

# **Precautionary Principle and Approach for the Keeyask Generation Station Project**

Manitoba Hydro Keeyask Generation Station Project

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Manitoba Wildlands – January 2014

## **ABSTRACT**

This Manitoba Wildlands report provides definitions and sources for the precautionary principle, precautionary approach and adaptive management concepts in relation to their use in the Keeyask Generation Station Project EIS, and presentation materials.

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## Report Overview

This short report is intended to discuss the purpose of the precautionary principle (PP), highlighting the various interpretations of the principle as it relates to sustainable development and the environment. The underlying tenets of the PP will be defined, and their application to industry. The PP will be further explored by defining the difference between the PP, precautionary approach (PA) and adaptive management. Throughout the Keeyask Generation Station Project EIS materials, the precautionary approach is referenced over the term precautionary principle. Therefore, to bring the PP report into context with the Keeyask Generation Project, we will briefly discuss the application of the PP to the project and locations within the Keeyask Response to EIS Guidelines that reference the PP or PA.

To link the association between the PP and sustainable development, Appendix 4 and 5 from the report to the Clean Environment Commission from Kyrke Gaudreau and Robert Gibson entitled “Framework for Sustainability-based Assessment for the Keeyask Hydro Project” is attached for review. Appendix 4 entitled Sustainability Requirements of Manitoba Hydro outlines the 13 Manitoba Hydro policies and principles for sustainable development. Appendix 5 entitled “A proposed set of evaluation and decision criteria for the Keeyask case” sets out a series of questions relating to the PA and Hydro development.

Manitoba Wildlands previously raised concern with the Provincial Government in 2012, regarding the interpretation and utilization of the PP as outlined by the Environmental Impact Statement (EIS) Guidelines and Scoping Document for the Keeyask Generation Station Project, by Manitoba Hydro. On February 3, 2012, Manitoba Wildlands sent a letter to Darrel Ouimet of Manitoba Conservation regarding the Keeyask Generation project. Below is an excerpt from the letter pertaining to the PP and PA referenced within the EIS Guidelines and Scoping Document.

*“.....As indicated in the CEA Background Document, the hope is to move forward in a precautionary manner. If a review of existing generation stations shows a high degree of predictive uncertainty then clearly additional precaution and scrutiny will be required before moving forward. We recommend the proponent’s aside as to a precautionary approach in its Scoping Document be taken as an indication that precaution needs to be a criterion throughout the EIS. Perhaps the EIS Guidelines need to specify the precautionary approach so the proponent will move beyond its aside using definition, examples, and predictive modeling.”*

***“The Scoping Document discusses the precautionary approach as follows:***

*“The EIS will demonstrate that the proposed Project has been examined in a careful and precautionary manner. ... [identify] effects of the Proposed project ... [consider ways to] minimize adverse effects ... monitoring and follow-up activities. ... limitations in the information will be reported.”*

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## Wingspread Statement on the Precautionary Principle

*Wingspread Conference, January 23-25 1998*

*“The release and use of toxic substances, resource exploitation, and physical alterations of the environment have had substantial unintended consequences on human health and the environment. Some of these concerns are high rates of learning deficiencies, asthma, cancer, birth defects and species extinctions; along with global climate change, stratospheric ozone depletion; and worldwide contamination with toxic substances and nuclear materials.*

*We believe existing environmental regulations and other decisions, particularly those based on risk assessment, have failed to adequately protect human health and the environment, as well as the larger system of which humans are but a part.*

*We believe there is compelling evidence that damage to humans and the worldwide environment, is of such magnitude and seriousness that new principles for conducting human activities are necessary.*

*While we realize that human activities may involve hazards, people must proceed more carefully than has been the case in recent history. Corporations, government entities, organizations, communities, scientists and other individuals must adopt a precautionary approach to all human endeavors.*

*Therefore it is necessary to implement the Precautionary Principle: Where an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.*

*In this context the proponent of an activity, rather than the public bears the burden of proof. (Ashford et al 1998)”*

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## Introduction

The precautionary principle (PP) is a principle used to assist in decision making, where under the circumstances, limited scientific evidence available, and there is risk of causing adverse effects if no precautionary action is implemented prior to activity taken. Mitigating risk is a pillar of risk management, which involves avoidance or anticipation of predicted outcomes prior to event occurrence. In theory, the application has a three-fold advantage if applied correctly; 1) limiting harm to the environment, people and society at large, 2) assisting sustainable development to ensure future prosperity, continued habitation, resource extraction, etc and 3) Mitigating risk and minimizing adverse outcomes translates into long-term cost-savings.

