli*, the owner shall:

1) Immediately disinfect the water source as per the well disinfection procedures outlined in *Disinfection of Water Wells by Chlorination* available on the website at: www.gov.ns.ca/enla/water/docs/DisinfectWaterWell.pdf.

2) Re-sample the well 5 days after the well has been disinfected or after confirmatory tests, using a chlorine test kit, indicates the absence of chlorine residual.

It is critical that there be no remaining chlorine residual prior to taking the re-sample from a well that is normally untreated (i.e. does not have a continuous chlorination system).

a) Positive Re-sample Following Disinfection

If the re-sample result indicates the presence of total coliform or *E. coli* following disinfection, the owner shall immediately seek the expertise of a person qualified under the *Well Construction Regulations* to confirm the well is constructed properly. Any upgrading of the well to address deficiencies must meet the requirements of the *Well Construction Regulations*.

Once the well is confirmed to be constructed properly and contamination persists, the owner shall submit an action plan to NSEL outlining the corrective measures that will be taken to remediate the situation. The action plan shall be prepared by a qualified professional, complete with a schedule for implementation of the corrective measures and copies of any water quality results. The action plan shall be submitted to NSEL within 30 calendar days of the initial notification unless otherwise advised by NSEL.

The proposed action plan must be acceptable to NSEL. The acceptance of the proposed action plan does not preclude the owner from having to take additional corrective measures if the proposed action plan is unsuccessful at remediating the problem or from having to submit a revised or new action plan.

Qualified professionals may include licensed hydrogeolgoists, licensed engineers, or water treatment specialists.

b) Negative Re-sample Following Disinfection

If the re-sample result indicates the absence of total coliform or *E.coli* following disinfection, the owner shall continue following the *Guidelines for Monitoring Public Drinking Water Supplies*.

#### 5.4.2.2 Obvious Signs of Well Construction Problems

Where there are obvious signs of well construction problems, the owner shall immediately seek the expertise of a person qualified under the *Well Construction Regulations* to remediate the situation. Any upgrading of the well to address deficiencies must meet the requirements of the *Well Construction Regulations*.

Once the well is confirmed to be constructed properly and contamination persists, the owner shall submit an action plan to NSEL outlining the corrective measures that will be taken to remediate the situation. The action plan shall be prepared by a qualified professional, complete with a schedule for implementation of the corrective measures and copies of any water quality results. The action plan shall be submitted to NSEL within 30 calendar days of the initial notification unless otherwise advised by NSEL.

The proposed action plan must be acceptable to NSEL. The acceptance of the proposed action plan does not preclude the owner from having to take additional corrective measures if the proposed action plan is unsuccessful at remediating the problem or from having to submit a revised or new action plan.

Qualified professionals may include licensed hydrogeolgoists, licensed engineers, or water treatment specialists.

| |
|---|
| Where corrective measures have failed to remediate problems related to the presence of total coliform or *E. coli*, treatment shall be required pursuant to Section 34 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations.* |

### 5.4.3 Surface Water Supplies

Where total coliform or *E. coli* are present, the owner shall:

1) Immediately notify NSEL.
2) Immediately initiate a boil water advisory, in accordance with Section 5.6, or seek an acceptable alternate potable water supply until satisfactory bacteriological quality is restored.
3) Immediately re-sample the supply.

NSEL will respond within 24 hours. Based on this response the following protocol will apply.

If the re-sample result indicates the presence of total coliform or *E. coli*, the owner shall submit an action plan to NSEL outlining the corrective measures that will be taken to remediate the situation. The action plan shall be prepared by a qualified professional, complete with a schedule for implementation of the corrective measures and copies of any water quality results. The action plan shall be submitted to NSEL within 30 calendar days of the initial notification unless otherwise advised by NSEL.

The proposed action plan must be acceptable to NSEL. The acceptance of the proposed action plan does not preclude the owner from having to take additional corrective measures if the proposed action plan is unsuccessful at remediating the problem or from having to submit a revised or new action plan.

Qualified professionals may include licensed engineers or water treatment specialists.

All public water supplies registered under the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* made pursuant to the *Environment Act* that derive their supply from surface water sources shall be filtered and disinfected.

## 5.5 Boil Water Advisories

### 5.5.1 Deficiencies That Require a Boil Water Advisory

Deficiencies that require a boil water advisory include:

1) Presence of total coliform or *E. coli*.
2) Lack of disinfection, where required.
3) Ineffective disinfection, where required, due to high turbidity or high chlorine demand.
4) Suspected cross-connection or negative pressure.
5) Other circumstances which in the opinion of NSEL or the MOH constitutes a risk to public health (e.g. *Giardia*, *Cryptosporidium* contamination, etc.).
6) Evidence of an outbreak of waterborne illness as determined by the MOH (the risk to young children, elderly and immuno-compromised people should be considered in a decision).
7) A serious incident of raw water contamination.

## 5.6 Boil Water Advisory Protocol and Signage

### 5.6.1 Initiating the Boil Water Advisory

Where one or more of the conditions described in Section 5.5.1 exist, the owner shall initiate the boil water advisory and contact NSEL immediately.

In the event that NSEL or the MOH is aware of a potential serious health risk, NSEL will advise the water supply owner to initiate the boil water advisory.

During the boil water advisory there should be frequent communication between NSEL, the MOH and the owner.

### 5.6.2 Procedure for Notification of Boil Water Advisory

1) The owner will ensure that proper signage is posted to inform consumers of the boil water advisory. Signage must be acceptable to NSEL.
2) If the owner fails to notify the consumers, NSEL will take appropriate steps to notify the consumers.
3) Signage is to be posted for the duration of the boil water advisory.

### 5.6.3 Instructions for Boiling and Disinfecting Tap Water

During an advisory it is essential that all water to be used for the following activities be boiled:

1) drinking;
2) preparing infant formulas;
3) preparing juices and ice cubes;
4) washing fruits and vegetables;
5) cooking; or
6) dental hygiene.

Detailed instructions for boiling and disinfecting tap water during a boil water advisory are included in APPENDIX E. Instructions for businesses, institutions, manufacturing plants or health care facilities that may have special requirements when a boil water advisory is in effect are provided in APPENDIX F.

### 5.6.4 Removing the Boil Water Advisory

The boil water advisory will be removed by NSEL, in consultation with the MOH and the owner. Under normal circumstances the boil water advisory will be removed when:

a) the *Guidelines for Canadian Drinking Water Quality* for bacteriological quality are met for 2 consecutive sets of samples separated by a minimum of 24 hours; and

b) the deficiencies which led to the boil water advisory are corrected.

**Dated:** _____ _____

**William G. R. Lahey**
**Deputy Minister**

## APPENDIX A

## Sample Collection and Preservation - Microbiological Quality

### Container

- Use a sterilized sample bottle containing sodium thiosulfate preservative (a chlorine neutralizer). Bottles are available from some local Nova Scotia Environment and Labour offices, water quality laboratories, and from some hospitals. A list of approved laboratories is available at: http://www.gov.ns.ca/enla/water/labs/thm.

- Keep sample containers clean and free from contamination before and after collecting the sample. Do NOT open them prior to collecting the sample.

- Examine the sample bottle for cracks, a missing seal, or other signs that its sterility may be compromised. If any of these indications are found, discard the bottle and use a suitable one.

- Label the bottle with the water supply owner's name, location of the water source and/or sampling location, date, and time.

### Flush the System

- For locations at which the sample must be collected from a tap, inspect the outside of the faucet. If water leaks around the outside of the faucet, select a different sampling site.

- Remove any aerators, strainers, attachments, or purification devices from the tap.

- If necessary, remove debris and sterilize the faucet outlet, for example by swabbing with a disinfecting wipe.

- DO NOT take samples from a flexible hose or garden hose or outside hose bib. Sample from the cold water faucets only.

- If the sample is to be taken from a tap or a pump, allow the water to run for at least 5 minutes before collection. This will help to remove stagnant water from the system.

## Collect the Sample

- If there is a chlorine disinfection treatment unit, measure and record chlorine residual. Normally free chlorine residual is measured, however, total chlorine residuals may be required on occasion. In either case, the chlorine residual should be recorded on the lab requisition form and be marked "F" or "T" to indicate free or total chlorine residual, respectively.

- Before taking the sample, reduce the tap flow rate to approximately the width of a pencil before taking the sample. The flow rate should be low enough to ensure that no splashing occurs as the container is filled. Do not adjust the flow rate while taking the sample. At sampling points where water runs continuously, do not adjust flow rate.

- While holding the sample container at the base, remove the seal around the cap before attempting to open the bottle.

- Remove the cap with the free hand. Be careful NOT TO TOUCH the inside of the bottle cap or bottle lip. Continue to hold the cap in one hand with the inside facing down while the bottle is being filled. Do NOT touch the interior of the cap or lay it down. Do NOT breathe on the bottle or cap.

- Do NOT rinse the bottle.

- Fill the bottle to the fill line. Do NOT allow the bottle to overflow. Carefully replace the cap.

- Complete the laboratory requisition form. Include all required information including sampling location, date, time, etc. and who took the sample. Registered water supply owners must also record the registration number. All water samples are to be analysed for total coliform and *E. coli*.

## Storage and Transport

- Samples shall be kept in a refrigerator or cooler with ice packs to maintain a temperature of 4°C until delivered to the lab. Samples should not be frozen.

- Transport the sample to the laboratory as soon as possible and definitely within 24 hours of collection. Check ahead with the lab about day and/or time deadlines for sample acceptance to ensure meeting the 24-hour criterion.

## APPENDIX B

## Sample Collection and Preservation - Chemical and Physical Quality

### Container

- For most basic parameters, use a clean polyethylene bottle available from water quality laboratories. A list of approved laboratories is available on the web at: http://www.gov.ns.ca/enla/water/labs/htm.

- For additional or specialized parameters, discuss the requirements with the laboratory or a trained professional before sampling.

- Label the bottle with the water supply owner's name, location of the water source and/or sampling location, date, and time.

- Make sure all information on the requisition is filled out completely. Registered water supply owners must also record the registration number.

### Flush the System

- If the sample is to be taken from a tap or pump, allow the water to run for 10 minutes if possible before collection. This will help to remove stagnant water that may have artificially elevated metal concentrations from the system.

### Collect the Sample

- Rinse the bottle and cap 2 to 3 times unless specialized sampling requires non-rinse procedures.

- Turn flow volume down so that water runs gently.

- Sample for sensitive parameters (organics, metals) first. Filtration and preservation may be necessary for metals, depending on the purpose of sampling.

- Fill bottle to top (overflow) and cap tightly with no air gap.

- If a treatment device is in place to remove any chemical or physical substances, two samples shall be collected, one sample from the raw water source and one sample from a point after treatment.

**Storage and Transport**

- Samples shall be kept in a refrigerator or cooler with ice packs to maintain a temperature of 4°C until delivered to the lab. Samples should not be frozen. Samples should be kept in the dark.

- Transport the sample to the laboratory as soon as possible, preferably within 24 hours.

## APPENDIX C

## The Growth of Biofilm in a Water Works System

### Introduction

Biofilm in a water works system refers to organic or inorganic surface deposits consisting of microorganisms, microbial products and debris. Biofilm may occur on interior pipe surfaces, in sediments, inorganic tubercles, suspended particles or virtually any substratum immersed in the aquatic environment. Biofilm may be evenly distributed or occur as sporadic random patches.

### Public Health Significance

Portions of a biofilm lining the interior of a water pipe may periodically slough off into the passing water thereby seeding it with microorganisms contained in the biofilm. If such bacteria are coliforms, the occurrence must be considered a public health concern until it is proven that a treatment failure or contamination has not occurred. It is difficult to distinguish between a true biofilm event and an unexplained coliform occurrence. Determination of coliform contamination due to biofilm is usually a negative conclusion; that is, there are no observable coliforms in the treatment plant effluent, no identified breakdown in treatment barriers, no apparent cross-connection or other contamination of the water works system (breaks, construction, etc.). While a true coliform biofilm event may not in itself signal a public health risk, it may mask a real contamination event and therefore must be viewed with concern. The onus is on the owner to show that these coliform occurrences are a result of biofilm release into the water supply.

