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SUBMISSION BY THE CANADIAN ENVIRONMENTAL LAW ASSOCIATION TO THE CANADIAN NUCLEAR SAFETY COMMISSION REGARDING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR NEXGEN ENERGY LTD.'S PROPOSED ROOK I PROJECT

CEAA Reference Number: 80171

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CONTENTS

LIST OF ACRONYMS

ALARP/ALARA	As Low as Reasonably Practicable/As Low as Reasonably Achievable
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
CEA Agency	Canadian Environmental Assessment Agency
CNSC	Canadian Nuclear Safety Commission
COPC	Constituent of Potential Concern
CRDN	Clearwater River Dene Nation
EA	Environmental Assessment
EcoRA	Ecological Risk Assessment
EIS	Environmental Impact Statement
ERA	Environmental Risk Assessment
GHG	Greenhouse Gas Emissions
GUDI	Groundwater Under the Direct Influence of Surface Water
LSA	Local Study Area
IAAC	Impact Assessment Agency of Canada
NSCA	*Nuclear Safety and Control Act*
PAG	Potentially Acid Generating
RFD	Reasonably Foreseeable Development
RSA	Regional Study Area
SDG	Sustainable Development Goal
SMR	Small Modular Reactor
SWPP	Source Water Protection Plan
UGTMF	Underground Tailings Management Facility
WRSA	Waste Rock Management Facility
WNISR2022	World Nuclear Industry Status Report 2022
VC	Valued Component
ZOI	Zone of Influence

I. INTRODUCTION

The Canadian Environmental Law Association ("CELA" or the "intervenor") welcomes the opportunity to review the draft Environmental Impact Statement ("EIS") for the proposed Rook I Project submitted by the proponent, NexGen Energy Ltd ("NexGen").[1]

Based on CELA's initial review of the draft EIS and the deficiencies contained within, this submission should be considered a commentary on missing and inadequate information for decision making. We reserve the right to provide additional substantive comment on subsequent stages of this environmental assessment being reviewed under the *Canadian Environmental Assessment Act, 2012*.

II. INTEREST AND EXPERTISE OF THE INTERVENOR

CELA is a non-profit, public interest law organization. CELA is funded by Legal Aid Ontario as a speciality legal clinic to provide equitable access to justice to those otherwise unable to afford representation for environmental injustices. For over 50 years, CELA has used legal tools to advance the public interest, through advocacy and law reform, in order to increase environmental protection and safeguard communities across Canada.

CELA has been involved in number of nuclear facility licensing and regulatory matters before the CNSC including federal environmental assessments. CELA also maintains an extensive library of public legal education materials related to Canada's nuclear sector on its website.[2]

Supporting this intervention are experts Luc Lance and Dr. Robert Patrick, who CELA has retained to provide advice on NexGen's draft Environmental Impact Statement ("EIS").

Luc Lance is a certified Radon Measurement and Analytical Provider, certified by the Canadian National Radon Proficiency Program and also a member of the Canadian Association of Radon Scientists and Technologists. Mr. Lance has extensive experience in the monitoring of radiological hazards, the sufficiency of controls and monitoring of radiological hazards, including but not limited to water sampling (ground and surface), air monitoring programs, offsite controls and monitors and mitigation techniques.

Dr. Robert Patrick is an Associate Professor in the Department of Geography and Planning at the University of Saskatchewan, specializing in regional and environmental planning, cumulative effects analysis and watershed planning for source water protection, mainly with First Nation communities in Alberta and Saskatchewan.

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[1] NexGen Energy Ltd, "Rook I Project Saskatchewan Canada: Environmental Impact Statement" (April 2022), online: https://www.ceaa-acee.gc.ca/050/evaluations/document/144418 [**Draft EIS**]
[2] Canadian Environmental Law Association, online: www.cela.ca

III. BACKGROUND/FACTS

A. Project

NexGen is proposing the development of an underground uranium mine and milling operation, called the Rook I Project. It is estimated that the project would produce up to 14 million kg of U_3O_8 annually for twenty-four years.[3] NexGen anticipated that the lifespan of the project would be 43 years, based on the following phases and their timelines:

- Construction (4 years);
- Operations (24 years);
- Closure (15 years)
    - Active Closure Stage (5 years)
    - Transitional Monitoring Stage (10 years).[4]

The project would be developed on the Patterson Lake peninsula in Northwestern Saskatchewan, which is situated within the southern Athabasca Basin, along the upper Clearwater River System, and the site intersects the Boreal Shield and Boreal Plain Ecozones.[5] The project site is situated on Provincial Crown Land within Treaty 8 territory and the Métis Homeland, and adjacent to Treaty 10 territory.[6]

On February 20, 2020, the Canadian Nuclear Safety Commission ("CNSC") released its decision on the scope of an environmental assessment for the proposed Rook I Project. The proposed project meets the definition of a "designated project" under section 31 of the *Regulations Designating Physical Activities* made under the *Canadian Environmental Assessment Act, 2012* ("*CEAA 2012*")[7], requiring that an environmental assessment ("EA") be carried out for the project.[8] Although the *Impact Assessment Act*[9] came into force in August 2019, replacing *CEAA 2012*, it includes provisions to allow ongoing projects with EAs initiated under *CEAA 2012* to continue under their existing EA processes.

[3] Impact Assessment Agency, "Rook I Project", Canadian Impact Assessment Registry, online: https://www.ceaa-acee.gc.ca/050/evaluations/proj/80171?&culture=en-CA
[4] Draft EIS, p. 1-43.
[5] Draft EIS, p. 1-18.
[6] Draft EIS, p. 1-14.
[7] *Canadian Environmental Assessment Act, 2012* (SC 2012, c 19m s 52) at s. 31. [**CEAA 2012**]
[8] Canadian Nuclear Safety Commission, Record of Decision dated February 20, 2020, online: https://www.ceaa-acee.gc.ca/050/documents/p80171/134827E.pdf
[9] *Impact Assessment Act*, SC 2019, c 28, s 1.

In addition to the EA under CEAA 2012, this project is also subject to the environmental assessment requirements of the Government of Saskatchewan, and must be approved and licenced by the CNSC in accordance with the *Nuclear Safety and Control Act*.[10]

B. Scope of Review

CELA received participant funding to review NexGen's draft EIS, provide recommendations in response to the purposes and scope of factors to be considered in an EA per *CEAA 2012*, review the sufficiency of their considerations in the draft EIS, and to review and comment on any CNSC Commission Member Documents and applicable Regulatory Documents.

Pursuant to our Participant Funding Program application, CELA has engaged the professional services of Luc Lance and Dr. Robert Patrick. Section V of this report, titled "Radon and Gamma Monitoring & Workers' Health ", comments on the document's assessment of radon, considering the sufficiency of existing controls and monitoring radiological hazards, and mitigation techniques to reduce exposure. Section VI of the report, titled "Source Water Protection", provides comments on the Draft EIS's review of impacts to ground and surface waters from a watershed planning and source water protection perspective.

Our recommendations, are summarized in **Appendix A**. A summary of our information requests are compiled in **Appendix B**.

[10] Nuclear Safety and Control Act, SC 1997, c 9 [**NSCA**].

IV. LEGAL FINDINGS & ANALYSIS

CELA submits that due to deficiencies within the Draft EIS, the requisite statutory and regulatory requirements of *CEAA 2012* have not been fulfilled. Additional information is required before NexGen's Draft EIS can be deemed sufficient. The deficiencies within the Draft EIS are broken down into three issues, each detailed below:

A. NexGen's assessment of environmental effects lacks adequate detail and analysis to meet the purposes of *CEAA 2012*;
B. The Draft EIS has failed to adequately consider key factors required in undertaking an EA under *CEAA 2012*; and
C. There are procedural issues which prevent this EA from being transparent, inclusive, informed, and meaningful.[11]

A. Assessing 'Adverse Environmental Effects' and the Purposes of *CEAA 2012*

CELA submits there are significant issues and gaps in information within the Draft EIS, and without amending these issues and gaps, the CNSC will be unable to find under section 7 of *CEAA 2012* that the project is not likely to not cause significant adverse environmental effects.[12]

NexGen has made the following determination on adverse environmental effects:

> No significant adverse effects on biophysical, cultural, and socio-economic VCs were predicted for the Project or for the Project in combination with RFDs, with the exception of woodland caribou. Effects on woodland caribou are already significant under existing conditions, and NexGen's commitment to implementing a Caribou Mitigation and Offsetting Plan is expected to provide a net increase in functional woodland caribou habitat.[13]

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[11] Minister of Environment and Climate Change, Building Common Ground: A New Vision for Impact Assessment in Canada (2017), online: https://www.canada.ca/content/dam/themes/environment/conservation/environmental-reviews/building-common-ground/building-common-ground.pdf, pp. 13-14. *This report determined that for the assessment process to be effective, the assessment process must be governed by these four principles.* [**Expert Report**]

[12] *CEAA 2012* at s. 7 provides: A federal authority must not exercise any power or perform any duty or function conferred on it under any Act of Parliament other than this Act that could permit a designated project to be carried out in whole or in part unless
(a) the Agency makes a decision under paragraph 10(b) that no environmental assessment of the designated project is required and posts that decision on the Internet site; or
(b) the decision statement with respect to the designated project that is issued under subsection 31(3) or section 54 to the proponent of the designated project indicates that the designated project is not likely to cause significant adverse environmental effects or that the significant adverse environmental effects that it is likely to cause are justified in the circumstances.

[13] Draft EIS at p. 24-28. "VC" stands for valued component, and "RFD" stands for reasonably foreseeable development.

CELA undertook a sustainability-based evaluation of the NexGen's Draft EIS for the Rook I Project. This section considers the purposes of *CEAA 2012* which guides the process for assessing adverse environment effects, and evaluates how the purpose and justification of the Rook I Project fit within the context of an environmental assessment, pursuant to the purpose of *CEAA 2012*.

Our analysis rested in part of the purpose of *CEAA 2012*, as set out in sections 4(1)(b), (h), and (i):[14]

> **4(1)** The purposes of this Act are:
>
> **(b)** to ensure that designated projects…are considered in a careful and precautionary manner to avoid significant adverse environmental effects;
>
> **(h)** to encourage federal authorities to take actions that promote sustainable development in order to achieve or maintain a healthy environment and a healthy economy; and
>
> **(i)** to encourage the study of the cumulative effects of physical activities in a region and the consideration of those study results in environmental assessments.

These three factors indicate that the purpose of *CEAA 2012* is to ensure there is a well-rounded, precautionary approach to assessing potential risks that could cumulatively and adversely affect the environment. The intervenor submits that NexGen's Draft EIS fails to fulfill the purpose of *CEAA 2012* as the consideration of "environmental effects" is grossly inadequate. CELA submits these inadequacies arise from the following issues, which will be addressed below:

1. The Draft EIS disregards the purpose of the Act requiring the application of a precautionary approach for matters of uncertainty and potential risk per section 4(1)(b) of *CEAA 2012*;

2. The purpose of the project is based on a faulty sustainable development justification; and

3. The Draft EIS fails to properly apply a cumulative effects assessment to fully assess the environmental effects associated with the proposed project.

1. The Precautionary Principle

The precautionary principle, a fundamental purpose of *CEAA 2012*,[15] is also a principle in which a federal authority (i.e., the CNSC) is mandated to exercise when administering their powers to

[14] *CEAA 2012* at ss. 4(1)(b),(h),(i), *emphasis added*.
[15] *CEAA 2012* at s. 4(1)(b).

protect the environment and human health.[16] The precautionary principle, requires a cautionary approach in which a decision-maker presented with evidence that an activity is likely to cause irreversible harm to the environment is obligated to prevent or terminate the activity.[17] This principle of international environmental law has also been adopted into Canada's application of environmental law, as held by the Supreme Court of Canada in its seminal 2001 decision in *Spray-Tech*:

> The interpretation of By-law 270 contained in these reasons respects international law's "precautionary principle", which is defined as follows at para. 7 of the Bergen Ministerial Declaration on Sustainable Development (1990):
>
> > In order to achieve sustainable development, policies must be based on the precautionary principle. Environmental measures must anticipate, prevent and attack the causes of environmental degradation. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.[18]

As such, there is a positive duty on the CNSC to ensure the activities it licences do not cause unacceptable or irreversible harm to the environment.[19] The intervenor **submits** that the Draft EIS fails to provide sufficient data for the CNSC to determine that the Rook I Project would not cause unacceptable or irreversible harm to the environment.

First, the intervenor **submits** NexGen has not provided a sufficient assessment of the potential adverse environmental effects of this project beyond the closure phase. The Draft EIS divides the project's estimated 43-year lifespan into three phases: construction, operations, and closure. Beyond the projected 15-year decommissioning and reclamation (closure) phase, the Draft EIS makes reference to a "far-future scenario" throughout the assessment. The far-future scenario, which is discussed further in Section IV. B.1 of this submission, is explained in the Draft EIS's Environmental Assessment Approach and Methods section:

> In certain circumstances, the duration of effects may extend beyond specific phases of the Project, including Closure, depending on the physical, biological, social, and/or cultural properties and resilience of VCs and intermediate components. Under these circumstances, effects from the Project that may occur well beyond Closure were also assessed using a far-future scenario. This far-future scenario is not a Project phase; it encompasses the long-

[16] *CEAA 2012* at s. 4(2).
[17] Cameron J and Abouchar J, "The precautionary principle: a fundamental principle of law and policy for the protection of the global environment" (1990) 14:1 Boston College International and Comparative Law Review at p. 3, online: https://lawdigitalcommons.bc.edu/cgi/viewcontent.cgi?article=1335&context=iclr [**Cameron & Abouchar**].
[18] 114957 Canada Ltee (Spray-Tech) v Hudson (Ville), 2001 SCC 40 (CanLII) at para. 31.
[19] Cameron & Abouchar at p. 22.

> term period during extremely slow migration of COPCs from the underground tailings management facility and waste rock storage areas to the environment are anticipated (i.e., more than 5,000 years). The far-future scenario is applicable for groundwater and surface water quality intermediate components and to the human health VC, including ecological receptors, which are assessed through the ERA. While it is not possible to accurately predict any process thousands of years into the future, the far-future scenario is a reasonable representation of the long-term return to steady-state conditions.[20]

The "far-future" scenario is mentioned 267 times within the Draft EIS,[21] and depending upon the context of the far-future scenario (e.g., hydrological conditions, water quality and sediment quality, etc.), the far-future timeline can range from 200 years to more than 5000 years.[22] However, there is no dedicated section to summarize all far-future scenarios, and provide a timeline of the anticipated durations for various scenarios. CELA **recommends** that the Draft EIS be updated to include a timeline of various far-future scenarios, which would provide a visual of the potentially adverse environmental effects that future generations would be burdened with should this Project be approved.

As stated in by the Draft EIS above, it is not possible to accurately predict any process thousands of years in the future. And while NexGen does take climate change into consideration with assessment modelling, the variables of climate change are unpredictable, and the scale of climate change impacts are dependent on local and global action on Greenhouse Gas emissions and other decarbonization actions. As there are many variables that can impact the proposed project, the far-future modelling within the Draft EIS becomes riddled with uncertainty. Approaching this proposed project in a precautionary manner would indicate that there is a lack of scientific certainty regarding the likelihood of serious or irreversible environmental harm.

Second, the intervenor **submits** that the post-closure and far-future time periods surrounding the proposed project lack sufficient detail on what monitoring and maintenance mechanisms are required to prevent adverse environmental effects from occurring in the future. The Rook I Project is anticipated to complete the Decommissioning and Reclamation (Closure) phase after 15 years. The Draft EIS explains that "once performance criteria have been fully demonstrated, an application to be released from the CNSC licence would be submitted to the CNSC for approval.

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[20] Draft EIS at p. 6-19, *emphasis added*.

[21] This was found by conducting a "CTRL +f " (or on Mac commuters a "command +f") search of "far-future" within the Draft EIS document. A significant number of word search hits for "far-future" where found within the headers of individual pages (e.g., "Appendix 11A, Aquatic Health Assessment of the Potential Adverse Effects of Predicted **Far-Future** Copper Concentrations in Patterson Lake"), and therefore "far-future" was not necessarily discussed 267 times within the Draft EIS.

[22] *See for example,* Draft EIS at p. 10-19 marks surface water quality modelling over a span of 400 years, including the 43-year project timeline and 357 years after closure. Whereas, p. 6-19 (cited above) indicates that the COPCs from the UGTMF and the WRSA facilities are expected to migrate into the environment over the course of 5,000 years.

Once release from licence is achieved, and upon Provincial approval, the land would be transferred under Provincial management through the Institutional Control Program."[23]

Therefore, according to the Draft EIS, after NexGen gains the financial benefit of owning and operating the mine for 24 years, closes down the project site for approximately 15 years, and then turns over the perpetual care of the site to the Province of Saskatchewan. Decommissioned uranium mines must be managed in perpetuity in order to prevent contaminated tailings and waste rock from being released into the local environment, as emphasized by the Pembina Institute:

> The management of all decommissioned mines must be considered in perpetuity. The Auditor General of Canada has observed that,
>
> > In Canada, a "walk-away" solution is not realistic for decommissioning most uranium tailings sits. Long-term storage requires long-term institutional care to monitor and maintain the containment structures and to control access to, and use of, the land.[24]

With the far-future scenario indicating that there is an anticipated slow migration of constituents of potential concern from the underground tailings management facility and waste rock storage areas to the environment, the Rook I Project is a site that must be monitored and maintained in perpetuity. However, beyond the closure phase, the Draft EIS does not elaborate on the remedial measures needed in the future.

For example, in the far-future scenario for surface water quality, there is an assumption that the potentially acid generating ("PAG") waste rock storage area ("WRSA") liner would not function in the far future and that "all infiltration and seepages through and from the WRSAs and UGTMF would generate mass loading via contact with waste rock and tailings and carry the loads to surface waters via groundwater pathways."[25] This far future scenario was based on modelling that spanned 400 years, including the 43-year project timeline and the 357 years after closure.[26] By the time that the PAG WRSA liner is no longer functioning, the project would not be the responsibility of NexGen. The Draft EIS is not clear about what would need to be done in the far-future to mitigate the adverse effects of the anticipated releases of cobalt and copper (these releases would exceed thresholds).[27] The Draft EIS indicates that should the project be approved, monitoring and follow-up plans and management plans would further be developed.[28] Without a fulsome managing and

[23] Draft EIS at p. 1-34, Table 1.2-3.
[24] M Winfield et al., "Nuclear Power in Canada: An Examination of Risks, Impacts and Sustainability" (December 2006), The Pembina Institute, online: https://www.pembina.org/reports/Nuclear_web.pdf at p. 39
[25] Draft EIS at p. 10-19.
[26] Draft EIS at p. 10-19.
[27] Draft EIS at p. 10-97.
[28] Draft EIS at p. 23-12.

monitoring process available for the CNSC to review at this stage of the EA, there is insufficient information available to determine that adverse environmental effects will not occur post-closure.

CELA **requests** that NexGen provide plans for monitoring and follow-up programs and management plans to be assessed within the context of the EIS. CELA also **requests** that NexGen provide details about the expected lifespan of the PAG WRSA liners, as well as recommended management systems for the far-future generations that would be burdened with the COPC metal concentrations expected to flow from the site.

Third, CELA **submits** that the scoping analysis within the Draft EIS is inadequate and prevents a thorough study of environmental effects from being completed in compliance with the purpose of *CEAA 2012*. CELA has identified a number of deficiencies in the study of valued components ("VCs")—specifically the climate change, fish and fish habitat, terrain and soils, vegetation, and wildlife and wildlife habitat VCs—in which the Draft EIS is missing crucial environmental data. Additionally, the scoping of both spatial and temporal boundaries is too narrow. Section IV.B.1 addresses the specific shortfalls within the environmental effects assessment of VCs and scoping boundaries. CELA **submits** that the gaps in environmental effects assessment data prevents the precautionary approach from being implemented by the CNSC to determine whether this project is likely to cause irreversible harm to the environment.

For instance, in one far-future modelling timeframe, copper was predicted to exceed both water quality guidelines for the protection of aquatic life and reference values used in the Ecological Risk Assessment ("EcoRA") and aquatic health assessment, and "the survival and reproduction of fish VCs could be directly affected by exposure to copper in the water column or indirectly by changes in habitat availability resulting from potential effects on the lower trophic food base for fish…"[29] According to the EcoRA and the aquatic health assessment:

> … Effects on the health of fish due to direct exposure to copper in the water column, and therefore survival and reproduction, are not expected for predator fish (e.g., lake trout, walleye, northern pike) and are unlikely for forage fish (e.g., lake whitefish). As described above, only limited effects on the available food supply for fish are possible due to exposure of lower trophic level organisms and forage fish species to predicted copper concentrations. Additionally, these effects would be spatially limited to Patterson Lake North Arm – West Basin. Broad scale changes to the fish food base are not expected to occur. Therefore, any changes in habitat quality are considered unlikely to measurably affect the survival and reproduction of fish VCs.[30]

[29] Draft EIS at section 11, pp. iv-v.
[30] Draft EIS at section 11, p. v.

The intervenor **submits** that the determination that any changes in habitat quality are considered unlikely to measurably affect the survival and reproduction of fish VCs to be inadequate, as the study of fish and fish habitat VCs is lacking crucial environmental data—which will be discussed further in this submission. Before such a determination about far-future fish VC effects can be drawn, the fish VC information gaps need to be rectified in this EIS.

Recommendation 1: The Draft EIS should be updated to include a timeline of various far-future scenarios, which would provide a visual of the potentially adverse environmental effects that future generations would be burdened with should this Project be approved.

Recommendation 2: To ensure the purposes set out in sections 4(1)(b) and 4(2) of *CEAA 2012* are upheld, greater attention must be paid to the precautionary principle. This means the far-future scenarios proposed by NexGen need to be re-assessed to align with any further data provided for VCs and boundary scoping.

Information Request 1: NexGen to provide plans for monitoring and follow-up programs and management plans specific to the various far-future scenarios to be assessed within the context of the EIS.

Information Request 2: NexGen provide details about the expected lifespan of the PAG WRSA liners, as well as recommended management systems for the far-future generations that would be burdened with the COPC metal concentrations expected to flow from the site.

2. Climate Change and Sustainable Development

CEAA 2012 at section 19 enumerates the factors to be considered when conducting an EA—some of which CELA has found not to have been properly considered in NexGen's draft EIS.[31] One such factor as set out in subsection 19(1)(f), is the purpose (i.e. justification) of a proposed project, which must be taken account during the assessment process.[32]

NexGen attempts to justify the need or purpose of the project as a means to address climate change through the reduction of greenhouse gas emissions ("GHGs"). The Draft EIS states that:

> The Project could meaningfully contribute to the Government of Canada's ability to meet its environmental obligations and commitments with respect to climate change (Prime Minister of Canada 2021) by displacing high-GHG intensity fossil fuel (e.g., coal, natural gas)

[31] Section IV.B. of this submission provides additional commentary on the factors that must be considered within an EA.
[32] *CEAA 2012* at s. 19(1)(f) states: The environmental assessment of a designated project must take into account the following factors: … (f) the purpose of the designated project.

> electricity generation in favour of low-GHG emitting, green energy. Providing a potential source of uranium would also support Saskatchewan's objective of developing lower carbon emission electricity generation over the next decade (Government of Saskatchewan 2019a). While uranium is not the only option to support these local and global endeavours, the demand for uranium is increasing, and this energy source can be an important part of the solution as the world moves towards more sustainable measures to protect the environment and reduce effects on climate change.[33]

In reviewing the stated purpose of the designated project, the federal authority conducting the assessment, i.e., the CNSC, must ensure that the proposed project aligns with the purposes of the Act, including section 4(1)(h) which encourages the CNSC to take actions that promote sustainable development in order to achieve or maintain a healthy environment and a healthy economy.[34]

NexGen attempts to justify the Rook I Project through their own sustainability lens of supplying uranium globally to address the forecasted increase in the global demand in electricity, noting that there would need to be an "80% increase in global nuclear power production by 2040 compared to current production levels, along with investments in renewable energy sources."[35] NexGen states that global demand for uranium is increasing, which is where the proponent roots the purpose of this project:

> The purpose of the proposed Project is to provide a potential source of uranium as part of meeting global demand for electricity through low-GHG emitting energy options. The development of the Project can support the establishment of renewable energy options, help meet the growing global electricity demands, and support both national and international efforts to reduce GHG emissions.[36]

As CELA sets out in the following sections (as well as in Dr. Robert Patrick's expert report at Section VI; which recommends the implementation climate change resiliency and source water protection plans for this Project), the justifications for the Rook I Project provided within the Draft EIS, namely that the project will support international and national climate efforts, are not well founded and thus do not align with the principles of sustainable development, which is a core purpose of *CEAA 2012*.

[33] Draft EIS at p. 1-15.
[34] As set out within the purpose of *CEAA 2012* at s. 4(1)(h).
[35] Draft EIS at p. 4-4.
[36] Draft EIS at p. 4-5.

Climate Change within EA

As one of the defining challenges of the 21st Century, climate change requires global collective action to slow the increase in global temperatures.[37] The changes to the climate since the Industrial Era have consequences global, and locally within Canada, impacting human health and natural ecosystem health.[38] In 2015, Canada adopted the 2030 Agenda for Sustainable Development at the UN General Assembly. The Agenda consists of 17 Sustainable Development Goals ("SDGs"), and SDG 13 requiring climate action.

As Target 13.2 requires nations to integrate climate change measures into national policies, strategies and planning,[39] CELA **submits** climate change becomes an integral part of assessing the sustainability of a proposed project, pursuant to section 4(1)(h) *CEAA 2012*.

However, CELA **submits** that considering climate change within EA is not simply an assessment of whether a project aids in meeting Canada's climate objectives, but rather whether the project itself is aligned with sustainability. The following questions assist in determining whether a project is aligned with sustainability:

- Does the project cause, induce, or exacerbate extreme weather events or slow onset events?
- Does it irreversibly alter an ecosystem?
- Does it make a community less resilient?
- Does it affect its life support systems?
- Does it sustain nature, life support systems and the community?[40]

Table 1 below offers a brief summary of differences between a traditional approach to climate change. As drafted, GenPGM's EIS documents reflect a traditional approach to climate change in EA.

[37] Environment and Climate Change Canada, "Canada's Changing Climate Report" (2019) Government of Canada, online: https://changingclimate.ca/site/assets/uploads/sites/2/2020/06/CCCR_FULLREPORT-EN-FINAL.pdf at p. 11 [**CCCR2019**]
[38] CCCR2019 at p. 428.
[39] United Nations, "Goal 13: Take urgent action to combat climate change and its impacts", Sustainable Development Goals, online: https://www.un.org/sustainabledevelopment/climate-change/
[40] A Majekolagbe, "Impact Assessment, Sustainability, and Climate Change: Lessons from Lower Churchill" (2021) Dalhousie Law Journal, online: https://digitalcommons.schulichlaw.dal.ca/cgi/viewcontent.cgi?article=2160&context=dlj, p 84 [**Majekolagbe, 2021**]

Table 1. Summary of Climate Change in Traditional IA and Sustainability based IA[41]

Climate Change in Traditional EA	Climate Change in Sustainability
Mitigation focused	Mutually considers mitigation, adaptation and loss and damages
Based on project's contribution to national mitigation commitment	Applies a presumption of harm approach
Project's emission intensity is determined on an individual project basis	Effects are considered cumulatively
Negative contribution to global warming is a primary contribution	Emphasizes positive contribution to nature, life support system, and the community
Trade-off is resolved in favour of emission mitigation	Trade-off is resolved in favour of overall contribution to sustainability

International Climate Efforts

CELA **submits** that NexGen's emphasis on the project's uranium production supporting international efforts to reduce GHG emissions does not align with a sustainability-based impact assessment.[42] The proponent focuses on the negative contribution to global warming, when there needs to be an emphasis on positive contributions to nature, life support systems, and the community. Furthermore, NexGen's and assertion that the Project will "support the establishment of renewable energy options" is not well founded nor supportable.

Unquestionably, the investment in a variety of renewable energy sources is crucial to address the global demand for electricity, and 2021 saw a global increase in wind power generation. The *World Nuclear Industry Status Report 2022* ("WNISR2022") states: "In 2021, the annual global growth rates for the generation from wind power were 17.0 percent (11.9 percent in 2020), 22.3 percent (20.9 percent in 2020) for solar PV, and 3.9 percent (-4 percent in 2020) for nuclear power."[43] The WNISR2022 further states that the global contribution of nuclear energy fell to 9.8 percent, with the nuclear share being below 10 percent for the first time in four decades.[44]

The role of nuclear power becomes increasingly complicated, however, taking into account the dramatic geopolitical changes in 2021. Because of the war in Ukraine, for the first time the WNISR2022 includes a chapter titled "Nuclear Power and War."[45] This chapter focuses on the risks of nuclear power facilities in war situations, and the risks of possible major releases of

[41] Majekolagbe, 2021
[42] Draft EIS at p. 4-5.
[43] M Schneider and A Froggat, "The World Nuclear Industry Status Report" (October 2022), Paris, online: https://www.worldnuclearreport.org/IMG/pdf/wnisr2022-lr.pdf at p. 32 [**WNISR2022**].
[44] WNISR2022 at p. 32.
[45] WNISR2022 at pp. 244-276.

radioactivity into the environment. The war in Ukraine has also highlighted the problems of dependency, especially of a single source, on fossil fuel imports, as some European nations have been dependent on fossil fuels from Russia.[46]

With the need for global transitioning away from fossil fuels from both a climate perspective and a geopolitical perspective, nuclear power generation is not the focal point to meet growing electricity demands. The WNISR2022 explains that:

> … renewables outcompete nuclear power and in fact fossil fuels in the majority of markets as they are cheaper and faster to build and ultimately produce less expensive power. Consequently, more investment is taking place in renewables, which leads to lower prices and more deployment experience, creating a virtuous circle in which renewables are becoming cheaper than all other forms of electricity generation.[47]

As the WNISR2022 points out, military conflict increases the environmental risks from nuclear power generation. However, the discussion of GHG emissions, security risks and environmental impacts of shipping and distributing uranium globally is omitted from the discussion in NexGen's Draft EIS.

National Climate Efforts

In addition to contributing to international climate emissions reductions, NexGen frames the purpose of the project[48] within the Draft EIS as assisting Canada in meeting its GHG-reduction targets.[49] The Draft EIS submits that "to meet [Canada's] growing demands and the GHG emission reduction targets, significant new nuclear and other low-carbon emitting electrical capacity would have to be established."[50]

The justification of the project also rests within Saskatchewan pursuing a small modular reactor ("SMR") in the early to mid 2030s.[51] The *Net-Zero Framework* which accompanies the Draft EIS provides further reliance on the development of an SMR in Saskatchewan. This *Framework* states:

> Federal and provincial government support would be required to overcome the barriers associated with implementation of SMRs, specifically the following:

[46] WNISR2022 at p. 35.
[47] WNISR2022 at p. 278.
[48] Draft EIS at section 4.2.
[49] Draft EIS at p. 4-5.
[50] Draft EIS at p. 4-4.
[51] Draft EIS at p. 4+4.

