
# AWA REPORT

## A Review of Suncor's McClelland Lake Wetland Complex Operational Plan for the Fort Hills Oil Sands Project

April 2023

# Table of Contents



Cover Photo © C. Wearmouth (2008)

# Executive Summary:

The Fort Hills Oil Sands Project is an existing Suncor-owned oil sands mine that is proposed to expand mining activities into the McClelland Lake Wetland Complex (MLWC) in 2025.

The MLWC is a wetland ecosystem that includes several environmentally significant features including McClelland Lake, a large, patterned fen, other wetlands, and sinkhole lakes. The area provides an important stopover point and breeding ground for migratory bird species from across North America. In addition to its biophysical properties, the area has socio-cultural importance for Indigenous communities in the region.

According to the 2002 Fort Hills regulatory approval decision from the Alberta Energy and Utilities Board, mining would only be permitted to occur in half of the MLWC so long as the ecological diversity and functionality of the unmined portion is maintained. Suncor was required to submit an Operational Plan for protecting the unmined portion of the MLWC two years prior to mining within the watershed. On December 15, 2021, Suncor submitted this Operational Plan to the Alberta Energy Regulator.

Alberta Wilderness Association contracted the services of two boreal peatland experts – Dr. Lorna Harris and Dr. Kelly Biagi – to review Suncor's Operational Plan and determine whether it would guarantee the protection of the unmined portion of the MLWC. The findings of the review conducted by Dr. Biagi and Dr. Harris indicate to AWA that the Operational Plan contains many uncertainties and deficiencies which pose a serious risk to the sustainability of the unmined portion of the MLWC, and which contravene the justifiably stringent regulatory requirements that have been placed upon the Fort Hills mine.

These concerns include:

1. Unaddressed potential saline contamination of freshwater (wetlands and groundwater);
2. Lack of modelling for potential impacts to groundwater quality;
3. Insufficient observational data for hydrological model calibration;
4. Uncertainty and risk with proposed "conceptual stage" water management plan;
5. Assumption of negligible impacts from predicted water level changes;
6. Unrecognized impacts to the ecological integrity and functionality of the patterned fen; and
7. Unrecognized impacts to peatland carbon stores and the resulting increase in greenhouse gas emissions.

These review findings indicate that Suncor has not provided evidence of sufficient knowledge and understanding of the complex natural water flow regime in the wetland complex to ensure that there will be no negative impacts to the ecological diversity and functionality of the unmined portion of the MLWC. The review findings also raise significant concern regarding whether the proposed underground wall and water pipeline system is robust enough to adequately substitute for these natural flows, and to counteract mining impacts upon local groundwater sources, continuously, throughout many decades of proposed mine operation and reclamation.

**This Operational Plan cannot guarantee the protection of the unmined MLWC**. The findings lead us to believe that Suncor's mitigation strategy described within the Operational Plan poses a significant risk of irreversible damage to the unmined portion of the MLWC, and therefore, **it should not have been approved by the AER.**

AWA believes that the activities proposed within the Operational Plan may violate the conditions of the 2002 EUB Decision Report and 2002/2015 *Water Act* approvals. Given the high level of risk associated with the activities proposed by the Operational Plan, **AWA is asking the AER to reconsider and revoke their approval of Suncor's Operational Plan** pursuant to Section 42 of the *Responsible Energy Development Act*. We also ask for Suncor to commit to halting all attempts to mine within the watershed of the vitally important, irreplaceable, and irrecoverable McClelland Lake Wetland Complex.

# Introduction:

## The Fort Hills Oil Sands Project

Fort Hills Energy Corporation is a subsidiary of Suncor Energy, and the Fort Hills Oil Sands Project (FHOSP) is an oil sands mine that began operations in 2018 and is proposed to expand mining activities (i.e., ditching, draining, and extraction) into the McClelland Lake Wetland Complex (MLWC) in 2025. In 1994, Alberta Wilderness Association (AWA) participated in a four-year sub-regional planning process that resulted in the protection of the MLWC from oil sands development. The Fort McMurray-Athabasca Oil Sands Subregional Integrated Resource Plan (IRP) was approved by the Government of Alberta in 1996 and placed the MLWC off-limits to oil sands mining. Again, in 1999, the Alberta Special Places 2000 Committee nominated the MLWC for a protective notation as an environmentally significant area[1], which was intended to ensure that the area would be managed to achieve conservation objectives.

However, after the discovery of oilsands bitumen reserves underneath the MLWC, the sub-regional planning rules suddenly changed in 2002 at the request of True North Energy (a subsidiary of Koch Industries), which had been allowed to acquire leases for the area in 1998 despite the existing protections for the area. At the 2002 Fort Hills mine application hearing, regulators allowed True North Energy to set aside the Environmental Impact Assessment (EIA) that was part of their application. This EIA had stated that water table disruptions from mine dewatering and other lease disturbances would likely kill peat-forming mosses, ending peat production on the fen. Subsequently, the 2002 Energy and Utilities Board (EUB) Decision Report[2] permitted mining in roughly half of the wetland complex so long as the ecological diversity and functionality of the unmined portion is maintained.

True North Energy's 2002 *Water Act* Approval[3] for the FHOSP was granted stating similar conditions. Conditions 3.12, 3.14 (B), and 3.14 (G) of True North Energy's 2002 *Water Act* Approval No. 00151636- 00-00 state that:

- 3.12: "the approval holder must submit an operational plan for the sustainability of the non-mined portion of the MLWC in accordance with the IRP",
- 3.14 (B): "the operational plan referred to in conditions 12 and 13 shall contain design features or measures, and others as required for the protection of the non-mined portions of the MLWC", and

---

[1] Sweetgrass Consultants Ltd., "Environmentally Significant Areas of Alberta Volumes 1, 2 and 3" (Alberta Environmental Protection, March 1997), https://albertaparks.ca/media/3194487/esa_ab_vol1.pdf.

[2] Alberta Energy and Utilities Board, "Alberta Energy and Utilities Board Decision Report 2002-089: Application to Construct and Operate an Oil Sands Mine and Cogeneration Plant in the Fort McMurray Area," October 22, 2002.

[3] Alberta Environment, "True North Energy L.P. *Water Act* Approval No. 00151636-00-00," December 30, 2002.

- 3.14 (G): “the operational plan referred to in conditions 12 and 13 shall contain the necessary contingency mitigation measures to maintain the water table, water chemistry and water flow within limits as indicated by natural fluctuations to maintain ecosystem diversity and function of the non-mined portions of the MLWC during operation and reclamation of the project”.

## The McClelland Lake Wetland Complex

The MLWC lies roughly 90 kilometers north of Fort McMurray (Figure 1) and it includes several environmentally significant features including McClelland Lake, a large, patterned fen, other peatlands, and sinkhole lakes (Figure 2). The MLWC is important both for its unique aesthetic qualities, as well as its diverse biophysical features and ecological functions it provides. Peatlands within the MLWC, including the patterned fen, also store a large amount of densely-packed carbon within peat deposits that are up to eight metres deep in some places.

The watershed supports rare plants[4] and provides an important stopover point and/or breeding ground for many migratory bird species from across North America (e.g., endangered whooping cranes [***Grus americana***][5], rusty blackbird [***Euphagus carolinus***] and yellow rail [***Coturnicops noveboracensis***][6]). With respect to birds, McClelland Lake is the largest natural waterbody between Fort McMurray and the Peace-Athabasca Delta, which makes it an important landing place for birds in an area dominated by hazardous tailings ponds, which have been responsible for numerous bird casualties[7].

The patterned fen features long rows of peat ridges (strings) separated by shallow pools of water (flarks). These surface patterns have taken thousands of years to develop and give the fen a unique and spectacular beauty. The fen is also larger than 91% of all patterned peatlands in the province, while the wetland complex is larger than 91% of all other wetlands in the province as well[8].

In addition to its biophysical properties, the MLWC and surrounding watershed has socio-cultural importance for Indigenous communities in the region. They have relied on the MLWC as a source of drinking water, an area to harvest traditional foods and medicines, and as a place to practice and maintain their beliefs, customs, history, and languages.

---

4 Dale H. Vitt et al., “Patterns of Bryophyte Richness in a Complex Boreal Landscape: Identifying Key Habitats at McClelland Lake Wetland,” ***The Bryologist*** 106, no. 3 (2003): 372–82; Alberta Energy and Utilities Board, “2002 EUB Decision Report.”

5 Kevin Timoney, “An Environmental Assessment of High Conservation Value Forests in the Alberta Portion of the Mid-Continental Canadian Boreal Forest Ecoregion” (World Wildlife Fund and Alberta-Pacific Forest Industries, November 5, 2003).

6 McLeod Logan J.T., “Predictive Mapping of Yellow Rail (***Coturnicops Noveboracensis***) Density and Abundance in the Western Boreal Forest via Ground and Satellite Remote Sensors” (M. Sc. Thesis in Ecology, Edmonton, Alberta, University of Alberta, 2019).

7 Jeff Wells et al., “Impact on Birds of Tar Sands Oil Development in Canada’s Boreal Forest,” NRDC Report (National Resources Defense Council and Pembina Institute, December 2008).

8 Timoney, “An Environmental Assessment of High Conservation Value Forests in the Alberta Portion of the Mid-Continental Canadian Boreal Forest Ecoregion.”