### Characteristic of a Situation Where Biofilm May be the Cause of Bacteria Counts Within a Water Works System

- No coliforms are detected in treatment plant effluent.
- Coliform bacteria persist in a water works system samples despite the maintenance of a disinfectant residual.
- Seasonal increase in coliform densities with highest recovery in warm summer months, decreasing in the fall.
- The duration of the coliform episode is prolonged for years.
- Growth of heterotrophic bacteria, detected using the heterotrophic plate count (HPC) method, frequently occurs before coliforms are detected.
- Coliform growth occurs as randomized pattern in the water works system.
- Some predominant coliform species can be identified, such as *Klebsiella*, *Enterobacter* or *Citrobacter*.

- Coliform occurrence persists despite proper operation and maintenance practices being carried out, including: consistently maintaining positive pressure in the water works system, implementing aggressive cross-connection control, thoroughly flushing and disinfecting pipes after construction and repair, providing efficient treatment.

## APPENDIX D

### Draft Press Release for Boil Water Advisory
### (Revise as necessary to fit specific circumstances)

Due to apparent contamination of the _____ public drinking water supply and the possibility of unsafe water, consumers are advised to boil all water for at least 1 minute before drinking, preparing infant formulas, preparing juices and ice cubes, washing fruits and vegetables, cooking, dental hygiene or any other activity requiring human consumption. This is to be done until further notice.

The water utility is doing all it can to determine the cause of the problem and to remedy it as quickly as possible. The water utility, Nova Scotia Environment and Labour and the Medical Officer of Health are continuing to monitor the water quality closely and are working in close consultation.

Detailed instructions on water usage when a boil water advisory is in effect are available from the water utility or the local office of Nova Scotia Environment and Labour.

For further information regarding this notice call:

## APPENDIX E

### Instructions for Boiling and Disinfecting Tap Water During a Boil Advisory

During an advisory, it is essential that all water to be used for the following activities be boiled:

1) drinking;
2) preparing infant formulas;
3) preparing juices and ice cubes;
4) washing fruits and vegetables;
5) cooking; or
6) dental hygiene.

Holding water at a rolling boil for at least 1 minute will inactivate all waterborne pathogenic micro-organisms. Water can be boiled either in a pot or kettle on a stove, an electric kettle without an automatic shut-off or in a microwave oven. If water is boiled in a microwave, it is advisable to include a glass rod or wooden or plastic stir stick in the container to provide nucleation sites for bubble formation and energy diffusion. This will prevent the formation of superheated water.

Under most circumstances it is not necessary to boil water used for other household purposes. Adults, adolescents and older children may shower, bathe or wash using tap water but should avoid swallowing the water. Toddlers and infants should be sponge bathed. In non-outbreak situations, dishes and laundry may be washed in tap water, either by hand or by machine.

In the event of a waterborne outbreak as declared by the Medical Officer of Health, it may be necessary to advise the public to take additional precautions. In this situation, hands should be washed in a dilute solution of household bleach and water (1 mL or 20 drops per litre of water). This is particularly important before preparing or eating meals, and after using the toilet, changing diapers, and handling animals. The solution should be allowed to stand 10 minutes before use. If dishes are hand washed they should be washed and rinsed in hot tap water, soaked in a dilute solution of household bleach (20 mL of bleach in 10 litres of water) for one minute and air dried. Alternatively, dishwashers with a hot water cycle will disinfect dishes.

Additional instructions for businesses, institutions, manufacturing plants or health care facilities that may have special requirements when a boil water advisory is in effect are provided in APPENDIX F.

## APPENDIX F

## Users That Must Take Particular Precautions During A Boil Advisory

### a) Commercial Establishments (Restaurants, Hotels, Convenience Stores, etc.)

- All water that is to be provided directly to customers for drinking purposes must be treated by boiling the tap water for at least 1 minute and then storing the water in clean, covered containers until used for serving. An alternative to this would be using commercially available "bottled water" from a supplier who is a member of the Canadian Bottled Water Association (CBWA) or the International Bottled Water Association (IBWA). Commercial coffee machines that achieve boiling temperatures as part of their design are exempt (see Notes).

- All foods (e.g. fruits and vegetables) that need washing are to be rinsed or soaked in tap water that has been boiled for at least 1 minute. An alternative to this would be using commercially available "bottled water" from a supplier who is a member of the Canadian Bottled Water Association (CBWA) or the International Bottled Water Association (IBWA).

- Tap water used as an ingredient in any food product that will be "ready to eat" without cooking (e.g. drink mixes, pudding, jellos, etc.) must be boiled for at least 1 minute. An alternative to this would be using commercially available "bottled water" from a supplier who is a member of the Canadian Bottled Water Association (CBWA) or the International Bottled Water Association (IBWA).

- Ensure that food handlers wash and rinse hands in water that has been treated with chlorine bleach.

- It is not necessary for bakeries to boil water that is part of a recipe or ingredient in a product that is to be baked. Water for other uses must be boiled.

- Disconnect ice machines and discard any ice and crushed ice products that has been made from this ice. All ice used during the boil water advisory must originate from tap water that has been boiled for at least 1 minute or from a commercial ice supply distributor. Ice machines at the establishment must be emptied and not used for the duration of the boil water advisory. Lines to ice machines must be disinfected prior to reuse.

- All soft drink beverage lines connected directly to tap water for mixing must be disconnected for the duration of the boil water advisory. Use bottled water or canned beverages exclusively. Lines to soft drink canisters must be disinfected prior to re-use.

- Disconnect water vending machines unless the water is treated by an approved method. Disinfect lines prior to re-use.

- Disconnect vegetable spraying/sprinkler supplies. Disinfect lines prior to re-use.

- Commercial dishwashers that use hot water 82°C or above are considered satisfactory. Beverage glass washers that utilize a "cold" water rinse must not be used unless the rinse water can be changed to use hot water 82°C or above. For manually washed dishes, it is important that the sanitizer concentration be a minimum of 100 parts per million of chlorine. It is also important that dishes are allowed to air dry. Do not rinse with tap water.

- Substitute boiled/cooled water for tap water in all other uses in the kitchen such as washing and sanitizing cutting boards, counter tops, etc.

- All employees reporting that they are suffering from a diarrheal illness must be excluded from work and should be tested by their family doctor. They are not to return to work until symptoms have subsided. Good hand washing should be emphasized for all staff.

**Notes**:

Commercial coffee brewers generally operate at a brew temperature of 88°C - 90°C with this temperature being thermostatially maintained in the water tank. Brewing is achieved by displacement of the hot water with cold water within the tank. The temperature attained by the hot water will control bacterial and protozoic organisms of concern during a boil water advisory.

The temperature of the water should be verified using a metal stem probe thermometer by running a full cycle of the brewer with water, taking the temperature at a point below the funnel when the decanter is half full. The temperature at this point should be 72°C or higher.

The decanter used for filling the brewer with water should not be used for receiving the coffee before being washed and sanitized.

This exemption is not applicable to non-commercial or domestic type coffee brewers as there may be wide variations of temperatures in these machines.

Upon rescinding of a boil water advisory:

- Re-start and flush any water-using fixture or piece of equipment in accordance with the manufacturer's specifications. This may vary from fixture to fixture. Consult your facility engineer and/or manufacturer when re-starting the equipment.

- Managers of large buildings with water-holding reservoirs should consult with their facility engineer about draining the reservoir.

- Follow the directions of your water utility or, as general guidance, run cold water faucets and drinking fountains for 3 minutes each.

- Run water softeners through a regeneration cycle.

- Drain and refill hot water heaters if set at a low temperature (below 64.2$^{o}$C) taking all necessary precautions to avoid electrical shocks.

- Consult your facility engineer regarding pool and/or whirlpool operations.

**b) Food Production**

- Dairy Plants - The contaminated water must not contact products following the pasteurization procedure and water used in clean-in-place procedures and in cleaning of product related equipment must be properly chlorinated.

- Bottling Plants - Pre-superchlorination and chlorine removal must be a part of production procedure.

- Ice Making - It is prohibited to make ice for domestic purposes or for cooling or preservation of food for the duration of the boil water advisory unless the water has undergone proper treatment to inactivate microbial pathogens.

**c) Hospitals, Clinics, Long Term Care Facilities, Nursing Homes, etc.**

- Boil water or use an acceptable alternate potable water supply in all applications of tap water intended for human consumption or treatment procedures where a risk of infection is possible. **Assess all water usage in consultation with infection control personnel.**

- Patients and employees should not consume tap water that has not been disinfected, ice or drinks made with tap water that has not been disinfected, or raw foods rinsed with tap water that has not been disinfected.

- Disconnect ice machines and discard any ice and crushed ice products that has been made from this ice. All ice used during the boil water advisory must originate from tap water that has been boiled for at least 1 minute or from a commercial ice supply distributor. Ice machines at the establishment must be emptied and not used for the duration of the boil water advisory. Lines to ice machines must be disinfected prior to re-use.

- For other food preparation and hand washing guidance, refer to the information provided under the "commercial establishments" (see Appendix F, Section a).

- Disinfect water by:
  - Boiling at a rapid, rolling boil for 1 minute; or
  - Filtering through a reverse osmosis filter, an "absolute 1 micron" filter.

  An alternate to this would be using commercially available "bottled water" from a supplier who is a member of the Canadian Bottled Water Association (CBWA) or the International Bottled Water Association (IBWA).

- All employees reporting that they are suffering from a diarrheal illness must be excluded from work and should be tested by their family doctor. They are not to return to work until symptoms have subsided. Good hand washing should be emphasized for all staff.

- Restrict burn patients and patients with open sores or wounds from whirlpool treatments.

- Monitor patients closely for signs and symptoms of gastrointestinal illness.

- Sanitize dishes by washing in dishwashing machines that have a hot water cycle at 82 °C or above. For manually washed dishes, it is important that the sanitizer concentration be a minimal of 100 parts per million of chlorine. It is also important that dishes are allowed to air dry. Do not rinse with tap water.

**Notes**:

Renal dialysis units are routinely treated with water using reverse osmosis. This is considered an acceptable treatment process for publicly supplied water under a boil water advisory.

Upon rescinding of a boil water advisory:

- Re-start and flush any water-using fixture or piece of equipment in accordance with the manufacturer's specifications. This may vary from fixture to fixture. Consult your facility engineer and/or manufacturer when re-starting the equipment.

- Managers of large buildings with water-holding reservoirs should consult with their facility engineer about draining the reservoir.

- Follow the directions of your water utility or, as general guidance, run cold water faucets and drinking fountains for 3 minutes each.

- Run water softeners through a regeneration cycle.

- Drain and refill hot water heaters if set at a low temperature (below 64.2$^{o}$C) taking all necessary precautions to avoid electrical shocks.

- Resume usual bathing practices and care for patients with breaks in the skin.

- Consult your facility engineer regarding pool and/or whirlpool operations.

**d) Day Care Facilities**

- Day care facilities in areas where a boil water advisory is in effect should be contacted and advised to use boiled or disinfected water for drinking, preparing infant formulas, preparing juices and ice cubes, washing fruits and vegetables and for all hand washing and dental hygiene.

- Children and employees should not consume tap water that has not been disinfected, ice or drinks made with tap water that has not been disinfected, or raw foods rinsed with tap water that has not been disinfected.

- Disinfect water by:
  - Boiling at a rapid, rolling boil for 1 minute; or
  - Filtering through a reverse osmosis filter, an "absolute 1 micron" filter.

An alternate to this would be using commercially available "bottled water" from a supplier who is a member of the Canadian Bottled Water Association (CBWA) or the International Bottled Water Association (IBWA).

- All employees reporting that they are suffering from a diarrheal illness must be excluded from work and should be tested by their family doctor. They are not to return to work until symptoms have subsided. Good hand washing should be emphasized for all staff.

- Sanitize dishes by washing in dishwashing machines that have a hot water cycle at 82°C or above. For manually washed dishes, it is important that the sanitizer concentration be a minimum of 100 parts per million of chlorine. It is important that dishes be allowed to air dry. Do not rinse with tap water.

Upon rescinding of a boil water advisory:

- Re-start and flush any water-using fixture or piece of equipment in accordance with the manufacturer's specifications. This may vary from fixture to fixture. Consult your facility engineer and/or manufacturer when re-starting the equipment.

- Managers of large buildings with water-holding reservoirs should consult with their facility engineer about draining the reservoir.

- Follow the directions of your water utility or, as general guidance, run cold water faucets and drinking fountains for 3 minutes each if they have not been used in the last 24 hours.

- Run water softeners through a regeneration cycle.

