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Report No. 172

March 2009

Valued Component Thresholds (Management Objectives) Project

by

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EXECUTIVE SUMMARY

The Environmental Studies Research Funds (ESRF) commissioned a study on "Valued Component Thresholds" relevant to the oil and gas industry in the Northwest Territories (NWT). Study objectives were to advance the understanding and awareness of thresholds or objectives in the management of cumulative effects, and to investigate how best to implement such an approach for the onshore energy sector. The study included a literature review, a stakeholder scan of representatives in the regulatory, resource management, aboriginal, industry, environmental non-profit and academic sectors, as well as a technical workshop.

The report adopts a tiered objective approach to the management of cumulative effects. Objectives for "Desirable", "Acceptable" and "Unacceptable" indicator status are related to three management and decision making stages differentiated by pre-defined markers, targets, threshold or limits. Desirable conditions are where cumulative effects have no or negligible adverse effects on the Valued Component. Acceptable conditions are where a greater level of adverse effects occurs, but the status of the Valued Component is considered adequate from a social or ecological perspective. Unacceptable conditions are where the status of the Valued Component does not achieve socially or ecologically based objectives.

The report recognized that Valued Component objectives must be evaluated and developed as part of an implementation framework. The proposed framework includes a suite of eight Valued Components that could be affected by hydrocarbon activities in the NWT. These include:

- Air Quality;
- Water Quality and Quantity;
- Sensitive Features and Habitat;
- Focal Wildlife Species;
- Focal Fish Species;
- Traditional Culture and Land Use;
- Community Well-being; and
- Economy and Business.

The report goes on to describe indicators to be used as part of the decision-making framework. Indicators are "a characteristic of the social or ecological setting that are used to describe, measure, manage and report on Valued Components". An example of an indicator is "Disturbed Area" for Focal Wildlife, as direct or indirect land use disturbance has been shown to be a good predictor of bird and mammal community integrity.

Emphasis throughout the report is placed on the importance of achieving landscape-scale objectives in the management of cumulative effects through implementing a series of management objectives. These reflect land use policy and ecological and socio-economic considerations that are often complex and multi-faceted. An example of how management objectives can be established for selected Value Component indicators is provided for Woodland Caribou, illustrated through reference to a research-based dose response curve.

The report provides a suggested implementation process that may advance the application of the scientific background on Valued Component and thresholds/objectives with respect to cumulative effects management. A "Cumulative Effects Curve" is introduced as a means to provide a visual model as to how management objectives can be developed and implemented in a way that allows for a clear and equitable decision making process. The cumulative effects curve identifies how various management tools, including management objectives, can change the slope of the curve over time so that it remains within acceptable conditions. It can also be used to model future scenarios under various assumptions about land and resource uses.

In general, stakeholders expressed broad support for an objective-based approach to cumulative effects management in the NWT. A pilot study is suggested as a means to publicly introduce the concept and to develop and test administrative procedures.

RÉSUMÉ

Le Fonds pour l'étude de l'environnement (FEE) a commandé une étude sur les « Seuils des composantes valorisées » connexes à l'industrie pétrolière et gazière dans les Territoires du Nord-Ouest (T.N.-O.). Les objectifs de l'étude étaient les suivants : faire mieux connaître et comprendre les seuils ou objectifs de gestion des effets cumulatifs, ainsi que rechercher la meilleure façon de mettre en œuvre une telle démarche pour le secteur énergétique côtier. L'étude comprend une analyse documentaire, des consultations auprès du monde de la réglementation et de la gestion des ressources, des Autochtones, de l'industrie, du milieu universitaire et des organismes sans but lucratif du secteur de l'environnement, de même qu'un atelier technique.

Le rapport propose une démarche à objectifs multiples en matière de gestion des effets cumulatifs. Les objectifs des indicateurs d'état « souhaitable », « acceptable » ou « inacceptable » sont liés à trois étapes de gestion et de prise de décision qui se distinguent par des détecteurs, cibles, seuils ou limites définis à l'avance. Les conditions sont souhaitables lorsque les effets cumulatifs ont des effets négatifs négligeables ou inexistants sur la composante valorisée. Les conditions sont acceptables lorsque les effets négatifs sont plus nombreux, mais l'état de la composante valorisée est jugé adéquat du point de vue social ou écologique. Les conditions sont inacceptables lorsque l'état de la composante valorisée ne permet pas d'atteindre des objectifs sociaux ou écologiques.

Le rapport reconnaît que les objectifs de la composante valorisée doivent être évalués et élaborés comme faisant partie d'un cadre de mise en œuvre. Le cadre proposé comprend huit composantes valorisées qui pourraient subir les effets des activités liées aux hydrocarbures dans les T.N.-O. Ces composantes sont les suivantes :

- Qualité de l'air;
- Qualité de l'eau et quantité;
- Caractéristiques et habitat sensibles;
- Espèces fauniques focales;
- Espèces de poissons focales
- Usage des terres et vie culturelle traditionnelles;
- Bien-être de la collectivité;
- Économie et affaires.

Le rapport décrit en outre les indicateurs à utiliser pour le cadre de prise de décisions. L'indicateur constitue « une caractéristique du cadre social ou écologique utilisée pour décrire, mesurer et gérer une composante valorisée, ainsi qu'informer à ce sujet ». Un exemple d'indicateur serait « zone perturbée » par rapport à une espèce faunique focale, étant donné qu'il est prouvé qu'une perturbation directe ou indirecte de l'usage des terres permet de déterminer l'intégrité d'une communauté d'oiseaux ou de mammifères.

Le rapport met l'accent sur l'importance d'atteindre des objectifs à l'échelle du paysage pour ce qui concerne la gestion des effets cumulatifs par la mise en œuvre d'une série d'objectifs de gestion. Ces derniers reflètent des considérations de politique d'usage des terres, écologiques et socioéconomiques souvent complexes et à multiples facettes. Un exemple d'établissement d'objectifs de gestion pour des indicateurs de composante valorisée est donné pour le caribou des bois, sous forme de renvoi à une courbe dose-effet fondée sur des recherches empiriques.

Le rapport propose un processus de mise en œuvre qui pourrait faire avancer l'application de fondements scientifiques sur une composante valorisée et les seuils/objectifs relativement à la gestion des effets cumulatifs. Une « courbe d'effets cumulatifs» est introduite comme moyen d'offrir un modèle visuel du développement et de la mise en œuvre d'objectifs de gestion d'une manière qui donne lieu à un processus décisionnel clair et équitable. La courbe des effets cumulatifs permet de déterminer de quelle façon divers outils de gestion, y compris des objectifs de gestion, peuvent modifier la courbe avec le temps pour qu'elle demeure dans les limites de conditions acceptables. Elle peut également servir à modéliser des scénarios futurs à partir de diverses hypothèses sur l'usage des terres et des ressources.

Les parties prenantes ont généralement appuyé l'adoption d'une démarche de gestion des effets cumulatifs axée sur des objectifs dans les T.N.-O. Une étude pilote a été suggérée comme moyen de faire connaître le concept et d'élaborer et mettre à l'essai des procédés administratifs.

1. INTRODUCTION

Cumulative effects are the end result of independent decisions that may have a small impact singly, but taken together have unanticipated or unintended effects. The potential for new and ongoing developments to result in adverse cumulative effects is of increasing concern in the North, as in other parts of Canada. The Northwest Territories Environmental Stewardship Framework (NWT ESF, formerly Cumulative Effects Assessment and Management Framework or NWT CEAMF) was established to address unintended effects; its key components are designed to assess and regulate activities for valued resources using pre-defined indicators and management thresholds.

Assessing, minimizing, and managing potential adverse cumulative effects has been the subject of an increasing number of studies, but the Environmental Studies Research Funds (ESRF) concluded that more definitive information on "Valued Component Thresholds" relevant to the oil and gas industry is required. A Valued Component is an aspect of the environment that is considered important on the basis of economic, social, cultural, community, ecological, legal or political concern. A threshold or objective is a management marker that relates the current or projected status of the Valued Component to ecological or social objectives. This study was commissioned to investigate how best to implement this approach for the northern onshore energy sector. As such, it begins with the assumption that a threshold-based approach should be implemented to manage adverse cumulative effects.

The specified objectives of the ESRF Valued Component Thresholds Project are the following:

1. Identify the needs, benefits, opportunities and challenges associated with developing Valued Components indicators and thresholds in the Northwest Territories (NWT);
2. Review the status of current Valued Component thresholds and their use in resource management and cumulative effects management generally;
3. Identify the Valued Component thresholds that are of highest priority to assist existing resource management boards in decision making—now and in the immediate future; and
4. Raise awareness of the need for Valued Component thresholds and the priorities for an implementation strategy.

Project oversight and advice on implementation options was provided by a Technical Advisory Group (TAG) with representatives from government, industry and regulators. TAG members included:

- Vern Christensen (Chair), Mackenzie Valley Environmental Impact Review Board
- Paul Barnes, Canadian Association of Petroleum Producers
- Ray Case, GNWT Environment and Natural Resources
- Alan Kennedy (ESRF Board Representative), Imperial Oil Resources
- David Livingstone, Indian and Northern Affairs Canada
- Shauna Sigurdson, Environment Canada
- Norm Snow, Inuvialuit Joint Secretariat
- Christy Wickenheiser, National Energy Board
- Dave Kerr (ESRF Research Manager), Golder Associates

The project was undertaken by an interdisciplinary team with members from Salmo Consulting Inc., Pembina Institute, Alberta Research Council and RMC & Associates. Team duties were assigned as follows:

- Terry Antoniuk: project manager and primary author
- Steve Kennett: implementation issues and strategy development
- Craig Aumann: Appendix A indicators and objectives literature review
- Marian Weber: market-based instruments summary
- Rob McManus: workshop facilitation and stakeholder interview guide
- Susan Davis Schuetz: stakeholder scan interviews and summary
- Kathryn McKinnon: stakeholder scan interviews
- Karen Manuel: report preparation

1.1 METHODS

During the teleconference meeting held to initiate the project, the TAG representatives said that because of previous work done on this topic, the emphasis for this project should be on developing a practical implementation strategy or action plan that addresses known challenges and opportunities. This direction to emphasize project objectives 3 and 4 was reflected in both our background work and the report.

1.1.1 LITERATURE REVIEW

ARC and Salmo completed a literature review to update the biophysical Valued Component and threshold reviews undertaken for projects in the Beaufort Delta region (Dillon and Salmo, 2006), Deh Cho region (Salmo et al., 2004); and northeast British Columbia (Salmo et al., 2003). Limited additional information was found; a summary of the relevant literature is included in Appendix A. A detailed description of the relevant information for woodland caribou is provided in Section 2.3.3.1 as an example of how science-based objectives can be developed.

1.1.2 STAKEHOLDER SCAN

Fulcrum Strategic Consulting obtained feedback from the project Technical Advisory Group (TAG) and 15 other knowledgeable representatives in the regulatory, resource management, Aboriginal, industry, environmental non-profit and academic sectors by using written questionnaires and 14 structured telephone interviews. The stakeholder scan was carried out in order to articulate and compare opinions from key groups on Valued Components, indicators, thresholds and implementation strategies, including management and monitoring. Twenty-one written surveys were received and fourteen individual structured interviews were conducted. Stakeholder questionnaire and interview results are summarized in Appendix B and included in the discussion in Sections 2.2, and 4.1.

1.1.3 IMPLEMENTATION WORKSHOP

A one day workshop of TAG representatives and consultant team members was held on March 4, 2008. The workshop objectives were the following: establish a common understanding of the project scope; describe the consultant team's intended deliverables; submit preliminary findings and recommendations; and solicit TAG

feedback and suggestions to ensure that the proposed Valued Component framework and implementation strategy were as practical and effective as possible. This meeting demonstrated that TAG members had wide-ranging views on both project scope and report priorities.

1.2 REPORT OUTLINE

The report begins with information on the proposed Valued Component management framework (Section 2), including definitions of key terms and a description of the process used to define objectives, using woodland caribou as an example. Section 3 is a discussion of potential cumulative effects that could occur as a result of northern hydrocarbon activities, and summarizes useful indicators identified in the literature review (Appendix A) and previous reports. Key elements and concepts supporting the proposed implementation framework are introduced and described in Section 4. This section also summarizes key challenges and opportunities identified in the stakeholder scan. Section 5 draws links between these discussions and sets out conclusions relevant to the four project objectives. Recommendations for framework implementation in a NWT pilot study are also provided.

2. VALUED COMPONENTS, INDICATORS AND OBJECTIVES

The concept of Valued Component objectives was introduced through the NWT ESF (formerly CEAMF) initiative. The NWT ESF and the Cumulative Impact Monitoring Program (CIMP) adopted a hierarchical framework of Valued Components and associated indicators in order to focus research, monitoring and management activities on priority issues. The NWT ESF also identified the need for explicit thresholds or limits to be linked to these indicators of environmental change in order to differentiate acceptable and unacceptable conditions. These elements form the basis of the Valued Component assessment and management framework introduced and defined here.

This section begins with an overview of the Valued Component framework elements and definitions that will be used in the report. Overall stakeholder views on this approach are summarized in Section 2.2 and based on stakeholder comments provided in Appendix B. An overview of framework elements is then provided in Section 2.3. Woodland caribou are used as an example of how management objectives could be derived within this framework using scientific and local knowledge to inform definitions of socially acceptable change.

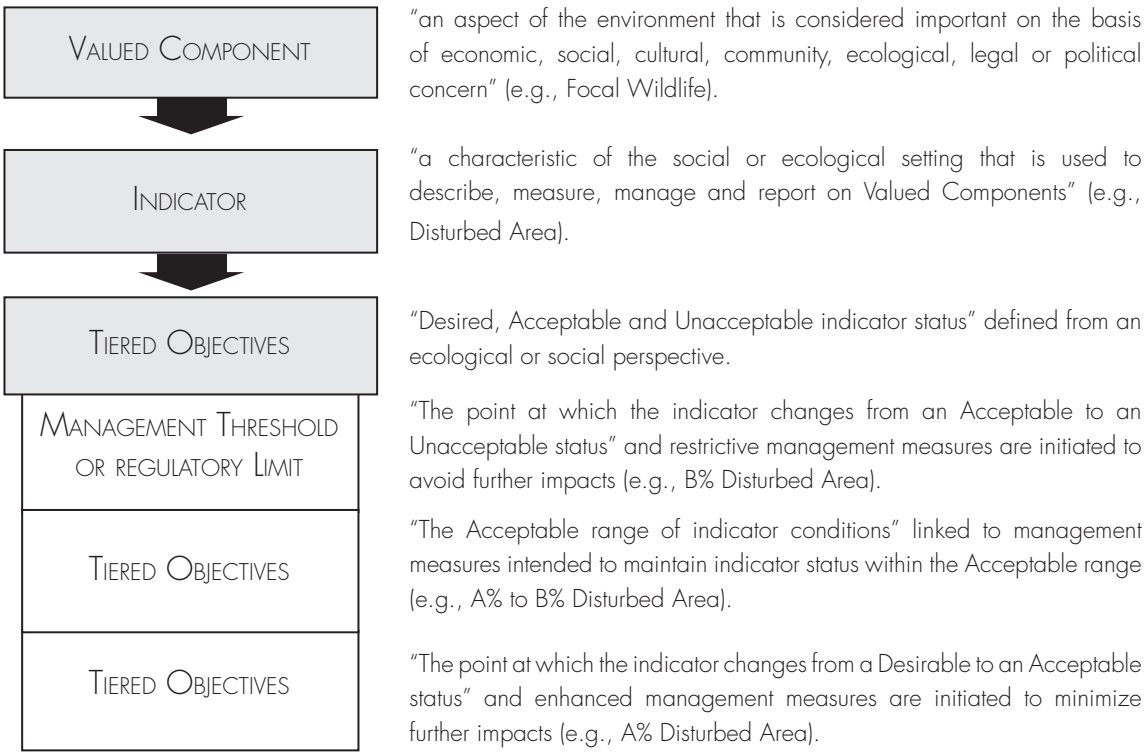
2.1 DEFINITIONS

One of the lessons learned from previous work on this topic is that language and definitions are critical. The terms and definitions provided below have been adopted in response to stakeholder and TAG recommendations that report terminology must be understandable, instructive and clearly defined.
The term 'thresholds' used in the Request for Proposal is particularly problematic because it is used and interpreted in many different ways. In this report the term 'objectives' is substituted for 'thresholds' because the former implies something to be managed rather than a cap or no-go point. A Management by Objective approach is commonly used in both the private and public sectors, and this proactive system is also applicable to resource management.

NWT ESF and CIMP recognized that it was not possible to consider all potentially affected ecological and socio-economic resources or values in equal detail. A hierarchical framework of Valued Components and associated indicators (Figure 1) was adopted to focus research, monitoring and management activities on priority issues.

NWT ESF also identified the need for explicit management objectives (such as thresholds or targets) to be linked to these indicators in order to differentiate acceptable and unacceptable conditions. This ESRF Valued Components report adopts a tiered objective structure that is a modified version of the 'tiered threshold' approach described in earlier reports (Salmo et al., 2003, 2004; Dillon and Salmo, 2006). In this structure, objectives for 'Desirable', 'Acceptable', and 'Unacceptable' indicator status are related to three management and decision-making stages differentiated by pre-defined markers, targets, thresholds or limits (Figure 1). Desirable conditions are where cumulative effects have had no or negligible adverse effect on the Valued Component. Acceptable conditions are where a greater level of adverse effects has occurred, but the status of the Valued Component is considered adequate from a social or ecological perspective. Unacceptable conditions are where the status of the Valued Component does not achieve socially or ecologically based objectives. These stages and associated tools are described in more detail in Section 2.3.

Figure 1.
Valued Component assessment and management hierarchy and definitions used in this report.



2.2 STAKEHOLDER SCAN COMMENTS

Feedback from the project Technical Advisory Group (TAG) and a small sample of other knowledgeable representatives was solicited in order to articulate and compare opinions of individuals active in cumulative effects assessment and management in the NWT. It is important to note that the feedback was provided by individuals rather than by representatives of a particular sector or organization. Nonetheless, the views summarized here, in Section 4.1, and Appendix 1, are consistent with past experience and clearly show that the primary barrier to objective implementation in the NWT is the polarized views on whether or not this is a necessary or effective approach. The authors believe that this difference of opinion must be acknowledged and dealt with as part of the implementation process. For this reason, divergent views are noted in this report in order to identify some of the key issues and positions that will need to be considered during implementation; this does not represent endorsement of a particular opinion.

TAG and stakeholder representatives indicated that a practical Valued Component framework should be

- based on the best available science and local knowledge;
- broadly applicable in all jurisdictions within the NWT;
- clearly defined up front;
- geographically flexible to address differing local or regional sensitivities, values and interests;
- adaptable over time to incorporate monitoring and research results and changes in local or regional social values;
- able to consider key cumulative effect pathways associated with northern onshore hydrocarbon activities;
- based on easily measured and understood indicators that provide information on Valued Component status; and
- fair to industry by reflecting existing commitments and avoiding unintended consequences.

All of the regulator, resource manager, Aboriginal and environmental representatives and some industry representatives supported the use of Valued Components objectives, including the use of management thresholds or regulatory limits. The need for explicit objectives was strongly opposed by a number of industry representatives.

The majority who supported this approach felt that it would

- help mitigate risks to Valued Components;
- help provide clear direction to decision-makers;
- encourage innovation;
- force people to think about desired outcomes in advance;
- provide an opportunity to avoid management crises by introducing objectives when activity levels are low; and
- allow for adaptive management.

Opponents felt that there was

- already enough regulation and that additional constraints would only restrict development;
- insufficient scientific support for objectives proposed to date; and
- insufficient activity planned over the short term to justify the need for objectives.

The results of the stakeholder scan demonstrate that, although there is broad support for this approach and it has been endorsed by the NWT ESF and many organizations, stakeholder views on the need for explicit management objectives are polarized. Supporters believe that the potential benefits outweigh the anticipated disadvantages, but that flexibility needs to be incorporated into any system. The majority of interviewees believe that there has been enough 'talking' about the use of Valued Components, indicators and thresholds and that it is time to start implementing them.

This finding is consistent with past experience. One of the key lessons learned from past northern thresholds projects is that Valued Component objectives (including thresholds) cannot be considered in isolation—they must be evaluated and developed as part of an implementation framework (Kennett, 2006; Salmo, 2006). For that reason, the following discussion of Valued Components, indicators and objectives reflects the implementation requirements introduced in Section 2.3.3.4 and described in more detail in Sections 4 and 5.

2.3 SELECTING VALUED COMPONENTS AND INDICATORS

2.3.1 VALUED COMPONENTS

The 'Valued Component' concept was originally introduced as a scientifically defensible way to focus environmental assessments on key resources and issues (Beanlands and Duinker, 1983). It is now commonly used in NWT environmental assessments and has subsequently been adopted for research and monitoring. As noted in Figure 1, a Valued Component has been defined by CIMP as "an aspect of the environment that is considered important on the basis of economic, social, cultural, community, ecological, legal or political concern" (e.g., Focal Wildlife). A Valued Component is not an indicator in itself, although impacts on, or trends in, some characteristic of a Valued Component may be used as an indicator." (DIAND, 2003).

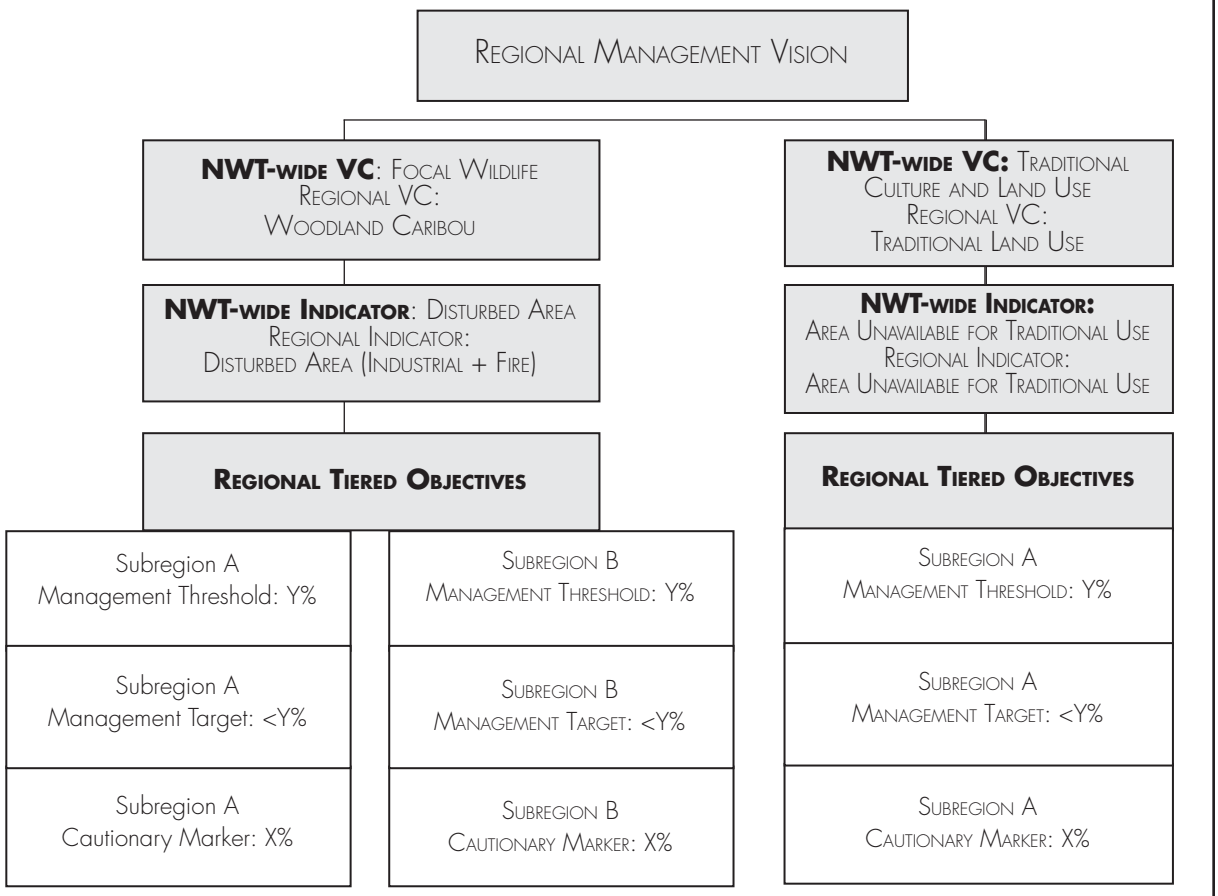
No standard, widely accepted suite of Valued Components currently exists in the NWT, although the NWT ESF supports such an approach and CIMP reports on the status of a number of Valued Components (DIAND, 2003). Table 3 in the ESRF Beaufort Delta Cumulative Effects report (Dillon and Salmo, 2006) provides a summary of Valued Components that have been used for northern research and monitoring initiatives. In most cases, these have been fish and wildlife species or species groups whose distribution and abundance are of management interest because they are harvested, at risk and/or sensitive to disturbance.

At the suggestion of the TAG, the framework proposed here includes a suite of eight standard Valued Components that could be affected by hydrocarbon activities and are generally applicable to all jurisdictions in the NWT. These broad Valued Components are consistent with those selected for the ESRF Beaufort Delta Cumulative Effects project (Dillon and Salmo, 2006):

1. **Air Quality**, including air quality, noise, greenhouse gas emissions and climate;
2. **Water Quality and Quantity** in lakes and streams;
3. **Sensitive Features and Habitats**, including sensitive soils and permafrost, rare or unique plants and plant communities, sensitive or unique landscape features, and protected and special management areas;
4. **Focal Wildlife Species**, including species of management or cultural interest and legislated species at risk;
5. **Focal Fish Species**, including species of management or cultural interest and legislated species at risk;
6. **Traditional Culture and Land Use**, including social, cultural, heritage and archaeological resources and traditional resource use;
7. **Community Well-being**, including community demographics, education and skills, cohesion, governance, mental and physical health, and infrastructure;
8. **Economy and Business**, including business and employment income, regional revenues and employment opportunities.

Stakeholder representatives were in general agreement with these broad Valued Components, although a number of more specific suggestions were made to make this list more operational or to reflect regional interests (Appendix B). Given the need to balance territorial consistency and regional flexibility, we recommend a hierarchical system, depicted graphically in Figure 2, where regional Valued Components identified in land use plans or resource management plans are linked to the standard NWT-wide Valued Components. These regional Valued Components would better reflect local or regional sensitivities, values and interests (i.e., the regional management vision). Using the example in Figure 2, Woodland Caribou would be the regional substitute for the NWT wide Focal Wildlife Valued Component.

Figure 2.
NWT Valued Component hierarchy with regional management indicators and tiered objectives linked to pre-defined Valued Components (VC) and regional management vision



2.3.2 INDICATORS

Indicators are "a characteristic of the social or ecological setting that is used to describe, measure, manage and report on Valued Components" (Figure 1 – DIAND, 2003). They enable managers, decision makers and land users to speak a 'common language' when they consider the risks of cumulative effects.

The selection of appropriate indicators is a critical step that has been extensively discussed in guidance documents and published literature. The selection of practical cumulative effects indicators is discussed in detail in Section 3 of Dillon and Salmo (2006) and Appendix 1 of Salmo et al. (2003).

The following list of criteria was considered when selecting indicators for the ESRF Valued Components objectives project. The ideal indicator would have all of these qualities, but some that do not may need to be used:

- clear and understandable by non-scientists;
- easy and cost-effective to collect, measure or calculate for small to large oil and gas projects (e.g., small 2D seismic program proposals reviewed by the Inuvialuit Environmental Impact Screening Committee or Land and Water Boards through petroleum exploration or development proposals reviewed by the Mackenzie Valley and Inuvialuit Environmental Impact Review Boards);
- provide information on the status of Valued Components;
- applicable to a broad geographic area and long time frames;
- capable of providing a continuous assessment from low through intensive land use; and
- able to differentiate or incorporate both project-induced and natural changes.

The highest priority indicators are those where there is already good scientific or local knowledge of how human activities and natural changes affect the indicator.

Using the framework example provided in Figure 2 as an example, 'Disturbed Area' is used as the NWT-wide indicator for Focal Wildlife because the area directly or indirectly disturbed by land use has been shown to be a good predictor of bird and mammal community integrity (e.g., Bayne et al., 2004; Appendix A). A more specific version of this indicator—'Industrial Footprint + Fire'—would be applied to woodland caribou (the regional Valued Component shown in Figure 2) because this has been shown to be correlated with population change (Sorensen et al., 2008). Regional or sub-regional management objectives would then be defined using the process described below.

2.3.3 DEFINING MANAGEMENT OBJECTIVES

From a decision-making or policy perspective, cumulative effects management requires the ability to achieve landscape-scale objectives through numerous individual land and resource use decisions. Explicit management objectives (including targets, thresholds or regulatory limits) are a required component of managing on the landscape scale. The following considerations are relevant to the management objective setting process.

- Landscape-scale management objectives are adopted because it is recognized that project-by-project management may not adequately protect sensitive resources where many effects overlap in space or time. Decision-making processes that seek to improve the design and mitigation of individual projects may not be sufficient to guarantee acceptable outcomes if the pace and intensity of development cancel out the gains that can be achieved through improved project design, best available technology, mitigation and reclamation.

- It is important to note that management targets, thresholds or regulatory limits generally address impacts and are not direct restrictions on development or growth per se. While some types of limits may adversely affect the economic viability of certain types of development, many activities may be possible within limits if these activities are undertaken in ways that minimize or eliminate their impacts. In fact, the implementation of thresholds and limits can be a significant driver for innovation. A good example of this is implementation of air and water quality objectives over the last three decades. They have resulted in measurable improvements

in air and water quality and ongoing innovation in air and water control technology. This has not restricted development per se, and has also created new business opportunities. Another example is the development of low-impact seismic technology to enable geophysical exploration to occur with minimal footprint.

- Resilience – In ecological systems, the ability to cope with land use impacts may vary between years, depending on natural or external influences. For caribou, annual variations in snow conditions, timing of plant growth and flowering, and the severity of insect harassment affect calf survival rates and ultimately population dynamics (Gunn et al., 2001). Thus, caribou are expected to be more resilient to land use impacts under favourable environmental conditions. In social systems, the rate of change is known to affect community cohesion and its ability to handle this change (e.g., Chandler and Lalonde, 1998; Kawachi and Berkman, 2000; Mitchell and Karpyshyn, 2005). In general, community resilience is likely to be lowest, and impacts greater, when stressors change rapidly.

- Limits as a biophysical and social reality – There is growing recognition around the world that environmental limits exist, whether defined in terms of absolute resource availability (e.g., water shortages), limits in carrying capacity of ecological systems, resilience, or limits of socially acceptable change. There is also clear evidence that cumulative effects can shift ecosystems into undesirable or unintended states (e.g., species extinction or biotic community shifts; Allen and Holling, 2002). The recognition of the need for management objectives acknowledges that impacts cannot expand indefinitely on a finite land base with resources or social systems that have finite capacity to handle changes, or whose resilience is affected by other natural or external factors.

- Objectives-based management is a proactive approach to cumulative effects. Past experience with air and water quality management demonstrates that implementing policy and management practices that reflect socially or ecologically derived objectives is an effective and efficient approach to environmental management.

Established air and water quality criteria demonstrate both the inherent value and the practicality of objectives for cumulative effects assessment and management. The perceived regulatory advantage of numerical objectives is that they allow development activities to proceed without detailed review until the defined marker is reached. Once predefined objectives associated with increased risk are reached, extra review or regulation is necessary (Zeimer, 1994). Harmonized objectives are one of the best ways of managing cross-jurisdictional resources because they create a common language and common 'rules of the road' for all land uses and regulators. As such, objectives can also provide a framework for market-based tools such as tradable land use credits (see Section 4.2.7).

In spite of these perceived benefits, identification of quantitative objectives is one of the most challenging aspects of land and resource management because they must be technically defensible, politically acceptable and administratively efficient. Identification of specific ecological thresholds is difficult because effects differ with the averaging period used, type of exposure, the ecological setting, as well as species and life stage. This inherent scientific uncertainty has most frequently been addressed by building in a safety margin when establishing objectives (Bull, 1991).

For the reasons noted above, setting management objectives for cumulative effects is ultimately a process of social choice—informed by the following:

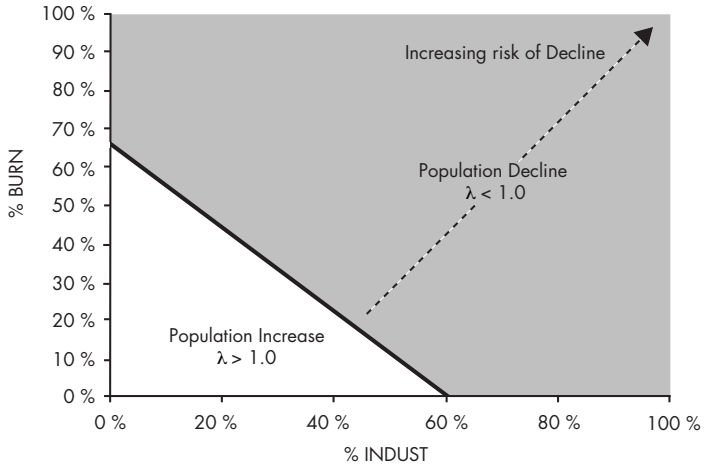
1. Science, e.g., dose-response curves that aggregate and simplify the relationships between management decisions, indicators and impacts on Valued Components;
2. Traditional and local knowledge;
3. Values and interests relating to land and resource use, including economic and social trade-offs and risk tolerance; and
4. Implementation issues and constraints, e.g., ongoing adaptive management and learning by doing, and the incorporation of flexibility mechanisms and adaptation to changing circumstances.

The following discussion uses woodland caribou as an example of how management objectives can be established for selected Valued Component indicators using this process. Woodland caribou were chosen as an example because this species is affected by oil and gas activities, it is a species of management interest, there is a strong scientific basis for defining an indicator and management objectives, and the appropriate indicator would be comparatively easy to measure, monitor and manage.

2.3.3.1 APPLYING SCIENCE

The science of cumulative effects theorizes that ecological, social and economic conditions respond to human-induced changes in ways that can be measured empirically. The best examples of existing science-based objectives are air and water quality criteria developed by the federal government (e.g., CCME, 2004). These are based on observed or modeled 'dose-response curves' that relate observed changes in Valued Component indicator status to changes in land use, human population or economic measures. Figure 3 provides an example of a dose-response curve developed for woodland caribou herds by Sorensen et al. (2008). This curve relates the population growth rate (referred to as lambda or λ) of Alberta woodland caribou herds to two indicators within the herd's range. Population decline occurs where lambda is <1 (the shaded area) and growth occurs where lambda is >1 (the light area); lambda of 1 indicates that the population is stable—neither growing nor declining.

Figure 3.
Dose-response curve relating woodland caribou population persistence to Industrial Footprint and burned area (from Sorensen et al., 2008).



The analysis of Sorensen et al. (2008) showed that woodland caribou population growth rate can be predicted by two factors: the proportion of each herd's range burned in the last 50 years (Y or vertical axis in Figure 3), and the proportion of each range within 250 m of the direct footprint (all types of clearings and corridors; X or horizontal axis in Figure 3). When these two indicators exceeded 60% of the herd's range, either singly or in combination, population decline was observed, with the risk of decline/extinction increasing as one moves further from the 60% mark. This provides a clear scientific foundation for establishing management objectives in NWT woodland caribou ranges.

Some land users and resource managers have criticized the use of dose-response curves such as that shown in Figure 3 because they

- are often based on data from outside the region in which they are being applied;
- may describe correlations rather than specific cause-effect relationships;
- frequently do not provide definite thresholds or limits; and
- represent generalized responses that may not occur in every situation.

These criticisms generally reflect the polarized views mentioned earlier: those who believe that precautionary management actions should be implemented using best available information, versus others who maintain that problems and specific causes must be documented locally before they are addressed. Fundamentally, these views represent different degrees of risk tolerance, social values or desired scientific certainty. The tiered objectives described below in Section 2.3.3.3 provide an effective and transparent approach for resolving these different views by documenting actual local responses at early stages of development and validating the dose-response curves while risk levels and mitigation costs are low.

2.3.3.2 APPLYING TRADITIONAL AND LOCAL KNOWLEDGE

Dose-response curves can also be built or refined using traditional (e.g., elders) and local (e.g., non-Aboriginal resident) knowledge. For example, community elders and outfitters can describe changes in caribou distribution or abundance that have occurred concurrently with increased land use (new roads), increased harvest levels or severe winters. Actual population monitoring data can then be used to supplement these knowledge-based curves as necessary. Dose-response curves that combine these two 'data sets' help build the common understanding and trust needed to work with northern communities and help stakeholders understand implications of further change.

2.3.3.3 SOCIAL VALUES AND RISK TOLERANCE

The dose-response curve shown in Figure 3 provides information on the probable responses and relative risks associated with different land management options, but it provides no direct measurement of which outcome(s) or level of risk(s) is acceptable. Setting management objectives therefore requires input on social values and preferences.

Tiered objectives are a series of progressive markers that reflect increasing degrees of concern or risk.
This approach was originally developed to manage deposition of acidic air pollutants (Bull 1991, 1992).
Tiered objectives provide an integrated framework that relates two or more numerical objectives to appropriate monitoring, management and regulatory responses.

