Incorporating Climate Change Considerations in Environmental Assessment:

General Guidance for Practitioners

Prepared by
The Federal-Provincial-Territorial Committee on
Climate Change and Environmental Assessment

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THE COMMITTEE

This guidance document is the collaborative product of The Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment (the Committee). The Agency has chaired the committee and acted as a secretariat. The Committee consisted of the following representatives: Garry Alexander – British Columbia; Jon Bowen and Ian Church – Yukon; Steve Burgess – Canadian Environmental Assessment Agency; Bill Calder – Alberta; Bas Cleary – Newfoundland and Labrador; Christopher Daly – Nova Scotia; Anne Dufresne – Climate Change Secretariat; Alan Ehrlich – Northwest Territories; Melissa Glen and Peter Sharp – Natural Resources Canada; Morrie Paul – Environment Canada; Peter Sherhols – Canadian Environmental Assessment Agency; Larry Strachan – Manitoba; and May Lyn Trudelle – Ontario. The Committee was supported in the development of this document by Rick George – Alberta; Daphne Stancil – British Columbia; Dave Broadhurst and Serge Nadon – Environment Canada; Stephanie El-Batrik, Rachel Samson, Al Vachon and Regina Wright – Canadian Environmental Assessment Agency; and Cathy Wilkinson – Global Change Strategies International Inc. The Committee also wishes to thank the other jurisdictions, numerous stakeholders and members of the Canadian public who provided comments on the guidance document throughout its development.

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To obtain copies of this guidance document, please visit the Agency Web site (www.ceaa-acee.gc.ca); or contact: Policy Analysis, Canadian Environmental Assessment Agency, 22nd Floor, Place Bell, 160 Elgin Street, Ottawa ON K1A 0H3, Fax (613) 957-0916; or contact your provincial or territorial decision-making authority for environmental assessments.

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Introduction

The purpose of this document is to provide environmental assessment (EA) practitioners with general guidance for incorporating climate change considerations in project EA. It is the result of federal, provincial and territorial collaboration, and is applicable across jurisdictions. This document provides general guidance, to be considered at the discretion of jurisdictions and regulatory authorities. It marks a unique initiative in Canada's response to climate change, and includes:

- methods that can be used to obtain and evaluate information concerning a project's greenhouse gas (GHG) emissions and the impacts of climate change on a project;
- key sources of information that practitioners can use to address climate change considerations in project EA; and
- methodology to encourage the consistent consideration of climate change in the EA process across federal, provincial and territorial jurisdictions and institutions of public government responsible for EA.

The document has been developed because:

- climate change has been recognized internationally and by the federal, provincial and territorial governments in Canada as an important environmental issue;
- EA has the potential to link project planning to the broader management of climate change issues in Canada; and
- members of the public and government agencies have raised questions and expressed interest in how climate change is, and should be considered in project reviews.

The Intentions of Canadian Jurisdictions for the Guide

Jurisdictions expect that the consideration of climate change in project EAs will:

- be consistent with broader climate change policy;
- increase attention to, and awareness of, GHG emissions from projects subject to EA;
- stimulate consideration of less emission-intensive ways to design and operate projects;
- help proponents manage or reduce the potential risks associated with climate change impacts on projects; and
- assure the public that climate change considerations are being taken into account.

Incorporating climate change considerations in EA can help to determine whether projects are consistent with jurisdictional actions and initiatives to manage GHG emissions, such as under the *Climate Change Plan for Canada*. It can also assist proponents in using best practices that

adapt to possible climate change impacts, such as changes in the frequency or intensity of extreme weather events, increases in mean temperatures or altered precipitation patterns and amounts.

Jurisdictions recognize that our understanding of climate change and its implications is still developing. Furthermore, there are currently no legal requirements or clearly sanctioned benchmarks for GHG emission reductions. Similarly, the assessment of potential climate change impacts and the identification of effective adaptation responses are new and evolving fields in which more research is required. While our understandings and policies are advancing, it is still useful that project proponents and government EA practitioners and decision makers be aware of any important climate change implications related to proposed projects. Potential risks to the project, providing they do not affect the public, public resources, the environment, other businesses or individuals, may be borne by the project proponent and are not generally a concern for jurisdictions.

Jurisdictional policies and regulations, for example the national *Climate Change Plan for Canada*, or Alberta's *Climate Change Action Plan*, should be the cornerstones of climate change related EA practice. Project EA conducted in accordance with this guidance document may include the following actions:

- the initial estimation/prediction of GHG emissions for projects;
- explicit, project specific consideration of GHG management in projects with medium to high emissions;
- review of all projects at the planning stage to promote consideration of best practices for the class or sector (i.e. lowest emissions intensity or volume);
- review of project plans in relation to jurisdictional climate change policies or objectives;
- identification of project sensitivities to climate parameters and variability;
- review of existing studies and information on climate change and the local, regional or inter-provincial/territorial changes to environmental conditions resulting from climate conditions, including trends and projections where available;
- public interest decision makers are made aware of the climate change context within which a project is being proposed; and
- jurisdictional variations in circumstances and approaches are respected.

This guidance will evolve as climate change related science, and broader policy and action evolve. General policies on GHG emission mitigation are being put into effect in Canada. The sections of this guidance relating to GHG requirements have not yet been translated into specific requirements of emitters. Once the entity or facility requirements arising from those broader climate change policies are in place, they will constitute the GHG mitigation requirements for assessments. The consideration of climate change in environmental assessments is not intended to impose any mitigation obligations over and above the obligations that will be imposed through the implementation of the general climate change policies. Likewise, the methodology described

in this document for assessing potential climate change impacts should be recognized as an initial attempt to be tested and refined as new information becomes available.

Some proposed projects may not be covered by the obligations arising from the general policies. Inclusion of climate change mitigation considerations may be appropriate for those projects. For all projects, the assessment may include the consideration of the impact of climate change on projects, where the impacts may be significant, likely and applicable.

1.0 Context

The Earth's climate system has demonstrably changed on both global and regional scales over the past century. An increasing body of observations gives a collective picture of a warming world and other climate system changes. There is now new and stronger evidence that most of the warming observed over the past 50 years is attributable to human activities such as the burning of fossil fuels for industrial use, transportation, electricity generation and land clearing, which have resulted in increased atmospheric concentrations of greenhouse gases (GHGs).

EA is a comprehensive and systematic planning process designed to identify, analyze and evaluate the environmental effects of proposed projects and ensure that these considerations are factored into project decision making. This is an effective means for governments and project proponents to advance an agenda of sustainable development and environmental protection. Climate change described in this guidance document is one of several factors to be considered in EAs. Information collected through the EA process relating to GHG emissions and the impacts of climate change on a project can:

- help proponents manage or reduce the potential risk posed by the impacts of climate change to their projects and contribute to climate change action;
- provide assurance to the public that climate change implications are being appropriately considered in the assessment of proposed projects;
- provide environmental managers with information that will assist their broader climate change action; and
- help decision makers to address climate change implications in a risk management context.

Like other environmental considerations factored into the EA process, climate change parameters are not explicitly identified in Canadian EA legislation and there remains a lack of legally binding federal, provincial or territorial regulations or targets for GHG emission reductions. However, governments are developing policies and plans for managing GHG emissions, which, in the future, will provide thresholds or limits relevant to project EAs. For example, Alberta has established a target to cut emissions in the province relative to Gross Domestic Product by 50 % below 1990 levels by 2020. The federal government released the *Climate Change Plan for Canada* in November 2002, establishing that covenants will be used with large emitters for achieving GHG emissions reductions in industrial sectors (thermal electricity, oil and gas, and mining and manufacturing). When put in place by jurisdictions, and applied to entities and facilities, such covenants, targets and/or regulations, should constitute the mitigation required of practitioners subject to these provisions.

EA is an effective means to incorporate climate change considerations in project planning, yet challenges remain. The EA process cannot consider the bulk of GHG emitted from already existing developments. Furthermore, unlike most project-related environmental effects, the contribution of an individual project to climate change cannot be measured.

Nevertheless, the environmental importance of a particular project can be assessed by placing it in the context of the policy objectives or regulations of the relevant jurisdictions, and if applicable, by the use of additional tools such as the strategic environmental assessment (SEA) of jurisdictional policies, plans or priorities. This would enable practitioners and decision makers to place the predicted GHG emissions associated with an individual project within a regional or jurisdictional context. Likewise, jurisdictions are uniquely situated to consider the cumulative effects associated with projects in a given industry or region. As such, when incorporating climate change considerations in a project EA, practitioners should consult with jurisdictional authorities on relevant climate change and EA-related policies, knowledge and practices.

Similar challenges confront the consideration of climate change impacts on individual projects. While research is ongoing, sufficiently detailed information may not be available on local changes in climatic factors, to be able to accurately predict climate change impacts on a specific project. However, scenarios based on climate model projections, existing climate data, local experiences and traditional ecological knowledge (TEK), can contribute to the identification of climate change considerations, and assist risk-based decisions. Although climate change projections are still developing, they can represent an improvement over the use of historical climate data, which in many cases, may not be representative of future climate conditions. Practitioners should draw upon expert authorities as necessary.

In spite of the challenges, some Canadian jurisdictions, such as Alberta and British Columbia, have already incorporated climate change considerations in selected EAs (see **Annex C** for selected case studies). Although not explicitly or consistently incorporated into the current EA process, changes in precipitation, snowmelt, wind, temperature, and other climatic and atmospheric parameters over time, have often been elements considered in EAs.

2.0 Incorporating Climate Change Considerations in Environmental Assessment

This section presents two practical approaches for incorporating climate change considerations in EA:

1. Greenhouse Gas (GHG) Considerations: where a proposed project may contribute to GHG emissions

2. Impacts Considerations: where climate change may affect a proposed project

Most projects may be more closely associated with one or the other climate change consideration. For example, the GHG consideration may be applicable to a proposed coal-fired power plant, while the impacts consideration may be more relevant to a proposed ski resort. However, the EA of some projects (for example, a pipeline with compressor stations) may incorporate both considerations.

