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February 21, 2019

Helen Yeh
Environmental Assessment Officer
Environmental Assessment Branch
Nova Scotia Environment

Subject: Northern Pulp Replacement Effluent Treatment Facility Project

Thank you for the opportunity to review and comment on the Environmental Assessment (EA) Registration Document for the proposed Northern Pulp Effluent Treatment Facility Project in Pictou, Nova Scotia.

As Transport Canada has previously informed Provincial and Federal departments, as well as the proponent, a Notice of Works (application) for *Navigation Protection Act* (NPA) approval from Transport Canada Navigation Protection Program (NPP) is required. An application for a Lease or License from Transport Canada may also be required, should the effluent pipeline cross at or near Transport Canada lands at the Caribou Ferry Terminal.

To date, neither application above has been received. Only when these applications are received can Transport Canada ascertain more clearly, its involvement in the project.

Specific comments on the EA Registration document as it relates to Transport Canada's Mandate:

- Suggest re-wording the paragraph under *Navigation Protection Act* (Transport Canada Navigation Protection Program Process) on page 21. Applications to the Navigation Protection and Ports programs are separate. The beginning of the paragraph refers to the 'requirement' for a waterlot lease/licence; however, as previously stated, this has not been determined.
- The EA registration document does not consider the potential impacts to navigation. Since a NPA approval is required, this should be added in Sections 7 and 8 of the document under the Socio-Economic Environment VEC. The direct effects on navigation are mitigated as terms and conditions associated with work approved or permitted pursuant to the NPA.

Should you have any questions in regards to this response, please do not hesitate to contact the undersigned.

J. Jason Flanagan, M. Sc.
Senior Environmental Affairs and Aboriginal consultation Unit

Date: February 22, 2019

To: Helen Yeh
Environmental Assessment Officer

Cc:

From: Contaminated Sites staff within the Resource Management Unit of
Nova Scotia Environment

Subject: Environmental Assessment Registration for Northern Pulp Nova Scotia:
Replacement Effluent Treatment Facility

Introduction

The following comments have been developed by technical staff within the Contaminated Sites Unit of NSE based on review of the Environmental Assessment Registration for Northern Pulp Nova Scotia: Replacement Effluent Treatment Facility, January 31, 2019.

Comments

Planning/Design Issues

- A reasonably well-defined characterization of likely effluent chemistry that represents a conservative prediction of the chemicals that may be present in the effluent discharge, as requested by Health Canada prior to the EA Registration submission has not been provided. The proponent has indicated that effluent chemistry characteristics (including the specific substances present in treated effluent and their anticipated concentrations) will not be known with certainty until the project is operational, as the chemical process engineering design work is continuing and there is presently uncertainty regarding the likely chemical composition and characterization of the marine treated effluent discharge. At this time the proponent has only identified candidate contaminants of potential concern (COPCs) that may be evaluated should a human health risk assessment (HHRA) of the project be a regulatory requirement. This lack of information hampers the evaluation of potential risk associated with the project. Northern Pulp Nova Scotia (NPNS) will likely be required to monitor for additional parameters to those listed within the Pulp and Paper Effluent Regulations (PPER). Without having a comprehensive list of chemicals present in the effluent discharge, it is not practical to establish monitoring

parameters or applicable guidelines for monitoring. The proponent has identified that refinement of the candidate COPCs would be anticipated for a potential HHRA study of the project, should one be required. Additional information on the specific substances present in treated effluent (including chemicals and microorganisms introduced in the treatment process), their anticipated concentrations and their risk to the environment should be provided.

- The potential impact to potable water supplies if a release occurs from the pipe line is a significant concern. The proposed pipeline traverses a drinking water supply area. Limited information has been provided on the proposed maintenance and inspection of pipeline during its operation. The proponent has indicated that there is an intention to have a system in place to detect leaks (or a significant drop in pressure) during operation and maintenance; however, details concerning this system have not been provided. It is unclear what impact a “significant drop in pressure” could have on a groundwater supply before being detected. Clarification should be provided to ensure appropriate leak detection, monitoring and action plans are in place to mitigate potential impacts to potable groundwater, particularly within the source water protection area for the well field. The potential HHRA referenced by the proponent should also consider impacts to drinking water, should the effluent pipeline experience a release in the sections that cross drinking water supply areas.
- The proponent has indicated that a component of the contingency plan for the replacement treatment facility is the construction of a spill basin with a capacity of 35,000 m³. Little information concerning design flow rates have been provided to determine whether the capacity of the spill basin will be sufficient in all scenarios (e.g. successive days with flow rate of 85,000 m³). The proposed spill basin will be located in close proximity to Pictou Harbour. The proximity of the spill basin to the harbour is concerning, should the spill basin be compromised due to internal or external forces; such as, berm or liner failures, overflows, storm events or potential impacts of climate change. Limited information has been provided at this stage to ensure that operational activities in and around the spill basin will not adversely affect the environment. The proponent has indicated that the existing NPNS groundwater monitoring network will be updated as required once the construction is complete; however, proposed changes have not been identified at this time.

Operational Issues/Other Permitting Processes

- The proponent has indicated that the US EPA under the Resource Conservation and Recovery Act, has made a technical determination that dewatered pulp and paper sludges managed in a manner that preserves the meaningful heating value of the materials, can be considered a standard fuel, with combustion related emissions that are no different than other forest-based solid fuels such as bark. Little information has been provided to indicate whether the sludge material from the Effluent Treatment Facility (ETF) will satisfy these conditions in order to achieve the objective of displacing the use of fossil fuels.

- The proponent has indicated that modelling results have predicted concentrations of the air contaminants of concern (i.e., CO, NO₂, SO₂, TSP, PM_{2.5}, and H₂S) from the operation of the existing mill and the future mill (with replacement ETF) are both expected to be in compliance with the reference criteria at the representative off-property discrete receptors. The composition of the sludge material has not been defined and it is unclear whether any additional contaminants of concern should be assessed and considered in the model calculations.

Other Observations

- The proponent has indicated that dredging will be required for the installation of the pipeline. Appendix F, *Description of Marine Pipeline Construction* briefly discusses the potential for land-based disposal of dredge materials. Further clarification should be provided. If disposal within provincial jurisdiction is being considered, sample results must be compared to applicable criteria (NS Tier I EQS and relevant CCME criteria (Sodium Absorption Ratio & Electrical Conductivity)) for the land use on which the material is proposed to be disposed. If the material is found to be contaminated, the material must be sent to an approved facility.

Memo

To: Helen Yeh

From: Environmental Health, NSE

Date: February 26, 2019

Subject: Northern Pulp Nova Scotia EA

The following comment are provided by Environmental Health following a review of the Northern Pulp Nova Scotia EA in consultation with the medical Officer of Health. The focus of the review was to evaluate project interactions on the environment and their potential to impact human health.

Planning/Design

A. Atmospheric Environment

The assessment of atmospheric impacts related to the proposed undertaking was limited to a handful of substances that are currently regulated under the NS Air Quality Regulations., and PM2.5. Unregulated substances that may be present in air emissions were not assessed with respect to their impact on air quality and human health, which may result in an underestimation of atmospheric impacts related to this project.

No evidence is provided to support the decision to restrict the assessment to regulated substances only. Based on the information provided there's no evidence to support a conclusion that any unregulated substance present in air emission is of no concern to the atmospheric environment and human health.

In Section 8.1.1.2 following a discussion of the Hoffman et. al. (2017) study, the EA states that VOC's may be released in stack and fugitive emissions from the NPNS mill, but based on a literature review VOC are not known to be associated with pulp mill activities and air emissions to any great extent. Conclusions of this nature need to be supported by evidence, which is not provided in the EA.

B. Sludge

A USEPA rule is referenced to support the proposal to co-combust sludge in the mill boilers. No evidence or analysis is provided, however, to demonstrate that the sludge produced as part of this project will comply with existing requirements related to the application of the EPA rule.

C. Treated Wastewater Effluent

Section 8.11.3.1, page 347 of the EA states,

The treated effluent will contain the following water quality parameters of concern: absorbable organic halides (AOX), total nitrogen (TN), total phosphorus (TP), colour, biochemical oxygen demand (BOD), total suspended solids (TSS), dissolved oxygen (DO), pH, and water temperature.

No evidence is provided to support the above statement. It is unclear as to how the proponent determined the parameters of concern. Also, no information is provided in support of excluding additional contaminants present in effluent. Conclusions of this nature need to be supported by evidence.

Considering the potential for effluent to impact drinking water (related to a pipeline leak and contamination of groundwater) and the receiving environment, a greater understanding of the type, nature and concentration of environmental contaminants present in effluent, and their potential impacts on groundwater and the receiving environment is warranted.

Operational

A. Noise

Section 5.6.4 of the EA states,

There will also be elevated noise emissions during HDD operation, if this method is selected for pipeline construction at wetlands and/or watercourses. Some activities will involve 24-hour a day operation for a period of up to several days, and will emit near continuous noise emissions during drilling.

The noise impact study that was undertaken, however, did not consider the impacts of the HDD as a noise source as evidenced in Table 8.2-2. Excluding the noise impacts of the HDD is likely to underestimate the impacts of the project on the acoustic environment. If horizontal directional drilling is undertaken during project construction, further consideration will be needed for the

“elevated noise emissions” generated by the HDD for mitigating impacts to the acoustic environment.

B. ETF and Cooling Towers

A on-line search revealed a case study involving two cases of Legionnaire’s disease that were found to be associated with waste water treatment systems used by the forest industry. A link to the case study is provided for review.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3014939/>

The EA does not consider the impact the ETF and cooling towers might have on human health from exposure to Legionella bacteria found in associated with the ETF. An examination of this risk is warranted.

Environment

Date: March 4th, 2019

To: Ms. Helen Yeh, Environmental Assessment Branch, NSE

From: Manager, Climate Change Division

Subject: Class I Environmental Assessment: Northern Pulp's Replacement Effluent Treatment Facility Project FINAL comments

The Climate Change Division has reviewed the Class I Environmental Assessment for Northern Pulp's Replacement Effluent Treatment Facility Project. Please find enclosed below our draft preliminary comments from a greenhouse gas emissions and climate change adaptation perspective.

Planning/Design Issues

Climate Change Adaptation

It is recommended that the proponent consider the combined effects of warmer temperatures as a result of climate change and project activities on water quality of Northumberland Strait and Caribou Harbour.

Greenhouse Gas Emissions

In the construction phase, the proponent states that the primary sources of greenhouse gases for this project are carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) from fossil fuel combustion in heavy construction equipment, trucks and other mobile equipment. The proponent further mentions that the total greenhouse emissions during the construction phase are expected to be immaterial. Though the immateriality of these emissions may be justifiable, it is recommended that the proponent provide the estimated direct and indirect greenhouse emissions that are expected during this phase to confirm the immateriality conclusion.

The proponent does not commit to implementing direct greenhouse control technologies in this environmental assessment for mitigation of greenhouse emissions in the construction phase of the Effluent Treatment Facility. There is commitment to employ operational measures to mitigate greenhouse gas emissions during construction in

Table 8.1-7. These measures include instituting an anti-idling policy and to maintain equipment. The opinion of the reviewer is that the indicated measures suffice for emissions that are deemed immaterial at this point.

Operational Issues/Other Permitting Processes

Greenhouse Emissions

Regarding the operation phase of the Effluent Treatment Facility, Appendix K indicates that the mill operations are not expected to vary much with the operation of the new Effluent Treatment Facility. The proponent also indicates that the removal of sludge from the rotary press to be co-combusted with hog fuel in the mill's existing power boiler could have a mitigative impact on GHG emissions from the facility. The removal of sludge from the Effluent Treatment Facility could reduce CH₄ emissions from the water treatment due to the reduction of organic solids in the effluent. Furthermore, the co-combustion of sludge in the boiler could displace natural gas which is the secondary fuel used in the boiler. It is recommended that the proponent should consider estimating the direct and indirect greenhouse emissions that are expected during the operation phase of the project. Where necessary the biogenic carbon content of the proposed sludge fuel should be estimated using methodology available in the Nova Scotia Greenhouse Gas Quantification, Reporting and Verification Standards.

Concerning the combustion of the sludge, Appendix K assumes the properties of the expected sludge will be similar to sewage sludge for which combustion properties are well known. Appendix K also indicates that further tests with the sludge to deduce its actual performance in the boiler will be conducted once operations begin. It is recommended that the proponent commits to these further tests to re-estimate the expected reductions in CH₄ emissions from the Effluent Treatment Facility, and expected reductions of CO₂ emissions from the boiler.

Other Observations

Climate Change Adaptation

While it is noted that the potential impacts of climate change on the project and mitigation measures have been documented the proponent should consider reviewing the Nova Scotia Environment's *Guide to Considering Climate Change in Environmental Assessment in Nova Scotia* for additional guidance on assessing the combined impacts of climate change and the project activities on relevant valuable environmental components.



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March 4, 2019

Helen Yeh
Environmental Assessment Officer
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Subject: Health Canada's Response to the Environmental Assessment (EA) Registration Document for the Northern Pulp Replacement Effluent Treatment Facility¹

Dear Helen:

Thank-you for your e-mail dated February 7, 2019, requesting Health Canada's review of the above-mentioned provincial Environmental Assessment Registration (EA) document for issues with respect to human health. Health Canada has reviewed the documentation (with particular emphasis on Section 9 (Human Health Evaluation) and Section 8 (Acoustics and Groundwater)) and is providing the following comments for your consideration with respect to the proposed project (hereinafter referred to as 'the project') which includes the treatment facility (power boiler), pipeline and pipeline diffuser to the Northumberland Strait. In general, Health Canada found that the information contained in the sections reviewed to be insufficient in order to fully evaluate the potential future health impacts of the project.

Human Health Evaluation (HHE)

- 1) **Section 9.1 (Introduction and Background)** states that "*at this time, effluent chemistry characteristics (including the specific substances present in treated effluent and their anticipated concentrations) will not be known with certainty until the project is operational. Some other current areas of uncertainty include limited recent or current baseline environmental media and marine food item chemistry data, and limited data on traditional marine food item harvesting and consumption patterns within the PLFN community*".

¹Dillon Consulting. 2019. Northern Pulp Nova Scotia Environmental Assessment Registration Document; Replacement Effluent Treatment Facility. Prepared for Northern Pulp Nova Scotia; submitted to the Nova Scotia Department of Environment, January 31.

Given the unknown chemical composition of the future effluent, lack of baseline information on contaminants in the various environmental media (including marine foods), and the lack of understanding of current traditional food harvesting and consumption patterns within the Pictou Landing First Nation (PLFN) community, it is unclear how human health risks from the proposed project can be evaluated with any degree of certainty. In order to reduce these uncertainties, Health Canada advises the following:

- A pilot-scale chemical testing of the effluent be conducted prior to the operational phase of the project (based on the suggested lists of contaminants as presented in Section 9.2.4 and as per Health Canada, 2012);
- adequate baseline sampling of the various environmental media (including marine species) (as per Health Canada, 2010) be conducted prior to any future effluent discharge from the new pipeline to the Northumberland Strait;
- the conduct of either a formal or informal country foods survey with the PLFN prior to the operational discharge of effluent to the Northumberland Strait and prior to the baseline marine food item collection and analysis (Health Canada, 2010; Health Canada, 2017a);
- the conduct of a more formalized human health risk assessment (HHRA) for baseline health risks and also for health risks related to future effluent releases, using the information collected as per the previous three bullets (above).

2) **Section 9.1 (Introduction and Background)** states that “*while such uncertainties would preclude the ability to conduct a HHRA at this time, a qualitative human health evaluation (HHE) was conducted (and presented herein) which serves as an interim approach to address the potential human exposure and risk in relation to project air emissions and treated effluent discharges. The HHE was conducted at the scoping level or screening level of effort and utilizes data and study outcomes that are currently available and/or feasible to address at this time*”.

If there are limited baseline studies and only a qualitative evaluation of health risks based on assumptions that may or may not have been validated with the PLFN or other people who use the area, an understanding of the future health risks associated with the project is limited. Health Canada acknowledges that it has no enforceable regulatory requirements for the project (e.g. permits, authorizations), however, given the lack of information provided in the Human Health Evaluation (HHE), and the unknown chemical composition of the future effluent, any advice provided would be speculative and may not adequately ensure the protection of human health.

- The information requested in Health Canada’s comment 1) above should be used to inform the lack of current data and should be collected prior to the commencement of effluent discharge from the new pipeline to the Northumberland Strait.

3) **Section 9.1 (Introduction and Background)** states that the HHE primarily addresses the following HHRA problem formulation items:

- *Identifying relevant exposure pathways, routes and scenarios;*
- *Identifying relevant human receptors; and*
- *Identifying candidate chemicals of potential concern (COPCs) in the project air emissions and treated effluent.*”

- Given the concerns related to effluent discharges and subsequent uptake by marine species that may be consumed by local people, Health Canada advises that this additional pathway (uptake by marine species and subsequent consumption by people) should be further evaluated in a more quantitative human health risk assessment (HHRA) that should be conducted prior to the commencement of the project (Health Canada, 2010).
- 4) **Section 9.1 (Introduction and Background)** states that “*with respect to the review and synthesis of historical data and reports, it is noted that a substantial amount of the reviewed historical data were collected from locations outside the current project study boundaries and/or are too old to represent current baseline concentrations of chemicals of interest in air, or in marine environmental media and marine traditional food items.*”
- Given the lack of current and local data, Health Canada advises that this information should be collected prior to the operation of the project in order to give a more fulsome and locally relevant context in which to evaluate human health effects in the local and regional study areas for this project.
- 5) **Section 9.1 (Introduction and Background)** – states that the “*construction [of the pipeline] is estimated to be approximately 21 months*”.
- Given the deadline of ceasing effluent discharge to Boat Harbour is January 31, 2020 under the provincial *Boat Harbour Act*, and the mill intends to continue operations subsequent to this date, it is unclear where the effluent will be stored or discharged during the project construction phase (estimated to be operational by late 2020). If effluent is expected to be discharged to a temporary location during pipeline construction, Health Canada would suggest that any risk assessment evaluate this temporary discharge location as well for potential human health effects.
- 6) **Section 9.2.1 (Identification and Potential Exposure Pathways and Routes)** states that “*residual chemicals contained in the treated effluent would.. diffuse within this mixing zone [within 2 m of the diffuser].. thus, this exposure pathway(s) would likely not be carried forward into a HHRA study*”.
- Since the composition of the future effluent is currently unknown, it is unclear how this conclusion (i.e. that chemicals would diffuse within 2 m of the diffuser) could be reached. Health Canada requests additional information be provided to substantiate this statement given the diversity of chemicals likely to be present in the final effluent to be discharged and the lack of characterization as presented in the EA.
 - Given public and Indigenous concerns about marine water quality and contamination of marine foods, it is unclear how this pathway would not be carried forward into an HHRA. Additional explanation is required if this pathway is not considered.
- 7) **Section 9.2.1 (Identification and Potential Exposure Pathways and Routes)** states that there are four provincially licensed marine shellfish aquaculture operations (all for American Oyster) in the vicinity of Caribou and Monroe’s Island near the proposed effluent diffuser location. However, in

Section 9.2.4.2 (Identification of Candidate COPCs in Treated Mill Effluent (page 510), the report states that when determining the potential COPC list, the perspectives that were considered included “*log Kow, bioaccumulation and/or bioconcentration factors, and degree of metabolism/excretion in marine fish*”. Given the presence of sedentary ‘non-fish’ species such as oysters at the aquaculture sites, other bivalves such as blue mussels, and invertebrates such as sea urchins, crabs and lobsters, it is unclear whether this COPC list is sufficient given that these more sedentary species may be more exposed to the effluent that is to be discharged from the diffuser.

- Health Canada requests additional information be provided to support whether or not the proposed chemical list is sufficient in order to evaluate non-fish species and their potential exposure and subsequent consumption by people including the PLFN.

8) **Section 9.2.1 (identification and Potential Exposure Pathways and Routes)** states that “*HHRA commonly and appropriately exclude exposure pathways and routes ...that lack sufficient data to enable their evaluation with a reasonable degree of confidence and/or accuracy.*”

- Health Canada advises that it is not appropriate to exclude any chemicals and/or pathways/routes of exposure that may result in adverse human health effects. See Section 2.4.1 of Health Canada (2012) for more information on appropriate methods to use to screen substances for further evaluation in an HHRA (Health Canada, 2012).

9) **Section 9.2.2 (Identification of Potential Human Receptors and their Characterization)** states that “*general physical/physiological and behavioural characteristics specific to the receptor type (e.g., body weight, breathing rate, food and soil consumption rates, etc.) are used to determine the amount of chemical exposure received by each human receptor.*” Based on the information provided, it appears that literature-based sources were used to identify these characteristics for the local study population. Given that the PLFN or other local non-Indigenous people may have different characteristics due to genetics, dietary patterns etc., the use of default assumptions may not represent the characteristics of local people. For example, the PLFN may have an increased reliance on country foods (including marine species), which may not be captured by using default characteristics. As described in Health Canada’s comment 1) above, the most accurate means by which to collect community/individual-specific information would be to conduct a targeted survey within the local communities (Health Canada, 2010; 2012; 2017a).

- Health Canada advises that a community survey (including a dietary survey) be undertaken prior to pipeline construction and operation in order to have more local and up-to-date receptor characteristic information that could then be used in evaluating the potential risk to human health from the proposed project in a more formalized HHRA.

10) **Section 9.2.4 (Identification of Candidate Chemicals of Concern)** states that “*if no health risk are predicted for the chemicals selected for evaluation, then no health risks would be expected for any chemicals not included in the evaluation*”. Given that the chemical composition of the future effluent is unknown, additional chemicals that are not part of the evaluation may be unintentionally omitted from any HHRA. In addition, some chemicals may affect the same target organ(s)/have the same adverse impact(s) but may be screened out from further evaluation. As

such, any additive or synergistic effects associated with these chemicals may not be evaluated in an HHRA. The lack of evaluation of certain chemicals (depending on their toxic effect(s) and interactions with other chemicals), may therefore underestimate current and future health risks.

- Health Canada advises that all chemicals which may have an adverse impact on human health be evaluated, including substances with similar toxic endpoints which may have otherwise been screened out. Where similar effects may be possible, the cumulative health risks should be evaluated.

11) **Section 9.2.4.1 (Identification of Candidate COPCs in Project Air Emissions)** states that “*the air dispersion modelling study selected and assessed ten discrete receptor locations that represent the nearest sensitive receptors (residential locations).*” The locations are described as being identified in Stantec (2019). It would be helpful for Health Canada’s review if the HHE identified the receptor locations in an appropriately scaled map within the HHE document itself. Nevertheless, given that these locations are considered ‘residential locations’, the selected locations may not be representative of areas where Indigenous and non-Indigenous peoples may exercise recreational and/or traditional activities, such as country foods harvesting. Given that some of the air contaminants identified have acute and/or chronic thresholds, evaluating concentrations at the nearest residence(s) may not be sufficient to protect human health.

- Health Canada advises that there should be a discussion about recreational/traditional land use in closer proximity to the proposed project and the possible health implications of shorter-term exposure to the proposed list of air contaminants.

12) **Section 9.2.4.1 (Identification of Candidate COPCs in Project Air Emissions)** - With respect to the air contaminants identified, odour issues may also be of concern, and two groups of substances that were absent from the proposed list were methyl-mercaptans and total reduced sulphurs. Health Canada does not specifically evaluate odours, however, it is important to note that these substances tend to be associated with pulp mill activities and have low olfactory thresholds and therefore can be ‘annoying’ at levels which may be below any other adverse human-health effects.

- Although Health Canada does not have specific expertise in the area of odours, if the community is concerned with odours, these substances should also be monitored as part of any air quality monitoring program.

13) **Section 9.2.4.1 (Identification of Candidate COPCs in Project Air Emissions)** of the report cites a recent paper by Hoffman et al. (2017) which evaluated ambient air levels of seven volatile organic compounds (VOCs) near the Northern Pulp Nova Scotia Inc. (NPNS) property, based on ambient monitoring data reported from the Canadian National Air Pollution Surveillance Network (NAPS). The paper reported that results of the temporal and spatial statistical analyses “*indicated that 1,3-butadiene, benzene, and carbon tetrachloride air concentrations routinely exceeded EPA air toxics-associated cancer risk thresholds, and that 1,3-butadiene and perchloroethylene levels in air were significantly higher when the prevailing wind direction blew from the northeast and the NPNS mill towards the Granton NAPS site.*” Despite these conclusions, the paper was discounted by the author(s) of the HHE. Health Canada acknowledges that the source(s) of these air pollutants

could not be confirmed (be it the mill and/or other industrial sources in the region), however, in the overall interest of protecting human health, these parameters should be further evaluated in the ambient air once the proposed treatment system (i.e. power boiler) has been installed and commences operation. Given the availability of baseline air quality data related to these COPCs, any changes subsequent to the commencement of the power boiler system could be identified.

- Consider evaluating these seven VOCs as part of the air monitoring program in order to evaluate any future changes and compare the future measured concentrations to applicable guideline values in order to be protective of human health.

14) **Section 9.2.4.1 (Identification of Candidate COPCs in Project Air Emissions)** of the report states that “*should future emission source testing and air dispersion modelling indicate that other air emissions merit evaluation, air quality and human health risk assessment may occur at that time to inform appropriate mitigation strategies (if necessary)*”. Given that the report only cites a limited number of air contaminants that may be of interest from a human health perspective, it is unclear how additional air contaminants will be identified and evaluated in order to ‘*inform appropriate mitigation strategies*’.

- Health Canada requests that additional information be provided to explain how other air contaminant emissions will be identified (and mitigated as necessary) given the limited number of contaminants that will be monitored as part of the air monitoring program.

15) **Section 9.2.4.1 (Identification of Candidate COPCs in Project Air Emissions)** (Page 508) identifies a list of chemicals which may be present in pulp and paper mill effluent. Health Canada (2012) (Table A2) identifies specific chemicals which may be relevant from a contaminated sites perspective for the pulp and paper mill industry.

- The list presented in Health Canada (2012) should be compared to the list of chemicals presented in the HHE to ensure all relevant chemicals related to pulp and paper mills are evaluated in the project.

16) Throughout **Section 9.2.4.2 (Identification of Candidate COPCs in Treated Mill Effluent)** (pages 516-518) there is a discussion about the candidate COPCs for future evaluation with respect to the project (including power boiler, pipeline and pipeline diffuser), which were identified based on a review of current effluent chemical concentrations at Points C and D within the Boat Harbour effluent treatment lagoon. Point C is at the confluence of the aeration/stabilization basin and the Boat Harbour lagoon; and Point D is at the discharge point at the weir between Boat Harbour and the Northumberland Strait. The challenge with using such information is that the new effluent treatment process will be different, and under the current discharge system, effluent released to Boat Harbour undergoes aeration and chemical enrichment, followed by multiple days of retention within Boat Harbour (to allow settling of any suspended particulates) before finally being discharged via the containment weir at Point D, with an approximate residence time in Boat Harbour of 30 or more days. Using the data collected related to water/sediment chemistry in the current process may not be valid considering the new process.

- Health Canada is requesting more information about the appropriateness of comparing the future process to the existing process to determine COPCs given that the current system has a 30 or more day settling process to remove contaminants whereas the new process is expected to result in effluent discharge directly to the Northumberland Strait following treatment in the power boiler.

17) **Section 9.2.4.2 (Identification of Candidate COPCs in Treated Mill Effluent) (page 516)** states that “*it is expected that future treated effluent that will be produced as a result of the NPNS project will be of higher quality than the current effluent and will contain fewer candidate COPC substances. For those substances that are present, it is anticipated that they will occur at lower concentrations in the future effluent relative to current effluent*”. However, the HHE also states in **Section 9.1 (Introduction and Background)** that “*at this time, effluent chemistry characteristics (including the specific substances present in treated effluent and their anticipated concentrations) will not be known with certainty until the project is operational*”. It is unclear how the conclusion that the future effluent will be of better quality than the current effluent can be assumed based on this lack of understanding of future COPCs and their respective concentrations.

- Health Canada is requesting additional information about the expected chemical composition and chemical concentrations of the future effluent be provided in order to substantiate the conclusion that the future treated effluent will be of higher quality than the existing effluent that enters the Northumberland Strait, particularly given that the two effluent treatment processes are very different. Without this information, Health Canada cannot provide advice on whether the contaminants in the future effluent may have an impact on human health (either more or less than the current effluent) either through direct exposure pathways or through the consumption of marine species which may uptake these COPCs.

18) **Section 9.2.4.2 (Identification of Candidate COPCs in Treated Mill Effluent) (page 517)** – The report indicates that environmental effects monitoring programs (EEMs) for Boat Harbour have periodically resulted in the collection of chemistry data on effluent parameters in media and biota. For example, in 1996, Jacques Whitford Environment Limited collected (and composited) a total of 10 blue mussels from the outlet area of Boat Harbour. Health Canada advises against compositing individual specimens given the diversity of contaminants that can occur within individual samples (Health Canada, 2010). Health Canada also advocates for a sufficient number of samples to be collected in order to derive a statistically-significant sample size (Health Canada, 2010). In addition, the samples were collected at the outlet of Boat Harbour after the effluent had spent approximately 30 days residing in Boat Harbour before being discharged to the outlet area. As such, this study (and any other bivalve studies conducted in the region) may have limited validity given that the new effluent pipeline is outside of the Boat Harbour outlet, and the effluent will have limited residency time before final discharge to the marine environment. Thus, the impacts of the new effluent pipe on sedentary species (e.g. oysters and mussels, particularly oysters given the presence of oyster aquaculture facilities in the vicinity of the proposed diffuser) may not be fully captured in the current EA.

- Health Canada requests additional information to validate the use of these bivalve studies in evaluating future contaminant concentrations given the different effluent treatment processes and the decreased residency time of the effluent in the proposed project.

Acoustic Environment

- 1) **Section 8.2.1.2 (Significance Criteria)** states that “*a significant adverse residual environmental effects on the acoustic environment is defined as one where the project-related emissions of noise (as determined through noise modelling) results in a prolonged exceedance of the NSE noise guidelines (prolonged period defined as a continuous 24 hour period) identified in Section 8.2.1 above, or a prolonged increase in ambient noise levels of 10 dBA above existing background levels at a sensitive receptor. For the purpose of this threshold, “prolonged” is defined as a continuous period of 24 hours.*”

Given that the *Nova Scotia Guidelines for Environmental Noise Measurement and Assessment* is separated into daytime (0700-1900 hours), evening (1900-2300 hours) and nighttime (2300-0700 hours) thresholds (with different acceptable levels for each time period), it would appear the test for significance would imply that noise levels would be required to exceed each of the three time periods over a 24 hour period before the effect is considered significant.

According to Health Canada (2017b), guidelines and recommendations presented in WHO (1999, 2009) regarding sleep disturbance should be considered in an EA. In particular, WHO guideline levels should not be exceeded for quiet rural areas and susceptible populations, such as those in hospitals, or convalescent or senior homes. For estimating the likelihood of sleep disturbance on any given night, the WHO’s *Guidelines for Community Noise* (1999) report a threshold for sleep disturbance as being an indoor sound level of no more than 30 dBA LAeq for continuous noise, during the sleep period. For individual noise events, the WHO has stated: “For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dBA L_{Amax} more than 10–15 times per night....” Health Canada recognizes that in many cases, people will want to keep windows at least partially open, depending on the season. Unless specified otherwise, it is assumed by Health Canada that an outdoor-to-indoor transmission loss with windows at least partially open is 15 dBA (United States Environmental Protection Agency [US EPA] 1974; WHO 1999).

- Health Canada suggests that in determining significance a greater emphasis be placed on noise levels during the evening and overnight hours in order to be protective against sleep disturbance.
- 2) **Section 8.2.2.1 (Baseline Noise Levels)** states that the baseline sound monitoring was completed between December 15 and December 19, 2017 (with paused measurements during the evening of December 16, 2017 until the early morning of December 17, 2017 and again during the evening of December 17, 2017 until the morning of December 18, 2017 because of cold temperatures). No additional information was provided with respect to ground cover (e.g. snow cover or bare ground) or the atmospheric conditions during the monitoring such as wind speed, wind direction, temperature, etc.

- Given that all of these variables have implications with respect to noise propagation, this information should be presented in the EA in order to determine the adequacy of the baseline sound pressure levels.

3) **Section 8.2.2.3 (Characterization of Residual Environmental Effects)** states that “*it is acknowledged that for traffic reasons the pipeline construction may occur at night. If this option is chosen, appropriate mitigation measures will be implemented.*” There is no further discussion about what mitigation measures will be implemented in the event of pipeline construction occurring at night to reduce noise levels to meet the provincial guidelines.

- Health Canada requests additional information related to mitigation measures that would be implemented in the event of night-time construction noise in order to reduce the potential for annoyance and sleep disturbance to nearby human receptors. See Health Canada (2017b) and the WHO (1999; 2009) for more information.

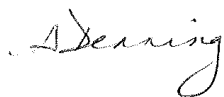
Potable Water Supplies

1) **Section 8.5 (Groundwater)** identifies the number of potable wells within the vicinity of the proposed project (including the effluent treatment facility and the on-land portion of the effluent pipeline). It was noted that the references used in the EA to identify current groundwater chemistry in the area are somewhat dated (e.g. Hennigar, 1968; Gibb and McMullin 1980). If recent groundwater monitoring of these nearby residential wells has not been undertaken (for general chemistry and any other parameters that may be relevant based on the expected new effluent chemical composition), Health Canada advises that baseline sampling be undertaken for any wells that may be impacted in the event of a future pipeline leak.

- Consider conducting baseline chemistry analyses of any nearby potable groundwater wells in order to have a sufficient understanding of current groundwater quality. In the event of a pipeline break/leak, future samples can then be compared with these baseline concentrations in order to determine whether there has been an impact on local drinking water quality.

If you have any questions, please contact the undersigned at your convenience.

Sincerely,



Allison Denning
Regional Environmental Assessment Specialist
Health Canada, Atlantic Region
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Allison.Denning@canada.ca

Sent by e-mail to Helen.Yeh@novascotia.ca

Cc: Rick O’Leary, Regional Manager, Health Canada, Atlantic
Gregory Kaminski, Senior Environmental Health Assessment Advisor, Health Canada
Lachlan MacLean, Project Manager, Canadian Environmental Assessment Agency, Atlantic
Region

References:

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March 5, 2019

Helen Yeh
Environmental Assessment Officer
Environmental Assessment Branch
Nova Scotia Environment

Dear Helen:

**Re. Northern Pulp Proposed Replacement Effluent Treatment Facility Project (Highway 106
Abercrombie to Caribou Harbour) - Environmental Assessment Comments from TIR Review**

Conceptual drawings (*Northern Pulp Effluent Treatment Plan by KSH Solutions Inc. "Conceptual Marine Effluent Outfall Pipeline Routing Plan Caribou Harbour" Rev. 18 dated Dec. 10, 2018 -10 sheets*) outlining Northern Pulp's proposal to construct a pipeline along the shoulder of Highway 106 to carry effluent from their mill in Abercrombie Point to Caribou Harbour were presented and submitted to Nova Scotia Transportation & Infrastructure Renewal (TIR) by representatives of Northern Pulp for preliminary review and feedback shortly prior to the related Environmental Assessment being registered on February 7, 2019. These drawings, and the Environmental Assessment Registration Document by Dillon Consulting were distributed to TIR stakeholders and the following comments are provided:

1. TIR Policy PO1000 "Construction of Gas/Oil Pipelines within or Adjacent to Highway Right-of-Way" offers guidelines and requirements for TIR to consider permitting pipeline infrastructure within TIR highways. This policy has been provided to and discussed with the proponent. With respect to the proposed project the policy states "no installation of low-pressure pipelines will be permitted on or within 30 metres of 100 Series Highways Right-of-Ways in any form. Any exception requires the approval of the Executive Director of Maintenance and Operations."
2. The concept of **placing the pipeline in the shoulder of the road is not acceptable to TIR** and would not be permitted as it would result in significant operational issues to TIR during construction and any future maintenance of the proposed project, may significantly impact TIR's flexibility to implement future highway improvements, and a significant failure of the pipeline could damage the highway.
3. **Placing the pipeline completely outside of TIR right-of-way is preferred by TIR.** It would be permitted adjacent to highway right-of-way (an approved TIR Work Within Highway Right-of-Way Permit is required for any structure within 60 meters of the boundary of a controlled access highway).
4. If TIR permits the pipeline within highway right-of-way in any location, it would be required to be placed as far as possible from the roadway, including adjacent to the causeway (i.e.

within 3 to 5 meters the right-of-way boundary) to minimize operational impacts to TIR during construction and in the future. Along the causeway, it is preferred to locate the pipeline at or near the toe of the slope of the causeway embankment beneath sea level. In other areas adjacent to Highway 106, the pipeline should be placed to the east of the current roadway to minimize impacts on future highway improvements (locate pipeline to opposite side of highway away from lands reserved for future highway twinning and/or expansion) and designed to be capable of supporting maintenance equipment that may be required to operate on the roadside (e.g. excavators).

5. Development and acceptance of a registered agreement between TIR and the proponent would be required to establish formal terms for location, maintenance/monitoring/inspection, emergency measures, liability, remediation/reclamation, relocation costs if required for future highway improvements, responsibilities for potential environmental impacts and to allow for assignment of responsibilities to future heirs/assigns. The Public Highways Act does not allow for any third-party interest in highway right-of-way such an easement.
6. A significant refundable and non-refundable security deposit would be required prior to permit approval, to cover TIR inspection costs and potential damages to the highway. Amounts would be determined upon review of final design plans acceptable to TIR, based on an assessment of risks and potential impacts to TIR. The refundable deposit would be held for at least one year following completion of construction to allow for monitoring of latent design/construction deficiencies and released following final inspection by TIR staff and once any deficiencies/concerns are addressed to the satisfaction of TIR.
7. Lane closures or stoppage of traffic for construction or future maintenance would not be permitted on Highway 106 for any significant amount of time including the Pictou Causeway. Construction phasing, work plans/schedules and traffic management plans would be required and must minimize impacts to highway traffic.
8. Jacking pits for proposed horizontal drilling shall not adversely impact highway infrastructure or traffic operations and would be required to be identified on design plans. Feasibility for horizontal directional drilling must be confirmed at the design stage (notes on current plans indicate contractor is to confirm feasibility for horizontal drilling).
9. The proposed pipeline would not be permitted at elevations above base material supporting highway culverts as not to impact future highway maintenance needs.
10. Encasement of the pipeline in a sleeve of acceptable design and material (e.g. steel or concrete) would be required at all locations where the proposed pipeline is installed across (beneath) structures and other highways including the Pictou Rotary. Further sleeving details would be required for subsequent design reviews.
11. With respect to proposed venting manholes within highway right-of-way, confirmation would be required that there would be no emissions of noxious or unpleasant/unfavourable vapours, gases or odours, or health/safety/environmental concerns to TIR maintenance staff or the public and that they would only be vented during start-up after an ill shut-down when flow resumes through the pipeline.
12. Comments from TIR Structural Engineering are summarized as follows:
 - a. All units on design drawings should be metric

- b. Section identifiers and stations on the last (section) sheet of drawings provided appear incorrect and do not match plan drawings in some cases.
 - c. The proponent should review if insulation and protection of pipe is required where above-ground (i.e. along structures), and if insulation/mitigative measures is required for impacts the higher temperature effluent carrying pipeline may have on surrounding soil conditions during winter conditions e.g. potential for differential settlement, melting snow on ground surface, etc.
 - d. The proponent should consider if additional manholes are required to facilitate future inspection/repair of pipeline.
 - e. Maintenance provisions for each TIR structure where pipeline is attached or constructed parallel or below would need to be included in formal agreements.
 - f. It is difficult to provide detailed comments on impacts to structures at this stage as structural analysis and connection details are not provided. The pipe is relatively large and a structural evaluation of each structure to determine if it could support the weight based on CHBDC Code would be required.
 - g. Running a pipe along any structure shall not impact the vertical clearance that is available.
 - h. Typically, pipes are run on the underside of bridges, not on the side of barrier, to minimize exposure to elements and risk of impact from traffic collisions with bridge rail.
 - i. Complete survey should be completed at each structure to confirm all dimensions. TIR may be able to provide design and/or as-built plans of some or all bridges for reference/information only. Plan, elevation, cross-section, excavation and fill details, and proximity to bridge elements for each structure would be required for subsequent design reviews.
 - j. Actual slopes and grades of pipe through bridge sites would be required. Section CI appears to show the pipe travelling through substructure (footings); presumably it would be offset laterally to be away from structural components as required.
 - k. Dimensions showing distances between pipe, excavations, and bridge footings would be required to ensure there are no concerns with excavation near footings.
 - l. More detailed design/construction notes and standard references would be required for subsequent design reviews.
13. Additional review by internal TIR stakeholders and opportunity to provide additional comments would be required as design for the project progresses.

Thank you for the opportunity to review this project.

Your truly,

Sylvie Colomb
Environmental Analyst

March 8, 2019

Helen Yeh
Environmental Assessment Officer
Environmental Assessment Branch
Nova Scotia Environment

Dear Helen:

**Re. Northern Pulp Proposed Replacement Effluent Treatment Facility Project (Highway 106
Abercrombie to Caribou Harbour) - Environmental Assessment Comments from TIR Review -
Addendum**

NSTIR is pleased to offer those additional comments to the above-mentioned project:

1. As per our previous comments, any work within the Right Of Way (ROW) will require a Working Within Highway Right Of Way Permit. But the document references multiple PID's, so in addition to the Department, permission would have to be obtained from any relevant property owners. It also references possible changes to access roads, as well as several public and private roads, as well as trenching and vegetation control. The proponent also references that roads frequently travelled will be "repaired as necessary". The complete scope of any work planned will need to be detailed in the ROW permit application and reviewed by local Department staff for suitability.
2. As indicated previously, NSTIR does not support the use of the ROW to have piping placed in the shoulder of the road. Should any work be completed that is outside the ROW, any work areas created on provincially owned roads as a result will need to be in compliance with the appropriate sections of the Nova Scotia Temporary Workplace Traffic Control Manual. The proponent has referenced this in section 5.7.2.11 Traffic Management and Road Infrastructure. Also, the proponent has referenced several possible mitigation measures on p. 539 as well as p. 577. In any case, any traffic control required as a result, speed limit changes etc. will need to be approved and signed off by appropriate Departmental staff.
3. The proponent has identified a possible need for a Special Move Permit for overweight and overdimension loads. If this is required, the proponent should contact our Departmental contact for Special Moves, Manuel Abreu, to determine any necessary requirements. He can be reached at Manuel.Abreu@novascotia.ca . Also, in conjunction with this, the Transportation Route for any loads needs to be clearly identified, so that Department staff can analyze it to determine suitability of the route, in terms of turning radii for trucks, as well as weights on overpasses and clearances on underpasses.

4. It is indicated p. 523 that the risk of a vehicle accident “would be limited to the construction phase of the project, as limited transportation is required for the project during operation and maintenance”. While the likelihood may be more during the construction phase due to the number of vehicles involved, vehicular accidents can occur at any time and are not eliminated completely for any reason. As a result, stringent mitigation and preventative measures need to be present and active at all phases of the project so that the potential for vehicle accidents is minimized.

Thank you for the opportunity to review this project.

Your truly,

Sylvie Colomb
Environmental Analyst

Environment

Date: March 6, 2019

To: Acting Water Management Unit Manager

From: Senior Surface Water Quality Specialist, Water Management Unit

Subject: Northern Pulp Nova Scotia Replacement Effluent Treatment Facility
Environmental Assessment – Review Comments & Recommendations

Scope of Review

As Senior Surface Water Quality Specialist with the Nova Scotia Environment (NSE) Sustainability and Applied Science Division, the following Northern Pulp Nova Scotia Replacement Effluent Treatment Facility (ETF) Environmental Assessment (EA) review focuses on the following subjects:

- Surface water quality & its management
- General surface and groundwater resources & their management

The following review considers whether the environmental concerns associated with the above subjects and the proposed mitigation measures have been adequately addressed in the Environmental Assessment. The recommendations provided below are meant to supplement the actions outlined in the EA submission documents.

While general comments on fish and fish habitat, wetlands, effluent discharge, surface water quantity, and groundwater quality and quantity may be included below, applicable technical specialists should be consulted for specific review and comment.

Reviewed Documents

The following document was the basis for this EA review:

Dillon Consulting. 2019. *Northern Pulp Nova Scotia Environmental Assessment Registration Document Replacement Effluent Treatment Facility*. Northern Pulp Nova Scotia Corporation. 17-64631-1300.

Comments

Surface Water Resources

- Section 8.4.2.1 provides a listing of watercourses, wetlands and other surface water features that will be potentially intersected by the Project footprint or are immediately adjacent.
 - The proposed ETF is within the tertiary watershed 1DP-SD8, which discharges into Pictou Harbour. One mapped unnamed watercourse (WC2) is identified within the footprint and the spill basin construction

area, which will require realignment and/or partial removal. The adjacent WC1 unnamed watercourse may require reconfiguration as well for proposed site activities. Both watercourses receive site drainage from the existing NPNS site and will continue to receive localized surface water runoff following Project construction.

- The pipeline alignment route crosses three tertiary watersheds, which are 1DP-SD8 (1 unnamed watercourse [WC4]), 1DP-SD3 (seven unnamed watercourses [WC5 – 6; WC12 - 16]) and 1DP-SD4 (five unnamed watercourses [WC7 – 11]). All of these are shore direct drainage areas that drain into either Pictou Harbour or the Northumberland Strait directly. The pipeline also directly crosses Pictou Harbour and within the Northumberland Strait to the discharge location near Caribou Point. These watercourses would be potentially impacted during the construction phase by the pipeline installation and in the case of an inadvertent release (leak or spill)
- Baseline surface water quality (Section 8.4.2.2) has been collected on a quarterly basis since 2012 from the watercourses WC1 (upstream and downstream of existing NPNS surface water runoff), WC2 (downstream of existing NPNS surface water runoff) and WC3 (upstream of proposed pipeline crossing). The results for the December 11, 2018 sampling event with analysis for general chemistry, total suspended solids (TSS) and metals was provided with discussion of observed exceedances in comparison to the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines for Freshwater Aquatic Life (CEQG-FAL). No reasoning was provided why surface water quality data collected since 2012 was not included in the baseline assessment. General discussion of exceedances was provided.
- Within the pipeline route, surface water quality grab samples were collected on Dec 3, 2018 along with *in-situ* field measurements using a water quality probe (Section 8.4.2.2). The results were compared against the CCME CEQG-FAL as well as CCME CEQG for marine aquatic life for watercourses with a direct marine connection. No additional criteria are provided as to what designates a watercourse a direct marine connection. General discussion of the water quality results in comparison to applicable CCME CEQG criteria is provided.
- Section 8.4.5 indicates that follow-up baseline surface water quality monitoring is not required within the proposed ETF site. Section 8.5.5 indicates additional baseline surface water quality monitoring may occur in areas identified as potential areas where surface water is expected to infiltrate into the local groundwater table along the pipeline footprint area. No other surface water baseline monitoring is proposed prior to Project construction along the pipeline corridor.
- An existing surface water quality monitoring program for the existing NPNS facility is proposed to be continued and expanded for this Project. The minimum surface water quality analysis package proposed is general chemistry, TSS and metals for at least three seasons.

Surface Water Quality

- The quality of the influent from the existing mill to be discharged into the ETF is not fully characterized using field and laboratory quantitative analysis for physical, chemical and biological parameters applicable to the pulp production

process. This characterization is used to identify potential contaminants of concern to be assessed by this EA. Identifying the project contaminants of concern at the influent stage of an ETF supports the following EA activities:

- Treatment system design
- Assessing treatment effectiveness
- Understanding end receiving environments for each contaminant following the treatment process (soil, water, air)
- Assessing potential effects of contaminants of concern to Project valued environmental components (VECs)
- Developing mitigation measures to address potential effects

The following is the level of characterization related to influent to the proposed ETF:

- Concentrations of total suspended solids (TSS) and soluble chemical oxygen demand (COD) of the influent to the ETF are presented and discussed in Sections 5.2.2.4 and 5.2.2.6, respectively.
- Section 9.2.4.2 *Current NPNS Mill Effluent Chemistry* discusses potential contaminants of concern within a single sample collected in 2018 from the plant influent discharge to the Boat Harbour Treatment Lagoon that underwent comprehensive contaminant analysis. No quantitative data, including concentrations or loads, is provided in the section and no reasoning as to why it is not included. No full list of parameters analysed in the sample is provided. No discussion on why one influent sample is enough to characterize the influent is provided. Contaminants of concern are identified as the following: hydrocarbons, toluene, cyanide, metals and metalloids, phenol, o-cresol, a phthalate ester compound, chloroform, total trihalomethanes, phenanthrene and pyrene. The potential contaminants were present at concentrations close to the laboratory reportable detection limits with no inclusion of what those specific quantitative limits were. Mercury, 2,3,7,8-TCDD and 2,3,7,8-TCDF were identified as parameters that were not analysed.

Without quantitative full characterization of the influent quality to identify potential contaminants of concern to be received by the ETF, there is insufficient information to assess the potential Project effects to receiving water systems and their associated VECs, and to support the subsequent selection of appropriate mitigation measures to address those effects.

- The Environmental Effects Assessment (Section 8) and Human Health Effects (Section 9) sections of the Registration Document identify potential contaminants of concern groups associated with the discharge from the proposed ETF. Potential contaminants of concern for the project following treatment are discussed in several sections with varying levels of assessment for each parameter, which are based on *Pulp and Paper Effluent Regulations* (PPER), literature review, characterization of Boat Harbour Treatment Lagoon discharge and review of other relevant historical water quality data:
 - Table 5.6-1 lists the anticipated daily maximum water quality of the treated effluent to be discharged by the Project and its associated concentrations, which are assessed in the discharge receiving water study (Appendices

E1 to E3). The table does not identify whether it is a comprehensive list of potential contaminants of concern.

- Dioxins and furans are listed within the Registration Document as below laboratory analysis detection limits in the effluent (Table 6.7-1) with no listing of the detection limit value. The metals manganese, cadmium and aluminum are listed in Table 6.7-1 as being potential parameters of concern within the Project effluent during the Operation phase.
- During the Project construction phase there is the potential for petroleum hydrocarbon spills from stationary and mobile equipment. Petroleum hydrocarbons were also measured above reportable detection limits in the untreated effluent sample in 2018 (Section 9.2.4.2). Reportable detection limit values are not provided.
- Section 9.2.4.2 *Candidate Contaminants of Potential Concern in Treated Effluent Summary and Path Forward* lists potential contaminants of concern to be evaluated in a Human Health Risk Assessment (HHRA) (if required for the project) which consists of the following:
 - some metals/metalloids (unidentified, except for mercury);
 - some polycyclic aromatic hydrocarbons (PAHs);
 - polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F);
 - some resin compounds;
 - a couple or few chlorophenolic compounds;
 - non-chlorinated phenolic compounds; and
 - chlorinated volatile organic compounds (VOCs)

The specific number of 'some' compounds is not defined. The list of compounds is expected to be reduced further with the completion of a detailed HHRA. The assessment used to develop this list of potential contaminants discusses concentrations with respect to reportable detection limits and background water quality without quantitative values.

As with the above influent contaminants of concern characterization comment, the identification of potential contaminants of concern in the treated effluent discharge are discussed using qualitative methods (Section 9). The discussions reference potential sources of quantitative data, but no reasoning is provided as to why this data is not provided in the Registration Document to support the contaminants of concern assessment. A detailed quantitative approach to estimate discharge contaminants of concern concentrations and loads from a treatment system, using a variety of information sources (e.g., literature review, background water quality and similar facility effluent data) would typically be expected as part of an EA Registration Document.

- The effluent water quality listed in Table 5.6-1 and subsequently evaluated with respect to discharge into the marine receiving waters (Appendices E1 to E3) did not include metal compounds, hydrocarbons and several organic compounds listed in Section 9 as potential contaminants of concern. The Registration Document does not discuss why the contaminants of concern listed in Section 9 are not included in Table 5.6-1 and its associated detailed assessments.
- In the Appendix E1 receiving water study, the single port diffusor option at the CH-B site has a simulated discharge plume that does not interact with the seabed for a distance greater than 200 m from the port, while the preferred three

port diffusor is simulated as interacting with the seabed at approximately a 10 m distance from the ports. The receiving water study indicates that dilution rates at this distance are enough to not impact the benthic environment. The effluent water quality is indicated as being primarily diluted to match ambient conditions prior to the 10 m distance for the Table 5.6-1 parameters. There is no detailed assessment of the discharge plume effluent and its interaction with seabed and benthic environment beyond the statement it is unlikely to have adverse effects. The lack of an assessment or further discussion beyond this statement is insufficient information to assess if there are adverse effects to the marine benthic environment.

- The receiving water study (Appendix E1) used the water quality results from the Pictou Road Area (Appendix E3) to represent the ambient water quality at the CH-B discharge point. Discussion was provided to indicate the Pictou Road Area water quality results represented a conservative worst-case estimate than what would be expected at CH-B near Caribou Point, based on existing land uses within the Pictou Harbour watershed. No discussion was provided in the Registration Document about whether follow-up monitoring and assessment at Caribou Point would be used to confirm the input parameter assumption.
- The Appendix E1 receiving water study presents in Figures 3.4 and 3.5 predicted plume dimensions in plan and side views. Two temperature scenarios are discussed prior to these Figures, which are for the winter and summer seasons. No indication is provided as to which seasonal temperature scenario is presented in the Figures. It would be expected that the plume dimensions may be different given the temperature differentiation between the effluent and ambient water for the two seasons. This information would support the effects assessment for the marine environment associated VECs.
- Table 8.4-3 and Appendix M4 present the field and laboratory analysis results from the freshwater surface water quality samples collected during at least one site visit. The samples were analysed for a suite of parameters that included general chemistry including nutrients, select total metals and TSS. The marine baseline water quality is presented in Table 3.1 in Appendix E.3. Table 5.6-1 lists the expected maximum daily effluent water quality of the NPNS effluent, while Section 9 lists several potential contaminants of concern that are not included in the above baseline assessment (e.g., total petroleum hydrocarbons (TPHs), PAHs, resin compounds, phenols (chloro and non-chloro)). Having pre-construction analysis results for the full list of potential contaminants of concern in the freshwater and marine systems within the Project footprint provides a comprehensive baseline for evaluating project effects.
- Appendix H, Section 2.5 presents a list of proposed sediment analysis parameters for a baseline follow-up benthic invertebrate community monitoring study. The list of parameters includes some that are listed as project contaminants of concern in Table 5.6-1 and Section 9 (metals, mercury, AOX, dioxins, furans). Three sites are proposed to be sampled along the pipeline route without discussion and/or supporting references as to whether that is a sufficient sampling density for the proposed length of marine pipeline. No sampling is proposed within the discharge plume area. There is no discussion of reportable detection limits for the associated laboratory analysis of the parameters, and applicable federal/provincial criteria for results assessment. Sampling for select parameters (Footnote 3) is proposed to occur as part of another pre-construction

assessment study proposed by Stantec (2017), Registration Document Appendix E3. The following are sediment quality analysis parameters that are listed in Table 5.6-1 and Section 9 as potential contaminants of concern that are not listed in the follow-up study:

- Nutrients (nitrogen and phosphorus compounds)
 - pH
 - PAHs
 - Specific chlorophenolic compounds
 - Specific non-chlorinated phenolic compounds
 - Specific resin compounds, in addition to resin fatty acids
 - Chlorinated VOCs
 - Total petroleum hydrocarbons, and/or other relevant hydrocarbon parameters
- Appendix H, Section 2.6 presents a list of proposed water quality analysis parameters for the baseline follow-up water quality monitoring study. The list of parameters includes many that are listed as potential contaminants of concern in Table 5.6-1 and Section 9 (pH, colour, TSS, metals, mercury, biochemical oxygen demand [BOD₅], nutrients, dioxins, furans, AOX). There is no discussion of reportable detection limits for the associated laboratory analysis of the parameters, and applicable federal/provincial criteria for results assessment. The following are potential water quality analysis parameters that are listed in Table 5.6-1 and Section 9 as contaminants of concern that are not listed in the follow-up study:
 - Chemical oxygen demand (COD)
 - PAHs
 - Specific chlorophenolic compounds
 - Specific non-chlorinated phenolic compounds
 - Specific resin compounds, in addition to resin fatty acids
 - Chlorinated VOCs
 - Total petroleum hydrocarbons, and/or other relevant hydrocarbon parameters
 - Appendix G, Section 3 lists the benthic invertebrate community assessment and fish population assessment pre-discharge surveys as 'proposed only' with respect to schedule. The pre-discharge studies are recommended by EcoMetrix to be conducted to improve interpretation of biological monitoring program results.
 - Horizontal direction drilling (HDD) is proposed as a pipeline installation method under watercourses/wetlands (Section 5.3.1.8). Drilling muds are listed as predominantly consisting of a mix of water and bentonite clay. Typically HDD mud mixtures also include the addition of polymers and surfactants to stabilize soils and disperse clay particles, respectively (<http://factsheets.okstate.edu/documents/pss-2916-can-urban-horizontal-directional-drilling-mud-be-land-applied-2/>).
 - HDD has the potential to inadvertently release drilling fluid into a wetland or watercourse that is above the borehole, which is sometimes referred to as a frac-out (<http://trca.on.ca/dotAsset/105401.pdf>). There is no direct discussion of this potential inadvertent release mechanism in the Registration Document and mitigating its impacts to aquatic ecosystems.
 - The mixing zone dilution ratio in Appendix E.1 for the CH-B site with a three-port

diffuser is stated as 144 times at 100 m from the discharge point, while the HHE listed the dilution ratio as 168 times at 100 m from the discharge. There is a discrepancy between the two dilution ratios used in the Registration Document.

- Appendix G, Section 2.5 lists proposed sediment analysis parameters for a pre-construction baseline benthic invertebrate community study along the pipeline route, which includes acid-volatile sulphide and low-level mercury. Both parameters have a Footnote 4 listed next to them with no associated footnote in the document with that number.
- The follow-up monitoring program proposed field verification of fish habitat within watercourses in the vicinity of the Project footprint, which would be conducted prior to the Construction phase.

Surface Water Quantity

- The ETF design includes a spill basin with a design capacity of 35,000 m³ to handle untreated effluent, which is predicted to handle 10 to 13 hours of full mill effluent diversion assuming an empty condition. The existing plant currently discharges into the Boat Harbour ETF, which would be expected to have substantially more storage capacity volume than the proposed spill basin for handling treatment system upsets. There is no discussion about the change in holding capacity within the proposed ETF compared to the existing process and what impacts to mill operations will be expected, and the robustness of the proposed design capacities in handling ETF system issues without inadvertently discharging into the environment.
- Table 8.4-1 indicates classification of watercourse types (intermittent, small and large permanent) based on site visits with those along the pipeline route only having one site visit in December 2018. Section 8.4.2.1 provides further details on the watercourse observations. One site visit is typically insufficient to assess whether a watercourse has a permanent or intermittent flow regime.
- Flow observations for each watercourse in Appendix M3 are subjective and based on one site visit conducted in December 2018. One site visit is typically insufficient to assess whether a watercourse has intermittent flow, particularly as per the photos in Appendix M2 where several the watercourses have partial ice coverage, which effects flows.
- Flows (Appendix M3) should also have been measured during the site visit for non-ice-covered sites using a velocimeter and calculated using the velocity-area method (or other standard method), instead of general categorization based on visual observations.
- Section 8.6.2.3 refers to watercourse widths and depths for the watercourses within or adjacent to the Project footprint. No table or field notes are provided listing these observed measurements. Having these values in a table or field notes would provide baseline data to support impact assessment and potential future watercourse alteration approval applications.

Groundwater Quantity & Quality

- Section 8.5.3.2 proposes lining the trench within the Town of Pictou source water protection area with an impermeable or low conductivity material/liner. No details are provided as to what type of liner would be considered 'impermeable' and where flows from a leak would potentially go and their potential impacts with reduced vertical infiltration. Understanding how leak flows will be managed within

these lined pipeline trench sections would assist with evaluating impacts to various VECs, including surface water resources, and development of appropriate mitigation measures (if required).