In essence the principle is founded upon two underlying themes (Jordan and O’Riordan 2004);

- 1) Prior to occurrence, decision makers must anticipate potential adverse effects:
- 2) Cost-benefit analyses need to be performed, comparing the cost of proposed mitigation action to the feasibility of action occurring and associated remediation expenses.

Application of the PP is generally through sustainable development and environmental stewardship initiatives or regulations that require application of the PP during planning and implementation. However, the extent to which the PP is applied is generally limited by political or industrial will, based on the cost-benefit analysis, vagueness and the array of interpretations of the principle (Marchant 2003; Foster et al 2000).

Furthermore the degree of precautionary “strength” or “weakness” depends on regulatory requirements pertaining to human health, safety and the environment. For example, a strong application of the precautionary principle, requires precautionary measures and liability for human and environmental harm to be in place, and involves intense regulation compliance and restriction of activities. A weak application of the principle is the least restrictive and allows, but does not require, preventative measures to be taken (Government of New Zealand 2006) .

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## Precautionary Principle Defined

The precautionary principle, as evidenced within the name, is a principle and therefore subject to interpretation. There are a variety of interpretations of the principle, of which six are presented below.

**Definition #1:** “In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation (1992 Rio Declaration on Environment and Development).”

**Definition #2:** “When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically (Wingspread 1998).”

**Definition #3:** “The application of “precaution”, “the precautionary principle” or “the precautionary approach” recognizes that the absence of full scientific certainty shall not be used as a reason for postponing decisions where there is a risk of serious or irreversible harm (Government of Canada 2003)”.

**Definitions #4:** “When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm.

Morally unacceptable harm refers to harm to humans or the environment that is:

- threatening to human life or health, or
- serious and effectively irreversible, or
- inequitable to present or future generations, or
- imposed without adequate consideration of the human rights of those affected.

The judgment of plausibility should be grounded in scientific analysis. Analysis should be ongoing so that chosen actions are subject to review. Uncertainty may apply to, but need not be limited to, causality or the bounds of the possible harm..... (COMEST 2005).”

**Definition #5:** “Federal legislation in Canada refers to the principle as one that prevents lack of full scientific certainty from being used as a reason to avoid taking preventive measures where there are threats of serious or irreversible environmental damage (Environmental Law Centre 2013)”.

**Definition #6:** “The precautionary principle denotes a duty to prevent harm, when it is within our power to do so, *even when all the evidence is not in*. This principle has

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been codified in several international treaties to which Canada is a signatory. Domestic law makes reference to this principle but implementation remains limited. (Canadian Environmental Law Association 2013)”.

## **Sustainable Development and the Precautionary Principle**

Global acceptance of the PP arose from work conducted during the United Nations Conference on Environment and Development, Rio Summit Conference 1992. The Rio Declaration makes reference to the precautionary approach Principle #15. Governments and business globally have made the PP a basis for decision making. MBH attempted to do this in the Keeyask Generation Station EIS.

## **Application of the Precautionary Principle: Precautionary Principle vs Precautionary Approach vs Adaptive Management**

Application of the PP requires an understanding of what the principle means and how it can be utilized to accomplish desired outcomes. We have already defined the PP, however the term is often used interchangeably with the precautionary approach and/or adaptive management practices.

It needs to be stressed that the PP, precautionary approach and adaptive management, all have different meanings and applications. Although the difference between precautionary terms is sometimes vague, controversy arises when legal requirements influence application.

As it relates to the PP, the fact that it is a principle has legal connotations, and outlined principles can be legally binding. Therefore, due to the legal implications of the PP, the term transcends concept and is a source of law.