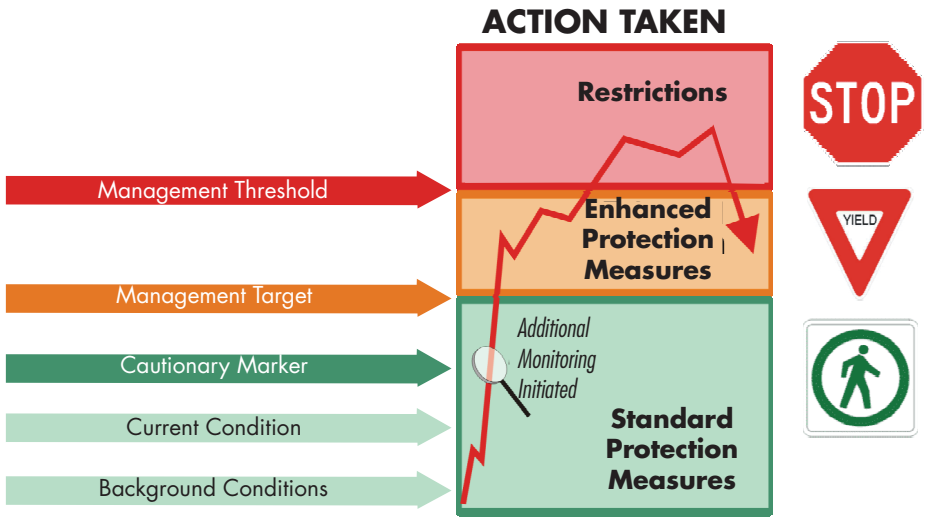
Tiered objectives:

- address scientific and political uncertainty by providing progressive decision points;
- encourage innovation;
- provide clear 'rules of the road'; and
- maintain flexibility for all land users.

Figure 4 shows a three tiered model originally developed for the Clean Air Strategic Alliance (AENV and CASA, 1999).

As shown earlier in Figure 1, Management Thresholds or Regulatory Limits represent the predefined point at which the indicator changes from Acceptable to Unacceptable status and restrictive management measures are initiated to avoid further impacts on the Valued Component (the red area in Figure 4). A level of acceptable change must be defined in order to establish this marker. Once the acceptable change level is defined, a science based threshold is derived from best available information. As examples, the management threshold may be based on predicted probability of population decline (Lamberson et al., 1992) or the probability and severity of an undesirable effect on a Valued Component (Francis and Shotton, 1997). CASA defined threshold loads using 'levels of protection', where a 100% level of protection meant protection for all ecosystems and a 90% level of protection meant that 10% of ecosystems or species might experience stress above their critical load. When indicator status reaches this marker, restrictive protection measures become approval requirements. Examples of such measures include market-based instruments that discourage further impact (see Section 4.2.7), no net habitat loss, best available technology, and restrictive harvest regulations.

Figure 4.
A conceptual tiered objective structure showing how markers, targets and thresholds are linked to management actions.



A Management Target is linked to enhanced protection measures intended to maintain indicator status within the acceptable range (the orange area in Figure 4). Management Targets may be characterized as the level that is politically and practically achievable and provides adequate long-term protection to the Valued Component (note that this reflects a trade-off relative to desirable conditions for the Valued Component). Management Targets may also be established conservatively to reflect scientific uncertainty or social preference, or to accommodate variability associated with natural disturbances such as weather, predation, disease, etc. When indicator status reaches this marker, enhanced protection measures are formally adopted. These measures can include the following: expanded environmental monitoring and applied research; required use of best practices such as Best Available Technology that is Economically Achievable (BATEA); or more detailed regulatory review. Management Targets are typically designed to be more flexible than thresholds so that they can be altered as research and monitoring information becomes available or social preferences change.

Cautionary Markers are used where there is uncertainty about the actual local response. They may be used to define the point at which monitoring is initiated or intensified, or the point at which the indicator changes from a desirable to an acceptable status. There is limited regulatory review during this phase (the green area in Figure 4), but all activities must comply with established regulatory guidelines and standard industry practices. Routine audits are conducted to confirm that these standards are being met. The example shown in Figure 4 suggests that the Cautionary Marker would be higher than background or current conditions, but it may actually be below or equal to one or both of these conditions.

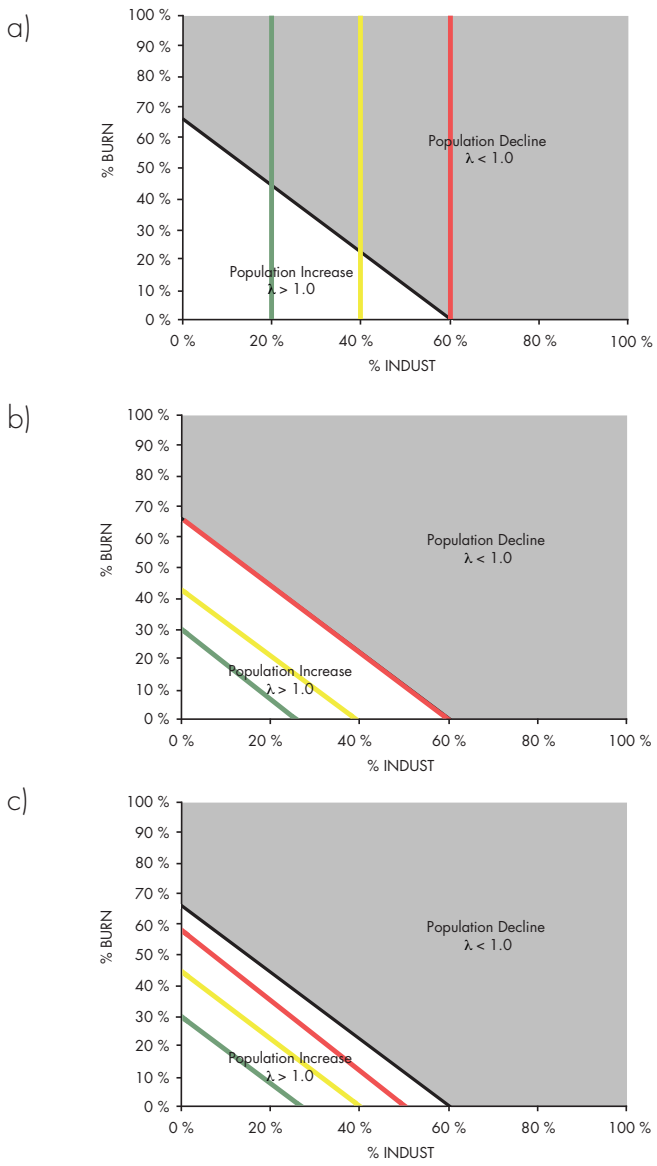
Figure 5 shows three examples of how tiered objectives could be applied to the woodland caribou dose-response curve developed by Sorensen et al. (2008). Here caribou population decline is assumed to represent an unacceptable condition; so the objectives are being set to minimize the risk of population decline.

Option a) represents a case where industrial development is maximized and the impact of burns on caribou range is not considered (i.e., single factor design). It would be the simplest to implement and would provide the greatest certainty for regulators and land users. This suite of objectives would have the highest risk for caribou because it ignores the potential influence of fires and maximizes allowable footprint. A large fire consuming a substantial portion of the range would lead to caribou decline if the industrial footprint were at or near the management threshold. The Cautionary Marker is set at 20% Industrial Footprint, the point at which detectable change has been observed elsewhere. This provides the impetus to collect regional data and confirm or refine the dose-response curve. The Management Target is set at a level that accommodates both fires and industrial development, but is deemed acceptable because it substantially minimizes the risk of population decline relative to the Management Threshold.

Option b) represents a case where both Industrial Footprint and burns are factored into the management objectives (i.e., multi-factor design). This would reduce the risk to caribou, but be more difficult to implement and provide less certainty to regulators and land users because both fire and footprint would need to be tracked and managed simultaneously. For example, if combined disturbance from fire and industrial footprint exceeds the management threshold following a large fire, no additional industrial footprint would be allowed until enough existing footprint is restored.

Figure 5.

Social risk ratings applied to Industrial Footprint indicator using the woodland caribou dose-response curve. Red, yellow, and green lines represent potential Management Threshold, Management Target and Cautionary Marker, respectively.



Option c) represents management objectives similar to those of Option b) where both Industrial Footprint and burns are considered, though in this case the markers are set more conservatively to accommodate natural variability, for example, greater than expected burned areas. In this case risk to caribou is minimized, but the maximum industrial footprint is reduced. This would increase the need for restrictive protection measures under intensive development scenarios and thus would have economic implications relative to Graph a). These trade-offs should be explicitly evaluated to identify the appropriate risk/benefit balance.

The three different management scenarios can be viewed in terms of a decision matrix:

	Economic Cost	Risk of Caribou Decline	Ease of Implementation	Resilience to Natural Fires
Option a)	Lowest	Highest	Easiest	Lowest
Option b)	Intermediate	Intermediate	Most Difficult	Intermediate
Option c)	Highest	Lowest	Intermediate	Highest

2.3.3.4 IMPLEMENTATION CONSIDERATIONS

Factors that would need to be considered in order to implement woodland caribou tiered objectives include the following:

- What land uses are included in the 'industrial footprint' indicator (e.g., both conventional and low impact seismic lines)?
- What is the appropriate indirect footprint buffer width (i.e., to calculate the 'industrial footprint')?
- Are there other relevant natural or external factors that need to be monitored (e.g., burned areas less than 50 years old)?
- Who is responsible for collecting information on and calculating the status of the industrial footprint and other relevant natural or external factors?
- Over what area will the indicator be measured (e.g., designated caribou range, ecodistrict, designated land use zone)?
- Under what conditions can industrial footprints be removed from calculations (e.g., cleared area has been reclaimed)?
- What is (are) the legal or regulatory authority(ies) for reviewing and approving/rejecting land use that meets/exceeds industrial footprint objectives?
- Who is responsible for compliance monitoring to ensure that the approved industrial footprint has not been exceeded (e.g., regulator, land use planning agency, industry)?
- Who is responsible for ongoing effects monitoring in order to validate the dose response curve and track actual caribou population response (e.g., government, industry, co operative program)?
- How should allowable industrial footprint be allocated in order to be fair to existing and future land users and maximize local, regional and national benefits (e.g., first in; annual auctions; maximum local benefits)?

These implementation issues are discussed in Sections 4 and 5

3. CUMULATIVE EFFECTS OF NORTHERN HYDROCARBON ACTIVITIES

To be effective, cumulative effects management must reflect both the economic realities and the potential impacts of northern hydrocarbon exploration and development. This project focuses on onshore hydrocarbon activities in the NWT. Candidate Valued Components, indicators and management objectives for offshore hydrocarbon activities were provided earlier in Dillon and Salmo (2006).

At present, natural gas reserves have been discovered in the Colville Hills and Mackenzie Delta/Beaufort Sea basins as well as in the Western Canada Sedimentary Basin extension in the Dehcho region. Oil reserves have been discovered in the Mackenzie Delta/Beaufort Sea and Mackenzie Plain basins. Ultimate hydrocarbon development potential in the NWT extends throughout the sedimentary basins west and north of the Precambrian shield (Figure 6).

Figure 6.
Sedimentary basins of the Northwest Territories

The hydrocarbon production life cycle includes the following: reserve discovery; reservoir and infrastructure development, production, and processing; transportation to market; and ultimately, infrastructure decommissioning and abandonment. In this report potential cumulative effects assessment and management tools are linked to four key activities:

1. Geophysical surveys
2. Exploratory drilling
3. Development and production
4. Decommissioning and abandonment

3.1 KEY PATHWAYS AND ISSUES

Table 1 provides a summary of the potential cumulative impacts associated with these four hydrocarbon development activities. Key pathways and issues were defined by the senior author based on previous reviews (e.g., Dillon and Salmo, 2006) and his 30 years of experience with the hydrocarbon sector in northern Canada.

The key impact pathways for air and climate resources are the following: the effect of routine and intermittent emissions on local and regional ambient air quality and deposition; contributions to global greenhouse gases; and effect of activities, equipment, and aircraft on ambient noise levels.

For aquatic resources (groundwater, surface water, fish and aquatic organisms and their habitats), the key cumulative impact pathways are the following: the influence of ground disturbance and planned and accidental withdrawals and discharges on water yield, sediment yield, and water quality; and changes in fish harvest caused by improved access and increased workforce or residents.

Land resources include soil, permafrost, vegetation, and wildlife and their habitats. Key cumulative impact pathways for these resources are the following: the influence of ground disturbance and associated indirect footprint on permafrost degradation, vegetation communities, wildlife habitat quality and predator-prey dynamics; changes in wildlife harvest caused by improved access and increased workforce or residents; and human-induced mortality of predators attracted to facilities and activities.

The key cumulative impact pathways for socio-cultural resources include the following: effects of ground disturbance on cultural resources and traditional use opportunities; and the influence of population, income, and employment changes on households, communities, businesses and social service providers.

TABLE 1. POTENTIAL CUMULATIVE EFFECTS OF ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT

Resource	Hydrocarbon Sector Activity	Potential Cumulative Effects
Air and Climate	Geophysical Surveys	• Explosives, equipment and aircraft create noise and elevate concentrations of NOx, SOx, CO and PM. • Greenhouse gas emissions contribute to global concentrations that influence regional climate.
	Exploratory Drilling	• Equipment, flaring and testing create noise and elevate concentrations of NOx, SOx, CO and PM. • Greenhouse gas emissions contribute to global concentrations that influence regional climate.
	Development and Production	• Flaring, testing, compressors and processing equipment create noise and elevate concentrations of NOx, SOx, CO, VOCs, PM and heavy metals. • Greenhouse gas emissions contribute to global concentrations that influence regional climate. • Roads can increase dust concentrations.
	Decommissioning and Abandonment	• Facility and pipeline purging may elevate concentrations of NOx, SOx, CO and PM.

TABLE 1. POTENTIAL CUMULATIVE EFFECTS OF ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Resource	Hydrocarbon Sector Activity	Potential Cumulative Effects
Freshwater	Geophysical Surveys	• Seismic lines, camps and other associated sites create direct and indirect footprints that alter permafrost, soil, vegetation, habitat quality, wildlife movements, distribution and abundance, and merchantable timber. • Seismic camps can attract predators, increase their mortality rates, and affect prey mortality rates. • Workforce can increase hunting pressure and harvest of renewable resources. • Vehicles can cause wildlife mortality.
	Exploratory Drilling	• Roads, well pads, camps and other associated sites create direct and indirect footprints that alter permafrost, soil, vegetation, habitat quality, wildlife movements, distribution and abundance, and merchantable timber. • Drilling camps and associated sites can attract predators, increase their mortality rates, and affect prey mortality rates. • Workforce can increase hunting pressure and harvest of renewable resources. • Vehicles can cause wildlife mortality.
	Development and Production	• Facilities, camps, pipeline and powerline rights-of-way, temporary workspace, and associated sites create direct and indirect footprints that alter permafrost, soil, vegetation, habitat quality, wildlife movements, distribution and abundance, and merchantable timber. • Roads and rights-of-way create direct footprints that can improve access for harvesters and hunters. • Production camps, facilities and other associated sites can attract predators, increase their mortality rates, and affect prey mortality rates. • Emissions and dust fall can affect vegetation and habitat quality. • Workforce can increase hunting pressure and harvest of renewable resources. • Vehicles, construction, and production activities and facilities can cause wildlife mortality.
	Decommissioning and Abandonment	• Recontouring and reclamation can alter permafrost, soil, vegetation, habitat quality, wildlife movements, distribution and abundance, and merchantable timber. • Workforce can increase hunting pressure and harvest of renewable resources. • Vehicles can cause wildlife mortality.

TABLE 1. POTENTIAL CUMULATIVE EFFECTS OF ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Resource	Hydrocarbon Sector Activity	Potential Cumulative Effects
Land	Geophysical Surveys	• Seismic lines, camps and other associated sites create direct and indirect footprints that alter permafrost, soil, vegetation, habitat quality, wildlife movements, distribution and abundance, and merchantable timber. • Seismic camps can attract predators, increase their mortality rates, and affect prey mortality rates. • Workforce can increase hunting pressure and harvest of renewable resources. • Vehicles can cause wildlife mortality.
	Exploratory Drilling	• Roads, well pads, camps and other associated sites create direct and indirect footprints that alter permafrost, soil, vegetation, habitat quality, wildlife movements, distribution and abundance, and merchantable timber. • Drilling camps and associated sites can attract predators, increase their mortality rates, and affect prey mortality rates. • Workforce can increase hunting pressure and harvest of renewable resources. • Vehicles can cause wildlife mortality.
	Development and Production	• Facilities, camps, pipeline and powerline rights-of-way, temporary workspace, and associated sites create direct and indirect footprints that alter permafrost, soil, vegetation, habitat quality, wildlife movements, distribution and abundance, and merchantable timber. • Roads and rights-of-way create direct footprints that can improve access for harvesters and hunters. • Production camps, facilities and other associated sites can attract predators, increase their mortality rates, and affect prey mortality rates. • Emissions and dust fall can affect vegetation and habitat quality. • Workforce can increase hunting pressure and harvest of renewable resources. • Vehicles, construction, and production activities and facilities can cause wildlife mortality.
	Decommissioning and Abandonment	• Recontouring and reclamation can alter permafrost, soil, vegetation, habitat quality, wildlife movements, distribution and abundance, and merchantable timber. • Workforce can increase hunting pressure and harvest of renewable resources. • Vehicles can cause wildlife mortality.

TABLE 1. POTENTIAL CUMULATIVE EFFECTS OF ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Resource	Hydrocarbon Sector Activity	Potential Cumulative Effects
Socio-cultural	Geophysical Surveys	• Program employment and business opportunities can affect households, communities, businesses and social service providers. • Ground-based activities and air traffic can alter harvesting opportunities and success. • Seismic lines create direct and indirect footprints that alter vegetation, habitat quality, cultural sites and subsistence and recreational use.
	Exploratory Drilling	• Program employment and business opportunities can affect households, communities, businesses and social service providers. • Air, soil and water contamination can affect the perceived or measured quality of plants, fish and wildlife. • Well pads and rights-of-way create direct and indirect footprints that alter vegetation, habitat quality, cultural sites and subsistence and recreational use.
	Development and Production	• Ongoing employment and business opportunities can affect households, communities, businesses and social service providers. • Air, soil and water contamination can affect the perceived or measured quality of plants, fish and wildlife. • Ground-based activities and air traffic can alter harvesting opportunities and success. • Facilities and rights-of-way create direct and indirect footprints that alter vegetation, habitat quality, cultural sites subsistence and recreational use.
	Decommissioning and Abandonment	• Program employment and business opportunities can affect households, communities, businesses and social service providers.

3.2 NWT VALUED COMPONENTS AND INDICATORS

Appendix A summarizes recent literature on the status of biophysical Valued Component indicators and management objectives. Additional information relevant to NWT onshore oil and gas activity was provided in Dillon and Salmo (2006) and Salmo et al. (2003, 2004). Cumulative effect indicators applicable to NWT onshore oil and gas activities are identified in Table 2. This includes information on the current status of indicators and management objectives in the NWT, the status of the science for each indicator and implementation considerations.

3.2.1 PRIORITY VALUED COMPONENTS AND INDICATORS

Some stakeholders expressed concerns about identifying one or more Valued Components as 'priorities' because all are important in certain contexts. Nonetheless, the majority of respondents believed that regardless of any potential challenges, identifying priority Valued Components for immediate implementation would be beneficial. Their thinking was that starting small and implementing two or three Valued Components initially would increase the likelihood of being successful and building stakeholder confidence so that other Valued Components could be added over time.

Two Valued Components (traditional land use and woodland caribou) are proposed as the priorities for implementation in the NWT. Many stakeholders identified focal wildlife species and traditional land use and culture as priority Valued Components for implementation (Table 1 in Appendix B), and these two can be linked with them as shown earlier in Figure 2. They have been selected because they would be the easiest to implement, given social values and the extent of our knowledge.

At present, the concept of social objectives is controversial because different individuals, households or communities can respond to change in different ways (Mitchell and Davis, 2005). Because of this, social scientists have been reluctant to develop dose-response relationships such as the one presented for caribou in Section 2.3.3. The opportunity to exercise traditional land use is an important social and cultural value throughout the north, and it has been identified as a management objective in all approved and proposed land use plans. Traditional Use is proposed as the most appropriate social Valued Component because it is a clear example of a social value that must be discussed with community residents in order to develop management objectives for a practical indicator.

Woodland caribou are identified as the most appropriate ecological Valued Component because there is a strong scientific foundation for defining management objectives. Although there is considerable regional and territorial interest in barren-ground caribou management, when compared to woodland caribou, insufficient information is currently available to identify a land use indicator that could be used to manage cumulative effects. For that reason, woodland caribou are proposed as the most appropriate science-based Valued Component for immediate implementation. One stakeholder noted that woodland caribou should be a priority because they are listed in federal species at risk legislation and are a Valued Component in many environmental assessments (Appendix B).

TABLE 2. STATUS OF VALUED COMPONENT INDICATORS AND MANAGEMENT OBJECTIVES RELEVANT TO ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT

Standard Valued Component	Cumulative Effect Indicator	Comments
Air and Climate	**Ground level concentration of regulated pollutants**	• Currently used for cumulative effects management in the NWT. • Regional indicator selected as ambient concentration of one or more pollutants emitted during oil and gas activities; provides a measurement of local and sub-regional cumulative effects risk to air quality. • Established federal or territorial standards (i.e., management objectives) exist for many pollutants; proposed as a cumulative effects indicator in Dehcho and Beaufort Mackenzie Delta regions (Salmo et al., 2004; Dillon and Salmo, 2006). • Established and accepted models that predict probable local and regional ambient concentrations. Site-specific data may be needed for detailed modelling. • Established project-specific and regional assessment and approval processes; routinely considered for oil and gas activities. • Regional values may differ from those used to develop existing guidelines and lead to need for Management Targets or Cautionary Markers to minimize emissions before established standards are approached or exceeded.

TABLE 2. STATUS OF VALUED COMPONENT INDICATORS AND MANAGEMENT OBJECTIVES RELEVANT TO ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Standard Valued Component	Cumulative Effect Indicator	Comments
Water Quality and Quantity	**Amount of water withdrawn from a waterbody**	• Currently used for cumulative effects management in the NWT. Recommended as an indicator in stakeholder scan. • Regional indicator is amount of water withdrawn from a waterbody (often expressed as proportion of existing volume/discharge or base flow). • Established territorial guideline (DFO, 2005) exists for temporary exploration-related water withdrawals, but this is not based on explicit risk assessment. No established objectives for ongoing withdrawals were identified. • Established and accepted models (Instream Flow Needs and water balance) that predict probable local effects of ongoing surface water withdrawal can be used to develop management objectives for river and lake withdrawals, respectively. Site specific data needed for modelling are generally lacking in the NWT. • Established project-specific and regional assessment and approval processes; routinely considered for oil and gas activities. • May be a need for Management Targets or Cautionary Markers to minimize withdrawals before guidelines are approached or exceeded.
	Concentration of regulated contaminants	• Currently used for cumulative effects management in the NWT. Frequently cited as high priority by communities. • Regional indicator selected as one or more contaminants released during oil and gas activities; provides a measurement of local and sub-regional cumulative effects risk to water quality. • Established federal guidelines exist for many contaminants. Proposed as a cumulative effects indicator in Dehcho and Beaufort Mackenzie Delta regions (Salmo et al., 2004; Dillon and Salmo, 2006). • Established and accepted models that predict probable concentrations in receiving waters. • Established project-specific and regional assessment and approval processes; routinely considered for oil and gas activities. • Regional values may differ from those used to develop existing federal guidelines and lead to need for Management Targets or Cautionary Markers to minimize releases before guidelines are approached or exceeded.

TABLE 2. STATUS OF VALUED COMPONENT INDICATORS AND MANAGEMENT OBJECTIVES RELEVANT TO ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Standard Valued Component	Cumulative Effect Indicator	Comments
Sensitive Features and Habitats	**Disturbed Area** (within sensitive features and habitats)	• Protection of sensitive environmental features is a clearly defined goal of many land-use plans, and zoning approach has generally been used to protect the most sensitive features and areas (e.g., Conservation Zones in the Gwich'in Land Use Plan). • Regional indicator is the area disturbed within sensitive features and habitats (expressed in both ha and %). • No established objectives in the NWT, but mitigation objectives exist for identified features and designated areas (i.e., enhanced mitigation or land use restrictions). • Routinely considered for oil and gas activities, where project specific indicators are developed to monitor these features. • Regional objectives would need to be set to reflect acceptable and unacceptable risk for specific features or habitats.
Focal Wildlife Species	**Total Disturbed Area** (by management unit)	• Available information suggests that focal wildlife species can be adequately protected by two indicators that track direct and indirect footprint and habitat loss: total area disturbed and total corridor density. Total area disturbed has been widely used in environmental assessments in the NWT and has been recommended as a cumulative effects indicator in the Dehcho (DCLUPC, 2006) and North Yukon (NYPC, 2008) regional land use plans. • Regional indicator is the total area disturbed in each management unit (expressed in both ha and %). • No established guidelines occur in the NWT, but relative risk ratings have been identified in scientific meta-analyses. Proposed land use disturbance targets were included for individual land management units in the Final Draft Deh Cho Land Use Plan (DCLUPC, 2006) and Recommended North Yukon Land Use Plan (NYPC, 2008) and for woodland caribou wintering habitat in Yukon (Adamczewski et al., 2003). • No established process for calculating or assigning disturbance footprints exists in the NWT; this would have to be implemented through land or water approvals. • Regional objectives would need to be set to reflect acceptable and unacceptable risk for selected focal wildlife species (e.g., woodland caribou or grizzly bear).

TABLE 2. STATUS OF VALUED COMPONENT INDICATORS AND MANAGEMENT OBJECTIVES RELEVANT TO ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Standard Valued Component	Cumulative Effect Indicator	Comments
Focal Wildlife Species (cont.)	**Total Corridor Density** (by management unit)	• Available information suggests that focal wildlife species can be adequately protected by two indicators that track direct and indirect footprint and habitat loss: total area disturbed and total corridor density. Total corridor density has been used in environmental assessments in the NWT and has been recommended as a cumulative effects indicator in the Dehcho (DCLUPC, 2006) and North Yukon (NYPC, 2008) regional land use plans and proposed as a candidate indicator in the Beaufort Mackenzie Delta region (Dillon and Salmo, 2006). Recent analyses indicate that corridor density is highly correlated with industrial footprint and can be used in place of industrial footprint (Boutin and Arienti, 2008). • Regional indicator is the corridor density (e.g., seismic lines, roads, pipelines) in each management unit, expressed as km/km^2. • No established guidelines occur in the NWT, but relative risk ratings have been identified in scientific meta-analyses. Proposed corridor density targets were included for individual land management units in the Final Draft Dehcho Land Use Plan (DCLUPC, 2006) and Recommended North Yukon Land Use Plan (NYPC, 2008). • No established process for calculating or assigning disturbance footprints exists in the NWT; this would have to be implemented through land or water approvals. • Regional objectives would need to be set to reflect acceptable and unacceptable risk for selected focal wildlife species (e.g., woodland caribou or grizzly bear).
	Industrial Footprint (by management unit)	• Industrial footprint has been identified as the best statistical land use predictor of woodland caribou population trends in Alberta (Sorensen et al., 2008) and was also correlated with woodland caribou mortality risk in BC (Antoniuk et al., 2007). Recent analyses indicate that corridor density is highly correlated with industrial footprint and can be used in place of industrial footprint (Boutin and Arienti, 2008). • Regional indicator is proportional area within 250 m of polygonal and corridor land use footprints in each caribou range or management unit (%). Core area analyses for grizzly bear typically use area within 500 m of high use features. • Sorensen et al. (2008) identify a science-based threshold associated with population decline of woodland caribou. • No established process for calculating or assigning industrial footprints exists in the NWT; this would have to be implemented through land or water approvals. • Regional objectives would need to be set to reflect acceptable and unacceptable risk for selected focal wildlife species (e.g., woodland caribou or grizzly bear).

TABLE 2. STATUS OF VALUED COMPONENT INDICATORS AND MANAGEMENT OBJECTIVES RELEVANT TO ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Standard Valued Component	Cumulative Effect Indicator	Comments
Focal Wildlife Species (cont.)	**Animal Industrial Mortality** (by management unit)	• Incremental mortality has been identified as key concern for grizzly bear and wolverine in the Beaufort Delta region. Proposed as a candidate cumulative effects indicator in Beaufort Mackenzie Delta region (Dillon and Salmo, 2006). • Regional indicator is focal species mortality due to management actions, illegal kills by industry workers, other industry-related mortality, and legal harvest by workers, and is reported in number per year. • Established territorial guidelines provide for critical harvest thresholds that vary depending on the wildlife management areas. Some land use plans also provide thresholds for industry-related mortality. Relative risk ratings can be derived through population dynamics modelling. Regional objectives would need to be set to reflect acceptable and unacceptable risk for selected focal wildlife species. Reported industrial mortality will continue to be factored into harvest management targets.
Focal Fish Species	**Total Disturbed Area** (by watershed or management unit)	• Disturbed area within a watershed has been identified as a good statistical predictor of aquatic integrity because it can affect stream flow, water quality and fish abundance and distribution. Total area disturbed has been widely used in environmental assessments in the NWT and has been recommended as a cumulative effects indicator in the Final Draft Deh Cho Land Use Plan (DCLUPC, 2006) and Recommended North Yukon Land Use Plan (NYPC, 2008). • Regional indicator is proportional area within watershed or management unit (expressed in both ha and %). • No established guidelines occur in the NWT, but relative risk ratings have been identified in scientific meta-analyses and watershed assessment procedures. Proposed terrestrial land use disturbance targets were included for individual land management units in the Final Draft Deh Cho Land Use Plan (DCLUPC, 2006) and Recommended North Yukon Land Use Plan (NYPC, 2008); these would also protect aquatic integrity. • No established process for calculating or assigning disturbed areas exists in the NWT; this would have to be implemented through land or water approvals. • Regional objectives would need to be set to reflect desired water quality/aquatic integrity by watershed or land management unit.

TABLE 2. STATUS OF VALUED COMPONENT INDICATORS AND MANAGEMENT OBJECTIVES RELEVANT TO ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Standard Valued Component	Cumulative Effect Indicator	Comments
Focal Fish Species (cont.)	**Total Corridor Density** (by watershed or management unit)	• Corridor density within a watershed has been identified as a good statistical predictor of aquatic integrity. Total corridor density has been used in environmental assessments in the NWT and has been recommended as a cumulative effects indicator in the Final Draft Deh Cho Land Use Plan (DCLUPC, 2006) and Recommended North Yukon Land Use Plan (NYPC, 2008) and proposed as a candidate indicator in the Beaufort Mackenzie Delta region (Dillon and Salmo, 2006). • Regional indicator is the corridor density (e.g., seismic lines, roads, pipelines) in each watershed or management unit, expressed as km/km2. • No established guidelines occur in the NWT, but relative risk ratings have been identified in scientific meta-analyses and watershed assessment procedures. Proposed terrestrial corridor density targets were included for individual land management units in the Final Draft Deh Cho Land Use Plan (DCLUPC, 2006) and Recommended North Yukon Land Use Plan (NYPC, 2008); these would also protect aquatic integrity. • No established process for calculating or assigning disturbance footprints exists in the NWT; this would have to be implemented through land or water approvals. • Regional objectives would need to be set to reflect desired water quality/aquatic integrity by watershed or land management unit.
	Total Riparian Disturbance (by watershed or management unit)	• Disturbed area within the riparian zone of a watershed has been identified as a good statistical predictor of aquatic integrity. Stream crossing density was recommended as a cumulative effects indicator in the Final Draft Deh Cho Land Use Plan (DCLUPC, 2006). Total riparian area disturbed was proposed as a candidate cumulative effects indicator in the Beaufort Mackenzie Delta region (Dillon and Salmo, 2006). • Regional indicator is the proportion of riparian area disturbed by stream crossings, bank and bed alterations, and riparian clearing/disturbance (expressed as ha and %). • No established guidelines occur in the NWT, but relative risk ratings have been identified in scientific meta-analyses and watershed assessment procedures. Proposed stream crossing density targets were included for individual land management units in the Final Draft Deh Cho Land Use Plan (DCLUPC, 2006). • No established process for calculating or assigning riparian disturbance exists in the NWT; this would have to be implemented through land or water approvals. Clear definitions of riparian habitat and publicly available mapping would be required. • Regional objectives would need to be set to reflect desired water quality/aquatic integrity by watershed or land management unit.

TABLE 2. STATUS OF VALUED COMPONENT INDICATORS AND MANAGEMENT OBJECTIVES RELEVANT TO ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Standard Valued Component	Cumulative Effect Indicator	Comments
Focal Fish Species (cont.)	**Fish Industrial Mortality** (by watershed or management unit)	• Incremental mortality has been identified as a key concern for lake trout and Dolly Varden in the Sahtu and Beaufort Delta regions. Proposed as a candidate cumulative effects indicator in Beaufort Mackenzie Delta region (Dillon and Salmo, 2006). • Regional indicator is focal species mortality due to construction in water bodies, other industry-related mortality, and legal harvest by workers, and is reported in number per year. • No established guidelines occur in the NWT, but relative risk ratings can be derived through population dynamics modelling. • Regional objectives would need to be set to reflect acceptable and unacceptable risk for selected focal fish species. Reported industrial mortality will continue to be factored into harvest management targets.
Traditional Culture and Land Use	**Total Disturbed Area** (within significant cultural features)	• Protection of significant cultural features is a management objective in all existing and recommended land use plans and zoning approach has generally been used to protect the most sensitive features and areas (e.g., Conservation Zones in the Gwich'in Land Use Plan). • Regional indicator is disturbed within significant cultural features (includes archaeology and heritage sites as well as cultural sites still in use: trapping, fishing, hunting and gathering locations; cabins; burial sites, historic trails; spiritual sites), expressed in both ha and %. • Established objectives for archaeological sites; no established objectives for other features in the NWT, but mitigation objectives exist for identified features and designated areas (i.e., enhanced mitigation or land use restrictions). • Regional objectives would need to be set to reflect acceptable and unacceptable risk for specific features or areas.
	Area Unavailable for Traditional Use (by management unit)	• Maintaining the opportunity to exercise traditional land uses is a management objective in all existing and recommended land use plans and zoning approach has generally been used to protect important use areas (e.g., Conservation Zones in the Gwich'in Land Use Plan). • Regional indicator is land area within 1,000 m of highly visible sites and those with intensive industrial use, including production facilities, active well sites, camps, and above ground pipelines. Definition will need to be confirmed through consultation. • No established guidelines occur in the NWT. • Regional objectives would have to be set to reflect desired social preference for specific areas.

TABLE 2. STATUS OF VALUED COMPONENT INDICATORS AND MANAGEMENT OBJECTIVES RELEVANT TO ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Standard Valued Component	Cumulative Effect Indicator	Comments
Community Well-being	**Employment** (by community)	• There is a positive correlation between education, employment and health status in Canada and other parts of the world. Sustainable development (to generate resident employment and income) is a management objective in all existing and recommended land use plans. Project employment is commonly projected in environmental assessments and was proposed as a candidate cumulative effects indicator in Beaufort Mackenzie Delta region (reviewed in Dillon and Salmo, 2006). • One of the most common social indicators (Mitchell and Davis, 2005). • The regional indicator is full and part-time employment by community, including projected project-specific change. • Existing guideline in the NWT is to maximize local employment. Formal monitoring programs have been implemented for diamond mines.
	Employee Training (by company)	• There is a positive correlation between education, employment and health status in Canada and other parts of the world. Measurements of education and training levels are used as a measurement of human capital in NWT social monitoring programs. Employee and contractor training was proposed as a candidate cumulative effects indicator in Beaufort Mackenzie Delta region (reviewed in Dillon and Salmo, 2006). • Regional indicator is resident employee and contractor skill training and non-resident cross-cultural training. • No established guidelines occur in the NWT. • Regional objectives would have to be set to reflect desired social preference for specific areas.
	Community Population (by community)	• Rapid or dramatic changes in community permanent and transient populations increase the risk of adverse cumulative effects on community well-being. Community population was proposed as a candidate cumulative effects indicator in Beaufort Mackenzie Delta region (reviewed in Dillon and Salmo, 2006). • One of the most common social indicators (Mitchell and Davis, 2005). • Regional indicator is projected permanent and transient population increase by community, including projected project-specific change. • No established guidelines occur in the NWT. • Regional objectives would have to be set to reflect desired social preference for specific areas.

TABLE 2. STATUS OF VALUED COMPONENT INDICATORS AND MANAGEMENT OBJECTIVES RELEVANT TO ONSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NWT (CONT.)

Standard Valued Component	Cumulative Effect Indicator	Comments
Economy and Business	**Employment** (by community)	• There is a positive correlation between education, employment and health status in Canada and other parts of the world. Sustainable development (to generate resident employment and income) is a management objective in all existing and recommended land use plans. Project employment is commonly projected in environmental assessments and was proposed as a candidate cumulative effects indicator in Beaufort Mackenzie Delta region (reviewed in Dillon and Salmo, 2006). • One of the most common social indicators (Mitchell and Davis, 2005). • Regional indicator is projected full and part-time employment by community, including projected project-specific change. • Existing guideline in the NWT is to maximize local employment. Formal monitoring programs have been implemented for diamond mines.
	Income (by community)	• There is a positive correlation between education, employment and health status in Canada and other parts of the world. Sustainable development (to generate resident employment and income) is a management objective in all existing and recommended land use plans. Project income is commonly projected in environmental assessments and was proposed as a candidate cumulative effects indicator in Beaufort Mackenzie Delta region (reviewed in Dillon and Salmo, 2006). • Regional indicator is projected business and employment income (expenditures) by community, including projected project specific change • Existing guideline in the NWT is to maximize local income. Formal monitoring programs have been implemented for diamond mines.