- Drain and refill hot water heaters if set at a low temperature (below 64.2°C) taking all necessary precautions to avoid electrical shocks.

**e) Dental Offices**

- Dentists, in areas where a boil water advisory is in effect, should be contacted and advised to use boiled or bottled water for patients to drink or rinse and for all hand washing.

- It is also recommended that the high/low speed turbines run dry and a hand syringe of boiled water or sterile saline be used for cooling/rinsing the tooth and/or oral tissues.

- Regular hand piece maintenance (i.e. oiling and sterilizing) should continue per the manufacturer's instructions.

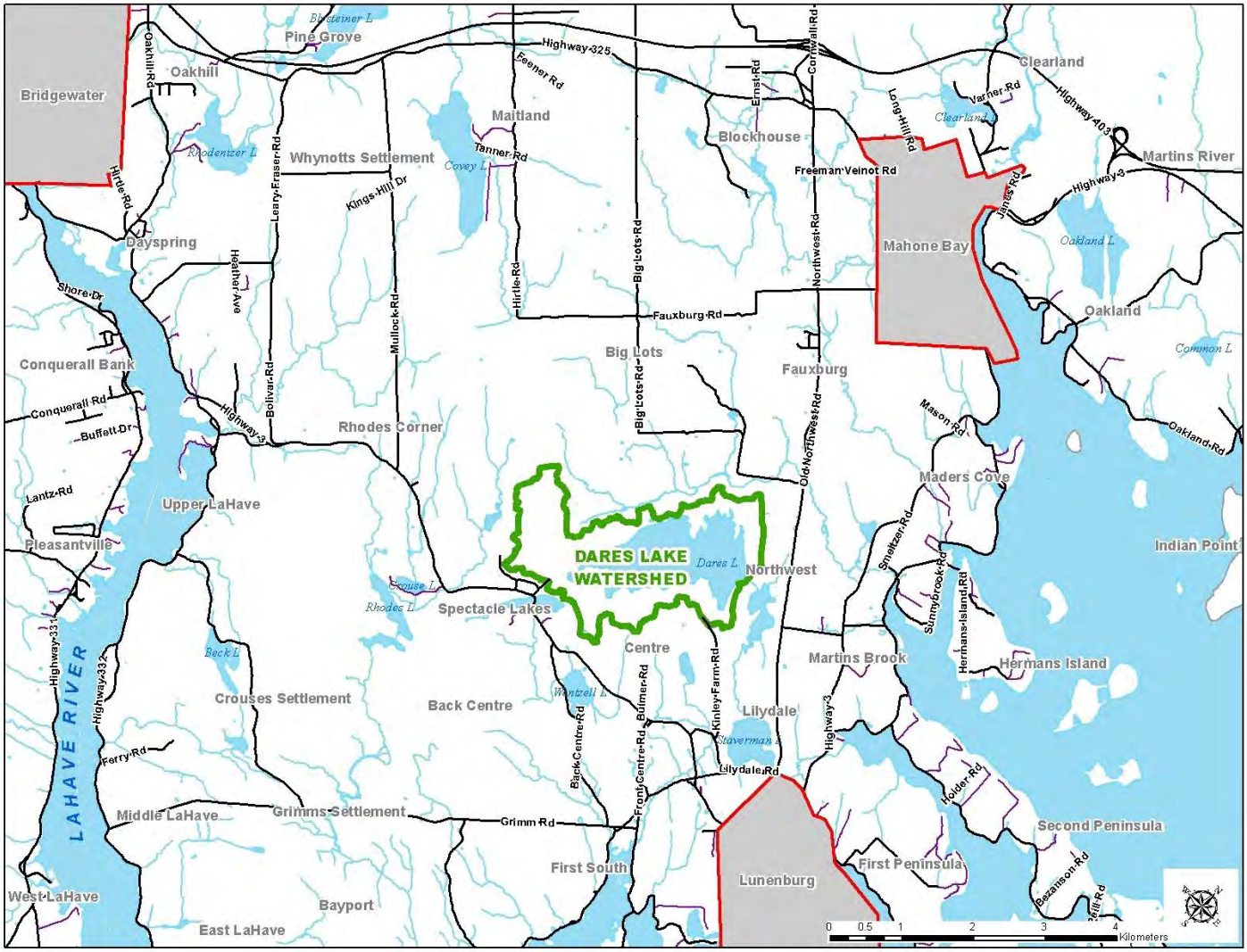
- To avoid any potential risk of contamination from the water supply that could occur from and during inadvertent use of dentist equipment with contaminated water during the advisory, dentists are advised to turn off the water supply to their dental units and sinks. If this is not possible, covering or taping the controls or outlets may be indicated (e.g. triplex syringe, water dispenser, cavitron, etc.).

## f) Water Vending Outlets (Includes Wine and Beer Vending)

Assess each system individually.

Appendix "Q"

# Location of Dares Lake



Schedule "F"

## Kelly Jardine

FROM: IAN TILLARD, TOWN ENGINEER

Town of Lunenburg sidewalk repairs and pot hole filling work is managed through:

- Weekly PW meeting and review of the work planner. All open items are reviewed. See below for one line item from the work planner as an example which shows all of the elements that are recorded.
- The work is planned on both a seasonal basis (ie it is time to plan sidewalk repairs in the spring) and on a two week look ahead basis.
- New requests are sent in to PW and added to the tracker.
    - If it is routine maintenance, then it is simply added to the planner.
    - If it is work that requires approval from PW and/or PW to perform the work then a Work Order Request is sent out to get filled out and returned to PW to start the process.
- When internal requests are made to shift priorities, this is then updated in the planner.

Condition reviews;

- Sidewalk conditions. A spreadsheet has been developed and the condition of all sidewalks is recorded in detail. There is also an overall town map showing coding for the sidewalk inspection results. The inspection is done by street grids. Work is then planned according to the budget available and priority – safety is usually the prime factor in priority. The survey is an annual survey.
- Ditto for road conditions. However the survey of conditions is a weekly event.

Safety;

- Due to the Covid situation, there will be changes needed for our internal work safety procedures. These are currently being worked on and will be in place prior to any sidewalk and road work being done.

| Section | Category | Type | Description | Open or | Active e a | Active in We | Active in Week | Job Notes | Person Responsible | Progress | Scheduled Start Date | Scheduled End Date | Actual or Projected End | Project Time Variance | Estimated Hours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Facilities | Buildings | One off Projects | Repair stage 250 park | o | a | x | | Inform Kelly C. after inspection | Peter | | | | | | |

# Pothole Inspection report

Date complete May 6th 2020

## OLD TOWN

**1st Prority**

Drivway @ 3 Kinley Dr.
In front of Mel's place from sewer issue, Lawerence st.
1 @ 108 York
1 @ York / Duke By Romkey's old house
1 @ Fox / Duke by apart. Building
Add some asphalt around water box infront of hydrant 151 Fox st.
Quite abit surface patching @ Cumberland / blockhouse hill rd.
3 holes by 275 Pelham st.
surface patching @ Rous's Brook Int
1 @ 326 Pelham
1 @ 322 Pelham
1 @ 141 Pelham
1 @ 207 Montague
1 Beside Anglican Parish Hall on cornwallis st.
Repair swail in front of 60 Cornwallis st.
1 around manhole @ 94 Creighton st.
a lot of surface patching in front of Daycare
a lot of surface patching on Prince st. @ 84
1 @ Pam Baltzer's on Prince st.
Swail beside Kendall Black's on Hopson St.
Swail on Hopson by Craig May's old house
Swail on Kempt from York down to Townsend in a bad way
Swail across from Bos's drivway on shipyard hill

**2nd Prority**

1 @ Creighton st. (right in front of their walkway)
13 Holes around Tourisim Bureau
3 Holes by Bubby Risser's Driveway, York st.
1 in front of Driveway across from Cathloic Church
1 @ 72 Cornwallis st. (on Courner)
1 Across from 61 york st.
1 @ 58 Fox st.
1 @ 93 Fox st. (surface patching some as well)
Surface Patch 2 holes @ Kings / Townsend int.
1 @ Cornwallis / Cumberland int.
1 @ walkway by Bandstand (surface patch) Cumberland st.
1 in middle of Road in front of old electronic Building on Lincoln st. (was Edgar Building
Surface Patching on Lincoln @ 369

Surface Patching @ Pelham / king int. by Manhole
1 @ corner of Pelham / Kaulbach
Surface patchign in front of Daycare
Can we add to a deep dip in front of 210 Montague st.
1 in front of Tourist Bureau by stop sign
1 surface patch and repiar part of swail on Hill st. by Jim Stewart's old house

## NEW TOWN

Maple ave. (whole road need to be re-done)
1 by Hugh Corkum's @ Maple ave.
New asphalt around catch basin @ Falkland / Broad
1 @ courner of Green / Montgomery
Surface patching @ Green / churchill Int.
1 in front of Driveway @ 32 Churchill (should be resurfaced)
3 by stop sign on Churchill / Broad int.
Add to a bad dip @ Green / Tupper
Surface patch around manhole @ 14 Mckenzie
Fill in a bit right in front of Jimmy Johnson's driveway
1 hole @ 60 Green (Driveway on McKenzie)
9 holes on the loop by Robin Scott's to Green st.
10 holes on Archibale st. by #58
Add a little asphalt around manhole @ 38 Archibald st.
1 hole by 38 Lorne
1 hole by 13 Young  (but its on Medway)
1 hole across Phan Creaser's on Young
1 hole by Greg Wentzell's on Masons Beach Road
3 dips @ golf coarse ent. (looks like a sink hole)
1 small on on Schwartz rd.
A few sm. Ones @ each ent. To the rink parking lot.

## Swails in Old Town

Cornwalls st. across from apart building parking lot
Swail @ shop and right up by Millers garage
Swail by Anne Kelly's where we ditched and put class A
Part of a swail on montague st. behind Anderson house that goes to catch basin on lower

## Swails in New Town

Swail by 78 & 70 Brook from Tupper to MacDonald both sides
Swail needed on corner of 138 Cent. Ave. by apartment buildings
Swail needed @ 41 McKenzie

Swail needs repair by Donna Zincks on McKenzie st.
Add more to Swail on the inside of it in front of 169 Brook st.

## Curb repair

179 Fox / Church Hall
209 Cent. Ave & 217 From Victoria rd. to Drivway
224 Harbourview heights, across street
207 harbourview Heights and across street
The whole way along Gurneys back yard