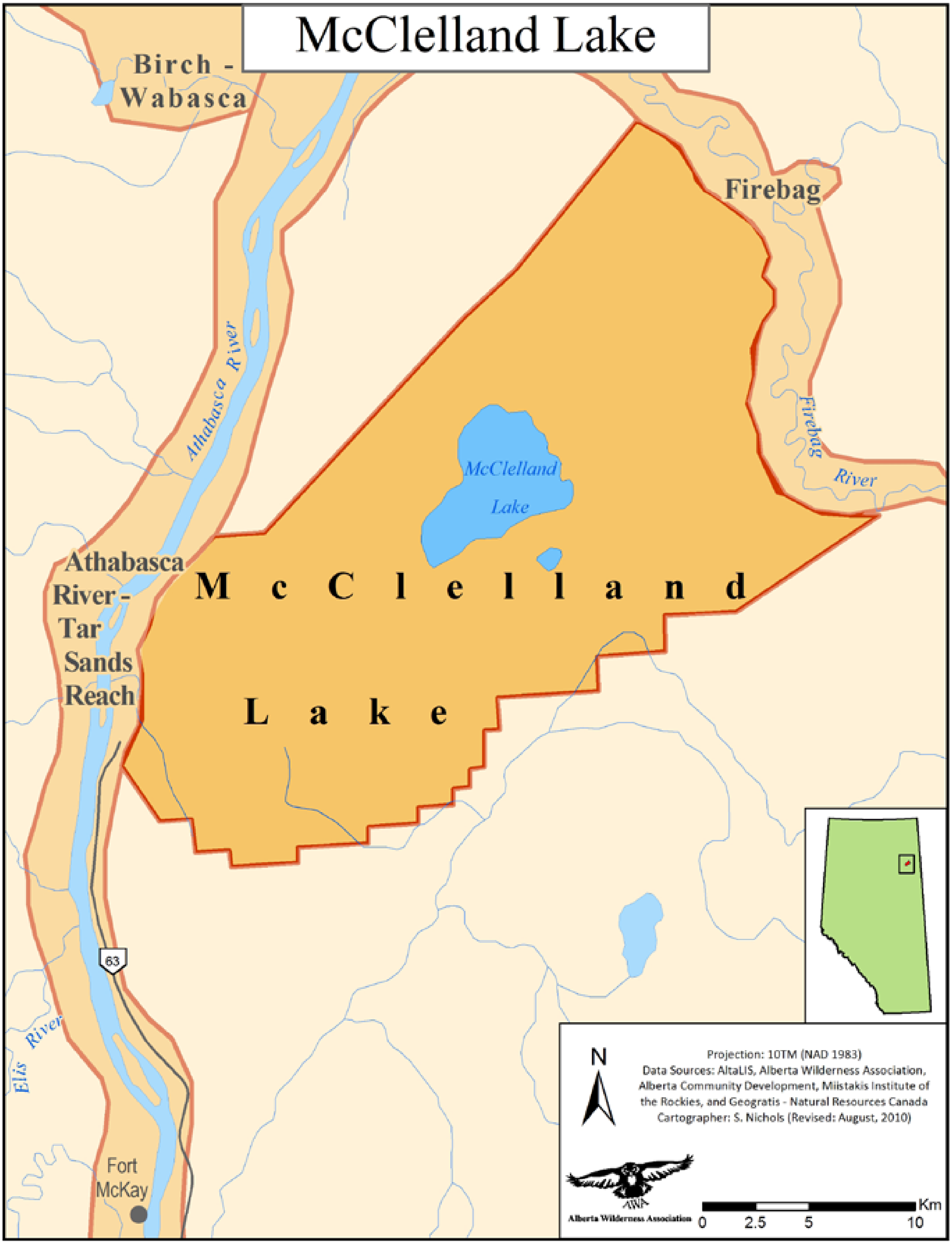


*Figure 1. A map showing the location of McClelland Lake relative to Fort McKay and the Athabasca River. The inset map displays McClelland Lake's location within Alberta.* Map © Alberta Wilderness Association (2010)

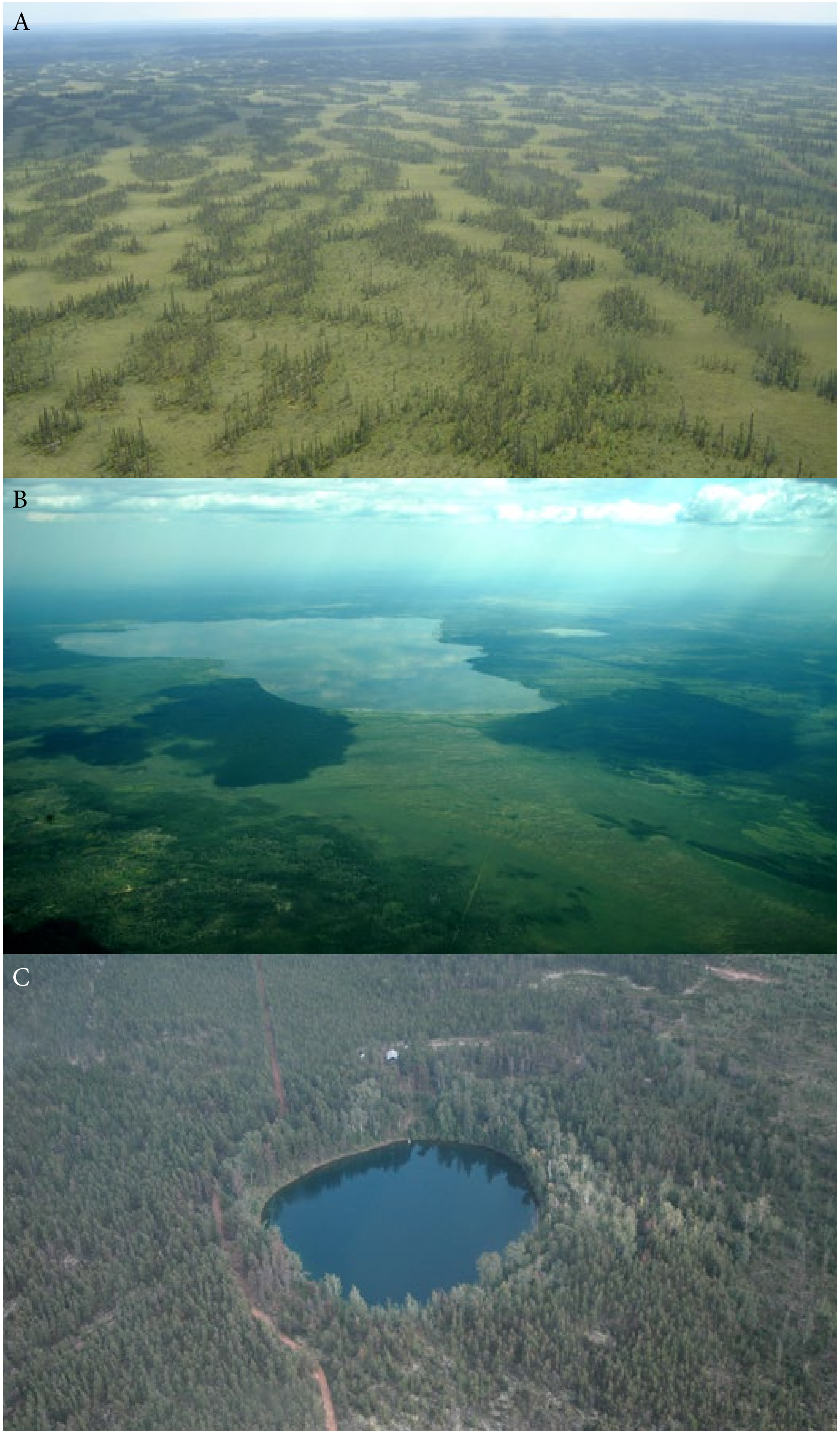


*Figure 2. Aerial photos of the McClelland Lake Wetland Complex including A) the patterned fen [© J. Hildebrand], B) McClelland Lake [© S. Bray], and C) a sinkhole lake [© C. Wearmouth].*

## Reviewing Suncor's McClelland Lake Wetland Complex Operational Plan

As part of Fort Hills' *Water Act*[9] and *Oil Sands Conservation Act* approvals, the proponent was required to submit an Operational Plan (OP) for maintaining the sustainability of the unmined portion of the MLWC two years prior to beginning any ditching or draining within the MLWC watershed. On December 15, 2021, Suncor Energy – on behalf of Fort Hills, submitted this Operational Plan to the Alberta Energy Regulator (AER). At the request of AER, Suncor provided AWA with a copy of the submitted OP for us to review on January 28, 2022.

Our intent with requesting a copy of the OP was to have an objective, independent, third-party review of the OP conducted by experts in the disciplines of ecology, hydrology, and hydrogeology. We wanted to conduct this review to ensure that the measures proposed by Suncor within the OP would guarantee the protection of the unmined portion of the MLWC, as required by the 2002 *Water Act* Approval (renewed in 2015) and 2002 EUB Decision Report for the FHOSP to proceed with its expansion. Based on AWA's understanding of these foundational Fort Hills regulatory documents, this Operational Plan needed to guarantee that the unmined portion of the MLWC would be unharmed by the mining, closure, and reclamation activities within the proposed mine area, otherwise the expansion into the MLWC would not be authorized.

Over the next six months (from January to August), AWA contacted nearly 20 expert scientists, searching for researchers with specific expertise related to boreal wetland hydrology and/or peatland ecosystems. This search was time-consuming as it was difficult to find experts who did not have existing contractual ties or conflicts of interest with Suncor Energy.

In August 2022, AWA successfully contracted the independent services of two boreal wetland experts – Dr. Lorna Harris and Dr. Kelly Biagi – to review Suncor's Operational Plan in an effort to understand Suncor's proposed mitigation plans and to determine whether any concerns had been left unaddressed, or if there were any evident deficiencies. Their review was completed on December 28, 2022.

## Expert Review Team

Dr. Lorna Harris is the Program Lead for Wildlife Conservation Society (WSC) Canada's Forests, Peatlands, and Climate Change Program. She is an ecosystem scientist with an interdisciplinary skill set, working from the local to global scale to assess the ways ecosystem structure and function may be impacted by global climate warming and other disturbances. As a dedicated research scientist with a policy background, she has worked to improve our scientific understanding of wetlands and peatland ecosystems for over 18 years, in both the UK and Canada. Dr. Harris completed her PhD at McGill University in Montreal, where her research focused on the ecohydrology and biogeochemistry of the vast peatlands of the Hudson Bay Lowlands in northern Ontario. Dr. Harris' studies of peatland ecohydrology and carbon dynamics continued for her Postdoctoral research, including in thawing and burned permafrost peatland landscapes in northern Alberta and the Northwest Territories. Prior to moving to Canada for her PhD, she worked as a Wetland Project Officer and a Senior Scientist for the Environment Agency of England and Wales for

[9] Alberta Environment, "2002 *Water Act* Approval"; Alberta Energy Regulator, "Fort Hills Energy Corporation *Water Act* Amended Approval No. 151469-00-00," December 9, 2015.

one year, then as a Wetland Ecologist and Senior Scientist for the Scottish Environment Protection Agency for six years. Dr. Harris has extensive research experience in a range of wetland, peatland, and forest ecosystems across Canada and has published several papers on peatland carbon cycling and greenhouse gas (GHG) fluxes. Dr. Harris has also worked to create stronger links in science and public policy for peatlands in both the UK and in Canada, with her most recent paper identifying research and policy gaps for peatlands across Canada.

