# Taltson Expansion Project

## Draft Environmental Monitoring Program

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# 1 Introduction

This draft monitoring program outlines the pathways from the environmental assessment (EA) that Dezé intends to monitor, the monitoring objectives and methods summary, timing, and the Project phase when the monitoring will occur (construction or operation). The Plan is a draft intended to provide information required for parties to complete their review of the Taltson Expansion Project Developer's Assessment Report (DAR) and to commence input to the monitoring program, when the project move into the regulatory phase. Monitoring programs will be further developed and refined in consultation with stakeholders.

The intent of this document is to cover aspects of environmental monitoring related to the Taltson Expansion Project. This includes monitoring aspects that would be included as commitments of a future Water Licence or Land Use Permit from the Mackenzie Land and Water Board, as well as commitments made during the EA review process and between Dezé and various regulatory agencies or parties. As the Project progresses through the regulatory process, this document may be separated into subject-specific documents to better fit with potential future Water Licence and Land Use Permit.

At this phase of the project design and environmental assessment process, information availability varies across design and environmental components. Also, the level of uncertainty and assumptions that were used in the EA vary across assessments, as has the level of involvement with agencies during the EA process. Therefore, at this time, the individual monitoring programs contained herein have varying levels of detail.

The monitoring program has multiple purposes, some of which include:

- Provide direct feedback on progress related to protecting the air; land, water, and people.
- Validate/invalidate predictions of the DAR
- Provide a way for regulators and communities to participate in monitoring the project effects.
- Give clear reasons for making decisions regarding Project environmental management.
- Assess effectiveness of mitigation
- Identify negative changes that result from Project activities
- Scope, if necessary, changes to monitoring or mitigation
- Outline adaptive management plans

## 1.1 Types of Environmental Monitoring

The four types of environmental monitoring are listed below. Each of the four can fall within the overall monitoring framework since the information generated from these programs can be used as feedback, lending to continuous improvement and adaptive management.

1. **Compliance**. The purpose of compliance monitoring is to demonstrate compliance with regulatory License and/or permit requirements.

2. **Certification**. The purpose of certification monitoring is to demonstrate compliance with certification requirements to regulators or other agencies

3. **Operational**. The purpose of operation monitoring is to provide information to the Dezé that would confirm effectiveness of environmental management practices; allow for flexible management of operational procedures and environmental issues; and contribute to adaptive management and continuous improvement.

4. **Regional**. The purpose of regional monitoring is to provide information to regulatory authorities, participating industries and communities that are useful to environmental management or cumulative effects monitoring at a regional scale. Unlike the compliance, certification and operational monitoring, regional monitoring is usually not project-specific, and is less likely to provide useful information for project environmental management.

This document does not include regional cumulative effects monitoring. However, Dezé may contribute to cumulative effects monitoring initiatives, as monitoring program outcomes could be used by others to better understand and manage regional cumulative effects, and participate in regional and/or collaborative programs (e.g., Cumulative Impact Monitoring Program, NWT Environmental Stewardship Framework, developing land use plans).

Occasionally, there are "special project" monitoring programs that address specific issues arising from the environmental assessment process that require additional data because of uncertainty around the assessment or because of the requirement for additional baseline data to support future interpretation of monitoring data. Examples of such monitoring include the data gaps described later in this document, where further environmental studies are required to design the monitoring program.

## 1.2 Other Principles Included in the Monitoring Program

There are five key principles supporting the Taltson monitoring program. These are:

1. Monitoring is not research. Monitoring provides answers to specific questions regarding compliance and operations. Monitoring information supports decision-making by the operator and regulator, and provides direct feedback to the operator regarding the effectiveness of current mitigation measures and the need for adaptive management. In comparison, environmental research is conducted to test hypotheses about uncertainties and usually tries to answer more fundamental questions regarding ecosystem structure or function.

2. Identify the central question of the monitoring program. Monitoring is only useful if it provides answers to specific compliance or operational questions, such as: What is the current status? Are there spatial area or temporal time trends? Are there effects to the environment?

3. Measures and indicators must have a clear purpose. Measures used in monitoring programs can be physical, chemical or biological. Indicators can be measures of amount or effect and are selected because they are of intrinsic importance, provide early warning, are sensitive to the stressors of concern, or provide information about ecosystem process and function.

4. Use consistent criteria for selection of indicators. The most common criteria for selection of indicators in monitoring programs are:

    - high signal-to-noise ratio so effects can be distinguished from natural background levels;
    - rapid response so effects can be detected as early as possible;
    - repeatable and reliable response that should be as specific to the stressor of concern as possible:
    - ease/economy of monitoring;
    - importance to the ecosystem;
    - well-established endpoints within the scientific literature and monitoring community allowing the significance of a change in that indicator to be interpreted with confidence;
    - effectiveness of feedback to regulation and adaptive management so that information can be acted upon with confidence.

5. Define thresholds, where applicable. Monitoring information is most useful when it guides decisions. Therefore, monitoring programs must identify how monitoring information provides the basis for decisions regarding compliance or adaptive management. The basis is usually a clear threshold where it is determined that a response would be required. Thresholds determined for use in decision-making will differ with the purpose of the monitoring program.

6. Not all effects can be detected. Detecting an effect to environmental indicator or receptor can be difficult, as the monitoring data will also contain noise from environmental variability. Often, the number of samples required to satisfy statistical requirements are unattainable or unavailable.

