# Assessor's Guide to the Assessment Of Cumulative Effects

YESAB
Yukon Environmental and Socio-economic Assessment Board

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## PREFACE

The *Yukon Environmental and Socio-Economic Assessment Act (YESAA* or *"the Act")* states that in conducting an assessment of a project or existing project, a Designated Office (DO), the Executive Committee (EC) or a Panel of the Board (PB) must consider:

> *The significance of any adverse cumulative environmental or socio-economic effects that have occurred or might occur in connection with the project or existing project in combination with the effects of*
>
> *(i) other projects for which proposals have been submitted under subsection 50(1), or*
>
> *(ii) other existing or proposed activities in or outside Yukon that are known to the designated office, executive committee or panel of the Board from information provided to it or obtained by it under this Act.* [1]

The *Act* does not provide a definition of cumulative effects, nor guidance on the means of addressing this requirement. The objective of these guidelines is not to re-invent the process of assessing and addressing cumulative environmental and socio-economic effects; the objective is instead to borrow from processes that have been successfully implemented in other jurisdictions, and attempt to improve upon those processes where appropriate, and tailor these guidelines specifically to Yukon and the intent of *YESAA*.

One common criticism by practitioners of cumulative effects assessments is that current frameworks do not account for the scale of a project, i.e. small projects are provided the same comprehensive guidelines afforded to large-scale developments. It has been the effort of the *YESAA* Board to provide guidelines that are scalable, such that the level of effort is commensurate with the level of potential or perceived effects associated with a project. The purpose of this guidance material is to provide a framework and methodology to help effectively address the issue of cumulative effects in environmental and socio-economic effects assessment, under *YESAA*.

These guidelines, coupled with the *Assessor's Guide to the Assessment of Environmental Effects* and the *Guide to Socio-economic Effects Assessment,* have

[1] Section 42(d)

attempted to explicitly outline the different phases during project development that should be taken into account during the cumulative effects assessment, including:

- Pre-development period: The environment as it appeared or would currently appear without development on the landscape

- Present period: A thorough characterization of baseline conditions

- Project activities period (including construction, operation, abandonment and reclamation, if relevant), accounting for environmental change

- Post-project activities period: Accounting for the duration of environmental and socio-economic effects that occur as a result of the Project

This guidance document is intended to be used in tandem with the *Assessor's Guide to the Assessment of Environmental Effects* and the *Guide to Socio-economic Effects Assessment*, and is based on the assumption that the assessor has already completed the assessment steps contemplated within those guidelines.

## 1.0 CUMULATIVE EFFECTS CONTEXT

Although many definitions of cumulative effects exist, the following captures the spirit and intent of the *YESAA,* with respect to the assessment of projects*:*

> **Cumulative Effects:** Changes to environmental or socio-economic components caused by an activity (related to a project being assessed) in combination with other past, present, and future activities.

The magnitude of cumulative effects can be additive (the sum of individual effects from each activity), or synergistic (equal to an effect greater or less than the sum of individual effects).

Some types of cumulative effects include the following (adapted from Hegmann *et.al* 1997):

Landscape Nibbling

The cumulative environmental effects of landscape nibbling generally result from landscape fragmentation or through the loss of habitat/connectivity. For example, the availability of habitat for wildlife can be lost through direct removal (e.g. clearing of land), indirect effects (e.g. changes to vegetation), or through sensory disturbances (e.g. noise). Together, these changes can functionally break up a landscape into smaller pieces that may no longer meet the needs of resident species (fragmentation) and can reduce movement between remaining habitat patches (connectivity). While the direct effects of landscape nibbling typically affect environmental components, socio-economic factors may also be affected directly (e.g. aesthetic effects) or indirectly (e.g. reduced opportunities for wildlife viewing).

Physical-chemical Transport

Physical-chemical transport is the introduction of a chemical or physical contaminant into the environment (e.g. into the air or waterways) where the contaminant is transported elsewhere and interacts with contaminants from other activities, or interacts with environmental components (e.g. water) that are also affected by activities. These

cumulative environmental effects may also translate into socio-economic effects if a socio-economic value is associated with the environmental component being affected (e.g. drinking water quality).

Socio-economic

The combined effects of various projects in a region may result in effects on human communities (e.g. social services and employment), use of the land (e.g. recreation), and traditional and cultural activities. Cumulative socio-economic effects may, for example, result in economic redistribution, changes to services, and impacts to quality of life.

A major challenge associated with addressing cumulative effects is that many different projects and activities on a regional scale may contribute to cumulative effects, while an assessor can only recommend mitigations with respect to the proposed project that is subject to assessment. Without the mandate or ability to change existing projects/activities, mitigative measures recommended by assessors are invariably relegated to the proposed project.

The assessor is generally limited in cumulative effects assessment by the same tools for the assessment of environmental and socio-economic effects; these tools are simply applied to larger spatial or temporal areas. The exception to this results from successful regional land use planning that incorporates the identification of environmental and socio-economic values on a regional scale, and sets out an acceptable approach for appropriate levels and types of development in an area, in the long term.

Land use planning provides the advantage of delineating appropriate uses of area and efficiencies that can be realized between various industries and undertakings. Without land use planning in place, assessors will continue to carry out assessments on a project by project basis, providing Decision Bodies (DBs) with recommendations based upon the merits or drawbacks of the project in the context of the current situation in an area.

It must be accepted that a likely outcome resulting from project-specific cumulative effects assessment in the absence of other regional planning exercises will be the attainment of a saturation point of acceptable effects on a particular environmental or

socio-economic component, and this may occur without much forewarning. The consequence of reaching the threshold of acceptable change on an environmental or socio-economic component will likely to be the recommendation from the Designated Office (DO) or Executive Committee (EC) for the project not to proceed. This will also likely mark the beginning of a common recommendation for similar projects in the region not to proceed if they affect the same component of concern.

It is therefore important for assessors to work closely with proponents, regulators, Decision Bodies, and interested persons to identify issues as early in the assessment process as possible, such that significant issues can be mitigated to the extent possible, and informed, effective, and appropriate decisions can be made.