- increasing public awareness and acceptance for implementation of SMRs; increasing the investment and innovation in the SMR technology and infrastructure;
- defining regulatory requirements (e.g., permitting and licensing) and ensuring the regulatory processes are efficient for implementation of the technology;
- conducting a detailed, sector-wide study that could help define the strategies and/or incentives for implementation of SMRs on the provincial scale; and
- aligning with the emission reduction potentials outlined in the Made-in-Saskatchewan Climate Change Strategy (Government of Saskatchewan 2017), by implementation of SMRs on remote mine sites.[52]

The Draft EIS depends on the hypothetical development of SMRs in order to justify the approval of the Rook I Project. CELA **submits** that the reliance on the development of SMRs to meet Saskatchewan's energy targets is not a sustainable justification for this project. CELA has previously expressed concerns about the unviability of SMRs due to cost of production in comparison with other low-carbon energy sources, as well as the concerns surrounding the lack of environmental assessment measures governing the approval of SMRs.[53]

The recently released WNISR2022 also emphasizes the shortfalls of SMRs, noting: "Small modular (nuclear) reactors or SMRs continue to hog the headlines in many countries, even though all the evidence so far shows that they will likely face major economic challenges and not be competitive on the electricity market."[54] In the context of Canada, the WNISR2022 points out that the development of SMRs like the proposed Micro Modular Reactor Project at the Chalk River Laboratories in Ontario are unlikely to meaningfully contribute to energy production:

> According to its proponents, the Micro Modular Reactor Project is intended to be "a commercial demonstration reactor" and "a model… to provide safe and sustainable low-carbon power and heat to industries, such as mining, and remote communities".930 The net electricity demand from remote mines and communities in Canada are insufficient to develop the facilities needed to manufacture SMRs, and the costs of the electricity any reactors small enough to power a remote mine or community would be prohibitively high.[55]

SMRs are not only economically unviable; these reactors do not fit within a sustainable development perspective in Canada, as SMRs are exempt from impact assessment under the *Impact Assessment Act.* Impact assessment is one of the key tools the federal government has to

[52] Golder Associates Ltd., "Net-Zero Framework Technical Support Document for the Rook I Project" (April 2022), online: https://www.ceaa-acee.gc.ca/050/evaluations/document/144429, at p. 12 [**TSD XII**]
[53] *See for instance:* Canadian Environmental Law Association, "Primer: Small Modular Nuclear Reactors (SMRs)", (November 17, 2020) CELA Blog, online: https://cela.ca/primer-small-modular-nuclear-reactors/
[54] WNISR2022 at p. 228.
[55] WNISR2022 at p. 232.

assess a project's impact or contribution to sustainability however, as the *Impact Assessment Act* only requires the largest of nuclear reactors to undergo review, SMRs are effectively exempt. [56]

While recognizing that NexGen would not be an SMR proponent, by supplying the uranium for these proposed reactors, the Rook I project would be cumulatively contributing to the potentially adverse environmental effects that would result from these non-assessed SMRs. With one of the key goals of sustainable assessment being the discouragement of decisions which would transfer the negative impacts of present day activities onto future generations,[57] the environmental uncertainty surrounding the impacts of SMRs would therefore negate NexGen's justification of this project resting in supplying uranium to operate these reactors.

CNSC Regulatory Guidance

In addition to the purposes of *CEAA 2012,* CNSC policy guidance provides another source from which to review NexGen's approach to sustainable development. REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.2,* specifies the CNSC's guiding environmental protection principles when making licensing decisions at section 2.1, including the implementation of the "polluter pays" principle:

> For each facility or activity that has direct interactions with the environment, the CNSC must determine that the licensee or applicant has made adequate provision for the protection of the environment. The applicant or licensee's licence application shall demonstrate (through performance assessments, monitoring or other assessments) that their environmental protection measures: […]
>
> - respect the precautionary principle, the "polluter pays" principle, and the concepts of pollution prevention, sustainable development and adaptive management […][58]

The "polluter pays" principle is a core concept within sustainable development, as this principle is centred around society acting for the long-term protection of the planet and future generations.[59] The polluter pays principle deems waste owners "…responsible for the funding, organization, management and operation of the facilities required to safely manage their wastes over the short

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[56] Kerrie Blaise and Shawn-Patrick Stensil, "Small Modular Reactors in Canada: Eroding Public Oversight and Canada's Transition to Sustainable Development" in Jonathan L Black-Branch and Dieter Fleck (eds), Nuclear Non-Proliferation in International Law – Volume V – Legal Challenges for Nuclear Security and Deterrence (2020, Asser Press: The Hague) 209 at p. 219 [**Blaise and Stensil, 2020**].
[57] Blaise and Stensil, 2020 at p. 224.
[58] CNSC, REGDOC-2.9.1, Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.2 (September 2020), online: http://www.nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/published/html/regdoc2-9-1-vol1-2/index.cfm#sec-2-1 at s. 2.1 [**CNSC, REGDOC-2.9.1**, **Version 1.2**].
[59] Blaise and Stensil, 2020 at p. 211.

and long terms."[60] By placing this financial burden on the polluter, there arises an economic interest for the producers of waste to engage in management and monitoring practices that would reduce the costs of environmental clean-up.

While the Draft EIS indicates that the proposed project would be "fully self-funded, and would not require any financial support from federal or provincial authorities,"[61] there is no indication within the Draft EIS of the anticipated costs for closure, or how much money would be set aside for monitoring the site post-closure, when NexGen would seek to absolve itself from maintaining the site. Because there are no management plans, monitoring and follow-up programs, or decommissioning and reclamation plans concretely provided within the Draft EIS,[62] it is not possible to determine whether there are adequate monitoring and management programs in place to protect future generations from environmental harm. CELA **submits** that NexGen must be responsible for its emissions into the environment in line with the polluter-pays principle, and is obligated to offset said emissions.

Recommendation 3: In order to fulfill *CEAA 2012*'s purpose promoting sustainable development and upholding international climate commitments, NexGen must incorporate climate change *within* sustainability, specifically applying a presumption of harm approach towards the projects that would depend on the uranium produced by the proposed Rook I Project.

Recommendation 4: The Purpose of this Project needs to be re-assessed to ensure that the information before the CNSC is grounded in sustainability, and does not contribute to irreversible environmental effects at a local or global scale.

Recommendation 5: The EIS should be updated to include management plans, monitoring and follow-up programs, or decommissioning and reclamation plans to allow the CNSC to consider the sustainability of the project and the measures that would be implemented to protect future generations from environmental harm.

Information Request 3: NexGen should an estimate of the costs required to adequately close, as well as monitor the mine site post-closure, in order to adhere with the polluter-pays principle.

[60] CNSC, "Oversight of Canada's Framework for Radioactive Waste Management" (April 2018) CNSC Fact Sheets, online: https://nuclearsafety.gc.ca/eng/resources/fact-sheets/oversight-canada-framework-radioactive-waste-management.cfm
[61] Draft EIS at p. 1-17.
[62] Draft EIS at pp. 23-12 and 23-17: the proponent indicates in the Summary of Mitigation, Monitoring and Follow-Up Programs section of the Draft EIS that these plans would be further developed if the EA is approved.

3. Cumulative Effects Assessment

One of the purposes of *CEAA 2012* is to encourage the study of cumulative effects of physical activities in a region and the consideration of those study results in environmental assessments.[63] Cumulative effects assessment is also a mandatory factor in an EA, pursuant to section 19(1)(a):

> **19 (1)** The environmental assessment of a designated project must take into account the following factors:
>
> > **(a)** the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out [emphasis added][64]

For EAs conducted by the CNSC, the approach and methods used by an applicant to identify and assess cumulative effects should be consistent with *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* ("*Cumulative Effects OPS*").[65] The *Cumulative Effects OPS* was prepared by then Canadian Environmental Assessment Agency ("CEA Agency") (which has now been replaced by the Impact Assessment Agency ("IAAC")) to assist proponents in complying with the cumulative effects assessment factor enumerated in *CEAA 2012*.[66]

The *Cumulative Effects OPS* sets out a 5-step framework that should be followed when conducting a cumulative effects assessment:

> **Step 1: Scoping**
> Step 1 defines the scope of the assessment. This includes identifying VCs for which residual environmental effects are predicted, determining spatial and temporal boundaries to capture potential cumulative effects on these VCs, and examining the relationship of the residual environmental effects of the designated project with those of other physical activities. Scoping helps determine which VCs should be carried forward to Step 2 analysis.

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[63] *CEAA 2012* at s. 4(1)(i).
[64] *CEAA 2012* at s. 19(1)(a), *emphasis added*.
[65] CNSC, REGDOC-2.9.1, Version 1.2 at Appendix A.3.5.
[66] CEA Agency, Operational Policy Statement *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*, Version 2, Ottawa, Canada, (2018), online: https://www.canada.ca/content/dam/iaac-acei/documents/policy-guidance/assessing-cumulative-effects-ceaa2012/assessing-cumulative-environmental-effects.pdf [**Cumulative Effects OPS, 2018**].

Step 2: Analysis
Step 2 considers how the physical activities examined during Step 1 may affect the VCs identified for further analysis in Step 1. Step 2 addresses those VCs within spatial and temporal boundaries determined for the assessment of cumulative effects.

Step 3: Mitigation
Step 3 aims to identify technically and economically feasible measures that would mitigate adverse cumulative effects. Mitigation may include elimination, reduction or control or, where this is not possible, restitution measures such as replacement, restoration or compensation should be considered.

Step 4: Significance
Step 4 is concerned with determining the significance of any adverse cumulative environmental effects that are likely to result from a designated project in combination with other physical activities, taking into account the implementation of mitigation measures.

Step 5: Follow-up
Step 5 involves the development of a follow-up program that addresses both project-specific environmental effects and cumulative effects. A follow-up program verifies the accuracy of the EA and determines the effectiveness of any mitigation measures that have been implemented.[67]

In order to properly execute this 5-step process, it is crucial to understand the types of cumulative effects that may be captured for analysis through the scoping process namely:

- Additive (the sum of individual effects of two or more physical activities);
- Synergistic (results from the interaction between two or more effects, when the resultant combination is greater or different than the simple addition of the effects);
- Compensatory (effects from two or more physical activities that "offset" each other); and
- Masking (effects of one project might mask or hide the effects of another in the field).[68]

CELA **submits** that the cumulative effects assessment conducted within the Draft EIS is insufficient, as it lacks crucial environmental data needed to complete the 5-step process of a cumulative effects assessment.

First, the scoping of VCs, spatial boundaries and temporal boundaries is inadequate, and without proper scoping, the rest of the cumulative effect assessment is disoriented and lacking key details required for analyzing the cumulative effects on VCs relevant to the project. CELA provides a

[67] Cumulative Effects OPS, 2018 at p. 5.
[68] Cumulative Effects OPS, 2018 at pp. 42-44.

breakdown of the inadequacies of valued component identification at Section IV.B.2. CELA also determined that the scoping of some spatial and temporal boundaries is too narrow, which narrows the identification of physical activities that may interact with the project and identified VCs. Details about the narrow scoping of spatial and temporal boundaries are provided in Section IV.B.2 of this submission.

Second, when conducting the analysis of environmental effects on the various VCs identified by the proponent, the Draft EIS does not clearly state what type of cumulative effect (e.g., additive, synergistic, compensatory, or masking) is being analysed. The Draft EIS does not provide a general explanation of the different types of cumulative effects. CELA **submits** that the providing a backgrounder of cumulative effects within the EIS would benefit the public in understanding how environmental effects are being analysed by the proponent. The Cumulative Effect OPS notes that "environmental effects of other physical activities can interact with those of the project in various ways. For example, some effects may simply be additive, while others may result in effects greater than if they had occurred on their own."[69] By clearly identifying the types of cumulative effects considered by the proponent for each VC, it is easier to determine that the proponent effectively assessed *how* the cumulative effects are acting on VCs.

For example, one wildlife VC identified within the Draft EIS is the little brown myotis. In the significance determination of the residual effects on little brown myotis, the Draft EIS points out that climate change will have permanent effects on survival and reproduction, stating:

> The peak abundance of some insects may shift as a result of climate change, which could limit survival of reproductive females and pups. It is unclear how climate change may affect the spread of WNS in the boreal portions of Canada and if winter temperatures would remain low enough to limit its sustained presence in bat populations (Layng et al. 2019). As discussed in previous subsections, there is a high degree of uncertainty in the direction and magnitude of effects from the climate change in the RSA.[70]

What is not clear within the Draft EIS is whether the cumulative effects assessment considered how climate change may mask the Rook I Project's potential effects to abundance of insects due to habitat disturbance in construction, or day-to-day operations on the site. This masking could ultimately result in a synergistic effect of depleting the primary food sources of regional little brown myotis, and therefore amplify significant adverse effects on the survival of the regional little brown myotis. To truly understand how the different cumulative effects associated with the little brown myotis are assessed, the Draft EIS must show that all the relevant types of cumulative effects were identified by the proponent. CELA **recommends** that the EIS be updated to clearly identify all the types of cumulative effects that were assessed for each VC.

[69] Cumulative Effects OPS, 2018 at p. 32.
[70] Draft EIS at p. 14-279.

Third, CELA **submits** the Draft EIS lacks accessible details surrounding the examination of different physical activities. The *Cumulative Effects OPS* provides guidance on examining physical activities that have been and will be carried out, which is a part of the scoping step. With regards to outcome documentation, the *Cumulative Effects OPS* emphasizes that the outcome of this scoping element should be clear, and that a table or matrix may be useful for presenting information regarding the rationale for including each physical activity identified and the VCs that they may effect.[71] This section of the *Cumulative Effects OPS* provides a sample matrix structure that could be used in a cumulative effects assessment to display this information.

CELA has reproduced this sample matrix at **Figure 1**, as the intervenor highly recommends this type of matrix be implemented in the EIS to provide clarity surrounding the different physical activities identified and the VCs that they may effect.

When reading through the Draft EIS, there are various physical activities revealed that one would expect to be included within a cumulative effects assessment. For example, Figure 1.2-1 in the Draft EIS shows a map which sets out the location of the Rook I Project in the context of northern Saskatchewan.[72] In addition to the populated places, and First Nation Reserves of the region, this map also identifies active uranium mining facilities, decommissioned uranium mining facilities, provincial parks, highways, and the Preston Lake Wildlife Preserve. However, throughout the various cumulative effects assessments, there is no specific mention of these sites. In fact, there is hardly any mention of decommissioned uranium mining facilities as physical activities that could interact with this project.

While CELA suspects that the omission of various uranium facilities is due to boundary scoping deficiencies, readers of the Draft EIS would benefit from understanding which physical activities were selected for analysis in the context of each VC. Furthermore, the Draft EIS has a tendency to discuss the proposed Patterson Lake South Property, planned by Fission Uranium Corp. as a designated reasonable foreseeable development ("RFD") for most VCs.[73] In the specific case of the woodland caribou VC, the assessment also included the physical activities associated with the future harvest areas of Carrier Forest Products and Mistik Management Ltd. Forest Management Plans, which are located south of La Loche and well outside of the Regional Study Area ("RSA"). These were included because both companies operate within the SK2 West Caribou Administration Unit.[74] The variables in selecting physical activities to analyze in the cumulative effects assessment should be clearly presented within the EIS to ensure that the EA conducted for Rook I Project is thorough and can truthfully come to the determination that no adverse effects are anticipated.

[71] Cumulative Effects OPS, 2018 at p. 30.
[72] Draft EIS at p. 1-20.
[73] Draft EIS at p. 6-21.
[74] Draft EIS at p. 14-35.

CELA therefore **recommends** that NexGen adopt a matrix structure like **Figure 1**, below, in order to provide clarity about the physical activities identified within the cumulative effects assessment.

Figure 1: Example of a Matrix Structure for Outcome Documentation[75]

Past, Existing, and Future Physical Activities in a Largely Undeveloped Area	Valued Components				
	1	2	3	4	Description
Physical Activity A	✓	✓			This future physical activity is reasonably foreseeable, since it is currently under regulatory review. It has the potential of affecting VC#1 & VC#2, given the nature of the physical activity and predicted effects pathways within the spatial boundaries established for these VCs. Furthermore, such effects on VC#1 & VC#2 are likely to occur within the same timeframe as the potential effects of the project on the same VCs. The effects of Physical Activity A and those of the project therefore both fall within the established temporal boundaries for VC#1 and VC#2. The environmental effects of Physical Activity A on these two VCs will be considered further in the Step 2 analysis.
Physical Activity B	✓	✓	✓		This is a past activity that will yield useful information about potential future effects on VC#1, VC#2 and VC#3.
Physical Activity C			✓	✓	This is a certain future physical activity with potential effects on VC#3 and VC#4. In the context of the area, it can be considered induced development.
Physical Activity X					This activity is not expected to affect any of the VCs identified for the cumulative effects assessment, therefore it is not included.

Recommendation 6: NexGen needs to rectify the deficiencies in the cumulative effects assessment by reconducting the scoping phase in accordance with CELA's VC and boundary recommendations.

Recommendation 7: The EIS be updated to clearly identify all the types of cumulative effects that were assessed for each VC.

Recommendation 8: The EIS should include a matrix or table which would present information regarding rationale for including each physical activity identified and the VCs that they may effect.

B. The Draft EIS Fails to Consider Key EA Factors Required by *CEAA 2012*

CELA **submits** that NexGen's draft EIS's consideration of "environmental effects" is grossly inadequate as the EIS reaches a finding of "no significant adverse effects on biophysical VCs predicted for the Project or for the Project in combination with RFDs, with the exception of woodland caribou", is rooted in insufficient environmental data.

This section addresses the Draft EIS's shortfalls in considering environmental effects, the inadequate assessment of malfunctions and accidents associated with the project, and the

[75] Cumulative Effects OPS, 2018 at p. 30. *Note:* "WNS" stands for white-nose syndrome.

insufficient details provided in the Alternative Means analysis. These three factors, which are set out in sections 19(1)(a) and 19(1)(g) of *CEAA 2012* respectively, must be adequately considered and addressed within a proponent's EIS in order to accurately determine whether adverse environmental effects are expected to arise from the proposed project.

1. Environmental Effects and Valued Components

As set out section 4(1)(b) of the Act, avoiding significant adverse environmental effects requires a designated project to be considered in a careful and precautionary manner. To do so, section 19(1)(a) requires an EA to consider: "the environmental effects of the designated project, including …. any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out"[76]

As indicated within the *Cumulative Effects OPS*, the first step in a cumulative effects assessment is the scoping of the assessment, which includes identifying VCs for which residual environmental effects are predicted, and the spatial and temporal boundaries which capture the potential cumulative effects of identified VCs.[77] If a cumulative effects analysis is not completed thoroughly, there is a greater uncertainty in determining whether there will be significant adverse environmental effects.

The *Generic Guidelines for the Preparation of an Environmental Impact Statement—Pursuant to the Canadian Environmental Assessment Act, 2012* [the "Guidelines"] is a guiding document prepared by the CNSC to assist proponents with the preparation of an EIS in compliance with *CEAA 2012*.[78] The *Guidelines* discuss the scope of the environmental assessment, and specifically discuss valued components (VCs), and spatial and temporal boundaries. The EIS must provide a rationale for selecting specific VCs (e.g., its role in an ecosystem, or scientific, social, cultural, economic, historical, archeological or aesthetic values). Rationale for including or excluding a VC must be provided. The *Guidelines* note that examples of justification include: "primary data collection, computer modelling, literature references, public consultation, expert input or professional judgement."[79]

In terms of spatial and temporal boundaries, the *Guidelines* explain that these boundaries may vary depending on the VC and will be considered separately for each VC. When defining these boundaries, a proponent is encouraged to consult with: "…the CNSC, federal and provincial

[76] *CEAA 2012* at s. 19(1)(a). Section 19(1)(b) of *CEAA 2012* requires the significance of these effects to be considered.
[77] Cumulative Effects OPS, 2018 at p. 5.
[78] CNSC, Generic Guidelines for the Preparation of an Environmental Impact Statement—Pursuant to the Canadian Environmental Assessment Act, 2012, (2021), online: http://www.nuclearsafety.gc.ca/eng/resources/environmental-protection/ceaa-2012-generic-eis-guidelines.cfm [**CNSC, Generic Guidelines**].
[79] CNSC, Generic Guidelines at s. 5.2.1.

government departments and agencies, local government and Indigenous groups. It is also encouraged to take into account public comments when defining the spatial boundaries used in the EIS."[80]

To ensure that the EIS provides an accurate representation of the potential environmental effects associated with the Rook I Project, CELA provides a series of recommendations and information requests that seek to fill gaps in the scoping of VCs, and the spatial and temporal boundaries. By rectifying these deficiencies, NexGen will be able to amend the cumulative effects assessment that is required under *CEAA 2012*.

Valued Components Assessment

This section provides a series of recommendations for the scoping of valued components (VCs). Some of CELA's concerns arise from gaps in the analysis of certain VCs and rationale for excluding other VCs.

The Draft EIS identified the following VCs to scope the cumulative effects assessment:

- Climate change;
- Fish and fish habitat (Lake trout, Lake whitefish, Walleye, and Northern pike);
- Vegetation (upland ecosystems, wetland ecosystems, riparian ecosystems, and Traditional use plants);
- Wildlife and wildlife habitat (Woodland caribou, Moose, Wolf, Black bear, Beaver, Little brown myotis, Olive-sided flycatcher, Mallard, Goldeneye, Rusty blackbird, and Canadian toad);
- Human Health (camp worker, subsistence harvester, seasonal resident/ lodge operator, future permanent resident of the Patterson Lake North Arm area);
- Cultural and heritage resources;
- Indigenous land and resource use;
- Other land and resource use;
- Economy; and
- Community well-being.[81]

In addition to the VCs, the Draft EIS assessed "intermediate components", which include physical attributes of the biophysical environment or media upon which VCs rely, such as air quality and hydrology. The identified intermediate components in the Draft EIS are:

- Air Quality;

[80] CNSC, Generic Guidelines at s. 5.2.2.
[81] Draft EIS at pp. 6-12—6-13 (Table 6.3-1).

- Noise;
- Hydrogeology (groundwater quality and quantity);
- Hydrology;
- Surface Water Quality;
- Sediment Quality; and
- Terrain and Soils.[82]

CELA **strongly urges** that the following requests and recommendations be rectified within the EIS to ensure there is a proper cumulative effects assessment conducted.

a) Intermediate Components

CELA **submits** that the classification of certain components as "intermediate components" is does not comply with the parameters of *CEAA 2012*. In "Section 6, Environmental Assessment Approach and Methods", the Draft EIS indicates that these components do not undergo the complete cumulative effects assessment process (i.e., no significance criteria):

> Intermediate components are identified using the same process described for VCs (Section 6.3.1, Valued Components). Similarly, VCs and intermediate components are assessed using the same steps. However, unlike VCs, intermediate components do not have assessment endpoints or significance criteria. The significance of changes in intermediate components can only be evaluated in the context of related influences to VCs, which are the ultimate receptors. As an example, changes to surface water quality cannot be evaluated without the context of what these changes would mean to fish, vegetation, wildlife, and human health VCs. The determination of significance requires a defined assessment endpoint or threshold, and thresholds for water quality are related to guidelines, which are explicitly linked to the health of aquatic organisms and people. Therefore, the consequences and significance of changes in surface water quality were evaluated in the context of those VCs.[83]

The *Guidelines* state that "in the EIS, the applicant should include a detailed analysis of the significance of each residual effect. The applicant should clearly explain the method and definitions used to describe the level of the residual adverse effect (e.g., low, medium, high) for each of the criteria assessed."[84] CELA **submits** that claiming that the significance of changes in intermediate components can only be evaluated in the context of related influences to VCs, which are the ultimate receptors, is a narrow view that diminishes the inherent value of components like air quality, for example. Components like air quality have been treated as valued components in

[82] Draft EIS at pp. 6-14—6-15 (Table 6.3-2).
[83] Draft EIS at p. 6-14.
[84] CNSC, Generic Guidelines at s. 10.

the EAs of other projects in Canada.[85] Additionally, the decision to deem some components as intermediate and others as valued, is inconsistent with the assessment of climate change, which was identified as a VC that has an influence on other VCs and the Project itself.[86] This treatment of climate change could easily be applied to the components identified as intermediate components, because from a sustainable, holistic lens, all the VCs interact and influence one another in some manner. If climate change can undergo a full cumulative effects assessment, then surface water quality, and the other intermediate components, require the same level of assessment.

CELA **requests** that the components identified as "intermediate components" should be assessed in the same manner as "valued components" and must undergo the full 5-step framework for conducting a cumulative effects assessment.

b) Climate Change[87]

As stated, climate change was deemed to be a VC requiring a cumulative effects assessment. Climate change has an interesting role with the environmental assessment of this project, as it is not only treated as a VC, but is considered in the context of other intermediate components and VCs, as well as potential effects of the environment on the Project.[88]

As a VC, the Draft EIS considers the influence of Project greenhouse gas ("GHG") emissions on climate change. The Draft EIS identified the following GHG emission sources:

- Electricity generation;
- On-site mobile equipment;
- Heating;
- Land-use change;
- Stationary combustion;
- Waste incinerators;
- Industrial processes; and
- Explosives.[89]

[85] *See for example:* Pacific NorthWest LNG, "Environmental Impact Statement and Environmental Assessment Certificate Application" (February 2014), online: https://www.ceaa-acee.gc.ca/050/documents/p80032/98680E.pdf at Section 6: Air Quality. This EIS notes: "Air Quality is a valued component (VC) because of its intrinsic importance to the health and wellbeing of people, wildlife, vegetation and other biota. The atmosphere is an important pathway for the transport of contaminants to the freshwater, terrestrial and human environments."
[86] Draft EIS at p. 7-1.
[87] *See* Draft EIS Section 7, Air Quality, Noise, and Climate Change.
[88] Draft EIS at p. 7-1.
[89] Draft EIS at Appendix 7C Greenhouse Gas Emissions Estimation Methodology Report, Table 7C-1: Greenhouse Gas Emission Sources.

What appears to be absent from the GHG emission sources is the estimated emissions associated with flights to and from the project site over the course of operations, as well as vehicular emissions associated with transporting conventional waste disposal (hazardous) off-site, decommissioning demolition waste disposal (hazardous) off-site, and bringing uranium to market. Omitting these sources from the GHG emissions results in the full extent of GHG emissions for this project being downplayed.

CELA **requests** that NexGen provide estimates for the GHG emissions associated with flights to and from the project site, and off-site transportation (e.g. off-site waste disposal during operations and decommissioning phases, and the delivery of finished product to market). CELA also **requests** NexGen to provide an estimate on the number of anticipated flights annually during the project's operations.

c) Fish and Fish Habitat[90]

The Draft EIS identified four fish species (i.e., lake trout, lake whitefish, walleye, and northern pike) to represent the Fish and Fish Habitat VCs in the EA. NexGen noted that these four species were selected "…based on the respective roles and linkages of each species in the ecosystem and food web, the high traditional and cultural importance of these species to local communities, and the species' presence within nearby waterbodies and watercourses."[91]

When determining which fish to select as VCs, there were 10 fish species identified (including the 4 species selected). The six species that were not selected as VCs were:

- White sucker;
- Longnose sucker;
- Burbot;
- Yellow perch;
- Cisco; and
- Arctic grayling.[92]

The proponent's rationale for fish VC selection was: "…to capture a range of potential effects of the Project on fish and fish habitat, while simultaneously avoiding redundancy by selecting one representative species when multiple species occupy a similar ecological niche and/or functional role in the aquatic food web."[93]

[90] *See* Draft EIS Section 11, Fish and Fish Habitat.
[91] Draft EIS at Section 11 Executive Summary.
[92] Draft EIS at pp. 11-15—11-16.
[93] Draft EIS at p. 11-17.

CELA **submits** that "avoiding redundancy" is not an acceptable rationale for excluding species of fish from the cumulative effects assessment. Furthermore, excluding certain species because they were "mentioned relatively infrequently by communities during engagement compared to species retained as VCs,"[94] is not a sufficient reason for exclusion. This line of reasoning pan-Indigenizes the communities that were consulted by NexGen. For example, the Clearwater River Dene Nation ("CRDN") identified grayling as a species that is considered important to community members.[95] The reasons for excluding the Arctic Graying from being a VC are as follows:

- Infrequently captured during the 2018 and 2019 baseline surveys (Annex V.1). A single Arctic grayling was captured during the baseline surveys, in the Clearwater River downstream of Naomi Lake. Therefore, this species is not representative of effects in the RSA.
- Functional role as forage species overlaps with that of lake whitefish, which has been included as a VC. Additionally, there is overlap with northern pike, which has been included as a VC, and is considered suitable for assessing potential changes to watercourse habitats.
- Number of comments received from communities about the importance of Arctic grayling was minimal compared to species that have been included as VCs.[96]

Because the other consulted communities did not refer to the Arctic Grayling, it was excluded, thus dismissing its value to the CRDN. Additionally, the infrequency of capture during baseline studies should not be a reason for excluding this species, as its presence has been indicated by the CRDN. By dismissing the low frequency of grayling captures as deeming the species as being non-representative of effects in the RSA, any underlying issues surrounding grayling populations go unnoticed, and the cumulative effects of the project would go undetected on this species.

CELA **submits** "avoiding redundancy" is not an acceptable reason for excluding fish species from VC scoping, and when selecting fish VCs, rationale come from a balancing of the recommended lines of reasoning: primary data collection, computer modelling, literature references, public consultation, expert input or professional judgement.[97] As a result, the scoping of fish species VCs needs to be restarted to ensure that the cumulative effects assessment accurately captures the potentially adverse environmental effects that would require mitigation and monitoring.

Because of the narrow scoping of fish VCs, NexGen has made determinations that do not adequately reflect the potential impacts of all relevant fish species in the RSA:

[94] Draft EIS at p. 11-13.
[95] Draft EIS at p. 11-13.
[96] Draft EIS at p. 11-16.
[97] CNSC, Generic Guidelines at s. 5.2.1.

> The predicted effects from the Project would not have a significant adverse effect on the assessment endpoint for fish and fish habitat. Although changes to habitat availability and survival and reproduction are possible, the predicted effects would be within the resilience and adaptability limits for the four fish VCs.[98]

CELA **requests** that the EIS be updated with a new cumulative effects assessment to reflect a proper selection of fish VCs.

d) Terrain and Soils [Intermediate Component][99]

In the discussion of project activities that would have the potential to affect terrain and soils during the project lifespan, NexGen noted that "As the pathways associated with these activities[100] do not have the potential to overlap with the pathways of the Fission Patterson Lake South Property, only the potential effects of the project were considered in the subsequent steps of the assessment process."[101] CELA suggests that the activities at the proposed Fission Patterson Lake South Property would be similar to that of the Rook I Project, including changes to air and water quality (which in turn could impact terrain and soils within the RSA). Given that these two proposed projects would be operating along the shores of Patterson Lake, there is potential for the Fission Patterson Lake South Property to adversely impact the air and water quality within the RSA, which in turn could impact the Rook I Project's activities cumulatively in the context of terrain and soils.