## 1.3 Community Participation

Dezé will provide continuous updates on the Taltson Project through direct participation and regular communication through community and site visits, regulatory meetings, public information sessions, annual reports, audit results and the Dezé website.

It is essential that communities are involved with monitoring so they can assess the outcome of the monitoring program and effects, and assist Dezé in looking for ways to improve environmental management. Dezé will achieve this by:

- developing monitoring programs that include input from communities, including traditional knowledge holders;
- incorporating community priorities into the monitoring program;
- community participating in the program development;
- including community members in monitoring activities;
- reviewing the results of monitoring with communities; and,
- providing a direct opportunity for commenting on these results.

Specifically, Dezé will provide the opportunity for participation in monitoring of the Taltson Project through:

- hiring and training of aboriginals and northerners as environmental staff;
- ongoing involvement of community members in field monitoring;
- hiring of skilled community representatives for specialized field studies,
- continuing with community consultation, and,
- Traditional Ecological Knowledge (TEK).

This proposed monitoring plan does not include a specific role for TEK beyond that of including TEK holders in the development, implementation and review of monitoring programs. This should not be taken to mean that Dezé will not be incorporating TEK into the monitoring program. Rather, it means that Dezé recognizes the difficulties associated, with the effective use of TEK in environmental management and monitoring. Dezé would prefer to first hear from the communities on how their knowledge can best fit in to these monitoring programs.

# 2 Monitoring Plan Framework

Dezé has reviewed various active monitoring programs and adaptive management plans developed for projects within the Northwest Territories, so to design studies and data collection protocols that are consistent with other monitoring programs in the Arctic (e.g., ., BHPB 2007; Diavik 2007; De Beers 2008, Tahera Diamond Corporation 2007) as well as Grieg, et al. (2008) *Guide for Development of Adaptive Management Plans, prepared for DFO Central and Arctic Region*; and MacDonald et al. (2008), *Guidelines for Designing and Implementing Aquatic Effects Monitoring Program for Development Projects in the Northwest Territories*, among other documents.

Based on this review, Dezé has developed this draft Taltson Expansion Project Environmental Monitoring Program, which describes environmental monitoring and commits to adaptive management including adaptation of monitoring, mitigation, or operations. The draft monitoring program is presented under the following sections.

- Introduction
- Monitoring Plan Framework
- Taltson Expansion Project Overview
- Project Issues and Concerns
- Monitoring Plan
- Reporting
- References

# 3 Taltson Expansion Project Overview

The following information is a brief summary of key project components presented to familiarize readers with the project. Full details of the project are presented in Chapter 6 of the DAR

## 3.1 Construction

### 3.1.1 Access

- In the Southern Sector, temporary winter roads will connect Fort Smith to Nonacho Lake, to supply staging camps and temporary access trails. These include:
    - Fort Smith to Twin Gorges: Dezé to use Northwest Territories Power Corporation's (NTPC) winter road from
    - Twin Gorges to Nonacho: new temporary winter road as presented in the DAR
- Temporary access trails will follow the transmission line right of way, for most of the distance between Twin Gorges and Nonacho Lake.
- In the Lake Sector, staging areas will be accessed by barge from Great Slave Lake during the summer
- In the Northern Sector, spur roads from the Tibbitt to Contwoyto winter road will be used to supply staging camps.

### 3.1.2 Transmission Line

The transmission line construction is summarized as follows:

- A three-phase transmission line will link Twin Gorges to Gahcho Kue, then branch off to Ekati, Diavik and Snap Lake. A steel-lattice design is proposed, with towers spanning approximately 350 m
- A 30 metre right of way will be required, but vegetation clearing within this will be selective (i.e., only removing vegetation as required for construction, access, to remove fire hazards, or to meet guidelines). No vegetation clearing is anticipated north of the treeline.
- A winter road from Twin Gorges to Nonacho Lake would be pioneered, to supply materials and crews for the transmission line construction. Construction in the Northern Sector will be supported by the existing Tibbitt to Contwoyto Winter Road. Staging areas (some with and some without camps) would be required.
- A 5 to 8 m wide temporary winter access trail will follow the transmission line, allowing ground crews to access for construction. This trail will be within the

transmission line right of way, although some deviations may be required if obstacles are encountered. In hilly areas, construction will be entirely by helicopter.

### 3.1.3 New Power Facility, Spillways and Control Structures

New power, spillway and control structures are described below.

- A new intake canal and generating station will be constructed, adjacent to the existing Twin Gorges facility.
- A bypass spillway will be constructed in the vicinity of the existing Twin Gorges to provide some spill capacity, to reduce water level changes within Trudel Creek.
- A minimum release structure will be installed in the SVS to ensure minimum flows through Trudel Creek are maintained.
- Upgrades will be required to the Nonacho Control Structure. Repairs are required to the existing dam, existing release gate will be replaced with one that allows greater control of water flows and that may be controlled remotely.
- Nonacho Lake water level to be reduced to the height of the spillway sill, a drawdown of 0.85 m based on the average lake elevation. Drawdown will commence in fall and remain low through the winter as construction takes place.
- Blasting near and within waterbodies
- General construction activities near waterbodies

### 3.1.4 Camps and Staging Areas

The project construction is supported by temporary construction camps and staging areas as follows.

