Town of Pictou

Response to

Northern Pulp Nova Scotia
Focus Report
Replacement Effluent Treatment Facility

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James Ryan, Mayor

1. Town of Pictou Re-Statement of Position:

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

1. Context for Responding to the Focus Report:

The Town of Pictou submitted a formal response to the Norther Pulp Environmental Assessment Registration Document on March 8, 2019. In that response (Appendix A), the Town expressed significant concern in three areas:

- Potential for Accidental Groundwater contamination within the Pictou and Caribou Wellfields,
- Potential negative effects of changes in air emissions and odours associated with the burning of sludge at Abercrombie Point and the
- Potential for negative Economic effects during the construction period.

A number of managers and scientists within numerous Divisions of Nova Scotia Environment and other Provincial and Federal Departments also expressed positions in their responses to the Northern Pulp Nova Scotia EA Registration document that support the Town of Pictou's reasoning. Assessments and recommendations were also made within the Department memos regarding the ability to reduce the risks associated with the potential environmental impacts of the project.

The former NS Minister of Environment, Margaret Miller, in the *Terms of Reference For The Preparation of a Focus Report Regarding the Replacement Effluent Treatment Facility Project* recognized the Town of Pictou's water and air emission concerns.

2. Responses to Areas of Concern within the Focus Report:

*******Note: Comments in this response should <u>not</u> be interpreted as to imply that there <u>could be</u> an acceptable plan to run the pipeline through the Town of Pictou Watershed.***

A. <u>Potential for Accidental Ground Water Contamination</u>

The modified route proposed for the on-land portion of the pipe carrying treated effluent to Caribou Harbour fails to address the previously stated concerns of the Town of Pictou. This plan continues to propose crossing the Pictou Watershed creating new risks to the groundwater supply. The following points identify items in the Focus Report that remain as concerns contributing to its' failure to meet the 'no additional risk' standard set by the Town.

- Moving the effluent pipe to the east side of Highway 106 and away from the shoulder does nothing to reduce risk to the Town water supply as it will remain within the watershed area.
- Thickening of the HDPE pipe to 67.7 mm from 53.8 mm does not address concerns of the Town or support recommendations by NSE Senior Surface Water Quality Specialist for the Water Management Unit regarding trench lining and/or secondary containment. (Appendix B, Page 7)
- Both trenching (Approximately 2.5 metres deep) and 'pipe jacking' can cause significant disturbance to soils and surface water along the pipeline route which could, in itself, lead to groundwater contamination in both the short and long term. (eg. Acid Rock Drainage (ARD), Appendix C, Page 8)
- The proposed fibre-Op monitoring for leakage is only being installed on that section of pipe from Pictou Town to Caribou Harbour (Focus Report, Page 62) and has not demonstrated the ability to detect leaks of less than 60L/Hr. What about smaller leaks buried 1.5 – 2.5 meters below surface?
- Preferred methods and standards of performance for the HDPE electrofusion and/or flange connectors in critical locations where the pipe moves from water to land or land to water have yet to be confirmed.
- The location of Vent approximately 1300 m from Caribou Harbour would place it very close to the watershed area. Despite the expectation of negative pressure (except when the pipe is "filling'), a collapse of the pipe beyond that point (land or water) could force the treated effluent from the pipe into the watershed area.
- No 'isolation valves' will be installed other than one for potential repairs to proposed vents.

- The Focus Report does not recognize, or account for, a recently commissioned well in the Caribou Wellfield. Although Well 17 is located south of Priests Road, it is the Town well closest to the 106 Highway corridor.

B: Changes in Air Emissions and Odours Associated with the AST (Activated Sludge Treatment), Burning of Sludge and Transmission of Treated Effluent

The Pictou West area receives a significant portion of the air emissions from Northern Pulp operations. Studies of wind direction prevalence (Focus Report, *(Stantec)Expanded Air Dispersion Modelling Study 2019* Appendix 6.2, Page 33, and, *Pilot study investigating ambient air toxics near a Canadian kraft pulp and paper facility in Pictou County, Nova Scotia*; Hoffman, Guernsey, Walker, Kim Sherren, Andreou, 2017) confirm that the Town of Pictou, located to the northeast of Northern Pulp (and the proposed ETF), is a regular recipient of the Ground Level Contaminants (GLCs). Residents and visitors alike have complained about the emissions including concerns for the longterm effects on health.