The **precautionary approach** is considered a tempered version of the PP. The two terms are subtly different, whereby the approach is influenced by circumstance and fiscal restraint, rather than complete risk aversion and regulation. In essence the two fundamental differences between precautionary principle and approach are; 1) approach acknowledges differences in community/industry capabilities and 2) approach is modified based on cost-effectiveness of applying preventative measures.

**Adaptive management** is a process of monitoring that evolves and improves over time as more information becomes available, with the aim of reducing uncertainty while assuming uncertainty is ever present. This management system involves the synergistic involvement of numerous scientific and social processes and include;

- Temporal and spatial scales;

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- Retains focus on statistical power and controls;
- Use of computer developed synthesis and embodied ecological consensus models
- Strategic alternatives evaluated through embodied ecological consensus
- Alternatives communicated to decision-makers

Application of adaptive management practices to environmental sustainability requires integration of project design, implementation, management and monitoring with the aim of testing assumptions to adapt and improve the process. (references from wiki and CEEA 2013)

<http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=50139251-1>

### Tenets of Precautionary Principle

- Presence of scientific uncertainty to predict outcomes and includes; causality, magnitude, probability and nature of harm;
- Requires some form scientific analysis to trigger the PP;
- Scientific uncertainty should not prevent application of environmental protection measures;
- Interventions are required before harm occurs;
- A need for a decision;
- risk of a serious or irreversible harm.

### Five Principles for Precautionary Measures:

1. Precautionary measures should be subject to reconsideration, on the basis of the evolution of science, technology and society's chosen level of protection.
2. Precautionary measures should be proportional to the potential severity of the risk being addressed and to society's chosen level of protection.
3. Precautionary measures should be non-discriminatory and consistent with measures taken in similar circumstances.
4. Precautionary measures should be cost-effective, with the goal of generating (i) an overall net benefit for society at least cost, and (ii) efficiency in the choice of measures.
5. Where more than one option reasonably meets the above characteristics, then the least trade-restrictive measure should be applied.



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## **Precautionary Approach from a Business Perspective**

According to United Nations Educational, Scientific and Cultural Organization (UNESCO), World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) Precautionary Principle report (2005), the PP will be included as an overarching consideration, particularly in matters pertaining to sustainable development and the environment.

- Included in the United Nations system; 1992 Rio Declaration on Environment and Development and Framework Convention on Climate Change.
- Incorporated in the World Trade Organization's article 5.7 on precaution within the Agreement on Sanitary and Phytosanitary Measures (1994), and Biosafety Protocol (2000).

*According to the United Nations Global compact:*

- Precaution requires the involvement and application of risk assessment, management and communication.
- From a business perspective, the PP is focused on prevention rather than cure: it is more cost effective to prevent a situation than to correct it.

## **Suggestions from United Nations (UN) for companies to apply the precautionary approach:**

- Develop a code of conduct or practice for its operations and products that confirms commitment to care for health and the environment.
- Develop a company guideline on the consistent application of the approach throughout the company.
- Create a managerial committee or steering group that oversees the company application of precaution, in particular risk management in sensitive issue areas.
- Establish two-way communication with stakeholders, in a pro-active, early stage and transparent manner, to ensure effective communication of information about uncertainties and potential risks and to deal with related enquiries and complaints. Use mechanisms such as multi-stakeholder meetings, workshop discussions, focus groups, public polls combined with use of website and printed media.
- Support scientific research, including independent and public research, on the issue involved, working with national and international institutions concerned.
- Join industry-wide collaborative efforts to share knowledge and deal with issues, in particular production processes and products around which high level of uncertainty, potential harm and sensitivity exist.

**The Precautionary Principle and the City and County of San Francisco – White Paper (March 2003):**

- People have a duty to take anticipatory action to prevent harm;
- Proponents of products and services bear responsibility for the safety of those products and services;
- Decision makers will examine a full range of alternatives and select alternatives with the least harmful impact on environmental health and human health;
- Decisions will be participatory, transparent, and informed by the best available science and complete product information;
- Decision makers will consider a full range of costs of products and services, including manufacturing, use, and disposal. Economic evaluations will broadly consider long-term costs and savings of environmental policies.