### *1.1 CUMULATIVE EFFECTS FRAMEWORK*

- □ Step 1: Identify Regional Valued Environmental and Socio-Economic Components
- □ Step 2: Identify and Characterize Cumulative Effects Baseline Information
- □ Step 3: Determine Spatial Bounding of Assessment
- □ Step 4: Identify Other Projects and *Act*ivities, and Residual Effects
- □ Step 5: Determine Temporal Bounding of the Assessment
- □ Step 6: Identify and Characterize Potential Cumulative Effects and their Mitigation
- □ Step 7: Rank Significance of Cumulative Effects

## 2.0 STEP 1: IDENTIFY REGIONAL VALUED ENVIRONMENTAL AND SOCIO-ECONOMIC COMPONENTS (VESECS)

The purpose and intent of using VESECs in an assessment is outlined in Step 1 of the *Assessor's Guide to the Assessment of Environmental Effects*. VESECs are values on the landscape that have a potential to be affected by the project. Concerns or issues with respect to effects of the project on valued environmental or socio-economic components are typically raised by interested persons, experts, federal/territorial/First Nation governments, or determined by the assessor to be relevant to the assessment.

Appropriate VESECs should be chosen by the assessor, using the criteria in Figure 1.

Generally, the assessor should consider the potential cumulative effects on all VESECs identified in the environmental and socio-economic effects assessments. If, however, all adverse effects on a particular VESEC were completely mitigated in previous steps of the assessment,[2] then cumulative effects on that VESEC do not need to be considered further.

Although rare in occurrence, there may be assessment situations where the assessor will want to consider additional VESECs for the purposes of the cumulative effects assessment, for example, if a species is of concern at a regional scale, but not at a local scale. In such instances, the assessor will first need to collect local baseline information specific to the VESEC and determine the local effects of the project on the VESEC prior to addressing cumulative effects.

Table 1 provides a suggested framework for identifying VESECs. If no additional VESECs are identified, the assessor may proceed to Step 2.

[2] For effects on a VESEC to be completely mitigated, no residual effects must exist, considering the application of mitigation.

**Figure 1 Criteria for Selecting VESECs**

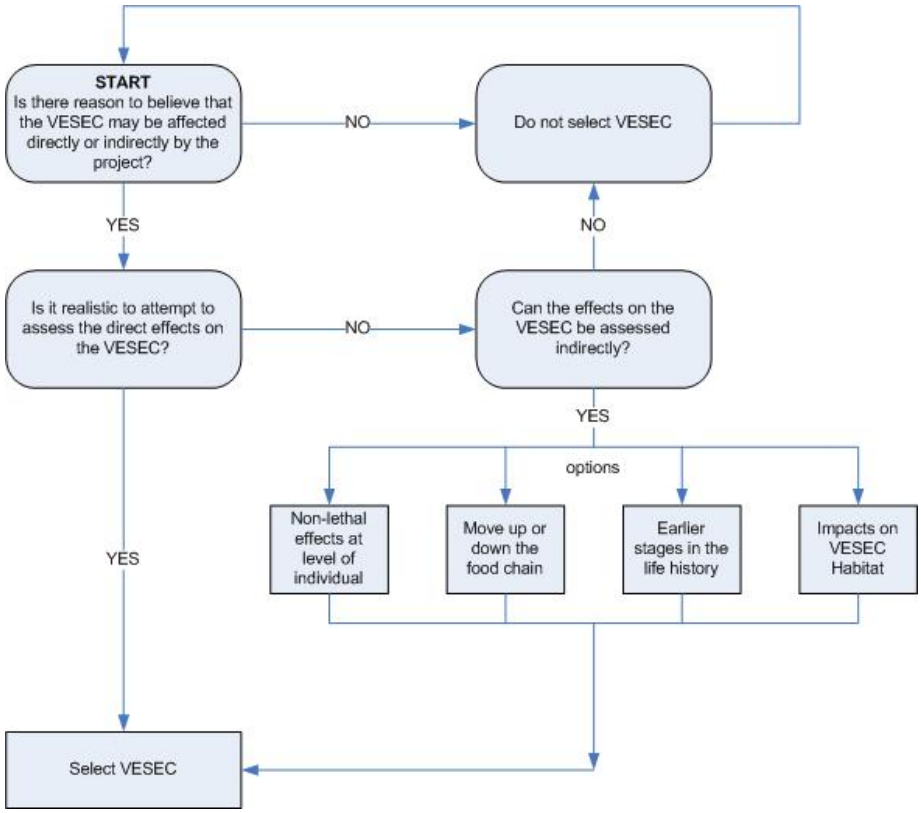

**Table 1 Identify the Valued Environmental and Socio-economic Components**

| VESEC | REASON FOR CHOICE | TYPE (✓) | | | | |
|---|---|---|---|---|---|---|
| | | Focal Species | Repre-sentation | Special Elements | Ecological Process | Socio-economic |
| *VESECs from Local Effects Assessment* | | | | | | |
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| *Additional VESECs added for the Cumulative Effects Assessment* | | | | | | |
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## 3.0 STEP 2: IDENTIFY AND COMPILE CUMULATIVE EFFECTS VESEC BASELINE INFORMATION

The *Guidelines for the Assessment of Environmental Effects under YESAA* (Step 3) establishes a framework for identifying VESEC-specific baseline information, for the purposes of assessing local project effects. Baseline information is used by the assessor to make better predictions about the potential project-related effects that might occur. For the purposes of the cumulative effects assessment, the assessor should seek out any additional applicable information for consideration, specifically any regional indicators of VESEC condition.

Appendix 1 provides examples of potential cumulative effects issues and indicators in Yukon.

Table 2 provides a suggested framework for detailing this additional cumulative effects baseline information.