- Section 8.5.3.2. indicates that a system will be installed for the pipeline and associated pumping works that will detect leaks or significant drops in pressure during operation and maintenance. No details are provided as to the types of detection systems that are technically feasible for the proposed discharge pipeline and its preliminary design criteria.
- The ETF spill collection system proposes to include a 1.9 mm thick HDPE liner to avoid leakage. No details are provided on whether a monitoring system/program will be instituted around the basin area with respect to detecting leaks. As the spill collection basin will contain untreated effluent, it will be important to confirm the adjacent VECs are being adequately protected or identify if there is an inadvertent release.
- Dewatering activities as part of below grade excavations for the pipeline installation are discussed in general terms within Section 5.3.1.7. There is no mention of whether expected dewatering rates and pumping periods for the project will be assessed with respect to the 'Application Requirements for Water Withdrawal Approvals'. These dewatering activities may trigger the need for the Project to obtain an NSE Water Withdrawal Approval or Approvals.

Recommendations

Planning/ Design Issues

Surface Water Quality

- There is insufficient quantification of the potential contaminants of concern being input into the ETF and subsequently discharged in receiving environments (soil, water and air). A quantitative full characterization of the influent quality to be received by the ETF is required to identify potential contaminants of concern, support treatment system design, evaluate effects on VECs associated with receiving environments for the ETF discharges (e.g., sludge, effluent and air) and develop appropriate mitigation measures to reduce those effects.
- A more detailed quantitative assessment is required to estimate the expected discharge contaminants of concern concentration and/or load ranges to the marine discharge area and other receiving environments. This assessment potentially could use treatment system models or mass balances to support the quantitative estimations. The results of this detailed assessment would then be used to evaluate effects on VECs associated with those ETF discharge receiving environments and develop appropriate mitigation measures to reduce those effects.
 - The effluent receiving water models (Appendix E) should be updated to simulate any potential contaminants of concern that are identified within the discharge effluent that have not been previously modeled. The results of these model runs should be used in the subsequent assessment of their impacts. Additional mitigation measures should be developed to address potential impacts that are identified.
- Further discussion and potentially quantitative assessment of the impacts on ambient marine water quality and the benthic environment with respect to the plume interacting with the seabed at 10 m away from the discharge ports should

be conducted to support the unlikely potential adverse effect statement in Appendix E1. If potential adverse effects are estimated by the additional assessment, then appropriate mitigation measures should be developed.

Groundwater Quantity & Quality

- Although a specific leak or significant pressure drop detection system is expected to be developed during detailed design, examples of relevant leak detection and/or pressure measurement technological options for this type of effluent discharge pipeline and operating flows should be provided to NSE for review. This will indicate to the reviewer whether the leak detection monitoring method types are adequate for the proposed effluent discharge pipeline design. The detailed design and operating parameters of the leak detection and/or pressure drop monitoring system for the pipeline should also be provided to NSE for review, comment and approval prior to the Construction phase.

Operational Issues/Other Permitting Processes

Surface Water Quality

- Additional baseline freshwater surface water quality and marine water sampling within the Project footprint should be conducted, and the field and laboratory analysis should include a suite of parameters that represents the full-list of potential contaminants of concern associated with the ETF influent (e.g., AOX, COD, BOD, mercury, cyanide, PAHs, PCCD/F, resin compounds, chlorophenolic compounds, non-chlorinated phenolic compounds, chlorinated VOCs). This list of parameters would be based on the results of the above requested influent and effluent characterization. A qualified professional should develop the list of additional baseline monitoring parameters to determine which parameters would not be expected to be present in existing water systems, and therefore not require baseline monitoring. This supplemental baseline water quality monitoring will support assessment of potential Project effects.
- Additional baseline marine sediment sampling within the Project footprint should be conducted as part of the EEM program, and the field and laboratory analysis should include a suite of parameters that represents the full-list of potential contaminants of concern associated with the ETF influent. A qualified professional should develop the list of additional baseline monitoring parameters to determine which parameters would not be expected to be present in existing water systems, and therefore not require baseline monitoring.
- Baseline marine water quality sample results within the discharge receiving area near Caribou Point should be compared against the Pictou Road Area water quality results, which were used as inputs in the receiving water study (Appendix E1 & E3). The receiving water study models should be updated, and results re-evaluated if the Caribou Point results represent a more conservative receiving water condition than the Pictou site.
- As part of EMP and/or EPP for the operations phase, the management of the spill containment basin, and associated plant operations, including shutdown, should be discussed with respect to preventing basin overflows.
- Detailed design for the HDD alignments should be conducted, including appropriate geotechnical investigations (including boreholes) and topographic surveys. These designs should be submitted to NSE for review and approval prior to commencement of activities.

- In support of the HDD alignment installations, a Project frac-out monitoring and contingency plan should be developed, particularly focusing on areas immediately adjacent to or within watercourses and wetlands. The monitoring and contingency plan should be submitted to NSE for review and approval prior to commencement of activities. This activity can potentially be done in conjunction with the proposed construction surface water quality monitoring program.
- The Registration Document proposed field verification of fish habitat within watercourses in the vicinity of the Project footprint, prior to the Construction phase, which should be conducted.
- The proposed construction surface water quality monitoring program (Section 8.4.5) should as described in the Registration Document be developed in consultation with NSE and include appropriate upstream and downstream monitoring during storm events. Monitoring should also be conducted when there are in-water activities occurring. Appropriate monitoring compliance criteria (e.g., Canadian Council of Ministers of the Environment Canadian Environmental Quality Guidelines for Freshwater Aquatic Life TSS and/or turbidity criteria [<http://st-ts.ccme.ca/en/index.html>]) should be part of the program to determine compliance and when to implement additional mitigation measures.

Groundwater Quantity & Quality

- An assessment should be conducted on where flows resulting from a pipeline leak would go with the use of a low permeability liner within certain sections of the pipeline trench during the Operations phase. This assessment should include determining whether flows would be diverted into specific local surface water features. If impacts are determined appropriate mitigation measures should be developed.
- A leak detection system or monitoring program should be developed for the ETF spill collection system. The details of this system/program should be provided to NSE for review, comment and approval prior to the Construction phase.
- The pipeline and ETF excavation dewatering activities should be evaluated with respect to the 'Application Requirements For Water Withdrawal Approvals' and appropriate Approval applications be submitted (if required), including development of mitigation measures to manage discharge flows. This assessment should include an estimation of expected daily dewatering rates and time periods for the Project, and whether they will or will not trigger requirement for an application or applications.

General

- The project specific construction and operations environmental management plan (EMP) and environmental protection plan (EPP) to be developed as part of detailed design within the Registration Document should be provided to NSE for review, comment and approval prior to commencement of applicable Project phases.
- The proposed approval application activities associated with the alteration and/or removal of wetlands and watercourses, and subsequent works within, should be implemented to minimize potential impacts to those aquatic ecosystems, and fish and fish habitat. In support of the approval application process, it is recommended that consultation with appropriate provincial and federal

government departments occur prior to submission of appropriate Approval applications.

Surface Water Quantity

- At least one additional watercourse site visit should be conducted during ice-free conditions to at least the pipeline route intercepted watercourses. The site visits should document qualitative and quantitative channel bed and bank measurements and characteristics (e.g., bed materials, vegetative cover) at an appropriate cross-section and potentially support watercourse and/or wetland applications (if required).

Date: March 5, 2019

To: Manager, Water Management Unit, Sustainability and Applied Science Division

From: Senior Hydrogeologist, Sustainability and Applied Science Division

Subject: Review of Class 1 Environmental Assessment – Northern Pulp Replacement Effluent Treatment Facility (ETF) Project

This EA review from the Sustainability and Applied Science Division Hydrogeologist focuses on the potential for the proposed undertaking/project to adversely affect groundwater resources, including general groundwater quality and local water wells/drinking water supply.

The purpose of the Project is to replace the existing Northern Pulp effluent treatment facility (ETF) with a new one to treat wastewater received from the Northern Pulp pulp mill at Abercrombie Point, Pictou County. The Project includes a new ETF and a new effluent pipeline that will carry treated effluent to be discharged in the Northumberland Strait.

Once treated, effluent would be sent via an approximately 15.5 kilometres-long pipeline. The effluent pipeline would follow the Highway 106 for approximately 11.4 kilometres, then enter the marine environment near the Northumberland Ferries marine terminal, and continue for approximately 4.1 kilometres through Caribou Harbour to the Northumberland Strait where the treated effluent would be discharged via an engineered diffuser.

Comments

1. There are no provincial Protected Water Area (PWA) near the proposed ETF or along the proposed pipeline route. PWA's are not required for drinking water supplies. The nearest PWA is for the New Glasgow Forbes Lake water supply approximately 17 km southeast of the Northern Pulp proposed ETF.
2. The Town of Pictou does have a Source Water Protection Area (SWPA) that extends to the town boundaries and in areas to the north. In particular, the SWPA covers significant sections (>50%) of Highway 106 to Caribou along the proposed

pipeline route. This SWPA is discussed in more detail under comment 4.

3. The nearest Registered Public Drinking Water Supplies (RPDWS from NSE records) to the ETF and pipeline route are as follows:

ETF –

- Country Villa Park RPDWS owned by Rivers Trailer Park company has registered a drilled well located approximately 1 km southeast of the proposed ETF
- Northern Pulp Nova Scotia Corporation has a RPDWS for the Pictou Mill ETF location

Pipeline Route north of the causeway –

- Piper's Landing Restaurant approximately 2.9 km west of the proposed pipeline route
- Several RPDWS located in the Braeshore area north of the Town of Pictou located >3 km east of the proposed pipeline route (Harbour Light Campground, Pictou Lodge Resort/Maritimes Inn and Caribou – Munroe's Island Provincial Park)

4. Municipal wells – Town of Pictou Wellfields and Source Water Protection Area

The Town of Pictou operates two municipal water supply wellfields containing 13 wells as reported in their 2013 System Assessment Report to Nova Scotia Environment.

The Caribou Wellfield is located mainly to the north of the existing town boundary (north of Division Road) and contains 5 wells. The Pictou Well Field is located almost entirely within the town boundaries and contains 8 wells.

These two wellfields have similar sedimentary bedrock geology, although in the Caribou Wellfield area there is an overlying surficial geological unit of gravel and sands that has potential use as a distinct shallow aquifer. To the south, in the Pictou Wellfield area the surficial geology consists of a silty ground moraine till and is likely not suitable for significant aquifer supplies. Data from the Pictou Group bedrock underlying both wellfields however does show both well and aquifer yields that can provide sustainable long-term supply.

The nearest municipal well to the proposed pipeline route is the "Public Works Well" located at the Pictou Public Works building about 150 m west of Highway 106, near the causeway. The next closest wells are > 1 km away, including the Caribou Wellfield wells to the north of the town boundary (and south of Highway 106).

It should be noted that many of the Town of Pictou municipal supply wells are located in urbanized municipal areas and have existing risks related to maintaining source water protection, unrelated to the proposed pipeline. The Town of Pictou has

developed a Source Water Protection Plan (latest revision Oct 2017) to address potential risks. Potential risks related to pipeline routing are not specifically addressed. The attached Figure 1 here shows the SWPA delineated boundary. In comparison to Figure 2 (pipeline route also attached) it can be seen the pipeline route along Highway 106 crosses the SWPA delineated boundary in two areas.

5. The registration document from Northern Pulp identifies in Figure 8.5-1 (p. 192) two sets of dashed lines estimating the Pictou and Caribou wellfields extent, and a delineation boundary from the Pictou Source Water Protection Committee (SWPP report). It should be noted that neither of these estimated boundaries represent a strong scientifically valid description of the wellhead protection zones. However they may be useful for planning purposes. Quantitative hydrogeological determination of the well head protection area (WHPA) (numerical computer modelling) showing wellfield zones of contribution and expected times of travel would be beneficial in managing specific risks to the wellfields.
6. The online Nova Scotia Groundwater Atlas (Energy and Mines) was used (by this reviewer) to estimate the number of residential drilled wells within a 500 m radius buffer (on either side) of the proposed pipeline route from the ETF to Caribou. See the attached Figure 2 showing the 500 m buffer zone. The Atlas identified 62 water wells within the 500 m buffer distance. The majority of these are identified as for domestic use, but two are listed as public (non-municipal).

In the registration document, the proponent reports 121 existing residential water supply drilled wells within a 500 m buffer of the proposed pipeline route. However, it is possible their search zone was different, as this number of wells could not be replicated using the Atlas identification tools with a 500 m radius buffer.

It has been noted previously that the Well Logs Database Records and any mapping based on these records need to be considered in terms of locational errors/accuracy of the original data. In addition, the Well Logs Database does not contain a complete listing of every water supply well in the province and some areas may contain water supply wells not reported. Field truthing and field surveys for water supply well locations is necessary. This is particularly important given the discrepancies in the registration document concerning the number of water supply wells.

7. The treated effluent will likely contain natural chemicals found in the wood chips, added chemicals from processing and the effects of treatment which can reduce, create or alter chemicals. The chemical characterization is important from a groundwater and drinking water perspective, primarily with regards to the potential for any leaks, spills or other releases that are uncontrolled and enter groundwater or surface waters. Characterization is beneficial in order to plan potential monitoring and mitigation strategies.

The chemical characterization of the treated effluent that would flow through the proposed pipeline is not determined, mainly because the new treatment processes proposed are not yet operational and no samples can be analysed. However, the

registration document does look at similar treatment plants from around the world. The document presents some lists of “candidate Chemicals of Potential Concern” or COPC that show the potential scope of chemicals in the treated effluent.

The document presents chemicals determined by similar pulp mill process in Tasmania, Australia. The “Toxikos (2006) study is considered to provide a reasonable interim indication of what may be expected in relation to NPNS project effluent chemical composition and characteristics” (p. 508). However, one uncertainty pointed out is that the wood chips used in the Tasmania are largely hardwood eucalyptus whereas at Northern Pulp they are softwood coniferous. The Tasmania project list of candidate COPC’s include:

From page 508:

- “Metals and metalloids.
- Selected plant sterols and steroids (phytosterols and phytosteroids).
- Methylphenols and other alkyl-substituted phenols.
- Nitrophenols.
- Phenol.
- Plant-based hydrocarbons such as pinenes, camphenes, carenes, limonene.
- Petroleum hydrocarbons (primarily long chain aliphatic hydrocarbons).
- BTEX (benzene, toluene, ethylbenzene, xylenes).
- Polycyclic aromatic hydrocarbons (PAHs).
- Alkyl and chloro-substituted PAHs.
- Numerous chlorinated volatile organic compounds (VOCs).
- Chlorinated benzenes and methoxybenzenes.
- Dehydrojuvabione.
- Juvabione.
- Furanones (chlorinated and non-chlorinated).
- Hydroxy and/or methoxy chlorinated diones and pyranonestals and metalloids.
- Thiolignins.
- Thiosulphates.
- Chloroacetic acids.
- Resin acids (chlorinated and non-chlorinated).
- Fatty acids.
- Various aliphatic and aromatic aldehydes and ketones (chlorinated and non-chlorinated).
- Aniline and chloroanilines.
- Chlorinated anisoles.
- Numerous chlorinated phenolic compounds including chlorinated phenols, catechols, cymenes, guaiacols, guaiacones, vanillins, veratroles.
- Vanillones (chlorinated and non-chlorinated).
- p-Cymene.
- Syringol and syringaldehydes.
- Various aliphatic alcohols.
- Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F).
- Chloromethyl sulfones.
- Chlorohydroxypyron.
- Thiophenes and chlorinated thiophenes.
- Hexachlorocyclopentadiene.
- Various ions such as ammonia, nitrate/nitrite, chloride, sulphate, hydrogen sulphide, carbon disulphide, chlorate, chlorite.”

Candidate COPCs for Northern Pulp Effluent

The proponent has gone further by considering other studies from the present Northern Pulp/Boat Harbour effluent and other Canadian studies that may be more relevant. They have reported another similar list, that is more specific regarding candidate COPC's expected for the Northern Pulp effluent. However, the focus here does seem to be on the ocean as the receiving environment.

From page 514:

“The chemicals that merit consideration as candidate COPCs from the review of previous studies and sediment or sea water data include the following:

- Metals (including mercury) and metalloids
- PAHs.
- PCDD/F.
- Phytosterols.
- Resin and fatty acids (non-chlorinated).
- Petroleum hydrocarbons, oils and greases.
- Chlorinated VOCs.
- Chlorinated phenols, catechols, guaiacols, vanillins and veratroles – [only detected in the ASB and other effluent-treatment process lagoons and basins, and primarily during the early 1990s; these compounds have not been detected in the marine receiving environment influenced by the current mill effluent discharge point].
- H₂S and other sulphides.
- Chlorate/chlorite.
- Cyanide.
- Syringaldehydes.”

On page 516 of the document, the proponent presents a description of sampling results from the untreated mill effluent. Actual sample results were not provided.

A recent (2018) sample of untreated mill effluent (collected from Point A) underwent a very similar suite of chemical analyses as the 2018 Point C and D samples. This sample represents worst case effluent chemistry as it was collected at a point prior to the current effluent treatment process. Comprehensive chemical analysis of this sample shows that most candidate COPCs are below detection limits even in untreated mill effluent. The only candidate COPCs that were measurable (above RDLs) in this Point A untreated effluent sample (also generally at low concentrations near RDL values or within typical natural ranges in water) were: hydrocarbons, toluene, cyanide, metals and metalloids, phenol, o-cresol, a phthalate ester compound (likely from pipe materials rather than due to mill processes), chloroform, total trihalomethanes, and trace PAHs (phenanthrene and pyrene only). Mercury was not tested for in this sample, nor was 2,3,7,8-TCDD; 2,3,7,8,-TCDF (as testing of untreated effluent for these dioxin and furan parameters is not required under the PPER).

The above lists of potential COPCs include a variety of metal and chemical parameters that are of potential concern if accidentally released into groundwater or surface water. The potential COPCs from a groundwater, surface water and drinking water quality perspective need to be considered separately from those determined important for the receiving ocean environment.

8. Groundwater is identified as a Valued Environmental Component (VEC) by the

proponent in Section 8.5 of the registration document. The document states:

“Groundwater was selected as a VEC because it contributes to drinking water aquifers in potable areas and may discharge to surface water and aquatic habitat.” (page 185)

Section 8.5 also documents a number of groundwater conditions including numbers of municipal and residential wells along the proposed pipeline route and ETF, as well as in the Town of Pictou wellfield. Statistics based on well construction details are also provided such as well yield and depth. Most wells in the area are very capable of providing adequate yields for domestic water supplies and as demonstrated by the Town of Pictou wellfield, for municipal drinking water supplies. Groundwater quality is also generally good, with some well-specific issues potentially related to chemicals such as chlorides, manganese and other generally natural contaminants (or effects of road salting/salt water intrusion in the case of chlorides).

9. ETF Groundwater Monitoring

The project proponent describes existing groundwater sampling networks at the Northern Pulp Nova Scotia (NPNS) site. One of these networks is the Industrial Landfill Monitoring Network (27 shallow monitoring wells). The other is the operational NPNS Monitoring Network, near the ETF (6 shallow monitoring wells). These networks are being monitored following Approval Conditions specified for the existing plant operation.

Groundwater in the ETF area is relatively isolated in that it is surrounded on three sides by water (Pictou Harbour). To the south of the ETF, there are isolated private well water supply systems, but the nearest of these is about 650 m to the southeast.

Details of the ETF groundwater monitoring program are not fully provided in the registration document (Figure 8.4-1 page 173 does show the existing monitoring well locations and page 194 summarizes some of the results). However, as new facilities are to be constructed on the Northern Pulp site (including clarifiers, aeration basin and effluent spill basin) the monitoring network plan needs to be revised to include these new activities and locations. Groundwater monitoring needs to provide adequate testing to ensure any operational issues are identified and addressed before they become a significant risk to the environment.

10. Pipeline Route Groundwater Monitoring

The project proponent recognizes the critical nature of the groundwater VEC, particularly in relation to drinking water supply. Although the actual proposed monitoring is not specific, the proponent does state (page 202):

“NPNS will develop a surface water monitoring program to monitor runoff within the pipeline footprint both during and subsequent to construction in areas where surface water can infiltrate to groundwater. As part of this program the frequency of monitoring and parameters to be assessed will be identified in consultation with NSE, particularly with respect to surface waters that could infiltrate

to groundwater within the municipal groundwater watershed areas identified within the SWPP and more populated residential neighbourhoods along the un-serviced portion of the pipeline footprint.”

Groundwater monitoring along the proposed pipeline route is also an important function for protection regarding potential post-construction accidental spills from leaks, ruptures or other damage to the pipeline. Groundwater monitoring would need to include two components:

- Baseline monitoring of water wells (residential well survey)
- Monitoring of the pipeline itself for potential leaks, with particular focus on sensitive groundwater use areas and important surface water features (e.g. watercourse crossings and installations of the pipeline below the water table).

11. Pipeline Installation Below the Water Table

The proposed pipeline route may need to include installation below the water table in some areas such as wetlands and watercourse crossings. Some pipeline installation by Horizontal Directional Drilling (HDD) under watercourses is being proposed (page 65). The registration document provides a general description of methodologies to be used, however, if employed, each site using HDD, or with pipe installed below the water table, would need detailed assessment by the proponent and probable NSE approvals.

12. Pipeline Monitoring and Mitigation Measures

Pipeline monitoring for potential leaks resulting from accidental damage is perhaps one of the most important measures for protection groundwater and surface water supplies. Monitoring as close to the potential contaminant source is critical. For a long pipeline, as proposed, this does represent some challenges. The proponent provides some of their potential monitoring/mitigation measures on page 197-198.

“In light of the pipeline route crossing over the Town of Pictou’s source water area, additional mitigative measures during construction of the pipeline will include:

- Lining the trench with an impermeable (or low conductivity) material so that, if a leak occurred, it would be contained and prevent vertical infiltration;
- The pipe will be constructed of >2 inch thick HDPE which combines strength and flexibility to withstand stresses as well as being resistant to corrosion;
- The pipeline will be constructed with fusion technology to eliminate most, if not all, jointed sections.
- Having a system in place to detect leaks (or a significant drop in pressure) during operation and maintenance; and
- Inclusion of the Pictou watershed area in the mill ERCP, including contacting the Pictou Water Utility, property owners with potable water wells along the pipeline route, and other stakeholders.”

The measures proposed seem preliminary and would need to be expanded upon to provide sufficient risk mitigation. For example, leak detection using only pressure monitoring detection may not be sufficient given the chemical quality expected of the treated effluent, the large volumes of treated effluent passing through the pipe daily and the likelihood that even small accidental release volumes could adversely affect a water supply based on drinking water criteria.

13. Acidic rock drainage (ARD) due to surface water contact with disturbed soils or bedrock geology is a potential concern for both groundwater and surface water where construction excavation projects occur. Acidic rock drainage is not expected by the proponent, based on their review of geological conditions (page 164, 166). They state that the “Underlying Pictou Group bedrock is not known to produce ARD.” However, ARD testing of any bedrock encountered during excavation may be a reasonable expectation in order to confirm this.
14. Although the project does not anticipate involving blasting during construction (page 201), should any blasting be necessary, water wells in the vicinity of blast locations should be included in pre-blast surveys for the ability to determine potential effects to groundwater quantity and quality (see document page 95).

Recommendations

The following recommendations relevant to the groundwater evaluation are made regarding the Northern Pulp proposed ETF industrial activity.

Planning/Design Issues

1. Monitoring design plans for detecting potential spills/leaks resulting from accidental damage to, or malfunctions of the pipeline should be prepared with methodologies for further evaluation.

Plans should include more details on methods to be used for monitoring for pressure drops/leaks. In addition, plans should address monitoring immediately adjacent to the pipeline where the pipeline is installed in areas of significant risk including: below the water table, in significant wetlands, in areas of watercourse crossings and in the two areas where the pipeline route crosses the Source Water Protection Delineated Boundary for the Town of Pictou Wellfields. The proponent should evaluate and present the use of pressure monitoring systems and shallow groundwater monitoring wells among other potential options.

2. Risk mitigation measures need to be more completely described for further evaluation regarding design to prevent/contain spills/leaks from pipeline accidental damage or malfunction, particularly in areas of significant risk. Description should be made of the practical operational efficacy of measures such as the trench lining proposed, as well as the potential need/benefits of secondary containment of the pipeline in areas of significant risk.

Operational Issues/Other Permitting Processes

1. Field-truthing and locational mapping of water wells within 500 metres radius of the proposed activities (ie. 500 m from each side of the centreline of the pipeline route, or from the ETF site boundaries) should be conducted prior to construction.
2. Pre-Construction Water Well Surveys should be conducted within 500 metres radius of the proposed activities (ie. 500 m from each side of the centreline of the pipeline route, or from the ETF site boundaries). These surveys should include both monitoring for drinking water quality parameters and well water levels and be conducted prior to any construction activities. Methodologies and monitoring proposed for the water well survey should be submitted to NSE for approval prior to implementation.
3. Groundwater monitoring plans in the ETF area will need to be enhanced to include the new activities proposed. This includes additional monitoring to include the area with the proposed new clarifiers, aeration basin and effluent spill basin. The effluent spill basin is proposed to be HDPE lined and this should incorporate leak detection monitoring. The ETF area monitoring plans should be reviewed and approved by NSE.
4. More details on the potential Chemicals of Potential Concern (COPCs) from a groundwater, surface water and drinking water quality perspective need to be provided and evaluated by the proponent in order that their contingency plans for monitoring and mitigation can appropriately include these parameters. Details should include a final list of COPCs and their range of concentrations expected both in untreated influent and treated effluent that could be released accidentally into the environment at the ETF site, or along the pipeline route.
5. Consideration should also be made for including specific measures in Northern Pulp's Environmental Response and Contingency Plan (page 97) that relate to contingencies that potentially involve the Town of Pictou Source Water Protection Plan, SWPA (Source Water Protection Area) and the Town of Pictou water supply wellfields.
6. If the project proceeds to the next stage, it is recommended that standard conditions be provided to the effect that the Proponent is responsible to replace or repair any water supply well found to be adversely affected by the project activities and operations to the satisfaction of the well owner.

Other Observations

1. The current Source Water Protection Plan for the Town of Pictou includes a conceptual indication of the groundwater zones contributing to the two wellfields and a larger Source Water Protection Area. As a greater protection measure, the Well Head Protection Area (WHPA) zones would be updated by better definition and quantitative (numerical) computer modelling to demonstrate the 0-2 year

(Zone A), 2-5 year (Zone B) and 5-25 year (Zone C) time of travel zones for the wells/wellfield. This would be useful in many ways for the beneficial management of the town's wellfield.

This would allow:

- a) greater definition of the capture zones of the wellfields,
- b) estimated times of travel for various contaminants to the wells which will be useful in providing greater definition and management of source water protection risks for the Town's SWPP
- c) greater confidence in a hydrogeological model and wellhead zone protection

It is noted that the Source Water Protection Plan (SWPP) for the town water supply is the responsibility of the Town of Pictou and additional work to better define WHPA zones in the SWPP would require their cooperation and involvement.

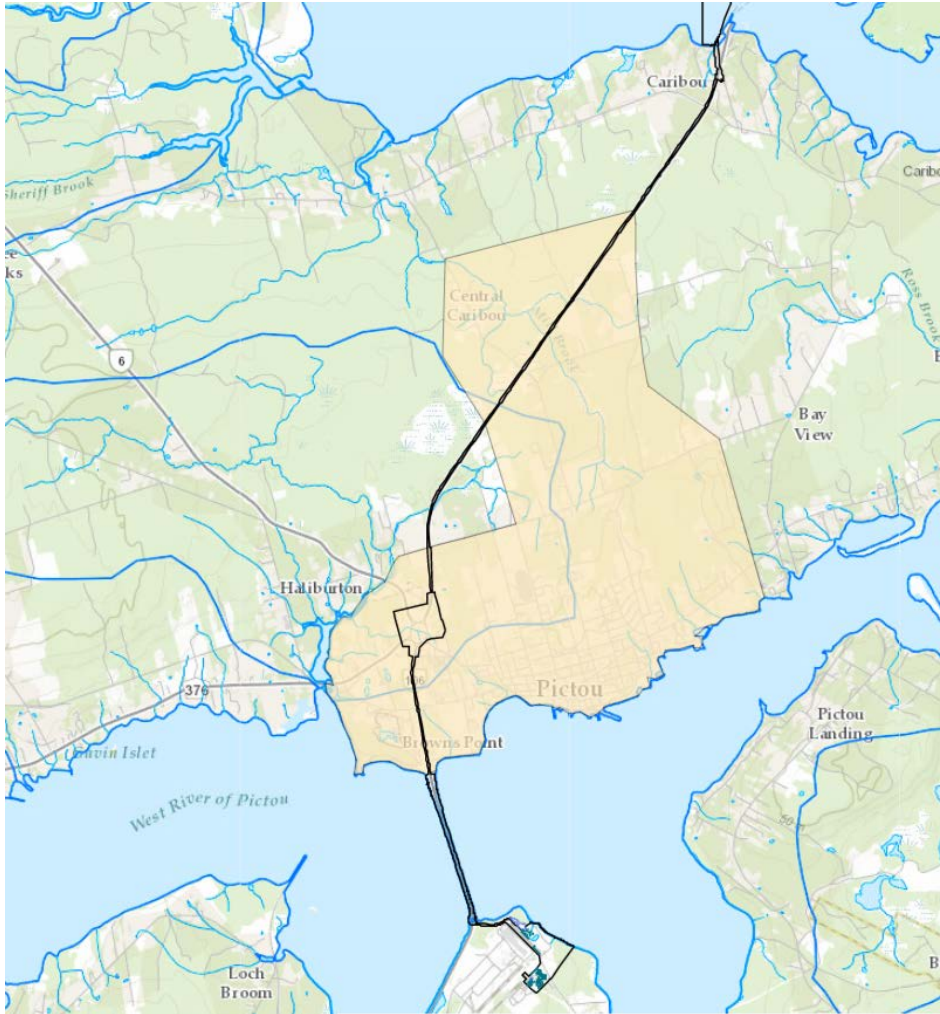


Figure 1 Town of Pictou Source Water Protection Committee Delineated Boundary (Town of Pictou, Pictou / Caribou Source Water Protection Plan 2017, NSE webmapping)

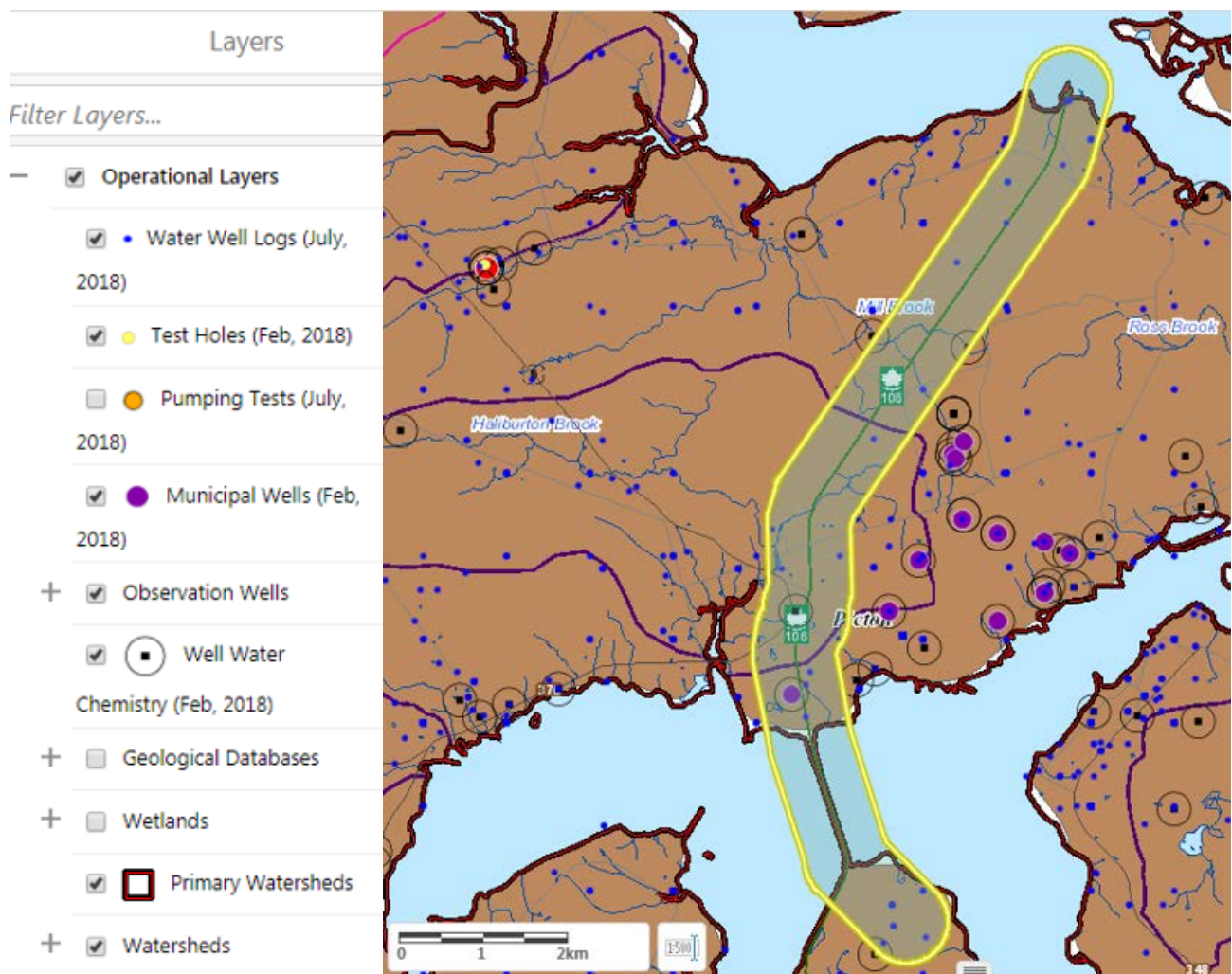


Figure 2 Proposed Pipeline Route 500 m radius buffer zone and water wells (NS Groundwater Atlas, Energy and Mines 2019)

Date: March 6, 2019.

To: Helen Yeh, Nova Scotia Environment

From: Beth Lewis, Consultation Advisor, Office of Aboriginal Affairs

Subject: **Replacement Effluent Treatment Facility Project**

The Nova Scotia Office of Aboriginal Affairs (OAA) reviewed the “Replacement Effluent Treatment Facility Project” and provides the following comments:

- Crown consultation is referenced on page 108 in a paragraph summarizing Northern Pulp’s (NPNS) participation in consultation meetings with Pictou Landing First Nation (PLFN). It also mentions that Dillon attended a consultation meeting in November 2017 where the EA was introduced in advance of the public sessions. The EA process was introduced at this meeting but, to clarify, a draft EA was not provided at this time.
- On page 109, Dillon references the April 26 technical meeting but refers to it was “crown-led consultation”. We wish to clarify that this was not an on-the-record consultation meeting, but a technical briefing provided by NPNS’s consultant (KSH) for PLFN.
- Dillon’s engagement summary does not include the meetings between OAA and NPNS/Dillon in which aboriginal engagement was reviewed and discussed (January 24 and February 26, 2018).

MEMORANDUM

To: Helen Yeh, EA Officer, EA Branch

From: Manager, IMU

Date: March 6, 2019

Subject: Northern Pulp Effluent Treatment Facility EA Review Comments

Hi Helen, below are comments provided by hydrologist engineering staff in my unit. Thanks

Scope of review:

The scope of this Environmental Assessment review from the NSE Sustainability and Applied Science Division Hydrologist is to assess the potential environmental impacts and proposed mitigations of the proposed undertaking on surface water quantity and management. While comments may also include considerations for impacts on general surface water quality, groundwater, freshwater fish habitat, and wetlands, appropriate technical specialists for these areas should be consulted for specific review and comment. This review is specifically focused on freshwater resources, and not on any potential marine impacts.

Documents reviewed:

The documents outlined below formed the basis for this EA review, and is referred to as the 'EA submission' through the rest of this memorandum:

- Northern Pulp Nova Scotia Environmental Assessment Registration Document – Replacement Effluent Treatment Facility. Including Appendices related to surface water. Report Prepared by Dillon Consulting. Dated January 31, 2019, and accessed from https://novascotia.ca/nse/ea/Replacement_Effluent_Treatment_Facility_Project/

Comments re: Northern Pulp Effluent Treatment Facility EA document:

General:

- Appendix C outlines that the “current mill average effluent flow varies between 70,000 and 75,000 m³/day”. This does not align with the 62,000 m³/day average reported in the submission.

- The values used in the receiving water study and for the design of the ETF are a maximum flow rate of 85,000 m³/day. A clear rationale for this design flow has not been provided in the submission.

Water quantity: Watercourses and Site Drainage

- Two watercourses (WC1 and WC2) will be impacted as a result of the construction of the ETF, and are documented to be small or intermittent watercourses that are previously influenced by the existing plant footprint and operations. WC2 is outlined as having potential for fish habitat, and it is reported that “Direct loss of fish habitat may occur at watercourse WC2 due to the spill basin and potential infrastructure footprint” (pg 218). An estimation of an affected area of 45 m² of fish habitat is provided in the submission.
- The proposed project “...does not intend to include in-watercourse or in-wetland crossings”, with plans to avoid in-stream work “where technically feasible” (p. 65). It is further outlined in the submission that “Instream work will not be considered unless additional assessment is made during appropriate seasons of potential habitat effects and approvable mitigation designed” (pg 65). As part of this approach, Horizontal Directional Drilling (HDD) has been proposed as a potential method to be used.
- It is outlined in the submission that “If open cut crossing or isolation methods are considered, a seasonally appropriate field habitat assessment will be undertaken, appropriate mitigation proposed to meet NSE/DFO requirements, and work would be conducted under applicable NSE and DFO approvals.” (pg. 73)
- As the effluent pipeline aligns with previously installed infrastructure, permanent alterations to watercourses and drainages associated with the pipeline are reported to be non-significant, with land clearing adjacent to the highway reported to “...not exceed a 10 m width, and in most areas will be considerably less” (p. 51). However, it is not clear in the submission whether the necessary permissions to use the existing infrastructure right of way in this way have been received.
- It is reported that “An Environmental Inspector will monitor the implementation of the EPP during all critical phases (i.e., clearing/mowing, topsoil salvage, replacement, grading drainage and watercourse crossings and clean-up) of construction;” (pg. 91).
- Monitoring for construction and post-construction near watercourses is outlined in Section 8.4.5. It is reported that “Watercourse monitoring will be conducted as part of the visual inspection of the construction of the project by a specialist” (pg 184), and the submission outlines that watercourses will be monitored and revisited after construction to ensure that they are stabilized (pg 184).
- It is reported that the timing of pipeline route selection only allowed for a preliminary reconnaissance visit to be completed prior to EA submission, and as a result, a “a conservative assessment was made on the potential for freshwater fish and their habitat and it was assumed that such species may be present where potential habitat is present in the pipeline local assessment area” (pg. 205). Additional assessment is reported to be planned for summer of 2019.
- The water availability report provided in Appendix M5 has been previously assessed as part of the Middle River water withdrawal application.

Water Quality

- Section 5.3.2.5 provides general details surrounding proposed approach to pipe leak detection and includes a reliance on regular inspection of the pipeline. Specific details surrounding the frequency and extent of these inspections are not provided in the submission.
- Section 5.7.2.3 outlines planned erosion and sedimentation control mitigations associated with project activities.
- Section 8.4.5. outlines that “The Construction Monitoring Program will be developed in consultation with NSE and will include monitoring of surface water (pH and TSS) during storm events” (pg. 184).
- It is outlined that a spill basin with 35,000 m³ capacity is proposed, which will have the capacity to store 10 – 13 hours of discharge at full production. It is noted that “The spill basin should never be kept full, since it would then have no capacity to absorb any system upsets” (pg 43). It is not clear in the submission what criteria were used in determining the volume of the spill basin, and whether the volume is appropriate in mitigating cases of system upsets. The plan for operation and maintenance of the spill basin is not clear, and as a result it is difficult to understand how the spill basin will be operated to ensure it is an effective mitigation.

Conclusions and Recommendations:

Planning/Design Issues:

- As it drives the design of the EFT and receiving water study, it is critical to have confidence in the 85,000 m³/day maximum water use. At current, it is unclear how this number was determined and whether it is appropriate. Clarification surrounding the rationale for this number is required.
- The rationale for the adequacy of the proposed Spill Basin size is not clear in the current submission. It is recommended that details regarding the rationale and adequacy of the proposed Spill Basin size be provided to confirm the effectiveness of this proposed mitigation measure.

Operational Issues/Other Permitting Processes:

- Considerations for risks to the environment from using the HDD method have not been provided in the submission. It is recommended that detailed plans for any Horizontal Directional Drilling be provided to the Department for review prior to use of this methodology, with considerations for any potential risk and mitigation to nearby watercourses associated with using this method.
- It is also recommended that alternatives to HDD are presented as part of the application process so that any watercourse alteration activities can proceed effectively if HDD is not deemed feasible in the field.
- A detailed sediment and erosion control plan for the various activities proposed is to be developed by a qualified professional and is required to be submitted for NSE review and approval prior to construction activities, including clearing, grubbing, and stripping, take place.
- Watercourse alteration applications for watercourse crossings shall be accompanied with enough detail to illustrate how impacts to upstream and downstream watercourses and any existing water users will be mitigated as part of construction activities, supported by results of

fish and fish habitat assessments that the submission outlines are to be conducted prior to these activities taking place.

- Additional details for the spill basin are required prior to construction, including details of operation and maintenance that outline the measures that will be taken to mitigate the risk of overflow, failure, and/or accidental release of substances from the basin.
- Additional details surrounding the approach to pipe leak detection, with considerations for addressing the areas with highest downstream risk, is recommended.

Agriculture

Date: 2019-03-07

To: Helen Yeh, Environmental Assessment Officer

From: Executive Director, Policy and Corporate Services
Nova Scotia Department of Agriculture

Subject: Replacement Effluent Treatment Facility Project Environmental Assessment

Thank you for the opportunity to review the Replacement Effluent Treatment Facility Project Registration Document.

The Nova Scotia Department of Agriculture (NSDA) has the following comments:

There are agricultural lands within 1 km of the proposed pipeline, however, the proposed pipeline route may not impact agricultural land bordering the Highway 106 directly.

Fisheries and Aquaculture

Date: 2019-03-07

To: Helen Yeh, Environmental Assessment Officer

From: Executive Director, Policy and Corporate Services
Nova Scotia Department of Fisheries and Aquaculture

Subject: Replacement Effluent Treatment Facility Project Environmental Assessment

Thank you for the opportunity to review the Replacement Effluent Treatment Facility Project Registration Document.

The Nova Scotia Department of Fisheries and Aquaculture has the following comments:

- The seafood industry in areas adjacent to the project are important commercial fishing waters for many species including lobster. There are three active processing facilities and four active fish buyers operating or located within 25 km of the proposed project.
- The abundance and safety of seafood is important to the Nova Scotia economy and the harvesters, processors and exporters in the area that rely on the fishery. Although the responsibility for the marine environment, commercial fish stocks and safety of seafood rests with the Federal government through agencies including Department of Fisheries and Oceans and the Canadian Food Inspection Agency, any adverse effects on fish stocks would negatively impact the industry and economic growth of Nova Scotia.
- The Province of Nova Scotia issues licenses and leases for commercial aquaculture operations in the province. There are currently 25 licensed aquaculture sites within 25 kilometers of the proposed project, with the potential to grow that number. There are 23 marine shellfish sites and two land-based sites, with the closest marine shellfish site is 2.47 kilometers away from the proposed outlet. Water quality is important to shellfish aquaculture and must be considered in evaluating the nature and dispersion of the effluent and in any mitigation strategies and emergency shutdown planning.
- The proposal outlines watercourses along the proposed pipeline footprint where freshwater habitat and recreational fishing could be impacted. Specific comments

include:

- Under Section 8.6, Table 8.6.1: The proponent describes brook trout as S3, *Uncommon in the province*, however this species is very common in the province, including in area assessed in this document, and the primary species targeted for freshwater sportfishing.
- Clarity on whether there are contingencies in place to mitigate potential large and rapid fluctuations in water temperature at the diffuser location during low production or maintenance shut down periods would be helpful.

MEMORANDUM

DATE: March 7, 2019

TO: Helen Yeh, Environmental Assessment Branch

FROM: Director of Protected Areas and Ecosystems

SUBJECT: Northern Pulp Nova Scotia Corporation (Northern Pulp) Replacement Effluent Treatment Facility Project

Following are comments from Protected Areas and Ecosystems Branch with respect to the Environmental Assessment application for Northern Pulp Nova Scotia Corporation (Northern Pulp) Replacement Effluent Treatment Facility Project

Wetland Comments:

Components of the project that have a direct impact on wetlands identified within the study area include the Effluent Treatment Facility (ETF) and the proposed effluent pipeline.

Summary ETF footprint:

Two wetlands were identified on the NPNS property within the footprint of the new ETF. These wetlands have been delineated and assessed in relation to the proposed work associated with construction, maintenance, operation of the facility. Both wetlands (WL1 and WL2) will be impacted by a direct loss of habitat as a result of construction of various components of the facility including the AST building and the effluent spill basin. Both wetlands receive stormwater runoff or have been historically altered/impacted by activities associated with development of the industrial site.

WL-1 (0.036 ha) – total loss of small wet meadow, likely result of site development.

WL-2 (0.75 ha)- removal of approx. 0.12 ha of habitat and associated functions relating to water retention and habitat services.

Wetlands on the landscape of the existing NSNP property represent approximately 4% of the total area, therefore it is unlikely that wetland loss will result in a significant loss of habitat. No species at risk (SAR) were identified to be specifically dependent on these features. As site development will likely require stormwater management, it is not anticipated that WL-2 would provide a significant role in this capacity as there is no defined inlet/outlet. Potential for impacts to wetlands as a result of operation of the facility are addressed through design of the effluent spillway and EPP document relating to spills/accidental releases.

Planning/Design

No specific concerns relating to design of the ETF.

Operational Issues/Other Permitting Processes

It is our understanding that specific design of the effluent spillway will be evaluated in conjunction with review of the treatment processes. This should be designed to ensure sufficient capacity in the event of a major malfunction/release from the mill facility and suitability of proposed system monitoring and environmental contingency plans.

Wetland approvals will be required for WL1 and WL2. Under the approval process, compensation for wetland loss will be required and additional monitoring of WL2 will be required to determine indirect impacts associated with construction/operation of the ETF. This could include vegetation, hydrology, soil/water quality monitoring.

Other Observations

Noted that both wetlands within the ETF have historically been impacted/influenced by site development history.

Summary of Pipeline:

While no formal delineation or assessment of wetlands that occur along the proposed pipeline route, preliminary identification of wetland habitats adjacent to the route have been identified using available datasets and site reconnaissance.

In total, 20 wetlands were observed in vicinity to the proposed pipeline route. No direct disturbance of wetlands associated with construction of the pipeline are anticipated based on the use of the existing Highway 106 shoulder and proposed trenchless methodologies for construction to avoid sensitive habitats (including wetland associated with watercourse crossings).

Indirect impacts associated with construction of the pipeline are addressed through the EPP relating to spills/releases of treated effluent. Ongoing maintenance (routine vegetation maintenance) of the route is also expected to minimally impact wetlands along the route by following NS TIR standard maintenance procedures used along roadways throughout the province. Indirect impacts, relating to hydrology changes and water quality inputs associated with the pipeline construction can be mitigated based on the construction procedures proposed and through post construction monitoring. Based on the proposed route, it is unlikely that construction and maintenance of the pipeline will result in significant impacts to the adjacent wetlands.

One saltmarsh (WS3) was identified adjacent to the proposed pipeline route. All saltmarshes (tidal/estuarine marshes) are designated as Wetlands of Special Significance by the NS Wetland Conservation Policy. Again, no direct impact is anticipated associated with construction activities as the route will be confined to the existing causeway and road infrastructure.

The pipeline route reportedly crosses lands included in the source water area for drinking water for the Town of Pictou. As the source water area has not been designated under legislation, these wetlands are not necessarily afforded status as Wetlands of Special Significance.

It was noted that vernal pools may be present along the pipeline route. These tend to be small wetlands and may not exceed 100 m² in which case they would be exempt from the NS Wetland Conservation Policy and approval process. The location and size of these features should be provided. Field delineation and assessment of all the wetlands, including presence or absence of priority species, will be required to support wetland alteration applications.

Planning/Design Issues

It is our understanding that the pipeline route as identified in the registration document is dependent on approval from NS TIR to construct the pipeline within the developed Right-of-way of Highway #106. Additional work would be required to determine wetlands that may be impacted as a result of a change to the proposed route (i.e. a new route is determined to be required).

Operational Issues/Other Permitting Processes

Where applicable, formal delineation and assessment of wetlands along the pipeline route will be required prior to construction activities. Dependent on method chosen to cross wetlands, post construction monitoring will also be a requirement under wetland approval process and can include vegetation, hydrology, water/soil quality monitoring.

Permissions from property owners is also be a requirement of the wetland approval process, which should be considered with respect to the proposed pipeline route.

Risks associated with pipeline construction and effluent monitoring should be evaluated in conjunction with treatment objectives, relevant environmental criteria, and environmental protection and emergency response plans.

Other Observations

Proposed route is along an existing developed corridor and methods proposed for wetland and watercourse crossings include methods that would limit or mitigate the potential for alterations to wetland area and function.

Summary of Marine Effluent Discharge:

The marine effluent discharge does not directly impact on wetlands through construction activities. Potential indirect impacts, as discussed below, relate primarily to characteristics of the effluent itself, ability to achieve treatment objectives, and identification of environmental criteria that are protective of aquatic environments as well as characteristics of the receiving waters.

The potential indirect risks to coastal wetlands associated with a marine effluent discharge is possible in the event of a major malfunction of treatment facility. While evaluation of treatment objectives and receiving water body characteristics (i.e. currents, tides, fate of contaminants in marine environments) are beyond current staff expertise, it is the understanding that modelling of the discharge plume has been completed. Evaluation of the modelling and proposed treatment objectives should be conducted to ensure sufficient protection is afforded and treatment objectives are achievable based on the proposed treatment processes and any other requirements for discharges of pulp mill effluents into marine waters.

Planning/Design Issues

Identification and evaluation of coastal wetlands habitats that may be impacted as a result of effluent

discharge has not been provided in the registration document and were not included within the study area presumably based on the results of the discharge plume modelling conducted. Identification of these features, and other coastal habitat (beaches, estuaries, etc.), could be required if deficiencies within the modelling and treatment capabilities are identified in subsequent review of these components of the registration document.

Operational Issues/Other Permitting Processes

It is our understanding that environmental effects monitoring, which could include water and sediment quality monitoring programs, would be required under various approvals required to be obtained should the proposed project be approved.

Other observations:

None at this time.

Summary

- Prior to any wetland alterations, the proponent must obtain Wetland Alteration Approval for any wetland directly or indirectly altered by the proposed development and assess wetland function and resulting changes to wetland area/function in association with the approval application.
- Prior to work within 30 metres of a wetland, the proponent should develop, in consultation with Lands and Forestry and other regulatory bodies, a wildlife management plan that includes priority species associated with the wetlands and be referenced in any wetland alteration applications.
- Prior to altering any wetlands, the proponent must develop a wetland monitoring plan, which should include the following:
 - How baseline conditions will be documented before construction (and grubbing) begins. This should include indicators of hydrology, water quality parameters and vegetation community.
 - How changes in hydrology of the partially impacted wetlands will be monitored and proposed performance indicators.
 - How changes in the vegetation community of the partially in filled wetlands will be monitored, especially regarding the proportions of wetland specific plants, and invasive species and proposed performance indicators.
 - How changes in water quality of the impacted wetlands will be monitored and proposed performance indicators.
- Prior to any wetland alterations, the proponent must develop a Wetland Compensation Plan. The Wetland Compensation Plan and associated reporting requirements must be developed to establish specific objectives intended to prevent the net loss of wetlands and functions in accordance with the Nova Scotia Wetland Conservation Policy.

Protected Areas Comments:

- Due to the distance from any Nova Scotia's protected areas there are no comments or concerns.

Environment

File No: 40100-30-273

Date: March 8th, 2019

To: Helen Yeh, Environmental Assessment Officer

From: Air Quality Unit

Subject: Northern Pulp Replacement Effluent Treatment Facility Environmental Assessment

Further to your request, the Air Quality Unit provides the following comments with respect to the Air Quality sections of the Class I Environmental Assessment Registration Document, dated January 31st, 2019, for the above-mentioned project:

Planning/Design Issues

- 1) The Air Dispersion Modeling Study limited the evaluation to air contaminants identified in Schedule A of the Air Quality Regulations and the current Operating Approval for the mill. The proponent should have identified the full air emissions inventory for the facility and modeled all potential air contaminants of concern, as a result of the proposed project.
- 2) An updated ambient air monitoring plan based on the air dispersion modeling results should be provided. This plan should include the identification and proposed location of additional monitor(s).

Operational Issues/Other Permitting Processes

- 1) Technical details associated with the method of sludge dewatering and proposed operational or physical modifications to the power boiler to manage sludge, should be provided with the Application for Approval under Division V of the Activities Designation Regulations.
- 2) Section 4 of the Air Dispersion Modeling Study indicates that the mill will conduct a pilot study on the co-combustion of hog fuel and wastewater sludge in the power boiler. Details of the proposed pilot study should be included as part of the Division V Application for Approval. The study plan should include, but not be limited to:
 - a. Proposed volume of fuels to be burned, fuel mixtures, fuel feed rates;
 - b. Proposed fuel feed method;
 - c. Analytical characterization of the wastewater sludge to identify the contaminants of concern;

- d. Comparison of the wastewater sludge with existing fuel characterization;
- e. Proposed contaminants of concern for testing;
- f. Proposed test methodologies;
- g. Identification of air quality standards proposed for comparison during testing;
- h. Proposed operating conditions of the power boiler during testing;
- i. Proposed testing scenarios to demonstrate that testing will be conducted for the cases when the highest concentration of air contaminants would occur.

Depending on the results of the study, further modeling and testing may be required.

- 3) The Division V Application for Approval should include an alternate method for sludge disposal in case the pilot study for co-combustion proves unsuccessful.
- 4) The Division V Application for Approval should include an environmental response plan to address any malfunctions or upset conditions at the power boiler resulting from the co-combustion of wastewater sludge with primary fuels.
- 5) The Division V Application should include odor mitigation strategies for operations as a result of the proposed activity.

Other Observations

- 1) The following issues should be addressed in an updated Air Dispersion Modeling Study:
 - a. The mill is authorized to operate at an annual production rate of 330 000 air dried metric tonnes/year. The air dispersion modeling study indicates that the mill currently produces between 280 000 to 300 000 air dried metric tonnes per year. The air dispersion modelling should represent results for the mill under its authorized production rate.
 - b. The Tables of Emissions included in the Emissions Inventory Section provides the emission rates of air contaminants for the mill sources. The "Other Mill Point Sources" category should be broken down to individual mill point sources and include the specific modeled emission rate for each source.
 - c. Sections 6.1 and 6.2 of the Air Dispersion Modeling Study should identify the maximum predicted concentrations of the modeling and the specific UTM Coordinates for the maximum concentration location.



P.O. Box 1006, P500
Dartmouth, NS B2Y 4A2

March 8, 2019

Your file *Votre référence*
17-6461-1300

Our file *Notre référence*
19-HMAR-00032

Nova Scotia Environment
Environmental Assessment Branch, Attn: Helen Yeh
Barrington Place
1903 Barrington Street, Suite 2085
Halifax, Nova Scotia B3J 2P8

Dear Helen Yeh:

Subject: Class I Environmental Assessment on the Northern Pulp Replacement Effluent Treatment Project

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received the Class I Environmental Assessment (EA) on the proposed Northern Pulp Replacement Effluent Treatment Project on January 31, 2019. For future reference, please refer to the below DFO file number and title:

DFO File No.: 19-HMAR-00032 / 19-EA-032
Title: Northern Pulp Replacement Effluent Treatment Project

At this time, the Program is pleased to offer general comments on the proposal for the Minister's consideration. A further evaluation of some aspects of the EA, such as fish species assemblages and fish population levels and distributions may follow, after the submission of additional information by Northern Pulp Nova Scotia (NPNS), through DFO's regulatory review process.

To begin, DFO would like to address the EA references to DFO's responsibilities for regulating effluent under the *Fisheries Act* (FA). The Pollution Prevention Provisions of the FA are intended to control the deposition of deleterious substances affecting fish, fish habitat or the use of fish, and are therefore of interest of DFO, Environment and Climate Change Canada (ECCC) and Health Canada (HC) in fulfilling their respective mandates. The administration and enforcement of Subsections 36(3) to 36(6) of the FA is led by ECCC, with support, cooperation and communication with DFO and HC, as appropriate.

With respect to the scope of the below comments, DFO's review of the EA was conducted pursuant to Section 35 of the FA; specifically related to the physical impacts from the proposed projects or activities, and the potential for them to cause serious harm to fish or fish habitat, which are part of, or support a commercial, recreational or

Aboriginal fishery. DFO's review also considered potential impacts to species at risk, as defined in subsection 2(1) of the *Species at Risk Act* (SARA).

At this time, the Project description is not sufficient to completely characterize the potential effects related to Section 35 of the FA. Additional information is required to sufficiently address the following information gaps: the disposal at sea location; the underwater marine benthic habitat survey; the detailed wetland and watercourse crossing information; and, the final pipeline construction methodology.

The Project description also identified and provided a thorough preliminary assessment of nine freshwater watercourses, and 11 wetlands that provide fish habitat. It should be noted that any watercourse or wetland alteration from pipeline installation works would be subject to regulatory review by DFO, under Section 35 of the FA. Therefore, DFO would require, for each watercourse or wetland alteration application, site specific information, including but not limited to, pipeline methodologies and timelines for any pipe installation. Additionally, a detailed fish habitat assessment, conducted by a certified habitat assessment specialist, would be required.

The Project also identifies that there will be approximately 4 kilometers of marine pipeline work, including the following: dredging, side casting, rock mattress placement, pipe placement, potential pipe armoring, construction of temporary access roads, and disposal at sea activities. Despite Appendix F of the EA document being detailed in terms of the potential installation methods for the marine section of the pipeline, additional information is required for the completion of DFO's full assessment of the proposed activities. This information includes the following:

- a) Detailed benthic habitat information in the pipeline route;
- b) Mitigation measures associated with each potential installation method;
- c) Information at the pre-construction (baseline) and post construction monitoring phases of the Project, as well as during construction (e.g., information on turbidity monitoring, and how it will be conducted (divers, ROV, sampling program, etc.);
- d) Construction timelines; and
- e) Blasting details, if likely.

Once the above information has been provided by NPNS, the potential effects can be reviewed and evaluated through DFO's request for review process, which will determine if there is a need for a Section 35 FA Authorization. At this time, DFO's regulatory review of the marine pipeline construction is underway, and additional information has been requested from NPNS.

With respect to the Marine Refuge Scallop Buffer Zone (SBZ) within Scallop Fishing Area 24, it forms part of DFO's Other Effective Area Based Conservation Measures that contribute toward Canada's 2020 Marine Conservation Targets (MCTs). The conservation objective is to protect juvenile lobster and its habitat by restricting the activity of scallop dragging in this area. If a new activity such as the effluent discharge is permitted in or around this area and later deemed incompatible with the stated

conservation objectives, loss of Marine Refuge status may occur, in whole or in part. DFO has noted that the boundary of the marine refuge is not accurately represented in the EA document. As such, DFO is developing a more accurate image of the boundaries to clearly define the current Marine Refuge. It should be noted that, it is probable that the marine portion of the effluent pipe construction will travel through, and discharge inside the Marine Refuge. DFO recommends that the EA document also reflect that other species such as Sea Scallop and Winter Flounder are protected as part of the Marine Refuge. DFO will carefully assess the potential impacts to this physical habitat as part of the regulatory review process.

In closing, DFO looks forward to continued involvement in the review of the Project, and all associated works, such that fish and fish habitat is protected and conserved, and residual adverse impacts are reduced and mitigated to acceptable levels.

Thank you for the opportunity to review and provide comment. Should you wish to discuss the above, please do not hesitate to contact me at Michael.Wambolt@dfompo.gc.ca or 902-402-5851.

Yours sincerely,



Mike Wambolt,
Section Head, Marine Developments
Regulatory Review, Ecosystem Management



Lands and Forestry

MEMORANDUM

TO: Helen Yeh, NS Department of Environment
FROM: Department of Lands and Forestry
DATE: March 8, 2019
RE: Northern Pulp's Replacement Effluent Treatment Facility Project

The Department of Lands and Forestry provides the following comments on the above project:

Crown Land

The proponent will require permissions from Land Administration (permit/easement/lease) for any pipelines, outfalls/intakes and other associated infrastructure beneath the Ordinary High-Water mark of both the large crossing at the junction of the three rivers before federal Pictou Harbour and in the Northumberland Strait.