4. NWT IMPLEMENTATION CONSIDERATIONS

Previous northern studies on Valued Component objectives have described them in theory and discussed how they might be developed, but there has been limited analysis of how they might be implemented in the Northwest Territories. This section of the report discusses material relevant to ESRF project objectives 1 and 2: (1) needs, benefits, opportunities and challenges associated with implementing objectives in the Northwest Territories; and (2) the use of Valued Component objectives in resource and cumulative effects management. Information provided here is also relevant to components of project objective 3: raising awareness of the need for objectives and implementation priorities.

4.1 STAKEHOLDER SCAN COMMENTS

As noted in Section 2.2, the stakeholder scan revealed broad support for the use of Valued Component management objectives. However, while the majority of those contacted believed in the need for regulatory limits, most industry study participants only supported the use of guidance markers (i.e., a target to strive for that does not have regulatory consequences if not met).

Key implementation-related findings from the stakeholder scan included in Appendix B have been consolidated into the six recommendations provided below.

1. **Get started:**
   There was general support for the Valued Components, indicators and objectives concept and approach as a way to manage risks. Acknowledging that there will never be the perfect science, most interviewees recommended moving forward to 'learn by doing'. Implementing thresholds or limits already identified in existing development decisions is a way to get started. Study participants also recommended getting started by working with the best environmental information and technology as well as by using a combination of science and professional judgement.
   The majority of study participants believed that the implementation of Valued Components, indicators and objectives would support the development of land use plans in areas where they do not currently exist.

2. **Adopt an adaptive management approach:**
   All study participants recommended an adaptive management approach to ensure there is sufficient flexibility to accommodate changing landscapes, technology, scientific information and values. The desire for a balance between prescriptive and flexible was noted; a cautionary or flexible approach should be adopted where there is scientific or social uncertainty.

3. **Start small:**
   Stakeholders recognized the value of starting small and building on success, given limited capacity and resources as well as the need to address some stakeholder concerns. Starting simple by implementing a few Valued Component indicators to help build stakeholder confidence and awareness about long-term benefits of such a management approach.

4. **Leverage off of existing work:**
   Stakeholders recognized a number of existing initiatives that would be helpful in implementing Valued Components, thresholds and limits in the NWT, including the following:

   - Use existing land use plans as the vehicle for implementing Valued Components, indicators and thresholds;
   - Adopt a single portal for managing information as currently incorporated in the ESF;
   - Use the existing ESF initiative to build integration and co operation;
   - Consider using existing organizations in the process (e.g., Land & Water Boards);
   - Apply targets, thresholds or limits that have been identified in previous reports and research but not yet applied in management decisions.

5. **Adopt a collaborative approach:**
   Involvement of all interested parties in the target development and implementation process was a key stakeholder recommendation. This would minimize the risk of unintended and undesirable consequences and ensure that implementation reflects regional jurisdictional, ecological and social differences.

6. **Educate:**
   Study participants acknowledged that education about the management by objectives approach must be ongoing and should be conducted through a variety of mediums (e.g., informal dialogue, workshops, presentations, website, information meetings, fact sheets, radio discussions and television). Some key messages include the following:

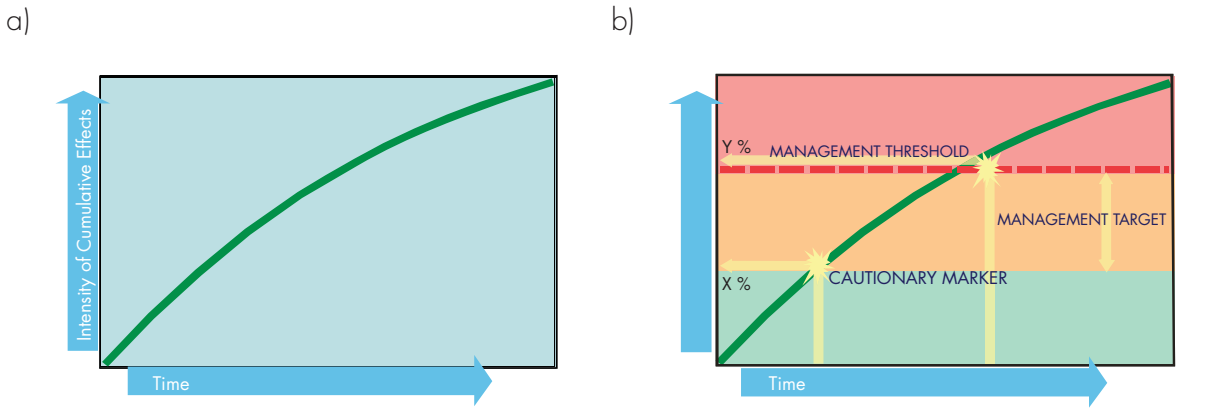
   - Clarify the meaning of Valued Components, indicators and objectives;
   - Communicate the benefits of using Valued Components, indicators and objectives in managing all interests more proactively;
   - Demonstrate the need for the use of Valued Components, indicators and objectives to all stakeholder groups;
   - Emphasize that objectives can be set with limited information and can change over time; and
   - Facilitate Aboriginal community level education efforts to encourage Aboriginal peoples' understanding and buy-in.

4.2 APPLYING THE CUMULATIVE EFFECTS CURVE

The key challenges identified by stakeholders and past experience are (1) the need to provide a clear decision-making process that also maintains flexibility; and (2) maintaining a level playing field for all land users, including new entrants. The '**cumulative effects curve'** introduced below provides a visual model of how management objectives can be developed and implemented in a way that addresses these challenges. This concept is intended to show how the intuitively simple concept of management by objective can be applied to the complex context of cumulative effects.

As discussed earlier in this report, the precondition for implementation is the identification of Valued Component indicators and management objectives that are understandable and measurable, and can be incorporated directly into management decisions. In this case, we use the example of the Disturbed Area (Industrial Footprint + Burn) indicator (see Section 2.3.3) that quantifies the areas directly and indirectly affected by land use and natural disturbance. The cumulative effects curve shown in Figure 7 has time on the horizontal access and the Disturbed Area indicator on the vertical axis. Figure 7 a) shows an example of how this indicator changes over time as more land use features are added to the landscape. As explained earlier (Section 2.3.3.1), changes in the Industrial Footprint indicator status can be translated into risk of woodland caribou population decline using the dose-response curve provided in Figure 3.

Figure 7.
Using the 'cumulative effects curve' (graph a) to visualize management objectives (graph b).



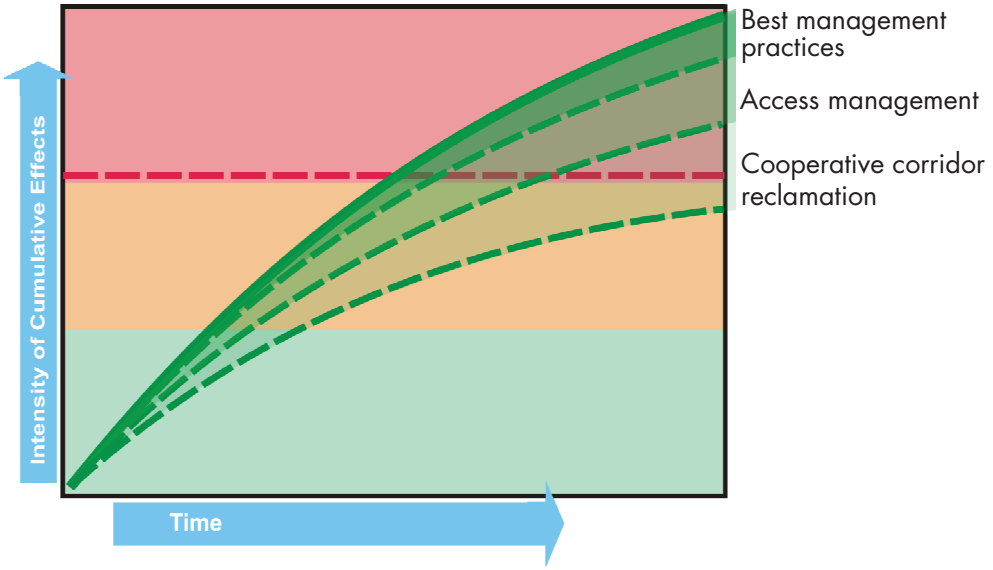
Specific objectives (Cautionary Markers, Management Targets and Management Thresholds) can be related to risk of decline by drawing horizontal lines on the cumulative effects curve diagram (Figure 7 b). If the cumulative effects curve is on a trajectory that will surpass (or if it has already exceeded) the Management Target or Management Threshold, then measures are needed to alter the slope of that curve. Success occurs when the cumulative effects curve is within the Desirable or Acceptable range (i.e., below the Management Threshold) and is horizontal or downward sloping.

The cumulative effects curve provides the basis for examining how various management tools—including management objectives—can change the slope of the curve over time so that it remains within acceptable conditions. The cumulative effects curve can also be used to model future scenarios under various assumptions about land and resource uses, thereby allowing the costs and benefits of different management objectives and mitigation measures to be directly evaluated.

The objective of the implementation strategy for each Valued Component indicator is to maximize land use (and associated benefits) while minimizing the risk of unacceptable effects. This is achieved by 'bending' the cumulative effects curve to avoid crossing the management threshold (thereby minimizing ultimate restrictions), or returning below that limit if it has already been crossed (thereby minimizing unacceptable impacts on the Valued Component). The concept of 'tiered objectives' is applied to trigger appropriate management responses if the cumulative effects curve reaches certain socially derived levels. Even if the ultimate limit of socially acceptable impacts has not been determined, cautionary markers and management targets can be put in place to trigger management or decision-making responses as the indicator—and risk to the Valued Component—increases. Management options for bending the curve can be represented by a 'wedge diagram' where different mitigation and management tools contribute to changing the curve's slope (Figure 8).

The principal determinants of slope for a cumulative effects curve are the amount, pace and types of activities that are contributing to the cumulative effects indicator and any countervailing factors (e.g., rate of reclamation or regeneration) that offset new impacts. The 'wedges' show how various mitigation and management tools affect these determinants to decrease the slope of the curve. Analysis of historical cumulative effect curves can provide

Figure 8.
'Bending the Curve' with management wedges



insight into the relative benefits and costs of these tools and other drivers on the slope. For example, if the curve under business as usual is relatively flat and well below the Cautionary Marker there may be little need to apply enhanced protection measures. However, a very steep curve, even if within management target levels, indicates a potential problem and invites attention to the factors driving the curve. Particularly if impacts are long-lasting, early action to bend the curve may avoid more difficult management choices or restrictions later on. As an example, while industry participants indicated that oil and gas activity is currently low, future scenarios developed for the Mackenzie Gas Project forecast substantial increases in activity once a pipeline is in place to transport production to market. Identification of management objectives would be one approach to bending the curve and reducing future risk of unacceptable effects on Valued Components.

The following sections discuss the following issues identified by stakeholders and report authors that an NWT Valued Component implementation strategy must address:

- Multiple jurisdictions and interests (Section 4.2.1);
- Managing permanent or long-lasting effects (Section 4.2.2);
- Managing impacts of early entrants (Section 4.2.3);
- Allocating space within objectives (Section 4.2.4);
- Flexibility and adaptation (Section 4.2.5);
- Project review and mitigation tools (Section 4.2.6);
- Market-based instruments (Section 4.2.7); and
- Management and monitoring (Section 4.2.8).

4.2.1 MULTIPLE JURISDICTIONS AND INTERESTS

The complexity created by multiple jurisdictions and interests is a key consideration for cumulative effects management. Decisions on land and resource uses are frequently made one at a time by many decision makers within a region (e.g., First Nations on settlement lands and Land and Water Boards elsewhere) without reference to overall territorial or regional objectives. Independent management decisions are also made by groups whose mandates focus on a single sector or type of activity (i.e., departmental 'silos' for oil and gas vs. forestry vs. wildlife management).

The need to aggregate individual decisions when managing cumulative effects is intuitively obvious. For example, objectives related to the priority Disturbed Area indicator would ultimately be implemented through a large number of individual decisions about roads, electric power transmission lines, seismic lines, pipeline rights of way, facilities, and land use disturbances.

The proposed Valued Component objectives-based approach helps address these issues because it is explicitly integrative and outcome-based. Once indicator objectives have been identified, cumulative effects curves represent total impacts because they integrate the effects of all significant land uses over meaningful space and time.

Setting landscape-scale objectives is most appropriately conducted through policy or land use planning because these are exercises in social choice that acknowledge the need to consider multiple values and interests (Kennett, 2006). In the NWT, regional land use planning processes are the forum designed to provide guidance about how these decisions are to be co ordinated or integrated in order to achieve the desired collective outcome. However, existing or future land-use plans are unlikely to anticipate all of the individual projects and activities that may occur on a landscape. Plan implementation is less about following through on prescribed actions and more about ensuring that subsequent decisions, taken together, produce landscape-scale results that are consistent with the plan. This is the value of including specific objectives in land-use plans.

Management objectives were not included in the first two plans developed for the NWT: Inuvialuit Community Conservation Plans and the Gwich'in Land Use Plan (GLUPB, 2003). However, since being identified as a useful tool by the NWT EST, they have been considered in later plans: candidate objectives were included in the draft Dehcho Land Use Plan (DCLUPC, 2006; currently being revisited), and are being evaluated for the Sahtu Land Use Plan (Holroyd et al., 2008; Antoniuk et al., 2009).

More specific guidance may be provided through detailed sub-regional or sectoral objectives that focus on smaller geographic areas or specific resources. At this level, it may be easier to prescribe management actions to ensure that the total level of activity is within the prescribed limit. However, mechanically implementing this type of plan can still result in unintended or undesirable trade-offs where these trade-offs have not been considered beforehand.

This challenge might be addressed by applying objectives to all land users and decision makers, or through improved institutional co ordination or integration—for example, modifying existing processes so that Land and Water Boards serve as the decision maker for all land and resource uses. Similarly, project review processes could be integrated across sectors. Even this degree of integration will not, by itself, fully resolve the aggregation issue, because decision makers must also have clear mechanisms or guidance for determining socially appropriate trade-offs.

Integration of individual decisions can also be achieved using market-based mechanisms, described in Section 4.2.7 below. These mechanisms combine management objectives with price signals or incentives that use markets to ensure that decisions on individual activities result in cumulative impacts within prescribed limits.

4.2.2 MANAGING PERMANENT OR LONG-LASTING IMPACTS

The difficulty of keeping cumulative effects within the desirable or acceptable range is likely to increase when permanent or long-lasting impacts or sources of impacts accumulate over time and reduce the 'space' available for new development. Seismic lines may be used only briefly for geophysical exploration, but can persist on tundra and forest landscapes for decades (Felix et al., 1992; Lee and Boutin, 2006). Other types of linear disturbances, such as transportation corridors, are essentially permanent. In some cases, the impacts continue long after the disturbance in question has ceased to have any economic value—as is the case with seismic lines or access roads to abandoned well sites. In other instances, ongoing impacts may be the result of uses of the disturbance that have little or no relationship to the original reason for creating it. Use of seismic lines for recreational access is an illustration of this phenomenon. If cumulative impacts are to be managed by reducing the total area of disturbance, the accumulation of these disturbances over time is a significant problem.

Decisions that create long-lasting sources of impacts create a similar challenge for cumulative effects management. As more and more of these uses are approved within a given area, unacceptable conditions will be approached and there will be less and less space within the management threshold to accommodate new activities. For example, the accumulation of extractive water uses along a river may eventually make it impossible to make any new allocations without significant consequences for aquatic ecosystems and, eventually, other users. Without mechanisms to reallocate water use among existing users, the accumulation of approved uses will eventually restrict or prevent further development that requires water as a resource input.

As noted above, the slope of the cumulative effects curve is determined by the type of impacts and by offsetting factors such as reclamation. Shortening the lifespan of long lasting impacts is therefore a very effective way to bend the cumulative effects curve for oil and gas activities in the NWT. To give some examples of the benefits of innovation: (1) The shift from conventional six metre to low impact, two- to three metre seismic lines reduces the total area cleared and speeds reclamation, and (2) Bridge installation can reduce aquatic habitat fragmentation caused by hanging culverts. Best management practices can therefore reduce incremental impacts of continued

development. If the intensity of development continues to increase, however, reducing individual impacts may not be enough to keep cumulative effects within the desirable or acceptable range.

Long-lasting sources of impacts therefore accentuate the problem of trade-offs for objectives-based approaches to cumulative effects management. Where reducing individual impacts is not an adequate solution, explicit or implicit choices between existing and new impact sources are unavoidable if Management Thresholds are to be respected. From a management perspective, this knowledge should send a clear signal to both decision makers and land users that preventing and removing long-lasting impacts and sources of impacts helps maintain opportunities for future land use.

4.2.3 MANAGING IMPACTS OF EARLY ENTRANTS

Setting management objectives establishes constraints that force decision makers and land users to consider their actions in the light of a present or future 'impact constrained' world. For society as a whole, 'space' within the limit on cumulative impacts is scarce and therefore valuable. This space may be subject to over-use and misallocation, however, because it is what economists refer to as a public good.

The most familiar example of a public goods problem is the 'tragedy of the commons'. In the absence of private property rights and effective regulation, individual users of the commons face incentives to increase their own use of the common property resource (e.g., common grazing pasture), even though the end result is to overuse and degrade the resource to the detriment of all individual users and society as a whole. Incentives favouring individuals result in a sub-optimal social outcome. Private decision makers act according to incentives to over-exploit that space for immediate gain, without taking account of the broader, long-term public interest in maintaining the productivity of the commons and allocating its use to achieve optimal social benefits.

The same problem may occur because of unconstrained competition for land use within a management objective. Individual land and resource users have reason to maximize their own use of that space, but as is currently the case in the NWT, without regulatory direction or price signals there are no incentives to ensure that these uses generate the socially optimum outcome. In fact, the likelihood that a management threshold or regulatory limit will be imposed may lead to a rush to get a share of the space within that limit, and there is no guarantee that this rush will lead to a socially desirable mix of land and resource uses.

How space within the objectives is used has important implications for other land users as well as regional and territorial residents and other Canadians. In terms of overall efficiency, available space should be allocated—and reallocated over time—to land uses that yield the highest net benefits per unit of disturbance. Determining 'highest net benefits' could involve considering economic return per unit of disturbance relative to impact on cultural values, traditional land uses, ecological goods and services, and esthetics.

An important challenge for the implementation of management objectives is to ensure that the incentives and regulations governing land use decisions and actions reflect these broader values. As noted by industry interviewees, early entrants pose particular problems for objectives-based management because their activities may foreclose other options for subsequent land and resource use. Thus, policy decisions to encourage exploration that ignore footprint may allow some early entrants to gain competitive advantages by strategically occupying space (e.g., maximizing their own development footprint) in advance of other land and resource users.

Furthermore, the combination of long-lasting impacts, tenured land and resource rights, and an absence of market incentives to shift towards higher value land uses may make it very difficult to remove low value land uses once they are in place. Ultimately, regulatory or market-based mechanisms will be needed in the NWT to ensure that the allocation of space optimizes the broader societal values associated with use of that public good and that the mix of land uses can be altered over time—where necessary—to reflect changes in relative social values.

These problems are best addressed by implementing tools that reduce the slope of the cumulative effects curve from the onset of development. This is contrary to the view expressed by some stakeholders that implementation should wait until land use intensity is higher or unacceptable outcomes have been documented.

4.2.4 ALLOCATING SPACE WITHIN OBJECTIVES

The factors described above imply that allocating space to competing land uses and increasing the available 'space' within objectives are two key issues for implementation. As collective markers are approached, management actions to maintain activities within acceptable conditions will require either explicit or implicit allocation rules that determine how trade-offs are made.

These rules will have important consequences for competing land and resource users. They will also have broader social implications, since they constitute judgments about the allocation of scarce resources among alternative uses. Overall social well-being will be increased if these decisions favour higher valued uses over lower valued ones. However, not all allocation rules are well suited to making this type of choice.

Trade-offs within cumulative limits can occur among competing uses over both space and time, depending on the type of objective concerned and the activities that it affects. In a case where two activities contribute to a cumulative effect and a pre-determined management threshold is reached, several options may exist. First, one activity may be deemed more important or more easily mitigated, and allowed to proceed, while the other becomes economically unviable or is restricted. Second, the proposed intensity of both activities may be reduced so as to bring the cumulative total within the threshold. Lastly, the activities themselves may be mitigated with more protective measures or innovative technology, enabling the desired land and resource uses to occur without violating the collective limit. These alternatives could include no net impact measures or sharing infrastructure.

The proposed implementation framework allows trade-off decisions to be made in two ways. First, trade-offs may be considered explicitly or implicitly when setting objectives in land use plans. With this approach, evaluations would be undertaken to forecast expected trade-offs among sectors or between desired social outcomes with different management objectives and assumptions. Trade-offs can also be considered when allocating 'space' within pre-defined objectives among competing land and resource uses. Guidance on this point can come at various stages of decision making—when allocating land and resource rights; when developing land use plans; through regional, territorial or national policy; and when reviewing projects. These choices can be made through regulatory decisions or market-based instruments (e.g., tradable rights as discussed in Section and 4.2.7).

4.2.5 FLEXIBILITY AND ADAPTATION

The Valued Component implementation strategy must be adaptive in order to respond appropriately to changes in information and context. Several types of changes may affect either the slope of the cumulative effects curve or the appropriate management responses.

First, new information may emerge regarding the scientific and management assumptions underlying the dose-response relationships. For example, monitoring undertaken in association with a Cautionary Marker may indicate that assumptions about land footprint reclamation rates or the amount of new disturbance associated with certain activities are incorrect. If assumed reclamation rates are shown over time to be overly optimistic, the cumulative effects curve will be steeper than originally thought and additional policy or management actions may be required to flatten the curve. Conversely, if it is shown that the permanent or long-lasting footprint required by certain land uses has been overestimated the cumulative impacts curve will be flatter than forecast.

Second, the drivers that determine the slope of the cumulative effects curve may change over time. Changes in the pace, type and intensity of land use will affect cumulative impacts and should therefore be reflected in the management responses to an upward slope. For example, changes in the price of natural gas and oil or the availability of pipeline capacity may reduce or increase exploration and development activity.

Third, new options for bending the curve may emerge over time. For example, technological advances and economies of scale may produce cost-effective ways of dramatically reducing the land disturbance associated with certain types of activities. As an example, techniques for low-impact seismic exploration have evolved significantly in recent decades, although these advances have not been routinely applied in the NWT. Implementation strategies that include requirements or incentives for the adoption of these types of changes would promote efficient use of 'space' within the management objectives.

Lastly, societal values may change over time regarding the appropriateness of certain land-use practices and the relative priority among different land uses. Mechanisms to revisit the management objectives or allocate space within them should be incorporated into an objectives management framework.

The use of tiered objectives is one way of formalizing an adaptive approach to implementation. When the cumulative effects curve reaches certain pre-determined markers, changes in policy and management are set in motion.

4.2.6 PROJECT REVIEW AND MITIGATION TOOLS

The more effective the combined suite of tools used to bend the curve, the longer the time before an unacceptable level of impact is reached (if ever). Axys et al. (2003) describe project-specific, co operative industry and regional mitigation tools available to help manage cumulative effects. Project-specific tools include: environmental reviews to establish approval terms and conditions; mitigation guidelines (e.g., standard and best practices guides and activity timing windows); compliance monitoring; and follow-up effects monitoring. Co operative industry tools include: strategic environmental assessments for individual industry sectors; integrated landscape management (e.g., shared corridors); and indicator status mapping. Regional tools include: regional land use and resource

databases; research to generate dose-response curves; monitoring to document actual Valued Component response to indicator changes; land use and protected areas planning; Valued Component management plans (e.g., NWT barren ground caribou management strategy); and pre-tenure plans.

Opportunities to link these review and mitigation tools to tiered objectives are noted in Section 5.

4.2.7 MARKET-BASED INSTRUMENTS

The environment provides a number of beneficial goods and services to individuals and firms and businesses. In the past, these services have either been available for 'free' or been managed through 'command and control' policies such as pollution standards. In spite of regulation, the continued decline in environmental quality in the second half of the 20th century challenged governments to develop new models for addressing environmental problems. Over the last 20 years, market based instruments (MBIs) have emerged as a new suite of tools that use price signals to align the incentives of land and resource users with the environmental objectives of the public.

MBIs are discussed in some detail here because they are thought to be one of the most effective ways to deal with concerns identified by industry stakeholders: allocating space within objectives, managing the impact of early entrants, and providing a flexible and adaptable system (see Sections 4.2.3 through 4.2.5 above).

Market based instruments are tools that address 'environmental externalities' either by incorporating the external cost of production or consumption activities through taxes or charges on processes or products, or by creating property rights and facilitating the establishment of a proxy market for the use of environmental services' (EEA, 2007). MBIs change behaviour by altering the cost of environmental services, either through directly shifting prices or by regulating quantities of environmental goods and services that can be used and allowing private markets to set the price. By pricing environmental services, MBIs encourage land users to minimize environmental effects through reduced impacts and innovation. MBIs are intended to align business and public objectives and at the same time reduce society's costs for environmental management. Experience has shown that MBIs are usually more efficient than traditional command and control policies.

MBIs work best when the following conditions are present:

- Multiple land use or emission sources;
- Individual costs of mitigation or abatement are not known;
- Impact magnitude and mitigation costs differ between land users;
- Need to encourage innovation;
- Flexibility of individual response is desirable;
- Voluntary programs are the preferred policy tool, but require more support;
- Command & control is in place or will be put in place, but pre-compliance, beyond compliance, or compliance transition support is desired.

Because MBIs operate through the market, it is not necessary to establish separate rules for each firm or industry. Instead, a land use plan or the government can establish a common environmental objective, and a common set of rules (whether prices or charges), by which covered sectors will meet those objectives. This reduces the

information required by the regulatory agency about firm specific costs and technologies. By creating prices for environmental services, MBIs encourage innovation by providing financial incentives and rewards. This can be contrasted to command and control, where technological standards are specified, and there are no rewards for innovations that reduce costs of meeting objectives. MBIs can also be used as a backstop to a voluntary program.

MBIs fall into two broad categories: (1) price based instruments and (2) quantity based instruments.

4.2.7.1 PRICE BASED INSTRUMENTS

Price based instruments include taxes, subsidies, user charges and effluent fees. These instruments allow firms and individuals to determine the quantity of environmental services in demand and the final level of environmental quality.

Ecological fiscal reform at the federal level in Canada and the United States has focused largely on subsidy and expenditure programs rather than tax programs. The emphasis here has been on reducing the costs of adopting practices that flatten the curve through the use of tax credits, exemptions or reductions, or accelerated capital-cost allowances. Examples of federal policies include: income tax exemptions for donating ecological gifts, fuel tax exemptions for alternative fuel consumption and production, and subsidies for investments in renewable-energy technologies. At the territorial and provincial level, policies include user fees and deposit refund schemes for items such as beverage containers, tires, batteries and solid waste.[1]

In many European countries fiscal reform has been pursued through a combination of incentives to encourage environmentally beneficial behaviour and taxes to dissuade environmentally harmful behaviour. Taxes and fees in Organisation for Economic Co operation and Development (OECD) countries are also often accompanied by exemptions, refunds and other tax reductions, which are introduced for social, environmental and economic reasons, including concerns about the international competitiveness of certain sectors. Tax rate reductions are sometimes contingent on liable firms improving their environmental performance through other means. For example, energy-intensive firms in the United Kingdom can benefit from an 80% reduction in the Climate Change Levy if they reach targets set in negotiated Climate Change Agreements.

4.2.7.2 QUANTITY BASED INSTRUMENTS

Quantity based instruments are commonly referred to as tradable permits. Under tradable permits, a limit on environmental impact is introduced either as a maximum ceiling for **'cap and trade'** schemes or as a minimum performance commitment for **'baseline and credit'** systems. Rights for these environmental services are then allocated using market mechanisms, such as auctions or tradable permits. This approach can be applied to a number of the proposed territory-wide Valued Component indicators identified earlier in Table 2 (i.e., disturbed area, corridor density, riparian disturbance, and industrial footprint).

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[1] Pembina Institute, "The State of EFR in Canada and elsewhere: A Scoping Report for Alberta Environment", April 2006. See EFR database for more details on these programs.

[2] Tietenberg, T., and N. Johnstone, "Ex Post Evaluation of Tradeable Permits: Methodological Issues and Literature Review" in *Tradeable Permits: Policy Evaluation, Design and Reform*, OECD, 2004.

Regulators may also combine quantity and price based approaches. For example, tradable permit markets for greenhouse gas (GHG) emissions cap the total number of tons per year of carbon that can be emitted. Firms are allowed to trade rights to emit carbon under the cap. Because of uncertainty about the cost of GHG abatement, price ceilings have been proposed for this market in Canada. Price ceilings are equivalent to a tax on GHG emissions and are an escape mechanism in case the environmental market overly restricts economic activity.

The case for tradable permits is often made on the following grounds:

- They minimize mitigation costs for a given environmental target;[3]
- They provide positive incentives for technological innovation;
- They provide a high degree of environmental certainty;
- They have relatively low administration costs;
- Through the assignment of entitlements they have the flexibility to address distributional concerns (see Section 4.2.4) without affecting efficiency.

The degree to which these criteria are realized depends on the specific design of the market, and the type of environmental problem they are applied to. In particular, abatement costs are not necessarily minimized if damages from emissions are 'non assimilative'; environmental hot spots can emerge without additional zoning constraints; start up costs for trading systems can be high if they require new administrative systems, and lastly, verification costs for offset and baseline and credit schemes can be very high. [4]

Currently, tradable quota or permit systems are being employed in OECD countries for water, GHGs, air emissions, wetlands protection and fisheries management. In all cases these programs have been effective at lowering overall impacts well as encouraging the adoption of environmentally beneficial technologies. While tradable permit systems are expanding globally, particularly with the successful implementation of the United States national market for SO2 emissions in the 1990s, they are also controversial, both because they are unfamiliar to decision makers, and because setting the cap can be a difficult political exercise. One of the unique aspects of tradable permit systems is that they reveal information about the willingness of firms to pay for environmental services and the cost of compliance and the value that firms see in doing so. In addition, permit systems ensure high quality monitoring by land users, since compliance is key to maintaining the 'market value' of their investments in mitigation.

[3] Tietenberg, T., and Johnstone, N. *ibid*

[4] See for example, costs of verifying GHG offsets in Marbek Resource Consultants et al., *Administration and transaction cost estimates for a greenhouse gas offset system, Final Report*, AAFC, 2004.

4.2.8 MANAGEMENT AND MONITORING

Several of the issues discussed above contribute to a significant implementation challenge in the areas of accountability, monitoring and enforcement. In the NWT, land and resource management responsibilities are shared by a number of Aboriginal, co management, territorial and federal organizations and bodies. There is typically no single agency or individual that is the land manager—responsible and accountable for ensuring that cumulative impacts are considered in decision making and that management objectives are respected. Implementation options span the range from a primary government role to a primary role for Aboriginal and industrial land users. Past experience demonstrates that the active support and participation of all groups will be needed. The following principles identified by Salmo et al. (2003) are also relevant to management objective implementation in the NWT:

- The level of assessment, review and environmental protection should be related to the potential risk of adverse effects;
- Management actions should be explicitly linked to objectives so that resource users can choose the most effective method of achieving them;
- Resource managers are responsible for providing clear guidance on the calculation of indicator status and application of management objectives, for providing the information necessary to complete these evaluations in a timely and efficient manner, and for ensuring that rules (including implementation as proposed) are consistently and fairly applied; and
- Land users are responsible for defining a project's contribution to cumulative effects in the land management area in which the activity is proposed and for participating in co operative regional initiatives.

Co operative research and monitoring will need to be conducted in selected areas to provide information necessary for refining dose-response relationships, management objectives and management actions. In the NWT, cumulative effects monitoring is required as a condition of the Mackenzie Valley Resource Management Act *(MVMRA)* and land claims. Research and monitoring must be a fundamental part of a Valued Component objective framework (DIAND, 2003). Additional monitoring will be needed to track Valued Component indicator status, confirm that dose-response relationships apply within the implementation area, monitor ongoing trends of the Valued Component, confirm compliance with approval conditions, and confirm the application and effectiveness of impact management (Axys and Salmo, 2003).

Examples of research and monitoring that would be required for the woodland caribou indicator identified in Section 2.3.3 include the following:

- Age, area and vegetation condition of each burned or naturally disturbed area;
- Age, area, vegetation condition, tenure holder and land use type of each industrial or man-made feature;
- Woodland caribou population dynamics (age structure, maternal condition, survival and recruitment).
- Disturbed area reclamation: How quickly does vegetation on land use features and burns recover following natural or human disturbance, and at what point do these disturbances cease to have an effect on woodland caribou behavioural response and population growth?
- How does low impact seismic technology change the rate of disturbed area reclamation?
- Consider a rigorous adaptive management approach testing different management options/management treatments in different ranges or pilot study areas.

5. CONCLUSIONS AND RECOMMENDATIONS

The concept of Valued Component objectives was introduced through the NWT Environmental Stewardship Framework (ESF, formerly CEAMF) initiative. Both NWT ESF and the associated Cumulative Impact Monitoring Program (CIMP) adopted a hierarchical system of Valued Components and associated indicators to focus research, monitoring and management activities on priority issues. The NWT ESF also identified the need for explicit thresholds or limits to be linked to these indicators of environmental change in order to differentiate acceptable and unacceptable conditions. These elements form the basis of the Valued Component assessment and management framework described here.

The specified objectives of the ESRF Valued Component Thresholds (Management Objectives) Project are the following:

1. Identify the needs, benefits, opportunities and challenges associated with developing Valued Components indicators and thresholds in the Northwest Territories (NWT);
2. Review the status of current Valued Component thresholds and their use in resource management and cumulative effects management generally;
3. Identify the Valued Component thresholds that are of highest priority to assist existing resource management boards in decision making—now and in the immediate future; and
4. Raise awareness of the need for Valued Component thresholds and the priorities for an implementation strategy.

This section summarizes material presented earlier for each of these objectives and provides recommendations for the implementation of a pilot study to evaluate and refine this approach.

5.1 DEVELOPING VALUED COMPONENT INDICATORS AND OBJECTIVES

A Valued Component has been defined by CIMP as "an aspect of the environment that is considered important on the basis of economic, social, cultural, community, ecological, legal or political concern" (DIAND, 2003). Indicators are "a characteristic of the social or ecological setting that is used to describe, measure, manage and report on a Valued Component" (DIAND, 2003). Valued Component indicators enable managers, decision makers and land users to speak a common language when they consider risks of cumulative effects.

In this report, the term **'objectives' is substituted for 'thresholds'** because the former implies something to be managed, rather than a cap or no-go point. The term thresholds used in the project Request for Proposal is particularly problematic because it is used and interpreted in many different ways. In contrast, a Management by Objective approach is commonly used in both the private and public sectors and this proactive system is also applicable to resource management.

5.1.1 NEEDS, BENEFITS, OPPORTUNITIES AND CHALLENGES

In spite of perceived benefits, defining quantitative Valued Component objectives is one of the most challenging aspects of land and resource management because they must be technically defensible, politically acceptable and administratively efficient.

The opinions of 21 knowledgeable and informed stakeholders were solicited in order to identify the needs, benefits, opportunities and challenges of developing Valued Component indicators and thresholds in the NWT. The stakeholder scan findings presented in Appendix B are consistent with previous experience, but they must be considered in context. First, participants were voicing their own opinions, not necessarily those of their respective organizations. Second, a relatively small number of stakeholders participated, and findings are not statistically defensible, nor representative of all stakeholders in the NWT. With these caveats, TAG and other stakeholder representatives indicated that a practical Valued Component management framework should be as follows:

- Based on the best available science and local knowledge;
- Broadly applicable in all jurisdictions within the NWT;
- Clearly defined up front;
- Geographically flexible to address differing local or regional sensitivities, values and interests;
- Adaptable over time to incorporate monitoring and research results and changes in local or regional social values;
- Able to consider key cumulative effect pathways associated with northern onshore hydrocarbon activities;
- Based on easily measured and understood indicators that provide information on Valued Component status; and
- Fair to industry by reflecting existing commitments and avoiding unintended consequences such as additional regulatory burden (Alvarez, 2006).

All of the regulator, resource manager, Aboriginal and environmental representatives and some industry representatives supported the use of Valued Components objectives, including the use of management thresholds or regulatory limits. The need for explicit objectives was strongly contested by a number of industry representatives.

Results of the stakeholder scan conducted for the ESRF project are consistent with feedback provided during the Dehcho, Saht, and North Yukon land use planning initiatives. Although there is broad support for use of the management objectives approach and it has been endorsed by the NWT ESF and many organizations, stakeholder views on the need for explicit management objectives are polarized. Supporters believe that the potential benefits outweigh the anticipated disadvantages, while opponents believe that the potential disadvantages outweigh the anticipated benefits. Fundamentally, these views represent different degrees of risk tolerance, social values or desired scientific certainty.