**Table 2 Identify and Characterize Available Cumulative Effects Baseline Information**

| VESEC | DATA TYPE (e.g. spatial, habitat, wildlife, socio-economic, vegetation, traditional) | Time Period | | | DATE COMPILED | SOURCE |
|---|---|---|---|---|---|---|
| | | Past | Current | Future | | |
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## 4.0 STEP 3: DETERMINE SPATIAL BOUNDING FOR ASSESSMENT

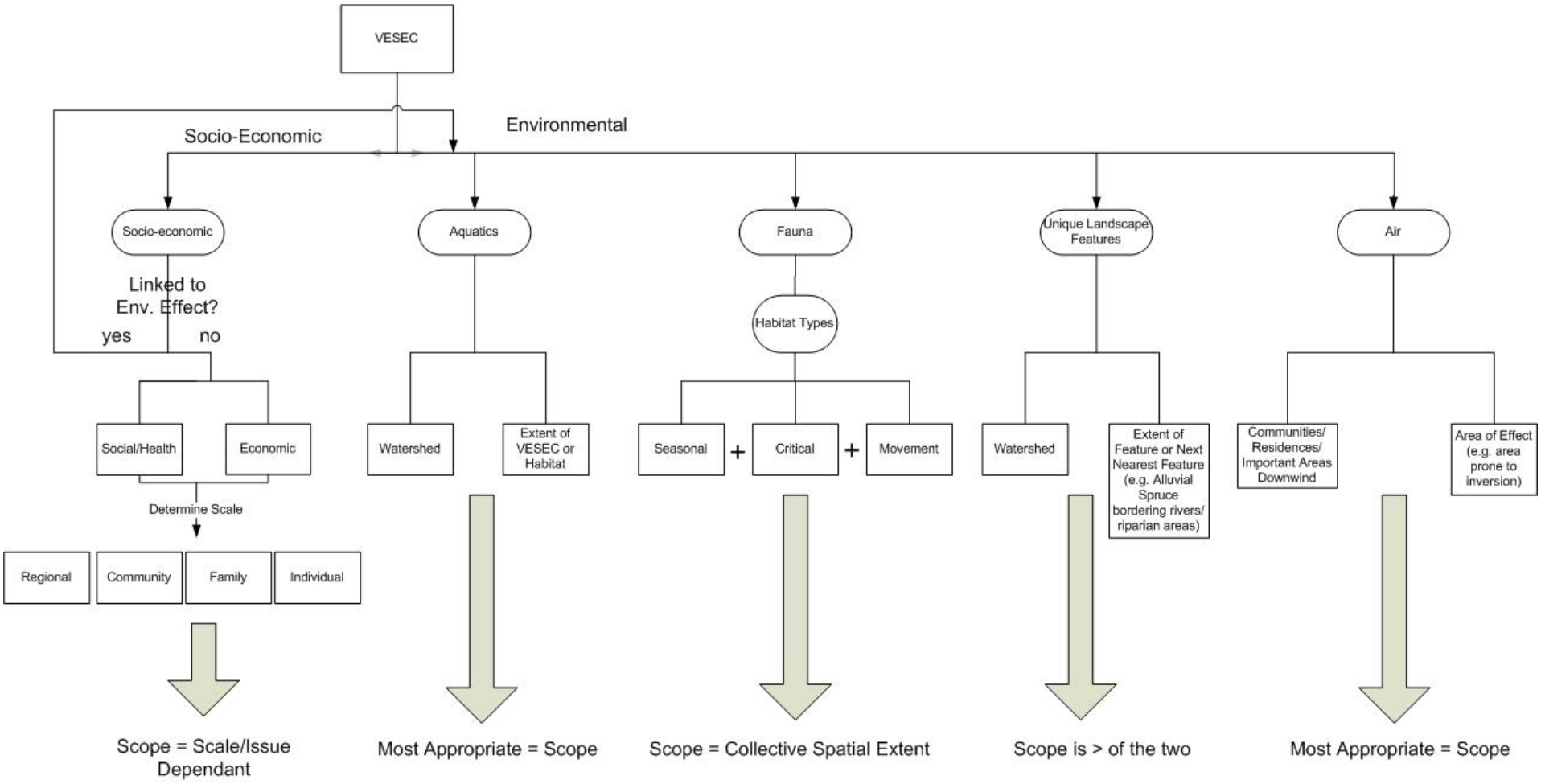
Prior to considering further the implications of the project's residual effects in combination with those of other projects or activities, the assessor must first determine the spatial area within which effects will be assessed. This area is referred to as the spatial scope, or the study area. The spatial scope can, and in most cases should, be unique for each VESEC, and should encompass an area large enough to consider most, if not all, regional pressures (past, present, and future) on the selected VESEC.

A cumulative effects assessment should consider all influences originating from other projects and activities that affect the VESECs identified in Step 1. To be more precise, the projects and activities considered in the cumulative effects assessment are not required to overlap spatially with identified VESECs; it is the effects of these projects and activities within the defined spatial bounds that the assessment should consider. If the effects of a project/activity overlap in some manner with a VESEC (i.e. could have some potential to contribute to adverse effects), then the spatial scope of the assessment should be extended to include that project/activity.

The spatial scope of a VESEC generally is relevant to the ecology or some aspect of the socio-economic system. For example, a common geographical unit used is the watershed, since it represents the source area for any material washed into a waterway, and is commonly the most appropriate unit in which to address problems as varied as erosion, flooding, and contamination of streams by waste. A watershed is determined by topography, whereby the boundaries are indicated by the nearest ridge tops. Ridges are also recognized as natural semi-permeable boundaries to flora and fauna, and as such these boundaries can at times be functional assessment boundaries for VESECs, both aquatic and terrestrial. The use of watersheds as planning units for non-aquatic VESECs may be less appropriate; annual population ranges or home ranges might be more appropriate for larger mammals.

It is important that the assessor consider the specific characteristics (e.g. range, habitat usage, etc) of VESECs when determining the spatial scope of the cumulative effects assessment. Figure 2 provides a suggested framework.

**Figure 2 Appropriate Spatial Scopes of Assessment for selected VESECs**



## 5.0 STEP 4: DETERMINE TEMPORAL BOUNDING OF THE ASSESSMENT (TEMPORAL SCOPE)

Defining the temporal scope (time period for consideration) of an assessment requires an understanding of the likely residual (post-mitigation) effects of the project (Table 4, Guidelines for the Assessment of Local Project Effects under *YESAA*), coupled with an understanding of the likely duration of these effects.

With a reasonable understanding of the duration of direct and indirect residual effects, the assessor can begin to define the time period within which cumulative effects will be considered; this is referred-to as the temporal scope. The assessment should cover a period long enough to incorporate long-term, direct, and indirect effects of the proposed project that overlap with the residual effects of other projects.

Table 3 provides a suggested framework.