The project description notes portions of the pipeline will be constructed within the limits of the public highway, should this design change, there are Crown lands that abut that public highway, and would require permissions from Land Administration (easement).

Coast Line Area:

The Department's mandate includes operating provincial parks in the immediate coast line area of the outfall. The cumulative effects monitoring program should be expanded to include monitoring for impacts to recreation activities, specifically swimming and beach use, as part of the socioeconomic impacts in the outfall area. Provincial park coast line areas of interest include: Caribou-Munroes Islands, Waterside Beach, MacKenzie Beach and Melmerby Beach.

Wildlife, Wildlife Habitat and Surveys:

The Department recommends that the following mitigation measures be included:

- *Section 8.9.3.1 and 8.10.3.1.* Construction activities should be mitigated to address any impacts to wildlife and wildlife habitat with respect to light, noise, and dust.

- *Section 8.10.3.1.* Options be developed to discourage waterfowl and other wildlife from using spill basin and clarifiers.
- *Section 8.10.3.2.*
 - The majority of anticipated work for the pipeline appears to occur within the highway Right of Way (ROW). If this project receives approval, a condition of approval should be that development of mitigations for non-migratory bird species, and nests or habitat for reptile and amphibian species that may be encountered during the course of work, must be done in consultation with, and approved by the Department of Lands and Forestry.
 - A mitigation plan specific to raptor species be developed, given the high number of raptors encountered within the Local Area of Assessment (LAA) through desktop analysis and encountered during field work (Appendix Q).
- An explanation is required on how the interpretation of the bird survey results may have been affected as a result of discrepancies in the survey methods. Section 8.10.2.3 indicated that surveys were conducted for 10 min and all birds seen and heard during this timing window recorded from a stationary location, with additional time given to ensure all birds were recorded. However, Appendix Q shows time spent at each survey site, with a range from 1 min-33 min spent on site. Although there is sufficient explanation for the time extension beyond 10 min, no explanation is given for when a survey took less than 10 min to complete.
- Develop a mitigation plan for *priority species (as defined in Section 8.0 under Valued Environmental Components (VECs))* that are encountered during field surveys to be undertaken in 2019 along the proposed pipeline route. The proponent is also advised to consult with the Department of Lands and Forestry and to seek approval for the plan.
- Section 8.13.3.2: The Department requires additional mitigation measures be taken to prevent disturbance of the colony of Double Crested Cormorants nesting on the banks of the causeway. A colony survey by the Department in 2009 recorded 413 Double Crested Cormorants nests on the banks of the causeway and 83 nests of the causeway pilings. This bird is a provincial responsibility; therefore, appropriate mitigation measures must be approved by the Department of Lands and Forestry.

It is recommended that the following surveys be added to the 2019 field season survey for birds and plants:

- Dedicated owl surveys and raptor nest searches at all project locations prior to the commencement of any work.
- Previous survey efforts were not sufficient to assess Common Nighthawk (*Chordeiles minor*) as they are most active at dawn and dusk. Surveys for Common Nighthawks be conducted within the project area prior to

- commencement of work.
- Surveys for the colony of Double Crested Cormorants nesting on the banks of the causeway and adjacent wharf pilings. This survey was not identified in the Environment Assessment under: *Nesting Calendar for Breeding Birds within the Northumberland Lowlands Ecodistrict* (section 8.10.1.2).
 - *Section 8.9.2.* Herptile surveys were conducted once in June 2018. Herptiles typically have peak activity periods twice in the year (spring and fall). Additional herptile surveys be conducted during the fall activity period.

Other information:

- *Section 8.10.2.4.* Great Cormorants are known to have bred on Amet Island in the Northumberland Strait and may still occur. This is a corrective note that the proponents may want to consider in future work on potential impacts to marine birds.



Municipal Affairs

Maritime Centre, Floor 14 North
1505 Barrington Street
PO Box 216
Halifax, NS B3J 2M4

Date: March 8, 2019
To: Helen Yeh, Environmental Assessment Officer
From: Gordon Smith, Provincial Director of Planning
Subject: Northern Pulp's Replacement Effluent Treatment Facility Project

As requested, the Department of Municipal Affairs has reviewed the Environmental Assessment Registration Documents for the proposed Northern Pulp's Replacement Effluent Treatment Facility Project.

Departmental staff in their review have found nothing of particular concern within our Department's area of mandate. Still, we highlight the Statement of Provincial Interest Regarding Drinking Water, and assume that adequate consideration is being given to the Town of Pictou's water supply, since the proposed effluent pipeline crosses the source water area for that supply.

Thank you for the opportunity to review the Registration Document for the above-noted project. Should you require additional information, please feel free to contact either Andrew Paton, Senior Planner (902-424-7492) or me (902-424-7918).

Yours truly,

A handwritten signature in black ink, appearing to read "Gordon Smith".

Gordon Smith
Provincial Director of Planning

c: Andrew Paton, Senior Planner, DMA

From: John Appleby <John.Appleby@pwgsc-tpsgc.gc.ca>
Sent: March 8, 2019 4:50 PM
To: Yeh, Helen X <Helen.Yeh@novascotia.ca>
Subject: FW: NPNS EA

Hello Helen. By way of introduction, I am the Operations Manager for PSPC Environmental Services group for Nova Scotia. I have attached our comments on the NPNS Replacement Effluent Treatment Facility registration material, originally provided to the Canadian Environmental Assessment Agency (Agency) on February 27th. The document summarizes our Department's interest and mandated responsibilities in relation to the Project. While the comments were originally developed to assist the Agency in making a decision concerning the most appropriate EA track, they may also provide some useful context to your current exercise related to Class I process elements. Please contact me at any time should wish to discuss. Have a great weekend.



PSPC Atlantic Response to the Canadian Environmental Assessment Agency: NPNS Designation Request. February 27, 2019.

1). Indicate if the project description of the Project presented in the project website is sufficient in characterizing project effects to the components of the environment as defined under section 5 of CEAA 2012 that related to your mandate including whether these effects may be adverse.

Public Service and Procurement Canada (PSPC) has provided a brief description of its mandated authority in respect of the Project in response to question 3 (below). As the custodian of the seabed for the affected portion of the internal waters and territorial sea of Canada lying outside a province, PSPC would need to be asked to provide a licence allowing the use of the ocean floor for the construction and operation of the effluent pipe and outfall.

PSPC has determined the Departments' scope of participation as a Federal Authority in relation to the Project according to CEAA 2012 (Act). In this regard, Section 2 of the Act provides a broad definition of the environment including specified "components of the Earth", and defines federal lands to include the relevant portions of the sea floor. Section 5(1)(a) of the Act requires several environmental effects to be taken into account by a federal authority, and Section 5 (1)(b) specifies that related effects need to be assessed for federal lands. Section 5(1) (c) of the Act provides specific requirements related to Aboriginal peoples that must be met over the course of any Federal environmental assessment of a Project, and Section 5(2) provides further requirements for involved Federal Authorities which include effects relating to health, socioeconomics, and physical and cultural heritage.

The majority of concern expressed in relation to the potential effects of the Project on the environment are focused on the potential adverse impacts from sustained effluent introduction into the marine environment, either during normal operations or due to upset conditions. While PSPC regards the environmental assessment registration document produced by Dillon Consulting Ltd. as being of professional quality, the Department also notes informational deficiencies related to the marine environment. Specifically, Dillon has indicated in the registration submission that for situational reasons "... it was not possible to conduct field work in the new pipeline corridor or marine environment in order to inform this EA Registration". It is understood that the additional work will be carried out during the spring and summer of 2019.

Under CEAA section 5, PSPC will need to satisfy itself as to the potential significance of environmental effects related to the Project, and in particular with those respecting the ocean floor and receiving waters, prior to making any final decision concerning the licencing of the seabed to enable the Project to proceed. Part of the related decision making will be dependent upon addressing these informational deficiencies.

PSPC is mindful of the duty to consult First Nations on the Project, and in this regard will consult with, or will participate in broader federal consultations with, First Nations communities and organizations to meet these obligations.

PSPC also notes that the Province of Prince Edward Island has officially expressed concern over the potential environmental effects of the Project on the Northumberland Strait lobster fishery, and has asked that a federal environmental assessment be carried out prior to approving the Project.

Subject to receiving a request for a license, PSPC is of the opinion that additional environmental assessment work will need to be carried out in order to satisfy CEAA 2012 Section 5 requirements and that additional consultations, particularly with First Nations, will be required.

2). Identify potential environmental effects not described on the project website and their linkage to components of the environment under federal jurisdiction (as defined under section 5 of CEAA 2012).

a). Identify whether any potential adverse effects are likely to be significant in nature; and,

b). Comment on whether any potential adverse effects identified could be managed by existing regulatory processes.

The registration material indicates that no residual impacts are likely to be significant in nature. As indicated above, the document has been crafted to a high standard. That being said, it is reasonable to assume that the additional information required regarding potential marine environmental effects will inform an evaluation of potential significance. Pursuant to CEAA 2012, Section 5(1) and 5(2), PSPC expects that additional consultations and assessment efforts pertaining to social, economic and cultural factors will also require additional assessment.

Once the environmental effects and mitigation strategies are understood, it is expected that existing regulatory processes (outside of PSPC) will figure prominently in ensuring that predicted effects are verified through follow up and monitoring and in evaluating mitigation efficacy. Regulatory compliance monitoring and associated enforcement activity lying within the purview of our federal counterparts is anticipated to comprise an essential part of this.

3). List the potential powers, duties or functions that your department may issue to enable the project to proceed, why they might be issued, and which project components and activities are related to the power, duties or function.

PSPC is the custodian of the seabed for the affected portion of the internal waters and territorial sea of Canada lying outside a province. PSPC would need to be asked to provide a licence allowing the construction and operation of the pipeline and outfall components proposed for that portion of the seabed that is subject to the Department's jurisdiction.

4). Potential environmental effects associated with power, duty or functions identified above., as described in subsection 5(2) of CEAA 2012. Please include in your response a description of the scope or extent (i.e. project activities addressed and components of the environment included) under this power, duty or function).

As previously noted, PSPC may be asked by the proponent to licence the use of the seabed. Should this occur, PSPC will need to be satisfied with regard to the significance of impacts on the marine environment as well as socioeconomic and cultural issues in relation to these environmental effects. PSPC will engage with other directly mandated federal counterparts for advice as we proceed.

5).Has your department or agency already exercised the above-noted power or performed a duty or function to enable the proposed project to proceed in whole or in part? If yes, please describe.

No.



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March 8, 2019

Attached is a formal response from the Town of Pictou regarding the Northern Pulp Nova Scotia, Replacement Effluent Treatment Facility Project.

Thank you for your consideration of the identified concerns.

James Ryan
Mayor



Town of Pictou

Response to

Northern Pulp Nova Scotia
Environmental Assessment Registration Document
Replacement Effluent Treatment Facility

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1. Statement of the Town of Pictou Position
2. List of Concerns to be Addressed in this Response
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 - A: Potential for Accidental Ground Water Contamination
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 - C: Economic Effects for the Town During the Construction Phase of the Project
5. Appendices

1. Town of Pictou Statement of Position:

The Town of Pictou hereby informs the Nova Scotia Department of Environment that it can not support the Northern Pulp Nova Scotia plan for the Replacement Effluent Treatment Facility. Additional risk, however small, to the domestic water supply is unacceptable.

2. List of Concerns to be Addressed:

- A. The plan creates additional risk to the Town water supply by the on-land portion of the proposed transmission pipe carrying treated effluent to Caribou Harbour.
- B. The limited information in the Environmental Assessment Registration Document regarding the potential for increased (new) toxins and/or odours produced as a result of the re-location of the Activated Sludge Treatment (AST) facility to Abercrombie Point, the burning of sludge in the power boiler, and the venting of air as part of the transmission of warm effluent through the Town of Pictou.
- C. Economic effects of potential disruption(s) to tourism traffic to and from the (Caribou, NS – Wood Island, PEI) ferry terminal during the construction phase of both the on-land and under water portions of the effluent pipe.

3. Context for Responding:

The Town of Pictou is a community of approximately 3200 residents located on the north shore of Pictou Harbour approximately three kilometers from the Northern Pulp Nova Scotia facility. The Trans-Canada Highway (TCH) 106 runs through the west end of the Town and proceeds to the Northumberland Ferry Terminal at Caribou Harbour. The Harvey A. Veniot Causeway connects the Town of Pictou to Abercrombie Point where Northern Pulp is located.

For 52 years Northern Pulp and its previous owners have provided a reliable and, depending with whom you speak, a greatly appreciated source of income for many members of the community through direct employment at the processing facility and the integrated forestry and trucking industries. The mill and its air emissions are visible from most (all) locations in the Town of Pictou. In November 2017, Pictou Town Council passed a Resolution to request

consideration for Federal oversight of the Northern Pulp project and that there be 'no harm to the Northumberland Strait fishery' (Appendix F, Pg. 1)

In the 1990s The Town of Pictou created the Pictou Waterfront Development Corporation with the goal of improving the waterfront/downtown district while promoting the tourism sector. The signature attraction for the development was the construction of a full-size replica of the *Ship Hector*. The \$10M project was completed with financial support from the Atlantic Canada Opportunities Agency (ACOA), the Province of Nova Scotia and the Town of Pictou. The Pictou Waterfront has since been and is expected to continue to be significant focus of economic interest within the Town.

Pictou is the home of Advocate Printing and Publishing, AECON Fabco (Shipyard), CMS Steel Pro Mechanical. Council continues to embark on projects promoting the Town as the service and entertainment centre for Pictou West and a tourist destination.

Within the past 15-20 years the Town of Pictou, with financial support from Provincial and Federal governments, has completed several significant additions and upgrades to important infrastructure ensuring the comfort and security of residents and visitors. This work is aimed at ensuring long term sustainability and compliance with health and safety standards.

Construction and commissioning of a municipal Wastewater Treatment Facility for the Town of Pictou and surrounding area took place in 2011. The facility processes one hundred percent (100%) of the Town's sewage and, unfortunately, a large portion of the storm water. Our tests reveal one hundred percent (100%) compliance in achieving standards for effluent and the development of a storm water plan for the Town is now underway so future wastewater needs can be met. We are extremely proud of our advances in service to the community and the protection of our environment.

The Town of Pictou has, in the past, consistently experienced issues associated with water discolouration and mineral build-up in the distribution pipes. A new 'state of the art' Water Treatment Plant was commissioned in October 2019 to centralize water treatment and distribution while removing high levels of manganese and iron from the supply. We are very pleased that initial scientific testing and a positive public response indicate great success as we continue to upgrade our infrastructure to ensure safe and reliable water for home and commercial use.

4. Environmental Assessment Concerns (In Order of Significance):

A. Risk of Ground Water Contamination

The proposed on-land portion of the pipe carrying treated effluent to Caribou Harbour will cross both the Pictou wellfield which is completely within the Town of Pictou boundaries, and, the Caribou wellfield which is situated completely within the boundaries of the Municipality of Pictou County. Both wellfields are located within the delineated boundary of the Caribou/Pictou Watershed protected area identified of in Figure 1 of Appendix D (Pg 6).

The Town has been granted Permits from the Province of Nova Scotia to draw approximately half of the Town's potable water from wells within the Caribou wellfield and the rest from the Pictou wellfield. A total of approximately 600K cubic meters are pumped annually from eight active wells. Limits for water extraction from the various wells can be found in Table 2 of the Permit (Appendix B, Pg. 8). As part of the permitting process, the Caribou/Pictou Source Water Protection Committee was formed, and the Pictou/Caribou Source Water Protection Plan was completed (Appendix D). This plan identifies risk and best management practices for mitigating risk should accidents occur.

Residents of the Town of Pictou depend on the groundwater drawn from the Pictou/Caribou watershed for their drinking water. The Caribou and Pictou wellfields are the only viable sources of potable water and it would be safe to conclude that without this dependable source of water there could be no town. It is the Town's position that we can not be supportive of any activity that would add additional risk to our water supply regardless of the many references to 'insignificant' risk in the Environmental Registration Document. More specifically, we cannot support the planned construction of a pipe carrying the treated effluent containing 'residual contaminants' (Registration Document, Pg. 32) along TCH 106. In the original Source Water Protection Program from 2005 the hydrologist representing *ADI Limited* identified a 'Zone of Influence' which shows the extent of the sand and gravel aquifer where surface water could affect the Town water supply (Appendix A, Pg. 4). A large stretch of TCH 106 is situated well within the aquifer and, therefore, we should assume that any accidental spills in the area could be harmful to our citizens.

It should also be noted that, as a 'General Term' within the Town's Permit To Withdraw Water, the Town has indemnified the Province against our (the Town) actions in causing 'damage resulting from the activities performed pursuant to this Approval' (Appendix B, Sec. 3(v)).

B. Additional Air Emissions and Odours Associated with the AST (Activated Sludge Treatment) and Transmission of Effluent

The Pictou West area, including the Town of Pictou is the recipient of a significant portion of the air emissions from the mill operations as shown in (Appendix E, Figures 1 and 2, Pages 3 and 5). As a result of this, residents and visitors alike have complained about the emissions including concerns for the long term effects on their health. Numerous studies suggest that higher levels of certain illnesses are evident in the area. For many years, dining and accommodation operators have also expressed concern about lost revenue as the result of odours associated with the air emissions from the mill.

Despite significant improvements to overall emissions with the recent construction of the Precipitator Unit, emissions and associated odours continue to affect the Town on a regular basis.

With the relocation of the Activated Sludge Treatment (AST) Facility to Abercrombie Point we are concerned that new odours, similar to those that have been a problem around Boat Harbour since the mill was made operational, might have a tendency to 'drift' in the Town's direction. Additional contaminants in the emissions from the Power Boiler when the sludge from the new treatment facility is incinerated will also be of concern. The Environmental Assessment fails to provide comfort that particulate emission and odours will be handled to the Town's satisfaction.

An additional concern exists regarding the proposed venting along the on-land portion of the effluent pipe. It is our understanding the vent must be placed at a high point in the transmission line which could be between the Harvey A. Veniot Causeway and the Pictou Rotary. If this is to be the case, we expect that there could be additional odours from the warm treated effluent at that location. Also, should any unintended blockages of the pipe occur beyond that point, it could be concluded that the vent would provide a release point for effluent until the flow is stopped. It is important to note that this point is within the Town limits and is above the Pictou Wellfield.

C. Potential Economic Effects of the Pipe Construction Phase on the Economy

The Town of Pictou is located approximately eight kilometers from the ferry linking Nova Scotia to Prince Edward Island. This is a major entry and exit point to Nova Scotia where approximately 20 000 vehicles use the ferry each year between April and December.

Our community is, not only, a service centre for the Pictou West area but also a stopping place for travellers and a tourist destination. Many of the Town's businesses and tourist attractions are seasonal operations and depend on the high traffic volumes from May to October.

The timeline for construction outlined in Table 5.4-1 (Registration Document, Pg. 82) indicates that land clearing, construction and watercourse construction for the land portion of the pipe will take place from November 2019 until possibly September 2020 and the Marine portion from April 2020 to October 2020.

Should travellers choose to avoid the Northumberland or TCH 106 due to construction, financial impacts would be felt by the businesses and seasonal operators in the Town and the surrounding area.

5. Appendices:

- Appendix A: Source Water Protection Program (Prepared by ADI Limited, September 2005)
- Appendix B: NSE Approval to Withdraw Groundwater from Pictou and Caribou Wellfields (Approval No: 2002-026956-R01, June 21, 2013)
- Appendix C: NSE Permit to Operate a Water Supply System (Approval No: 2012-080096-R02, March 4, 2016)
- Appendix D: Pictou Caribou Source Water Protection Plan (2013, Revised in 2014 and 2017)
- Appendix E: *Pilot study investigating ambient air toxics emissions near a Canadian kraft pulp and paper facility in Pictou County, Nova Scotia* (Hoffman, Guernsey, Walker, Kim Sherren, Andreou, 2017)
- Appendix F: Correspondence on the Matter of the Effluent Treatment Facility Proposal(s).
- To: NS Minister of Environment, Federal Minister of Environment and Climate Change, Federal Minister of Fisheries and Oceans (December 2017)
 - From: Canadian Environmental Assessment Agency (CEAA), (March 27, 2018)
 - To: Mr. Bruce Chapman, General Manager, Northern Pulp Nova Scotia (October 24, 2018 and November 2, 2018)
 - From: Mr. Bruce Chapman (October 26, 2018)
 - To: Canadian Environmental Assessment Agency (CEAA) (February 24, 2019)

Appendix A

Source Water Protection Program

(Prepared by ADI Limited, September 2005)



Environment and Labour
Environmental and Natural
Areas Management Division
Water and Wastewater Branch

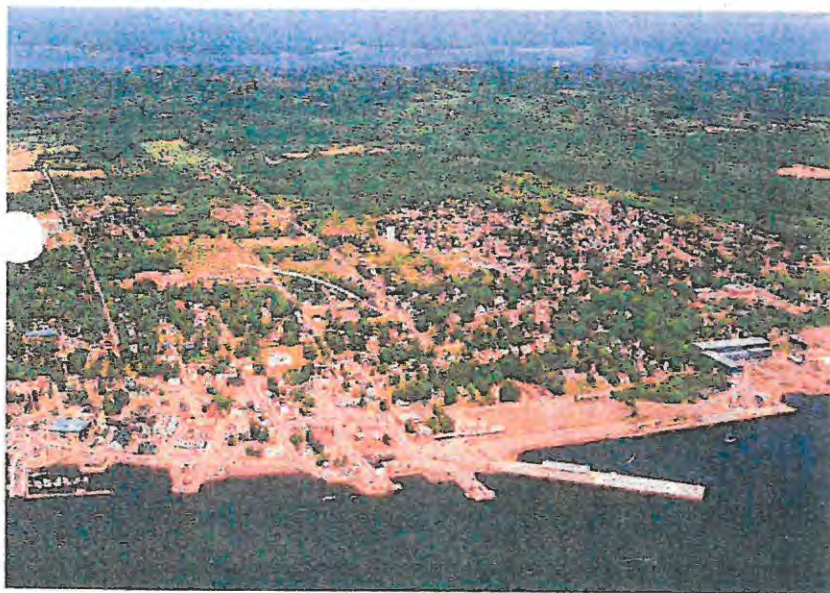


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Oblique aerial view of the Town of Pictou looking north with the urbanized "Town" Well Field in the foreground and the forested area surrounding the "Caribou" Well Field in the background.

Source Water Protection Program Town of Pictou

ADI Limited

File: (24) 3945-001.1

Date: September 2005



This report was prepared by ADI Limited for the account of the Town of Pictou.

The material in it reflects ADI Limited's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. ADI Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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ADI Quality System Checks	
Project No.: (24) 3945-001.1	Date: 2005.Sept.22
Issue Status: Final	Revision No.: 0
Prepared By: Fred Baechler, M.Sc., P.Geo.	<i>Fred Baechler</i>
Reviewed By: Matt Blais, B.Sc., CET	<i>mb</i>

1.0 INTRODUCTION

1.1 Location

The Town of Pictou is located along the Northumberland shore of Nova Scotia within the Municipality of the County of Pictou (Figure 1-1A). The Town encompasses some 8.14 km² within its political jurisdiction along the north shore of Pictou Harbour.

Pictou was first settled in 1767 with the Hector arriving in 1773. It was subsequently “founded” (1788), and given its name as the Shiretown of Pictou County in 1792. It became incorporated in 1873. Since that time, the Town’s population has grown gradually to its present level of approximately 4000 people.

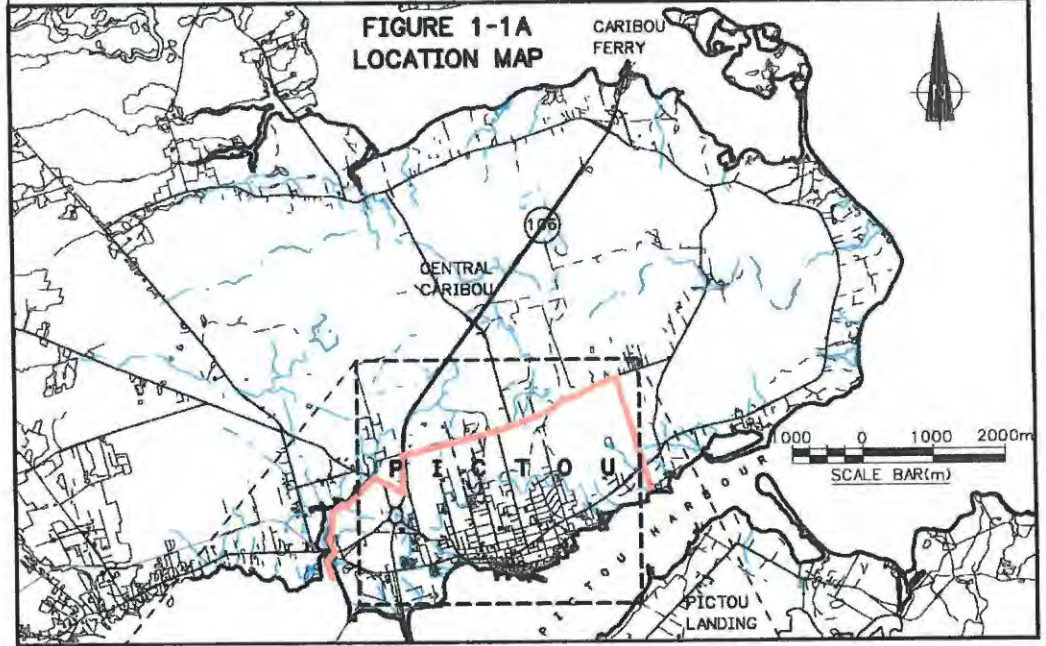
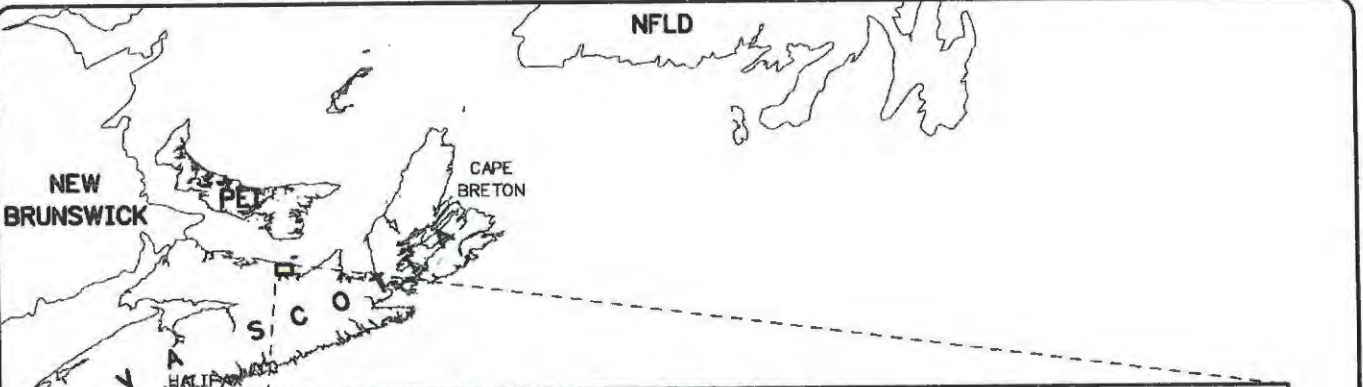
1.2 Goals of This Report

This report has been prepared for the Town of Pictou by ADI Limited (ADI) to meet the requirements of the Nova Scotia Department of Environment and Labour’s (NSDEL) Source Water Protection Planning. This is now a condition of approval for all water works in the Province. Given historical work (Section 1.3) and ongoing studies (Section 1.4) this Protection Plan should be considered a continual “work in progress”.

1.3 Background

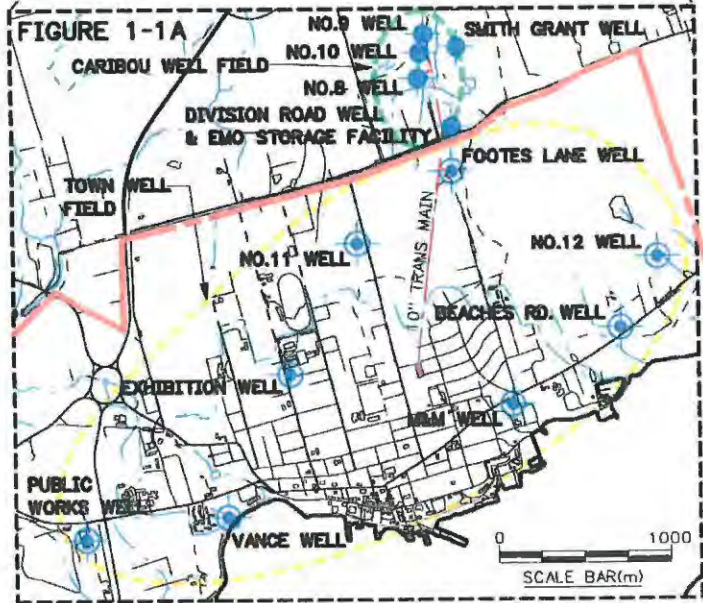
The Town of Pictou was authorized to develop its water supply in 1888 and has been extracting groundwater for municipal services since 1901. Up until 1901, water was supplied from privately owned wells in the Town, which were not maintained in a sanitary condition. To overcome the danger of disease, the first council (1874) appointed a Superintendent of Wells and Pumps and requested aid from the provincial government. Subsequently, Chapter 120 of the Nova Scotia Acts in 1888 provided for supplying the Town with water. This authorized and empowered the Town Council to provide a sufficient supply of water for domestic, fire and other purposes. These early actions started what is now over 125 years of Development, Management and Protection of its water supply. *This foresight and list of accomplishments form a remarkable achievement for such a small community, and only a 1250 domestic user rate base.*

The first well field outside the Town, referred to as the Caribou Well Field, was constructed in the early 1900’s. The first seven wells were drilled in 1901, followed by additional ones in 1907 (Smith-Grant) and 1943 (Footes Lane), all drawing from the bedrock aquifer. Although outside of urban activities, and easier to protect, it was within a different political



**FIGURE 1-1B
LOCATION OF
WELL FIELDS**

LEGEND:



This drawing is not to be scaled

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Proj. TOWN OF PICTOU
 GROUNDWATER RESOURCE
 MANAGEMENT

Dwg. LOCATION OF TWO WELL FIELDS
 SUPPLYING TOWN OF PICTOU

Drawn By: NEB	Proj. No. 3945-001.1
Dwg Standards Chk. By:	Dwg. No. FIGURE 1-1
Designed By: FEB	Date Last Modified: 05.AUG.25
Design Chkd. By: FEB	Last Modified By: NEB
	Rev. 0

jurisdiction, a source of future problems. By the late 1960's the well field supplying the Town encompassed 14 active pumping wells, nine of which were on the vacuum system within the Caribou Well Field (Figure 1-1B).

The 1970's and 1980's saw a period of Resource Evaluation and Well Field Expansion. These technical studies culminated in two new production wells in the Caribou Well Field and delineation of additional target areas for future expansion.

The 1990's focused on Well Field Protection, long before it became the “thing-to-do” after the Walkerton tragedy in 2000. During this decade, the Town brought on a hydrogeologist for technical guidance. Numerous studies focused on delineating the extent and source of recharge supplying the Caribou Well Field aquifer, as well as assessing and mitigating potential risks; before NSDEL requested it in 2002. A three zone Well Head Protection Area (WHPA) was outlined with a listing of “permitted uses” and suggested “constraints”.

This work culminated in a formal request to the Minister of NSDEL to designate lands surrounding the Caribou Well Field as a protected area in 2002. Unfortunately, this request was turned down.

The last five to eight years have been characterized as Adaptive Management. This approach is “learn by doing”, which manages multiple issues with action based on incomplete knowledge using the Pre-Cautious Principle, supported by feedback through monitoring requirements.

1.4 On-Going Studies

At the time of submission of the Surface Water Protection Program (SWP) a number of relevant studies and activities are ongoing, specifically:

1.4.1 Activities

The Town is maintaining their hydrogeological technical advisor, purchasing land around the Caribou Well Field, developing protection plans for the Urban Well Field, hiring summer staff, upgrading the distribution system, searching for additional supplies within the Town boundaries, expanding their digital database, working with the Pictou County District Planning Commission on land use constraints, addressing demand side management by installing water meters and requesting rate increases, as well as continuing to educate the public on water.

1.4.2 Studies

Groundwater under Direct Influence (GUDI): The Town is presently eight months into the one year assessment of NSDEL's Phase II level GUDI of surface water effort on 12 wells.

Distribution System: The Town is presently assessing and upgrading the distribution system, parts of which are over 100 years old. It has instituted an assessment of chlorine demands, potential for trihalomethanes (THMs) and haloacetic acids.

Additional Production Wells: Foresight necessitated assuming replacement wells would be a more efficient response to any GUDI problems which arise, if they can be positioned within Town boundaries and direct flow to the central reservoir for treatment. A test drilling/pump exploration program is underway to locate such supplies.

Water Sampling of Wells: As part of "due diligence" associated with the Adaptive Management Approach, the monitoring program supplying feedback on the Town's actions encompasses more than that required by the NSDEL permit. Along with "Source" and "Distribution" system monitoring, the Town has incorporated a "Source Protection" program, which monitors the "health" of the aquifers and allows us to reflect impacts of climate change into our strategies.

1.5 Report Outline

Building upon the background outlined above, the main body of the report initially summarizes the characteristics of the existing water system supplying the Town of Pictou (Section 2.0). The remaining sections follow NSDEL's five steps to Source Water Protection Planning namely:

- Section 3.0 Delineate Source Areas
- Section 4.0 Identify Potential Risks
- Section 5.0 Develop SWP Strategies to Manage Risks
- Section 6.0 Develop a Monitoring Plan
- Section 7.0 Develop SWP Advisory Committee

The text for each section summarizes salient points. Support documentation can be provided upon request.



2.0 EXISTING SYSTEM

The groundwater supply for the Town presently comprises 13 wells encompassed with two well fields identified as the “Caribou” and “Town” Well Fields (Figure 1-1B). Presently, the demand ranges from 950 to 1040 Lpm for a population of about 4,400.

The Pictou Water Utility was issued an operating permit for the Town of Pictou’s Water Supply by the NSDEL on 19 March 2003: Approval No. 2001-024443.

The Caribou Well Field is located north of the Town Boundaries, within the basin-shaped, central part of the Pictou Peninsula. It is presently comprised of five active pumping wells (No’s 8, 9 and 10, as well as Smith-Grant and Division Road wells). This comprises approximately 45% of the present total Town demand.

The Town Well Field is located within the Town of Pictou’s political boundaries. It is presently comprised of eight active pumping wells. They include Footes Lane, Public Works, Exhibition, Vance, M and M, Beeches Road, No. 11 and No. 12. All were constructed between 1942 and 1969, except for No.’s 11 and 12, which were brought on line in 1989 and 1996 respectively.

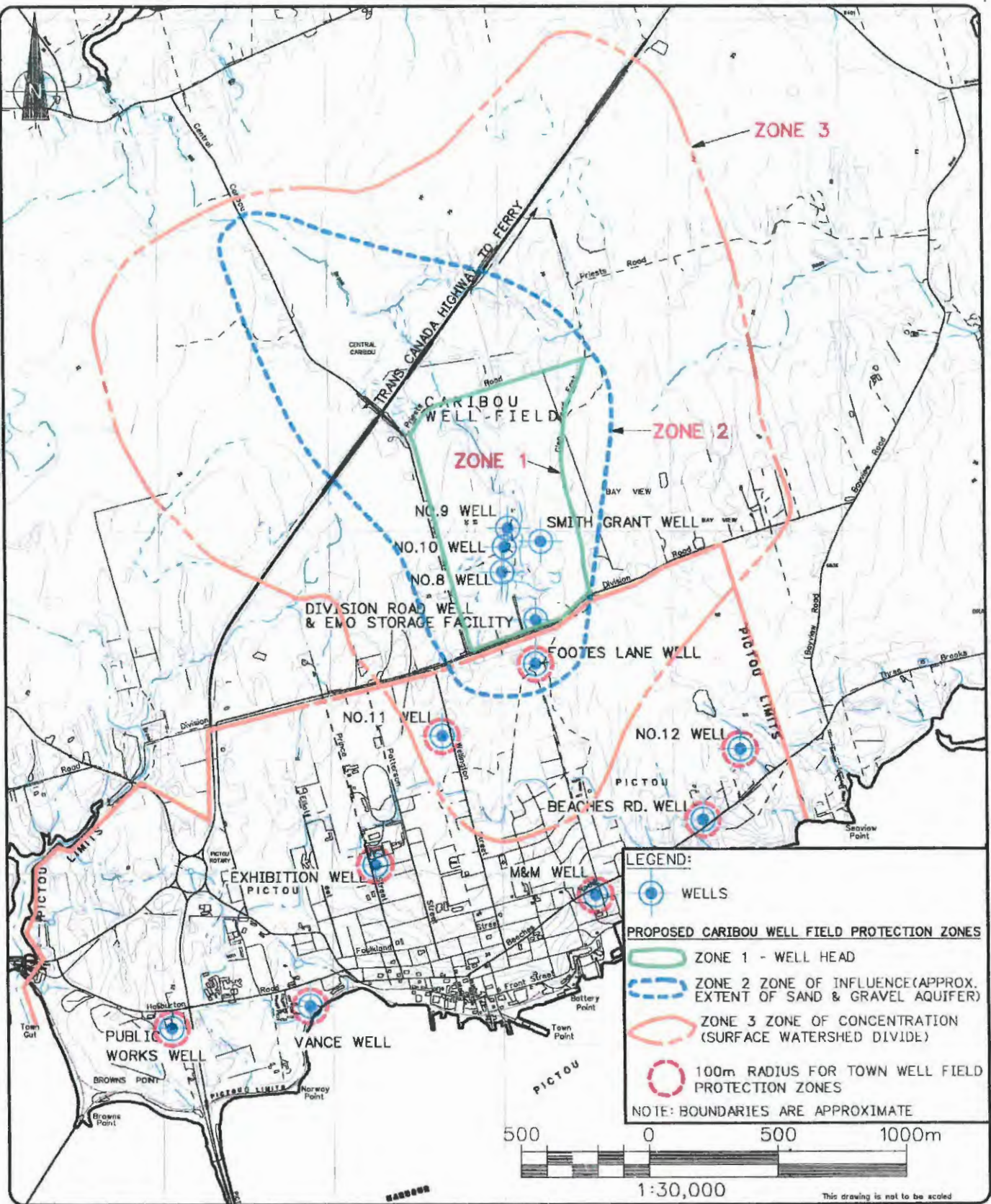
3.0 DELINEATION OF SOURCE AREAS

This section initially summarizes the present state of knowledge of the physical and chemical characteristics of the hydrological cycle within which the extractions are occurring; support documentation can be provided if so required. This forms the technical base upon which the delineation of Source Water Protection areas is based, as outlined in Section 3.2.

3.1 Conceptual Model for Ground and Surface Water Flow Fields

Climatologically, the area experiences a humid continental climate. A water balance analysis indicates slight water deficits in June, July and August, with moisture surplus creating Spring and Fall groundwater recharge periods. Longer term trends note gradual declining precipitation and elevated air temperature since the early 1990’s, suggesting less water available for recharge.

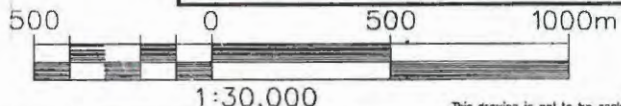
Physiographically, the Town and its well fields are located within the Pictou peninsula (Figure 1-1A), bounded to the northeast and south by salt water of the Northumberland Straits and Pictou Harbour.



LEGEND:

- WELLS
- ZONE 1 - WELL HEAD
- ZONE 2 ZONE OF INFLUENCE (APPROX. EXTENT OF SAND & GRAVEL AQUIFER)
- ZONE 3 ZONE OF CONCENTRATION (SURFACE WATERSHED DIVIDE)
- 100m RADIUS FOR TOWN WELL FIELD PROTECTION ZONES

NOTE: BOUNDARIES ARE APPROXIMATE



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Proj. TOWN OF PICTOU
 GROUNDWATER RESOURCE
 MANAGEMENT

Dwg. CARIBOU WELL FIELD
 PROTECTION ZONES - 2001

Drawn By: NEB	Proj. No. 3945-001.1
Dwg Standards Chk. By: FEB	Dwg. No. FIGURE 3-1
Designed By: FEB	Date Last Modified: 05.SEP.09
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Hydrogeologically, the Peninsula is positioned with a “Lowland Setting” consisting generally of a glacial till over bedded sedimentary rock. The Caribou Well Field extracts water from the Upland Aquifer Complex, combining both a surficial sand/gravel, as well as a bedrock aquifer. The Town Well Field draws water from the bedrock aquifer.

There are three Hydrostratigraphic Units (HUs), which control water flow to the well fields, including the Pictou (bedrock) HU, Sand and Gravel (S/G) HU and the Till HU. The Pictou and S/G HUs can be defined as a Class 1 Aquifers, utilizing NSDEL’s classification (Shawinigan Eng. Ltd., 1980). The Till HU is an aquitard, which semi confines the Pictou HU.

Hydrological analysis has keyed to the Caribou Well Field, given the surficial nature of the S/G aquifer, and its susceptibility to the introduction of contaminants from streamflow. A tributary of Mill Brook, identified as Beaton’s Brook, extends through the middle of the well field, draining from south to north. Of the four inflow streams, only one is perennial, primarily since it over lies the S/G aquifer, which provides base flow during the summer. All channels disappear upon entering the central core of the S/G aquifer in the lowland area surrounding the production wells, and continuing through almost to Priest Road. This is expected to be a function of recharge into the S/G aquifer.

3.2 Source Water Protection Areas

3.2.1 Approach

Delineation of SWP’s for a groundwater source requires detailed hydrogeological analysis of the aquifers transmissivity (T) and storage coefficient (S) in order to delineate drawdown cones and travel times. However, most of the production wells became operational prior to requirements for pump testing and cannot be turned off to allow for testing, due to demand on the system. Therefore, T and S values for every well are not available and delineation of Well Head Protection Zones based upon travel times is not possible. At this stage the conceptual/analytical model summarized in Section 3.1 has been used to aid in delineating protection area coupled with the Pre-Cautious approach; numerical modelling has not been incorporated to date.

3.2.2 Caribou Well Field

For the Caribou Well Field, a three zone WHPA was tentatively outlined utilizing existing information (Figure 3-1). Zone 1 (Well Head) was based upon existing roads, and the historical approach by the Town in acquiring land. Zone 2 (Zone of Influence) was based

upon the known limits of the S/G aquifer. Zone 3 (Zone of Contribution) was delineated using surface watershed boundaries.

3.2.3 Town Well Field

Three wells have been pump tested to date. Pump testing of No. 12 production well provided a T of 15 to 22 m²/d with a storage coefficient of 1×10^{-4} to 1×10^{-5} , representing a semi-confined aquifer with leakage. Assuming these values are representative of the Pictou HU, an average continuous pumping rate over 30 days of 250 to 295 Lpm creates a 1 metre drawdown some 3 km radius from the pumping well, assuming equivalent porous media approach applies. At the 100 metre radius, drawdown is in the order of 1.5 to 5 metres. The 100 metre radius has been applied to each well to delineate Zone 1 of a WHPA, the extents of which is shown on Figure 3-1. Zone 2 and 3 would be encompassed by the 3 km radius. It was this zone that an intensive study was undertaken to assess land use and potential sources of contamination.

4.0 RISK IDENTIFICATION

4.1 Caribou Well Field

Review of aerial photographs and field assessment of WHPA Zone 1 identified a number of potential risks as summarized below and on Figure 4-1.

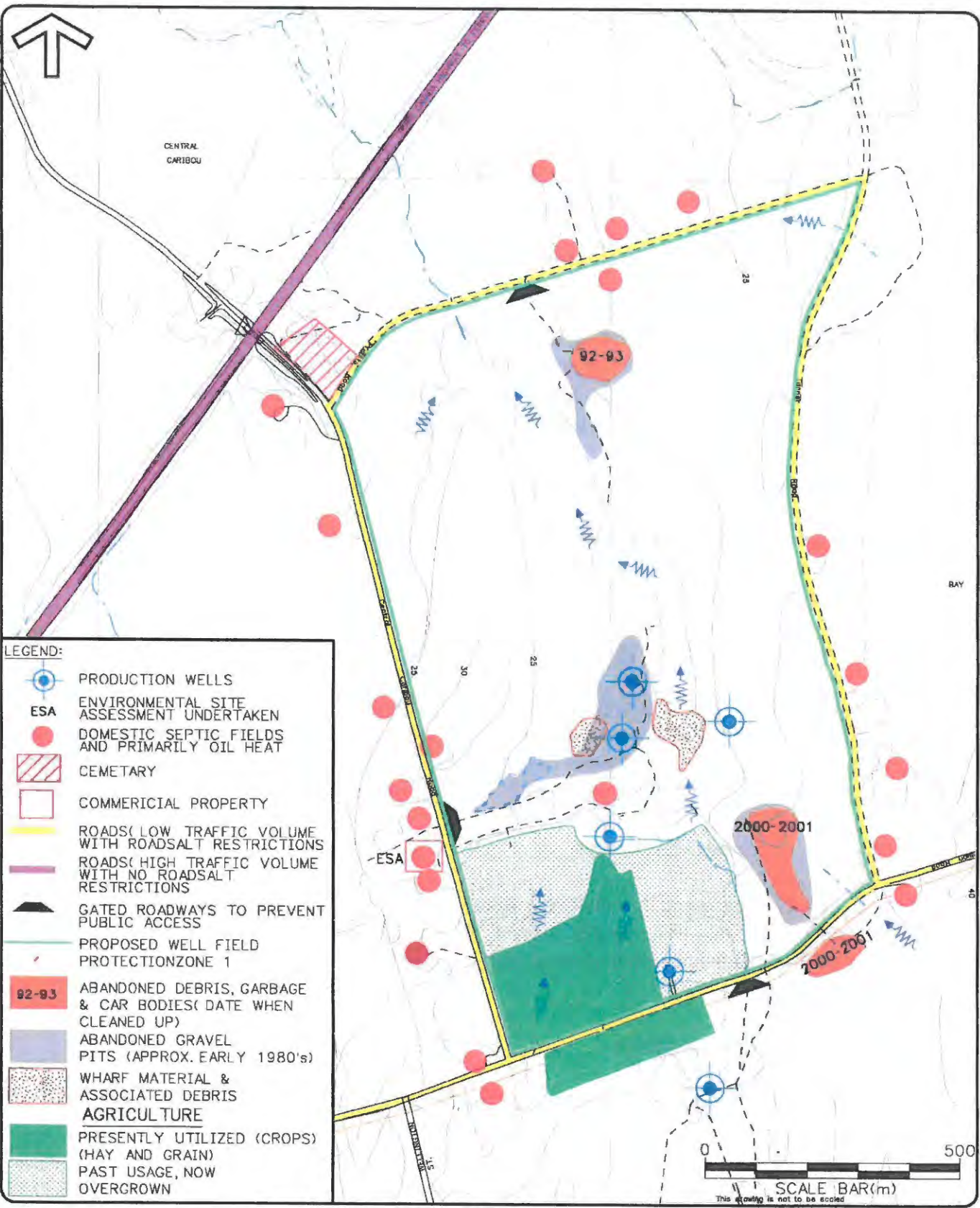
4.1.1 Sand and Gravel Pits

Extraction of sand and gravel for aggregate from the S/G HU in the southeast corner and north boundary occurred historically from the early 1900's until the late 1970's. Although operations have ceased, indiscriminate disposal of various municipal wastes and auto bodies has sporadically continued to present. In 1985, the Town barricaded all access roads into Zone 1. Debris was gradually removed from 1987 to present and continues as necessary.

4.1.2 Waste Disposal

In approximately 1959, burnt creosote timbers from a fire on the Pictou Wharf were disposed of in the core of the Well Field, adjacent to Production Wells No.s 9 and 10. Concern expressed with leaching of PAHs into the S/G HU prompted NSDEL to undertake an investigation; sampling indicated no problems were being created. Monitoring wells were installed within the S/G HU between the disposal area and the wells by the Town in 2000.

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- LEGEND:**
- PRODUCTION WELLS
 - DOMESTIC SEPTIC FIELDS AND PRIMARILY OIL HEAT
 - CEMETARY
 - COMMERCIAL PROPERTY
 - ROADS(LOW TRAFFIC VOLUME WITH ROADSALT RESTRICTIONS)
 - ROADS(HIGH TRAFFIC VOLUME WITH NO ROADSALT RESTRICTIONS)
 - GATED ROADWAYS TO PREVENT PUBLIC ACCESS
 - PROPOSED WELL FIELD PROTECTIONZONE 1
 - ABANDONED DEBRIS, GARBAGE & CAR BODIES(DATE WHEN CLEANED UP)
 - ABANDONED GRAVEL PITS (APPROX. EARLY 1980's)
 - WHARF MATERIAL & ASSOCIATED DEBRIS
 - AGRICULTURE PRESENTLY UTILIZED (CROPS) (HAY AND GRAIN)
 - PAST USAGE, NOW OVERGROWN



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Proj.	TOWN OF PICTOU GROUNDWATER RESOURCE MANAGEMENT
Dwg.	CARIBOU WELL FIELD-ZONE 1 INVENTORY OF POTENTIAL CONTAMINANT SOURCES AS OF AUGUST 2001

Drawn By:	NEB	Proj. No.	3945-001.1
Dwg Standards Chk. By:		Dwg. No.	FIGURE 4-1
Designed By:	FEB	Date Last Modified:	05.AUG.25
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There was no visual or analytical evidence of PAHs. Some of the surficial materials were removed by the Town in 1998.

4.1.3 Septic System

One septic field is present for the Fraser household in proximity to the No. 8 Production Well. The Town removed the old tank/field bed system and installed a new approved system at its expense during the summer of 2001. One septic bed is in use just north of the gated roadway along Central Caribou Road. This private residence has its own well and the Town has no access to validate the condition of either.

4.1.4 Abandoned Wells

The Town located and securely capped all of the known test holes and monitoring wells from previous hydrogeological investigations. This was to prevent contamination from entering the aquifer by transmission through open abandoned wells and deteriorated casing

4.1.5 Domestic Dwellings

A total of 38 private lots are present in Zone 2, but immediately adjacent to Zone 1. Each home is supported by its own drilled well water supply utilizing primarily the Pictou HU and on-site septic systems. Of these, 22 have been identified as of primary or secondary priority for Environmental Site Assessments (ESAs) to document past and present activities.

4.1.6 Agricultural Activities

Land use is present in the southwest corner of Zone 1, adjacent to Division Road and No. 8 Production Wells. The land is utilized for crop production utilizing standard acceptable agricultural practices. Manure spreading is not undertaken within 150 metres from each well head.

4.1.7 Forestry Activities

The forest within Zone 1 has been extensively harvested in the past. While little harvesting work has been conducted within the past 30 years, a significant amount of wood was harvested by clear cutting 20 to 40 years ago, for forestry as well as sand and gravel extraction. The abandonment of the latter since the 1970's has resulted in the regeneration of stands of pioneering species such as white birch, grey birch, poplar, white spruce, eastern larch (tamarack) and alder, generally with a high hardwood component. The abandonment

of agricultural land has also contributed to development of similar stands of pioneering species, usually with a greater softwood component.

4.2 Town Well Field

Since the wells are spread far apart, an investigation was undertaken within the 100 metre radius of each site to identify risk factors. To date, four well sites have been assessed as summarized below. Investigations are on-going for the remaining four sites.

4.2.1 No 12 Production Well

The pump house is on land owned by J.R. MacDonald of Far East Construction with the well parcel under easement to the Town.

There are four residential lots within the 100 metre radius of the well. There are no records of homes or subsurface facilities dating back at least to 1970. A quarry is present 300 metres north of the well used in the past to extract building stone, it is presently abandoned. The base of the quarry drains to the southeast corner, where a pond remains during dry periods some 320 metres from the well.

It would appear that most of the properties were wooded prior to construction of the homes, therefore, historical land use issues do not appear to present an issue of concern.

Garbage was noted scattered throughout all properties including car parts, beer bottles, cans, scrap metal and miscellaneous items. There is a small amount of household garbage in the northeast corner of the quarry; garbage has been removed in the past. Two power poles exist at 60 and 120 metres south from the well that have been treated with tar.

Two homes apply manure to their gardens some 110 to 130 metres from the well but do not use pesticides/insecticides/herbicides. Annual use of "roundup" as a lawn application was confirmed on one property, as well as use of a compost pile 125 metres from the well.

All homes are on individual septic tanks/fields at distances of 90, 125, 130 and 140 metres from the production well, primarily down-ground-surface gradient. The systems are older than 30 years; maintenance is unknown. Two of the homes are heated with oil and have on-site storage tanks. No chemicals are stored at any of the sites. Each dwelling has at least one abandoned water well, not in use since central water was brought in; one house has three wells. None have been abandoned according to well construction regulations. Negotiations are on-going with homeowners to ensure compliance.

A major transportation corridor, Beeches Road, is present 160 metres downgradient, which is salted.

4.2.2 No. 11 Production Well

This well is located in a rural residential area, just west of Wellington Street. There are no homes within the 100 metre radius of the well. The Town owns the building lot around the pump house encompassing approximately 0.39 hectares.

There are five nearby lots, two of which are empty. The land directly north and south of the well is vacant residential property. No historical land use was documented for the last 20 years, although 1971 aerial photos indicate land was used to grow hay. There are no surface or subsurface facilities (i.e., storm/sanitary sewers, power/communication lines) adjacent the site.

All lots within a 100 metre radius are in the R2 Zone, rural residential. There are few restrictions on land use activity, i.e., permitted to keep agricultural animals if this is subordinate to residential use. However, the land to the east across Wellington Street is the H₂O Zone which has more restrictions.

One house nearby is heated with oil; pesticides/insecticides/herbicide or fertilizers are not used. The house is on a septic system installed in 1979 less than 100 metres from the well; maintenance of the system appears to be poor. At least two abandoned wells are in the vicinity. One rusted vehicle full of garbage is within 70 metres of the pump house.

The site lies between Patterson and Wellington Streets some 280 and 110 metres respectively from the well head; both are paved and salted with no curb/gutter. They are not used for transporting goods, the only transport truck traffic would be for local oil supply.

Surface facilities include two power poles 17 and 90 metres from the well.

4.2.3 Beeches Road Production Well

The Town owns a rectangular area around the pump house of approximately 0.25 hectares, positioned adjacent Beeches Road. The next closest street is Sea Birch Drive, a residential road 160 metres directly north and upgradient.

Most of the lots within a 100 metre radius of Beeches Road well are in the R1 Zone, residential. There are more restrictions on land use activity in the R1 zone versus R2, i.e.,

not permitted to keep agricultural animals even if this is subordinate to residential use. Other zones in the proposed protected area are W-waterfront and R2. Currently, there are no by-laws protecting the wells in town. There are no restrictions in the entire town on pesticide/herbicide/insecticide use.

The well is located in a residential area. There are nine residential homes and a golf course within the 100 metre radius. Previous land use noted farming in the area. The homes are located between 50 and 160 metres from the well head. All are on Town water and sewer but some are expected to still have remnants of old well and septic systems. With the exception of one, all are heated with oil. There is no recorded residential use of pesticides/herbicides/insecticides; some use compost piles. There is no known chemical storage.

The club house for a golf course is 375 metres from the well head, with the course used since 1922. It operates off its own 63 metre deep well and on-site septic system; with oil used for heating. Herbicides/pesticides and fungicides are applied twice per year on greens and fairways. Runoff from the course comes within 100 metres of the well, and considering surface gradients, will run to Pictou Harbour.

The pump house is 3.8 metres off Beeches Road, which is paved with no curb/gutter and large ditches on each side of the road. It is a main road with relatively a large amount of traffic, but is not used for transporting goods.

A small first order stream runs within metres of the well head draining south into Pictou Harbour.

Garbage was noted scattered throughout the woods, including car parts, beer bottles, cans, scrap metal, etc.

4.2.4 M and M Production Well

The pump house is located in a residential area off Beeches Road along Union Street. The Town owns a small rectangular area around the pump house.

There are 23 residential homes within the 100 metre radius of the well. Most of the lots within the 100 metre radius are in the R1 Zone, residential. Other zones are I - Institutional and C2 - neighborhood commercial. Most lots have small wartime houses built in the early 1940's, all have been connected to town water and sewer. Most are heated with oil. No pesticides/herbicides/insecticides are used; there is no known chemical storage.

Beeches Road (some 30 metres upgradient of the well) has moderate traffic, but not used for transporting goods. Union Street may be a route for shipping supplies to the shipyard and servicing oil tanks. Both are salted.

The pump house is surrounded by a parcel of land owned by East End Grocery Store, which has been in operation since the 1940's. The building is 10 metres upgradient from the well with a rental unit upstairs and a hairdressing shop next door. The building is heated with oil, pesticides, etc., are not used, no chemicals are stored.

An existing storm drain and sewer line are positioned 90 and 60 metres from the well head respectively.

The new DND facility just south of the well head was constructed in 1992. An environmental site assessment prior to construction noted no contamination. Surface run off from the parking lot is controlled by curb and gutter and discharges to the existing Town storm drain system. The facility is heated by oil with a state-of-the-art, outside tank facility.

5.0 SOURCE WATER PROTECTION STRATEGIES

A total of 14 strategies have been developed to manage the risks outlined above, including:

- Land Use Planning
- Emergency Response
- Land Acquisition
- Forestry Management
- Inspection/Enforcement
- Building/Maintaining a Database
- Ecosystem Approach
- Public Education
- Counter Terrorism
- Road Maintenance
- Planning for Impact of Climate Change
- Personnel and Training
- Demand Side Management
- Best Management Practices

A summary of each is provided below, details can be provided for regulatory perusal only, if so required.

5.1 Land Use and Planning

The goal of land use planning was taken as the development of a practical, cost-effective means of managing land use activities within the Town of Pictou's well fields, to ensure the long-term viability of the water supply.

In so doing, it is recognized that since some of the land is privately owned, this will require balancing the rights and responsibilities of private citizens and Municipal Governments with the long-term costs and benefits of an uncontaminated water supply. As more data become available in the future, it may be possible to reduce any constraints while maintaining the same risk. In essence, science will never know all there is to know. Rather than allowing the unknown or uncertainty to paralyse us, we must apply the best of what we know today and at the same time be flexible enough to allow for change and for what we do not yet know.

