

Assessing Adaptive Management in the Keeyask EIS

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## SUMMARY

### The prevalence of uncertainty

Uncertainty is a reality when it comes to managing complex ecological and social systems. We are gradually learning more as scientific knowledge grows and as managers and policy makers increasingly recognize the value of local expertise and traditional knowledge, but our understanding remains incomplete. Uncertainty in resource management stems from several sources, such as:

- Variability in the natural environment
- Human impacts on the environment
- Lack of knowledge about most aspects of the ecosystems being managed
- Multiple social and political goals affecting resource management, and
- Imperfect sampling and modeling techniques.

### Adaptive management

Despite the prevalence of uncertainty, planning, decision making and development must and does proceed. Decisions must be made using the best information available at any given point in time. Among the methods and systems in resource management for dealing with uncertainty is adaptive management, considered to be a best practice for minimizing the environmental and social risks of development. Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational activities. We distilled the adaptive management process to the following four phases, and treated collaboration as a cross cutting element of each.

1. Plan (and hypothesize)
2. Do (and monitor)
3. Evaluate (and learn), and
4. Adjust (as needed or desired).

### Adaptive management in the Keeyask EIS

We were retained by the Consumers Association of Canada (Manitoba Branch) to provide an analysis of adaptive management in the Keeyask EIS. We found:

- A marked improvement over the approach used in the Bipole III environmental assessment
- A strong commitment to adaptive management
- Gaps in the Environmental Protection Program
- Missed opportunities for integration in the adaptive management strategy
- Potential problems for reconciling discrepancies between technical science and Aboriginal Traditional Knowledge monitoring results
- A strong commitment to research and development
- Lack of resources, capacity and authority for the Monitoring Advisory Committee
- Unclear implementation of experimentation and subsequent learning
- Unclear processes, timelines and resource allocations for evaluating, learning and adjusting
- Lack of transparency regarding the effectiveness of Manitoba Hydro's environmental management system, and
- Lack of public involvement in making adjustments to monitoring.

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## ABOUT THE AUTHORS AND THE RETAINER

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Drs. Diduck and Fitzpatrick were retained by the Consumers Association of Canada (Manitoba Branch) to provide an analysis of adaptive management in the Keeyask EIS. They both provided evidence in the Bi-Pole III hearings with respect to its incorporation of adaptive management principles and the related practices of environment monitoring and independent oversight.



## 1.0 INTRODUCTION<sup>1</sup>

There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we now know we don't know. But there are also unknown unknowns. There are things we don't know we don't know...That's basically what we see as the situation.

These comments by former United States Secretary of Defense Donald Rumsfeld offer a pithy summary of a critical concept in resource management: **uncertainty**. Developers, planners and government agencies make decisions with the best information available at a specific point in time even though they might face some uncertainty in what they know at that time.

The uncertainty inherent in resource management can emerge from a number of factors, including: 1) variability in the natural environment; 2) human impacts on the environment; 3) lack of knowledge about many aspects of the ecosystems being managed; 4) different social and political goals which impact resource management at any given time; and, 5) the potential for imperfect sampling techniques (Hilborn, 1987). Moreover, these factors are typically exacerbated in cases involving multiple jurisdictions and management objectives, long time frames, large projects, several types of ecosystems, and lack of knowledge of baseline conditions (Lee, 1993; Stankey & Allan, 2009).

Recognizing uncertainty does not necessarily block planning and decision making; there are methods and systems in resource management for dealing with uncertainty. One of these is adaptive management (AM), considered to be a best practice for minimizing the environmental and social risks of development.

AM is a systematic process for continually improving management strategies and practices by learning from the outcomes of operational programs. Its most effective form uses programs that are designed to experimentally compare selected strategies and practices by evaluating alternative hypotheses about the system being managed. AM is a continuous learning cycle designed to link policy and implementation on a continuous basis. It is iterative, meaning decisions are reviewed and reassessed on a regular basis, and it emphasizes feedback and learning as a way to address uncertainties.

From this definition, we have pulled out four core features. AM:

- is **iterative**, meaning decisions are reviewed and assessed on a regular basis;
- includes **ongoing experimentation**, which involves treating human interventions in natural systems as “experimental probes”;
- focuses on **system monitoring**, involving observing and evaluating changes in the environment caused by the ongoing experimentation; and,
- emphasizes **feedback and learning** as a way to minimize “known unknowns” and “unknown unknowns”.

In short, the ‘adaptive’ element focuses on linking results from management ‘experiments’ to policy and decision-making processes. (See Figure 1 for an AM model from Australia.)

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<sup>1</sup> This section is taken from Diduck, Fitzpatrick & Robson (2012), with only minor modifications.

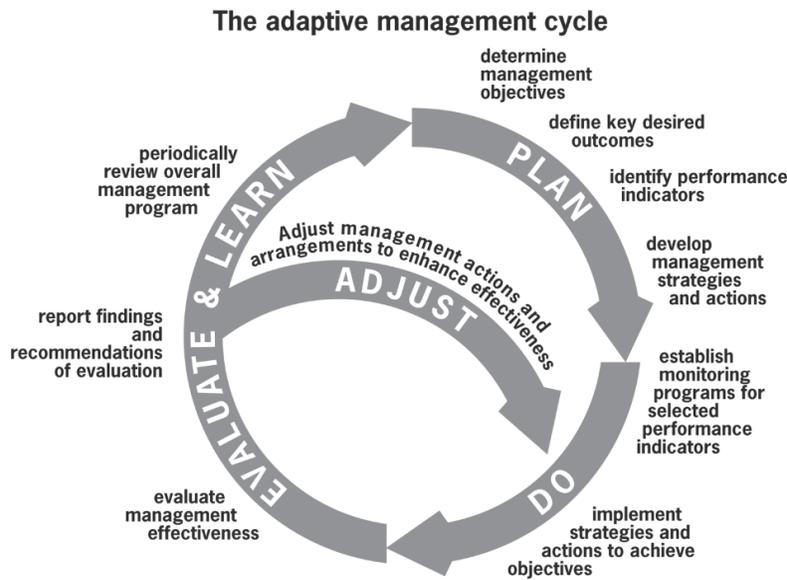


FIGURE 1: THE AM CYCLE FOR THE TASMANIAN WILDERNESS WORLD HERITAGE AREA (JONES, 2009, P.237)

While people will often learn and adapt simply because of their experiences, what distinguishes AM from such reactive learning is its **purposefulness**, which explicitly replaces learning through *ad hoc*, trial-and-error with learning by careful tests. This form of “**learning by doing**” (Walters & Holling, 1990) is the essence of AM, and the means by which uncertainty is winnowed (Gunderson, 1999), with environmental management policies treated as hypotheses, or questions rather than answers. With policies as questions, management actions become treatments, in an experimental sense, with AM structured to make learning both deliberate and more efficient.

### 1.1 Key concept: Experimentation

**Experimentation** is at the core of AM, with managers treating human interventions in natural systems as experimental probes (Lee, 1993). That is, management actions are designed (from the outset) to test hypotheses about the behaviour of an ecosystem being changed through human use. Beyond trial-and-error approaches, two main categories of AM have been identified – **passive** and **active** – distinguished by the degree to which management actions are treated as experiments (Walters & Holling, 1990).

**Passive AM** (a form of sequential learning) is where historical data are used to frame a single best approach, to be taken along a path that is assumed to be correct. Faced with uncertainty, managers implement the alternative they think is ‘best’ (with respect to meeting management objectives), and then monitor to see if they were right, making adjustments if desired objectives are not met (Figure 2).