Below are samples of items from the Focus Report that raise concerns about increased levels of air emissions:

- Discrete Receptor 10 (Focus Report, *Expanded Air Dispersion Modelling Study 2019* Appendix 6.2, Figure 5.4, Page 37) does not adequately measure emissions throughout the Town of Pictou and portions of Pictou West. Personal observations and wind direction models would indicate that emissions are more frequent and significant in eastern portions of the Town where there are no receptors identified.
- The maximum predicted GLCs for ammonia, chloroform, and TRS exceeded applicable criteria at one or more of the discrete receptors.
- Projected emission Rates are Based on a calculated assumption that precipitator working at (only) 81.3% efficiency indicating new emissions. (Focus Report, *Expanded Air Dispersion Modelling Study 2019* Appendix 6.2)
- Projected exceedances of Ground Level concentrations (GLCs) of some contaminants (Total Reduced Sulfur) could possibly affect health outcomes and produce odours) (Focus Report Appendix 6.2 *Expanded Air Dispersion Modelling Study*, Table 6.1)
- The Focus Report confirms that new odorous emissions will be evident as a result of the re-location of the proposed treatment facility. The proposed AST ETF' is a more advance treatment technology compared to the current ASB ETF' and 'It is expected that odourous emissions from the new system will be lower than the current ETF.' (Focus Report, *Expanded Air Dispersion Modelling Study 2019* Appendix 6.2, Page 47)

- Total Reduced Sulphur (TSR) measurements, although below Ontario standards most receptors, could represent new (increased) effects on Pictou residents 'Although not based on health effects, a number of epidemiological studies suggest that the effects of exposure to TRS (Total Reduced Sulphur) are similar as that observed with exposure to hydrogen sulphide (e.g., irritation, respiratory and central nervous system effects)' (Ontario 2007). (Focus Report, *Expanded Air Dispersion Modelling Study 2019* Appendix 6.2, Page 47)

C: Other Concerns:

Despite assurances of minimizing traffic disruptions during the construction of the on-land and marine portions of the pipe, we are concerned that the 18+ month construction period will affect tourism traffic.

Changes to the plan that involve positioning of the pipe in a trench below Pictou Harbour (Parallel to the Causeway) without leak detection. Based on elevations and plans for 'venting' in the Central Caribou area, it is expected that the liquid treated effluent will be under significant pressure in the submerged portion of the pipe.

3. Appendices:

Appendix A: *Town of Pictou Response to Northern Pulp Nova Scotia Environmental Assessment Registration Document Replacement Effluent Treatment Facility -March 8, 2019*

Appendix B: NP EA Review Memo from **NS Environment**, Senior Surface Water Quality Specialist to Acting Water Management Unit Director -March 6, 2019

Appendix C: NP EA Review Memo from **NS Environment**, Senior Hydrogeologist in the Sustainability and Applied Science Division to the Manager of the Water Management Unit Specialist to Acting Water Management Unit Director -March 6, 2019

Appendix D: *Terms of Reference For The Preparation of a Focus Report Regarding the Replacement Effluent Treatment Facility Project -NSE, April 23, 2019*

Appendix A: *Town of Pictou Response to Northern Pulp Nova Scotia Environmental Assessment Registration Document Replacement Effluent Treatment Facility -March 8, 2019*

Town of Pictou

Response to

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

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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 his 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 B: NP EA Review Memo from **NS Environment**, Senior Surface Water Quality Specialist to Acting Water Management Unit Director -March 6, 2019

NOVA SCOTIA
Environment

1894 Barrington Street
PO Box 442
Halifax, Nova Scotia
Canada B3J 2P8

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, 2,3,7,80-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 (PCCD/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 [BOD_5], 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 rout, 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 m^3 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).

Appendix C: NP EA Review Memo from **NS Environment**, Senior Hydrogeologist in the Sustainability and Applied Science Division to the Manager of the Water Management Unit Specialist to Acting Water Management Unit Director -March 6, 2019

NOVA SCOTIA
Environment

Barrington Tower
1894 Barrington Street
Suite 1800
PO Box 442
Halifax, Nova Scotia
Canada B3J 2P8

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.