The Draft EIS goes on to identify climate and natural disturbance factors that can effect terrain and soils, namely:

- Increased precipitation can cause groundwater levels to rise, which can increase mobility of solutes for the soil to waterbodies. The removal of solutes can negatively change soil quality due to the decrease in available soil nutrients; and

- Forest fires in boreal environments can remove vegetative cover, increase erosion potential, and affect soil nutrients.[102]

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[98] Draft EIS at p. 20-4, Table 20.3-1.
[99] *See* Draft EIS Section 12, Terrain and Soils.
[100] NexGen identified the following activities that could affect terrain and soil:
- Land clearing;
- Site preparation;
- Construction of facilities and infrastructure;
- Handling of ore and waste rock;
- Changes to air and water quality; and
- Other supporting mining construction, operation, and decommissioning and reclamation activities.

[101] Draft EIS at Section 12 Executive Summary, p. ii.
[102] Draft EIS at p. 12-66.

With the potential for groundwater levels to rise, along with forest fires risking increased erosion potential due to climate change, the potential pathways from the Fission Patterson Lake South property should not be ruled out within the context of terrain and soils. CELA **requests** the proponent use the precautionary principle to re-assess potential pathways from the proposed Fission Patterson Lake South Property on the terrain and soils cumulative effects assessment.

e) Vegetation[103]

The Draft EIS claims a moderate to high degree of confidence in the predictions related to changes in vegetation VCs.[104] It is admitted that there is "some uncertainty regarding the quantity, distribution, and ecological function (i.e., condition) of reclaimed ELC units during and after Closure."[105] CELA **submits** there is too much uncertainty surrounding the vegetation VC for NexGen to establish a moderate to high degree of confidence within the assessment. For example, the section's Executive Summary comments:

> Currently, it is unclear whether climate change would positively and/or negatively affect vegetation VCs. Projected future climate extremes indicate a future that is likely to be warmer and wetter on an annual basis. Changes to upland ecosystems would likely be driven by shifts in the fire regime, which is closely related to weather and climate; such changes would be permanent and occur beyond the RSA scale. Wetland ecosystems may be adversely affected by climate change as these ecosystems are considered one of most sensitive to changes in precipitation and temperature.[106]

The *Cumulative Effects OPS* urges that:

> Caution should be exercised if the degree of uncertainty is unusually large (e.g., effects are expected in the future, but it is not possible to predict whether they will improve or harm a particular VC). In these cases, predictions will be highly sensitive to the assumptions made. Relying on a particular assumption could result in a faulty conclusion. It would therefore be appropriate to present the results as a range, in line with the range of underlying assumptions.[107]

Given the high degree of uncertainty surrounding the effects of climate change on the vegetation VC, CELA **recommends** that the proponent re-evaluate its confidence level of moderate to high, as this determination likely arose from a faulty conclusion based on uncertain climate change assumptions.

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[103] *See* Draft EIS Section 13, Vegetation.
[104] Draft EIS at p. 13-167.
[105] Draft EIS at p. 13-167. Note: "ELC" means "Ecological land classification".
[106] Draft EIS at Section 13 Executive Summary, p. vi, *emphasis added*.
[107] Cumulative Effects OPS at p. 39.

CELA also **submits** that the vegetation VC assessment is missing data to assess. During the discussion of Valued Components, the Draft EIS states:

> Habitat requirements for species that are not well known or understood (i.e., tracked bryophytes, such as mosses, and lichens) were excluded as VCs because of the high degree of uncertainty associated with the distribution of these taxa (e.g., species) within the area of the anticipated Project (and generally in Saskatchewan) (DeVries and Wright 2015) and because such organisms often require detailed chemical or taxonomic procedures for their identification (Eldridge et al. 2003).[108]

Excluding this information is not advised by the Canadian Environmental Assessment Agency/Impact Assessment Agency, as the *Cumulative Effects OPS* explains that "where there is little supporting data, or where there is predictive uncertainty, the assessment of cumulative effects should still be conducted."[109] The exclusion of data surrounding the habitat requirements for mosses and lichens is not only problematic for the vegetative VC assessment, but the woodland caribou assessment as well, since lichens are a part of this species' diet. CELA **requests** that the EIS include the habitat requirements for tracked bryophytes—despite the lack of data available. CELA **requests** that the proponent conduct studies of bryophyte habitat requirements to assist in filling in the gaps in knowledge.

Additionally, as mentioned for the fish and fish habitat VC discussion, avoiding redundancy is not an acceptable reason for determining vegetation VCs. Of the multiple considerations involved in selecting vegetation VCs, one consideration listed was "avoidance of redundancy with other VCs; for example, if two potential VCs represent the same attributes, mitigation actions, and potential effects from the Project, only one was evaluated as part of the assessment."[110] CELA **recommends** that any species disqualified from being included as a VC on the grounds of redundancy should be re-evaluated to ensure the cumulative effects assessment of vegetation accurately captures any potential environmental effects requiring mitigation and monitoring.

f) Wildlife and Wildlife Habitat[111]

First, a recurring theme within the Draft EIS's Cumulative Effects Assessment is the scoping of VCs through avoiding redundancy. When selecting wildlife VCs, the Draft EIS explains: "Wildlife VCs were selected to focus the assessment on the primary areas of concern with respect to the Project. In cases where effects would be similar for multiple wildlife species that use similar habitats, only one species was selected as a VC to reduce ecological and assessment

[108] Draft EIS at p. 13-13, *emphasis added*.
[109] Cumulative Effects OPS at p. 30.
[110] Draft EIS at p. 13-10.
[111] *See* Draft EIS Section 14, Wildlife and Wildlife Habitat.

redundancy."[112] CELA **reiterates** that avoiding redundancy should not be a reason when selecting wildlife VCs, and submits there can be no "ecological redundancy" when attempting to understand how an ecosystem operates, and what dynamics exist between different species within the ecosystem.

For the wildlife and wildlife habitat VC, there were 37 species considered, but only 11 were selected as VCs.[113] There were three federally listed species (northern myotis, common nighthawk, and barn swallows) which were not selected as they "are appropriately represented by other by other species."[114] CELA **submits** that federally listed species should not be excluded as VCs simply because they are represented by other species. The point of an EA is not to have the shortest cumulative effects assessment as possible; it is to ensure there is an accurate assessment of significant adverse environmental effects. When sensitive species are excluded from a cumulative effects assessment for the sake of "redundancy", crucial information to shape mitigation and monitoring is lost from the assessment equation.

In addition to federally list species excluded as VCs, CELA **submits** that there are other species worth revising as VCs to assess. For example, the river otter was excluded as a VC for the following reasons:

- They occupy similar habitats as beavers; and
- Assessments of beaver and wetland and riparian ecosystem VCs are representative of effects on river otter.[115]

The Draft EIS indicates that river otters were requested as VCs by Indigenous communities, and there has been an observed decrease in the population of furbearers (such as river otters). With these factors in mind, the river otter would be an excellent choice of a VC. CELA further **submits** that the beaver VC is not representative of the river otter, namely because a beaver is a herbivore, whereas river otters are opportunistic omnivores, whose diet preferably consists of fish.[116] As a distinct species that has an intertwined relation with the fish and fish habitat VC due to its diet, the EIS should reconsider the river otter as a wildlife VC. CELA **requests** that the listed species in Table 14.2-1 of the Draft EIS be re-evaluated to ensure the cumulative effects assessment for wildlife VCs accurately assesses how this proposed project may impact a large variety of species within the RSA.

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[112] Draft EIS at p. 14-12.
[113] Draft EIS at pp. 14-15—14-18, Table 14.2-1: Species Considered for Selection as Valued Components.
[114] Draft EIS at p. 14-11.
[115] Draft EIS at p. 14-16.
[116] Environment and Climate Change Canada, "North American river otter: non-detriment finding" (February 17, 2014) Trade in protected species: non-detriment findings, online: https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/non-detriment-findings/north-american-river-otter.html *See also*: Nature Conservancy of Canada, "Beaver" (no date), Resource Centre, online: https://www.natureconservancy.ca/en/what-we-do/resource-centre/featured-species/mammals/beaver.html

Second, when reviewing the VCs selected by the proponent, there was no identification of insects as potential VCs. According to the Terms of Reference for the Rook I Project, the initial list of VC categories identified in relation to the Environmental Risk Assessment ("ERA") included terrestrial invertebrates and aquatic invertebrates.[117] While benthic invertebrates are referenced throughout the Draft EIS in the context of assessment for fish and fish habitat modelling, [118] and insects are mentioned in passing during climate change discussions,[119] there are no identifiable insect VCs.

While insects may not necessarily deemed economically, or culturally significant, they do play key roles within ecosystems (e.g., playing a key role in food chains, especially for species like little brown myotis). Furthermore, there are a number of arthropods (insects) found on the federal Species at Risk Public Registry which are found in Saskatchewan.[120] There is no mention of any of the listed species from the Species at Risk Public Registry within the Draft EIS. CELA **seeks clarification** on whether NexGen considered insects as wildlife VCs, and whether any federally-listed arthropods were located within the RSA. If the answer to both of these questions is no, CELA **recommends** that the EIS address the absence of insects within the scoping of VCs.

Third, CELA has concerns about the woodland caribou VC. As explained in the Draft EIS, residual adverse effects to woodland caribou are predicted to be significant.[121] Habitat loss, habitat alteration, and sensory disturbance were all identified as pathways for residual effects for woodland caribou.[122]

The Draft EIS notes that the caribou in SK2 West are designated as unlikely to be self-sustaining because the amount of critical habitat available does not meet the threshold of 65% undisturbed habitat, "…even the incremental effects due to the small amount of habitat loss from the Project in SK2 West are predicted to result in a significant adverse effect on caribou in the Application Case."[123] In terms of mitigation measures, the Draft EIS states:

> A Caribou Mitigation and Offsetting Plan would be developed and implemented for the Project, whereby offsets would be used to reduce the residual effects on woodland caribou

[117] Draft EIS at Appendix 1A, p. 12, Table 1A-2: Rook I Project Concordance Table for the NexGen Energy Ltd. Rook I Project Terms of Reference (NexGen 2019).
[118] For example, mentioned at Draft EIS p. 11-1.
[119] For example, Draft EIS at p. 14-37 states: "changes in temperature may lead to increased potential for insect invasion, particularly by mountain pine beetles."
[120] Government of Canada, "Species at risk public registry, species search" (accessed October 8, 2022), online: https://species-registry.canada.ca/index-en.html#/species?ranges=3&taxonomyId=8&sortBy=commonNameSort&sortDirection=asc&pageSize=10. *Note: this search is filtered to Saskatchewan specific species.*
[121] Draft EIS at Executive Summary p. x.
[122] Draft EIS at p. 14-175.
[123] Draft EIS at p. 14-198.

> and provide a net increase in functional habitat for caribou. Offsets may be achieved through a financial mechanism, or through management actions that protect or enhance existing biodiversity. Offset requirements to date for woodland caribou in Canada have primarily focused on habitat restoration, but in some cases financial compensation.[124]

CELA has a number of concerns surrounding the mitigation measures proposed for woodland caribou. Because the Caribou Mitigation and Offsetting Plan is not readily available with the Draft EIS, there is no way to accurately gauge whether this plan would adequate mitigate the significant effects woodland caribou face with this proposed project. This plan should be provided with the EIS in order to have a complete cumulative effects assessment.

CELA also **requests** that NexGen provide details about offsetting through a financial mechanism, and how that will protect both existing and far-future woodland caribou from the environmental effects of this proposed uranium mine.

CELA **requests** clarification on how NexGen intends to balance the mitigation measures required for different VCs. For example, a wildlife and bird deterrents around contact water ponds (e.g., fences, cannons, sonic guns) would be proposed for a project-specific Environmental Protection Program,[125] meanwhile noise suppression is also proposed throughout the site[126] Given that woodland caribou are sensitive to sensory disturbance, how does NexGen balance this issue with the importance of protecting wildlife from contact water ponds by using sensory disturbance devices?

Narrow Scoping of Spatial and Temporal Boundaries

The scoping of spatial boundaries and temporal boundaries should be identified and justified clearly to ensure that potential environmental effects on selected VCs are accurately captured within the cumulative effects assessment. When reading through the Draft EIS, CELA identified a number of concerns related to various spatial boundaries and temporal boundaries identified by NexGen. CELA requests that the following recommendations and information requests be resolved within the EIS before this project undergoes further assessment.

Spatial Boundaries

When determining spatial boundaries, there are a number of different methods that may be utilized, such as: VC-centred spatial boundaries; ecosystem-centred spatial boundaries; activity-centred

[124] Draft EIS at p. 14-356.
[125] Draft EIS at Appendix 23A, Table 23A-1: Summary of Environmental Design Features and Mitigation Measures Proposed for the Project including Linkages to Management and Monitoring Programs and Plans.
[126] Draft EIS at Appendix 23A, Table 23A-3: Summary of Environmental Design Features and Mitigation Measures Proposed for the Project Pertaining to Air, Noise and Climate Change.

spatial boundaries; administrative, political, or other human-made spatial boundaries; or any other option.[127] Of these approaches, VC-centred spatial boundaries is the option that is generally recommended, as it allows for the most meaningful spatial boundaries to be drawn for the identified VCs undergoing the cumulative effects assessment.[128]

The Draft EIS indicates that NexGen opted for setting spatial boundaries for each VC or for related sets of VCs.[129] When considering the spatial boundaries identified for certain VCs within the Draft EIS, CELA identified several instances in which the scoping is too narrow and the zone of influence ("ZOI")[130] is not accurately captured. CELA requests that the EIS rectify the following spatial boundary scoping issues:

First, CELA submits that the spatial boundaries for VCs (and intermediate components) like hydrology, hydrogeology, and fish and fish habitat are too narrow. For the Hydrological assessment, for example, the local study area ("LSA") encompassed the Clearwater River watershed to Naomi Lake outlet, and the RSA encompassed the Clearwater River watershed above the Mirror River confluence.[131]

Figure 1.2-1, Location of the Rook I Project within the Draft EIS indicates the project's proximity to Lake Athabasca.[132] A map of major basins within Saskatchewan prepared by the Saskatchewan Water Security Agency indicates that the project Lake Athabasca Basin.[133] CELA **submits** that the scoping of spatial boundaries for VCs associated with water should encompass the Lake Athabasca Basin. By considering a wider watershed ZOI for these VCs, there will be a better identification of potential environmental impacts from activities within the watershed.

For example, north of the Rook I Project rests the decommissioned Cluff Lake uranium mill and mine, which is also situated within the Lake Athabasca Basin. This mine closed in 2002 and is currently in a long-term monitoring and maintenance phase.[134] This mine has been a topic of concern amongst Indigenous groups and other local communities according to the proponent's consultation and engagement opportunities: "Indigenous Groups have expressed concerns regarding potential Project effects on water quality, and have indicated that they are experiencing adverse effects from industrial developments, including mineral exploration activities and the

[127] Cumulative Effects OPS at p.. 14-16.
[128] Cumulative Effects OPS at p. 14.
[129] Draft EIS at p. 6-18.
[130] Cumulative Effects OPS at p. 14: "The ZOI sets a spatial limit beyond which the residual environmental effects of the designated project and other physical activities on a given VC are not detectable."
[131] Draft EIS at Appendix 9A Hydrological Modelling Summary Report, p. 2.
[132] Draft EIS at p. 1-20.
[133] Saskatchewan Water Security Agency, "Major Basins in Saskatchewan" (2013), map, online: https://www.wsask.ca/wp-content/uploads/2021/03/WSA_Major_Basins_M181_8_5X11.pdf
[134] Draft EIS at p. 5-11.

Cluff Lake Mine, which they believe has affected the health of the land and resources."[135] When looking at the maps of various water-centric VCs, Cluff Lake and the history of its activities are not captured within the determined RSAs.[136] CELA **submits** Cluff Lake is a physical activity that is should be considered within the context of various water-centric VCs.

Additionally, the use of the Lake Athabasca Basin as an aquatic spatial boundary for various VCs would allow projects surrounding Lake Athabasca (e.g., former projects in the Uranium City region) to be considered during the cumulative effects analysis phase.[137] Considering these projects in the context of hydrological processes ensures that cumulative effects analyses are not shaped by shifting baseline syndrome. Therefore, CELA **recommends** that certain VCs would benefit from spatial boundaries being refined ecologically (e.g., utilizing watershed boundaries).

Second, CELA requests that information be provided concerning the baseline RSA for the Vegetation VC. The Draft EIS states:

> The RSA includes the LSA, Forrest Lake, Beet Lake, Naomi Lake, and the watershed east and north of the confluence of the Clearwater and Mirror rivers as described in the hydrology assessment (Section 9.2.3, Spatial Boundaries). The RSA also overlaps the transition between the Boreal Plain and Boreal Shield ecozones and likely includes any potential variability in diversity between the two ecozones. The combined coarse- and fine-filter approach applied to the assessment of vegetation (Section 13.2.2.1, Valued Components) and wildlife VCs (Section 14.2.2.1, Valued Components) and the assessment of fish and fish habitat (Section 11.2.3, Spatial Boundaries) at the watershed scale and represents the use of both VC- and ecosystem-centred approaches to defining the RSA (CEA Agency 2018) and in determining Project effects on overall biodiversity.[138]

The RSA covers approximately 107,491 ha (1,075 km2), and is "…expected to be at a scale suitable for assessing the significance of effects on upland, wetland, riparian ecosystems and traditional use plants distributed inside the RSA.".[139] The Draft EIS provides a map displaying the vegetation baseline and assessment study areas at Figure 13.2-1.[140] When comparing the Vegetation RSA with the baseline RSA used by Omnia Ecological Serves (Omnia) to conduct

[135] Draft EIS at p. 8-61 (Hydrogeology Section).
[136] See for example, Draft EIS at pp. 11-23—11-24: Figures 11.2-1 and 11.2-2 highlight the Aquatic Environment Baseline Study Area and the Fish and Fish Habitat Assessment Study Areas in the context of the Fish and Fish Habitat VC.
[137] Saskatchewan Geological Survey (2022): Resource Map of Saskatchewan, 2022 Edition; Saskatchewan Ministry of Energy and Resources, Saskatchewan Geological Survey, Miscellaneous Report 2022-1, online: https://publications.saskatchewan.ca/api/v1/products/84143/formats/112504/download
[138] Draft EIS at p. 13-16.
[139] Draft EIS at p. 13-15.
[140] Draft EIS at p. 13-18.

vegetation surveys, there is a large size discrepancy in the boundaries of these two different RSAs. The baseline LSA used by Omnia includes the entire footprint of the assessment LSA.[141]

The Draft EIS notes "Baseline study areas were selected with limited knowledge of the precise location and layout of the Project footprint to be used in the assessment. As a result, the baseline study areas are different than the spatial boundaries or assessment study areas defined for the EA, which were based on more recent and detailed Project design information."[142] CELA **submits** that there is a drastic difference between the baseline RSA and the assessment RSA, which impacts the understanding of the existing environmental conditions within the vegetation VC's RSA. While having limited knowledge of precise location and layout of the Project during the baseline study stage is somewhat understandable, this degree of variance in study area size impacts the accuracy of the cumulative effects assessment conducted for the vegetation VC. Vegetation plays a key role in ecosystem health, and interacts with. Numerous VCs selected for this project.

Therefore, CELA **requests** a revised baseline study for the vegetation VC be conducted to accurately reflect the established RSA. CELA **submits** the EA process for this Project should be paused until a more accurate cumulative effects assessment is conducted for the vegetation VC, following the revised baseline study within the vegetation RSA.

Temporal Boundaries

When determining temporal boundaries, there are a number of different methods that may be utilized, such as: VC-centred temporal boundaries; ecosystem-centred temporal boundaries; activity-centred temporal boundaries; or any other option.[143] The Activity-centred temporal boundary option may help inform the setting of temporal boundaries, but it should not be used in isolation: Focusing purely on physical activities for setting temporal boundaries may create a number of issues:

- time horizons of physical activities may not align well with consequential environmental effects on VCs (i.e., the lag time it might take a VC to respond to or recover from an environmental effect may extend beyond the phases of physical activities);
- this approach may not reflect natural variation in the VC over time, or its continuing evolution in response to effects from current or past physical activities; and
- temporal boundaries could stretch too far into the past or future, requiring extra effort to support the analysis, or may require information that cannot be obtained, as

[141] Draft EIS at p. 13-15: there is even 1.6km buffer to the preliminary Project site layout for the scoping of the baseline LSA, meaning that all of the LSA and then some is captured by baseline studies.
[142] Draft EIS at p. 13-16.
[143] Cumulative Effects OPS at pp. 19-20

> uncertainty generally increases the farther into the future the temporal boundary is extended.[144]

The Draft EIS provides the following rationale for temporal boundary scoping:

> The temporal scope of the EA focuses on the 43-year period from initial Construction to the end of Decommissioning and Reclamation (i.e., Closure). The temporal scope of the EA is intended to evaluate the shorter- and longer-term changes from the Project and the associated Project-specific and cumulative effects on biophysical, cultural, and socio-economic environments.[145]

While the temporal scope varies by VC, the minimum temporal boundary for the EA is defined by the Construction, Operations, and Closure [which consists of an Active Closure phase and a Transitional Monitoring phase] Phases.[146] Furthermore, the Draft EIS states: "in certain circumstances, the duration of effects may extend beyond specific phases of the Project, including Closure, depending on the physical, biological, social, and/or cultural properties and resilience of VCs and intermediate components."[147]

CELA **submits** the Proponent's focus on activity-based temporal boundaries is not appropriate for the Rook I Project, as the environmental effects of a uranium mine require monitoring in perpetuity to protect future generations from radiological impacts.[148] This is precisely one of the issues pointed out within the *Cumulative Effects OPS*—temporal boundaries could stretch too far into the past or future.

While the Draft EIS also notes that "the temporal boundaries used in the EA were specific to the VCs and intermediate components and considered the identified Project phases,"[149] the emphasis of temporal boundaries is grounded within the 43-year scope of the Project's phases, and less so on the VCs being assessed.

For example, for wildlife VCs, the temporal boundaries are project-centric, focusing on the 43-year phase timeline. For woodland caribou, the Draft EIS predicts that effects from habitat loss are predicted to be reversible 40 years after the Active Closure Stage when reclaimed areas have reached defined critical habitat for caribou.[150] Habitat availability, habitat distribution, and survival and reproduction are anticipated to be reversible effects, and NexGen claims that "overall,

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[144] Draft EIS at p. 20.
[145] Draft EIS at. pp. 6-18—6-19.
[146] Draft EIS at p. 6-19.
[147] Draft EIS at p. 6-19.
[148] Draft EIS at p. 6-19, the Draft EIS relies on far-future scenarios for effects that extend beyond the specific phases of the project (i.e., environmental releases more than 5000 years in the future).
[149] Draft EIS at p. 6-19.
[150] Draft EIS at p. 20-6, Table 20.3-1: Summary of Residual Project and Cumulative Effects.

the Project is predicted to contribute little to the existing cumulative effects on caribou."[151] The reversibility of survival and reproduction effects do not neatly fit within the activity-focused temporal boundary timeframe. This is one of the issues with an activity-centred temporal boundary: "time horizons of physical activities may not align well with consequential environmental effects on VCs."[152]

In the case of woodland caribou, the temporal boundary scoping would be better suited through the VC-centred option: "determining temporal boundaries according to each selected VC enables an examination of the unique characteristics of environmental effects on VCs and takes into account the VC's natural variation over time."[153] Therefore, taking this approach to scoping woodland caribou temporal boundaries would better consider the behavioural changes in the caribou associated with Project activities, estimating a recovery period for caribou to feel comfortable returning to the (potentially) restored habitat.

CELA **recommends** that the cumulative effects assessment for the EIS revisit the temporal boundaries of different VCs, and apply more VC-centric or ecosystem-centric modelling for temporal boundaries. The application of an activity-centric temporal boundary arises in too many issues due to the complex timeline of a uranium mine's potential environmental effects which exceed the 43-year operation timeline.

Another issue arising from the scoping of spatial and temporal boundaries is the exclusion of potential physical activities. The Draft EIS notes that there are approximately 92 active mineral dispositions that have been granted to twelve companies which are located within, or partially overlap, with the Project's LSA for other land and resource use VCs, including the project and Fission's mineral dispositions, which are proposed for development.[154] These active mineral dispositions are not included in the Project's assessment of potential physical activities for the cumulative assessment of VCs, because the Draft EIS comments: "although mineral dispositions are in the area, they do not necessarily lead to the development of resources due to the many factors that exist (e.g., resource geology, environment, technical and economic feasibility, markets)."[155]

The exclusion of these dispositions from this project's EA does not align with the rationale for the Rook I Project to be approved; NexGen alleges there is a need for uranium,[156] therefore one would assume that these twelve companies would be interested in exploration processes to potentially develop resources that are allegedly desired in local and global markets.

[151] Draft EIS at p. 20-6, Table 20.3-1: Summary of Residual Project and Cumulative Effects.
[152] Cumulative Effects OPS at p. 20.
[153] Cumulative Effects OPS at p. 19.
[154] Draft EIS at Section 17 Executive Summary, p. ii.
[155] Draft EIS at p. 1-19.
[156] Draft EIS at p. 1-15.

CELA **submits** that given these mineral dispositions would be consistent with the long-term economic of financial assumptions made for the Rook I Project's planning purpose (i.e., the need to produce uranium for market demand),[157] these future physical activities (i.e., future mines) could be considered reasonably foreseeable and should be included in the cumulative effects assessment. They are situated within the LSA for other land and resource use VC (and would likely fall within other VC LSAs or RSAs), and given NexGen's claim of urgent need for uranium, development (even early development) of resource extraction for these mineral dispositions would likely fall within the Rook I Project's temporal boundaries.

Recommendation 9: The components identified as "intermediate components" need to be assessed in the same manner as "valued components" and must undergo the full 5-step framework for conducting a cumulative effects assessment.

Recommendation 10: "Avoiding redundancy" is not an acceptable reason for excluding fish species from VC scoping, and when selecting fish VCs, rationale come from a balancing of the recommended lines of reasoning: primary data collection, computer modelling, literature references, public consultation, expert input or professional judgement. As a result, the scoping of fish species VCs needs to be restarted to ensure that the cumulative effects assessment accurately captures the potentially adverse environmental effects that would require mitigation and monitoring.

Recommendation 11: The EIS should provide an updated cumulative effects assessment for fish and fish habitats to reflect proper selection of fish VCs.

Recommendation 12: The proponent should re-evaluate its confidence level of moderate to high in assessing cumulative effects on vegetation VCs, as this determination likely arose from a faulty conclusion based on uncertain climate change assumptions.

Recommendation 13: Any vegetation species disqualified from being included as a VC on the grounds of redundancy should be re-evaluated to ensure the cumulative effects assessment of vegetation accurately captures any potential environmental effects requiring mitigation and monitoring.

Recommendation 14: Any wildlife species disqualified from being included as a VC on the grounds of redundancy should be re-evaluated to ensure the cumulative effects assessment of wildlife and wildlife habitat accurately captures any potential environmental effects requiring mitigation and monitoring.

[157] Cumulative Effects OPS at p. 26.

Recommendation 15: Federally listed wildlife species (northern myotis, common nighthawk, and barn swallows) should not be excluded from VCs on the grounds of "appropriate representation" by other species.

Recommendation 16: The EIS should be updated with cumulative effects assessment scoping for potential insect VCs.

Recommendation 17: The Caribou Mitigation and Offsetting Plan needs to accompany the EIS in order to determine mitigation measures will effectively reduce residual effects on woodland caribou.

Recommendation 19: The scoping of spatial boundaries for VCs associated with water should encompass the Lake Athabasca Basin.

Recommendation 20: Certain VCs would benefit from spatial boundaries being refined ecologically (e.g., utilizing watershed boundaries), and the proponent should assess whether certain ecological boundaries need to be utilized to provide a more fulsome scope of potential physical activities that may interact cumulatively with the proposed project.

Recommendation 21: The EA process for this Project should be paused until a more accurate cumulative effects assessment is conducted for the vegetation VC, following the revised baseline study within the vegetation RSA.

Recommendation 22: The cumulative effects assessment for the EIS should revisit the temporal boundaries of different VCs, and apply more VC-centric or ecosystem-centric modelling for temporal boundaries. The application of an activity-centric temporal boundary arises in too many issues due to the complex timeline of a uranium mine's potential environmental effects which exceed the 43-year operation timeline.

Recommendation 23: The 92 mineral dispositions located in close proximity to the Rook I Project site should be considered reasonably foreseeable physical activities (future mines), and should therefore be included in the cumulative effects assessment for the Rook I Project.

Information Request 4: NexGen should provide estimates for the GHG emissions associated with flights and off-site transportation, as well as estimates on the number of anticipated flights annually during the project's operations.

Information Request 5: There should be a re-assessment of potential pathways from the proposed Fission Patterson Lake South Property on the terrain and soils cumulative effects assessment, to ensure the precautionary principle is being adhered to.

Information Request 6: The EIS should include the habitat requirements for tracked bryophytes—despite the lack of data available.

Information Request 7: The proponent should conduct studies of bryophyte habitat requirements to assist in filling in the gaps in knowledge.

Information Request 8: The EIS should re-assess the wildlife VCs and include the following species as VCs:

(a) Northern myotis;
(b) Common nighthawk;
(c) Barn swallow; and
(d) River otter.

This is not an exhaustive list of species to reconsider as VCs; the EIS should provide an updated assessment for selecting wildlife VCs that aligns with cumulative effects assessment scoping guidelines.

Information Request 9: NexGen should provide clarification on whether insects were as wildlife VCs, and whether any federally-listed arthropods were located within the RSA.

Information Request 10: NexGen should provide details about offsetting through a financial mechanism, and how that will protect both existing and far-future woodland caribou from the environmental effects of this proposed uranium mine.

Information Request 11: Seeking clarification on how NexGen intends to balance the mitigation measures required for different VCs (e.g., woodland caribou sensory disturbance reduction vs. detracting wildlife from contact water ponds via cannons or sonic guns).

Information Request 12: A revised baseline study for the vegetation VC should be conducted to accurately reflect the established RSA

2. Inadequate Assessment of Accidents and Malfunctions

Another enumerated factor within *CEAA 2012* that must be taken into account is the environmental effects of malfunctions and accidents, which is set out in subsection 19(1)(a):

> **19(1)** The environmental assessment of a designated project must take into account the following factors:
>
> > **(a)** The environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and any cumulative environmental effects that are likely to result from the

> designated project in combination with other physical activities that have been or will be carried out;[158]

The CNSC provides specific guidelines within REGDOC-2.9.1 to ensure proponents undergoing a *CEAA 2012* environment assessment are properly assessing malfunctions and accidents.[159] CELA **submits** the assessment of malfunctions and accidents within the Draft EIS are inadequate, and fail to capture the potential health and environmental effects resulting from postulated radiological and conventional malfunctions or accidents.[160]

The Draft EIS ought to provide a description of postulated malfunction and accident sequences leading to radiological or non-radiological (conventional) releases.[161] The Draft EIS claims there were 93 accident and malfunction hazard scenarios were identified and evaluated in the "hazard identification analysis."[162] The full list of these hazards is provided in Appendix A of the "Accidents and Malfunctions for the Rook I Project- Technical Support Document" ("TSD VIII"), which identifies the for each hazard: the accident/malfunction; the phase when it could occur; the consequence; the existing safeguards/design features; the likelihood; the severity; its risk ranking/significance; and the screening decision/rationale. [163]

While these 93 hazards were identified, not all of them were subjected to further assessment such that a more detailed evaluation risk and potential management activities could be considered.[164] Instead, NexGen reviewed these hazard scenarios to select bounding scenarios: "the approach for selecting bounding scenarios focused on key accidents or malfunctions that were equal to, or exceeded the potential severity of, other possible scenarios that could occur. This approach maintained an appropriate level of conservatism in the assessment while avoiding redundancies."[165] NexGen selected six hazard scenarios as bounding scenarios:

1. An aquatic (i.e., to water) release of uranium concentrate and radioactivity from a traffic accident at or near the access road bridge crossing of the Clearwater River.
2. An aquatic release of fuel or hazardous chemicals from a traffic accident at or near the access road bridge crossing of the Clearwater River.