**Table 3 Determine Temporal Bounding of the Assessment (Temporal Scope)**

| ANTICIPATED RESIDUAL EFFECT OF THE PROJECT (FROM TABLE 3, THE PROJECT ACTIVITY/ DISTURBANCES NOT COMPLETELY MITIGATED) | TYPE OF EFFECT (✓) | | VESEC AFFECTED (✓) | | | | | | | | ANTICIPATED DURATION OF EFFECT A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Env't | Socio-Ec | VESEC 1 | VESEC 2 | VESEC 3 | VESEC 4 | VESEC 5 | VESEC 6 | VESEC 7 | VESEC 8 | |
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| **RESIDUAL EFFECTS FROM PAST PROJECTS** | | | | | | | | | | | **B** |
| | | | | | | | | | | | |
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| | | | | | | | | | | | |
| **ANTICIPATED EFFECTS OF FUTURE PROJECTS** | | | | | | | | | | | **C** |
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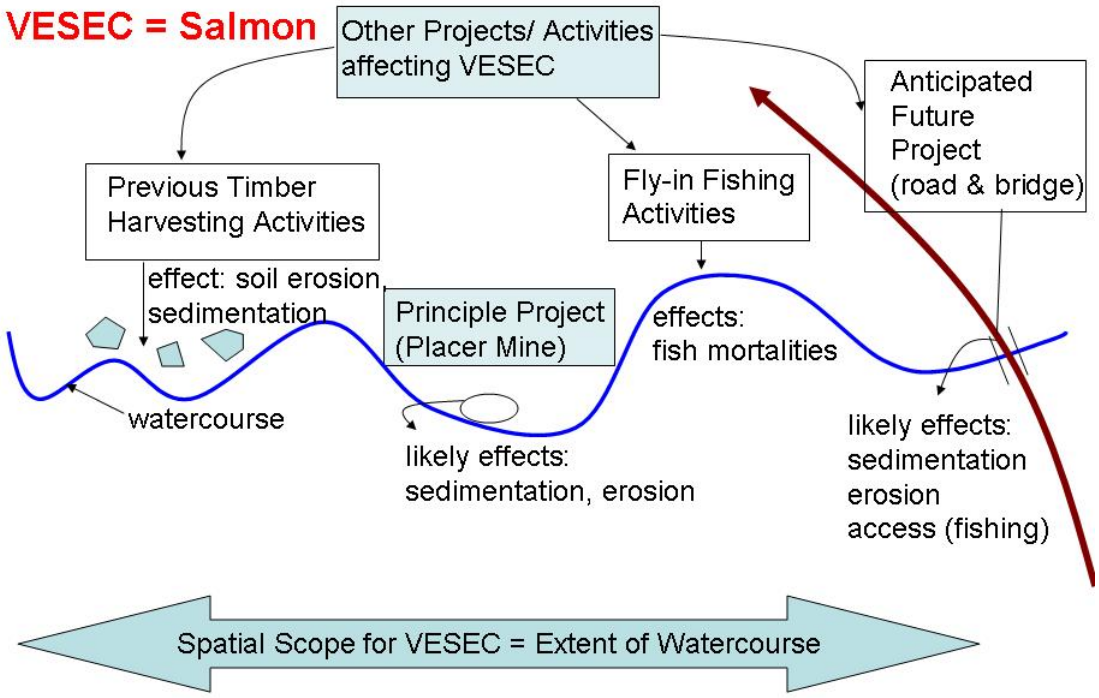
| | | | | | | | | | | | |

**TEMPORAL SCOPE = A+B+C (BY VESEC)**

## 6.0 STEP 5: IDENTIFY OTHER PROJECTS AND ACTIVITIES, AND RESIDUAL EFFECTS

The purpose of a cumulative effects assessment is to consider the effects of the project coupled with the effects of other past, present, or future projects and activities. The scope of the VESECs determines the area within which effects are considered. Projects do not have to physically occur within the spatial scope of the VESEC to be considered contributory to environmental or socio-economic impacts. It is the effects stemming from those projects that occur within the spatial scope of the VESEC that are considered. This is illustrated in Figure 3.

**Figure 3 Considering the Effects from Other Projects and *Act*ivities**




The objective of this step is to identify all inputs from other projects that could influence the VESECs identified in step 1. The assessor should identify:

- Past, present, and likely future projects and activities in the area that may affect identified VESECs
- Other existing or anticipated pressures (direct and indirect) on identified VESECs

Spatial information analyzed using a Geographical information System (GIS) can be useful in the identification of spatial overlaps of various projects and activities with VESECs. Expert sources of local effects baseline information that were identified in Step 3 of the Guidelines for the Assessment of Local Project Effects under *YESAA* may also be logical sources for cumulative effects assessment baseline information. Where possible, the assessor should seek to correlate historic project and activity pressures on the VESEC with changes in VESEC condition. This may provide direction in projecting anticipated future VESEC responses to added pressures.

For cumulative socio-economic effects, the assessor should consider all projects or activities for which an effect is still perceptible. This will be a balancing act for the assessor to determine a reasonable time period to consider for the purposes of the assessment. For instance, one may argue that some Yukon towns are still experiencing effects of the gold rush (e.g. Dawson wouldn't be there if it had not happened), however the time that has lapsed since that period has resulted in a new condition, (i.e. the existence of Dawson City *is* the new baseline).

Table 4 provides a suggested framework for identifying which other projects, and their associated residual effects, should be included in an assessment.

**Table 4 Identify Other Projects/Activities and Associated Residual Effects**

| Projects/Activities with Effects Identified within Scope (✓) | Description of Project / Activities | Status (✓) | | | Residual Effects of Project/Activities | VESEC(s) Affected |
|---|---|---|---|---|---|---|
| | | Past | Current | Future | | |
| Forestry | | | | | | |
| Harvesting | | | | | | |
| Mining | | | | | | |
| | | | | | | |
| Linear | | | | | | |
| Developments | | | | | | |
| Roads | | | | | | |
| | | | | | | |
| Settlements | | | | | | |
| | | | | | | |
| Resource | | | | | | |
| Extraction | | | | | | |
| Recreational | | | | | | |
| | | | | | | |
| Other | | | | | | |
| | | | | | | |

## 7.0 STEP 6: IDENTIFY AND CHARACTERIZE POTENTIAL CUMULATIVE EFFECTS AND THEIR MITIGATION

The function of this step in the assessment of cumulative environmental and socio-economic effects is to determine the likely adverse environmental effects, and to identify appropriate actions to mitigate those effects, and the resultant residual effects of the project on the VESECs. Residual effects are the effects of the project that occur subsequent to the application of mitigation.

This step involves the consideration of likely residual effects of the principal project in combination with the effects/residual effects of other projects (cumulative effects), mitigation measures to reduce or eliminate the likely cumulative effects of the project, and a consideration of the success of the proposed mitigation measures.