- Southern Sector stating camps will be supplied by winter road from Fort Smith, Lake Sector camps will be supplied by barge on Great Slave Lake, and Northern Sector camps will be supplied by spurs from the existing Tibbitt to Contwoyto winter road.
- Three of the southern sector staging camps will include accommodations (not including the Twin Gorges site), as will the barge-supplied staging camps. In the Northern Sector, construction crews will be accommodated at existing camps.
- The temporary Twin Gorges camp would accommodate a maximum of 200 people during peak construction and over the three-year life would accommodate an estimated 160,000 person-days. The temporary Nonacho Lake camp would accommodate a maximum of 50 people during peak construction and over the three-year life would accommodate an estimated 55,000 person-days.
- Small camps would be necessary for construction of the transmission line. Small camps would be highly self-contained modular facilities suitable for accommodating up to 40 people. Currently, small camps dedicated to transmission line construction in the southern sector are forecast to be installed at Twin Gorges between the airstrip

and the South Valley Spillway, Taltson Lake staging area, and Sparrow Bay on Nonacho Lake. For the East Arm Sector, small camps at both Charlton Bay and McLeod Bay staging areas and at treeline south of Gahcho Kué would be used. For the northern sector, small camps at Gahcho Kué, East Mackay Lake and Ekati are planned. For the Gahcho Kué to Snap Lake sector, small camps would be necessary at the mine sites if accommodations are not available.

- 15 staging areas are proposed to store materials and act as a base for transmission line tower construction, each two to five hectares in size.

## 3.2 Operations

### 3.2.1 Transmission Line

Vegetation under the transmission line will be maintained, although this is anticipated to be very infrequent (estimated at once every 15 years). Annual inspections will be required to monitor status of transmission towers and conductor line. Inspections will be conducted through helicopter over-flights.

### 3.2.2 Nonacho Control Structure

Very little activity is anticipated at the new Control Structure, as it will be remotely controlled. Annual inspections of control structure and dam are anticipated.

### 3.2.3 Taltson Watershed

Increased control at Nonacho Lake will affect the downstream hydrology in Taltson River. Key information in regard to the revised hydrological control follows.

- No new flooding will occur.
- Taltson Project has been designed to maintain river hydrology within existing baseline and water licence limits
- Two expansion scenarios are under consideration: 36 MW and 56 MW
- Project related changes within the Taltson watershed relate to changes in hydrology
- Hydrological changes resulting from the Project presented herein are based on changes from average flow conditions as defined in the Taltson Flow Model Report from 1978 to 1991
- The Taltson Watershed has been divided into 5 Zones plus Nonacho Lake, for hydrological modeling.

### 3.2.4 Twin Gorges

Staff will continue to reside at the Twin Gorges camp throughout the year, to operate and maintain the generating plants.

### 3.2.5 Access

All access to the project during operations will be conducted by fixed wing plane to Twin Gorges or by helicopter to the transmission line or outlying locations. The project will have no road access as the Fort Smith to Twin Gorges access road will not be maintained following construction, and will be blocked with slash and gates to discourage use.

# 4 Project Issues and Concerns

## 4.1 Overview

The project issues and concerns, based on the valid pathways in the DAR, assumptions used to make predictions, and feedback from communities, Aboriginal groups and regulatory agencies are overviewed below.

## 4.2 Construction Phase

### 4.2.1 Water Quantity

Construction will involve water drawdown of Nonacho Lake and water use for construction works as described below.

- Nonacho Lake water level to be reduced to the height of the spillway sill, a drawdown of 0.85 m based on the average lake elevation. Drawdown will commence in fall and remain low through the winter as construction takes place. During this drawdown event, Lake Trout eggs that were spawned in fall in water depths within the drawdown zone would be dewatered prior to emergence.
- Water withdrawal for winter ice roads and construction use, primarily concrete mixing. Water withdrawal from small fish-bearing waterbodies can affect the waterbody elevation and fish habitat conditions.

### 4.2.2 Water Quality

Water quality can be affected by construction activities, as noted below:

- General earthworks construction activities can cause localized mobilization of fines and cause sedimentation to be introduced to of waterbodies
- Nutrients, specifically nitrates, can be released to waterbodies from blasting
- Poor material handling and spills can enter and contaminate a watercourse.

### 4.2.3 Fish and Fish Habitat

Fish and fish habitat can be affected by construction activities, such as from contaminated water quality (discussed above), or from activities such as:

- Blasting vibrations and particle velocities
- Disruption or destruction of habitat from instream works
- Direct effects to fish from instream works

### 4.2.4 Camp and Construction Waste

Construction camps and wastes can affect water, lands, fish and wildlife from activities such as:

- Inappropriate waste handling and storage
- Incineration and open burning
- Liquid effluent discharges

### 4.2.5 Wildlife and Terrestrial Habitat

Construction activities can affect wildlife and terrestrial habitat as follows:

- Construction activities may lead to disturbance to wildlife.
- The presence of construction camps with accommodations can lead to problem wildlife.
- Vegetation loss and changes to wildlife habitat at a local scale will occur.
- Temporary access will be created from Twin Gorges to Nonacho Lake, which, if not adequately managed, could lead to increased land access and harvesting.

## 4.3 Operations Phase

### 4.3.1 Water Quantity

The basin hydrology changes are presented in the DAR and developed in a Hec-ResSim model, which predicts the change in flow and water levels from Nonacho Lake through to Great Slave Lake. These flow changes have potential to affect biological and physical components discussed further below.

### 4.3.2 Ice Regime

The ice development process could be affected by changes in flows and water levels through the winter season. Ice changes were predicted to generally represent baseline conditions. Two sites that may experience slight changes from baseline conditions are Nonacho Lake and Trudel Creek. An average 0.5 m increased winter drawdown in Nonacho Lake could potentially cause shoreline ice to breakup over winter if ice cover were to drop by an additional 0.5 m.