5.1.1 Caribou Well Field

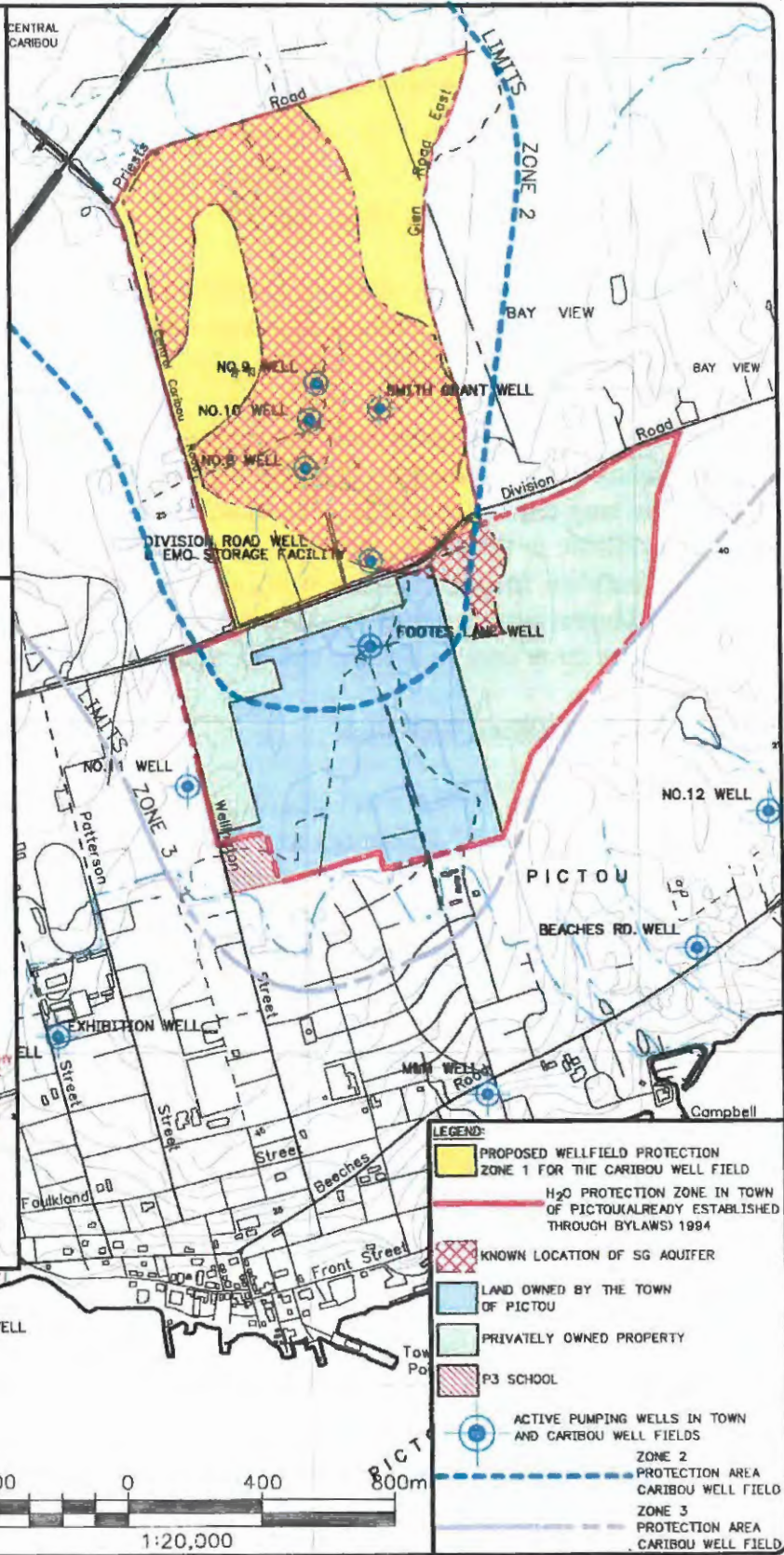
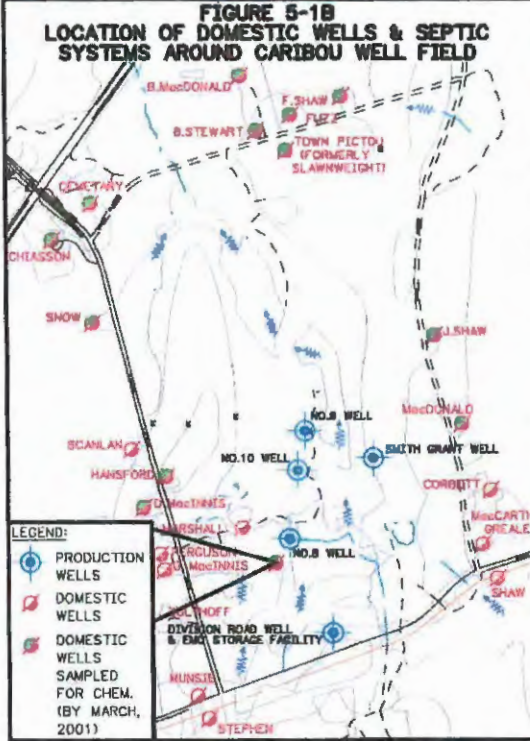
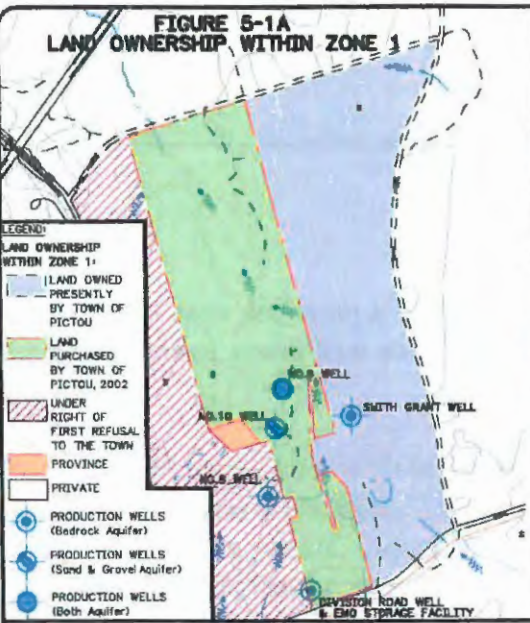
A three zone WHPA was tentatively outlined (Figure 3-1), including Zone 1 (Well Head), Zone 2 (Zone of Influence) and Zone 3 (Zone of Contribution). This was based upon protecting the Caribou aquifer, rather than a residence timing around a well head. A listing of "permitted uses" and "constraints" was developed for 10 land use activities within Zone 1 including: Residential/Industrial/ Commercial and Institutional, Waste Disposal, Agriculture, Forestry, Transportation/Power/Communication Corridors, Mining/Pits/Quarries, Pest Control Products and Biocide Restrictions, Soil Erosion and Sedimentation Control, Cemeteries and Recreational. Uses and constraints within Zones 2 and 3 were to be governed by existing County, Provincial and Federal Regulations.

Aquifer monitoring suggests no noticeable impact of operational pumping of the Caribou Well Field in either the bedrock or S/G aquifers along the outer ring roads, where the domestic wells are located (Figure 5-1B). Therefore, the well field extraction is not mining the resource.

5.1.2 Town Well Field

A portion of the Town is still predominately under rural land use. An H₂O Protection Zone (Figure 5-1) was established in this area by the Town Council, then approved by the Minister in June 1994. Zoning By-laws were developed to protect the groundwater resources by placing constraints on land use within this zone. As noted in Figure 5-1, the H₂O zone also protects that portion of Zones 2 and 3 for the Caribou Well Field, which are positioned within the Towns' political boundaries.

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Dwg. WELLFIELD PROTECTION
 ZONES

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Dwg Standards Chk. By: FEB	Dwg. No. FIGURE 5-1
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Over the last decade, work has gradually been undertaken to provide additional land use protection. Starting in the summer of 2001, production well sites had begun to be inspected to develop short and long-term protection strategies.

5.2 Best Management Practices

On privately owned land, the Town will suggest, demonstrate and, where necessary, financially support the use of Best Management Practices, as exemplified by activities in the Caribou Well Field.

1. For homeowners who agreed to support the request for designation, the Town Council agreed to share the costs of required upgrades in fuel storage, on-site septic disposal and other matters on a 50% basis to a total of \$2,500.00 per home.
2. Upgrades to the on-site septic system on the Fraser property were paid for by the Town. In addition, a new fuel containment structure was installed at the Town's expense.
3. An ESA was carried out on the former North Shore Ballast property in proximity to Production Well No. 8.
4. A total of 13 domestic wells surrounding Zone 1 have been sampled for inorganic water chemistry at least once, at the Town's expense.
5. Agricultural land use is present in the southwest corner of Zone 1 WHPA for the Caribou Well Field adjacent to Division Road and No. 8 Production Wells. The land is utilized for crop production. Discussions with the farmer in 2001 resulted in his acceptance not to spread manure within 150 metres of the two wells.

To demonstrate the Town's willingness to meet its own targets imposed on private citizens it has undertaken upgrades in areas it has responsibility for, as exemplified by work undertaken to date in both well fields:

Exhibition Well: A nearby sewer line was upgraded to ensure no leaks could occur in close proximity to the well head. An open ditch was collected with piping to divert road wash runoff to a location 65 metres northwest of the well head.

Public Works Well: Underground oil storage tanks were removed and changed to aboveground systems. A french drain system was installed to divert chlorides and/or oil away from the well head. The salt storage was placed on an asphalt pad.

Vance Well: A new service line was installed in 1991, just north of the well head. An abandoned septic field bed at the former Odd Fellows building was abandoned and connections made to a new sewer in 1995.

The Caribou Well Field: The Town located and securely capped/abandoned a number of test holes and monitoring wells installed during previous hydrogeological investigations to prevent aquifer contamination.

5.3 Emergency Response Plan

As a part of the Town's Emergency Response Plan, a number of procedures and equipment have been put in place to enable Town staff to quickly respond to accidental spills that could potentially affect the production wells.

In summary, these activities include storage of "soak-up" products and disposal bags at selected well sites, as well as information on well sites and contact numbers distributed to local petroleum delivery vehicles. The Town's Public Works Department is equipped with a vacuum operated sucker truck to lift and remove any floating products. Water Utility staff are trained in Transportation of Dangerous Goods to ensure their ability to react in the appropriate manner in event of a spill. The Watershed Emergency Response Plan will become part of the Emergency Measures Organization Response Plan for the Town of Pictou and the Municipality of the County of Pictou.

5.4 Counter Terrorism Plan

Given the results of September 11, 2001 counter terrorism plans have been formulated to assess the risks to all three attributes crucial to water supply, namely: quantity of water on demand, delivered at sufficient pressure and safe for any use. Presently, the utility is assessing its vulnerabilities and prioritizing them for necessary security improvements.

Overall, a groundwater supply is more difficult to contaminate, given its slow transport rate and natural attenuation. All well heads are enclosed in locked structures and checked daily by Town personnel. Additional activities have been put in place, or are under development, but are not for discussion in a public environment.

5.5 Land Acquisition

5.5.1 Caribou Well Field

The Town purchased the land on which the former well-vacuum system was situated between 1907 and 1916. Arrangements were made with the major land owner within Zone 1 of the WHPA for this Well Field to purchase their land when it became available.

In 2001, the Town purchased one 1.34 hectare property within Zone 1 and in 2002, acquired 19.87 hectares. Figure 5-1A outlines the 68% of Zone 1 presently owned by the Town. The additional land is under right of first refusal for the Town.

Production Wells No. 9, 10 and Division Road are located on land purchased by the Town in 2002. Production Well No. 8 is on land for which rights for water were purchased from the Fraser Estate on September 12, 1907.

5.5.2 Town Well Field

A H₂O Protection Zone was established within a portion of the Town limits in June 1994. It encompasses a portion of the Town boundaries still under predominately natural land use, effectively covering the topographic high, or groundwater recharge area for the Bedrock aquifer underlying the Town itself.

In 2001, the Town purchased an additional 18.5 hectare piece of property within this zone to provide additional protection. Figure 5-1 outlines the 47.5 hectare or 52% of the H₂O area now owned by the Town. In the summer of 2005, the Town acquired an additional 2.17 hectares, not shown on Figure 5-1.

The Zone encompasses, however, only one of the production wells, Footes Lane. A very small portion of land around each of the other Town well heads is owned by the Town, the rest is privately owned. There is no intention at this stage of purchasing additional land around each until the results of the GUDI testing and assessment of the new production well are known.

5.6 Road Maintenance

Consultation between the Pictou Water Utility and Nova Scotia Department of Transportation and Public Works has lead to cessation of the use of highway salt on Division Road for one kilometre east and west of the Caribou Well Field. This also included Central Caribou Road

along the west boundary. The other two boundary roads are gravelled surface and not normally salted. Dust suppression products are discouraged on secondary gravel roads within the Caribou Well Field

The Town has agreed to maintain the access road (private lane) into the Caribou Well Field to ensure that non-contaminated products are used for road maintenance work.

Illegal dumping and quarrying sites along woods roads within the Caribou Well Field have been curtailed by preventing access. Off-road motorized recreational vehicles will be prohibited on Town owned lands and discouraged within the Caribou Well Field's WHPA Zone 1.

Risk identification (Section 4.0) noted numerous paved roads surrounding most of the Town wells. Discussions are presently on-going to determine how best to address road salting and road wash runoff to storm sewer issues.

5.7 Forestry Management Plan

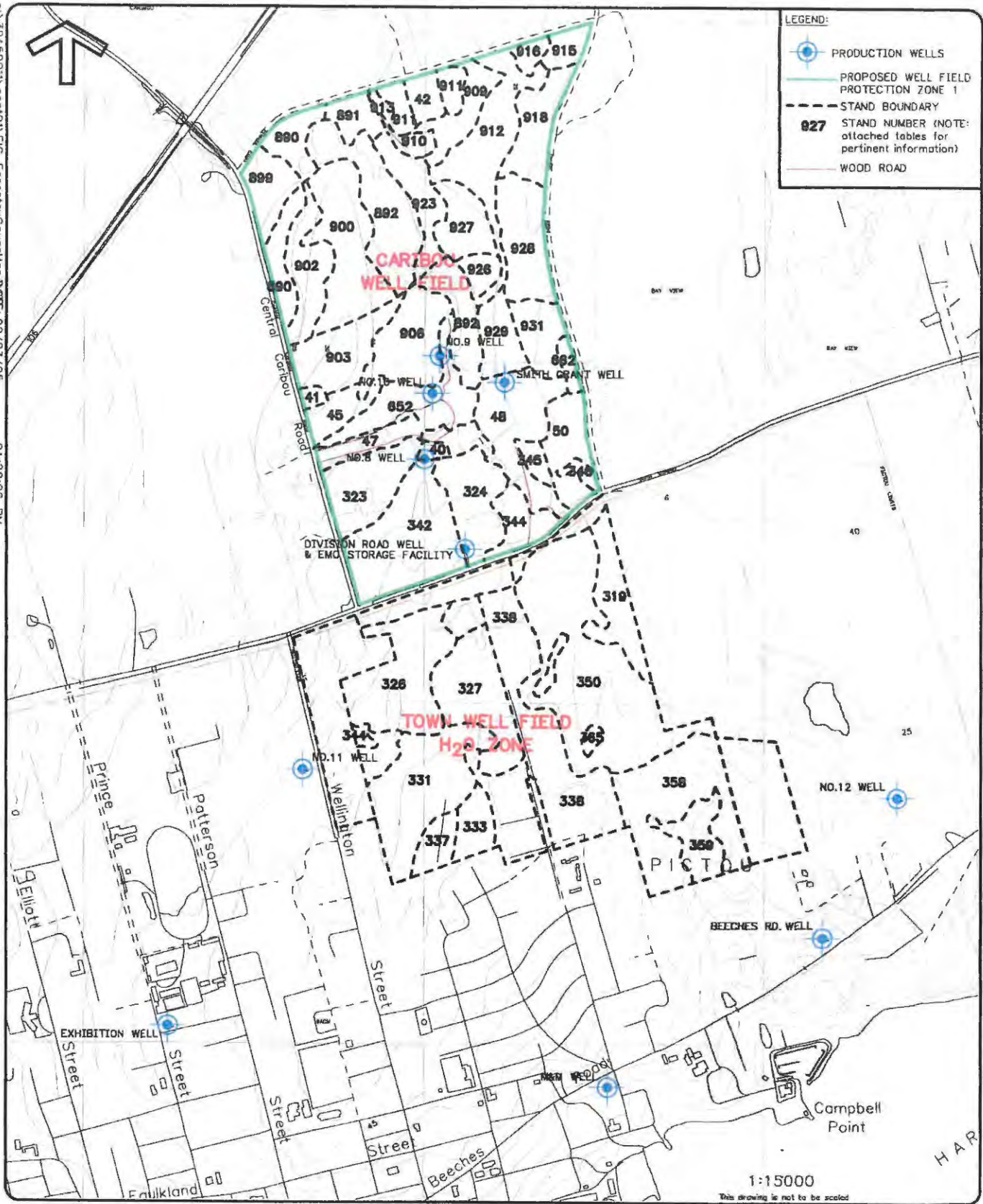
Century Forestry Consultants Ltd. was contracted by the Town to develop a Forestry Management Plan for Zone 1 of the WHPA area of the Caribou Well Field and the H₂O Zone within the Town boundaries (Figure 5-2). The following forms a summary of the reports. Details are available for the regulators upon request.

5.7.1 Caribou Well Field

The block contains approximately 126 hectares in total. The area is occupied by 104 hectares (82%) forested land and 22 hectares (18%) non-forested. The most dominant cover types within the block are mixed wood and softwood, which each comprise 29 hectares. Hardwood cover types make up the next most significant portion of productive forest at 23 hectares or 18% of the landmass. There is a significant proportion of non-productive forest land within the block at 23.5 hectares or 19% of the landmass. Agricultural land covers 19 hectares (15%) and residential lands occupy 3 hectares (2%).

Very little in the way of serious insect and disease problems or blow down were found throughout the block.

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Dwg. FORESTRY COVER MAP

Drawn By: NEB	Proj. No. 3945-001.1
Dwg Standards Chk. By:	Dwg. No. FIGURE 5-2
Designed By: FEB	Date Last Modified: 05.AUG.26
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5.7.2 Town H₂O Zone

The plan includes approximately 73 hectares containing the Town's H₂O Zone along with a small portion outside of the zone. The area is split in ownership between the Town (41 hectares) and a private woodlot owner (32 hectares). The land base of this block is occupied by 57.5 hectares of forested land (78%) and 11 hectares of abandoned farm land (22%).

Forest cover types are divided into softwood, mixed wood and hardwood. Hardwood occupies the largest portion of the forest at 29.5 hectares (51%), followed by mixed wood cover types at 19 hectares (33%) and softwood at 9 hectares (16%). Immature stands make up the largest portion (40%) and occur on Town owned land. Regenerating stands cover 30% as a result of a recent harvest on privately owned land. There are no over mature stands. Very few serious insect or disease problems were encountered throughout the block.

5.7.3 Management Plans

The basis of the Forestry Management Plan is the understanding that the forest is a dynamic entity, continually changing as trees grow and die with the overall structure of the forest evolving through a number of stages. Because the forest is dynamic, it must be continually monitored for changes which have occurred as a result of significant influences, often unpredictable in nature.

The operators of the plan must be committed to acting decisively when the need arises, while staying the course on the overall plan, its long-term principles and goals, and its short-term objectives. If the management principles, management recommendations and the operating recommendations are followed, it is possible to conduct forestry activities while protecting the Town's most valuable natural resource - its water supply.

Put in the context of strategic planning, long-term management principles and goals must support the mission of maintaining water quality and quantity. A total of four Management Principles and 26 Management Recommendations and six Operating Recommendations based upon Best Management Practices of the day were outlined to guide decisions that affect the future structure of the forest by guiding (limiting and encouraging) activities conducted on the ground. The Principles are summarized below.

***MANAGEMENT PRINCIPLE 1.0** - Forest related activities should encourage the establishment and growth of long-lived species such as red spruce, white pine, eastern hemlock and red oak.*



MANAGEMENT PRINCIPLE 2.0 - Forested areas should maintain a tree cover of not less than ten (10) feet in height and not less than fifty (50) percent stocking.

MANAGEMENT PRINCIPLE 3.0 - The forest should be maintained in a healthy, actively growing state.

MANAGEMENT PRINCIPLE 4.0 - Forestry activities should be conducted so as to minimize disturbance or pollution to the forest floor and the underlying soil.

5.8 Adaptation for Climate Change

At present, the operational concept in how the utility is adapting to climate change is to assume the climate is warming, whether due to man-made and/or natural factors. The results will be seen more in terms of extremes, i.e., floods, droughts.

The actual impact of this change in climate on groundwater resources is less clear. Baechler (2003) noted that deep groundwater supplies were less susceptible to on-going changes in climate over the last 15 years than surface waters.

The nearest Environment Canada Climate Stations most representative of the well field were selected in consultation with personnel of the Atlantic Climate Centre. These were determined to be Lyons Brook and Caribou.

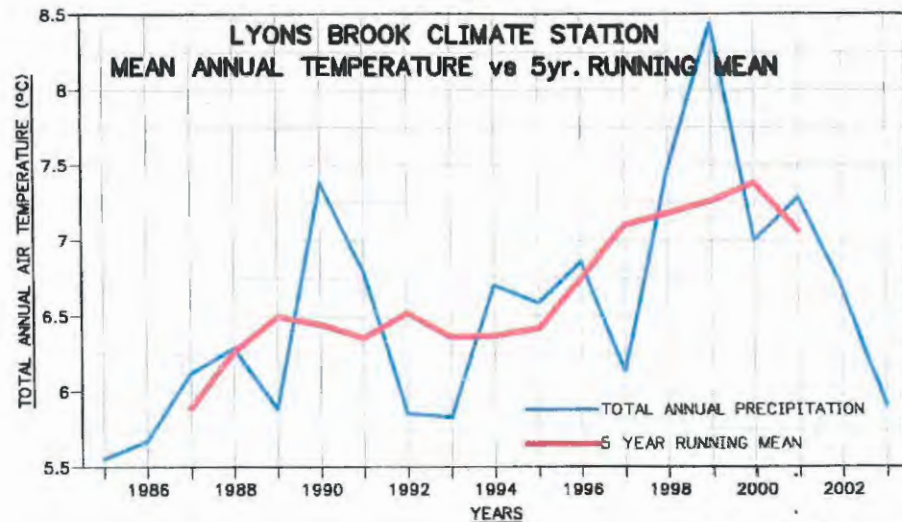
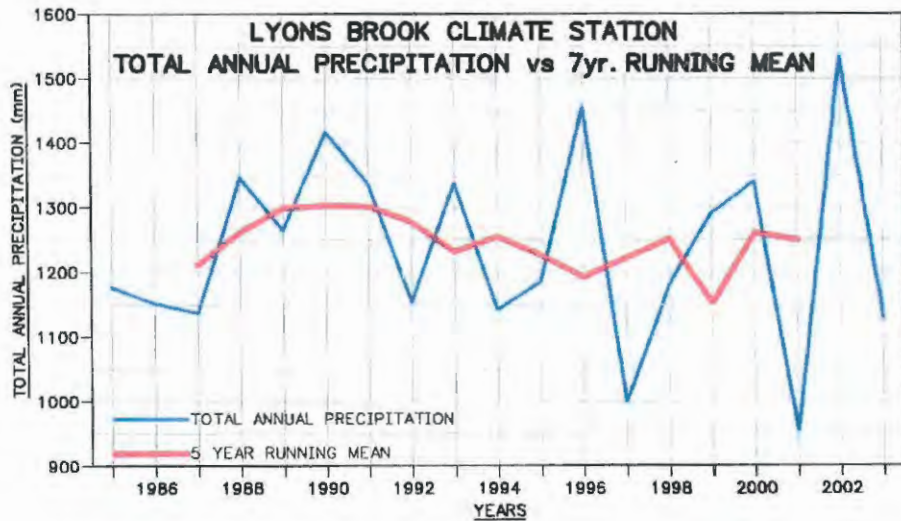
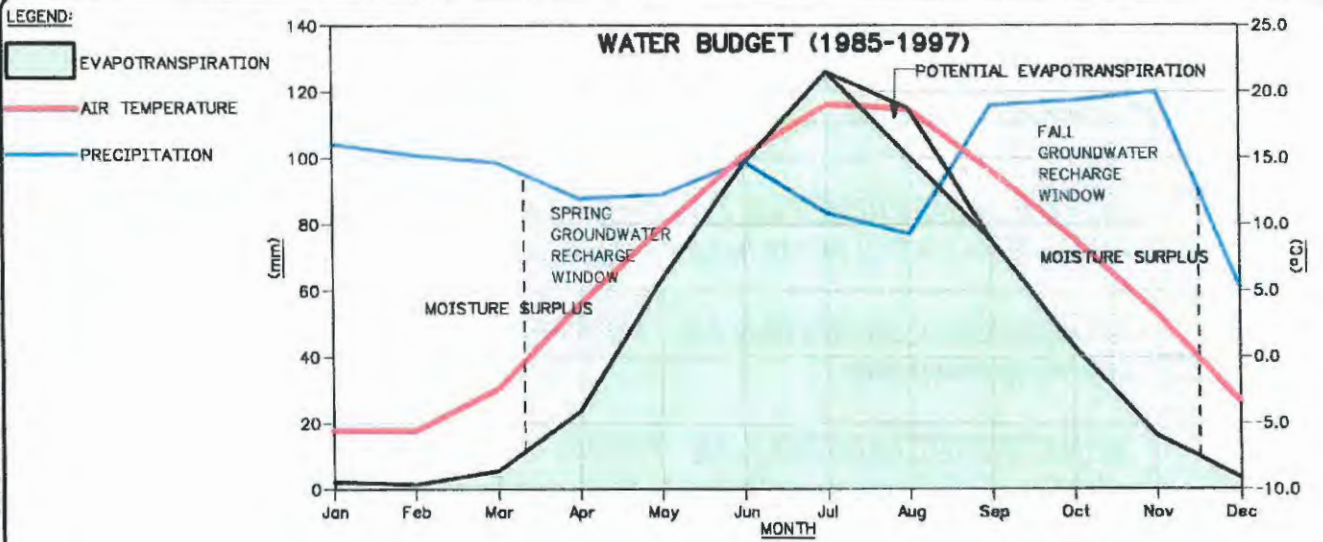
Since 1998, the Town received the data on a monthly basis to assess monthly and seasonal trends in precipitation and temperature. Longer term trends have been established by updating a moving decadal analysis (Figures 5-3). To date the “warm” years experienced over the last portion of the 1990's have resulted in declining precipitation and rising air temperature.

The Atlantic Climate Centre was also requested to undertake a water balance analysis to better define Fall and Spring Groundwater recharge periods (Figure 5-3).

To quantify the impact of climate change on groundwater resources within the two main aquifers, two automated groundwater level recorders have been installed to monitor changes in head levels (Figure 5-4). No large scale long-term trends are apparent in the data to date.

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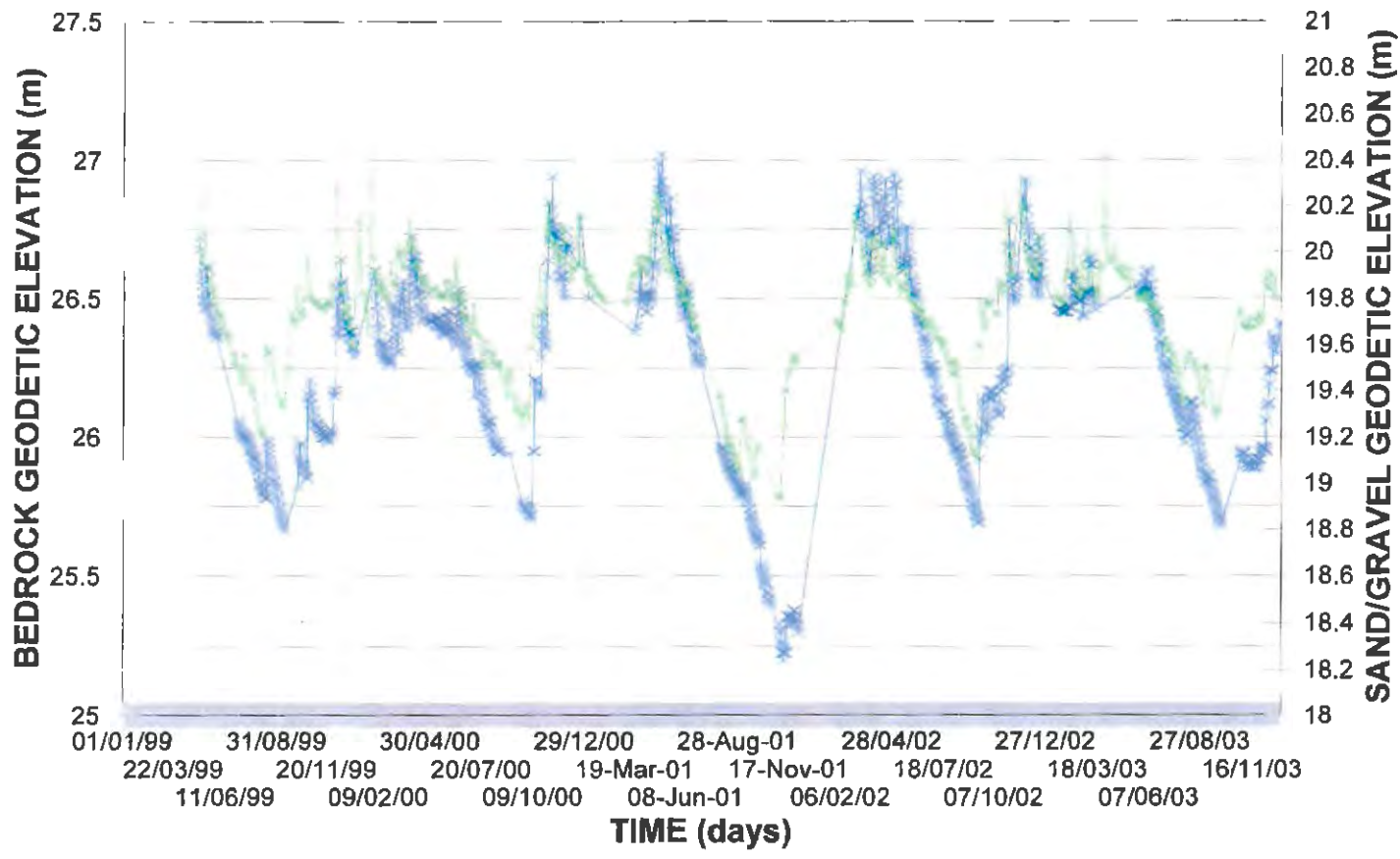
ADI [®] ADI Limited
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 Port Hawkesbury, St. John's, Fredericton and Salem, NB

Proj. TOWN OF PICTOU
 GROUNDWATER RESOURCE
 MANAGEMENT

Dwg. CLIMATIC TRENDS
 AND WATER BUDGET

Drawn By: NEB	Proj. No. 3945-001.1
Dwg Standards Chk. By:	Dwg. No. FIGURE 5-3
Designed By: FEB	Date Last Modified: 05.SEP.09
Design Chkd. By: FEB	Last Modified By: NEB
	Rev. 0

**FIG.5-4: 5 YEAR HYDROGRAPH
BEDROCK and SAND/GRAVEL AQUIFERS**



Bedrock Aquifer Sand/Gravel Aquifer

5.9 Public Education Program

Given the critical nature of the groundwater resources and the importance of public education and consultation, a range of activities have been on-going since 1991.

In 1996, ADI and Town staff held a public open house to provide the residents with detailed information about groundwater in general, and about the development of the aquifer in the immediate Caribou Well Field area. Prior to this Public Open House, the Town notified all affected landowners again by letter and advertised in the Pictou Advocate newspaper of this "Open House" information session. Seventeen interested persons attended. A second, well publicized open house was held on March 13, 2000, less than five people attended.

Meetings were held twice with the owners of the Fraser property, located in the middle of the well field during 1999 and 2000 to discuss the proposed land use guidelines and their impact on them. Modifications were made to the plan to accommodate some of their concerns. Town representatives presented information on preliminary land use constraints to a public open house on December 6, 2000. Town representatives met with the core of the Caribou Well Field Community Ad Hoc Committee on Land Use in February 2001.

A continuous display of educational information on the Town's water supply and water related issues was established, and made available to the public. The Director of Public Works continues to discuss the well field and the groundwater aquifer in this area with any interested persons

5.10 Inspection/Enforcement

Staff visit each production well site daily to record production and inspect for security violations. A weekly inspection of the perimeter of the watershed is undertaken to note any unauthorized use of Town lands.

For those private lands, especially in the County, the Town strongly believes it is the responsibility of the NSDEL to undertake a weekly to bi-weekly inspection visit of lands within WHPA Zones 2 and 3 for the Caribou Well Field and enforce existing environmental legislation as required.

5.11 Development of a Hydrogeological Model for the Well Fields

The Town has committed to acquire and fund the collection of additional technical information on the ground and surface water resources forming the Well Fields and



Protection Zones. These data have been used to continually update the database and refine the hydrogeological model. This allows for a more comprehensive understanding of the occurrence, quantity and quality of the water resources. When sufficient data has been collected to form a satisfactory conceptual model, consideration will then be given to development of a computer numerical model for the groundwater flow field, the impact of the pumping wells and groundwater stream interaction.

The intention is to undertake affordable, practical program each year over the long-term to obtain information pertinent to answering specific operation/protection issues as they arise. The overriding concept is "It is difficult to protect what you don't understand".

This commitment includes the hiring of a summer student each year to aid in these investigations, while providing practical experience to upcoming qualified students.

5.12 Building and Maintaining a Database

A computerized map of the well field and environs has been established by ADI using MICROSTATION. The base was developed with existing LRIS digital mapping at a scale of 1:10,000. This base allows for development of the technical figures presented in this report, as well as large scale colour overlays for public presentation.

Information being collected on wells, GUDI, chemistry, etc., is entered into EXCEL spreadsheets, which are being maintained at two sites to prevent loss of data. This database includes information such as water levels, water chemistry, pumping rates and volumes, streamflow, subsurface lithographic logs, etc. This forms the basis for presenting updated information in the annual reports to NSDEL.

5.13 Demand Side Management

The Town recognizes that Demand Side Management (controlling demand) is as important as Supply Side Management (finding new water sources) in managing its water supply. This not only reduces the demand on the system, but also supplies additional revenues to undertake additional monitoring and investigations as so required.

A recent investigation on usage in the Town by ADI noted that the average residential water consumption in Pictou is high, with a residential usage of approximately 380 litres/person/day. This is compared with average Canadian residential water demands in 1996-1997 of 72 to 76 litres/person/day. The Atlas of Canada reported in 1999 that average per capita water demand in Nova Scotia ranged from 160 to 320 litres/person/day.

Domestic users are presently unmetered. There are 1251 such users currently being charged a quarterly rate of \$41.25. Schools pay \$291.50 per quarter. A total of 116 commercial services are metered based upon service size. A total of 16 sprinkler systems are billed at \$110/yr. The above rates were set out and agreed to by the Board of Public Utilities as of January 1, 1986. Recently the Town has made a submission to the Board for a new rate structure based upon domestic metering.

5.14 Ecosystem Approach

A relatively new system is being employed in source water protection in specific Ontario communities identified as the Ecosystem approach. This approach is grounded in ecological science and a belief that human decisions should be made with due regard for essential ecological process, biodiversity and sustainable uses. It acknowledges the importance of human needs while at the same time confronting the reality that the capacity of our world to meet these needs in perpetuity has limits and depends on the functions of ecosystems.

In essence, it combines what was already covered with the above strategies for land use management, forestry management, adaptation for climate change and Public Education Program. The Town is considering other ways to incorporate this strategy into Source Water Protection Planning and is watching its implementation in Ontario with interest.

6.0 SOURCE WATER PROTECTION ADVISORY COMMITTEE

The Pictou Watershed Management Committee was established in 1993 to guide future initiatives designed to protect the Town's water resource and to pursue the designation for the Caribou Well Field. Participation included a member of the Pictou County Council, since the designated land in question was positioned within the County. The Committee also included a hydrogeological technical advisor from ADI. In 1993, the Town contacted each identified landowner within the boundaries of the survey and advised them of the Town's proposal to protect the groundwater resources within the well field. Out of the 74 separate landowners, only 14 responded by mail or telephone.

The Town pro-actively commenced a public consultation program. Two newsletters were sent out to property owners within the proposed protection area identifying the watershed management committee and its long-term goals. In 1996, they invited the residents to a public open house and requested their input and ideas.

The Management Committee has held ongoing meetings with NSDEL, a representative from the Pictou Planning Advisory Committee and the Warden of Pictou County since 1994.

On going participation from the Pictou County District Planning Commission has included the preparation of the Caribou Well Field Protection Project Status Report and a draft Joint Land Use By-Law between the Town of Pictou and the Municipality of the County of Pictou.

As part of the requirement for designation, the Town developed a Terms of Reference in 2002 for a Town of Pictou Watershed Advisory Committee for the Caribou Well Field. Given that designation is not possible at this time, it is the Town's intent to build upon those guidelines to develop a Source Water Protection Committee that would be responsible for "advising" on both well fields. The key components of the mandate for the committee are expected to include:

1. It exists by the authority of the Council of the Town of Pictou and will act as an advisory body to Council. However, individuals still retain the ability to address Town Council directly on issues relating to the well fields.
2. On-going contact with the Committee shall be provided for by the Town of Pictou's Administrative offices.
3. The committee has an advisory mandate only, and is not responsible for managing the day-to-day operations of the Pictou Water Utility.
4. Its mandate is to provide assistance and suggestions with regard to:
 - Land use activities that have an impact on the water supply;
 - Providing for public comment and education on specific matters;
 - Making recommendations regarding remedial measures aimed at correcting, or minimizing harmful effects on the water supply; and
 - Maintaining an appropriate emergency response protocol to respond to any crisis, which might affect the water supply.
5. All meetings shall be open to the public and press, or as allowed under the municipal Government Act
6. Membership shall be comprised of at least
 - The mayor for the Town of Pictou
 - The Warden for the Municipality of Pictou County
 - The Chair of the Planning Advisory Committee
 - A member of Municipal Council for Pictou County

- A member at large representing the Town of Pictou
- A member of the Ad Hoc Committee representing the Municipality of Pictou County. This member shall be a land owner who occupies a dwelling year round within Zones 1, 2 or 3 of the WHPA for the Caribou Well field; and
- Technical and support staff may be present when requested and agreed to by the Committee.

7.0 MONITORING PLAN

As part of “due diligence”, the water supply monitoring program established by the Utility encompasses more than that required by the NSDEL permit. It involves both “Source” and “Distribution” System monitoring. The key components are located on Figure 7-1.

The Town draws groundwater from the Pictou (bedrock) aquifer and the Caribou (S/G) aquifer. The monitoring program entails head levels and chemistry from background wells within the aquifer. This includes two automated head level recorders, as well as monthly head levels on up to 35 observation wells, with periodic chemical analysis.

Environment Canada’s Lyons Brook and Caribou weather stations provide real time weather data on temperature and precipitation. NSDEL’s Durham groundwater level recorder provides historical head level data on the Pictou Aquifer.

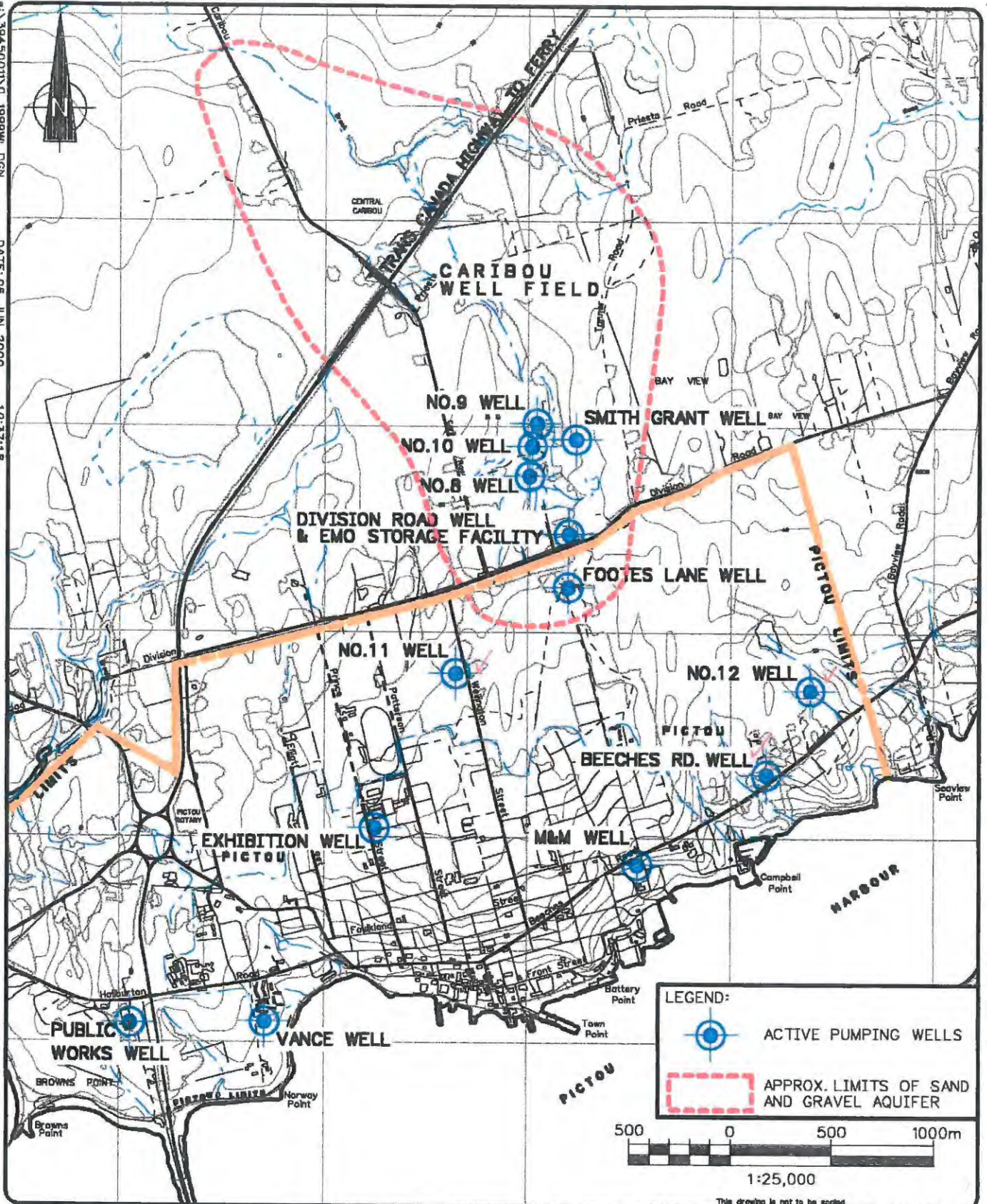
Staff visit each production well daily to record production and chlorine levels at each injection site. Tri-monthly chemical analyses are conducted on raw and treated samples for iron and manganese, where treatment is provided. Weekly sampling is undertaken for bacteria at various locations. The water level is continuously monitored in the reservoir.

Annual monitoring reports are submitted to NSDEL as a requirement of the approval to operate.

External monitoring wells to Caribou aquifer are in place and monitored, designed around aquifer protection, not necessarily well head protection. To date, there are no monitoring wells positioned around any of the Town’s production wells to forewarn of contaminant incursion.

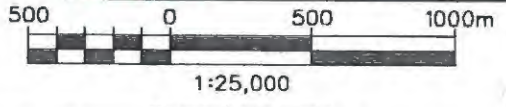
The costs/benefits of utilizing a SCADA system to aid in data collection is presently being assessed.

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LEGEND:

- ACTIVE PUMPING WELLS
- APPROX. LIMITS OF SAND AND GRAVEL AQUIFER



This drawing is not to be scaled

ADI GROUP ADI Limited
Sydney, NS, Canada
Engineering, Consulting, Procurement and
Project Management
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St. John's, Fredericton and Salem, NH

Proj. **TOWN OF PICTOU
GROUNDWATER RESOURCE
MANAGEMENT**

Dwg. **PUMPING WELLS, 1999**

Drawn By: NEB	Proj. No. 3945-01.1
Dwg Standards Chk. By:	Dwg. No. 2
Designed By: FEB	Date Last Modified: 00.06.05
Design Chkd. By: FEB	Last Modified By: NEB
	Rev. 0

TOWN OF PICTOU - TOWN WELL FIELD
WELL HEAD PROTECTION - URBAN WELLS
CHECK LIST FOR EVALUATION OF EACH WELL

DRAFT 1 JUNE 18/02 - for review and comment

NOTES ON METHOD OF APPROACH

- ✓ includes wells, but not storage tank or distribution system
- ✓ assesses principally Zone 1 assumes between 150 - 300 m radius around each well head - until refined by analysis of drawdown cone (incorporates all properties within that zone therefore extent of zone not circular but determined by property boundaries).
- ✓ historical perspective goes back 100 years
- ✓ Will result in a report on each well, with appendices including interview forms, photos, maps etc.

↑ for an example

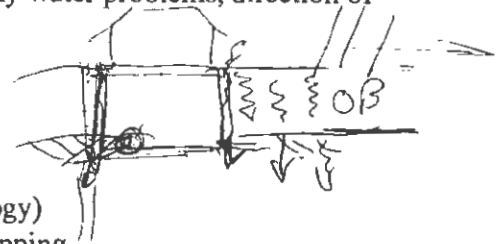
A - FACILITY EVALUATION (pumphouse and property)

- ✓ Extent, shape, size of Town owned land around well head
- ✓ Pump House Construction (size, structure, building materials)
- ✓ facilities contained within Pump House (treatment, chemicals etc)
- ✓ Signage ←
- ✓ access restriction : 1) personnel, rodents, 2) vehicles, 3) back flow preventers, 4) well cap, 5) link with distribution system (seepage collars), and 6) airborne.
- JB ✓ Well Construction details (casing, annular seal, drive shoe, age, total depth)
- ✓ Wastes (type, nature of disposal)
- ✓ Level and type of surveillance, inspection frequency, alarms ←
- ✓ History of land use on site - prior to well installation
- ✓ Presence of groundwater monitoring program at perimeter of drawdown cone
- JB ✓ Groundwater chemical/quality monitoring of Production Well
- ✓ Direction which on-site drainage is transported to
- ✓ Remoteness (distance to existing structure, access to site, distance to nearest road and sidewalk/trail)
- JB ✓ Distance to and height above sea level
- ✓ Distance and direction to nearest watercourse

B- LAND USE IN PROPOSED PROTECTION AREA

- ✓ present land use - all types (domestic, commercial, industrial, parks etc) with description and photos
- ✓ past land use (historical research, air photos, interviews)
- ✓ Subsurface facilities - storm/sanitary sewers, power/communication lines, wet wells, drains from homes (need age and construction details if possible)
- ✓ Surface facilities (power, communication poles, transformers, grounding etc)
- ✓ vegetation (trees, lawns, gardens etc.)
- ✓ surface drainage patterns (natural and man-made)

- ✓ present property ownership, names, contact numbers, address
- ✓ road network - location, construction, curb and gutter, age, direction of roadwash runoff, culverts, AADT's if available, truck/tanker traffic (and type of chemicals), accident rates, de-icing materials and volume
- ✓ land use policies/restrictions
- ✓ any previous history of blasting
- ✓ buildings (description, presence of basements and any water problems, direction of roof gutter drainage etc.)



C - HYDROGEOLOGIC SETTING

- ✓ Overburden (type, thickness, presence of fill, pedology)
- ✓ bedrock (lithology, structure - from well log and mapping)
- ✓ hydrostratigraphic units
- ✓ pumping rates and water levels
- ✓ water chemistry from pumping well (looking for signs of contamination or trends)
- ① → ✓ surface watersheds (upstream of well site)
- ② → ✓ groundwater water watershed (upstream of well site)
- ③ → ✓ Sewersheds (for storm and sanitary sewers passing well head)
- ✓ location and description of any other wells (i.e. drilled wells, geotechnical boreholes, sumps, wet wells etc)

D - CONTAMINANT SOURCE INVENTORY

- Don't*
- ✓ Nature of contaminant (chemical, biological, physical, radiological etc)
 - ✓ Nature of release (point or non-point, surface or subsurface release, continuous or time related, volume)
 - ✓ i.e. - fuel handling and storage (LUSTs)
 - road wash runoff ←
 - storm/sanitary sewers
 - fertilizer/pesticides/herbicides/insecticide application
 - material handled by tanker trucks
 - roof wash runoff
 - ✓ Identify toxicity of contaminant to man (acute, chronic, carcinogenicity, mutagenicity etc)
 - ✓ Characterize pertinent Properties (solubility, density, viscosity, vapour pressure etc)
 - ✓ Characterize Relationship to Water (dissolved, colloidal, LNAPL, DNAPL)
 - ✓ Identify what concentrations necessitate "Action" (Drinking Water Guideline)
 - ✓ Identify whether contaminant is presently analyzed for in Pumping well and what concentrations are found

E - HAZARD ASSESSMENT

Natural and human disasters that can create major emergencies specific to each well - doesn't include general ones that would in all likelihood impact all wells (i.e. earthquakes, hurricanes etc.)

Appendix B

NSE Approval to Withdraw Groundwater from Pictou and Caribou Wellfields

(Approval No: 2002-026956-R01, June 21, 2013)



Environment
Environmental Monitoring and Compliance

RR 43, New Glasgow
Nova Scotia
B2H 5C6

902 396-4194 t
902 396-1765 a
www.gov.ns.ca

Our File Number: 95100-30-PIC-2002-026956R01

June 20, 2013

Mr. James Chisholm
Town of Pictou
40 Water St
PO Box 640
Pictou, NS
B0K 1H0

Dear Mr. Chisholm:

RE: Approval to Withdraw Groundwater - Town of Pictou; Approval No. 2002-026956-R01; Authorization No. 3889

Enclosed please find Approval # 2002-026956-R01 issued to the Town of Pictou to withdraw groundwater from wells within the Town Wellfield and the Caribou Wellfield, located at or near Pictou and Central Caribou, Pictou County, Nova Scotia.

You will be invoiced an annual user fee based on the approved withdrawal volumes. You will also be invoiced for an annual approval administration fee. These fees are subject to review and adjustment by the Minister and you will be invoiced annually.

This Approval or a copy is to be kept on-site at all times. All personnel involved in the project must be made fully aware of the terms and conditions of this Approval. The terms and conditions are shown as attached and it is the Approval Holder's responsibility to ensure that they are followed. Failure to comply with the terms and conditions is an offence under the *Environment Act*.

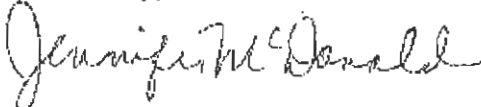
It is the Approval Holder's duty to advise the Department of any new and relevant information respecting any adverse effect that results or may result from the approved activity, which comes to the Approval Holder's attention after the issuance of the Approval. This is required under Section 60 of the *Environment Act*.

If the activity is altered, extended or modified beyond the description given in this Approval, please reapply as a new Approval may be required.

Despite the issuance of this Approval, the Approval Holder is still responsible for obtaining any other authorization which may be required to carry out the activity, including those which may be necessary under provincial, federal or municipal law.

Should you have any questions, please contact Bonnie MacDonald, Northern Region,
Pictou Office at (902) 396-2426.

Yours truly,



Jennifer D McDonald, M.Sc., P.Geol.
Regional Hydrogeologist

cc: B MacDonald
P McLeod
S Conrod, Town of Pictou

Elmas #: 2002-028856-R01



Environment

APPROVAL

Province of Nova Scotia
Environment Act, S.N.S. 1994-95, c.1

APPROVAL HOLDER: Town of Pictou
SITE PID: 00812909
APPROVAL NO: 2002-026956-R01
AUTHORIZATION NO: 3889
EXPIRY DATE: June 20, 2023

Pursuant to Part V of the *Environment Act, S.N.S. 1994-95, c.1* as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Withdrawal of groundwater from multiple wells within the Town Wellfield and Caribou Wellfield, located at or near Pictou and Central Caribou, Pictou County in the Province of Nova Scotia.

Administrator

Penny McLeod
Penny McLeod

Effective Date

June 21, 2013

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder: Town of Pictou

Project: Withdrawal of Groundwater
Site: Pictou and Central Caribou, Pictou County
PID # 00812809

Approval No: 2002-026956-R01

Authorization No. 3889

File No: 95100-30-PIC-2002-026956A02

Average Withdrawal Volume: 2.26 million liters per day

Maximum Withdrawal Volume: 4.28 million liters per day

Reference Documents:

- Application dated April 3, 2013 and attachments.
- exp Services Inc. April 2013. *Application of Approval Water Withdrawal Production Well Foots Lane (No. 2) Town Wellfield.*
- exp Services Inc. November 1, 2012. *Memorandum: Pump Test Analysis PW #15 Addendum Report for NS Environment.*
- exp Services Inc. September 2011. *Town of Pictou: Application of Approval Water Withdrawal Production Well No. 15, Town Well Field.*
- CBCL Limited. November 2010. *Town of Pictou Water System Upgrades Pre-Design Report.*
- ADI Limited. July 2006. *Town of Pictou Application of Approval Water Withdrawal Well No. 14 - Town Wellfield; ADI Report: (24)3945-001.1.*
- ADI Limited. October 2002. *Town of Pictou Groundwater Wellfield Hydrological Budget Analysis; ADI Report: (24) 3945-001.1.*
- C.J. MacLellan and Associates Inc. March 12, 2004. *System Assessment Report for the Town of Pictou Water Works.*
- ADI Limited. February 2002. *Town of Pictou Caribou Wellfield Report for Designation as a Protected Water Supply; ADI Report (24) 3945-001.1.*
- ADI Limited. October 2001. *Town of Pictou Data Supporting Wellfield Water Withdrawal Permit; ADI Report: (24)3945-001.1.*

1.0 Definitions:

- a) "Act" means the *Environment Act* S.N.S. 1994-1995, c.1 and includes all regulations made pursuant to the Act.
- b) "Activity" means the withdrawal of groundwater from multiple wells within the Town and Caribou Wellfields, and associated works.
- c) "Administrator" means the Manager of the Northern Region, Pictou Office of Nova Scotia Environment or the Manager's designate.
- d) "Department" means the Northern Region, Pictou Office, of Nova Scotia Environment located at the following address:

Nova Scotia Environment
Environmental Monitoring and Compliance Division
Northern Region, Pictou Office (Granton)
20 Pumphouse Road
RR #3
New Glasgow
Pictou County, NS B2H 5C6

Phone: (902) 396-4194
Fax: (902) 396-4765

- e) "Groundwater" means all water naturally occurring under the surface of the Province of Nova Scotia.
- f) "Minister" means the Minister of Nova Scotia Environment.
- g) "NSE" means Nova Scotia Environment.
- h) "Watercourse" means
 - i) the bed banks and shore of every river, stream, lake, creek, pond, spring, lagoon or other natural body of water, and the water therein, within the jurisdiction of the Province, whether it contains water or not, and
 - ii) all groundwater;

2.0 Scope of Approval

- a) This Approval (the "Approval") relates to the Approval Holder and their application and supporting documentation, as listed in the reference documents above, to withdraw groundwater from multiple wells within the Town and Caribou Wellfields, situated at or near Pictou and Central Caribou, Pictou County.
- b) This Approval supercedes previous Approval number(s) which is/are now null and void.

3.0 General Terms and Conditions

- a) The Approval Holder shall construct the watercourse alterations in accordance with provisions of the:
 - i) *Environment Act* S.N.S. 1994-1995, c.1;
 - ii) Regulations, as amended from time to time, pursuant to the above Act;
 - iii) Standards, Policies, or Guidelines issued by Nova Scotia Environment, as amended from time to time.
- b) The Activity shall be conducted in accordance with the details and specifications in the Application and attached appendices and the reference documents. **If there is a discrepancy between the reference documents and these terms and conditions, the terms and conditions of this Approval shall apply.**
- c) Any request for renewal or extension of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.
- d) The Minister or Administrator may modify, amend or add conditions to this Approval at anytime pursuant to Section 58 of the Act.
- e) This Approval is not transferable without the consent of the Minister or Administrator.

- f) i) If the Minister or Administrator determines that there has been non-compliance with any or all of the terms and conditions contained in this Approval, the Minister or Administrator may cancel or suspend the Approval pursuant to subsections 58(2)(b) and 58(4) of the Act, until such time as the Minister or Administrator is satisfied that all terms and conditions have been met.
- ii) Despite a cancellation or suspension of this Approval, the Approval Holder remains subject to the penalty provisions of the Act and regulations.
- g) The Approval Holder shall notify the Department prior to any proposed extensions or modifications of the Activity, including, but not limited to, an increase in withdrawal rates or the addition of production wells. The Approval holder shall obtain written authorization or amendment from the Administrator before implementing any change that would not comply with the Terms and Conditions of this Approval.
- h) The Approval Holder shall immediately notify the Department of any incidents of non-compliance with this Approval.
- i) Pursuant to Section 60 of the Act, the Approval Holder shall submit to the Administrator any new and relevant information respecting any adverse effect that actually results, or may potentially result, from any activity to which the Approval relates and that comes to the attention of the Approval Holder after the issuance of the Approval.
- j) The Approval Holder shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.
- k) Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures.
- l) The Approval Holder shall submit any monitoring results or reports required by this Approval to the Department. Unless specified otherwise in this Approval, All monitoring results shall be submitted within 30 days following the month of monitoring.

- m) The Approval Holder shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel directly involved in the watercourse alterations are made fully aware of the terms and conditions which pertain to this Approval.
- n) Within one month of the issuance of this Approval, the Approval Holder shall designate in writing, to the Department, a contact for this Approval. If the contact should change, the Approval Holder shall immediately notify the Department in writing.
- o) The Approval Holder shall, upon receipt of an invoice from the Minister of Nova Scotia Environment stating the amount owing, pay to the Minister of Finance the amount stipulated in said invoice. Said amount shall be in accordance with the schedule of fees established by the Minister of Nova Scotia Environment, as may be revised from time to time.
- p) The failure of the Minister to insist upon a strict performance of a Term and Condition contained in this Approval shall not be deemed a waiver of any rights or remedies that the Minister may have and shall not be deemed a waiver of any subsequent breach of the Terms and Conditions of this Approval.
- q) This Approval does not give sole or exclusive rights to any watercourse or water resource, and the Minister reserves the right to use and to allow others to use the watercourse or water resource and the water therein.
- r) The Approval Holder may not alter or use the watercourse or water resource so as to:
 - i) prejudice any riparian or other rights, should any such rights exist, of a person lawfully in possession of lands abutting the watercourse or water resource;
 - ii) cause damage or nuisance to adjacent or abutting lands.
- s) The Approval Holder shall not place a pecuniary value on or claim any pecuniary value for the rights granted by this Approval, over and above the amounts, if any, paid to the Minister by the Approval Holder for the rights.
- t) The Approval Holder shall maintain a culvert, bridge, dam, sluice, flume, conduit, well or other structure built or used in or on the watercourse or water resources so that it does not cause an adverse effect. This condition survives the expiry or cancellation of this Approval.

- u) The Approval Holder shall conform to a direction of the Minister or an Administrator concerning the maintenance or rehabilitation of a watercourse or water resource or the maintenance, rehabilitation or removal of a culvert, bridge, dam, sluice, flume, conduit, or structure used or maintained in and on the watercourse or water resource. The Approval Holder shall, pursuant to an Approval where required, remove a culvert, bridge, dam, sluice, flume, conduit or other structure and any equipment or personal property built, used or maintained in and on the watercourse or water resource at the end of the useful life of the culvert, bridge, dam, sluice, flume, conduit or structure. In the event the Approval Holder fails to remove a culvert, bridge, dam, sluice, flume, conduit or other structure or equipment or personal property, the Minister may, without any liability, remove or demolish the same in whatever manner the Minister deems necessary and the Approval Holder shall reimburse the Minister for all expenses and costs of such removal or demolition. This condition survives the expiry or cancellation of this Approval.
- v) The Approval Holder shall indemnify and save harmless the Minister and an employee, servant or agent of the Department against any loss, cost or damage resulting from the activities performed pursuant to this Approval. Such indemnity shall include, but not be restricted to, all losses, costs or damages occasioned by the improper or faulty relocation of a watercourse or water resource or the improper or faulty construction of, repair, alteration or addition to any culvert, bridge, dam, sluice, flume, conduit or other structure in or on the watercourse or water resource, or by any trespass, negligence or wilful act of the Approval Holder or any employees, agents, contractors or guests of the Approval Holder.
- w) This Approval shall enure to the benefit of and be binding upon the Minister, the Minister's successors, assigns and authorized representatives and upon the Approval Holder, and the heirs, administrators, executors and assigns of the Approval Holder.
- x) The Minister and all persons designated as Inspectors pursuant to the *Environment Act* shall have free access at all times to the Activity and to land under control of the Approval Holder to ensure these Terms and Conditions are being fulfilled.
- y) Nothing in this Approval relieves the Approval Holder of the responsibility for obtaining and paying for all licences, permits, approvals or authorizations necessary for carrying out the work authorized to be performed by this Approval which may be required by municipal by-laws or provincial or federal legislation. The Minister does not warrant that such licences, permits, approvals or other authorizations will be issued.

4.0 Approved Withdrawal

- a) The location and construction of the production wells covered by this Approval is restricted to those shown in Table 1.
- b) The maximum pumping rate, average pumping rate, 30 day withdrawal volume and annual withdrawal volume for each individual well and the total wellfield shall not exceed the values shown in Table 2.
- c) The Department may amend the approved withdrawal limits specified in Table 2. The Approval Holder will be notified in writing of any changes to the approved withdrawal limits.