Dr. Kelly Biagi is an Assistant Professor in the Department of Earth Sciences at Brock University. Dr. Biagi's research aims to understand the effect of landscape mitigation practices on ecosystem hydrology and hydrochemistry to provide guidance on the effectiveness of those strategies. Much of Dr. Biagi's research has been on wetland-watershed with a focus on peatland ecosystems. Dr. Biagi completed her Bachelor of Science in Environmental Science at Dalhousie University in Halifax, Nova Scotia (2008 - 2013). She continued her academic career at McMaster University where she obtained her M.Sc. (2013 – 2015) and Ph.D. (2016 – 2021) in environmental science with a focus in hydrological sciences. There, her research examined the hydrological and hydrochemical functioning of reconstructed wetland systems in the Athabasca oil sands region of Canada. One of the overall goals of this research was to evaluate the system's trajectory and success potential to guide future design and construction of peatland-watersheds. Following these degrees, Dr. Biagi worked as a post-doctoral fellow at the Toronto Metropolitan University where she studied the nutrient loads from Lower Great Lakes headwater streams to better understand the distribution of nutrient loads, their causes and potential mitigation strategies to limit excess nutrients. Currently, Dr. Biagi continues her studies on these topics while incorporating local Niagara wetland restoration work.

## Summary of Concerns

The findings of the independent review conducted by Dr. Biagi and Dr. Harris are summarized in the list below, described briefly in the next section, with the detailed review notes from each expert included as appendices. We recognize that the Operational Plan was developed with the input and guidance of experienced and respected scientists, however the analyses provided by Dr. Biagi and Dr. Harris indicate that the Operational Plan contains many concerns which pose a significant risk to the sustainability of the unmined portion of the MLWC.

These concerns include:

1. Unaddressed potential saline contamination of freshwater (wetlands and groundwater);
2. Lack of modelling for potential impacts to groundwater quality;
3. Insufficient observational data for hydrological model calibration;
4. Uncertainty and risk with proposed "conceptual stage" water management plan;
5. Assumption of negligible impacts from predicted water level changes;
6. Unrecognized impacts to the ecological integrity and functionality of the patterned fen; and
7. Unrecognized impacts to peatland carbon stores and the resulting increase in greenhouse gas emissions.

In response to an AWA query in November 2022, the AER informed AWA it had approved the OP via a Letter of Authorization (LOA) to Suncor on September 9, 2022, which seems to indicate that mining activities will be permitted within the MLWC beginning in 2025. The AER provided AWA with a copy of this Letter of Authorization on January 6, 2023, after our initial request on November 14, 2022.

Our review found that Suncor's mitigation strategy described within the Operational Plan **poses a significant risk of irreversible damage to the unmined portion of the MLWC**, and therefore, it should not have been approved by the AER. AWA believes that the activities proposed within the Operational Plan may violate Conditions 3.12, 3.14 (B) and 3.14 (G) of True North Energy's 2002 *Water Act* Approval No. 00151636-00-00[10]. The findings summarized in this report indicate that the Operational Plan cannot guarantee – without a reasonable doubt – the protection of the unmined MLWC. Given the concerns expressed by our expert reviewers and the high level of risk associated with the activities proposed by the Operational Plan, **AWA is asking the AER to reconsider and revoke their approval of Suncor's Operational Plan**. We also ask for Suncor to commit to halting all attempts to mine within the watershed of the vitally important, irreplaceable and irrecoverable McClelland Lake Wetland Complex.

## Concerns with Suncor's Operational Plan

Based on the review notes provided by Dr. Harris and Dr. Biagi, our concerns with Suncor's submitted Operational Plan can be grouped into the following seven categories.

### 1. Unaddressed Potential Saline Contamination of Freshwater (Wetlands and Groundwater)

The Operational Plan contains very little recognition for the potential saline contamination of groundwater from Fort Hills' mining activities in the upper half of the MLWC. There is evidence of elevated salinity from mining activities within the oil sands region[11], and it is therefore a reasonable expectation that this could be a potential impact of FHOSP mining activities within the MLWC. If saline contamination of groundwater does occur, this will likely have an impact on surface water quality as well, as groundwater is transported to the surface in this wetland complex. This potential impact is likely for both the unmined portion of the MLWC beyond the cutoff wall, as well as within the reclaimed mining site itself – which poses concerns for the future health of the ecosystem following mine closure and reclamation. These concerns are based on published evidence for previously reclaimed areas within the oil sands region where clear shifts in plant community composition were

[10] Alberta Environment, "2002 *Water Act* Approval."

[11] Brett G. Purdy, S. Ellen Macdonald, and Victor J. Lieffers, "Naturally Saline Boreal Communities as Models for Reclamation of Saline Oil Sand Tailings," *Restoration Ecology* 13, no. 4 (2005): 667–77, https://doi.org/10.1111/j.1526-100X.2005.00085.x.

observed as a result of elevated salinity and water table changes[12]. Shifts in plant communities can alter the ecological functioning of peatlands as their unique functions are dependent on the survival and growth of peatland-specific vegetation species. For example, peatlands can often persist for a while in wet and dry conditions due to their complex feedback mechanisms between their unique hydrology, soil structure, nutrients, and specific peatland vegetation[13]. AWA believes that there is a probable and significant risk of irreversible damage to wetland species, and therefore to ecosystem diversity and function, due to the impact of increased salinity on the reclaimed MLWC ecosystem.

One of the proposed solutions to mitigate any observed water quality issues is to pump in additional freshwater, but depending on the severity of the salinity, this mitigation measure could require massive quantities of water in order to adequately flush the concentration of salts. The addition of large volumes of water could lead to highly variable water tables (beyond the natural range of variability for these peatlands) and/or could lead to persistent standing water – both of which are not favourable conditions for maintaining the existing peatland vegetation, and therefore the ecological diversity and functionality of the patterned fen and other peatlands. Dr. Biagi and other researchers observed a similar occurrence at the Sandhill Fen Watershed where elevated water tables promoted a shift in vegetation species in the peatland[14]. While the OP describes the cut off wall as a mitigation strategy, it is unlikely that the unmined MLWC will remain completely isolated from the disturbed landscape, which increases the risk of contamination by highly saline waters. It is therefore critical to consider the ecological impacts and additional mitigation strategies in the event that saline groundwater begins to intrude within the unmined MLWC, yet the submitted OP has omitted this analysis.

## 2. Lack of Modelling for Potential Impacts to Groundwater Quality

The Operational Plan contains little to no modelling to assess any potential changes to groundwater quality. Based on observations in previously reclaimed systems in the Alberta Oil Sands Region, intrusion of saline groundwater is a considerable risk to the success of reclaimed ecosystems, yet the OP did not model this potential threat or discuss mitigation strategies. Due to the likelihood of water quality degradation, modeling of potential changes to groundwater quality is crucial to fully understand potential impacts of mining activities and to implement effective mitigation strategies. Maintaining the ecological diversity and functionality of the patterned fen and other peatlands requires maintaining the

---

[12] Kelly M. Biagi and Sean K. Carey, "The Hydrochemical Evolution of a Constructed Peatland in a Post-Mining Landscape Six Years after Construction," *Journal of Hydrology: Regional Studies* 39 (February 1, 2022): 100978, https://doi.org/10.1016/j.ejrh.2021.100978; K. M. Biagi et al., "Increases in Salinity Following a Shift in Hydrologic Regime in a Constructed Wetland Watershed in a Post-Mining Oil Sands Landscape," *Science of The Total Environment* 653 (February 25, 2019): 1445–57, https://doi.org/10.1016/j.scitotenv.2018.10.341; Jeremy A. Hartsock et al., "A Comparison of Plant Communities and Water Chemistry at Sandhill Wetland to Natural Albertan Peatlands and Marshes," *Ecological Engineering* 169 (November 1, 2021): 106313, https://doi.org/10.1016/j.ecoleng.2021.106313.

[13] J. M. Waddington et al., "Hydrological Feedbacks in Northern Peatlands," *Ecohydrology* 8, no. 1 (2015): 113–27, https://doi.org/10.1002/eco.1493.

[14] Biagi and Carey, "The Hydrochemical Evolution of a Constructed Peatland in a Post-Mining Landscape Six Years after Construction"; Melissa House et al., "Reclaiming Wetlands after Oil Sands Mining in Alberta, Canada: The Changing Vegetation Regime at an Experimental Wetland," *Land* 11, no. 6 (June 2022): 844, https://doi.org/10.3390/land11060844; Hartsock et al., "A Comparison of Plant Communities and Water Chemistry at Sandhill Wetland to Natural Albertan Peatlands and Marshes."

same groundwater quality and the omission of this analysis in the OP raises serious questions about the validity of the potential negative impacts of mining on the MLWC.

The Operational Plan does contain a statement that says that this modeling work is to be conducted "as part of future work" but given the requirement that the OP guarantees the protection of the unmined portion of the MLWC, this important modelling should already have been completed for Suncor and the AER to understand the potential groundwater impacts of their activities prior to OP approval.

## 3. Insufficient Observational Data for Hydrological Model Calibration

Our review of the Operational Plan found that some of the hydrological modeling was validated using only two to three years of real-world observational data, and that much of the data used for calibrating these models was simulated data. This means that the modeling simulations are based on previous simulations. Using simulated data for model calibration is not uncommon, however, using simulated data introduces the potential for greater error, which is a risky approach when the Operational Plan needs to guarantee the protection of a sensitive peatland ecosystem.