The reduce flow in Trudel Creek could lead to earlier ice formation, thicker ice cover, and delayed ice breakup. In addition, scheduled and unscheduled power outages would result in increased flows in Trudel Creek which could cause ice break-up and ice jams, which could cause effects to the biological environment.

Environmental assessment predictions indicate that these changes are expected to be relatively minor changes from baseline conditions.

### 4.3.3 Water Quality

Mercury in waterbodies has been raised by stakeholders as a concern. Mercury increases are attributed to new flooding or increased ranges in seasonal water elevations. Taltson Expansion involves no new flooding, and the mercury accumulation model (run conservatively: redistribution of sediments equals new flooding effects) found negligible increases in accumulation.

In addition to mercury concerns, decreased flows to Tronka Chua Lake and Trudel Creek have potential to decrease dissolved oxygen levels in those lakes over winter.

Although effects predictions indicate that water temperature as a result of extended minimum release to Trudel Creek over summer would not substantially increase water temperatures and would not reach fish health thresholds, stakeholder input has identified the assumptions as an uncertainty for further consideration.

### 4.3.4 Riparian Habitat in the Taltson River

Reduced summer flows in the watershed will initiate a transition of riparian habitats from current elevations to lower elevations over time. This will result from the migration of wetland and riverbank meadow plant species downslope as substrates enter into new hydrological regimes and become preferable habitat for new plant species due the lowered water levels. This transition will include upper level plants (i.e. willows) moving into the existing riverbank meadow plant communities, and meadow plant communities transitioning downslope. Based on literature and experience, this transition is likely to take 5 to 8 years.

Some meadow plant species are relatively slow in colonizing bare substrate (i.e. sedges) while others (i.e. grasses) are not. This means that the transitioning process might be initiated quite quickly when the water levels change but the full development of an analogous ecotype will take a number of years.

In Trudel Creek, scheduled and unscheduled power outages will cause increases in flow that may also affect the development of downslope movement of meadow communities, if those communities are developing from seed, as the young plants are quite susceptible to wash out. This is especially true if the flows are strong enough to cause erosion along the river banks.

### 4.3.5 Aquatic Resources

During the aquatic growing season (late spring through summer) water levels will be lower on average from current conditions. As a result the littoral areas will undergo a transit as the “new” littoral area develops that will establish aquatic plant community within the new littoral zone and establish benthic invertebrate community within the new littoral zone

Scheduled and unscheduled outages could disturb aquatic plants and invertebrate community in Zone 5 and Zone 3 downstream of Elsie Falls to Tsu Lake, with potential effects on aquatic productivity, biodiversity and community structure.

Extended duration of the minimum flow in Trudel Creek is not anticipated to negatively affect the vegetation in Trudel Creek. However, limited information is available on littoral vegetation community succession is northern climates, therefore uncertainty exists in regard to extended minimum flows and the effect on habitat complexity, nutrients and organic levels, and resulting effects on aquatic productivity, biodiversity and community structure in the riverine sections of the Trudel system.

### 4.3.6 Fish and Fish Habitat

Operational issues identified with fish and fish habitats are both direct and indirect. Indirect issues are addressed in other sections (i.e. dissolved oxygen, aquatics, etc). Direct issues identified include:

- Winter drawdown of Nonacho Lake as it may affect Lake Trout incubating eggs and thus populations;
- Reduced flows to Tronka Chua Lake affecting habitat
- Reduced flow to Trudel Creek affecting habitat
- Displacement or stranding of fish as a result of ramping events in Trudel Creek and downstream of tailrace
- Entrainment of fish into intake canals and turbines

### 4.3.7 Wildlife and Terrestrial Habitat

During operations, effects on wildlife and terrestrial habitat could result from the change in water levels and from the presence of the transmission line, as noted below:

- Water level changes within the Taltson River may affect habitat requirements for aquatic furbearers and shoreline nesting habitat for waterfowl, primarily in Trudel Creek.
- Unscheduled power outages may lead to water level changes (ramping) within Trudel Creek that could potentially lead to loss of waterfowl nests or mortality of beaver and muskrat within Trudel Creek.
- The presence of the transmission line may cause disturbance to migrating caribou.

# 5 Monitoring Plan

## 5.1 Plan Overview

As noted above, this monitoring program is designed to monitor specific predicted project effects. The individual monitoring programs may involve a number of steps, such as testing of assumptions; gathering additional detailed environmental information to base the monitoring; monitoring of effects; reporting; and adaptive management, if necessary, which may include amending monitoring programs; increased/decreased monitoring programs; amending mitigation; additional mitigation; increased environmental and project knowledge; and changes to project operations.

Specific Valued Ecosystem Components were selected for the monitoring program based on the issues identified in Section 4, and the following rationale (Salmo 2006):

- public concern;
- required by or compatible with regulatory requirements and existing initiatives;
- easily understood and known to be important to residents, managers, and regulators;
- when taken together, reflect overall environmental and social conditions; and
- can be easily measured or described with one or more practical indicators (measurement endpoints).

An important aspect of the VC selection process is that it reflects the values of concerned people, which were presented during DAR review process. Concerns raised by government agencies, Aboriginal organizations, community members, and other stakeholders were considered in the monitoring plan development process. The VC selection for monitoring also drew upon scientific principles, the major effect pathways, important ecosystem processes, the presence of species at risk, and the availability of information.

