Gahcho Kué Project
Assessment Approach

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What is Environmental Impact Assessment?

- A process that identifies and assesses the environmental effects from the Project and provides a determination of the significance of effects.
- Assesses effects to the air, land, water, and people
  - Air includes air quality and noise levels
  - Land includes terrain and soils, vegetation, and wildlife
  - Water includes ground and surface water quality and quantity, and fish and other aquatic life
  - People includes archaeological, cultural, social, and economic components
- Process is iterative
  - assessment results may lead to changes in the Project design and identification of mitigation to eliminate or reduce environmental effects

Identify Key Issues and Potential Environmental Effects

- Project Description and preliminary knowledge of the existing environment
  - scoping of Project effects pathways (i.e., interactions between Project and biophysical and socio-economic environments)
- Engagement with the Public, First Nations and Métis, and government
- Issues identified in the *Terms of Reference for the Gahcho Kué Environmental Impact Statement* (Gahcho Kué Panel 2007) and the Report on the Environmental Assessment (MVEIRB 2006)
- Scientific knowledge and experience with other mines in the NWT and Nunavut

Identify Valued Components and Endpoints

- Valued Components (VCs)
  - physical, biological, cultural, social, and economic properties of the biophysical and human environments that are considered important to society
- Assessment Endpoints
  - key properties of VCs that should be protected for use by future human generations (incorporates *sustainability*)
  - used to assess significance of impacts on VCs
- Measurement Endpoints
  - quantifiable (measurable) expressions of assessment endpoints (chemical concentrations, rates, area, abundance, full time equivalents, family income)

Examples of Valued Components and Endpoints

Valued Component	Assessment Endpoint	Measurement Endpoints
Surface water	Suitability of Water Quality to Support a Viable Aquatic Ecosystem	-physical characteristics of water -water chemistry (e.g., concentrations of major ions, nutrients, and metals) -water levels and flow
Soils	Not applicable	-soil chemistry -soil quantity and distribution -soil erosion
Fish and fish habitat	Persistence of fish habitat and populations	-water chemistry -steam flow and lake levels -benthic invertebrates -plankton community
Socio-economics	Persistence of long-term social, cultural, and economic properties	-employment and income -education, training, and opportunities for youth -heritage resources

Spatial Boundaries

- Specific to VCs
  - Study areas were designed to capture factors that influence geographic distribution and movement patterns specific to each VC
  - Sometimes used a range of spatial scales to describe baseline conditions, and analyze and predict effects
- Local study area (LSA)
  - direct effects from the Project (geology, soil and habitat loss, water quantity and quality, individual animal mortality)
  - small-scale indirect effects on environment (changes to soil and vegetation from dust deposition)
- Regional study area (RSA)
  - mostly larger-scale indirect effects from Project activities on VCs (noise, dust and air emissions on animal movement and behaviour)
  - captures the maximum predicted extent of the combined direct and indirect effects from the Project on VCs
- Beyond Regional Study Area
  - for quantifying baseline conditions, and measuring and predicting cumulative effects on VCs with distributions and movements larger than the RSA (caribou, traditional land use)

Temporal Boundaries

- Development phases of the Project
  - construction
  - operation
  - closure

- Predicted duration of effects on VCs from Project
  - duration = amount of time between start and end of Project activity or stressor (related to Project phases) plus time required for the effect to be reversible
  - reversible = time required for Project to no longer influence a VC

- Incorporates sustainability
  - links duration of Project effects on VC to the amount of time that human use of ecological resources may be influenced

Pathway Analysis

- A screening level assessment that uses environmental design features and mitigation, experience, logic, and science to distinguish no linkage, secondary (minor), and primary pathways
- Consider all potential linkages between the Project and VCs
- Apply environmental design features and mitigation to remove the pathway or limit effects to VC assessment endpoints
  - Project designs, environmental best practices, management policies and procedures, and social programs
  - iterative process between Project engineers and environmental scientists

Project activity → change to environment → effect on VC

Pathway Analysis

- No Linkage – pathway is removed by environmental design features and mitigation so that the Project results in no detectable environmental change and no residual effects to a VC relative to baseline or guideline values;

- Secondary - pathway could result in a measurable and minor environmental change, but would have a negligible residual effect on a VC relative to baseline or guideline values; or

- Primary - pathway is likely to result in a measurable environmental change that could contribute to residual effects on a VC relative to baseline or guideline values.