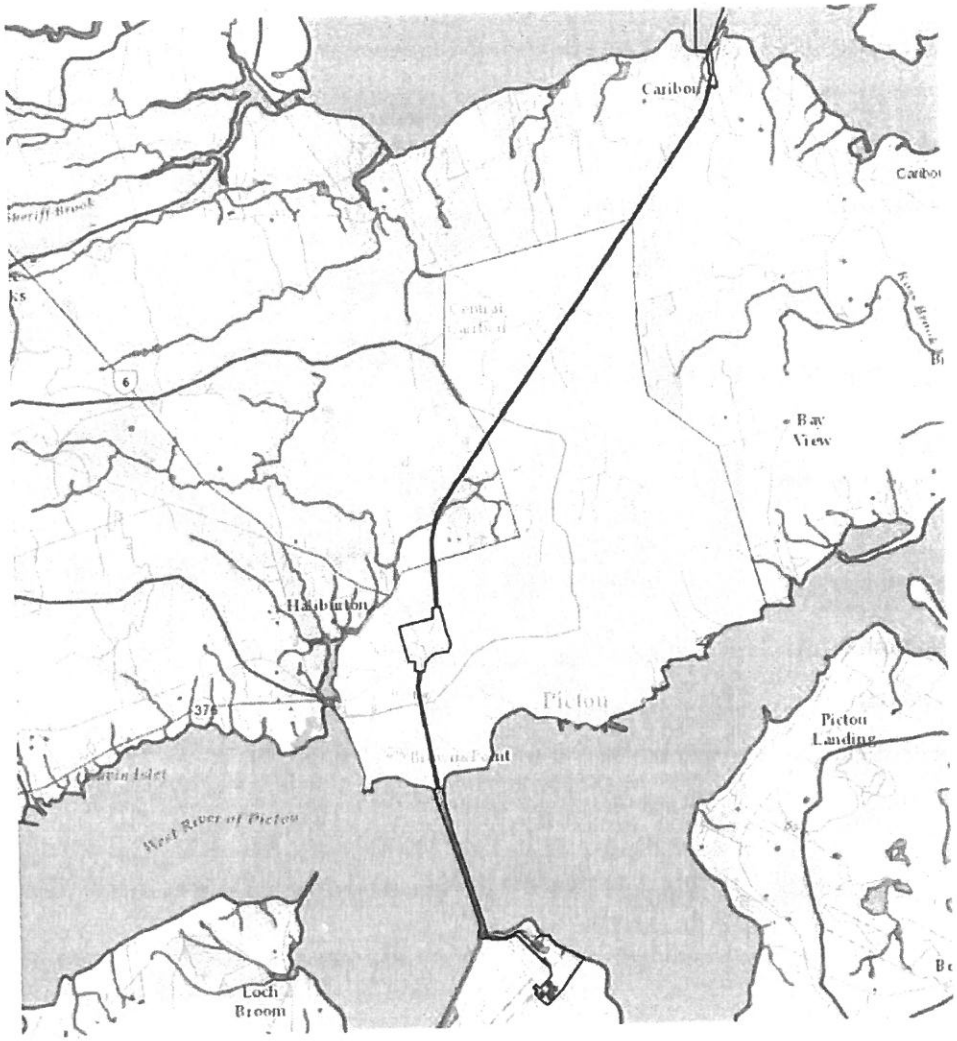

Figure 1 Town of Pictou Source Water Protection Committee Delineated Boundary (Town of Pictou, Pictou / Caribou Source Water Protection Plan 2017, NSE webmapping)