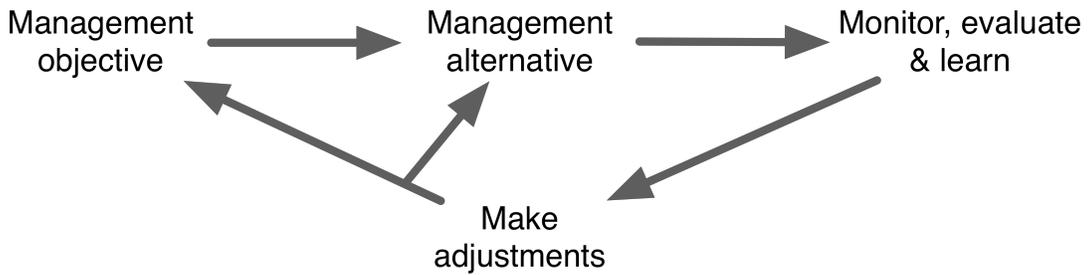


FIGURE 2: A BASIC MODEL OF PASSIVE AM.

While this can be an informative strategy, there are two fundamental limitations to passive AM. First, it is often unclear whether observed changes are due to the way in which the environment was treated, or whether they are due to other variables affecting the system. Second, it can fail to detect all the opportunities for improving the performance of the management intervention.

**Active AM** is the second model, and is explicitly designed to provide data and feedback on the relative efficacy of alternative management or policy options. Faced with uncertainty, managers implement more than one strategy as concurrent experiments to see which will best meet management objectives (Figure 3).

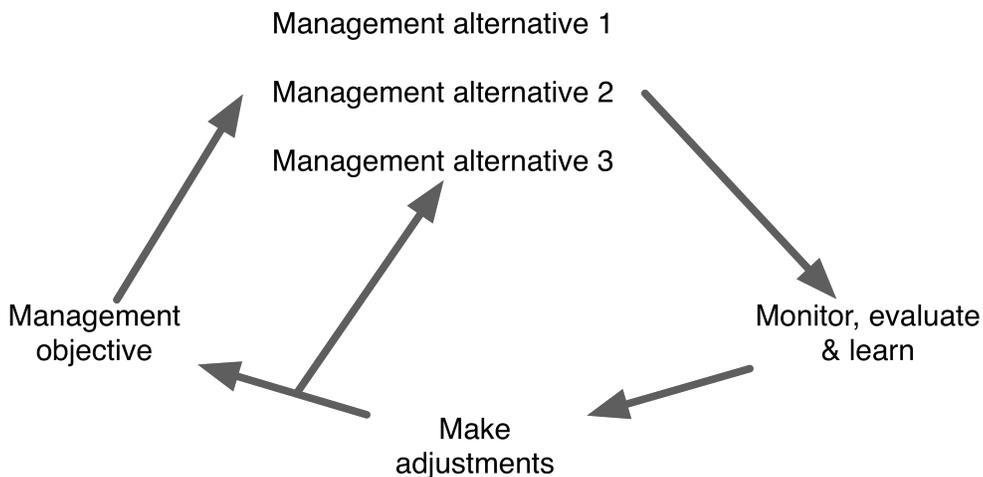


FIGURE 3: A BASIC MODEL OF ACTIVE AM.

While both passive and active AM are characterized by iterative decision making, feedback between monitoring and decisions made (learning), embracing risk and uncertainty as a way of building understanding, **only active AM deliberately probes** the system to test competing hypotheses. When a policy is successful under active AM, the hypothesis is validated. When the policy fails the adaptive approach is designed so that learning occurs, adjustments are made and future initiatives are based on the new understanding.

### 1.2 Best Practice Adaptive Management

One can find considerable guidance for the design and implementation of AM strategies and practices, much of which is based on empirical evidence from case studies. For our assessment of the Bipole III project (Diduck, et al., 2012) we drew from Allan and Stankey (2009). This analysis focused on six principles:

Understanding context is crucial – which reinforces the importance of having a broad-based, inclusive, and participatory structure to AM.

- Understanding adaptive approaches – to be careful, honest and public about what it means to undertake AM, and to explain that “it is a significant departure from past practice and will require new and specific policies, skills and resources to succeed”.
- Purposeful and deliberate – good AM starts with the framing of good questions, which directs subsequent undertakings, guides monitoring and evaluation, and emphasises the social and political nature of the process.
- Careful documentation – good documentation is transparent and open to scrutiny, and designed to encourage thoughtful and constructive debate.
- Designed to promote learning that translates into action – acknowledge that the process is hard, time-consuming, and expensive and requires ongoing investment, all of which necessitates organisational commitment and will to act.
- Supporting the “right” people – the choice of suitable participants is critical, with organisational leaders ensuring that practitioners have the latitude, organisational support and resources to undertake their work.

This approach was appropriate for a general review of material. However, as we noted in our Bipole III report (Diduck, et al., 2012), others have proposed more specific criteria (e.g., Gregory et al. 2006). In the Bipole report we also offered a more detailed framework for Manitoba Hydro to consider when planning future AM strategies. We suggested that by engaging with these questions, Hydro could more fully harness the power of AM for responding to the complexity, uncertainty and conflict inherent in the corporation’s upcoming development proposals.

The detailed framework became the basis for our analysis of the Keeyask EIA. We simplified the framework, developed a set of basic probative questions, and organized these around the AM cycle (Box 1). The questions are intended to offer guidance for inquiring into AM plans, strategies and practices. Echoing the core features presented earlier, we distilled the AM cycle to four phases: plan (and hypothesize), do (and monitor), evaluate (and learn), and adjust (as needed or desired). Additionally, we view collaboration as a cross cutting ingredient of each phase.

**BOX 1: BEST PRACTICE AM****Plan (and hypothesize)**

1. To what degree does the proponent's management strategy recognize and accept uncertainty and thereby create safe and rewarding conditions to experiment carefully (and to make occasional errors as long as the errors result in learning that leads to an improved project or better management)?
2. To what extent does the management strategy take a long-term, multi-scale, and integrative view of the environment?
3. Are the right people involved for developing a deep and nuanced understanding of ecological, social, economic, and cultural contexts?
4. Are opportunities being taken for active experimentation using questions and hypotheses that are testable, quantifiable and replicable? And are the experiments focused on the uncertainties most likely to influence management decisions?
5. Is the design of the undertaking and its implementation as well as the adaptive management strategy sufficiently flexible to make adjustments in response to lessons learned?
6. Is planning transparent, open to scrutiny, and designed to encourage thoughtful and constructive debate? And does the strategy explicitly address the multiple goals of stakeholders?
7. To what degree does the strategy cover adaptive capacity to pursue emerging opportunities for new or enhanced positive effects as well as unexpected risks or damages?

**Do (and monitor)**

1. Are the right people involved for regular monitoring of ecological, social, economic, and cultural effects and for effective sharing and application of associated learning?
2. Are the timelines to obtain verified results compatible with management decision-making requirements?
3. Will monitoring differentiate among different hypothesized outcomes from a particular strategy, and thus contribute to learning about how the managed system works?
4. To what degree is implementation and monitoring transparent, open to scrutiny, and designed to encourage thoughtful and constructive debate?
5. How is the monitoring designed to track and identify indirect and cumulative as well as direct and project-specific effects?