**Precautionary Principle and Keeyask Generation Station Project**

To gain a better understanding of the use of the PP within the planning framework of the Keeyask Generation Station Environmental Impact Assessment (EIS), a search of the Response to EIS Guidelines was performed.

We observed limited and vague references to the use of the PP, precautionary approach or precautionary manner. Please note that the PP did not appear, and terms precautionary approach and manner were used interchangeably.

**Table 1.** Term search of the precautionary principle, precautionary approach and precautionary manner within Keeyask Generation Station EIS Guidelines, Scoping Document and Response to EIS Guidelines documents.

<b>Scoping Document</b>	<b>Location</b>
The EIS will demonstrate that the proposed Project has been examined in a careful and precautionary manner. It will outline the conclusions made about the effects of the proposed Project on the environment and will describe the approaches to minimize adverse effects. Where conclusions drawn from ATK, local knowledge and technical sources differ from each other, the EIS will present the various points of view and the Proponent’s conclusion(s) (which may include a commitment for further monitoring).	3.7 Precautionary Approach pg 3-5
<b>Final EIS Guidelines</b>	<b>Location in EIS</b>
Describe how the implementation of the project components and activities have been planned in a careful and precautionary manner in order to ensure that significantly adverse or unwarranted environmental effects will not	EIS 4.3.3 EIS 4.5.1 EIS Chapter 8 EIS 10.3

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occur, especially with respect to environmental functions and integrity, considering system tolerance and resilience, and/or the human health of current or future generations	
Outline and justify the assumptions made about the effects of all project components and activities and the approaches to minimize these effects	EIS 4.3.3 EIS 6.3 – 6.8
Demonstrate that in designing and operating the project, priority has been and would be given to strategies that avoid the creation of adverse environmental effects.	EIS 4.5.1 EIS 6.3 – 6.8
Develop contingency plans that explicitly address accidents and malfunctions of the project	EIS 4.7.8, 4.7.8.2
Identify the proposed follow-up and monitoring activities, particularly in areas where scientific uncertainty exists in the prediction of effects.	EIS Chapt 8
Present public views on the acceptability of all of the above.	EIS chapt 2 EIS 3.5, 3.6

<b>Response to EIS Guidelines</b>	<b>Location</b>
Acknowledge and respect the caution that many KCN members have about predictions of environmental effects of hydro-electric development (uncertainty associated with predictive models). It is important to employ a <b>precautionary approach</b> that identifies knowledge gaps and recognizes the uncertainty of predictions.	EIS Appendix 2A: 2A-2
The KHLPP partnership examined and planned the Project in a careful and <b>precautionary manner</b> (chpt 4, 8 and 10)	EIS 5.2 Overview of Approach, 5-2
Manitoba hydro is currently conducting a detailed analysis of the overall effect of climate change of the Nelson River flows. Quantitative information is not expected for several years. Since detailed information is not yet available, a <b>precautionary approach</b> was used to test the sensitivity of the effects assessment to potential climate change impacts on Nelson river flows.	EIS 6.3.12.4 Surface water and ice regime, 6-230
Although creating a barrier to upstream fish movement is not expected to affect population size, DFO has identified the need to include upstream fish passage in the project design to maintain existing connections among fish populations. This reflects a <b>precautionary approach</b> with respect to uncertainty regarding the importance of maintaining connections among populations.	6.4.6.1.2 Operation effects and mitigation, 6-269  EIS 6.4.6.2.1 Construction Effects and mitigation, 6-283
Effects on the species of particular interest to the KCNs are expected to be low because most of these species are widespread in appropriate habitats and the percentages of	EIS 7.5.2.2 Summary of cumulative effects of the project with