The purpose of monitoring program will monitor key predictions made during the effects assessment. This monitoring program is also intended to gather meaningful data that will assist in *early* identification of negative habitat changes which are directly attributable to the altered hydrograph.

The program is designed to gather information from which predicted changes to habitats, specifically negative changes, which are attributable to the project, can be identified relatively easily.

The specific objectives of monitoring programs are:

- to provide information to assess anticipated project impacts
- to identify unanticipated effects to environmental components;
- to implement a mitigation and management designed to reduce the risks and disturbance to VCs, and other species and habitats;
- to determine the effectiveness of mitigation;

- to consider and incorporate, where possible, traditional knowledge;
- to meet regulatory requirements and corporate commitments for monitoring
- to propose action levels or adaptive management triggers that can be used as early warning signs for reviewing and implementing mitigation measures;
- to design studies and data collection protocols that are consistent with other monitoring programs in the Arctic (e.g., BHPB 2007; Diavik 2007; De Beers 2008, Tahera Diamond Corporation 2007), and can be used by others to better understand and manage regional cumulative effects, and participate in regional and/or collaborative programs (e.g., Cumulative Impact Monitoring Program, NWT Environmental Stewardship Framework, developing land use plans); and
- to provide an annual report that will satisfy all interested and concerned stakeholders, and will provide the opportunity for feedback from communities, governments, and the public.

### 5.1.1 Taltson Basin Watershed

The basin hydrology changes are presented in the DAR and developed in a Hec-ResSim model, which predicts the change in flow and water levels from Nonacho Lake through to Great Slave Lake. These flow changes have potential to affect biological and physical components.

The Taltson Watershed has been divided into 5 Zones plus Nonacho Lake, for hydrological modeling. Based on the modeled flow and elevation changes within these Zones and Nonacho Lake, the effects assessment and subsequent EA review process identified a series of issues and concerns. These issues and concerns are spatially defined by lakes and riverine sections within the various modeled zones.

### 5.1.2 Terrestrial Wildlife and Habitats

To assess the potential effects of the Project on the VCs, it is necessary to define appropriate spatial boundaries. The spatial boundaries were delineated based on the predicted extent of the Project-related effects, as well as life history attributes of the VCs potentially interacting with the Project, and available landscape classification data. The Project footprint includes the location and geographic extent of the Project components. The location and extent of these components were determined by using the most recent engineering plans, where available; conservative estimates were used where no engineering plans were available. The transmission line right-of-way (ROW) was estimated to be 30 m wide, winter haul roads were estimated to be 15 m wide, temporary access trails were estimated to be 5 m wide, and each staging area was estimated at 5 ha. Where uncertainty existed in the geographic extent of the Project components, the maximum expected extent was used. For example, transmission line ROW clearing will likely range from 15 m to 30 m wide, and each staging area is expected to range between 2 and 5 ha. The study areas used for the purposes of monitoring were these.

- Local Study Area (LSA): This was defined as the entire Project footprint (or area to be disturbed), plus a 100 metre (m) buffer on either side. The LSA was selected to

assess existing conditions, and the immediate direct and small-scale indirect effects of the Project on individual animals.

- Regional Study Area (RSA): This area was defined as the entire Project footprint, plus a 5 km buffer on either side (for a total area of 1,003,443 ha). The RSA was developed to assess the larger scale direct and indirect effects to the VCs.

### 5.1.3 Species at Risk

The MVEIRB has prepared draft guidelines outlining their expectations for considering effects to species at risk for the environmental effects assessment process in the Mackenzie Valley (MVEIRB 2008b), until such time as the Species At Risk Act for the Northwest Territories is fully implemented. The guidelines were produced with substantial input from Environment Canada and the GNWT Department of Environment and Natural Resources. These guidelines (MVEIRB 2008b) recommended that species at risk include:

- species listed as At Risk in the General Status Ranks in NWT (Working Group on General Status of NWT Species 2006);
- species listed as Endangered, Extirpated, Threatened, or of Special Concern under COSEWIC (2008); or
- species listed as Endangered, Threatened, or of Special Concern under Schedule 1 of SARA (2008).

Although not required by the MVEIRB species at risk guidelines, species listed as May Be at Risk under the Northwest Territories General Status Ranks were also included in the assessment.

The final list of wildlife Species At Risk for the Project included nines species; two mammals, one amphibian, and six bird species (Table 1). All nine species are considered to be Endangered, Threatened, or of Special Concern under COSEWIC (2008), and two species (the whooping crane and short-eared owl) are included under the schedules of SARA. Under the General Status Ranks for NWT, only the whooping crane is considered At Risk (Working Group on General Status of NWT Species 2006). The remaining eight species included in Table 9.5.3 are considered Secure or Sensitive in the NWT indicating that the risk of extirpation for NWT populations of the species is less than populations elsewhere in Canada. For example, the common nighthawk (*Chordeiles minor*) is listed as Threatened under COSWEIC (2008), but is listed as Secure according to the General Status Ranks for NWT (Working Group on General Status of NWT Species 2006) (Table1). This is likely due to differences in the scales of assessment; COSEWIC must consider the national status of a species; whereas, the General Status Ranks considers populations only in the context of the largely undisturbed NWT.