**Evaluate (and learn)**

1. Are suitable organizational structures and financial resources in place for evaluation of monitoring results, and for promoting learning and innovation?
2. Are the right people involved for careful evaluation, and for promoting learning and innovation?
3. Are suitable approaches being used for evaluation purposes?
4. To what degree are evaluation and learning processes transparent, open to scrutiny, and designed to encourage thoughtful and constructive debate?

**Adjust (as needed or desired)**

1. Are suitable organizational structures, skills and financial resources in place for adjusting the strategy and the project in response to lessons learned?
2. Does the proponent address how adjustments will be made?
3. Are the right people involved to ensure effective implementation?
4. Is the process of making adjustments transparent, open to scrutiny, and designed to encourage thoughtful and constructive debate?

## 2.0 MANITOBA HYDRO AND ADAPTIVE MANAGEMENT BEST PRACTICES

The project under review involves the construction and operation of a 695 megawatt (4400 gigawatt, average annually) dam, with a proposed in-service year of 2019 or 2020 (e.g. Executive Summary Part I). The Keeyask dam will be located 180km NE of Thompson, 40km SW of Gillam, and 74 km E of Split Lake (Physical Supporting Volume).

Some aspects of the project have been, or will be reviewed under different regulatory processes (Project Description p. 3-8; Physical Supporting Volume p. 1-4). For example, the Keeyask Infrastructure Project, which includes the temporary construction camp, was licensed in 2011. The Construction Power Transmission Line will undergo separate review. The need for and alternatives to the project are under consideration by the Public Utilities Board. The license for the Bipole III transmission line project, which will carry the power to southern markets, was reviewed by the CEC and was issued in 2013.

Our analysis focuses on the proposed development, as outlined in the EIS Supporting Documentation. Specifically, we reviewed:

- Executive Summary
- Response to EIS Guidelines
- Project Description
- Cree Nation Partners Keeyask Environmental Evaluation
- Fox Lake Cree Nation Evaluation Report
- Kipekiskwaywinan: Our Voices
- Physical Environment Supporting Volume
- Terrestrial Environment Supporting Volume
- Draft Environmental Protection Program
  - Preliminary Generating Station Construction EPP
  - Preliminary South Access Road EPP
  - Preliminary Instream Construction Sediment Management Plan
  - Preliminary Fish Habitat Compensation Plan
  - Preliminary Construction Access Management Plan
  - Preliminary Heritage Resources Protection Plan
  - Waterways Management Program
  - Reservoir Clearing Plan
  - Preliminary Physical Environment Monitoring Plan
  - Preliminary Aquatic Effects Monitoring Plan
  - Preliminary Terrestrial Effects Monitoring Plan
  - Preliminary Socio-Economic Monitoring Plan
  - Preliminary Resource Use Environmental Monitoring Plan
- Hydropower Sustainability Assessment Protocol
- Joint Keeyask Development Agreement
- Fox Lake AEA
- Tataskweyak Cree Nation AEA
- War Lake AEA
- York Factory First Nation AEA
- Information Requests and Responses focused on monitoring and AM

- CEC Hearing Transcripts
  - September 24
  - September 25
  - September 26
  - September 30
  - October 1
- A selection of Bipole III Transmission Project Documentation

An assessment of the extent to which the Keeyask proposal is consistent with the framework presented in Box 1 reveals both positive and negative aspects. The strengths and weaknesses are detailed below, and summarized in section 3 (Highlights and Conclusion).

## 2.1 Plan (and hypothesize)

### 2.1.1 To what degree does the proponent’s management strategy recognize and accept uncertainty and thereby create safe and rewarding conditions to experiment carefully (and to make occasional errors as long as the errors result in learning that leads to an improved project or better management)?

A strong feature of the Keeyask Hydropower Limited Partnership’s (also referred to as KHLP, the partnership, or the proponent) approach is its explicit recognition of uncertainty and its general commitment to AM. The partnership referenced the Canadian Environmental Assessment Agency’s guidance document on AM, highlighting how uncertainty is a condition resulting from the adequacy of scientific information, and that some “effects are predictable with a high level of certainty while other effects may be unknown until they occur” (Response to EIS Guidelines, p. 5-14).

The partnership defined AM as, “The implementation of new or modified mitigation measures over the construction and operation phases of a project to address unanticipated environmental effects. The need for implementation of AM measures may be determined through an effective follow-up program” (Project Description, p. 7-1). This definition is consistent with that presented during the hearings for the Bipole III Transmission project, and as we noted in our analysis for that project, this description addresses, “at least in a rudimentary way”, each phase of the AM cycle (Diduck, Fitzpatrick, Robson 2012, p.16).

Responses to IRs increased our understanding of how AM is implemented in the assessment, as the proponent confirmed it saw AM as a way “to address unanticipated and unforeseen effects” (CEC Rd1 CAC-0061) and that experimentation “is a valuable tool in the process of AM in order to gain confidence in dealing with uncertainty and the effectiveness of alternate measures” (CEC Rd1 CAC-0062). Further, section 8.1.3 of the Response to EIS Guidelines outlined and gave examples of a three-fold approach involving predetermined AM, AM designs based on monitoring results, and monitoring with no probable AM available (also see CEC Rd1 MMF-0013).

Where the evidence was lacking was the degree to which the partnership has established safe and rewarding conditions for experimentation in its AM strategy. Although we learned about various long-term research projects (see section 2.1.4), which show Hydro’s interest in creating knowledge, we know little of the proponent’s internal culture with respect to using AM as a vehicle for research.

**2.1.2 To what extent does the management strategy take a long-term, multi-scale, and integrative view of the environment?**

Different components of the AM strategy adopt different time frames, some of which are suitably long-term. Aspects of the Aquatic Effects Monitoring Plan (AEMP) establish a minimum 10-year post impoundment horizon (e.g., water quality, aquatic habitat), although pre-determined endpoints are not set out for sturgeon and mercury monitoring (section 1.2). Regarding the former, monitoring activities will continue until a self-sustaining population exists in the area, and with respect to the latter activities will continue until stable levels are detected. On a related note, the Socio-Economic Monitoring Plan (SEMP) indicates that the food consumption survey will be done every five years, the Human Health Risk Assessment will be updated every five years, and mercury monitoring will continue for up to 35 years (section 5.2).

The Terrestrial Effects Monitoring Plan (TEMP) covers long-term operations, with some activities planned over a 20–30 year post-impoundment horizon. Other activities will be conducted on “an as required basis (e.g., focused monitoring for specific construction activities with short-term impacts)” (section 1.3). The Physical Environment Monitoring Plan (PEMP) (section 1.4.2) also covers long-term operations, but activities over the long-term are not set out, and the section states, “Relative to monitoring in the first ten years of operation, it is anticipated that long-term monitoring activities will be reduced in terms of frequency and spatial extent, or possibly discontinued for some program components.”

We found little direct evidence concerning the degree to which the AM strategy reflects a multi-scale perspective, and no explicit discussion of cross-scale interactions. However, some of the plans provide indirect evidence of a multi-scale outlook. For example, the PEMP recognizes the need for monitoring at both local and what could be called ‘local-regional’ levels (i.e., the peat modeling areas from Gull Lake to Clark Lake). “Project effects differ spatially within the open water hydraulic zone of influence and monitoring is planned to capture these effects in different representative areas” (section 1.4.3). Similar passages could be cited from the TEMP, and in this regard, CEC Rd1 CEC-0037 shed light on the proponent’s intentions for taking a regional approach to caribou monitoring. It indicated how it is, “developing an approach for coordinating its caribou monitoring activities and for sharing the outcomes of its monitoring with other key stakeholders in the lower Nelson region, including Manitoba Hydro’s other proposed northern hydroelectric developments, local communities, Resource Management Boards and, possibly, government.”