For example, the spring freshet process, which is the primary source of annual water replenishment to the MLWC, is cited as a parameter of uncertainty. As well, we have concerns whether there was enough observational data included in the model calibration to ensure that Suncor has adequately accounted for decadal wet and dry cycles, which is characteristic of this region. Without accounting for these wetting and drying cycles in the presented modelled and simulated historical data, it raises questions over the accuracy and/or validity of these models.

## 4. Uncertainty and Risk with Proposed "Conceptual Stage" Water Management Plan

The proposed water management plan included within the Operational Plan appears to be high risk and contains much uncertainty. "The water management design features are currently at a conceptual stage and engineering work to advance the features is ongoing", according to the OP. There is a high risk that the construction and operation of all the necessary mitigation infrastructure (called "Design Features" within the OP) will result in significant damage to the downstream non-mined fen and connected wetlands, watercourses, and lake. This includes the large underground cut-off wall that is proposed to be placed in the middle of the fen, the associated network of water resupply pipelines and distribution systems, groundwater injection wells, sedimentation ponds, interception ditches, and more. All these components – and the people employed to operate them – need to work together faultlessly during mining operations (from 2025 to 2063), reclamation (2064 to 2075), and closure (2076 onwards) to ensure there is no significant damage to the unmined MLWC. These risks are not adequately addressed in the OP.

The proposed construction of a cut-off wall to protect the non-mined portion of the patterned fen from mining activities (and the adjacent mining area from flooding) will cut off surface and groundwater flow from the upstream mined area to the fen and to downstream ecosystems, with various resulting water level scenarios described by the modelling studies. Available literature did not provide any previous examples for mining projects of this sort (i.e., putting a large subterranean wall in the middle of a groundwater-connected peatland while maintaining ecological values). This mitigation strategy is therefore largely untested in this area and there is no guarantee that it will be effective. Additionally, the OP provides no alternative mitigation strategy should the cutoff wall fail or have unanticipated issues.

Overall, the plan for water supply to the fen peatlands is very poor. Maintaining water levels, chemistry and flows within wetlands impacted by oil sands activities has proven to be difficult (e.g., Sandhill Fen Watershed and Nikanotee Fen), and will therefore be just as – if not more – complicated for the non- mined fen and other wetland ecosystems in the MLWC during and after construction of the wall. The success of maintaining adequate ecosystem conditions will be dependent on the success of the proposed water management plan, which contains much uncertainty, a limited risk assessment, and inadequate details of the measures required if the cut-off wall and associated infrastructure (e.g., water resupply infrastructure) fails.

## 5. Assumption of Negligible Impacts from Predicted Water Level Changes

We are concerned that many of the predicted changes to the water table and/or water levels are assumed to have negligible impacts, but without any associated justification provided for why that is assumed to be the case. For example, there is no basis for describing an expected 27 mm per year increase in groundwater flow as 'moderate', nor for the assumption that this impact is 'negligible'. There are no ecological impacts described for potential rising water levels in the fen, even though the upper range of water levels could drastically reduce peat accumulation and shift the vegetation communities away from a fen peatland. We find these assumptions and lack of associated justifications to be concerning.

There are also a few instances within the Operational Plan where error estimates have been excluded when presenting data for predicted changes. Typically, a range of potential errors is included for presented data – such as with predicted changes to the water table (i.e., a change of 0.10 metres), but there are instances in the OP where a +/- error estimate has not been included.

It is crucial to understand the uncertainties associated with predicted changes to the water table in the unmined MLWC from FHOSP mining activities, as water level changes pose a significant risk to maintaining peatland vegetation and therefore the ecological diversity and functionality of the patterned fen and other peatlands. A comprehensive analysis of the potential impact of all potential water change scenarios is required to better understand the impacts on peatland vegetation, ecological integrity, and ecosystem function in the unmined MLWC. Our review of the Operational Plan found that it was lacking a detailed discussion on potential ecological changes (or shifts), and a lack of associated mitigation strategies if (for example) vegetation was observed to be shifting towards a non-peat-forming wetland.

## 6. Unrecognized Impacts to the Ecological Integrity and Functionality of the Patterned Fen

The Operational Plan does not adequately describe the ecohydrological processes that are necessary to maintain the structure and function (the ecological integrity and functionality) of the unmined portion of the McClelland patterned fen and other wetlands. The distinct surface topography of patterned fens (i.e., the formation of strings and flarks) develops slowly over thousands of years. The structure of these fens is then maintained by complex, small-scale feedback mechanisms, and these mechanisms have not been described to any level of detail within the Operational Plan. The Operational Plan describes how changes in hydrology and chemistry may impact the composition and vegetation within the fen, but it does not adequately describe how these changes may impact peat accumulation and the ecohydrological feedbacks essential for maintaining the string-flark structure of the fen.

Since the Operational Plan is supposed to guarantee the protection of the fen ecosystem that currently exists within the unmined portion of the MLWC, the OP should include a discussion of how fen structure and function will be maintained during mining activities, mine closure, reclamation, and post- reclamation.

## 7. Unrecognized Impacts to Peatland Carbon Stores and the Resulting Increase in Greenhouse Gas Emissions

The FHOSP expansion into MLWC will result in the irrecoverable loss of currently intact and relatively undisturbed peatlands within the mined area. Our review also found that potential GHG emissions caused by FHOSP activities in both the mined and unmined MLWC have not been addressed within the Operational Plan.

We recognize that an analysis of peatland carbon storage destruction and GHG emissions were not requirements under the approval conditions set out by the 2002 EUB Decision Report or the 2002/2015 *Water Act* Approvals. However, we feel that it is important to highlight that the loss of stored carbon from destroyed or degraded peatlands will increase Canada's greenhouse gas (GHG) emissions and should have been considered in the development of this Operational Plan. Estimates provided by Dr. Harris indicate that the mineable area of the MLWC may store between 2.2 and 9.7 million tonnes of carbon, which is equivalent to roughly eight million tonnes to 35.5 million tonnes of CO2.

According to the International Union for Conservation of Nature, peatlands are critical for preventing and mitigating climate change, in addition to preserving biodiversity and clean drinking water[15]. Peatlands occupy only three percent of Earth's terrestrial surface area but store a staggering 30 percent of all land-based carbon. This means that peatlands are the best terrestrial carbon storage we have available to us, and one of the strongest tools we have at our disposal for preventing the worst impacts of climate change. Intact peatlands not only serve as carbon storage, but also act as a carbon sink by taking carbon from the atmosphere and storing it in plants and soil. In addition, the March 2023 Synthesis Report[16] from the Intergovernmental Panel on Climate Change (IPCC) included the conservation of peatlands in their list of land uses which deliver immediate benefits for mitigating the impacts of climate change that should be prioritized in the near term across most regions.

GHG emissions and removals (known as fluxes) in peatlands are controlled by a combination of ecosystem factors, with changes in water levels, vegetation composition, and temperatures all influencing GHG fluxes. The potential impact of the FHOSP site construction, mining operations, and the proposed water management plan on GHG fluxes in the non-mined fen and other wetland ecosystems have not been addressed within the OP. For example, higher water levels within the fen when coupled with potentially warmer water from resupply sources may unintentionally increase

---

[15] International Union for Conservation of Nature, "IUCN Issues Brief: Peatlands and Climate Change," November 2021, https://www.iucn.org/sites/default/files/2022- 04/iucn_issues_brief_peatlands_and_climate_change_final_nov21.pdf.

[16] Intergovernmental Panel on Climate Change (IPCC), "Synthesis Report of the IPCC Sixth Assessment Report (AR6): Summary for Policymakers" (United Nations Environment Programme, March 19, 2023), https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_SPM.pdf.

methane production and overall emissions from the fen. The fluctuation of water levels within the unmined portion of the MLWC could also impact net ecosystem production over time, and this needs to be considered to better understand potential ecosystem shifts due to FHOSP activities.

It is important to consider that the Government of Canada signed onto the Paris Agreement in 2015 – committing Canada to 40 to 45 percent greenhouse gas emissions reductions by 2030, and net zero by 2050. The ***Canadian Net-Zero Emissions Accountability Act*** was passed in June 2021, which legislated Canada's commitment to achieve net-zero emissions by 2050. On top of these commitments, in March 2022, the Government of Canada released the 2***030 Emissions Reduction Plan: Canada's Next Steps for Clean Air and a Strong Economy***, which was intended to outline Canada's approach to reach its target of cutting emissions by 40 percent by 2030. We are unsure whether the FHOSP has been factored into Canada's accounting as it relates to future emissions, but we are concerned that the authorization of the FHOSP expansion into the MLWC and the destruction and damage to the large peatland carbon stores may potentially hinder Canada's ability to meet our climate targets and international commitments. This Operational Plan also ignores the increased emission contribution from production and combustion of fossil fuels that this project will lock in if permitted to proceed.

Another proposed oil sands mine – of which Suncor is the proponent – known as Base Mine Extension, is currently under review by the Impact Assessment Agency of Canada (IAAC)[17]. In a letter dated April 6, 2022, from Canada's Minister of Environment and Climate Change Steven Guilbeault to Suncor Energy regarding the Base Mine Extension Project[18], Minister Guilbeault stated:

"As currently described by Suncor Energy Inc. in its Detailed Project Description, the Project would produce an estimated three million tonnes of carbon dioxide equivalent annually over the life of the Project. As your company and Canada work towards net-zero, I am pleased that we have come to a shared recognition that **emissions at this level may not align with the pace and scale of emissions reductions required to achieve our targets, and that this would hinder Canada's international commitments in respect of climate change nor would it make a net positive contribution to sustainability**. Under the Impact Assessment Act, these factors are considered in the determination of whether the adverse effects of the Project within federal jurisdiction are in the public interest. **As such, I am of the opinion that the Project, as currently proposed, would likely cause unacceptable environmental effects within federal jurisdiction**." Emphasis has been added here in bold (not in original letter).

We recognize that the FHOSP has not been required to undergo a federal environmental impact assessment with IAAC, and that GHG emissions were not required to be a component of Suncor's Operational Plan. However, given the statement above from Minister Guilbeault, we felt it was important to highlight the contradictory approaches being applied between the FHOSP and the Base Mine Extension project with respect to GHG emission contributions.