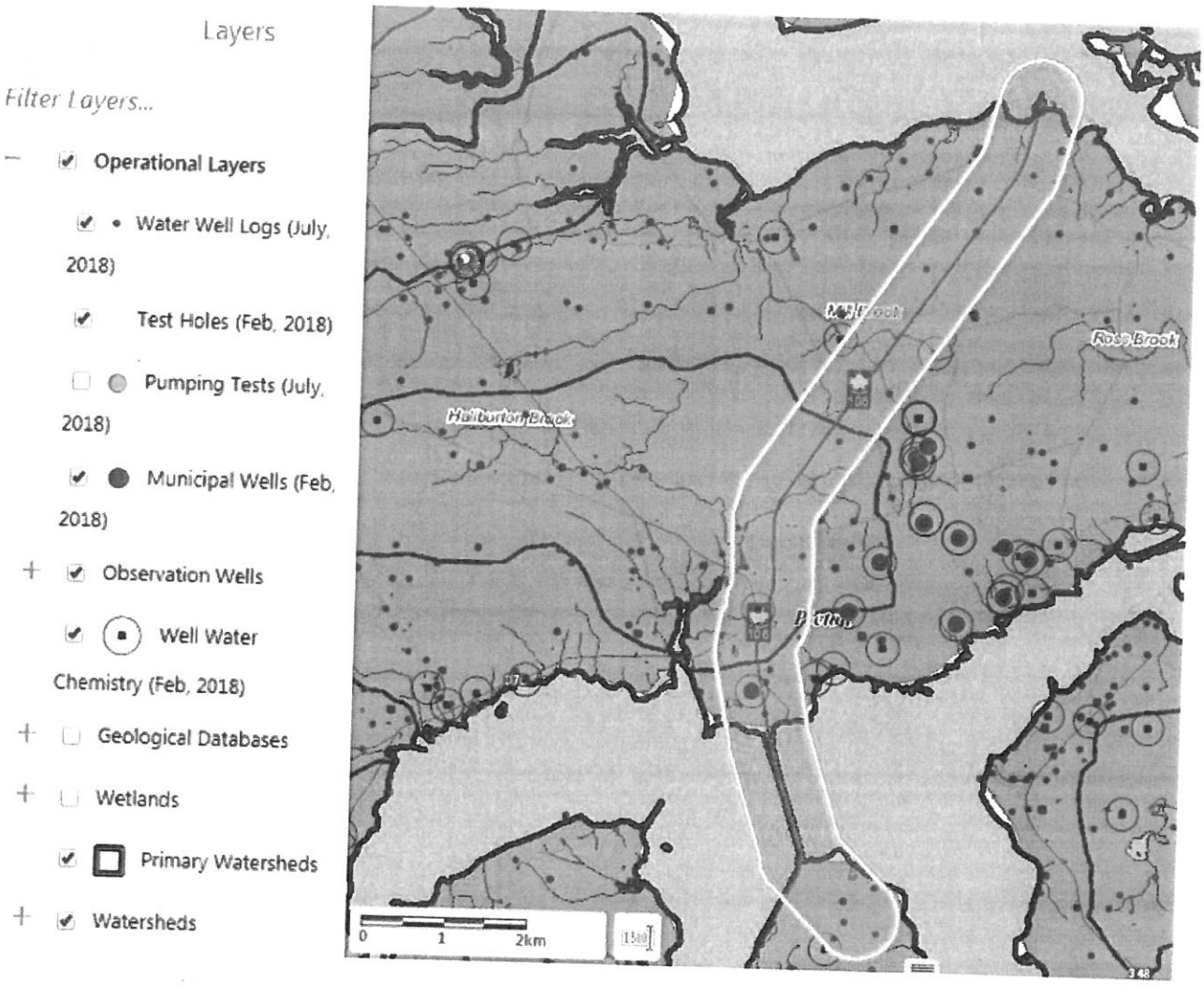

Figure 2 Proposed Pipeline Route 500 m radius buffer zone and water wells (NS Groundwater Atlas, Energy and Mines 2019)

Appendix D: *Terms of Reference For The Preparation of a Focus Report Regarding the Replacement Effluent Treatment Facility Project - NSE, April 23, 2019*

TERMS OF REFERENCE FOR THE PREPARATION OF A FOCUS REPORT

Regarding the Replacement Effluent Treatment Facility Project Proposed by Northern Pulp Nova Scotia Corporation

NOVA SCOTIA ENVIRONMENT
April 23, 2019

INTRODUCTION

The Replacement Effluent Treatment Facility Project (the Project or undertaking) proposed by Northern Pulp Nova Scotia Corporation (NPNS) was registered on February 7, 2019 for environmental assessment (EA) as a Class 1 undertaking pursuant to Part IV of the *Environment Act* and the Environmental Assessment Regulations.