# TOWN OF LUNENBURG

## STREET MAP

**LEGEND**

- Road
- Abandoned Railroad
- Private Road

**NOTE:** Private streets are shown in italics

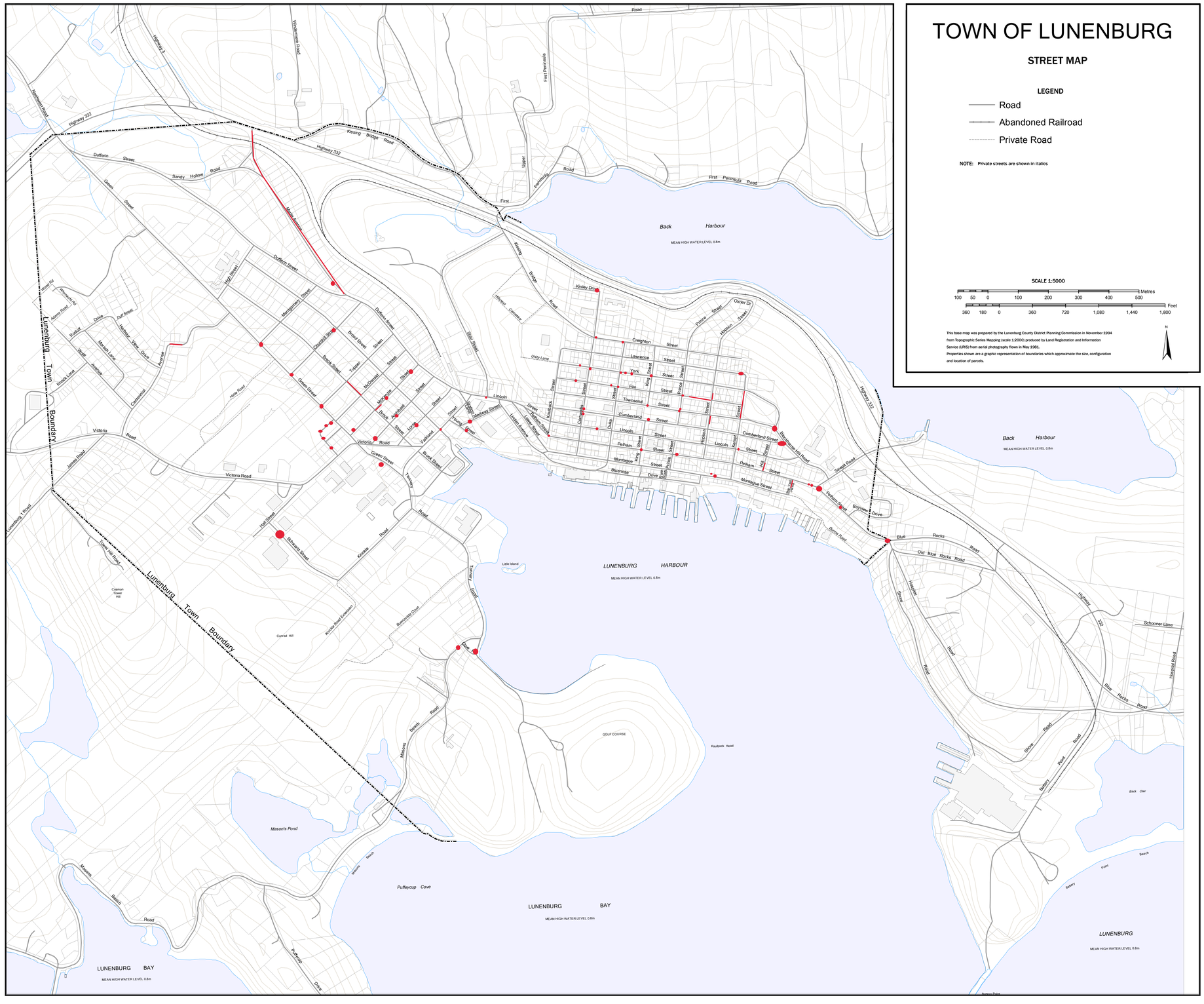
**SCALE 1:5000**

Metres: 100 50 0 100 200 300 400 500

Feet: 360 180 0 360 720 1,080 1,440 1,800

This base map was prepared by the Lunenburg County District Planning Commission in November 1994 from Topographic Series Mapping (scale 1:2000) produced by Land Registration and Information Service (LRIS) from aerial photography flown in May 1981.
Properties shown are a graphic representation of boundaries which approximate the size, configuration and location of parcels.

N



| NENBURG CONCRETE SIDEWALK RATINGS MAY 2019 | |
|---|---|
| | |
| | |
| **1** | |
| STREET | Bluenose Drive |
| FROM | Rum Row To Hopson Street Extension |
| SIDE | North |
| TOTAL LENGTH | 350 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 13% |
| NUMBER OF DEFECTIVE BLOCKS | 16 |
| TOTAL NUMBER OF BLOCKS | 126 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 16 |
| | |
| **2** | |
| STREET | Bluenose Drive |
| FROM | King Street to Rum Row |
| SIDE | North |
| TOTAL LENGTH | 250 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 4% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 44 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **3** | |
| STREET | Bluenose Drive |
| FROM | Montague Street to King Street Extension |
| SIDE | North |
| TOTAL LENGTH | 1,000 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 2% |
| NUMBER OF DEFECTIVE BLOCKS | 4 |
| TOTAL NUMBER OF BLOCKS | 234 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 3 |
| ASPHALT OR GRAVEL BLOCKS | 0 |

| | |
|---|---|
| **4** | |
| STREET | Broad Street |
| FROM | Falkland Street to Lorne Street |
| SIDE | North |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 6% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 35 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **5** | |
| STREET | Broad Street |
| FROM | Lorne Street to Archibald Street |
| SIDE | North |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 3% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 36 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **6** | |
| STREET | Broad Street |
| FROM | Archibald Street to McKenzie Street |
| SIDE | North |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 8% |
| NUMBER OF DEFECTIVE BLOCKS | 3 |
| TOTAL NUMBER OF BLOCKS | 36 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |

| | |
|---|---|
| **7** | |
| STREET | Broad Street |
| FROM | McKenzie Street to McDonald Street |
| SIDE | North |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 9% |
| NUMBER OF DEFECTIVE BLOCKS | 4 |
| TOTAL NUMBER OF BLOCKS | 45 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 2 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **8** | |
| STREET | Brook Street |
| FROM | Victoria Road to Lorne |
| SIDE | North |
| TOTAL LENGTH | 106 feet |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | |
| NUMBER OF DEFECTIVE BLOCKS | |
| TOTAL NUMBER OF BLOCKS | 21 |
| CRACKED BLOCKS | |
| SPALDED BLOCKS | |
| HEAVED BLOCKS | |
| ASPHALT OR GRAVEL BLOCKS | |
| | |
| **9** | |
| STREET | Cornwallis Street |
| FROM | Montague Street to Pelham Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 18 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |

| | |
|---|---|
| **10** | |
| STREET | Cornwallis Street |
| FROM | Pelham Street to Lincoln Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 22% |
| NUMBER OF DEFECTIVE BLOCKS | 6 |
| TOTAL NUMBER OF BLOCKS | 27 |
| CRACKED BLOCKS | 5 |
| SPALDED BLOCKS | 1 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **11** | |
| STREET | Cornwallis Street |
| FROM | Lincoln Street to Cumberland Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 52% |
| NUMBER OF DEFECTIVE BLOCKS | 15 |
| TOTAL NUMBER OF BLOCKS | 29 |
| CRACKED BLOCKS | 11 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **12** | |
| STREET | Cornwallis Street |
| FROM | Cumberland to Townsend Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 43% |
| NUMBER OF DEFECTIVE BLOCKS | 15 |
| TOTAL NUMBER OF BLOCKS | 35 |
| CRACKED BLOCKS | 6 |
| SPALDED BLOCKS | 7 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |

| | |
|---|---|
| **13** | |
| STREET | Cornwallis Street |
| FROM | Pelham Street to Lincoln Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 43% |
| NUMBER OF DEFECTIVE BLOCKS | 12 |
| TOTAL NUMBER OF BLOCKS | 28 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 5 |
| HEAVED BLOCKS | 3 |
| ASPHALT OR GRAVEL BLOCKS | 3 |
| | |
| **14** | |
| STREET | Cornwallis Street |
| FROM | Lincoln Street to Cumberland Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 17% |
| NUMBER OF DEFECTIVE BLOCKS | 5 |
| TOTAL NUMBER OF BLOCKS | 29 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 3 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **15** | |
| STREET | Cornwallis Street |
| FROM | Townsend Street to Fox Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 21% |
| NUMBER OF DEFECTIVE BLOCKS | 7 |
| TOTAL NUMBER OF BLOCKS | 33 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 7 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |

| | |
|---|---|
| **16** | |
| STREET | Cornwallis Street |
| FROM | Fox Street to York Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 22% |
| NUMBER OF DEFECTIVE BLOCKS | 7 |
| TOTAL NUMBER OF BLOCKS | 32 |
| CRACKED BLOCKS | 4 |
| SPALDED BLOCKS | 2 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **17** | |
| STREET | Cornwallis Street |
| FROM | York Street to Lawrence Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 3% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 34 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **18** | |
| STREET | Cornwallis Street |
| FROM | Lawrence Street to Creighton Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 15% |
| NUMBER OF DEFECTIVE BLOCKS | 5 |
| TOTAL NUMBER OF BLOCKS | 34 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |

| | |
|---|---|
| **19** | |
| STREET | Cornwallis Street |
| FROM | Creighton Street to Kinley Drive |
| SIDE | West |
| TOTAL LENGTH | 175 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 6% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 36 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **20** | |
| STREET | Cumberland Street |
| FROM | Hopson Street to Prince Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 13% |
| NUMBER OF DEFECTIVE BLOCKS | 8 |
| TOTAL NUMBER OF BLOCKS | 60 |
| CRACKED BLOCKS | 6 |
| SPALDED BLOCKS | 2 |
| HEAVED BLOCKS | 0 |
| ASPHALT AND GRAVEL BLOCKS | 0 |
| | |
| **21** | |
| STREET | Cumberland Street |
| FROM | Prince Street to King Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 21% |
| NUMBER OF DEFECTIVE BLOCKS | 16 |
| TOTAL NUMBER OF BLOCKS | 78 |
| CRACKED BLOCKS | 13 |
| SPALDED BLOCKS | 2 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |

| | |
|---|---|
| **22** | |
| STREET | Cumberland Street |
| FROM | King Street to Duke Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 18% |
| NUMBER OF DEFECTIVE BLOCKS | 9 |
| TOTAL NUMBER OF BLOCKS | 50 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 3 |
| HEAVED BLOCKS | 3 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **23** | |
| STREET | Cumberland Street |
| FROM | King Street to Duke Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 17% |
| NUMBER OF DEFECTIVE BLOCKS | 11 |
| TOTAL NUMBER OF BLOCKS | 63 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 5 |
| | |
| **24** | |
| STREET | Cumberland Street |
| FROM | Cornwallis Street to Kaulback Street |
| SIDE | North |
| TOTAL LENGTH | 35 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 12 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |

| | |
|---|---|
| **25** | |
| STREET | Cumberland Street Extension |
| FROM | Kaulback Street to Lincoln Street |
| SIDE | Donut Hill Footpath |
| TOTAL LENGTH | 360 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 72 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT AND GRAVEL BLOCKS | 0 |
| | |
| **26** | |
| STREET | Dufferin Street |
| FROM | Lorne Street to Archibald Street |
| SIDE | North |
| TOTAL LENGTH | 250 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 34% |
| NUMBER OF DEFECTIVE BLOCKS | 20 |
| TOTAL NUMBER OF BLOCKS | 58 |
| CRACKED BLOCKS | 10 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 3 |
| ASPHALT AND GRAVEL BLOCKS | 3 |
| | |
| **27** | |
| STREET | Dufferin Street |
| FROM | Archibald Street to McKenzie Street |
| SIDE | North |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 50% |
| NUMBER OF DEFECTIVE BLOCKS | 23 |
| TOTAL NUMBER OF BLOCKS | 46 |
| CRACKED BLOCKS | 9 |
| SPALDED BLOCKS | 10 |
| HEAVED BLOCKS | 4 |
| ASPHALT OR GRAVEL BLOCKS | 0 |

| | |
|---|---|
| **28** | |
| STREET | Dufferin Street |
| FROM | McKenzie Street to McDonald Street |
| SIDE | North |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 28% |
| NUMBER OF DEFECTIVE BLOCKS | 13 |
| TOTAL NUMBER OF BLOCKS | 47 |
| CRACKED BLOCKS | 7 |
| SPALDED BLOCKS | 5 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **29** | |
| STREET | Dufferin Street |
| FROM | McDonald Street to Tupper Street |
| SIDE | North |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 27% |
| NUMBER OF DEFECTIVE BLOCKS | 14 |
| TOTAL NUMBER OF BLOCKS | 51 |
| CRACKED BLOCKS | 7 |
| SPALDED BLOCKS | 5 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 2 |
| | |
| **30** | |
| STREET | Dufferin Street |
| FROM | Tupper Street to Churchill Street |
| SIDE | North |
| TOTAL LENGTH | 494 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 14% |
| NUMBER OF DEFECTIVE BLOCKS | 15 |
| TOTAL NUMBER OF BLOCKS | 108 |
| CRACKED BLOCKS | 7 |
| SPALDED BLOCKS | 6 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **31** | |
| STREET | Duke Street |
| FROM | Pelham Street to Lincoln Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 15 |
| CRACKED BLOCKS | 0 |