The degree to which an assessor will characterize cumulative environmental effects, and instructions on how to do so, is beyond the scope of this guideline given the limitless number of potential effects that may impact an equally vast number of potential VESECs. There are however certain methods that are commonly used in the characterization of cumulative effects (listed below). The selection of relevant methodological approaches to characterizing cumulative effects should be related to the type of VESEC being addressed, the nature of effects, categories and significance of issues, and the level of available resources or expertise.

In practice, it may be common for an assessor to use a variety of the following approaches concurrently:

Spatial Analysis: Spatial analysis is a way of analyzing data that explicitly incorporates information about location as well as attributes of the data set. This approach is commonly undertaken through the use of GIS. Spatial analysis has a large number of applications, including (but not limited to) evaluating habitat suitability and capability, estimating and predicting project/VESEC overlaps and effects, and for interpreting and understanding natural succession of vegetation. Spatial analysis approaches are useful for identifying and representing certain cause-effect relationships, and provides the

assessor with the advantage of examining relatively large areas with respect to project effects and values.

Landscape Indicators: The use of landscape indicators involves the measurement of specific variables that track over time the state of air, water, and land resources, pressures on those resources, and resulting effects on ecological condition. This approach is useful for objectifying inherently subjective values. For example, forest health may be a difficult concept to measure, however select indicators have been chosen by forest scientists to describe forest health, including: Crown condition, ozone injury, tree damage, tree mortality, lichen communities, down woody material, vegetation diversity and structure, and soil condition. In some cases, a VESEC chosen in Step 1 may be a landscape indicator in and of itself.

Socio-economic Indicators: The use of socio-economic indicators involves the measurement of specific variables that track over time relevant socio-economic components, pressures or influences on those components, and resulting effects on socio-economic conditions. In some cases, a VESEC chosen in Step 1 may be an indicator in and of itself.

Trends: Trend analysis is the process of analyzing data to identify underlying longer-term trends, e.g. population growth over time. Effective analysis of changes over time may help the assessor determine future performance. Any assumptions and uncertainties should be identified if and when this approach is used in forecasting probable future effects.

Thresholds: Threshold measurements enable both project proponents and regulators to evaluate the acceptability of project-related effects on a specific component of the environment by comparing the effects of the project against a predetermined limit of acceptable change. If project effects, either independently or in combination with other land-use pressures, force a VESEC into an unacceptable condition or level, then the project effects will likely be deemed significant. If the effects of the project do not force the VESEC into an unacceptable condition or level (locally or cumulatively), then project effects are typically viewed as not significant, and the project may be recommended to proceed. Naturally, reliable pre-development baseline information (Step 5) is vital where

planning is based upon thresholds which have been developed for particular VESECs, e.g. the level at which development within a caribou herd's winter range becomes a significant effect. Thresholds are often refined through time, as understandings of populations and ecological interactions evolve. Therefore, the assessor should seek the most up-to-date and applicable thresholds when and where available.

Where objective threshold information is available, this is a recommended methodology for use in assessments. This approach, however, is typically limited by the availability of such information.

Computer Modeling: Computer modeling is a technique for predicting effects in space and/or time. Models rely upon information about the source of an effect (either assumed or measured), and assumptions that this effect is dispersed in a particular way that can be described mathematically. Models can be reasonably accurate when describing the dispersion of a single effect from a single point source. However, the greater number of assumptions equate to greater probability of error. Many models, even sophisticated ones, can have large margins of error (± 100% or worse). Results from computer models are only as good as the information and assumptions being used. Where quality information and proven models are unavailable, this approach is not recommended as a primary means of identifying and characterizing effects.

In practice, the assessor should seek out professional expertise and relevant examples of effects assessment carried out previously, when and where possible, specific to the VESEC and/or effect at hand.

As with the mitigation of direct and indirect environmental and socio-economic effects of the project, mitigation of cumulative effects may take the form of measures to reduce, eliminate, or control adverse effects related to the proposed project activities (e.g. the use of high-flotation tires on forestry equipment to reduce rutting and soil damage), compensation (e.g., a no-net-loss approach to specific regional values/resources), or alternative ways of undertaking or operating the project that would avoid or minimize any significant adverse effects (e.g. requiring winter-only timber harvesting in sensitive areas) as per Section 42(1)(e) of the *Act*. Mitigation measures may also need to occur in relation to an adaptive management plan (step 10).

In addition to issues identified by the assessor during the course of conducting an evaluation or screening, the assessor will also typically rely upon input of the public, experts, regulators, and Decision Bodies to identify pertinent issues, and will determine on a case-by-case basis the appropriate merit given to each issue raised. It is often important that experts are included in the exercise of identifying environmental effects. In-depth knowledge about a particular aspect of a proposed project or effect can support an assessor in areas where they do not have as much experience. These experts may provide a perspective that is both relevant and helpful to effective and responsible environmental and socio-economic assessment.

To the extent possible, assessors should seek input from experts with a relevant background and knowledge of the local environment, and/or community affected by the project. In instances where this local expertise is unavailable, the assessor may extrapolate likely project effects from issue- or VESEC-specific scientific, local and/or traditional information that is available.

The *Act* requires the assessor to consider any matter that a Decision Body has asked it to take into consideration.[3] Notification of the Decision Body at the beginning of an assessment facilitates this process, however the assessor may choose to more actively seek input from the Decision Bodies with respect to any concerns and issues related to the project. Ongoing communication is essential to fulfilling this requirement.

The Designated Office and Executive Committee Rules establish the process through which the public can participate in assessments. Further guidance can be found in the Board document *Assessor's Guide to Public Participation Opportunities*. All relevant comments received in a manner consistent with the Rules must be given full and fair consideration in the assessment.

Before determining the significance of identified cumulative effects, any feasible mitigations and their relative success should be considered. The significance of

[3] *YESAA* 42(1)(i)

cumulative effects (Step 6) considers the application of mitigation measures that have been taken into account over the course of the assessment.

The process of determining the likely success of mitigative measures should include the consideration of existing conditions, the likely changes to existing conditions as a result of the project, and the extent to which mitigative measures eliminate, reduce, or control the identified adverse environmental/socio-economic effects on a VESEC. Ultimately, it is the resultant effect on the VESEC, as it differs from existing conditions, which will determine the effectiveness of mitigative measures. This is different from the process of determining the significance of cumulative effects, where it is the effect of the change on the VESEC from pre-development conditions that is considered.