Implementation benefits and challenges are explored more fully in Section 4. Key challenges include the need to accommodate multiple jurisdictions and interests (Section 4.2.1), manage permanent or long-lasting impacts (Section 4.2.2), manage the impacts of early entrants (Section 4.2.3), allocate 'space' within objectives (Section 4.2.4), and allow flexibility and adaptation (Section 4.2.5). Other challenges are the need to consider natural

disturbance and uncertainty when establishing objectives (Section 2.3.3.3) and the need to minimize the likelihood of unanticipated or unexpected outcomes for land users.

Most interviewees contacted for this study believe there has been enough 'talking' about the use of Valued Components, indicators and thresholds and that it is time to begin developing and testing them in a meaningful, flexible way. The authors believe that polarized views should not become a roadblock to implementation and that formal testing is also a logical next step in acknowledging and addressing the issues and concerns identified in this study.

This report emphasizes the need to develop an integrated Valued Component management framework rather than focusing on objectives or thresholds in isolation. The authors recommend this because technical, political and administrative implementation issues are best evaluated and addressed when Valued Component indicators and objectives are being developed, rather than as subsequent 'add-ons'.

An example of a Valued Component management objective framework is shown in Figure 9. A framework is an administrative arrangement that combines various initiatives or tools to assist decision makers in assessing and managing cumulative effects. The framework example provided in Figure 9 links the Valued Components, indicators and tiered objectives hierarchy shown in Figure 2 (Section 2.3.1) with specific mitigation, decision-making, and monitoring measures. This is a more comprehensive version of the 'tiered threshold' structure described in earlier reports (Salmo et al., 2003, 2004; Dillon and Salmo, 2006). The decision-making examples in Figure 9 are intended to be applicable to hydrocarbon proposals covered by both the Inuvialuit and Mackenzie Valley environmental review processes. The specific Valued Component objectives, philosophies and tools for actual Valued Component frameworks will need to be developed for each region to reflect existing processes, issues and impact mitigation technologies using the procedures described below in Section 5.4.2.

Objectives for 'Desirable', 'Acceptable' and 'Unacceptable' indicator status are related to three management and decision-making stages differentiated by pre-defined markers, targets, thresholds or limits (Figure 1 in Section 2.1). Desirable conditions are where cumulative effects have had no or negligible adverse effect on the Valued Component. Acceptable conditions are where a greater level of adverse effects has occurred, but the status of the Valued Component is considered adequate from a social or ecological perspective. Unacceptable conditions are where the status of the Valued Component does not achieve socially or ecologically based objectives.

FIGURE 9. TIERED VALUED COMPONENT (VC) MANAGEMENT OBJECTIVE FRAMEWORK EXAMPLE SHOWING HOW INDICATOR OBJECTIVES AND STATUS CAN BE LINKED TO MITIGATION, DECISION-MAKING AND MANAGEMENT AND MONITORING TOOLS

Valued Component Indicator Status	**Mitigation Approaches**			**Decision-making Tools**	**Management and Monitoring Tools**
UNACCEPTABLE	Impact Minimization Philosophy	• No net impact requirement	• Offsets	• Mandatory environmental impact review	• Detailed VC indicator response monitoring
Management Threshold or Regulatory Limit					
ACCEPTABLE	Enhanced mitigation (best available technology)	• Best practices required • Cooperative accelerated reclamation	• Subsidies and incentives • Taxes and charges • Tradable permits	• Preliminary/ environmental screening if enhanced measures adopted; Environmental assessment/ impact review if not	• Enhanced VC indicator response monitoring • Enhanced audit of medium and high risk land users
Cautionary Marker					
DESIRABLE	Best practices (best practicable technology)	Low impact seismic • CAPP footprint minimization measures	• Subsidies and incentives • Taxes and charges	• Preliminary/ environmental screening if best practices adopted, Environmental assessment/ impact review if not	• Routine indicator status monitoring • Routine audit of high risk land users

} Management Target for Working Landscapes

The implementation framework shown in Figure 9 addresses stakeholder interests and concerns because it can

- Incorporate standard NWT-wide Valued Components as well as more specific Valued Components that reflect regional priorities and values (Section 2.3);
- Include a suite of Valued Component indicators that have been proposed or used in the NWT or elsewhere and are relevant to northern onshore oil and gas activities (Section 3.2 and Appendix A);
- Apply dose-response curves that provide a clear, scientific basis for establishing management objectives (Section 2.3.3.1);
- Incorporate traditional and local knowledge to refine dose-response curves and understand regional values and interests when setting management objectives (Sections 2.3.3.2 and 2.3.3.3);

- Be clarified to ensure that rules for all land users are clear and consistent and implementation is fair to both existing and future land users (Sections 2.3.3.4 and 4);
- Relate management response to risk of unacceptable effects (Section 2.3.3.3); and
- Allow pre-defined management objectives to be implemented on both a project by project and regional basis with minimal changes to the existing regulatory structure.

While land use planning is the most appropriate process for developing Valued Component objectives, other bodies will generally be responsible for applying and enforcing them. Guidance provided by the Mackenzie Valley Resource Management Act (MVRMA) and the Inuvialuit Final Agreement (IFA) suggests the following roles and responsibilities:

- **Develop management objectives:** land use planning boards, renewable resources boards, joint secretariat, other co-management bodies, and departments or agencies of the federal and territorial governments responsible for conservation, development or use of one or more resources in the Sahtu Settlement Area.
- **Apply management objectives:** the responsible authority or party responsible for conducting a preliminary/environmental screening or where screening or environmental assessment is not required, and for issuing leases, licences, permits or other authorizations or interests related to the use of land or waters or the deposit of waste. This includes: Environmental Impact Screening Committee and Review Board; Inuvialuit Land Administration; Mackenzie Valley Land and Water Board and regional boards; Mackenzie Valley Environmental Impact Review Board; First Nations; land use planning boards (in case of referral); departments or agencies of the federal and territorial governments, and any body having authority under any federal or territorial law to issue leases, licences, permits or other authorizations or interests.
- **Monitor and enforce management objectives:** the responsible authority defined in the MVRMA or the IFA or by the Mackenzie Valley Land and Water Board and regional boards, Sahtu First Nation, departments and agencies of the federal and territorial governments, and any body having authority under any federal or territorial law to issue leases, licences, permits or other authorizations or interests related to the use of land or waters or the deposit of waste. Ultimately a central information management group, such as the NWT ESF, Joint Secretariat, Mackenzie Valley Land and Water Board, regional land and water boards, or regional land use planning boards, should be designated to maintain up to date information on the target status for each management zone in which it is applied.

5.2 CURRENT VALUED COMPONENT OBJECTIVES

Section 3 of this report provides a summary of the potential cumulative impacts associated with northern hydrocarbon development activities (Table 1). It also summarizes Valued Component objectives that have been used or proposed for northern areas with onshore energy potential (Table 2 in Section 3.3). Linear corridor density and disturbed area indicator objectives have been adopted for woodland and barren-ground caribou management; all other examples have been proposed, but not implemented.

Social objectives are best developed using the 'limit of acceptable change' approach developed for wilderness resource management. Section 2.3.3 describes an example of a science-based dose-response curve that relates woodland caribou population performance to the amount of combined natural and land-use disturbance in their range. Science- or traditional knowledge-based relationships like this are thought to be the most transparent way to develop or refine management objectives for Valued Component indicators.

5.3 PRIORITY VALUED COMPONENT OBJECTIVES

At the suggestion of the TAG, a suite of eight standard Valued Components are proposed for the NWT. These are generally applicable to all jurisdictions in the NWT where hydrocarbon activities are expected to occur. Stakeholder representatives were in general agreement with these broad Valued Components, although a number of more specific suggestions were made to make this list more operational or reflect regional interests (Appendix B).

A hierarchical Valued Component system, depicted graphically in Figure 2 (Section 2.3), is proposed in order to balance the needs for territory-wide consistency and regional flexibility. This system will allow regional Valued Components identified in land use plans or resource management plans to be clearly linked to the standard NWT-wide Valued Components. These regional Valued Components can better reflect local or regional sensitivities, values and interests (i.e., the regional management vision).

The authors were also asked to identify the Valued Components objectives that are of highest priority in order to quickly assist existing resource management boards in their decision making. This was done by surveying stakeholders, evaluating existing objectives and the uncertainty surrounding them, and considering short-term implementation opportunities.

Some stakeholders expressed concerns about identifying one or more Valued Components as 'priorities' because all are important in certain contexts. Nonetheless, the majority of respondents believed that identifying priority Valued Components would be beneficial because it would facilitate a more manageable implementation process. Their idea was to allow objective implementation to mature gradually by starting small to build success and stakeholder confidence and then adding other Valued Components over time.

Two Valued Components (traditional land use and woodland caribou) are identified as implementation priorities. These specific Valued Components are linked to the general NWT-wide Valued Components of Traditional Culture and Land Use and Focal Wildlife (Figure 2). They were selected because they will likely be the easiest to implement now and in the immediate future, given social values and the extent of our knowledge. Many stakeholders identified focal wildlife species and traditional land use and culture as priority Valued Components for implementation (Table 3).

TABLE 3. STAKEHOLDER OPINIONS ON WHICH VALUED COMPONENTS SHOULD BE A PRIORITY IN THE NWT

Valued Component	Industry	Regulator	Resource Manager	ENGO	Aboriginal
Air Quality	✓	✓	✓		✓
Water Quality	✓	✓	✓		✓
Water Quantity					✓
Sensitive Features & Habitats		✓			
Focal Wildlife Species	✓	✓	✓		✓
Focal Fish Species			✓		✓
Traditional Culture & Land Use	✓		✓	✓	✓
Community Well-being	✓		✓	✓	✓
Economy and Business	✓				

Traditional Use is proposed as the most appropriate social Valued Component because it is an obvious example of a social value that must be discussed with community residents in order to develop management objectives.

Although there is considerable regional and territorial interest in barren-ground caribou as a Valued Component, when compared to woodland caribou, there is currently not enough information available to identify a land use indicator that could be used to manage cumulative effects on summer and winter range. For that reason, woodland caribou were proposed as the most appropriate science-based Valued Component for immediate implementation.

5.4 RAISING AWARENESS: BENEFITS AND IMPLEMENTATION PRIORITIES

5.4.1 COMMUNICATING THE BENEFITS OF VALUED COMPONENT OBJECTIVES

Section 4 describes a number of key issues for cumulative effects management in general, and Valued Component objectives more specifically. It also discusses some of the ecological and administrative benefits of tiered management objectives and introduces tools that may have value for framework implementation in one or more regions of the NWT.

Valued Component objectives represent a fundamentally different approach to land and resource management. The current project-by-project management approach may not adequately protect sensitive resources where many effects overlap in space or time. In addition, the resilience of systems (their ability to adapt to change) may vary between years or over time. Resilience is likely to be lowest, and impacts greater, when stressors change rapidly. Taken together, there is a growing recognition around the world that environmental and social limits exist, whether defined in terms of absolute resource availability (e.g., water shortages), resilience, or limits of socially acceptable change. Valued Component objectives provide the best available tool to manage cumulative impacts.

It is important to note that Valued Component objectives as described here should be used to manage impacts and are not intended to be direct restrictions on development or growth per se. In fact, the implementation of limits can be a significant driver for innovation, as demonstrated by the evolution of low impact geophysical exploration technologies in western Canada.

This report also describes three concepts thought to be valuable for raising awareness of the need for Valued Component objectives:

- Dose-response relationships that provide a transparent approach for linking land use and human activity with the cumulative effects risk for each Valued Component.
- Tiered management objectives that link Valued Component objectives to risk-based mitigation, decision-making, and management and monitoring tools.
- A cumulative effects curve that shows how land use can increase cumulative effects risk little by little over time, and how early application of impact mitigation and other management measures can increase future land use opportunities.

The dose-response curve concept is discussed in Section 2.3.3.1 using woodland caribou as an example (see Figure 3). The relationship developed for woodland caribou relates population performance (growth or decline) to combined disturbance from fire and industrial land use. It was derived from up to 15 years of monitoring data, and provides a clear scientific foundation for establishing management objectives. Dose-response curves such as this should be developed for each Valued Component using best available information. This can include verbal descriptions based on traditional or local knowledge. Both monitoring- and knowledge-based approaches translate expertise into visual relationships that can be used to help communities, decision makers, managers and land users understand that ecological and social systems have limited capacities to accumulate impact. These curves therefore help describe risks and trade-offs in ways that can inform the debate about appropriate regional objectives.

The tiered management objective approach is described using woodland caribou as an example in Section 2.3.3.3 (see Figures 4 and 5). In this structure, objectives for 'Desirable', 'Acceptable', and 'Unacceptable' Valued Component status are related to three management and decision-making stages differentiated by pre-defined markers, targets and thresholds/limits (see Table 3 in Section 5.1). Section 2.3.3.3 describes how tiered management objectives can be established to address the scientific, political and administrative challenges described in Sections 4 and 5.1.1.

A cumulative effects curve is shown in Figure 7 in Section 4.2. This links dose-response curves and tiered management objectives to show how cumulative effects risk increases over time as a land use indicator (here disturbed area) becomes more pronounced. This curve provides the basis for evaluating how different management tools can change the slope of the curve over time so that impacts remain within acceptable conditions. The cumulative effects curve can also be used to model future scenarios under various assumptions about future land and resource uses, thereby allowing the benefits and costs of different approaches to be directly evaluated.

The generalized NWT-wide discussion and graphs presented in this report can be refined for each region using local examples to help build understanding and support for Valued Component objectives.

5.4.2 IMPLEMENTATION PRIORITIES

Implementation of an objectives-based approach to cumulative effects management in the NWT will signal the intention to integrate land and resource management in a way that reduces the risk of undesirable problems in the future. Experience with this type of system innovation in other jurisdictions suggests the following general principles for an implementation process (Weber et al., 2007):

- Start with a simple approach, adding complexity and learning as you go;
- Start with one or more pilot projects to introduce the concept and experiment with policy innovations;
- Involve all key players—while recognizing that there may be obstacles to consensus decision-making;
- Raise awareness of the problem, the policy objectives and the solution; and
- Keep the concepts simple and pay attention to the use of language.

Although the key decision-making processes for this approach are in place in some regions of the NWT, it will be necessary to consult with communities, land and resource managers, decision makers and land users in order to set management objectives and confirm implementation roles and responsibilities and tools for managing impacts.

The following implementation priorities were identified based on the stakeholder scan, feedback from the TAG and a review of other relevant initiatives and information. Each is described in more detail below:

1. Select one or more pilot study area(s) for an implementation trial;
2. Confirm the pilot Valued Components and indicators;
3. Generate a land use dataset for pilot study area(s);
4. Consultations and candidate Valued Component management objectives;
5. Define and test the management framework using scenario modeling;
6. Implement a non-binding trial in the pilot study area; and
7. Initiate or continue monitoring.

1. Select Pilot Study Area(s)

At least one pilot study is recommended in order to publicly introduce the Valued Component objective concept and develop and test administrative procedures. Stakeholders identified several criteria for selecting pilot study area(s): focus on issues with a sense of urgency, particularly locations with high resource development potential, such as the Beaufort–Mackenzie Delta and Mackenzie Valley; focus on areas with the greatest chance of success, such as areas where land use planning is under way or where there is leadership interest in applying this approach; and focus on political factors by implementing a study in each land claim area. All regions were proposed, but the Gwich'in Settlement Area was generally considered to have the lowest priority (Appendix B).

To help raise awareness, pilot studies are best conducted in areas where the probability of success is highest—based on interest and the presence of an appropriate study sponsor or political champion. For that reason, the Dehcho or Sahtu region is considered to be the most appropriate location for a Valued Component objectives pilot study. These regions were identified because land use planning is currently under way there, and the planning process provides a good foundation for raising awareness, consulting with all key players, developing initial objectives that can be implemented and revisited as part of the legislated land use plan development, and reviewing initiatives.

Initiation of a pilot study in the Sahtu region appears to have the highest chance of immediate success because the Sahtu Land Use Planning Board (SLUPB) supports this concept and has already initiated work to evaluate its applicability. The SLUPB convened a two-day workshop on objectives-based management in November 2007. A wide variety of stakeholders, including Sahtu community members, and representatives from government, industry and non-governmental organizations attended. There was a high degree of support from workshop participants for implementing management objectives in the Sahtu Land Use Plan. Many participants expressed the need to manage the cumulative effects of existing and proposed human activity on the environment and cultural values, and felt that management objectives could be used to help achieve the sustainable development vision of the Plan by guiding decision making on land and resource use (Holroyd et al., 2008).

Pilot studies in the Dehcho, Inuvialuit and Gwich'in regions should also be implemented if there is sufficient interest and a political or administrative champion for this work.

2. Adopt or Modify Valued Components and Indicators

To facilitate future discussions, the standard NWT suite of Valued Components and indicators and the priority Valued Components proposed in Section 3 should be reviewed and formally endorsed or modified by the NWT ESF. Priority Valued Components for each pilot study area should also be endorsed or modified by the sponsoring body. Environmental review bodies may also wish to make project proponents aware of the NWT suite of Valued Components and any candidate indicators and objectives.

3. Generate a Land Use Dataset

Information on required land cover, traditional land use and culture, and industrial land use needs to be compiled, updated and integrated for each pilot study area so that it can be used to report on current and future Valued Component indicator status. Industrial land use data are limited in many parts of the NWT, and specific work will probably have to be done to generate usable data. The NWT ESF information management initiative is well suited to co ordinate this work.

4. Consultations and Candidate Valued Component Management Objectives

Management objectives will need to be developed for the two priority Valued Components (Traditional Land Use and Woodland Caribou) in the pilot study area(s). Ideally, this should be an iterative process conducted as part of a land use planning consultation program. Where this is not possible, it will need to be overseen by a land or resource co-management body to ensure that all interested groups and individuals have an opportunity to participate.

All stakeholders contacted for this project felt that interested parties do not have a solid understanding of what management objectives are, nor of the process that would be used to develop and implement them. Plain language presentations and communications material (fact sheets, radio discussions, websites) should be prepared to explain the benefits of the results-based management approach in workshops and meetings, and to solicit feedback on values, interests, candidate objectives and administrative procedures. Maps should be used to show current conditions for each indicator.

Traditional use indicator objectives must be developed in consultations with potentially affected communities, ideally as part of a land use planning consultation process. For communities to participate meaningfully, the consultations must be facilitated by a group or agency with management or decision making responsibilities that could affect traditional land use.

Candidate management objectives for woodland caribou can be developed independently using best available science. Indicator status must be calculated in a standardized way to ensure that all land use proposals are evaluated consistently and fairly. Descriptive procedures on how to calculate and update indicator status should accompany the candidate targets; this is necessary in order to address the implementation issues noted in Section 2.3.3.4. These candidate objectives and procedures should then be refined through discussions with communities and traditional/local knowledge holders.

5. Define and Test the Management Framework Using Scenario Modeling

Experience with the Dehcho and North Yukon land use plans demonstrates that the economic and social implications of applying management objectives must be clearly communicated to stakeholders. This requires an understanding of the following: the process that will be used to set management objectives; the methods that will be used to calculate and report on indicator status; roles and responsibilities; the process to be used to allocate disturbance rights; the relationship between management objectives and management responses; review and permitting procedures for land use applications; and the compliance and monitoring program.

As an example, tiered objectives provide triggers for graduated management responses that are intended to bend the cumulative effects curve. This will maintain long-term flexibility without unnecessarily restricting development or exceeding management thresholds or regulatory limits. Figure 9 provides examples of graduated management responses for three main tool types: mitigation, decision making, and management and monitoring. Existing and proposed mitigation, decision-making, and management/monitoring tools will need to be described in detail for each Valued Component objective in each pilot study area.

Mapping is required to define current conditions for each indicator and provide benchmarks against which comparisons can be made. Scenario modeling is strongly recommended in order to understand the potential future outcomes of various land use decisions and management tools. Computer simulation models allow the status of economic, social and ecological indicators, such as hydrocarbon production, jobs and woodland caribou populations, to be forecast for different scenarios (i.e., sets of assumptions). They also provide a tool that helps various groups discuss their collective management vision in a clear, consistent way. This can be helpful in educating land users and decision-makers about what the Valued Component objectives framework means and in encouraging Aboriginal peoples' understanding and buy-in.

The ALCES® model was used by the North Yukon Planning Commission for this purpose. Land use scenarios were developed by technical experts to explore the results of probable energy, tourism and mining activities on regional landscape composition, wildlife, the economy and the status of proposed management objectives. Regional population and workforce were used as social indicators. The effects of various energy sector mitigation tools were also assessed based on best available information (NYPC, 2007). Modelling results were considered during the development of plan objectives and strategies (NYPC, 2008).

Modeling results and discussions with land users can be used to understand the projected social, economic and ecological benefits and disadvantages of various management objectives, ideally as part of land use planning consultations. Stakeholders should be asked to help refine the assumptions and procedures with their local and expert knowledge.

6. Non-binding Trial Implementation

Once a refined management framework is developed for a specific pilot area, it should be implemented on a trial basis by the appropriate land manager(s). The lowest risk approach would be for decision-makers and regulatory bodies to implement the framework in a non-binding way in parallel with the existing review and approval process for a preset period. This will allow both decision makers and applicants to understand the process, test design features and see whether or not using management objectives will affect project design, application costs, review times, decision support, and project approvals. Results of the parallel processes should then be compared so that any unintended administrative or environmental consequences can be resolved prior to formal implementation of the Valued Component objectives framework.

7. Initiate or Continue Monitoring

Monitoring should be initiated or continued in the pilot study area(s) as required in order to develop or test dose-response curves and confirm the influence of mitigation tools on Valued Component response. Opportunities to collaborate with the NWT CIMP should be investigated.

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APPENDIX A

BIOPHYSICAL VALUED COMPONENTS, INDICATORS AND OBJECTIVES RELEVANT TO ONSHORE HYDROCARBON CUMULATIVE EFFECTS IN THE NORTHWEST TERRITORIES

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1. AIR QUALITY

Air quality is used as a cumulative effects indicator in the NWT and is also recommended as aValued Component for assessing the cumulative effects of oil and gas activities (Table 1). The Government of the NWT has adopted ambient air quality standards to protect ambient air quality throughout the NWT (Table 2); these limits apply to selected pollutants established under the NWT *Environmental Protection Act* and are summarized in RWED (2002). NWT air quality standards are used to assess air quality monitoring results and to determine the acceptability of emissions from proposed and existing developments. Where NWT standards are not available for a particular pollutant, the Canadian National Ambient Air Quality Objectives or limits established by other jurisdictions are used (RWED 2002).

TABLE 1. PROPOSED AIR QUALITY INDICATORS FOR THE NWT.

Valued Component	Candidate Indicators	Rationale
Air Quality	Ground levelconcentration of regulated emission parameters listed inTable 2.	• Reflects cumulative effects of air emissions. • Air quality identified as valued resource in the DCLUP, ICCPs, and the GLUP. • Established standards exist for Total Suspended Particulates (TSP), fine particulate matter (PM 2.5 and PM 10), sulphur dioxide (SO2), ground-level ozone (O3), and acid precipitation (RWED 2002). • These parameters are routinely considered in project applications and accepted predictive models exist. • Provides a measure of local and sub-regional cumulative effects risk to air quality.

DCLUP – Deh Cho Land Use Plan;
ICCP - Inuvialuit Community Conservation Plan
GLUP – Gwich'in Land Use Plan

The rationale for selecting ambient air quality as a cumulative effects indicator is summarized in Table 1. The use of the same air quality indicators were also proposed by Dillon and Salmo (2006) for the Beaufort Delta Region, and by Salmo et al. (2004) for the Deh Cho Region.

Approved NWT ambient air quality standards shown in Table 2 and represent appropriate Management Thresholds for assessing the cumulative impacts of oil and gas activities. Project designs and regulatory approvals have been, and will continue to be, designed to maintain ambient air quality below these values. Consideration should also be given to the use of Management Targets below these Management Thresholds in areas where pristine air quality is identified as a management objective.

TABLE 2. NWT AIR QUALITY STANDARDS (RWED 2002).

Parameter	Standard (ug/m^3)*	Standard (ppbv)**
Sulphur dioxide 1 hour average 24 hour average Annual arithmetic mean	450 150 30	172 57 11
Ground level ozone 8 hour running average	127	65
Total suspended particulate 24 hour average Annual geometric mean	120 60	
Fine particulate matter ($PM^{2.5}$)	30	

* - micrograms per cubic metre ** - parts per billon by volume

2. WATER QUALITY AND QUANTITY

2.1 WATER QUALITY

Water quality is commonly used as a cumulative effects indicator (e.g., IORVL 2004; MRBB 2004). It is also given a high priority in the Inuvialuit Community Conservation Plans (ICCPs), Deh Cho Land Use Plan, and the Gwich'in Land Use Plan. Indicators for water quality are recommended because of the social and economic importance of high water quality in the NWT. The most common water quality indicators are the concentration of one or more parameters of interest such as turbidity (CCFM 1997), dissolved organic carbon (Schindler et al. 1992), nutrients (Hession et al. 1996; Cooke and Prepas 1998; Olson+Olson et al. 2002), biological quality (Dube et al. 2006), or contaminants associated with point sources (e.g., metals).

Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2007) identify guidelines for many water quality parameters (see Table 4). A recent study looking at water quality along the Athabasca River (Dube et al. 2006), found that the Canadian Water Quality Index (which aggregates information from individual indicators into an index) did not adequately reflect the changes in water quality occurring along the river – in part because phosphorus was the only component of the index that was measured consistently so it could be included in the index. Lumb et al. (2006) was able to compute the Canadian Water Quality Index for the Mackenzie River by using decadal time intervals – even though such long time interval lowered the numeric values of the Water Quality Index. Given the relatively pristine nature of this basin, likely existing and near-term development is unlikely to cause detectable cumulative effects on water quality in the Mackenzie River Basin. Dube et al. (2006) recommends that biological indicators such as benthos or fish be used as surrogates of cumulative effects on water quality in large systems where changes in physical or chemical parameters cannot be easily detected.

The rationale for selecting ambient water quality as a cumulative effects indicator is summarized in Table 3, and relevant water quality guidelines are provided in Table 4.

TABLE 3. PROPOSED WATER QUALITY INDICATORS.

Valued Component	Candidate Indicators	Rationale
Water Quality	Concentration of parameters listed in Table 4.	• Water quality identified as valued resource in ICCPs, NWT CIMP (DIAND 2003), federal reporting (NRTEE 2003), and Deh Cho (Salmo et al. 2004), and Beaufort-Delta (Dillon and Salmo 2006). • Reflects cumulative effects of industrial and municipal discharges and activities. • Established guidelines exist for many domestic and industrial discharges. • Water quality parameters are routinely considered in project applications and accepted predictive models exist. • Provides a measure of

VC – Valued Component ICCP – Inuvialuit Community Conservation Plan

TABLE 4. CANADIAN WATER QUALITY GUIDELINES FOR PROTECTION OF FRESHWATER AQUATIC LIFE (CCME 2007).

Indicator	Guideline	Comments
Aluminum:	5 µg/L 100 µg/L	pH ≤6.5 pH >6.5
Arsenic:	5 µg/L	
Cadmium:	0.017 µg//L	Must be adjusted for water hardness. See Eqn 1 in Fact Sheet.
Chromium: - Cr(VI) - Cr(III)	1.0 µg//L 8.9 µg//L	Freshwater
Copper:	2.0 µg//L 2.0 µg//L 3.0 µg//L 4.0 µg//L	Hardness 0-60 mg/L ($CaCO^3$) Hardness 60-120 mg/L ($CaCO^3$) Hardness 120-180 mg/L ($CaCO^3$) Hardness >180 mg/L ($CaCO^3$)
Cyanide:	5.0 µg//L	Free cyanide as CN
Dissolved Oxygen:	6.0 mg/L 5.5 mg/L 9.5 mg/L 6.5 mg/L	warm-water biota – early life stages – other life stages cold-water biota – early life stages – other life stages
Iron:	300 µg/L	
Lead:	1.0 µg//L 2.0 µg//L 4.0 µg//L 7.0 µg//L	Hardness 0-60 mg/L ($CaCO^3$) Hardness 60-120 mg/L ($CaCO^3$) Hardness 120-180 mg/L ($CaCO^3$) Hardness >180 mg/L ($CaCO^3$)
Mercury:	0.1 µg//L	
Nickel:	25 µg//L 65 µg//L 110 µg//L 150 µg//L	Hardness 0-60 mg/L (CaCO3) Hardness 60-120 mg/L (CaCO3) Hardness 120-180 mg/L (CaCO3) Hardness >180 mg/L (CaCO3)
Nitrogen: - ammonia (total) - nitrite - nitrate	32.4 mg/L 1.04 mg/L 60 µg/L	pH 6.5; temp. 10°C pH 8.0; temp. 10°C Avoid concentrations that stimulate prolific weed growth
pH:	6.5 to 9.0 (units)	
Phosphorous	No criterion available	
Selenium:	1 µg//L	
Silver:	0.1 µg//L	
Total Suspended Solids:	Max increase of 25 mg/L from background levels over 24 hour period. Max increase of 25 mg/L when background levels between 25 & 250 mg/L	Clear Flow High flow
Zinc:	30 µg/L	

The CCME guideline values in Table 4 represent appropriate Management Thresholds and project design and regulatory approvals should maintain water quality below these values. Appropriate Cautionary Markers could be based on the Guidelines for Canadian Drinking Water Quality (Health Canada 2008). Given the diverse natural spatial variability in water quality, it is important to account for such variability when setting objectives. It is recommended that monitoring be conducted at all approved discharges in order to document actual water quality and confirm impact predictions. Also because some water quality parameters naturally exceed the recommended Canadian water quality standards, site-specific monitoring would provide the data required to allow guidelines to be modified to reflect local conditions.

2.2 WATER QUANTITY

Water quantity was suggested as a Valued Component by several stakeholders contacted for the stakeholder scan. Large volumes of water may be needed for winter road and pad construction, industrial processes, and domestic use. Excessive water withdrawal, particularly during winter or summer low flow conditions can reduce minimum instream flows or waterbody volume and affect dissolved oxygen concentration, temperature, and the availability and suitability of fish habitat (Cott et al. 2008a,b).

Theoretical water withdrawal guidelines related to total depth and underice volume have been developed and applied by Department of Fisheries and Oceans in the NWT (DFO 2005). Research conducted in the NWT found that the effect of water withdrawals was variable and reflected lake basin characteristics. This work suggested that a maximum withdrawal threshold of 10% of underice volume, when coupled with precautionary mitigative measures, can be used with minimal risk to overwintering fish (Cott et al. 2008a).

The Instream Flow Incremental Methodology (IFIM; also known as Instream Flow Needs or IFN) models relate aquatic habitat availability to incremental discharge in flowing waters and are commonly used to evaluate project-specific or cumulative withdrawals from rivers and establish recommended minimum flows for protection of aquatic life. IFIM models require detailed sitespecific information to relate aquatic habitat values with changes in stream flow. Models can be aggregated over space and time to consider critical events such as droughts and floods (Stalnaker et al. 1995).

DFO guidelines represent appropriate Management Thresholds, where detailed site-specific modelling (e.g., IFIM) does not exist. Implementation of these guidelines should be flexible enough to accept recommendations from more detailed investigations.

3. SENSITIVE TERRESTRIAL FEATURES AND GENERAL HABITAT QUALITY

Both sensitive feature indicators and more general indicators of habitat quality have been recommended for management of cumulative impacts on land, vegetation, and terrestrial wildlife in the NWT (Salmo et al. 2003; Dillon and Salmo 2006). Sensitive features occur at both the local and landscape scales and include areas of particularly favourable or critical habitats - such as the Mackenzie River Delta Migratory Bird Habitat, seasonal caribou ranges or migration routes, and seasonally important den sites. Sensitive features tend to be rare in terms of their spatial extent, but extremely important for the maintenance of wildlife populations and biological diversity.

While such sensitive areas are critically important, the general or "non-sensitive" habitats that species use are also necessary for ecosystem integrity. Without adequate general habitat quality, wildlife species will be adversely impacted regardless of how well sensitive feature habitats are maintained. Thus, ensuring species long-term persistence requires metrics for both sensitive and general habitat components. Several recent reviews of ecological indicators and thresholds are relevant, although most have been developed for forested landscapes. Information on ecological indicators and thresholds applicable to the NWT are provided in Macleod (2002), Salmo et al. (2003), Dillon and Salmo (2006), and NYPC (2008).

In the scientific literature there is an ongoing debate (e.g., Hannon and McCallum 2004; Salmo et al. 2004) about the relative merits of sensitive feature (i.e., species specific) approaches and general habitat quality approaches. The major assumption underlying the single species-habitat approach is that it assumes that by meeting the specific habitat needs of a selected focal species, the habitat requirements for other species will also be met (Carignan and Villard 2002).

Alternatively, others have advocated that large-scale, general landscape indicators that capture broad landscape quality should be used because landscape composition and spatial patterns affect habitat quality, and ultimately species population dynamics (Franklin and Forman 1987; Andrén 1994; Dooley and Bowers 1998; Mönkkönen and Reunanen 1999; Fahrig 2001, 2002;

Schmiegelow and Mönkkönen 2002). We think that both approaches have merit in the context of the NWT and thus propose indicators that capture both sensitive features and more general landscape quality characteristics.

3.1 SENSITIVE FEATURE INDICATORS

Protection of sensitive environmental features is a clearly defined goal of many land-use plans (e.g., Inuvialuit Community Conservation Plans, Gwich'in Land Use Plan, Deh Cho Land-Use Plan). Such plans attempt to protect point features such as mineral licks, dens, wallows, nests, and rare plants; uncommon habitat features such as the Caribou Hills (Inuvik ICCP 2000) and Campbell Hills (GLUPB 2003); and designated areas such as Kendall Island Bird Sanctuary. Such specialized environmental features are commonly indentified and monitored using

projectspecific indicators to ensure that these important sites and areas are properly managed. Sensitive features (particularly protected areas), were identified as an important Valued Component during the stakeholder scan (Appendix B). Disturbed Area was recommended as the sensitive features indicator for the Dehcho and Beaufort Delta regions (Salmo et al. 2003; Dillon and Salmo 2006) and this appears to be appropriate for managing cumulative effects of onshore oil and gas activities in the NWT. Additional rationale for this indicator is provided in the generalized habitat indicator discussion below.

3.2 GENERALIZED HABITAT INDICATORS

General conservation guidelines reflect ecological principles such as the size of habitat patches that species require to survive, or the amount of habitat necessary for long-term persistence of native species (ELI 2003). General habitat quality indicators and objectives are a practical option for cumulative impact management because they can be readily quantified and are assumed to be biologically meaningful (Hill et al. 1997; Axys 2000). These general indicators can reflect the availability of specific habitat types (e.g., disturbance of each habitat type or quality class; MSRM 2004), or to measures of larger scale habitat patterns (e.g., proportion of area in forest cover and proportion of area in wetlands; NRTEE 2003).

A variety of generalized landscape-level metrics have been proposed and used to monitor or assess effects of habitat loss and fragmentation (e.g., Flather et al. 1992; McGarigal and Marks 1995; Mladenoff et al. 1995; Edenius and Elmberg 1996; Reed et al. 1996a, b; Miller et al. 1997; Tewksbury et al. 1998; Villard et al. 1999; Vos et al. 2001; Cumming and Vernier 2002; Gu et al. 2002; McGarigal and Cushman 2002). Total area disturbed has been widely used for land and resource management and recommended as a cumulative effects indicator elsewhere in the NWT (Salmo et al. 2004) and western Canada (MSRM 2004).

The advantages of ‘top-down’ generalized indicators such as total area disturbed are that: i) they can be more easily related to cumulative effects through the development of dose-response relationships using data from different areas encompassing a gradient of landscape changes without requiring season-specific evaluations of habitat quality; ii) they incorporate ‘time lags’ that are not apparent with short-term response studies; iii) they can be used to identify thresholds between acceptable and unacceptable conditions before the change actually occurs; and iv) they are easy to apply by review bodies and land managers. The main weaknesses of generalized indicators are that underlying mechanisms may not be apparent, so the value of mitigation measures is difficult to predict (Bayne et al. 2004).

The three generalized habitat indicators proposed (total area disturbed, core area, and corridor density) are discussed below.

3.2.1 TOTAL AREA DISTURBED

Total area disturbed is recommended as a candidate indicator to track the direct footprint of industrial and human activities and includes all forms of surface disturbance that could affect permafrost, plants and vegetation communities, wildlife habitat, or be perceived as a negative visual effect. One advantage of total area disturbed as an indicator is that, provided sufficient information is available, it can be calculated for specific terrestrial values (e.g., plant communities, focal species habitat), or designated areas (e.g., Conservation Zones defined through land use plans).

Disturbance and habitat objectives are generally outcome-based. However, given the relatively low levels of disturbance across the NWT presently, no single amount of existing available habitat is likely to represent a transition from an acceptable to unacceptable state. Instead, outcome-based targets may be established: i) based on our scientific knowledge of where rapid landscape-level changes in the size and isolation of habitat patches occur; ii) based on calculated risks to populations; or iii) using social preferences that incorporate both i) and ii) in addition to other factors. The implementation strategy presented in the accompanying report relies on the use of iii).