| | |
|---|---|
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **32** | |
| STREET | Duke Street |
| FROM | Pelham Street to Montague Street |
| SIDE | East |
| TOTAL LENGTH | 150 feet |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 14 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **33** | |
| STREET | Duke Street |
| FROM | Pelham Street to Lincoln Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 23 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **34** | |
| STREET | Duke Street |
| FROM | Lincoln Street to Cumberland Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 46% |
| NUMBER OF DEFECTIVE BLOCKS | 12 |
| TOTAL NUMBER OF BLOCKS | 26 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 9 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **35** | |
| STREET | Duke Street |
| FROM | Lincoln Street to Cumberland Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 15 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **36** | |
| STREET | Duke Street |
| FROM | Cumberland Street to Townsend Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 44% |
| NUMBER OF DEFECTIVE BLOCKS | 8 |
| TOTAL NUMBER OF BLOCKS | 18 |
| CRACKED BLOCKS | 8 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **37** | |
| STREET | Duke Street |
| FROM | Townsend Street to Fox Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 30% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 33 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **38** | |
| STREET | Duke Street |
| FROM | Fox Street to York Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 7% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 27 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **39** | |
| STREET | Duke Street |
| FROM | Fox Street to York Street |
| SIDE | West |
| TOTAL LENGTH | 138 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | |
| NUMBER OF DEFECTIVE BLOCKS | |
| TOTAL NUMBER OF BLOCKS | 28 |
| CRACKED BLOCKS | |
| SPALDED BLOCKS | |
| HEAVED BLOCKS | |
| ASPHALT OR GRAVEL BLOCKS | |
| | |
| **40** | |
| STREET | Duke Street |
| FROM | Fox Street to Townsend Street |
| SIDE | West |
| TOTAL LENGTH | 139 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | |
| NUMBER OF DEFECTIVE BLOCKS | |
| TOTAL NUMBER OF BLOCKS | 28 |

| | |
|---|---|
| CRACKED BLOCKS | |
| SPALDED BLOCKS | |
| HEAVED BLOCKS | |
| ASPHALT OR GRAVEL BLOCKS | |
| | |
| **41** | |
| STREET | Duke Street |
| FROM | Cumberland Street to Townsend Street |
| SIDE | West |
| TOTAL LENGTH | 128 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | |
| NUMBER OF DEFECTIVE BLOCKS | |
| TOTAL NUMBER OF BLOCKS | 26 |
| CRACKED BLOCKS | |
| SPALDED BLOCKS | |
| HEAVED BLOCKS | |
| ASPHALT OR GRAVEL BLOCKS | |
| | |
| **42** | |
| STREET | Falkland Street |
| FROM | Brook Street to Green Street |
| SIDE | West |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 12% |
| NUMBER OF DEFECTIVE BLOCKS | 9 |
| TOTAL NUMBER OF BLOCKS | 73 |
| CRACKED BLOCKS | 9 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **43** | |
| STREET | Falkland Street |
| FROM | Broad Street to Brook Street |
| SIDE | West |
| TOTAL LENGTH | 225 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 7% |
| NUMBER OF DEFECTIVE BLOCKS | 3 |
| TOTAL NUMBER OF BLOCKS | 39 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 2 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **44** | |
| STREET | Falkland Street |
| FROM | Dufferin Street to Broad Street |
| SIDE | West |
| TOTAL LENGTH | 350 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 18% |
| NUMBER OF DEFECTIVE BLOCKS | 11 |
| TOTAL NUMBER OF BLOCKS | 62 |
| CRACKED BLOCKS | 4 |
| SPALDED BLOCKS | 7 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **45** | |
| STREET | Falkland Street |
| FROM | Young Street to Broad Street |
| SIDE | East |
| TOTAL LENGTH | 122 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 4% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 24 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **46** | |
| STREET | Fox Street |
| FROM | Hopson Street to Prince Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 16% |
| NUMBER OF DEFECTIVE BLOCKS | 12 |
| TOTAL NUMBER OF BLOCKS | 74 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 10 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **47** | |
| STREET | Fox Street |
| FROM | Prince Street to King Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 7% |
| NUMBER OF DEFECTIVE BLOCKS | 6 |
| TOTAL NUMBER OF BLOCKS | 77 |
| CRACKED BLOCKS | 4 |
| SPALDED BLOCKS | 2 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **48** | |
| STREET | Fox Street |
| FROM | King Street to Duke Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 1% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 77 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **49** | |
| STREET | Fox Street |
| FROM | Duke Street to Cornwallis Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 27% |
| NUMBER OF DEFECTIVE BLOCKS | 20 |
| TOTAL NUMBER OF BLOCKS | 75 |
| CRACKED BLOCKS | 6 |
| SPALDED BLOCKS | 12 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **50** | |
| STREET | Fox Street |
| FROM | Cornwallis Street to Kaulback Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 39% |
| NUMBER OF DEFECTIVE BLOCKS | 29 |
| TOTAL NUMBER OF BLOCKS | 74 |
| CRACKED BLOCKS | 8 |
| SPALDED BLOCKS | 17 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 4 |
| | |
| **51** | |
| STREET | Green Street |
| FROM | Community Centre entrance to Falkland Street intersection |
| SIDE | South |
| TOTAL LENGTH | 204 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 48% |
| NUMBER OF DEFECTIVE BLOCKS | 23 |
| TOTAL NUMBER OF BLOCKS | 48 |
| CRACKED BLOCKS | 4 |
| SPALDED BLOCKS | 16 |
| HEAVED BLOCKS | 1 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 2 |
| | |
| **52** | |
| STREET | Green Street |
| FROM | Victoria Road to Community Centre entrance |
| SIDE | South |
| TOTAL LENGTH | 350 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 30% |
| NUMBER OF DEFECTIVE BLOCKS | 26 |
| TOTAL NUMBER OF BLOCKS | 86 |
| CRACKED BLOCKS | 10 |
| SPALDED BLOCKS | 12 |
| HEAVED BLOCKS | 3 *need asphalt in holes |
| ASPHALT OR GRAVEL BLOCKS | 1 |
| | |
| **53** | |
| STREET | Green Street |
| FROM | Victoria Road to McKenzie Street |
| SIDE | South |
| TOTAL LENGTH | 50 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 45% |
| NUMBER OF DEFECTIVE BLOCKS | 5 |
| TOTAL NUMBER OF BLOCKS | 11 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 2 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **54** | |
| STREET | Green Street |
| FROM | McKenzie Street to McDonald Street |
| SIDE | South |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 43% |
| NUMBER OF DEFECTIVE BLOCKS | 20 |
| TOTAL NUMBER OF BLOCKS | 47 |
| CRACKED BLOCKS | 6 |
| SPALDED BLOCKS | 10 |
| HEAVED BLOCKS | 3 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 1 |
| | |
| **55** | |
| STREET | Green Street |
| FROM | McDonald Street to Tupper Street |
| SIDE | South |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 27% |
| NUMBER OF DEFECTIVE BLOCKS | 15 |
| TOTAL NUMBER OF BLOCKS | 55 |
| CRACKED BLOCKS | 9 |
| SPALDED BLOCKS | 5 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **56** | |
| STREET | Green Street |
| FROM | Tupper Street to Churchill Street |
| SIDE | South |
| TOTAL LENGTH | 450 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 19% |
| NUMBER OF DEFECTIVE BLOCKS | 22 |
| TOTAL NUMBER OF BLOCKS | 116 |
| CRACKED BLOCKS | 7 |
| SPALDED BLOCKS | 13 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **57** | |
| STREET | Green Street |
| FROM | Churchill Street to Montgomery Street |
| SIDE | South |
| TOTAL LENGTH | 500 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 21% |
| NUMBER OF DEFECTIVE BLOCKS | 25 |
| TOTAL NUMBER OF BLOCKS | 117 |
| CRACKED BLOCKS | 7 |
| SPALDED BLOCKS | 18 *need asphalt in holes |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **58** | |
| STREET | Green Street |
| FROM | Montgomery Street to Centennial Avenue |
| SIDE | South |
| TOTAL LENGTH | 420 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 34% |
| NUMBER OF DEFECTIVE BLOCKS | 35 |
| TOTAL NUMBER OF BLOCKS | 104 |
| CRACKED BLOCKS | 17 |
| SPALDED BLOCKS | 14 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 3 |
| | |
| **59** | |
| STREET | Green Street |
| FROM | Centennial Avenue to High Street |
| SIDE | South |
| TOTAL LENGTH | 190 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 49 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **60** | |
| STREET | Hall Street |
| FROM | Schwartz Street to the end of Hall Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 29% |
| NUMBER OF DEFECTIVE BLOCKS | 12 |
| TOTAL NUMBER OF BLOCKS | 41 |
| CRACKED BLOCKS | 7 |
| SPALDED BLOCKS | 3 |
| HEAVED BLOCKS | 2 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **61** | |
| STREET | Hall Street |
| FROM | Victoria Road to Schwartz Street |
| SIDE | East |
| TOTAL LENGTH | 500 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 18% |
| NUMBER OF DEFECTIVE BLOCKS | 18 |
| TOTAL NUMBER OF BLOCKS | 100 |
| CRACKED BLOCKS | 7 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 7 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **62** | |
| STREET | High Street |
| FROM | Broad Street to Dufferin Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 48% |
| NUMBER OF DEFECTIVE BLOCKS | 11 |
| TOTAL NUMBER OF BLOCKS | 23 |
| CRACKED BLOCKS | 5 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **63** | |
| STREET | High Street |
| FROM | Brook Street to Broad Street |
| SIDE | West |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 9% |
| NUMBER OF DEFECTIVE BLOCKS | 5 |
| TOTAL NUMBER OF BLOCKS | 57 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 1 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 3 |
| | |
| **64** | |
| STREET | High Street |
| FROM | Green Street to Brook Street |
| SIDE | West |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 44 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **65** | |
| STREET | Hopson Street Extension |
| FROM | Montague Street to Bluenose Drive |
| SIDE | West |
| TOTAL LENGTH | 75 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 15 Bricks missing |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **66** | |
| STREET | Hopson Street |
| FROM | Pelham Street to Lincoln Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 42% |
| NUMBER OF DEFECTIVE BLOCKS | 14 |
| TOTAL NUMBER OF BLOCKS | 33 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 9 |
| HEAVED BLOCKS | 3 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **67** | |
| STREET | Hopson Street |
| FROM | Lincoln Street to Cumberland Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 6% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 32 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **68** | |
| STREET | Hopson Street |
| FROM | Cumberland Street to Townsend Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 8% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 26 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **69** | |
| STREET | Hopson Street |
| FROM | Townsend Street to Fox Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 17% |
| NUMBER OF DEFECTIVE BLOCKS | 6 |
| TOTAL NUMBER OF BLOCKS | 35 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 3 |
| HEAVED BLOCKS | 1 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **70** | |
| STREET | Hopson Street |
| FROM | Fox Street to York Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 34 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **71** | |
| STREET | Hopson Street |
| FROM | York Street to Lawrence Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 22% |
| NUMBER OF DEFECTIVE BLOCKS | 8 |
| TOTAL NUMBER OF BLOCKS | 36 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 6 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **72** | |
| STREET | Hopson Street |
| FROM | Lawrence Street to Creighton Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 22% |
| NUMBER OF DEFECTIVE BLOCKS | 7 |
| TOTAL NUMBER OF BLOCKS | 32 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 2 |
| HEAVED BLOCKS | 2 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **73** | |
| STREET | Kaulback Street |
| FROM | Lincoln Street to Cumberland Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 15% |
| NUMBER OF DEFECTIVE BLOCKS | 5 |
| TOTAL NUMBER OF BLOCKS | 33 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **74** | |
| STREET | Kaulback Street |
| FROM | Cumberland Street to Townsend Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 30% |
| NUMBER OF DEFECTIVE BLOCKS | 10 |
| TOTAL NUMBER OF BLOCKS | 33 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 8 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **75** | |
| STREET | Kempt Street |
| FROM | Lincoln to Pelham |
| SIDE | West |
| TOTAL LENGTH | 130 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0% |
| TOTAL NUMBER OF BLOCKS | 26 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **76** | |
| STREET | Kempt Street |
| FROM | Montague Street to Pelham Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 29 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **77** | |
| STREET | Kaulback Street |
| FROM | Townsend Street to York Street |
| SIDE | West |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 5% |
| NUMBER OF DEFECTIVE BLOCKS | 4 |
| TOTAL NUMBER OF BLOCKS | 71 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **78** | |
| STREET | King Street Extension |
| FROM | Bluenose Drive to Montague Street |
| SIDE | West |
| TOTAL LENGTH | 60 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 6% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 16 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **79** | |
| STREET | King Street |
| FROM | Montague Street to Pelham Street |
| SIDE | West |
| TOTAL LENGTH | 161 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 6% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 34 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **80** | |
| STREET | King Street |
| FROM | Montague Street to Pelham Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 12% |
| NUMBER OF DEFECTIVE BLOCKS | 3 |
| TOTAL NUMBER OF BLOCKS | 26 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **81** | |
| STREET | King Street |
| FROM | Pelham Street to Lincoln Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 12% |
| NUMBER OF DEFECTIVE BLOCKS | 3 |
| TOTAL NUMBER OF BLOCKS | 25 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **82** | |
| STREET | King Street |
| FROM | Pelham Street to Lincoln Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 3% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 72 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 7 |
| | |
| **83** | |
| STREET | King Street |
| FROM | Lincoln Street to Cumberland Street |
| SIDE | West |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 42% |
| NUMBER OF DEFECTIVE BLOCKS | 11 |
| TOTAL NUMBER OF BLOCKS | 26 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 2 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 9 |
| | |
| **84** | |
| STREET | King Street |
| FROM | Lincoln Street to Cumberland Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 24% |
| NUMBER OF DEFECTIVE BLOCKS | 12 |
| TOTAL NUMBER OF BLOCKS | 50 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 5 |
| | |
| **85** | |
| STREET | Knickle Road |
| FROM | Tannery Road to Bus Loop |
| SIDE | West |
| TOTAL LENGTH | 358 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 144 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **86** | |
| STREET | Lincoln Street |
| FROM | Kempt Street to Hill Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 14% |
| NUMBER OF DEFECTIVE BLOCKS | 10 |
| TOTAL NUMBER OF BLOCKS | 63 |
| CRACKED BLOCKS | 4 |
| SPALDED BLOCKS | 6 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **87** | |
| STREET | Lincoln Street |
| FROM | Kempt Street to Hopson Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 76 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **88** | |
| STREET | Lincoln Street |
| FROM | Hopson Street to Prince Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 5% |
| NUMBER OF DEFECTIVE BLOCKS | 4 |
| TOTAL NUMBER OF BLOCKS | 76 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **89** | |
| STREET | Lincoln Street |
| FROM | Prince Street to King Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 61 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **90** | |
| STREET | Lincoln Street |
| FROM | King Street to Prince Street |
| SIDE | South |
| TOTAL LENGTH | 224 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 2% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 101 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **91** | |
| STREET | Lincoln Street |
| FROM | King Street to Duke Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 2% |
| NUMBER OF DEFECTIVE BLOCKS | 3 |
| TOTAL NUMBER OF BLOCKS | 152 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 2 |
| | |
| **92** | |
| STREET | Lincoln Street |
| FROM | King Street to Duke Street |
| SIDE | North |
| TOTAL LENGTH | 325 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 7% |
| NUMBER OF DEFECTIVE BLOCKS | 10 |
| TOTAL NUMBER OF BLOCKS | 134 |
| CRACKED BLOCKS | 6 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 2 |
| | |
| **93** | |
| STREET | Lincoln Street |
| FROM | Duke Street to Cornwallis Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 26% |
| NUMBER OF DEFECTIVE BLOCKS | 30 |
| TOTAL NUMBER OF BLOCKS | 114 |
| CRACKED BLOCKS | 17 |
| SPALDED BLOCKS | 8 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 5 |
| | |
| **94** | |
| STREET | Lincoln Street |
| FROM | Duke Street to Cornwallis Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 9% |
| NUMBER OF DEFECTIVE BLOCKS | 13 |
| TOTAL NUMBER OF BLOCKS | 144 |
| CRACKED BLOCKS | 11 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **95** | |
| STREET | Lincoln Street |
| FROM | Cornwallis Street to Kaulback Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 150 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **96** | |
| STREET | Lincoln Street |
| FROM | Cornwallis Street to Kaulback Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 4% |
| NUMBER OF DEFECTIVE BLOCKS | 3 |
| TOTAL NUMBER OF BLOCKS | 75 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 1 |
| HEAVED BLOCKS | 1 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **97** | |
| STREET | Lincoln Street |
| FROM | Kaulback Street to Pelham Street |
| SIDE | South |
| TOTAL LENGTH | 60 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 9% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 11 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **98** | |
| STREET | Lincoln Street |
| FROM | Kaulback Street to Donut Hill Foot Path |
| SIDE | North |
| TOTAL LENGTH | 400 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 16% |
| NUMBER OF DEFECTIVE BLOCKS | 12 |
| TOTAL NUMBER OF BLOCKS | 77 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 7 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **99** | |
| STREET | Lincoln Street |
| FROM | Donut Hill Foot Path to Starr Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 25% |
| NUMBER OF DEFECTIVE BLOCKS | 17 |
| TOTAL NUMBER OF BLOCKS | 68 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 14 |
| HEAVED BLOCKS | 0 |