The applicability of the guidance is dependent on the circumstances of a proposed project. Moreover, it should be noted that the type and scope of information to be considered in an EA varies by jurisdiction and remains at the discretion of the relevant authorities.

Figure 2.1 illustrates how both types of climate change considerations could fit within a typical EA process. (**Annex A** includes several worksheets that might be of assistance to EA practitioners in incorporating climate change considerations.)

Figure 2.1
Incorporating Climate Change Considerations in Environmental Assessments: Recommended Procedures

Environmental Assessment Process	GHG Considerations where a project may contribute to GHG emissions	Impacts Considerations where climate change may affect a project
1. Scoping	Preliminary scoping for GHG considerations	Preliminary scoping for impacts considerations
2. Data and Information Collection	If needed, identify GHG considerations: • industry profile • project specifics	If needed, identify impacts considerations: • regional climate and related environmental considerations • project sensitivity
3. Analysis of Environmental Effects	Assess GHG considerations: • direct and indirect emissions • effects on carbon sinks	Assess impacts considerations: • impact on project • risks to public and the environment
4. Identification of Mitigation Measures[1]	If needed, prepare GHG management plan: • jurisdictional considerations • project specifics, if appropriate	If needed, prepare impacts management plan: • project specifics • ongoing data clarification
5. Monitoring and Follow up	Monitoring, follow-up and adaptive management	Monitoring, follow-up and adaptive management

[1] Climate change related mitigation measures should be consistent with jurisdictional policies, plans and programs which may extend beyond the specific project subject to assessment, for example, the purchase of emission credits internationally. As such, the consideration of mitigation measures could accommodate policies that address emissions at a national or international level.

2.1 Greenhouse Gas Considerations: Where a Project May Contribute to GHG Emissions

The objective of this section is to help practitioners consider whether GHG emissions associated with a project are sufficient to be addressed in greater detail within the EA. This analysis can help decision makers identify, where applicable, the need for, and scope of practical measures to manage the project's GHG emissions, and where possible, link GHG prevention methods with air and water pollution reduction opportunities. This should reflect jurisdictional climate change policies and regulations, taking into account broader measures such as domestic and international emission credit trading and other initiatives. The analysis can also help decision makers consider other offsetting options or any large-scale effects that a project might have on carbon sinks. The consideration of GHG emissions in EA should be commensurate with the level of anticipated emissions from individual projects, and should reflect applicable policies and the specifics of each region and jurisdiction.

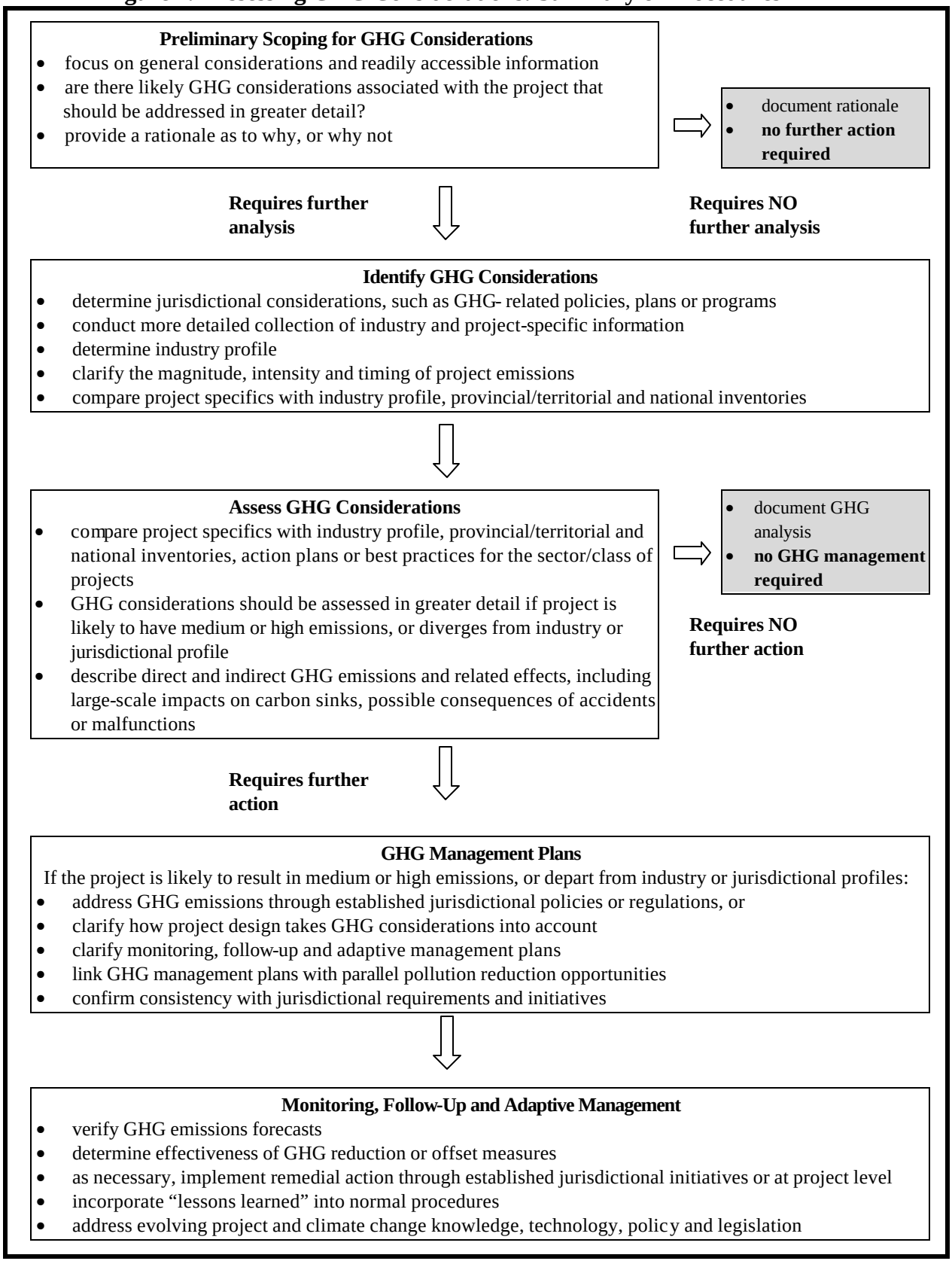
Recommended Procedures

The recommended procedures for addressing GHG considerations are as follows:

1. Preliminary Scoping for GHG Considerations
2. Identify GHG Considerations: jurisdictional considerations, industry profile and project specifics
3. Assess GHG Considerations: direct and indirect GHG emissions, and effects on carbon sinks
4. GHG Management Plans: jurisdictional considerations and project specifics
5. Monitoring, Follow-up and Adaptive Management: jurisdictional considerations and project specifics

Figure 2.2 illustrates the flow of procedures.

Figure 2.2 Assessing GHG Considerations: Summary of Procedures



2.1.1 Preliminary Scoping for Greenhouse Gas Considerations

As part of the preliminary scoping, the EA practitioner should seek to determine relatively quickly and as early as possible in the process, whether there are likely to be relevant GHG emissions considerations associated with the project that should be addressed in more detail. Additionally, a rationale should be provided as to why or why not GHG emissions were considered in more detail within the EA.

Scoping allows the practitioner to focus the EA analysis on those issues that are relevant to the project, potentially important and reasonably foreseeable. The preliminary scoping should seek to identify whether the project's GHG emissions are likely to be of relatively low, medium or high volumes or intensity during any phase of the project. Jurisdictional initiatives might assist this determination. If the project's emissions are likely to be of only low intensity or volume, there may be no need to conduct further analysis. Most projects would not require additional assessment of GHG considerations.

At this step, the practitioner should focus on general considerations, rather than on detailed quantitative analysis. In addition, the practitioner should apply readily accessible information sources (e.g., the project description submitted by the proponent or previous EAs of similar projects). Table A.1 in **Annex A** provides possible questions and illustrative examples that a practitioner might use in identifying important GHG considerations.

2.1.2 Identify Greenhouse Gas Considerations

If the preliminary scoping suggests likely GHG considerations, such as medium or high emission intensity or volume, or departure from industry or jurisdictional profiles, it is followed by a more detailed consideration of jurisdictional GHG-related policies or regulations and the collection of industry and project-specific information. Information should be collected as to the emissions profile of the target industry, as well as the specifics of the proposed project. Table A.2 in **Annex A** outlines potential questions and illustrative examples of projects that could be associated with this exercise.

An industry profile suggests to what extent a proposed project is likely to contribute to GHG emissions. It is important to note that although an industry or project may be identified as a 'low' emitter, GHG considerations might still need to be addressed in the EA depending upon evolving climate change policies and jurisdictional or regional profiles. Canada's Climate Change Voluntary Challenge and Registry (http://www.vcr-mvr.ca/FAQ.cfm) is a potential source of information on industrial and institutional GHG emissions, as is the Large Final Emitters Group, accessible at http://www.nrcan-rncan.gc.ca/lieg-ggei/. Further guidance will be included in this document as new information is developed.

Once an industry profile has been constructed, more detailed information is collected as to predicted project specifics. The proposed project can then be evaluated relative to industry standards, jurisdictional climate change policies and profiles. In particular, if the project plan demonstrates that the project does not fit the industry or jurisdictional profile, it should be examined in greater detail to determine if it should be dealt with as a "medium" or "high" intensity emitter.

2.1.3 Assess Greenhouse Gas Considerations

If the identification of industry profile and project specifics suggests that the project is likely to have GHG emissions of medium or high intensity or volume, or if the project plan indicates that the project will exceed the industry profile for GHG emissions, or relevant jurisdictional policies or regulations, the practitioner should assess the emissions in more detail.