Theoretical and field investigations have identified so called 'critical thresholds' in the process of habitat fragmentation where changes in the size and isolation of patches occur (Andrén 1994; With and Crist 1995; Mönkkönen and Reunanen 1999; Fahrig 2001, 2002). As habitat becomes increasingly fragmented the likelihood of local extinctions increases. In remnant patches, even moderate habitat loss increases the extinction risk of abundant species, although there is a 50 to 400 year lag before this is predicted to occur (Tilman et al. 1994). However, recent research also suggests that some hypothesized habitat fragmentation effects - such as patch isolation and edge effects - have likely been overstated for boreal landscapes (Findlay and Houlahan 1997; Fahrig 2001, 2002; Crooks 2002; Schmiegelow and Mönkkönen 2002). For most species, habitat fragmentation effects do not occur when less than 10% of available regional habitat is lost. Cumulative effects risk increases at intermediate levels of habitat loss (30% to 40%), and increases dramatically when 70% to 90% of functional habitat in a region is lost (Andrén 1994; Rich et al. 1994; Fahrig 1997; Forman and Collinge 1997; Hannon 2000; Schmiegelow and Mönkkönen 2002, Price et al. 2007). Habitat specialists associated with localized or uncommon habitats or features (e.g., riparian shrub lands), and species with large area requirements (Schmiegelow and Mönkkönen 2002) or low resilience (Weaver et al. 1996; BCC 2003) are more sensitive.

Total area disturbed was identified as a cumulative effects indicator for the North Yukon (NYPC 2008), Dehcho (DCLUPC 2006), and Beaufort Delta regions (Dillon and Salmo 2006). Proposed tiered management objectives were also identified for these areas. The general risk ratings described above provide the scientific foundation for establishing management objectives. Because existing relationships between landscape change and environmental response are based largely on research conducted in forested landscapes, it is important that research into responses of land, vegetation and wildlife to habitat factors in barren ground and other non-forested landscapes (e.g., the Beaufort Delta) is used to develop management objectives.

3.2.2 TOTAL CORRIDOR DENSITY

Total corridor density is proposed as an indicator of cumulative effects risk to woodland caribou and other sensitive species in forested areas. Relationships between corridor density and population-level response have been developed for a number of focal wildlife species (see Section 4 below). Increasing access density has also been found to be correlated with a shift from native to non-native mammal communities in Alberta's boreal forest (Boutin and Bayne 2004).

3.2.3 CORE AREA

Core areas (core security areas) are portions of the landscape that are relatively undisturbed by direct and indirect effects of noise, vegetation alteration, and human-caused mortality or harvest. These are defined on the basis of wildlife reactions to various types or intensities of disturbances. Effects can occur where wildlife use areas immediately adjacent to man-made features differently from nearby areas of similar habitat. This is called an indirect footprint effect since the effect of the footprint extends to areas without the footprint, reducing overall habitat effectiveness. When multiple projects are occurring across the landscape, such indirect footprints can quickly lead to severe cumulative impacts and lead to reduced productivity, biodiversity, and species abundance.

In general, impacts are inversely related to the level and predictability of human activity. Animals may habituate to repeated or predictable disturbance that is perceived to be nonthreatening. Unpredictable high-intensity activities (e.g., motorized snow machines, powerboats, hunting, and aircraft fly-overs) cause greater response than low intensity continuous activities (e.g., stationary, constant motor noise). However, specific responses vary, and are complicated by many factors (Salmo et al. 2003).

The zone-of-influence around industrial, recreational, and community sites and activities depends (among other factors) on: the resource being considered; the nature of the disturbance; and the season. The proposed method for calculating core area in open landscapes is based on the assumption that indirect effects are confined to an area within 4,000 m of sites that have intensive human use or are highly visible (i.e., roads, industrial facilities, roads, above ground pipelines, operating well sites, active camps and staging areas, airstrips, active seismic programs, cabins and communities) (Nellemann and Cameron 1998). This zone of influence is considered conservative for most species and all seasons except nesting/birthing (Henson and Grant 1991; Monda et al. 1994). In forested landscapes of Canada, core security habitat for bears is normally assumed to be 500 m from roads or other high use features (e.g., Gibeau et al. 1996; ESGBP 1998; Axys 2001a; Kansas 2002). In open landscapes this distance will be increased because there are fewer visual barriers to provide security. In habitat models for Yellowstone Park grizzly bears, setbacks from roads and trails are two- to four-fold greater in open habitats (Weaver et al. 1996).

Core area was identified as a cumulative effects indicator for the Dehcho (DCLUPC 2006), and Beaufort Delta regions (Dillon and Salmo 2006). As discussed below in Section 4.1, a doseresponse relationship has also been developed for woodland caribou; this uses the inverse of core area, referred to as 'Industrial Footprint' as an indicator of population status. Subsequent

work has demonstrated that both core area and Industrial Footprint are highly correlated with total corridor density in the Western Canadian Sedimentary basin where linear features are a dominant land use (Antoniuk et al. 2007; S. Boutin, pers. comm.). Because of this, we recommend that total corridor density be used instead of core area because it is simpler to understand and compute.

TABLE 5. PROPOSED LAND INDICATORS FOR DIRECT AND INDIRECT FOOTPRINT IN THE NWT.

Valued Component	Candidate Indicators	Rationale
Sensitive Features	Area disturbed (ha and %) in unique vegetation communities, rare plants, mineral licks, dens, nests, nesting colonies; Pingo Canadian Landmark	• Can be calculated for specific terrestrial values where sufficient information is available (e.g., land-forms; plant communities, focal plant and wildlife species). • Reflects cumulative effects of habitat loss and alteration; complements generalized habitat indicators. • Routinely considered in project applications. • Provides measure of local, sub-regional, and regional cumulative effects risk for landforms, perma-frost, vegetation, and terrestrial wildlife. • Important areas and wildlife (e.g., caribou, grizzly bear, and geese) identified in regional land use plans.
General Habitat Quality	Total area disturbed (ha and %) of area disturbed by communities, camps, borrow pits, sewage lagoons, airstrips, military and industrial facilities, roads, pipelines, seismic lines.	• Reflects cumulative effects of habitat loss and alteration. • Can be calculated for specific terrestrial values where sufficient information is available (e.g., plant communities, focal wildlife species). • Provides measure of local, sub-regional and regional cumulative effects risk for permafrost, vegetation communities, and terrestrial wildlife habitat,
	Total corridor density (km/km2) of seismic lines, pipeline rights-of-way, and roads per square kilometre)	• Reflects both direct and indirect effects of habitat loss and alteration. • Can be used as measure of sub-regional and regional cumulative effects risk for all terrestrial wildlife and plant communities.

4. FOCAL WILDLIFE SPECIES

Appropriate species or guilds used for cumulative effects assessment and management are generally selected by considering the following criteria (adapted from Noss 1990):

- Importance (economic or social) of the species for hunting, fishing, traditional land use, or recreation
- sensitivity to potential development activities or early indicator of environmental stress or incremental demand on facilities and services
- importance in the food chain or for ecosystem function such as keystone species that are pivotal for the overall functioning of the ecological community
- special conservation status such as vulnerable species that may be rare, genetically impoverished, low fecundity, dependent on patchy or unpredictable resources, extremely variable in population density, or persecuted.
- ability to quickly and cost-effectively model the species' response to disturbance from existing data sources, and
- able to efficiently and cost-effectively monitor the species.

The following species have been consistently used as ecological indicators in the NWT (e.g., Geo-North and Axys 1997; DIAND 2003; EBA 2003; Paramount 2003):

- **Woodland and barren-ground caribou** *(Rangifer tarandus)*: species of concern; occasional traditional harvest species; associated with terrestrial lichen in forest and tundra; intolerant of human disturbance; very sensitive to overharvest and increased predation.
- **Moose** *(Alces alces)*: important subsistence and sport harvest species; associated with young to intermediate-aged boreal forest and subalpine habitat; relatively tolerant of human disturbance; moderately sensitive to overharvest.
- **American marten** *(Martes americana)*: important trapping species; associated with old boreal forest; relatively tolerant of human disturbance; sensitive to overharvest.
- **Grizzly bear** *(Ursus arctos)*: widely used umbrella species for regional assessment; associated with foothills and subalpine habitat; intolerant of human disturbance; very sensitive to overharvest.
- **Wolverine** *(Gulo gulo)*: require a year-round food supply in large, sparsely inhabited wilderness areas where large ungulates and carrion are abundant in winter from predation and natural mortality.

Thresholds literature reviews relevant to these species include: Axys (2000, 2001b, 2002) and Anderson et al. (2002) who reviewed indicators and thresholds for selected wildlife species in the Yukon; Salmo et al. (2003, 2004) who reviewed ecological indicators and thresholds for management of wildlife resources in the boreal forest and foothills of northeast British Columbia and the Deh Cho Planning region; and Dillon and Salmo (2006), who reviewed ecological indicators and thresholds relevant to wetland, barren-ground, and forested areas in the . Beaufort Mackenzie Delta region. Additionally, a literature review and meta-analysis of ecological indicators and thresholds applicable to land use planning is provided in ELI (2003).

Summaries of each species /indicator are provided in the following sections.

4.1 WOODLAND CARIBOU

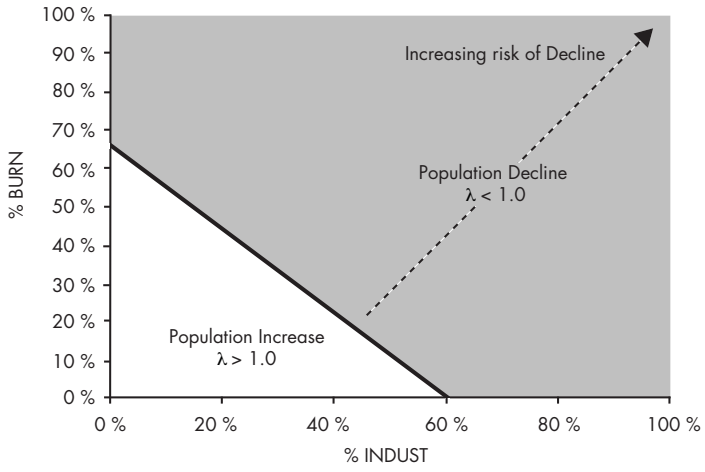
Woodland caribou have low ecological resilience and southern populations have declined precipitously over the last 40 years, concurrently with an increase in road access and industrial and recreational activities. These factors are believed to have resulted in a significant increase in mortality from wolves and hunters (Bergerud et al. 1984; Seip 1992; Culling and Culling 2001; Thomas and Gray 2002; McCutchen 2007). The challenge for woodland caribou conservation is to maintain sufficient quantities of suitable habitat through time in each range without inducing excessive predation and harvest pressure (Dzus 2001). Three indicators have been used, or proposed, for management of southern woodland caribou populations: corridor density; habitat effectiveness; and a regression equation developed for Alberta herds. An overview of these indicators is provided below; additional information is provided in Salmo et al. (2004).

Figure 1 provides the dose-response curve developed for woodland caribou herds by Sorensen et al. (2008). This curve relates the population growth rate (referred to as lambda or λ) of Alberta woodland caribou herds to two indicators within the herd's range. Population decline occurs where lambda is <1 (the shaded area) and growth occurs where lambda is >1 (the light area); lambda of 1 indicates that the population is stable – neither growing nor declining.

Sorensen et al.'s (2008) analysis showed that woodland caribou population growth rate can be predicted by two factors: the proportion of each herd's range burned in the last 50 years (Y axis in Figure 1); and the proportion of each range within 250 m of an Industrial Footprint (all types of clearings and corridors; X axis in Figure 1). When these two indicators exceeded 60% of the herd's range, either singly or in combination, population decline was observed; with the risk of decline/extinction increasing as one moves further from the 60% mark. This provides a clear scientific foundation for establishing management objectives in NWT woodland caribou ranges.

Figure 1.

Dose-response curve relating woodland caribou population persistence to Industrial Footprint and burned area (from Sorensen et al. 2008).



Some NWT stakeholders have criticized use of the dose-response curves provided in Figure 1 because it:

- is based on data from outside the territory;
- describes correlations rather than specific cause-effect relationships;
- does not provide definite land use thresholds or limits; and
- represents a generalized response that may not occur in every situation.

These criticisms generally reflect the polarized views mentioned earlier: those who believe that precautionary management actions should be implemented using best available information, versus others who maintain that problems and specific causes must be documented locally before they are addressed. Fundamentally, these views represent different degrees of risk tolerance, social values, or desired scientific certainty. Tiered objectives described in Section 2.3.3.3 of the attached report provide an effective and transparent approach to resolve these different views by documenting actual local responses at early stages of development and validating the doseresponse curves while risk levels and mitigation costs are low.

This dose-response relationship was recently re-evaluated by Dr. Stan Boutin of the University of Alberta for the Alberta Caribou Committee using data from more herds and more independent variables. Access density and burns (less than 30 years old) provided the best model of population response. Access density was used instead of Industrial Footprint because the two variables are highly correlated, and the access density indicator requires no assumptions about buffer width (S. Boutin, pers. comm.).

Available information thus indicates that woodland caribou population response in the NWT can be adequately indicated using either total linear corridor density or industrial footprint indicators. Approaches to developing specific management objectives for this indicator are described in the attached report.

4.2 MOOSE

Moose are highly sought after by subsistence and recreational hunters, and are abundant over much of the NWT, although infrequently observed on tundra landscapes. Densities are relatively low, ranging from 3 to 17 animals per 100 km2 (Graf 1992 in EBA 2003). Key factors limiting moose populations are:

- human-caused direct and indirect mortality (sport, subsistence and illegal harvest, increased predation risk, vehicle collisions),
- natural environmental and biotic factors (predation, tick infestations and disease, snow depth, natural succession), and
- habitat loss and alteration (clearing, fire suppression).

Moose have been shown to avoid human developments and activity, but response appears to vary by sex, season, and population. Reduced use has been documented near roads (Rolley and Keith 1980; Knight and Temple 1995), industrial activity (Penner and Duncan 1983; Morgantini 1984),

residences (Rolley and Keith 1980), and skiers (Ferguson and Keith 1982). Moose in hunted populations appear to display greater behavioural and physiological response to human activity than to vehicles or aircraft (Andersen et al. 1996). However, moose will move closer to sources of disturbance if alternate undisturbed habitat is not available (Rolley and Keith 1980).

A review of habitat availability and population thresholds applicable to moose in the Yukon is provided in Axys (2000). Cumulative effects indicators and thresholds have been infrequently applied to this species even though they have been intensively studied. This likely reflects the fact that moose populations are more sensitive to overharvest and other sources of mortality than to habitat loss and fragmentation. Thus, the available information including the case studies conducted in the boreal forest and foothills of northeast British Columbia (Salmo et al. 2003), indicates that habitat-related effects on moose in the NWT can be adequately managed using total area disturbed and total corridor density indicators.

4.3 AMERICAN MARTEN

American, or pine, marten are a small, commercially important furbearer found in boreal and subalpine forests. Marten are considered 'Secure' in the NWT (EBA 2003). The marten was selected as a wildlife indicator because it is an important furbearer, its requirement for mature forest cover, and its avoidance of open areas. These attributes make it a valuable indicator of environmental change. In addition, the species ecology has been studied throughout its range and field techniques have been refined to allow marten to be efficiently and cost-effectively monitored (Zielinski and Kucera 1996). The marten has been considered one of the most habitatspecialized mammals in North America (Buskirk and Powell 1994) and is absent from small forest patches (Chapin et al. 1998).

Research on marten's use of working forests has been conducted in a wide range of habitat types from Maine to Newfoundland, to western Quebec to Utah and California. Marten can tolerate clear-cutting within their home range, but various limits of habitat conversion have been observed. The abundance and availability of food may affect marten habitat use and productivity in both natural and disturbed landscapes (Lensink et al. 1955; Koehler and Hornocker 1977).

Logging or clearcutting extensive areas will reduce marten habitat and possibly prey availability. Marten tend to avoid small cutovers in the first year, and clearcuts up to 15 years old are poor habitat (Snyder and Bissonette 1987). Females avoid openings more than males (Thompson 1991). Low use of logged forests is due to deep snow in openings, lack of coarse woody debris and reduced cover resulting in predation on marten, particularly by raptors (Hargis and McCullough 1984; Thompson and Colgan 1994). In clearcuts, home range size increases, probably to ensure adequate resources in winter. Thompson (1994) found that marten density indices were 90% greater in uncut forests than in logged forests. Resident marten in uncut forests had higher mean ages, were more productive, and had lower natural and trapping mortality. Marten are also known to use regenerating clearcuts, but there is an indication that these habitats are mostly frequented by juveniles and in heavily trapped areas can function as populations 'sinks'.

In summary, marten are a habitat specialist with moderate reproductive potential and are relatively tolerant of human disturbance when habitat loss, hunting, and trapping are not limiting (Holyan et al. 1998). Available information indicates that habitat-related effects on marten can be adequately can be adequately managed using total area disturbed and total corridor density indicators.

4.4 GRIZZLY BEAR

Human-induced mortality is the proximate cause of population-level effects for most grizzly bear populations. This species is particularly sensitive to combined mortality from harvest and management actions because it has low ecological resilience (Weaver et al. 1996; Branigan et al. 2003; McLoughlin et al. 2003). Localized sources of bear mortality may affect the demographics of grizzly bears in the entire region.

Industrial activity substantially increases bear-human interactions that can lead to increased harvest and management kills to protect life or property, although it is difficult to correlate actual mortality with project-specific activities. McLoughlin and Messier (2001) studied population dynamics of barren-ground grizzly bear in the Slave Geological Province east of the sedimentary basins where oil and gas potential exists. They concluded that population declines could occur with comparatively small changes in mortality. Incremental grizzly bear mortality has been identified as key concern for oil and gas development in the Beaufort Delta region, but there is no recent information relating mortality to industrial activity intensity (IORVL 2004). All bears killed to protect life or property must be reported and taken off established community quotas. Bear harvest is currently near quota levels so any additional mortality from management actions is considered undesirable in the Inuvialuit Community Conservation Plans.

Grizzly bear industrial mortality was recommended as a candidate cumulative effects indicator for the Beaufort Delta region (Dillon and Salmo 2006). Their rationale was that this indicator should be relatively easy to track and relate to the direct and indirect industrial footprint. This will allow mortality from industry-associated sources to be tracked and combined with legal and illegal harvest statistics to document cumulative annual mortality for regional population management purposes. This project also recommended the use of general habitat indicators shown in Table 6.

TABLE 6. PROPOSED LAND INDICATORS FOR THE PREDATION AND HARVEST.

Valued Component	Candidate Indicators	Rationale
Grizzly Bear	**Grizzly Bear Industrial Mortality** Grizzly bear mortality from management actions, illegal kills by industry workers, other industry-related mortality, and legal harvest	• Overall grizzly bear population is relatively small, therefore requiring special monitoring. • Reflects cumulative effects of human-induced mortalities on grizzly bear populations • Can be combined with other sources of human-induced mortalities that are tracked and considered in established community quotas • Critical harvest thresholds already exist for grizzly bears • Provides measure of local, sub-regional and regional cumulative effects risk for grizzly bear populations
	General Habitat Quality - total area disturbed - core habitat available - total corridor density	Captures habitat quality as it relates to potential for bear-human interactions.

4.5 WOLVERINE

The wolverine is considered to be an important indicator of ecosystem health because of its dependence on large, connected and intact ecosystems. Wolverines inhabit a variety of treed and treeless areas across elevations and have home ranges that can be as large as 40-400 km2 for females and 230-1580 km2 for males (COSEWIC 2003). Its habitat requirements are best characterized in terms of an adequate food supply in large, sparsely inhabited wilderness areas – and not in terms of particular types of topography or vegetation (COSEWIC 2003). Wolverines do have specific habitat requirements for den sites – typically in boulders, under deadfall or snow tunnels and they may re-use denning sites over several years. Biological factors contributing to the wolverine's vulnerability include its large spatial requirements, natural low densities, low reproductive rates, and poor juvenile survival. Wolverine populations are vulnerable worldwide (COSEWIC 2003), while in the NWT the resident population is estimated to be between 3500-4000 (Slough 2007). The wolverine populations across the Northwest Territories are believed to be stable, but harvesting pressures and increasing levels of non-renewable resource development may lead to further habitat loss and fragmentation, which may adversely affect wolverine distribution and abundance in the future (COSEWIC 2003).

Wolverine fur is valued for its frost-resistant properties and First Nations peoples have viewed wolverines both as spiritual guides and relentless enemies and much folklore exists around its ferocity and cunningness. The fur trade statistics for the NWT are based on furs exported to fur auction and not total harvest and thus the harvest of many communities is likely underestimated.

However, land claim agreements in three settlement areas (Sahtu, Gwich'in, and Inuvialuit) all require harvest studies. All hunters and trappers in the communities are interviewed annually regarding their wildlife harvest. Harvests from the Sahtu region were reported to range from 5 to 12 wolverine (1998 to 2001; COSEWIC 2003) and in the Gwich'in settlement area the harvest ranged from 4 to 14 (Rose 2002). The Inuvialuit harvest ranged between 21 and 62 annually from 1986 to 2000, except in 1997 when the harvest by Inuvik hunters and trappers was estimated to be 62 wolverines, and the total harvest was 124 (0 to 5 in other years) (Fabijan 1991a, b, c, 1995a, b, c, d, 1996, 1997, 1998, 2000; Pinard 2001). The Government of the Northwest Territories is considering establishing a territory-wide wolverine carcass collection program to obtain better data on regional harvest levels (COSEWIC 2003).

Recent work looking at the predictors of wolverine presence/absence at both the landscape and sub-basin scale indicated that the best predictors were the amount of intact habitat or the amount of intact habitat coupled with road density (Rowland et al. 2003). This focus on intact habitat agrees with the conclusion of others (e.g., Carroll et al. 2001; COSEWIC 2003). Thus, habitat effects on wolverine in the NWT can be adequately managed using the generalized indicators described earlier: total area disturbed, available core habitat, and total corridor density. Wolverine industrial mortality is also recommended as an indicator to allow oil and gas contribution to mortality to be tracked.

5. AQUATIC INTEGRITY AND FOCAL FISH SPECIES

Cumulative effects on watersheds can result from the accumulation of small routine activities or from changes in dominant watershed processes (Collins and Pess 1997). Studies in western North America have shown that clearings and road and trail networks created for resource extraction can create direct and indirect effects on flow rates, patterns, sediment yield, stream habitat, invertebrates, and fisheries (Furniss et al. 1991; McGurk and Fong 1995; Trombulak and Frissell 2000). Several models and indicators have been developed to describe these effects.

Investigators in Alberta, British Columbia, and the northwest United States have developed watershed assessment techniques that use indicators to evaluate the potential for reduced aquatic integrity in a watershed due to effects of combined land use. Most cumulative effect techniques consider disturbed area, potential for sediment yield, water quality, or changes in probable peak flow and channel characteristics (Salmo et al. 2003). The British Columbia Level I Interior Watershed Assessment Procedure (IWAP) is an example of an indicator model. This procedure used 13 indicators calculated as part of reconnaissance level analysis to examine the potential for cumulative effects due to past or planned forest harvesting (BCFS and BCE 1995). Indicators were ultimately used to generate 'hazard levels' for peak flow, erosion, riparian condition, and landslides. IWAP results from 1,400 sub-watersheds were reviewed by Carver and Teti (1998, in Carver 2001 and Chatwin 2001).

They found that the distribution of hazard scores was reasonable and conservatively segregated watersheds into no problem and possible problem groups. It was also inexpensive, consistent,

and repeatable (Chatwin 2001). While individual indicators have poor predictive power, especially when applied to large geographic areas with variable geological, climatic, and hydrological conditions, they do provide useful and consistent information about the risk of cumulative effects on aquatic integrity (Collins and Pess 1997; Carver 2001; Chatwin 2001).

As with terrestrial ecosystems, both sensitive feature indicators and more general indicators of habitat quality have been recommended for management of cumulative impacts on aquatic habitat, organisms, and fish in the NWT (Salmo et al. 2003; Dillon and Salmo 2006). Olson and Olson et al. (2002) reviewed watershed indicators applicable to the oil sands area of Alberta, and these are also relevant to the NWT.

5.1 TOTAL AREA DISTURBED

Watershed clearing and disturbance also affects aquatic cumulative effects risk. Cleared or disturbed areas may affect stream flow and water quality (Troendle and King 1985; Nip 1991; Minshall et al. 1997) and cause declines in fish abundance or distribution (Moscrip and Montgomery 1997; Wang et al. 1997; Pess et al. 2002; Scrimgeour et al. 2003; McLeary 2004). The Equivalent Cleared Area (ECA) index has been used to identify watersheds with increased risk. ECA calculations include all areas that have been harvested, cleared, or burned with factors applied to account for hydrological recovery due to vegetation regrowth, regeneration, or harvest system. Hazard levels assigned in the BC IWAP (BCFS and BCE 1995) for total area disturbed were:

- Low: 0-18% cleared;
- Moderate: 18-36% cleared; and
- High: >36% cleared.

5.2 TOTAL CORRIDOR DENSITY

Corridor density appears to be one of the most useful watershed cumulative effect indicators for aquatic systems (BCF 1999; Bauer and Ralph 2001; Carver 2001).

Road densities greater than 2.5 km/km2 were reported to increase sediment yield in a forested coastal watershed (Cederholm et al. 1981). The BC IWAP (BCFS and BCE 1995) rated aquatic access corridor hazard as:

- Low: <0.9 km/km^2;
- Moderate: 0.9 to 1.8 km/km^2; and
- High: >1.8 km/km^2.

Quigley et al. (1996) rated overall aquatic risk for the Columbia river basin as:

- Very Low: 0 to 0.06 km/km^2;
- Low: 0.06 to 0.4 km/km^2;
- Moderate: 0.4 to 1.1 km/km^2;
- High: 1.1 to 2.9 km/km^2; and
- Very High: >2.9 km/km^2.

Bull trout populations were seven times more likely to be strong in watersheds with road densities less than 1.55 km/km2 (Rieman et al. 1997); road density less than 1.5 km/km2 was recommended to protect bull trout (BCF and MELP 1999).

In general, adverse cumulative effects on fish and aquatic environments appear to occur at high corridor densities than for terrestrial species or habitat. This reflects the indirect link between linear corridors and waterbodies (Salmo et al. 2003). Because of this, total corridor density management objectives set for terrestrial Valued Components will also protect all but the most sensitive aquatic Valued Components.

5.3 RIPARIAN DISTURBANCE

Riparian areas include the banks and slopes next to streams, lakes and wetlands that are affected by elevated soil moisture for at least part of the year. These riparian areas protect water quality, stabilize stream banks, regulate stream temperature, and provide a continuous source of plant debris, nutrients, and food organisms (BCF 1999). Clearing of riparian areas can lead to increased bank erosion, altered summer temperatures, and winter icing (Armour et al. 1994; BCFS and BCE 1995). Riparian habitat can also be altered by deliberate or inadvertent introduction of non-native vegetation that alters substrate, banks, or trophic relationships.

Riparian are conditions have been used as indicators of both cumulative land use and waterbody integrity because this influences species presence, distribution, and abundance at both local and watershed scales (e.g., Platts 1991; Waters 1995; Roth et al. 1996; Jones et al. 1999, Cows and Fish nd). Aquatic ecosystem integrity is lower in coldwater streams with reduced riparian vegetation (Hughes et al. 2004). A negative relationship between watershed disturbance and sensitive native species has been observed elsewhere (Eaglin and Hubert 1993; Frissell and Bayles 1996; Wang et al. 1997, 2003). Several watershed and riparian metrics were included in the BC IWAP (BCFS and BCE 1995), and riparian indices were found to be the best predictors of waterbody condition (D. Toews pers. comm.).

A riparian disturbance indicator (number of stream crossings per subwatershed) was recommended for cumulative effects management in the Dehcho region (DCLUPC 2006). Management objectives based on BC IWAP hazard ratings were identified. This indicator is an easily calculated measure of sediment and mortality sources and stream habitat fragmentation in a watershed (Salmo et al. 2004).

5.4 FISH MORTALITY

Sportfish abundance was a cumulative effects indicator used for the Mackenzie Gas Project (IORVL 2004) and has also been used as a cumulative effects indicator in other watersheds (e.g., McLeod River sub-basin in west central Alberta - Allan 1999). Caution must be applied when considering combined sportfish abundance without identifying which species are likely to increase or decrease as a result of changes in water flow, habitat quality, or improved access and increased angling pressure (Antoniuk 2000). To address such concerns, some investigators have used fish community assemblages (e.g.: native and non-native assemblages – Antoniuk 2000;

fish community structure – Scrimgeour et al. 2003); species-specific indicators such as bull trout (e.g., Scrimgeour et al. 2003; Ripley et al. 2004; Popowich and Volpe 2004); or several focal species (e.g., Arc 2005).

Although fish abundance, biomass and distribution can all be used as indicators for cumulative effects, these parameters are typically influenced by year-to-year (as well as seasonal) variation in fish populations, and long-term trend data is generally needed to distinguish differences between natural year-to-year variation and variation caused by a specific project. There are also large numbers of migratory species. Predators such as nearshore marine mammals, avian predators, and humans may respond differently to changes in habitat or other human-caused impacts (e.g., some species may increase due to changes in habitat or fishing pressure while others may decrease – Antoniuk 2000). Thus, without adequate baseline datasets, fish abundance cannot be recommended as a project-specific cumulative effects indicator. However, regionally the use of such species does make sense. Proposed freshwater indicators for harvest and predation and their rationale are described in Table 7.

TABLE 7. PROPOSED FRESHWATER INDICATORS FOR HARVEST AND PREDATION.

Valued Component	Candidate Indicators	Rationale
Focus Fish Species	**Char Industrial Mortality** (number of lake trout and Dolly Varden mortalities caused by all industry-related causes in addition to legal/illegal harvest)	• Reflects cumulative effects of human-induced mortalities on fish populations. • Can be calculated based on numbers provided through existing sources of fish harvest data and information from fish research licenses and Section 32 authorizations. • Critical harvest thresholds already exist for some fish species • Provides measure of local, sub-regional and regional cumulative effects risk for fish populations

For most species, the co-management boards do not restrict the total allowable harvest (e.g., inconnu – FJMC et al. 2000). However, for some species or stocks which are considered at risk, management plans have been developed (e.g., Rat River Dolly Varden population). Workshop participants involved in the Beaufort Delta Cumulative Effects project (Dillon and Salmo 2006) indicated that similar concerns exist for lake trout. Sustainable harvest levels of slow-growing northern lake trout populations are <0.2 kg/ha/year (M. Sullivan, pers. comm.) which lead to a conservative suite of candidate thresholds being proposed for industry-associated mortalities of char species in the Beaufort Delta Region.

Estimates of industry-related char mortality should include mortality attributable to all activities (e.g., oil and gas, mining, forestry and transportation) as well as the commercial fishing industry (e.g., fishing lodges and guides and any other commercial fishing activity in the future). These industries would be required to report all char mortalities as well as captured and released char.

This would allow mortality from industrial-associated activities to be tracked and combined with legal and illegal harvest statistics to document cumulative annual mortality for regional population management purposes.

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APPENDIX B

STAKEHOLDER SCAN

SUMMARY OF STAKEHOLDER COMMENTS
WRITTEN SURVEY GUIDE
TELEPHONE INTERVIEW GUIDE
WRITTEN SURVEY RESPONSES
TELEPHONE INTERVIEW RESPONSES

Susan Davis Schuetz, Rob McManus and Kathryn McKinnon
Fulcrum Strategic Consulting

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1. SUMMARY OF STAKEHOLDER COMMENTS

1.1 BACKGROUND

The consultant team (RMC & Associates) undertook two approaches to gather perspectives from representatives within the energy industry, regulator, resource management, academic, environmental and aboriginal sectors for the purposes of supplementing the literature review as well as informing the strategic scan and recommended implementation plan. First, a written survey was used to collect as many opinions as possible on Valued Components, indicators and thresholds from both a conceptual and implementation lens. Second, structured telephone interviews were conducted to gather more detailed feedback on potential challenges and opportunities in using Valued Components, indicators and thresholds in the Northwest Territories (NWT).

The written survey was sent by e-mail to forty written survey candidates from the Chair of the Technical Advisory Group (TAG). Twenty-one written surveys1 were completed between January 20 and February 28, 2008 and included written submissions from the following sectors:

- 6 energy industry representatives;
- 4 regulator representatives;
- 8 resource manager representatives;
- 1 Environmental Non-Governmental Organization (ENGO) representative; and
- 2 Aboriginal representatives.

The Consultant Team also contacted seventeen interviewee candidates a minimum of three times by e-mail and/or telephone in an effort to schedule a telephone interview. Fourteen structured telephone interviews were conducted between January 29 and February 11, 2008. One-on-one interviews were completed with the following sector representatives:

- 4 energy industry;
- 3 regulator;
- 4 resource manager;
- 1 ENGO; and
- 2 Aboriginal representatives.

With the exception of two energy industry representatives who spoke on behalf of the Canadian Association of Petroleum Producers (CAPP), study participants were sharing their own perspectives versus those of their respective organizations.

[1] All fourteen telephone interviewees completed the written survey during the telephone interview.

The following is a high-level summary of study participants' responses. For more detailed information on these perspectives, please refer to the attached tables titled Written Survey Responses and Telephone Interview Responses respectively.

1.2 CONCEPTS OF USING VALUED COMPONENTS, INDICATORS, AND THRESHOLDS IN THE NWT

All the regulator, resource manager, Aboriginal and environmental study participants conceptually supported the use of Valued Components, indicators and thresholds. Out of the six industry study participants, four opposed their use, one was unsure and one did not support the use of Valued Components, indicators and thresholds because they believed there was insufficient scientific information available to set objective, quantitative measurements.

Industry study participants2 who opposed to the use of Valued Components, indicators and thresholds shared that:

• the energy industry is already highly regulated and as such, the use of Valued Components, indicators and thresholds is not needed;
• the setting of additional limits will only restrict development;
• the growth of the NWT regulatory system should be commensurate with the growth of development;
• additional limits will only facilitate industry 'first-in' mentality;
• the use of thresholds only serves to reduce flexibility in the system; and
• one cannot rely on a limit to manage something that is far broader and complicated.

Supporters indicated that conceptually, the use of Valued Components, indicators and thresholds would:

• provide a proactive approach to managing risks to Valued Components;
• better facilitate sustainable development;
• provide the justification for undertaking additional, much needed research;
• facilitate more informed regulatory decision-making;
• encourage industry innovation; and
• allow for adaptive management to accommodate landscape, technology, scientific information and stakeholder value changes.

Every study participant believed that all interested parties did not have a solid understanding of the concept or use of Valued Components, indicators and thresholds.

[2] CAPP respondents did indicate they were open to the use of 'markers' to mange risks to Valued Components. Unlike a threshold or limit, a 'marker' would not be a regulatory requirement. A 'marker' would be more like a clue to provide insight as to what is happening and whether more attention was required.

1.3 IMPLEMENTING VALUED COMPONENTS, INDICATORS AND THRESHOLDS IN THE NWT

NWT Valued Components

Embedded in the written survey tool was a list of eight Valued Components: Air Quality, Water Quality, Sensitive Features & Habitats, Focus Wildlife Species, Focus Fish Species, Traditional Culture & Land Use, Community Well-being and Economy & Business. Study participants were asked if this list was complete and if it was not, what Valued Components they believed were missing. The majority of respondents indicated it was a difficult question to answer because the Valued Components had not been defined. Approximately fifty percent of the study participants believed the list complete. Those respondents that did not believe the list to be complete added the following Valued Components.

- **Industry:** local community economic benefits; quality of life & sustainable infrastructure; soil; ground water; a legal Valued Component given the manner in which Valued Component had been defined; and a political Valued Component given the manner in which Valued Component had been defined.
- **Resource Manager:** vegetation; permafrost; protected areas; GHG emissions; climate change; ecological integrity; and ice.
- **Aboriginal:** water quantity.

It appears clear from the study participants' responses there was some confusion as to what is a Valued Component versus what is an indicator.

Prioritizing Valued Components for the NWT

Eleven out of twenty-one respondents believed that in the context of the NWT, some Valued Components were a higher priority than other Valued Components. Two respondents shared that Valued Components should not be prioritized; rather the focus should be on finding a balance between environmental, social and economic interests. Three respondents believed all Valued Components were of equal importance and the remaining five study participants were challenged to answer the question given the inherent relationship that exists between the Valued
Components. Table 1 below illustrates eleven study participants' opinions on which Valued Components should be a priority in the NWT.

TABLE 1. OPINIONS OF STUDY PARTICIPANTS ON WHICH VALUED COMPONENTS SHOULD BE A PRIORITY IN THE NWT.

Valued Component[3]	Industry	Regulator	Resource Manager	ENGO	Aboriginal
Air Quality	✓	✓	✓		✓
Water Quality	✓	✓	✓		✓
Water Quantity					✓
Sensitive Features & Habitats		✓	✓		
Focus Wildlife Species	✓	✓	✓		✓
Focus Fish Species			✓	✓	✓
Traditional Culture & Land Use	✓		✓	✓	✓
Community Well-being					✓
Economy and Business					
Local Community Economic Benefits	✓				
Quality of Life/ Sustainable Infrastructure	✓				

Study participants shared the following challenges to prioritizing Valued Components:

- obtaining agreement on priority Valued Components would be difficult given the different competing interests (although there was more consistency than study participants thought there would be);
- there are inherent relationships between the Valued Components and as such, it will be a challenge to unbundle them for the purposes of identifying priorities;
- one Valued Component may apply to one region and not another and as such, there is a need to set priorities at a region or sub-region level
- some Valued Components will be easier to define than others; and
- cross cultural communication issues exist in that often industry does not understand elder priorities.