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[158] *CEAA 2012* at s. 19(1)(a), *emphasis added.*
[159] CNSC, REGDOC-2.9.1, Version 1.2 at Appendix A, section A.3.4, Malfunctions and Accidents.
[160] CNSC, Generic Guidelines at s. 9.4.1.
[161] CNSC, REGDOC-2.9.1, Version 1.2 at Appendix A, section A.3.4, Malfunctions and Accidents.
[162] Draft EIS at Section 21, Accidents and Malfunctions Executive Summary p. ii.
[163] Ecometrix Incorporated, "Accidents and Malfunctions for the Rook I Project- Technical Support Document" (May 2, 2022), online: https://www.ceaa-acee.gc.ca/050/evaluations/document/144426, at Appendix A pp. 3.2-3.24 [**TSD VIII**]
[164] Draft EIS at Section 21, Accidents and Malfunctions Executive Summary p. ii.
[165] Draft EIS at Section 21, Accidents and Malfunctions Executive Summary p. ii.

3. An atmospheric (i.e., to air) release of uranium and radioactivity from a fire or explosion involving equipment or vessels containing uranium-bearing solutions in the solvent extraction building.
4. A terrestrial (i.e., to ground) release of uranium and radioactivity from a tailings transfer pipe or pump failure at surface.
5. A terrestrial release of uranium and radioactivity from untreated effluent transfer pipe failure at the surface.
6. An atmospheric release of sulphur dioxide from an acid plant tail gas scrubber failure.[166]

CELA **submits** that the process for reviewing the 93 potential accidents/malfunctions is insufficient, and ignores the principles set out in REGDOC-2.9.1.

First, by classifying certain accidents/malfunctions as low risk, or ALARP (as low as reasonably practicable), moderate risk, most identified accidents/malfunctions do not contain additional environmental information because it was deemed that these hazards would not undergo further assessment. For instance, REGDOC-2.9.1 explains: "the EIS should include source, quantity, mechanism, pathway, rate, form and characteristics of contaminants and other materials (physical and chemical) likely to be released to the surrounding environment during the postulated malfunctions and accidents."[167]

After reviewing Appendix A within TSD VIII. CELA compiled a sample of accident/malfunction scenarios (see **Figures 2, 3, and 4**, below) that did not undergo further assessment, despite having high severity scores.[168]

Figure 2: Table 3-10: Hazard Identification Evaluation – Tailings Transfer Pipe and UGTMF[169]

Table 3-10: Hazard Identification Evaluation – Tailings Transfer Pipe and UGTMF

ID#	Accident/Malfunction	Phase or Stage	Consequence	Existing Safeguards / Design Features	L	S	RR / Significance	Screening Decision / Rationale
10.1	Failure of tailings cell containment	OP / ADR	Potential for groundwater contamination	Engineered Design Groundwater monitoring	1	5	ALARP, moderate	Best practice in tailings management and highly unlikely event resulting in ALARP, Inherent Safety, no further assessment
10.2	Tailings transfer pipe or pump failure	OP / ADR	Potential for soil / groundwater contamination	The pipe is in a secondary containment Groundwater monitoring Routine inspection and maintenance Emergency response plan	3	3	ALARP, moderate	Recommended for further assessment

OP = Operation; ADR = Active Decommissioning and Reclamation; L = likelihood; S = severity; RR = risk ranking; ALARP = As Low as Reasonably Practicable.

[166] Draft EIS at Section 21, Accidents and Malfunctions Executive Summary p. ii.
[167] CNSC, REGDOC-2.9.1, Version 1.2 at Appendix A, section A.3.4, Malfunctions and Accidents.
[168] TSD VIII at Appendix A, pp. 3.13, 3.15, 3.17.
[169] TSD VIII at Appendix A, p. 3.13.

Figure 3: Table 3-12: Hazard Identification Evaluation – Ore, Special, and Potentially Acid Generating Waste Rock Stockpiles[170]

12.4	Uncontrolled leachate / seepage release through lining failure	CO / OP / ADR	Discharge of contaminants into the environment	Regular inspection and maintenance of lining Groundwater monitoring Spill response plan	1	4	ALARP, moderate	Best management practice results in ALARP, highly unlikely event, no further assessment

Figure 4: Table 3-14: Hazard Identification Evaluation – Ponds and Retention Berms[171]

Table 3-14: Hazard Identification Evaluation – Ponds and Retention Berms

ID#	Accident/Malfunction	Phase or Stage	Consequence	Existing Safeguards / Design Features	L	S	RR / Significance	Screening Decision / Rationale
14.1	Pond overtopping	OP / ADR	Contaminant and radioactivity release	Ponds to have capacity for a 24-hour probable maximum precipitation or 1 in 100 year event Process control Surface water management Ambient monitoring Spill and emergency response plan	2	3	Low	Low risk, low probability event, no further assessment
14.2	Pond containment or embankment failure	OP / ADR	Contaminant and radioactivity release	Regular inspection and maintenance program Surface water management Ambient monitoring Spill and emergency response plan	1	5	ALARP, moderate	Best engineering practice in maintenance and inspection of the containment systems and berms. No further assessment
14.3	Pond lining failure and leakage	OP / ADR	Contaminant and radioactivity release	Groundwater monitoring Hydraulic containment with a separate well	2	4	ALARP, moderate	Best engineering practice in maintenance, no further assessment
14.4	Surface flooding	OP / ADR	Contaminant and radioactivity release	Ponds to have capacity for a 24-hour probable maximum precipitation event Process control Surface water management Ambient monitoring Spill and emergency response plan	1	3	Low	Low risk, low probability event, no further assessment

OP = Operation; ADR = Active Decommissioning and Reclamation; L = likelihood; S = severity; RR = risk ranking; ALARP = As Low as Reasonably Practicable.

For example, **Figure 4** indicates that pond contaminant or embankment failure would result in contaminant and radioactivity release, which is a catastrophic consequence.[172] However, because of "best engineering practice in maintenance and inspection of the containment systems and berms," it was established that there would be no further assessment of this hazard. While the likelihood of this scenario happening is low, accidents and malfunctions still happen. But due to the assessment process provided within the Draft EIS, there are no details surrounding the quantities, rate, form or characteristics of contaminants and other materials (physical and chemical) likely to be released to the surrounding environment during this accident or malfunction.

CELA **strongly recommends** the EIS be updated to provide include source, quantity, mechanism, pathway, rate, form and characteristics of contaminants and other materials (physical and chemical) likely to be released to the surrounding environment during the 93 postulated malfunctions and accidents, pursuant to REGDOC-2.9.1.

Second, CELA **cautions** against the Draft EIS utilization of "bounding scenarios" within the assessment of accidents and malfunctions. When assessing radiological accidents and malfunctions, REGDOC-2.9.1 explains that:

[170] TSD VIII at Appendix A, p. 3.15.
[171] TSD VIII at Appendix A, p. 3.17.
[172] TSD VIII at Appendix A, p. 2.2.

> The applicant can use a bounding approach or use facility- or activity-specific information (for example, design, operation, projected environmental releases) in the assessment of radiological accidents and malfunctions. If a bounding approach is used, the applicant should provide a detailed rationale for the selection of each bounding scenario.[173]

NexGen's selection of bounding scenarios for both radiological and non-radiological accidents/malfunctions results in an oversimplification of the 93 identified hazard scenarios. In the Draft EIS, bounding scenarios are described as events for which "…the potential effects are considered to represent those associated with similar accident and malfunction scenarios; or, alternatively, the potential effects of scenarios that are bounded by another scenario are expected to fit within the scope of those associated with the bounding scenario."[174]

The sheer volume of hazards identified by NexGen indicate that a bounding scenario approach is not appropriate for assessing the accidents and malfunctions associated with this project. To better capture the extent of the potential environmental risks that would arise from Rook I Project accidents/malfunctions, CELA **submits** this assessment would have been better suited by reviewing and assessing both facility-specific information (e.g., UGTMF operations) and activity-specific information (radioactive waste management), depending on the situation. CELA **recommends** not adopting a bounding approach, and revising the EIS using a different approach for assessing accidents and malfunctions to ensure all identified accident/malfunction scenarios are adequately reviewed.

Recommendation 24: The EIS be updated to provide include source, quantity, mechanism, pathway, rate, form and characteristics of contaminants and other materials (physical and chemical) likely to be released to the surrounding environment during the 93 postulated malfunctions and accidents, pursuant to REGDOC-2.9.1.

Recommendation 25: The sheer volume of hazards identified by NexGen indicate that a bounding scenario approach is not appropriate for assessing the accidents and malfunctions associated with this project. The EIS should not use a bounding approach, and should be revised to use a different approach for assessing accidents and malfunctions to ensure all identified accident/malfunction scenarios are adequately reviewed.

[173] CNSC, REGDOC-2.9.1, Version 1.2 at Appendix A, section A.3.4, Malfunctions and Accidents.
[174] Draft EIS at p. 21-13.

3. Alternative Means Analysis

The alternative means of carrying out the designated project is another enumerated factor in *CEAA 2012* which requires consideration within the EA, as set out in section 19(1)(g):

> **19(1)** The environmental assessment of a designated project must take into account the following factors:
>
> > **(g)** alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means;

The former Canadian Environmental Assessment Agency ("CEA Agency") defines "alternative means" as: "the various technically and economically feasible ways under consideration by the proponent that would allow a designated project to be carried out."[175] Addressing alternative means for a project should consider: the characteristics of the project; the environmental effects associated with the potential alternative means; the health or status of VCs that may be impacted by the alternative means; the potential for mitigation and the extent to which mitigation measures may address potential environmental effects; and the level of concern expressed by Indigenous groups or the public.[176]

When considering the alternative means of carrying out a designated project, there are four steps that should be followed:

1. Identify all technically and economically feasible alternative means;
2. List their potential effects on valued components;
3. Select the approach for the analysis of alternative means (i.e., identify the preferred means); and
4. Assess the environmental effects of alternative means (i.e., focus the analysis on the environmental effects of the preferred means).[177]

CELA **submits** the discussion of alternative means for the Rook I Project is insufficient, and does not fully address the environmental effects associated with the potential alternative means. The 4-Step process identified by the CEA Agency for considering the alternative means for this project should be used in the EIS. This ensures there is a robust assessment of how different alternatives will affect the environment. Table 4.4-2 within the Draft EIS provides the categories and key

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[175] Canadian Environmental Assessment Agency (CEA Agency), *"Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012*, (2015), online: https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/addressing-purpose-alternative-means-under-canadian-environmental-assessment-act-2012.html [**CEA Agency, "Alternative Means"**].
[176] CEA Agency, "Alternative Means".
[177] CEA Agency, "Alternative Means".

considerations for evaluating alternatives assessments. It identifies four assessment categories: environmental considerations; technical feasibility; economic feasibility; and social considerations.[178]

The key considerations for "environmental considerations" are not specific enough to fulfill Step 2 requirements for identifying the potential effects on VCs. The environmental considerations identified in the Draft EIS include: how do the likely effects on the aquatic, terrestrial, or atmospheric environments compare; and can the alternative be constructed, operated, and decommissioned in a manner that provides long-term protection of ecological health?[179] According to the CEA Agency, when completing Step 2 of the alternative means assessment, the proponent should:

- Identify the key VCs potentially affected by each alternative means. The end result is an understanding of what VCs should be retained for analysis given the nature of the alternative means under consideration.
- Examine briefly the potential effects on the VCs for each alternative means. The intent is to relate the alternative means under consideration with their potential effects on key VCs. A full assessment of environmental effects is not necessary at this stage.

The intent is to develop a sufficient understanding of potential environmental effects of the alternative means under consideration to inform the selection of an approach in Step 3 and subsequently, to serve in scoping the assessment of environmental effects in Step 4.[180]

In the context of environmental considerations, the Draft EIS identifies ecological integrity, hydrologic regime, and air quality as "assessment sub-categories."[181] However, no VCs are identified for the assessment of each alternative means.

For example, Table 4.5-33 in the Draft EIS presents the alternatives assessment for Sewage Treatment Technology in the environmental assessment category, the sub-criteria identified was the potential to affect Lake Patterson, surface water, or groundwater.[182] For this assessment, there were three options assessed, and the Table 2 below provides the environmental considerations for each option:

[178] Draft EIS at p. 4-11.
[179] Draft EIS at p. 4-11.
[180] CEA Agency, "Alternative Means", *emphasis added*.
[181] Draft EIS at. p. 4-1: "sub-categories were not used in an assessment if considered non-differentiating for the alternatives being evaluated."
[182] Draft EIS at p. 4-97.

Table 2: Environmental Assessment of Sewage Treatment Technology Alternative Means

Sewage Treatment Technology Option	Environmental Assessment
Sewage Lagoon [selected alternative]	- Larger footprint required - Treated effluent quality acceptable for environmental discharge
Membrane Bioreactor (MBR)	- Better treated effluent quality - Smaller footprint - Potential reduction in water supply and discharge volumes due to reuse of treated sewage effluent in process plant
MBR with nanofiltration (NF) or reverse osmosis (RO)	- Best treated effluent quality - Smaller footprint - Potential reduction in water supply and discharge volumes due to reuse of treated sewage effluent in process plant

As this summary in **Table 2** shows, there is no identification of key VCs (i.e., fish and fish habitat); instead, NexGen references a catch-all of surface water or groundwater. The Draft EIS does mention that certain alternatives assessments used a different assessment approach (an MAA assessment). These assessments were for complex alternatives with high interdependencies and/or potential significance to achieving Project success, such as mine waste (i.e., tailings, gypsum, and waste rock), effluent treatment plant technology, and conventional and demolition waste disposal.[183]

In considering NexGen's mine waste storage assessment, there is a breakdown of the criteria for the environmental sub-categories. For instance, the ecological integrity sub-category includes "potential effect on plant, fish, and other wildlife population and habitat during construction, operation, and closure."[184] However, these are still high-level references to VCs like fish. And when the actual alternatives assessment for mine waste storage is reviewed at Table 4.5-9 in the Draft EIS, the ecological integrity assessment for the selection option (underground with paste at location U-4), is vaguely summarized as: "lease surface disturbance area and potential to affect the environment."[185]

CELA **submits** the vague and inconsistent references to VCs within the alternative means assessments fail to develop a sufficient understanding of potential environmental effects of the alternative means under consideration, and CELA **recommends** the alternative means assessment within the EIS carefully assess potential effects on VCs.

[183] Draft EIS at p. 4-13.
[184] Draft EIS at p. 4-38.
[185] Draft EIS at p. 4-39.

In terms of one of the alternative means assessed in the Draft EIS, CELA is seeking more information concerning the selected alternative means. For the power supply type assessment, there were four alternatives considered:

- Grid power;
- In-site diesel power plant;
- On-site liquified gas (LNG) power plant; and
- On-site hybrid system (LNG power plant and renewable energy supply).[186]

After conducting the alternative means analysis, NexGen selected the "on-site LNG power plant". The Draft EIS also explains:

> A feasibility study was conducted to assess the economic viability of alternative energy options (Stantec 2019). In that study, economically viable combinations of numbers and sizes of generators, wind turbines, solar cells, and batteries were identified and assessed in terms of net present cost. Results of the study indicated that a hybrid system would be more economically attractive than connecting to the existing power grid. Results also indicated that the combination of generator (assumed to be LNG) and wind turbines would be the most attractive type of hybrid system. Further study is ongoing to confirm the potential of integrating a hybrid power system at the Project.[187]

According to *the Net-Zero Framework* for the Rook I Project, on-site electricity generation would account for 59.3% of the Project's annual GHG emissions.[188] With NexGen's stated interest in reducing GHG emissions, transitioning to a hybrid system would be the goal to pursue. To gain a better understanding of the on-site hybrid system alternative and the economic considerations set out in the Draft EIS,[189] CELA request that the following feasibility studies be made available for the public to review:

- SLR Consulting (Canada) Ltd. 2021. Renewable Energy Scoping Study for Mining Operations. Prepared for NexGen Energy, Arrow Development – Rook I Project.

- Stantec Consulting Ltd. 2019. Alternative Energy Assessment, Arrow Deposit, Rook I Project. Prepared for NexGen Energy Ltd.

[186] Draft EIS at p. 4-60.
[187] Draft EIS at pp. 4-60—4-61.
[188] TSD XII at p. 3.
[189] Draft EIS at p. 4-11 provides the following economic feasibility considerations: How does the total cost of each alternative over the Project lifespan compare to the other(s)?; Are the costs of the alternative supportable within the current funding framework?; and Are the costs of the alternative well defined and sustainable through the Project lifespan?

Recommendation 26: The 4-Step process identified by the CEA Agency for considering the alternative means for this project should be used in the EIS.

Recommendation 27: The vague and inconsistent references to VCs within the alternative means assessments fail to develop a sufficient understanding of potential environmental effects of the alternative means under consideration, and therefore the alternative means assessment within the EIS carefully assess potential effects on VCs.

Information Request 13: To gain a better understanding of the on-site hybrid system alternative and the economic considerations set out in the Draft EIS, the following feasibility studies should be made available for the public to review:

- SLR Consulting (Canada) Ltd. 2021. Renewable Energy Scoping Study for Mining Operations. Prepared for NexGen Energy, Arrow Development – Rook I Project.
- Stantec Consulting Ltd. 2019. Alternative Energy Assessment, Arrow Deposit, Rook I Project. Prepared for NexGen Energy Ltd.

C. Procedural Issues

The following section addresses procedural issues that impact the quality of the EA process being conducted for the Rook I Project. Here, CELA provides recommendations for ensuring that the EA process is transparent, inclusive, informed, and meaningful.[190]

1. Accessibility of the Draft EIS Document

CELA's first procedural issue concern is that of the presentation of NexGen's EA findings. According to the *Generic Guidelines* prepared by the CNSC,

> One of the purposes of the EA identified in the CEAA 2012 is to ensure opportunities for meaningful public participation during an EA. The CNSC ensures that the public is provided with opportunities to participate in the EA. Meaningful public participation is best achieved when all parties have a clear understanding of the proposed project as early as possible in the review process. The proponent is required to provide current information about the project to the public and especially to the communities likely to be most affected by the project.[191]

One of the barriers to having meaningful public participation is the lack of informed participation. The *Building Common Ground Final Report* emphasized that the information regarding proposed activities and the assessment processes must be easily accessible and understandable for members

[190] Expert Report at pp. 13-14.
[191] CNSC, Generic Guidelines at s. 2.3, *emphasis added*.

of the public, stakeholders and Indigenous Peoples.[192] In particular, participants in the *Building Common Ground Final Report* study found that, "…it is sometimes difficult to access complete and thorough information to review; and it is often difficult to understand the information that is provided, especially for lay persons looking to review long technical documents without in-house expertise.[193]

In the context of the Rook I Project's Draft EIS, it is a large document—both in page number and file size. CELA **recommends** the EIS document be uploaded into multiple PDFs, broken down by section (in addition to uploading the EIS as one whole document). There are several reasons why this would improve the informed participation of this EA.

First, by having multiple, smaller pdf documents, it is much easier for individuals with slow internet or older electronic devices to download and review the elements of the EIS that they are concerned about.

Second, it allows readers to conduct key-word searches in different documents without overloading the processing power of whatever device is being used to access the EIS.

Third, having smaller documents makes approaching the EIS less daunting for individuals, be it a member of the public or subject matter expert, to navigate the Draft EIS and areas of interest. Multiple documents would provide greater ease to those interested in reviewing the Draft EIS.

Other **recommendations** to build informed participation within this Project's EA include the following:

- Upload a "Master Index" so that interested parties can have an overview of where certain topics are covered throughout the EIS.
- Upload a document that provides hyperlinks to the various Technical Study Documents referenced throughout the EIS. This simplifies the process of locating these documents on the EA registry for the Rook I Project.
- PDFs should not be "locked". Currently, the Draft EIS is locked, which prohibits text from being copied in the document to be pasted elsewhere. By preventing this simple action from being done, it creates a barrier for concerned parties to engage with content in the EIS by compiling verbiage that is of concern. For example, the block-quote references throughout this submission could not be copy-pasted, and had to be typed out verbatim. This is an accessibility barrier, and an unfair presentation of information.

[192] Expert Report at p. 40.
[193] Expert Report at p. 40.

Recommendation 28: the EIS document should be uploaded into multiple PDFs, broken down by section (in addition to uploading the EIS as one whole document).

Recommendation 29: Upload a "Master Index" so that interested parties can have an overview of where certain topics are covered throughout the EIS.

Recommendation 30: Upload a document that provides hyperlinks to the various Technical Study Documents referenced throughout the EIS. This simplifies the process of locating these documents on the EA registry for the Rook I Project.

Recommendation 31: PDFs uploaded by the proponent should not be "locked," prohibiting the copying and pasting of text.

2. CNSC as an Authority for Federal EA

To ensure that the Environmental Assessment process for the Rook I Project—including the review of the Draft (and Final) EIS documents—is conducted in a manner that reflects the purpose of protecting the environment from significant adverse environmental effects, the intervenor is compelled to address the role of the CNSC as the federal authority for this EA.

As the federal authority responsible for conducting the EA process for this Project under *CEAA 2012*, the CNSC must comply with *CEAA 2012*'s mandate, which states:

> **4(2)** The Government of Canada, the Minister, the Agency, federal authorities and responsible authorities, in the administration of this Act, must exercise their powers in a manner that protects the environment and human health and applies the precautionary principle.[194]

CELA **reiterates** the importance of CNSC exercising its powers to protect the environment and human health in the context of this environmental assessment. Adhering to this mandate is essential in preventing the further erosion in the public's trust of the CNSC ability to responsibly conduct EAs.

The lack of public trust and confidence in the CNSC acting as an environmental assessment regulator arises from the structure of the CNSC-led EAs of designated nuclear projects, where public interest participants have found the process to be narrowly-focused, insufficiently robust and procedurally unfair.[195] In particular, the *Building Common Ground Final Report* identified

[194] *CEAA 2012* at s.4(2), emphasis added.
[195] Kerrie Blaise, Theresa McClenaghan and Richard Lindgren, "Nuclear Law, Oversight and Regulation: Seeking Public Dialogue and Democratic Transparency in Canada" in Black-Branch J., Fleck D. (eds) Nuclear Non-

public concerns grounded in a perceived lack of independence and objectivity due to the close relationship between the CNSC and the nuclear industry which it promotes.[196]

Members of the public also cited concerns that "….industry-specific regulatory agencies are more focused on technical issues than they are on the planning process that is fundamental to a thorough IA. Participants felt the issues were not properly assessed and were put off to the post-decision regulatory phase."[197] CELA **urges** the CNSC to refrain from delaying the assessment of issues to the post-regulatory phase; the fundamental scoping and planning processes must be carefully considered before making an EA decision on this project.

Public trust and confidence in the environmental assessment process for the Rook I Project is crucial to all parties, and an absence of it de-legitimizes any outcomes from the assessment process.[198] In this case, the CNSC must conduct its review process in a manner that is transparent and in line with the purpose of *CEAA 2012*.

CELA **urges** the CNSC carefully consider the critiques and recommendations within this submission to ensure the Draft EIS and its future iteration accurately reflect the necessary factors that must be assessed to protect the environment and human health from significant adverse environmental effects that may arise from the proposed Rook I Project.

As has been previously raised by CELA, there remains a need for legislative review of *Nuclear Safety and Control Act,* in order to address weaknesses in the current legal framework and the CNSC's EA authority.[199]

Recommendation 32: The CNSC must refrain from delaying the assessment of issues to the post-regulatory phase; the fundamental scoping and planning processes must be carefully considered before making an EA decision on this project.

Recommendation 33: The CNSC must carefully consider the critiques and recommendations within this submission to ensure the Draft EIS and its future iteration accurately reflect the necessary factors that must be assessed to protect the environment and human health from significant adverse environmental effects that may arise from the proposed Rook I Project.

Proliferation in International Law - Volume IV (2019), T.M.C. Asser Press, The Hague, online: https://doi.org/10.1007/978-94-6265-267-5_12 at pp. 242-243 [**Blaise et al**].

[196] Blaise et al at p. 243; Expert Report at p. 49.

[197] Expert Report at pp. 49-50.

[198] Expert Report at p. 50.

[199] The Convention on Nuclear Safety requires that all Contracting Parties (including Canada) take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy; *See also*: Blaise et al; CELA letter to Prime Minister Trudeau re: CNSC oversight (2021), online: https://cela.ca/wpcontent/uploads/2022/01/CNSC_Oversight_22NOV21.pdf.

V. EXPERT REPORT ON RADON AND GAMMA MONITORING, & WORKERS' HEALTH BY LUC LANCE

I, Luc Lance, provide the following comments on the draft EIS. I am A certified Radon Measurement and Analytical Provider, certified by the Canadian National Radon Proficiency Program and a member of the Canadian Association of Radon Scientists and Technologists. I have extensive experience in the environmental monitoring field in the uranium mining industry. My experience includes monitoring of radiological hazards, water sampling (ground and surface), air monitoring programs, offsite controls and monitors, mitigation techniques and operation of Water and Wastewater Treatment Plants.

Having thoroughly reviewed the draft EIS, I am dismayed that in all aspects of the mining project proposed, the proponent only has a moderate degree of confidence in their predictions. Generally, there was a lack of specific details on critical worker and environmental health and safety matters, including management plans, monitoring schedules, personnel who will conduct the testing and carry-out the analysis of the water samples etc. More accurate and defined detail is necessary to determine that the predictions contained in the draft EIS will be met. Only by establishing a rigorous equality control and quality assurance program within the draft EIS can there be confidence in their predictions. My CV is attached as **Appendix C.**

Ventilation

The draft EIS states that the production shaft will be used to remove ore and waste rock from underground and function as the fresh air intake for the underground operation. Information on fresh air intake is critical to the health of workers and indoor environment. Sufficient modelling with specificities of location of fans, their volume and size ought to be provided.

Information Request 14: Where will the fans be located, at the production shaft or at the fresh air intake? The size of fans and volume of air circulated must be specified.

Gamma Monitoring Program

Mine rock is any naturally occurring material that could be removed from underground activities. The mine rock that will be removed from the underground areas is classified into four categories, ore, special waste rock, potentially acid generating waste rock and non-potentially acid generating waste rock.

A gamma radiation monitoring program should be in place to determine the gamma radiation levels close to the ore and waste rock stock piles. The gamma radiation measurement is required

to determine an employee's total external dose when the radiation source is outside of (or external to) the body. As these stockpiles increase in size gamma radiation will be more evident.

Recommendation 34: A gamma radiation monitoring program should be in place to determine the gamma radiation levels close to the ore and waste rock stock piles. The monitoring program must specify the frequency of monitoring, how data will be made available to workers, and thresholds which will be put in place to ensure radiation doses remain As Low As Reasonably Achievable. Critical to the health and safety of all workers at the site is radiation protection. This issue is given little attention in the draft EIS and must be remedied.

Recommendation 35: All employees who frequent the area must wear a gamma radiation dosimeter badge. The gamma radiation dosimetry badges worn by employees must be replaced on a quarterly basis. Workers' written consent must be obtained for a position where exposure to radiation above the allowable annual dose to the public may occur.

Recommendation 36: Proper signage should be place in the area indicating that gamma radiation exposure is in effect. This area should be delineated with a barrier such as a fence or berm.

Radon Monitoring

Radon is a radioactive noble gas that comes from the decay of radium. Radium is also a daughter or progeny nuclide of Uranium (Uranium decay). Radon is a colorless, odorless, invisible gas that can only be detected through the use of proper equipment and protocols. Chronic exposure to elevated radon levels has been linked to an increased incidence of lung cancer in underground miners.

Recommendation 37: A program should be in place for wetting the ore and special waste stockpiles to reduce air born radioactive dust. The special waste rock may contain insufficient grade but still has some uranium content. This is especially necessary as radioactive dust could be blown towards buildings, such as the bunk houses and as a result radon levels could increase within the buildings.

Recommendation 38: A radon progeny and gamma radiation program must be implemented for all underground and surface employees. The gamma radiation dosimetry badges worn by employees must be replaced on a quarterly basis. Radon progeny testing must be completed at all underground workplaces and designated surface locations on a monthly basis.

Recommendation 39: The Working Level results and hours worked at each workplace must be documented to determine the radiation dose for each employee. The accumulated yearly radiation dose from radon progeny should not exceed 4WLM/year (Working Level Month). More

information on radiation protection is found in Section 4 of the CNSC Radiation Protection Program. All licensees are required to implement a radiation protection program and this ought to be profiled and detailed in the draft EIS.

Recommendation 40: The Environmental Protection Program, Industrial Air Source Environmental Protection Plan and baseline monitoring program would continue through all phases of the project. Radon gas and dust monitoring from mining activities not clearly defined.

Recommendation 41: An Environmental Surveillance Program should include ambient air monitoring stations for control measures. The types of air monitoring equipment must include dust fall jars, high-volume air sampling units, meteorological stations, and radon detector monitoring stations. Air monitoring stations for radon should installed in buildings on the mine sites. This would include bunk houses and other enclosed areas where radon could accumulate to elevated levels. Radon detectors should be located at the mine exhaust and downstream to determine radon concentrations. Dust fall jars must also be installed downstream of the mine exhaust to determine the distance the mine dust could potentially travel and accumulation of airborne radionuclides.

Environmental and Wastewater Monitoring

Recommendation 42: Ground water monitoring boreholes should be installed at several locations around the perimeter of the ore, special waste and acid generating stockpiles. Testing of the ground water on a semi-annual schedule would ensure that the ground water surrounding the stock-plies does not become contaminated and to ensure the integrity of the polyethylene liner has not failed.

Recommendation 43: The contingency pond should be kept full of water as to not allow the polyethylene liner to dry out and crack and to allow frost build-up in the ground under the liner and potentially cracking it.

Recommendation 44: The potentially acid generating stockpile should be dual-lined. Acid generated from this pile could potentially cause deterioration of the liners and contaminate the ground water.

Recommendation 45: There is no mention of which water disinfection treatment would be used for the potable water treatment system. Disinfection kills or removes pathogens from drinking water, reducing health risks. You can disinfect water by adding chemicals, ultraviolet (UV) radiation, filtration, or a combination of these methods.

Recommendation 46: The sludge generated by the operation of the sewage wastewater treatment plant should be disposed in a designated land fill location within the mine area. The location should be signed, fenced, and gated as such.