The practitioner should seek to describe the project's direct and indirect GHG emissions and related effects, including possible large-scale impacts on carbon 'sinks' (e.g. impact on forests, agricultural soils, landfills or wetlands) or large GHG emissions, which are the consequence of accidents or malfunctions. **Annex A** includes a worksheet (Table A.2) providing a checklist of potential questions that could assist practitioners at this step. How a project will or will not comply with jurisdictional climate change policies, plans or programs should be noted.

2.1.4 Greenhouse Gas Management Plans

If the project is likely to result in GHG emissions that depart from jurisdictional criteria, are greater than the industry profile, are of relatively medium or high intensity or volume and/or have adverse effects on large-scale carbon sinks, the practitioner should clarify how emission considerations are addressed through jurisdictional policies or regulations and, if necessary, how the project has incorporated emission reduction or offset measures.[2] This consideration may be evidenced by the incorporation and/or consideration of mitigation measures,[3] such as international emission credit trading, industry best practices, GHG management plans, compensatory measures, etc.

The practitioner should first confirm that management plans are consistent with any GHG management policies or regulations that jurisdiction(s) might have in place. Then, if necessary,

[2] If a sinks-based mechanism is included in the EA as a mitigation measure, the practitioner should assess the potential impacts of future climate change on the sink component separately from an assessment of the impacts of climate change on the physical project.

[3] **Mitigation measures** refer to measures to reduce the adverse environmental effects of a project (see Glossary), and include, but are not limited to the control or reduction of GHG emissions. Depending upon jurisdictional policies, mitigation measures may extend beyond the individual project being assessed, and Canada itself, as in international emission credit trading recognized under the *Climate Change Plan for Canada*. In this case, additional project-specific measures may not be necessary.

project-specific efforts should be considered, such as monitoring emissions, with a view to modifying the project or introducing other new mitigation measures in response to new information. The GHG management plan could also link to other air and water pollution reduction opportunities, as these may reinforce each other, and should happen concurrently.

Information concerning GHG management plans should be reported to public interest decision makers, such as regulatory authorities and relevant expert departments, providing a context for their decisions, consistent with the parameters set out earlier in this guidance document.

2.1.5 Monitoring, Follow-up and Adaptive Management

The need for monitoring and follow-up through the EA process will vary by jurisdiction, and may also depend on the nature of the broader GHG management system that each jurisdiction has in place. For example, federal monitoring and reporting standards are currently being developed consistent with Canada's *Climate Change Action Plan*. During this phase, the practitioner should verify the GHG emission forecasts used in the EA. This should be consistent with established jurisdictional procedures. The practitioner should also seek to determine the effectiveness of any emission reduction, offset or compensatory measures that have been implemented. Adaptive management may be an appropriate method of implementing any remedial actions identified during the follow-up program and/or incorporating "lessons learned" into normal procedures.

Moreover, climate change related knowledge, technology, policy and legislation are evolving. For projects with longer lifespans, it may be appropriate to consider these changes as part of the follow-up program.

2.2 Impacts Considerations: Where Climate Change May Affect a Project

The objective of this section is to help practitioners assess, reduce and manage the adverse impacts that climate change may have on projects and ensure that these impacts will not pose a risk to the public or the environment. The consideration of climate change impacts on a project is a component of the standard EA practice of considering possible changes to a project caused by the environment. The consideration of climate change impacts in EA should reflect regional variations in climate and environment, and jurisdictional practices.

Where the risks associated with the impacts of climate change on a project are of a private sector nature alone (for example, affecting the long-term profitability of the project), the proponent can choose to absorb this risk. However, if climate change risks extend beyond the project itself to potentially affect the public or the environment, this information must be factored into an informed decision by relevant authorities. Priority should also be given to projects that are both located in areas where there is a known sensitivity to climate change (i.e. projects located in Arctic regions or near large bodies of water), and are identified as sensitive to the effects of changing climatic parameters.

As with other considerations in EA, it should be noted that the onus remains on the practitioner to ensure sufficient and accurate information required to conclude whether or not there is a risk to the public or environment.

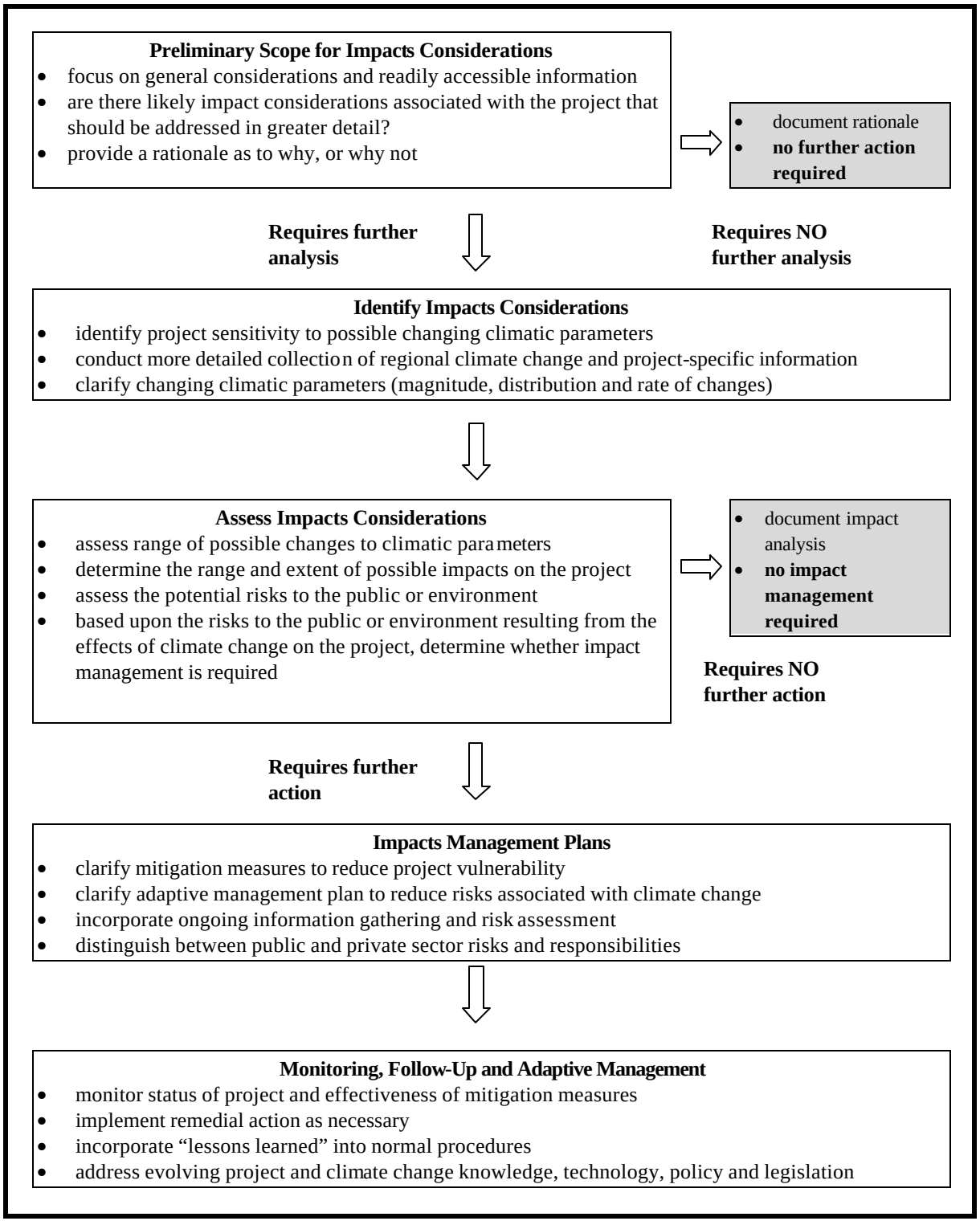
Recommended Procedures

The recommended procedures for addressing impacts considerations are as follows:

1. Preliminary Scoping for Impacts Considerations
2. Identify Impacts Considerations: regional considerations and project sensitivity
3. Assess Impacts Considerations: impact on project and risks to public and the environment
4. Impacts Management Plans: project specifics and ongoing data clarification
5. Monitoring, Follow-up and Adaptive Management

Figure 2.3 illustrates the flow of procedures.

Figure 2.3
Assessing Impact Considerations: Summary of Procedures



2.2.1 Preliminary Scoping for Impacts Considerations

The objective of the preliminary scoping is to assist the EA practitioner in determining relatively quickly and as early in the process as possible, whether there are likely to be important climate change impacts on the project, the potential level of risk posed to the public or the environment, as well as the level of confidence that the scientific community places in readily available climate change projections relevant to the project (see **Annex B** for Sources of Information). Additionally, a rationale should be provided as to why or why not climate change impacts were considered in more detail within the EA.

Preliminary scoping should focus on general considerations rather than detailed, quantitative analysis, and can be undertaken as part of the scoping activities conducted in most EA processes. An examination of the potential impacts of climate change on key climate parameters is part of the thorough assessment of the interactions between the environment and the project. Projects may be affected by a change, over time, in climate parameters, or in the frequency and/or severity of extreme events.

The preliminary scoping identifies the key components of the project and whether these are sensitive to changes in climate and weather parameters. The practitioner assesses whether any of these parameters are projected to change over the duration of the project, and may pose a risk to the project, and consequently to the public or environment. For most projects of short to medium duration, impacts considerations will not require further analysis.

The practitioner should focus upon readily accessible information sources regarding changes to regional climate patterns[4], reports by the Intergovernmental Panel on Climate Change (IPCC), previous EAs of similar projects, regional EAs, local experience and traditional ecological knowledge (TEK). Confidence in the accuracy of climate models and climate change scenarios is higher at the continental level than at the local or regional levels. Due to the related uncertainty surrounding projections of future impacts, and the limitations inherent in existing data, judgment-based analytical tools (such as surveying regional/local experiences, expert opinion, TEK and employing a range of possible outcomes in the risk assessment) may be used when compiling climate change information.