Table 1 - Well Construction Information								
Production Well	Date Completed	NSE Well Log Number	Well UTM Coordinates		Well Total Depth (m)	Casing Depth (m)	Dia-meter (mm)	Screen Description
			Easting	Northing				
Beaches Road	1945	-	-	-	158	-	203	none
Division Road	1974	740136	523052	5080347	152	13	203	none
Exhibition	1972	-	-	-	117	10	203	none
Footes Lane 2	2012	121531	522960	5059950	87	15.2	203	none
M&M	-	-	-	-	152	82	184	none
Public Works	1982	-	-	-	188	-	203	none
Smith Grant	1908	-	-	-	103.6	-	203	none
No. 8	-	-	-	-	49	6.8	203	none
No. 10	1965	-	-	-	5.4	4.2	162	4.2-5.1
No. 11	1989	891346	522465	5059463	86	13	203	none
No. 12	1998	960944	524144	5058632	87	26.6	203	none
No. 14	2005	050084	521084	5057969	67	19.2	203	none
No. 15	2009	090257	523942	5058682	99	18	203	none

Table 2 - Approved Withdrawal				
Production Well	Pumping Rate (litres/day)		Withdrawal Volume (litres)	
	Maximum ¹ (over 3 days)	Average ² (Over 30 days)	30 day ³	Annual ⁴
Beaches Road	393,120	230,400	6,912,000	84,096,000
Division Road	264,880	164,160	4,924,800	59,918,400
Exhibition	164,160	79,200	2,376,000	28,908,000
Footes Lane 2	328,880	230,400	6,912,000	84,096,000
M&M	228,960	144,000	4,320,000	52,560,000
Public Works	228,960	164,160	4,924,800	59,918,400
Smith Grant	228,960	129,600	3,888,000	47,304,000
No. 8	131,040	93,600	2,808,000	34,164,000
No. 10	817,820	194,400	5,832,000	70,956,000
No. 11	228,960	129,600	3,888,000	47,304,000
No. 12	681,120	331,200	9,936,000	120,888,000
No. 14	524,160	357,200	11,016,000	134,028,000
No. 16	326,880	326,880	9,806,400	119,311,200
Total Wellfield⁵	4,260,000	2,260,000	67,800,000	824,900,000

Notes:

- 1 Pumping rate shall at no time exceed the maximum based on actual rate averaged after 3 days.
- 2 Average allowable pumping rate is based on the demonstrated water needs of the applicant and sustainable yield.
- 3 30 day withdrawal volume = Average pumping rate multiplied by 30 days.
- 4 Annual withdrawal volume = Average pumping rate multiplied by the number days pumped per year (i.e. 365).
- 5 Total well field is based on the previous approved withdrawal limits and current demand; it is not a sum of the approved limits for all production wells.

5.0 Flow Monitoring

- a) Well production flow meters shall be installed, maintained and monitored separately for all production well(s).
- b) The Approval Holder shall keep daily well production records for each well to include water usage volumes. Data shall be tabulated within a spreadsheet program.

6.0 Groundwater Withdrawal Records

- a) The Approval Holder shall maintain monitoring records for:
 - i) pumping flow rates;
 - ii) duration of pumping;
 - iii) total withdrawal volumes;
 - iv) water quality;
 - v) changes in use; and
 - vi) reported effects of the withdrawal on other groundwater users.
- b) These records shall be maintained on Site for a period of ten years and are to be available for review immediately upon request by the Department.

7.0 Well Interference Remedy

- a) If production causes interference problems with any existing well supplies, the withdrawal rates shall be reduced and/or the problem rectified by the Approval Holder in accordance with an action plan acceptable to the Department.

8.0 Well Decommissioning

- a) Any new or existing well located at the Site that is required to be decommissioned by the Minister or is not used or maintained for present or future use shall be decommissioned in accordance with the *Well Construction Regulations* and *Water Well Decommissioning Guidelines*. This condition survives the expiry or cancellation of this Approval.

9.0 Water Level Monitoring

- a) The Approval Holder shall collect manually, or with electronic data loggers, water levels in all production wells on at least a weekly basis. Data shall be tabulated within a spreadsheet program.
- b) The Approval Holder shall collect manually, or with electronic data loggers, water levels in dedicated observation wells on at least a semi-annual basis. Data shall be tabulated within a spreadsheet program.
- c) The water level monitoring data is to be maintained on Site for a period of ten years and is to be available for review immediately upon request by the Department.

10.0 Groundwater Withdrawal Reporting

- a) The Approval Holder shall submit the following records to the Department on an annual basis:
 - i) production records for each well (i.e. groundwater withdrawal volumes), in comparison with approved withdrawal limits;
 - ii) a summary of any occurrences during the year that may have resulted in potential hazards or changes to the water supply (nearby land development, new wells or pumps installed, wells abandoned, contaminant spills etc.);
 - iii) a description of any water conservation measures implemented;
 - iv) a summary of any effects reported by other groundwater users in the area;
- b) The records shall be incorporated as part of the annual report for the Municipal Water Works Approval and submitted to the Department on or before April 1 following completion of the calendar year being reported upon.
- c) Data submissions completed for the requirements of this Approval does not remove the Approval Holder from meeting any other registration, reporting, data maintenance and compliance requirements such as those specified in the Guidelines for Monitoring Public Drinking Water Supplies or other regulatory guidelines.

11.0 Site Specific

- a) If salt water intrusion problems occur as evidenced by changes to water level or water quality effects, the Approval Holder shall notify the Department immediately and the withdrawal rate shall be reduced and/or the problem rectified to the satisfaction of the Department.
- b)
 - i) The Approval Holder shall review the safe yield estimates for the following production wells: No. 12, No. 14, No. 15, and Footes Lane 2 after the collection of one year of operational data with No. 15 and Footes Lane 2 added to the system.
 - ii) A report outlining the results of this review shall be submitted to the Department within 18 months of Well No. 15 and Footes Lane 2 being connected to the system. The report shall include recommended updates to the safe yields and withdrawal rates specified in Table 2, as applicable. Approved withdrawal limits specified in this Approval may be amended by the Department pending the results of this review.
 - iii) The items referenced in 11 b) i) and 11 b) ii) shall be completed by a qualified Hydrogeologist, licensed to practice by the Association of Professional Geoscientists of Nova Scotia (APGNS) or the Association of Professional Engineers of Nova Scotia (APENS).

Appendix C

NSE Permit to Operate a Water Supply System

(Approval No: 2012-080096-R02, March 4, 2016)

APPROVAL

Province of Nova Scotia
Environment Act, S.N.S. 1994-95, c.1, s.1

APPROVAL HOLDER: Town of Pictou

APPROVAL NO: 2012-080096-R02

EXPIRY DATE: February 16, 2026

Pursuant to Part V of the *Environment Act*, S.N.S. 1994-95, c.1, s.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Operation of non-GUDI and medium risk GUDI wells with natural filtration credit, greensand filters, and UV and chlorine for primary and secondary disinfection, water distribution system and associated works, located at or near 40 Water St, Pictou, Pictou County in the Province of Nova Scotia.

Administrator 
Penny McLeod

Effective Date March 4, 2016

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder: Town of Pictou
Project: Water Supply System Serviced by non-GUDI and Medium Risk GUDI wells with Natural Filtration Credit, Greensand Filters, and UV and Chlorine for Primary and Secondary Disinfection

40 Water St
Pictou, Pictou County

Approval No: 2012-080096-R02

File No: 94600-30

Reference Documents:

- Application dated February 2, 2015 and attachments.
- E-Mail Correspondence between NSE and the Town dated October - December 2015.
- Town of Pictou. August 2014. Water Utility Operating Manual.
- K. Slaunwhite. July 30, 2014. Approval No. 2012-0800096 Compliance Update.
- K. Slaunwhite. September 16, 2013. Corrective Action Plan for Approval No. 2012-0800096.
- B. McDonald. March 31, 2013. System Assessment Report for Town of Pictou.
- K. Slaunwhite. March 2013 - June 2014. Quarterly Update Reports for Approval No. 2012-0800096:
 - Quarterly Update #1. March 15, 2013.
 - Quarterly Update #2. June 14, 2013.
 - Quarterly Update #3. September 16, 2013.
 - Quarterly Update #4. December 17, 2013.
 - Quarterly Update #5. March 14, 2014.
 - Quarterly Update #6. June 20, 2014.
- CBCL Limited. July 2011. Town of Pictou Phase I - Water Treatment Upgrades
- GUDI Assessment Reports:
 - CJ MacLellan and Associates Inc. March 12, 2004. System Assessment Report and Step 1 GUDI Assessment.
 - ADI Limited. November 2006. Step 2 GUDI Report.
 - ADI Limited. June 2009. Step 3 GUDI Report.
- exp Services Inc. September 2011. GUDI Natural Filtration Credits.
- Source Water Protection Plan (Draft). No date. Received via e-mail October 26, 2015.

1. Definitions:

- a. "Act" means the Environment Act S.N.S. 1994-1995, c.1, s.1 and includes all regulations made pursuant to the Act.
- b. "Administrator" means a person appointed pursuant to Section 21 of the Act.
- c. "Associated Works" means all the piping, valves, instrumentation, controls, electrical works, etc., required for the operation of the Facility and Water Supply System.
- d. "CT" means disinfectant residual in mg/L multiplied by the contact time in minutes.
- e. "Contact Time" denoted as T_{10} is an effective contact time for disinfection in minutes and represents the time when 10% of the water passes the contact unit; that is 90% of the water remains in the unit and will be exposed to longer disinfection within the unit. T_{10} can be established by tracer studies or calculated using theoretical hydraulic detention times multiplied by an appropriate baffling factor listed in the "Treatment Standard for Municipal Surface Source Water Treatment Facilities" or "Treatment Standards for Municipal Groundwater Source Water Treatment Facilities".
- f. "Continuous monitoring" is sampling or flow through analysis equipment that creates an output signal a minimum of once every five minutes.
- g. "Department" means the Northern Region, Pictou Office, of Nova Scotia Environment located at the following address:

Nova Scotia Environment
Environmental Health and Food Safety Division
Northern Region, Pictou Office (Granton)
20 Pumphouse Road
RR #3
New Glasgow
Pictou County, NS B2H 5C6

Phone: (902) 396-4194
Fax: (902) 396-4765
- h. "Facility" means the medium risk GUDI wells, greensand filters, Chlorine for primary disinfection, Chlorine for secondary disinfection and associated works.

- i. "GCDWQ" means the latest edition of "Guidelines for Canadian Drinking Water Quality".
- j. "Grab sample" means an individual sample collected in less than 30 minutes and which is representative of the substance sampled.
- k. "Groundwater under the direct influence of surface water " or "GUDI" means any water beneath the surface of the ground with:
 - i. significant occurrence of insects or other macro-organisms, algae, organic debris, or large-diameter pathogens such as *Giardia lamblia* or *Cryptosporidium*; or
 - ii. significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions.
- l. "GUDI well" means a well that has been classified as GUDI based on the "Protocol for Determining Groundwater Under the Direct Influence of Surface Water" and has been accepted as such in writing by the Regional Hydrogeologist.
- m. "Inadequately disinfected" means water that does not meet the required contact time.
- n. "Log reduction" means a negative of the base 10 logarithm of the fraction of pathogens remaining after the treatment process.

log reduction = log removal by physical treatment + log inactivation by disinfection

where log removal by physical treatment is equal to the credit assigned to the filtration technology indicated in the Department's "Treatment Standard for Municipal Surface Source Water Treatment Facilities", as amended from time to time; and

log inactivation by disinfection is equal to the inactivation which shall be calculated as defined by the Department's "Treatment Standard for Municipal Surface Source Water Treatment Facilities" or "Treatment Standard for Municipal Groundwater Source Water Treatment Facilities", as amended from time to time.
- o. "Maximum day demand" means the highest daily use rate during the year.

- p. "Minister" means the Minister of Nova Scotia Environment.
- q. "MPA testing" means Microscopic Particulate Analysis which analyses for significant numbers of large macro-organisms, algae, and surrogate indicators of surface water.
- r. "Non-GUDI well" means a well that has been classified as non-GUDI based on the "Protocol for Determining Groundwater Under the Direct Influence of Surface Water" and has been accepted as such in writing by the Regional Hydrogeologist.
- s. "NSE" means Nova Scotia Environment.
- t. "QA/QC" means quality assurance and quality control.
- u. "Quarterly sampling" means samples taken once per quarter with no less than 45 days interval between sampling events.
- v. "Site" means the structure used by the operator in overall direct responsible charge to maintain and store documents and records required by this approval.
- w. "Total trihalomethanes" means the level of total trihalomethanes as defined by the latest edition of the GCDWQ.
- x. "Water Supply System" means the Facility and all auxiliaries/associated works for the collection, treatment, storage and distribution of water from the source of supply to the service connection of the ultimate consumer.
- y. "Water Withdrawal Approval" means an approval from Nova Scotia Environment for the withdrawal of water from a surface or groundwater source. For clarity, this approval was also formerly known as a "water rights", "water licence", "water permit" or "water authorization".

2. Scope of Approval

- a. This Approval (the "Approval") relates to the Approval Holder and their application and supporting documentation, as listed in the reference documents above, to operate the Water Supply System.
- b. This approval relates to aspects of the application and reference documents necessary to meet the operational, environmental, and public health requirements of the Water Supply System.

- c. This Approval supercedes previous approval number 2012-080096-R01, which is now null and void.

3. General

- a. The Approval Holder shall operate the Water Supply System in accordance with provisions of the:
 - i. *Environment Act* S.N.S. 1994-1995, c.1, s.1 as amended from time to time;
 - ii. Regulations, as amended from time to time, pursuant to the above Act.
- b. The Water Supply System shall be operated in accordance with the details and specifications in the Application and attached appendices and the reference documents. **If there is a discrepancy between the reference documents and these terms and conditions, the terms and conditions of this approval shall apply.**
- c. Any request for renewal or extension of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.
- d. The Minister or Administrator may modify, amend or add conditions to this Approval at anytime pursuant to Section 58 of the Act.
- e. This Approval is not transferable without the consent of the Minister or Administrator.
- f.
 - i. If the Minister or Administrator determines that there has been non-compliance with any or all of the terms and conditions contained in this Approval, the Minister or Administrator may cancel or suspend the Approval pursuant to subsections 58(A)(1) and 58(A)(2) of the Act, until such time as the Minister or Administrator is satisfied that all terms and conditions have been met.
 - ii. Despite a cancellation or suspension of this Approval, the Approval Holder is at all times subject to the penalty provisions of the Act and regulations.
- g. The Approval Holder shall notify the Department prior to any proposed extensions or modifications of the Water Supply System, including process changes or waste disposal practices which are not granted under this Approval. Written approval from the Administrator may be required before implementing any change.

- h. Pursuant to Section 60 of the Act, the Approval Holder shall submit to the Administrator any information respecting any adverse effect that actually results, or may potentially result, from any activity to which the Approval relates and that comes to the attention of the Approval Holder after the issuance of the Approval.
- i. The Approval Holder shall immediately notify the Department of any incidents of non-compliance with this Approval.
- j. The Approval Holder shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.
- k. Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures.
- l. Unless written approval is received otherwise from the Administrator, all samples required by this Approval shall be analysed by a laboratory that meets the requirements of the Department's "Policy on Acceptable Certification of Laboratories" as amended from time to time.
- m. Notwithstanding the above item, the following parameters may be analysed at the Facility or a laboratory that is not certified.
 - Alkalinity*, Aluminium Residual*, Chloramines, Chlorine Dioxide Residual, Chlorine Residual, Colour, Conductivity*, Fluoride Residual*, Hardness*, Iron*, Manganese*, Methane*, Free Ammonia (as N)*, Ozone Residual, pH, Temperature, Total Organic Carbon, Turbidity and UV Absorbance.
 - * These parameters must have a QA/QC component that includes quarterly confirmation by an accredited laboratory.
- n. The Approval Holder shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel involved in the Water Supply System operation are made fully aware of the terms and conditions which pertain to this Approval.

4. Spills or Releases

- a. All spills or releases shall be reported in accordance with the Act (Part VI) and the *Environmental Emergency Regulations*.
- b. Spills or releases shall be cleaned up in accordance with the Act.

5. Operations - General

- a. The Water Supply System has been classified as a **Class II Water Treatment Facility** and a **Class II Water Distribution Facility**.
- b. In accordance with the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations*, the Approval Holder shall place the responsibility for the operation, repair and maintenance of the Water Supply System under the overall direct responsible charge of an operator who holds a valid Operator Certification Certificate of a classification rating that is equivalent to or greater than the classification rating applied to the Water Supply System.
- c. Notwithstanding Clause 5(b) above, if the Approval Holder cannot meet the requirement of Clause 5(b), the Approval Holder shall work towards satisfying Clause 5(b) in accordance with a transition plan approved by the Administrator. The transition plan shall be submitted to the Administrator within 90 days of being unable to satisfy Clause 5(b). This plan shall be subject to review and acceptance by the Department.
- d. The Approval Holder shall ensure the contingency plan for the Water Supply System:
 - i. meets the minimum requirements of the Department's "Water Utility Standard Operating Procedures and Contingency Plan Guidance", as amended from time to time.
 - ii. is reviewed and updated on a yearly basis, if required. The Approval Holder shall document in the annual report what modifications were made to the plan, if any, and how the plan was communicated to their staff.
 - iii. A copy is maintained on Site at all times and is available to the Department upon request.
 - iv. All employees are apprised of the contingency plan.
- e. When it is necessary to use a by-pass, the Approval Holder shall immediately notify NSE, identify the anticipated period of time that the by-pass system will be in service and initiate a Boil Water Advisory as stated in the "Guidelines for Monitoring Public Drinking Water Supplies". The Approval Holder shall maintain the boil advisory until otherwise advised by Nova Scotia Environment.
- f. The Approval Holder shall take immediate preventive or corrective action, using methods that are acceptable to the Department, when results of an inspection or sampling results identify conditions which are currently or may result in an adverse effect to the environment or public health.
- g. The Approval Holder shall protect the Water Supply System from

contamination due to cross-connections. If repairs, construction or maintenance are required, the Approval Holder shall ensure that the necessary work meets the requirements of the latest revision of CSA B64.10/B64.10.1.

- h. The Approval Holder shall demonstrate that any Water Supply System component in contact with treated water has been disinfected after construction, repair or maintenance in accordance with ANSI(American National Standards Institute)/AWWA (American Water Works Association) C651 - Disinfection of Water Mains, ANSI/AWWA-C653 - Disinfection of Water Treatment Plant, and ANSI/AWWA C652 - Disinfection of Water Storage Facilities or the latest revisions.
- i. The Approval Holder shall ensure that all chemicals used in the treatment process and all materials contacting the water are of "food grade" quality and meet both the AWWA quality criteria as set out in AWWA standards and the ANSI safety criteria as set out in ANSI standard NSF/60 (for chemical additives) or NSF/61 (for materials). A copy of the appropriate NSF certification is to be kept on Site and is to be available for review immediately upon request by the Department.
- j. The Approval Holder shall discontinue use of any chemical found to have adverse effects on finished water quality limits as prescribed in the GCDWQ or this Approval.
- k.
 - i. The Approval Holder shall ensure that the emergency notification procedures are reviewed and updated on a yearly basis. The Approval Holder shall document in the annual report what modifications were made to the emergency notification procedures and how the procedures were communicated to their staff.
 - ii. A copy of the emergency notification procedures are to be maintained on Site at all times and are to be available to the Department upon request.
 - iii. All employees shall be apprised of the emergency notification procedures.
- l.
 - i. The Approval Holder shall ensure a comprehensive operations manual is kept up to date.
 - ii. A copy of the operations manual is to be kept on Site at all times and is to be available for review immediately upon request by the Department.
 - iii. All employees shall be apprised of the operations manual.

- m. A set of current engineering drawings, shall be retained on Site by the Approval Holder for as long as the Water Supply System is in operation. These drawings shall be made available to the Department upon request.
- n. The Approval Holder shall establish procedures for receiving and responding to complaints including a reporting system which records and documents what steps were taken to determine the cause of complaint and the corrective measures taken to alleviate the cause and prevent its recurrence.
- o. The Approval Holder shall establish security measures to assure the safety of the Water Supply System.
- p. The Approval Holder shall maintain a written list of the name of each laboratory utilized, and the parameters analysed by each laboratory, and shall submit this list to the Department upon request.

6. Source Water Protection

- a. On or before May 2, 2016, the Approval Holder shall submit the updated Source Water Protection Plan to the Department for review and acceptance.
- b. On or before June 30, 2016, the Approval Holder shall submit an updated implementation schedule for the Source Water Protection Plan to the Department for review and acceptance.
- c. The Approval Holder shall implement the accepted Source Water Protection Plan, required under Condition 6 (b), in accordance with the accepted schedule.
- d. The Approval Holder shall review and update the Source Water Protection Plan and implementation schedule on a yearly basis, if required. The Approval Holder shall document in the annual report the status and activities of the Source Water Protection Plan and modifications made to the Source Water Protection Plan or implementation schedule, if any.
- e. If directed by NSE, the Approval Holder shall modify the updated Source Water Protection Plan or Implementation schedule to the satisfaction of the Department.

7. Water Quality Requirements - Performance and Limits

a. General Requirements

- i. The treated water shall meet the health-related concentration limits for the substances listed in the "Guidelines for Canadian Drinking Water Quality" (GCDWQ), latest edition unless stated otherwise in this Approval. These are described in the guidelines as Maximum Acceptable Concentration (MAC).
- ii. For the medium risk GUDI wells (No. 8, No. 10, Smith Grant, Public Works, Beeches Road, and M&M), through a combination of natural filtration, UV, and chlorination, the treatment facility shall meet the following treatment efficiencies:
 - (1) Treatment shall be sufficient to ensure 99.9% reduction of *Giardia* cysts and *Cryptosporidium* oocysts (3-Log Reduction);
 - (2) Treatment shall be sufficient to ensure 99.99% reduction of viruses (4-Log Reduction); and
 - (3) Natural filtration is assigned a 1-log reduction credit for *Giardia* and *Cryptosporidium*.
 - (4) Primary disinfection shall address a minimum of 2-log inactivation for *Giardia* and *Cryptosporidium* and 4-log inactivation for viruses. CT/IT values shall be calculated in accordance with the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, 2012.
- iii. For the non-GUDI wells (No. 11, No. 12, No. 14, No. 15, Division Road, Exhibition, and Footes Lane 2), using both the natural filtration and disinfection processes, the treatment facility shall meet the following treatment efficiencies:
 - (1) Treatment shall be sufficient to ensure 99.99% reduction of viruses (4-Log Reduction); and
 - (2) Primary disinfection shall address a minimum of 4-log reduction for viruses. CT values shall be calculated in accordance with the "Nova Scotia Treatment Standards for Municipal Drinking Water Systems" (2012).

- iv. The treated water shall be treated to minimize corrosion of the water distribution and/or plumbing systems.

b. **Primary Disinfection Requirements**

- i. Primary disinfection through the use of chlorine, ultraviolet light or an alternate disinfection method which is acceptable to the Department, shall contribute a minimum of 2-log reduction for *Giardia* and *Cryptosporidium* and 4-log inactivation for viruses for each GUDI well or if water from individual GUDI wells is combined, for the combined flow. The disinfection log inactivation shall be based on CT values which shall be calculated as defined by the Department's "Treatment Standard for Municipal Surface Source Water Treatment Facilities".
- ii. Primary disinfection through the use of chlorine shall contribute a minimum of 4-log inactivation for viruses for each non-GUDI well or if water from individual non-GUDI wells is combined, for the combined flow. The disinfection log inactivation shall be based on CT values which shall be calculated as defined by the Department's "Treatment Standard for Municipal Drinking Water Systems" (2012).
- iii. System-wide redundancy shall apply - individual disinfection units shall be configured to apply primary disinfection at all times to ensure that inadequately disinfected water does not enter the distribution system. A well shall shut down automatically when the monitoring system detects inadequate disinfection.
- iv. Each disinfection unit shall be designed to meet the rated design flow capacity of the wells or combined wells.
- v. Disinfection equipment shall be operated in such a manner as to prevent inadequately disinfected water from being distributed.
- vi. Continuous monitoring of the primary disinfection process is required with measurements taken at no more than five minute intervals.
- vii. The Facility shall be equipped with instrumentation capabilities to notify operations staff if the disinfection process fails to operate properly.
- viii. In the event of an emergency situation where inadequately disinfected water enters the water distribution system, the Approval Holder shall issue a boil water advisory and immediately notify the Department as required by the "Guidelines for Monitoring Public Drinking Water Supplies".

ix. UV Light Requirements

- (1) UV systems shall provide a minimum dosage of 40 mJ/cm² at all points within the reactor at all times when water is passing through the treatment process provided that the water quality characteristics indicate that this is a sufficient dosage.
 - (2) Water flow shall be stopped or directed to waste, or another method of disinfection shall be used, during the minimum design warm-up period for the UV unit.
 - (3) UV disinfection unit shall be equipped with UV sensors reading calibrated UV intensity.
 - (4) The system shall be equipped with an alarm notification and shutdown procedures in the event of:
 - high temperature in the reactor, lamp, ballast or transformer;
 - high flow rate that causes dose to fall below design specifications;
 - low UV dose;
 - low UV intensity;
 - UV has shutdown;
 - or any other emergency situation.
 - (5) UV lamp operation shall be monitored in a manner that ensures bulb replacement can be accomplished prior to reaching the maximum lamp life expectancy.
 - (6) The Approval Holder shall receive written verification from an independent third party that the manufacturer's system will continually meet the 40 mJ/cm² requirement and provide this information to NSE immediately upon request.
- x. On or before May 2, 2016 the Approval Holder shall submit standard operating procedures (SOPs) for the disinfection process to the Department. The SOP's shall be implemented and communicated to all operations staff and documented in the operations manual required by Clause 5(l) above. The procedures and a log indicating the date and method of communication to staff shall be made available to NSE upon request.
- xi. The SOPs shall indicate the design ranges for achieving the required log inactivation by disinfection, for example:
- CT: lowest temperature, highest pH, lowest chlorine, minimum contact time.

- IT: UV intensity, UV transmittance, flow rate.
- xii. The Approval Holder shall maintain a log of events when operational conditions are outside the design ranges for achieving the CT/IT. These records shall be made available to NSE immediately upon request. Log inactivation shall be calculated during every such event.
- xiii. When operational conditions are outside the design ranges, the Approval Holder shall immediately notify NSE, investigate the cause and take necessary corrective action. CT/IT shall be calculated during every such event.

c. **Secondary Disinfection and Residual Monitoring Requirements**

- i. Secondary disinfection through the use of chlorination shall be used to maintain a chlorine residual in the water distribution system.
- ii. The disinfection process shall be operated in such a manner as to ensure that the following minimum chlorine residual value is achieved throughout the water distribution system at all times:

- 0.20 mg/L free chlorine residual.

The disinfection process shall be operated in such a manner as to ensure that the maximum chlorine residual delivered to consumers does not exceed the following values:

- 4.0 mg/L free chlorine residual.

- iii. Continuous online monitoring of the chlorine residual is required for finished water at each location where water enters the water distribution system from an individual well or combined wells, with measurements taken at no more than five minute intervals.
- iv. Continuous on-line monitoring of the chlorine residual is required for the water entering the distribution system and leaving any water storage structure within the water distribution system, with measurements taken at no more than five minute intervals.
- v. Monitoring of the water distribution system for chlorine residual is required. Unless specified otherwise in this approval, sampling and testing frequency is the same as for bacteriological sampling requirements as stated in the "Guidelines for Monitoring Public Drinking Water Supplies".

d. Turbidity Requirements:

- i. Continuous raw water turbidity monitoring (with measurements taken at no more than five minute intervals) is required at the wellhead prior to disinfection for the medium risk GUDI wells (i.e., Public Works, M&M, Beeches Road, No. 8, No. 10, and Smith Grant).
- ii. Continuous (with measurements taken at no more than five minute intervals) or daily grab raw water turbidity monitoring is required from each non-GUDI well or combined flow from non-GUDI wells entering the distribution system (i.e., No. 11, No. 12, No. 14, No. 15, Division Road, Exhibition, and Footes Lane 2).
- iii. Turbidity levels entering the distribution system from individual wells or combination of wells shall not exceed 1.0 NTU:
 - in at least 95% of the measurements taken by grab sample for each calendar month; or
 - in at least 95% of the time each calendar month if continuous monitoring is the method of turbidity measurement.
- iv. Notwithstanding clause 7(d)(iii), if the Approval Holder cannot meet the requirement of clause 7(d)(iii), the Approval Holder may request that a less stringent value apply provided the Approval Holder can demonstrate to NSE that the turbidity is not health-related and that the disinfection process is not compromised by the use of a less stringent value.
- v. A turbidity value of 5.0 NTU or less shall be achieved on water distribution system sampling. Unless specified otherwise in this approval, sampling and testing frequency is the same as for bacteriological sampling requirements as stated in the "Guidelines for Monitoring Public Drinking Water Supplies".
- vi.
 - i. Where turbidity values of greater than 1.0 NTU are observed entering the water distribution system, from individual GUDI or non-GUDI wells or combined flow from non-GUDI wells, the Approval Holder shall investigate the cause and take corrective action as necessary and notify the Department.
 - ii. Where turbidity values of greater than 5.0 NTU are observed in the water distribution system, the Approval Holder shall investigate the cause and take corrective action as necessary and notify the Department.

e. **Greensand Filtration Requirements:**

- i. The greensand filtration process shall be monitored and equipped with alarms and instrumentation to notify the Approval Holder of any problems that may compromise the disinfection process or result in a health-related drinking water guideline exceedence.
- ii. Standard operational procedures for the greensand filtration process shall be developed, implemented and communicated to all operations staff and documented in the operations manual required by Clause 5(I) above. The procedures and a log indicating the date and method of communication to staff shall be made available to the Department immediately upon request.
- iii. The standard operational procedures referenced in 7 e) ii) shall be submitted to NSE by May 2, 2016.

8. **Filter Backwash Water System - Performance and Limits**

- a. Filter backwash water from the Facility shall be discharged to an approved location.
- b. The Approval Holder shall submit an updated filter backwash plan to NSE for approval on or before June 30, 2016, for the independent wells and an interim plan for the wells that will be connected to the treatment plant. The filter backwash plan shall address the concerns identified in the 2013 System Assessment Report and shall include discharge locations and limits.

9. **Sludge Disposal**

- a. The Approval Holder shall submit a plan for the ultimate disposal of solids from the waste treatment process to the Department for review and approval on or before June 30, 2016.
- b. All solids from the waste treatment process shall be disposed in accordance with the approved sludge disposal plan.
- c. Written approval is required from the Department to modify the sludge disposal plan.

10. Upgrade Approvals

- a. The Approval Holder shall obtain from NSE a separate Approval for the construction of any proposed facilities required to meet the drinking water treatment standards and waste discharge requirements.
- b. The Approval Holder shall submit an application for an amendment to this Approval if any new wells are to be connected to the existing Water Supply System. No additional wells shall be connected to the existing Water Supply System without prior written approval from the Minister.

11. Production

- a. The Approval Holder shall comply with the Terms and Conditions of the water withdrawal approval for the Facility.
- b. The Approval Holder shall report water withdrawal data in the annual report.

12. Backup Water Systems

- a. When a backup water system is used for supplying water for human consumption, the Approval Holder shall immediately notify the Department and identify the anticipated period of time that the backup system will be in service.
- b. For backup systems that do not meet the Nova Scotia Treatment Standards, the Approval Holder shall immediately initiate a Boil Water Advisory as stated in the "Guidelines for Monitoring Public Water Supplies". The Approval Holder shall maintain the boil advisory until otherwise advised by Nova Scotia Environment.
- c. For backup systems that meet the Nova Scotia Treatment Standards, the backup water system may continue to operate as under normal conditions until the main water system is ready to be put back into service.

13. Monitoring and Recording

- a. All monitoring shall be carried out as per the requirements of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* and the "Guidelines for Monitoring Public Drinking Water Supplies" as amended from time to time.

- b. The Approval Holder shall monitor and sample the Water Supply System in accordance with a monitoring program approved by the Department and which meets the minimum requirements of Schedule A attached. In the case of a discrepancy between Schedule A and the approved monitoring program, the approved monitoring program shall apply.
- c. Sampling shall be representative of the water distribution system.
- d.
 - i. On or before October 1, 2016, the Approval Holder shall undertake a review of sampling sites (post water upgrades) and submit to the Department for approval a recommended monitoring program for the Water Supply System for the current year. The proposed sampling plan shall address the items identified in the 2013 System Assessment Report and associated Corrective Action Plan.
 - ii. On or before October 1 of each year, the Approval Holder shall recommend to the Department the monitoring program for the Water Supply System for the following year highlighting any changes and the reason for the change. Any existing monitoring program shall remain in place until the recommended monitoring program is approved by the Department.
 - ii. The monitoring program shall include compliance monitoring, as required by this Approval, and process monitoring, response monitoring, special process characterization and optimization monitoring and source water characterization monitoring.
 - iii. The monitoring program shall meet the minimum requirements of the Department's "A Guide to Assist Nova Scotia Municipal Water Works Prepare Annual Sampling Plans", as amended from time to time.
 - iv. The monitoring program shall be acceptable to the Department.
 - v. The Approval Holder is responsible for implementing, on an annual basis, the monitoring program and subsequent revisions as approved by the Department.
 - vi. The Approval Holder shall not move, relocate or otherwise alter the location of the sampling locations indicated in the approved monitoring program without written permission from the Department.
 - vii. Following a review of any of the analytical results required by this Approval, NSE may alter the frequencies, location, and parameters for analyses required for this Approval or require other remedial action.

- e. Any flow measuring devices and continuous water quality analysers and indicators with alarm systems shall be installed, maintained and calibrated as specified by the instrument manufacturer's instructions. Calibration logs for each instrument shall be maintained on Site and be available for inspection immediately upon request by the Department.
- f. The Approval Holder shall establish a QA/QC program to validate the measurements obtained from continuous monitoring equipment and for all analysis conducted at the Facility or a non-certified laboratory.
- g. The Approval Holder shall establish and conduct process control testing and sampling and record the results. Results are to be made available for inspection or review by departmental staff immediately upon request.
- h. The Approval Holder shall establish and conduct source water protection testing and sampling and record the results. Results are to be made available for inspection or review by departmental staff immediately upon request.

14. Laboratory Reports and Water Quality Results

- a. The Approval Holder shall submit copies of the laboratory certificate of analysis to the Department immediately upon request.
- b. The Approval Holder will authorize and work with laboratories to electronically report water quality results to the Department upon implementation of an on-line drinking water quality surveillance program.
- c. Electronic reporting shall not replace the Approval Holder's responsibility to immediately notify the Department when bacteria is present or an exceedance of a maximum acceptable concentration or interim maximum acceptable concentration for a health-related parameter listed in the "Guidelines for Canadian Drinking Water Quality" is detected.

15. Reporting

a. Reporting Upon Request

- i. The Approval Holder shall keep records continually updated in such a way that weekly and/or monthly reporting of monitoring and sampling results can be immediately sent to the Department upon request.

b. Annual Reporting

- ii. The Approval Holder shall prepare and submit to the Department, an annual performance report for the Water Supply System.
- iii. The annual report shall be submitted on or before April 1 following the completion of the calendar year being reported upon.
- iv. The annual report shall contain but not be limited to the following information on the form provided by the Department.
 - (1) a summary and discussion of the quantity of water supplied during the reporting period on a per month basis showing design values, maximum daily flow and average daily flow for each month and any other parameters or conditions specified in the Water Withdrawal Approval.
 - (2) a summary and interpretation of analytical results obtained in accordance with the monitoring and recording section of this Approval, including an explanation for any exceedance of the maximum acceptable concentration (MAC) or interim maximum acceptable concentration (IMAC) of health-related parameters listed in the "Guidelines for Canadian Water Quality", latest edition and the actions taken to address the exceedance.
 - (3) annual trend graphs for parameters that are continuously monitored.
 - (4) date and description of any emergency or upset conditions which occurred during the period being reported upon and action taken to correct them.
 - (5) any modifications to the contingency plan or emergency notification procedures including a description of how the information was communicated to staff.
 - (6) a list of the names of each laboratory utilized by the Approval Holder and the parameters analysed by each laboratory.
 - (7) an update on the status of the source water protection plan, including any modifications to the plan or implementation schedule, and a summary of activities taken to achieve the goals and objectives of the plan.
 - (8) all incidents of free chlorine residual below 0.20 mg/L in the water

distribution system shall be detailed with a description of any actions taken.

- (9) verification that the operational conditions remained within the design range for achieving CT/IT; if operational conditions went outside the design ranges, provide CT/IT calculations and a summary of corrective actions taken.
- (10) records of any violations of the conditions of this Approval and actions taken by the Approval Holder to correct those violations.
- (11) any complaints received and the steps taken to determine the cause of the complaint and the corrective measures taken to alleviate the cause and prevent its recurrence.
- (12) a review of the QA/QC program to validate the measurements obtained from continuous monitoring equipment and for all analysis conducted at the Facility or a non-certified laboratory.
- (13) a list of each certified operator and their level of certification.

c. Immediate Reporting on Operation

- i. The Approval Holder shall notify NSE immediately in the event of an incident that may adversely affect the quality of the water within the Water Supply System. Notification shall be made to a live person followed by fax or email. These incidents shall include but not be limited to: the presence of bacteria; inadequately disinfected water being directed to the water distribution system; sewage or other spills in the source water supply area; line breakage that may result in cross contamination; etc.
- ii. The Approval Holder shall notify NSE immediately if any analytical results of any specific parameter exceed the maximum acceptable concentration (MAC) or interim maximum acceptable concentration (IMAC) of health-related parameters listed in the "Guidelines for Canadian Drinking Water Quality", latest edition.
- iii. When bacteria are detected at the Facility or in the water distribution system the Approval Holder shall notify NSE immediately and undertake corrective action as outlined in the latest edition of the "Guidelines for Monitoring Public Drinking Water Supplies", as amended from time to time or other Policies or directives issued by NSE.

- iv. If the chlorine residual in the water distribution system is less than 0.20 mg/L free chlorine, the Approval Holder shall notify NSE immediately and take immediate action to obtain the required residual.

16. MPA Testing and Reporting

- a. MPA testing (of the raw water from each individual GUDI well) is required every two years in spring following a rainfall.
- b. The Approval Holder shall immediately notify the Department if the GUDI status of a well changes and take any necessary corrective action.
- c. MPA testing shall be conducted in accordance with Appendix A of the Nova Scotia Treatment Standard for Municipal Drinking Water Systems, Protocol for Determining Groundwater Under the Direct Influence of Surface Water.

17. Records

- a. The Approval Holder shall keep the following records and water quality analyses:
 - i. All incidents of suspected and/or confirmed disease outbreaks attributed to the water system shall be documented and kept for a minimum of ten years.
 - ii. Bacteriological, chlorine residual and turbidity analyses shall be kept for two years.
 - iii. Chemical analysis shall be kept for 10 years.
 - iv. Annual water withdrawal records shall be kept for 10 years.
- b. The Approval Holder shall also retain the following information for a period of three years:
 - i. calibration and maintenance records;
 - ii. continuous monitoring data.
- c. A copy of project reports, construction documents and drawings, inspection

reports, shall be kept for the life of the Water Supply System.

18. Site Specific Conditions

- a. i. The Approval Holders shall sample the following wells on a quarterly basis, to be analyzed for polycyclic aromatic hydrocarbons (PAHs): Well No. 10 and observation well No. GWMW 99-5.
- ii. Any amendment(s) to the sampling program referenced in 19(a)(i) must be approved in writing by NSE.
- b. The Approval Holder shall inspect all observation wells within the Town of Pictou Wellfield and Caribou Wellfield on an annual basis to evaluate the structural integrity of the wells and make repairs as necessary. All observation wells shall be properly capped with security measures in place.

SCHEDULE A		
SAMPLING REQUIREMENTS		
Non-GUDI and Medium Risk GUDI Wells, with Natural Filtration, Greensand Filtration, Disinfection and Water Distribution System		
PARAMETER	MINIMUM FREQUENCY	LOCATION
parameters as per the source water protection monitoring plan	In accordance with Step 5 of the Source Water Protection Plan and approved annual monitoring program	In accordance with Step 5 of the Source Water Protection Plan and approved annual monitoring program
water volume	continuous*	each individual well and combined flow; as per the Water Withdrawal Approval
temperature	daily grab or continuous*	CT control point
pH	daily grab or continuous*	water entering the distribution system; and as required by process monitoring if pH control is practised

SCHEDULE A		
SAMPLING REQUIREMENTS		
Non-GUDI and Medium Risk GUDI Wells, with Natural Filtration, Greensand Filtration, Disinfection and Water Distribution System		
PARAMETER	MINIMUM FREQUENCY	LOCATION
turbidity	<u>For GUDI Wells</u> continuous*	<u>For GUDI Wells</u> raw water at each individual GUDI well before pre-treatment and/or disinfection; and as requested by NSE.
	<u>For Non-GUDI Wells</u> Daily Grab or continuous*	<u>For Non-GUDI Wells</u> from individual wells or the combined flow entering the distribution system; and as requested by NSE
turbidity within distribution system	weekly grab	distribution system sample points
backwash waste water	in accordance with the approved annual monitoring program to comply with discharge criteria	in accordance with the approved annual monitoring program to comply with discharge criteria
chlorine residual	continuous*	all locations where water enters the distribution system from individual wells or combined wells; storage tank outlet
	twice weekly grab, spread evenly throughout the week	distribution system sample points

SCHEDULE A		
SAMPLING REQUIREMENTS		
Non-GUDI and Medium Risk GUDI Wells, with Natural Filtration, Greensand Filtration, Disinfection and Water Distribution System		
PARAMETER	MINIMUM FREQUENCY	LOCATION
total coliform and E.coli (present/absent) **	twice weekly (spread evenly throughout the week)	all locations where water enters the distribution system from individual wells or combined wells; and distribution system sample points
parameters as per the corrosion control program	quarterly grab sample	select distribution sample points
lead	annual grab sample - during warmest month	select distribution system sample point(s)
total trihalomethanes	quarterly grab sample	select water distribution system sample point(s) representative of the longest retention time - generally furthest from the source
haloacetic acids	quarterly grab sample	select distribution system sample point(s)
parameters as per the process monitoring program	in accordance with the approved annual monitoring program	in accordance with the approved annual monitoring program
	UV monitoring	see 7(b), UV light requirements

SCHEDULE A		
SAMPLING REQUIREMENTS		
Non-GUDI and Medium Risk GUDI Wells, with Natural Filtration, Greensand Filtration, Disinfection and Water Distribution System		
PARAMETER	MINIMUM FREQUENCY	LOCATION
parameters as per the Guidelines for Monitoring Public Drinking Water Supplies (GMPDWS)	annually for GUDI wells; every two years for non-GUDI wells (Note - fluoride is a required parameter regardless of whether fluoridation is occurring or not because natural fluoride may be present)	raw water from each individual well; and treated water entering the distribution system
MPA testing	every 2 years, in spring following a rainfall	raw water from each individual GUDI well; in accordance with the Protocol for Determining Groundwater Under the Direct Influence of Surface Water.
unless specified otherwise in the approved monitoring program, all health-related parameters in the Guidelines for Canadian Drinking Water Quality, latest edition, having maximum acceptable concentrations (MACs)	every 5 years - timing for individual parameters may fluctuate (e.g. pesticides during application periods, etc.) (Note - algal toxins does not apply to groundwater supplies.)	raw water from each individual well; and treated water entering the distribution system except bacteria, THMs, HAAs, and lead which are to be taken in the distribution system
Viruses	as requested by NSE	raw water from each individual well; and water distribution system

SCHEDULE A		
SAMPLING REQUIREMENTS		
Non-GUDI and Medium Risk GUDI Wells, with Natural Filtration, Greensand Filtration, Disinfection and Water Distribution System		
PARAMETER	MINIMUM FREQUENCY	LOCATION
<i>Giardia & Cryptosporidium</i>	as requested by NSE	raw water from each individual well; and water distribution system

- * Continuous monitoring - readings shall be taken a minimum of once every five minutes. Any report submitted to NSE shall include the maximum value for turbidity and the minimum value for residual chlorine recorded on the continuous monitoring equipment.
- ** The presence of coliform will require an immediate notification to NSE and resampling of the water.

Appendix D

Pictou Caribou Source Water Protection Plan

(2013, Revised in 2014 and 2017)



Pictou / Caribou Source Water Protection Plan
 Approved: October 16, 2017

Revised: October 10, 2017

Prepared For



Environment

Prepared By

Town of Pictou



Birthplace of New Scotland

Caribou Source Water Protection Committee
 Members

REVISIONS

October 2017

REMO officer updated

January 2017

Minor Grammar Changes

Deleted Preamble – this section did not add value to the report and was captured in the Introduction.

Added Sections 3.7 and 4.7 to include “environmental risk” and how the source water protection committee can identify and respond. This changed the numbering the proceeding subsection headers.

3.7 To include reference to the sampling and monitoring standards the town has applied since the 2014 wellhead upgrades.

4.7 Added this section on Climate Change monitoring and mitigation strategies. Updated the status of current town related best practices to reflect recent upgrades. This describes current actions taken to monitor impact of climate change and suggested action plans in events of major droughts.

4.10 Include action plan to eliminate all chemical and minimize travel requirements to wells located in the connected wellfield (Caribou and Pictou Wellfields)

5.2 Added new program to address water conservation in drought events

Included newly programmed alarms to notify if well parameter or water chemistry exceeds guidelines set by NSE or internally.

Describe the impact and monitoring of centralized treatment on source water safety.

December 2014

Updated Figures and Table numbers to reflect new map

Approved: October 16, 2017

Pictou / Caribou Source Water Protection Plan

Section 4.4	Included graphic of Town sewer and water systems
Section 5.8	Created a risk management ranking system
Section 5.9	Renumbered Implementation Plan and included references to Utility EP and CP as well as REMO involvement

July 2013

General	Updated names of all provincial and federal government departments. Changed NSEL to NSE.
Table of Contents	Update Table to reflect changes in plan
Section 1.	Updated Introduction.
Section 1.1	Changed to Section 2.
Section 2.	Changed to Section 3.
Section 3.	Changed to Section 4.
Section 4	Changed to Section 5.
Section 5.	Changed to Section 6.
Section 3.	Updated map of delineated source water area.
Section 4.	Modified Table 1 to include type/category of potential risk.
Section 4.6	Changed Forestry to Forestry Operations
Section 5.4	Referenced all NSE pesticide regulations in second bullet.
Section 5.8	Included Tables 2. Modified table to identify status of activity, completion date, and the activities intended audience. Activities organized by risk management strategy (i.e. Education and Stewardship Initiatives, Best Management Practices, Emergency and Contingency Planning, Monitoring).
Section 6.2	Added Table 3. Table provides a status of monitoring activities, and recommended next steps.
APPENDICES	All Appendices updated include websites, names of provincial departments, and contact information.
APPENDIX II	Appendix II has been replaced with Wellfield Management Policy adopted by the Town of Pictou. Text from previous Appendix II has been incorporated into sections 1 and 2 of the document.

Pictou / Caribou Source Water Protection Plan

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Pictou / Caribou Source Water Protection Plan

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INTRODUCTION

Water is a provincial resource and regulated by Nova Scotia Environment (NSE) under the Environment Act. All Municipalities are required to obtain an approval from NSE to withdraw from water sources (i.e. groundwater and surface water) in Nova Scotia. The Town of Pictou (Town) holds water withdrawal approvals for both the Caribou and Pictou wellfields and an Approval to Operate (Approval) for their water treatment and water distribution system from NSE under the Activities Designation Regulation. The Approval details the operational conditions for the Town to ensure compliance with the Environment Act. Included are provisions for the Town to develop a source water protection plan (SWPP).

In 2002, NSE introduced its Drinking Water Strategy to ensure clean drinking water for all Nova Scotians. The main goal of a Water Utility is to provide safe, clean drinking water to its customers. Protecting the quality and quantity of the source water is a top priority for utilities as one-step in the multiple barrier strategy developed for the protection of drinking water quality in Nova Scotia.

The Town is located along the Northumberland shore of Nova Scotia. The Town's source of drinking water comes from two wellfields - one directly underlying the Town itself (Town Wellfield) and one to the north of the Town, referred to as the Caribou Wellfield. The Town Wellfield is bounded to the south by Pictou Harbour while the Caribou Wellfield extends from the Town boundary north into central Pictou Peninsula.

The Town's two wellfields utilize 13 wells. The Caribou Wellfield contains five wells (#8, #10, Division Road, Smith Grant and Footes Lane) while the Town Wellfield contains the remaining eight (#11, #12, #14, #15, Public Works, Exhibition, M&M and Beeches Road). All 13 wells are housed in structures constructed and maintained by the Town's water utility on lands owned by the Town and supply water to a population of 4,400.

The fundamental goal of the SWPP is to ensure the continued safety and quality of the Town's drinking water supply through protection of its source waters in the Town and Caribou watersheds. The procedures for development of the Plan are:

- 1) Form a Source Water Protection Advisory Committee (Committee);
- 2) Delineate a Source Water Protection Area Boundary;
- 3) Identify Potential Contaminants and Assess Risk;

4) Develop a Source Water Protection Management Plan; and

5) Develop a Monitoring Program to Evaluate the Effectiveness of a Plan.

This document provides details for source water protection through education and monitoring processes, and is not intended to form a basis for any regulation or watershed designation brought forth at a future time.

STEP 1: WATERSHED ADVISORY COMMITTEE

A Watershed Advisory Committee was appointed to develop a Source Water Management Plan and provide advice to Town and Municipality of the County of Pictou Councils, as well as the residents living in the area. The Watershed Advisory Committee consists of members representing a cross section of the various interested stakeholders such as the Water Utility, council members (Town and Municipality of the County of Pictou Councils), landowners, and land users. The Terms of Reference (Appendix I: Pictou / Caribou Source Water Protection: Advisory Committee - Terms of Reference) explains the details of operations and make-up of the Committee. The Wellfield Management Policy (Appendix II: Wellfield Management Policy) provides a framework for ensuring a co-ordinated effort by the Town and the Municipality of the County of Pictou representatives for protecting water quality and quantity for all residents served by the Town and Caribou Wellfields.

The goals of this committee are to:

- 1) Protect water quality and quantity for both Town and Municipality of the County of Pictou Residences;
- 2) Establish an effective SWPP; and
- 3) Develop a SWPP that enhances information sharing, promotes mutual respect and fosters open communications;

STEP 2: Delineating the Source Water Area

The source water area is determined as any lands inside the Town boundaries and those lands north of town included in the area shown in Figure 1: Source Water Area for the Town's water supply. The following geographical coordinates bind the source water area:

"From the intersection of Patterson St. and Division Rd. 343 degrees to Highway 106 at:

N45 42.101 W62 43.275

Then 327 degrees to N 45 42.470 W 62 43.618

Then 02 degrees to the Central Caribou Rd. at N 45 43.016 W 62 43.596

Then 76 degrees to Highway 106 at N45 43.289 W 62 42.078

Then 178 degrees to Glenn East Rd. at N 45 42.631 W 62 42.046

Then 171 degrees to N 45 42.305 W 62 41.969

Then to the Division Rd. at the eastern town boundary"

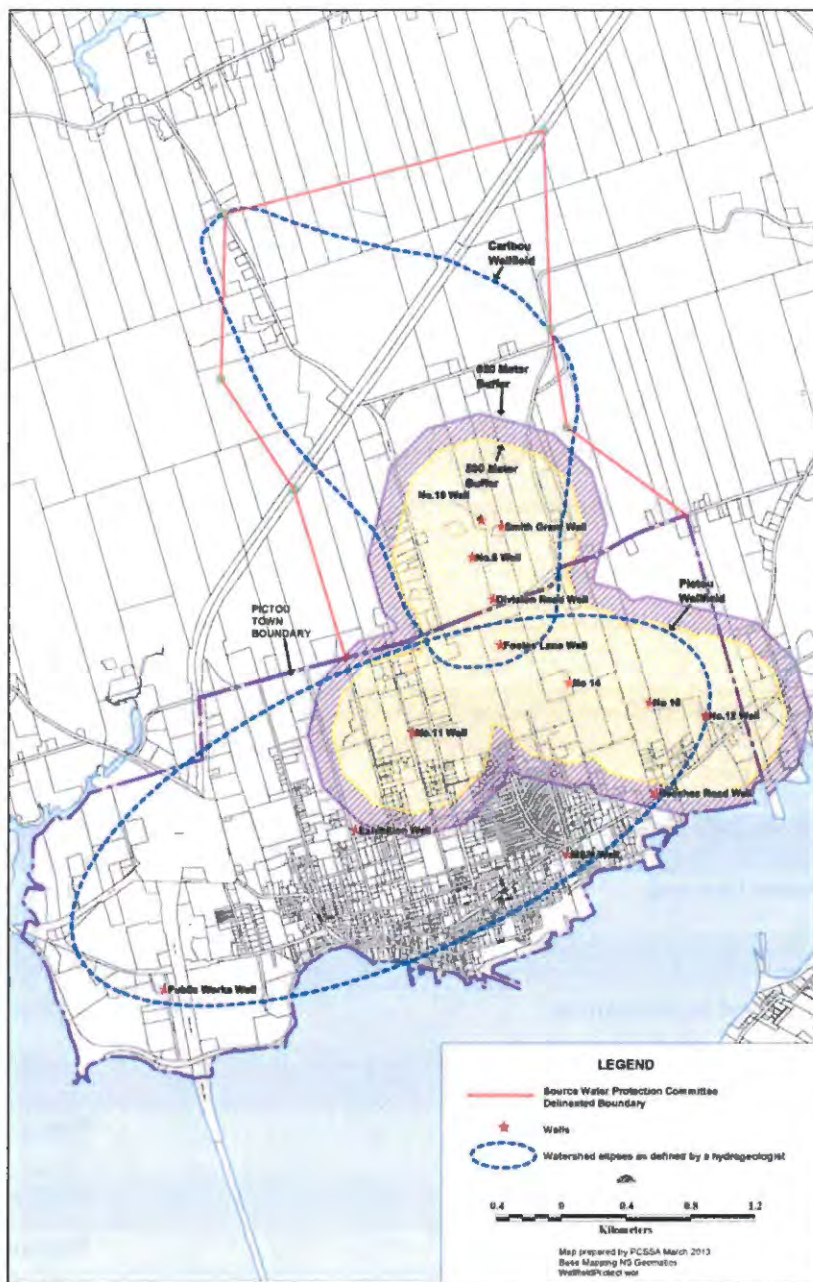


Figure 1: Source Water Area for the Town’s water supply

The Pink shaded area is where privately owned domestic wells located within 650 m of a planned installation of a Town production well, with consent, will have an Hydrogeologist pre-assessment (Appendix II: Wellfield Management Policy). This boundary roughly represents the geological “bowl” of the source water area and is not a legal or surveyed description.

STEP 3: SOURCE WATER RISK IDENTIFICATION

The risks to water quality have been identified and are discussed with respect to the activity or land use. These activities include transportation, residential development, waste disposal, agriculture, industrial development, recreation and environmental. Potential risks associated with these activities are listed in Table 1: Potential Risks for Source Water Quality. These include pathogens, salt, petroleum products, pesticides, sediment and climate change.

These risks are grouped into activities or land uses in the following section to more easily apply selected management strategies. For example, residential risks might utilize educational initiatives. The implementation of an education program would cover several of the individual risks identified such as oil tanks, septic tanks and storage of pesticides.

Table 1: Potential Risks for Source Water Quality

Risk	Category
Changing Conditions of Wellfield including test well security	All
Well Drilling Activities	Utility / Residential
Creosote Timbers in Wellfield, above and below ground	Industrial
Increase in Water Demand	Utility
Salvage Yard impact on water quality	Industrial
Use of round-up and liquid manure	Agricultural
Forest clear cutting	Forestry Operations
Speed Zones	Transportation
Garbage Dumping	Other
Road Conditions	Transportation
Abandoned Sand and Gravel Pits	Industrial
Abandoned Wells	Utility / Residential
Septic Tank System malfunctions	Residential
Oil Tank leaks	Residential / Industrial / Commercial

Risk	Category
Transportation, fuel trucks, etc.	Transportation
Urban run-off and contaminants generated by Commercial, Residential & Recreational activities	Commercial / Residential / Recreational
Existing Commercial Activities	Commercial
Cemeteries	Other
Use of Pesticides	Agricultural / Residential
Forest or building fires	Forestry Operations
Climate Change	Environmental

3.1 AGRICULTURE

Agriculture risks are considered low because of the limited activity in the watershed. Potential risks can exist and should be addressed to protect drinking water quality. Risks are primarily associated with pesticide/herbicide use and manure storage and spreading, i.e. biological and organic contaminants. Continued due diligence on the part of the farming community will ensure that any risks associated with agricultural operations will be managed appropriately.

3.2 INDUSTRIAL AND COMMERCIAL ACTIVITIES

Industrial and commercial risks are mainly related to shops and services in the watershed area. Risks include chemical spills/leaks, septic system malfunctions, petroleum contamination, and contaminants generated from salvage yards.

The following commercial sites are potential sources of contaminants in the Town or Caribou Wellfields:

- Salvage Yard (petroleum products, chemicals, antifreeze)
- Abandoned Sand and Gravel Pit (direct pathway to groundwater)
- Gas Stations (petroleum products, antifreeze)
- Ship Yard (petroleum products, various chemicals)
- Print Shop (chemicals associated with inks and solvents)
- Metal Fabrication (petroleum products, various chemicals used in fabrication)
- Landscaping (pesticides/herbicides, organic materials)
- Concrete Plant (chemicals)
- Power Substations (herbicides, petroleum products)

3.3 RECREATION

Recreation risks are mainly chemical and biological in nature. These include pesticide use on sports fields, the exhibition grounds, and chemicals used at various sports venues such as the arena and the pool.

Marinas also have potential risks as various potential contaminants are transported to and from the sites.

Garbage disposal and campfires are also additional recreation risks.

Finally, risks are sometimes associated with pet wastes. Pet owners should be encouraged to pick-up waste and dispose of it appropriately.

3.4 RESIDENTIAL ACTIVITIES

The main risks identified in the Caribou and Town wellfields included those from septic systems, oil tanks, runoff, yard maintenance and household waste.

Septic systems are potential sources of microbial, inorganic, organic contaminants, pesticides and herbicides as well as pharmaceutical products. Septic systems are considered an elevated risk to water quality in some situations.

Oil tanks are a potential source of organic contaminants. Oil entering a watercourse or groundwater is both difficult and extremely expensive to remove. Accidental spills can occur in several ways. Fuel storage tanks can rust over time and develop holes in the tank. Fuel lines can leak or break if something falls on the line, such as snow or ice. Spills can also occur during fueling. Only certified fuel storage tanks should be used for fuel storage and the owner is responsible to inspect their tank for signs of deterioration or damage.

Residential runoff could contain pesticides, herbicides, as well as other chemicals used for household and landscaping maintenance.

Fire suppression could also create runoff contamination. Runoff should be contained if possible or remediated as soon as possible after the fire is extinguished.

The Town of Pictou also understands that residential sewage collection and water distribution could impact groundwater. To fully understand the area of influence, the map on the next page displays all water and sewer lines.

Pictou / Caribou Source Water Protection Plan

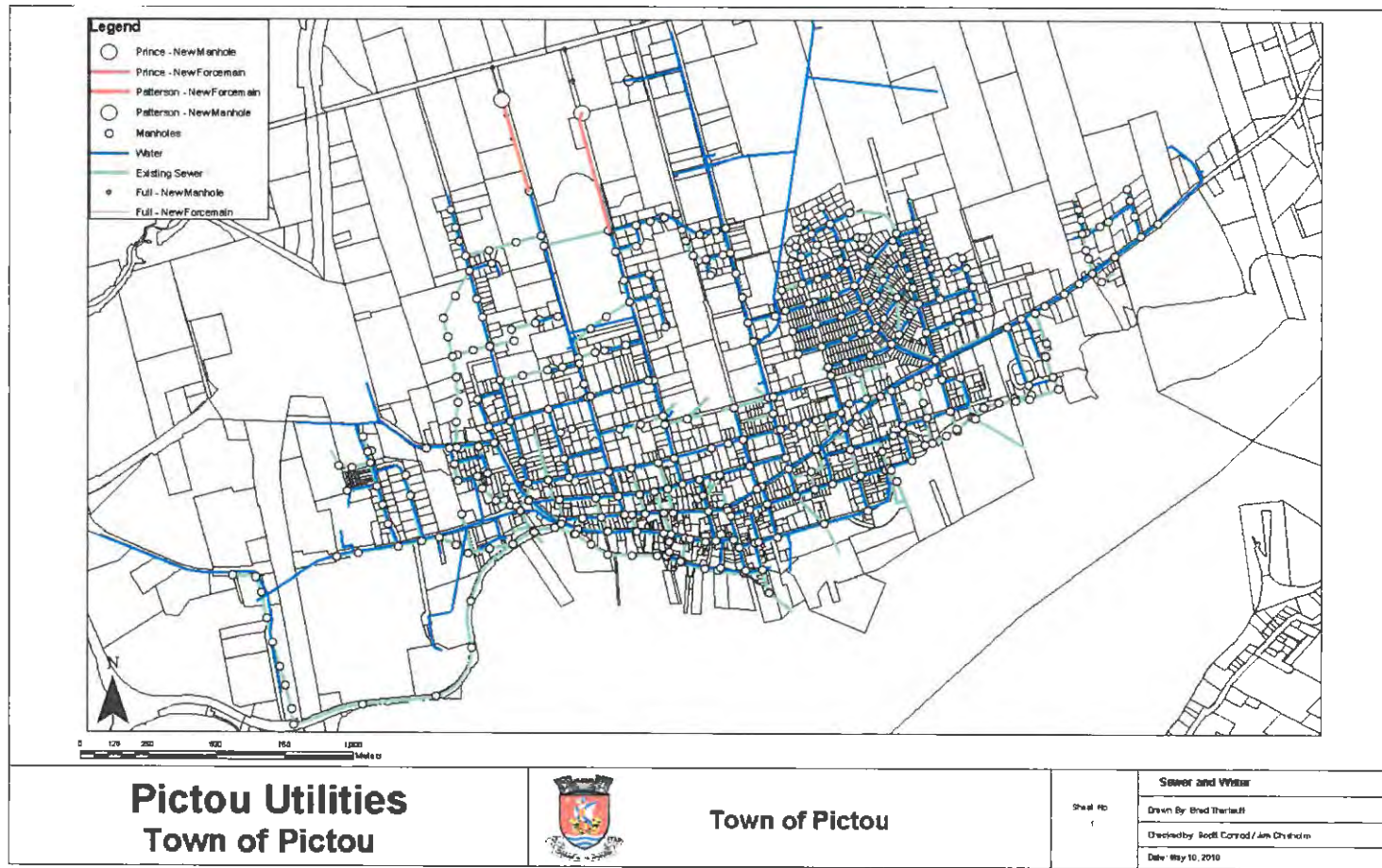


Figure 2: Town sewer and water mains

3.5 TRANSPORTATION / ROAD MAINTENANCE

Accidental spills resulting from transport of various materials (ex. petroleum products, chemicals used in commercial businesses or industrial processes in the area) are potential threats. The use of oil for residential heating and its transportation pose the greatest risk. Petroleum products (oil, gasoline and diesel) may enter watercourses and subsequently groundwater, because of automobile or transport accidents.