Outside of mitigating the local environmental and socio-economic effects of a project (which is the primary means of mitigating cumulative effects), it can be particularly difficult to establish appropriate measures to mitigate cumulative effects on a project by project basis, since cumulative effects are regional in nature and are a result of conditions expressed by more than the activities of the project being assessed. When and where regional initiatives such as land use planning are available, assessors are encouraged to use them where appropriate, as they are logical frameworks within which to address regional cumulative effects. Currently, however, such regional initiatives are uncommon in Yukon.

From a socio-economic standpoint, if cumulative effects cannot be avoided they may be most effectively mitigated through reparation measures, e.g. the establishment of additional social infrastructure to compensate for effects on existing services. Environmentally, a cumulative effects condition is typically more difficult to address, and mitigation measures are most commonly in the form of a recommendation for reduced pressure on the VESECs in question, through effects treatment or through a recommendation of reduced activity as expressed by the project. It is not common for the assessor or Decision Bodies to be in a position to require additional mitigations on projects other than the project being assessed.

Although not common in practice, in instances where the project will not be recommended to proceed due to significant cumulative effects, the proponent may

indicate to the assessors and/or Decision Bodies a willingness to mitigate existing residual effects not related to the project. The assessor should discuss with Decision Bodies the extent to which such mitigations can be incorporated and/or implemented in the regulatory process. It is generally unreasonable to expect a single proponent to bear the burden of mitigating effects attributable to other actions in the region.

Table 5 provides a suggested framework for the identification and characterization of potential cumulative effects and their mitigation.

**Table 5 Identification and Characterization of Potential Cumulative Effects and Their Mitigation**

| VESEC | Residual Effects Influencing VESEC (Sum = Potential Cumulative Effects) | Project/*Act*ivity Responsible for Residual Effect | Type(s) of Cumulative Effects by VESEC (✓) | | | | | | | | | | | Additional Mitigation (other than established in local effects assessment) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Transport of Chemical Constituents | Transport of Physical Constituents | Habitat Loss/Alteration | Habitat Fragmentation | Blockage of Regional Wildlife Movement | Direct Mortality of Wildlife | Disruption of Ecological Processes | Changes to population | Changes to Community/ Institutional | Transitional community changes | Individual and Family level effects | |
| **1.** | **1.** | | | | | | | | | | | | | |
| | **2.** | | | | | | | | | | | | | |
| | **3.** | | | | | | | | | | | | | |
| | **4.** | | | | | | | | | | | | | |
| | **5.** | | | | | | | | | | | | | |
| **2.** | **1.** | | | | | | | | | | | | | |
| | **2.** | | | | | | | | | | | | | |
| | **3.** | | | | | | | | | | | | | |
| | **4.** | | | | | | | | | | | | | |
| | **5.** | | | | | | | | | | | | | |
| **3.** | **1.** | | | | | | | | | | | | | |
| | **2.** | | | | | | | | | | | | | |
| | **3.** | | | | | | | | | | | | | |
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| | **5.** | | | | | | | | | | | | | |
| **4.** | **1.** | | | | | | | | | | | | | |
| | **2.** | | | | | | | | | | | | | |
| | **3.** | | | | | | | | | | | | | |
| | **4.** | | | | | | | | | | | | | |
| | **5.** | | | | | | | | | | | | | |

## 8.0 STEP 7: RANK SIGNIFICANCE OF CUMULATIVE EFFECTS

When the effects of the project (subsequent to mitigation) and other projects and activities in the vicinity have been identified, the assessor can determine the additive or synergistic consequences of these combined effects.

Any conclusions and recommendations provided to Decision Bodies as per s.56 or s.58 of the *Act*, for DO evaluations and EC screenings respectively, should be based upon the determination of significance. For cumulative effects this means the assessor must determine if the residual effects of the project combined with the residual effects of other projects and activities within the scope of the assessment represent a significant effect.

Figure 4 and Table 6 establish a suggested framework for determining the significance of a project.

**Figure 4 Reference Table for Ranking Significance for Cumulative Effects**

| Questions for each Local Effect | Significance Rankings | | | Significance Conclusion |
|---|---|---|---|---|
| | Low (L) | Moderate (M) | High (H) | |
| **Effects on Biological Species** | | | | |
| 1. How much of the population may have their reproductive capacity and/or survival or livelihoods affected? Or, for habitat, how much of the productive capacity of their habitat my be affected | <1% | 1-10% | >10% | L if Low. If M or H, go to question 2. |
| 2. How much recovery of the population or habitat could occur, even with mitigation? | Complete | Partial | None | L if Low. If M or H, go to question 3. |
| 3. How soon could restoration occur to acceptable conditions? | <1 year or 1 generation | 1-10 yrs or 1 generation | >10yrs or >1 generation | L, M, H |
| **Effects on Physical/Chemical Environment** | | | | |
| 1. How much could changes in the VESEC exceed that associated with natural variability in the region? | < 1% | 1-10% | >10% | L if Low. If M or H, go to question 2. |
| 2. How much recovery of the VESEC could occur, with recommended mitigation? | Complete | Partial | None | L if Low. If M or H, go to question 3 |

| **Effects on Physical/Chemical Environment** | | | | |
|---|---|---|---|---|
| 3. How soon could restoration occur to acceptable conditions? | <1 year | 1-10 yrs | >10 yrs | L, M, or H |

| **Effects on Socio-Economic Variables** | | | | |
|---|---|---|---|---|
| 1. Could the effect be of concern to local residents or administrative authorities, or directly impact on commercial operations or subsistence livelihood, or alter quality of life of residents or recreational enjoyment by residents and/or visitors? | Little or no concern or change | Some concern or change | Substantial concern or change | L if Low. If M or H, go to question 2. |
| 2. Could the effect be unacceptable to users even after the application of compensation or mitigation measures? | Acceptable to most people | Somewhat acceptable | Unacceptable to most people | L if Low. If M or H, go to question 3. |
| 3. How soon could restoration occur to acceptable conditions? | < 1 year | 1-10 yrs | > 10 yrs | L, M, or H. |

(adapted from Hegmann et.al.,1997[4])

[4] Users Guide for Screening of Cumulative Effects, Yukon Government (Hegmann et.al.1997)