For practitioners to describe and assess risks related to the project as well as possible under these circumstances, they will need to identify the level of confidence associated with the applicable climate change projections and the range of climate change impacts that may affect the project. As more scientific data is collected and climate change knowledge improves, it is hoped that the predictive power and confidence levels related to the climate change projections and risk assessments will be strengthened.

[4] i.e. http://adaptation.nrcan.gc.ca/posters/home-accueil_en.asp; or http://adaptation.nrcan.gc.ca/perspective_e.asp?CaID=13&PgID=25 which is written on a sectoral basis but includes more detailed regional considerations, and the Canadian Climate Impact Scenarios Project listed in **Annex B**.

If medium or high levels of sensitivity or risks to the public or environment are identified, the practitioner should proceed with the analysis outlined below. Most projects would not require additional assessment of impacts considerations.

2.2.2 Identify Impacts Considerations

The identification of impacts considerations should:

- identify the sensitivity of the project to variations in or changes to specific climate parameters (e.g. precipitation, wind, water levels, temperature, humidity, ice conditions, etc.) and identify the potential impacts that changes in such parameters may have on the project, including the possible impacts resulting from changes to multiple parameters; and

- review available information on how regional climate change may affect these parameters to which the project is sensitive and on the level of confidence of the information and forecasts.

Table A.3 in **Annex A** provides a matrix that may be useful in identifying climate parameters that are important to any phase of a project's life cycle, from construction to decommissioning, or any of its key components.

A project may be sensitive to the impacts of climate change if any of its components or any of its life cycle stages:

- could be easily affected by or are dependent on specific climate parameters; and/or

- could be at risk if subject to long-term climate parameter patterns that differ from historical norms.

If the project is identified as sensitive to one or more climate parameters, the practitioner should conduct further analysis and consider the range of possible climate change scenarios and determine the confidence level associated with the data. **Annex B** contains links to various information sources that might be of use to practitioners.

An important aspect is the timing of the project. Climate change parameters will not change appreciably for projects of short duration. Therefore, projects that are likely to be completed and decommissioned within a few years time are unlikely to be sensitive to longer-term climate change effects, although they could be sensitive to variations in or changes to climate variables including the frequency and/or severity of extreme weather events.

The practitioner should identify the potential magnitude and likelihood of changes in the climate parameters over the life of the project (e.g., high, medium or low likelihood). Additionally, the level of confidence attached to existing climate change projections for the region where the project is located should be ascertained, when possible. The IPCC report (2001), *Impacts and Adaptation and Vulnerability* could be used as a starting point to identify the anticipated impacts of climate change on the project. Other Canada-specific sources of information include the *Canada Country Study*, which is a comprehensive, region-by-region examination of climate change and its potential impacts, and *Climate Change Impacts and Adaptation: A Canadian Perspective.* Both resources can be used to identify potential regional and sector-based climate change impacts that may affect a proposed project.

2.2.3 Assess Impact Considerations

An assessment of the nature or characteristics of any climate change impacts may be undertaken as a component of the analysis of environmental effects in a typical EA. The results of Step 1 and 2 should be applied to assess the potential changes (or range of potential changes) in climate parameters for the project. The analysis should also consider the range of possible outcomes under which the climate parameter may adversely affect the project or one of its components. The practitioner should then determine if there are potential risks to the public or the environment if one or more project components is affected by identified changes to climate parameters (i.e. the consequences of a road collapsing due to melting permafrost). This identifies the perceived risks to the environment or the public. When assessing risks from climate change on a project, it should be cautioned that several climate change parameters might act together in a cumulative fashion.

In assessing impact considerations, project planners and practitioners may wish to consider the following, for the range of potential outcomes:

- the sequence of project/environment interactions that would be necessary for the occurrence of the adverse change that is being evaluated;
- the probability that this sequence will occur, given high, medium or low certainty of projections and why;
- the importance of the outcome if the adverse sequence does occur (Does it involve public safety, lead to deterioration or elimination of a public resource, inflict harm on the environment or lead to cost increases or project viability issues for another project?).

In identifying and assessing impact considerations, there are four possible cases to be considered. The four cases are based upon the level of confidence in projected changes to climate parameters and the risk to the public or the environment resulting from the potential effects of these changes on a project:

Case One: occurs when there is a high confidence level associated with data indicating changes to a climate parameter and a high risk to the public or the environment as a result of the effect of these changes on a project. In this case, the practitioner should proceed with the next steps in the risk assessment and indicate the probable range of changes to the appropriate climate parameters. Appropriate monitoring, follow-up and adaptive management procedures should be implemented.

Case Two: occurs when there is a high level of confidence associated with data indicating changes to a climate parameter, but a low risk to the public or the environment as a result of these changes on the project. Except to document these findings in the EA, no further action need be taken by the practitioner.

Case Three: when there is a low confidence level associated with data indicating changes to a climate parameter, but a high probability that the public or the environment will be placed at risk due to the effects of these changes on the project. All available climate change information (including the range of possible changes to the climate parameter) should be provided to the practitioner and public interest decision makers, the next steps in the risk assessment should be conducted. Emphasis should be placed on the probable range of changes to the appropriate climate parameters and the uncertainty associated with this information should be stressed in the EA. Appropriate monitoring, follow-up and adaptive management procedures should be implemented.

Case Four: when there is a low confidence level associated with data indicating changes to a climate parameter and a low risk to the public or the environment if the project is effected by these changes. In this case, no further action need be taken by the practitioner, other than documenting the findings in the EA.

If a project is identified as either case one or case three, the practitioner may then proceed with steps 4 and 5 to ensure that consideration is given to how identified risks may be managed or avoided and proper monitoring, follow-up and adaptive management is conducted.

Figure 2.4 presents a matrix illustrating the possible cases that may be determined from a preliminary examination of, and confidence level in, the available climate change data and risks to the public or the environment resulting from the effects of climate change on a project.

Figure 2.4
Possible Cases Determined from the Preliminary Examination of the Data and Risks to the Public or Environment from Climate Change Impacts on a Project

	High risk • of impacts to the public or the environment	**Low risk** • of impacts to the public or the environment
High Confidence Level • of the project's sensitivity to a climate change parameter	**Case One** • proceed with risk assessment outlined in guidance document • implement appropriate monitoring, follow-up and adaptive management measures	**Case Two** • proponent should be provided with all relevant climate change information • report in EA • no further action required
Low Confidence Level • of the project's sensitivity to a climate change parameter	**Case Three** • proceed with risk assessment outlined in guidance document • emphasize the uncertainty inherent in climate change data • implement appropriate monitoring, follow-up and adaptive management measures	**Case Four** • no further action required • report in EA

2.2.4 Impacts Management Plan

For any probable outcomes indicating sufficient risks to the project, the practitioner and proponent should consider how the risk may be managed or avoided. Where possible, the practitioner should advocate the most efficient and effective design or mitigation measures. This step may be undertaken at the same time as the consideration of mitigation measures and the determination of significance in a typical EA, factoring in the uncertainty associated with climate change considerations. Additionally, jurisdictions have various options at their disposal such as lease or tenure renewals to facilitate mitigation measures.

Impacts management plans could include:

- the application of mitigation measures to reduce the project's vulnerability to changes in specific climate parameters (e.g., changes in project design and/or timing);
- implementing an adaptive management plan to reduce risks and adapt to future changes (e.g., collecting and evaluating data on key climate parameters over the lifetime of the project, with a view to modifying the project or introducing new mitigation measures in the future in response to new information);

- an attempt to reduce the uncertainty associated with readily accessible generic information sources by incorporating regional-scale information or results, if applicable; such as the *Canadian Climate Impacts Scenarios Project* as discussed in **Annex B**.

A key element when considering how risks may be managed is the extent to which the project or its components are flexible or adaptable to future circumstances. Some projects, such as bridges, are highly inflexible; it will be difficult to modify them in response to future changes in, for example, sea level, rainfall or streamflow patterns. Other projects, such as aquaculture farms or tourism projects may be more flexible and more easily modified to mitigate future impacts of climate change on a project.

The analysis should identify any risks that may not be managed or avoided (e.g., because there may not be any apparent mitigation measure or because the proponent decides to assume the risk), and any implications of proceeding with the project in the absence of a risk management measure.

It is essential in reporting possible impact considerations that the public and private sector risks are differentiated and that the practitioner does not recommend that public sector decision makers take responsibility or assume any liability for risks rightfully borne by the private sector. It should be noted that in cases where there are only private sector risks associated with the climate change impacts on the project, the private sector may simply wish to assume the risks and not undertake mitigation or adaptation measures.

2.2.5 Monitoring, Follow-up and Adaptive Management

During the monitoring, follow-up and adaptive management phase, the responsible federal, provincial or territorial authority may monitor the status of the project and the effectiveness of the mitigation measures that have been implemented. An adaptive management process may be employed by the proponent to implement any remedial actions identified as necessary during the follow-up program, as well as incorporate any new lessons learned into normal procedures. The adaptive management plan would also be implemented during the follow-up phase. Adaptive management can serve as an important learning tool for climate change action, as uncertainty about vulnerabilities and risks can be reduced by experience only if that experience is identified and passed on (to others) to benefit other projects.

Moreover, project and climate change related knowledge, technology, policy and legislation are evolving. For projects of longer lifelines, it may be appropriate to consider these changes as part of the follow-up program.

3.0 Conclusion

The purpose of this document is to provide EA practitioners with general guidance for incorporating climate change considerations in project EA, in particular:

- GHG Considerations; and
- Climate Change Impact Considerations

It represents the collaborative efforts of federal, provincial and territorial jurisdictions, and marks a unique initiative in Canada's response to climate change. While some effort has already been made in incorporating climate change considerations in EA, this guidance document is distinctive in putting forth a consistent methodology developed for practitioners and its assembly in a separate document.