---

[17] Suncor Energy Inc., "Suncor Energy Inc. Base Mine Extension Detailed Project Description Summary," July 2020.

[18] Steven Guilbeault, "Letter from ECCC Minister Steven Guilbeault to Suncor President and COO Mark Little Regarding Suncor Energy Inc.'s Proposed Base Mine Extension Project," April 6, 2022.

## Other Considerations:

AWA has reviewed many of the foundational documents created to guide the development of this oil sands project including (but not limited to):

- The 2002 Energy and Utilities Board Decision Report;
- The December 2002 Alberta *Water Act* Approval No. 00151636-00-00 issued to TrueNorth Energy L.P.;
- The December 2015 Alberta *Water Act* Approval No. 00151636-01-00 issued to Fort Hills Energy Corporation;
- Suncor's 2018 Conceptual Operational Plan – also known as the proposal to develop an Operational Plan for the sustainability of the non-mined portion of the MLWC; and
- Suncor's submitted 2021 McClelland Lake Wetland Complex Operational Plan for the Fort Hills Oil Sands Project.

Our reading of these key documents has allowed us to recognize three key commitments – among many others – which AER should ensure are satisfied before authorizing Suncor's proposed MLWC Operational Plan. These three commitments are listed below, along with which document(s) they were found within:

1. The proposed mitigation plan and associated design features will protect the unmined portion of the MLWC (EUB Decision Report, 2002/2015 *Water Act* Approvals, 2018 Proposal);
2. In defining the functionality of the MLWC – develop a list of indicators, including those which recognize Indigenous traditional socio-cultural needs and values through extensive consultation with local Indigenous communities (EUB Decision Report, 2002/2015 *Water Act* Approvals, 2018 Proposal); and
3. The Operational Plan must implement the recommendations of the MLWC Sustainability Committee – including an agreed upon list of proposed indicators (EUB Decision Report).

It is AER's responsibility to ensure that Suncor fulfills all FHOSP requirements and commitments, especially the three key commitments highlighted above. Our report has focused heavily on the first commitment, as the protection of the unmined portion of the MLWC is our primary concern.

AWA has declined – on numerous occasions – to participate as part of the Sustainability Committee, as we felt it was more valuable to maintain our independence so that our participation in the SC couldn't be considered by AER and the wider public as tacit approval for the submitted Operational Plan. Given our position external to SC activities, we are unable to comment as to whether commitments two and three have been sufficiently addressed by the Operational Plan. AWA requests that AER be transparent about how it ensured that these commitments were addressed as part of their approval process.

Suncor's Operational Plan was approved by a Letter of Authorization submitted by the AER to Suncor on September 9, 2022. The AER provided AWA with a copy of this Letter of Authorization on January 6, 2023, following our initial request for a copy on November 14, 2022. This letter states that "the

AER authorizes the implementation of the Operational Plan" subject to the following three conditions:

1. As outlined in both the Operational Plan and the Supplemental Information Request (SIR1) Response Letter, Fort Hills Energy Corporation (FHEC) has committed to various engagement, operational, monitoring and reporting activities. Authorization of the Operational Plan by the AER signifies that FHEC is required to comply with these commitments; any changes or amendment to the Operational Plan must be submitted in writing to the AER for review and authorization prior to their implementation.
2. The SIR1 Response Letter, SIR #18 Response, stated that certain parameters were missing from Table 3.4-2. FHEC is required to provide an updated version of the Table 3.4-2, including all the missing parameters in all appropriate rows, to the AER for review, this updated Table is to be referenced in the 2022 Annual Progress Report.
3. With regards to Surface Water Hydrology triggers: as discussed in the SIR1 Response Letter, SIR #8 Response, the AER expects the Operational Plan to include triggers that are designed to detect significant departures from the expected performance as quickly as practical. For example, in the case of a major performance failure, some of the Surface Water Hydrology triggers should be capable of detecting deviations within the first one to two years of operations. FHEC is required to assess the performance of the Surface Water Hydrology triggers in Annual Progress Reports and evaluate whether more sensitive triggers should also be included.

None of these conditions included within the Letter of Authorization meaningfully address the concerns that our review has highlighted with regards to the Operational Plan and Suncor's ability to guarantee the protection of the unmined portion of the MLWC.

## Conclusion:

Based upon our expert review, AWA believes there are significant risks and deficiencies in Suncor's submitted Operational Plan that fall considerably short of the FHOSP's regulatory requirements to guarantee the protection and sustainability of the unmined portion of the MLWC. We recognize and appreciate that the Operational Plan is a detailed document that has been developed using the input of leading scientists and was informed by Indigenous Traditional Knowledge about the area and its history. However, the knowledge expressed within the Operational Plan does not ease our concerns regarding Suncor's mitigation plan, which appears to be more of a water management experiment with a high level of risk for the unmined portion of the MLWC.

Taken together, these review findings indicate that Suncor has not provided evidence of sufficient knowledge and understanding of the complex natural water flow regime in the wetland complex to ensure that there will be no negative impacts to the ecological diversity and functionality of the unmined portion of the MLWC. The review findings also raise significant concern regarding whether the proposed underground wall and water pipeline system is robust enough to adequately substitute for these natural flows, and to counteract mining impacts upon local groundwater sources, continuously, throughout many decades of proposed mine operation and reclamation.

**The activities proposed within the Operational Plan seem likely to violate the conditions of True North Energy's 2002 EUB approval and 2002/2015 *Water Act* Approvals, and we believe that this mitigation strategy poses a significant risk of irreversible damage to the unmined portion of the MLWC**. Based on the findings we have presented in this report, the AER should not have approved the Operational Plan, and Suncor's proposed mining activities as part of the FHOSP expansion should not be permitted within the MLWC.

In light of these findings, **Alberta Wilderness Association is asking the Alberta Energy Regulator to reconsider and revoke their approval of Suncor's Operational Plan** pursuant to Section 42 of the *Responsible Energy Development Act*. We also ask for Suncor to commit to halting all attempts to mine within the watershed of the vitally important, irreplaceable and irrecoverable McClelland Lake Wetland Complex.

## References:


Alberta Energy and Utilities Board. "Alberta Energy and Utilities Board Decision Report 2002-089: Application to Construct and Operate an Oil Sands Mine and Cogeneration Plant in the Fort McMurray Area," October 22, 2002.

Alberta Energy Regulator. "Fort Hills Energy Corporation *Water Act* Amended Approval No. 151469-00-00," December 9, 2015.

Alberta Environment. "True North Energy L.P. *Water Act* Approval No. 00151636-00-00," December 30, 2002.

Biagi, K. M., C. J. Oswald, E. M. Nicholls, and S. K. Carey. "Increases in Salinity Following a Shift in Hydrologic Regime in a Constructed Wetland Watershed in a Post-Mining Oil Sands Landscape." *Science of The Total Environment* 653 (February 25, 2019): 1445–57. https://doi.org/10.1016/j.scitotenv.2018.10.341.

Biagi, Kelly M., and Sean K. Carey. "The Hydrochemical Evolution of a Constructed Peatland in a Post-Mining Landscape Six Years after Construction." *Journal of Hydrology: Regional Studies* 39 (February 1, 2022): 100978. https://doi.org/10.1016/j.ejrh.2021.100978.

Guilbeault, Steven. "Letter from ECCC Minister Steven Guilbeault to Suncor President and COO Mark Little Regarding Suncor Energy Inc.'s Proposed Base Mine Extension Project," April 6, 2022.

Hartsock, Jeremy A., Melissa House, M. Graham Clark, and Dale H. Vitt. "A Comparison of Plant Communities and Water Chemistry at Sandhill Wetland to Natural Albertan Peatlands and Marshes." *Ecological Engineering* 169 (November 1, 2021): 106313. https://doi.org/10.1016/j.ecoleng.2021.106313.

House, Melissa, Dale H. Vitt, Lilyan C. Glaeser, and Jeremy A. Hartsock. "Reclaiming Wetlands after Oil Sands Mining in Alberta, Canada: The Changing Vegetation Regime at an Experimental Wetland." *Land* 11, no. 6 (June 2022): 844. https://doi.org/10.3390/land11060844.

Intergovernmental Panel on Climate Change (IPCC). "Synthesis Report of the IPCC Sixth Assessment Report (AR6): Summary for Policymakers." United Nations Environment Programme, March 19, 2023. https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_SPM.pdf.

International Union for Conservation of Nature. "IUCN Issues Brief: Peatlands and Climate Change," November 2021. https://www.iucn.org/sites/default/files/2022-04/iucn_issues_brief_peatlands_and_climate_change_final_nov21.pdf.

Logan J.T., McLeod. "Predictive Mapping of Yellow Rail (***Coturnicops Noveboracensis***) Density and Abundance in the Western Boreal Forest via Ground and Satellite Remote Sensors." M. Sc. Thesis in Ecology, University of Alberta, 2019.

Purdy, Brett G., S. Ellen Macdonald, and Victor J. Lieffers. "Naturally Saline Boreal Communities as Models for Reclamation of Saline Oil Sand Tailings." ***Restoration Ecology*** 13, no. 4 (2005): 667–77. https://doi.org/10.1111/j.1526-100X.2005.00085.x.

Suncor Energy Inc. "Suncor Energy Inc. Base Mine Extension Detailed Project Description Summary," July 2020.

Sweetgrass Consultants Ltd. "Environmentally Significant Areas of Alberta Volumes 1, 2 and 3." Alberta Environmental Protection, March 1997. https://albertaparks.ca/media/3194487/esa_ab_vol1.pdf.

Timoney, Kevin. "An Environmental Assessment of High Conservation Value Forests in the Alberta Portion of the Mid-Continental Canadian Boreal Forest Ecoregion." World Wildlife Fund and Alberta-Pacific Forest Industries, November 5, 2003.

Vitt, Dale H., Linda A. Halsey, James Bray, and Abel Kinser. "Patterns of Bryophyte Richness in a Complex Boreal Landscape: Identifying Key Habitats at McClelland Lake Wetland." ***The Bryologist*** 106, no. 3 (2003): 372–82.