Having said this, the majority of respondents believed that regardless of any potential challenges, identifying priority Valued Components would be beneficial because to do so would:

- create a more manageable process;
- channel resources into values that are most important;

[3] Local Community Economic Benefits and Quality of Life/Sustainable Infrastructure were added to the original list of Valued Components by one industry study participant and subsequently ranked as a priority. Water Quantity was also added to the original list of Valued Components by an Aboriginal representative and was subsequently ranked as a priority.

- be a good indicator of a rapid change in current conditions; and
- allow the process to mature –start small, build success, build stakeholder confidence.

Use of Thresholds / Limits to Manage Valued Components

The majority of study participant were consistent in their responses when asked to identify potential challenges with the setting of limits or thresholds for the purposes of managing risks to Valued Components. Respondents indicated it would be a challenge to:

- obtain agreement to use thresholds;
- obtain agreement on the limit itself;
- have sufficient scientific and traditional knowledge information to support or defend thresholds;
- find a numerical value for all Valued Components;
- unbundle the inherent relationships that exists between the Valued Components sufficiently enough to identify a threshold;
- coordinate the numerous jurisdictions that would need to be involved in developing limits;
- resource the process of setting limits in terms of cost and capacity; and
- prevent industry 'first-in' mentality.

However, the majority of respondents indicated that regardless of any potential challenges, setting limits would be beneficial because to do so would:

- provide a proactive, preventative tool to facilitate more responsible resource and environmental management;
- better support and align with Aboriginal communities' desire for sustainable4 development;
- produce a regulatory system that was more clear and transparent;
- facilitate improved decision-making; and
- encourage innovation.

The use of a tiered thresholds approach was seen to have additional benefits because this approach would:

- likely facilitate stakeholder buy-in;
- provide the signal when additional research was required;
- better condition interested parties to think about issues and manage them proactively (e.g., modify project plans, develop new technologies, etc); and
- help to focus resources more proactively.

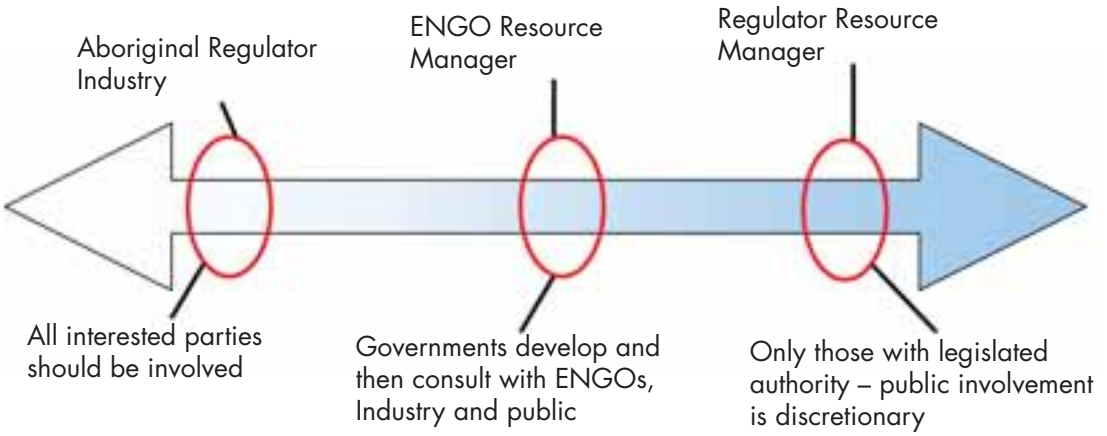
Study participants were also asked to share their perspectives as to how thresholds should be developed. Again, responses were varied not only between, but within sectors.

[4] It is important to note that Aboriginal respondents expressed concern about the impact that the pace of development has on their culture – their way of life. These respondents support the use of thresholds (incorporating science and traditional knowledge) as a tool to better manage these two interests.

- **Industry:** carefully, sensitive to divergent interests; use of science only to inform limits.
- **Regulator:** use both science and intuition depending on Valued Component; thresholds should be set via precedent and only changed when new information comes in.
- **Resource Manager:** develop all thresholds in the same manner using existing environmental information and best available technology; develop only limits that are doable; use science to develop the baseline and then identify socially and culturally acceptable targets; use the land use planning process; identify priority Valued Components, engage in a literature review, engage all interested parties and practice adaptive management.
- **ENGO:** use land use planning process; develop limits collectively.
- **Aboriginal:** use land use planning process; develop limits collectively.

When asked who should be involved in developing thresholds, study participants' responses were mixed. As Figure 1 illustrates, answers ranged from everyone should be involved to only those with legislated authority should be responsible for setting thresholds.

Figure 1.
Study participant response to 'who should be involved in setting thresholds'.



Priority Regions in the NWT

When asked if there are any priority regions in the NWT where the use of Valued Components, indicators and thresholds were of a higher priority, study participants answers were varied both within and between stakeholder groups. Responses, organized by sector, are noted below.

- Industry: only culturally sensitive areas; and Inuvialuit Settlement Region (ISR).
- Regulator: criteria used to determine priority regions should be degree of development pressures and/or areas where Valued Components are nearing or currently at threshold levels; and only local communities should set priority regions with other parties' input.
- Resource Manager: criteria used to determine priority regions should be degree of development pressures and/or areas where Valued Components are nearing or currently at threshold levels; McKenzie Delta; McKenzie Valley; Deh Cho region; Sahtu region; and Beaufort-Delta.

- ENGO: land use plan should be the vehicle and as such priority regions should be Deh Cho and Sahtu.
- Aboriginal: ISR; culturally and ecologically sensitive areas; and no priority regions should be identified because to focus on one region over another would only serve to fracture the NWT community.

However, a number study respondents believed there was an opportunity to use land use plans as the vehicle for implementing Valued Components, indicators and thresholds because these plans already contain thresholds that have incorporated both local community and scientific information.

Regulatory and Administrative Barriers

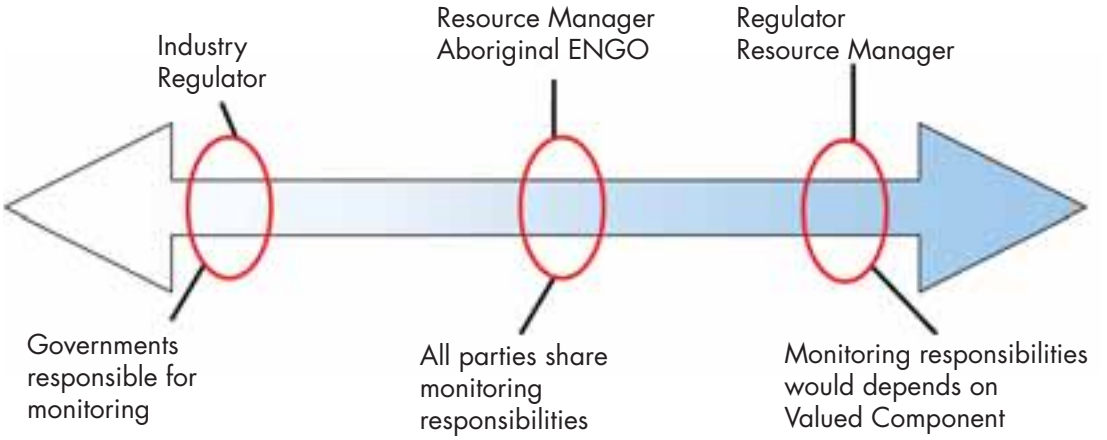
Study participants shared a number of perceived regulatory or administrative barriers to implementing the use of Valued Components, indicators and thresholds. Barriers raised by respondents included:

- regulator uncertainty as to how to put thresholds into practice;
- current regulatory project-by-project structure coupled with the use of thresholds would facilitate 'first-in' industry mentality;
- application process would require restructuring to accommodate industry review and assessment of thresholds;
- the considerable amount of funding that would be required;
- current lack of northern / community capacity;
- the fragmentation of responsibilities that exists today such that a regulator is not allowed to consider all Valued Components;
- uncertainty regarding liability if one ignores a threshold;
- data management including coordination, integration, access to and monitoring;
- uncertainties along with capacity related to monitoring and enforcement;
- differing Land & Water Board philosophies; and
- possibility that quantitative limits will become the number Resource Managers will live by – lack of flexibility to accommodate context presented.

When asked who should be responsible to monitor for the purposes of updating land and resource information used to track conditions relative to management thresholds and confirm the application and effectiveness of these thresholds, study participants provided a variety of perspectives (Figure 2).

Figure 2.

Study participant response to 'who should be responsible for monitoring /updating land and resource information'.



Regulatory and Administrative Opportunities

While a number of possible regulatory and administrative barriers to implementing thresholds were raised, study participant also believed there a number of opportunities that exist. Many respondents commented on a time-limited opportunity - the NWT is ideal to implementing thresholds now because there is not a currently a high level of development. Too, the majority of respondents believed that the use of thresholds would lead to better decision-making because there would be more information upfront in the process. Other opportunities and/or benefits raised by study participants included:

- having more information upfront in the process may lead to regulatory efficiencies / streamlined processes;
- there is the option of building on the Cumulative Effects Assessment and Management Framework (CEAMF) central data portal;
- implementing thresholds would provide the needed catalyst for the development of other land use plans which in turn would allow Valued Components to be incorporated in the planning process;
- all parties would have a better understanding of those areas that are of high value to Aboriginal peoples;
- would be better able to meet the objectives laid out in the McKenzie Valley Resource *Management Act*;
- industry will likely acquire greater clarity and certainty; and
- relationships will be strengthened by having people work together.

1.4 STUDY PARTICIPANTS' RECOMMENDATIONS

1. Get started

The majority of study participants believe there has been enough 'talking' about the use of Valued Components, indicators and thresholds and it is time to take action.

- People learn by doing.
- Implement the use of thresholds in development decisions.
- Move forward while being aware of the potential challenges. There will never be the perfect scientific knowledge.
- Focus on the 80%.
- Use a combination of science and intuition.
- Use available environmental information and best technology.
- Use the implementation of Valued Components, indicators and thresholds to drive the development of much needed land use plans in other regions of the NWT.

2. Adopt an adaptive management approach

Adopt a cautionary or flexible approach where there is uncertainty with limits. Ensure there is sufficient flexibility to accommodate changing landscapes, technology, scientific information and values.

3. Start small

Recognizing limited capacity and resources as well as some stakeholder hesitation, start small and build success, which in turn will build stakeholder confidence.

4. Leverage off of existing work

Use existing land use plans as the vehicle for implementing Valued Components, indicators and thresholds.

- Adopt the Indian and Northern Affairs Canada approach to managing information – one portal.
- Use the existing CEAMF to build integration and cooperation.
- Consider using existing organizations in the process – Land & Water Boards.
- Use thresholds that have been identified but not adopted yet.

5. Adopt a collaborative approach

Involve all interested parties (degree of involvement varied between study participants) in the process.

6. Educate

- Demonstrate that the current context has a need for the use of Valued Components, indicators and thresholds to all stakeholder groups.
- Communicate the benefits of using Valued Components, indicators and thresholds in

managing all interests more proactively. There is a real opportunity to think about tomorrow today.
- Education needs to include the message that thresholds can be set with limited information and can change over time.
- Education needs to occur at the Aboriginal community level to facilitate Aboriginal peoples' understanding and buy-in.
- Explore a variety of mediums to educate all parties on the benefits and use of Valued Components, indicators and thresholds: informal dialogue; workshops, presentations, website, information meetings, fact sheets, radio discussions, television, etc.
- Education needs to be ongoing.

2. WRITTEN SURVEY GUIDE

ESRF VALUED COMPONENT THRESHOLDS PROJECT
PROJECT OVERVIEW

The potential for new and ongoing developments to result in adverse cumulative effects is of increasing concern in the North, as in other parts of Canada. Assessing, minimizing, and managing potential adverse cumulative effects has been the subject of a number of studies, but more definitive information on "Valued Component Thresholds" relevant to the oil and gas industry in the Northwest Territories is required.

The Environmental Studies Research Fund (ESRF) is sponsoring a project to:

- Identify the needs, benefits, opportunities, and challenges of developing Valued Components, indicators, and thresholds in the Northwest Territories;
- Review the status of current Valued Component thresholds and their use in resource management and cumulative effects management generally;
- Raise awareness of the need for Valued Component thresholds and the priorities for an implementation strategy; and
- Identify the Valued Component thresholds that are of highest priority to assist existing resource management Boards in their respective decision making – now and in the immediate future.

Valued Components are defined as "an aspect of the environment that is considered important on the basis of economic, social, cultural, community, ecological, legal or political concern". (e.g., sensitive features and habitats)

Indicators are defined as 'a characteristic of the social or ecological setting that is used to describe, measure, manage, and report on Valued Components'. (e.g., proportion of a region where ground is disturbed at any point in time)

Management thresholds (also referred to as limits or targets) are defined as 'a point at which an indicator changes to an unacceptable condition, with acceptability defined either from an ecological or social perspective'. (e.g., no more than 10% of a region disturbed at any point in time.

We have been asked to look at the concept of tiered thresholds as an implementation approach. **Tiered**

thresholds are a series of progressive thresholds that reflect increasing degrees of concern or risk. Tiered thresholds were originally developed to manage deposition of air pollutants. This approach provides an integrated framework that relates two or more quantitative thresholds to appropriate management and regulatory responses.

Critical threshold – a science-based target reflecting the maximum amount of development that an environmental or social system can support without long-term harm. When this threshold is reached or approached, restrictive management practices are formally adopted to reduce risk.

Target threshold – a politically defined goal of the total amount of development that is desirable and provides adequate long-term protection to the environment or resource of interest in a defined region. This threshold is more protective than the critical threshold to provide a margin of safety. When this threshold is reached, enhanced management practices are formally adopted to reduce risk or increase understanding of the system.

Cautionary Threshold – a threshold established to indicate the point at which additional or more intensive monitoring is required to document conditions or environmental and social response.

ESRF VALUED COMPONENT THRESHOLDS PROJECT WRITTEN SURVEY

1. **Valued Components** are defined as "an aspect of the environment that is considered important on the basis of economic, social, cultural, community, ecological, legal or political concern". The following Valued Components have been recommended for cumulative effects management purposes in the NWT:

    1. Air Quality
    2. Water Quality
    3. Sensitive Features and Habitats
    4. Focus Wildlife Species
    5. Focus Fish Species
    6. Traditional Culture and Land Use
    7. Community Well-being
    8. Economy and Business

    From your perspective is this list complete? Yes _____ No_____
    If this list is not complete, what Valued Components would you add?

_____
_____
_____

2. Are there any Valued Components that you would identify as having higher or lower priority with respect to identifying management targets and/or limits? Yes_____ No_____

   If yes, which Valued Components?

_____

_____

3. Do you (and/or your organization) feel that target limits should be set in order to manage Valued Components in the NWT? Yes_____ No_____

   If yes, do you support the use of tiered thresholds that reflect local conditions and the overall land management vision? (i.e. cautious thresholds in special management areas and generous thresholds in areas with development emphasis) Yes _____ No _____

4. Are there any region(s) in the NWT where management limits or targets are a higher or lower priority? Yes _____ No _____

If yes, which region(s)?

_____

_____

5. Currently there are numerical management targets or thresholds for some Valued Components such as Air Quality and Water Quality. For the Valued Components that don't have numerical management targets or thresholds, how should they be developed?

_____

_____

_____

   Who do you think should be involved in developing these numerical management targets or thresholds?

_____

_____

6. What is the appropriate scale for numerical targets or thresholds (i.e. entire territory, oil and gas play, land claim area, sub-regional land use zone, etc?)

_____

_____

7. Do you feel public, industry and government have a solid understanding of the tiered thresholds approach? Yes_____ No_____
   If no, what can be done to improve understanding?

_____
_____

8. Who should be responsible for monitoring to update land and resource information used to track conditions relative to management thresholds, and confirm the application and effectiveness of these thresholds and mitigation measures?

_____
_____

9. Do you have any other thoughts and/or suggestions about Valued Component limits and thresholds?

_____
_____
_____
_____
_____
_____

3. TELEPHONE INTERVIEW GUIDE

ESRF VALUED COMPONENT THRESHOLDS PROJECT
PROJECT OVERVIEW

The potential for new and ongoing developments to result in adverse cumulative effects is of increasing concern in the North, as in other parts of Canada. Assessing, minimizing, and managing potential adverse cumulative effects has been the subject of a number of studies, but more definitive information on "Valued Component Thresholds" relevant to the oil and gas industry in the Northwest Territories is required.

The Environmental Studies Research Fund (ESRF) is sponsoring a project to:

- Identify the needs, benefits, opportunities, and challenges of developing Valued Components, indicators, and thresholds in the Northwest Territories;
- Review the status of current Valued Component thresholds and their use in resource management and cumulative effects management generally;
- Raise awareness of the need for Valued Component thresholds and the priorities for an implementation strategy; and
- Identify the Valued Component thresholds that are of highest priority to assist existing resource management Boards in the respective decision making – now and in the immediate future.

Valued Components are defined as "an aspect of the environment that is considered important on the basis of economic, social, cultural, community, ecological, legal or political concern". (e.g., sensitive features and habitats)

Indicators are defined as 'a characteristic of the social or ecological setting that is used to describe, measure, manage, and report on Valued Components'. (e.g., proportion of a region where ground is disturbed at any point in time)

Management thresholds (also referred to as limits or targets) are defined as 'a point at which an indicator changes to an unacceptable condition, with acceptability defined either from an ecological or social perspective'. (e.g., no more than 10% of a region disturbed at any point in time.

We have been asked to look at the concept of tiered thresholds as an implementation approach. Tiered thresholds are a series of progressive thresholds that reflect increasing degrees of concern or risk. **Tiered thresholds** were originally developed to manage deposition of air pollutants. This approach provides an integrated framework that relates two or more quantitative thresholds to appropriate management and regulatory responses.

Critical threshold – a science-based target reflecting the maximum amount of development that an environmental or social system can support without longterm harm. When this threshold is reached or approached, restrictive management practices are formally adopted to reduce risk

Target threshold – a politically defined goal of the total amount of development that is desirable and provides adequate long-term protection to the environment or resource of interest in a defined region. This threshold is more protective than the critical threshold to provide a margin of safety. When this threshold is reached, enhanced management practices are formally adopted to reduce risk or increase understanding of the system.

Cautionary Threshold – a threshold established to indicate the point at which additional or more intensive monitoring is required to document conditions or environmental and social response.

ESRF VALUED COMPONENT THRESHOLDS PROJECT
PHONE INTERVIEW GUIDE

1. What do you think are the challenges and/or opportunities with prioritizing Valued Components?

2. What do you think are the barriers and/or opportunities in setting target limits in order to manage Valued Components?

3. From a technical perspective, what challenges and/or opportunities does the tiered thresholds approach provide?

4. What might be some of the challenges to achieving public, industry and government support for numerical management limits, targets or thresholds? How might one overcome those challenges?

5. What might be some of the opportunities to achieving public, industry and government support for numerical management limits, targets or thresholds?

6. What might be some regulatory or administrative barriers that would impede the implementation of the NWT management limits or thresholds?

7. What might be some regulatory or administrative opportunities that would facilitate the implementation of the NWT management limits or thresholds?

8. Do you have any other thoughts and/or suggestions about Valued Component limits and thresholds?

4. WRITTEN SURVEY RESPONSES

QUESTION #1: From your perspective is this list complete? If this list is not complete, what Valued Components would you add?		
INDUSTRY	1	Yes list is complete.
	2	No the list is not complete. Would add Vegetation, Permafrost and Protected Areas
	3 & 4	#3 comments: It appears to be a long list. Feels one can always add more to the list. Basically it represents on way you can 'split' the pie. Would add that he is not seeing soil and ground water. Too according to the definition of VC provided, he is not seeing both the legal and political aspects. Not sure what some of the social and cultural VCs mean – require definitions. #4 comments: Sees the list as fairly complete
	5	Yes.
	6	No the list is not complete #9 should be local community economic benefits #10 should be quality of life and sustainable infrastructure
REGULATOR	1	Yes the list is complete but the VCs are not enough to be operational – guide behaviour on the ground. VCs as listed are more of a 50,000 foot, political comment. There is a need to have specific definitions as water quality can mean different things to different groups of people
	2	Yes
	3 & 4	#3 comments: His initial comment is that the objective is to the efforts and resources. It is about maximizing the value for resource decision makers. Therefore VC should not be too general but also should not too specific. He pointed to the examples of water quality and air quality as being very broad. He would want to focus much more carefully. There is a need to define the VC as well as drill down to critical few indicators of a VC but of course developing the critical few challenge is that it will be context dependent. There is a lot of effort in developing baseline information and doing the research but investment piece is too diverse and disorganized (see his presentation). He wants to see a clear focus on the highest VC priority VC so that resource managers receive valuable information and can make better quality decisions. It is this need that should drive how VC are defined and which ones are deemed a priority. He suggested a short-term plan (based on above comments) and a longer term plan.
RESOURCE MANAGERS / PLANNERS	1	Yes. List is robust as everything fits under some category. It is an exhaustive list.
	2	Yes. List is robust as everything fits under some category. It is an exhaustive list.
	3	No. The components seem comprehensive although landscape level components should be considered within a regional context. Overarching bounds that identify "how much development is acceptable on this landscape?" The indicators within each VC will determine if all aspects of the environment that are considered important have been accounted for (i.e. if the list is complete).
	4	No. Protected areas – defined as areas where subsurface rights have been withdrawn (i.e. fully protected).
	5	Feels the list is almost complete. One other that would be of interest to him is ecological/landscape integrity. In looking at the protection of wildlife or species it often isn't until late in the measurement that things start to show, by having an ecological/landscape valued component there is a leading indicator with which they can measure impacts on wildlife.
	6	Yes. But other VCs may be more important ecologically and be better indicators of change provided early warning signs of impending change to VCs that are further up the food chain and more economically important. These VCs are very broad.

QUESTION #1: From your perspective is this list complete? If this list is not complete, what Valued Components would you add? (Cont.)		
RESOURCE MANAGERS / PLANNERS (Cont.)	7	No. Will "ice" be captured under "sensitive features and habitats"? I am not sure how the role of climate change will be overlain on this list – perhaps it will need to be considered in the development of appropriate thresholds. These seem quite high level. It may be valuable to discuss the "indicators" at the same time to provide a relationship between the VC and the thresholds that could be established for the indicators. Ice is a threatened sensitive feature of the north – it is a sensitive feature – wanting to ensure that it is reflected within the box of sensitive features & habitats
	8	Yes. Consideration: At first I thought you may be missing something with respect to the land base availability: % land base covered by protected areas or otherwise exclude which brought me into thinking about the links between thresholds and with land use planning. Perhaps you are already considering the interaction.
	9	No. There are a few aspects to this might warrant consideration: (1) Climate change -effects of the environment on the project (this can either be its own item or should be a stressor applied to each VC across the board. (2) Air quality and ghg emissions. There is likely an assumption that these are already dealt with. One of the interesting discussions that arose in MGP was the suggestion that ghgs might need to be considered in a cumulative effects context on a different scale than other air pollutants; i.e. the "airshed" of interest is global_-this approach h is already being used internationally Not sure what "focus "species are intended to be. Strongly suggest that this include at a minimum any species given particular status in a legal sense .That means relative to SARA; at a minimum ALL species listed under Schedule 1 of SARA. This will ensure that the legal requirements under CEAA are addressed
ACADEMIA / ENGOS	1	Yes. Comment: The challenging part is defining valued components and thresholds. Some would be easier than others.
ABORIGINAL	1	Yes and No. Not sure if this fits under water quality but you may have good water but limited supply. Impacts on transportation, human use etc.
	2	No. She couldn't think of any additional ones off hand but believes that if one asks the various parties, others will surface. She also believes that these are very broad 'headings' and that if one looks at for example the Focus Wildlife Species there would be many species identified.
QUESTION #2: Are there any Valued Components that you would identify as having higher or lower priority with respect to identifying management targets and/or limits? If yes, which Valued Components?		
INDUSTRY	1	Air Quality and Water Quality are universal in scope
	2	Yes…Wildlife, Water Quality and Traditional Use
	3 & 4	#4 comments: When first reviewing the list one instinctively feels the VCs can be prioritized. However, when actually trying to prioritize, he believes it falls apart as all VCs will be seen as important. Too, wouldn't be able to have a consistent list across the full NWT but rather VCs of importance would be regional or sub-regionally level dependent. #3 comments: Doesn't believe there are more important VCs over others. For him it is all about finding balance.
	5	No – hence the challenge with implementing targets
	6	Priorities are local community economic benefits and community well being All other VCs are of equal importance

QUESTION #2: Are there any Valued Components that you would identify as having higher or lower priority with respect to identifying management targets and/or limits? If yes, which Valued Components? (Cont.)		
REGULATOR	1	Yes, but VECs are have an inherent relationship with one another. If the priority is sensitive features and habitats then for him one would naturally protect water, air, land, etc as well. Traditional Culture and Land Use, Community Well-Being and Economy and Business are not as linked.
	2	Yes. Air Quality Water Quality Sensitive Features and Habitats Focus Wildlife Species (indicator species for the specific area).
	3 & 4	#3 comments: Adopt a tiered approach to setting priorities. First tier: Caribou have been in the news quite a bit over the last few years. Boreal caribou populations are crashing. Boreal caribou are under federal species at risk legislation and surface in many EAs and is in the heart and soul of aboriginal peoples. Traditional culture and land use requires attention as this VC surface regularly in EA and is a considerable source of concern in proposed developments. Second tier: McKenzie Valley watershed and special habitats within the watershed as well as boreal forest and community well being (albeit seriously focused in more). Means to identify a priority should be to take the list of VCs and overlay them with development pressures as well as what a particular eco-system which should produce a focus on the critical few. Believes you could and likely would have different thresholds in one area versus another as thresholds would be developed based on urgency (development pressures) and what is important (VCs – eco-zone dependent) in a given area. #4 comments: Agrees with #3's comments. He added that determining what is important is derived from the community but if there is no urgency (development pressures) then that area is not the focus. He also added that water quality can be a serious issue depending on the context and as such would fall into the second tier. #3 & #4 comments: feel that targeting Tier 1 and the Tier 2 would allow the process to mature resulting in people seeing the benefits. Feedback loops would be essential.
RESOURCE MANAGERS / PLANNERS	1	Yes. His experience when talking with northerners is there are three priorities: Focus wildlife species (caribou and possibly polar bears) Traditional culture and land use Water quality
	2	Disagrees strongly with prioritizing and sees all VCs as important and completely dependent on the context that is presented. Believes that there should be a full and complete list and then the context (landscape and proposed development) drives what becomes a priority. He thinks the primary issues for northerners is water (quality and quantity), caribou and community well being. Recommends getting a comprehensive list of VCs to the best of available knowledge and then fill in 'blanks' later. Build the list based on issues that have already been identified. Recommends that there be work done to understand what thresholds mean and build the capacity for that understanding and subsequent thresholds' implementation.
	3	Yes. VCs that span multiple 'concerns' as identified above. VCs currently under threat or pressure, near thresholds of concern. VCs with legal obligations.
	4	Yes. The highest priorities (in random order) should be; air quality, water quality, focus wildlife species, focus fish species, and sensitive features and habitats. If these aspects are managed properly and maintained in a healthy state community well-being, traditional culture and land use, and economy and business will all benefit.

QUESTION #2: Are there any Valued Components that you would identify as having higher or lower priority with respect to identifying management targets and/or limits? If yes, which Valued Components? (Cont.)		
RESOURCE MANAGERS / PLANNERS (CONT.)	5	Would like to prioritize in terms of what gets addressed first. Given that there is a limited capacity to work on these things, he would prefer to see the focus on things that are less easy to define i.e. air, water and economics seem to be able to identify quantitative indicators fairly easily. Whereas with things like landscape integrity, community well being and wildlife species are harder to come up with numerical approaches. He feels that they need to focus additional effort on the areas that are harder to define. The easier ones like air & water quality might be able to gain ground quickly but feels that if they are going to make good progress on thresholds need to tackle more difficult ones and prove that it can be done.
	6	No. As VCs they are probably all important as per the definition of VCs
	7	Yes. Those which are viewed to be near the "critical threshold" so that the management objective may have to be set at this critical threshold. An example of this would be listed species at risk.
	8	Yes. If we are trying to maintain a focus on sustainable development (SD) I would put priority on Focus Wildlife and fish species as a representative for the Environment pillar of SD Traditional Culture and Land Use for the Social Pillar and Economy and business for the Economic Pillar
	9	There may be merit in having a second tier of VCs to ensure that it is clear that all potential issues can be fit into one or more of these or can be explained in an explanatory note on each category i.e. "Waste management" can fit in almost every one of these categories or it could be a category on its own or missed altogether. Also it is clear that "sensitive features and habitats" may have intrinsic characteristics that may affect how it is treated as a VEC .At the top of the hierarchy one would expect to find designated protected areas and legally defined critical habitats and then below that candidate areas, and then other areas based on scientific, technical,cultural or social criteria. Yes. The VC s that have legally defined requirements. i.e. SARA listed species; regulated emissions limits, etc.
ACADEMIA / ENGOS	1	Find the question difficult to answer. All valued components are important but certainly some of them are easier to define and identify and measure targets…particularly quantitative targets. CPAWS focuses primarily on environmental issues but they do recognize social and economic valued components are important to community sustainability. Additional challenge is that the valued components are all tied together (related). She would like to see a focus on Focus Wildlife Species.
ABORIGINAL	1	Yes. Water – sustains life
	2	Related to her #1 response, she recently went through an exercise where over 30 wildlife species were identified. Challenge is that even within one VC different wildlife species were important to different regions. She does believe some VCs have a higher priority and mentioned at the community level priorities would be water, air, wildlife and fish species as local communities depend on their local environments being healthy. Need to include traditional culture and land use as a higher priority as well.

QUESTION #3: Do you (and/or your organization) feel that target limits should be set in order to manage Valued Components in the NWT? If yes, do you support the use of tiered thresholds that reflect local conditions and the overall land management vision? (i.e. cautious thresholds in special management areas and generous thresholds in areas with development emphasis)?		
INDUSTRY	1	Perhaps – not sure if targets should be set to manage valued components. Very complicated issue. Not sure we have seen any real successful holistic models in the world yet. The smaller the focus is the easier it is to maintain but once you carve up areas within a broader management areas you may create economic winners and losers. The other challenge is that you may pit one Industry against another depending upon how definitive the numbers are. You also must allow for accounting for thresholds to go backwards (i.e. reclamation, when is a seismic line not a seismic line anymore, other mitigation). Conceptually everyone can buy into the idea but it struggles to work from a practical standpoint. You must be very careful of unintended secondary consequences. Do support tiered thresholds that reflect local conditions.
	2	No.
	3 & 4	#3 comments: No, do not support the use of thresholds. CAPP has an appreciation for existing thresholds but at the end of the day it is about finding something that is workable His main objection to thresholds is that they purport to measure something and it measuring something very specific and yet this something specific is to inform on a VC – doesn't think so. There is a reliance on a number to cover something much broader. One is trying to measure something very specific on something that is very broad. He cited measuring water quality as an example and said that simplifying water quality down to a number is an oversimplification. The world is too complex. Although he recognized that it was a poor example, he talked about mercury in water which is poisonous at a certain level and that he gets this but he feels that the amount in mercury in water doesn't really tell you about its quality – it is about so much more. Too what is unacceptable in some areas is in fact natural in others – referenced Fort McMurray / oil as an example. Feels strongly that it is very presumptuous that science could find a specific number that will tell you how a VC is doing. #4 comments: There is a need to look at how targets are established. Industry is adopting these limits as a management tool and yet lacking any kind of confidence in how they were developed. The challenge is in wanting to set limits before there is science to support them Once you begin to measure values on the land such as wildlife he doesn't see how one indicator can tell you how you are doing with any real kind of certainty. There are so many variables interacting on this wildlife that it would be very difficult to say with any kind of certainty how wildlife are doing.
	5	Not enough information
	6	No. Strongly fees that limits are already in place with the regulatory framework and no additional ones are needed. Additional targets will only make it very difficult for companies to conduct business.

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REGULATOR	1	Yes. Setting limits is a great way to manage risks to VCs. However, how VCs, targets etc would be implemented? Implementing at the EA level is not the proper place – needs to be at a land use planning level. EA can look at VCs and targets etc but this tool has limited ways it can operationally impact development. EA help define mitigation measures and identify concerns but EA is inherently a single project process. EA won't accomplish what you need which is tying in other influences. Yes, really likes the idea of a tiered approach.
	2	Yes
	3 & 4	#4 comments: Yes. Believes the limits will sometimes be numerical and sometimes not. What is important from his perspective is the 'keeper of the limit' especially when the limits are not so black and white. The big challenge will be identifying / deciding who the arbitrator will be. #3 comments: Believes that values and targets are dynamic / not fixed. He anticipates changes and so there is a need for feedback / a revalidation process.
RESOURCE MANAGERS / PLANNERS	1	Yes and yes. Really appreciates the benefits of the tiered threshold approach (proactive, flexible etc)
	2	Yes, does believe in setting targets but believes it should be guidance limits developed and implemented. This will allow for additional, much needed flexibility in the system. He understands the benefits of having targets be regulation but feels that if limits are regulations there should be a caveat attached that land and water boards have discretion to lower the limit according to context.
	3	Yes and yes. Support the use of tiered thresholds but not the definition above. Environmental VC thresholds will typically be set a higher landscape level. Within the landscape there may be land use zones that define acceptable types and intensities of development but they should be combined (i.e. cumulative effect) in considering the VC threshold. There may be development focused and protection focused areas which will have significantly different development intensities (thresholds) but these should represent unique thresholds.
	4	Yes and yes
	5	He believes that targets and thresholds are a very important tool for managing resources because: They force people to think in advance of what they want final outcomes to look like Allow for adaptive management as these things progress on the landscape Furthermore, he supports the development of tiered thresholds as he feels that they need to be relevant to what you are trying to manage and to the level of knowledge that is available. For example, in some areas you would want more precautionary thresholds that ramp up as you go. In other areas, it might be possible to set one individual threshold and if you have sufficient information to do so. He doesn't think that one approach will work for all areas in the territory – there will need to be regulations down to cautionary tiered thresholds and targets
	6	Yes and yes.
	7	Yes and yes. I don't agree with how this has been described – "cautious" and "generous". Tiered thresholds allow for a management system that reflects our knowledge of the ecosystem/social tolerance and values that are based choices on the environmental or social quality within a particular area. We support this concept rather than the idea that within a development area the "threshold" is more generous.