While acknowledging that our understanding of climate change and its implications are still developing, federal, provincial and territorial jurisdictions recognize the importance of integrating existing knowledge and practices into project planning at the earliest stage. It is hoped that the consistent consideration of climate change in project EAs will increase attention to, and awareness of, GHG emissions, stimulate consideration of less emission-intensive ways to realize projects, help proponents minimize risk associated with climate change impacts on projects, and assure the public that climate change considerations are being taken into account.

In addition, incorporating climate change considerations in EA can help to determine whether projects are consistent with jurisdictional actions and initiatives to manage GHG emissions. It can also assist proponents in using best practices that adapt to possible climate change impacts, such as changes in the frequency or intensity of extreme weather events, increases in mean temperatures or altered precipitation amounts. This is an effective means for governments and project proponents to advance an agenda of sustainable development and environmental protection.

As climate change knowledge, policies and EA-related practice continue to develop, it is expected that this document will continue to be updated by jurisdictions.

Glossary of Terms

Adaptation – Adjustment in natural or human systems in response to actual or expected climatic *stimuli* or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.

Adaptive Management – Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Adaptive management also provides a framework for actively responding to any inaccurate forecasts and ineffective mitigation measures.

Carbon Sinks – see **Sinks**

Climate Change – defined by the *United Nations Framework Convention on Climate Change* as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."

Climate Change Impacts – a series of changes within the overall global climate system, brought about as a result of increased atmospheric concentrations of GHGs. These impacts may have far-reaching and unpredictable environmental, social, and economic consequences, and may include: global sea level rise, increases in severe weather events, and changes in precipitation.

Climate Change Parameters – The measurable physical properties of climate. Where climate is the average pattern of weather for a particular region, this average is commonly taken over a 30-year time period. Climatic elements include precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, hail storms, etc.

Climate Variability – The year-to-year fluctuation in the climate record.

Confidence Levels – A level of confidence as defined in the 2001 report of the Intergovernmental Panel on Climate Change, *Technical Summery: Impacts, Adaptation, Vulnerability* representing the degree of scientific consensus based on the collective expert judgment of observational evidence, modeling results, and theory. In this paper:

Very high:	95% or greater consensus
High:	67-95%
Medium:	33-67%
Low:	5-33%
Very Low:	5% or less

Environment – the components of the Earth and their interacting natural systems, and includes:

- land, water and air, including all layers of the atmosphere; and
- all organic and inorganic matter and living organisms.

Environmental Assessment – a systematic process of identifying, predicting, evaluating and mitigating the broad environmental effects of proposed undertakings before irrevocable decisions are made.

Environmental Assessment Practitioner – see **Practitioner**

Framework Convention on Climate Change (FCCC) – the agreement signed by 154 countries, including Canada, at the Earth Summit in 1992, under which climate change is monitored and addressed globally.

Greenhouse Gas (GHG) – gas that accumulates in the earth's atmosphere and traps heat, thus contributing to the greenhouse effect. The major GHGs responsible for causing climate change are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_20). The Kyoto Protocol also addresses hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6).

GHG Emissions – releases of GHG, from either natural sources or from human activities, such as the burning of fossil fuels for electricity generation, industrial processes, or transportation.

Intergovernmental Panel on Climate Change (IPCC) **–** A body made up of the world's leading climate scientists, established in 1988 by the UN Environment Program and the World Meteorological Association to assess the scientific research on climate change and its environmental and economic impacts.

Jökulhlaup – A catastrophic release of water from a glacier. Jökulhlaups or outburst floods may originate from trapped water in cavities inside a glacier or at the margins of glaciers or from lakes that are dammed by flowing glaciers.

Mitigation Measures – measures to eliminate, reduce or control the adverse environmental effects of a project, including restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means. Mitigation measures may extend beyond the individual project being assessed, and Canada itself, as in international emission credit trading recognized under the *Climate Change Plan for Canada*. In which case, additional project-specific measures may not be necessary.

Offsets – When a new technology is introduced or activity undertaken that reduces emissions or removes GHG from the atmosphere, a credit or "offset" could be created within an offset system. For example, if the mass planting of trees meets all the conditions for a project in an

offset system, then the resulting measured, reported and verified carbon sink could be sold as offset credits.

Practitioner – A person involved in some aspect of the conduct or the direction of an environmental assessment. A practitioner could be a proponent, a representative of the government or have some other affiliation. This guidance does not distinguish between government and proponent roles in environmental assessments because those roles vary under different environmental assessment regimes.

Project – An undertaking in relation to a physical work, such as any proposed construction, operation, modification, decommissioning, or abandonment, or any physical activity not relating to a physical work that is listed in the *Inclusion List Regulations* under the *Canadian Environmental Assessment Act*.

Sensitivity – The degree to which a system is affected, either adversely or beneficially, by climate-related stimuli.

Sinks (Carbon Sinks) **–** any activity, process or mechanism that removes a GHG from the atmosphere, such as oceans, forests, soils and wetlands. Human activities can either enhance sinks (i.e. help to store additional carbon) or release existing stored carbon (e.g., deforestation). Activities that protect and enhance carbon storage can be supported as two aspects of an overall climate change strategy.

TEK (Traditional Ecological Knowledge) **–** is generally used to refer to a component of Aboriginal traditional knowledge about the environment (e.g., weather, geology, biology) and the use of the environment (e.g., hunting and gathering). It is governed by community beliefs and values, and thus TEK is an integral part of a community's social, cultural, and spiritual framework. TEK is held by a community, although different segments of a community may hold different types of TEK. It is living knowledge. TEK is added to, and subtracted from, and therefore changes over time.

VEC (Valued Ecosystem Component) **–** Any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern.

Annex A: Proposed Worksheets for Potential Use by EA Practitioners

The following worksheets are intended to provide more detailed "how to" information for EA practitioners seeking to incorporate climate change considerations in EAs. These are not intended to be prescriptive, but rather to outline potential approaches EA practitioners could employ to a broad range of climate change scenarios.

Proposed Worksheets – GHG Considerations

Table A.1 can be used to assist in the preliminary scoping of a project's GHG considerations. It includes possible questions about the project that may help the EA practitioner to identify important GHG considerations (i.e., the magnitude of emissions associated with the project) or whether there is a high level of uncertainty associated with the project's GHG considerations. The table also includes illustrative examples of projects that *may* be associated with each question.

Table A.1
Preliminary Scoping of GHG Emissions Considerations

Checklist	Illustrative Examples of Projects
1. Is the project likely to generate high or medium volumes of GHG emissions or a high or medium level of GHG emission intensity during any phase of the project, including exploration, construction, operation, modification or decommissioning?	Coal-fired generating plant
2. Is the project likely to generate high or medium volumes of GHG emissions or a high level of GHG emission intensity over its operational lifetime?	Hydrocarbon production (e.g., petroleum refining) Electrical generation through fossil fuels Some types of large-scale industrial manufacturing (e.g., petroleum refining, cement, pulp and paper, iron and steel, chemical production)
3. Is the project's construction or lifetime operation likely to adversely affect, on a large scale, forest cover, crops or wetlands that may serve as carbon sinks for GHG emissions?	Large-scale forest harvesting operations Large-scale flooding of land Large-scale changes in land use, settlement and/or industrial mix

Table A.2 may assist the EA practitioner in the review of likely GHG considerations associated with a specific project. It includes examples of questions that may provide a focus for the analysis under each suggested task area.

Table A.2
Reviewing Likely GHG Considerations

Review Task	Checklist of Possible Questions (where appropriate)
1. Describe and/or quantify direct GHG emissions, or level of GHG emission intensity, if any	What are the expected GHG emissions over all phases of the project, including exploration, construction, operation, modification or decommissioning? What are the expected GHG emissions over the operational lifetime of the project? What will be the project's marginal contribution to total national and provincial emissions on an annual basis? What is the intensity of GHG emissions per unit of energy produced and how does it compare with industry and technology performance? (where appropriate)
2. Describe and/or quantify direct impacts on large-scale carbon sinks as a result of the project, if any	What qualitative or quantitative changes in carbon sinks can be identified as a result of the project?

3. Clarify project GHG management plans and confirm, if necessary, consistency with broader jurisdiction GHG management requirements	What is the overall consistency of the project's GHG emissions or emission intensity with jurisdictional climate change policies and plans? Are there best practices for the sector with respect to the project's GHG emissions or emission intensity? If so, is the proponent planning on applying these best practices/technologies? Has the proponent proposed specific innovative approaches toward managing emissions over the life of the project, such as participation in voluntary industry programs? Has the proponent proposed an emissions offsets plan for the life of the project? Is there a need for and/or has the proponent proposed an emissions management plan for the life of the project? Has the proponent proposed to monitor GHG emissions or emission intensity over the lifetime of the project and apply adaptive management measures as appropriate?

Proposed Worksheets – Impacts Considerations

Table A.3 can be used to identify project sensitivity to changes in specific climate and related environmental parameters. EA practitioners could rank the project's sensitivity to changes or variations in climate parameters on a scale of nil/low/medium/high, using the most relevant and readily available climate change information obtained during the preliminary scoping phase of the assessment. This table is meant to illustrate the types of sensitivities that a project might have, not to represent a complete or exhaustive list of all possible effects related to climate change. Proponents should also be aware of how changes in multiple components might interact and pose a risk to a project. Climate parameter-project component interfaces evaluated as being of medium or high risk should be assessed in more detail.