**Table 1 Wildlife Species At Risk in the Taltson Project Area**

| Common Name | Scientific Name | COSEWIC Status(1) | SARA Status(1) | GNWT Status(2) | Rationale |
|---|---|---|---|---|---|
| Grizzly bear | *Ursus arctos* | Special Concern | - | Sensitive | habitat fragmentation; sensitivity to human-caused mortality |
| Wolverine | *Gulo gulo* | Special Concern | - | Sensitive | habitat fragmentation, increased harvester access |
| Northern leopard frog | *Rana pipiens* | Special Concern | Schedule 1 | Sensitive | limited distribution in NWT, contraction of range nationwide |
| Peregrine falcon | *Falco peregrinus anatum/tundrius* | Special Concern | - | Sensitive | small population |
| Whooping crane | *Grus americana* | Endangered | Schedule 1 | At Risk | small population; restricted distribution |
| Rusty blackbird | *Euphagus carolinus* | Special Concern | - | May Be At Risk | population declines |
| Short-eared owl | *Asio flammeus* | Special Concern | Schedule 3 | Sensitive | small, declining population |
| Common nighthawk | *Chordeiles minor* | Threatened | - | Secure | long-term population declines |
| Olive-sided flycatcher | *Contopus cooperi* | Threatened | - | Sensitive | long-term population declines |
| Horned Grebe | *Podiceps auritus* | Special Concern | - | Secure | long-term population declines |

Notes: "-" indicates species not listed under SARA.
[1] SARA Registry 2009
[2] Working Group on General Status of NWT Species 2006

## 5.2 Construction Monitoring

### 5.2.1 Water Quantity

As the Nonacho Lake one-time construction drawdown is the equivalent drawdown as the annual drawdown under the 36 MW scenario, monitoring is addressed under the same plan as discussed in the Operations sections.

Environmental monitors will undertake monitor of any water withdrawal for construction works and winter road construction, to ensure works are conducted in accordance with the DFO guidelines for water withdrawal. Environmental monitors will record and report their monitoring activities, and will have authority to raise concerns and report infractions directly to the developer and its contractors.

***Schedule/Timing***

Water quantity monitoring will be continuous when occurring throughout the construction phase.

### 5.2.2 Water Quality

***Monitoring***

Water quality monitoring during construction will focus on routine environmental monitor inspections of construction sites in and near stream, waste water discharge quality, best management practices, sediment and erosion control, materials handling and storage, and general work practices and housekeeping.

Monitors will monitor sites in accordance with the Environmental Management Plans, permit conditions, Operational Statements for stream crossings, and DFO blasting guidelines, and other mitigation commitments such as blasting product use and handling.

In addition, monitors and/or biologists will be on site during all instream works, and will take routine water quality samples and conduct in-situ testing to ensure water quality meets CCME guidelines for protection of aquatic life.

Monitors will also monitor camp liquid effluent discharges to ensure discharges are in compliance with permit limits.

A list of potential water discharge sites that would be monitored include:

- Waste rock stockpiles
- Blasting settling ponds
- Instream work sites
- Concrete works
- Sediment & erosion control sites and
- Waste water treatment facilities

***Schedule/Timing***

Water quality monitoring will respond to incidents as they occur, and will be continuous throughout the construction phase.

### 5.2.3 Fish and Fish Habitat

***Monitoring***

- Environmental monitors and biologists will inspect and monitor instream construction activities, and manage issues as they arise. Monitoring will include activities such as work site isolation planning, fish salvage plans, and program implementation to isolate instream work sites from fish.
- Detailed fish protection plans will be developed with the engineering and/or the construction contractor to ensure fish are protected during construction works. All plans will be presented to agencies for review and comment prior to implementation.

***Schedule/Timing***

Fish and fish habitat protection planning will occur prior to construction, and monitoring will respond to incidents as they occur, and will be continuous throughout the construction phase.

## 5.2.4 Wildlife and Terrestrial Habitat

### 5.2.4.1 Habitat Loss

Habitat loss will occur within the three year construction period. No further habitat loss or project footprint expansion is anticipated to occur during operations. There are a number of factors that make assessment of the resulting vegetation and habitat loss problematic. These are:

- The Project footprint is very diffuse, spanning almost 700 km north to south. Landscape classifications over this wide an area suffer from poor accuracy, particularly at the relatively small scale of the Project footprint (transmission line ROW of 30 metres width).
- Most (76%) of the Project footprint is associated with the 30 m wide ROW. Often, the available land cover information is at too coarse a scale to accurately track habitat loss in anything but general terms.
- The level of disturbance within the Project footprint is in some cases difficult to quantify. Features such as the Twin Gorges facilities and staging areas will likely lead to total vegetation disturbance. However, the transmission line and winter road portages will require selective vegetation clearing south of the treeline, and negligible vegetation clearing north of the treeline. Thus, the project footprint boundaries do not necessarily imply vegetation or habitat loss.

The proposed approach to monitoring vegetation and habitat loss therefore involves tracking the actual Project footprint as construction proceeds, and making this information available to interested parties.

***Monitoring***

Following the construction phase, a GIS shapefile will be created that describes the Project footprint. This will include new facilities, winter road alignments, transmission line right of way, and location and layout of the staging areas. This shapefile can then be used to estimate vegetation and habitat loss, compare this loss to that predicted in the DAR, and to assess cumulative effects in future environmental assessments.

***Schedule/Timing***

The shapefile will be developed as construction proceeds, and will be complete within four months of completion of construction. The shapefile will describe the projectas-built.

### 5.2.4.2 General Wildlife

The Project will lead to a range of interactions with wildlife. This may include observations, interactions and problem wildlife. A general wildlife monitoring program is proposed to identify the species, numbers and locations where these interactions occur, to identify risks to wildlife or construction crews, and to describe Project general effects to wildlife.