Recommendation 47: The heavy metal sludge which was generated from the chemical treatment in the treatment plant and settled in the pond must be properly disposed. In the uranium milling process radium is removed by chemical treatment. In most cases barium chloride is added at the treatment plant. This allows the radium to precipitate out into the settling ponds producing a radium sludge. It is important that the radium is removed from the water as to not affect the water quality at the final water sampling location which must meet provincial water quality and CNSC standards. Iron precipitated by lime addition to regulate pH levels from the mine wastewater forms a sludge in the settling ponds and must be removed as to not allow the ponds to fill up with sludge. The more sludge the less retention time for treated mine water to remain in the ponds.

Recommendation 48: Water sampling boreholes should be installed in the West Berm. This is the final overflow of the water collected around the mine site. It is essential that the ground water at this point meet all water quality standards. This would include suspended solids. The berm is designed as a filter, however the sludge accumulating against the berm may affect the ground water as well as overflow water quality.

Recommendation 49: A silica dust monitoring program for underground workers must be implemented. Silica dust particles become trapped in lung tissue causing inflammation and scarring. The particles also reduce the lungs' ability to take in oxygen. When silica dust particles are less than 10 μm, they will stay airborne for up to several hours until gravity and electrostatic forces help them settle onto surfaces. Of greater importance, at this size, they can easily enter the lungs, where they are even more toxic than coal dust. The monitoring program should include monthly testing at all underground workplaces and the dust monitors must be worm by the mine employee.

Radioactive Waste

The draft EIS mentions that conventional waste (domestic/industrial) will be incinerated, and hazardous waste recycled. Concerningly, there is no mention of final disposal of low-level radioactive waste, only that it will be placed in a colour coded bin and labeled to minimize contamination.

Items from the mining and milling process become radioactively contaminated. This would include rags, wood, machinery, valves, and rubberized piping. Valves and non- rubberized piping must be cleaned in a specified location as to minimize contamination. The contaminated water would require diversion to the underground or to the water treatment plant.

Information Request 15: The proponent must detail all plans for all wastes, both non-radioactive and radioactive, including but not limited to their storage and handling, environmental monitoring, worker health and safety programs, and their oversight throughout the project's lifecycle.

Other Comments

The draft EIS fails to mention a Mine Rescue Station. Operating mines must have a mine emergency response mine rescue program. The main goals of mine rescue are to:

1. Ensure the safety of the mine rescue team.
2. Make every effort to rescue or secure the safety of trapped workers.
3. Protect mine property from further damage caused by fire, cave-in, etc.
4. Return the mine to a safe condition so operations can resume.

Fish and fish habitat are considered a Valued Component. There is no mention of a creel census monitoring program for Patterson Lake or the fishery downstream of mining activities. It is important that a program be set up to ensure that the fishery is not affected by the mining activities. If there is a reduction in the fish population a creel census (duration of a several years) would determine that overfishing may be the cause and not mining related.

VI. EXPERT REPORT ON SOURCE WATER PROTECTION BY DR. ROBERT PATRICK

I, Bob Patrick, of Integrated Water Resource Planning provide the following comments resulting from my review of the ROOK 1 Project Draft Environmental Impact Statement dated April 2022 prepared by NexGen Energy Ltd., specifically sections 5, 6, 8, 9,and 10.

I am an Associate Professor in the Department of Geography and Planning at the University of Saskatchewan, specializing in regional and environmental planning, cumulative effects analysis and watershed planning for source water protection, mainly with First Nation communities in Alberta and Saskatchewan. My CV is attached as **Appendix D.**

Section 5: Project Description

Bio-Regional Setting:

Rook 1 project is centrally located and surrounded by pristine lakes, rivers, and wetland environments. Each of these environments contains unique ecosystems supporting a rich diversity of interconnected and interdependent habitats. The site of Rook 1 mining activity is on a peninsula surrounded by the aforementioned aquatic ecosystems. This is a sensitive lake basin containing abundant wetlands. The ecological value of this environment has not been adequately assessed in the project description. The ecosystem benefits to humans and ecosystem services have not been valued within the overall description of the project. More specifically, the carbon sequestration of wetlands and lake environments is second only to the world's oceans. The global and regional importance of this wetland environment has not been expressed.

Recommendation 50: The global and regional importance of this wetland environment ought to be described.

Transportation of materials off-site:

While there is detail contained in the EIS (April 2022) provided on infrastructure for extraction activities, there is a noticeable absence of information regarding safe transport of materials offsite. There is also lack of clarity what will be transported offsite. Reference is made to "special waste rock" that is of "low grade ore", and yet this ore will contain U_3O_8. Please define "Low Grade Ore" and its hazard level. The impacts of the proposed mine site development and operation on Highway 955 have not been discussed. The addition of heavy transport trucks and other vehicles on Highway 955 and other roads to the south will impact road safety and roadway condition. These impacts will be borne by Indigenous community members dependent on the aforementioned road system.

Information Request 16: Provide information regarding safe transport of materials offsite, including definitions for low grade or and hazard levels, impacts to road safety and roadway condition due to large trucks, and impacts borne to Indigenous communities.

Site detail:

The project development fronts Patterson Lake. In places there will be vegetation removal to the lake. The bulk of buildings and project infrastructure will be located approximately 50 meters from the lake shore. Patterson Lake forms a partial headwater to downstream waterbodies including rivers, lakes and wetlands. In addition, this is a sloping site where surface drainage will flow to the lake and lowland areas within the site. The provision of vegetation buffers, density of vegetation, species selection and areal coverage of vegetation is not mentioned. There appears to be insufficient setback of the mine development site from neighbouring water bodies. The site detail placed greater emphasis on describing built infrastructure rather than local drainage and the proposed methods of surface water and groundwater protection.

The main site development will be approximately 50 metres from Patterson Lake. Surface "contact water" run off, settling pond and the placement of constructed berms in the event of an uncontrolled spill, or climate-related flood event, are not discussed. Any method of site containment in such an event is not mentioned (see Section 6 comments). The lakeshore zone may be compromised by development to facilitate road and dock access and servicing infrastructure.

Vegetation removal is a major concern across the full lakeshore zone. Removal of vegetation from the lakeshore will impact shade protection for aquatic species but also limit the ability of natural processes to bio-accumulate and filter surface water runoff contaminants. The absence of any riparian buffer along the shoreline is alarming. Site infrastructure encroaches to within 300 metres of the lake (see Figure 5.4-22). Groundwater-to-surface water interaction is not discussed. Groundwater flow to lakes and streams is critical during drought conditions. Groundwater contamination will transmit pollutant to adjacent water courses. Groundwater is not sufficiently assessed in the EIS report. Overall, methods and processes to protect both surface water and groundwater are not considered nor addressed adequately.

Climate change appears to be discussed on a global-scale context and not specifically to the proposed site development. Increasingly, climate change is being associated with an increased incidence of violent weather, including prolonged drought, sudden flooding and wildfire events. These extreme conditions have not been identified as having potential for negative impacts on the site or even the region. In what ways can the proposed mine site adapt to climate change by adaptive and resilient design features in order to thrive under extreme weather events?

Onsite wastewater (black and grey water) servicing is by septic tank (section 5.4.55). The details of this tank and its servicing are not described. Is this secondary or tertiary wastewater treatment. Maintenance of these systems is critical to their medium and long-term operation. How will septic tank solids be removed? Where will these solids be disposed of, and how frequently?

What constitutes domestic and industrial hazard waste? In what way will it be safely stored on site? The term "storage solution" is used, we are unclear of the meaning (5.4.6.2). Again, proximity of the lakes to the proposed mine site activities, slope of site terrain to lake, removal of vegetation and "hard" surfacing of mine site requires a high level of surface and groundwater protection.

The location of the explosives storage appears to be precariously close to the runway.
Site construction and development is silent on any priority for proactive environmental protection (see Source Water Protection section). For example, what means of protection are planned for fuel storage containment to protect against leaks.

The proposed mineshaft is extremely deep relative to other similar ore-bearing provincial mines. This mineshaft will generate much mine rock waste (see earlier comments regarding storage and transportation). Groundwater impacts relating to a deep mine have been given no extra consideration in the EIS.

Recommendation 51: Impacts to groundwater must be sufficiently assessed in the Draft EIS report. Overall, methods and processes to protect both surface water and groundwater are not considered nor addressed adequately.

Information Request 17: In reference to onsite wastewater (section 5.4.55) the following gaps remain: is this secondary or tertiary wastewater treatment? How will septic tank solids be removed? Where will these solids be disposed of, and how frequently? What constitutes domestic and industrial hazard waste? In what way will it be safely stored on site?

Section 6: EA Approach and Methods

Applying a simple word search it was revealed that: "Riparian protection"; "buffer protection" and "Lake buffer"; "Source water" and "Source Water Protection" do not appear in this EIS document. This is surprising given the proposed mine site location in a lake and wetland dominant ecosystem. Similarly, there is no mention of groundwater protection. Reference is made to the diversion of "clean rainwater and runoff". The method of diversion is not discussed in the EIS. There is strong evidence suggesting that containment and diversion of rainwater and surface water merely transfers surface and airborne contaminants to a single, concentrated area. In addition, the erosive force of water increases when water is concentrated in a collection system. Onsite retention and

mediation is a preferred method. The diversion of rainwater off-site may create new, and unintended, flood and contamination problems.

Further, while reference is made to valued ecosystem components (VECs), no description of specifics regarding any ecosystem is made (section 6.1.2). What are the identified ecosystems that are valued in this proposed mine site development? The methodology and approach specified in Section 6 does not adequately address water quality and site development impacts on groundwater. Cumulative impacts monitoring and assessment should be detailed and described in this section. This could be better addressed by inclusion of a source water protection planning process (see Source Water Protection).

Recommendation 52: Cumulative impacts monitoring and assessment should be detailed and described within Section 3. This could be better addressed by inclusion of a source water protection planning process.

Information Request 18: What are the identified ecosystems that are valued in this proposed mine site development?

Section 7: Air Quality, Noise and Climate Change

Noise and visual impacts should be detailed over the timing of site development and mine site operation. Impacts should be provided for time of day, and time of year. These impacts should be assessed against bird migration patterns and wildlife movement. Can a corridor of transit be implemented for wildlife in this area to facilitate access to and between waterbodies?

Climate change is having, and will continue to have significant impacts on facilities and operations in industrial activities in Canada. The EIS blends climate change with noise and air quality (section 7.7). The key finding respecting climate change from this section states that the project will improve Canada's commitment to Green House Gas (GHG) reduction targets by producing uranium for nuclear power generation. While this may be true regarding climate change mitigation at some level, this observation does not address the potential impacts of climate change on the project. There is no mention of how this project will adapt to the very real impacts of climate change such as increased incidence of drought and wildfire or violent weather creating floods and other sudden weather events. How will resiliency be built into this project in the face of continued regional impacts of climate change?

Recommendation 53: Noise and visual impacts should be detailed over the timing of site development and mine site operation. Impacts should be provided for time of day, and time of year. These impacts should be assessed against bird migration patterns and wildlife movement.

Information Request 19: What are the noise and visual impacts detailed over the timing of site development and mine site operation? Can a corridor of transit be implemented for wildlife in this area to facilitate access to and between waterbodies?

Information Request 20: There is no mention of how this project will adapt to the very real impacts of climate change such as increased incidence of drought and wildfire or violent weather creating floods and other sudden weather events. How will resiliency be built into this project in the face of continued regional impacts of climate change?

Section 8: Hydrogeology

During mine site development and operation there is a significant potential for negative impacts to Patterson Lake from groundwater inflow. Groundwater depletion and groundwater quality impacts are noted in the EIS. However, there is little evidence, nor analysis, to suggest that these impacts will recover after mine closure. Wetland impacts from groundwater depletion is not discussed.

Recommendation 54: Groundwater recovery after mine closure ought to be detailed as well as wetland impacts from groundwater depletion.

Section 9: Hydrology

There is a lack of information regarding subsurface disturbance with only proposed mitigation measures mentioned. No specific details are provided regarding mitigation. Groundwater contributions to wetlands and Patterson Lake are absent. Groundwater is significant to the regional water balance. There is a lack of studies to provide necessary details regarding groundwater contributions to regional water balance. Similarly, few details are provided regarding any long term monitoring program.

Baseline data on local water quality, groundwater recharge rates, and water quantity is not described in any detail. Sediment transport and local impacts on water quality are predicted to be small, yet there is no proof of this and no integrated monitoring proposed. In addition, in this section, and in all other sections, there is a repeated message that "Indigenous and Traditional Knowledge is incorporated into the project". While such language is an open expression of respect toward Indigenous land users, there is little substantive evidence to suggest how this approach will be mobilized and monitored during the lifespan of the proposed project.

Recommendation 55: Baseline data on local water quality, groundwater recharge rates, and water quantity ought to be described in detail.

Section 10: Water Quality

To help address many of the aforementioned concerns around surface and groundwater condition, a source water protection (SWP) planning approach is recommended (see next section). The EIS has not taken a proactive, preventative approach to water quality protection. A threats analysis followed by a risk assessment would be a beneficial addition to the EIS.

The Canadian Drinking Water Guidelines are not referenced in this EIS. There is a general lack of detail respecting longer term monitoring program. Water quality parameters such as arsenic, lead, cadmium, all associated with deep well drilling, have not been assessed for longer term monitoring. Similarly, nutrient loading from sewage discharge and septic tank pumping have not been included into an monitoring program going forward.

Recommendation 56: Patterson Lake forms a partial headwater to downstream waterbodies including rivers, lakes and wetlands. To help address many of the aforementioned concerns around surface and groundwater condition, a source water protection (SWP) planning approach is recommended. The EIS has not taken a proactive, preventative approach to water quality protection. A threats analysis followed by a risk assessment would be a beneficial addition to the EIS.

Source Water Protection

The following section will outline the purpose, and practice, of source water protection and how this approach will benefit this proposal.

What is Source Water?

Source water is untreated water from groundwater or surface water sources that supplies potable water for human consumption or contact. Source water is also water available for ecosystem services.

Source water protection, an important component of water management in Canada and elsewhere, is about preventing contaminants from reaching water sources by using a variety of management actions. Protecting water at the source is an important means of preventing human illnesses. In addition, protecting water at the source helps to protect ecosystems and local economies. It is many times less expensive to protect a water source from contamination than it is to remediate it after contamination.

The Multi-Barrier Approach to Safe Drinking Water

Source water protection, represents a vital barrier in the protection of water supplies. The multi-barrier approach is really a system of redundancies that allows a drinking water system to avoid failure should a single barrier fail. The Canadian Council of Ministers of the Environment (CCME) defines the multi-barrier approach as an integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from "source-to-tap" in order to reduce risks to public health. In the absence of source water protection, the potential for contamination of the drinking water supply will certainly increase. The development and implementation of a source water protection plan should be the critical first step in any overarching environmental impact statement.

What is a Source Water Protection Plan?

A source water protection plan (SWPP) is a document aimed at protecting source water quality and quantity. A SWPP is a systematic and organized assessment of contamination sources and pathways linked to human activity and natural processes that occur in a watershed. Based on this inventory, the SWPP identifies and prioritizes management actions to mitigate or reduce water contamination risks to an acceptable level.

Types of water sources

Source water is the natural, untreated raw water found in aquifers and surface waters that are the source of drinking water. Source water contained in surface water supplies includes water found in lakes, rivers and other water streams. Groundwater is another source of raw water. Groundwater is water found beneath the earth's surface. The term "groundwater under the direct influence of surface water", or "GUDI" is often used to refer to a groundwater source that is located near enough to surface waters to receive direct surface water recharge. Everything is connected!

Water contamination from natural factors

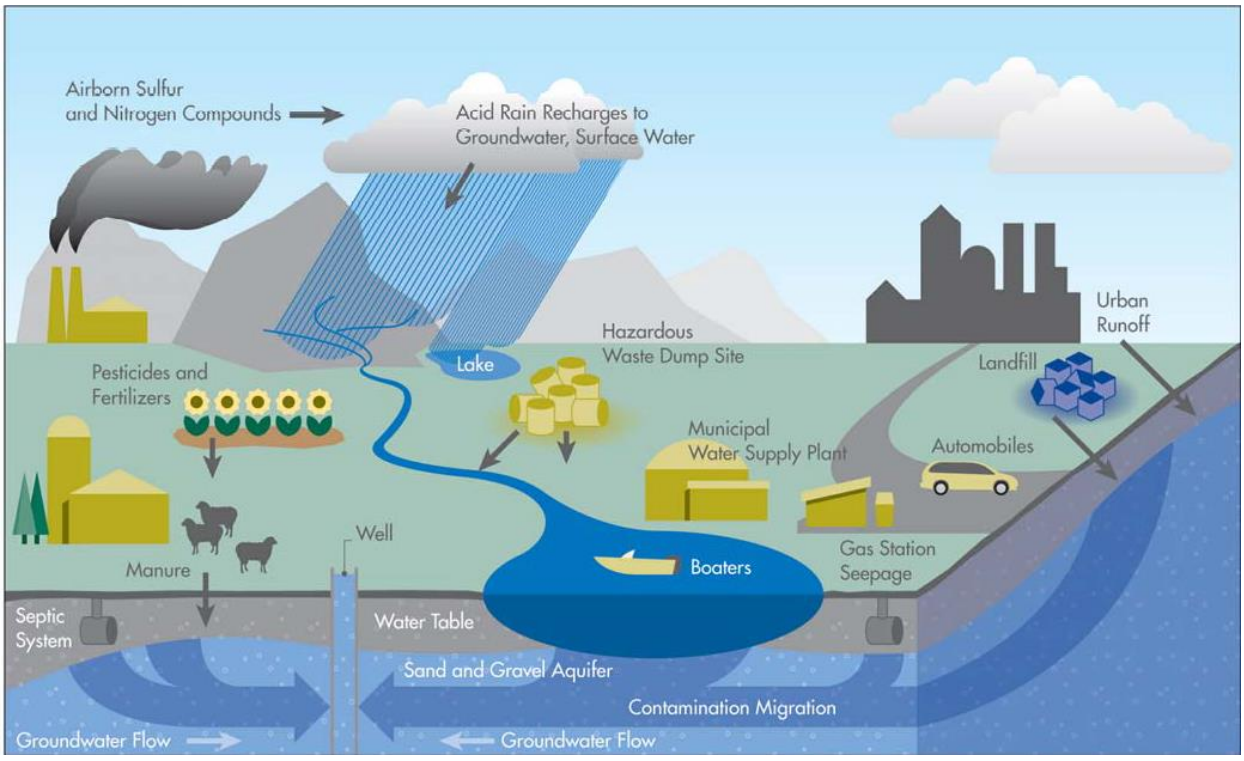
Natural factors may contribute to drinking water contamination if left unchecked. Wildlife, for example, contains micro-organisms such as bacteria, parasites and viruses that may cause diseases in humans. Ongoing changes to the natural environment such as wildfire, storm events, flooding and erosion can also introduce risk to source waters. These "natural" conditions are expected to accelerate under climate change. Natural factors affecting water quality are often unpredictable and may occur very suddenly. For example, a severe rain storm may cause stream bank erosion and introduce sediments into source water, raising turbidity (cloudiness). Naturally occurring overland flow into an aquatic environment may also impact water quality by adding surface

contaminants, organic debris and soil in the water material causing high turbidity. Human activity, such as forestry, urbanization, mining, and agriculture may exacerbate these natural conditions.

Water contamination from human activities

The quality of a source water may be negatively impacted by past and present land use activities that introduce a risk to human and environmental health. Land use activities including agriculture may introduce pesticides and nutrient into water sources. Many residential activities also introduce potential risk to source water such as domestic animals, sewage disposal systems, landfills, lawn care, road networks, road salts, personal care products, pharmaceuticals and abandoned residential wells. Commercial and industrial activities add additional risks in the form of waste products, hazardous goods transportation, toxic by-products, dry cleaning wastes, car wash wastewater, fuel storage leaks, etc. Past and present industrial activity such as railroad routes, aging oil tanks, mine tailings, and other industry may also contribute to water quality degradation. **Figure 1** illustrates contamination pathways from human activity.

Figure 1: Human Activities Affecting Source Water



Source: Pollution Probe – The Source Water Protection Primer 2004

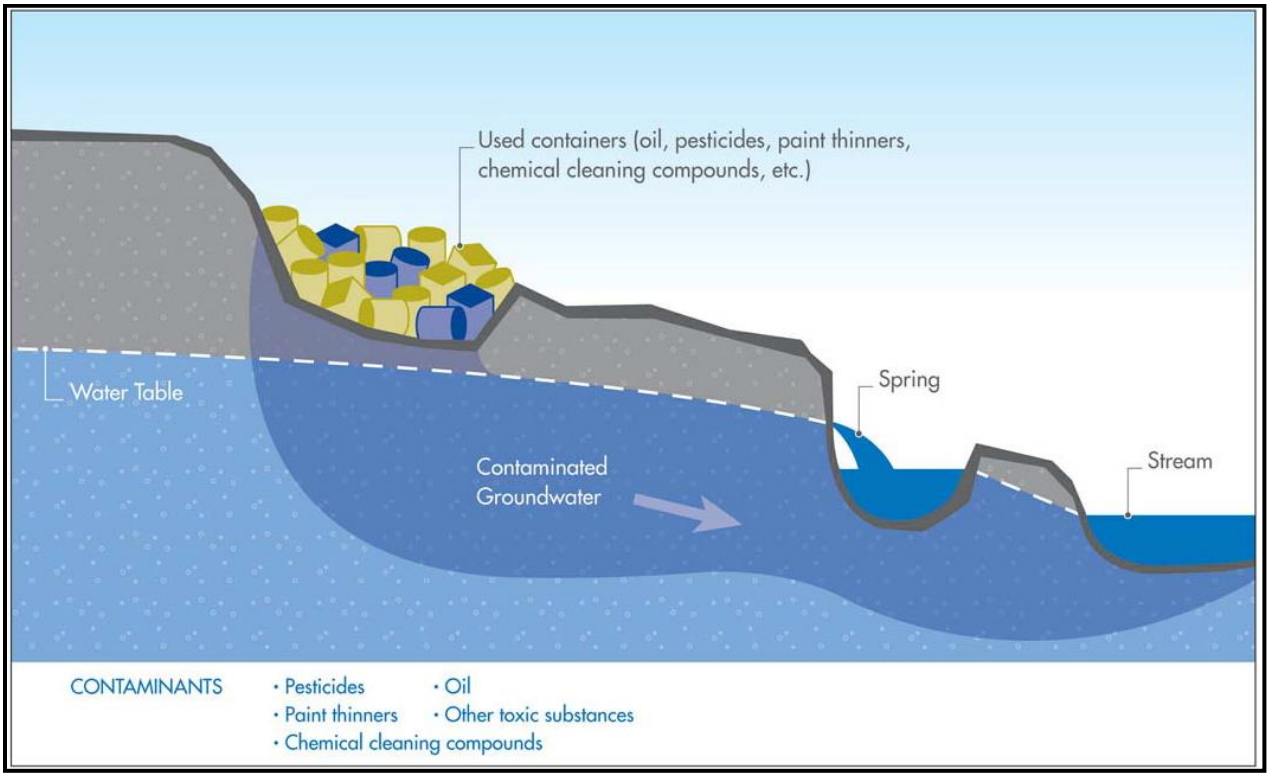
In the context of developing a SWPP, water contamination that results from human activities is of greater interest because this type of contamination is the one over which society has control.

Point source pollution

Point source pollution is pollution that can be traced to a fixed point such as an effluent pipe, a smoke stack, or a leaking fuel tank. Point source pollution enters the environment at a specific place from an identifiable source. A point source of pollution is something that you can "point" your finger toward, such as a sewage outfall pipe and surface drainage culvert (stormwater). **Figure 2** below illustrates point source pollution originating from a landfill or industrial mine site, where leachate contaminates groundwater which then feeds downstream source water. Other examples of point source pollution that should be considered in a SWPP include, but are not restricted to:

- Industrial point discharges, as well as spills and leaks of industrial chemicals
- Municipal wastewater effluents
- Landfill site leachate
- Wastes from existing and abandoned mining sites
- On-site septic systems
- Leaking oil and gas storage tanks
- Mine tailings leachate

Figure 2: Point Source Pollution: Contaminants from Landfill/Industrial Site



Source: Pollution Probe – The Source Water Protection Primer 2004

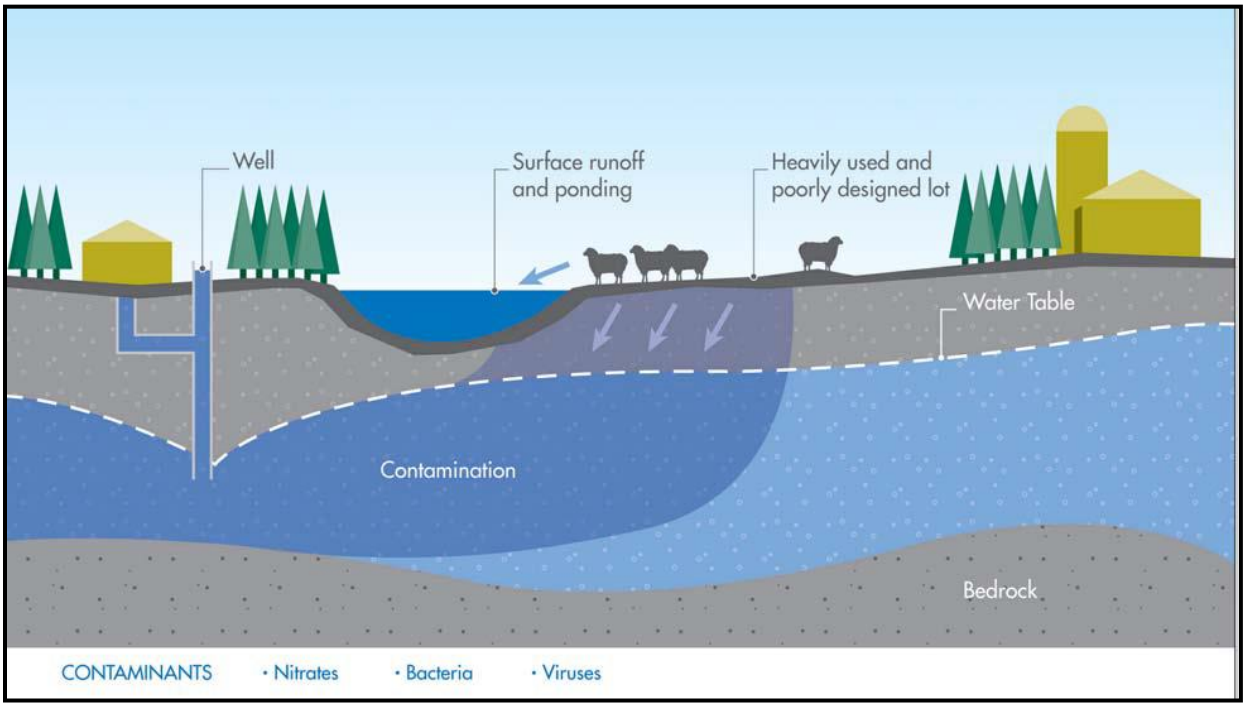
Non-point source pollution

Non-point source pollution is pollution that cannot be traced to a fixed point such as an industrial site, roadways, and urban runoff. Non-point source pollution is more difficult to identify and a much trickier problem to address in terms of land management practices to reduce contamination of source waters. Non-point sources of pollution come from multiple areas. These are sources you cannot exactly point your finger towards. Non-point sources are generally the result of water running over land that picks up natural and human-made pollutants and deposits these pollutants into surface waters, or into groundwater through infiltration. **Figure 3** illustrates non-point source pollution originating from agricultural runoff, which contaminates groundwater. Agricultural runoff can contain oil, grease, fertilizers, pesticides, bacteria and nutrients from livestock and manure. Other examples of non-point source pollution that you might need to consider for your SWPP include, but are not restricted to:

- Urban runoff from buildings, streets and sidewalks that carry sediment, nutrients, bacteria, oil, metals, chemicals, pesticides, road salts, pet droppings and litter;
- Bacterial and petroleum products from industrial facilities;
- Mine site drainage;
- Acid precipitation and other forms of air pollution that fall into surface waters and onto the land.

In **Figure 3**, non-point source pollution from a large agricultural area is disbursed over the landscape. Eventually, the contaminants from this agricultural activity, or other industrial scale activity, may enter source water at multiple points. These contaminants may reduce the quality of source water, possibly to dangerous levels.

Figure 3: Non-Point Source Pollution: Agricultural Runoff



Source: Pollution Probe – The Source Water Protection Primer 2004

Types of drinking water contaminants

The following provides basic information on the types of contaminants that originate from source contamination and are commonly found in source water. This section also describes typical contamination pathways, which can be useful when it comes to planning source protection efforts aimed at preventing contaminants from entering water sources.
There are five main types of drinking water contaminants: physical, microbiological, inorganic, organic and radioactive.

1. **Physical Contaminants:** Turbidity, or cloudiness, in water is caused by the presence of suspended particles such as clay, silt or microscopic organisms. Cloudy water is a problem because the particles in the water are a source of food for bacteria. Cloudy water can also interfere with the effectiveness of chlorination at eliminating pathogens in the water.
2. **Microbial Contaminants:** Human and animal wastes are the main sources of microorganisms, or microbial contaminants, which can cause diseases in water supplies. Improperly treated sewage, bird droppings, and runoff from farms and city streets are a source of microorganisms in drinking water. The following briefly describes the main microbial contaminants affecting drinking water:

Bacteria: While bacteria are present virtually everywhere, certain types which exist in untreated water may be pathogenic.

Campylobacter: Certain types of *campylobacter* may cause gastroenteritis (inflammation of the stomach and intestines). They are typically found in human and animal wastes, including bird droppings, and they often end up in water after a heavy rainfall.

Escherichia coli: *E. coli* is naturally present in human intestines and plays an important role in digestion. However, some forms of *E. coli* can cause gastrointestinal diseases, including a severe form of diarrhea that can lead to kidney failure and death. One way that *E. coli* ends up in water is from untreated sewage and agricultural land uses.

Giardia: In Canada, Giardia is the most common protozoa found in water. It causes a gastrointestinal disease known as giardiasis or "beaver fever," which can last for a long time. Symptoms of Giardia infection may include watery diarrhea, loss of appetite, dehydration, cramps and vomiting. Wilderness campers and others who drink untreated water are most susceptible to Giardia exposure.

Cryptosporidium: Another common protozoan, Cryptosporidium is very resistant to chlorination, but can be killed by boiling water. In humans it causes cryptosporidiosis, a disease with symptoms that may include diarrhea, stomach cramps and a mild fever. For people with a weakened immune system, cryptosporidiosis can be fatal.

3. **Inorganic Contaminants:** Inorganic, or non-living, water contaminants include various metals, arsenic and nitrates.

Metals: Metals may be naturally present in water from weathering and erosion or they may be present as a result of human activities, such as mining and manufacturing.