Contaminants could also be biological in nature. This could occur as in the case of a spill during the transport of septic sludge. Since accidents are always a possibility, these risks must be managed appropriately.

Road salt is a contaminant associated with winter road maintenance. Salt contamination can find its way into groundwater via ditches or direct infiltration and affect water quality.

Another risk associated with transportation is the high occurrence of excessive vehicular speeding on various roads through the watershed. Speeding is the leading cause of accidents and in a sensitive area like the Central Caribou Watershed, any increased potential for accidents should be addressed.

3.6 FORESTRY OPERATIONS

Risks associated with forestry operations include:

- wood harvesting and extraction;
- road construction and maintenance;
- pest and weed control; and
- fuel use, transfer and storage.

These are potential sources of pesticides and organic contaminants. A significant concern exists with respect to the long-term impact of clear cutting and the impact on changes in water table levels due to the loss of vegetative cover.

Forestry operations have been mainly mechanized clear cutting of various stands. Unfortunately, several properties were clear cut as a response to the uncertainty of regulations being proposed that were perceived to affect a landowner's ability to carry out forestry activities.

The selective harvesting of mature stands is a common practice in several watersheds in Nova Scotia. A forest management plan designed to protect water quality is the best way to minimize the impacts in the watershed.

Forestry operations utilize petroleum products for fuel and lubrication. Accidental spills can occur because of the use of these products and pose an elevated risk if the operation is within the recharge area for town or other individual wells. Accidental spills can occur during refueling or when hydraulic hoses break. Containers used for temporary storage of petroleum products can pose a risk to water quality if the containers are not properly constructed.

Other risks associated with forestry include fire and the suppressants utilized to control forest fires. Since the watershed is mainly covered by forest and that there are active forestry operations, there is a potential for fire and degraded water quality from the loss of forest cover and possibly from the use of chemical suppressants. In the case of large forest fires, the use of appropriate additives to water, or even the use of salt water is preferable to loss of cover.

The term “pesticide” is a generic term used to describe a variety of poisons used to kill plants (herbicides), insects (insecticides) and even fungus (fungicides). The use of pesticides in the watershed can potentially contaminate drinking water. Runoff from areas where these chemicals have been applied can enter groundwater and pose a human health risk.

3.7 ENVIRONMENTAL

Global warming is inevitable, therefore and it is essential to consider this risk of it. Specifically, naturally occurring events, such as drought, will increase in frequency. The committee and Pictou Water Utility should consider these events as probable and should determine best practices for creating indicators and mitigating impact.

3.8 OTHER

The watershed committee has identified several other concerns that may affect water quality. A frequent problem in rural Nova Scotia is the uncontrolled and illegal dumping of garbage. Road networks through watershed lands provide the perfect access to remote locations where unconcerned individuals will simply

dump garbage regardless of the potential impacts. It is often the case that those that dump the garbage do not usually live in the watershed area. Illegal dumping can introduce various contaminants into the groundwater system depending on the nature of the garbage.

A legacy of past practices, i.e. creosote timbers that once were the structural framework of wharfs along the waterfront, are now buried in the middle of the Central Caribou Wellfield. While, in cooler temperatures, creosote is immobile, contamination of drinking water from the creosote remains a concern for Town and Municipality of the County of Pictou residents and should continue to be monitored over time.

The location of cemeteries is another concern for residents although they are considered a minor concern at this point. There are two cemeteries - one located on the fringes of the Caribou Wellfield and one is in the Town Wellfield. The main contaminant associated with cemeteries is formaldehyde in embalming fluid that leaches out during decomposition. Other contaminants can be associated with cemeteries as well, such as ammonia, nitrate, bacteria, viruses, etc. Continued monitoring is required to identify any changes in groundwater quality.

Although bio-solids are not in use at this time, the development of application methods in other areas suggests that they should be considered a potential risk, and their use in the source water area must be discouraged.

Refer to Table 4: Status of Effectiveness of Monitoring Land-use Activities.

Finally, the Town of Pictou water withdrawal is also considered a risk. To mitigate risks, the Town has installed state-of-the-art monitoring and controlling devices as well follow a rigorous sampling protocol defined by NSE. In 2016, the Town of Pictou did not have any Health Parameter exceedances.

STEP 4: RISK MANAGEMENT RECOMMENDATIONS

A SWPP contains a variety of management options that work together to effectively manage risks to water quality in a watershed. Management options fall into a variety of categories referred to as the ABC's of source water protection as outlined by the NSE guides to source water protection planning. They include Acquisition of land, By-laws, Best management practices (BMP's), Contingency plans, Designation and Education and stewardship.

Acquisition of Land: The acquisition of land by the Town gives direct ownership and control of portions of the source water area to the Town. This allows for a high level of protection of a source area due to direct control over the activities that can take place there. Targeted acquisition of specific parcels of land, as the need and opportunity arises are common practices in water supply areas throughout Nova Scotia. For more information please see Figure 3: Map of Town owned Land (brown).

Best Management Practices (BMP's): These standardized and widely accepted practices for activities and products are the most practical and effective means of preventing or reducing contaminants from reaching source water. BMP's have been developed for most activities, which occur in a wellfield. They can be applied to various aspects of residential development, including septic system and oil tank installation and maintenance, and construction activities. Most aspects of agriculture have operating BMP's in place through a variety of regulatory and market driven processes. Many of these practices are specifically designed to manage specific activities, which may affect water quality. BMP's are also in place for many industrial products, services, and activities related to motorized recreation and transportation.

Land Use By-laws – Municipal Planning Strategy: Development and implementation of a Municipal Planning Strategy (MPS) allows a municipality to develop land-use bylaws to manage development and control activities near sensitive areas. The Town has developed a MPS that covers the Town Wellfield, which outlines policies aimed at protecting water quality. There are no Municipality of the County of Pictou By-laws for the Caribou area.

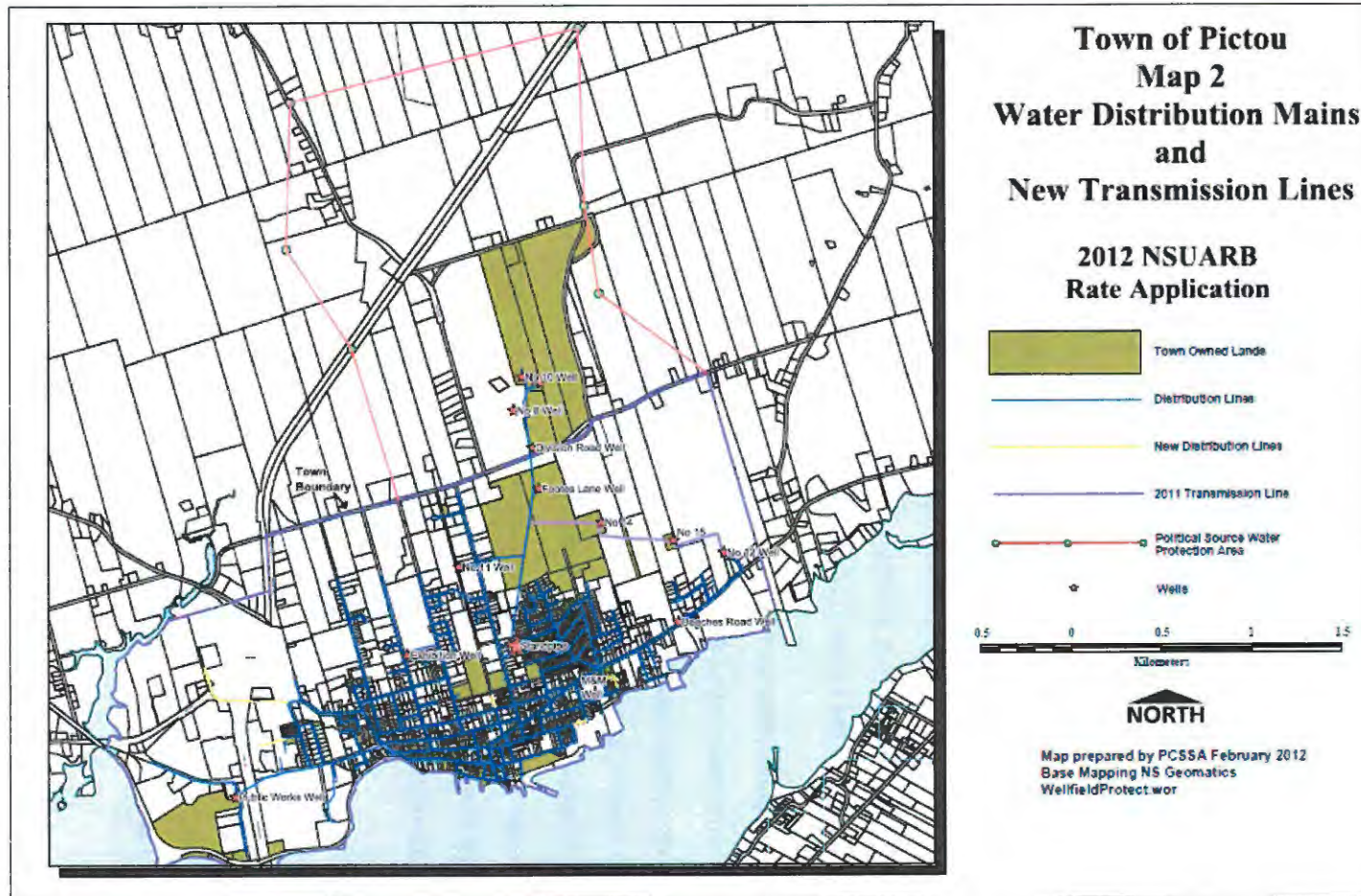


Figure 3: Map of Town owned Land (brown)

Contingency Planning: Contingency planning provides protocols to use in case of a contamination emergency in the source water area. The goal of the plan is to protect residents against contamination and ensure the immediate and long-term viability of the source area for water supply. The Town currently has an emergency response plan in place that includes boil water directives, mapping, resource lists, work plans and communications protocols to deal with emergency situations. These plans are reviewed and updated annually.

Designation as Source Water Protection Area: Designation is not being considered as a management option.

Education and Stewardship Initiatives: The development and promotion of an education and stewardship program can be an effective management option for protecting source water quality.

Education of stakeholders can reduce the uncertainty of the objectives of the Town and can help introduce a change in behavior if necessary. Education also creates a sense of ownership and responsibility among residents in a water supply area, which can significantly increase the success of other con-current management practices adopted. Specific opportunities for education and stewardship initiatives have been identified in the residential development, recreation, and forestry sectors.

The following sections describe the management options selected to address and reduce the risks identified in STEP 3: Source Water . The Watershed Advisory Committee selected these management options based on the type of water supply, the physical nature of the watershed and the specific activities that take place within the watershed. Refer to Table 3: Activities to Manage Identified Risks in Pictou/Caribou Wellfields in Implementation Plan for all the activities identified below.

4.1 AGRICULTURE

Agriculture activities are limited within the Central Caribou Watershed. The following management options are proposed to manage risks associated with, bacterial contamination of source water due to manure spreading and storage, and the use of chemical fertilizers.

- Make available the Recommended Agriculture Practices within Municipal Watersheds that has been developed by NSE, and Nova Scotia Department of Agriculture (Appendix III: A Guide to Recommended Agricultural Practices within Municipal Drinking Water Supply Areas in Nova Scotia) and general information on the Source Water Protection initiative.

4.2 INDUSTRIAL/COMMERCIAL ACTIVITIES

Industrial and commercial development is found throughout the watershed area, especially in the Town. It is important to emphasize contaminants that runoff from these activities can enter the groundwater system either directly through infiltration or through leaking storm sewers. It is important to educate proprietors that prevention and due diligence is the key to preventing accidental release of substances into the environment that can adversely affect water quality. The following recommendation was developed to address industrial and commercial contamination/pollution concerns.

- Develop an information/education package targeted at commercial and industrial users in the watershed area that introduces the Source Water Area Planning initiative and discusses potential contaminants associated with industrial/commercial activities such as petroleum storage, fuel spills, chemical storage, the use of pesticides, etc. The package should highlight the various best management practices for fuel storage, spill clean up, chemical storage, etc. Proper disposal of substances that could potentially affect groundwater quality should be explained. The information package should also include existing publications that discuss issues such as spraying. (See Appendix IV: Industrial/Commercial Best Management Practice References and Appendix V: Emergency Response Planning)

4.3 RECREATION

Recreation is generally considered a desirable aspect associated with living in a rural setting. Passive recreation needs to be promoted. Passive recreation fosters an appreciation for the environment and aids in the informal policing of sensitive areas. Recommended management options include:

- Establish signage at trail heads in the Caribou Wellfield and at Town boundaries educating users on the sensitive nature of the area (i.e. as a source water protection zone) and to keep it clean by not littering and being diligent with respect to forest fires etc.
- Develop bylaws regarding pet waste pickup near streams, and other sensitive areas.

Activities or concerns associated with “active recreation” include golfing, ice making and maintenance at the arena, the swimming pool and activities at the marinas. As illustrated in STEP 3: Source Water , the main concerns are associated with transfer of petroleum products, various chemicals used in cleaning and disinfecting and the use of pesticides. The recommended management options to address concerns associated with these activities include:

- Develop an information package for managers of the various recreational venues in the source water area. This package should include BMP's for golf courses, BMP's for the handling/disposal of chemicals or liquids, petroleum products and other substances that may impact water quality and general information on the Source Water Protection Planning initiative.
- Signage discussed in the above section is also an important management option that can be used.

4.4 RESIDENTIAL ACTIVITIES

The main risk activities associated with existing residential development in the watershed were identified as on-site septic systems, sewage lines, exterior oil tanks and household hazardous waste management. The management options selected to manage risks in the residential sector are as follows:

- Develop a Homeowner Education Program to help residents understand the importance of maintaining septic systems and oil tanks and the potential impacts to water quality from malfunctioning systems. The education program will include BMP's that have been developed by NSE with respect to septic systems, oil tanks, the use/storage and disposal of various household hazardous wastes and general information on other practices that contributes to watershed protection and the Source Water Protection initiative. (See Appendix VI: Residential Best Management Practice References).
- Develop a general SWP Newsletter to educate the public about impact on water quality, because of specific activities. For example, stress the importance of eliminating or restricting the use of pesticides, and when necessary use only those that degrade quickly and are recommended for use in such areas. Pesticide application must be done in accordance to the Non-Essential Pesticides Control Act, List of Allowable Pesticides Regulations, and Exceptions to Prohibitions on Non-Essential Pesticides Regulations from NSE.
- Encourage landowner responsibility for clean-up of derelict vehicles, old tanks, drums, tires, etc. for proper disposal through the SWP Newsletter.

4.5 TRANSPORTATION

In Transportation / Road Maintenance, the main risks identified with the transportation sector were associated with road construction/maintenance and accidental spills of petroleum products or other contaminants and the management of road salt contamination. The critical areas were identified as the intersections between roads and watercourses, roadside ditches and proximity to wellheads. The recommended options to manage these risks are as follows:

- Establish high profile signage along public access routes indicating the presence of the Water Supply Area and to use caution.
- Develop an awareness program (BMP's i.e. reduced speeds) for transport companies focusing on watershed protection. Include contact numbers for Emergency Response.

- Employ Contingency/Emergency Response Plan for spill response and containment (Appendix V: Emergency Response Planning).
- Continue to monitor salt levels and evaluate alternatives (i.e. sanding, de-icing chemicals) if required.

4.6 FORESTRY OPERATIONS

Forests are the dominate vegetation in the watershed. Healthy and properly managed forests support quality water protection, generate economic activity for public and private owners, and support wildlife, recreation, and other forest-based values. Potential risks to water quality identified in STEP 3: Source Water include biological, chemical and petroleum contamination and potential impacts to water quantity/availability. The following management options have been identified to manage risks associated with harvesting, pest and weed control, and fuel use, transfer and storage.

- Stress the benefit of maintaining forest cover in watershed areas. Landowners should be encouraged to minimize forestry harvesting, and to follow best management practices regarding harvest/extraction, silviculture, and fuel use and storage, developed by the Departments of Natural Resources and Environment (Appendix III: A Guide to Recommended Agricultural Practices within Municipal Drinking Water Supply Areas in Nova Scotia). In addition, any forestry activities on Town owned lands must follow the Forestry Management Plan (Appendix VII: Forest Management Plan).
- Discourage the use of pesticides for silviculture and forest protection through education (newsletter, etc.).

4.7 ENVIRONMENTAL

Drought is the immediate concern for conservation of water. Steps have already been conducted to ensure early indication of adverse effects. The Town has several monitoring sites as well as real time water level monitoring in all well houses. The Town currently has all wells alarm to notify operators when the water level in wells drop below 100 feet above the sensor. This value was chosen as it provides the operator early noticed of well drawdown and time to respond. In the event of alarms, operators will adjust the pumping rate down to help reduce the impact on drawdown. It is noticed that an immediate pumping rate change creates instantaneous relief in circumstances observed to date.

If decreases in pumping rates do not create the desired affects, a policy should be created for water conservation. This policy will be triggered by a series of events such as XX number of days without rain, XX consecutive attempts at decreasing pumping rates or some other consideration. Several communities currently

have similar policies in place which limits grass watering or car washes on certain days of the week or just provides a request to the public to conserve water.

The Source Water Protection Committee should with Pictou's Water Utility to develop a communications plan before these events occur or happen on a regular basis. For example, water conservation plans will need to be developed and proper communication channels considered. These could include alternating days of the week for watering lawns/gardens or public awareness campaigns.

4.8 OTHER

The Watershed Advisory Committee identified three additional concerns were through the development of this plan; illegal dumping, the creosote timbers buried in the watershed area and the two cemeteries - one inside Town and one in the Central Caribou Watershed area. The following management strategies are proposed to address these concerns.

- Develop a general education package or newsletter on the value of protecting source water for all residents. Groundwater is a shared resource and all residents play a part in protecting it.
- Develop a school education program focusing on the groundwater resources in the area. Education programs of this nature are generally successful in helping to educate an entire family with respect to the various challenges in protecting water quality and the important roles the various stakeholders play.
- Continue to monitor groundwater quality in monitoring wells and residential wells adjacent to the buried creosote timbers.
- Continue to monitor water quality in wells adjacent to the cemeteries.

4.9 RISK RANKING

Each risk has a varying level of probability and potential impact on the source water. To assess each risk, a rating system must be developed to rank the risk based on threat to the water system. A rating system should be based on possibility of occurrence and the severity of the impact on the water system.

As a single contamination of the water source, which makes the water unsafe could have a greater impact than several minor inconveniences. It is proposed to weigh impact as 8/10 and the probability of occurrence at 2/10. These two factors will provide a risk rating out of 10 for each activity. The table below ranks each activity based on risk:

Pictou / Caribou Source Water Protection Plan

TABLE 2: RISK ASSESSMENT

Section	Activity	Frequency (2)	Severity (8)	Total Score (10)
5.1	Agriculture			
5.2	Industrial/Commercial			
5.3	Recreation			
5.4	Residential			
5.5	Transportation			
5.6	Forestry			
5.7	Other (creasote piles, illegal dumping, two cemeteries)			

4.10 IMPLEMENTATION PLAN

Following the adoption of the SWPP the management options or strategies that have been identified to manage the risks in the Town and Central Caribou Watersheds. Several general management strategies could be implemented immediately after the SWP Plan has been approved and these are outlined below:

- Develop a broad education and stewardship program outlining the purpose and status of the management plan and opportunities for participation. This could be done internally (with help from NSE) and take the form of a watershed newsletter and include information on sewer lines, septic systems, oil tanks, passive recreation and other general stewardship initiatives. Encourage feedback and questions from homeowners and other interested parties.
- Establish signage at access roads indicating the nature of the area as a source water protection zone and provide contact information in case of an emergency.
- Contingency Plans (CP) and Emergency Procedures (EP) are annually updated within the Town of Pictou's operating manual in Chapter 5. Any suggestions for new plans or procedures can be suggested through email or directly to the Utility. These procedures identify the plan of action in the event of emergencies and a contact list depending on the type of issue (news, high-risk customers, emergency services, etc.). The Utility's EP and CP focus on well site-specific contamination or failures and how to mitigate them.
- The Regional Emergency Measures Organization (REMO) has a countywide response plan on dealing with emergencies or disasters. All major emergencies should involve this committee. The Chief Administrative Officer (CAO), **Scott Conrod**, of the Town of Pictou is the local contact, while John Davison is the regional contact. To contact **Scott**, call the Town Office at 902-485-4372 and to reach John call 902- 759-1797.

The remaining strategies identified in Step 4: Risk Management Recommendations are listed in the Table 3: Activities to Manage Identified Risks in Pictou/Caribou Wellfields to illustrate when the strategy may be implemented.

Pictou / Caribou Source Water Protection Plan

Table 3: Activities to Manage Identified Risks in Pictou/Caribou Wellfields

Management Activity	Target Area	Status	Date of Completion	Comments
Education and Stewardship Initiatives				
Develop and distribute SWPP Newsletter	All	Ongoing		Distributed in 2007, 2008, and 2011.
Establish Signage at Access Roads	Transportation / Recreation	Complete	September 2007	
Assemble and Distribute Homeowner Information Package (Appendix VI: Residential Best Management Practice References)	Residents	Complete	September 2007	Available on the Town's website.
Develop & Distribute Forestry Education Package (Appendix VII: Forest Management Plan)	Forestry Operations	Complete	September 2007	Available on the Town's website.
Develop an information package: Managers of recreational venues	Recreation	Complete	September 2007	
Develop an information package: Industrial / Commercial sector (Appendix IV: Industrial/Commercial Best Management Practice References)	Industrial / Commercial	Complete	December 2008	Available on the Town's website.
Develop and deliver a school education program	Residents	Incomplete	TBD	
Develop conservation plans	Residents	Incomplete	TBD	
Best Management Practices				
Distribute Agricultural BMP's (Appendix III: A Guide to Recommended Agricultural Practices within Municipal Drinking Water Supply Areas in Nova Scotia)	Agricultural	Complete	September 2007	Contact NS Department of Agriculture annually to determine if any changes have been made. Available on NS Department of Agriculture website.
Develop & Distribute Transportation BMP's	Transportation	Complete	December 2007	Contact NS Department of TIR annually to determine

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Management Activity	Target Area	Status	Date of Completion	Comments
				if any changes have been made.
Develop Forestry Management Plan	Forestry Operations	Complete	December 2008	Contact NSDNR annually to determine if any changes have been made.
Wellhead Upgrade Project	Utility	Complete	November 2014	Phase 1: November 2013 Phase 2: November 2014
Water Meter Installation	All	Complete	Spring 2014	Conservation
Wellfield Management Policy (Appendix II: Wellfield Management Policy) ¹	Utility	Complete	August 2011	
Eliminate Chemical Use at multiple sites and reduce traffic near water sources	Utility	In Progress	April 2019	When the Town builds a Water Treatment Plant it will centralize chemical and monitor requirements
Emergency and Contingency Planning				
Review Existing Contingency / EMO Plans	All	Complete	March 2008	
Develop Contingency Plan for Accidental Spills (residential) (Appendix V: Emergency Response Planning)	Residents	Complete	September 2007	Available on the Town's website.
Develop Contingency Plan for Accidental Spills / Accidents	All	Complete	September 2007	
Monitoring				
Monitor salt levels		Ongoing		Sampled annually
Monitor wells adjacent to buried creosote timbers		Ongoing		Sampled quarterly
Monitor water quality in wells adjacent to the cemeteries		Ongoing		Sampling frequency to be determined.
Review and Evaluation				
Review and update SWPP		Ongoing		Latest Update January 2017

¹Activity added since previous version of SWPP.

STEP 5: EVALUATION AND MONITORING

An evaluation and monitoring program has been developed in conjunction with the management plan described above. Monitoring is the basis for Step 5 of the Five Step Guide under the Drinking Water Strategy for Nova Scotia. The purpose of the program will be to carry out on-going monitoring of water quality within the watershed to assess the effectiveness of management controls, warn of potential problem areas and contaminants in the watershed and track the overall health of the supply area.

The evaluation and monitoring program will provide an on-going snapshot of conditions in the watershed and help to provide early warning of potential risks to water quality and target areas where attention is required. Monitoring will also help to determine whether the management plan is working effectively and if any changes to the plan need to be made.

The monitoring program is comprised of two main components – a water quality-monitoring component, to directly measure the quality of source water; and a general component, to monitor land use changes and other activities in the watershed.

The SWPP should be reviewed regularly to assess effectiveness and reflect any major changes in activities or land uses in the watershed or changes in source water quality. Management options should be reviewed individually to assess their effectiveness, usefulness and cost/benefit. It is recommended that the watershed committee meet at least once a year to review the plan and source water quality, or as additional information, concerning the source area, becomes available.

5.1 WATER QUALITY MONITORING

The main component of the monitoring plan is the regular sampling of the source waters within the watershed for quality analysis. Water analyses will provide an indication of the overall source water quality within the watershed and any changes in quality that occur over time because of changing land use practices or other activities in the watershed.

At present, the Utility has in place a comprehensive raw water-monitoring program for each of the wells, as part of its operating permit for drinking water supply. The program includes continual, weekly, quarterly, annual, and five-year sampling. Water quality parameters related to the SWPP are sampled on

a quarterly basis. District 3 residents, under the guidance of the Pictou County Council should develop plans to test private wells adjacent to the creosote timbers, the cemetery, and the salvage yard, at four to six well locations on a semi-annual basis, or as deemed necessary.

5.2 SWPP EVALUATION AND REVIEW

Monitoring of the activities and issues identified during the risk analysis (Step 3) of the source water protection planning process should be carried out as a general provision of the overall monitoring activities. This can be accomplished by the Watershed Advisory Committee meeting regularly to exchange information regarding changes in land use, water quality or proposed activities throughout the watershed. The Committee may also choose to review and change portions of the SWPP to reflect changes in the watershed.

The following specific monitoring and evaluation activities may be conducted, either formally or informally, and reviewed by the Source Water Protection Committee. The monitoring activities are grouped by major land-use activities:

Pictou / Caribou Source Water Protection Plan

TABLE 4: STATUS OF EFFECTIVENESS OF MONITORING LAND-USE ACTIVITIES

Monitoring Activities	Status	Next Steps
Agriculture		
Monitor changes in agricultural operations and monitor water quality with respect to changes in water quality from contamination that is associated with agriculture such as nutrient levels or coliform counts.	No major change in activity identified. The Utility monitors for coliform counts weekly at each well operated by the utility. Nutrient levels are monitored annually at each well operated by the utility. Results are found in the Utility's Annual Report submitted to NSE.	Continue monitoring. Evaluate Committee's ability to monitor agricultural operations.
Industrial / Commercial		
Monitor changes in water quality with respect to industrial and commercial operations throughout the watershed	No major changes in industrial or commercial activity in the watershed.	Evaluate Committee's ability to monitor this activity.
Recreation		
Continue monitoring recreation activities with respect to potential fuel spills and littering. Encourage recreational users of the watershed to report any irregularities or problems they encounter.	No significant issues identified with respect to recreational activities.	Evaluate Committee's ability to monitor this activity.
Residential Development		
Monitor the development activities within the watershed, especially new commercial or industrial developments.	No major activities identified.	Continue monitoring.
Monitor any serious issues that arise with septic systems/sewers, such as major malfunctions or changes in policy with respect to waste	No key issues identified with respect to septic	Work closer with NSE to discuss whether septic

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Monitoring Activities	Status	Next Steps
disposal.	systems / sewers.	systems malfunctions occur in watershed, and discuss methods for notification.
Develop plans for monitoring private wells adjacent to the creosote timbers, the cemetery, and the salvage yard, at four to six well locations on a semi-annual basis, or as deemed necessary.	No monitoring plan developed.	TBD
Transportation		
Monitor water quality results for any signs of potential contamination of source waters from road salting (i.e. high chloride levels).	Salt levels are continually monitored at each well operated by the Utility. Wells with increasing levels have been identified. These wells do not have surface water influences. Road salt not suspected to be source of increasing levels. Results are found in the Utility's Annual Report.	Continue monitoring.
Monitor transportation patterns in the watershed, to ensure that dangerous goods that are transported through the watershed follow BMP's.	No monitoring of this activity.	Evaluate Committee's ability to monitor this activity. Invite Nova Scotia Department of Transportation and Infrastructural Renewal and / or Transportation Canada to committee meeting to discuss approaches and feasibility.
Forestry Operations		

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Monitoring Activities	Status	Next Steps
Monitor changes the forest cover due to the frequency, size, and extent of harvesting or natural disasters such as from wind, fire, insects/diseases, or other agents.	No monitoring of this activity.	Evaluate Committee’s ability to monitor this activity. Invite Nova Scotia Department of Natural Resource to committee meeting to discuss approaches and feasibility.
Monitor water quality results for any signs of potential contamination of source waters due to construction, development or other activities (i.e. nutrient levels, coliform counts, TSS).	No major change in activity identified. The Utility monitors for coliform counts weekly at each well operated by the utility. Nutrient levels are monitored annually at each well operated by the utility. Results are found in the Utility’s Annual Report submitted to NSE.	Continue monitoring.
Environmental		
The Town will monitor groundwater level and set alarms to provide early notice adverse effects.	These alarms are programmed through the Utilities SCADA system and send automatic alarms to the operators	Continual Monitoring. This should be supplemented by a communication plan during time when conservation protocols are in place.
Other		
Monitor changes in PAH’s due to creosote timber burial.	PAHs are sampled quarter annually since 2009 and included in the Utility’s	Continue monitoring. Developed policy / procedure for enhanced sampling and

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Monitoring Activities	Status	Next Steps
Monitor changes in water chemistry due to contaminants associated with cemeteries.	Annual Report submitted to NSE. Benzo(a)pyrene detected in June 2009. No detection since June 2009. No sampling frequency established.	notification. Develop plan for including private well owners in sampling. Establish sampling frequency. Developed policy / procedure for enhanced sampling and notification. Develop plan for including private well owners in sampling.
Monitor solid waste practices.	No major change in activity identified.	Evaluate Committee’s ability to monitor solids waste practices of individuals.
Groundwater Level	Continually through SCADA system	The system is designed to alarm if the water level drops below 100 feet above the sensor’s head.
System turbidity, pH, temperature	Continually through SCADA	Alarms will sound if parameters exceed NSE recommended parameters
Centralize Treatment and Disinfection Operations	Build and use a centralized treatment plant	This will eliminate untreated backwash, multiple chemical injection sites and several vehicle trips to the wellfield.

APPENDIX I: PICTOU / CARIBOU SOURCE WATER PROTECTION:
ADVISORY COMMITTEE - TERMS OF REFERENCE

Advisory Committee - Terms of Reference

The following are the Terms of Reference for the Source Water Protection Advisory Committee for the Town and Central Caribou Wellfields, the source area for Town, Central Caribou & surrounding area, Pictou County, Nova Scotia. The Pictou / Caribou Source Water Advisory Committee will be recognized by the Pictou Town Council (the Town), the Municipality of the County of Pictou, and the Water Utility.

Mandate:

The Pictou /Caribou Source Water Protection Advisory Committee (the Committee) shall:

1. Elect a Chair to provide leadership to the Committee;
2. Review and make recommendations to the Pictou Town Council and Municipality of the County of Pictou Council on all activities that may adversely affect the water quality in the Town and Central Caribou Source Water Area (source area) as requested by the Utility, Council, the Central Caribou Watershed Advisory Committee, landowners or other stakeholders in the source area;
3. Provide a forum for landowner and stakeholder involvement and for reporting to landowners and stakeholders on matters regarding water resources and water quality/quantity protection;
4. Review and make recommendations regarding monitoring of water quality and quantity programs and other studies related to the source area. All water quality/quantity information shall be available to the Committee;
5. The Committee will develop information for educational programs regarding water quality/quantity and source water protection for landowners and other stakeholders in the source area;
6. Develop a SWPP and Implementation Schedule to protect the Town and Central Caribou Wellfields.

Membership of the Committee:

To develop and implement a comprehensive SWPP, the following will be included as members of the Committee:

- members of the Pictou County Council;
- members of Town Council;
- members of Municipality of the County of Pictou Council;
- the water utility operator;
- landowners from the area;
- other interested stakeholders;

The following may be invited to assist the Committee in an advisory capacity:

- Nova Scotia Department of Environment;
- Other government or technical advisors if necessary.

Operation of the Committee:

- 1 The Committee will be chaired by a member selected by the Committee;
- 2 Members will serve for a term that is to be determined by the Committee;
- 3 Secretarial services will be provided by the Committee;
- 4 These terms of reference may be amended by the Committee;
- 5 The Committee will endeavour to conduct business by consensus, but should voting be necessary, all motions require support from a quorum (two-thirds) of the Committee members;
- 6 Disputes that cannot be resolved through consensus will be addressed at a special session mediated by a third-party;
- 7 The Committee will meet as necessary, but no less than once in each calendar year.
- 8 The Committee may from time to time request or admit individuals or groups to make representation to the Committee regarding matters or issues affecting the source area.
- 9 The Committee will liaise with government agencies not represented on the Committee, particularly Nova Scotia Environment;
- 10 The Committee will prepare an annual report at the end of each calendar year and circulate it to all members of the committee

APPENDIX II: WELLFIELD MANAGEMENT POLICY

Wellfield Management Policy

Policy Objective

The policy objective is to efficiently and effectively address management of existing Town wells and the activities related to the planning of new well installations.

Policy Presentation

1. Exploration and Installation of New Production Wells

The Town's statement of general policy is to:

- 1.1 Employ the services of a licensed Hydrogeologist to recommend future Town well sites, assess valid complaints, and to prepare an aquifer testing report (ATR). Such an ATR will include, with the permission of private well owners, the completion of pre-assessment reports as described in provision 1.3 of this policy.
- 1.2 To reduce impacts on private wells, the Town will first focus its exploration for new wells, when and if new Town wells are required, to sites located within the northeastern portion of the Town as shown on the attached map.
- 1.3 For privately owned domestic well(s) located within 650 meters of a planned installation of a Town production well, and upon consent of the private well owner(s), the Town shall have a Hydrogeologist conduct a pre-assessment.^a The purpose of the pre-assessment is to collect baseline information specific to the private well(s), e.g., the collection of pre-pumping data, which can be used for comparison purposes should private well interference effects be suspected in the future. Private well owners who do not wish to participate in a pre-assessment process are not necessarily excluded from opportunity to make future complaint, but are advised that a determination of future impact without a pre-assessment is less probable.

* The Guide to Groundwater Withdrawal Approvals issued by the Province of Nova Scotia references 500m for the identification of potential interference effects of new installations on nearby groundwater users. The Town increased this distance to 650m due to the number of homes that are just beyond the 500m distance from Town owned lands.

- 1.4 To advise the owners of private wells within 650 meters of a new Town production well of the expected date of well testing and the date on which the new Town production well is expected to be operational; and
- 1.5 To maintain observation (background) wells located outside of Town pumping areas (outside of Town pumping influence) for the purposes of collecting data related to natural fluctuations in the water table.^b

2. Operation of Existing Production Well

The Town's statement of general policy is to:

- 2.1 Apply steps 2.2 through 2.4 below for the operation of existing production wells following the commissioning of Well #15, currently underway, and including any other new wells after commissioning.
- 2.2 Employ the services of a licensed Hydrogeologist to prepare an aquifer testing report (ATR) and act upon written complaints from private land owners. Such an ATR will include an assessment of valid complaints from private land owners within 650 meters of a Town production well in a manner consistent with provisions 3.1 through 3.6 of this policy (excluding 3.2))^c
- 2.3 Maintain a series of observation wells, which are both within the Zone of Influence of existing production wells, and located outside the Zone of Influence between the production wells and adjacent private wells. These wells will be used for the purposes of establishing background aquifer water levels and variations due to pumping of Town wells.
- 2.4 For the purposes of establishing baseline conditions for existing production wells installed prior to the implementation of this policy, the aquifer data to be considered shall be that available under the present wellfield conditions, and is limited to data collected on or after the installation of a production well.

^b The Town maintains two background wells, each is equipped with a hydrograph. One well is located within an aquifer comprising sand and gravels, while the second is located within an aquifer comprising bedrock.

^c This aspect will be part of a standardized application to NSE for Groundwater Withdrawal Approval by the Town. Other requisites of the NSE application typically include the drilling and monitoring of an observation well within the adjacent influence area of a proposed production well. The observation well is to be used by the Hydrogeologist to gauge the pumping effects of the production well (drawdown cone) relative to groundwater levels within the related area.

3. Administration of Valid Complaints

Specific to the processing of valid written complaints received from private owner(s) of well(s) wherein the owner(s) of said well(s) alleges unacceptable interference (diminished water levels) caused by Town activities, the Town shall:

- 3.1 A written complaint received by the Town shall be deemed valid based on records of aquifer water levels in existing production and observation wells in addition to pumping rates from existing wells. Water levels in observation wells must be shown to have varied outside normal seasonal fluctuations and/or production rates must have exceeded normal 3-day maximum withdrawal volumes for a written complaint to be deemed valid. Such an assessment will be made by a licensed Hydrogeologist engaged by the Town.
- 3.2 Engage a licensed Hydrogeologist to undertake an independent review of the complaint. The independent review shall include:
 - a) a comparison of the conditions encountered by the private well owner(s) to those benchmarked during the pre-assessment (if completed) as referenced above;
 - b) a comparison of the conditions encountered by the private well owner(s) to those benchmarked within the observation (background) wells as referenced above; and
 - c) a determination by the reviewing Hydrogeologist of whether there is a relationship between Town pumping activity and water shortage encountered by the complainant.
- 3.3 In response to valid written complaint(s) received by the Town from owner(s) of private well(s), where the subject well(s) are located within 500 meters of a Town well currently in production, and upon the owner of such well executing a release of liability to the Town in respect of responsibility for loss of water prior to the completion of the Hydrogeologist independent review, the Town shall furnish the owner of said private domestic well with a temporary supply of water, at Town expense, until such time as the independent review referenced in provision 3.2 of this policy is complete.
- 3.4 In response to a written complaint(s) received by the Town from the owner(s) of a private well(s), where the subject well(s), is located between 500 and 650 meters of a Town well currently in production, the Town shall engage an independent licensed Hydrogeologist as soon as possible to

undertake an independent review and file a report pursuant to provision 3.2 of this policy. The Town will not provide temporary water supply in this instance.

3.5 If it is determined in the independent review that Town pumping activities create unacceptable interference (diminished water levels) within private wells, the Town shall:

- a) Notify the owner of the well and NSE in the form of a copy of the report upon its receipt;
- b) Attempt at the earliest reasonable date to negotiate a resolution with the private well owner, wherein the deficiencies being experienced are satisfactorily addressed to an objectively reasonable standard. The negotiation/resolution may require the engagement of professional and independent Hydrogeologists and/or professional design engineers; and
- c) To keep NSE apprised of independent review work and negotiations in a timely manner.

3.6 This policy shall not relate to new or replacement domestic wells drilled after the date on which Town production wells are operational.

4. Water Conservation Planning

Over the eighteen (18) months succeeding the adoption of this policy, the Town agrees to develop a water conservation program that may include without limitation:

4.1 Determining the feasibility of installing residential water meters and a central water monitoring system for Town wells (known as **SCADA**) *that in part could be used to conserve usage and to quantify and locate unaccounted water production.*

4.2 Have the Nova Scotia Utility and Review Board modify the Town's regulations to include a conservation provision empowering the Town to control (restriction or denial) of water usage by its customers during dry periods.

4.3 Analyze historic data relative to precipitation and well operating parameters (e.g., rates of drawdown and recharge) for benchmarking normal operating parameters and quantifying points under which the Town would invoke conservation regulations described above.

APPENDIX III: A GUIDE TO RECOMMENDED AGRICULTURAL PRACTICES WITHIN MUNICIPAL DRINKING WATER
SUPPLY AREAS IN NOVA SCOTIA

Prepared by

Nova Scotia Department of Agriculture and Fisheries

Nova Scotia Department of Environment and Labour

2005

INTRODUCTION

Some types of agricultural practices can impair water quality. If not carefully managed, common pollutants of water originating from farming activities may include: sediment, nutrients (especially nitrogen and phosphorous), bacteria, and pesticides. The challenge to farmers is to balance agricultural production with the protection and conservation of water quality.

This document is designed as a guide to farmers and to operators of municipal drinking water supplies, providing recommended management practices that can be incorporated into daily farming activities to help protect water quality in areas, which drain into public drinking water supply areas. It was developed in conjunction with the Nova Scotia Department of Agriculture and Fisheries and the Nova Scotia Department of Environment and Labour. It is aimed at minimizing the risk of an impact on water supply areas, while recognizing that there is no practical method of ensuring an absolute zero risk approach, particularly regarding surface water supplies (rivers and lakes).

Farmers operating within drainage areas contributing to municipal drinking water supplies are expected to demonstrate due diligence. This means taking every reasonable precaution to prevent or minimize impacts from activities that can impair water quality. The best approach to ensuring due diligence is achieved is by using Beneficial Management Practices, or BMPs. The BMPs outlined in this guidance document have a proven record of success in reducing impacts to water from farming activities. Some of the management practices in this document may be superseded by regulations in some water supply areas. For certainty, contact the water utility operator responsible for the water supply in question, or the Nova Scotia Department of the Environment and Labour.

BENEFICIAL MANAGEMENT PRACTICES

ENVIRONMENTAL FARMS PLANS AND NUTRIENT MANAGEMENT

The Nova Scotia Federation of Agriculture and Department of Agriculture and Fisheries have developed programs to assist farmers in reducing impact to the environment from farming activities.

The **Environmental Farm Plan (EFP)** is a voluntary program that helps farmers identify and assess environmental risks on their property. Farmers work with an EFP coordinator and engineer to develop a confidential environmental farm plan for their operation.

The objective of the EFP Initiative is to help farm families develop a practical plan for operating the farm in an environmentally responsible manner. The Environmental Farm Plan acts as a guide which enables farm families to incorporate sound environmental practices into their operations. The EFP Initiative is industry-led and industry-driven.

The **Nutrient Management Program (NMP)** is a farm-specific tool that determines the amount, timing and application of nutrients from manures and fertilizer. Livestock and poultry producers operating in areas which drain into municipal drinking water supplies are strongly encouraged to develop a nutrient management plan for their farming operations. The major elements of such a plan should include:

- 1.1 Periodic analysis of the manure produced in the animal operation
- 1.2 Routine soil testing program
- 1.3 Realistic yield goals for rate calculation
- 1.4 Accurate records of fields manured and the application rates used
- 1.5 Sufficient storage capacity
- 1.6 Field maps where wetland and other freshwater ecosystems are identified
- 1.7 Proper timing of manure application
- 1.8 Calibration of manure spreaders so application rates can be determined

For more information about these programs please contact:

Environmental Farm Plan Coordinator

NSFA office - (902) 839-2293.

Email: info@nsfa-fane.ca

Website: www.nsfa-fane.ca

Programs and Risk Management Division

Farm Investment Fund

Nova Scotia Department of Agriculture and Fisheries

176 College Road, PO Box 550, Truro, NS B2N 5E3

Tel: (902) 893-6510 Toll-free: 1-866-844-4276, Fax: (902) 893-7579

MANAGEMENT OF LIVESTOCK MANURES

The land application of livestock manure is recognized as an acceptable farming practice. When properly managed, the risk of an impact on a water supply area is minimized to a level that can be managed by other components of a water supply protection plan.

Between the time manure is excreted and the time it is incorporated into the soil, the loss of nutrients and the resulting potential for pollution can be quite high depending on how manure is handled. The following methods should be employed when managing manure in drinking water supply areas:

- 1.1 Ensure that all manure hauling and spreading equipment is suited to the type and consistency of the manure produced on the farm.
- 1.2 Ensure storage structures have the capacity to hold the total volume of manure, wastewater, and bedding produced between periods of land application.
- 1.3 Time the loading and field application of manure to reduce the potential for environmental contamination and to provide the greatest benefit for soils and crops.
- 1.4 Make storage facilities manure tight to contain and protect manure from the weather thereby

- providing the greatest conservation of nutrients and the best protection against water contamination.
- 1.5 Keep manure handling to a minimum, agitating manure, particularly in liquid form, causes the gaseous loss of nitrogen, which causes odours. Manage manure to minimize the number of times that manure is mixed and spread.
 - 1.6 Plan the location of animal production and manure storage facilities so that they are adequately separated from water sources.
 - 1.7 Always apply manure following minimum separation distances for water resources.
 - 1.8 Avoid applying manure on wet soils to minimize compaction, runoff and leaching.
 - 1.9 Unless immediately incorporated into the soil, surface apply manure at reasonable distances from residences and public buildings to reduce odor problems.
 - 1.10 Rotate fields receiving manure to avoid nutrient buildup and maximize nutrient utilization, as dictated in the nutrient management plan.
 - 1.11 Only spread manure on slopes greater than 5% between the months of June and August.
 - 1.12 Supplement commercial fertilizers only when manure nutrients do not meet crop yield goals.
 - 1.13 Apply manures as close as possible to the time crop utilization of the nutrients in the manure. Utilize fall cover crops to minimize soil erosion and runoff and to maximize nutrient utilization from manure application.
 - 1.14 Avoid surface application of manure on steep slopes, frozen soil or near surface waters.

SEPARATION DISTANCES FROM WATERCOURSES AND WELLS

The Department of Agriculture and Fisheries has developed Manure Management Guidelines that recommend minimum setback distances for spreading manure on agricultural land. The following tables summarize minimum setback distances recommended for use within the manure management

guidelines.

TABLE 5: MINIMUM SEPARATION DISTANCES FOR MANURE APPLICATION

Water Source	Separation Distance (meters)	
	clay loam & loam soils	sand & gravel soils
Dug or Drilled Wells	30	60
Primary Watercourse	10	10
Tributaries to Primary	5	5
Ditches	3	3

TABLE 6: RECOMMENDED SEPARATION DISTANCES FOR SPREADING MANURE ON SLOPED LAND

Slope gradient to watercourse (located within 2 km of water treatment plant intake)	Separation Distance (meters)
< 2 %	20
2 - 5 %	50
5 - 10 %	100
> 10 %	Not Recommended

Farmers operating within a water supply area that has been designated as a Protected Water Area (PWA) under the Environment Act, may have to comply to other specified setback distances outlined within the PWA designation regulations.

Farmers should also be familiar with the Department of Agriculture and Fisheries Guidelines for the Siting and Management of Hog Farms in Nova Scotia, as well as any guidelines or regulations associated

with separation distances required for the storage of animal manures.

For more information:

<http://www.gov.ns.ca/agri/rs/envman/pub.shtml>

Nova Scotia Department of Agriculture and Fisheries, Guidelines for the Management and Use of Animal Manure in Nova Scotia, Publication No. R-91-2000, 1991.

Nova Scotia Department of Agriculture and Fisheries, Environmental Regulations Handbook for Nova Scotia Agriculture, January 1997.

Nova Scotia Department of Agriculture and Fisheries, The Development of an On-Farm Manure Management Program, March 1996.

Nova Scotia Department of Agriculture and Fisheries, Factsheets on Manure Nutrients, Manure Spreader Calibration, Earthen Manure Storages, and Integrated Fly Management for Livestock Farms.

PASTURING LIVESTOCK

As a measure of due diligence, pasture land must be fenced to prohibit the entry of livestock into adjacent watercourses.

The minimum recommended setback for fencing pastured cattle from a well or watercourse is 5 meters. If livestock are pastured on both sides of the water supply, an approved crossing must be constructed so the livestock can cross without entering and disturbing the watercourse.

MANAGEMENT OF CHEMICAL FERTILIZERS

Farmers operating in areas which drain into municipal drinking water supplies that use surface water should use the following setback distances when applying fertilizer to crops:

- < 10 meters from the primary watercourse
- < 5 meters (minimum) from a natural watercourse other than the primary watercourse

< 3 meters from a ditch

BUFFER STRIPS

Buffers are strips of land in permanent vegetation, designed to intercept pollutants and manage other environmental concerns. Buffers include: filter strips, grassed waterways, shelterbelts, windbreaks, living snow fences, contour grass strips, cross-wind trap strips, shallow water areas for wildlife, field borders, alley cropping, herbaceous wind barriers, and vegetative barriers. Riparian buffers refer to a buffer strip along a stream.

Strategically placed buffer strips in the agricultural landscape can effectively mitigate the movement of sediment, nutrients, and pesticides within farm fields and from farm fields. When combined with appropriate beneficial management practices, buffer strips should allow farmers to achieve a measure of economic and environmental sustainability in their operations. Buffer strips can also enhance wildlife habitat and protect biodiversity. Buffers slow water runoff, trap sediment, and enhance infiltration within the buffer. Buffers also trap fertilizers, pesticides, pathogens, and heavy metals, and they help trap snow and cut down on blowing soil in areas with strong winds. Buffers help stabilize a stream, create shade and reduce its water temperature. Buffer strips also offer a setback distance for agricultural activities from water sources. If properly installed and maintained, they have the capacity to:

- 1.1 remove up to 50 percent or more of nutrients and pesticides.
- 1.2 remove up to 60 percent or more of certain pathogens.
- 1.3 remove up to 75 percent or more of sediment.
- 1.4 reduce noise and odor.

MANAGEMENT AND USE OF PEST CONTROL PRODUCTS

All users of pest control products within a municipal drinking water supply area shall hold a valid certificate of qualification as defined in the Pesticide Regulations of the Nova Scotia Environment Act (1995). Farms operating within a Designated Protected Water Area must comply with Section 21 of the Pesticide Regulations of the Nova Scotia Environment Act (1995), which states.

“No person shall apply a pesticide within a protected water area designated under Section 106 of the Act unless the person complies with any regulations regarding the use of pesticides within the protected water area.”

In other words, farmers are responsible for finding out if they are conducting their agricultural activities within a Protected Water Area, in addition to, complying with any associated regulations which may apply to their farm activities.

SOIL CONSERVATION AND MANAGEMENT

The following recommended practices for soil conservation and management apply only within those Municipal Drinking Water Supply Areas in which the water supply is derived from surface waters (lake, river, stream, etc.). Farmers are encouraged to use erosion control methods if the following circumstances apply to their operation:

- 1.1 In any year that annual crops (i.e. corn, small grains, vegetables, etc.) are grown on slopes exceeding 3%.
- 1.2 Tillage operations or harvesting are conducted that will expose bare soil during mid-October through mid-April.
- 1.3 Perennial crops which are subject to erosion (i.e. small fruits and tree fruits) are grown.
 - 1.1 Reduce soil compaction by tilling or harvesting when soil is not wet. Studies have shown fields with soil compacted by farm equipment results in greater runoff of nutrients and pesticides.
 - 1.2 Avoid exposing large areas of bare soil during the winter period
 - 1.3 In Nova Scotia, it is recommended that fields with bare soil or less than 50% cover, be mulched with hay or straw if it is too late to provide adequate field cover with cover crop

APPENDIX IV: INDUSTRIAL/COMMERCIAL BEST MANAGEMENT PRACTICE REFERENCES

Pictou / Caribou Source Water Protection Plan

Industrial/Commercial Best Management Practices; Nova Scotia Environment online references:

Pollution Prevention Guide for Printers in Atlantic Canada

http://www.gov.ns.ca/nse/pollutionprevention/docs/Printer_PollutionPreventionGuide.pdf

Business Environmental Checklist

http://www.gov.ns.ca/nse/pollutionprevention/docs/biz_checklist_factsheet.pdf

Pollution Prevention Workbook for Business

<http://www.gov.ns.ca/nse/pollutionprevention/docs/PollutionPreventionBusinessWorkbook.pdf>

APPENDIX V: EMERGENCY RESPONSE PLANNING

Emergency Response Plan

In general, initial response to emergency situations will be provided by the fire departments, police and ambulance services. The provincial emergency system is set up to facilitate quick response from these agencies. The responding group will be able to assess the nature of the situation and call for additional resources, ranging from the town and local contractors with equipment and materials to construct containment areas, regional EMO managers, environment department personnel, to hazardous materials response units, and environmental consulting firms with knowledge of the proper procedures. These first response groups have been informed of the sensitive nature of the area, and have been given contact information to the resources available.

The Town has provided emergency response procedures related to source water protection in the regional emergency response plan. For additional information related to the protection of the source water during the emergency responses refer to the Regional Emergency Response Plan and the Water Utility Operations Manual. The Operations Manual can be found at the Town Office or the Public Works building.

APPENDIX VI: RESIDENTIAL BEST MANAGEMENT PRACTICE REFERENCES

Pictou / Caribou Source Water Protection Plan

Residential Best Management Practices; NSE online references:

Installation and Environmental Management Guide for Aboveground Domestic Oil Tanks

<http://www.gov.ns.ca/nse/petroleum/docs/OilTankInstall.pdf>

Homeowners Guide to Heating Oil Tank Systems

<http://www.gov.ns.ca/nse/petroleum/docs/OilTankGuide.pdf>

Heating Oil Tank System Checkup

<http://www.gov.ns.ca/nse/petroleum/docs/DomesticOilTankChecklist.pdf>

Non-essential Pesticide Uses

<http://www.gov.ns.ca/nse/pests/docs/Non-Essential-Consumer.Brochure.pdf>

Taking Care of Your Home Sewage Disposal System

<http://www.gov.ns.ca/nse/wastewater/docs/Homeowners.Guide.to.Septic.Systems.pdf>

APPENDIX VII: FOREST MANAGEMENT PLAN

FOREST MANAGEMENT PLAN

INTRODUCTION

The committee recommends that landowners follow a management plan which would provide a mature forest cover on lands in the source water area, providing the benefits of such wooded areas to water protection and conservation. While acknowledging the owner's rights to the property it is suggested that a long term sustainable harvesting plan be used to insure the regeneration of new growth while thinning over mature trees and keeping a healthy land cover.

MANAGEMENT PRINCIPLES

- 1 Forest related activities should encourage the establishment and growth of long-lived species such as red spruce, white pine, eastern hemlock and red oak.
- 2 Forested areas should maintain a tree cover of not less than 10' in height and not less than 50% stocking.
- 3 The forest should be maintained in a healthy, actively growing state.
- 4 Forestry activities should be conducted to minimize disturbance or pollution to the forest floor and the underlying soil.

SHORT-TERM OPERATING PLAN (5 YEARS)

Operating recommendations are as follows:

Shelterwood Harvesting

The primary objective is to establish the natural regeneration of shade-tolerant species under the existing canopy of mature or over mature stands through a series of partial cuttings.

Selection Harvesting

Selection harvesting will include partial cutting in which the salvaging of over-mature components of stands is the primary objective, whereas the establishment of natural regeneration is the secondary objective.

It must be remembered that the forest is a dynamic entity, continually changing as trees grow and die with the overall structure of the forest evolving through several seral stages. Because the forest is dynamic, it must be continually monitored for changes which have occurred because of significant influences, often unpredictable in nature. The operators of the plan must be committed to acting decisively when the need arises, while staying the course on the plan, its long-term principles and goals, and its short-term objectives.

GUIDELINES FOR FORESTRY ACTIVITIES AND OPERATIONS

NOTE: All guidelines as presented are subject to amendment from time to time by the Source Water Protection Committee.

1. White pine and red oak should only be cut when individual trees are diseased or pose a health threat.
2. Where possible, tolerant tree species such as red spruce, hemlock, white pine and red oak should be selected as crop trees (leave trees) over all other species in harvesting or thinning treatments.
3. Maximum basal area removal should not exceed 50% at any given time.
4. Any equipment proposed for use should be free of leaks.
5. Fuel barrel and jugs, oil containers or other similar containers should not be stored on site other than enough to complete a day's work and then on PVC lined areas.
6. It is recommended that absorbent materials such as peat moss, saw dust, or other material be on hand in case of spillage of fuel, oil, lubricants, antifreeze, or other liquids. All contaminated materials, including contaminated soil, should be immediately removed from the area and properly disposed.
7. Carpet or other absorbent mats will be used at the point of chainsaw refueling to absorb spillage from fuel and oil jugs. The mats should be removed from the site daily and properly disposed of when they become saturated.
8. Adequate fire fighting equipment must be kept on site during fire season. Only fresh water may be used for fire suppression. Flame retardant chemicals may not be used other than as approved commercial fire extinguishers, which must be kept with each piece of equipment

Appendix E

Pilot study investigating ambient air toxics emissions near a Canadian kraft pulp and paper facility in Pictou County, Nova Scotia

(Hoffman, Guernsey, Walker, Kim Sherren, Andreou, 2017)

RESEARCH ARTICLE

Pilot study investigating ambient air toxics emissions near a Canadian kraft pulp and paper facility in Pictou County, Nova Scotia

Emma Hoffman¹ · Judith R. Guernsey² · Tony R. Walker¹ · Jong Sung Kim² ·
Kate Sherren¹ · Pantelis Andreou²

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Abstract Air toxics are airborne pollutants known or suspected to cause cancer or other serious health effects, including certain volatile organic compounds (VOCs), prioritized by the US Environmental Protection Agency (EPA). While several EPA-designated air toxics are monitored at a subset of Canadian National Air Pollution Surveillance (NAPS) sites, Canada has no specific “air toxics” control priorities. Although pulp and paper (P&P) mills are major industrial emitters of air pollutants, few studies quantified the spectrum of air quality exposures. Moreover, most NAPS monitoring sites are in urban centers; in contrast, rural NAPS sites are sparse with few exposure risk records. The objective of this pilot study was to investigate prioritized air toxic ambient VOC concentrations using NAPS hourly emissions data from a rural Pictou, Nova Scotia Kraft P&P town to document concentration levels, and to determine whether these concentrations correlated with wind direction at the NAPS site (located southwest of the mill). Publicly accessible Environment and Climate Change Canada data (VOC concentrations [Granton NAPS ID: 31201] and local meteorological conditions [Caribou Point]) were examined using temporal (2006–2013) and spatial analytic methods. Results revealed several

VOCs (1,3-butadiene, benzene, and carbon tetrachloride) routinely exceeded EPA air toxics-associated cancer risk thresholds. 1,3-Butadiene and tetrachloroethylene were significantly higher ($p < 0.05$) when prevailing wind direction blew from the northeast and the mill towards the NAPS site. Conversely, when prevailing winds originated from the southwest towards the mill, higher median VOC air toxics concentrations at the NAPS site, except carbon tetrachloride, were not observed. Despite study limitations, this is one of few investigations documenting elevated concentrations of certain VOCs air toxics to be associated with P&P emissions in a community. Findings support the need for more research on the extent to which air toxics emissions exist in P&P towns and contribute to poor health in nearby communities.