the known locations and available habitat affected by the project are predicted to be low. For the remaining priority plant species, the project would affect small proportions of their known locations and their habitats. In addition, the risk that invasive plants will crowd out priority species is minimized by <b>precautionary</b> and eradication measures included in the Environmental Protection Plans	past and current projects, 7-28
A primary purpose of the federal Act is “to ensure that projects are considered in a careful and <b>precautionary manner</b> before federal authorities take action in connection with them, in order to ensure that such projects do not cause significant adverse environmental effects.”	EIS 10.2 Federal Criteria, 10-1
The concept of using a <b>precautionary approach</b> has been an implicit foundation in the planning and design of the project and design of the project, using both technical science and ATK.....	EIS 10.4 The precautionary approach, 10-3
While the <b>precautionary approach</b> has been used in many project related decisions to avoid adverse effects in the absence of scientific knowledge, it is important to stress that the project has benefitted from more than 10 years of both scientific study and discussions and input from the local Cree Nations in sharing their ATK.....	EIS 10.5 KCN evaluations of the project, 10-4

## Framework for Sustainability-based Assessment for the Keeyask Hydro Project: Kyrke Gaudreau and Robert Gibson

### Appendix 4: Sustainability Requirements of Manitoba Hydro

As a Crown corporation, Manitoba Hydro is subject to the Government of Manitoba’s *Sustainable Development Act C.C.S.M. c. S270*. Second, Part 6 Guideline 13 of C.C.S.M. c. S270 states:

*“Each Crown Corporation shall, within two years after the establishment of the code of practice, prepare and adopt a corporate sustainable development code of practice.”*

Manitoba Hydro has developed a set of thirteen policies and principles for sustainable development, and these are shown in Table 10 below.

**Table 10 - Manitoba Hydro Sustainable Development Policy/Principles**

**MH 1 - Stewardship of the Economy and the Environment**

Recognize its responsibility as a caretaker of the economy and the environment for the benefit of present and future generations of Manitobans. Meet the electricity needs of present and future Manitobans in a manner that ensures the longterm integrity and productivity of our economy, our environment, our natural resources and safeguards our human health.

**MH 2 - Shared Responsibility**

Ensure that Manitoba Hydro's employees, contractors, and agents are aware of our sustainable development policies and guiding principles and encourage them to act accordingly. Encourage the Corporation's employees to share their knowledge of the concepts and practical application of sustainable development.

**MH 3 - Integration of Environmental and Economic Decisions**

Treat technical, economic and environmental factors on the same basis in all corporate decisions, from initial planning to construction to operations to decommissioning and disposal. To the extent practical, include environmental costs in economic and financial analysis.

**MH 4 - Economic Enhancement**

Enhance the productive capability and quality of Manitoba's economy and the wellbeing of Manitobans by providing reliable electrical services at competitive rates.

**MH 5 - Efficient Use of Resources**

Encourage the development and application of programs and pricing mechanisms for efficient and economic use of electricity by our customers. As well, efficient and economic use of energy and materials will be encouraged throughout all our operations.

**MH 6 - Prevention and Remedy**

To the extent practical, anticipate and prevent adverse environmental and economic effects that may be caused by Corporate policies, programs, projects and decisions rather than reacting to and remedying such effects after they have occurred. Purchase, where practical, environmentally sound products taking into account the life cycle of the products. Address adverse environmental effects of Corporate activities that cannot be prevented by:

- endeavouring, wherever feasible, to restore the environment to predevelopment conditions or developing other beneficial uses through rehabilitation and reclamation;
- striving to replace the loss with substitutes that would enhance the environment and/or associated resource uses while offsetting the type of damage experienced;
- making monetary payments for compensable damages on a fair, equitable and timely basis.

Give preference, where practical, to projects and operating decisions that use renewable resources or that extend the life of supplies of nonrenewable resources.

**MH 7 - Conservation**

To the extent practical, plan, design, build, operate, maintain and decommission Corporate facilities in a manner that protects essential ecological processes and biological diversity. Give preference, where practical, to projects and operating decisions that use renewable resources or that extend the life of supplies of non-renewable resources.

**MH 8 - Waste Minimization**

Manage all wastes arising from Corporate activities by: first, endeavouring to eliminate or reduce the amount generated; second, striving to fully utilise reuse and recycling opportunities; third, disposing of remaining waste in an environmentally sound manner.