| | |
|---|---|
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **100** | |
| STREET | Lincoln Street |
| FROM | Starr Street to Lorne Street |
| SIDE | North |
| TOTAL LENGTH | 250 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 11% |
| NUMBER OF DEFECTIVE BLOCKS | 16 |
| TOTAL NUMBER OF BLOCKS | 143 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 4 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 10 |
| | |
| **101** | |
| STREET | Lincoln Street |
| FROM | Lower Street to Linden Avenue (Island) |
| SIDE | South |
| TOTAL LENGTH | 77 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | |
| NUMBER OF DEFECTIVE BLOCKS | |
| TOTAL NUMBER OF BLOCKS | 15 |
| CRACKED BLOCKS | |
| SPALDED BLOCKS | |
| HEAVED BLOCKS | |
| ASPHALT OR GRAVEL BLOCKS | |
| | |
| **102** | |
| STREET | Montague Street |
| FROM | Rum Row to Hopson Street |
| SIDE | South |
| TOTAL LENGTH | 360 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 3% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 72 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |

| | |
|---|---|
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 2 |
| | |
| **103** | |
| STREET | Montague Street |
| FROM | Hopson Street to Kempt Street |
| SIDE | South |
| TOTAL LENGTH | 258 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 2% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 58 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 1 |
| | |
| **104** | |
| STREET | Montague Street |
| FROM | King Street to Prince Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 13% |
| NUMBER OF DEFECTIVE BLOCKS | 8 |
| TOTAL NUMBER OF BLOCKS | 62 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 6 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **105** | |
| STREET | Montague Street |
| FROM | King Street to Prince Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 12% |
| NUMBER OF DEFECTIVE BLOCKS | 7 |
| TOTAL NUMBER OF BLOCKS | 58 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 4 |

| | |
|---|---|
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **106** | |
| STREET | Montague Street |
| FROM | Duke Street to King Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 25% |
| NUMBER OF DEFECTIVE BLOCKS | 22 |
| TOTAL NUMBER OF BLOCKS | 88 |
| CRACKED BLOCKS | 10 |
| SPALDED BLOCKS | 8 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 2 |
| | |
| **107** | |
| STREET | Montague Street |
| FROM | Cornwallis Street to Duke Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 5% |
| NUMBER OF DEFECTIVE BLOCKS | 4 |
| TOTAL NUMBER OF BLOCKS | 83 |
| CRACKED BLOCKS | 2 |
| SPALDED BLOCKS | 1 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **108** | |
| STREET | Montague Street |
| FROM | Kaulback Street to Cornwallis Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 6% |
| NUMBER OF DEFECTIVE BLOCKS | 4 |
| TOTAL NUMBER OF BLOCKS | 62 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 0 |

| | |
|---|---|
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **109** | |
| STREET | Montague Street |
| FROM | Duke Street to King Street |
| SIDE | North |
| TOTAL LENGTH | 92 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 4% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 23 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **110** | |
| STREET | Montague Street |
| FROM | Cornwallis Street to Duke Street |
| SIDE | North |
| TOTAL LENGTH | 120 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 4% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 24 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 1 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **111** | |
| STREET | Pelham Street |
| FROM | Kempt Street to Shipyard Hill |
| SIDE | South |
| TOTAL LENGTH | 600 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 2% |
| NUMBER OF DEFECTIVE BLOCKS | 3 |
| TOTAL NUMBER OF BLOCKS | 160 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |

| | |
|---|---|
| HEAVED BLOCKS | 2 *tripper in Front of 242 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **112** | |
| STREET | Pelham Street |
| FROM | Kempt Street to Hopson Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 38 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **113** | |
| STREET | Pelham Street |
| FROM | Hopson Street to Prince Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 25% |
| NUMBER OF DEFECTIVE BLOCKS | 12 |
| TOTAL NUMBER OF BLOCKS | 48 |
| CRACKED BLOCKS | 4 |
| SPALDED BLOCKS | 8 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **114** | |
| STREET | Pelham Street |
| FROM | Prince Street to King Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 24% |
| NUMBER OF DEFECTIVE BLOCKS | 12 |
| TOTAL NUMBER OF BLOCKS | 51 |
| CRACKED BLOCKS | 4 |
| SPALDED BLOCKS | 6 |

| | |
|---|---|
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **115** | |
| STREET | Pelham Street |
| FROM | Prince Street to King Street |
| SIDE | North |
| TOTAL LENGTH | 75 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 24 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT AND GRAVEL BLOCKS | 0 |
| | |
| **116** | |
| STREET | Pelham Street |
| FROM | King Street to Duke Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 11% |
| NUMBER OF DEFECTIVE BLOCKS | 7 |
| TOTAL NUMBER OF BLOCKS | 61 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 3 |
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **117** | |
| STREET | Pelham Street |
| FROM | King Street to Duke Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 28% |
| NUMBER OF DEFECTIVE BLOCKS | 15 |
| TOTAL NUMBER OF BLOCKS | 53 |
| CRACKED BLOCKS | 11 |
| SPALDED BLOCKS | 2 |

| | |
|---|---|
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 1 |
| | |
| **118** | |
| STREET | Pelham Street |
| FROM | Duke Street to Cornwallis Street |
| SIDE | North |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 2% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 56 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **119** | |
| STREET | Pelham Street |
| FROM | Duke Street to Cornwallis Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 5% |
| NUMBER OF DEFECTIVE BLOCKS | 3 |
| TOTAL NUMBER OF BLOCKS | 57 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 2 |
| | |
| **120** | |
| STREET | Pelham Street |
| FROM | Cornwallis Street to Kaulback Street |
| SIDE | North |
| TOTAL LENGTH | 50 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 80% |
| NUMBER OF DEFECTIVE BLOCKS | 16 |
| TOTAL NUMBER OF BLOCKS | 20 |
| CRACKED BLOCKS | 7 |
| SPALDED BLOCKS | 2 |

| | |
|---|---|
| HEAVED BLOCKS | 4 |
| ASPHALT OR GRAVEL BLOCKS | 3 |
| | |
| **121** | |
| STREET | Pelham Street |
| FROM | Kaulback Street to Lincoln Street |
| SIDE | North |
| TOTAL LENGTH | 50 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 30 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **122** | |
| STREET | Prince Street |
| FROM | Pelham Street to Montague Street |
| SIDE | West |
| TOTAL LENGTH | 140 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 4% |
| NUMBER OF DEFECTIVE BLOCKS | 1 |
| TOTAL NUMBER OF BLOCKS | 25 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **123** | |
| STREET | Prince Street |
| FROM | Cumberland Street to Townsend Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 9% |
| NUMBER OF DEFECTIVE BLOCKS | 2 |
| TOTAL NUMBER OF BLOCKS | 22 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 0 |

| | |
|---|---|
| HEAVED BLOCKS | 1 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **124** | |
| STREET | Prince Street |
| FROM | Townsend Street to Fox Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 24 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **125** | |
| STREET | Prince Street |
| FROM | Fox Street to York Street |
| SIDE | East |
| TOTAL LENGTH | 150 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 28 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **126** | |
| STREET | Rum Row |
| FROM | Montague Street to Bluenose Drive |
| SIDE | West |
| TOTAL LENGTH | 60 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 11 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |

| | |
|---|---|
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **127** | |
| STREET | Tannery Road |
| FROM | Falkland Street to Knickle Road |
| SIDE | South |
| TOTAL LENGTH | 322 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 7% |
| NUMBER OF DEFECTIVE BLOCKS | 8 |
| TOTAL NUMBER OF BLOCKS | 114 |
| CRACKED BLOCKS | 6 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **128** | |
| STREET | Townsend Street |
| FROM | Duke Street to King Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 23% |
| NUMBER OF DEFECTIVE BLOCKS | 15 |
| TOTAL NUMBER OF BLOCKS | 66 |
| CRACKED BLOCKS | 13 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 2 |
| | |
| **129** | |
| STREET | Townsend Street |
| FROM | King Street to Prince Street |
| SIDE | South |
| TOTAL LENGTH | 300 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 5% |
| NUMBER OF DEFECTIVE BLOCKS | 3 |
| TOTAL NUMBER OF BLOCKS | 66 |
| CRACKED BLOCKS | 3 |
| SPALDED BLOCKS | 0 |