We found evidence pertaining to different aspects of integration. The terrestrial and aquatic effects assessments used an ecosystem-based approach, and all of the monitoring plans discuss the need for integration among the plans. A basic example is the coordination and integration of mercury-monitoring results from the aquatic effects program with the Human Health Risk Assessment being done under the SEMP (section 5.2). Another example is how the physical environment plan deals with four key environmental components (surface water and ice-regimes, shoreline erosion processes, sedimentation, and greenhouse gases), but states that it will also support other monitoring programs, especially the aquatic plan. To do so, it will monitor woody debris, surface water temperature and dissolved oxygen, and total dissolved gas pressure (sections 1.1 and 7).

We also found evidence of tentative steps to integrate, or at least coordinate, technical science and ATK monitoring results. The Resource Use Monitoring Plan sets an objective to “coordinate information generated from other monitoring programs”, and states this will involve preparing a compilation of

technical science and ATK results (section 2.1). The PEMP (section 1.2) promises to help address concerns identified in the evaluations carried out by the Keeyask Cree Nations (KCNs), and the TEMP (section 1.1.3) indicates that the Monitoring Advisory Committee (MAC) will, where possible, promote coherence and complementarities between technical science and ATK monitoring.

**2.1.3 Are the right people involved for developing a deep and nuanced understanding of ecological, social, economic, and cultural contexts?**

A strong feature of the AM strategy is that, along with technical expertise, planning included consideration of ATK. The response to CEC Rd1 CEC-0051c discussed the wide array of technical experts who have been involved and outlined the efforts made to promote coordination and collaboration among the technical teams. CEC Rd 2 CAC-135 reviewed examples of collaboration between Hydro and the KCNs, such as joint oversight of the preparation of the environmental assessment and regular meetings of the Environmental Studies Working Group. The establishment of the MAC will create an opportunity for ongoing ATK input into AM planning. However, we have concerns (outlined in section 4) about the lack of resources available to the MAC that would enable a level playing field. We also note that although the MAC is supposed to guide the partners, the board retains ultimate decision-making authority. Additionally, each of the KCNs will be responsible for collecting and interpreting Aboriginal Traditional Knowledge (ATK), based on community-specific ATK Monitoring Plans (CEC Rd1 CFLGC-005a). However, we did not find evidence regarding the extent to which this monitoring will be done and how exactly it will be carried out. Lastly, we note that all partners are represented on the Partnership Board of Directors itself, and that this entity has a process for dispute resolution, set out in the JDKA, and described in CEC Rd2 CAC 0124.

**2.1.4 Are opportunities being taken for active experimentation using questions and hypotheses that are testable, quantifiable and replicable? And are the experiments focused on the uncertainties most likely to influence management decisions?**

A strong feature of the documentation submitted by the proponent is that when prompted, it was able to identify examples where experimentation may be necessary. For example, CEC Rd 2 CAC 0132a explores potential adaptive examples for unanticipated water quality effects related to hypothetical scenarios involving total suspended solids and dissolved oxygen. CEC Rd 2 CAC 173 explained a typical strategy in the event targets for vegetation remain outstanding, and two potential modifications should monitoring regarding lake sturgeon suggest the fish are not gathering where expected, or if cycling at the dam is impacting survivability. This illustrates that, at least for some VECs, the proponent has given thought to the hypothetical problems that may create the need for adaptation (even if the responses were lacking in detail).

It is unfortunate that, given the partnership's commitment to AM, and the recognition of the role of experimentation as part of this strategy (see 2.1.1), that there were limited examples of experimentation, and that these examples emerged only when prompted.

Beyond monitoring associated with the Keeyask project, indirect evidence related to Manitoba Hydro's commitment to experimentation can be garnered through externally funded research. The proponent's response to CEC Rd 2 CAC 163a states that funded research can be grouped in three general areas:

- "investigating the application of new technologies;

- developing new methods, procedures, or products to carry out work more efficiently or safely; and,
- gaining specific knowledge about our environment to enhance our design and/or operating practices.”

The response notes that total funding over the past five years is roughly three million dollars, and a list of general research themes is provided (with additional information found at [http://www.hydro.mb.ca/corporate/research & development](http://www.hydro.mb.ca/corporate/research&development)). While all of this research is admirable, it is not clear from the answer how much of the research was done (is being done) to address high priority management uncertainties. Furthermore, there is generally no indication if findings resulted in an actual management adjustment. This oversight is a missed opportunity by the proponent to clearly illustrate how it implements AM.

Two examples in the assessment documentation are more direct. The proponent’s response to CEC Rd1 CEC-0040 notes that Manitoba Hydro “has successfully developed an artificial island on the Lower Churchill River System for the primary purpose of providing nesting habitat for Arctic terns and gulls.” CEC Rd1CAC-0038 discusses research focused on using isotopic signatures for sturgeon identification, which may be used to evaluate the success of fish stocking. Both may be examples of active experimentation with positive outcomes, although more information is required.

**2.1.5 Is the design of the undertaking and its implementation as well as the adaptive management strategy sufficiently flexible to make adjustments in response to lessons learned?**

Other than those aspects of implementation governed by the Environmental Protection Program (EPP), we found no evidence that the design of the project is sufficiently flexible to make adjustments in response to lessons learned. In their report, Drs. Gibson and Gaudreau discuss the importance of having adaptive capacity in the fundamental design features of undertakings, reviewing issues such as design for reversibility, fall-back options, fail-safe technologies, reserves of financial, social and other capital, and cushion space between anticipated effects and suspected adverse effects thresholds.

With respect to the AM strategy itself, we sought evidence of flexibility pertaining to Hydro’s broader environmental management system, which provides the foundation and context for the strategy. CEC Rd2 CAC 172 asked for examples of how the management system has resulted in continual improvement (which would show flexibility to learn and make adjustments), but the request did not yield concrete examples. Nevertheless, we found some evidence of flexibility in the EPP documents, pertaining to each stage of the AM cycle. See, for example, section 2.1.4, above, which notes flexibility in planning. Similarly, CEC Rd1CAC-0044 elicited evidence of flexibility in fish monitoring: “If it is deemed necessary to create compensatory young-of-the-year habitat in the reservoir post-project, as the reviewer suggests, monitoring would include benthic invertebrate and drifting invertebrate sampling, in addition to fish community sampling.” Further, sections 2.3.3 and 2.4.1 consider how Hydro’s organizational processes and resources create conditions for evaluating monitoring results, learning from those results, and making suitable management adjustments. We thus recognize some flexibility in the approach to monitoring described in the preliminary plans.

**2.1.6 Is planning transparent, open to scrutiny, and designed to encourage thoughtful and constructive debate? And does the strategy explicitly address the multiple goals of stakeholders?**

This criterion focuses on the planning to date, that is, the development of the project, and the submission of documentation subject to the regulatory approval. A strong feature of the project design was the inclusion of sub-groups working on elements of the assessment, such as the Environmental Studies Working Group and the Working Group on Operational Jobs (see also section 2.1.2). We note that the Hydropower Sustainability Assessment Protocol found that the input contributed to the “robustness and credibility of the environmental assessment” (p.33).