***Monitoring***

Environmental staff will respond to and record incidents involving the presence, injury, or mortality of wildlife during construction and operations, according to the methods outlined in the Human Wildlife Conflict Management Plan. These monitoring activities would occur along winter roads, and at the Twin Gorges facility, the Nonacho Lake facility, and at all staging areas and barge landing sites.

Environmental staff will be trained to use wildlife management techniques (e.g., deterrents, herding) to reduce injury and mortality risks to wildlife and humans. Routine inspections of the waste management area would be conducted by environmental staff to enumerate the occurrence of wildlife species and wildlife attractants (waste products).

Grizzly bear and wolverine interactions with winter roads and construction camps will be monitored and reported. In the case of an interaction, the Human Wildlife Conflict Management Plan will be initiated.

Finally, observations of any species at risk will be reported, including the time and date, location, number, and other details. Due to the low abundance or density of the species at risk in the RSA, it is unlikely that a monitoring program will be able to detect effects to these species. An exception is the peregrine falcon, for which a monitoring program is proposed to mitigate effects to this species during the construction season. See Section 5.3.5.4.

***Schedule/Timing***

General wildlife monitoring will respond to incidents as they occur, and will be continuous throughout the construction phase.

***Thresholds***

Wildlife Advisory and Management reporting will provide information for adaptive management such as identifying areas requiring improvements to wildlife management and the effectiveness of mitigation to reduce potential mortality risks. This monitoring will also enumerate direct project-related mortalities as it relates to changes to the abundance of VCs

### 5.2.4.3 Waste Management

Experience at existing camps and mines in the region have shown the importance of waste management in reducing incidents of problem wildlife (with regards to wolverine, grizzly bear, black bear, fox, ravens and gulls in particular), as waste food in particular can be a powerful wildlife attractant. Waste management monitoring is proposed to identify and correct problems with the waste management processes. See also the Human-Wildlife Conflict Management Plan.

To assist with waste management, Dezé will develop, prior to construction, an Incineration Management Plan that will detail the following:

- waste diversion programs (reduce, reuse, and recycle);
- types and quantities of wastes expected to be generated at each camp;
- types and quantities of wastes expected to be incinerated at each camp;
- the selection of incineration and monitoring equipment is designed for use with the types and amounts of waste for incineration for each camp;
- waste segregation, storage and batching procedures designed and employed to ensure compliance with manufacturer's specified waste types and device operating conditions are maintained for each camp; and
- operator training.

The Incineration Plan will include an annual report that will provide the following information:

- types and quantities of waste incinerated at each camp;
- quantity of auxiliary fuel used at each camp;
- record of operation of each incinerator;
- a list of trained staff and type of training they have received;
- record of all maintenance for each incinerator;
- quantity of incinerator ash generated and how it was disposed; and
- results of any stack testing or ash sampling

For wastes that are not incinerated, but are appropriate for open burning, Dezé will follow the GNWT open burning policies.

In addition, to manage wastes, Dezé will make re-useable material available to local communities.

***Monitoring***

Environmental monitors will conduct regular inspections of the waste management process at each camp. This will include inspections of waste storage, incineration, landfills and landfarms, grey and sewage water treatment. Observations of wildlife and wildlife sign associated with waste streams will be recorded. Wildlife incidents or wildlife deterrent actions will be reported, to determine if they were linked to waste management processes.

Monitors will also conduct routine inspections to ensure the project follows the Environment Canada batch incineration guidelines and the incinerator management plan.

***Schedule/Timing***

Inspections will be conducted regularly and as frequently as possible at all operational construction camps. Details are to be determined.

***Thresholds***

Should the inspections identify potential or actual availability of wildlife attractants (food waste in particular), or should observations of wildlife, wildlife sign or wildlife incidents point to problems in the waste management process, corrective action will be suggested by the environmental monitor immediately. Some level of wildlife activity is anticipated regardless of the efficacy of the efficiency of waste management, as wildlife may be present naturally, or be attracted by smells or shelter, even if there is no food reward. Regardless, the potential or actual availability of food waste for wildlife will be the trigger to initiate an investigation and corrective action.

### 5.2.4.4 Raptors

ENR has recommended that activity within 1.5 km of either peregrine falcon or short-eared owl nests between April 15 and September 15 should be avoided. During baseline studies, a total of 50 cliffs within approximately 1.5 km of the transmission line route were investigated. Of these, 15 had signs of historic nesting such as whitewash or stick nests (see the DAR, Section 9.5.3). These historic nests were found to be largely concentrated in specific areas, such as within the proposed East Arm National Park, southeast of Snap Lake, and near the Indian Shack staging area (see the DAR, Figure 15.4.3). Monitoring will be required to determine which of these nest sites are active during construction, so that the area can be avoided.

Between Gahcho Kué and Snap Lake, no construction activity is planned between April 15 and September 15, thus there would be little sensory disturbance to raptors in this area. Between Gahcho Kué and Ekati and Diavik, the setting of transmission tower foundations and anchors is anticipated to extend from mid-February to late April, in 2010. As there are few raptor nests in this area, and the overlap between construction activity and the nesting season is short, effects would be negligible and construction may be scheduled to avoid known raptor nests.