Table A.3
Ranking Project Sensitivities to Climate and Related Environmental Parameters
(rank: Nil, Low, Medium, High)

Climate Parameters	**Typical Project Phases/Components**						
	Construction	Large Structures	Linear Structures	Transportation and/or Energy Infrastructure	Raw Material Supply	Waste Disposal	Decommission-ing and Abandonment
Mean Temperature							
Frequency and/or Severity of Extreme Temperature							

Total Annual Rainfall							
Total Annual Snowfall							
Frequency and/or Severity of Precipitation Extremes (return periods)							
Sea level							
Lake Levels and Streamflows							
Soil Moisture and Ground Water							
Evaporation Rate							
Wind Velocity							
Frequency and Severity of Extreme Weather Events (other than temperature or precipitation)							
Arctic Sea Ice Extent							
Permafrost Extent/Levels							
Glacier Dammed Lake Failures (Jökulhlaup)							

Annex B: Sources of Information for Practitioners

I. Measuring and Reducing GHG Emissions

With respect to GHG considerations, the following resources are available to EA practitioners:

- Natural Resources Canada's Large Final Emitters Group: http://www.nrcan-rncan.gc.ca/lieg-ggei/English/lieg_en.htm
- Environment Canada's GHG Inventory: http://www.ec.gc.ca/pdb/ghg
- Canada's Climate Change Voluntary Challenge and Registry Inc.: http://www.vcr-mvr.ca/
- EcoGESte: www.mef.gouv.qc.ca/fr/environn/dev_dur/ecogeste.htm [link requires updating]
- *Canada's Third National Report on Climate Change, 2001*; provides a summary of Canada's GHG inventory and projections of emissions to 2020: http://www.climatechange.gc.ca/english/3nr/index.html
- *Intergovernmental Panel on Climate Change's Third Assessment Report, Volume III* assesses options for limiting GHG emissions: http://www.grida.no/climate/ipcc_tar/wg3/index.htm
- The Canadian Forest Service's Forest Carbon Accounting Web site: http://carbon.cfs.nrcan.gc.ca/

II. Climate Change Impacts in Canada

In general, the resources described in this section would be the first places to go to obtain published information about climate change impacts relevant to specific regions and/or sectors in Canada.

With respect to impacts considerations, Step 1 requires that practitioners conduct a preliminary scoping based on readily available information. These resources will help practitioners to identify potential impacts of climate change in the geographical region, and on the biophysical systems of interest to the project. The IPCC *Third Assessment Review* should be of particular value to EA practitioners, as it represents the views of dozens of internationally recognized experts, and attaches levels of confidence, where possible, to potential future climate change impacts.

The resources in this section should also provide practitioners with preliminary information for use in: Step 2 – identifying the impacts of climate change on specific climate parameters (e.g., temperature, precipitation, ice conditions) to which the proposed project is sensitive; Step 3 – accumulating and assessing more detailed information about the potential impacts of climate change on the specific project and risks to the public and environment; Step 4 – developing a plan for managing or avoiding risks to the project from climate change; and Step 5 – monitoring, follow-up and adaptive management.

A. Synthesis Documents

The documents described below reflect a synthesis of the opinions of researchers, and in some cases of stakeholders as well, on the potential impacts of climate change. For the most part, these documents are based on review and assessment of the existing scientific literature.

IPCC - Third Assessment Report

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to address climate change. The IPPC's role is to assess – on a comprehensive, objective, open and transparent basis – the scientific, technical and socio-economic information relevant to understanding the risk of human-induced climate change, its potential impacts, and options for adaptation and mitigation. A main activity of the IPCC is to provide a regular assessment of the state of knowledge on climate change. The *First IPCC Assessment Report* was completed in 1990, the *Second Assessment Report* in 1995, and the *Third Assessment Report* (TAR) in 2001. The TAR and other IPCC documents can be found on the IPCC Web site at: http://www.ipcc.ch/.

The TAR includes three volumes, reflecting the work of the three IPCC Working Groups.

- Volume I assesses the scientific aspects of the climate system and climate change.
- Volume II assesses the vulnerability of socio-economic and natural systems to climate change, negative and positive consequences of climate change, and options for adapting to it.
- Volume III assesses options for limiting GHG emissions and otherwise mitigating climate change.

The TAR summary report produced by Working Group II of the IPCC, *Climate Change 2001: Impacts, Adaptation and Vulnerability* provides a synthesis of the most recent findings on regional climate changes, the effects on and vulnerability of natural and human systems to these changes, as well as key regional impacts and issues. Chapter 15 deals with North America. The direct link to this chapter is http://www.grida.no/climate/ipcc_tar/wg2/545.htm.

Canada Country Study

The Canada Country Study (CCS) was the first comprehensive program aimed at determining the impacts of climate change on different regions and economic sectors within Canada. Launched in 1996, the CCS reviewed existing knowledge about the potential social, biological, and economic impacts of climate change. Some chapters reflect individual research studies, while others review and assess the broader scientific literature. Six regional reports (B.C. and

Yukon, Arctic, Prairies, Ontario, Quebec, and Atlantic), along with a series of reports on individual sectors and cross-cutting issues were released in 1997 and 1998. They are available at http://www.ec.gc.ca/climate/ccs. [Environment Canada is currently rebuilding its Web site]. The regional reports only are available at: http://www.carleton.ca/~tpatters/teaching/climatechange/canada/.

Climate Change Poster Series

Climate Change in Canada, a series of seven posters and related materials based on the Canada Country Study and depicting climate change impacts in regions across Canada, is available through the following Web site: http://www.adaptation.nrcan.gc.ca/posters/

Canadian National Assessment

Climate Change Impacts and Adaptation: a Canadian Perspective, is a review of Canadian impacts and adaptation research from 1997 to the present. The report builds on the *Canada Country Study*, and reflects a greater emphasis on review and assessment of existing literature. It provides information on various sectors, including water resources, agriculture, forestry, fisheries, coastal zone, and health, as well as general information on impacts and adaptation, advances in research techniques, and existing knowledge gaps. Sector-specific chapters are available at http://adaptation.nrcan.gc.ca/home2_e.asp?CaID=9&PgID=25. More comprehensive information on region-specific issues is expected to be released by 2006.

US National Assessment

The US *National Assessment of the Potential Consequences of Climate Variability and Change* – published in 2000 and 2001 – synthesizes, evaluates, and reports on current knowledge of the potential consequences of climate variability and change on the United States in the 21st century. It includes information about climate change impacts on 10 mega-regions, 19 regions, and five sectors: agriculture, water, health, forests, and coastal areas and marine resources. Much of this information, particularly in regions bordering on Canada, will be of value to Canadian practitioners. Both regional and sectoral reports are available from the main US National Assessment Web site, at: http://www.usgcrp.gov/usgcrp/nacc/default.htm.

B. Targeted Documents

Many other studies and reports describe climate change impacts on specific regions, bio-physical systems, or sectors in Canada. The following list, while incomplete, provides links to some of the most significant sources of such information.

Government of Canada – Natural Resources Canada

Natural Resources Canada hosts the main Government of Canada climate change impacts and adaptation Web site, at http://adaptation.nrcan.gc.ca/.

The Resource Centre portion of this Web site includes reports, fact sheets, presentations, papers, and links to other Web sites. The main link is http://adaptation.nrcan.gc.ca/resource_e.asp.

The Web site also includes links to projects funded under the federal *Climate Change Action Fund and Action Plan 2000*, by sector and by region, and links to related papers and resources http://adaptation.nrcan.gc.ca/home_e.asp?CaID=9&PgID=23. These projects include, for example, a study on the possible consequences of climate change along the Beaufort Coastlands (available at http://sts.gsc.nrcan.gc.ca/beaufort/), as well as critical information on permafrost and climate change (available at http://sts.gsc.nrcan.gc.ca/permafrost/climate.htm).

Government of Canada – Environment Canada

The main Environment Canada climate change Web site is http://www.ec.gc.ca/climate/
[the Environment Canada climate change site is currently under construction]

Adapting to Climate Change in the Toronto-Niagara Region: Towards an Integrated Understanding of Science, Impacts, and Responses (1999)

Adapting to Climate Change and Variability in the Great Lakes – St. Lawrence Basin (1998)

Climate Change and Canada's National Park System (1998)

Extreme Weather and Climate Change (1998)

Mackenzie Basin Impact Study: A regional study on the effect of climate change in Canada

Water Resources: Monitoring the effect of climate change on freshwater ecosystems

Canadian Climate Impacts and Adaptation Research Network (C-CIARN)

C-CIARN is a national network established and funded by Natural Resources Canada, which facilitates the generation of new climate change knowledge by bringing researchers together with decision makers from industry, governments, and non-governmental organizations. C-CIARN is comprised of six regional offices (British Columbia, Prairies, Ontario, Quebec, Atlantic, and North) and seven sectoral (Health, Water Resources, Coastal Zone, Forest, Agriculture, Landscape Hazards, and Fisheries), connecting researchers and stakeholders across the country. Further information about C-CIARN can be found at: http://www.c-ciarn.ca/.

Some of the C-CIARN offices have produced summaries of the literature relevant to their area of interest. The national C-CIARN database includes references to hundreds of papers on climate change impacts and adaptation in Canada, and allows searches by title, author, abstract, keywords, and publication date. The database can be found at http://www.c-ciarn.ca/index_e.asp?CaId=9&PgId=20

International Institute for Sustainable Development

The International Institute for Sustainable Development (IISD) is a non-profit organization that promotes sustainable development by advancing policy recommendations on international trade and investment, economic policy, climate change, measurement and indicators, and natural resource management. The IISD is looking at climate change impacts and adaptation in Canada's North. Information about this project, *Focusing on the Arctic*, can be found at http://www.iisd.org/climate/arctic/.

Canadian Council of Ministers of the Environment

The Canadian Council of Ministers of the Environment (CCME) is preparing a report – available later in 2003 – that describes twelve climate change indicators, documents changes in these indicators during the 20th century, and identifies the potential implications of such changes to things Canadians value. This report is written for a general audience, and is based on scientifically sound, readily available data. The CCME Web site, located at www.ccme.ca, provides free access to the document in PDF format.

Government of British Columbia – Ministry of Water, Land and Air Protection

Indicators of Climate Change, 2002, documents how temperature, precipitation, and some related physical and biological systems changed in British Columbia during the last 100 years.

The trends suggest that many regions of British Columbia are starting to feel the early impacts of climate change. The report and supporting technical documents are available at: http://wlapwww.gov.bc.ca/air/climate/#indicators.