**2.1.7 To what degree does the strategy cover opportunities for new or enhanced positive effects as well as unexpected risks or damages?**

We found little evidence that the AM strategy covers opportunities for new or enhanced positive effects. The main evidence was found in the report prepared under the Hydropower Sustainability Assessment Protocol. Section 5.2.2 p. 32 sets out examples for opportunities to enhance pre-existing conditions, such as employment and business opportunities for KCN communities, fishing in lakes and rivers away from the Nelson River to avoid elevated mercury levels, and Lake Sturgeon management on the Lower Nelson. The report indicates how in each of these cases, the project has processes in place to identify specific measures that could be taken during implementation and operation. Further, funding for any such measures would be available from contingencies in the project budget and from other sources, including the KCN Adverse Effects Agreements. On the flip side, the report also describes how there is no firm plan to take advantage of opportunities to improve non-communicable health conditions, regardless of the effects attributable to Keeyask. “Owing to the significance of public-health risks, the absence of detailed processes at this stage is a significant gap” compared with proven best practice (section 18.2.2 p.98).

## 2.2 Do (and monitor)

**2.2.1 Are the right people involved for regular monitoring of ecological, social, economic, and cultural effects, and for effective sharing and application of associated learning?**

As noted earlier, the establishment of the MAC will create an opportunity for ongoing ATK input into AM planning. An example of how the MAC will be involved can be found in section 3.2.2 of the Socio-Economic Monitoring Plan, namely in developing the key person interview protocols with respect to housing. As well, each of the KCNs will be responsible for collecting and interpreting ATK, based on community-specific ATK Monitoring Plans (CEC Rd1 CFLGC-005a). The KCNs will also be responsible for the management, implementation and operation of their own community’s offsetting programs established under Adverse Effects Agreements (CEC rd1 CAC-0079b).

Technical science monitoring will be conducted by the partnership and specialized consultants contracted by the KHLP, who will in turn hire members of the KCNs to work with them to fulfill the monitoring activities. The partnership will also have contracts with each of the KCNs to undertake ATK monitoring of the project (e.g., the preface of each of the monitoring plans). CEC Rd1 CEC-0011 discusses five-year contribution agreements signed with the KCNs (June 1, 2009, expiring March 31, 2014), and new five-year agreements effective April 1, 2014. These provide for one full-time community employee dedicated to carrying out the activities of the Working Group on Operation Jobs, established under section 12.7 of the JDKA. At present, the working group meets quarterly, with each community taking the lead in planning activities. In addition, although community-based environmental monitoring positions will not be

created as they were for the Bipole III project (CEC Rd1 CAC-0065b), there will be community liaison positions to be filled by members of the KCNs (CEC Rd1 CAC-0065c). These positions, on the surface, create capacity for dispersing monitoring results and lessons derived from the evaluation of those results.

### **2.2.2 Are the timelines to obtain verified results compatible with management decision-making requirements?**

We found considerable evidence concerning timelines for monitoring, reporting, and evaluation cycles. For example, the PEMP (section 1.4.4) projected these activities to occur regularly, while the AEMP (section 1.2) said they would be annual. Additionally, some plans specified evaluations to occur after designated periods of time, such as five years for Human Health Risk Assessments (SEMP section 5.2) and three years after post-impoundment monitoring (AEMP section 1.2). Similarly, the PEMP (section 1.4.4) indicated that during the initial period of operation of the project, “the scope of the program will be reviewed after the third and fifth year of monitoring results have been obtained.” Additionally, at the end of the initial operating period (i.e., the first ten years) the requirements for physical environment monitoring over the long-term will be assessed.

CEC Rd 2 CAC 170e asked about Hydro’s general approach to timing between obtaining monitoring results and making adjustments, and the answer revealed that since a variety of VECs will be monitored and there is substantial variability in the timeline when effects can be determined Hydro has no set project-wide schedule for the evaluation of monitoring results that covers all plans and parameters that are being studied. “The timelines between the review of results and the implementation of changes to either monitoring or mitigation will vary depending on the circumstances, the nature of the results being observed, the VEC under consideration and the extent of the required changes.”

While this answer is in the spirit of AM, the lack of specific examples is somewhat problematic. We remain unable to assess if the timelines for results are compatible with management decisions necessary for effecting change. As a consequence, we are forced to conclude this criterion has not been met.

### **2.2.3 Will monitoring differentiate among different hypothesized outcomes from a particular strategy, and thus contribute to learning about how the managed system works?**

We found it problematic to address this criterion specifically. We note the proponent included some examples where it had considered adaptive strategies should predictions not be born out (see section 2.1.4). We also found several examples throughout the assessment documentation where the proponent identified uncertainties surrounding potential impacts, or in some instances the baseline data. For example:

- CEC Rd1 CEC-0013 notes “It is difficult to predict if an increase <in the demand for RCMP services in Gillam and Thompson> will occur and the extent of the increase if it does occur.”
- CEC Rd1 CEC-0043 observes that data related to mercury in bird populations is not based on Manitoba reservoirs.
- CEC Rd1 CEC-0037b recognizes there is uncertainty surrounding the prediction that “no large increase in caribou drowning is expected with the development...”

These examples were often accompanied by plans for monitoring, which is appropriate for this type of analysis. However, a description of potential adaptations would have provided a richer description of

the potential for learning arising from these uncertainties. Furthermore, the proponent missed an opportunity to link uncertainties and unknowns to corporately-funded research projects (see section 2.1.4) as a way to illustrate opportunities for longer term organizational learning.

**2.2.4 To what degree is implementation and monitoring transparent, open to scrutiny, and designed to encourage thoughtful and constructive debate?**

While section 2.1.6 considers the planning to date, this criterion focuses on transparency while doing. As noted in other sections, a key component of transparency rests with the MAC, discussed in sections 2.4.3 and 2.4.4. There will also be community liaison positions (CEC Rd1 CAC-0065c). The proponent will then submit reports to regulatory authorities as required (e.g., TEMP section 1.1.4) or annually (e.g., PEMP section 6; SEMP sections 5.1 and 5.2).

Project documentation also describes the mechanisms in place for informing the general public of decisions. For example, the project will have a website, and monitoring information will be posted on that site (see CEC Rd 2 CAC 166). This includes a commitment by the proponent to post annual reports to the province (CEC Rd 2 CAC 167), and changes to the monitoring program (CEC Rd CAC 168).

However, the decisions surrounding any potential changes will be made in consultation with the MAC, and government (CEC Rd CAC 168) without the public at large (CEC Rd CAC 170c and d). Section 2.4.4 provides more detailed analysis of the change-processes identified in the report.

**2.2.5 How is the monitoring designed to track and identify indirect and cumulative as well as direct and project-specific effects?**

Despite the proponent recognizing the uncertainty stemming from cumulative effects (e.g., CEC Rd1 CAC-0010), as noted in the report submitted by Drs. Gunn and Noble, the EPP does not include a cumulative effects monitoring plan. Developing such a plan would fill an important gap in the program, and guidance for doing so can be found in experiences from other jurisdictions. For example, the NWT Cumulative Impact Monitoring Program, in effect since 1999, could be instructive. It is community-based, supports and conducts monitoring using both technical and traditional knowledge, and considers both human and biophysical environments (Aboriginal Affairs and Northern Development Canada, 2010).

## 2.3 Evaluate (and learn)

**2.3.1 Are suitable organizational structures and financial resources in place for evaluation of monitoring results, and for promoting learning and innovation?**

This criterion considers the extent to which the proponent has provided for capacity to evaluate monitoring results and to promote learning and innovation. This consideration is linked closely with the issue of capacity to implement AM adjustments treated in section 2.4.1, and some of the evidence presented here is also relevant there.