Waddington, J. M., P. J. Morris, N. Kettridge, G. Granath, D. K. Thompson, and P. A. Moore. "Hydrological Feedbacks in Northern Peatlands." ***Ecohydrology*** 8, no. 1 (2015): 113–27. https://doi.org/10.1002/eco.1493.

Wells, Jeff, Susan Casey-Lefkowitz, Gabriela Chavarria, and Simon Dyer. "Impact on Birds of Tar Sands Oil Development in Canada's Boreal Forest." NRDC Report. National Resources Defense Council and Pembina Institute, December 2008.

# Appendices:

## Appendix 1: Review of Suncor's Operational Plan Conducted by Dr. Kelly Biagi

**FHOSP OP Review**
**Prepared by Kelly Biagi**
**3 November 2022**

### 1. Summary

My largest concerns with the report:

1) Water quality analysis based on current water chemistry values and do not explore potential for contamination (my biggest concern with the report)
   - Despite much published data of the influence of elevated salinity from construction materials and groundwater sources in reclaimed systems in the Athabasca oil sands region (AOSR), there is almost no discussion throughout the report about the potential for elevated salinity in the MLWC or any potential solutions
     Discussions of ecological effects of changes to water quality are minimal and the report does not address the potential for elevated salinity or sodium levels which has been documented/published in many reclaimed ecosystems in the AOSR
   - There are many areas where groundwater exfiltrates at the surface. If groundwater sources in the proposed area become saline, it could transport these salts to the fen
   - Wetland and lake will receive flow the surrounding landscape as water drains towards the lake (from conceptual model of water flow pathways)
     - Likely will not be isolated from disturbed landscape which increases the potential for contamination of highly saline waters

2) Vague discussions surrounding ecological impacts with potential hydrological scenarios (Objective 3). The report discusses some potential outcomes but offers no solutions (for example persistent standing water in the peatland). Particularly with respect to water quality (there is almost no mention of the potential for elevated sodium which is a major problem in many other reclaimed systems in this region).

3) Uncertainties model validation
   - My major concern with the modelling is the data used to calibrate/validate the model which can amplify uncertainties in model results
   - Some historical data is limited and had to be simulated for model calibration
   - Some parameters only had 2-3 years of observed data and was used for model validation. However, 2-3 years of observed data does not capture decadal wet/dry cycles that this region experiences.
   - Many simulated results of historic hydrological conditions overestimate values which could ultimately lead to the HGS model overestimating the quantity of water available in future scenarios
   - How do these discrepancies affect model results in future scenarios (including the influence of climate change)?
   - Winter makes up the majority of the year in this region where freshet is a critical process for water replenishment, yet these parameters are highlighted as an area of uncertainty in the model (Page 754)

**2. Objective 3**

- Groundwater quality was not modelled but is part of future work (pg 7)
  - Many studies of reclaimed peatland/wetland systems following surface mining in the Athabasca oil sands region has shown that groundwater plays a major role in transporting elevated salinity waters which leads to many negative ecological effects
  - Groundwater is known to carry the majority of salts which has caused the majority of water quality issues leading to ecological issues
  - Figure 4.3-2 shows many locations where groundwater discharges at the surface where highly saline water could interact at the surface
  - "the surface and subsurface flow systems are highly interactive with several locations where groundwater is exfiltrating to the surface and flowing as surface water towards the MLWC fen and lakes" (page 11)
  - Location 7 has significant groundwater drainage to HRA 11 which is neighbouring to McClelland Lake
  - The assumptions made about groundwater quality (example Location 7 on page 12) excludes the potential for future contamination from saline water
    - Large assumption that the hydrogeochemical signature of this groundwater would be similar in character to current conditions
  - Many assumptions surrounding groundwater quality which could potentially transport large quantities of saline water
- Water quality surface model EFDC+ (pg 14)
  - Model only simulates surface water quality and most of water quality issues come from deep groundwater (EFDC+ model)
  - They are working on continued modelling and use the conceptual model in the meantime
- Prediction confidence with data used in models (page 16)
  - While baseline water quality data seems sufficient, it is used in the model under the assumption that mining activities will not impact water quality which is not realistic based on previously published research in the region
  - Report states that better climate data is needed to drive numerical models, but in what way? This statement is vague
  - Stream discharge is only 2 years – very short based on the fact that this project will take decades and the region experiences decadal wet and dry cycles
- There are no error estimates (± m) reported with simulation results in section 4.3.2.1.2 (Page 23)
  - The model says WT will change less than 0.1 m – but what is the error associated with that estimate?
- What are the ecological impacts of the following:
  - Groundwater input to McClelland Lake predicted to increase by up to 60 mm/year in the far future scenario (page 29) which is a considerable increase compared to the current groundwater input into the lake (78 mm)
    - What ecological effects could this have on the lake long term?
    - There is the potential for increased transport of contaminants since deeper groundwater flows originate from the surrounding landscape (some of which will come from the disturbed landscape)
  - Water levels in the fen could rise by 24 cm. This is enough to encourage marsh vegetation growth as standing water is unfavourable for fen vegetation. This will drastically slow peat formation and could shift the wetland away from a peatland system
- What is the justification that that groundwater increases (27 mm/year) is moderate? (pg. 26)
  - Predicted to have negligible impact - why?

- Flows are assumed to be typical of a boreal ecosystem? Based on research, this is not the case in current reclaimed systems (pg 48)
  - It is very hard to execute design strategies perfectly to mimic boreal ecosystems (we've seen this with existing reclaimed ecosystems in the region)
- No substantial water quality changes assumed since water is coming from upper fen to lower fen (pg 48 – fen)
  - It is assumed that water quality from upper fen will remain the same as current conditions – this is unlikely due to the high amount of landscape disturbance that will occur on neighbouring landscapes
- No mention of implications of sodium intrusion, or high salts
  - Would be beyond their control
  - Though groundwater movement is slow, research shows that it is a primary source of high salts in reclaimed systems
  - Any materials used in reclamation are typically high in salts
  - Many landscapes in close proximity to mining activities can be exposed to elevated salinity (the clearwater formation can contain a very high level of salts which becomes disturbed during surface mining. The clearwater formation underlies the MLWC)
- No mention of impact of carbon loss from peat extraction from fen peatland

**Water Quality**

- Groundwater up to 1000 uS/cm already underneath the fen
- Problem with the outliers – they probably aren't outliers that can be ignored
- Upper limits of groundwater sodium and electrical conductivity (EC) (table 2.5-15) are already moderately high
- As the region becomes increasingly disturbed, it is likely that there will be mixing between groundwaters (with higher EC) and fen surface waters which will impact vegetation and peat accumulation

## 3. Appendix D

- Overestimates in modelled historic data:
  - Lake outflow (pg.701)
  - Inflow south creek (pg. 702)
- Modelled AET underestimates values (pg. 704)
  - Only 2 years of observed data used to calibrate
  - Potentially excludes decadal wet/dry cycles
- What statistical analysis was done to compare observed and modelled data mentioned in points above?
- WT drawdown will affect the fen based on model predictions (5-10 fig) on the outskirts of the fen. How will this effect fen levels?
- More groundwater and surface water entering the fen in the far future
  - How will this affect the WT?
  - Fig 5-1 compared to 5-23
  - Increased potential for contaminant transport
- Freeze impacts on structural integrity of the cutoff wall? (747 pg)

## 4. Appendix E

- Groundwater small part of water balance but "plays an important role in determining the water chemistry reaching McClelland Lake..." (page 901)
  - However, groundwater quality wasn't modelled (Pg 7 of Objective 3)
  - Groundwater from NOP and FHUC have the potential to become contaminated as they will be in close proximity to mining activities.
- Groundwater surface water interactions at base of hillslopes and swamp areas (pg 901) offer a potential transport mechanism of salts to the fen
- This region and system rely on groundwater during dry periods (pg 906)
  - Groundwater exfiltrates at the patterned fen which could bring salts to the surface
- "Wet years dilute groundwater contributions especially snowmelt" (pg 906)
  - In an undisturbed ecosystem, yes. However, in reclaimed ecosystems in this region, research shows that snowmelt (and heavy rain events) has little effect on diluting salts that have accumulated in these systems
  - Studies show snowpacks will decrease with climate change which will decrease dilution via freshwater input
- Future model scenario for water quality used historical baseline climate data
  - This is a large assumption based on the fact that reclaimed ecosystems in this region have become saline due to contamination from reclamation materials and mining waste materials
  - What if it becomes contaminated with high ion concentrations? How would the system be impacted?
- Lacking in historical water quality data for groundwater exfiltration areas which could be sources of contamination to the wetland (pg. 919)
- Report states that climate variability primary driver of water chemistry changes
  - What about from mine waste?

## 5. Objective 4

- Water redistribution system supply
  - 11 $mM^3$ – analysis of impact of taking water from potential sources?
- Freshwater of adequate quality will be provided to the fen to maintain water quality targets for vegetation
  - What if that requires inputting more water than the system needs? Could promote standing water conditions which is unfavourable for peatland vegetation
  - What if it breaks? Is there a backup plan?

## 6. Objective 1 - Historic data

- Much has been modelled
- Inflow/outflow for M Lake overestimates a lot and during peak events when the majority of water/solutes are transported
- No reports of error with simulated data (just say "comparable")
  - Wetland water levels
- Measured data doesn't cover wet and dry decadal periods
- No obvious decadal wet and dry periods in simulated WL for lake and fen

## Appendix 2: Review of Suncor's Operational Plan Conducted by Dr. Lorna Harris

### Review of Suncor McClelland Lake Wetland Complex (MLWC) Operational Plan (OP) for Alberta Wilderness Association

Reports Titled: Fort Hills Energy Corporation, Fort Hills Oil Sands Project
Reports Dated: December 2021

***Lorna Harris, PhD – Wildlife Conservation Society (WCS) Canada***
***December 28, 2022***


### Summary

The McClelland Lake Wetland Complex (MLWC) Operational Plan (OP) describes proposed measures to protect a portion of a moderately-rich patterned fen and other connected wetlands and downstream water bodies (McClelland Lake) from mining activities in the upstream portion of the MLWC.