Arsenic: Arsenic may enter water bodies from smelting operations, the burning of coal and waste, and dumping of industrial wastewater. It may be in particles in the air, which then land in the water. It may also be present as a result of natural processes, such as weathering and erosion. Deep wells may be susceptible to naturally occurring arsenic contamination.

Nitrates: Nitrates occur naturally in water, resulting from decaying plant matter. Nitrates are also a main ingredient in commercial fertilizers and can end up in water via runoff from farmers' fields, septic systems and landfills. When homeowners apply fertilizers to their lawns and gardens, up to 50% of the nitrogen in the product ends up in nearby water sources (Pollution Probe 2002).

4. **Organic Contaminants**

Pesticides: Pesticides are chemical and biological agents that are used to control pests such as weeds, insects, rodents, fungi, bacteria and viruses. Pesticides are sprayed on crops, lawns and gardens, and golf courses. These chemicals can easily end up in drinking water sources.

Volatile organic compounds. Volatile organic compounds (VOCs) are among the most frequently detected organic contaminants in groundwater. VOCs are chemicals that readily evaporate and include such substances as trichloroethylene and tetrachloroethylene. These two chemicals are found in household products and are also used as solvents by the metal-degreasing and dry-cleaning industries.

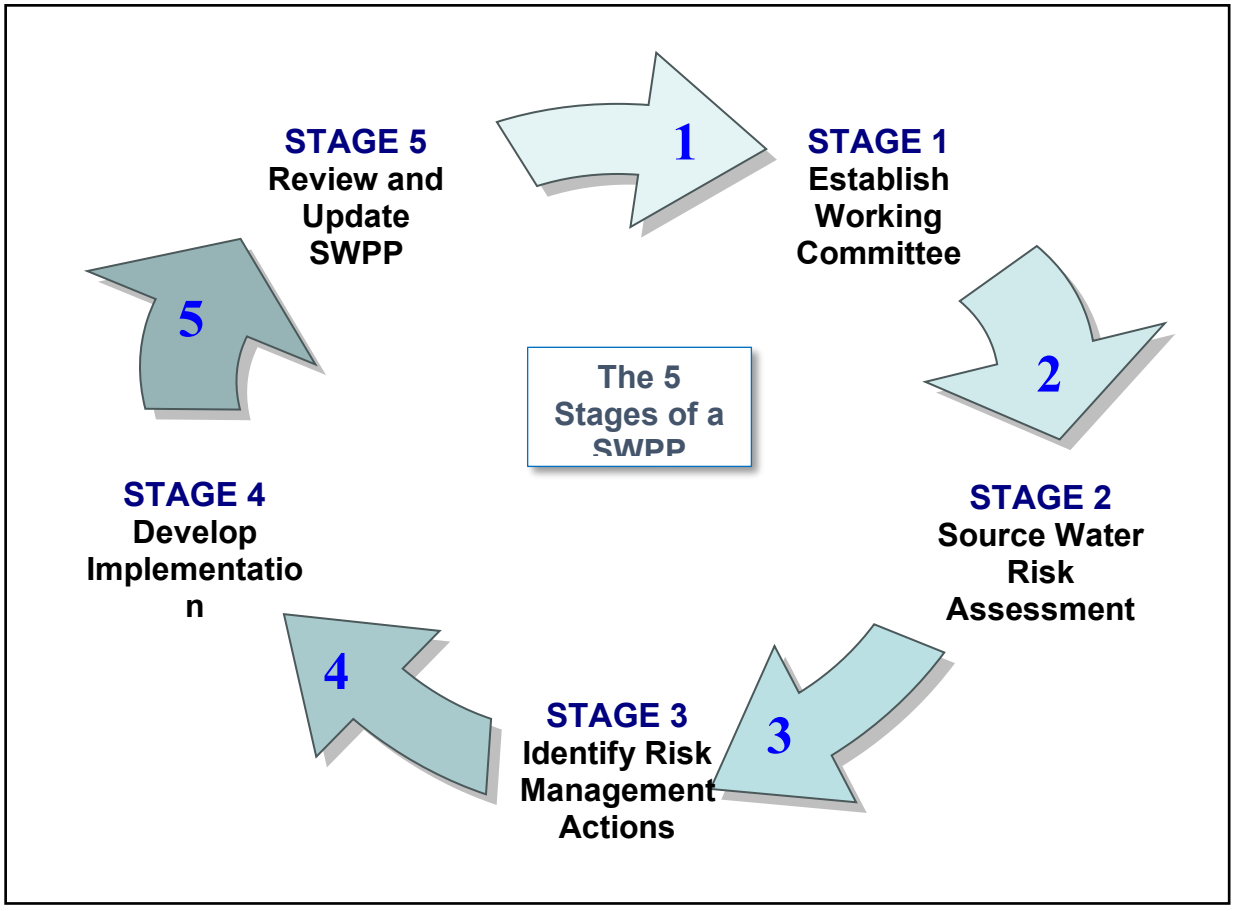
5. **Radioactive Contamination:** Water may become contaminated with radioactive atoms (called radionuclides) from both natural and human sources. Exposure to such radionuclides is associated with an increased risk of cancer and genetic disorders (Pollution Probe 2002).

Overview and scope of the procedure

SWPP follows a five stage process with the goal of producing a watershed assessment which includes the ranking of risks to the source water, identifying management actions to reduce those risks, and an implementation strategy to deliver on those management actions. It is recommended that the ROOK 1 project consider undertaking a SWPP process prior to any onsite development activity. The five stages are illustrated in **Figure 4**. In summary, the stages are:

Stage 1: Establish a SWPP Working Committee
Stage 2: Complete a source water assessment
Stage 3: Identify management actions to address potential risks to your source water
Stage 4: Develop an implementation strategy
Stage 5: Review and update your SWPP approximately every 5 years

Figure 4: Source Water Protection Plan Process



It is recommended that a watershed approach be undertaken to better protect water resources at the time of mine site industrial development activity. This includes the development proposed at ROOK 1, Saskatchewan, by NexGen. A source water protection plan would provide a more comprehensive and detailed assessment of all threats, and risks, to drinking water and the natural aquatic environment posed by this development.

References

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VII. CONCLUSION

CELA has sought to identify the gaps in the existing draft EIS, its consideration of international guidance and alignment with the purposes of *CEAA 2012*, and the project's impacts on the environment and human health.

As detailed in Sections IV – VI above, CELA submits that due to deficiencies within the Draft EIS, the requisite statutory and regulatory requirements of *CEAA 2012* have not been fulfilled. Additional information pertaining to NexGen's assessment of the precautionary principle, climate change and sustainability, cumulative effects, environmental effects, accidents and malfunctions, and alternative means, must be remedied before NexGen's Draft EIS can be deemed sufficient.

As explained within Luc Lance's expert report, it was found to be disappointing that in all aspects of the mining project proposed, the proponent only has a moderate degree of confidence in their predictions. Generally, there was a lack of specific details on critical worker and environmental health and safety matters, including management plans, monitoring schedules, personnel who will conduct the testing and carry-out the analysis of the water samples etc. More accurate and defined detail is necessary to determine that the predictions contained in the Draft EIS will be met. The establishment of a rigorous equality control and quality assurance program within the Draft EIS can there be confidence in NexGen's predictions.

CELA further submits that before the Draft EIS can be deemed sufficient, a source water protection plan should be developed, as outlined within Dr. Robert Patrick's expert report. The geographic and hydrological location of the Rook I Project, in conjunction with the proposed mining activities, calls for protection of water resources at the time of mine site industrial development activity. A source water protection plan would provide a more comprehensive and detailed assessment of all threats, and risks, to drinking water and the natural aquatic environment posed by this development.

CELA requests that all recommendations enclosed at Appendix A and information requests enclosed at Appendix B be responded to before the EA of the Rook I Project proceeds for further review.

Sincerely,

CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Sara Libman

Sara Libman
Legal Counsel

APPENDIX A – SUMMARY OF RECOMMENDATIONS

Recommendation 1: The Draft EIS should be updated to include a timeline of various far-future scenarios, which would provide a visual of the potentially adverse environmental effects that future generations would be burdened with should this Project be approved.

Recommendation 2: To ensure adherence to the purposes set out in sections 4(1)(b) and 4(2) of CEAA 2012, greater attention must be paid to the precautionary principle, and the far-future scenarios need to be re-assessed to align with any further data provided for VCs and boundary scoping.

Recommendation 3: In order to fulfill CEAA 2012's purpose promoting sustainable development and upholding international climate commitments, NexGen must incorporate climate change *within* sustainability, specifically applying a presumption of harm approach towards the projects that would depend on the uranium produced by the proposed Rook I Project.

Recommendation 4: The Purpose of this Project needs to be re-assessed to ensure that the information before the CNSC is grounded in sustainability, and does not contribute to irreversible environmental effects at a local or global scale.

Recommendation 5: the EIS should be updated to include management plans, monitoring and follow-up programs, or decommissioning and reclamation plans to allow the CNSC to consider the sustainability of the project and the measures that would be implemented to protect future generations from environmental harm.

Recommendation 6: NexGen needs to rectify the deficiencies in the cumulative effects assessment by reconducting the scoping phase in accordance with CELA's VC and boundary recommendations.

Recommendation 7: The EIS be updated to clearly identify all the types of cumulative effects that were assessed for each VC.

Recommendation 8: The EIS should include a matrix or table which would present information regarding rationale for including each physical activity identified and the VCs that they may effect.

Recommendation 9: The components identified as "intermediate components" need to be assessed in the same manner as "valued components" and must undergo the full 5-step framework for conducting a cumulative effects assessment.

Recommendation 10: "Avoiding redundancy" is not an acceptable reason for excluding fish species from VC scoping, and when selecting fish VCs, rationale come from a balancing of the recommended lines of reasoning: primary data collection, computer modelling, literature references, public consultation, expert input or professional judgement. As a result, the scoping of fish species VCs needs to be restarted to ensure that the cumulative effects assessment accurately captures the potentially adverse environmental effects that would require mitigation and monitoring.

Recommendation 11: The EIS should provide an updated cumulative effects assessment for fish and fish habitats to reflect proper selection of fish VCs.

Recommendation 12: The proponent should re-evaluate its confidence level of moderate to high in assessing cumulative effects on vegetation VCs, as this determination likely arose from a faulty conclusion based on uncertain climate change assumptions.

Recommendation 13: Any vegetation species disqualified from being included as a VC on the grounds of redundancy should be re-evaluated to ensure the cumulative effects assessment of vegetation accurately captures any potential environmental effects requiring mitigation and monitoring.

Recommendation 14: Any wildlife species disqualified from being included as a VC on the grounds of redundancy should be re-evaluated to ensure the cumulative effects assessment of wildlife and wildlife habitat accurately captures any potential environmental effects requiring mitigation and monitoring.

Recommendation 15: Federally listed wildlife species (northern myotis, common nighthawk, and barn swallows) should not be excluded from VCs on the grounds of "appropriate representation" by other species.

Recommendation 16: The EIS should be updated with cumulative effects assessment scoping for potential insect VCs.

Recommendation 17: The Caribou Mitigation and Offsetting Plan needs to accompany the EIS in order to determine mitigation measures will effectively reduce residual effects on woodland caribou.

Recommendation 19: The scoping of spatial boundaries for VCs associated with water should encompass the Lake Athabasca Basin.

Recommendation 20: Certain VCs would benefit from spatial boundaries being refined ecologically (e.g., utilizing watershed boundaries), and the proponent should assess whether certain ecological boundaries need to be utilized to provide a more fulsome scope of potential physical activities that may interact cumulatively with the proposed project.

Recommendation 21: The EA process for this Project should be paused until a more accurate cumulative effects assessment is conducted for the vegetation VC, following the revised baseline study within the vegetation RSA.

Recommendation 22: The cumulative effects assessment for the EIS should revisit the temporal boundaries of different VCs, and apply more VC-centric or ecosystem-centric modelling for temporal boundaries. The application of an activity-centric temporal boundary arises in too many issues due to the complex timeline of a uranium mine's potential environmental effects which exceed the 43-year operation timeline.

Recommendation 23: The 92 mineral dispositions located in close proximity to the Rook I Project site should be considered reasonably foreseeable physical activities (future mines), and should therefore be included in the cumulative effects assessment for the Rook I Project.

Recommendation 24: The EIS be updated to provide include source, quantity, mechanism, pathway, rate, form and characteristics of contaminants and other materials (physical and chemical) likely to be released to the surrounding environment during the 93 postulated malfunctions and accidents, pursuant to REGDOC-2.9.1.

Recommendation 25: The sheer volume of hazards identified by NexGen indicate that a bounding scenario approach is not appropriate for assessing the accidents and malfunctions associated with this project. The EIS should not use a bounding approach, and should be revised to use a different approach for assessing accidents and malfunctions to ensure all identified accident/malfunction scenarios are adequately reviewed.

Recommendation 26: The 4-Step process identified by the CEA Agency for considering the alternative means for this project should be used in the EIS.

Recommendation 27: The vague and inconsistent references to VCs within the alternative means assessments fail to develop a sufficient understanding of potential environmental effects of the alternative means under consideration, and therefore the alternative means assessment within the EIS carefully assess potential effects on VCs.

Recommendation 28: the EIS document should be uploaded into multiple PDFs, broken down by section (in addition to uploading the EIS as one whole document).

Recommendation 29: Upload a "Master Index" so that interested parties can have an overview of where certain topics are covered throughout the EIS.

Recommendation 30: Upload a document that provides hyperlinks to the various Technical Study Documents referenced throughout the EIS. This simplifies the process of locating these documents on the EA registry for the Rook I Project.

Recommendation 31: PDFs uploaded by the proponent should not be "locked," prohibiting the copying and pasting of text.

Recommendation 32: The CNSC must refrain from delaying the assessment of issues to the post-regulatory phase; the fundamental scoping and planning processes must be carefully considered before making an EA decision on this project.

Recommendation 33: The CNSC must carefully consider the critiques and recommendations within this submission to ensure the Draft EIS and its future iteration accurately reflect the necessary factors that must be assessed to protect the environment and human health from significant adverse environmental effects that may arise from the proposed Rook I Project.

Recommendation 34: A gamma radiation monitoring program should be in place to determine the gamma radiation levels close to the ore and waste rock stock piles. The monitoring program must specify the frequency of monitoring, how data will be made available to workers, and thresholds which will be put in place to ensure radiation doses remain As Low As Reasonably Achievable. Critical to the health and safety of all workers at the site is radiation protection. This issue is given little attention in the draft EIS and must be remedied.

Recommendation 35: All employees who frequent the area must wear a gamma radiation dosimeter badge. The gamma radiation dosimetry badges worn by employees must be replaced on a quarterly basis. Workers' written consent must be obtained for a position where exposure to radiation above the allowable annual dose to the public may occur.

Recommendation 36: Proper signage should be place in the area indicating that gamma radiation exposure is in effect. This area should be delineated with a barrier such as a fence or berm.

Recommendation 37: A program should be in place for wetting the ore and special waste stockpiles to reduce air born radioactive dust. The special waste rock may contain insufficient grade but still has some uranium content. This is especially necessary as radioactive dust could be blown towards buildings, such as the bunk houses and as a result radon levels could increase within the buildings.

Recommendation 38: A radon progeny and gamma radiation program must be implemented for all underground and surface employees. The gamma radiation dosimetry badges worn by employees must be replaced on a quarterly basis. Radon progeny testing must be completed at all underground workplaces and designated surface locations on a monthly basis.

Recommendation 39: The Working Level results and hours worked at each workplace must be documented to determine the radiation dose for each employee. The accumulated yearly radiation dose from radon progeny should not exceed 4WLM/year (Working Level Month). More information on radiation protection is found in Section 4 of the CNSC Radiation Protection Program. All licensees are required to implement a radiation protection program and this ought to be profiled and detailed in the draft EIS.

Recommendation 40: The Environmental Protection Program, Industrial Air Source Environmental Protection Plan and baseline monitoring program would continue through all phases of the project. Radon gas and dust monitoring from mining activities not clearly defined.

Recommendation 41: An Environmental Surveillance Program should include ambient air monitoring stations for control measures. The types of air monitoring equipment must include dust fall jars, high-volume air sampling units, meteorological stations, and radon detector monitoring stations. Air monitoring stations for radon should installed in buildings on the mine sites. This would include bunk houses and other enclosed areas where radon could accumulate to elevated levels. Radon detectors should be located at the mine exhaust and downstream to determine radon concentrations. Dust fall jars must also be installed downstream of the mine exhaust to determine the distance the mine dust could potentially travel and accumulation of airborne radionuclides.

Recommendation 42: Ground water monitoring boreholes should be installed at several locations around the perimeter of the ore, special waste and acid generating stockpiles. Testing of the ground water on a semi-annual schedule would ensure that the ground water surrounding the stock-plies does not become contaminated and to ensure the integrity of the polyethylene liner has not failed.

Recommendation 43: The contingency pond should be kept full of water as to not allow the polyethylene liner to dry out and crack and to allow frost build-up in the ground under the liner and potentially cracking it.

Recommendation 44: The potentially acid generating stockpile should be dual-lined. Acid generated from this pile could potentially cause deterioration of the liners and contaminate the ground water.

Recommendation 45: There is no mention of which water disinfection treatment would be used for the potable water treatment system. Disinfection kills or removes pathogens from drinking water, reducing health risks. You can disinfect water by adding chemicals, ultraviolet (UV) radiation, filtration, or a combination of these methods.

Recommendation 46: The sludge generated by the operation of the sewage wastewater treatment plant should be disposed in a designated land fill location within the mine area. The location should be signed, fenced, and gated as such.

Recommendation 47: The heavy metal sludge which was generated from the chemical treatment in the treatment plant and settled in the pond must be properly disposed. In the uranium milling process radium is removed by chemical treatment. In most cases barium chloride is added at the treatment plant. This allows the radium to precipitate out into the settling ponds producing a radium sludge. It is important that the radium is removed from the water as to not affect the water quality at the final water sampling location which must meet provincial water quality and CNSC standards. Iron precipitated by lime addition to regulate pH levels from the mine wastewater forms a sludge in the settling ponds and must be removed as to not allow the ponds to fill up with sludge. The more sludge the less retention time for treated mine water to remain in the ponds.

Recommendation 48: Water sampling boreholes should be installed in the West Berm. This is the final overflow of the water collected around the mine site. It is essential that the ground water at this point meet all water quality standards. This would include suspended solids. The berm is designed as a filter, however the sludge accumulating against the berm may affect the ground water as well as overflow water quality.

Recommendation 49: A silica dust monitoring program for underground workers must be implemented. Silica dust particles become trapped in lung tissue causing inflammation and scarring. The particles also reduce the lungs' ability to take in oxygen. When silica dust particles are less than 10 μm, they will stay airborne for up to several hours until gravity and electrostatic forces help them settle onto surfaces. Of greater importance, at this size, they can easily enter the lungs, where they are even more toxic than coal dust. The monitoring program should include monthly testing at all underground workplaces and the dust monitors must be worm by the mine employee.

Recommendation 50 The global and regional importance of this wetland environment ought to be described.

Recommendation 51: Impacts to groundwater must be sufficiently assessed in the Draft EIS report. Overall, methods and processes to protect both surface water and groundwater are not considered nor addressed adequately.

Recommendation 52: Cumulative impacts monitoring and assessment should be detailed and described within Section 3. This could be better addressed by inclusion of a source water protection planning process.

Recommendation 53: Noise and visual impacts should be detailed over the timing of site development and mine site operation. Impacts should be provided for time of day, and time of year. These impacts should be assessed against bird migration patterns and wildlife movement.

Recommendation 54: Groundwater recovery after mine closure ought to be detailed as well as wetland impacts from groundwater depletion.

Recommendation 55: Baseline data on local water quality, groundwater recharge rates, and water quantity ought to be described in detail.

Recommendation 56: Patterson Lake forms a partial headwater to downstream waterbodies including rivers, lakes and wetlands. To help address many of the aforementioned concerns around surface and groundwater condition, a source water protection (SWP) planning approach is recommended. The EIS has not taken a proactive, preventative approach to water quality protection. A threats analysis followed by a risk assessment would be a beneficial addition to the EIS.

APPENDIX B – SUMMARY OF INFORMATION REQUESTS

Information Request 1: NexGen to provide plans for monitoring and follow-up programs and management plans specific to the various far-future scenarios to be assessed within the context of the EIS.

Information Request 2: NexGen provide details about the expected lifespan of the PAG WRSA liners, as well as recommended management systems for the far-future generations that would be burdened with the COPC metal concentrations expected to flow from the site.

Information Request 3: NexGen should an estimate of the costs required to adequately close, as well as monitor the mine site post-closure, in order to adhere with the polluter-pays principle.

Information Request 4: NexGen should provide estimates for the GHG emissions associated with flights and off-site transportation, as well as estimates on the number of anticipated flights annually during the project's operations.

Information Request 5: There should be a re-assessment of potential pathways from the proposed Fission Patterson Lake South Property on the terrain and soils cumulative effects assessment, to ensure the precautionary principle is being adhered to.

Information Request 6: The EIS should include the habitat requirements for tracked bryophytes—despite the lack of data available.

Information Request 7: The proponent should conduct studies of bryophyte habitat requirements to assist in filling in the gaps in knowledge.

Information Request 8: The EIS should re-assess the wildlife VCs and include the following species as VCs:

(a) Northern myotis;
(b) Common nighthawk;
(c) Barn swallow; and
(d) River otter.

This is not an exhaustive list of species to reconsider as VCs; the EIS should provide an updated assessment for selecting wildlife VCs that aligns with cumulative effects assessment scoping guidelines.

Information Request 9: NexGen should provide clarification on whether insects were as wildlife VCs, and whether any federally-listed arthropods were located within the RSA.

Information Request 10: NexGen should provide details about offsetting through a financial mechanism, and how that will protect both existing and far-future woodland caribou from the environmental effects of this proposed uranium mine.

Information Request 11: Seeking clarification on how NexGen intends to balance the mitigation measures required for different VCs (e.g., woodland caribou sensory disturbance reduction vs. detracting wildlife from contact water ponds via cannons or sonic guns).

Information Request 12: A revised baseline study for the vegetation VC should be conducted to accurately reflect the established RSA

Information Request 13: To gain a better understanding of the on-site hybrid system alternative and the economic considerations set out in the Draft EIS, the following feasibility studies should be made available for the public to review:

- SLR Consulting (Canada) Ltd. 2021. Renewable Energy Scoping Study for Mining Operations. Prepared for NexGen Energy, Arrow Development – Rook I Project.
- Stantec Consulting Ltd. 2019. Alternative Energy Assessment, Arrow Deposit, Rook I Project. Prepared for NexGen Energy Ltd.

Information Request 14: Where will the fans be located, at the production shaft or at the fresh air intake? The size of fans and volume of air circulated must be specified.

Information Request 15: The proponent must detail all plans for all wastes, both non-radioactive and radioactive, including but not limited to their storage and handling, environmental monitoring, worker health and safety programs, and their oversight throughout the project's lifecycle.

Information Request 16: Provide information regarding safe transport of materials offsite, including definitions for low grade or and hazard levels, impacts to road safety and roadway condition due to large trucks, and impacts borne to Indigenous communities.

Information Request 17: In reference to onsite wastewater (section 5.4.55) the following gaps remain: is this secondary or tertiary wastewater treatment? How will septic tank solids be removed? Where will these solids be disposed of, and how frequently? What constitutes domestic and industrial hazard waste? In what way will it be safely stored on site?

Information Request 18: What are the identified ecosystems that are valued in this proposed mine site development?

Information Request 19: What are the noise and visual impacts detailed over the timing of site development and mine site operation? Can a corridor of transit be implemented for wildlife in this area to facilitate access to and between waterbodies?

Information Request 20: There is no mention of how this project will adapt to the very real impacts of climate change such as increased incidence of drought and wildfire or violent weather creating floods and other sudden weather events. How will resiliency be built into this project in the face of continued regional impacts of climate change?

APPENDIX C – CV OF EXPERT LUC LANCE

LUC G. LANCE
50 Westview Crescent
Elliot Lake, ON
P5A 2B2

Email: Algoma.radon@gmail.com

OBJECTIVE:

To obtain employment in the following fields:
> Environmental Technician
> Environmental Health and Safety

EDUCATION:

>Elliot Lake Secondary School, Science, Technology and Trades
>Water Resources Field Technician, Loyalist College of Applied Arts & Technology

QUALIFYING CERTIFICATION and COURSES:

> Basic Water Treatment Plant Operation - Ministry of Environment
> Basic Wastewater Treatment Plant Operation - Ministry of Environment
> Water Treatment Plant Operation (Vol. 1) Correspondence Course, California State University
> Water Distribution System O&M Operation Correspondence Course, California State University (August 2002)
> Wastewater Treatment Plants Operation (Vol.1) Correspondence Course, California State University (October 2002)
> Water Treatment Plant Operation (Vol. 11) Correspondence Course, California State University (November 2002)

Ministry of Environment Certificates:
Operator-In-Training:
Water Treatment Plant Operation
Wastewater Treatment Plant Operation

Ministry of Environment License:
Water Treatment Plant Operator License - Level I (expired)
Wastewater Plant Operator License - Level I (expired)

Training Courses

> Ministry of Environment Municipal Industrial Strategy for Abatement Monitoring Program
> Transportation of Dangerous Goods
> St.John's Ambulance Standard First Aid (Advanced Level) (expired)
> C.P.R. Training
> Radiation Health and Safety

> WHIMIS (updated July 2017 at Musselwhite Mine))
> Confined Space Entry
> Respiratory Protection Program
> Industrial Hygiene
> Safety and Loss Control
> Environmental Responsibility

Ministry of Labour

> Basic Mine Rescue Certificate
> Standard Mine Rescue Certificate
> Advanced Mine Rescue Gold Seal
> Supervisory Mine Rescue Training

Computer Skills:

> Microsoft Suite (Word and Excel)
> Microsoft Power Point
> ENVISTA Environmental Data Monitoring Program
> SCADA (Supervisory Control & Data Acquisition) Environmental Remote Monitoring System
> Ministry of Environment MISA Monitoring Computer Program

Working Experience

Small business owner: **Present**
Algoma Radon Testing
Elliot Lake, ON

Responsibilities:
>Testing for radon gas in homes and buildings
>Testing for radon progeny in mining facilities
>Consulting on Radon Mitigation Reduction Systems
>Liaison with government agencies (Health Canada, Canadian Nuclear Safety Commission)
>Member of Canadian Association of Radon Scientist and Technologists (5 years)

City of Elliot Lake
Elliot Lake, ON

Water and Wastewater Treatment Plant Operator **3 years**

Responsibilities:
>Daily operation of Water and Waste Water Treatment plants
>Collecting required water sample as per MOE Certificate of Approval
>Analyzing water samples as required for operation

Mine Waste Management Inc., **3.5 Years**
Elliot Lake, ON

Environmental Control Technician
Wastewater Treatment Plant Operator

Responsibilities:
Include all aspects of environmental control monitoring some of which are as follows:
>monitoring of several waste water treatment plants, including remote monitoring for uranium decommissioned tailing sites
>surface water sampling
>ground water sampling
>bacteriological sampling
>dam instrumentation monitoring (piezometers)
-air quality monitoring (dust fall, rain gauges, Hi-volume sampling, Meteorological Stations)
-flow metering from lake out flows and rivers
-custodian for PCB Storage Facility
-liaison with regulatory agencies during quarterly and annual site inspections
-responsible for coordinating data for annual reports as required by MOE Certificate of Approvals and Canadian Nuclear Safety Commission Operating Licenses

Rio Algom Limited, **17 years**
Elliot Lake, ON

Environmental Control Technician

Responsibilities:
Some additional responsibilities similar to the above descriptions included:

Responsible for various types of radiation monitoring; gamma radiation scans (soil, waste material), ambient air radon gas testing and radon daughter monitoring (around mine sites, waste management areas and within the City of Elliot Lake), Rio Algom housing units

Rio Algom Stanleigh Uranium Mine, **3 years**
Elliot Lake, ON

Mine Ventilation Officer
Responsibilities:

-regular workplace radon progeny testing, management and control of ventilation systems in the underground mine facility
-development and performance with respect to the presence and potential hazardous substances and other occupational health hazards (silica dust sampling, noise levels)
-development and presentation of hazard awareness and control program training related to radon and hazardous materials to mine employees

REFERENCES:

Available on request

APPENDIX D – CV OF EXPERT DR. ROBERT PATRICK

CURRICULUM VITAE

FOR

ROBERT J PATRICK

Department of Geography and Planning
University of Saskatchewan
Saskatoon, Canada

June 2020

1. PERSONAL:

Date of Birth October 23, 1956

2. ACADEMIC CREDENTIALS:

Ph.D., University of Guelph, 2007, Department of Geography, Water Resources Management
M.A., Simon Fraser University, 2002, Department of Geography, Indicators for Sustainable Communities
B.Ed., Dalhousie University, 1984, School of Education, Secondary School Education
B.A., University of British Columbia, 1980, Department of Geography, Human Geography

3. OTHER CREDENTIALS:

Canadian Institute of Planners, 1990
Canadian Association of Geographers, 1995
Canadian Water Resources Association, 2002
Saskatchewan Professional Planning Institute 2008

4. APPOINTMENT(S) AND PROMOTIONS (U OF S):

Awarded Tenure and Promotion to Associate Professor (July 1, 2013)

5. ASSOCIATE MEMBERSHIPS:

5.1 In Other Departments or Colleges at the U of S

Global Water Futures, 2017 to present
Global Institute for Water Security, 2011 to present
School of Environment and Sustainability, 2009 to present
Centre for Hydrology, 2008 to present

6. LEAVES:

Sabbatical Leave: January 1, 2019 – July 1, 2019
Sabbatical Leave: January 1, 2015 – July 1, 2015

7. HONOURS (MEDALS, FELLOWSHIPS, PRIZES):

U of S College of Arts and Science Teaching Award Social Sciences, Spring 2014
U of S Student's Union Teaching Excellence Award nomination, 2012
U of S Student's Union Teaching Excellence Award nomination, 2009
U of S New Faculty Graduate Student Support Program, 2008
Canadian Association of Geographers Travel Award, University of Guelph, 2004
Latornell Graduate Travel Scholarship, University of Guelph, 2004
Arthur D. Latornell Graduate Scholarship, University of Guelph, 2003
Canadian Association of Geographers Travel Award, University of Guelph, 2003
Canadian Association of Geographers (Ontario Division) Best Paper Award, 2002
Ontario Graduate Scholarship in Science and Technology, University of Guelph, 2002
Graduate Student Fellowship Award, Simon Fraser University, 2000

8. PREVIOUS POSITIONS RELEVANT TO U OF S EMPLOYMENT:

Faculty Lecturer, Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Alberta, 2006-2008
Sessional Instructor, Department of Geography, Simon Fraser University, Burnaby BC, May 2006 to September 2006
Instructor, Department of Geography, Capilano College, North Vancouver, BC, September 2005 to April 2006
Instructor, Department of Geography, Lakehead University, ON, January 2005 to April 2006
Sessional Instructor, Department of Geography, University of Guelph, ON, January to December 2004
Water Management Planner, Sunshine Coast Regional District (SCRD), Sechelt, BC,
Land-use Planner (SCRD), Sechelt, BC, January 1991 to May 2000 May 2000 to September 2002
Planning Assistant (SCRD), Sechelt, BC, January 1988 to January 1991
Secondary School Teacher (Sunshine Coast School District), Sechelt, BC, September 1983 to January 1988

PATRICK, Robert J.