**MH 9 - Access to Adequate Information**

Share relevant information on a timely basis with employees, interested people and governments to promote a greater understanding of Manitoba Hydro's current and planned business activities and to identify impacts associated with the Corporation's plans and operations.

**MH 10 - Public Participation**

Provide opportunities for input by potentially affected and interested parties when evaluating development and program alternatives and before deciding on a final course of action.

**MH 11 - Understanding and Respect**

Strive to understand and respect differing social and economic views, values, traditions and aspirations when deciding upon or taking action.

**MH 12 - Scientific and Technological Innovation**

Research, develop, test and implement technologies, practices and institutions that will make electrical supply and services more efficient, economic and environmentally sound.

**MH 13 - Global Responsibility**

Recognize there are no political and jurisdictional boundaries to our environment, and that there is ecological interdependence among provinces and nations. Consider environmental effects that occur outside of Manitoba when planning and deciding on new developments and major modifications to facilities and to methods of operation.

***Manitoba Hydro Act***

Purposes and objects of Act (Manitoba 2012c, p. 4.1)

The purposes and objects of this Act are to provide for the continuance of a supply of power adequate for the needs of the province, and to engage in and to promote economy and efficiency in the development, generation, transmission, distribution, supply and end-use of power and, in addition, are

(a) to provide and market products, services and expertise related to the development, generation, transmission, distribution, supply and end-use of power, within and outside the province; and

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(b) to market and supply power to persons outside the province on terms and conditions acceptable to the board.

### **Appendix 5: A proposed set of evaluation and decision criteria for the Keeyask case (Selected sections from Appendix 5)**

This section proposes a set of evaluative and decision-making criteria for application in the Keeyask case. In comparison with the fragmentary approach to assessment provided in Environmental Impact Statement developed by the project proponent, this framework attempts to be more consistent and integrated. It is clear there are important issues to be addressed to ensure the proposed Keeyask project delivers constructive, equitable and lasting gains for the citizens of Manitoba, while avoiding significant adverse effects, both now and in the future.

The points below identify the main categories of sustainability-related considerations to be addressed in the evaluations and decisions in this case as required by existing law and regulation and proper attention to the public interest. Each category includes a set of themes (shown in *italics*) that are then elaborated upon in the relevant criteria. In certain instances, the categories overlap and the particular considerations interact, and this is a reflection of the interrelated and integrated nature of the proposed project. When considered as an integrated set, the categories, themes and criteria provide the basis for evaluations and decisions in planning, assessments and approvals. Their application should ensure proper attention is given to the full interacting set of key determinants of net gains while avoiding significant adverse effects and trade-offs.

**Table 11.** A proposed set of evaluative and decision criteria for the Keeyask case

<p><b>Promoting resource maintenance, conservation and efficiency</b></p> <p><b>Goal</b> Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.</p> <p><b>Criteria</b></p> <p><b><i>Reducing overall energy and resource consumption</i></b></p> <ul style="list-style-type: none"><li>· Will the cumulative effects reduce overall material and energy use, resource depletion (including agricultural lands), extractive damage and waste generation (including GHG emissions)?</li><li>· Will the cumulative effects foster more efficient allocation and use of energy and other resources in the region, in the province, in Canada and beyond?</li></ul> <p><b><i>Fostering responsible use of energy</i></b></p> <ul style="list-style-type: none"><li>· Will the proposed project in combination with other programs and infrastructure at Manitoba Hydro help foster short and long-term conservation and demand management initiatives in the region, Manitoba, Canada and beyond (e.g. American consumers)?</li><li>· Will the proposed project in combination with other programs and infrastructure at Manitoba Hydro encourage consumers and customers to match the quality of the energy supplied to the quality of the end-use?</li><li>· Will the proposed project in combination with other programs and infrastructure at Manitoba Hydro promote the consumption of energy only as necessary to provide services in the pursuit of constructive social ends?</li></ul> <p><b><i>Developing resilient energy supplies</i></b></p> <ul style="list-style-type: none"><li>· Will the proposed project in combination with other programs and infrastructure at Manitoba Hydro promote resilient energy supply systems with sufficient diversity, modularity and redundancy of energy pathways to respond to changing conditions (e.g. climate change, political change, changing demographics)?</li><li>· Will the proposed project in combination with other programs and infrastructure at Manitoba Hydro promote opportunities for multiple uses of energy inputs (e.g. cogeneration)?</li><li>· Will the proposed project in combination with other programs and infrastructure at Manitoba Hydro contribute to the development of new energy efficient technologies and practices?</li></ul> <p><b><i>Avoidance of resource conflicts</i></b></p> <ul style="list-style-type: none"><li>· Will the proposed project take steps to avoid potential future resource conflicts (such as for food and fibre)?</li></ul> <p><b><i>Mitigating perverse effects</i></b></p> <ul style="list-style-type: none"><li>· Will the proposed project in combination with other programs and infrastructure at</li></ul>
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Manitoba Hydro avoid perverse effects (e.g. increased electricity consumption due to increased supply, increased hunting and trapping due to increased access)?