My main comments on the OP reports are summarised below, followed by comments on specific sections of the reports.

1. **The mining activities will result in the irrecoverable loss of a currently intact (undisturbed) patterned fen peatland and other wetlands – the consequences of the loss of stored carbon in the peatlands, which are also likely to be an active carbon sink are not addressed in the OP.**

Peat depths across MLWC are noted in the OP to be 2 to 3 m on average and up to 7 or 8 m in places. It is therefore likely that these peatlands store a large amount of carbon. However, there are no estimates in the OP of carbon stored in these peatlands and the expected quantity of carbon to be lost from the peatlands due to construction activities and mining operations. Rough calculations detailed below indicate that these peatlands may store between 2.2 and 9.7 million tonnes of carbon.

The intact peatlands are also likely to be a long-term carbon sink, but the loss of the capacity of the mined portion of the peatlands to sequester carbon from the atmosphere is not discussed in the OP. The potential loss or reduction of the carbon sink capacity of the non-mined portion of the fen and other connected wetland ecosystems, due to potential changes in water levels, vegetation composition and structure etc. from the proposed mining operations and water management plan (construction of the cut-off wall and water resupply), is also not considered in the report.

It is also important to highlight that while post-mining reclamation work in Alberta has created new fens at an earlier successional stage and partially restored some damaged fens [1,2,3,4], the distinct microtopography and surface patterning of the original patterned fen peatlands is lost and near impossible to restore. The loss of this intact peatland, its biodiversity, and its stored carbon is irrecoverable in our lifetimes [5,6].

---

[1] Borkenhagen and Cooper (2015). Creating fen conditions: a new approach for peatland reclamation in the oil sands region of Alberta. ***Journal of Applied Ecology***, 53, 550-558. https://doi.org/10.1111/1365-2664.12555

[2] Xu and others (2021). Restoration of boreal peatland impacted by an in-situ oil sands well-pad 1: Vegetation response. ***Restoration Ecology***, 30, e13514. https://doi.org/10.1111/rec.13514

[3] Engering and others (2021). Restoration of boreal peatland impacted by an in-situ oil sands well-pad 2: Greenhouse gas exchange dynamics. ***Restoration Ecology***, 30, e13508. https://doi.org/10.1111/rec.13508

[4] Nwaishi and others (2016). Preliminary assessment of greenhouse gas emissions from a constructed fen on post-mining landscape in the Athabasca oil sands region, Alberta. ***Ecological Engineering***, 95, 119-128. https://doi.org/10.1016/j.ecoleng.2016.06.061

[5] Harris and others (2021). The essential carbon service provided by northern peatlands. ***Frontiers in Ecology and the Environment***, 20, 222-230. https://doi.org/10.1002/fee.2437

[6] Goldstein and others (2020). Protecting irrecoverable carbon in Earth's ecosystems. ***Nature Climate Change***, 10, 287-295. https://doi.org/10.1038/s41558-020-0738-8

2. **The OP does not adequately describe the ecohydrological processes necessary to maintain the structure and function of the non-mined portion of the patterned fen and other wetlands.**

The OP provides a detailed description of the hydrology and ecology of the MLWC, with a focus on the patterned fen peatland. The fen has string-flark (raised linear ridges and pools) microtopography that has developed perpendicular to surface and shallow groundwater flow, with water flowing through the fen towards McClelland Lake. Patterned fens occur in many northern peatland landscapes, often called 'ribbed fens' or 'string fens' in North America, and 'aapa mires' in northern Europe. The distinct surface topography of these fens has developed very slowly over thousands of years. Many studies describe how small-scale feedbacks among vegetation, hydrology, and nutrients (ecohydrological feedbacks) cause spatial differences in peat accumulation that enable these microforms (raised hummocks, ridges, hollows, pools) to develop over time[7,8,9,10,11,12]. Despite being critical for maintaining the structure and function of the non-mined portion of the patterned fen, and essential information for the proposed water management plan, these small-scale feedback mechanisms and their complexity in patterned fens is not described in any detail in the OP. The OP describes how changes in hydrology and chemistry may impact vegetation composition within the fen but does not adequately describe how these changes may impact peat accumulation and the ecohydrological feedbacks essential for maintaining the string-flark structure of the fen.

3. **Potential changes in greenhouse gas (GHG) emissions and removals within the non-mined patterned fen and other connected wetland ecosystems of the MLWC caused by the construction activities, the proposed water management plan, ongoing mining operations and reclamation plans are not discussed in the OP.**

Greenhouse gas (GHG) emissions and removals (fluxes) in peatlands and other wetland ecosystems are controlled by a combination of ecosystem factors, with changes in water levels, vegetation composition, and temperatures (soil, water) changing GHG fluxes. The potential impact of the site construction, mining operations, and the proposed water management plan on GHG fluxes in the non-mined fen and other wetland ecosystems is not addressed in the OP. For example, higher water levels in the fen coupled with potentially warmer water from resupply sources may increase methane production and emissions from the fen. Potential changes in NEE (net ecosystem production) from fluctuating water levels over time also need to be considered.

---

7 Belyea and Baird (2006). Beyond "The limits to peat bog growth": cross-scale feedback in peatland development. *Ecological Monographs*, 76, 299–322. https://doi.org/10.1890/0012-9615(2006)076[0299:btltpb]2.0.co;2.

8 Foster and others (1988). Patterned fens of western Labrador and adjacent Quebec: phytosociology, water chemistry, landform features, and dynamics of surface patterns. *Canadian Journal of Botany*, 66, 2402–18. https://doi.org/10.1139/b88-327

9 Glaser and others (1981). The patterned mires of the Red Lake Peatland, northern Minnesota: vegetation, water chemistry, and landforms. *Journal of Ecology*, 69, 575–99. https://doi.org/10.2307/2259685

10 Glaser and others (2004).Rates, pathways and drivers for peatland development in the Hudson Bay Lowlands, northern Ontario, Canada. *Journal of Ecology*, 92, 1036–53. https://doi.org/10.1111/j.0022-0477.2004.00931.x

11 Swanson and Grigal (1988). A simulation model of mire patterning. *Oikos*, 53, 309–14. https://doi.org/10.2307/3565529

12 Harris and others (2020). Mechanisms for the development of microform patterns in peatlands of the Hudson Bay Lowland. *Ecosystems*, 23, 741-767. https://doi.org/10.1007/s10021-019-00436-z

4. **The proposed water management plan is high risk and contains much uncertainty, in both design needs and ultimate effectiveness.**

There is a high risk that construction of the cut-off wall and associated infrastructure, ongoing mining operations, and reclamation plans will result in significant damage to the downstream non-mined fen and connected wetlands, watercourses, and lake. These risks are not adequately addressed in the OP. The proposed construction of a cut-off wall to protect the non-mined portion of the patterned fen from mining activities (and the adjacent mining area from flooding) will cut off surface and groundwater water flow from the upstream mined area to the fen and to downstream ecosystems, with various resulting water level scenarios described by the modelling studies. Maintaining water levels and flows within the non-mined fen and other wetland ecosystems during and after construction of the wall will be dependent on the success of the proposed water management plan, which contains much uncertainty, a limited risk assessment, and few details of the measures required should the cut-off wall and associated infrastructure (e.g., water resupply infrastructure) fails.

## Comments on OP sections

### MLWC OP Objective 1 – Define Baseline Conditions

#### Section 2.3.2

Page 2-11 - "…the persistence of these species (*Hamatocaulis vernicosus and Scorpidium scorpioides present today*) over thousands of years indicates that the water regime in the patterned portion of the fen is resilient to environmental changes and has remained stable throughout time".

It is important to clarify in the OP that these are natural environmental changes that have occurred slowly over time, or abrupt disturbances over short periods that did not push the peatland ecosystem beyond thresholds for change. The environmental changes caused by site construction, mining operations and reclamation are likely to be more extreme and may not only reduce the resiliency of the peatland, but also push the ecosystem past the threshold for an ecosystem shift, resulting in a change in peatland structure and function.

Page 2-12 – Data on the bulk density of peat cores from across the MLWC are provided here, but there are no calculations of carbon stocks for these peat cores or for the site. The data for peat bulk density and peat depths (if more detailed survey data are available for the site – see comment below) could be used with an estimate for the carbon content of fen peat from the literature (including from studies of fens in the same region of Alberta) to provide an estimate of the total carbon stored within both the mined and non-mined portions of the fen.

I have provided some rough estimates of carbon storage for the MLWC peatlands below, based on the limited information on peat depths ('average 2 to 3 m and up to 8 m thick in places') and peatland area in the report and using data from the available literature (carbon content of peat = 50 %). These numbers can be refined by using spatial data to get better estimates of the area of different peatland types (e.g., fens, bogs, permafrost, swamps) across the site, data on bulk density and carbon content from peat cores in each peatland type, and peat depths across the site.

- Assuming peat is 2 m deep on average across the site with average bulk density of 0.12 $g/m^3$:
  - 1878 ha peatland = ~2.2 million tonnes of carbon (~8 million tonnes $CO_2$ eq)
  - 2785 ha peatland = ~3.2 million tonnes of carbon (~11.7 million tonnes $CO_2$ eq)
- Assuming peat is 3 m deep on average across the site with average bulk density of 0.12 $g/m^3$:
  - 1878 ha peatland = ~3.2 million tonnes of carbon (~11.9 million tonnes $CO_2$ eq)
  - 2785 ha peatland = ~4.8 million tonnes of carbon (~17.6 million tonnes $CO_2$ eq)

- Assuming peat is 5 m deep on average across the site with average bulk density for upper 4m as 0.12 g/m$^3$, and 0.16 g/m$^3$ for lower section to 5.5m):
  - 1878 ha peatland = ~6.5 million tonnes of carbon (~23.8 million tonnes CO2 eq)
  - 2785 ha peatland = ~9.7 million tonnes of carbon (~35.5 million tonnes CO2 eq)

Page 2-21 – "…there are three areas in the MLWC watershed with permafrost and areas of thaw – southern edge of fen, SW of patterned fen, and NE of patterned fen."
There is no discussion of how permafrost and thaw areas may influence the current hydrology of the patterned fen, or how mining activities and the proposed water management plan may impact these permafrost areas. There is also no discussion of how any changes to hydrology across the site from more rapid permafrost thaw (even if considered minor relative to the mining activity) may impact the hydrology of the non-mined portion of the patterned fen, other fen areas and connected wetlands and the lake.