9. TEACHING RECORD:

9.1 SCHEDULED INSTRUCTIONAL ACTIVITY

YEAR	COURSE	INST. TYPE	ENROL	YIH	YCSH
2019-20	GEOG 240	LEC	105	39	4095
	PLAN 442	LEC	30	39	1170
2018-19	GEOG 240	LEC	60	39	2340
	PLAN 442	LEC	21	39	1092
	GEOG 240	LEC	100	39	3315
2017-18	GEOG 130	LEC	150	39	4173
	GEOG 130	LEC	107	39	4173
	PLAN 490	LEC	24	39	936
	GEOG 240	LEC	85	39	3315
2016-17	PLAN 442	LEC	28	39	1092
	GEOG 130	LEC	121	39	4719
	PLAN 442	LEC	32	39	1248
2015-16	GEOG 240	LEC	119	39	4641
	PLAN 442 Regional Planning	LEC	30	39	1170
2014-15	GEOG 240 Sustainable Cities	LEC	101	39	3939
	PLAN 442, Regional Planning	LEC	20	39	780
2013-14	PLAN 329, Watershed Planning	LEC	15	39	585
	GEOG 898, Advanced Planning	SEM	4	39	156
	RUP 490, Planning Project	LEC	30	39	1170
	GEOG 442, Regional Planning	LEC	30	39	1170
	GEOG 240, Sustainable Cities	SEM	101	39	3939
2012-13	GEOG 990, Colloquium	SEM	40	4	160
	GEOG 240, Sustainable Cities and Regions	LEC	73	39	2847
	GEOG 329, Watershed Planning	LEC	19	30	741
2011-12	GEOG 442, Regional Planning	LEC	19	39	741
	RUP 490, Applied Planning Project	LEC	23	39	897
	GEOG 442, Regional Planning	LEC	30	39	1170
	GEOG 240, Sustainable Cities & Regions	LEC	52	39	2028
2010-11	RUP 490, Applied Planning Project	LEC	23	39	897
	RUP 398, Models of Indigenous Planning & Development	SEM	9	39	351
	GEOG 442, Regional Planning	LEC	23	39	897
	GEOG 329, Watershed Planning & Mgmt	LEC	23	39	897
	GEOG 130, Space, Place & Society	LEC	180	39	7020
2009-10	RUP 490, Applied Planning Project	LEC	5	39	195
	GEOG 898, Integrated Water Resource Mgmt	LEC	3	39	117
	GEOG 442, Regional Planning	LEC	36	39	1404
	GEOG 329, Watershed Planning & Mgmt	LEC	22	39	792
	GEOG 490, Special Topics in Physical Geog.	LEC	1	39	39
2008-09	GEOG 208, World Regional Development	LEC	78	39	2925
	GEOG 130, Space, Place & Society	LEC	125	39	4875

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9.2 UNSCHEDULED INSTRUCTIONAL ACTIVITY:

Guest Lecturer:

2017-18	Guest lecture: PUBH 815 (for Lalita Bharadwaj), March 15, 2018. Guest Lecture on source water protection
2018	Guest Lecture. GEOG 803. February 5, 2018. Doing Research with First Nations.
2017	Guest Lecture: NSERC Create for Water Security. October 4, 2017. Source Water Protection Planning.
2016-17	PUBH 815: Guest lecture: "Protecting Water Sources on First Nations". Dr Lalita Bharadwaj, School of Public Health. March 9, 2017, 3 hours
2014-15	GEOG 130, Space Place & Society, 150 students, 2 hours
2013-14	NS 265, Aboriginal Peoples and Development, 30 students, 1 hour.
2011-12	GEOG 130, Space Place & Society, 150 students, 2 hours GEOG 280, Environmental Geography, 40 students, 1 hour
2009-10	ENVS 821, Sustainable Water Resources, 30 students, 1 hour
2008-09	GEOG 280, Environmental Geography, 50 students, 1 hour GEOG 351, Northern Environments, 30 students, 1 hour GEOG 280, Environmental Geography, 50 students, 1 hour

9.3 POSTGRADUATE STUDENTS SUPERVISED OR ON THEIR COMMITTEE

	Name	Degree	Department	Thesis Subject Area	Time Frame
Supervised:	A. Akobundu	MA	GEPL	Climate Change	In Progress 2020
	J. Schultz	MA	GEPL	Indig Planning	In Progress 2020
	W. Baijius	PhD	GEPL	Indigenous Water	In progress 2020
	O. Awume	MA	GEPL	Water Security	Completed 2018
	D. Iuliano	MWS	SENS	First Nations water	Completed 2017
	H. Carriere	MNGD	SPP	Dam licensing	Completed 2017
	V Mauel	MSEM	SENS	Urban Habitat	Completed 2017
	R Smith	MNGD	SPP	Northern School	Completed 2017
	C Coccola	MWS	SENS	Source Protection	Completed 2017
	T McKay	MNGD	SPP	Water Access	Completed 2017
	J. Daigneault	MNGD	ICNGD	Source Water	Completed 2016
	B. Cowan	MNGD	ICNGD	Source Water	Completed 2016
	M. Dawe	MA	GEPL	Road Access	Completed 2016
	J. Dejarlais	MNGD	ICNGD	Watershed Planning	Completed 2016
	A. Carlson	MNGD	ICNGD	Source Water	Completed 2015
	W. Baijius	MNGD	ICNGD	Lakeshore planning	Completed 2016
	K. Grant	MA	GEPL	Aboriginal Planning	Completed 2016
	K. Richardson	MSEM	SENS	Urban biodiversity	Completed 2015
	K. Young	MSEM	SENS	Watershed Planning	Completed 2014
	F. Goulet	MNGD	ICNGD	Water Perspectives	Completed 2015
	A. Al Abrahim	MA	GEPL	Water Management	Completed 2015
	J. Miller	MA	GEPL	Indigenous Water	Withdrew
	K. Trefry	MSEM	SENS	Housing	Completed 2014

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F. Younes	MSEM	SENS	Water Regulations	Completed 2013
H. Wang	MA	GEPL	Water Policy	Completed 2013
N. Lemoine	MA	GEPL	Water Policy	Completed 2012
J. Skwaruk	MA	GEPL	Cumulative Effects	Completed 2011
B. Morgan	MSEM	SENS	Water Policy	Completed 2011
J. Misfeld	MSEM	SENS	Water Policy	Completed 2012
F. Rawlyk	MA	GEPL	Source Protection	Completed 2012

Co-Supervised:

W. Baijius	PhD	GEPL	Water Planning	2015-
D. Johns	MNGD	ICNGD	Northern Planning	Completed 2012
E. Heffring	MSEM	SENS	Green Roofs	Completed 2010

Committee Member:

B. Field	PhD	GEPL	Spatial An	2018-
G. Apatinga	MSc	GEPL	Water/Health	2019-
F. Quader Nijhum	MSc	GEPL	EIA	2018-
V. Santafe	MES	SENS	Food Security	2016-
L Wong	MSc	GEPL	EIA	2016-
S. Striech	MSc	GEPL	Gndwater	2016-Completed
J Cronmiller	MSc	GEPL	EIA	2016-
B. Fawcett	PhD	GEPL	Housing	2015-
M. Tootoosis	PhD	INDST	Water rights	2015-
Zhibang Lv	PhD	GEPL	Hydrology	2013-Completed
Sarem Nejad	PhD	GEPL	Housing	2013-Completed
Sisi Zhang	MSc	GEPL	GIS	2013-Completed
Phillip Harder	MSc	GEPL	Hydrology	2013-Completed
Kabir Rasouli	PhD	GEPL	Hydrology	2013-Completed
D. Beveridge	PhD	GEPL	Groundwater	2012-Completed
J. Chilma	PhD	SENS	Water Quality	2012-Completed
A. Sizo		GEPL	SEA	2011-Completed
C. Finnigan	MSc	GEPL	Remote Sensing	2011-Completed
P. Basnet	MSc	GEPL	Cumulative Effects	2011-Completed
A. Petrenko	MSc	GEPL	GIS	2011-Completed
L. Chen	MA	GEPL	Urban GIS	2011-Completed
N. Rahimova	PhD	SENS	Tradable water rights	2011- Complete
T. Czerniak	MA	GEPL	Pedestrianization, SK	2011- Complete
G. Hagblom	MA	GEPL	Aboriginal Housing	2011- Complete
B. Sikorski	MA	GEPL	Cumulative Effects	2010-Completed
S. Kristensen	MA	GEPL	Cumulative Effects	2010-Completed
J. Chilma	MA	SENS	Cumulative Effects	2009-Completed
M. Ball	MSc	GEPL	Watershed Assess.	2009-Completed
A. Mahaffey	MSc	GEPL	Water Contaminants	2009-Completed
R. Lepage	MA	JSGS	Sustainability Assess.	2009-Completed
Y. Prusak	MA	GEPL	Indigenous Housing	2009-Completed
L. White	PhD	SENS	Energy, Sustainability	2009-Completed

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M. Tubbsum	PhD	GEPL	Indigenous land title	2009-Withdrew
N. Seitz	MSc	GEPL	Cumulative Effects	2009-Completed
P. Sheelanere	MSc	SENS	Cumulative Effects	2008-Completed
N. Fraser	MA	GEPL	Aboriginal Housing	2008-

External Examiner:

C. Steele	MSc	USASK	Engineering	April 2020
A. Khalafzai	PhD	UAlberta	Water policy	April 2020
S. Perry	MA	PolSt	Water policy	Completed 2015
D. Potter	MA	English	Novel	Completed 2014
J. Hardy	MA	Sociology	Renewable Energy	2009- Complete
A. Buonocore	MES	Geography	Lakehead University	May 2014
D. Carrier	MNGD	ICNGD	U of S	Sept 2014
J. Wasacase-Merasty	NORD 990	Second Reader		Sept 2014

9.4 NEW OR REVISED TEACHING MATERIALS DEVELOPED OR AUTHORED

2014-15, PLANNING 329 Integrated Water Resource Planning: Online Distance Education course development

9.5 SUBSTANTIALLY REVISED OR NEW COURSES DEVELOPED AND APPROVED

2015 PLAN 329 On-Line version course and module development

2010 GEOG 442 Revised course outline, new cource content – Course title change from Sustainable Land Use Planning to Regional Planning
2008 GEOG 329 New course develop for January 2009: Watershed Planning and Management

9.6 PUBLICATIONS IN JOUNALS OR BOOKS RELATED TO TEACHING METHODS

9.7 ATTENDANCE AT TEACHING IMPROVEMENT WORKSHOPS

2014 Gwena Moss Centre for Teaching Effectiveness "Preparing and Personalizing the Course Syllabus Using the New U of S Template". June 4, 2014
2013 Gwena Moss Centre for Teaching Effectiveness. *Teaching Large Classes: The More the Merrier*. September 16, 2013.
2011 Gwena Moss Centre for Teaching Effectiveness. *Graduate Supervision: Effective Strategies for Mentoring Graduate Students*. Spring Workshop with Brad Wuetherick and Jim Thornhill. May 5 2011.

9.8 TEACHING AWARDS OR RECOGNITIONS RECEIVED

2014 Teaching Excellence Award. College of Arts and Science
2012 Nominated for USSU Teaching Award (Geography 442)
2010 Nominated for USSU Teaching Award (Geography 329)

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10. THESES SUPERVISED

	Name	Degree	Department	Thesis Subject Area	Time Frame
Supervised:					
	O. Awume	MA	GEPL	Water Security	Completed 2018
	R. Smith	MNGD	ICNGD	Education	Completed 2017
	C. Coccola	MWS	SENS	Source protection	Completed 2017
	V. Mauel	MSEN	SENS	NE Swale	Completed 2017
	M. Dawe	MSEM	SENS	Source protection	Completed 2016
	J. Daigneault	MNGD	ICNGD	Water planning	Completed 2016
	B. Cowan	MNGD	ICNGD	Water planning	Completed 2016
	K. Grant	MA	GEPL	Water Planning	Completed 2016
	A. Carlson	MNGD	ICNGD	Source Protection	Completed 2016
	F. Goulet	MNGD	ICNGD	Water Policy	Completed 2015
	W. Baijius	MA	GEPL	Lake Planning	Completed 2015
	K. Richardson	MSEM	SENS	Biodiversity	Completed 2015
	A. Al Ibrahim	MA	GEPL	Urban Water	Completed 2015
	K. Young	MSEM	SENS	Watershed Planning	09/2013-09/2014
	H. Wang	MA	GEPL	Water Policy	01/2011-09/2013
	K. Trefry	MSEM	SENS	Sustain. Housing	09/2012-08/2013
	N. Lemoine	MA	GEPL	Northern water	09.2010-09/2012
	F. Younes	MSEM	SENS	First Nations water	09/2011-09/2012
	J. Skwaruk	MA	GEPL	Cumulative Effect	05/2010-11/2011
	J. Misfeld	MSEM	SENS	Water Policy	09/2010-04/2012
	B. Morgan	MSEM	SENS	Water Policy	09/2010-08/2011
	F. Rawlyk	MA	GEPL	Source Protection	09/2008-04/2012
Co-Supervised:					
	D. Johns	MNGD	ICNGD	Northern Planning	01/2011-04/2013
	E. Heffring	MSEM	SENS	Green Roofs	09/2009-08/2010

11. BOOKS, CHAPTERS IN BOOKS, EXPOSITORY AND REVIEW ARTICLES:

BOOKS:

Patrick, R.J. 2020. *Sustainable Cities and Regions*. Kendall Hunt Publishing Company, Dubuque, IA, USA. [eBook for use in Geography 240]

Patrick, R.J. 2020. *Protecting Sources of Drinking Water: A Resource Guidebook for Indigenous Communities, Watershed Associations, Local Governments and Non-Governmental Associations*. Kendall Hunt Publishing Company, Dubuque, IA, USA. ISBN 978-1-7924-0877-9. [eBook for use in Geography 130]

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CHAPTERS IN BOOKS

PUBLISHED:

Patrick, R. J. 2016 "Indigenizing Source Water Protection" in Indigenous Peoples and Resource Development in Canada by Robert Bone and Robert Anderson. Captus Press. Toronto, pp 307-316.

Patrick, R. 2013. Indigenous Planning and Source Water Protection in Ian Skelton and Octavio Ixtacuy Lopez (eds) Models of Indigenous Development. Common Ground Publishers.

Patrick, R. 2013. Indigenous Source Water Protection: Lessons for Watershed Planning in Canada in Ryan Walker, David Natcher, Ted Jojola and Tanira Kingi (eds) Walking Backwards into the Future. McGill Queens University Press.

EXPOSITORY AND REVIEW ARTICLES

PUBLISHED:

Patrick, R. 2013. Invited guest statement (vignette). Source Water protection for safe drinking water in Norton, B. Human Geography, Eighth Edition. Oxford University Press.

12. PAPERS IN REFEREED JOURNALS:
ACCEPTED:
PUBLISHED:

Obadiah Awume, **Robert Patrick** * and Warrick Baijius (2020). Indigenous Perspectives on Water Security in Saskatchewan, Canada. *Water*, 12, 810; doi:10.3390/w12030810

Baijius W., & **Patrick, R. J**.(2019). Planning around reserves: Probing the inclusion of First Nations in Saskatchewan's watershed planning framework. *The International Indigenous Policy Journal*, 10 (5). doi: https://10.18584/iipj.2019.10.5.8502

Patrick R.J. (2019). Building Water Security through Drinking Water Protection Planning with First Nations in Canada. Invited paper in: *Global Water Security Issues - Case Studies: Water Security and the Sustainable Development Goals*. Invited special collection of papers on water security. UNESCO International Centre for Water Security and Sustainable Management (i-WSSM). Republic of Korea. Global Water Security Issues. UNESCO i-WSSM website:
http://unesco-iwssm.org/board/select?bbsNo=0000000064&nttSn=35

Baijius, Warrick and **Robert Patrick** (2019). "We Don't Drink the Water Here": The Reproduction of Undrinkable Water for First Nations in Canada. *Water* 11, 1079. (Special Issue).

Patrick, Robert; Kellie Grant and Lalita Bharadwaj (2019). Reclaiming Indigenous Planning as a Pathway to Local Water Security. Water 11(5) 936. (Special Issue)

Patrick, R. J. (2018). Adapting to Climate Change Through Source Water Protection: Case Studies from Alberta and Saskatchewan, Canada. *The International Indigenous Policy Journal*, 9(3). DOI: 10.18584/iipj.2018.9.3.1

PATRICK, Robert J.

Patrick, Robert; Graham Strickert; Tim Jardine and Warrick Baijius (2018). A Watershed for Collaboration: A Multi-Jurisdictional Approach to Indigenous Water Stewardship. *Plan Canada* Vol 58(3).

Al Ibrahim, A.; **Patrick, RJ.** 2017. Source Water Protection Planning and Management in Metropolitan Canada: A Preliminary Assessment. *Water*, 9(7), 497.

Patrick, R. 2017. Social and cultural impacts of the 2013 Bow River flood at Siksika Nation, Alberta, Canada. *Indigenous Policy Journal* 28(3) Research Notes.

C Kleinschmidt, **RJ Patrick** and M Mayer, 2017. "It's not just the food we produce, it's the community we are building": Growing Healthy Communities in Saskatoon, Canada. *Prairie Perspectives*. Volume 19 (Melfort Papers).

Robert J Patrick, Laura Machial, Lenny Quinney, Kendra Quinney. 2017. Lessons Learned Through Community-Engaged Planning. *International Indigenous Policy Journal* (April 2017 Special Issue. Reconciling Research: Perspectives on Research Involving Indigenous Peoples - Part 1) Volume 8, Issue 2.

Jania S. Chilima, Jill A.E. Blakely, Bram F. Noble & **Robert J. Patrick**. 2017. *Canadian Water Resources Journal*. Institutional arrangements for assessing and managing cumulative effects on watersheds: Lessons from the Grand River watershed, Ontario, Canada. http://dx.doi.org/10.1080/07011784.2017.1292151

R. Patrick & L. Bharadwaj 2016. Mining and campesino engagement: an opportunity for integrated water resources management in Ancash, Peru, *Water International*, 41:3, 468-482, DOI: 10.1080/02508060.2016.1160311

Young, K. and **R. Patrick** 2015**.** A Planning Framework for Community-Based Lakeshore Management Planning: A Case Study. Saskatchewan Professional Planners Institute. *Planning Journal*. pp. 4-7.

Wang, H. and **R. Patrick** 2014. Implementing source water protection plans in Saskatchewan: Local watershed perceptions. *Prairie Perspectives*. Vol 17: 1-10.

Morgan, B., **R. Patrick**, and M-A. Bowden 2014. Water Governance in the Saskatchewan River Basin: A Preliminary Study. *Journal of Rural and Community Development*. Vol. 9(4). pp 34-48.

Lemoine N. and **R. Patrick** 2014. Water Governance in Northern Saskatchewan: Opportunities and Challenges. *Canadian Journal of Urban Research* 23:1 Supplement 2014. pp. 46-60.

Patrick, R. 2014. Source water protection planning: A role for planners. *Alberta Professional Planners Institute Journal* 13:12-15.

Patrick, R. and D. Espeseth. 2014. A Planning Tool for the Protection of Drinking Water Sources in Canada. *Plan Canada* 54 (4): 28-33.

Noble B., Skwaruk, J. and **R. Patrick.** 2013. Toward cumulative effects assessment and management in the Athabasca watershed, Alberta, Canada. *The Canadian Geographer*. DOI. 10.1111/cag.12063

Rawlyk, F. and **R. Patrick.** 2013. Capacity Needs for source water protection plan implementation: Lessons from the South Saskatchewan River. *Canadian Journal of Urban Research* 22(1): 19-45.

Kevinson J., **Patrick R.** and L. Bharadwaj. 2014. A framework for assessing effective urban water management: lessons from the Canadian prairie. *Water International* 39(1): 113-127.

PATRICK, Robert J.

Rizvi, Z., Adamowski, J. and **Patrick, R.J.** 2013 'First Nation capacity in Quebec to practice integrated water resource management' *International Journal of Water* 7(3), 161-190.

Sheelanere, P., Noble, B.F., **Patrick, R.J.** 2013. Institutional requirements for watershed cumulative effects assessment and management: Lessons from a Canadian trans-boundary watershed. *Land Use Policy* 30: 67– 75.

Kristensen, S.; Noble, B.F. **Patrick, R.J.** 2013. 'Capacity for Watershed Cumulative Effects Assessment and Management: Lessons from the Lower Fraser River Basin, Canada. *Environmental Management*. DOI 10.1007/s00267-013-0075-z.

Chilma, J.S., Gunn, J., Noble, B.F., **Patrick, R.J.** 2013. 'Institutional considerations in watershed cumulative effects assessment and management' *Impact Assessment and project Appraisal* 31(1), 74-84.

Patrick, R. and A. MacDonald. 2012. Symbolism and the city: From towers of power to 'Ground Zero'. *Prairie Perspectives*. 15: 14-18.

Patrick, R.J. and Cheesborough, D. 2012 'Revisiting Food Deserts in the Canadian Prairie'. *Plan Canada* 52(3).

Patrick, R.J. 2011. Enhancing water security in Saskatchewan, Canada: an opportunity for a water soft path. *Water International* 36 (6). 748-763.

Smith, B. and **Patrick, R.J**. 2011. Xeriscape for Urban Water Security: A Preliminary Study from Saskatoon, Saskatchewan. *Canadian Journal of Urban Research*, Volume 20 Issue 2, pages 56-70.

Noble, B. F., Poornima S. and **Patrick, R.J.** 2011. Advancing watershed cumulative effects assessment and management: Lessons from the South Saskatchewan River Watershed, Canada. *Journal of Environmental Assessment Policy and Management* 13 (4): 567-590.

Patrick, R. 2011. Uneven access to safe drinking water for First Nations in Canada: Connecting health and place through source water protection. *Health & Place* (17). 386-389.

Patrick, R. 2009. A political ecology of source water protection. *Prairie Perspectives* 12: 43-61.

Patrick, R. 2009. Source water protection in a landscape of 'New Era' deregulation. *The Canadian Geographer* 53 (2): 208-221

Patrick, R. 2008. Planning for Source Water Protection. *Plan Canada* 48 (4):19-22.

Patrick, R. 2008. Source Water Protection for Nonmetropolitan Drinking Water Operators in British Columbia, Canada. *Journal of Rural and Community Development* 3(2):64-78.

Patrick, R., R. Kreutzwiser and R. de Loë. 2008. Factors facilitating and constraining source water protection. *Canadian Water Resources Journal* 33(1): 39-54.

Patrick, R. 2005. Protecting Drinking Water Sources and Public Health. *Healthcare Quarterly* 3(3): 2-7.

Patrick, R. and M. Roseland. 2005. Using sustainability indicators to improve access to public transit in rural residential areas: Alternatives for the Georgia Basin, BC. *Journal of Rural and Community Development* 1:1-18. www.jrcd.ca

Patrick, R. J. 2004. [Re-]Designing rural residential areas with public transit in mind: developing indicators for a more sustainable future. *Western Geography,* 13/14: 109-131. http://office.geog.uvic.ca/dept/wcag/patrick.pdf

PATRICK, Robert J.

Patrick, R.J. 2003. Public transit and the Kyoto Protocol: How local government in Canada can promote greenhouse gas emission reductions. *The Great Lakes Geographer*, 9(2): 94-101. [student paper prize winner PhD category, CAGONT 2002] http://geography.ssc.uwo.ca/great_lakes_geographer/GLG_volume9/patrick.pdf

13. PAPERS IN NON-REFEREED JOURNALS:
PUBLISHED:

Patrick, Robert. 2018. Solution Source: First Nation communities in Saskatchewan are adapting to climate change impacts through source water protection planning. WATER CANADA. May/June 2018 issue.

Patrick, R.J. , Millward, W. and B. Noble. 2013. Source Water Protection Policy in Canada. Municipal World 123(11): 9-13.

Patrick, R.J. 2013. First Nations and Source Water Protection. Safe Drinking Water Foundation (Saskatoon, SK) Editorials. (http://www.safewater.org/resources/sdwf-editorials.html)

Patrick, R. 2005. Planning for safe drinking water: A role for planners. *Planning West* 47 (3): 7-9. Planning Institute of British Columbia.

Patrick, R. 2005. A political ecology of drinking water source protection. *Rhizome*, 14(2): 11-12.

Brooks, D., de Loë, R.C., **Patrick, R.,** and Rose, G. 2004. *Water Soft Path for Ontario: Feasibility Study*. Final Report, July, 2004. Prepared for the Walter and Duncan Gordon Foundation. Ottawa, ON: Friends of the Earth Canada. 87 pp.

Patrick, R. 2002. Public transit and Kyoto: Developing indicators for sustainable development. *Planning Institute of British Columbia News* 44(4): 13-16.

14. INVITED PAPERS IN PUBLISHED CONFERENCE PROCEEDINGS AND ABSTRACTS:

Noble B. and **Patrick R.** 2013. Requisites for regional cumulative effects assessment and management. Invited presentation, Theme Forum on Regional and Ecosystem-based Approaches to Cumulative Effects Assessment. 33rd Annual Conference of the International Association for Impact Assessment, 'Impact Assessment: The Next Generation.' 13-16 May, Calgary, AB.

Patrick, R., June 2012. Uneven access to safe drinking water for Indigenous Peoples in Canada Presented at: Indigenous Planning Exchange Program (IPEX) conference "Conferencia En Modelos De Desarrollo Indigena". Hosted by: Universidad Autónoma de Chiapas San Cristobol, Mexico, Feb. 23-25, 2011.

15. CONTRIBUTED PAPERS IN PUBLISHED CONFERENCE PROCEEDINGS AND ABSTRACTS:

Patrick, R. and Kreutzwiser, R.D. 2006. *A political ecological perspective on source water protection: Case studies from the Okanagan Valley, British Columbia*. In Working from the Source: Towards Sustainable Management. Proceedings of the CWRA 59th Annual Conference, Toronto, June, 2006. Cambridge, ON: Canadian Water Resources Association (reviewed by a selection committee).

PATRICK, Robert J.

16. TECHNICAL REPORTS RELEVANT TO ACADEMIC FIELD:

Patrick, R. 2019. Position Paper. Building Indigenous Research Capacity and Reconciliation Through Source Water Protection. Presented to Social Sciences and Humanities Research Council of Canada. Indigenous Research Capacity and Reconciliation – Connection Grants. File No. 612-2018-0155.

Patrick, R. 2013. Aboriginal and Northern Development Canada. Source Water Protection Template and Guidance Document. AANDC. Gatineau, QC. Sole author.

Patrick, R. Canada Mortgage and Housing Corporation 2001. Your Next Move: Choosing A Neighbourhood with Sustainable Features. CMHC Publication No. NH15-377/2001E

Patrick, R. Halfmoon Bay Liquid Waste Management Plan - Stage 2. Prepared for Sunshine Coast Regional District Board: Sechelt, BC.

Patrick, R. 2001. Future Water Capacity and Alternatives. (Reports 1-4). Prepared for the Sunshine Coast Regional District Board: Sechelt, BC.

Patrick, R. 1998. Egmont/Pender Harbour Official Community Plan. Prepared for the Sunshine Coast Regional District Board: Sechelt, BC.

Patrick, R. 1994. Roberts Creek Official Community Plan, Prepared for the Sunshine Coast Regional District Board: Sechelt, BC.

Patrick, R. (1991). Inland Centres of New South Wales: Trends and Opportunities. Prepared for the New South Wales Department of Planning: Sydney, Australia.

17. BOOK REVIEWS:

Sproule-Jones, M.C. Johns, and B.T. Heinmiller (eds). 2008. Canadian Water Policy. McGill-Queens University Press, 390 pages. Reviewed for Journal Environments.

18. INVITED LECTURES OUTSIDE U OF S AND INVITED CONFERENCE PRESENTATIONS:

Patrick, R. 2020	Assembly of First Nations. Climate Gathering. Whitehorse, Yukon. March 2-5, 2020. Invited Workshop Presentation: *"Climate Change Impacts and Adaptation Planning: Stories from Saskatchewan"*.
Patrick, R. 2020	Fraser Basin Council. Adaptation Canada 2020. Vancouver, BC. Feb 19-21, 2020. Invited Presentation: *"Kikawinaw Askiy: Reconciling with Indigenous Sacred Ecology"*.
Patrick, R. 2019	Household Water Insecurity Experiences (HWISE). UBC/Texas A&M Workshop. Invited Participation. Vancouver, BC. November 17-19, 2019.
Patrick, R. 2019	Partners for the Saskatchewan River Basin. Annual Conference "Where Waters Meet". Indigenizing Water Security. Gimli MB. Sept. 30-Oct 2.
Patrick, R. 2019	*Kikawinaw Askiy: Reconciling with Indigenous Sacred Ecology*. Global Water Futures Second Annual Science meeting held in Saskatoon, SK. May 12-17, 2019. Co-Presented.
Patrick, R. 2019	*First Nations (Canada) and Water Security*. Presentation at: American Association of Geographers (AAG). Washington, DC. USA. April 3-7, 2019. Presented by R. Patrick

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Patrick, R. 2019	Participant at SSHRC Workshop (Recipients of Connectins Grant - Indigenous Research Capacity and Reconciliation). Workshop held in Ottawa, ON. March 12-13, 2019.
Patrick, R. 2019	*Kikawinaw Askiy: Reconciling with Indigenous Sacred Ecology*. Presentation at Assembly of First Nations (AFN) second annual National Water Symposium and Tradeshow at Niagara, ON. Feb 25-27, 2019.
Patrick, R. 2019	Participant at Technical Services Advisory Group (TSAG - Alberta First Nations) Workshop. (Indigenous Research Capacity and Reconciliation – SSHRC Connections Grant awarded to TSAG). Banff, AB. Workshop January 21-23, 2019.
Patrick, R. 2018	University of California Santa Barbara. Water Realities in Canada. Guest lecture presented to graduate students of Prof. Robert Wilkinson, UCSB Bren School of the Environment. 14 Nov 2018.
Patrick, R. 2018	University of California Santa Barbara. Source Water Protection Planning with First Nations in Canada. Guest lecture presented to graduate students of Prof. Robert Wilkinson, UCSB Bren School of the Environment. 15 Nov 2018.
Patrick, R. 2018	*Indigenous Perspectives on Water Security*. Presentation at: Prairie Division, Canadian Association of Geographers. Annual General Meeting. Held at Hecla, MB. September 28-30, 2018. Presented by R. Patrick.
Patrick, R. 2018	Toward water security and climate change adaptation through source water protection planning: Stories from the Canadian Prairie. Alberta Watershed Planning Advisory Committee (WPAC) 2018 Summit held in Peace River, AB. June 19-22, 2018.
Patrick, R. 2018	Source Water Protection Planning. Global Water Futures Inaugural Annual Science meeting held in Hamilton, ON. June 3-6, 2018.
Patrick, R. 2018	Yorkton Tribal Council (April 24, 2018). Housing Workshop for Touchwood Agency, Qu'Appelle and Yorkton Tribal Councils. Presentation title: Source water protection planning in your community.
Patrick, R. 2018	American Association of Geographers (AAG) New Orleans April 9-14, 2018. Lessons learned from community-based participatory research: Cumberland House Water Stewardship Plan.
Patrick, R. 2018	File Hills Qu'Appelle (March 22, 2018) Water Operators Workshop. Advancing source water protection in your community.
Patrick, R. 2017	Partners for the Saskatchewan River Basin. Leduc, AB. Annual Conference October 17-19, 2017.Presentation Topic: Frog Lake Source Water Protection Plan (with Len Quinney).
Patrick, R. 2017	FSIN Health and Social development Climate change Adaptation Workshop. Sept 21-22, 2017. Presentation: Adapting to Climate Change: University Research in your Community.
Patrick, R. 2017	Community Navigators Workshop (First Nations). Presentation title: "Planning 101" Saskatoon. Hosted by Indigenous and Northern Affairs Canada. March 14, 2017.