| | |
|---|---|
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **130** | |
| STREET | Victoria Road |
| FROM | Hall Street to Save Easy entrance |
| SIDE | South |
| TOTAL LENGTH | 200 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 45% |
| NUMBER OF DEFECTIVE BLOCKS | 10 |
| TOTAL NUMBER OF BLOCKS | 22 |
| CRACKED BLOCKS | 1 |
| SPALDED BLOCKS | 5 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 2 |
| | |
| **131** | |
| STREET | Victoria Road |
| FROM | Hall Street to Tim Hortons entrance |
| SIDE | North |
| TOTAL LENGTH | 114 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 0% |
| NUMBER OF DEFECTIVE BLOCKS | 0 |
| TOTAL NUMBER OF BLOCKS | 23 |
| CRACKED BLOCKS | 0 |
| SPALDED BLOCKS | 0 |
| HEAVED BLOCKS | 0 |
| ASPHALT OR GRAVEL BLOCKS | 0 |
| | |
| **132** | |
| STREET | Victoria Road |
| FROM | Exhibition Building, Blue Barn to Hall St |
| SIDE | East |
| TOTAL LENGTH | 400 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 28% |
| NUMBER OF DEFECTIVE BLOCKS | 29 |
| TOTAL NUMBER OF BLOCKS | 105 |
| CRACKED BLOCKS | 16 |
| SPALDED BLOCKS | 10 |
| HEAVED BLOCKS | 2 |
| ASPHALT OR GRAVEL BLOCKS | 1 |
| | |
| **133** | |
| STREET | Victoria Road |
| FROM | Brook Street to Green Street |
| SIDE | South |
| TOTAL LENGTH | 600 |
| DEFICIENCIES | |
| PERCENT DEFECTIVE | 17% |
| NUMBER OF DEFECTIVE BLOCKS | 19 |

| | | |
|---|---|---|
| TOTAL NUMBER OF BLOCKS | 111 | |
| CRACKED BLOCKS | 16 | |
| SPALDED BLOCKS | 2 | |
| HEAVED BLOCKS | 1 | |
| ASPHALT OR GRAVEL BLOCKS | 0 | |
| | | |
| **134** | | |
| STREET | Victoria Road | |
| FROM | Circle K to Centennial Avenue | |
| SIDE | North | |
| TOTAL LENGTH | | |
| DEFICIENCIES | | |
| PERCENT DEFECTIVE | 1% | |
| NUMBER OF DEFECTIVE BLOCKS | 2 | |
| TOTAL NUMBER OF BLOCKS | 282 | |
| CRACKED BLOCKS | 2 | |
| SPALDED BLOCKS | 0 | |
| HEAVED BLOCKS | 0 | |
| ASPHALT OR GRAVEL BLOCKS | 0 | |
| | | |
| **135** | | |
| STREET | Community Centre | |
| FROM | West of Green Street | |
| SIDE | East | |
| TOTAL LENGTH | 156 | |
| DEFICIENCIES | | |
| PERCENT DEFECTIVE | 0% | |
| NUMBER OF DEFECTIVE BLOCKS | 0 | |
| TOTAL NUMBER OF BLOCKS | 31 | |
| CRACKED BLOCKS | 0 | |
| SPALDED BLOCKS | 0 | |
| HEAVED BLOCKS | 0 | |
| ASPHALT OR GRAVEL BLOCKS | 0 | |
| | | |
| **136** | | |
| STREET | Community Centre | |
| FROM | West of Green Street | |
| SIDE | West | |
| TOTAL LENGTH | 149 | |
| DEFICIENCIES | | |
| PERCENT DEFECTIVE | 0% | |
| NUMBER OF DEFECTIVE BLOCKS | 0 | |
| TOTAL NUMBER OF BLOCKS | 30 | |
| CRACKED BLOCKS | 0 | |
| SPALDED BLOCKS | 0 | |
| HEAVED BLOCKS | 0 | |
| ASPHALT OR GRAVEL BLOCKS | 0 | |
| | | |
| | | |
| | | |
| | Feet | Miles |
| Total Length | 30896 | 5.851515152 |
| | | |

| | |
|---|---|
| Average deficencies rating | 15% |
| | |

# TOWN OF LUNENBURG

## STREET MAP

**LEGEND**

- Road
- Abandoned Railroad
- Private Road

**NOTE:** Private streets are shown in italics

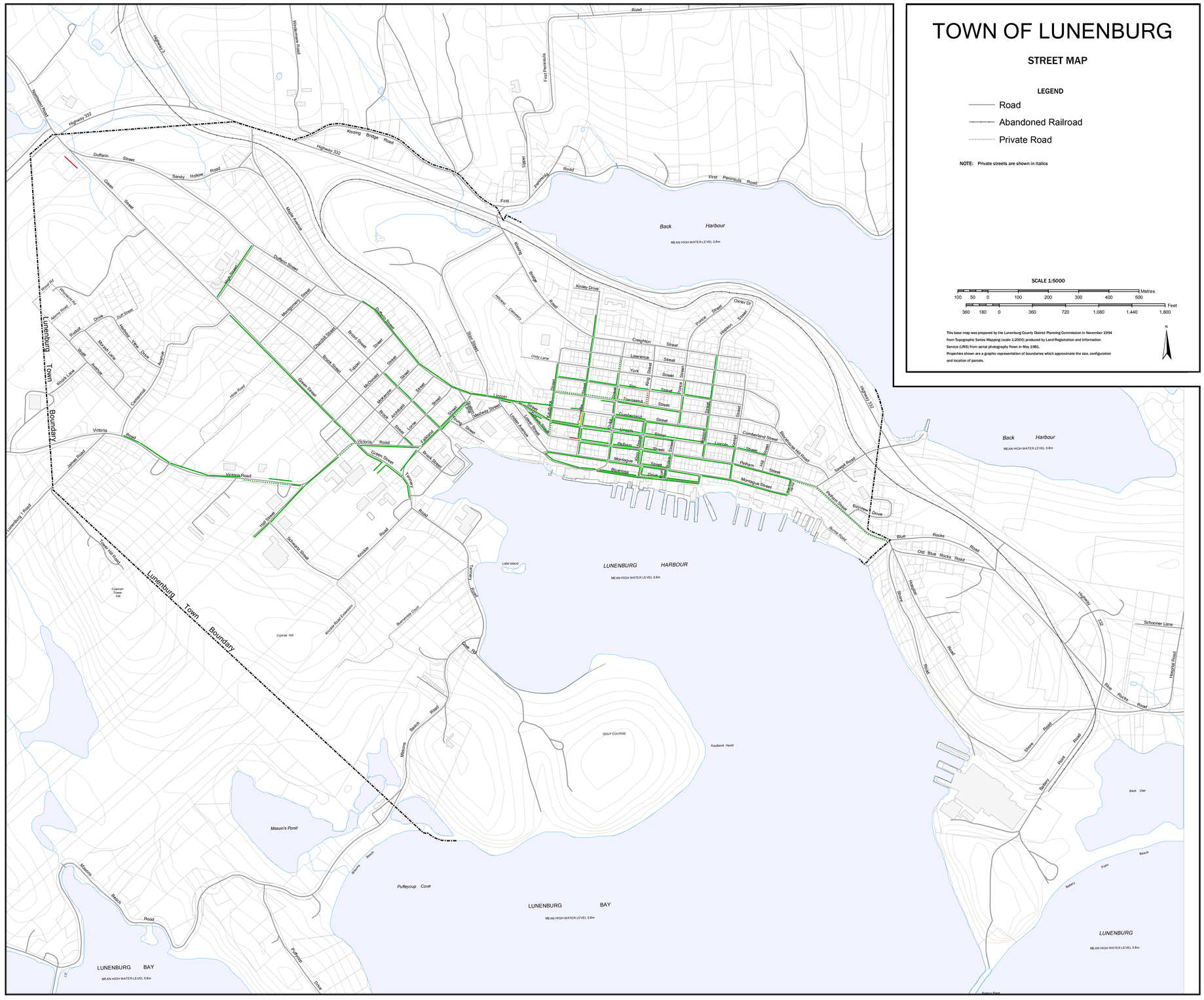
**SCALE 1:5000**

Metres: 100 50 0 100 200 300 400 500

Feet: 360 180 0 360 720 1,080 1,440 1,800

This base map was prepared by the Lunenburg County District Planning Commission in November 1994 from Topographic Series Mapping (scale 1:2000) produced by Land Registration and Information Service (LRIS) from aerial photography flown in May 1981.
Properties shown are a graphic representation of boundaries which approximate the size, configuration and location of parcels.

N



Schedule "G"

Circulated: _____

Document No: 7
Meeting: Council June 9, 2020
Circulate To: Council, BR, JL, JM, PB
File: Water/Wastewater - General

# M E M O R A N D U M

**TO:** **TOWN COUNCIL**

**FROM:** **PETER BAKER, PUBLIC WORKS SUPERINTENDENT, JOHN LOHNES, TAYLOR ROMBAUT AND JOHN MADER, WATER RESOURCE OPERATORS**

**DATE:** **MAY 26, 2020**

**RE:** **APRIL 2020 WATER AND WASTEWATER QUALITY TEST RESULTS**

## 1. FACTS

The Nova Scotia Environment "Approval" documents to operate both for the Water Treatment Plant (Class II water treatment facility) and the Wastewater Treatment Plant (Class II wastewater treatment facility) require that certain tests be carried out to verify the quality of treated water and wastewater at the respective plants. There are also Federal testing standards. Routine testing is conducted both in Town labs at each plant and independently certified labs to determine compliance levels with both the Provincial and Federal standards. If any test result exceeds the standards then explanations are provided. This report provides a monthly summary of these results.

At the end of each year an annual report is also prepared for both treatment plants and filed with the Provincial and Federal governments.

## 2. ISSUES AND OPTIONS

### Wastewater Treatment Plant

The Provincial Approval to operate requires that treated wastewater be tested a minimum of five times per month (once per week) for:

- biochemical oxygen demand (BOD maximum 20 mg/L);
- suspended solids (SS maximum 20 mg/L); and
- fecal coliform (maximum 1000 counts/100 mls).

pH (between 6.5 - 9.0) is tested daily (five times per week).

Disinfection is required to be continuous with the use of UV lights.

The Approval document further states that the facility is considered to be “in compliance with effluent limitations if 80% of the sample test results, at the frequency and number specified…meet the specified limit(s)...No single test result can be greater than two times the limits”.

The Town is also required to comply with the Federal Environment Canada Wastewater Systems Effluent Regulations. We test treated water from the Wastewater Treatment Plant for Carbonaceous Biochemical Oxygen Demand (CBOD maximum 25 mg/L), Total Suspended Solids (TSS maximum 25 mg/L), un-ionized ammonia (maximum 1.25 mg/L) and pH (between 5.5 - 9.5) every two weeks. Acute lethality tests are conducted quarterly and in this test rainbow trout are used to determine if they can survive in wastewater effluent over a 96-hour period. According to the regulations if four consecutive acute lethality tests pass when taken quarterly (over a year) then the testing for acute lethality can be reduced to once per year.

## Results

The following table identifies test results which exceeded the Provincial Standards.

| Parameter Tested (# of test) | Maximum Limit | Exceeded Maximum Limit |
|---|---|---|
| BOD (5) | 20 mg/L | None |
| SS (5) | 20 mg/L | None |
| Fecal Coliform (5) | 1,000 counts/100 mls | None |
| pH (22) | 6.5 – 9.0 | None |
| Comment: All April test results met the Provincial Standards | | |

All April test results met the Federal Standards. No rainbow trout died in the last acute lethality test performed on December 3, 2019. According to the Environment and Climate Change Canada regulations we are now only required to test for acute lethality yearly as the last four consecutive samples passed the test requirements. The next acute lethality test will be performed in December 2020.

We have attached a table which provides a summary of the average monthly daily flow (US gallons per day) of wastewater which has been treated from 2009 to date.

## Water Treatment Plant

The Provincial Approval document requires weekly total coliform and E. coli bacteria tests for water entering the distribution system and various water distribution system sample points. In addition, aluminum is tested monthly. Quarterly we test for: parameters for corrosion control; lead; trihalomethanes; bromodichloromethane; and haloacetic acids. Annually, we test raw water and treated water for compliance with the Federal Guidelines for Monitoring Public Drinking Water Supplies and a fuller assessment every five years. The Province can also request viruses, Giardia and Cryptosporidium testing at any time.