On March 29, 2019, the Minister of Environment released a decision concerning this review. The Minister has determined that the EA Registration Document (EARD) is insufficient to make a decision on the Project, and a Focus Report is required in accordance with clause 13(1)c of the Environmental Assessment Regulations, pursuant to Part IV of the *Environment Act*.

NPNS is required to submit the Focus Report within one year of receipt of the Terms of Reference. Upon submission of the Focus Report by NPNS, Nova Scotia Environment (NSE) has 14 days to publish a notice advising the public where the Focus Report can be accessed for review and comment.

A 30-day public consultation period of the Focus Report follows. At the conclusion of the 30-day public consultation period, NSE has 25 days to review comments, and provide a recommendation to the Minister.

The Minister of Environment will have the following decision options, following the review of the Focus Report:

a. the undertaking is approved subject to specified terms and conditions and any other approvals required by statute or regulation;

b. an Environmental-Assessment Report is required; or

c. the undertaking is rejected.

During the preparation of the Focus Report, it is strongly recommended that NPNS continues to engage with relevant stakeholders and the Mi'kmaq including Pictou Landing First Nation, and to share relevant studies and reports.

Within the Focus Report, all impact assessment, mitigation and impact conclusions outlined in the Environmental Assessment Registration Document must be updated based upon the information requirements outlined below. The Addendum to this document includes additional questions for consideration and response. Consultation with NSE in the development of the Focus Report is required.

TERMS OF REFERENCE

The following items must be included in the Focus Report submission:

1. PUBLIC, MI'KMAQ AND GOVERNMENT ENGAGEMENT

1.1 Provide a response (via a concordance table) to questions and comments raised by the public, Mi'kmaq and government departments, and incorporate these comments in the Focus Report where applicable. Comments may be summarized prior to providing the response.

1.2 Provide a plan to share future reports and/or studies relevant to this Project with the public and the Mi'kmaq such as the Pictou Landing First Nation, including but not limited to the future Environmental Effects Monitoring results for the new effluent treatment facility.

2. PROJECT DESCRIPTION

2.1 Provide the following information regarding the on-land portion of the effluent pipeline:

- a re-alignment route for the effluent pipeline, given Department of Transportation and Infrastructure Renewal does not permit the pipeline to be placed in the shoulder of Highway 106;
- maps and/or drawings of the new pipeline location;
- a list of properties (ie., Premises Identification number or PID) that will intersect with the new pipeline alignment.

2.2 Conduct geotechnical surveys and provide the survey results to confirm viability of the marine portion of the pipeline route. The surveys must determine the potential impacts of ice scour on the pipeline.

2.3 Submit data regarding the complete physical and chemical characterization of NPNS' raw wastewater (ie., influent at Point A for the Project), to support the assessment of the appropriateness of the proposed treatment technology. The influent characterization results must be compared against the proposed treatment technology specifications.

2.4 Submit a complete physical and chemical characterisation of NPNS's expected effluent following treatment by the proposed technology. To assess the efficacy of the proposed treatment technology, the following must be included:

- Data from laboratory trials on NPNS's raw wastewater that were conducted at Veolia/AnoxKaldnes in Lund, Sweden in May 2018;
- Modelling results using the raw wastewater parameters and quality;
- A comparison of the effluent characterization results from the laboratory trials and modelling work, against appropriate regulations and/or guidelines.

2.5 Provide any proposed changes to the pipeline construction methodology and other associated pipeline construction work, related to the potential changes to the marine portion of the pipeline route (e.g., infilling, trenching, temporary access roads, excavation, blasting, disposal at sea, and others where applicable).

3. FACILITY DESIGN, CONSTRUCTION & OPERATION AND MAINTENANCE

3.1 Submit treatment technology specifications (e.g., optimal performance range of the technology) and an assessment of the efficacy of the proposed treatment technology for use at the NPNS facility, to the satisfaction of NSE. For example, peak effluent temperature is proposed to be above the generally accepted range of temperatures to achieve optimal biological treatment. Explain how the proposed higher than optimal treatment temperature would affect the treatment performance.