**Table 6 Ranking Significance of Cumulative Effects (L, M, or H - From Figure 3)**

| **Project Activity / Disturbance** | VESECs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| Environmental | | | | | | | | | | | | |
| Alteration of surficial geology | | | | | | | | | | | | |
| Disturbance of soils | | | | | | | | | | | | |
| Removal of vegetation | | | | | | | | | | | | |
| Controlled burns | | | | | | | | | | | | |
| Contaminant discharge | | | | | | | | | | | | |
| Solid waste disposal | | | | | | | | | | | | |
| Water consumption | | | | | | | | | | | | |
| Water diversion | | | | | | | | | | | | |
| Facility construction | | | | | | | | | | | | |
| Human presence | | | | | | | | | | | | |
| Motorized vehicle use | | | | | | | | | | | | |
| Aircraft use | | | | | | | | | | | | |
| Boat use | | | | | | | | | | | | |
| Resource extraction | | | | | | | | | | | | |
| Other: | | | | | | | | | | | | |
| Socio-economic | | | | | | | | | | | | |
| Consumption of goods and services | | | | | | | | | | | | |
| Direct/indirect employment | | | | | | | | | | | | |
| Project effects on infrastructure | | | | | | | | | | | | |
| Worker presence/ absence from community | | | | | | | | | | | | |
| Other: | | | | | | | | | | | | |

If all effects are ranked as Low, the project effects are not likely significant, and the project may be recommended to proceed.

If any effects are ranked Moderate, there is a moderate likelihood for significant effects. Mitigation approaches should be reviewed with the intention of increasing mitigation success. Based upon information received in the assessment, the DO or EC (as determined by the Regulations) will determine and consequently recommend to Decision Bodies on a case-by-case basis, whether:

1. The project be allowed to proceed, if it determines that the project will not have significant adverse environmental or socio-economic effects in or outside Yukon.
2. The project be allowed to proceed, subject to specified terms and conditions, if it determines that the project will have significant adverse environmental or socio-economic effects in or outside Yukon that can be mitigated by those terms and conditions.
3. The project not be allowed to proceed if it determines that the project will have significant adverse environmental or socio-economic effects in or outside Yukon that cannot be mitigated.
4. The project be referred to the Executive Committee (if the assessment was completed by a Designated Office) if, after taking into account any mitigation measures included in the project proposal, it cannot determine whether the project will have significant adverse environmental or socio-economic effects.
5. A review of the project is required (if the assessment was completed by the EC), if, after taking into account any mitigation measures included in the project proposal, it cannot determine whether the project will have significant adverse environmental or socio-economic effects.

If any effects are ranked High, there is a high likelihood for significant effects, and the project should not be recommended to proceed without additional mitigation or changes to project activities.

For moderate and high rankings, the assessor should consider the following criteria in Table 7, and the means through which they may be affected, so as to reduce the significance of effects.

**Table 7 Criteria for Evaluating Socio-Economic Effects Considered Moderate or High**

| | |
|---|---|
| Magnitude | The probable severity of each potential adverse effect (degree, extensiveness, or scale). How serious is the impact? Does it cause a large change over baseline conditions (e.g. will crime rates double?). Does it cause a rapid rate of change – large changes over a short time period? Will these changes exceed local capacity to address or incorporate change? Does it create a change which is unacceptable? Does it exceed a recognized threshold value? |
| Geographical Limits | The extent to which the potential effect may eventually extend (e.g. local, regional, national, global), as well as geographical location (e.g. far north, isolated location) |
| Duration and Frequency | The length of time (day, year, decade) for which an effect may be discernible, and the nature of that impact over time (is it intermittent and/or repetitive). If repetitive, then how often? |
| Risk | The probability/predictability of an effect occurring. For many socio-economic effects, a qualitative assessment would be appropriate (i.e. high, medium, low). |
| Socio-economic Importance | The degree to which the potential effects may (or may be perceived to) affect local economies or social structure. |
| People Affected | How pervasive will the impact be across the population? This criterion should be used to assess both the percentage of the population affected and the extent to which it will affect different demographic groups, particularly the vulnerable groups (e.g. children, elderly, pregnant women, etc.). |
| Reversibility | How long will it take to mitigate the effect by natural or man-induced means? Is it reversible, and if so, can it be reversed in the short or long-term? |
| Economic Costs | How much will it cost to mitigate this impact? Who will pay? How soon will finances be needed to address this effect? |

## APPENDIX 1 EXAMPLES OF CUMULATIVE EFFECTS ISSUES AND INDICATORS IN YUKON[5]

| ANTICIPATED EFFECT | VESECS | INDICATORS |
|---|---|---|
| Reduced Air Quality<br>Cumulative effects arise from:<br>• Emissions that lower ambient air quality by elevating levels of ozone, particulates, and other pollutants;<br>• Long-range transport of emissions from other jurisdictions. | Human Health | • Concentration of standard air quality parameters, particularly during seasonal and weather conditions that minimize air dispersion (e.g. inversions);<br>• Estimates of human exposure to air pollutants. |
| Decline in Water Quality<br>Cumulative effects arise from:<br>• Effluent pollutant loadings from industrial and domestic sources;<br>• Increased sedimentation due to soil erosion, road construction, forestry practices, and agriculture;<br>• Sedimentation due to direct disturbance of substrate in rivers, lakes, and streams from mining operations, and stream crossings. | Water Quality for:<br>• Humans;<br>• Fish;<br>• Wildlife use. | • Standard aquatic life protection and drinking water quality parameters (including Total Suspended Solids, Dissolved Oxygen, Biological Oxygen Demand, COD);<br>• Contaminants associated with specific industries (including dioxins, petroleum hydrocarbons, and heavy metals) measured in effluents and downstream. |
| Decline in Fisheries Productivity<br>Cumulative effects arise from:<br>• Direct mortality on fish populations from toxic chemicals;<br>• Reductions in populations due to declines in habitat or habitat quality;<br>• Over-harvesting of fish populations due to increased fishing pressure;<br>• Tainting and other adverse impacts on fish flesh making fish inedible or unappetizing. | • Fish habitat;<br>• Fish populations;<br>• Fish harvests; | • Estimates of spawners and escapement of anadromous (migrating up rivers from the sea to breed in fresh water) fish;<br>• Densities of resident fish;<br>• Harvests of anadromous and resident fish;<br>• Contaminant levels in fish tissue. |