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RESOURCE MANAGERS / PLANNERS	8	I am not clear on what you mean here are you asking if I agree with the use of a critical threshold type approach. If s Yes that would help to manage and also aid in making the social and political decisions that come along with management of resources. That being said it should be recognized that decision makers are required to take more into consideration than just the science of issues and that the threshold would be an important guide for decision makers but decision may not be based on Threshold information alone. The use of tiered thresholds in my mind is a good approach as it acknowledges in its own nature that thresholds are estimates but these estimates or best guesses (based on science and experience). It allows for increasing study and awareness which in effect could change the thresholds as we come to understand them better. IE We may reach a cautionary threshold that could bring us to more study which could take us to the next level where political and social decision may need to be made or it may take us back down below the Cautionary threshold if new science says we were over conservative.
	9	Yes and yes
ACADEMIA / ENGOS	1	Yes and yes.
ABORIGINAL	1	Yes and yes
	2	Yes, understand the concept. She believes that limits should be used through a land use plan. The challenge she feels will be determining how these limits will be identified. She pointed to the example of caribou and the use of limits with respect to herd populations - if you reach a certain number then management work needs to be done. However, she feels strongly there needs to be an understanding of the numbers themselves and the science behind them. How do you measure limits and using what rotations? Every five years, counting?
QUESTION #4: Are there any region(s) in the NWT where management limits or targets are a higher or lower priority? If yes, which region(s)?		
INDUSTRY	1	Unsure – see # 3 response
	2	Yes. ISR
	3 & 4	#4 comments: Given the current level of oil and gas activities(quite low) in the NWT he doesn't see any areas as being priority areas #3 comments: Agrees with 4. We are talking about the drilling of three wells and one seismic activity occurring this winter and industry already puts forth so much effort to protect values. Strongly suggests that this needs to be put into perspective. Also, repeated his concern of using a single number as an indicator of a VC – far too complex – one number cannot be an implication of a given activity.
	5	Yes. Some regions will be developed and some will not. A target should not apply overall to the land. If so, development will cease.
	6	Yes ONLY in the sense that culturally sensitive areas identified by Aboriginal peoples should be no go areas. Strongly feels that landowners should be the only ones to have input. Again, environmental VCs are well taken care of through the existing regulatory framework.
REGULATOR	1	Don't feel it is appropriate for him to answer this question. Priorities need to be set by local communities (local people on the land) in consultation with other interested parties and so doesn't feel he can say today what the priorities should be.
	2	Yes. Regions that are experiencing higher levels of development/industrial activity should receive higher priority. Similarly, regions that currently contain VCs that are thought to be at a critical threshold level should receive a higher priority.
	3 & 4	Both #3 & #4 believe that the criteria to determine region priorities should be based on 1) importance (VCs) and 2) sense of urgency (development pressures)

QUESTION #4: Are there any region(s) in the NWT where management limits or targets are a higher or lower priority? If yes, which region(s)? (Cont.)		
RESOURCE MANAGERS / PLANNERS	1	Yes. The generic response is higher priority regions would be where regulatory decisions need to be made. Actual regions are South Slave Basin (mines) McKenzie Delta (oil and gas) and McKenzie Valley (pipeline)
	2	For him the McKenzie Valley area should be a priority. The criteria he suggests using to determine priority areas is wherever there is significant development proposed or underway. Other specific areas would include Cameron Hills, Deh Cho area and also where the diamond mines are.
	3	Yes. Beaufort-Delta is a high priority due to potential oil and gas development pressures.
	4	No. All regions are either currently experiencing significant development pressure or will in the near future. I would place a slightly higher priority on the Mackenzie Delta region
	5	Yes: #1 Within the Deh Cho is a key area #2 Within the greater McKenzie Delta area
	6	Yes. One could argue that areas where there are more significant management issues (because of development pressures) could be a higher priority.
	7	Yes. Beaufort Delta
	8	Yes. Where there is the greatest or reasonably foreseeable high level of industrial activity for Oil and Gas - focus on the Mackenzie Delta and Beaufort Sea as well as the Central Mackenzie Valley and for mining it is would be within the Slave Geologic area around Yellowknife and up towards the Nunavut border. (I am not exactly sure where). There could be some potential new hotspots for mining which should be considered.
	9	Yes. Given the high likelihood for induced and secondary development arising as a result of anticipated MGP approval –Mackenzie Delta /Beaufort Sea
ACADEMIA / ENGOS	1	The highest priority region is the Deh Cho region. A draft land use plan that contains thresholds does exist. The plan incorporates both community and scientific information. Strongly believes that a land use plan is the vehicle for the use and integration of thresholds. Second highest priority region would be the Sahtu region as thresholds are currently being explored Gwitch'in do not have a land use plan and they don't seem to have the same level of leadership interest so this area would be a lower priority. Factors in determining priority regions would therefore include: Existing land use plan Leadership interest Where is the most change likely to occur
ABORIGINAL	1	Yes. Higher priority is ISR. Example Husky Lakes and Beluga Zone 1 areas – culturally and ecologically important for the continuance of traditional activities and culture
	2	No. Believes strongly that everybody should be treated equally. If you concentrate on one region then others feel left out. She pointed to air quality and contaminants in Arctic as an example. They see money going to the Arctic but nothing for NWT. It is all politics. If one had to set priorities then one should focus on a VC that is a priority – i.e. wildlife for all of NWT and the specific wildlife may change according to region.

QUESTION #5: Currently there are numerical management targets or thresholds for some Valued Components such as Air Quality and Water Quality. For the Valued Components that don't have numerical management targets or thresholds, how should they be developed? Who do you think should be involved in developing these numerical management targets or thresholds?		
INDUSTRY	1	Carefully – must be sensitive to the divergent needs of the various stakeholders. Unlikely to achieve consensus. Government, Industry, First Nations, Public should be involved.
	2	Development of management targets should be developed through research studies and should be developed by resource managers and environmental researchers.
	3 & 4	#3 comments: Comment: written survey and interview guide presuppose the acceptance and/or support of thresholds and yet CAPP does not support their use. However, if it moves forward then only scientists should be involved in the development of thresholds other than the social VCs which should involve the communities themselves. Concerned about the social / cultural VCs as can't see how they would be measured – how one would make them defendable #4 comments: Developing thresholds should always be science-based Feels all parties with an interest should in involved in their development
	5	Through a lot of research and modeling – may not even be possible. Led by researchers (university); input from stakeholders.
	6	Again, only VC that requires targets or thresholds is FN culturally sensitive areas and requires their input to determine targets.
REGULATOR	1	Set targets by engaging the appropriate interested parties…local community voice should have greater weighting to it over others. All interested parties should be involved…industry, local communities and government
	2	Perhaps collaboratively through VC committees or focus groups scaled appropriately for the VCs under investigation. Parties that should be involved in the development of targets should be: Specialists/experts/ professionals who are somehow involved professionally, academically or culturally with the VC in the local area (i.e. scientists, land and water boards, GNWT and first nations). Local involvement and 'buy-in' would likely be critical for successful implementation/ monitoring outcomes

QUESTION #5: Currently there are numerical management targets or thresholds for some Valued Components such as Air Quality and Water Quality. For the Valued Components that don't have numerical management targets or thresholds, how should they be developed? Who do you think should be involved in developing these numerical management targets or thresholds? (Cont.)		
	3 & 4	#3 comments: How limits are set will depend on the VC. Believe some targets will be purely scientific and some will be more intuitive. He believes the concept of temporary thresholds needs to be built in – get the 80% instead of waiting for the 100%. Strongly believes those with the legislative authority and/or mandate for a particular threshold need to make the decisions. For example, under land claims there are renewable resource boards that set wildlife management plans and have authority over these plans – they are responsible for ensuring the welfare of the herds. They should be responsible for making decisions. Some legislative authorities (land claims, resource boards, and NWT government) share mandates. With Traditional Culture and Land Use there may be a need to have more involved. #4 comments: Limits may also be set by precedent until additional information comes to light. Take for example Cameron Hills seismic line threshold of 1.8 km linear disturbance. This target is in place until there is something better (more informed). The need is to have solutions in the meantime until new information comes forward. He also agrees with #3 that those with legislated mandates making decisions but did add that in this day in age, a collective approach is expected. #3 comments: The public has a voice as those with legislated authority could engage them but believes this to discretionary. However at the end of the day seeking process certainty then public buy-in is important. #4 comments: Feels that the public has played a huge role in determining VC – already played this role – already identified concerns.
RESOURCE MANAGERS / PLANNERS	1	Collaborative dialogue with all interested parties
	2	All thresholds and targets should be developed in the same way. Limits should be based on environmental information received and best available technology. Water quality is an example – they are trying to set water quality objectives for the NWT based on both factors. If effluent being put into McKenzie River is at the same turbidity then why wouldn't you simply discharge at the same level versus trying to make the levels better? Lac De Gras is a water body known for its clarity and poor nutrient quality and thinking is that you don't want to discharge effluent into this body regardless of best available technology. Targets or limits' decisions need to made based on the following: Context presented; available tools or technology; and community values Believes that one needs numbers in order for thresholds to be doable - need a target that is measurable otherwise how do you know if you have met target? Also need to recognize that science can only bring limits so far as one needs to look at community values. All parties that have an interest should collaboratively develop targets / limits. A decision maker ultimately will need to make a call but he feels it will be the process itself that will be most important versus the limit decision. Decisions could be made binding in land use plans. If targets become regulations then need to ensure that land and water boards have some flexibility to move those limits.
	3	Need to establish reference and baseline conditions and then develop socially / culturally acceptable numerical targets and thresholds. Communities and appropriate expects should be involved in developing thresholds.
	4	Using best currently available scientific and technical knowledge, implement thresholds in a precautionary and adaptive way, and refine the thresholds over time in response to ongoing research and through practical experience. Federal, territorial and aboriginal governments collectively should develop these thresholds in consultation with industry, NGO`s, academics, and boards

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RESOURCE MANAGERS / PLANNERS (Cont.)	5	The land use planning process will have a significant role to play in this. At this point in time, the processes in some areas have been focused on putting lines on maps re: socio-economic issues and classifying "no go zones". They haven't been provided with the resources to go to the point of setting landscape objectives that could be related to valued components – if the process was enhanced it might be an avenue to develop targets and thresholds. The processes within government are another area that could be used to focus some effort on this Finally, the academic community is somewhere that also needs to be tapped in developing these – there are experiences around the world with using various threshold approaches that need to be looked at to see what might work in their backyard and the academic community is likely the best vehicle to tap into this. One thing he has thought about is that there doesn't seem to be a whole lot of process with respect to socio-economic valued components – it always seems to be high-level government documents that set out objectives for healthy and educated people but there isn't anything that focuses down on key objectives for the region – they have been pushing with land use, and watershed planning to identify some specific objectives for those areas but doesn't see it happening on socio-economic side - having these is key to finding the management balance. Sees the potential for a lot of it to come together at the land use planning process but in order to them to be successful, Government support would be required to build capacity and to keep the land use planning process on the right track. Other groups that could be involved are the land & water planning boards and the MV environmental impact review board as they will likely need to put the results in place
	6	Thresholds could be based on a number of things i.e. values cultural, socio-eco consultation should be the approach with stakeholders. As many stakeholder as possible should be involved.
	7	Need to identify priority VCs – initiate literature review of the state of knowledge regarding thresholds that will inform identification of 3 levels or thresholds. Validate consultation with the affected stakeholders. Provide for adaptive management that will be informed as new information comes available. Affected stakeholders should be involved.
	8	Based on science (i.e. carrying capacity of species etc) and in consideration of existing or proposed land use planning and protected areas strategy initiatives. It will also be imperative to involve the local aboriginal groups in decision around cautionary and critical thresholds. Territorial and federal scientists, regulators and land managers. Individuals with experience I the development and preferably the application of a tiered threshold approach to resource and land management.
	9	Management targets need to be based on sound scientific knowledge, developed through informed and reasoned discussion between key parties affected by the initiative and "backstopped" by meaningful regulatory implementation mechanisms. Should involve industry, regulators, scientific and technical experts, communities, resource users
ACADEMIA / ENGOS	1	Believe the targets should be developed collectively. Governments, territories, communities should be intimately involved in developing targets. Doesn't believe industry or ENGOs should be part of main / primary discussions but rather have industry and ENGOs review something and provide comment. It is important that the process is transparent so that a review can be done

QUESTION #5: Currently there are numerical management targets or thresholds for some Valued Components such as Air Quality and Water Quality. For the Valued Components that don't have numerical management targets or thresholds, how should they be developed? Who do you think should be involved in developing these numerical management targets or thresholds? (Cont.)		
ABORIGINAL	1	"I think the following (questions 5-8) is something that all parties have to deal with and they should 'work' together to make these determinations which would satisfy all parties and their values"
	2	The targets should be developed collectively. It should be about co-management. There is a need for solid science AND traditional knowledge. One needs the latter to understand their way of life. Elders really express this to the youth – only harvest what you need. Same can be applied to development. There will be a need to have some baseline numbers / background research from the past. Studies have to be thorough. Ongoing research needs to be done to ensure limits are where they should be. Information needs to be accepted by all parties – needs top be defendable.
QUESTION #6: What is the appropriate scale for numerical targets or thresholds (i.e. entire territory, oil and gas play, land claim area, sub-regional land use zone, etc?)		
INDUSTRY	1	Likely some sort of mixture
	2	Regional and sub-regional (Deh Cho and Sahtu)
	3 & 4	#4 comments: ecological significant area but the area needs to be determined based on science
	5	Ecologically based – don't know specifics.
	6	N/A given that he believes that the existing regulatory framework effective sets limits for VCs. Culturally sensitive areas identified by FN would be context dependent.
REGULATOR	1	Recommends a tiered approach with respect to determining scale by setting limits at a higher landscape ecosystem level and cascade these limits down to a more manageable scale
	2	In order for some targets to be germane they would need to be related/scaled to natural regions or subregions or habitat types (i.e. focus wildlife species that only occur in woodlands should not be scaled to areas that include regions above treeline). Other targets such as air quality could be scaled to the entire territory.
	3 & 4	Both #3 & #4 believed that it would depend on the VC. For example community well-being or biophysical targets may be able to be generically applied. It will be based on eco-zone (geographic) as well as demographics.
RESOURCE MANAGERS / PLANNERS	1	This is a difficult question to answer. Many thresholds will be generally applied throughout the territories. NWT is the most homogeneous spot – certainly more than Canada. However, he does feel that there needs to be a place for local adaptations for a couple of reasons: a particular contaminant of concern may naturally be high in a given area and so if development is in this area then require different standards; and different standards for needed for different landscapes i.e. national park
	2	Believes there is a need to build generic numbers that apply to all circumstances but then there is enough flexibility to adapt to a given context. There are basic principles that should be followed: need to do no harm protective to receiving environment use of best available technology It should be these principles that guide the process in developing targets.

QUESTION #6: What is the appropriate scale for numerical targets or thresholds (i.e. entire territory, oil and gas play, land claim area, sub-regional land use zone, etc?) (Cont.)		
RESOURCE MANAGERS / PLANNERS (CONT.)	3	Appropriate scale should be determined by the VC in question. Target and thresholds should be established at the scale which the VC occurs. For example air and water targets could be set for entire territory. Population of sub-population distribution should be considered in establishing wildlife VC geographical scales (i.e. barren land versus woodland caribou). Once established at the ecological appropriate level, political boundaries will need to be considered in developing regional contribution to the target.
	4	Scale will vary with the VC and possibly other factors but generally should be as broad as possible. For example, the scale for thresholds with respect to boreal caribou should generally encompass the entire range in NWT. However, these thresholds may need to be sensitive to variable population densities, habitat quality and other factors
	5	Depends on what valued component you are looking at – there is difficulty in being at too large or small a scale. He thinks the ideal would be at the scale of ecological regions –they have been doing a lot of work with identification of geo-climatic regions and ecological regions within the NWT – approx 46 within the whole territory have been identified to date and they are fairly substantive areas. Airshed and watershed level could be nested within a geo-climatic region and within some geo-climatic regions, they may want to develop targets at a watershed level Have published geo-climatic zones for Taiga Plains (McKenzie valley area) and are publishing ones for Taiga Shield and ones for mountainous and arctic regions within next couple of years.
	6	Scale is important consideration – it will vary consistently depending on what you are trying to manage.
	7	Ideally will want consistency between planning frameworks (for the critical thresholds) – management objectives would be established for appropriate planning areas (LUPs, regional plans)
	8	I would suggest land claim area is appropriate because of the political differences and community differences which may greatly contribute towards the risk tolerance or aversion in the area thus impacting thresholds. This is also consistent with the other operating rules i.e. land use plans and land and water Boards. Going smaller i.e. sub-regional land use zones could lead to substantial confusion on the part of the regulators ad n operators especially when there are cross boundary activities.
	9	Ideally should be ecosystem-based (likely a subset of a land claim area or a land–use zone)
ACADEMIA / ENGOS	1	Regional or territory wide
ABORIGINAL	1	"I think the following (questions 5-8) is something that all parties have to deal with and they should 'work' together to make these determinations which would satisfy all parties and their values"
	2	Difficult question to answer as animals don't know boundaries. It will be hard to find an acceptable region. It will depend on the VCs. Other challenge is that she anticipates that Aboriginal peoples will have the same priority VCs but they may differ on the 'subgroup' in that VC.

QUESTION #7: Do you feel public, industry and government have a solid understanding of the tiered thresholds approach? If no, what can be done to improve understanding?		
INDUSTRY	1	No. Public Consultations, Workshops, etc
	2	No. Better communications
	3 & 4	#3 comments: Parties only possess a very simple understanding and certainly don't appreciate that you would have thousands of targets ESRF Valued Component Project – Appendix B Fulcrum Strategic Consulting 29 Parties are sold on the basis that thresholds will accomplish something Also not asking the question of how much and where the resources to support such an effort would come from – huge amount of resources required – don't think people realize this. #4 comments: Parties only have a surface level understanding Conceptually the idea of thresholds is very appealing but parties have no clue as to what it will take to develop, implement and manage these thresholds
	5	No. Not enough information.
	6	No. Local communities don't understand thresholds as well as they should. His perception is that ENGOs advance their agendas through First Nation peoples and it is important that First Nation peoples better understand what they are getting into. Landowners should have the say as to what happens on their land.
REGULATOR	1	No. Very complicated subject matter – even he doesn't have a full understanding. Considerable education of all parties is required.
	2	No. Workshops/ presentations/ websites / information meetings.
	3 & 4	#3 comments: Thinks that in some cases there is understanding but not a good understanding. He believes that awareness needs to be raised. There is the idea of achieving education and awareness through some initiative such as a stakeholder workshop but feels that more awareness comes through an EA. Awareness and understanding through demonstration. #4 comments: Strongly agrees that one learns by doing and that it would be hard to educate in the absence of doing.
RESOURCE MANAGERS / PLANNERS	1	No. Following are ways to improve understanding: Education Research such as this project Most critical is demonstrating why this approach to managing impacts is effective or if not effective, why not
	2	Generally feels that the notion of red, green and yellow is understood but current understanding is not as good as it needs to be if wanting to move forward in the use of thresholds to manage possible risks to valued components. The complexity is that one could have a range of numbers even within a number. There is a need to very carefully explain the concept to all parties. This education is part of the collaborative process. Key point: It should be noted that tiered thresholds may work in some contexts and not in others but even if one can't have a tiered threshold approach for a particular valued component, he believes the tiered approach is inherent through the monitoring program. Water quality would be a good example – specific numbers (i.e. ammonia) exist but the monitoring approach is inherently a tiered approach.

QUESTION #7: Do you feel public, industry and government have a solid understanding of the tiered thresholds approach? If no, what can be done to improve understanding? (Cont.)		
RESOURCE MANAGERS / PLANNERS (CONT.)	3	No. They may not have solid understanding but stakeholders have been exposed to the concept of tiered thresholds through harvest management, land use planning, CCPs, etc. Best approach to improve understanding of thresholds is to implement their use in making development decisions.
	4	No. Education and communication exercises are always valuable but perhaps most important of all is utilization. Awareness and understanding will come with implementation and utilization. More workshops etc. to attempt to educate may be of limited value without practical, working examples from the NWT
	5	No. He thinks that the biggest thing to get over is how thresholds can fit within the overall regulatory process. People see thresholds as quotas and feel that they can develop or use a resource safely up until it hits the threshold level. Need to ensure that public has clear understanding of difference between thresholds and quotas – need to educate people about what thresholds are not – can tell people what they are and how they can be used but also need to talk about what they are not. Should be looking at other examples from around the world to highlight the understanding of them and the level of acceptance that they have received in other areas.
	6	More education, consultation.
	7	No. Society uses thresholds all the time – however the ability to use them in an environmental or social context is somewhat limited. A few good examples need to be developed to demonstrate how they can be used and updated in a practical sense.
	8	No. Greater education and debate is required. I don't think the concept of application of tiered thresholds as a land and resource management tool has been debated enough. We may be moving in the direction of tiered thresholds without giving other initiatives like land us planning, Environmental Assessment and Protected Areas the time they need to be established and tested. I see the use of a tiered thresholds approach useful in guiding science not only for cumulative effects but for other regulatory decisions but we just need to be conscious of everything else that is occurring simultaneously.
	9	No. Likely requires a pro-active communications strategy that requires a "body" (i.e.CEAM Steering Committee) to actively and deliberately engage with others who are perceived to not understand the concept. May require development of factsheets, discussions on radio, TV, public presentations, etc. (i.e. a public workshop in conjunction with another event (i.e. Geoscience forum, Inuvik Petroleum Show, etc). Many ways to approach it, key is to push and follow through.
ACADEMIA / ENGOS	1	No…new science and most do not have a good understanding of it. Ways to improve understanding include: Increased dialogue Better communication on how thresholds can be used Increase the number of areas that have legally enforced thresholds Promote the use of thresholds / show the benefits such as thresholds is a proactive approach to manage land; thresholds can maintain values and monitor what is happening on land at cumulative level; thresholds can provide certainty and clarity for everyone Communicate that currently we are playing a board game without instructions or rules – very ad hoc. The use of thresholds would change this – they would be the vehicle to providing clarity and certainty

QUESTION #7: Do you feel public, industry and government have a solid understanding of the tiered thresholds approach? If no, what can be done to improve understanding? (Cont.)		
ABORIGINAL	1	"I think the following (questions 5-8) is something that all parties have to deal with and they should 'work' together to make these determinations which would satisfy all parties and their values"
	2	No. There is a lack of understanding of traditional knowledge, lack of understanding of the science behind any limits and there is a lack of science. Again expressed the need to adopt a co-management approach. There is a need to educate on a regular basis. She sees a co-managed board going out and doing consultation with local communities. It needs to be face-to-face as this is the only way one will get buy-in. Consultation needs to be ongoing in order to provide status updates. Communication needs to happen with broader community members. One cannot expect consultation to happen only with leadership – leadership lacks the resources to undertake consultation with their community members. Need to find the money to support ongoing consultation.
QUESTION #8: Who should be responsible for monitoring to update land and resource information used to track conditions relative to management thresholds, and confirm the application and effectiveness of these thresholds and mitigation measures?		
INDUSTRY	1	The Government
	2	Resource Managers GNWT and federal government
	3 & 4	N/A as do not support the development of thresholds.
	5	Land managers; input from stakeholders
	6	N/A
REGULATOR	1	In a perfect world there would be an independent board tracking and correlating data as well as providing this information to interested parties. However, not living in an ideal world and so perhaps INAC would be the best choice to have this responsibility. Shared data is a constant problem even today and caribou is the nest example of this.
	2	Perhaps teams formed from groups who have the most local interest, knowledge/access and/or regulatory authority (i.e. Land and Water Boards, First Nations). There may need to be different organizational structures for different VCs depending on the scale in which the VC occurs (i.e. Air Quality vs. Dolly Varden Char). Perhaps an overarching territorial body (GNWT) could act as a coordinator.
	3 & 4	Both #3 & #4 agree that those with the legislated mandate responsibility should be responsible for monitoring to update information. There is a need for communication mechanisms to be developed so information is accessible.

QUESTION #8: Who should be responsible for monitoring to update land and resource information used to track conditions relative to management thresholds, and confirm the application and effectiveness of these thresholds and mitigation measures? (Cont.)		
RESOURCE MANAGERS / PLANNERS	1	Strongly believes there needs to be a shared responsibility approach. Comment on word monitor: typically means repeated measurements. Strongly believes in monitor, evaluate and manage through followup.
	2	Currently multiple parties have information responsibilities (the Act requires a cumulative impact monitoring program, Northern Affairs has information responsibilities, industry is responsible for their own monitoring, land and water boards are responsible for ensuring industry reports are sound, etc). The heart of the problem is that there is a huge amount of information already and 'we don't know what we know'. Believes the approach being taken for the McKenzie Valley project is an appropriate one here. Develop a portal – a window into the information – a link to the data holders. It is not at all feasible to have one database and one manager. What is needed is a means to link information versus 're-invent the wheel'. There will be a need to develop standard protocols for collection of information. The portal would be collaboratively developed. Governments would ultimately be accountable for it and for funding its development and ongoing implementation.
	3	Government agencies have a shared lead responsibility based upon mandates. Needs to be coordinated within multi-stakeholder committee. Project specific monitoring and assessment of mitigation measures should be the responsibility of the project proponent.
	4	Monitoring of land and water use and resource development relative to thresholds should be the responsibility of the land and water managers; INAC, the Land and Water Boards and perhaps some day Land Use Planning Boards. This information should be collected and made easily accessible to the public in a timely and transparent process. Industry should be responsible to provide data on footprint, etc. as required and in a standardized format as specified by the land and water managers. Confirmation of the application and effectiveness of the thresholds and mitigation measures should be the responsibility of governments collectively (federal, territorial and aboriginal) in consultation with industry, NGOs, academics, and boards. Confirmation of the application and effectiveness should be subject to independent assessment through the Office of the Auditor General for Canada and the NWT Environmental Audit.
	5	It will have to be a bit of a broad group – it will depend on the valued component. Some will fall to aboriginal and community governments Some will fall to other governments There will need to be site/project specific monitoring and reporting as well. Could potentially need an independent or new administrative unit will be required to compile and asses the information is a potential approach. Alternatively, it could also fall within the land use planning process but there is also the cumulative impact monitoring program. Currently the Government of NWT is doing state of the environment reporting and there is a cumulative impact audit and that is a mechanism for pulling things together. There is a possibility to link this project in with those efforts. Would suggest exploring the potential to link it to land use planning process as over the long term he thinks that is likely where the info will be required but that isn't the only place that will need info therefore it may sit better outside of the land use planning process.
	6	Again, it could be any one of a number depending on the situation. Government, industry, regulatory boards, regulators etc.

QUESTION #8: Who should be responsible for monitoring to update land and resource information used to track conditions relative to management thresholds, and confirm the application and effectiveness of these thresholds and mitigation measures? (Cont.)		
RESOURCE MANAGERS / PLANNERS	7	This will be a shared responsibility. The CASA model for airshed monitoring and maintaining the data warehouse could be considered. Evaluation of the thresholds and mitigation measures will also be shared with some aspects being a requirement of project specific EAs.
	8	I think it is a joint responsibility. Government needs to establish the framework so that science can be collected by companies and communities and government so that it may all feed into a database that is used for analysis and application.
	9	Combined responsibility–Industry and government as part of adaptive management process
ACADEMIA / ENGOS	1	Sees a co-managed approach.
ABORIGINAL	1	"I think the following (questions 5-8) is something that all parties have to deal with and they should 'work' together to make these determinations which would satisfy all parties and their values"
	2	Need a co-management approach for monitoring but funding the monitoring programs needs to be government and industry. She would want to see Aboriginal groups assisting with monitoring in order to ensure their issues and concerns are being addressed.
QUESTION #9: Do you have any other thoughts and/or suggestions about Valued Component limits and thresholds?		
INDUSTRY	1	Thresholds should just be a part of the standard tool kit for resource managers in the NWT
	3 & 4	See phone interview responses.
	5	We are far away from having a working model. Society must understand that there are trade-offs to industrial development and must accept these trade-offs before a target system will succeed.
	6	Key messages – no additional limits needed for environmental VCs as regulatory system has enough in place to protect the environment – and local landowners need to better understand how thresholds may hinder their attainment of sustainable infrastructure and economy
RESOURCE MANAGERS / PLANNERS	1	General comment: found some of the wording in the project description piece of these interview tools 'offensive'. This is a conversation that he has had with Terry. He believes that thresholds are extremely important to managing impacts but disagrees strongly with the distinction between managing impacts and managing cumulative impacts. Thresholds manage impacts period and managing single project impacts is no less important than managing cumulative impacts. He is sharing his own perspectives versus those of any organization he is associated with.
	3	Need to ensure that VC targets and thresholds are established at ecologically relevant scales. Social / cultural importance, political boundary considerations etc can be then used to adjust smaller scale targets and thresholds within the overarching objectives. Where uncertainty exists regarding the current baseline, appropriate targets and/or thresholds, a precautionary approach is required until uncertainty is reduced. Current uncertainties around status, trends, and population dynamics for some wildlife VCs will require increased focus on habitat-based versus population-based thresholds. VC targets and thresholds need to be strongly linked to regulatory decisions and monitoring within a feedback loop.

QUESTION #9: Do you have any other thoughts and/or suggestions about Valued Component limits and thresholds? (Cont.)		
RESOURCE MANAGERS / PLANNERS (CONT.)	4	Implementation should not wait for 100% scientific certainty as this is rarely, if ever, achievable. Critical thresholds must be precautionary and must represent "hard caps". Cautionary and target thresholds should allow for flexibility. Only implementation (in the form of a pilot project if necessary) of a tiered threshold approach will get us beyond the status quo and moving in the direction of acceptance and (perhaps) broad application.
	6	The whole idea of thresholds or limits should involve adaptive management – an iterative process to make the process credible.
	8	It is good that ESRF is taking the initiative to further research with respect to this approach and in so doing advancing the debates and conservations that need to be held. ESRF has produced other discussion pieces such as this one which had a limited audience. Throughout this exercise efforts should be made to make appropriate government authorities aware of the process so that they may encourage greater debate/discussion which may help in the development of some sort of policy
	9	Environmental sustainability depends on effective and timely management of the interaction between project components and VCs. In order to establish priorities, focus attention where it is most needed and apply adaptive management appropriately in a manner that ensures positive environmental performance and achievement of positive conservation outcomes; there is a need for ground rules and road map that outlines how to achieve success and identifies when we get there. That's why defined agreed upon limits and thresholds feeding back into regulatory oversight and project management decision making are essential components in a Regional cumulative effects management regime.
ABORIGINAL	2	She likes the idea of using tiered thresholds to manage risks to VCs. She would like to see it start as a management approach but be flexible enough that if a better approach comes along then it would be adopted. The approach needs to be adaptive. There is constantly changing technology, information, research findings, and interested parties' interests. There is a need to do something now. There has been talk and talk for years but we are not stepping up to the plate and doing something. She feels the biggest impediment will be funding. There is a need to figure this out. From her perspective there is so much money being spent on so many different studies but the approach is ad hoc and is not coming together to create a management approach. Sees thresholds as being a component of land use plans – hard to do without plan. Land use plans have cultural importance and are for general use. Even if the plans are simply draft they can be amended as needed. Additional comment: Don't like the idea of protected areas in that control is reverted back to government and out of their control. Also, if new technologies come along that reduce impact, area is protected and can't use.

5. PHONE INTERVIEW RESPONSES

QUESTION #1: What do you think are the challenges and/or opportunities with prioritizing Valued Components?		
INDUSTRY	1	Challenges: numerous competing interests and so the challenge is how to deal with competing interests ultimately trade-off decisions will need to be made believes trade-off decisions need to be made by government as they are accountable and they also have the advantage of a balcony perspective (versus a single interest group who may not be in tune with public interests) government is to represent the people but the diversity of people perspective is where the challenge is feels governments need to find the balance point challenge is that government can move according to who is in power or media coverage/ pressure government situation is exacerbated in the NWT due to involvement of federal and multiple provincial governments – getting trade-off decisions made is further complicated with so many jurisdictions involved. Further challenged because those residing in the North are exposed to much more pressure on which way to regulate Opportunities: NWT is a frontier area with little infrastructure and so there is an opportunity and/or ability to get out in front of development and create a framework Framework can be developed and coordinated in a manner to actually meet government objectives (that inherently consider stakeholder objectives as government represents the people)
	2 & 3	Challenges – #2 comments: Competing interests – landing on agreed upon priority VCs will be a considerable challenge Values will be forever shifting. If it is smoggy out then that is the priority and if tomorrow there is no smog but the water is cloudy, then water quality and not smog) will be the priority. Questions being asked are very presumptuous as they presuppose agreement in the development and use of thresholds. He has no faith whatsoever in the use of VCs and thresholds to manage risks to these VCs is doable. Far too complex. No defendable science behind the numbers. CAPP does not support the use of thresholds nor guidelines. He is open to the term 'marker' Challenges – #3 comments: Would need to prioritize VCs based on a region or sub-region level as couldn't have NWT priorities. Huge challenge in having the conversation as to who gets to set the priorities Challenge in trying reconcile the differing perspectives
	4	Strongly can't address environmental values until there is sustainable infrastructure in place. Need to have the MG Project go ahead. Feels that the environmental groups are trying to carve out protected areas. Feels that regulatory system is so strict as it is and already protects the environment – no more is needed.

QUESTION #1: What do you think are the challenges and/or opportunities with prioritizing Valued Components? (Cont.)		
REGULATOR	1 & 2	Challenges - #1 comments: One size does not fit all. McKenzie Valley is huge for example. Believe that water quality is becoming quite an issue. Getting agreement Regional differences Certain VCs are mandated – Canada has mandate to protect some things and not others Current process to flush out VCs and priorities is so disorganized – really need some type of facilitated process Decisions are ad hoc and definitely do not want this Opportunities – #1 & #2 comments: There is a need to prioritize as there is a need to demonstrate it can be done. Too limited resources and challenges with manageability if don't prioritize. Recommends dividing stakeholders into three groups: resource managers – decision makers; cumulative effects information gatherers and cumulative effects investors. Recommends then focusing on resource managers as primary users of the framework. There is a need to consider methods and processes to further the system at some point.
	3	Challenges: The difficulty is that the VCs are s inherently related that it is a challenge to un-bundle them. These VCs are not defined and believes there would be differing interpretations amongst with different groups Getting agreement on what is valued will be a challenge. So many competing interests and while most may agree that caribou should be a focus some may ask what about wolverines. Inherently the process of defining priorities will be a political and cultural process. Does believe that local communities should drive the determination of what are the most important values. Doing this will protect the culturally sensitive areas and as a result, protect the other environmental values. Opportunities: If successful getting agreement on priorities that this is the first step to a proactive approach to managing values. Need to ensure that interested parties are involved and buy into the priorities.
	4	Challenges: Dealing with different groups having different priorities – local FN may have cultural priorities whereas federal may have a legislated mandate – multi jurisdictional multi-cultural Assuming that all interested parties would be invited to comment Changing nature of values over time <u>Opportunities:</u> New collaborative process – getting sustainable NWT – front end of industrial development Existing organization that are in place – land and water boards <u>Benefits</u> Even if temporal implementation – there is a starting point – not as overwhelmed – start with priorities and then build on success and bring in other VCs Give an opportunity to find out what are the values of the group – provide needed direction

QUESTION #1: What do you think are the challenges and/or opportunities with prioritizing Valued Components? (Cont.)		
RESOURCE MANAGERS / PLANNERS	1	There will need to be some kind of an evaluation framework in order to make prioritizing VCs possible. She also feels there is a need for criteria that allows you to set priorities for decision-making. She would want to ensure that the key valued components are the ones that Boards will need to issue licences and making decisions on. Therefore she recommends that we look to what the Boards are making decisions on. Feels this is critical re: getting down to operational level
	2	<u>Opportunities:</u> Thinks that a lot of opportunity exists within land use planning within the north. A lot of people have a real interest in what the landscape will look like and are interested in making proactive decisions re: what the landscape will look like. Feels that the situation in the NWT is unique in Canada and possibly in the world because of the careful concern and attention to what the landscape will look like. <u>Challenges:</u> The biggest limitation they are likely to face would deal with the capacity in the north to take the lead on some of these types of questions. The Government resources in the NWT are not enormous and most government employees seem to be fully engaged in other projects. Another capacity issue is within the community to get people involved and discussing things – so many other things going on in the community with environmental assessments etc. that it is hard to engage people – there are constraints in terms of time, knowledge and interest among the public. In addition it is hard to get people to start thinking about the more proactive things in advance of the more immediate questions. Too busy dealing with more immediate things to be able to think about the long term – both community & government issue
	4	<u>Challenges:</u> Experience is that we are pretty good at identifying VCs but really bad at setting priorities and/or determining scope. Decision makers are not good at determining the scope of an EA. Also difficult to set priorities due to the inherent relationship amongst the VCs. For example, air quality is not a priority for the NWT but it is important that it not be completely ignored because air quality is linked to caribou re: need to pay attention to dust disposition on food that caribou eat Tendency for people hate to listen to others and then reject their ideas no matter how foolish their ideas are – have a tendency to include these ideas. This situation is exasperated in the north as there is a tendency to defer to elders / extreme reluctance to ignore what they say. However, many listening to elders are not adept at listening to elders. There are considerable cross-cultural communication issues. There is no methodology in place to prioritize VCs <u>Opportunities</u> It has been done before – the Ekati diamond mine has submitted an adaptive management plan which has tiered thresholds in the plan – regulators are catching onto this idea – opportunity is the idea of "what exists is possible" <u>Benefits:</u> Allows the focus to be on what's most important. Some need to study everything as believe that it is all related / linked but in the real world there is a need to set priorities and focus on what really matters. If priorities

QUESTION #1: What do you think are the challenges and/or opportunities with prioritizing Valued Components? (Cont.)		
ACADEMIA / ENGOS	1	Challenges: Considerable challenge is in obtaining government interest and support. She has been in involved in the land use plan for Deh Cho through a review process and her experience is that there has been no real support from government on enforcing thresholds. She has found the experience to be quite frustrating. There always seems to be the questions around is there enough information and is the information valid Having sufficient research and information in order to be able to prioritize Have sufficient funding for research to get more information on valued components and thresholds Getting enough information to support the prioritization of valued components Constant onus on the developer with a focus on a project-by-project perspective. Feels strongly that cumulative discussions (including discussions on valued components) needs to happen on a broader level and need to use the land use planning tools as a means to have these discussions. Where no land use plans exist, the discussion on valued components and thresholds still needs to happen and so there need to be some creative thinking to come up with other ways to apply valued components / thresholds on a regional level. There is a lack of community interest. Certain valued components are fairly easy to define (i.e. for Deh Cho water quality and focus species such as caribou and grizzly bear) but other valued components are far more difficult to define and are more open-ended. Challenge is defining valued components is not part of the initial discussions with communities. Believes defining these cannot be done from the outside. Opportunities: There is an opportunity to obtain, at a minimum guidance thresholds. Regulatory required targets are more difficult to obtain. Guidance thresholds will enable parties to start testing and to see if they will work. At some point the discussions need to stop and implementation needs to happen. Information can be gathered to determine if thresholds are at the right level. There is an opportunity to lever off of large scale projects to acquire additional resources to study thresholds - capitalize on development levels to advance this work Federal and territorial governments need to be working together to prioritize valued components. Priorities need to be set at a regional level that is reflective of community values.
ABORIGINAL	1	Challenges: It will depend who you are talking with – everyone has different priorities. Her experience is that business groups will prioritize economics and business as high but traditional people will prioritize based on their livelihood and what they depend on Feels that even within a group there will be regional differences. Huge Aboriginal capacity challenges exist which would impede even the prioritization of VCs' discussions. While prioritizing VCs may make the process more manageable, there will be gaps in information as VCs are all related. At the time we get to collecting information on second level priorities we will be back at collecting information on the first priorities Funding – government turnover – one government supports and therefore funds work but new government doesn't and therefore stops providing money. Boards are terribly under-funded - can't complete their current work according to their mandate Opportunities: The only way she can see VCs being prioritized would be at a regional or local level May be a more manageable process

QUESTION #1: What do you think are the challenges and/or opportunities with prioritizing Valued Components? (Cont.)		
ABORIGINAL (CONT.)	2	Challenges: Everything (VCs) seems to be extremely interconnected – if you take VC out then you are bound to have a ripple effect. He sees all the VCs as important. Some of the VCs are very broad (i.e. wildlife). There is a need to break them down. He is worried about marine animals in particular so for him water quality is very important. There is a possibility that priorities could be made on a species by species basis and focus on how it related in the food chain and respective eco-systems Benefits: There may be some benefit in trying to focus on a single species as a particular species could be a real good indicator of a rapid change in current conditions. He pointed to polar bears as an example. There is a hierarchy in the marine world and focusing on polar bears may bring some understanding of what is happening with seals, fish, etc. (how the food chain has been affected. He used the example of mercury. But then the challenge would be where the species has been such that it picked up mercury – is it migratory condition. It gets further complicated as one would need to understand the life span of mercury to be able to tell. There will be a strong need to have a group of people that possesses a lot of expertise There is also a strong need to include aboriginal knowledge
QUESTION #2: What do you think are the barriers and/or opportunities in setting target limits in order to manage Valued Components?		
INDUSTRY	1	Benefits: Setting limits to manage valued components aids government in controlling the pace of development – it helps government get out in front and manage more proactively Challenges There is an inherent challenge in setting the numbers (limits) themselves – in determining what the limit should be. There is a need to look beyond just one industry – this complexity makes it very difficult. Challenge in trying to manage these limits – the inputs and outputs. The complexity includes being mindful of unintended secondary consequences – i.e. thresholds may cause conflicting land users to exist together in a different way - today industry tends to work on top of one another but targets may facilitate the upsetting of the market and causing oil and gas companies to buy out forestry companies, trappers etc. Challenge is finding the user to user balance.