The Environmental Protection Program is grounded in broader corporate policies, management systems, and programs that acknowledge the need for evaluation and learning. And individual elements of the EPP contemplate processes of evaluation and the need for learning, although details of those processes and how learning will be promoted are often lacking. For example, section 1 of the AEMP, states, “A synthesis report, which will form the basis for decisions about long-term monitoring, will be prepared

after 10 years of post-impoundment monitoring.” In a similar vein, the Hydropower Sustainability Assessment Protocol (section 18.2.5 p. 100) indicated an absence of processes to respond to monitoring results that might show “an increased incidence and severity of non-communicable diseases resulting from Keeyask’s development”.

The proponent’s environmental management system is registered to the ISO 14001 standard, which requires the system to be geared to continuous improvement (or learning and improving based on experience). However, despite making requests (e.g., CEC Rd1 CAC 0064, CEC Rd 2 CAC 171), we did not obtain details of the environmental management system and information about the performance of the system.

### **2.3.2 Are the right people involved for careful evaluation, and for promoting learning and innovation?**

As noted previously, each of the KCNs will be responsible for collecting and interpreting the results of community-based ATK Monitoring Plans (CEC Rd1 CFLGC-005a), and for the management of their own community’s offsetting programs established under Adverse Effects Agreements (CEC rd1 CAC-0079b). Regarding the offsetting programs, evaluation will occur at the community level. “Each community will develop their own approach to evaluate the effectiveness of their offsetting programs and, based on their own values and priorities, will measure whether the programs continue to address their concerns about project-related effects. If required, provisions in the AEA’s allow communities the opportunity to modify offsetting programs or to reallocate annual program funding to more appropriately address project effects as they are experienced” (CEC rd1 CAC-0082).

With respect to Hydro’s monitoring program, we earlier noted the establishment of the MAC, but we found few details on the extent to which the MAC will be involved in interpreting or evaluating monitoring results. One exception is the answer provided to CEC Rd 2 CAC 170e, which described how monitoring plans will be evaluated on an ongoing basis as results become available, and how the “MAC will regularly be reviewing results and discussing if plans need to be revised.”

### **2.3.3 Are suitable approaches being used for evaluation purposes?**

Although we did not find evidence that the proponent would be open to rethinking the assumptions upon which the AM strategy is based, we found considerable evidence of suitable evaluation goals or objectives. As just one example, the AEMP (section 1.2) sets out how “evaluation of monitoring results will be completed to determine whether: (i) unexpected effects are occurring; (ii) mitigation measures need to be modified; and (iii) refinements to the monitoring approach are necessary.” The same section later reiterates that evaluation will also yield recommendations for continued monitoring “based on results to date, whether and the extent to which the environment is continuing to evolve, and the need for modifications to mitigation measures.”

We found considerable evidence concerning procedures to help determine whether observed changes in the environment are due to the project or an experiment and not due to other variables affecting the system. A simple example from the PEMP (section 2.1) relates to ice cover development, which will be monitored under different flow conditions to test predicted effects both upstream and downstream of the project. Another relatively straightforward example deals with hunting and fishing opportunities arising from the project. CEC Rd1 CEC-0009 states that no increases in hunting and limited levels of fishing by

the project workforce are expected. It further explains how, to test these predictions, the Resource Use Monitoring Plan will involve regular monitoring and annual reporting on construction workforce harvest (if any).

In addition, we found considerable evidence concerning the range of parameters, or indicators, and the use of thresholds. For example, the TEMP sets out in detail parameters or indicators for each of the environmental components that are included in the plan as well as suggestions of how the indicators might show that the strategy is not delivering expected outcomes. However, there is variation in the level of detail regarding the parameters, indicators and methods. For example, more detail can be found in section 7.2.2, dealing with changes in mercury levels in caribou and moose, than in section 6.2.5, which deals with increased abundance and habitat of predators adjacent to linear features and in important ungulate habitats. Similar observations can be made about the AEMP. For the most part, there is a high level of detail for the water quality parameters in Tables 3 and 4 (sections 2.1.2.4 and 2.2.2.3), the benthic macroinvertebrate community descriptors (section 4.1.2.3), and the methods and thresholds concerning mercury in fish flesh (section 7, CEC Rd 2 CEC-0108). With respect to sturgeon, we note the gaps in the sturgeon monitoring plan identified by Dr. Peake.

#### **2.3.4 To what degree are evaluation and learning processes transparent, open to scrutiny, and designed to encourage thoughtful and constructive debate?**

This criterion focuses on evaluation and learning processes. To some degree, it was difficult to distinguish between evidence pertaining to these processes and evidence regarding adjustments (discussed in section 2.4.4) because these two phases of the AM cycle are so intricately linked. However, we found evidence of openness to government scrutiny, appropriately enough, in that regulatory authorities will be involved in evaluation in aspects of the AEMP (section 1.2). As well, as noted in section 2.2.1, each of the KCNs will head up the interpretation of results from ATK monitoring so this presents an opportunity for community-based deliberations and learning. With respect to Hydro's monitoring program, as noted in section 2.3.2, the MAC will regularly review results and discuss whether monitoring plans need to be revised, showing a degree of transparency and openness and creating an opportunity for deliberation and learning beyond the Partnership's corporate bounds.

## **2.4 Adjust (as needed or desired)**

#### **2.4.1 Are suitable organizational structures, skills and financial resources in place for adjusting the strategy and the project in response to lessons learned?**

This criterion considers the degree to which the proponent has provided for capacity to implement adaptive measures in the monitoring and mitigation program. As noted in section 2.3.1, the Environmental Protection Program is grounded in Manitoba Hydro's broader corporate policies, management systems, and programs that acknowledge the need for continuous improvement (which include making adjustments based on evaluation and learning). Moreover, the environmental management system is registered to the ISO 14001 standard, which requires the system to be geared to continuous improvement. However, as previously noted, despite making requests (e.g., CEC Rd1 CAC 0064, CEC Rd 2 CAC 171), we were not given details of the environmental management system nor information about the performance of the system.

Individual elements of the EPP acknowledge the need to make adjustments. For example, see section 1.1 of the PEMP, however in this particular case the need to make adjustments is presented in the context of responding to the assessment and regulatory process. Thus the original submission speaks, in part, to adaptive capacity, albeit in response to assessment and regulation, rather than the lessons learned from evaluating the monitoring results, which is more on point.

This area was canvassed extensively in the IRs. For example, CEC Rd2 CAC 151 (which also references CEC Rd 1 CAC 0072) seeks information about long-term capacity, with specific consideration of resources (money and otherwise), and the process used to ensure those resources. The response re-emphasizes that the EPP is a regulatory/legal requirement, and involves oversight in the form of “regular reporting and oversight of contractors...” It then references the level and type of effort in project planning (past practice) as “a reasonable level of comfort that the likely effects have been identified, characterized/quantified and mitigated.”

CEC Rd2 CAC 169 focuses specifically on future funding, and inquires about the process through which additional funds may be secured for monitoring, or dispute resolution, if necessary. The response notes that “The Partnership has taken into account the cost of fulfilling the four currently filed monitoring plans and the entire Environmental Protection Program and has allocated sufficient funds to implement them both during construction and operations with contingency...” The answer continues by affirming that monitoring is a regulatory/ legal requirement for the Partnership, and that the proponent is “fully committed to fulfill all licence requirements.”