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Patrick, R. 2017	Partners for the Saskatchewan River Basin. Annual Conference. Presentation title: "Source Water Protection Planning with Siksika Nation, Treaty 7, Alberta" Saskatoon, Oct 19, 2017.
Patrick, R. 2016	North American Lake Management Society. Science to Stewardship: Balancing Economic Growth with Lake Sustainability. First Nations and Water special session. "Saskatchewan River Delta: Water Stewardship Planning Initiative". November 1-4, 2016. Banff, Alberta.
Patrick, R. 2015	Prince Albert Model Forest. Workshop. Presentation title: "Cumberland House Water Stewardship Plan". Prince Albert, SK. December 2015.
Patrick, R. 2015	Partners for the Saskatchewan River Basin. Annual Conference. Presentation title: "Cumberland House Water Stewardship Plan". Winnipeg, MB. Nov 2/3, 2015.
Patrick, R. 2015	Technical Services Advisory Group. Annual Conference. Presentation title: "Source Water Protection at Muskowekwan First Nation, SK." Edmonton, AB. October 28, 2015 (with J. Manitopyes)
Patrick, R. 2015	Canadian Institute of Planners. Annual Conference. Presentation title: Planning for source water protection with First Nations on the Canadian Prairie". Saskatoon, SK. July 2015.
Patrick, R. 2015	Canadian Association of Geographers. Annual Conference. Presentation title: "First Nations and Source Water Protection Planning on the Canadian Prairie". Vancouver, BC. June 2015.
Patrick, R. 2015	Canadian Water Resources Association. Annual Conference. Presentation title: "Source water protection with First Nations". Winnipeg, MB. June 2015.
Patrick, R. 2014	Partners for the Saskatchewan River Basin. Annual Conference. Presentation title: "Muskowekwan First Nation Source Water Protection Planning". Saskatoon, SK. October 27, 2014 (with J. Manitopyes).
Patrick, R. 2014	Technical Services Alberta Group Environmental Management Trade Show and Conference. Presentation Title: 'Source Water Protection'. October 17, 2014. Edmonton, AB.
Patrick, R. 2014	Saskatchewan Aboriginal Land Technicians. Annual Conference. Presentation Title: A Planning Template for Source Water Protection with First Nations. Saskatoon, August 14, 2014.
Patrick, R. 2014	Saskatchewan Association of Watersheds Annual Conference. Presentation Title: Taking a Soft Path to Water Management. Saskatoon, March 19-21, 2014.
Patrick, R. 2014	Ontario First Nations Technical Services Corporation – Water Symposium. Presentation Title: "Source water protection planning in your community". Niagara Falls, ON. March 3-5, 2014.
Patrick, R. 2014	Government of the Northwest Territories. Presentation Title: Capacity building for source water protection: Yellowknife, MWT. February 20, 2014.

Patrick, R. 2014	Saskatoon Sustainability Networking Conference. Title: Transportation Planning and Design. Presentation Title: Urban Transportation and Design: Getting to Where we Need to Go". Saskatoon, SK. Jan 24, 2014.
Patrick, R. 2013	Partners for the Saskatchewan River Basin. Annual Conference. Presentation Title: "How to develop a source water protection plan in a community near you!" . Medicine Hat, Alberta. October 23, 2013.
Patrick, R. 2012	Saskatoon Cycles Annual General Meeting. Presentation title: 'Economics of Cycling'. Oct 11, 2012. Saskatoon, SK.
Patrick, R. 2012	Provincial Association of Resort Communities of Saskatchewan, Annual Conference. Presentation Title: 'Source water protection in your community'. Oct 13, 2012 PARCS, Manitou Beach, SK.
Patrick, R. 2012	Touchwood Agency Tribal Council, The Gift of Life. Annual Saskatoon Conference. Presentation Title: 'First Nations source water protection planning: Getting started!' October 17, 2012. Saskatoon Inn, Saskatoon.
Patrick, R. 2012	Technical Services Alberta Group Environmental Management Trade Show and Conference. Presentation Title: 'Source Water Protection: Getting Started!'. Nov 6, 2012. Edmonton, AB.
Patrick, R. 2013	Planning for Environmental Change Workshop. Technical Services Advisory Group. Presentation Title: 'A Template for Source Water Protection in Your Community'. Feb 12, 2013 Edmonton, AB.
Patrick, R. 2013	Water Security Agency. Old Wives Lake Source Water Protection Plan workshop. Presentation Title: 'Source Water protection: Getting Started'. Jan 31, 2013. Gravelbourg, SK.
Patrick, R. 2012	Watershed Planning and Management for Safe Drinking Water, College of Agriculture and Bioresources, Land Management Workshops. June 2012, English River First Nation, SK.
Patrick, R. 2012	Watershed cumulative effects assessment and management in Canada: Institutional arrangements, capacity and scale. Canadian Water Resources Association annual conference, June, Banff, AB. (with B. Noble)
Patrick, R. 2012	State of the Saskatchewan River Basin Report. Treaty 7 water sub-table, June, Calgary, AB.
Patrick, R. 2012	2012 Nonpoint Source Pollution/Low Impact Development. 2012 Canon Envirothon Current Issue Topic. Hosted by Meewasin Valley Authority, held May 4 at U of S. Annual event for high school students in Saskatchewan.
Patrick, R. 2012	Northwest Territories Source Water Assessment and Protection planning workshop for southern communities, March, Yellowknife, NWT.
Patrick, R. 2012	First Nations source water protection planning: Getting started! Assembly of First Nations. National Water Conference, March, Edmonton, AB.
Patrick, R. 2012	Northwest Territories Source Water Assessment and Protection planning workshop for northern communities, February, Inuvik, NWT.
Patrick, R. 2012	Source Water Protection in a Nutshell (invited workshop). Canadian Association of Planning Students conference "Planning Horizons: The Edge, Future, and Potential of Planning, February, Simon Fraser University, Vancouver, BC.

PATRICK, Robert J.

Patrick, R. 2012	Source Water Protection and Public Health. Department of community Health Services, Faculty of Medicine, January, University of Calgary, Calgary, AB.
Patrick, R. 2012	Source Water Protection in a Nutshell. A presentation to the Fort Chipewyan Research Team. Department of Community Health Services, Faculty of Medicine, January, University of Calgary, Calgary, AB.
Patrick, R. 2012	Source Water Protection (In a Nutshell). Indigenous Peoples Land Management Program module III, January, Presentation at Wanuskewin Heritage Park, SK.
Patrick, R. 2011	Resident Mentor. Water and Agriculture: A Workshop for Saskatchewan's Future Leaders, hosted by Waterlution, November, Craik Eco-Village, SK.
Patrick, R. 2011	"What about Source Water Protection?". Moving Towards Safe Drinking Water to First Nations. Touchwood Agency Tribal Council. Water: The Gift of Life conference, September, Saskatoon, SK.
Patrick, R. 2011	Water Security in Northern Saskatchewan. Presented at Keepers of the Water V, August, Lac Brochet, MB.(hosted by Northlands First Nation).
Patrick, R. 2011	Protecćion de la fuente de agua. Presented at Urpichallay farm community workshop, April, Marcara, Peru. CIDA funded research exchange.
Patrick, R.2011	Building Water Security through source water protection. Presented at Universidad Nacional "Santiago Antunez De Mayolo" Facultad De Ciencias Del Ambiente. EXPOSITOR en el Ciclo de Conferencias Magistrales "Calidad y Gestion del Agua". April, Huaraz, Peru. CIDA funded research exchange.
Patrick, R. 2011	Water in Canada and the Prairies: An uncertain future. Presented at Universidad Nacional "Santiago Antunez De Mayolo" Facultad De Ciencias Del Ambiente. EXPOSITOR en el Ciclo de Conferencias Magistrales "Calidad y Gestion del Agua", April, Huaraz, Peru. CIDA funded research exchange.
Patrick, R. 2011	Access to Safe Water for Indigenous Pepoles' in Canada. Indigenous Peoples' Health Research Centre. First Annual Indigenous Health Conference, March, Saskatoon, SK.
Patrick, R. 2011	Watershed Planning in Indigenous communities in Saskatchewan, Canada. Presented at: Indigenous Planning Exchange Program conference "Conferencia En Modelos De Desarrollo Indigena". February, Hosted by: Universidad Autónoma de Chiapas San Cristobol, Mexico. IPEX involves USASK and 5 other universities.
Patrick, R. 2011	Watershed Planning in Indigenous communities in Saskatchewan, Canada. February, Classroom lecture presented at: Indigenous Planning Exchange Program at: Universidad Autónoma de Chiapas San Cristobol, Mexico.
Patrick, R. 2011	IPRM 200.3: Water Rights. Indigenous Peoples Resource Management Program (Module III). Invited guest, January, University of Saskatchewan, Saskatoon, SK.
Patrick, R. 2010	Water Demands for Nuclear Power on the Northern Saskatchewan River. Presented at Keepers of the Water IV: Wollaston Lake August, hosted by Hatchet Lake Denesuline First Nation, SK.

PATRICK, Robert J.

Patrick, R. 2009 Water and Nuclear Energy. Presented at Sustainable Water and Sustainable Energy Conference. Sponsored by Canadian Water Resources Association and Partners FOR the Saskatchewan River Basin held at Saskatoon Inn, Saskatoon, November 3-5, 2009.

Patrick, R. 2009 Climate Change Impacts on Water Resources. Presented at USSU Green Yourself Week, Campus Sustainability Day. October 23, 2009. Arts 146 Public Lecture.

Patrick, R. 2009 Implementing Source Water Protection. Presented at the Association of Professional Community Planners of Saskatchewan Annual Conference, Regina, SK. October 7, 2009.

Patrick, R. 2008 Connecting Land Use and Public Transit: How local government in Canada can promote greener, healthier communities. Presented at the Association of Professional Community Planners of Saskatchewan Annual Conference, Saskatoon, SK. October 15-17, 2008.

Patrick, R. 2007 Factors Facilitating and Constraining Source Water Protection in the Okanagan Valley: a Perspective from Political Ecology. Presented at the Water Supply Association of BC 13th Annual General Meeting, Penticton, BC. October 26, 2007.

19. PRESENTATIONS AT CONFERENCES (Non-Invited):

Patrick, R. 2017. Prairie CAG Morris Manitoba Sept 30-Oct 1, 2017. Paper: Cumberland House Water Stewardship Plan

Patrick, R. 2014. Source Water Protection with First Nations. 37th Annual Meeting of the Prairie Division of the Canadian Association of Geographers. Sept 26-28, 2014. Riding Mountain, MB.

Patrick, R., P. Sheelanere and B. Noble. 2011. Requisites for watershed-scale cumulative effects assessment and management. 35th Annual Meeting of the Prairie Division of the Canadian Association of Geographers. Sept 16-18, 2011. Devils Lake, North Dakota, USA.

Morgan, B., **R. Patrick** and M.A. Bowden. 2011. Exploring Watershed Governance: Opportunities for the Saskatchewan River Basin. 35th Annual Meeting of the Prairie Division of the Canadian Association of Geographers. Sept 16-18, 2011. Devils Lake, North Dakota, USA.

Patrick, R. 2011. Institutional requirements to support watershed cumulative effects assessment and monitoring in the South Saskatchewan Watershed Special Session Chair. Presented at Canadian Association of Geographers, Calgary, AB. June 1.

Patrick, R. 2008. Canadian Water Resources Association – Saskatchewan Branch. TOPIC: Eight reasons for the world to act on water and sanitation. October 23, 2008.

Patrick, R. 2008. Colloquium Series. Department of Geography and Planning. University of Saskatchewan. October 3, 2008.

Patrick, R. 2008. Factors Constraining Source Water Protection in the Okanagan Valley. Presented to the Prairie Division of the Association of Canadian Geographers. Boissevain, Manitoba. September 26/27, 2008.

Patrick, R. 2007. Evaluating Alberta's 'Water for Life' Program. Presentation at the Canadian Association of Geographers (Western Division). Abbotsford, BC March 9-11.

PATRICK, Robert J.

Patrick, R. 2006. Source Water Protection from a Political Ecological Perspective: Case Studies from the Okanagan Valley, BC. Atlas Speaker Series. Department of Earth and Atmospheric Sciences. University of Alberta. October 27, 2006

Patrick, R. and R. Kreutzwiser. 2006. Source water protection in the era of neo-liberalism: Tales from the Okanagan Valley, BC. For presentation at Western Division Canadian Association of Geographers, Kamloops, BC March 10-12.

Patrick, R. and R. Kreutzwiser. 2004. Drinking Water Source Protection in BC: A Perspective from Political Ecology. Presented at Canadian Association of Geographers, Moncton, NB May 25-29.

Patrick, R. and R. Kreutzwiser. 2003. Who's Guarding the Well? The status of drinking water source protection in British Columbia. Presented at Canadian Association of Geographers, Victoria, BC May 27-31.

Patrick, R. 2002. Public transit and the Kyoto Protocol: How local government in Canada can promote greenhouse gas emission reductions. Presented at Canadian Association of Geographers (Ontario Division), London, ON October 26. [Student paper prize winner (PhD category)].

Patrick, R. 2000. Developing indicators for sustainable development based on access to public transit. Presented at Canadian Association of Geographers (Western Division), Calgary, Alberta.

Patrick, R. 1998. Urbanization or suburbanization? A time for growth management on the Sunshine Coast. Presented at annual conference: Canadian Association of Geographers (Western Division), Kelowna, BC.

21. RESEARCH GRANT AND CONTRACT INFORMATION:

2019/20 New Grants Received

Sask First Nations and Metis Health and Wellness Research, Training and Knowledge Mobilization Network. Healthy Land-Healthy People, First Nation of Na-Cho Nyak Dun, Yukon Territory. Community Partnership Grant. $6800. May 2020.

Department of Fisheries and Oceans. Indigenous Habitat Partnership Program, April 2020. Assisted Tla'amin Nation (Powell River, BC). Funding for a Watershed Assessment project with Tla'amin Nation. $60,000.

Prince Albert Grand Council, March 2020. Student stipend for MA research. Climate Change impacts in selected Indigenous communities in Saskatchewan. $10,000.

Completed/in-progress Grants

Patrick, R. 2019. Collaborator. NSERC New Frontiers in Research Fund. tems swiya: túlákw'útl'kwu ʔe s-ts'ukw' / Our World: from Sea to Sky. This is a community-based, interdisciplinary research partnership between the shíshálh Nation (BC), the University of Saskatchewan, Memorial University, and Simon Fraser University. $247,850. Dr Terence Clark, PI.

PATRICK, Robert J.

Patrick, R. 2019. Principal Investigator. Crown-Indigenous Relations and Northern Affairs Canada. Climate Change Monitoring Stations for six First Nation communities. $34,000. Funds awarded to R. Patrick.

Patrick, R. 2018. SSHRC Connections Grant. Project title: "Building Indigenous Research Capacity and Reconciliation through Source Water Protection Planning". Awarded October 2018. File No. 612-2018-0155. $28,000

Patrick, R. 2018. Co-Principal Investigator. We need more than just water: Assessing sediment limitation in a large freshwater delta. Global Water Futures. Special Projects fund. $200,000. Dr. Tim Jardine, PI.

Patrick, RJ. 2018. Global Water Futures (Awarded $25,000 in the Capacity Building Competition – Seed Funding April 2018). *Project Title: Challenges and Opportunities for Source Water Protection Plan Implementation in First Nation Communities: A Pan-Canada Assessment.*

Patrick. RJ. 2018. SSHRC Explore (Awarded June 2018, $7,000). Project title: Integrating community-based participatory research into source water protection planning: A case study at Onion Lake Cree Nation, SK

Patrick, RJ. 2018. SSHRC Exchange (Awarded June 2018, $3,000). Project title: Saskatchewan River Delta Water Stewardship Plan.

Patrick, R. Global Institute for Water Security (Awarded $19,960 in the Capacity Building Competition – Seed Funding March 2015). Title: Delta Stewardship Planning for Water Security. Completed May 2018.

Patrick, R. Canadian Pacific Railway Partnership Program in Aboriginal Development, $100,000, full amount available to RP.

Patrick, R. $7000. President's SSHRC Award (Nov 2011 call). Source Water Protection and First Nations, full amount available to RP.

Waldner, C., Bharadwaj, L., Dupont, D., Epp T., Koster, W., **Patrick, R**., Petrucka, P.: $147,900. Canadian Institutes of Health Research. Operating Grant Population Health Intervention Research. Water Regulations: Impact of Health Equity Promotion.2011, none available to RP.

Clark, D., Reed, M., Gober, P., Wheater, H., **Patrick, R**., Noble, B., McKenzie, M., Bharadwaj,L., Pomeroy, J. $30,000. Science in Society Award. USASK Office of Vice President Research. A Collaborative Approach to Defining Water Security in the Saskatchewan River Basin. 2011, none available to RP.

Patrick, R. $1,000. University of Saskatchewan (Proposal Development Award). 2010, full amount available to RP.

Patrick, R., $6,000 SSHRC Bridge Fund. 2010, full amount available to RP.

Noble, B. and **R. Patrick** $210,797 SSHRC (Canadian Environmental Issues, 2008-2011), $50,000 available to RP.

Bharadwaj, L. and **R. Patrick** $13,450. Association of Universities and Colleges of Canada. LACREG (Canada-Latin American and the Caribbean research Exchange Grants) "Building capacity for integrated water resource management in the Ancash Region, Peru". Funded through International Development Research Centre (IDRC). 2010-2011, $6725 available to RP.

Patrick, R. $1,000. University of Saskatchewan (Proposal Development Award). 2009, full amount available to RP.

PATRICK, Robert J.

Patrick, R. $5,000 Presidents' SSHRC. 2008, full amount available to RP.

23. PROFESSIONAL PRACTICE:

2019 Source Water Protection 101. Webinar. Canadian Water Resources Association. Invited presentation for CWRA Webinar Series, January 8, 2019.
2019 Special Editor. Water (academic journal). Special Issue: Water Security.
2019 Editorial Board. The International Indigenous Policy Journal
2019 Editorial Board. Indigenous Policy Journal
2019 Secretary Treasurer. Prairie Division Canadian Association of Geographers
2018 Federation of Saskatchewan Indigenous Nations (FSIN). 2017/18. Healthy Water Working Group (HWWG). A sub-committee of FSIN to develop drinking water standards and protocol for water and wastewater for all First Nations in Saskatchewan. Monthly meetings June 2017–April 2018.
2018 Professional Standards Board Re-Accreditation 2018. Review for University of Toronto Planning Program. Canadian Institute of Planners. January 29-30, 2018.
2017 Editor, Prairie Perspectives (Academic journal), Volume 19 (Melfort Papers).
2017 Source Water Protection 101. Webinar. CWRA Webinar Series. January 18.
2017 Editor. Water (Academic journal). Special Issue: Source Water Protection papers.
2017 Professional Standards Board Re-Accreditation Review for University of Northern British Columbia. Canadian Institute of Planners. March, 2017.

2000–2002 *Water Management Planner* (SCRD) responsible for water conservation programs, liquid waste management planning, and watershed management.

1992–2000 *Land-use Planner* (SCRD) duties included preparation of Official Community Plans, technical report writing, bylaw preparation, development control activities including subdivision processing and development permit processing.

1991–1992 *Town Planner*, New South Wales Department of Planning, Australia responsible for preparation of State, Regional, and Local Environmental Plans and bylaw submission reviews from local government.

1988–1991 *Planning Assistant* (SCRD) duties included automated mapping with geographic information system, technical research and writing.

24. CONSULTING WORK UNDERTAKEN:

2018 First Nations Technical Services Advisory Group (Edmonton, Alberta). First Nations. January 2018. Project Title: Assessing Land Use and Infrastructure Planning in First Nation Communities. Ongoing. Fee for service.
2018 Okanese First Nation (Saskatchewan). Climate Monitoring Project Facilitator. Grant submission to Indigenous Community-Based Climate Monitoring Program. Project title: Kikawinaw Askiy: Reconciling with Indigenous Sacred Ecology. Crown-Indigenous Relations and Northern Affairs Canada. $97,570 Funded.

PATRICK, Robert J.

2017	Submission to Climate Change and Health Adaptation Program for First Nations South of 60N. Hatchett Lake Denesuline First Nation. $58,400. Funded. Gratis.
2017	Submission to Climate Change and Health Adaptation Program for First Nations South of 60N. Cumberland House Cree Nation. $100,000. Funded. Gratis.
2017	Submission to Climate Change and Health Adaptation Program for First Nations South of 60N. James Smith Cree Nation. $75,000. Funded. Gratis.
2017	Submission to Climate Change and Health Adaptation Program for First Nations South of 60N. Red Earth Cree Nation. $51,000. Funded. Gratis
2017	Submission to Climate Change and Health Adaptation Program for First Nations South of 60N.Shoal Lake Cree Nation. $62,020. Funded. Gratis.
2014	Partners for the Saskatchewan River Basin. Frog Lake First Nation, Source Water Protection Plan. Completed. Gratis.
2015	Public Interest Law Centre of Legal Aid Manitoba. Lake Winnipeg Water Levels Regulation. Research, review, writing. Completed. Fee for service.
2015	O2 Design (Calgary). Saskatoon North Partnership for Growth. Regional Plan. Technical review. Completed. Fee for service.
2014	Partners for the Saskatchewan River Basin. First Nations Water Initiative. Survey of First Nations water issues in Saskatchewan. Completed. Fee for service.
2013	Government of Canada. Aboriginal and Northern Development Canada (AANDC). Produced and field tested a Source Water Protection Guidance document for use by First Nation communities in Canada. Completed. Fee for service.
2012	First Nations Alberta. Technical Services Advisory Group. Development of a Source Water Protection Guidance document for use by First Nation communities. Completed. Fee for service.
2011	Government of the Northwest Territories. Source Water Assessment and Protection Guidance document. Preparation of a document to guide source water protection planning. Completed.
2004	Friends of the Earth Canada (July 2004). Research toward preparation of report entitled: Water Soft Path for Ontario: Feasibility Study. Final Report, July, 2004. Prepared for the Walter and Duncan Gordon Foundation. Ottawa, ON. 87 pp.

25. DEPARTMENTAL AND COLLEGE COMMITTEES:

2008-present	U of S Faculty Association Representative (Department of Geography and Planning)
2008-present	RUP Committee Member
2017/18	Departmental Hiring Sub-Committee (Planning Program)
2016	Graduate Chair, Centre for Northern Governance and Development, UofS
2015-16	Chair, Regional and Urban Planning program, GEPL
2016/17	Departmental Salary Review Committee, GEPL
2013/14	Departmental Salary Review Committee, GEPL
2011-2014	Chair, Regional and Urban Planning program, GEPL

PATRICK, Robert J.

26. UNIVERSITY COMMITTEES:

2013-present U of S Faculty Association Representative (GEPL)

27. PROFESSIONAL AND ASSOCIATION OFFICES AND COMMITTEE ACTIVITY OUTSIDE UNIVERSITY:

2010-present:	Canadian Water Resources Association (Saskatchewan Branch) Board of Directors
2009-present	Prairie Division of Canadian Association of Geographers. Secretary Treasurer,
2009-present	Safe Water for Health Research Team (University of Saskatchewan), Member.

28. PUBLIC AND COMMUNITY CONTRIBUTIONS: UNIVERSITY RELATED:

2018/19	Federation of Saskatchewan Indigenous Nations (FSIN). Healthy Water Working Group (HWWG). A sub-committee of FSIN to develp drinking water standards and protocol for water and wastewater for all First Nations in Saskatchewan. Adhoc meetings.
2018	Global Water Futures. Indigenous Partners Workshop. Wanuskewin Park. April 17-18.
2018	University-Meewasin-City partnership. Northeast Swale Stewardship Committee. Committee Member. Ongoing.
2016	Organizing Committee for Prairie Division of Canadian Association of Geographers Conference in Melfort, SK. Sept 23-25.
2013	Saskatoon Regional Growth Summit. Workshop facilitator at Saskatoon Regional Growth Summit held in Saskatoon. November 20-22.
2013	City of Melfort. Invitation from City of Melfort to tour the city and provide recommendations to city council and community service groups. No cost to the city. This was a free public engagement. May.
2013	Planner in Residence, Dr Larry Beasley. Coordination of this event with scheduling of guest lectures and public lectures in Saskatoon March 18-22. RUP Program initiative
2012	Global Institute for Water Security. A Panel Discussion: 'Attack of the Blue-Green Algae' Oct 31. Guest presentation
2010	Organizing Committee for Prairie Division of Canadian Association of Geographers Conference in North Battleford, SK. Sept 24-26.
2010	Geography Challenge (sponsored by Royal Canadian Geographical Society). Volunteer on Committee to host 2010 Geography Challenge held at U of S, Saturday April 10th.
2009	Geography Challenge (sponsored by Royal Canadian Geographical Society). Volunteer on Committee to host 2009 Geography Challenge held at USASK. March.

PATRICK, Robert J.

NOT UNIVERSITY RELATED:

2011 Member of Organizing Committee, Design Council of Saskatchewan. Design Week held in Saskatoon, SK, 2011.

2009 Member of Organizing Committee, Design Council of Saskatchewan. Design Week held in Saskatoon, SK, 2009

29. EXTENSION PUBLICATIONS AND ACTIVITIES

EXTENSION ACTIVITIES (Community Engagement)

2019 Onion Lake Cree Nation. Source Water Protection Plan. In partnership with North Saskatchewan River Basin Council. (Nov 2018-August 2019). Community-engaged research, site visits and community meetings. SSHRC Connections Grant funded. Indigenous Research Capacity and Reconciliation.

2019 Okanese First Nation. Climate Change Adaptation Planning and Source Water Protection Planning. Installation of climate monitoring station. (Oct 2018-August 2019). Community-engaged research, site visits and ongoing community meetings. Funded by First Nations Adapt (Indigenous Services Canada -ISC).

2019 James Smth Cree Nation. Source Water Protection Planning. Installation of climate monitoring station. (March-August 2019). Community-engaged research, site visits and community meetings. Funded by First Nations Adapt (ISC).

2019 Hatchet Lake Dene Nation. Climate Change Adaptation Planning. Training community interviewers. In collaboration with Prince Albert Grand Council. Installation of climate monitoring station. (March-August 2019). Community-engaged research, site visits and community meetings. Funded by First Nations Adapt (ISC).

2018 Sturgeon Lake Source Water Protection Plan (Nov 2017-August 2018). Community-engaged research, site visits and community meetings.

2016 Mistawasis First Nation source water protection plan. Facilitated meetings. Completed July 2016.

2016 Cumberland House source water protection plan. Facilitated meetings. Completion March 2016.

2016 La Ronge source water protection plan. Facilitated meetings. Completed July 2016.

2016 Cumberland House Water Stewardship Plan. Facilitated meetings. Completed July 2016.

2015 Beardy's & Okemasis First Nation source water protection plan. Facilitated meetings. Start Up October 2015.

2015 Muskowekwan First Nation source water protection plan. Facilitated meetings. Completion July 2015.

2014 Frog Lake First Nation (Alberta). Source Water Protection Planning process. Facilitated meeting with Frog Lake First Nation Working Committee, May 22/23 and June 5/6, 2014.

2014 Pike Lake Stakeholders Meeting and Pike Lake Environmental Planning Process. Presentation and workshop facilitation. Nov. 2013 to June 2014.

PATRICK, Robert J.

EXTENSION PUBLICATIONS

Patrick, R. Star Phoenix. Mobility Choices for Good Urbanism. Letter to the Editor. Dec 2, 2017.

Patrick, R. Opinion Editorial: We need to protect our drinking water, not just treat it. Edmonton Journal. June 13, 2017.

Patrick, R. Letters to the Editor: Invest in watershed plans. Saskatoon Star Phoenix. August 6, 2016.

Patrick, R. Viewpoint: Plan required to protect potable water. Saskatoon Star Phoenix. August 3, 2016.

Patrick, R. Star Phoenix (Saskatoon daily newspaper). June 11, 2013. Letter to the Editor. Gravel Burgh.

Patrick, R. Star Phoenix (Saskatoon daily newspaper). April 26, 2013. Viewpoint. Local control comes with responsibility.

Patrick, R. StarPhoenix (Saskatoon daily newspaper). June 1, 2013. Cited by Joe Couture "Province's role in regional municipal planning at issue'

Patrick, R. Saskatoon Planet S. (Saskatoon's City Magazine). May 30-June 12, 2013 Vol. 11(20). Cited by Lisa Johnson "Acreage Angst'.

Patrick, R. Saskatoon StarPhoenix. Bike Lanes Needed. Letters to the Editor. June 12, 2012.

Patrick, R. Saskatoon Star Phoenix. Downtown design rules overdue. Opinion Editorial. March 25, 2012.

Patrick, R. Saskatoon StarPhoenix. 'Rightsizing' transit needs good land use planning. Opinion Editorial. December 9, 2011.

Patrick, R. Saskatoon StarPhoenix. City Needs 10K New Homes. Most will be in the suburbs. Cited in front page. December 3, 2011.

Patrick, R. Vancouver Sun. Aboriginal issues, education deficit examined. Letter to Editor. (in response to The Editorial Page June 8, 2011). July 18, 2011.

Patrick, R. Saskatoon StarPhoenix. Build it and they will drive. Opinion Editorial. November 2010.

Patrick, R. Saskatoon StarPhoenix. Cityscape must reflect values of citizens. Opinion Editorial. February 20, 2009.

Patrick, R. Saskatoon StarPhoenix. Real cost of parking spaces hidden. Opinion Editorial. October 31, 2008.

Patrick, R. Star Phoenix. Letter to the Editor. P3 A Slippery Slope. May 10, 2014.

Patrick, R. Star Phoenix. Letter to the Editor. Bridge Madness. April 2, 2014.

Patrick, R. Star Phoenix. Letter to Editor. Corman Park and Crossmount Senior's Village. March 2014.

Patrick, R. Star Phoenix. Letter to Editor. Not Only For Cars. January 2014.

Patrick, R. Star Phoenix. Letter to Editor. Regional Planning Framework Needed. October 31, 2013.

Patrick, R. Star Phoenix. Letter to the Editor. Traffic Calming Makes Sense. September 2013.

PATRICK, Robert J.