3.2 Provide effluent flow data to support the proposed peak treatment capacity of 85,000 m^3 maximum flow of effluent per day. At a minimum, data from 2017 and 2018 is required. Provide flow data for Point A, clarify source of the effluent flow volumes given in the EARD, and provide other relevant data and information to support the proposed treatment system design. If the 85,000 m^3 cannot be justified based on historical data, identify water reduction projects, or re-evaluate the treatment system design and update the receiving water study accordingly.

3.3 Effluent discharge parameters must be updated (where necessary) based upon the results of the effluent characterization in Section 2.4 and relevant additional studies. Refer also to Addendum item 2.0

3.4 Provide the following information regarding the spill basin:

- Submit 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 m^3. The basis of this design has not been provided. If flows exceed 85,000m^3 per day on a consistent basis (e.g., during summer months), confirm that there will be sufficient recovery time in the treatment system to empty the basin before the additional volume is required;
- Explain where the overflow will be directed in the event of unforeseen scenarios (e.g., power outage).

3.5 Provide the following information regarding the effluent pipeline:

- Provide viable options including the selected option for leak detection technologies and inspection methodologies, with specific consideration to any portion of the pipeline located in the Town of Pictou's water supply protection area;
- Provide viable options including the selected option for the enhanced pipeline protection, such as trench lining and justify how the chosen option is an adequate option for secondary containment. Be sure to address any potential changes in flow regimes, especially within the Town of Pictou's water supply protection area, due to the installation

of the pipeline and secondary containment. If different options are provided for different areas of the proposed re-aligned pipeline route, the locations for each option must be identified.

3.6 Clarify where the potential releases of waste dangerous goods at the Project site will be directed for treatment and/or disposal. It is important to note that the new treatment facility is not proposed to treat waste dangerous goods based on the information provided in the EARD and requirements of NSE.

4. MARINE WATER AND MARINE SEDIMENT

4.1 Conduct baseline studies for the marine environment (such as marine water quality and marine sediment) in the vicinity of proposed marine outfall location.

4.2 Update the receiving water study to model for all potential contaminants of concern in the receiving environment (based on the results of the effluent characterization and/or other relevant studies such as Human Health Risk Assessment). Baseline water quality data for Caribou harbour must be applied to this study. Refer also to Addendum 3.0.

4.3 Provide results of sediment transport modelling work to understand the impacts of potential accumulation of sediment within near field and far field model areas. This should include chemical and physical characterization of the solids proposed to be discharged by NPNS as well as a discussion of how these solids will interact with the marine sediments and what the potential impact will be on the marine environment as a result.

5. FRESH WATER RESOURCES

5.1 Complete a wetland baseline survey along the proposed re-aligned effluent pipeline route (if wetlands are expected to be altered).

5.2 Provide monitoring methodologies for areas with significant risk of pipeline leaks or spills (e.g., two areas where the pipeline crosses the Source Water Protection Delineated Boundary for the Town of Pictou wellfields; below water table; important wetlands; watercourse crossings; etc.).

6. AIR QUALITY

6.1 Provide a revised inventory of all potential air contaminants to be emitted from the proposed project, including but not limited to, speciated volatile organic compounds, semi-volatile organic compounds, reduced sulphur compounds, polyaromatic hydrocarbons and metals.

6.2 Update the air dispersion modelling for the pulp mill facility for all potential air contaminants of concern related to the Project.

6.3 Complete an updated ambient air monitoring plan for the Project site based on the air dispersion modelling results. This plan must include the potential air contaminants to be monitored and proposed air monitoring location(s).

7. FISH AND FISH HABITAT

7.1 Conduct fish and fish habitat baseline surveys for the freshwater environment, to the satisfaction of Fisheries and Oceans Canada.

7.2 Conduct fish habitat baseline surveys for the marine environment, to the satisfaction of Fisheries and Oceans Canada.

7.3 Conduct additional impact assessment of treated effluent on representative key marine fish species important for commercial, recreational and Aboriginal fisheries. This must be based upon updated information, additional studies and/or an understanding of expected movement of contaminants. Assessment methodology must first be agreed upon by NSE in consultation with relevant federal departments.