Government of the United States

The United States and other signatories to the *United Nations Framework Convention on Climate Change* (UNFCCC) are obligated to submit to the UNFCCC Secretariat periodic national communications (reports). These reports are to provide a wide ranging and comprehensive update on a country's mitigation and adaptation efforts in response to climate change. The most recent such report from the US government – *Climate Action Report 2002* – contains a chapter on impacts and adaptation based largely on the US National Assessment. It is available at:
http://www.usgcrp.gov/usgcrp/Library/thirdnatcom/chapter6.htm

The US Environmental Protection Agency (EPA) maintains a Web site on climate variability and change. The "Where You Live" section of this Web site contains links to clickable maps of the World, United States, and Natural Places, as well as material on how these regions and ecosystems may be affected by climate change. The link is:
http://yosemite.epa.gov/OAR/globalwarming.nsf/content/index.html

III. Climate Change Impact Assessments

In some cases, a preliminary literature review will identify potential climate change impacts on a project that require more detailed assessment. Although the resources in Section II should provide practitioners with background information relevant to all these tasks, in some cases practitioners may need access to more specialized information about climate change, its impacts, and potential adaptation measures. A number of organizations in Canada can provide guidance on ways to obtain this specialized information, including links to more specialized information sources and expertise in using and interpreting this information.

Canadian Climate Impacts Scenarios Project

The Canadian Climate Impacts and Scenarios (CCIS) project provides climate scenario information and scenario construction advice to impacts researchers in Canada. Its goal is to ensure that resulting impacts studies can be used to provide Canadians with a meaningful national assessment of the impacts of climate change and can contribute to future international assessments such as those undertaken by the IPCC. Goals of the program include:

- the provision of basic national climate change scenarios, advice and related information to the Canadian impacts and adaptation communities;

- the development of a nationally consistent framework within which sector- and region-specific climate change scenarios will be developed through engagement of the respective impacts and adaptation research communities;
- the development and maintenance of a capacity within the Canadian impacts and adaptation research communities to develop nationally consistent climate change scenarios to support climate impacts and adaptation research and assessments; and
- the engagement of the university research community and scenario users in the further development of the young and growing science of climate change scenarios.

Further information on the program can be found at: http://cics.uvic.ca/scenarios.

Canadian Institute for Climate Studies

The Canadian Institute for Climate Studies (CICS) is a not-for-profit Canadian corporation established to further the understanding of the climate system, its variability and potential for change and the application of that understanding to decision making in both the public and private sectors. CICS hosts the Canadian Climate Impacts Scenarios Project (see below) and on a fee-for-service basis provides advice, consultation, analysis, interpretation and seasonal climate predictions to business, industry, government, and individuals whose decisions are climate sensitive. More information about CICS can be found at: http://www.cics.uvic.ca/index.cgi?/About_Us/Canadian_Institute_for_Climate_Studies.

Canadian Climate Impacts and Adaptation Research Network

The Canadian Climate Impacts and Adaptation Research Network (C-CIARN) is a national network that facilitates the generation of new climate change knowledge by bringing researchers together with decision makers from industry, governments, and non-governmental organizations to address key issues. C-CIARN is comprised of six regional offices (British Columbia, Prairies, Ontario, Quebec, Atlantic and North) and seven sectoral offices (Health, Water Resources, Coastal Zone, Forest, Agriculture, Landscape Hazards and Fisheries), connecting researchers and stakeholders across the country. Individual C-CIARN offices may be able to identify resources and expertise for more detailed analysis of climate change impacts on specific projects. Further information about C-CIARN can be found at: http://www.c-ciarn.ca/.

Ouranos

Ouranos is a research consortium founded by seven departments of the Government of Québec, Hydro-Québec, and Environment Canada's Meteorological Service of Canada. It hosts the Quebec office of the C-CIARN network. Ouranos looks at climate change issues and adaptation at the regional level throughout North America, although its area of emphasis is

Quebec. It focuses on the needs of a changing group of users, the most proactive of which are the members of the Consortium. Through sharing human and financial resources, Consortium members gain access to scientific knowledge essential to decision making and to adapting their activities to climate change. Ouranos is accessible at: http://www. ouranos.ca.

Centre de Ressources en Impacts et Adaptation au Climat et à ses Changements is a Ouranos partnership site whose activities include climate monitoring, climate change scenarios development and linkages with the Ouranos site for Impacts and Adaptation issues. CRIACC can be found at: http://criacc.qc.ca.

Science Assessment Integration Group (Environment Canada)

The Science Assessment Integration Group within the Meteorological Service of Canada provides expert advice on impacts, predictions and modeled projections of climate change. Its Web site includes special reports on climate model projections for Canada, climate change and extreme weather, frequently asked questions, as well as annual reviews of emerging international literature, including those on impacts, which update the information available from IPCC. For more information visit the group's Web site at: http://www.msc.ec.gc.ca/saib/climate/climat_e.cfm.

Adaptation and Impacts Research Group (Environment Canada)

The Adaptation and Impacts Research Group (AIRG) within the MSC was established to ensure that information is available to Canadians on the environmental, social and economic impacts caused by vulnerabilities to atmospheric change, variability and extremes, and on viable adaptive responses. AIRG research results can be used by Canadians (e.g., decision and policy makers within communities, organizations, the private sector, and government) to promote and facilitate adaptation to atmospheric change, variability and extremes and to assist in identifying the need for other response options (e.g., mitigation when impacts and/or adaptation response are deemed unacceptable or insufficient). The main AIRG link is: http://www.msc-smc.ec.gc.ca/airg/

Climate Change Action Fund/Action Plan 2000 (Government of Canada)

The Climate Change Action Fund (CCAF) was established in 1998 by the federal government to help Canada meet its commitments under the Kyoto Protocol to reduce GHG emissions. Through the CCAF, the Government of Canada has taken steps to engage governments, businesses, communities and individual Canadians to address climate change. Budget 2000 extended the CCAF for three more years to 2003-2004 at $50 million per year. The CCAF now has five components:

- Building for the Future
- International Policy and Related Activities
- Public Education and Outreach
- Science, Impacts and Adaptation
- Technology Early Action Measures (TEAM)

CCAF main Web site:
http://climatechange.gc.ca/english/actions/action_fund/index.shtml.

The Science, Impacts and Adaptation (SIA) component of the CCAF aims to advance knowledge of the magnitude, rate and regional distribution of climate change and its impact on Canada and the capacity of Canadians to adapt to climate change. It supports global- and regional-scale climate modeling for impact and adaptation needs, as well as the development and provision of climate scenarios for impacts and adaptation researchers. It contributes to the development of adaptation strategies in regions and sectors where impacts are presently being felt and where decisions taken now have long-term implications. More information about the SIA program is available at: http://climatechange.gc.ca/english/actions/action_fund/science.shtml.

The Science Program within the SIA component of the CCAF has supported, among other things, research on climate and weather extremes, improvements to climate system models, and the development of sector-specific scenarios of climate change. More information about the Science program can be found at: http://www.ec.gc.ca/climate/CCAF-FACC/Science/lang.htm, or by contacting the Science Liaison Office (Environment Canada) at (819) 997-2724.

The Adaptation Liaison Office at Natural Resources Canada manages the federal Climate Change Impacts and Adaptation Program within the SIA component of CCAF. The program provides funding for research and activities to improve knowledge of Canada's vulnerability to climate change, to better assess the risks and benefits posed by climate change and to build the foundation upon which appropriate decisions on adaptation can be made. The Program also facilitates interaction between stakeholders and researchers through support of the Canadian Climate Impacts and Adaptation Research Network (C-CIARN). More information can be found at: http://adaptation.nrcan.gc.ca.

Prairie Adaptation Research Collaborative

The Prairie Adaptation Research Collaborative (PARC) is a facilitative, interdisciplinary research network established to understand the potential impacts of climate change on the Canadian prairie provinces and conduct research necessary to develop appropriate adaptation strategies. It hosts the Prairies office of the C-CIARN network. PARC was established in 2000 to:

- promote and coordinate collaborative research among sectors and disciplines on climate change impacts and adaptation;

- increase the synergy among participating groups and sectors to reduce the negative impacts of climate change while taking advantage of new opportunities that arise. PARC is located at: http://www.parc.ca/.

IV. Climate Change Policy

International Framework for Action on Climate Change

The international climate change negotiations process home page: http://unfccc.int/

Guide to the International Climate Change Negotiations Process: http://unfccc.int/resource/process/index.html

Text of the Kyoto Protocol: http://unfccc.int/resource/docs/convkp/kpeng.pdf

Text of the UNFCCC: http://unfccc.int/resource/docs/convkp/conveng.pdf

Government of Canada

- *A Climate Change Plan for Canada*, November 2002: http://www.climatechange.gc.ca/plan_for_canada/index.html
- National Climate Change Process: http://www.nccp.ca/NCCP/index_e.html
- As part of its international commitment on climate change, Canada, along with other signatories to the *United Nations Framework Convention on Climate Change* (UNFCCC), is obligated to submit to the UNFCCC Secretariat periodic national communications (reports). These reports are intended to provide a wide ranging and comprehensive update on a country's mitigation and adaptation efforts in response to climate change. Canada submitted its *Third National Report on Climate Change* in 2001. The report includes: an overview of Canada's National Implementation Strategy on Climate Change and resulting key policies and measures; a summary of Canada's national GHG inventory and projections of emissions to 2020; and an overview of the science, impacts (vulnerability assessment), and adaptation issues facing Canada in the future: http://www.climatechange.gc.ca/english/3nr/index.html

Federal, Provincial and Territorial Government Web sites on Climate Change

Jurisdiction	Web Link
Government of Canada	http://www.climatechange.gc.ca
British Columbia	http://wlapwww.gov.bc.ca/air/climate/index.html
Yukon	http://www.environmentyukon.gov.yk.ca/epa/climate.shtml