**Section 2.4**
Page 2-24+ - The six ecohydrological zones are a decent attempt to classify and delineate the different wetland types within this hydrologically connected wetland complex. However, the reasons for the grouping of EHZ5 are not clear – this ecohydrological zone is very broadly described as a 'permafrost/bog/fen/swamp complex' with no further delineation of these very different wetland types with different water sources and ecohydrological characteristics within this area.

**Section 2.5.9**
*Scorpidium scorpioides, Meesia triquetra,* and *Triglochin maritima* are described as indicators of extreme-rich fens but these species are also frequently found in moderately-rich fens.
Page 2-129 - "Water chemistry changes in the direction of lower pH and lower base cation concentrations may create conditions unfavourable for the extreme-rich fen species currently predominating in the southern portion of the fen and absent from the northern areas. Conversely, changes that increase pH and base cation concentrations would have less effect on the northern species, as they currently also occur in the southern area where higher concentrations of base cations are found."
The latter sentence is not correct, as it will depend on the magnitude of the increase in pH and base cation concentrations. If the pH and base cation concentrations increase beyond the thresholds for the present fen species, then they will be lost and replaced by species more tolerant of the different water chemistry conditions.

"A rise in the fen water table could negatively impact some of the species on strings, as these species do not inhabit flarks; however, a lowered water table may not have as much of a negative effect on plant diversity."

This statement is not correct as any changes in the plant species composition or structure are dependent on the magnitude of the change in water levels in the fen and the duration of these changes. A drop in water levels across the site may be beyond the range of tolerance for some moss species in the flarks, and may also favour increased growth and cover of shrub and sedge species with deep roots.

**Section 2.6**
The interdisciplinary analysis presented in this section of the OP is poor, particularly as it misses the importance of ecohydrological feedbacks in maintaining the structure and function of patterned fen peatlands and contains no analysis of the effects of the proposed mining activities and reclamation on carbon storage and sequestration (GHG emissions and removals) within the non-mined portion

of the patterned fen or other ecosystems in the MLWC (or the mined portion of the MLWC). The main flow paths described on page 2-163 include carbon cycling but this focuses on transport and transportation in water (including $CO_2$ production and degassing – a water chemistry analysis) and misses carbon uptake and loss in the peatland as net ecosystem exchange (NEE – balance of gross primary production and ecosystem respiration) and methane.

## MLWC OP Objective 2 – Define Functionality

**Section 3.1**

"For a peatland to persist, peat accumulation rates must exceed peat decomposition rates. To maintain this imbalance between peat accumulation and decomposition, the physical, hydrological, chemical, and biological functions need to be maintained in the system."

While this general statement for peatlands is correct, it is important that the specific functions of different peatland types are understood, to inform the proposed water management plan. The processes (including small-scale feedbacks) controlling peat accumulation in bogs and fens do not differ much but there are important differences in hydrological regimes, chemistry, and vegetation in these very different peatland types. For example, a change in water chemistry can significantly alter vegetation composition and structure and therefore the type of organic matter being added to the peat profile – this in turn can affect peat hydraulic properties and peatland hydrology which can impact the rate of peat accumulation. Understanding the complexity of ecohydrological feedbacks in peatlands is very important and should inform the water management plan (particularly the engineering design) and monitoring plan for this development (i.e., relationships between primary effects indicators and 'complementary data' and potential for changes in the system).

## MLWC OP Objective 3 – Assess Potential Impacts of Mine Development

"Confidence in the success of the effectiveness of the water management design features; the water management design features are currently at a conceptual stage and engineering work to advance the features is ongoing. The conceptual engineering work to date has not identified any fatal flaws in the design features. The features will continue to be rigorously evaluated (additional field data acquisition, monitoring and numerical modelling) as the engineering work advances."

Confidence in the effectiveness of the engineering design for the wall is critical for maintaining the structure and function of the non-mined portion of the patterned fen and connected downstream ecosystems (including McClelland Lake). However, the OP states that the design is at a conceptual stage and indicates that the uncertainty in the engineering design is acceptable, but with a very limited risk assessment. Maintaining the non-mined portion of the fen and other connected ecosystems, including downstream streams and rivers within the MLWC depends on this wall and other water management features being successful. Mitigation options for if the wall or parts of the wall or other associated construction fails are not included in the OP. The model data for the scenario without the water management features (the cut-off wall and water resupply) indicates the destruction of the non-mined fen through a 1.5 m drop in water levels, which is deemed unacceptable in the report. But a full risk assessment of potential engineering problems and failures (a range of scenarios, which could include lower water levels that would cause significant damage to the fen) is not included in the OP.

The plans also do not address the risk to the non-mined portion of the patterned fen and connected ecosystems from the construction and maintenance of the cut-off wall and its future status. Plans to remove the wall or part of the wall at closure are suggested but the risk to the non-mined fen, from direct construction impacts (e.g., sediment release into the fen) but also due to changes in hydrology and water chemistry, is not discussed.

Page 4-18 – A 0.1 m change in water levels in the fen (on average, noting it is not clear if this is an increase or a decrease in water levels or both) is anticipated throughout the installation of the cut-off wall and operations. During active closure the water levels are predicted to increase by 0.3 m. There is no discussion here of the likely impacts of these water level changes on the structure and function of the fen, including on carbon uptake and methane emissions (noting methane emissions may increase with higher water levels in the fen). Small changes in water level and chemistry can have a significant impact on fen vegetation (including bryophytes as noted on page 4-55) and function (including carbon dynamics).

Page 4-43 – "If the 'wall operations' (re-supply) flows can be managed to resemble the water coming from the upstream fen, no substantial change in water quality is expected."
This statement highlights the uncertainty in the plans to maintain the water chemistry of the fen and does not convey the actual risk of these possible changes in water chemistry to the patterned fen. The impact of changes in water chemistry on the structure and function of the patterned fen could be substantial, potentially causing a shift in the vegetation composition and overall function of the ecosystem. Potential problems and failures in the proposed water management plan and the levels of risk of each causing significant damage to the non-mined portion of the patterned fen are not adequately described in the OP.

Page 4-56 – The impacts on peat accumulation processes described here are general to peatlands, and while correct, the details of how peat accumulation in a patterned fen (with a distinct hydrological regime and ecohydrological feedbacks controlling microform patterns) may be impacted are missing.

**Section 4.3.2.4 Vegetation+**
Overall, this section provides a decent detailed review of fen vegetation and potential response to water levels and chemistry. However, there is no discussion of how combined changes (e.g., lower water levels and changes in water chemistry) could impact vegetation and overall fen structure (the microtopography) and function.

**Section 4.3.2.4.3 Potential Wetland Function Response**
Rates of peat accumulation at MLWC are included here and an estimate of the amount of organic matter accumulated over 50 years (158,056 metric tons), but there is no analysis of carbon accumulation and carbon stocks. Impacts on carbon dynamics are also missing from this section – particularly GHG emissions and removals. Changes in water level and chemistry in the fen can have considerable impacts on NEE (carbon uptake or loss) and methane fluxes.

## MLWC OP Objective 4 – Establish Necessary Design Features and Contingency Measures

The plan for water supply to the fen (patterned fen and other fen areas) throughout mining operations and closure is very poor, with considerable uncertainty on water sources to be used and the required volumes, and importantly, their chemistry, and the methods to be used.

The risk of runoff from constructed fens located upstream of the non-mined fen changing water chemistry, and therefore the structure and function of the non-mined fen, is not addressed.

Page 5-41 – "The cut-off wall and working platform may cross fen with peat up to 8m thick or thicker".

This suggests the construction will disturb/excavate a significant volume of peat (and stored carbon). The OP does not describe any plans for peat excavation, how to minimise the impacts of peat excavation, and proposed uses for the excavated peat. There are no other data on peat depths across the site provided in the report – statements are scattered in the report and limited to 'peat deposits may be up to 8 m thick' or other similar general description ('average of 2 to 3 m, and up to 7 m thick'). These are deep peat deposits that are likely to require substantial excavation activities and produce a large amount of excavated peat. These deep peat deposits are also likely to store a large amount of carbon, but the OP contains no analysis of carbon storage and expected loss of carbon in the peatlands.

## MLWC OP Objective 5 – Develop an Effects Monitoring Program

A basic monitoring plan is provided, including suitable early warning indicators (e.g., water level and chemistry indicators).

## MLWC OP Objective 6 – Develop a Response Framework

The Response Framework contains details of causes, triggers, limits etc. but contains no details of the actual mitigation measures and management response to be taken if thresholds/triggers are reached. Noting also that some examples of management response for water resupply are high risk for maintaining the water chemistry of the fen (e.g., using water supply from the Athabasca River to increase water levels in the fen – page 7-21).

**Appendix D - Integrated Hydrologic Modelling of the MLWC (report by Aquanty dated 10 December 2021)**

Page 33 – The 'fill and spill' process of surface water flow through the fen is described here and included in both the coarse and fine hydrological models but is not addressed in other sections of the OP. Importantly, details of how this fill and spill process will be maintained during construction of the cut-off wall and associated infrastructure, and ongoing mining operations, are not included in the proposed water management plan.

**Attachment B – Wetland Reclamation Modelling of the McClelland Lake Watershed – 2019 Interim Technical Memo**

The following summary statements from the 2019 memo (page 22) on the risks to the non-mined portion of the patterned fen are not adequately addressed in the proposed water management plan and reclamation proposals in the OP:

"…while the reclamation designs might not a have significant effect on the water level of McClelland Lake, they have the potential to increase the duration of dry periods in the remnant fen and decrease surface water and groundwater fluxes into the remnant fen."

"The absence of any significant impact to the McClelland Lake levels, despite clear changes in the hydrologic function of the fen, indicates that the fen itself is more sensitive to the final reclamation design relative to the lake. This highlights the need for a specific focus on the fen when optimizing the reclamation designs in 2020."