7.4 Submit an updated Environmental Effects Monitoring (EEM) program based on the results of various relevant baseline studies and an updated receiving water study. Refer also to Addendum item 4.0

7.5 Clarify what contingency measures will be in place to mitigate potential impacts (e.g., thermal shock to fish) due to potential large and rapid fluctuations in water temperature in the winter at the diffuser location during low production or maintenance shut down periods.

8. FLORA AND FAUNA

8.1 Complete a plant baseline survey along the proposed re-aligned effluent pipeline route.

8.2 Complete a migratory bird survey along the re-aligned pipeline route.

8.3 Complete a bird baseline survey for common nighthawk (*Chordeiles minor*), double crested cormorants (*Phalacrocorax auratus*), owls, and raptors and raptor nests, for the entire project area which includes the re-aligned pipeline route.

8.4 Complete a herptile survey for the Project area which includes the re-aligned pipeline route.

9. HUMAN HEALTH

9.1 Complete baseline studies for fish and shellfish tissue (via chemical analysis) of representative key marine species important for commercial, recreational and Aboriginal fisheries in the vicinity of the proposed effluent pipeline and diffuser location.

9.2 Commence a Human Health Risk Assessment (HHRA) to assess potential project-related impacts on human health. The risk assessment must consider human consumption of fish and other seafood, consumption of potentially contaminated drinking water, exposure to recreational water and sediment, outdoor air inhalation, and any other potential exposure pathways. The analysis must inform the identification of contaminants of concern and updating of the receiving water study.

10. ARCHAEOLOGY

10.1 Complete an Archaeological Resource Impact Assessment for the marine environment related to the Project.

10.2 Complete shovel testing for areas in the terrestrial environment that are identified to have elevated or medium potential of archaeological resources, to confirm the presence or absence of these resources.

11. INDIGENOUS PEOPLE'S USE OF LAND AND RESOURCES

11.1 Complete a Mi'kmaq Ecological Knowledge Study (MEKS) for the Project.

ADDENDUM: Items Raised by Reviewers Requiring Clarification

The following items must be addressed with NSE and included in the Focus Report where appropriate:

1.0 Provide information regarding whether and when new technology and equipment will be installed at the NPNS pulp mill to improve the effluent quality, including but not limited to the following:

- Will O_2 delignification be installed at the NPNS pulp mill?
- What other technology and equipment will be installed at the NPNS pulp mill?
- How will each proposed new technology and/or equipment improve the effluent quality?

2.0 With respect to the effluent discharge parameters:

- Explain why the total nitrogen parameter has changed to 6 mg/L (daily maximum) from the 3 mg/L (proposed in the August 11, 2017 receiving water study);
- Provide data to support assertions that chemical oxygen demand (COD) can be reduced to the proposed limit.

3.0 With respect to the updating of the Receiving Water Study:

- Provide a response to questions and comments on the receiving water study (not already outlined in this document) from Environment and Climate Change Canada's EARD review submission dated March 18, 2019, and update the receiving water study as applicable;
- Explain 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 of Appendix E1 of EARD. It appears that the far-field model simulations were run before the near-field model. One could expect that the behaviour of the plume further afield depends a large extent on how it behaved at the diffuser, i.e. how quickly it mixed and spread and rose to the surface;
- Confirm dilution ratios and distances required to achieve background level for water quality parameters in Appendix E1 of the EARD, as the dilution ratios and distances may be overestimated;
- Explain if the salinity and temperature differential between the effluent and the receiving waters has been accounted for in the model. When the buoyancy differential between the effluent and receiving waters are greater in winter, it results in a faster rising plume. This can potentially affect the visibility of the effluent in the receiving environment. Has this been accounted for in the model? Also provide results for winter conditions;
- Explain if re-entrainment of effluent and sediment at the diffuser location was accounted for in the one-hour period surrounding slack tide. Support this explanation with model results using a smaller time step (30 minutes) if necessary.

4.0 It is important to note that the following field study and monitoring are likely to be required as part of an EEM program regulated under the Pulp and Paper Effluent Regulations for the Project if it is approved:

- Field delineation of treated effluent plume to confirm the prediction from the receiving water study;
- Monitoring of marine water quality and marine sediment quality;
- Sublethal toxicity testing and chemistry testing of the treated effluent; and
- Biological monitoring studies including benthic invertebrate community study, fish population study, and dioxin and furan levels in fish as applicable.