QUESTION #2: What do you think are the barriers and/or opportunities in setting target limits in order to manage Valued Components? (Cont.)		
INDUSTRY (CONT.)	2 & 3	Challenges - #2 comments: Challenge in wanting to set limits before science is able to support the numbers Disagrees that a specific measurement of an indicator is really telling as to the status of a VC World is far more complicated than this Numbers do not accommodate what is natural in a given context Good public policy is about balance between economic, environmental and social values. Thresholds are NOT good public policy. Already ample protection that exists Need to put all of this into perspective – only 3 wells drilled and one seismic activity occurred this winter Oil and gas is already a very heavily regulated industry – already very restrictive Do not support the development and implementation of additional thresholds. Would not even want to see them as guidelines. He may be open to the idea of a marker – a gauge of how we are doing with respect to a VC. Markers can be refined as new science comes along. Thresholds only fracture but perhaps some quasi notion of thresholds may be okay such as markers. Markers create the 'we are all in this together' mentality and could facilitate cooperation. Markers could be measured but would be only used as a clue that something was happening and more attention was required. Disagrees strongly with an arbitrary line in the sand and this is how he views thresholds. Thresholds do not do what they purport to do. Challenges – #3 comments: Doesn't believe there is sufficient and credible science to support the development of thresholds. He has no issue with measuring valued components – it is what is done with those measurements. If thresholds are used to restrict
	4	Overall comment – do not support the adding of more restrictions <u>Barriers:</u> Get everyone to agree whether there should be limits and then what those limits should be Restricts development and Restricts development of local infrastructure which they need Already a highly regulated environment –convoluted and complex and adding more limits would only add more time and chase investment away <u>Opportunities</u> protection of significant cultural areas
REGULATOR	1 & 2	<u>Challenges – #1 & #2 comments:</u> Once thresholds are set then there are consequences. Many do not want thresholds To what extent are we willing to set a threshold and actually stick to it? Difficult to obtain consensus May not always be able to have numerical value and as such, the 'keeper of the limit' is critical – how is this decision made? Biggest challenges – once set thresholds then has consequences – lot don't want thresholds – to what extent are we willing to set threshold and stick to it. <u>Opportunities – #1 comments:</u> Both targets and tiered targets are a proactive, preventative tool to responsible resource and environmental management. Industry acquires the certainty they are looking for Protection of the environment can be achieved Once a more robust awareness that targets provide a win-win solution then public concern should be reduced – projects shouldn't be referred to an EA as often. Believes public concern is often a perceived concern rather than a real concern.

QUESTION #2: What do you think are the barriers and/or opportunities in setting target limits in order to manage Valued Components? (Cont.)		
REGULATOR (CONT.)	3	Challenges: Getting agreement on the targets Lack of flexibility in limits Inherently a win-lose situation. Can have a collaborative process but ultimately you will have some parties not happy and most likely all parties won't be totally satisfied / happy. Possible secondary impacts Question of whether there is enough science to get behind these targets. There is a need to make targets strong and defensible/ Paramount Hills perfect example of targets that were not defensible. 1.8 km over two entire eco-districts but it still meant that a company could pave the whole area and still be below the threshold. It should have been balanced against % of land use area. The question is who makes these limits and then makes this information available? Challenge in finding a balance between flexibility and prescriptive. Possible impediment to setting targets is the numerous jurisdictions that are involved in NWT Opportunities: All parties know what the rules are. Companies have a clear understanding,
	4	
RESOURCE MANAGERS / PLANNERS	1	Barriers: The debate on the science as to what are the right numbers. There will need to be a strong commitment to the concept of adaptive management. There will be a fear that the numbers will be cast in stone. The numbers may be difficult to change but you need to make the leap and have a commitment to modify over time. It could also be costly to try and develop the numbers – that is why they need to set numbers Other barrier is the integration of the ideas i.e. there are inter-relationships between the issues and she isn't sure they have a good handle on that and it can be expensive to try and track these. This will makes it difficult to distinguish between valued components for the sake of setting targets. Opportunities: Targets will set the framework or the box that we will play in. If we do it right, it is a way to manage cumulative effects for a certain project. From the context of a development scenario, it gives people the sense of what the key issues and parameters are. Can be a little more conservative in setting levels in areas that they aren't too certain of.
	2	Barriers: People will want to have solid information in place in order to justify the target limit – however this information may not be available and they shouldn't let it stop the progress of the initiative. Furthermore, a key goal of the initiative is for it to be about adaptive management which means that as new information comes available it will be brought into account Opportunities: Feels that you don't need to know it all and the thresholds can be adapted as information increases over time – there is a concern that once something is published it won't change – in some cases that is a justified concern – in wildlife area sometimes temporary quotas are put in place that never leave – hurdle is in convincing people that these can be set with a limited information base and that they are key to an adaptive management process and if the info doesn't support them or demonstrates a need to change them then this can happen. Need to ensure that a mechanism is in place to adapt thresholds as needed

QUESTION #2: What do you think are the barriers and/or opportunities in setting target limits in order to manage Valued Components? (Cont.)		
RESOURCE MANAGERS / PLANNERS (CONT.)	3	Barriers / challenges: The research to support a basic social understanding of the socio-economic issues is not there present Lack the monitoring systems. Attempting to deal with a number of issues that are all related to the level of knowledge we have – challenge is trying to figure out what we know and what we don't know on top of trying to set a threshold is very difficult. Many areas do not have land use plans and so there current system is on a project-by-project level Opportunities: Conducting research Recommendations: Taking an adaptive approach by recognizing that thresholds will likely change over time. Therefore, we can't wait for perfect knowledge as there is a real need to move forward recognizing there will be challenges. Recommends taking the approach taken with Deh Cho land use plan. Thresholds are a good thing in principle but recommends they be used as guidelines as the science to support the threshold is not necessarily there. Recommends that a particular party has the option not to use the thresholds but if they decide not to us them, then they need to explain way. This allows for the necessary flexibility. It also allows for plans to improve over time. He is a little cautious about setting thresholds in regulations however he also understands peoples' skepticism if thresholds are only guidelines. He believes there needs to be a caveat for land and water boards to change limit based on context if making thresholds regulations.
	4	Barriers: Believes it is in the setting limits where the 'rubber hits the road' and where very reasonable people will differ The law is that traditional knowledge must be considered with same weight as scientific evidence but as he already mentioned, traditional knowledge is difficult to interpret There are a number of existing, guiding features such as the CCME guidelines but he thinks some of the guidelines area questionable with respect to their applicability in north. He believes that there may be a need for a study to determine if lower standards would be equally protective. EPA has all sorts of requirements re: costs, benefits and scientific certainty which he feels are too much detailed and not very operational. There needs to be a legitimate discussion of various points of view in order to set thresholds. Adopting a paternalistic approach (decide, announce and defend) will not be sustainable but the challenge is trying to deal with the many and diverse points of views. Opportunities: Believe that regulators require it. It is an opportunity to reinforce intelligent decisions by regulators and point to other regulators that this type of environmental management is beneficial Industry has greater certainty with respect to what is expected All parties have greater clarity and certainty
ACADEMIA / ENGOS	1	Challenges: Again, having sufficient funding for research to get more information on thresholds Having sufficient information to support the numbers for thresholds Getting governments' support Having scientific information to support the numbers for thresholds Getting scientific information to support the thresholds Getting agreement amongst all the interested parties One target may not look at everything else that is going on – other impacts that are occurring Opportunities: All parties will have greater clarity and certainty A tool to manage the potential risks to the valued components Proactive versus reactive approach to managing values Better means to integrate valued components collectively

QUESTION #2: What do you think are the barriers and/or opportunities in setting target limits in order to manage Valued Components? (Cont.)		
ABORIGINAL	1	Challenges: There will be a challenge in getting the science (numbers) defendable. Aboriginal peoples' lack of understanding of the science. Setting targets will create tension. For example if a target means that there will be limits on how many caribou can be harvested. Lack of understanding by local people will have these people not accepting the limits regardless of whether they have been 'consulted'. Some will simply say the numbers are not right. How to obtain the level of education at the local level that is required to obtain buy-in – huge challenge in terms of resources, funding etc. Opportunities: If the science is correct then sustainable populations could be achieved. Believes limits are a good tool to managing risks Suggests developing limits one at a time versus 10 at once Should have limits on economic development as well so 30 years from now people still have jobs
	2	Benefits: He believes in limits. There is a certain amount of industrial development on land and offshore now His community depends so heavily on beluga whales so there is a need to set a limit to better manage the risks to this species. Need to still allow free movement of whales in natural world and avoid displacement. The challenge with oil and gas development is that once one finds something, everyone comes running. There is a need to have some type of management framework in place now to ensure there is sustainable development and environmental values are protected. It is very important to ensure future generations have the same access that he has had. He believes that if development continues at its current pace then the environmental values (i.e. caribou) will be displaced and won't be accessible for his children's children.
QUESTION #3: From a technical perspective, what challenges and/or opportunities does the tiered thresholds approach provide?		
INDUSTRY	1	Opportunities He has seen tiered landscape approaches have success in other jurisdictions such as BC parklands and Alberta Foothills. Feels that industry tends to support this type of approach if this work has been done before industry proposes an activity. Advantage is doing this work upfront. Challenges – Often threshold decisions are made based on whatever is happening on the surface versus what is under the surface and therefore may be missing a huge economic development opportunity
	2 & 3	Challenges - both: See #2 responses plus With tiered approach you have tripled all your challenges
	4	N/A as disagrees that thresholds are needed

QUESTION #3: From a technical perspective, what challenges and/or opportunities does the tiered thresholds approach provide? (Cont.)		
REGULATOR	1 & 2	Challenges – both comments: Is somewhat a subjective call Getting consensus on decisions (more decisions to reach) So many conducting research but the research is not really focused Lacking knowledge to create thresholds (i.e. fragmentation of caribou habitat but lacking the understanding of why it is happening) Opportunities – both comments: Use of tiered thresholds – sees this approach as the only plausible way to introducing thresholds. A cautionary level is needed to help condition interested parties to think about problems and figure out how they will manage these problems. Believe that there will never be universally agreed to targets and a tiered approach allows flexibility that interested parties will be seeking – potential facilitate greater buy-in Approach is proactive in that when concerns start to fester something can be done Strongly feel that it is the only workable approach Even with air quality and water quality thresholds there is still a certain amount of uncertainty and having a tiered approach accommodates this uncertainty Facilitates focusing resources more appropriately Tiered approach permits a signal that further research is required. This approach also helps to prioritize VCs
	3	Challenges: Same challenges for tiered thresholds as for setting limits: Getting agreement on the targets Lack of flexibility in limits Inherently a win-lose situation. Can have a collaborative process but ultimately you will have some parties not happy and most likely all parties won't be totally satisfied / happy. Possible secondary impacts Question of whether there is enough science to get behind these targets. There is a need to make targets strong and defensible/ Paramount Hills perfect example of targets that were not defensible. 1.8 km over two entire eco-districts but it still meant that a company could pave the whole area and still be below the threshold. It should have been balanced against % of land use area. The question is who makes these limits and then makes this information available? Challenge in finding a balance between flexibility and prescriptive. Possible impediment to setting targets is the numerous jurisdictions that are involved in NWT And: Even more difficult as more decisions needing to be made amongst parties with competing interests Opportunities: Really likes the red, yellow, green light approach as the approach still guides / directs behaviour and manages values but it has more flexibility Believes may be able to get more buy-in to the targets if tiered approach is used.

QUESTION #3: From a technical perspective, what challenges and/or opportunities does the tiered thresholds approach provide? (Cont.)		
REGULATOR (CONT.)	4	Challenges Getting agreement on the thresholds Gathering resources to facilitate the setting of thresholds (Anticipates that setting thresholds for some values will be easier than others and for some values there is existing knowledge) Opportunities or benefits Believes that there is existing work / knowledge that one can leverage off of – focus on values where there is existing knowledge Land use plans will have specific objectives that one can then focus in on and work off of and so land use plans could be a vehicle Can help to facilitate the development of certain research programs i.e. caribou at yellow – can better pitch why funding for research is warranted – provide justification for putting resources into research Offer the opportunity to find out the pulse of people's values in general – help government on several levels to really understand the values – shared understanding of values
RESOURCE MANAGERS / PLANNERS	1	See answer to #5 above. Challenges: In some cases if you set a threshold (from a habitat perspective) you may not have the right understanding about how a geographic base threshold translates to a specific project. From a land use planning perspective it can be accommodated. Feels that they have the knowledge but the challenge is getting agreement to and then to implement them. There is a need to get agreement among regulatory community, landholders and those with responsibility for implementing land use plans and the stakeholders who might be impacted. At the end of the day the regulatory community will have to agree to use the thresholds. Industry needs to be part of the community consulted on the thresholds.
	2	Challenge: One of the biggest challenges will be convincing people what the rationale for the levels are The other problem is that in setting tiered threshold is that if something passes a cautionary threshold – need to have a clear idea about what information is needed to assess impacts at that level – need to have this info well in advance – should have an idea of what the response need is and how to address it early enough so that something can be done Ideally he would like to see the government responses laid out clearly so that land managers and regulators know how to effectively respond if a cautionary threshold is reached The NWT Government have used this approach with wildlife population management and have found it to be helpful
	3	Challenges: Compounds the realization that there is not enough science by highlighting uncertainties It is difficult enough to set one limit let alone three The sheer complexity of trying to administer this approach – hunches that having a no go number would be far easier administratively particularly from a monitoring standpoint Opportunities Demands careful monitoring that in the end has greater potential of teasing out better buffers in the face of uncertainty Allows for regional, project specific, etc application
	4	Opportunities With the target and cautionary thresholds one of the most critical responses is not management action but conducting more studies. If something is happening (something is getting out of hand) then people need to look at what's happening closely. Cautionary thresholds can trigger studies as to what's happening. For him, knowing, means knowing what to do about it. One can only design appropriate mitigative measures when one understands the exact cause of why a threshold is being exceeded. Use of further studies also allows regulator more certainty as they then can approve / not approve a mitigative measure Early learning supports adaptive management

QUESTION #3: From a technical perspective, what challenges and/or opportunities does the tiered thresholds approach provide? (Cont.)		
ACADEMIA / ENGOS	1	Challenges: One of the biggest challenges will be determining who is responsible for monitoring where we are at – where we are on the spectrum. Currently there is no centralized location for data (i.e. no one place one can go to find out road density in a given area). Best scenario is that there is a quasi-regional board that compiles and maintains information in a centralized location. It should be a land use planning board. Challenge will be in resourcing the board but feels this is the government's responsibility. Government also has a responsibility to see their information in one location. Getting scientific justification especially for the amber targets Opportunities: 'Amber' means a proponent can start to modify their project plans and develop new technologies. Tiered approach permits flexibility. It is a much more open, transparent and intuitive method to manage values.
ABORIGINAL	1	Challenges: There will be some who won't understand or believe that when a threshold has been hit and so there will need to be some restrictive management There will need to be adaptive management tools developed Sheer extent of education that would be required and all this entails – resourcing and funding Education will need to be continuous. If in ten years one hits amber then the same level of understanding will be needed in order to have the appropriate buy-in and so resourcing education on an ongoing basis will be a challenge Feels that it is fine to do studies (and studies are needed) but if there isn't continuous education of those directly affected on the results of these studies then people won't understand and you won't get the buy-in. People will simply do what they feel is right. Challenge in that there will need to be a continuous review process Opportunities: Feels a tiered approach to setting limits is most likely the easiest to manage amber is good proactive piece to have so there is an opportunity to address something before the impact is irreversible
	2	Benefits: Tiered approach makes sense to him – the idea of a cautionary zone appeals to him. Feels that many of industry are good corporate citizens and that the relationship with the oil and gas industry has really come a long way– they listen and pay attention. (Mining on the other hand – huge footprint and feels it will be really tough to obtain a positive relationship with the mining industry although supposes that it could be done.) Challenges: He doesn't see how one can focus on a single species as he feels they are all interconnected. There are a lot of elements for example that impact caribou such as water quality. Too, animals know no borders and so we could be impacting caribou populations and not be aware. Again, if water quality poor, may not be impacting caribou populations, rather their health. This will mean that the monitoring program for monitoring caribou for example will need to be quite extensive. The question that comes to mind for him is whether the 'flag' will come up in time and did we respond in time? He is concerned that maybe the right mechanism may not be in place to catch amber and if missed then irreversible impacts.

QUESTION #3: From a technical perspective, what challenges and/or opportunities does the tiered thresholds approach provide? (Cont.)		
ABORIGINAL (CONT.)	2	Within a project description there is suppose to mitigative measures identified. Current communication network has direct access through co-management arrangement and so if need something needs to be checked out then can do so but there has been considerable challenges with respect to timing of the monitoring. He referenced a recent example where people noticed a diesel smell and sheen on the water. By the time a response was made, it was too late – environmental damage had been done. Given that there is so much development in McKenzie delta and offshore he feels it is imperative that a way to wave flags more proactively is found. He feels all need to be involved in all decision making. He feels there needs to be easy access to industry and so industry needs to be at the table. There will be a challenge in determining when there is too much development. He feels there needs to be group of people (all parties that have responsibility to indicators) working in consensus. Some Aboriginal peoples want the poor animals just left alone - that even current research demands are too intrusive. This is an internal conflict within communities. You want to protect and thus monitor to be able to detect a change but don't want the animals bothered anymore. He is hoping that science develops really small transmitters that aren't invasive, last a long time and which will mean the animals can then be left alone. Again, feels a significant hurdle will be in setting up an effective monitoring program
QUESTION #4: What might be some of the challenges to achieving public, industry and government support for numerical management limits, targets or thresholds? How might one overcome those challenges?		
INDUSTRY	1	Often environmental groups clearly know what their interest etc and are prepared to speak to these interests but communities may not be as aware of their own interests, what targets mean and their potential consequences etc. Communities often identify economic development as an interest well into the process. Lack of understanding creates challenges in getting stakeholder buy-in – can't meaningfully comment Stakeholders may waiver with strict limits / absolutes. Many, many different groups in NWT and many with competing interests so challenge in engaging them all Government tends to focus on short-term goals and projects. Their focus is on the next election. Often 5, 10 or 20 year plans announced but no consideration as to how they will achieve their objectives. For this project, no real idea of HOW they will set their targets. Industry struggles as a result because if the detail isn't present as to how an objective will be achieved then investment decisions are difficult to make. <u>Overcoming these challenges:</u> Engage in public and community consultation Focus on education (why consultation is taking place as well as the proposed use of numerical limits) Develop a process that is flexible so it can adapt to changes Have government build flexibility into their processes
	2 & 3	N/A as do not support the development and implementation of additional thresholds. Okay with the idea of 'markers'
	4	N/A as disagrees that thresholds are needed
REGULATOR	1 & 2	Both comments: Industry nervousness Getting interested party buy-in Lack of solid understanding of tiered thresholds approach and the benefits of adopting such an approach Funding issues*

QUESTION #4: What might be some of the challenges to achieving public, industry and government support for numerical management limits, targets or thresholds? How might one overcome those challenges? (Cont.)		
REGULATOR (CONT.)	3	To obtain a shared understanding of tiered threshold approach Defining what is the VEC and sharing why it is you are trying to define it Understanding what they mean – get a shared understanding Overcoming these challenges: Education
	4	Fear of constraints from some groups – fear that thresholds will limit flexibility in decision making Increased liability concerns – liable if ignore the threshold in one's decisions Possible anxiety in industry and government if thresholds made regulatory requirements Hard to get support for concept if groups do not understand Getting enough local buy-in
RESOURCE MANAGERS / PLANNERS	1	Feels that the lack of certainty on numbers is where the debate happens and the source of why not moving forward. However, we have had this experience with the oil sands and at some point we need to just pick a number as a starting point. <u>Overcoming the challenges:</u> Part of the challenge to obtaining support might also be how people understand thresholds. Her feeling is that we already have them and perhaps if this was communicated and people saw that thresholds were not a new concept. Could point to examples of where they already exist to build support. Need to get used to using thresholds on the broader scale – people need to accept that it is the way that things will be.
	2	In order to get support it is important to make sure that the processes needed to identify, implement, review etc. exist and identify how they can and will take place. <u>Challenge:</u> There will likely be a perception that the thresholds will get put in place and will never change. This belief needs to be addressed in order to build industry and community support Also, industry needs to understand how they might have an influence on the thresholds and how they are developed.
	3	Industry will be nervous as his perception is that industry doesn't like notion of limits even though say want to know the rules. There is a need to have industry at the table in order to fully understand their concerns. Most will want number that is practicable or achievable but then there will be others that will not want to compromise environmental values. Some will want some to be part of the process and others will not want them to be a part of the process – His experience is that government usually just wants government at the table Funding needs will be considerable Challenge in reaching a place where limits are defendable Some parties will lack capacity to participate
	4	Considerable lack of understanding of the subject matter People will demand you take a tiered threshold approach for everything which is not possible – there is a need to focus on what is most important There is lots of scientific and traditional knowledge uncertainty Obtaining the needed funding <u>Overcoming these challenges:</u> Demonstrate the benefits of using a tiered approach education

QUESTION #4: What might be some of the challenges to achieving public, industry and government support for numerical management limits, targets or thresholds? How might one overcome those challenges? (Cont.)		
ACADEMIA / ENGOS	1	All party lack of awareness and knowledge of thresholds Industry and government perception that this approach will cost lots of money. She believes in the long run there will be cost savings for both parties as an open, transparent and proactive process will save money. Seems to be a lot of parties supporting that thresholds and land use planning are the true vehicles to attaining sustainable development but no one really knows how to put it into practice. <u>Overcoming these challenges:</u> Education lots of dialogue early engagement
ABORIGINAL	1	Industry not seeing the problem as their problem – challenge in getting industry buy-in. There is a need to target the right industry – those deflecting responsibility. The impacts are often not seen until long after a project has been completed. No responsibility for the social impact or the education that is required. Responsibility constantly thrown back on Aboriginal peoples and yet we are already overburdened and overtaxed. We have huge capacity issues. Issue of government buy-in – completely dependent on who is currently in office. Issue of government funding – still trying to get resources for Part 6 of the 1994 McKenzie Valley Resource Act. Money that has been received to date has been on an ad hoc basis. <u>Overcoming these challenges:</u> Really believes that given industry's resistance there is a need to develop legislation to have them pay. There is an opportunity to do this by writing the requirement into a permit or licence. Too, could have security deposits that sit there for life of project but again, you have effects long after industry has gone and so is the security cheque Government – could be through Aboriginal land claims? But implementing land claims is still a problem
	2	Doesn't fell that any party has a good understanding of thresholds. Sheer amount of education that needs to happen is huge. He referenced an example with the beluga whales. There was massive and constant education happening with Aboriginal communities about the impacts of shooting versus harpooning and why the former was having a considerable impact on the whale population. Education needs to be at community level. Challenge has been that education occurs at the environmental staff or land manager level and not at the community level. Therefore community doesn't buy-in and disregards. <u>Overcoming these challenges:</u> Need to develop thresholds and educate affected parties in partnership Aboriginal people are not against development. Already have "green / go areas" identified in community conservation plans. These plans HAVE to be respected. Yes, there are red flags noting traditional harvesting areas, traditional use areas, culturally significant areas but the fact that there are no go areas implies there are green areas as well. The challenge for Aboriginal communities is that the growth is too quick. With oil and gas once somebody finds something, everyone comes running. He would like to see more sustainable development occurring. Develop one or two at a time. Companies are always telling them that they can support their efforts by bringing in their own people. Aboriginals are concerned about the impacts this will have (i.e. southern employees fishing). Companies say they will have a no fishing policy but they aren't thinking of all the other impacts such as social impacts. Yes, they would like to see economic development in their communities but in a sustainable way/ Their youth not wanting to be trappers so having job opportunities is nice etc but not at the expense of their culture, way of life, wildlife etc.

QUESTION #5: What might be some of the opportunities to achieving public, industry and government support for numerical management limits, targets or thresholds?		
INDUSTRY	1	The current state demonstrates a need for targets / thresholds All stakeholders desire to manage their interests more proactively Media, Internet etc are facilitating stakeholder understanding through providing information Stakeholders are looking to become involved now with changing landscape
	2 & 3	N/A as don't support the development and implementation of additional thresholds. Okay with idea of 'markers'
	4	N/A as disagrees that thresholds are needed
REGULATOR	1 & 2	Both comments: Industry obtains the increased certainty they are looking for Start small and demonstrate success
	3	Need to demonstrate mutually beneficial – companies get the clarity and certainty that they are looking for Companies have an easier application process Educate on this approach being proactive in managing risks to values
	4	If setting values and thresholds with local involvement then will have increased understanding and support for concept Demonstrate benefits to all groups such as governments would have a template for making decisions, industry may move through approvals process faster (avoid show stopping situations) etc
RESOURCE MANAGERS / PLANNERS	1	Could leverage off of existing thresholds work such as the ConocoPhillips proposal for regional land use plan, the cumulative effects management framework etc, land use plans, etc. These are all examples of places where thresholds have been identified but just haven't been adopted yet. The mechanism is in place and it needs to be used.
	2	Could involve industry in the development of them in the first place However, a certain amount of background work needs to be done in order for people to participate effectively Providing some basic information and a communication strategy is probably something that needs to be developed and provide opportunities for people with experience with these to come and speak to stakeholders (part of annual environment and geoscience conference) as a forum to get the ideas dispersed. May need to have something that is broader than the NWT – could be circumpolar – i.e. climate change issues have been dealt with in a broader forum.
	3	NWT is an area where everyone has an interest to build partnerships and to have better environmental management Anticipates that there will be considerable research and monitoring techniques spin off benefits
	4	The motivation for all parties to support a tiered thresholds approach should be quite strong. The challenge is the chicken and egg scenario – there is a need to demonstrate that it will be effective. Therefore start with a pilot project.
ACADEMIA / ENGOS	1	Show the mutual benefits Education although believes that there is agreement with the concept. The problem is that no real action has been taken Therefore start small: Develop guidance thresholds versus regulator required thresholds Pilot the concept in areas where there are conflicts or where we know that targets are approaching amber (Cameron Hills, near Kakisa, etc)
ABORIGINAL	1	Education of all parties – includes education on traditional knowledge
	2	Education of all parties including Aboriginal communities

QUESTION #6: What might be some regulatory or administrative barriers that would impede the implementation of the NWT management limits or thresholds?		
INDUSTRY	1	Believes there are opportunities: Having more information upfront in the process will only lead to better decision-making Industry will have more buy-in as if this information is upfront in the process then industry expectations are better managed Also if information is upfront, should lead to regulatory efficiencies and speedier approvals for industry There is not a high level of development in the North and so it should be easier to create limits / targets and get them in place – put them into action Government has the opportunity to put a better data management system in place which will lead to improved shared information, improved decision-making, reduce duplication of work
	2 & 3	N/A
	4	N/A as disagrees that thresholds are needed
REGULATOR	1 & 2	There is an opportunity to get people to work together, build consensus leading to the strengthening of the resource and environmental management framework Could have a complementary initiative to one that INAC is leading – opportunity to provide a portal as well for information Could be a win for everyone – improve capacity for regulators – process applications with clarity – less time spent on research that may not be appropriately focused. Better able to meet the objectives laid out in the Resource Management Act
	3	Implementation of thresholds will drive the development of much needed land use plans which in turn will get VCs nested into something that will work well.
	4	May help streamline processes Anticipate greater efficiencies in the approval process If done by land and water boards it may boost these groups / create opportunities for them thereby facilitating communication and shared understanding as well as solidify common objectives.
RESOURCE MANAGERS / PLANNERS	1	This study is a great move. If the Board can take leadership to incorporate this into their decision making then it is a way to provide on the ground integration. The existing cumulative effects management framework could also be leveraged to build integration and cooperation. There is a commitment by participants to implement recommendations from the CEAMF
	2	We have an opportunity in the north to build on a lot of co-management processes if they can continue to foster and build on those then having a big group with different legislative mandates can really help move things forward for decision making
ACADEMIA / ENGOS	1	The application process may go faster with expedited approvals. If we have land use plans indicating where development will occur and if a project is proposing development in one of these areas and demonstrates the project is not near thresholds then should move through application process quickly There is a real opportunity in the NWT to do this work now – before it is too late – this is a time limited opportunity.

QUESTION #7: What might be some regulatory or administrative opportunities that would facilitate the implementation of the NWT management limits or thresholds?		
INDUSTRY	1	Believes there are opportunities: Having more information upfront in the process will only lead to better decision-making Industry will have more buy-in as if this information is upfront in the process then industry expectations are better managed Also if information is upfront, should lead to regulatory efficiencies and speedier approvals for industry There is not a high level of development in the North and so it should be easier to create limits / targets and get them in place – put them into action Government has the opportunity to put a better data management system in place which will lead to improved shared information, improved decision-making, reduce duplication of work
	2 & 3	N/A
	4	N/A as disagrees that thresholds are needed
REGULATOR	1 & 2	There is an opportunity to get people to work together, build consensus leading to the strengthening of the resource and environmental management framework Could have a complementary initiative to one that INAC is leading – opportunity to provide a portal as well for information Could be a win for everyone – improve capacity for regulators – process applications with clarity – less time spent on research that may not be appropriately focused. Better able to meet the objectives laid out in the Resource Management Act
	3	Implementation of thresholds will drive the development of much needed land use plans which in turn will get VCs nested into something that will work well.
	4	May help streamline processes Anticipate greater efficiencies in the approval process If done by land and water boards it may boost these groups / create opportunities for them thereby facilitating communication and shared understanding as well as solidify common objectives.
RESOURCE MANAGERS / PLANNERS	1	This study is a great move. If the Board can take leadership to incorporate this into their decision making then it is a way to provide on the ground integration. The existing cumulative effects management framework could also be leveraged to build integration and cooperation. There is a commitment by participants to implement recommendations from the CEAMF
	2	We have an opportunity in the north to build on a lot of co-management processes if they can continue to foster and build on those then having a big group with different legislative mandates can really help move things forward for decision making
ACADEMIA / ENGOS	1	The application process may go faster with expedited approvals. If we have land use plans indicating where development will occur and if a project is proposing development in one of these areas and demonstrates the project is not near thresholds then should move through application process quickly There is a real opportunity in the NWT to do this work now – before it is too late – this is a time limited opportunity.

QUESTION #7: What might be some regulatory or administrative opportunities that would facilitate the implementation of the NWT management limits or thresholds? (Cont.)		
ABORIGINAL	1	Better decision making Industry clarity and certainty Government will know which areas are of high value to Aboriginal peoples. They will have an understanding of our values prior to issuing mineral rights
QUESTION #8: Do you have any other thoughts and/or suggestions about Valued Component limits and thresholds?		
INDUSTRY	1	Is supportive of adopting a valued components / thresholds approach Hope is that being a part of its development and moving in this direction it will result in a better system. Believes that the system can't really become more convoluted than it already is so envisions heading in this direction will only result in improvements. Setting parameters is a good thing but the challenge is going to be how it is those parameters are set. Need to have an inclusive process toobtain stakeholder buy-in but ultimately at the end of the day, given that government is accountable, government will need to make decisions. Feels that setting parameters is a very complicated issue and he is not sure that there are any successful holistic models anywhere. Believes the smaller the focus the easier it will be to maintain Challenge is going to be that once you carve up areas with broader management areas you may create economic winners and losers Another challenge is that one industry may be pitted against another industry Need to allow for accounting for thresholds to go backwards (i.e. reclamation, when is a seismic line not a seismic line anymore?, other mitigation). Conceptually everyone can buy into the idea but it struggles to work from a practical standpoint. You must be very careful of unintended
	2 & 3	#2 comments: Already have far too complex of a regulatory environment and thresholds would only worsen this situation Do not support the development and implementation of additional thresholds Do not believe that thresholds accomplish what they set out to accomplish Far too complicated and convoluted Feels very strongly that moving down this path now is way before it is required Industry wants to see the regulatory regime grow as activity grows Not looking how oil and gas has evolved. There use to be flaring all the time but now it is not acceptable. Current issues are around seismic activities but there is new technology coming. Oil and gas technology evolves over time. There is a need to have faith. There is a need to keep an appropriate regulatory pace. Neil McCrank and Minister of Indian & Northern Affairs are in the process of undertaking a regulatory review to flush out regulatory complexities and how they may be addressed in keeping with balance – conservation concerns can be addressed and yet balanced with economic development. #3 comments: It is okay to not have all the answers at this time. Industry can adapt and so can the regulatory system. Start with markers – just clues as to whether more attention is required.
	4	Key messages: no additional limits needed for environmental VCs as regulatory system has enough in place to protect the environment local landowners need to better understand how thresholds may hinder their attainment of sustainable infrastructure and economy

QUESTION #8: Do you have any other thoughts and/or suggestions about Valued Component limits and thresholds? (Cont.)		
REGULATOR	1 & 2	#1 comments: Wanted to offer his thought on definitions in the project description re: target / threshold. He believes that the use of political understates the importance and rational for scientific basis for defining a target. He also mentioned his presentation and the segregation of stakeholders into information gatherers, investors and users. To date the focus in developing information has been on the gatherers and he feels it needs to the primary users that need to define VCs and targets as well as communicating what information they need so good quality resource management decisions can be made. In other words, academia is there to support this effort. CEAMF does play a foundational role but to date have had gatherers collecting cumulative effects information and documenting this information. He believes the group that should be driving where work is being done are the resource managers – regulatory and assessment boards Final comment was to reiterate that it should be those with legislated authority making the decisions – interface with other interested parties such as the public and what that interface looks like is discretionary. Challenge is that the public is not homogeneous. #2 comments: The reality is that INAC is a loose organization of 15 agencies - all having observable status to manage cumulative effects. This is not an INAC driven project Can't forget the notion of a monitoring program – huge challenge in finding the money and parties interested in investing in monitoring projects
	3	Right now there isn't too much development and so have the chance to think about tomorrow.
	4	Believes thresholds to be a brave concept New way of doing things so anticipate considerable learning curve but believes if we realize it will take time to get there and persevere then it has the potential to more proactive, responsible and sustainable resource and environmental management Has potential to go beyond political boundaries and work within them Get out of managing things in an island – more eco-system based
RESOURCE MANAGERS / PLANNERS	2	The biggest concern he has is that as we move forward there will be a tendency to head toward the targets and not give them too much concern until you reach the target level They might be seen as a licence to do this much damage – there has to be some way of motivating industry, government, regulators etc. to do whatever it can to slow the rate at which the target is approached. The quicker you head toward a carrying capacity of a wildlife range the faster the population increase goes towards that the faster you will overshoot it. Need to try and have regulatory tools in place to support conservation and protection in addition to the targets and thresholds Wants to see more of developers not just being land users but also being land managers.
	3	Do see a number of challenges and opportunities. The need for thresholds was identified years ago so no real need to focus on getting consensus on this – it is more about how to go about developing and implementing these thresholds

QUESTION #8: Do you have any other thoughts and/or suggestions about Valued Component limits and thresholds? (Cont.)		
ACADEMIA / ENGOS	1	Curious that Review Board is conducting this study. Strongly recommends that findings of this study be communicated to all levels of government as well as all Aboriginal groups. This is a priority and should be front and centre.
ABORIGINAL	2	Thinks the idea of using thresholds fits the current context Does feel there needs to be more cross culturally awareness. Referenced the 1960's and 70's when huge assumptions would be made about Aboriginal people if someone didn't show up on the job. People were fired and industry thought they couldn't rely on Aboriginal people. Cross cultural training allowed industry to better understand why people may not show up on the job and also allowed Aboriginal people to better understand industry's needs.

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