[5] Adapted from *Scoping for Cumulative Effects Assessment* (ESSA, 2003)

| ANTICIPATED EFFECT | VESECS | INDICATORS |
|---|---|---|
| <u>Decline in Aquatic Habitat and Degradation of Aquatic Habitat Quality</u><br>Cumulative effects arise from:<br>• Direct loss of habitat due to direct removal or changes in water levels;<br>• Adverse changes in water quality (e.g. depressed levels of dissolved oxygen, toxic level of chemicals pollutants, high levels of total suspended solids, temperature regime);<br>• Drastic changes in the annual hydrograph including minimum flows. | • Aquatic Habitat and Habitat Quality | • Area of degraded fish habitat;<br>• Loss (area) of fish habitat. |
| <u>Decline in Vegetation Communities</u><br>Cumulative effects arise from:<br>• Reduction in vegetation productivity resulting from local acute or chronic industrial effluent discharges, aerial emissions, and/or accidental spills;<br>• Direct losses or changes in vegetation communities as a result of localized spills of fuel and other hazardous wastes, municipal sewage disposal, changes in drainage patterns, firewood collection, winter road use and expansion, man-caused fires and facility construction in the vicinity of communities and towns;<br>• Permanent or long-term losses of vegetation communities as a result of direct disturbance from development activity (e.g. mines, pipelines, highways) and resource harvesting (e.g. logging);<br>• Changes in riparian vegetation as a result of modified hydrological regimes associated with upstream hydroelectric development. | Vegetation Communities | • Spatial extent of terrestrial vegetation communities and species;<br>• Plant community composition in riparian areas;<br>• Berry-picking – times, locations, volumes, etc. |

| ANTICIPATED EFFECT | VESECS | INDICATORS |
|---|---|---|
| Decline in Forest Sustainability<br>Cumulative effects arise as a result of:<br>• Fragmentation from the cumulative effects of multiple land clearing activities, including timber harvesting, agriculture, and urban development;<br>• Decline in the health structure, diversity, and composition of forests and forest ecosystems due to human interventions;<br>• Disturbances such as fire, insect infestations, and weather damage. | • Biological diversity;<br>• Ecosystem condition and productivity;<br>• Soil and water conservation;<br>• Global ecological cycles;<br>• Sustainability and economy and social responsibility | Biological diversity:<br>• Percentage and amount of area forested;<br>• Percentage and amount of interior forest conditions;<br>• Protection afforded to sites of biological significance;<br>• Number of known species at risk;<br>• Population levels and changes over time of selected species.<br>Ecosystem condition and productivity:<br>• Natural disturbance and stress by type and severity;<br>• Forest stand health<br>• Biodiversity index<br>Soil and water resources:<br>• Percentage of riparian areas with suitable vegetation cover;<br>• Buffering capacity and soil acidification<br>Global ecological cycles:<br>• Ground-level ozone and pollution deposition<br>• Climate trends<br>Economic benefits:<br>• Production of timber forest products;<br>• Regional wood prices;<br>• Employment in forest-related sectors |

| ANTICIPATED EFFECT | VESECS | INDICATORS |
|---|---|---|
| | | Social responsibility:<br>• Community involvement in sustainable forest management;<br>• Implementation of integrated resource management, and land use plans; |
| Decline in Grizzly bear populations:<br>Cumulative effects arise as a result of:<br>• Reduction in habitat availability as a result of multiple land clearing activities, including oil and gas exploration and extraction, mineral exploration and extraction, logging, agriculture, urban development, and linear developments;<br>• Direct mortality due to harvesting;<br>• Road construction increasing road density which leads to: i) avoidance of habitat near roads by Grizzly bears; and ii) increases access for hunting and non-consumptive recreational use. | Grizzly Bears | • Distribution and abundance of Grizzly bear populations;<br>• Habitat effectiveness;[6]<br>• Core habitat security.[7] |
| Decline in Woodland and Mountain Caribou Populations<br>Cumulative effects arise from:<br>• Direct mortality due to increased susceptibility to predation, harvesting, and road kills;<br>• Reduction in habitat availability from the cumulative effects of multiple land clearing activities, including oil and gas exploration and extraction, mineral exploration and extraction, logging, agriculture, urban development, and linear developments. | Woodland and Mountain Caribou | • Abundance of individual herd populations;<br>• Habitat effectiveness;<br>• Core habitat security;<br>• Hunting statistics;<br>• Subsistence harvest information. |

[6] The quotient of realized or actual habitat suitability to potential habitat suitability.

[7] The size of core habitat patches

| ANTICIPATED EFFECT | VESECS | INDICATORS |
|---|---|---|
| Decline in Moose Populations<br>Cumulative effects arise from:<br>• Direct mortality due to increased hunting pressure and predation due to increased access (i.e. linear corridors);<br>• Reduction in habitat availability (thermal and hiding cover) from cumulative effects of multiple land clearing activities. | Moose | • Distribution and abundance of moose populations;<br>• Hunting statistics;<br>• Subsistence harvest information. |
| Decline in Furbearers<br>Cumulative effects arise from:<br>• Reductions in populations due to declines in habitat or habitat quality;<br>• Over-harvesting of populations due to increased trapping. | Aquatic and terrestrial furbearers | • Populations of marten, beaver, muskrat and other furbearers;<br>• Harvests of marten, beaver, muskrat, and other furbearers;<br>• Trapline information (use, numbers, etc). |
| Impairment of Resource Use by Communities<br>Cumulative effects arise from:<br>• Reductions in consumption of harvested species resulting from perceived or real increases in contamination;<br>• Reduction in harvest levels due to alienation of local areas, growth of communities, improved access, and industrial development;<br>• Alterations of river-based travel patterns and routes in response to changes in water levels and flows. | Traditional resource use by communities | • Fish harvests;<br>• Wildlife harvests;<br>• Transportation routes;<br>• Community reporting. |
| Cumulative socio-economic effects, impacting communities<br>Cumulative effects arise from:<br>• Changes to population;<br>• Changes to community/ institutional arrangements;<br>• Transitional community changes;<br>• Individual and family level effects;<br>• Effects on community infrastructure needs. | Communities and residents | Issue-dependant, examples:<br>• Community structures;<br>• Livelihoods;<br>• Community history with development;<br>• Alcoholism, divorce rates;<br>• Recreational impacts;<br>• Environmental footprint. |