The Hydropower Sustainability Assessment Protocol supports the proponent’s assertion that funding has been allocated for mitigation and compensation in the project budget (p.52), with specific reference to “Adaptive management, capable of responding to both risks and opportunities, of social and environmental issues...” While this provides external support, we could not access the data to reach a similar conclusion.

In sum, the proponent stated, on many different occasions, a commitment of resources in the future to implement the EPP, as directed by the regulatory authorities. Despite efforts to explore this in greater detail (e.g. CEC Rd2 CAC 151), we were unable to find evidence that would lead us to conclude the proponent’s program meets this criterion.

#### **2.4.2 Does the proponent address how adjustments will be made?**

We found considerable evidence of the proponent’s intention to make adjustments to monitoring and to other aspects of its AM strategy. As just one example, section 1.1.2 of the TEMP states, “The approach to monitoring in the TEMP is adaptive with provisions to review results and modify monitoring programs and mitigation measures, if and as required. For example, during the operation period, whether or not little brown myotis (bats) are found to be using Project infrastructure for roosting will determine the frequency of the follow-up monitoring required.” Similar expressions of intent can be found in each of the monitoring plans and in other Environmental Protection Program documents.

We also found evidence, although not as much, concerning adjustment processes. Noteworthy examples from selected Environmental Protection Program documents are set out below. CEC Rd1 CAC 0061b asked for details of procedures for “determining adaptive management programs and practices for

unforeseen events” using the sediment management plan as an example, but the answer shed little light on the matter.

- Feedback loops between evaluation and adjustment are contemplated in each of the monitoring plans and in selected management (e.g., construction) and protection (e.g., heritage resources) plans. For example, regarding water quality, section 1.1.1.1 of the Aquatic Environment Monitoring Plan provides that, “The timing and spatial extent of monitoring in the long term will be determined in a review of program results ten years after impoundment.”
- Broad timelines for making adjustments are established in some of the monitoring plans. Regarding water quality, the Aquatic Environment Monitoring Plan states, “monitoring will be conducted annually for the first ten years after impoundment of the reservoir” (section 1.1.1.1). The PEMP provides that during the initial period of operation, “the scope of the program will be reviewed after the third and fifth year of monitoring results have been obtained” (section 1.1.4).
- The Heritage Resources Protection Plan is prescriptive about the protocol for addressing unanticipated events, such as the discovery of human remains, and it clearly sets out the processes applicable to high- medium- and low-priority heritage resources.

In summary, there are clear indications in the Environmental Protection Program and other EA documentation of the proponent’s intention to be adaptive.

However, there is less information about the processes by which it will make adjustments. The feedback loop between evaluation results and adjustments is recognized, and in the case of the Heritage Resources Protection Plan, which is governed by legislation, clear procedures and protocols are established for responding to unforeseen events. Timelines for making adjustments are established in many of the monitoring plans, but it is not clear the degree to which the timelines take into account the need for transparent, open and deliberative evaluation processes. The Hydropower Sustainability Assessment Protocol makes a similar observation about an unclear process for responding to non-communicable diseases, finding this to be a gap (section 18.2.5, p. 100). The timelines and processes connecting evaluation and adjustment need to be unpacked just a little bit more.

Finally, the Keeyask AM strategy is grounded in broader corporate policies and an environmental management system that acknowledges the need for continuous improvement and for making policy and management adjustments. We know the system is registered to the ISO 14001:2004 Standard but we know little of its workings, including evaluation, learning, and adjustment processes, whether these relate to a particular AM strategy or at the macro organizational level. We asked for examples of learning and adjustments stemming from the management system but did not receive a concrete answer (CEC Rd2 CAC 172, CEC Rd2 CAC 172), and were informed that external audit reports of system performance were confidential (CEC Rd1 CAC 0064). Having access to environmental management system audits or other reports could help shed light on adjustment processes contemplated for the Keeyask AM strategy.

#### **2.4.3 Are the right people involved to ensure effective implementation?**

In addition to the proponents and federal and provincial regulatory authorities, the MAC will be involved in the adjustment phase. We earlier noted with approval the establishment of the MAC and its potential roles in the AM strategy. With that said, we are concerned about the committee’s general lack of resources, capacity, and authority. “The activities that occur and the results generated from the Environmental Protection Program will be discussed at MAC meetings. The MAC is an advisory committee

to the Partnership Board of Directors and will review outcomes of the programs and, if appropriate, provide advice and recommendations to the Partnership on additional monitoring or alternative mitigation measures that may be required” (ICEC Rd1 CAC-0063a).

It appears the MAC will not have an externally funded budget and it is not anticipated that it will engage outside expertise to review monitoring plans or results (CEC Rd 2 CAC 170a). Further, it will not conduct independent studies (CEC Rd 1 CAC 0063c), and it has no access to dispute resolution, should the Partnership Board of Directors not follow its advice (CEC Rd 2 CAC 164). Further, the “MAC is not an entity charged with a duty to challenge, or oppose, decisions that are the responsibility of those it advises” (CEC Rd 2 CAC 164).

Given these constraints, we have serious reservations about whether the MAC can be an effective oversight body if this is one of the roles it will be expected to play, as stated in CEC Rd 2 CAC 265. The MAC is charged with reviewing monitoring reports, providing advice and guidance, and acting as a liaison with home communities. Each activity requires specific expertise; with such a broad mandate, it is difficult to identify person(s) with expertise across all areas. To strengthen the role of the MAC, it should be given stable funding to, at a minimum, be able to retain experts as needed to review results, have a different relationship with the Governing Board than that articulated above, and have the option to engage in dispute resolution, as required.

#### **2.4.4 Is the process of making adjustments transparent, open to scrutiny, and designed to encourage thoughtful and constructive debate?**

There is discussion in the assessment documentation and supporting literature about the process through which adjustments will be made. For example, the Joint Keeyask Development Agreement “provides a variety of mechanisms whose purpose is to provide simple and efficient processes to resolve concerns arising during the operation of the business of the Partnership” (CEC Rd2 CAC 0124). These processes are summarized in the response to CEC Rd2 CAC 0124, including provisions for avenues for dispute resolution among partners.

As noted above, the Monitoring Advisor Committee will be involved in the adjustment phase related to EMP. However, it is our understanding based on the responses to the IRs that once the MAC makes a recommendation to the Board of the General Partners, its role is finished (e.g. CEC Rd1 CAC-0063b, CEC Rd2 CAC 164). There is no opportunity for dispute resolution triggered by the Committee. Furthermore, we are unclear about how the General Partners will make decisions related to monitoring programs. Thus decision-making about future modifications is not transparent, or open to scrutiny.

The proponent notes that the MAC will be responsible for communicating food consumption recommendations and these will “be provided to the KCN communities via communication products, and will also be provided (e.g., via signage) for other domestic resource harvesters and sport fishers” (SEMP section 5.2). However, less clear is how this reporting will be carried out.

Furthermore, the proponent has indicated that that it sees the MAC will act as independent oversight, which would eliminate the need for external audits of the project, as recommended by the Clean Environment Commission for Bi-pole III (CEC Rd 2 CAC 265). We are not convinced that the MAC can serve this function, given its funding limitations (discussed above), and its mandate: “MAC is not an entity charged with a duty to challenge, or oppose, decisions that are the responsibility of those it advises”

(answer to CEC Rd2 CAC 164). As such, we would strongly support a recommendation for external, publicly available audit of the project 5 years, and 10 year post construction, as recommended for Bi-Pole III. Post-hoc audits will not only increase the level of transparency during the adjustment phase, but also adhere to assessment best practice literature (e.g., Sadler, 1998).