### **Prioritizing precautionary and adaptive management**

#### **Goal**

Favour the selection, design and implementation of the undertaking (including provisions for monitoring and adjustment) that reflect the application of precautionary approaches that respect uncertainty and avoid both well and poorly understood risks of serious or irreversible damage to the foundations of sustainability, and a willingness to act on incomplete but suggestive information where there may be risks to social and/or ecological systems that are crucial for sustainability.

#### **Criteria**

##### ***Responsive monitoring and adaptive management***

- Are contingency plans in place and sufficiently effective to deal with unexpected events?
- Are there reliable grounds for entrusting governance capacities (e.g. of provincial government agencies) to manage adverse effects?
- Will the KHLP maintain sufficient resources (financial and otherwise) to respond to both anticipated and unanticipated issues that arise during and after the project lifetime?
- Are appropriate measures in place to respond to changing outcomes from ecological management strategies (e.g. stocking fish, creating spawning habitat)?

##### ***Developing baseline data***

- Are the characteristics and potential vulnerabilities of relevant biophysical systems and human-environment relations well enough understood to provide a reliable base for confident prediction of effects?
- Given historical impacts of previous hydropower projects in Manitoba, has an appropriate baseline been established for assessing cumulative effects?

##### ***Dealing with uncertainty***

- Will the selection, design and implementation of the proposed project (including provisions for monitoring and adjustment) favour resilience characteristics (diversity, flexibility, reversibility, mechanisms for learning, and management for adaptation)?
- Have the main uncertainties been identified and taken into account in identifying potential risks and opportunities, as well as in the prediction of effects?
- Are monitoring programs and management frameworks in place or reliably planned that focus on establishing or maintaining sustainability of valued biophysical and socio-ecological conditions?
- Are monitoring programs and management frameworks in place or reliably planned that focus on ensuring projected socio-economic benefits (e.g. employment opportunities, project income) are in line with projections?
- Are there sufficient means present to assess the effectiveness of monitoring and adaptive management?

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***Managing for climate change***

- Does the project sufficiently address anticipated and unanticipated changing environmental conditions due to climate change (e.g. changing precipitation levels) and the increased rate of change (*i.e.* the rate of change is faster than 2007 IPCC expectations)?
- Does the project sufficiently anticipate changes in magnitude and probability of extreme weather events (e.g. 1/20 year flooding)?

***Avoiding lock-in***

- Will the project promote economic diversification and reduce vulnerability to world market volatility (e.g. fluctuating electricity markets)?
- Will the project favour energy options that minimize geopolitical risk (e.g. nuclear proliferation, terrorist attack)?
- Will the proposed project in combination with other programs and infrastructure at Manitoba Hydro maintain sufficient flexibility to change operations as new information becomes available on the impact of hydro dams on the climate in particular, and ecological integrity more generally?
- Will the proposed project in combination with other programs and infrastructure at Manitoba Hydro be responsive to changing economic cycles and societal patterns?

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