Alberta	http://www3.gov.ab.ca/env/climate/index.html
Saskatchewan	http://www.serm.gov.sk.ca/environment/climatechange/
Manitoba	http://www.gov.mb.ca/conservation/climatechange
Northwest Territories	http://www.gov.nt.ca/RWED/eps/energy.htm
Ontario	http://www.est.gov.on.ca/english/energy/en_air_climate.cfm
Quebec	http://www.mrn.gouv.qc.ca/climatiques/
Nunavut	http://www.gov.nu.ca/sd.htm
New Brunswick	http://www.gnb.ca/0078/index-e.asp
Nova Scotia	http://www.gov.ns.ca/natr/climate/
Prince Edward Island	http://www.gov.pe.ca/infopei/Government/GovInfo/ Environment_and_Land/Climate_and_Weather/
Newfoundland and Labrador	http://www.gov.nf.ca/env/

V. Canadian Environmental Assessment Processes

Jurisdiction	**Web-link**
Federal Government	http://www.ceaa.gc.ca/
British Columbia	http://www.eao.gov.bc.ca/
Yukon	http://www.gov.yk.ca/depts/eco/dap/yeaa.html
Alberta	http://www3.gov.ab.ca/env/protenf/assessment/index.html
Saskatchewan	http://www.serm.gov.sk.ca/environment/assessment/
Manitoba	http://www.gov.mb.ca/conservation/envapprovals/publs/procbull.html
Northwest Territories	http://www.rwed.gov.nt.ca/
Mackenzie Valley EIRB	http://www.mveirb.nt.ca
Ontario	http://www.ene.gov.on.ca/envision/env_reg/ea/English/index.htm
Quebec	http://www.menv.gouv.qc.ca/programmes/eval_env
Nunavut	http://www.gov.nu.ca/sd.htm; http://www.polarnet.ca/nirb/
New Brunswick	http://www.gnb.ca/0009/0377/0002/index-e.html
Nova Scotia	www.gov.ns.ca/enla/ess/ea
Prince Edward Island	http://www.gov.pe.ca/infopei/Government/GovInfo/EnvironmentandLand/ Environmental_Impact_Assessment/
Newfoundland and Labrador	http://www.gov.nf.ca/env/Env/EA%202001/pages/index.htm

Annex C: Case Studies of Canadian Approaches

This Annex provides examples of projects where climate change considerations have been incorporated into the EA process, either at the federal or provincial levels. The Annex outlines how each of these project EAs addressed the general steps outlined in Section 2. These case studies seek to illustrate how climate change considerations were incorporated into the EA, and do not seek to assess either the effectiveness of the assessment or the project outcomes.

Brooks Power Plant and Coal Mine Project

In 2001, Fording Coal Limited proposed the development of a 1000 MW coal-fired power generating station and associated coal mine near Brooks, Alberta. This project required an environmental assessment under both federal and provincial legislation and a joint review was commenced under the 1999 *Canada-Alberta Agreement for Environmental Assessment Cooperation*, with Alberta assuming the lead.

Step 1: Preliminary Scoping for GHG Considerations/Identify GHG Considerations

Alberta considered the order of magnitude of anticipated emissions from this project, the nature of the project and emissions from similar activities before deciding to assess GHG emissions as part of the project's EA.

Step 2: Assess GHG Considerations

The terms of reference issued by Alberta for this project required the proponent to address the incremental loading of GHG to the atmosphere as a result of the project. The proponent was asked to identify the sources and quantities of GHG emissions associated with the project, as well as the intensity of GHG emissions per unit of energy produced. Other requirements included: comparing emissions intensity to industry and technology performance (i.e. best available technology); addressing risk management, and considering phased action for continuous improvement and timing. Relative to continuous improvement, the proponent was also asked to describe how flexibility was accounted for in the plant design and layout to accommodate potential modifications that may be required by any future change in standards, limits and guidelines. While relevant to long-term management of GHG, this part of the terms of reference related to future changes in standards for any parameters.

Step 3: GHG Management Plans

The terms of reference for this assessment asked the proponent to discuss the impact of the plant emissions and Fording's overall project and corporate GHG management plans, including plans for the use of offsets or other innovative approaches, with reference to the objectives set out in Alberta's *Strategy for Action on Climate Change* (1998) and relevant national

initiatives (including the Voluntary Challenge and Registry program). The proponent was also asked to identify any emission minimization processes or programs that it plans to employ.

In addition, the proponent was asked to comment on the adaptability of the project in the event that the region's climate changed significantly, and to identify implications that possible climate change might have for the sustainability of the project. The intent was to have the proponent approach the issue as a simple situation analysis. For instance, if the climate was to change by the approximate amount that generally available scenarios indicate as possible, would there be any implications for the project? The proponent was not expected to do climate modeling.

Step 4: Monitoring, Follow-up and Adaptive Management

It was expected that reporting would be required for gross emissions, net emissions, and gross and net emission intensities. Emission offsets would also be reported and verified as real and measurable by an independent third party.

Northumberland Crossing Project

The Northumberland Crossing project, which involved the construction of a 13-km fixed link from Prince Edward Island to New Brunswick, was assessed federally under the Environmental Assessment and Review Process (EARP). The assessment considered the potential impacts of climate change on the project and was completed in 1993.

Step 1: Preliminary Scoping for Impacts Considerations

The Northumberland Crossing Review Panel examined how atmospheric conditions, geological factors and marine conditions might affect the project.

Step 2: Identify Impacts Considerations

Specific sensitivities identified included a potential decrease in regional ocean temperatures and resulting formation of thicker ice, as a result of increased outflow of Arctic meltwater and/or more frequent occurrence of Arctic air masses in the winter.

Step 3: Assess Impact Considerations

The likelihood of these changes was assessed by the initiating department. Mathematical models were used to observe the possible effects of long-term sea level rise on the project.

Step 4: Impacts Management Plan

The panel determined that a safety factor would be required to ensure that the maximum tolerable ice-out delay was not exceeded in the event of significant climatic shifts. Based on the results of mathematical models (see Step 3), the structure was designed to withstand all marine conditions (salt, ice, sediment, etc), including a one-meter sea level rise, and a 100-year tidal current.

Step 5: Monitoring, Follow-up and Adaptive Management

The review panel recommended that effects monitoring be established as an ongoing commitment to monitor both the impact of the project on the environment, and the impact of the environment (including climate change) on the project. The panel also recommended that a general environmental monitoring program be put in place. These recommendations were not adopted by the responsible authority in the final approval.

Keenleyside Power Plant Project

In 1997, the Government of British Columbia explored the potential climate change impacts on the proposed 150 mw hydro-electric Keenleyside Power Plant as part of its EA of the project.

Step 1: Preliminary Scoping for Impacts Considerations

In order to determine the project's sensitivities to climate change, the EA practitioner requested that the proponent provide an analysis of the effects of climate change on the power plant.

Step 2: Identify Impacts Considerations

The proponent assessed the likelihood of climate parameters being affected by climate change by considering existing information and scenarios developed by Neitzel et al. and Snover. However, while these results suggested that climate change would result in warmer, wetter winters and warmer, drier summers, there was little consensus among the scientific community at that time (1997) regarding the potential significance of impacts in the Pacific Northwest.

Step 3: Assess Impact Considerations

The EA examined the risks associated with climate change impacts on aquatic systems, resources and transmission lines. The risk assessment determined that, because the Arrow Lakes are large and deep, increased flooding, runoff and sediment input would not have any effect on the project (and might in fact benefit it). It was also determined that anticipated changes to the spring snowpack (due to higher freezing levels and refill to the reservoir) were unlikely to be significantly affected by climate change. Risks associated with changing icing

conditions, higher summer temperatures, elevated risk of fire and increased snowfall were also evaluated with regard to the transmission line.

Step 4: Impacts Management Plan

Mitigation measures were considered in the design of the project. For example, adjusting tensions in the transmission line were designed to accommodate a temperature rise. In addition, potential effects from increased snowpack and faster runoff were offset by protecting riparian zones, road and crossing designs. These mitigation measures are consistent with the level of certainty of available climate change forecasts, as well as the risk of project effects.

Diavik Diamond Mine Project

The Diavik Diamond Mine, located in the Northwest Territories, was assessed by federal comprehensive study in 1999. The assessment considered both the potential contribution of the project to climate change and the potential impact of climate change on the project.

Step 1: Preliminary Scoping for GHG and Impacts Considerations

Scoping for GHG considerations was done both by the proponent and by Environment Canada in the early stages of the assessment. Given the relative size of the potential emissions from the project from a regional perspective (approximately 9% of combined Yukon and NWT emissions), further consideration of emissions was given in the EA.

The identified sensitivities of the project to specific climate parameters were related to the structural integrity of the mine's kimberlite containment dam which relied extensively on permafrost in the initial project proposal.

Step 2: Identify and Assess GHG and Impacts Considerations

In its EA overview and environmental effects reports, the proponent identified specific sources of emissions of carbon dioxide, methane and nitrous oxide associated with the project.

The likelihood of changes in key climate parameters (i.e., permafrost) was considered through the use of general circulation models and thermal modeling. This modeling work was done by Environment Canada. These models predict significant warming at high latitudes, including the NWT, over the next century, with consequent potential impacts on the containment dam.

Step 3: GHG and Impacts Management Plan

Both Environment Canada and the Government of the Northwest Territories recommended measures to reduce emissions from the project, through energy efficiency and energy reduction measures, as well as the use of alternative energy sources. Diavik Diamonds Mine Inc. agreed to register with the Voluntary Challenge and Registry Program, as part of its commitment to reduce emissions of GHG, and also agreed to consider the use of wind power on site.

While no immediate concern for permafrost was identified, it was recommended that special attention be directed to the permeability and stability of containment dams, emergency spillway and rock cap proposed for closure. It was also recommended that Diavik rely on geomembrane structures, rather than frozen core dams. A number of design modifications were made to the project on the basis of this assessment.

Step 4: Monitoring, Follow-up and Adaptive Management

While general follow-up was suggested for the overall environmental effects of the project, no specific follow-up program was required for GHGs and climate change.