Keywords Air toxics · Air quality · Volatile organic compounds (VOCs) · Community health · Pulp and paper · Cancer risk

Introduction

Poor ambient air quality is an increasing global concern with recent revelations that 92% of the world's population is exposed to air pollution levels above the World Health Organization (WHO) air quality guidelines (WHO 2006, 2016; Kelly and Fussell 2015). Ambient air pollution is widely recognized and increasingly associated with a wide range of acute and chronic adverse health effects, including cancer, cardiovascular, respiratory, and mortality outcomes (IOM 2011; Villeneuve et al. 2013; ECCO 2015a). The pathological mechanisms by which these toxic exposures exert their effects are not well understood. WHO highlights the need for research in order to better inform exposure-response relationships (WHO 2016).

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Most air pollution surveillance activities are limited to measurement of respirable fine particulate matter $\leq 2.5 \mu\text{m}$ ($\text{PM}_{2.5}$), without regard to their specific chemical composition and criterion air contaminant (CAC) gases (i.e., nitrogen oxides [NO_x] and ground-level ozone [O_3]). There is growing concern about the toxicity of volatile organic compounds (VOCs) (Cicolella 2008) and the consequences of long-term, low-dose exposure to these agents. VOCs are varied and widespread air pollutants (e.g., hydrocarbons, aromatics, and some chlorinated compounds) that are increasingly recognized as important precursors to $\text{PM}_{2.5}$ and ground-level O_3 formation through photochemical reactions (Ryerson et al. 2001). Atmospheric deposition of VOCs may contaminate other environmental media (e.g., soils, sediments, and biota) (ATSDR 2014a; MacAskill et al. 2016). Many VOCs are included in the US Environmental Protection Agency (EPA) “air toxics” list. “Air toxics” are defined as “those pollutants that cause or may cause cancer or other serious health effects [...] or adverse environmental and ecological effects” (EPA 2015a).

According to the Canadian Environmental Protection Act 1999 (CEPA), VOC releases are acknowledged as a health concern, but, due to their highly volatile properties, are challenging to monitor and manage (CCME 2011). Although no specific Canadian legislative or regulatory tools address ambient VOC levels, emissions are indirectly controlled through regulatory mitigation of $\text{PM}_{2.5}$ and ground-level O_3 under the Canadian Ambient Air Quality Standards (CAAQS). Under CEPA, it is mandatory for owners or facility operators, who meet reporting requirements, to self-report pollutant releases to air, water, and land to Environment and Climate Change Canada (ECCC)’s National Pollutant Release Inventory (NPRI) (ECCC 2014). While this provides a disincentive to those industries releasing these agents, there is less regulatory control or routine monitoring of these agents in Canada which, in turn, limits scientific understanding of sources, exposures, and the effectiveness of current control measures across the country.

Ambient air monitoring in the US is conducted in accordance with the *Clean Air Act* (CAA) (Clean Air Act 1970). CAA amendments identify 187 air toxics, which form the basis for EPA’s approach to regulating emissions (EPA 2015a). Of these, EPA identified 30 air toxics that pose the greatest potential health threat in urban areas (EPA 2015b). Although many CEPA-toxic or equivalent agents are monitored by the National Air Pollution Surveillance (NAPS) network, it includes a selection (not all) of EPA’s list of prioritized air toxics, and the main criteria for air toxics monitoring in Canada has been their potential contribution to ambient PM and ground-level O_3 (Galarneau et al. 2016). Consequently, there are gaps in understanding of air toxics concentrations across the NAPS network. Using the risk-based principles outlined in CAA, EPA

developed the National Air Toxics Assessment (NATA), a comprehensive evaluation tool that prioritizes efforts to regulate emissions of air toxics (EPA 2015c). Such a rigorous initiative has yet to be implemented in Canada, where no federal guidelines exist for ambient air toxics.

Despite economic benefits of the P&P industry, it generates large quantities of atmospheric and effluent emissions, resulting in environmental degradation (Hewitt et al. 2006; Hoffman et al. 2015; Hoffman et al. 2017). P&P mill emissions vary depending on the pulping method, wood species, and by the age and technology used (Soskolne and Sieswerda 2010). P&P mills are industrial emitters of air toxics, although few investigations (e.g., the Nez Perce National Air Toxics Program, funded by EPA [STI 2009]) have characterized ambient concentrations in nearby communities.

Potential adverse health effects associated with exposure to air pollutants in the vicinity and downwind from P&P facilities include respiratory disease, neurophysical symptoms, and higher risks of contracting lung cancer (Soto et al. 1991; Toren et al. 1996; Mirabelli and Wing 2006). Yet, few investigations reported adverse health effects from chronic community-level ambient exposures to P&P mills emissions in Canada (Mirabelli and Wing 2006; Soskolne and Sieswerda 2010). While there have been a number of occupational epidemiological studies of P&P workers, these investigations have not been extended to examine community exposures, due to research design challenges including ecological fallacy (i.e., inferences made about individuals deduced from the population) in community studies (Soskolne and Sieswerda 2010). Additionally, most of these studies focused on respiratory disease outcomes; there is a dearth of epidemiological studies of cardiovascular effects or cancer effects in these communities.

Decades-long concerns for perceived higher incidence and mortality rates for all-cause cancer, cardiovascular disease, chronic respiratory disease, and diabetes (Reid 1989; PCHA 2008; Statistics Canada 2013) in PC, Nova Scotia, have generated considerable community antipathy among residents towards a local P&P mill (Hoffman et al. 2015). This bleached kraft P&P mill (“the mill”) is located approximately 3 km south of the town of Pictou (population 3500) and produces approximately 280,000 t of bleached kraft pulp annually from softwood and hardwood chips (NP 2016b) (Fig. 1) and has been in production since 1967 (Ogden 1972). Public backlash gained momentum during 2014 due to the failure of the recovery boiler electrostatic precipitator (i.e., particulate filtration device).

Environmental reporting by the mill, when compared against provincial and federal regulatory compliance standards, contrasted to local perceptions of impacts. Most environmental monitoring reports indicated some

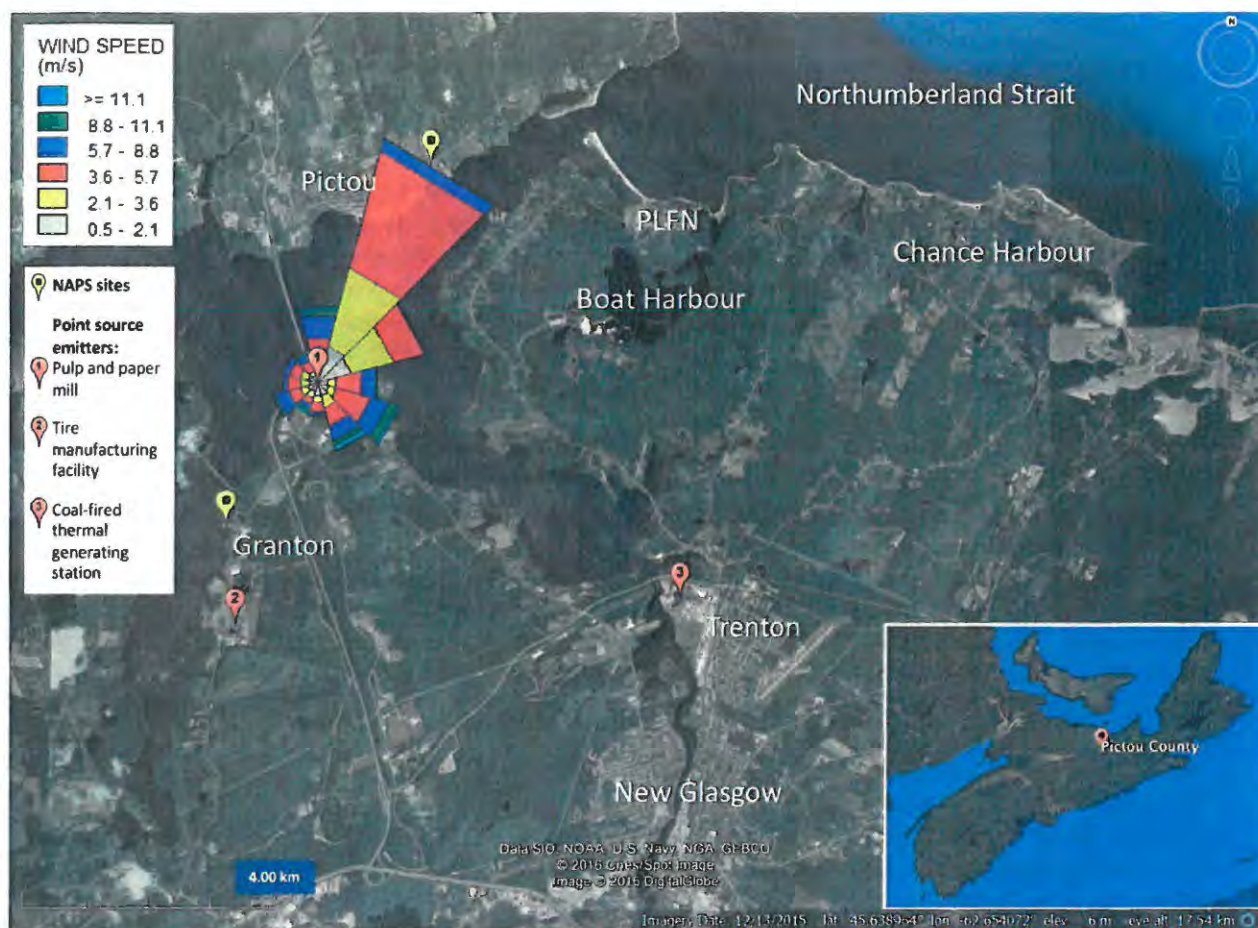


Fig. 1 Summer (2006–2013) wind rose simulation using WRPlot View™ (blowing to direction) with the mill as the focal point (1), relative to communities (e.g., Pictou and Pictou Landing First Nation [PLEN]), NAPS discrete receptor sites, and other local point source

emitters (e.g., tire manufacturing facility (2), coal-fired thermal electrical generating station (3)). The length of each radial spoke represents the relative frequency of wind direction (©Google Earth)

level of compliance in atmospheric emissions, but when compliance targets were exceeded, there were inconsistent regulatory enforcement (Hoffman et al. 2015). The mill is required to report emissions to NPRI: conduct third-party stack testing, continuous emission monitoring of total reduced sulfur (TRS), and ambient air monitoring for pollutants found in the Nova Scotia Air Quality Regulations pursuant to the *Environment Act* (NSE 2015). The mill’s air emission monitoring data are reviewed by provincial and federal regulators to ensure compliance with applicable environmental permits and air quality objectives (ECCC 2014). Hoffman et al. (2015) provided detailed information on new and existing environmental policies that impose pollution abatement in the P&P industry in Canada, particularly the PC mill (e.g., 2015 Industrial Approval).

These are critical research gaps both in relation to community exposures to VOCs in P&P communities and in regard to adverse health effects resulting from

chronic exposure to P&P emissions which are a concern given the potential adverse health outcomes that VOCs and other P&P air emissions pose. This further justifies the need for more research to characterize air quality in this particular subset of industrial communities, which have often been neglected because of their remote locations.

An intensive study of specific ambient air toxic emissions in PC has not been undertaken. The aim of this pilot study was to assess levels of PC community exposures to VOC air toxics emissions from 2006 to 2013, and to evaluate these data in relation to potential risks suggested by EPA air toxic guidelines. The main objective of this study was to determine whether wind direction correlated with prioritized air toxic ambient VOC concentrations at a nearby NAPS site (Granton). As the Granton NAPS site is positioned southwest of the mill, it was hypothesized that prevailing winds (PW) from northerly and northeasterly directions would

positively correlate with an increase in ambient VOC concentrations, as capturing potential VOCs from the mill's plume would be optimized (Fig. 1).

Materials and methods

Spatial and temporal sampling

Historical meteorological and NAPS data from the Granton NAPS site discrete receptor (ID: 31201) were collected from publically assessable ECCC databases (<http://climate.weather.gc.ca/climateData/>; <http://maps-cartes.ec.gc.ca/rmspa-naps/>). Hourly surface wind observations (i.e., speed and direction to the nearest 10°) were obtained from the closest EC meteorological station, Caribou Point (45.767° N; 62.683° W), located ~10 km north of the mill (45.652° N; 62.718° W). Temporal data for ambient VOCs monitored at the Granton NAPS station were limited to 2006 to 2013.

Nova Scotia Environment (NSE) operates both NAPS monitoring stations in PC: (i) downtown Pictou (ID: 30901) located 3.5 km northeast of the mill and (ii) Granton (ID: 31201) located 2.5 km southwest of the mill (Fig. 1). The Pictou NAPS site routinely monitors NO, NO₂, NO_x, O₃, PM_{2.5}, TRS (not VOCs), and wind characteristics, whereas the Granton site monitors 36 VOC species. Multi-component VOC monitoring at NAPS sites are conducted using canister sampling and gas chromatography/mass spectrometry (GC/MS) (CCME 2011). Sampling of 24 h (midnight to midnight) cumulative ambient air samples (μg/m³) are taken on a 1-in-6-day schedule by pumping ambient air into pressurized stainless steel SUMMA® canisters and analyzed by an EC accredited Laboratory (CCME 2011; Galarneau et al. 2016).

Statistical analyses

Variation of meteorological conditions and VOC concentrations were assessed by conducting a spatiotemporal analysis to characterize ambient air toxics emissions in PC from 2006 to 2013. Various analytical methods can be applied to concentration data to estimate source apportionments of air pollutants to provide additional insights into the source/receptor relationships to guide development of more effective air quality management strategies (Hopke 2016). However, given the limitations of having complete VOC data from only one NAPS monitoring station in the region, a full chemical mass balance analysis to identify and apportion sources of atmospheric contaminants were not conducted in this study.

Wind rose plots were generated with WRPlot View™ (©Lakes Environmental Software) to simulate seasonal and

spatial variation of wind direction (°) frequency and wind speed (m/s) with the mill as the focal point. Although simplified, wind rose models have proven utility for estimating spatial gradients for fate and transport of pollutants from emission sources (Gibson et al. 2013). Summer, when local people spend more time outdoors (and more vulnerable to outdoor pollution exposure), was a focus of this study (Figs. 1 and 2).

This pilot study was conducted to determine whether ambient concentrations of VOCs exceeded their EPA-associated cancer and/or noncancer risk thresholds, to help identify potential human health concerns in PC. VOCs selected for analysis were based on EPA's list of 30 urban air toxics (EPA 2015b) and *National Air Toxics Trends Station Work Plan Template* (EPA 2015d). Health Canada and the province of Nova Scotia currently do not have specific guidelines for air toxics exposures. Therefore, EPA thresholds were considered a more acceptable standard for carcinogenic exposures in this study. Cancer risk threshold refers to the probability of contracting cancer if exposed to a substance every day over the course of a lifetime (assumed to be 70 years for the purposes of NATA risk characterization). Lower threshold values correspond with higher toxicity. Noncancer risk threshold is associated with effects other than cancer, based on reference concentrations via the "hazard quotient" ratio (HQ; exposure divided by appropriate chronic or acute value) (EPA 2015c). The HQ should not be interpreted as a probability of adverse effects. Noncancer risk thresholds are typically higher compared to cancer risk thresholds, as lower concentrations can elicit a carcinogenic response, whereas other diseases are not triggered until higher exposure thresholds are reached. US and Canadian method detection limits (MDL) are provided (Health Canada 2010; EPA 2015d) (Table 1).

The mill is located approximately 40° northeast of the Granton NAPS site. The selected PW range expected to result in increased VOC concentrations at the NAPS site (±40° either side of the mill [80° total]). A narrower range may be more accurate; however, due to the sample size of VOC samples, the selected range captured more data. All other wind directions (AOWD) represent ranges outside PW (i.e., >80°, <360°). AOWD represent sampling days when no time PW blew from the selected range (i.e., 0 h). VOC concentrations for AOWD were compared to when PW were present for at least 1 h.

Hourly meteorological data were compiled to correspond with ambient VOC sampling. Hourly wind direction within defined PW range (i.e., 360°–80°) was assigned a value of 1; AOWD were assigned a value of 0. Daily totals represented the proportion of time with PW (i.e., 1–24 h) compared to AOWD. Daily

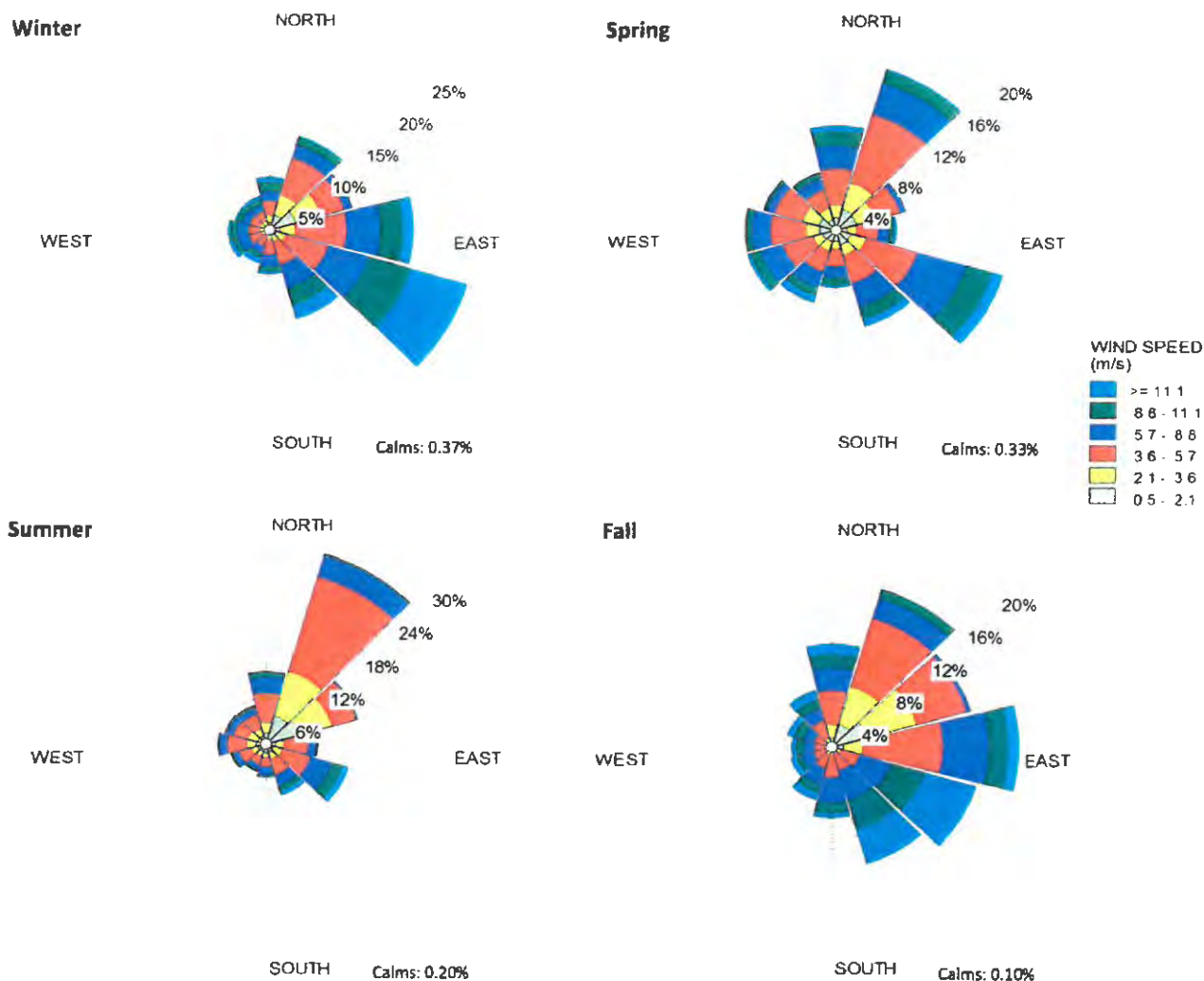


Fig. 2 Seasonal (2006–2013) wind rose simulations using WRPlot View™ (blowing to direction). Percentages represent frequency of wind direction

totals corresponding to VOC sampling were paired. Increasing proportions of PW (AOWD [0 h], ≥1 h, ≥4 h, ≥8 h, ≥12 h) categorized VOC concentrations, which were predicted to correlate with higher VOC concentrations. To test the effect of wind direction and season on ambient VOC concentrations, multivariate analysis of variance (MANOVA) and univariate analysis of variance (ANOVA) were applied in ©R. Due to right-skewed distributions for all VOCs, except for carbon tetrachloride, statistical procedures were performed on both raw and log-transformation of VOC concentrations (Supplementary material Table S1).

Box plots and histograms were used to compare VOC concentrations with PW ≥ 1 h to AOWD on an annual and seasonal basis in relation to their respective cancer and noncancer risk thresholds. See Supplementary material for histograms, and additional box-and-whisker plots illustrating VOC

concentrations with increasing time categories with PW (AOWD [0 h], ≥1 h, ≥4 h, ≥8 h, ≥12 h) (Figs. S2 and S4). Box plots display the distribution of data based on a five-number summary: minimum, first quartile, median, third quartile, and maximum. The central rectangle (“box”) spans the first to the third quartile (i.e., interquartile range [IQR]). The horizontal line segment within the box represents the median, and “whiskers” above and below the box represent the minimum and maximum. Radar plots consist of a sequence of angular spokes, whose length extending from the center along a separate axis is proportional to the magnitude of the variable relative to the magnitude of the variable across all data points. Lines connect the data values for each spoke. Radar plots were used to display seasonal variation of median VOC concentrations for PW ≥ 1 h and AOWD. One-tailed *t* tests, assuming unequal variance, were performed to determine whether seasonal variation associated with increasing proportions of time

Table 1 List of priority air toxics (i.e., VOCs), associated cancer/noncancer risk thresholds ($\mu\text{g}/\text{m}^3$), and method detection limits (MDL) ($\mu\text{g}/\text{m}^3$) (Health Canada 2010; EPA 2015d)

VOC	Cancer risk ^a ($\mu\text{g}/\text{m}^3$)	Noncancer risk at HQ = 0.1 ^b ($\mu\text{g}/\text{m}^3$)	MDL ^c (NATS) ($\mu\text{g}/\text{m}^3$)	MDL (Health Canada) ($\mu\text{g}/\text{m}^3$)
Chloroform	–	9.8	0.50	0.089
1,3-Butadiene	0.0300	0.2	0.10	0.055
Vinyl chloride	0.1100	10.0	0.11	0.046
Benzene	0.1300	3.0	0.13	0.038
Carbon tetrachloride	0.1700	19.0	0.17	0.123
Trichloroethylene	0.2083	0.2	0.20	0.190
Tetrachloroethylene	3.8462	4.0	0.17	0.120

^a Cancer risk threshold: the probability of contracting cancer over the course of a lifetime (assumed to be 70 years for the purposes of NATA risk characterization). Lower threshold values correspond with higher toxicity (EPA 2015c)

^b Noncancer risk threshold: the risk associated with effects other than cancer, based on the reference concentration via a ratio known as the “hazard quotient” (HQ; the exposure divided by the appropriate chronic or acute value)

^c MDL: the lowest concentration that can be detected with confidence. NATA and Health Canada’s MDLs are listed for comparison (Health Canada 2010; EPA 2015d)

with PW (i.e., ≥ 1 h, ≥ 4 h, ≥ 8 h, ≥ 12 h) resulted in a significant increase ($p < 0.05$) in VOC concentrations compared to AOWD (see Supplementary material, Table S3).

Quality control

Standard procedures of the Meteorological Service of Canada have been developed in accordance with internationally recommended procedures established by the World Meteorological Organization (ECCC 2013a). As part of the quality assurance and quality control (QA/QC) program, observational meteorological data are subjected to a computer analysis or review to reveal possible errors. EC and the operating agency are jointly responsible for the NAPS network QA/QC program. Elements of the program include site selection, sampling system requirements, instrument calibration and reference standard requirements, and inter-laboratory testing and performance audits. With few exceptions, analyzers are accorded with EPA designation as either a reference or equivalent method for ambient air monitoring (ECCC 2004). ECCC’s air quality laboratories use International Organization for Standardization requirements (i.e., ISO 9001:2008 or ISO/IEC 17025:2005) (ECCC 2013b).

Results and discussion

Meteorological observations

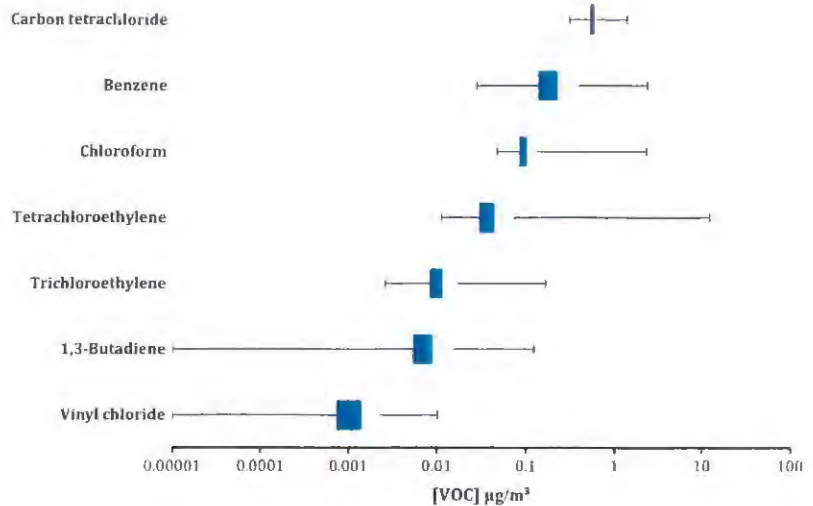
Wind rose simulations illustrate seasonal variability with respect to wind direction, with the mill as the focal point (Fig. 2). During summer, wind blew NNE

(25.47%) and ENE (11.80%) directions (aggregate range 15° – 75°) towards Pictou and Pictou Landing First Nation (PLFN) (Figs. 1 and 2). Wind blew less frequently towards S-NNW (aggregate range 165° – 345°) towards the Graton NAPS site. During winter, wind typically prevailed from the north; the highest frequency (21.99%) blowing ESE, followed by E (15.37%) directions (aggregate range 75° – 135°) (Fig. 1). Spring and fall have meteorological characteristics that are similar to summer and winter and were considered transitional periods. Pictou, PLFN, Chance Harbour, Trenton and New Glasgow are communities close to the mill that are downwind of annual PW (range 15° – 165°). The Graton NAPS site correlates poorly with seasonal or annual wind directions (Fig. 2).

VOC concentrations

Carbon tetrachloride had the highest median concentration ($0.5452 \mu\text{g}/\text{m}^3$) and vinyl chloride had the lowest ($0.0014 \mu\text{g}/\text{m}^3$) (Fig. 3). Carbon tetrachloride concentrations exceeded its EPA cancer risk threshold ($0.1700 \mu\text{g}/\text{m}^3$) for all samples, with maximum and minimum concentrations of 0.7047 and $0.2892 \mu\text{g}/\text{m}^3$, respectively. Benzene concentrations exceeded its cancer risk threshold ($0.1300 \mu\text{g}/\text{m}^3$) for most samples, with maximum and minimum concentrations of 1.889 and $0.0266 \mu\text{g}/\text{m}^3$, respectively. Concentrations of 1,3-butadiene concentrations occasionally exceeded its cancer risk threshold ($0.0300 \mu\text{g}/\text{m}^3$), with maximum and minimum concentrations of 0.1062 and $0 \mu\text{g}/\text{m}^3$, respectively (Fig. 3). Consequently, 1,3-butadiene, benzene, and carbon tetrachloride were air toxics of primary concern in terms of local

Fig. 3 Relative VOC concentrations ($\mu\text{g}/\text{m}^3$) (2006–2013). Should not be interpreted as orders of magnitude of toxicity. Minimum concentration for 1,3-butadiene and vinyl chloride is $0 \mu\text{g}/\text{m}^3$ or undetectable



population risk. Other VOCs are presented in Supplementary material (Fig. S5).

ANOVA and MANOVA results revealed that 1,3-butadiene was significantly higher with the presence of $\text{PW} \geq 1 \text{ h}$ ($p = 0.001$ and $p = 0.01$ for raw and log-transformed data, respectively). Tetrachloroethylene was also statistically higher with the presence of $\text{PW} \geq 1 \text{ h}$ ($p < 0.01$) for log-transformed data. Benzene approached significance with the presence of $\text{PW} \geq 1 \text{ h}$ ($p = 0.07$) for log-transformed data. Although not statistically significant, median concentrations of other VOCs,

except carbon tetrachloride, were equal or marginally higher with presence of $\text{PW} \geq 1 \text{ h}$ compared to AOWD. Season had a consistent significant effect on VOC concentrations, except chloroform and tetrachloroethylene (Supplementary material Fig. S2 and Table S1).

Box plots combined with radar graphs illustrate seasonal variation of VOC concentrations of primary concern (i.e., 1,3-butadiene, benzene, carbon tetrachloride) under $\text{PW} \geq 1 \text{ h}$ and AOWD conditions (Figs. 4, 5, and 6). Median VOC concentrations associated with $\text{PW} \geq 1 \text{ h}$ and AOWD display parallel

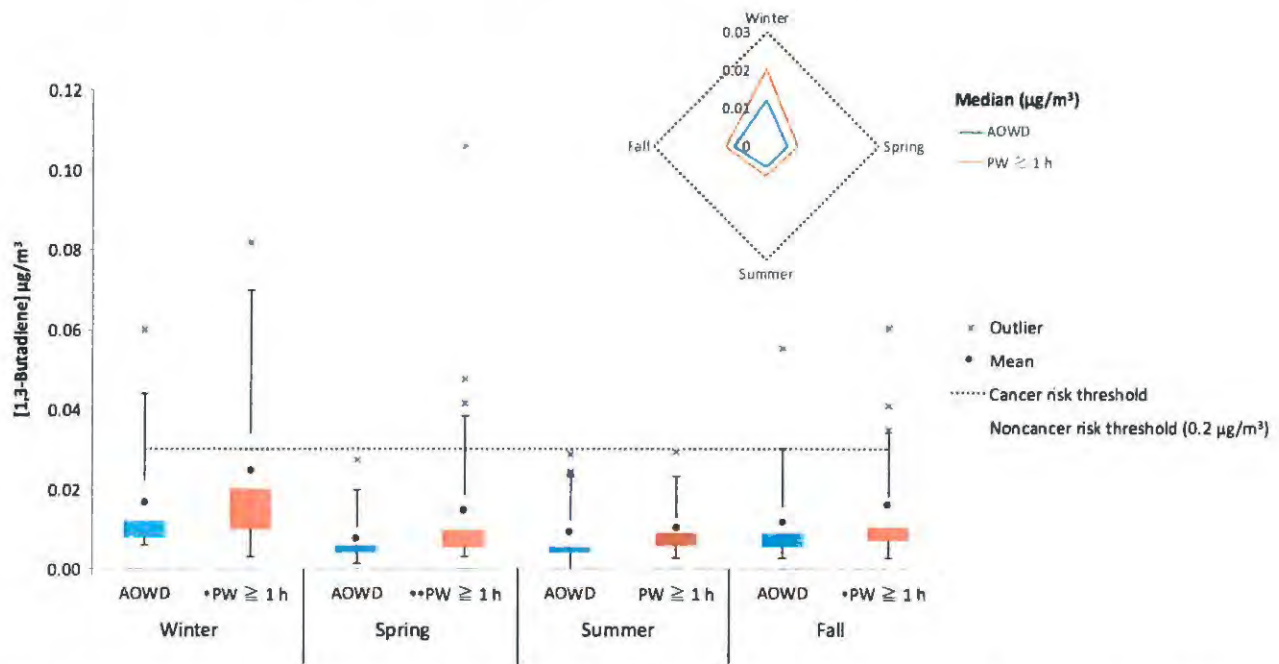


Fig. 4 Seasonal variation (2006–2013) of [1,3-butadiene] ($\mu\text{g}/\text{m}^3$) comparing AOWD to $\text{PW} \geq 1 \text{ h}$ on sampling days (i.e., $360^\circ - 80^\circ$), relative to associated cancer and noncancer risk thresholds.

Minimum concentration is $0 \mu\text{g}/\text{m}^3$ or undetectable. Significant differences indicated as $* < 0.05$; $** < 0.01$

seasonal trends. Concentrations of 1,3-butadiene (Fig. 4) and benzene (Fig. 5) exhibit seasonal variation. Both have evidently higher concentrations during winter, with summer having overall lowest concentrations. In addition to exceeding cancer risk thresholds, *t* test results revealed that 1,3-butadiene and benzene concentrations were significantly higher with the presence of PW ≥ 1 h compared to AOWD during at least two seasons, including spring and fall. Conversely, median carbon tetrachloride concentrations showed little variation (Fig. 6). Regardless of season or wind direction, all carbon tetrachloride samples exceeded its associated cancer risk.

This pilot study presents findings of a secondary analysis of 8 years of air toxic VOC exposure data associated with ambient air quality in a Canadian P&P town. Concentrations of three ambient outdoor air toxics routinely exceeded EPA air toxics-associated cancer risk thresholds and are consequently of primary health concern in relation to population health risk in PC: 1,3-butadiene, benzene, and carbon tetrachloride. Exceedance in cancer risk thresholds for these air toxics is consistent in the literature (e.g., Morello-Frosch et al. 2000). The extent to which threshold exceedances of 1,3-butadiene adversely affect human health is poorly understood, with little toxicity information available to compare with cancer risk estimates (Morello-Frosch et al. 2000). With respect to benzene exposure, most monitoring data are associated with occupational studies (ATSDR 2007a), where long-term exposure can cause leukemia (ATSDR 2007b). High exposure to carbon tetrachloride can cause liver, kidney, and central

nervous system damage (ATSDR 2005). Combinations of air toxics may have additive or synergistic adverse health effects (Morello-Frosch et al. 2000). Therefore, exposure to mixed VOCs might pose health risks to facility employees and neighboring residents (An et al. 2014; He et al. 2015).

Emission sources within the defined PW range, N to ENE of the Granton NAPS site, may be a causal factor for the increase in VOC concentrations, except carbon tetrachloride. The largest point source emitter within this range is likely the mill; however, the origin(s) of VOCs are inconclusive. According to the mill's most recent substance report submitted to NPRI in 2012, 143.18 t of VOCs were atmospherically emitted on-site (ECCC 2012). An estimated 3.195 t of benzene were released to the air from a stack higher than 50 m and 0.022 t were released within 50 m of the ground. Additionally, benzo(a)anthracene and of benzo(a)phenanthrene were emitted to the air (9.7 and 6.7 kg, respectively) and deposited on-site (0.753 and 0.142 kg, respectively) (ECCC 2012). Although trichloroethylene, tetrachloroethylene, and carbon tetrachloride were not reported to have been released, they may become airborne through evaporation from P&P wastewater (Soskolne and Sieswerda 2010). Boat Harbour (the mill's effluent treatment facility) may therefore contribute to ambient concentrations of VOCs. Collectively, these emissions may have contributed to the ambient atmospheric levels of VOCs measured at the Granton NAPS site. While

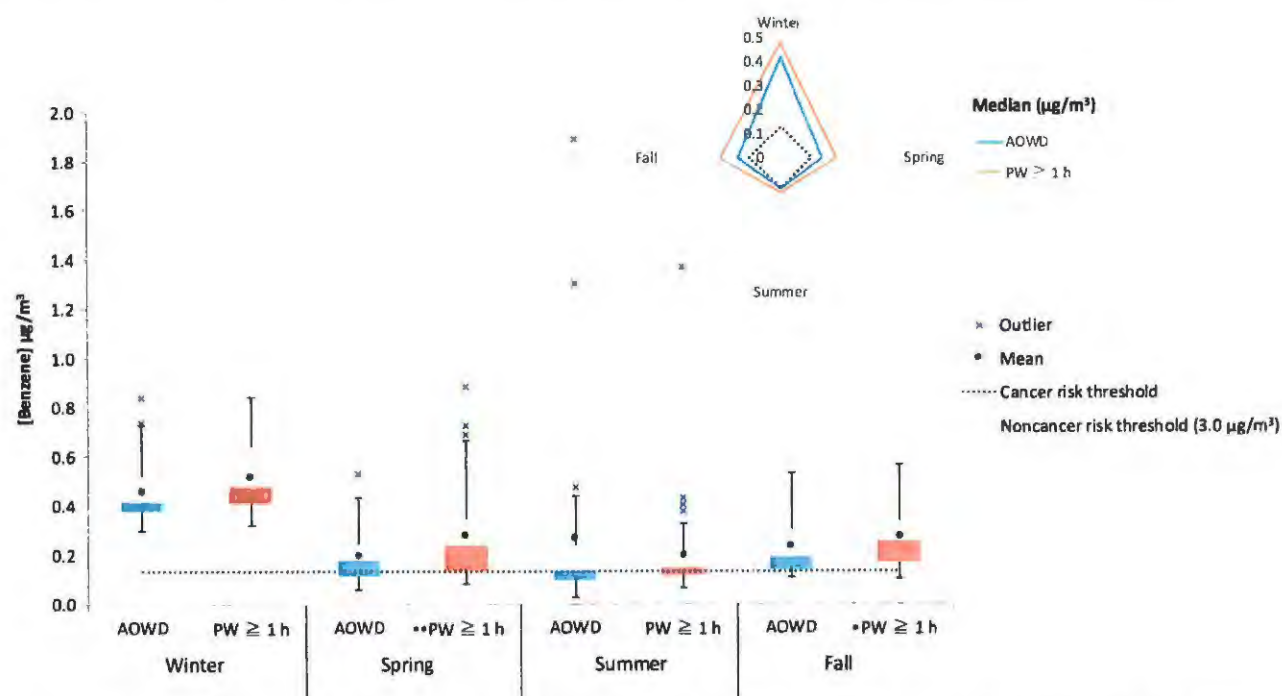


Fig. 5 Seasonal variation (2006–2013) of [benzene] ($\mu\text{g}/\text{m}^3$) comparing AOWD to PW for at least 1 h on sampling days (i.e., $360^\circ - 80^\circ$), relative to associated cancer and noncancer risk thresholds. Significant differences indicated as $* < 0.05$; $** < 0.01$

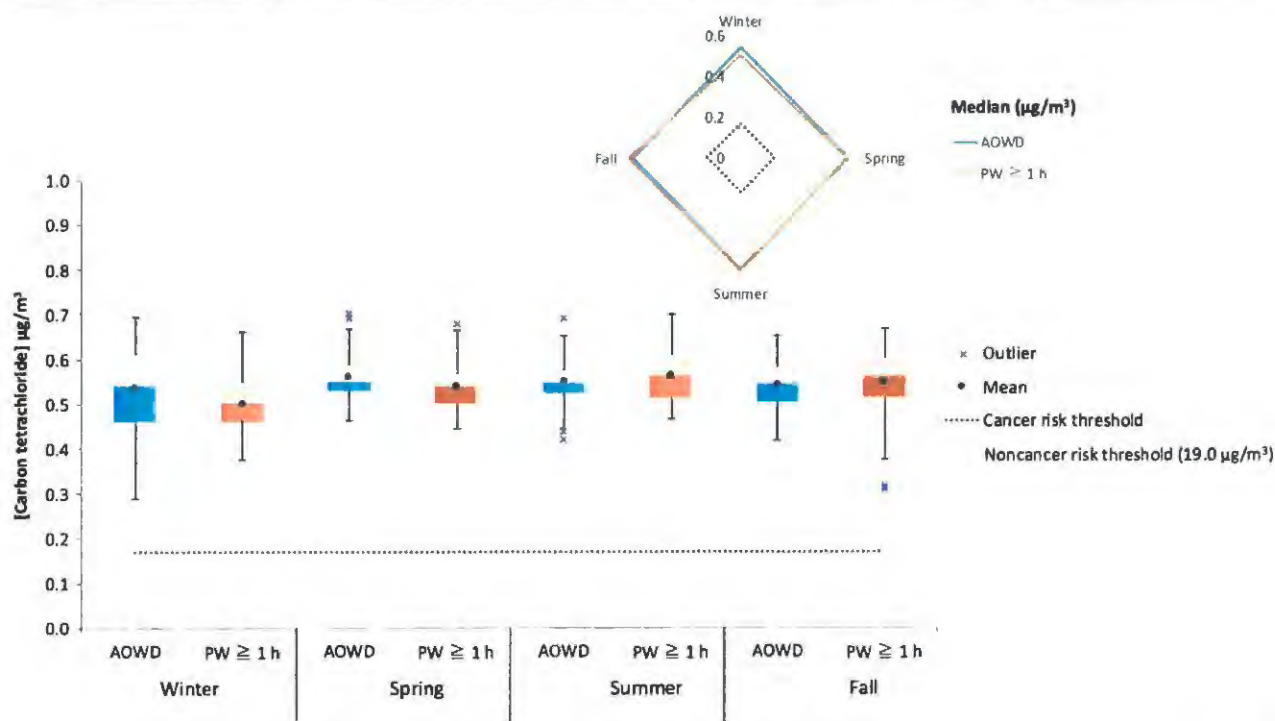


Fig. 6 Seasonal variation (2006–2013) of [carbon tetrachloride] ($\mu\text{g}/\text{m}^3$) comparing AOWD to PW for at least 1 h on sampling days (i.e., $360^\circ - 80^\circ$), relative to associated cancer and noncancer risk thresholds

NPRI provides detailed information on pollutant releases, data are self-reported by facilities, with no audits to ensure accuracy. Consequently, data quality may be compromised.

The major chlorinated hydrocarbon emitted into the air from bleached kraft pulp mills of concern is chloroform, which is produced by heating a mixture of chlorine and either chloromethane or methane (EPA 1985). Although chloroform is a recognized by-product of the chlorination process in the P&P industry, it has been suggested that up to 90% of total emission sources may be natural in origin and is widely dispersed in marine environments (McCulloch 2003). As PC is located along the coast of the Northumberland Strait, marine environments may have contributed to the observed ambient chloroform concentrations (see [Supplementary material](#)).

Results implicate the mill as a source of air toxics (particularly 1,3-butadiene and tetrachloroethylene); however, other local sources likely contribute to air toxics emissions. Area and mobile sources have been reported to largely contribute to concentrations of 1,3-butadiene (ATSDR 2014b) and benzene (ATSDR 2007a). Because the Granton NAPS site is located near a highway and access roads, vehicle emissions may have contributed to the observed concentrations of these compounds. A coal-fired thermal generating station and a tire manufacturing facility (located 7 km E and 1.5 km S from the Granton NAPS site, respectively) may be other local point

source emitters of VOCs (e.g., 1,3-butadiene is used to make synthetic rubber [ATSDR 2014b]) (Fig. 1). According to the latest NPRI substance reports: the tire manufacturing facility released 220 t of atmospheric VOCs, whereas no VOC releases were reported by the thermal generating station (ECCC 2015b), despite that coal combustion is a significant contributor (Chagger et al. 1999). Direct links between 1,3-butadiene and vinyl chloride with P&P industries were not found in the literature.

Major monitored pollutants at the mill include NO_x , sulfur dioxide (SO_2), and total PM ([TPM] upper size limit of $100 \mu\text{m}$ diameter) (NP 2016a). A 2013 study concluded that $\text{PM}_{2.5}$ concentrations were highest ($0.88 \mu\text{g}/\text{m}^3$) downwind from the mill from using an AERMOD atmospheric dispersion model (Gibson et al. 2013), though this investigation used Halifax wind speed and direction meteorological data (130 km to the south). Hoffman et al. (2015) reported an analysis of 2013 data showing that when Pictou is downwind of the mill, average 1 h ambient $\text{PM}_{2.5}$ concentrations result in a twofold increase ($12.96 \mu\text{g}/\text{m}^3$), compared to all other wind directions ($5.73 \mu\text{g}/\text{m}^3$), suggesting the mill is likely the primary contributor of ambient $\text{PM}_{2.5}$ in the community. Additionally, TRS, TPM, $\text{PM}_{2.5}$, and coarse particulate matter $\leq 10 \mu\text{m}$ (PM_{10}) emission exceedances at the mill during 2012 were two to three

orders of magnitude higher than five similar Canadian kraft P&P mills; however, VOC emissions were comparable (Hoffman et al. 2015).

A comparable ambient air toxics monitoring study of a P&P community was conducted in the metropolitan Lewiston, Idaho area and the Nez Perce Reservation (STI 2009). Findings revealed that concentrations of formaldehyde and acetaldehyde were much higher than expected relative to Lewiston's size. Chloroform, tetrachloroethylene, and trichloroethylene were highest at monitoring sites nearest the mill, which presumably contributed at least 50% to pollutant concentrations (STI 2009). However, due to insufficient information on local concentrations of anthropogenic and biogenic VOCs, it was inconclusive whether the mill was a causal factor.

Recent (2009–2013) measurements of ambient CEPA-toxic or equivalent agents monitored at NAPS sites revealed that 11 air toxics, including benzene, chloroform, trichloroethylene, and tetrachloroethylene exceeded ambient air quality guidelines set by respective Canadian jurisdictions (Galameau et al. 2016). An additional 16 air toxics approached guidelines. Although these guidelines are not necessarily enforceable, CEPA outlines provisions for toxic compounds and are thus subject to risk management actions. Air toxics' contribution to poor health on a regional and national scale has not been thoroughly investigated; therefore, calls into question the effectiveness of current toxic substance management in Canada.

Nova Scotia is known as the “tail pipe of North America,” due to being within the trajectory of long-range transport of emissions from transboundary sources along the Eastern Seaboard, plus central and eastern Canada (NSE 2014). Background levels of air pollution that originate from resuspension and natural sources has been found to be major contributors to concentrations of carbon tetrachloride and benzene (Morello-Frosch et al. 2000). Background levels, in combination to carbon tetrachloride's capacity to persist in the atmosphere for at least a year, may explain why observed concentrations are consistently above its associated cancer risk threshold at the Granton NAPS site, regardless of wind direction.

Atmosphere circulation plays a complex role in dispersion, transformation, and removal of pollutants. The dispersion of pollutants from source emitters (e.g., smokestacks) is affected by crosswind mixing in both horizontal and vertical directions. Meteorological variables, including wind speed, wind direction, temperature, humidity, precipitation (process of removal), and atmospheric pressure are the main drivers of variation in pollutant concentrations and dispersion (Bates and Caton 2002). Furthermore, gravitational settling is

important for pollutants with larger molecular weights (Oliver 2008); heavier particles settle or deposit closer to emission sources (Walker et al. 2003a, 2003b). Gravitational settling may also explain the high concentrations of carbon tetrachloride.

Topography and coastal conditions can affect wind characteristics (e.g., direction, speed) and the behavior of pollutant transport. A sea breeze that is trapped under descending warmer air from land can exaggerate conditions at coastal zones, a phenomenon known as coastal inversion (Bates and Caton 2002). In addition, turbulent winds along the coast may influence wind characteristics at the Caribou Point meteorological station, and the fate and transport of pollutants. Such coastal conditions, in combination with transboundary air pollution, may be occurrences that coastal areas experience in Nova Scotia, including PC.

Seasonal variability

Seasonal variability exists for both meteorological conditions and VOC concentrations. Variations in meteorological conditions, the nature and intensity of emissions from nearby sources, and photochemical activity are factors that could have led to the observed seasonal variability of outdoor VOC levels (Al-Khulaifi et al. 2014). Of the three VOCs considered particular concern in this study, 1,3-butadiene and benzene exhibited the highest concentrations during winter. Photochemical reactions involved with ground-level O₃ formation are catalyzed by ultraviolet radiation and temperature. Therefore, peak ground-level O₃ levels typically occur during warm days with sufficient sunlight exposure; thus, people are more vulnerable to exposure during summer. The opposite is true during winter, when available light is diminished, and temperatures are colder (ATSDR 2014b).

Demographic behavior and technological improvements that aim to mitigate emissions (e.g., smokestack precipitator installation in 2015) also need to be considered when evaluating pollutant concentrations. For instance, households in the Atlantic provinces are heated primarily with oil, electricity, and wood or wood pellets (Statistics Canada 2011); therefore, as residential heating increases during winter, biogenic VOCs (e.g., benzene [ATSDR 2007a], 1,3-butadiene [ATSDR 2014b]) from wood burning may have contributed to higher concentrations of these compounds observed in this study. As the mill operates on a 24/7 schedule (ECCC 2012), atmospheric VOC emissions were assumed consistent throughout the year.

Implications

Location of ambient air quality monitoring stations has a direct impact on the observed concentrations of pollutants

(Craig et al. 2008). Based on the time series and spatial analyses, wind direction appears to play a key role in the Granton NAPS site's ability to monitor ambient VOCs from the mill. PW ≥ 1 h from the selected range (360°–80°) typically resulted in equal or higher VOC concentrations for all compounds, except carbon tetrachloride, compared to AOWD (Figs. 4, 5, and 6; [Supplementary material](#)), suggesting that the mill is likely a causal factor. Furthermore, as there is a higher frequency of northerly winds blowing towards the south during winter (Fig. 2), the Granton NAPS site is more likely to capture ambient pollutants from the mill's atmospheric emissions. Southwest PW blowing towards Pictou dominate during the summer months when people are more vulnerable to ambient air pollution exposure. Due to Pictou's geography, air toxics from the Eastern Seaboard in combination with local emission sources, including the mill, converge there; hence, higher concentrations of VOCs are expected in Pictou during summer. Subsequently, southwest PW are expected to result in lower VOC concentrations at the Granton NAPS site, as capturing the mill's atmospheric emissions would not be optimized. Therefore, VOC concentrations at the Granton NAPS site during winter would likely be representative of ambient VOC concentrations in Pictou during summer. Moreover, Pictou's considerably larger population base compared to the rural area of Granton further confirms that the NAPS site is not strategically positioned to accurately represent ambient levels of air toxics where there is higher residential exposure.

Study limitations

This study only evaluated exposure to ambient VOC air pollutants. Human exposure to air pollution is a combination of both outdoor and indoor environments and varies according to daily activity patterns and the conditions of specific settings. Secondary data analysis was used in this study; therefore, the ecological nature of these findings limit the explicit attribution of ambient air toxic exposures to the risk potential for cancer for community residents. Personal exposure monitoring, more detailed spatial analysis of ambient conditions, and source apportionment studies would be required to establish more explicitly the health risk associated with these exposures. The analysis was limited by the inability to examine the interaction of local meteorological conditions. Meteorological data were retrieved from Caribou Point, located approximately 10 km from the mill; consequently, coastal conditions may cause differences in meteorological measurements between sites.

Future research and monitoring

A *field component* consisting of real-time measurements of ambient air toxics would improve the rigor and validity of the present study. Although labor intensive, air toxics samples

can be analyzed with a high degree of accuracy (Craig et al. 2008). Because monitoring stations are typically fixed, government-approved *atmospheric dispersion modeling* that considers landscape dynamics and seasonal meteorological variability (e.g., CALPUFF, AERMOD) would more accurately estimate spatial patterns of air toxics dispersion, and human exposure at the population or individual level (EPA 2013). This would require numerous stations within the community so would likely only be feasible for a specific research investigation. Further, installation of a new precipitator in 2015 has likely changed in ambient conditions. A follow-up assessment would provide a comparison to these findings to determine if VOC levels have improved. Additional research includes applying a *Conditional Probability Function* to calculate the probability that an air pollution source is located within a particular wind direction sector to help determine direction of a source from a NAPS discrete receptor site, and conducting an analysis of the effect of mixing height on measured VOC concentrations to further investigate seasonal patterns.

Investigation of health outcomes might involve longitudinal epidemiological research of human exposures to air toxics emissions in the ambient Pictou environment with appropriate consideration for latency of health outcomes, while controlling for indoor and occupational sources and other contextual factors. Several recent Canadian nationwide cohort studies that may provide a foundation for such investigations have been described (e.g., Crouse et al. 2012).

A *comprehensive risk assessment* investigates uncertainties that have implications for risk estimates in the present study, including those surrounding toxicity information (Morello-Frosch et al. 2000). More research is required to determine what cancer and noncancer risks are from ambient air toxics exposure. Further, it is important to consider synergistic effects of a full suite of ambient pollutants, and physical and chemical processes involved in fate and transport of these compounds. Comprehensive emission inventories are necessary to thoroughly address (i.e., characterize, model, and manage) air quality issues (CEC 2009). Collectively, these research efforts aim to better inform air quality management, composed of federal (e.g., ECCC, Health Canada) and provincial (e.g., NSE, Nova Scotia Department of Health and Wellness) government and public health agencies, how best to proceed to ensure the health of residents in industrial communities is prioritized. Implications of the current findings warrant further investigation.

Given the contribution emissions from local sources have to regional, national, and global airsheds, local mitigation initiatives should be an integral part of air quality strategies. There is no common approach to assess health effects of a mixture of pollutants, as they tend to be site specific; hence, an assortment of effective measures may be required. Case studies that provide evidence of effective of air quality

management interventions and guidance documents for risk managers may help inform air quality management for stakeholders (Craig et al. 2008).

To address potential adverse health effects associated with degraded air quality, Health Canada, the Public Health Agency of Canada (PHAC) and provincial partners might work collaboratively with local stakeholders to mitigate health risks and improve efficient industrial technology, while balancing economic, political, and social factors in development and implementation of air quality management. Mitigating industrial emissions has beneficial outcomes for wellbeing (Clougherty 2010); environmental stewardship and governance fosters a more proactive and cleaner environment, while building trusting relationships between industrial stakeholders (Pascal et al. 2013). “A comprehensive enforcement program with mandatory reporting of emissions, [...] and meaningful penalties for noncompliance ensures that emission standards are being met” (Craig et al. 2008), and facility operators are held accountable. Data collected internally by the mill is not readily available. To improve transparency, siting rationale for air quality monitoring stations and accompanying data should be provided as part of a commitment to corporate responsibility of the mill (Hoffman et al. 2015).

To improve air quality conditions, stakeholders could increase the capacity for surveillance, assessment, and response to air quality. Furthermore, evaluation of a wide-suite of air toxics, including NATA compounds not measured by the NAPS network (particularly prioritized air toxics) would contribute to ensuring that air quality in Canada is adequately studied. Therefore, ECCC and NSE should consider implementation of a long-term monitoring program for priority air toxics that is comparable to the NATA network monitored by EPA to characterize air toxics exposure on local, regional, and national scales. Data will be useful to help mitigate emissions and achieve acceptable air quality standards that do not exceed cancer or noncancer risk thresholds.

ECCC should also consider the feasibility of installing and maintaining additional strategically placed NAPS sites to improve air pollution evaluation in both rural and urban areas, as well as in microenvironments (e.g., near point source emitters, high-traffic areas) (Craig et al. 2008). More effective communication of the results is required to increase transparency among stakeholders, including the public (Hoffman et al. 2015). Based on the population’s risk of exposure, it is strongly recommended that ambient air toxics monitoring to be incorporated at the established NAPS station in Pictou to optimize capturing of said air toxics, and to best correlate pertinent results. Additionally, atmospheric dispersion modeling should use local meteorological data; therefore, meteorological data should also

be collected concurrently at NAPS sites to help identify source emitters.

Measurement of individual VOC compounds is necessary to provide insight into their contribution to $PM_{2.5}$ and ground-level O_3 formation. Data would be useful to help target large source emitters and aid regulatory enforcement. Establishment of stringent and/or adapted air quality standards that encompass more air toxics (e.g., VOCs) fosters strong public support and political engagement to address air quality issues. Moreover, health impacts associated with background air pollution should be estimated. Air quality management programs are human resource intensive; therefore, they must have clear and feasible short- and long-term objectives. These initiatives gain predictive insights on atmospheric chemistry, and engage and support relevant sectors in the development and implementation of policies to reduce health risks associated with air pollution exposure (Craig et al. 2008).

Conclusions

Findings reveal that 1,3-butadiene, benzene, and carbon tetrachloride exceeded their respective cancer risk thresholds and are of primary health concern in terms of population risk. Results highlight associations with wind direction and the Granton NAPS site’s ambient VOC concentrations in relation to location of the pulp mill. Compared to AOWD, PW from the selected range (360° – 80°) typically resulted in higher VOC concentrations for all compounds, except carbon tetrachloride, suggesting that the mill is likely a contributor to increased concentrations. In addition, there are clear seasonal variations of meteorological conditions and VOC concentrations. Southwest PW blowing towards Pictou dominate during summer months, when people spend more time outdoors, and consequently are exposed to higher concentrations. Due to Pictou’s geography, air toxics from transboundary and local sources may converge in summer, resulting in higher VOC concentrations. Findings suggest the Granton NAPS site is not positioned to accurately represent ambient levels of toxicity in PC. Therefore, ECCC and NSE should consider incorporating ambient air toxics (e.g., VOCs) monitoring at the established Pictou NAPS site where there is higher residential exposure.

Future research will provide air quality management with a comprehensive characterization of air toxics to support informed public health decisions. Moreover, this pilot study may serve as a precursor to gaining awareness, so that government agencies adopt more stringent air quality regulations and monitoring programs to ensure health of citizens is safeguarded and prioritized.

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Appendix F

Correspondence on the Matter of the Effluent Treatment Facility
Proposal(s).



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December 20, 2017

The Honourable Iain Rankin
Nova Scotia Environment
PO Box 442
Halifax, NS B3J 2P8

Via Email: minister.environment@novascotia.ca

Dear Minister Rankin;

I am writing on behalf of the Town of Pictou to inform you of a motion passed by Council at its Regular meeting on December 18, 2017.

The motion was passed following presentations made to Council by the **Northumberland Fisherman's Association** and **Friends of the Northumberland** expressing their concerns regarding the plan for effluent treatment at the Northern Pulp, Paper Excellence Facility located at Abercrombie Point in Nova Scotia. More specifically, both groups are against the dispersion of the effluent via pipe, into the Northumberland Strait.

We believe that the motion as passed speaks to the expectations of Pictou Town Council that all aspects of the effluent treatment plan are thoroughly examined by both provincial and federal departments prior to making a decision regarding its construction.

Motion: It is moved that a letter be written to the Nova Scotia Environment Minister, and the Federal Ministers of the Environment and Climate Change and Fisheries and Oceans, requesting a review of the environmental assessment process being employed to assess the Northern Pulp proposal for effluent treatment. This request supports the completion of an Environmental Assessment Report and the possibility of a Class 2 environmental assessment to insure that the best possible solution for effluent treatment, disposal and monitoring is used and the fishing industry on the Northumberland Strait is not placed at risk.

December 20, 2017
Page 2



Thank you for your attention to this important issue.

Sincerely,

A handwritten signature in blue ink, appearing to read "James J. Ryan", is written over a horizontal line.

James J. Ryan
Mayor

Cc: *Hon. Dominic LeBlanc, Federal Minister of Fisheries and Oceans*
Hon. Catherine McKenna, Federal Minister of the Environment and Climate Change
Karla MacFarlane, MLA, Pictou West
Pat Dunn, MLA, Pictou Centre
Tim Houston, MLA, Pictou East



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COPY

December 20, 2017

The Honourable Catherine McKenna, P.C., M.P.
Minister of Environment and Climate Change Canada
200 Sacré-Coeur Boulevard
Gatineau QC K1A 0H3

Via Email: ec.ministre-minister.ec@canada.ca

Dear Minister McKenna;

I am writing on behalf of the Town of Pictou to inform you of a motion passed by Council at its Regular meeting on December 18, 2017.

The motion was passed following presentations made to Council by the **Northumberland Fisherman's Association** and **Friends of the Northumberland** expressing their concerns regarding the plan for effluent treatment at the Northern Pulp, Paper Excellence Facility located at Abercrombie Point in Nova Scotia. More specifically, both groups are against the dispersion of the effluent via pipe, into the Northumberland Strait.

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December 20, 2017
Page 2

Thank you for your attention to this important issue.

Yours sincerely,



James J. Ryan

Cc *Hon. Dominic LeBlanc, Federal Minister of Fisheries and Oceans*
Hon. Iain Rankin, NS Minister of the Environment
Karla MacFarlane, MLA, Pictou West
Pat Dunn, MLA, Pictou Centre
Tim Houston, MLA, Pictou East



Canadian Environmental
Assessment Agency

Agence canadienne
d'évaluation environnementale

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March 27, 2018

COPY

James J. Ryan
40 Water Street
PO Box 640
Pictou, NS
B0K1H0
Jim.ryan@townofpictou.ca

Dear Mr. Ryan,

Thank you for your email dated December 18, 2017, expressing concern regarding the Northern Pulp Effluent Treatment Facility Replacement Project proposed by Northern Pulp Nova Scotia Corporation.

The Canadian Environmental Assessment Agency recently received a request for the Minister of Environment and Climate Change Canada to designate the Project for a federal environmental assessment under section 14 of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). The Agency is currently assessing the applicability of CEAA 2012 to this Project and is seeking input from other government departments and Indigenous groups on whether the Project should be designated under CEAA 2012. The Agency will reflect the input received in its advice to the Minister.