**Results**

All April and quarterly test results were in compliance with the Provincial Approval requirements.

Additional information is attached with the line loss since January 2014 up to date and the location and cause of water leaks within the distribution system since January 2015 up to date.

## 3. FINANCIAL IMPACT

Funds are included in the Water Treatment Plant and Wastewater Treatment Plant operating budgets to pay for these water quality tests.

## 4. STRATEGIC PLAN RELEVANCE

Strategic Planning Goal #3. A. (a.) of the Town's Strategic Plan is to "Champion opportunities for our community's health and well-being by ... Protecting our natural environment ... Continue to provide solid waste management, sewage treatment and high-quality water to all of our residents".

## 5. RECOMMENDATION

This report is provided for Town Council's information.

Acknowledged only by:

Bea Renton, CAO

Encls. 3

**Waste Water Treatment Plant**

| Average Monthly Daily Flows (USGPD) | 2020 | 2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 940,294 | 767,857 | 840,324 | 990,669 | 798,500 | 821,333 | 1,228,376 | 797,289 | 963,316 | 906,324 | 636,808 | 681,049 |
| February | 959,648 | 592,263 | 978,915 | 822,827 | 902,320 | 632,291 | 1,171,563 | 804,590 | 969,710 | 974,459 | 693,503 | 689,140 |
| March | 903,731 | 726,059 | 915,953 | 916,966 | 1,083,288 | 949,220 | 965,278 | 1,043,356 | 965,597 | 998,449 | 802,902 | 914,341 |
| April | 1,153,251 | 1,107,593 | 1,113,196 | 736,749 | 933,020 | 1,602,759 | 965,278 | 764,799 | 632,395 | 985,934 | 569,976 | 1,070,959 |
| May | | 974,489 | 792,349 | 855,584 | 728,810 | 485,225 | 573,635 | 887,125 | 654,174 | 1,157,628 | 477,666 | 702,156 |
| June | | 914,011 | 678,713 | 884,103 | 626,112 | 991,863 | 639,974 | 989,508 | 656,993 | 840,575 | 559,765 | 678,842 |
| July | | 601,530 | 643,826 | 580,779 | 615,238 | 628,417 | 526,474 | 834,703 | 605,139 | 629,526 | 686,258 | 547,631 |
| August | | 577,504 | 504,183 | 617,797 | 508,015 | 627,702 | 509,224 | 601,246 | 559,871 | 834,769 | 582,341 | 577,263 |
| September | | 273,878 | 520,990 | 601,488 | 524,950 | 462,222 | 550,710 | 662,096 | 996,792 | 588,082 | 571,014 | 502,385 |
| October | | 649,833 | 884,682 | 491,703 | 773,368 | 728,372 | 851,612 | 716,092 | 714,657 | 1,188,019 | 578,492 | 944,224 |
| November | | 942,787 | 1,067,517 | 554,340 | 735,231 | 625,240 | 1,053,808 | 889,923 | 774,717 | 1,028,785 | 948,721 | 636,926 |
| December | | 906,862 | 770, 823 | 939,003 | 930,390 | 831,210 | 1,207,248 | 1,128,674 | 1,117,587 | 1,050,063 | 1,109,152 | 1,006,181 |
| **Average Daily Volume/Year USG** | | 752,889 | 745,054 | 749,334 | 763,270 | 782,155 | 853,598 | 843,283 | 800,912 | 931,884 | 684,717 | 745,925 |
| **Days per year** | | 365 | 365 | 365 | 366 | 365 | 365 | 365 | 366 | 365 | 365 | 365 |
| **Total Yearly Volume USG** | | 274,804,455 | 271,944,679 | 273,506,897 | 279,356,880 | 285,486,407 | 311,563,392 | 307,798,420 | 293,133,914 | 340,137,812 | 249,921,529 | 272,262,573 |
| **Year to Year Increase (Decrease) USG** | | 2,859,776 | -1,562,218 | -5,849,983 | -6,129,528 | -26,076,984 | 3,764,972 | 14,664,506 | -47,003,898 | 90,216,284 | -22,341,045 | |

*** Due to power outages these volumes may not be completely accurate**

**Town of Lunenburg Water Use**

| 2014 | | | | |
|---|---|---|---|---|
| | **Pumped** | **Sold *** | **Unaccounted Water Use/Loss** | **Percent** |
| January to March | 41,343,988 | 33,477,361 | 7,866,627 | 19.03% |
| April to June | 41,683,941 | 34,045,724 | 7,638,217 | 18.32% |
| July to September | 46,966,995 | 35,008,429 | 11,958,566 | 25.46% |
| October to December | 38,523,608 | 33,039,285 | 5,484,323 | 14.24% |
| **2015** | | | | |
| January to March | 38,685,055 | 31,474,195 | 7,210,860 | 18.64% |
| April to June | 41,053,551 | 33,846,179 | 7,207,372 | 17.56% |
| July to September | 44,926,119 | 33,983,269 | 10,942,850 | 24.36% |
| October to December | 38,532,914 | 35,139,044 | 3,393,871 | 8.81% |
| **2016** | | | | |
| January to March | 39,065,596 | 32,368,168 | 6,697,428 | 17.14% |
| April to June | 38,905,020 | 34,990,883 | 3,914,137 | 10.06% |
| July to September | 50,366,140 | 39,678,233 | 10,687,907 | 21.22% |
| October to December | 40,464,380 | 37,443,578 | 3,020,802 | 7.47% |
| **2017** | | | | |
| January to March | 37,574,680 | 33,531,323 | 4,043,357 | 10.76% |
| April to June | 39,237,440 | 36,096,612 | 3,140,828 | 8.00% |
| July to September | 48,072,704 | 42,657,360 | 5,415,344 | 11.26% |
| October to December | 40,528,840 | 35,983,255 | 4,545,585 | 11.22% |

| **2018** | | | | |
|---|---|---|---|---|
| January to March | 38,260,460 | 33,880,209 | 4,380,251 | 11.45% |
| April to June | 39,117,100 | 33,951,871 | 5,165,229 | 13.20% |
| July to September | 45,083,423 | 38,246,005 | 6,837,418 | 15.17% |
| October to December | 37,931,817 | 33,208,199 | 4,723,618 | 12.45% |

| **2019** | | | | |
|---|---|---|---|---|
| January to March | 38,188,700 | 32,842,069 | 5,346,631 | 14.00% |
| April to June | 41,667,340 | 34,992,919 | 6,674,421 | 16.02% |

| | | | | |
|---|---|---|---|---|
| July to September | 55,870,980 | 38,731,499 | 17,139,481 | 30.68% |
| October to December | 41,662,060 | 37,768,735 | 3,893,325 | 9.35% |

| **2020** | | | | |
|---|---|---|---|---|
| January to March | 39,497,480 | 31,682,469 | 7,815,011 | 19.79% |
| April to June | | | | |
| July to September | | | | |
| October to December | | | | |

*Based on an average of 150/gallons/day residential use. This typically increases during warm month periods.

**Water Leaks in Distribution System**

| 2015 | | | | |
|---|---|---|---|---|
| **Month** | **Date** | **Street** | **Address or Block** | **Problem or Cause** |
| January | 12 | Victoria Road | Civic 80 | 3/4" water service with pin holes |
| January | 22 | Kempt Street | Between Townsend and Cumberland | 6" valve bonnet broke |
| January | 26 | Lincoln Street | Civic 187 | 3/4" water service brass connection |
| January | 26 | Falkland Street | Civic 71 | 6" valve bonnet broke |
| February | 11 | Blockhouse Hill Road | Between Civic 11 and Civic 24 | 6" watermain cracked |
| February | 18 | High Street | Civic 24 (Hospital) | 6" sprinkler service leaking |
| February | 20 | McDonald Street | Between Brook and Green | 4" watermain cracked |
| April | 15 | Victoria Road | Civic 167 | 8" watermain long split |
| May | 1 | Lorne Street | Civic 20 | 3/4" water service swedge curb stop |
| June | 8 | Pelham Street | Civic 178 | 3/4" water service brass connection |
| November | 24 | McDonald Street | Between Brook and Green | 4" watermain cracked |
| December | 3 | Kaulback Street | Between Kissing Bridge Road and Kinley Drive | 8" watermain cracked |
| **2016** | | | | |
| **Month** | **Date** | **Street** | **Address or Block** | **Problem or Cause** |
| January | 19 | Falkland Street | Civic 71 | 6" sprinkler service cracked |
| February | 18 | Archibald Street | Intersection of Green Street | 8" X 6" reducer loose fitting |
| February | 25 | Centennial | Intersection of Victoria Road | 8" X 8" loose fitting (elbow) |
| March | 11 | Kaulback Street | Between Kissing Bridge Road and Kinley Drive | 8" watermain cracked |
| March | 29 | McDonald Street | Between Brook and Green | 4" watermain cracked |
| April | 15 | Falkland Street | Civic 32 | 3/4" water service brass connection |
| July | 6 | Mason's Beach Road | Between Civic 101 and 142 | 2" leak watermain |
| July | 25 | Bayview Drive | Behind 311 Pelham Street | 1 1/2" leak water service |
| October | 21 | Dufferin Street | 157 Dufferin Street | 3/4 " leak water service |
| October | 31 | Pelham Street | 106 Pelham Street | 3/4 " leak water service |
| December | 1 | Blue Rocks Road | Civic 359 | 1" leak water service |
| **2017** | | | | |
| **Month** | **Date** | **Street** | **Address or Block** | **Problem or Cause** |
| February | 4 | Montague | Civic 208 | 6" watermain cracked |
| September | 7 | MacDonald | Civic 59 | 3/4" Brass service leaking |
| September | 21 | Motague | Civic 257 | 3/4 Brass service leaking |
| **2018** | | | | |
| **Month** | **Date** | **Street** | **Address or Block** | **Problem or Cause** |
| February | 6 | Brook | Civic 108 | 6" watermain cracked |
| February | 15 | Green | Civic 23 | 6" watermain cracked |
| March | 19 | Victoria Road | Civic 79 | 8" watermain cracked |
| May | 15 | Bayview Drive | Behind 305 Pelham | 2" plastic line fitting |
| July | 2 | Victoria Road | Between 80 and 58 | 1" service holes in pipe |
| October | 4 | Dufferin Street | Civic 121 | 3/4 " leak water service |
| November | 4 | Young Street | End of Young Street in Park | 12" AC water line coupling failed |
| **2019** | | | | |
| **Month** | **Date** | **Street** | **Address or Block** | **Problem or Cause** |
| May | 2 | Kempt Street & Lincoln | Civic 24 Kempt Street | 6" watermain cracked |
| June | 10 | Harbour View Drive | Civic 232 | 3/4 " leak water service |
| June | 18 | Bluenose Drive | Civic 179 | 12" watermain coupling failed |
| October | 2 | Blue Rocks Road | Civic 359 | 3/4" service hole in pipe |
| October | 21 | MacDonald Street | Civic 59 | 4" cast iron watermain cracked |
| **2020** | | | | |
| **Month** | **Date** | **Street** | **Address or Block** | **Problem or Cause** |
| February | 18 | McKenzie | Civic 55 | 3/4 " leak water service |
| April | 30 | Falkland | Civic 29 | 3/4 " leak water service |

Schedule "H"

## Kelly Jardine

**Importance:** High

**From:** DONALD GRAY
**Sent:** May 25, 2020 8:45 AM
**To:** Rachel Bailey <RBailey@explorelunenburg.ca>; Bea Renton <brenton@explorelunenburg.ca>
**Cc:** McGowan Patricia >; Kevin Crouse <
**Subject:** Sign-Planter installation

Good morning

The Rotary Club is interested in installing a "Nova Scotia Strong" sign on a 2' x 6' planter to encourage positive support for the residents in this changed environment.

Suggested possible locations being

(1) near the information kiosk at the Lilydale entrance to the Town
(2) on Victoria St in the park behind the tennis courts

The sign is mounted above the planter which is made of womanized lumber and would be maintained by the Club including the annual installation of flowers.

The photos attached show the sign and the second shows the actual planter style to be utilized.

If the Town is interested in proceeding we can discuss the location site at the earliest opportunity.

Donald

Donald Gray, past president
Rotary Club of Lunenburg
902-

# NOVA SCOTIA STRONG

ROTARY INTERNATIONAL