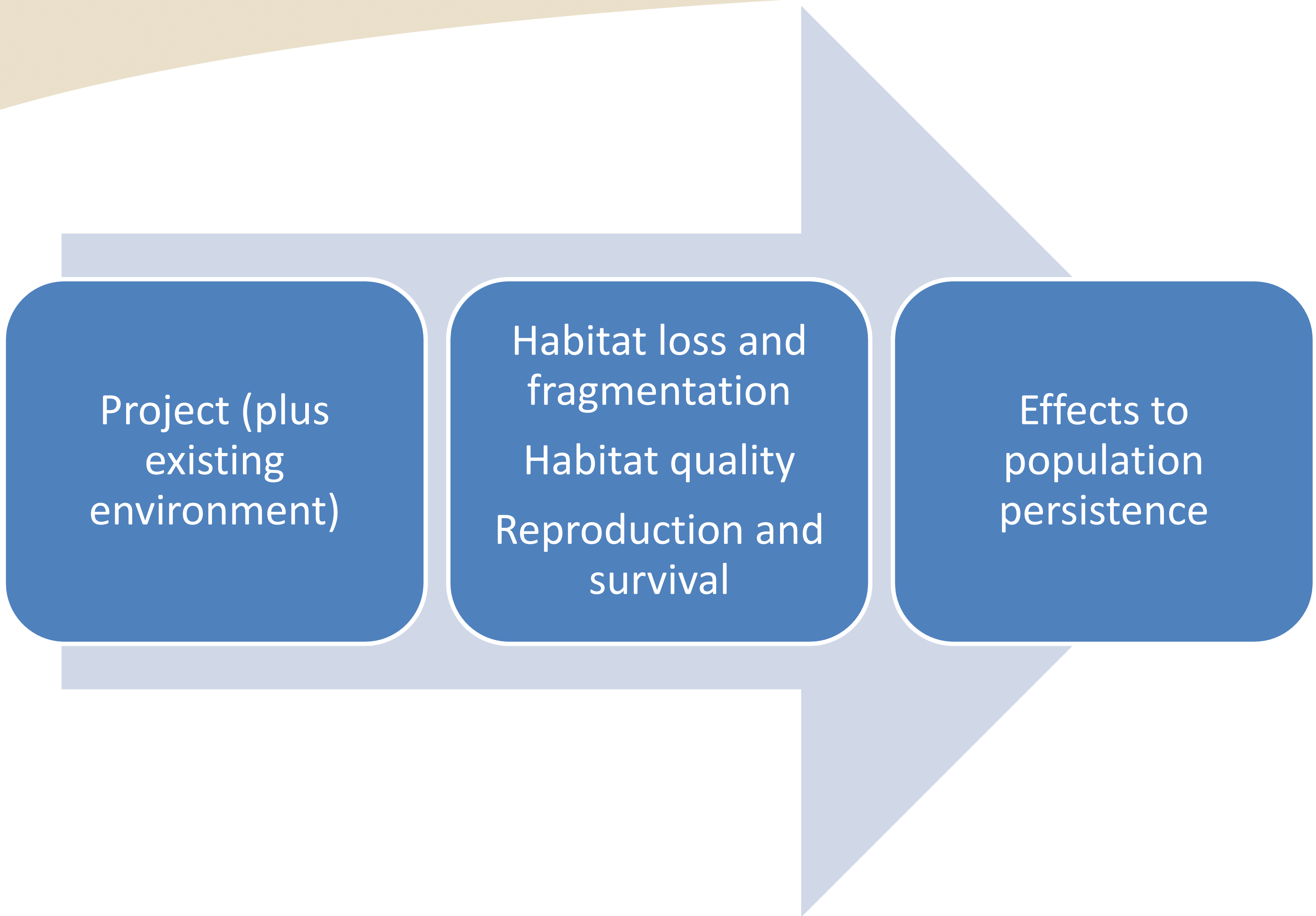
No linkage and secondary pathways are not predicted to have significant residual effects on VCs and are not considered further in the effects assessment