### 3.0 HIGHLIGHTS AND CONCLUSION

Section 2.0 provides a detailed evaluation of the degree to which the proposed Keeyask Project addresses AM. This section summarizes the key strengths and weaknesses of the overall approach.

First, it is important to recognize that this is a marked improvement over the approach and documentation submitted for the last Clean Environment Commission hearing. Relative to the Bipole III assessment, we had access to more information to complete this analysis, which should be considered an overall strength. Furthermore, the impact statement and supporting documents (including the IRs) show evidence of evaluation, learning and adjustments with respect to Hydro's plans for AM. For example, when prompted Hydro shared hypothetical examples of AM, including general opportunities for active experimentation (e.g., CEC Rd 1 CAC 0062, CEC Rd 2 CAC 132a, CEC Rd 2 CAC 173, section 8.1.3 of the Response to EIS Guidelines).

Nonetheless, gaps exist in the record. While the proponent submitted many preliminary environmental monitoring plans, five remain outstanding (the Vegetation Rehabilitation Plan, the Terrestrial Mitigation Implementation Plan and the ATK Monitoring Plans). Given the integrative nature of AM, this is a critical oversight. Another gap relates to using information not available on the record as evidence. For example, if ISO 14001 certification demonstrates "continual improvement of environmental performance" (Response to EIA Guidelines 8-1; CEC Rd 2 CAC-0171), the Clean Environment Commission should be able to access, at a minimum, the proponent's compliance audits. This is particularly important when another external verification system (the Hydropower Sustainability Assessment Protocol) draws on this in part of its evaluation.

A second type of gap surrounds data analysis. Our report identifies a number of missed opportunities where the proponent could have strengthened its evidence by demonstrating integration. For example section 2.1.4 notes that the documentation would have benefited had the proponent linked research to uncertainties, and identified how research findings resulted in adaptations. The proponent should be encouraged to document its learning outcomes, and subsequent changes in implementation in a systematic way. Notwithstanding these gaps, we want to restate that this is a clear improvement over the approach and documentation submitted by the proponent for the last hearing.

#### *Commitment to adaptive management*

The proponent's commitment, in principle, to AM is a strong feature of project design. As noted in section 2.1.1, the proponent's description of this approach is consistent with the literature, and includes important aspects such as the recognition of uncertainty, and the use of experimentation to address unanticipated or unforeseen impacts.

#### *Tentative integration of technical science and ATK*

Akin to the search for transdisciplinary understanding of social-ecological systems (e.g., Kates et al.'s "sustainability science"), integration of technical science and ATK is ambitious, fraught with difficulties, and

can be contentious for the risks posed to knowledge holders (Berkes, 2013; Robson, 2013). We do not necessarily advocate for integration in this EA if the partners purposefully chose not to pursue it, but we note the tentative step toward integration represented by the partners' plans for coordination of technical and ATK monitoring results, coordination being a key element of integration (Mitchell and Shrubsole, 2007). In our view, taking tentative steps could become problematic with respect to addressing the outcomes of monitoring. Without clearly articulated conceptual frameworks, processes, and methods for addressing discrepancies between the two bodies of knowledge, recourse might be limited to legalistic and ill suited dispute resolution mechanisms (Crawford et al., 2010).

*Commitment to research and development*

CEC Rd 2 CAC163a provides a summary of research and development funded by Manitoba Hydro. Research and development are important because, in AM, experiments and designs should be focused on uncertainties most likely to influence management decisions. Linking research with identified uncertainties, and/or areas where baseline information is not available would have strengthened the documentation, and would demonstrate learning being done in a purposeful fashion (an important element of AM).

*Lack of resources, capacity and authority for the Monitoring Advisory Committee*

The MAC is charged with the “oversight of monitoring programs” (CEC Rd 2 CAC 265). However, in our view, in several respects the full potential of the MAC is limited because of lack of resources, capacity and authority.

First, it appears the MAC has no external budget and it is not anticipated that it will engage outside expertise to review monitoring plans or results (CEC Rd 2 CAC 170a). Further, it will not conduct independent studies (CEC Rd 1 CAC 0063a). Moreover, it has no access to dispute resolution, should the Board of the General Partners not follow its advice (CEC Rd 2 CAC 164). Perhaps most telling: “MAC is not an entity charged with a duty to challenge, or oppose, decisions that are the responsibility of those it advises” (CEC Rd 2 CAC 164).

Given these constraints, we have serious reservations about whether the MAC can be an effective oversight body. To strengthen the role of the MAC, it should be given stable funding to, at a minimum, be able to contract expertise as needed to review results, have a different relationship with the Governing Board than that articulated above, and have the option to engage in dispute resolution, as required. For further information about best practice surrounding independent oversight see Diduck et al. (2012) and Fitzpatrick (2012).

*Unclear implementation of experimentation and subsequent learning*

Although the proponent includes these elements in its explanation of AM, we found it difficult to assess the degree to which the AM strategy allowed for different hypothesized outcomes, and will thus lead to learning. When prompted through IRs, some examples of experimentation were identified, but overall, this was an area that could be improved.

*Unclear processes and timelines*

While there is clear recognition in the EA documentation of uncertainty, unknowns and the need to be adaptive, there is little information about the processes by which evaluation and adjustments will be

made. The CAC canvassed this area in the IRs, but the responses were vague such that it is hard to discern and analyze separate processes of evaluation, learning and adjusting.

First, Hydro's general approach respecting the time needed between monitoring, evaluating and learning, on one hand, and making adjustments on the other, is unknown. The response to CEC Rd 2 CAC 170e noted that the timing "will vary, depending on the circumstances, the nature of the results being observed, the VEC under consideration and the extent of the required changes". While this is true, in our view it should be possible to give hypothetical examples and a general timeframe.

Second, changes in monitoring and/or mitigation strategies will require financial resources. The response to CEC Rd 2 CAC 169 references a contingency fund, which will be accessed as required. The existence of the fund is a positive feature, but important questions remain, such as: How much is the contingency fund? For how long is the fund in effect? How is the fund apportioned among fiscal years and/or operational periods?

Third, Hydro needs to explain the process for adding capacity and for changing monitoring plans, either as a whole, or for each key committee (such as the MAC and the Worker Interaction Committee). In short, we need to know the processes through which evaluation, learning and making adjustments will occur, and who will be involved in those processes.

*Lack of transparency regarding the effectiveness of Hydro's environmental management system*

The Keeyask AM strategy is grounded in broader corporate policies and an environmental management system (EMS) that acknowledge the need for continuous improvement and for making policy and management adjustments. We know the EMS is registered to the ISO 14001:2004 Standard but we know little about the effectiveness of the EMS in enabling learning, whether at an AM strategy level or at a higher, macro organizational level. We asked for examples of learning as a result of the EMS but did not receive a concrete answer (e.g., CEC Rd 1 CAC 0064, CEC Rd2 CAC 172, CEC Rd2 CAC 172), and were informed that external audit reports of EMS performance were confidential (CEC Rd1 CAC 0064).

*Lack of public involvement in making adjustments to monitoring*

A point of clarity with respect to processes of evaluation, learning and adjusting relates to the extent of public involvement in changes to monitoring. Although changes to monitoring will be communicated to the public, which is a positive feature, members of the public – beyond the MAC – will not be involved in evaluating and making decisions about changes to monitoring plans, a countervailing negative feature (CEC Rd 2 CAC 170 c and d).

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