Further questions regarding the Project and this analysis can be directed to Ms. Melanie Smith, Team Leader, at (902) 426-6623 or by email at Melanie.Smith@ceaa-acee.gc.ca.

Yours Sincerely,

Mike Atkinson
Regional Director
Atlantic Region





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October 24, 2018.



Mr. Bruce Chapman
General Manager
Northern Pulp Nova Scotia Corporation
260 Granton Abercrombie Branch Road
Abercrombie, NS B2H 5C6

Mr. Chapman:

I have become aware, through media reports, that the draft of a revised proposal by Northern Pulp for the disposal of treated effluent involves the installation of a pipe along TCH 106 to the Caribou Harbour. I am very disappointed that the Town was not consulted, or at least, informed of this potential proposal prior to its release to the media.

Assuming the media reports to be factual, the proposed route for the pipe will not only pass through the Town of Pictou, but will pass directly over the Caribou wellfield which is a major source of domestic drinking water for residents of the Town of Pictou and many residents of Central Caribou.

In light of recent events, I believe the proposed pipeline route will, and should, cause a great deal of concern for all residents of the Town and surrounding area.

As the owners of the Water Utility, the Town of Pictou holds water withdrawal approvals issued by the Nova Scotia Department of Environment for both the Caribou and Pictou wellfields along with the approval to operate a water treatment and distribution system.

In 2002, NSE introduced its Drinking Water Strategy to ensure safe, clean drinking water to its customers. As part of this strategy and the approval process, the town has fulfilled its responsibility to:

- 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; and
- 5) Develop a Monitoring Program to Evaluate the Effectiveness of a Plan.

The Caribou/Pictou Source Water Protection Advisory Committee includes representation from both the Town of Pictou and the Municipality of Pictou County. It takes the responsibility to protect our source water for current and future generations very seriously and will continue to do so.

In conclusion, I am requesting that any future consideration of proposals that could have implications for the Town and its residents be communicated directly as part of your due diligence.

Sincerely,



James Ryan

*c.c. Hon. Margaret Miller, NS Minister of Environment
Karla MacFarlane, MLA, Pictou West
Robert Parker, Warden, Municipality of Pictou County*



October 26, 2018

His Worship James Ryan
Town of Pictou
40 Water Street
Pictou, NB B0K 1H0

Dear Mayor Ryan:

Thank you for your letter of October 24th and for the opportunity to speak with you that same day regarding the additional proposed route for an effluent pipeline.

Northern Pulp's effluent treatment facility (ETF) replacement project is a major undertaking. With work being carried out simultaneously on many files, timely communication with all stakeholders can be challenging. Unfortunately, due to unexpected circumstances, the past few days did not unfold as planned. Once again, please accept my apologies for not contacting you earlier.

Work on the Environmental Assessment (EA) submission documents for the ETF replacement project is still in progress. An important part of finalizing those documents is a feasibility study of the additional proposed pipeline route. Please understand that discovery on this additional proposed route is in its very early stages – there is much work yet to be done.

Northern Pulp acknowledges the Town of Pictou's responsibilities and interests in this matter. As part of our due diligence we will continue to engage and consult with all stakeholders, and look forward to those discussions, as we prepare to register for an EA.

I would welcome your call at any time throughout this process.

Sincerely,

A handwritten signature in black ink, appearing to read "Bruce Chapman", written in a cursive style.

Bruce Chapman
General Manager

Copy to: The Honourable Margaret Miller, Nova Scotia Minister of Environment
Karla MacFarlane, MLA, Pictou West
Robert Parker, Warden, Municipality of Pictou County

Northern Pulp Nova Scotia Corporation, a Paper Excellence Company
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November 2, 2018.

Mr. Bruce Chapman
General Manager
Northern Pulp Nova Scotia Corporation
260 Granton Abercrombie Branch Road
Abercrombie, NS B2H 5C6

Via Email: Bruce.Chapman@northermpulp.com

Mr. Chapman;

Thank you for your prompt response to my letter of October 24th.

I appreciate that you are in the 'very early stages' of a feasibility study of proposed route(s) for an effluent pipe as part of the effluent treatment process.

Following consultation with Town Councillors, I believe it is a good time to inform you that any plans to install the pipe across the Town of Pictou watershed would be unacceptable.

As a stakeholder in the recently proposed plan, we look forward to future communications.

Sincerely,

James Ryan

*c.c. Hon. Margaret Miller, NS Minister of Environment
Karla MacFarlane, MLA, Pictou West
Robert Parker, Warden, Municipality of Pictou County*



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Ms. Melanie Smith, Team Leader
Canadian Environmental Assessment Agency
1801 Hollis St., Suite 200
Halifax, NS B3J 3N4

February 24, 2019.

Re: Northern Pulp Effluent Treatment Facility
Environmental Assessment

In November 2017, the Town of Pictou passed a resolution calling for letters to be written to the Nova Scotia Minister of Environment, the Federal Minister of Environment and Climate Change and the Minister of Fisheries and Oceans supporting 'the completion of an Environmental Assessment Report and the possibility of a Class 2 Environmental Assessment' and that the 'fishing industry on the Northumberland Strait is not placed at risk'. It is my understanding, from the correspondence I received from Mr. Mike Atkinson dated March 27, 2018, that the information (letter) to the Hon. Catherine McKenna was forwarded to CEAA for consideration. This is greatly appreciated.

Since that letter was written in 2017, a great deal has transpired with respect to the proposed Northern Pulp Treatment Facility including a modified plan for effluent disposal and consideration of a possible review of the project by CEAA.

At this time, I feel it to be prudent, as Mayor of the Town of Pictou, to elaborate on our original position and comment on additional concerns regarding the modified plan.

We, the Town, remain firm in our position that Federal oversight of this project would provide the most comprehensive assessment of 'risk' to the Northumberland Strait fishery. Due to the financial and regulatory relationship between the mill and the Province, and the potential effects of the project on a lucrative and sensitive marine environment shared by multiple provinces, trust can only be restored with a full Environmental Assessment.

In addition to our originally stated concerns, the modified proposed route for the pipe carrying treated effluent will pass directly over the Caribou/Pictou Watershed. As you can imagine, in light of recent breaks in the current system feeding the Boat Harbour Effluent Treatment Facility (ETF), this causes concern for residents of our Town. Recognizing that water is a Provincially regulated resource the contents of the treated effluent and the security of the transmission system must be adequately addressed within the scientific studies to ensure safety of our water supply.

The Town also has concerns about any potential for increased odour produced by the re-location of the AST (Activated Sludge Treatment) process and risks associated with the emissions from the power boiler when the sludge is burned. We do not have in-house expertise to adequately assess potential effects and how they might affect air quality (safety), but believe the EA Proposal submitted by Northern Pulp may not fully address these concerns.

Thank you for your consideration of this matter.

Sincerely,



James Ryan, Mayor

*c.c. Hon. Catherine Miller, Min. of Environment, Province of Nova Scotia
Dan Troke, CAO, Town of Pictou*

*Attachments: Letter to Hon. Catherine McKenna -December 20, 2017
Letter from Mike Atkinson, CEAA – March 27, 2018*



**Communities,
Culture & Heritage**

1741 Brunswick Street
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P.O. Box 456
Halifax, NS
B3J 2R5

Tel: (902) 424-6475
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TO: Helen Yeh

FROM: Sean Weseloh McKeane

DATE: March 8, 2019

RE: **Environmental Registration
EA 19-02-07 Northern Pulp Effluent Treatment Facility**

Staff of the Department of Communities, Culture and Heritage has reviewed the EA document for the Northern Pulp Effluent Treatment Facility and have provided the following comments:

Archaeology

Staff reviewed the Registration Document and the sections particular to archaeology. There is considerable archaeological content. The sections that cover both marine and terrestrial archaeology (8.16 and 8.17), clearly indicate that work has been completed, but there is more work to be done including a marine Archaeological Resource Impact Assessment and monitoring during construction, possible shovel testing, and contingency planning; see section 8.16.3.2 for all recommendations for marine archaeology mitigation and section 8.17.3.2 for all recommendations for terrestrial archaeology mitigation. The ARIA by CRM Group Ltd. for terrestrial resources is noted, as well as the list of recommendations.

CCH has no additional comments at this time. However, this project will be followed to ensure future archaeological work and planning as noted in the EA document is conducted.

Botany

Staff reviewed the Registration Document and the sections particular to botany. The data and analysis completed to date are mostly reasonable. As noted in the document some key surveys for terrestrial plants and marine biota have not been completed.

Table E.1.1-1 lists all project-related residual environmental effects as NS, no significant residual environmental effects predicted. However, some key surveys for terrestrial plants and marine biota have not been completed. It is recommended that this table be revised once these surveys have been completed and the proponent can assess the residual environmental effects on the terrestrial plants and marine biota that are present in the study area.

Table 3.1-1 the federal Species at Risk Act should be included in this table. Until the additional botanical surveys are completed it is unknown if a species protected under SARA is present in the study area.

Section 8.7.2.4 notes that “The overstory (trees) within the wetland was dominated by white pine (*Picea glauca*) and American mountain-ash (*Sorbus americana*); as well, the overstory also consisted of red maple (*Acer rubrum*). The shrub layer was dominated by broadleaf cattail (*Typha latifolia*) and also contained field horsetail (*Equisetum arvense*), woolgrass (*Scirpus cyperinus*), cinnamon fern (*Osmunda cinnamomea*), sweet pea (*Lathyrus* sp.), Valerian (*Valeriana officinalis*), and common marsh bedstraw (*Galium palustre*).” Please note there are several errors of the Latin species names. The Latin name for eastern white pine is *Pinus strobus*. *Picea glauca* is the Latin name for white spruce. The currently accepted Latin name for cinnamon fern is *Osmundastrum cinnamomeum* (L.) C. Presl. It is unlikely that the canopy found in a natural swamp is white pine or white spruce. It is recommended that this be clarified through subsequent plant surveys. It is recommended that the proponent refer to and cite the Canadian Wetland Classification system in these descriptions (National Wetlands Working Group 1997).

Section 8.8.2.2 states that Jelly lichen (*Collex tenax*) “are typically calciphiles however salt from the ocean would increase the pH of coastal soils allowing them to thrive.” Increases in pH due to excessive sodium are not the same as a calcium-rich habitat for plants. The reference that supports this statement should be cited.

The plant species list in Appendix P should include the subspecific designations where possible. E.g., *Phragmites australis*: one subspecies is an exotic invasive, while the other is not. Exotic & invasive species should be controlled, where possible, to prevent spread into surrounding habitats.

Palaeontology

Staff have reviewed the Registration Document, and sections particular to geology and paleontology resources and do not see any omissions or errors in the characterization of the risk to paleontology heritage resources within the project zone. The document notes that no disruption of bedrock geology is planned, so there appears to be little or no risk of damage to potential fossil sites in the area.

Zoology

Staff have reviewed the Registration Document, and sections particular to zoology. The VEC approach has been used for this review. This project has a potential wider ecological impact and perhaps should have used a different approach, since potential mitigation for rare species may not necessarily be consistent with the maintenance of ecological integrity (depending on the basis for designation of the species at risk).

Within the broader context of the project, it should be noted that there are relatively recent reports in the public media concerning the occurrences and changes of abundances of some “priority” fish and mammal species (Blue Whales, Striped Bass). It is recognized that the registration document reflects the state of knowledge at a given time and may not capture more-current events. It is expected that the review by the pertinent Regulatory agency (Fisheries and Oceans Canada) will capture those comments (especially the SARA-listed species).



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Yeh, H.
March 8, 2019
Page 3

Sincerely,

Sean Weseloh McKeane
Coordinator, Special Places

Environmental Assessment Review-

March 8, 2019

NSE Engineers and ICE Review

PLANNING /DESIGN ISSUES

EFFLUENT FLOWS

1. FLOW DATA TO SUPPORT DESIGN FLOWS MUST BE PROVIDED.

- The proposed treatment facility and accompanying receiving water study are based on an annual average flow rate of 62,000 m³/day and a maximum daily flow rate of 85,000 m³/day. No data has been provided to support the basis of the design. Appendix C of the Registration Document states the average flow is 70,000 to 75,000 m³/day, not 62,000 m³/day.
- The EA submission does not provide an explanation of how flows will be reduced to achieve an annual average flow rate of 62,000 m³/day (a reduction of 8,000 to 13,000 m³/day by the data provided in the EARD). NPNS is required under their current IA (Conditions 5f) to submit a plan, including modelling, 1 year prior to proposed implementation of projects. To date, NPNS has not submitted any planned water/wastewater reductions.
- Unclear if design flows presented were based on Point A or Point C flows. Flow measurements from Point C of the BHTF may not be representative of the actual peak flows which will be experienced by the new ETF. The BHTF has the ability to buffer flows due to its sheer size (days retention), the new ETF will not have the capacity to do so (hours retention). Water usage data for 2017 from Internal Services indicates the Facility used more than 85,000 m³ 23.85% of the year, (83 days of the 348 operational days) and the data submitted monthly by NP indicates more than 85,000 m³ 27.9% of the year (97 days). The table below represents the number of days each month that 85,000 m³ was exceeded in 2017 and the maximum volume withdrawn on a single day during each month:

MONTH	# DAYS >85,000 m³	MAXIMUM 1 DAY WATER USE
January	1	94,029 m ³
February	1	92,023 m ³
March	3	90,275 m ³
April	3	99,306 m ³
May	1	86,951 m ³
June	9	91,054 m ³
July	21	94,495 m ³
August	17	120,731 m ³
September	16	109,716 m ³
October	4	99,185 m ³

November	3	96,350 m ³
December	4	97,031 m ³

Please note any influent volumes to the new ETF or discharge from the proposed outfall pipe in excess of 85,000 m³/day would invalidate the ETF design and the receiving water study results.

INFLUENT/EFFLUENT PARAMETERS

2. COMPLETE CHARACTERIZATION OF INFLUENT (AT POINT A) HAS NOT BEEN PROVIDED TO ASSESS THE APPROPRIATENESS OF THE PROPOSED TREATMENT TECHNOLOGY.

3. RATIONALE FOR THE INCREASE IN NUTRIENT LOADING MUST BE PROVIDED.

The receiving water study undertaken for the Pictou Road discharge location proposed a daily maximum total nitrogen concentration of 3.0 mg/L. The revised receiving water study included in the EARD indicates a daily maximum of 6.0 mg/L. No explanation has been provided with respect to increase in total nitrogen.

4. DATA TO SUPPORT COD REDUCTIONS (TOTAL AND SOLUABLE) AS WELL AS FRACTIONIZATION OF COD IN NPNS INFLUENT IS REQUIRED TO DETERMINE IF THE PROPOSED TREATMENT TECHNOLOGY IS APPROPRIATE.

- Under the current IA (Condition 6(e)), NPNS must achieve a 50% reduction from the benchmark total COD concentration of 1900 mg/L on the influent to the ETF by January 31, 2020. This means the influent total COD to the new ETF must not exceed 950 mg/L.
- The receiving water study proposes a COD effluent limit from the ETF of 725 mg/L.
- The EARD Section 5.2.2.6 indicates the ANOXKALDNES BAS™ system will reduce soluble COD by approximately 70% and the MBBR should be capable of removing approximately 40% of the easily biodegradable soluble COD. There is no data provided to support these assertions.
- The EARD does not provide data on current influent COD fractionization (i.e. what portion of NPNS' influent at Point A is readily biodegradable, slowly biodegradable, soluble non-biodegradable and particulate non-biodegradable) in order to understand the treatment efficiency of the proposed ETF with respect to total COD. In the absence of this information, an assessment of the new ETF's ability to achieve compliance can not be completed.

ETF TECHNOLOGY

5. TREATMENT TECHNOLOGY SPECIFICATIONS WERE NOT PROVIDED TO ASSESS THE EFFICACY OF THE TECHNOLOGY

6. MITIGATION OF MEDIA LOSS.

- Table 4.2-1 indicates MBBRs are sensitive to risk of loss of media and the technology has a limited degree of process automation. The EARD does not address how these highlighted drawbacks will be mitigated by NPNS. Please note, under-design of the system in terms of flows could increase the risk of media loss.

7. OPTIMUM TEMPERATURE OPERATING RANGES FOR THE ETF HAVE NOT BEEN PROVIDED.

- The temperatures indicated are above the range of optimum treatability, generally accepted to be between 25 to 35. °C The highest temperatures and highest flows will occur simultaneously during the summer months. What effect will these facts have on the ability of ETF to consistently meet and not exceed effluent limits?

SPILL BASIN

8. INSUFFICIENT INFORMATION TO ASSESS THE SIZING AND APPROPRIATENESS OF THE DESIGN OF THE SPILL BASIN.

- The EARD indicates a retention time of 10-13 hours at a design capacity of 35,000 m³. The basis of this design has not been provided therefore there is insufficient information to assess the appropriateness of the design.
- If flows exceed 85,000m³ per day on a consistent basis (77 out of 92 days for 3 consecutive months in the summer where daily water use is >85,000 m³), there will not be sufficient recovery time in ETF to empty the basin before it is required.
- There is only a mention of a “the standard operating procedure will be to keep the spill basin nearly empty so the full volume is available when needed” the document does not discuss how this will be accomplished.
- Is there an overflow? If so, where will the overflow be directed?

RECEIVING WATER STUDY

9. BASELINE DATA USED FOR THE UPDATED RECEIVING WATER STUDY DOES NOT REFLECT THE NEW LOCATION. BASELINE WATER QUALITY STUDIES ALONG WITH ADJUSTMENT TO THE MODEL ARE REQUIRED.

10. IT IS NOT CLEAR THAT THE SALINITY AND TEMPERATURE DIFFERENTIAL OF THE EFFLUENT HAS BEEN ACCOUNTED FOR IN THE MODELING.

- Regardless of allowable dimensions for mixing zones indicated by CCME, effluent plumes shall not create changes to aesthetics or use at the water's surface. The study indicates color will reach background and not be visible at surface. When buoyancy differences are greater in winter, it results in a faster rising plume. Has this been accounted for?

11. 2 PORT DIFFUSER MODELING WAS NOT PROVIDED.

- A 1-port and 3-port diffuser were modeled. The modeling indicates the plume will touch the seabed at 200 m and 10 m respectively. This is a large difference. Was a 2-port diffuser modeled? If so, at what distance does the plume interact with the seabed and what are the dilution factors?

12. DATA FROM LAB TRIALS ON NPNS RAW WASTEWATER AT SIMILAR FACILITIES NOR MODELLING OF NPNS RAW WASTEWATER PARAMETERS WERE NOT PROVIDED TO ASSESS THE EFFICACY OF THE PROPOSED TECHNOLOGY.

PIPELINE

13. DETAILS OF TRENCH LINING AS SECONDARY CONTAINMENT WERE NOT PROVIDED.

- Trench lining as secondary containment could divert shallow groundwater and change flow regimes. This would be of greater concern within the Town of Pictou Watershed.

14. DETAILS OF LEAK DETECTION WERE NOT PROVIDED IN THE EARD.

- Insufficient information was provided in the EARD regarding the proponent's plan for monitoring and mitigating potential leaks along the pipeline route. Detailed plans regarding monitoring and mitigation measures for the prevention/containment of potential pipeline leaks should be provided for further evaluation. This is particularly important in sensitive areas, such as the Town of Pictou's Source Water Protection Area and areas in proximity to private water supply wells, watercourses, and wetlands.
- Viable options for leak detection technologies and inspection methodologies should be provided.

OPERATIONAL ISSUES/OTHER PERMITTING PROCESSES

SPILL BASIN

1. DANGEROUS GOODS/WASTE DANGEROUS GOODS SPILL CONTAINMENT WHICH IS COMPLIANT WITH THE DANGEROUS GOODS MANAGEMENT REGULATIONS HAS NOT BEEN ADDRESSED.
 - The EARD proposes a spill basin for "excess process flows that are outside the tolerances of the ETF to handle". Current, any spills of dangerous goods from within the Facility go directly to the settling basins at BHETF. NPNS is currently not in compliance with the Dangerous Goods Management Regulations as the BHETF is not Approved to accept and/or treat dangerous or waste dangerous goods. NPNS has indicated since 2015 that spill containment would have to be addressed when a new ETF is proposed. NPNS has not provided details on spill containment for dangerous goods in accordance with the Dangerous Goods Management Regulations nor does the EARD address treatment of dangerous or waste dangerous goods within the new ETF.

TOWN OF PICTOU WATERSHED

2. CONSULTATION WITH THE TOWN OF PICTOU SHOULD BE REQUIRED.
 - The proposed pipeline location passes through the Town of Pictou watershed. The aquifer serving the Town is a shallow, sand and gravel aquifer. It is unclear in the EARD if NPNS consulted directly with the Town on potential concerns and mitigation measures.

ETF

3. TRAINED OPERATOR FOR THE NEW ETF.
 - The AnoxKaldnes BAS™ process is more complex than the existing lagoon based system with significantly less retention time available. Treatment systems only perform well when they are operated well. The submission does not comment on the specific training and experience of the proposed operator. Due to the complexity of the system and the importance of precise operation in order to achieve regulatory compliance, the system should be operated by an individual with education and experience necessary to operate the new ETF such as an individual who has achieved minimum of a Level 4 Operator Certification. These qualifications should be demonstrated to the Department. This individual would also be in direct responsible charge of the operation of the ETF.

COLOUR

4. O₂ DELIGNIFICATION REQUIRED.

- The receiving water study indicates the colour of the effluent will be 750 TCU at the point of discharge. Although background samples were not collected at the proposed discharge location, colour at the previously proposed Pictou Road discharge location was measured at an average value of 10.8 TCU. A BC Government document entitled “Ambient Water Quality Criteria for Colour in British Columbia” (<https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/colour-tech.pdf>) indicates colour is an issue for several Mills in BC who discharge freshwater effluent to freshwater receiving bodies, including some with diffusers. There is insufficient information and data provided to assess if temperature and salinity differential will have an effect on the visibility of the effluent.
- Alberta Environment regulate colour discharges at the Weyerhaeuser Grande Prairie kraft pulp mill.
- Dark coloured effluents could create a visual barrier for aquatic species to find food sources and also prevent/restrict light penetration, necessary for the growth of aquatic plants.
- The EARD Appendix C states O₂ delignification has many benefits to the process and the environment. NPNS does not commit firmly to an installation date for O₂ delignification.
- O₂ delignification will significantly reduce colour and COD to the influent of the new ETF.
- O₂ delignification would generate cost savings to the Mill in reduced chemical demands.
- A study entitled “Marine Pollution Effects of Pulp and Paper Wastes” by T.H. Pearson indicates the ferric oxides in mill effluent impart a yellow/orange colour to the marine sediments, becoming progressively black as the ferric compounds are reduced to ferrous compounds, nitrates are reduced to nitrites and ammonia, which have a negative influence on the macrobiology of the sediments. With the employment of O₂ Delignification, the management of transition metals, such as ferric oxides, is very important for the selectivity of oxygen delignification (Gullichsen and Fogelholm, 2000). Therefore removing transition metals by prior acid washing and/or chelation and stabilizing the transition metals by adding magnesium salts and silicates not only helps maintain pulp strength but also reduce the oxide redox reactions at the point of discharge.

ODOURS

5. ODOUR ISSUES AT THE NEW ETF LOCATION HAVE NOT BEEN FULLY DISCUSSED.

- The EARD does not discuss measures to control odours from the new treatment system during times of upset conditions.

STUDIES

6. SITE SPECIFIC PRE-DISCHARGE STUDIES OF THE POTENTIAL EFFECTS ON THE MARINE ECOSYSTEM.

- The submitted Scientific Literature Effect of BKME on Lobster report recommends site specific studies using actual Mill effluent to more accurately assess the potential for impact to adult lobsters including lethality, behavior, and sublethal impacts. The EARD proposes a post discharge survey within 24 months of the initiation of discharge from

the new outfall location. This study should be conducted before the discharge location is approved as there is insufficient information in the EARD to assess the appropriateness of the proposed discharge location in relation to the effects of BKME on the lobster population.

7. MARINE GEOTECHNICAL SURVEYS NEED TO BE COMPLETED.

- Insufficient information has been provided in the EARD to determine if the proposed discharge location is acceptable. Marine geotechnical surveys are required to determine the exact scour range the pipeline needs to be protected against.

8. DOMESTIC WELL SURVEY

- A pre-construction domestic well survey along the pipeline route would be beneficial as a means of collecting baseline data from nearby private water supply wells. Typical domestic well surveys include wells within a 500 m radius of the proposed activity and involve both water quality sampling and water level measurements. It is important to verify the number and location of wells to include in the survey in the field rather than relying on NSE's Well Logs Database.

9. SEASONAL ASSESSMENTS ARE REQUIRED FOR WETLAND ALTERATIONS AS WELL AS FOR GEOTECHNICAL ASSESSMENTS IN WATERCOURSES.

- Methods and locations for watercourse and wetland crossings have not been confirmed therefore additional information is required to assess the potential environmental impacts.

10. GROUNDWATER AND SURFACE WATER MONITORING (ETF SITE).

- There is an existing groundwater and surface water monitoring program at the mill site, which would have to be modified to accommodate the proposed project. Changes to the current monitoring locations, parameters, and frequency would be based on the proposed new infrastructure, such as the spill basin, clarifiers, and chemical storage, and effluent quality. Additional baseline data would also have to be collected.

11. GROUNDWATER MONITORING (PIPELINE ROUTE).

- The EARD suggests pre- and post-construction groundwater monitoring along the pipeline route to ensure no alterations to groundwater from the construction process. Details of this proposed monitoring program were not provided, and the EARD did not discuss the potential for impacts to groundwater associated with the operation of the pipeline. The potential for impacts to groundwater associated with the operation of the pipeline and should be evaluated along with the need for groundwater monitoring along the pipeline route. This is particularly important in sensitive areas, such as the Town's Source Water Protection Area, areas in proximity to private water supply wells, and locations where the proposed pipeline location is below the water table.

12. SURFACE WATER MONITORING (PIPELINE ROUTE).

- Surface water quality along the pipeline route was assessed in December 2018, including both field measurements and water quality samples. The EARD indicated that baseline surface water monitoring along the pipeline route would include, at a minimum, collection of water quality data over three seasons. It would also be beneficial to conduct post-construction water quality sampling for comparison to baseline to evaluate potential impacts to water quality associated with construction activities.

13. EXCAVATION BELOW THE WATER TABLE.

- According to the EARD, there is potential for some of the infrastructure associated with the project to be installed below the local groundwater table, e.g., clarifiers at the ETF site. The report indicates that water removed from the excavation(s) will be tested and released appropriately; however, no details were provided. Typically, such plans would be reviewed and approved by NSE prior to construction.

14. PILOT SCALE TESTING OF THE PROPOSED ETF TO CONFIRM ASSUMPTIONS.

- Pilot scale testing of treatment technology at the Facility on the actual effluent would provide confirmation that the technology can consistently achieve the effluent discharge concentrations outlined in the EARD.

15. POTENTIAL FOR CONTAMINATION

- Given the location of the proposed project, i.e., on an existing industrial site and within the highway right of way, there would be potential for contamination to be encountered during the construction phase of the project. NPNS committed to developing a contingency plan for managing any contamination that is encountered during construction. Typically, such plans are reviewed and approved by NSE.
- The EARD mentions the potential for encountering contaminants from the adjacent Canso Chemical site, however there is no specific plan for the management of the potentially encountered soil and groundwater. It is important to have a plan prepared prior to encountering materials.

16. CHEMICAL STORAGE (ETF SITE)

- The EARD states the ETF will require several chemical inputs, which will be stored on site. The proposed location of the chemical storage area(s) should be identified.

17. BASELINE STUDIES

- Many baseline studies have yet to be completed. These studies should be completed in order to assess the appropriateness of the proposed pipeline location.

TEMPERATURE

18. MITIGATION MEASURES FOR THE PROTECTION OF AQUATIC LIFE NEAR THE DIFFUSERS SHOULD BE REQUIRED.

- Temperatures could be as high as 37 °C (summer) and 25 °C above background (winter).

PIPELINE

19. PIPELINE INSTALLATION METHODS SHOULD BE PROVIDED.

- Several land-based installation options have been provided however the location where each option is proposed has not therefore there is insufficient information to provide comment.
- Detailed plans regarding directional drilling should be provided.

20. PERMISSIONS FROM TIR OPERATIONS AND TRANSPORT CANADA HAVE NOT BEEN OBTAINED.

- Based on previously reviewed projects proposed for installation within the TIR RoW, such installations have not been approved by TIR Operations. It is important for NPNS to obtain approval prior to EA approval as if the pipeline installation proposal changes to include widening of the shoulder of the road, an alteration of a wetland or wetland complex greater than 4 hectares may be triggered.

21. ADDITIONAL INFORMATION IS REQUIRED TO ASSESS THE POTENTIAL ENVIRONMENTAL IMPACTS OF BLASTING.

- Blasting has not been excluded as an option and could have significant impacts on the aquatic environment.

OPERATION & MAINTENANCE

22. DETAILS OF AND SCHEDULES FOR MAINTENANCE AND INSPECTION SHOULD BE PROVIDED.

- Operation and maintenance procedures for the spill basin should be provided.
- The diffusers are an integral component for NPNS to achieve water quality requirements.
- Pipeline operation 5.3.2.4 indicates that incremental replacement of components may be required, however, a maintenance and monitoring schedule based on the industry standards was not provided.

23. SPILL RESPONSE PLAN SHOULD BE PROVIDED.

- The document does not discuss in detail a coastal response plan for release from either the proposed new system or the pipeline.

OTHER OBSERVATIONS

1. Town of Pictou Source Water Protection Area: further delineation of the wellhead protection areas, i.e., 5, 10, and 25-year time of travel zones, would be beneficial in assessing the potential impacts to the municipal wells associated with operation of the proposed pipeline.
2. Existing Monitoring Well Network (ETF Site): as stated in the EARD, the existing monitoring well network should be protected during construction activities. As with all industrial sites, NSE requires any monitoring wells that are destroyed or damaged be decommissioned and replaced or repaired. Any change to the existing monitoring well network will trigger a change to the groundwater monitoring program for the mill site.
3. Existing Surface Water Monitoring Network (ETF Site): as stated in the EARD, there is one, possibly two, watercourses that fall within the footprint of the proposed project, which may have to be reconfigured. Any watercourse alterations would have to meet NSE requirements. Both watercourses are included in the existing surface water monitoring network for the mill site; therefore, the suggested reconfiguration may trigger a change to the existing surface water monitoring program for the mill site.
4. Comparison of the actual effluent plume travel from Point D into Pictou Road (actual data collected under current seasonal conditions) with the EARD proposed discharge location would have been useful for the public to compare current conditions with anticipated conditions from the new proposed discharge location.
5. 2017 and 2018 data reported for Pt. C indicates 9% and 13.7% of TSS samples had concentrations greater than 48 mg/L (33 of 365 for 2017; 50 of 365 for 2018) and 5% and 9.6% of BOD samples were greater than 48 mg/L (8 of 156 for 2017; 15 of 156 for 2018). Data also indicates 2017 and 2018 discharges into the Northumberland Strait at Pt. D were all below 48 mg/L with the exception of two TSS samples.
6. There was no in-depth discussion or analysis of the use of physico-chemical processes as an option to provide treatment of the effluent. Weyerhaeuser Grand Prairie bleached kraft mill in Alberta compared the efficiencies of ultrafiltration and reverse osmosis in a 1997 study conducted to reduce colour and total organic carbon (Sierka et al.). The study concluded UF and

RO gave excellent results removing 99% of colour and more than 80% of TOC from the effluent tested. Pilot scale studies have been conducted on pulp mill effluent using two-stage membrane filtration, ultrafiltration and reverse osmosis resulting in very high removals of COD, colour and conductivity from the effluents (Koyuncu et al.)

7. Acid Rock Drainage Potential: according to the EARD, it is not anticipated that bedrock with acid producing potential will be encountered during construction. As with all construction projects, any acid producing bedrock that is encountered during construction should be properly managed.
8. EPP and EMP have not been developed and throughout the documentation these future documents are referenced as the guiding principles of a large portion of the mitigation during all construction phase of the project. These are also mentioned as guiding documents for the project.
9. A statement is made in the Vernal Pools section *“Wet areas that are greater than 100 m² are not considered wetlands by the Nova Scotia Wetland Conservation Policy, and therefore receive no legal protection”*, NSE defines wetlands as follows: *Land commonly referred to as marsh, swamp, fen or bog that either periodically or permanently has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions.* Wetland alteration exemptions exist only for certain activities and in specific wetland types.
10. It is important that re-vegetation adjacent to wetlands not introduce alien species into the wetland environment. It was noted that DOT mix was proposed for all revegetation.
11. Based on a compliance history report from 2009 to present ICE 286 complaints about the operation of the mill.
12. Northern Pulp Nova Scotia Corporation has to date complied with all compliance items. Between 2009 to present this included thirteen directives, nine deficiencies, and one warning ticket.
13. Northern Pulp Nova Scotia Corporation received one Summary Offence Ticket.

From: [Peveril, Michele](#)
To: [Yeh, Helen X](#)
Cc: [Tan, Minh](#)
Subject: DoB EA comments
Date: March 11, 2019 5:31:23 PM

Northern Pulp EA Comments from DoB:

The Nova Scotia Department of Business has reviewed the January 2019 Environmental Assessment Registration Document for the Replacement Effluent Treatment Facility as provided by Northern Pulp Nova Scotia Corporation in the context of the Department's mandate to lead and align government efforts behind a common agenda for inclusive economic growth. That means ensuring we have the economic conditions so businesses can thrive and all Nova Scotians can participate and benefit. The department focuses on strategic priorities and opportunities that encourage Nova Scotia's innovation, competitiveness, entrepreneurship, and export orientation. In particular, the department concentrates on key sectors that represent a competitive or comparative advantage for Nova Scotia that will create opportunities for enterprises and entrepreneurship to thrive and lead to the export of more products and services. That includes private businesses, social enterprises, and institutions, working together in clusters in all regions of the province. To achieve government's mandate, the department works collaboratively with our Crown corporations (Develop Nova Scotia, Halifax Convention Centre Corporation (Events East Group), Innovacorp, Invest Nova Scotia, Nova Scotia Business Inc. and Tourism Nova Scotia), key partners in other levels of government, entrepreneurs, large businesses, post-secondary institutions, venture capital investors and Nova Scotians to create a dynamic environment for businesses to succeed. Working together, reinforcing each other's activities, creates a stronger, collective impact that can realize the province's inclusive economic growth objectives.

The Environmental Assessment Registration Document for the Replacement Effluent Treatment Facility section 8.14 "Socio-Economic Environment" (page 431) states that "The Valued Environmental Components (VECs) identified for the project include plants and wildlife on land and in the water – all of which directly or indirectly support coastal fisheries, aquaculture, tourism and recreation in the region and in the Northumberland Strait. Cultural heritage and other direct interactions with residents' health are also VECs." Each of these VECs is discussed subsequently in the Registration Document. The existing environment, potential effects, residual effects and mitigation during the construction phase and operation/maintenance phase were outlined. A listing of the VECs interdependent to the socio-economic environment and a summary was provided in the Registration Document to address residual environmental effects to the socio-economic environment. The activities, effects, mitigative factors/measures and residual effects were each characterized as "Not Significant – Adverse" in summarizing the significance of the residual effects. There is insufficient evidence presented in the Registration Documents to support the proponent's conclusions that the impacts are "Not Significant-Adverse". For instance, impact ranges were not estimated in quantified terms to fully address the various VECs identified.

Michele Peveril

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Environmental Stewardship Branch
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45 Alderney Drive
Dartmouth, NS B2Y 2N6

March 18, 2019

Helen Yeh
Environmental Assessment Officer
Nova Scotia Environment
1902 Barrington Street, Suite 2085
Halifax, NS B3J 2P8

Dear Ms. Yeh:

**Re: Northern Pulp Effluent Treatment Facility Replacement Project Environmental Assessment
Registration**

Environment and Climate Change Canada (ECCC) has reviewed the Environmental Assessment Registration (submitted February 7, 2019) for the above-noted project proposal.

ECCC's review of the project is based on the department's mandate and responsibilities under the *Canadian Environmental Protection Act, Fisheries Act* (Section 36 and the Pulp and Paper Effluent Regulations), *Species at Risk Act*, and the *Migratory Birds Convention Act*. Stemming from this, ECCC has identified a number of requirements for regulatory compliance the proponent will have to meet should it proceed to construct and operate the proposed facility.

For other matters, the level of information in the EA Registration is not sufficient for ECCC to determine that the project will conform to all applicable legislation or to understand the magnitude of impacts to environmental features of concern to the department. ECCC is prepared to work with Nova Scotia Environment and other regulatory departments and agencies to identify the timing and mechanisms to address these issues.

Please feel free to contact me or Stephen Zwicker at (902) 426-0992 / Stephen.Zwicker@canada.ca who is coordinating ECCC's review of this project if you have any questions or concerns.

Yours truly,

RC
Jeffrey Corkum
Regional Director
Environmental Protection Operations Directorate, Atlantic

cc: M. Hingston M. Dober MT Grant H. Dupuis F. Boisvert R. Gautreau

Northern Pulp Replacement Effluent Treatment Facility Project – Environment and Climate Change Comments, March 18, 2019

Applicable Legislation

The proponent should be made aware of federal legislation described in the following sections that falls under the mandate of Environment and Climate Change Canada (ECCC), and could be applicable to this project.

Effluent Discharges

The deposit of effluent from the facility would be subject to the *Pulp & Paper Effluent Regulations* <https://laws-lois.justice.gc.ca/eng/regulations/SOR-92-269/> (under the *Fisheries Act*), which prescribe certain deleterious substances related to the effluent from Pulp & Paper Mills, and authorizes the deposit of limited quantities of those deleterious substances under certain conditions. These regulations include a requirement to conduct environmental effects monitoring studies of the potential effects of effluent on fish, fish usability by humans and fish habitat. The facility would also be subject to the *Pulp & Paper Mill Effluent Dioxin and Furan Regulations* <https://laws-lois.justice.gc.ca/eng/regulations/SOR-92-267/>, and the *Pulp and Paper Mill Defoamer and Wood Chip Regulations* <https://laws-lois.justice.gc.ca/eng/regulations/SOR-92-268/>, (both under the *Canadian Environmental Protection Act*).

ECCC has been consulting with interested parties including industry, the provinces and territories, and Indigenous groups regarding the Modernization of the *Pulp & Paper Effluent Regulations*. Public consultation documents prepared to date include:

- *Proposed Modernization of the Pulp and Paper Effluent Regulations – Consultation Document September 2017*

Further information on the regulatory approach and/or status of the regulatory development process can be obtained from:

Bernard Lupien, Manager EEM and Forest Products
Forest Products and Fisheries Act Division – PPER Modernization
351 Boulevard Saint-Joseph – 19th Floor
Gatineau, Quebec K1A 0H3
E-mail: ec.refpppper.ec@canada.ca

Marine Pipeline Construction

In Table 3.1.1 and on page 21, the potential need for a Disposal at Sea Permit in relation to possible “ocean based disposal of dredged material” is acknowledged. To be clear, Disposal at Sea of dredged material would include any permanent sidecasting of sediment during the trenching of the pipeline route. ECCC will also need to determine the applicability of CEPA 122(1)(i) which speaks to “the placement of a substance for a purpose other than its mere

disposal...”. This permit exemption may potentially apply to any planned backfilling of the pipeline trench using sidecast material. If it is determined however, that the criteria for CEPA 122(1)(i) has not been met, then a Disposal at Sea permit would be required.

Page 20 of Appendix F states that the pipeline route will be verified with marine surveying and soil testing. Given that activities related to the pipeline installation may require a Disposal at Sea permit, it is strongly recommended that the proponent take that opportunity to characterize the sediment in a manner that meets ECCC’s requirements for a Disposal at Sea permit application.

The proponent is encouraged to contact ECCC directly to discuss minimum sampling requirements as well as evaluation criteria regarding CEPA 122(1)(i).

ECCC administers and enforces Subsections 36(3) to (6) of the *Fisheries Act*, which prohibits anyone from depositing or permitting “*the deposit of a deleterious substance of any type in water frequented by fish, or in any place under any conditions where the deleterious substance, or any other deleterious substance that results from the deposit of the deleterious substance may enter such water*”. Consideration of this must be given to all aspects of the project, including but not limited to on-land pipeline construction.

Wildlife and Wildlife Habitat

Migratory birds, their eggs, nests, and young are protected under the *Migratory Birds Convention Act* (MBCA). Migratory birds protected by the MBCA generally include all seabirds (except cormorants and pelicans), all waterfowl, all shorebirds, and most landbirds (birds with principally terrestrial life cycles). The list of species protected by the MBCA can be found at: <https://www.ec.gc.ca/nature/default.asp?lang=En&n=496E2702-1>. Bird species not listed may be protected under other legislation.

Under Section 6 of the *Migratory Birds Regulations* (MBR), it is forbidden to disturb, destroy, or take a nest or egg of a migratory bird; or to be in possession of a live migratory bird, or its carcass, skin, nest or egg, except under authority of a permit.

Furthermore, Section 5.1 of the MBCA describes prohibitions related to deposit of substances harmful to migratory birds:

“5.1 (1) No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.

(2) No person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds.”

Information Required to Support EA Conclusions

The following sections relate to information that would be required to support EA conclusions about the nature and magnitude of potential environmental effects that, in ECCC's view are not adequately described in the EA Registration Document.

Effluent Treatment and Discharges

- Without empirical baseline information on the Caribou Harbour area associated with the proposed outfall location, ECCC is not in a position to assess the predictions made in the report, nor to evaluate the potential environmental impacts related to that aspect of the project.
- Mixing Zone as defined in the report glossary in the context of this project, refers to the marine area within a 100 m distance from the termination of the effluent pipeline (page xxviii). However, several of the effluent plume figures refer to a "regulatory mixing zone." There is no federal regulatory mixing zone, however effluent concentration at fixed distances from discharge are relevant to determining EEM requirements. Clarification on what is intended by the term "regulatory mixing zone", and what regulations might be referred to here is needed.
- Table 3.1.1, p.17
 - *Fisheries Act* Section 36 is referenced in the "Summary of Applicability" column and then states no permit or approval is required. While there is no approval required, it should be clear that all activities must be carried out in compliance with Section 36(3)
 - *The Pulp and Paper Mill Effluent Dioxin and Furan Regulations* and *the Pulp and Paper Mill Defoamer and Wood Chip Regulations* (both under CEPA) have not been identified. The proponent currently submits information under these regulations and this would be expected to continue with a new treatment facility.
- Table 4.2.1, p.28
 - In reference to tertiary treatment, it is stated under the advantages: "Used when conventional treatment cannot remove a specific contaminant that is found harmful to a specific local ecosystem". Tertiary treatment is considered a general term rather than a process, so any "Tertiary Process" being referred to should be identified along with the parameter(s) that may require such treatment.
- Section 5.2.2.3, p.42. A discussion on the potential need and options for leak detection should be included as part of the Spill Collection System.
- Section 5.3.1.6, p.54. While it is stated effluent from the ETF will meet NSE requirements, it should be noted that the effluent discharged must also be in compliance with the *Pulp and Paper Effluent Regulations* (under the Fisheries Act) and the *Pulp and Paper Mill Effluent Dioxin and Furan Regulations* (under CEPA). The mill must also comply with the *Pulp and Paper Mill Defoamer and Wood Chip Regulations* (under CEPA).

- Section 5.6.1, p.83. It is stated “The PPER, and those regulations cited by the PPER, regulate the quality of effluent and remain under the jurisdiction of ECCC.” Similar statements are made in other sections. Any regulations, other than the PPER, that are being referenced should be specified.
- Section 8.4.1, p.168. This section references the *Fisheries Act* – Deleterious Substance Provisions (Section 36), as a guideline, standard or regulatory requirement related to surface water that may apply to the project. It should be clear that Section 36 of the *Fisheries Act* does apply to activities related to the project and any references to this section should be consistent with the specific regulatory language.
- Section 8.11.2.4, p.343. It is stated: “Pictou Harbour is used as a proxy for Caribou Harbour with respect to water quality, in the absence of available water quality data for Caribou Harbour. Pictou Harbour is similar to Caribou Harbour in terms of depth and geography, but likely has greater freshwater influence.” Without empirical baseline data from the actual discharge location, it is not possible to assess such statements or to evaluate the potential environmental impacts of the effluent discharge.
- Section 8.11.3.1, p.346. This section summarises the predicted residual effects on the physical environment of Caribou Harbour (sediment and water quality) despite the absence of baseline information on water and sediment quality in the assessment area.

No information has been provided with respect to the physical and chemical characteristics of the sediments to be excavated to install the pipeline. Conclusions on environmental quality resulting from the project are presented after extrapolating from data from Pictou Road.

Empirical baseline information on the Caribou Harbour and Caribou Point area of Northumberland Strait is necessary to estimate with some confidence the direction and impact of residual effects on the physical environment within the marine assessment area.

The follow-up and monitoring program outlined in Appendix H should be considered preliminary only, subject to modification once predictions, conclusions and decisions based on site specific data are made regarding the project.

- Appendix E1, Section 2.0. It appears that the Far-Field model simulations were run before the Near-Field model. One could expect that the behavior of the plume further afield depends to a large extent on how it behaved at the diffuser, i.e. how quickly it mixed and spread and rose to the surface. It should be explained how the initial mixing and dispersal of the plume was taken into account when simulating Far-Field extent and concentrations of effluent in Section 3.

- References should be provided to support the arguments on page 3. An alternative would be to provide the equivalent plume simulation during winter conditions to compare to the summer modelling results.
- Appendix E1, Table 2.1. The table identifies the simulation time step as 60 seconds. Is this correct? An explanation on the step interval used for the plume simulation should be provided.
- Appendix E1, p.6 and Figures 2.5 to 2.13. The explanatory details provided on far-field simulations are very brief and do not permit a full appreciation of the model's robustness or the credibility of its results.

Figure 2.13 shows the final state of the plume at the end of one month, more than 9 days after the tidal phase depicted by the preceding Figure 2.12. It is not specified whether any of these figures depict the maximum extent of the simulated plume, nor how isolated effluent patches form, nor why the final plume at the end of the month is further south-east than any of the preceding snapshots provided.

Given that EA predictions for the aquatic environment are based on the premise that simulated conditions return to surrogate (Pictou area) background levels within 2- to 100 m from the diffuser depending on the parameter in question, it is important to establish a high degree of confidence in the model simulation and input parameters.

It would be helpful in understanding the simulation to see how the isolated patches form and disintegrate, as well as an animation of the plume for the few days leading to the final state of the plume in Figure 2.13. The maximum extent of the modelled plume should have been provided, if it is not depicted in one of the figures.

- Appendix E1, p. 16. The report indicates that higher background level of contaminants from the Pictou area of the Strait were used as input parameters for background water quality, (due to a lack of data from the Caribou area), and as such can be considered more conservative. This may not be accurate: the Caribou Harbour area is expected to be less contaminated than Pictou Harbour, such that the effluent being discharged near Caribou would in reality be more concentrated relative to receiving water than what is suggested by the simulation based on Pictou baseline data. In other words, it would require greater dilution than estimated based on Pictou data to achieve a return to the levels theoretically prevailing in the Caribou area. To use an example from page 24, where TN is taken to be 0.24 mg/L (as in Pictou Road), a 1:25 dilution of effluent is needed to return TN levels to "background". But if TN in Caribou area were, say, 0.1 mg/L, then a 1:60 dilution would be required to return TN concentrations to ambient levels. The dilution ratios and distances required to achieve background levels for most other water-quality parameters may also be underestimated on page 24-25.
- Appendix E1, Table 3.1. The table presents some water-quality parameters used as background conditions for Caribou Harbour. The title of the table should have identified the source of the samples as being from Pictou rather than Caribou area. As well, the depth in the water column at which samples were collected to obtain these averages was not provided.

- Appendix E1, Figure 3.2. The figure shows the frequency and force of prevailing currents derived from the MIKE 21 model. A more intuitive representation of current directions and speeds would be a current “rose” as is commonly done with winds. The figure’s title should have specified that these are depth-averaged speeds and directions. Their pertinence to effluent mixing and entrainment at the discharge point near the bottom is not obvious.

Current directions should have been provided to aid in the visualization of prevailing currents. A rationale for the use of depth-averaged currents instead of near-bottom currents when simulating effluent mixing and entrainment at the diffuser should also be presented.

- Appendix E1, p.25. The dilution ratio required (1:7) to return salinity to ambient levels appears to be underestimated, as ambient salinity is being *reduced*, not increased, by mixing with freshwater effluent. The correct dilution and distance estimates for the return to ambient salinity should be provided. A discussion on how the adjustments affect all conclusions based on dilution throughout the EA registration document should also be provided.
- Appendix G, p.2.2. The proponent proposes to confirm the spatial extent of the effluent plume empirically with the use of a tracer dye once the project is operational.

Empirical verification of the plume will be important not only for validating the simulations but also for confirming the location of the exposure area(s) for EEM studies.

- Appendix G, p.2.8. The proponent plans to execute the fish-population component of the EEM study by deploying caged mussels in exposure and reference areas from early April to end of June. The overall approach for the fish population study appears sound, but ice conditions in early April could interfere with the deployment schedule.

The design for such a study should consider and plan for the possibility of the field schedule being delayed. Study designs must be submitted to ECCC at least 6 months before the beginning of sampling (subsection 4(1) of Schedule IV.1 of the Pulp and Paper Effluent Regulations).

- Appendix G, p.3.1. Although no sampling areas are specifically identified in Appendix G, the proposal to measure, using recommended methods for EEM, the baseline conditions in both the future exposure and reference areas before the new effluent outfall becomes operational is strongly supported by ECCC. Such a BACI (Before-After/Control-Impact) design can be very useful for distinguishing effluent effects from natural differences between reference and exposure areas that may have existed before the discharge of effluent. It is crucial, as with any EEM study, that a suitable reference area(s) with similar characteristics and habitat to the exposure area(s) be selected so that any future effects observed in the effluent exposure area(s) are not confounded by other factors.

The proposal of collecting baseline EEM information at the project site's future exposure and reference areas is supported by ECCC. The reference area(s) should match the characteristics of the exposure area as closely as possible.

- Appendix H, Section 2.0. The proponent proposes to monitor several ecosystem components, beginning with baseline (pre-operational) data and continuing once the effluent discharges from its new location. Vertical tows for phytoplankton and zooplankton, as well as more intensive horizontal tows targeting specifically fish larvae and emerging lobster larvae, benthic community along the pipeline corridor, and fisheries-resources tissue analyses for various chemicals will all contribute to filling the current information gaps and improve the understanding of the area.

The absence of substantive baseline information specific to the Caribou area of the Strait is a significant gap in the EA that makes evaluating potential environmental effects of the project difficult as well as developing a representative monitoring program.

- Appendix H, Section 2.2. The proposed sub-lethal toxicity tests on lobster larvae and herring eggs are scheduled to begin only once the new treatment facility and effluent outfall are operational.

According to the Registration document, the current and future mill effluents are not expected to be identical, while the mill's process is expected to remain unchanged. It is further stated that testing the current effluent's toxicity to lobster and herring could therefore provide invaluable baseline information to inform a decision regarding the potential toxicity of mill effluent to major fisheries resources in the Caribou area of Northumberland Strait.

In ECCC's view, toxicity testing on lobster larvae and herring eggs with current NPNS effluent would not provide baseline effluent toxicity information for the future effluent.

- Appendix J. While not directly applicable to the project's future effluent quality and discharge location, the Cycle 7 EEM interpretive report provides a useful summary of effects seen previously in the aquatic receiving environment for the mill's current effluent and of the mill's subsequent investigations into their likely causes.

Wildlife and Wildlife Habitat

Barrow's Goldeneye

For federal environmental assessments, ss. 79(2) of the Species at Risk Act requires that persons responsible for an environmental assessment "must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them." These measures must:

- be consistent with best available information including any Recovery Strategy, Action Plan or Management Plan in a final or proposed version; and

- respect the terms and conditions of the SARA regarding protection of individuals, residences, and critical habitat of Extirpated, Endangered, or Threatened species.

Environment and Climate Change Canada is the lead jurisdiction for birds, including SAR, protected under the MBCA, and offers the information, expertise and advice below as the primary management jurisdiction:

Barrow's Goldeneye, a species of Special Concern, is listed on Schedule 1 of SARA. Barrow's Goldeneye and other waterfowl are known to winter in ice-free areas near the Venoit Causeway. The proponent indicates that "Several Barrow's goldeneye were observed during the January 2018 surveys west of the ETF site and along the shores of Pictou Harbour from Highway 106" (Section 8.10.2.4). However, potential adverse effects of this project on Barrow's Goldeneye are not clearly identified, nor mitigation measures identified. For instance, when referring to blasting and other obtrusive activities related to the construction of the Pictou Causeway crossing of the pipeline, adverse effects to birds during the breeding season are considered, but no such consideration is given to avoidance of adverse effects to Barrow's Goldeneye and other staging/wintering waterfowl.

The proponent should clearly identify the potential adverse effects of project-related activities, including cumulative effects and effects of accidents, on Barrow's Goldeneye, as well as measures to avoid or minimize those effects, and to monitor them.

Migratory Bird Surveys along the Proposed Pipeline Route

Section 8.10.2.3. It is indicated that bird surveys in the vicinity of the proposed pipeline have not yet been conducted due to a change in design and location of the proposed pipeline, and surveys are planned for spring and summer 2019. Due to this lack of data, ECCC is not positioned to assess the predictions made in the report, nor to evaluate the potential environmental impacts related to that aspect of the project.

Migratory Birds and the Proposed ETF

Section 8.10.3.1. It is acknowledged that "The spill basin may attract birds, especially waterbirds and waterfowl" and that "Waterfowl may use open clarifiers as foraging or migratory habitat". However, the potential effects of bird use of these project components have not been identified. Measures to deter birds from using these project components have also not been described.

The Registration Document refers to bird deterrent devices to be used prior to blasting activities. The devices to be used should be identified.

The Registration Document states that the existing NPNS wildlife policies will be enforced, however they have not been provided or described.

Some aspects of the proposed project involve relatively standard activities typical to many project types. For these activities, ECCC recommends that the proponent undertake appropriate mitigation and project design including in the following areas:

Migratory Bird Interactions with Lighting

Birds may be attracted to lights at on-land coastal construction sites or on the vessels involved in the placement of the pipeline, even with the mitigation measures proposed by the proponent (e.g. reducing deck lighting on project vessels wherever practical).

On page 419, the proponent proposes to do routine checks of project vessels for stranded birds, and refers to the protocol described in Williams and Chardine's 1999 document entitled, *The Leach's Storm-Petrel: General information and handling instruction*. Williams and Chardine (1999) is specific to storm-petrels, and due to a better understanding of bird strandings at sea since 1999, ECCC's Canadian Wildlife Service (CWS) now expects proponents to implement protocols that are also applicable for other species of seabirds and for other bird groups, as in the CWS document *Procedures for handling and documenting stranded birds encountered on infrastructure offshore Atlantic Canada* (2017).

The proponent should therefore be prepared to conduct systematic checks for stranded birds, rather than only conducting routine checks, whereby designated crew members record search effort (even when no birds are found). Should storm-petrels or other species become stranded on vessels or on land, the proponent is expected to adhere to the attached *Procedures for handling and documenting stranded birds encountered on infrastructure offshore Atlantic Canada* (2017), which provides safe and effective procedures for dealing with and documenting live and stranded birds. A permit is required to implement this protocol. The proponent should be advised that it is required to complete a permit application form prior to proposed activities. Permit application forms can be obtained by contacting ECCC's Canadian Wildlife Service (CWS) via email at ec.scfatlpermis-cwsatlpermits.ec@canada.ca.

The proponent should also be advised that any storm-petrels that are found dead should be collected and sent to CWS. This is not a requirement that is mentioned in the Procedures document, but is a current requirement of permittees.

Also, as is mentioned in the Procedures document, CWS expects to be contacted within 24 hours in the event of mortality of an individual migratory bird species at risk or 10 or more migratory birds in one event or night.

Bird collisions at lit and floodlit structures are a known problem. In coastal area, nocturnal migrants and night-flying seabirds (e.g. storm-petrels) are the birds most at risk of attraction to lights and lit structures. Attraction to lights may result in collision with lit structures or their support structures, or with other birds. Disoriented birds are prone to circling a light source and may deplete their energy reserves and either die of exhaustion or drop to the ground where they are at risk of depredation.

It is recommended that proponents avoid or restrict the time of operation of exterior decorative lights such as spotlights and floodlights whose function is to highlight features of buildings, or to illuminate an entire building. Especially on humid, foggy or rainy nights, their glow can draw birds from far away. It would be best for the birds if these lights were turned off, at least during the migratory season, when the risk to birds is greatest and also during periods when Leach's storm-petrels would be dispersing from their colonies.

Lighting for the safety of the employees should be shielded to shine down and only to where it is needed, without compromising safety.

Street and parking lot lighting should also be shielded so that little escapes into the sky and it is directed where required. LED lighting fixtures are generally less prone to light trespass and should be considered.

Spills and Releases

It is not clear what measures would be taken to protect birds (including avian species at risk) or sensitive habitats in the event of a spill of a substance harmful to birds. Even a small spill could be significant if it were to impact avian species at risk, sensitive habitats, or large numbers of birds. A spill response plan for the project should be prepared, for each phase of the project, and which includes a response plan for environmental emergencies that involve wildlife, and including detailed information regarding:

- measures to be taken to contain a spill and to clean up an area;
- individuals/groups responsible for the cleanup;
- equipment to be available to contain spills;
- measures to be taken to prevent birds from becoming oiled (i.e. deterrents/measures to get oil off the water or land);
- wildlife monitoring in the area (i.e. surveys)
- a strategy to deal with accidents where birds were oiled (i.e. discussion of rehabilitation or euthanization) and/or sensitive habitat(s) was(were) contaminated.

In order to assist proponents in preparing a plan for dealing with an oil spill which would potentially threaten birds, CWS has prepared the attached draft guidance document.

Site Rehabilitation

If there is ultimately a need to decommission a building or structure used for nesting by gulls, swallows, or other species of migratory birds, Environment Canada's Canadian Wildlife Service (CWS) should be consulted in a timely manner in advance of any proposed decommissioning activities for species-specific considerations including potential permitting requirements.

A variety of species of plants native to the general project area should be used in revegetation efforts. Should seed mixes for herbaceous native species for the area not be available, it should be ensured that plants used in revegetation efforts are not known to be invasive.

Measures to diminish the risk of introducing invasive species be developed and implemented during all project phases. These measures could include:

- cleaning and inspecting construction equipment prior to transport from elsewhere to ensure that no matter is attached to the machinery (e.g., use of pressure water hose to clean vehicles prior to transport); and
- regularly inspecting equipment prior to, during and immediately following construction in areas found to support Purple Loosestrife to ensure that vegetative matter is not transported from one construction area to another.

Compliance with the MBCA

It is the responsibility of the proponent to ensure that activities comply with the MBCA and regulations. In fulfilling its responsibility for MBCA compliance, the proponent should take the following points into consideration:

- Information regarding regional nesting periods can be found at <http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1> . Some species protected under the MBCA may nest outside these timeframes.
- Most migratory bird species construct nests in trees (sometimes in tree cavities) and shrubs, but several species nest at ground level (e.g., Common Nighthawk, Killdeer, sandpipers), in hay fields, pastures or in burrows. Some bird species may nest on cliffs or in stockpiles of overburden material from mines or the banks of quarries. Some migratory birds (including certain waterfowl species) may nest in head ponds created by beaver dams. Some migratory birds (e.g., Barn Swallow, Cliff Swallow, Eastern Phoebe) may build their nests on structures such as bridges, ledges or gutters.
- One method frequently used to minimize the risk of destroying bird nests consists of avoiding certain activities, such as clearing, during the regional nesting period for migratory birds.
- The risk of impacting active nests or birds caring for pre-fledged chicks, discovered during project activities outside the regional nesting period, can be minimized by measures such as the establishment of vegetated buffer zones around nests, and minimization of activities in the immediate area until nesting is complete and chicks have naturally migrated from the area. It is incumbent on the proponent to identify the best approach, based on the circumstances, to complying with the MBCA.

Further information can be found at
<http://www.ec.gc.ca/paomitmb/default.asp?lang=En&n=C51C415F-1>

The proponent should also be reminded that the prohibitions under the *Species at Risk Act* (SARA) are now in force. The complete text of SARA, including prohibitions, is available at www.sararegistry.gc.ca.