Primary pathways require further effects analysis and classification to assess the potential significance of impacts on VC assessment endpoints

Wildlife Examples

Project Component/Activity	Effects Pathways	Environmental Design Features and Mitigation	Pathway Assessment
Mine Rock Management	leaching of PAG mine rock may change the amount of different quality habitats, and alter wildlife movement and behaviour	• mine rock used to construct the dykes will be non-acid generating • any mine rock containing kimberlite will be separated from the tundra by at least 2 m of inert and kimberlite-free rock	No linkage
Project Footprint (e.g., pits, Fine PKC Facility, Coarse PK Pile, mine rock piles, Winter Access Road and Tibbitt-to-Contwoyto Winter Road)	aircraft/vehicle collisions may cause injury/mortality to individual animals	• speed limits will be established and enforced • wildlife will be provided with the “right-of-way” • Wildlife Effects Mitigation and Management Plan	Secondary
	direct loss and fragmentation of wildlife habitat from the physical footprint of the Project may alter animal movement and behaviour	• backfilling the mined-out pits with PK and mine rock will decrease the on-land Project footprint • compact layout of the surface facilities will limit the area disturbed at construction	Primary

Approach to Effects Analysis



Effects Analysis

- Analyses are quantitative where possible and qualitative where necessary
  - Baseline values and guideline values
  - Modelling and statistical analysis
  - Scientific literature
  - Government data and publications
  - Traditional Knowledge reports and publications
- Includes both Project-specific and cumulative changes (where applicable)
- Analyses completed at the appropriate spatial scale for the VC
  - Kennady Lake and Kirk Lake watersheds
  - Caribou annual and seasonal ranges
  - Communities in the North and South Slave Regions of the NWT
- Changes in measurement endpoints are then linked to effects on VC assessment endpoints in the residual impact classification and determination of significance

Residual Impact Classification

- The purpose of the residual impact classification is to describe the residual effects from the Project using a scale of common words
- Completed for each primary pathway and associated measurement endpoints
- For VCs with cumulative effects, incremental (Project-specific) and cumulative effects are classified
- The following criteria are used to classify and assess residual impacts of pathways on VC assessment endpoints
  - Direction
  - Magnitude
  - Geographic extent
  - Duration
  - Reversibility
  - Frequency
  - Likelihood
  - Ecological context

Environmental Significance

- Classification of residual impacts provides the foundation to determine significance of effects on VC assessment endpoints
  - Magnitude, geographic extent, and duration (includes reversibility) are the principal criteria
  - Considers the relative contribution of all primary pathways (weight of evidence approach)
  - Includes uncertainty and methods used to reduce uncertainty
  - Application of ecological principles (resilience and stability) and experienced opinion

- Is there a significant risk to the VC assessment endpoint from the incremental and cumulative effects of the Project and previous, existing, and future developments?

Uncertainty

- Provide key sources of uncertainty in effects analysis and impact classification
  - adequacy of baseline data for understanding current conditions and future changes not related to the Project (extent of future developments, climate change)
  - understanding of Project-related effects on complex ecosystems
  - knowledge of effectiveness of mitigation for limiting effects
- Discuss how uncertainty was addressed to increase level of confidence that effects will not be worse than predicted
  - using results from several models to increase confidence
  - results form long-term monitoring programs at Ekati, Diavik, and Snap Lake diamond mines
  - implementing a conservative approach so that impacts are typically overestimated

Monitoring and Follow-Up

- Monitoring typically includes one or more of the following categories:
  - **Compliance inspection**: monitoring to make sure company is meeting conditions of approval and commitments
  - **Environmental monitoring**: monitoring to track conditions or issues during Project lifespan, and implementation of adaptive management (e.g., monitoring fresh water intake and treated water discharge volumes during the life of a project).
  - **Follow-up**: designed to:
    - test the accuracy of effect predictions
    - reduce uncertainty
    - evaluate the effectiveness of mitigation, and provide appropriate feedback to operations for adaptive management
    - results from these programs can be used to increase the certainty of effect predictions in future environmental assessments