Within the southern section (from Twin Gorges north to approximately the Snowdrift River), the erection of transmission towers and subsequent stringing would take place from mid-July to October 2011. This leaves some overlap between construction activity and nesting. Within the East Great Slave Lake section (from the Snowdrift River north, approaching the Treeline staging area), helicopter erection and stringing of the transmission towers and conductor is scheduled to take place from mid-July to late October. The area of greatest overlap between construction activities and raptor nesting is within the East Great Slave Lake sector. Hand-clearing of the transmission line ROW within the proposed Park would begin in August 2010. This area has high densities of raptor nests (Figure 15.4.3), and would require more prolonged construction activities than other regions. This is partly due to constraints imposed by hand-clearing, which is proposed to mitigate effects to vegetation and aesthetics.

The construction activities described above would be mobile. Hand-clearing is anticipated to progress at a rate of 0.5 km per day. Approximately 6 km of transmission towers may be erected

in one day by helicopter, while conductor stringing is anticipated to proceed at a rate of 2 km per day (Teshmont, 2008). Thus, construction activity would not remain within 1.5 km of a nesting raptor for long. Regardless, the potential remains for loss of eggs or delayed hatching if incubation is interrupted for this duration.

***Monitoring***

To avoid any disturbance of nesting raptors, the Environmental Monitors would identify areas where construction activity may pass within 1.5 km of a known nest site of any raptor species during the nesting season. As described above, this will be limited to the Project components south of the treeline. Surveys would be completed to ascertain which nests are occupied. Surveys will be conducted by helicopter, and will involve searches of raptor nests identified during baseline studies, other cliffs in the area, and searches for tree nests. For the transmission line right of way, surveys for raptor activity will be limited to the right of way with a 200 m buffer. This limitation is proposed to make the monitoring feasible, and as activity within the transmission line is short-term and transient.

***Schedule/Timing***

For all areas south of the treeline where construction activity is proposed during the raptor nesting season (April 15 to September 15), surveys will be conducted to identify raptor activity. The surveys will be conducted in April, and will include a 1.5 km buffer from all proposed activity.

***Data Gaps***

Additional information on active raptor nests within the vicinity of the Project is required, but this should wait until construction commences as we will need up-to-date information to make the most informed mitigation decisions.

***Thresholds***

Should an active raptor nest be identified within 1.5 km of construction activity south of the treeline, or within 200 m of the transmission line, construction managers would be notified and requested to find strategies to avoid the nest. ENR would be contacted for further advice if avoidance of the 1.5 km buffer around an active nest during the construction season is not easily achievable.

### 5.2.4.5 Caribou

Barren-ground caribou are a migratory species that show a large degree of variation in migration routes from year to year. Although their movements are unpredictable at the small scale, there are distinct seasonal differences in distribution and travel rates at the scale of the annual range. To mitigate effects to caribou during Project construction, and to focus caribou monitoring and mitigation efforts on the areas with the greatest likelihood of caribou presence, it is helpful to identify areas and seasons where caribou may occur.

To do so, the historic movements of satellite-collared Bathurst caribou from 1996 to 2007 were compared with the proposed transmission line right of way (ROW). The number of crossings of

the proposed ROW was mapped using GIS software, and areas of relatively density of crossings were identified subjectively. This process was repeated for the four seasonal ranges of the Bathurst caribou (spring migration, post-calving, autumn/rut, and winter), and the results were displayed diagrammatically.

Figures 1 to 4 illustrate the sections of the ROW with high, moderate, low and very low likelihood of caribou presence, during each season. These figures illustrate both the shift in caribou range south of the treeline during winter, and the higher movement rates in the spring and summer. As project planning proceeds, these figures will be used to plan construction activities to avoid seasons and areas where there is a high likelihood of caribou presence.

***Monitoring***

Environmental monitors will document the presence of caribou near construction areas, observations of caribou by construction crews, communicate this information to construction managers, and carry out any deterrent action that may be necessary. Further, movements of satellite collared caribou will be monitored, to provide forewarning of approaching caribou. This type of monitoring has been demonstrated to be of great value at the Diavik, Ekati and Snap Lake diamond mines.

***Schedule/Timing***

Caribou monitoring will be conducted throughout the year, during the entire construction phase. Figures 1 to 4 illustrate areas and seasons where caribou activity may be most intense, and environmental monitors will focus their efforts on construction activity occurring in these areas.

***Thresholds***

Should substantial numbers of caribou be present near construction activities, construction managers would be notified and requested to find strategies to avoid the caribou. Darby (1978, cited in Gunn et al. 2007), discussing thresholds for caribou protection measures, defined 'substantial' numbers of caribou as being greater than 1,000 individuals within a 500 $km^2$ area, or 5% of the herd if the herd is less than 20,000 individuals.

Generally wildlife will be left undisturbed. Caribou will be given priority over vehicles when crossing winter roads. In rare cases, caribou may be in areas that present a risk to the animal, humans, or equipment. In these cases, deterrent action should be considered. Deterrent actions to be taken will begin at the lowest level indicated below and may increase to higher levels, as appropriate to the situation, as outlined in the Human Wildlife Conflict Management Plan. The objective is to have wildlife voluntarily move away from potentially hazardous situations without causing unnecessary stress or possible injury.

### 5.2.4.6 Access

The Project will require the re-commissioning of an old winter road from Fort Smith to Twin Gorges, and the pioneering of a new winter road from Twin Gorges to Nonacho Lake. Temporary access trails will also be required within the transmission line right of way, for those boreal sections where construction will be conducted from the ground. Although mitigation has been proposed to limit use of this winter road by the public, there may be some use of these

winter roads for fishing, hunting, or other types of land use, by snowmobile. Creation of access is often considered detrimental to wildlife populations. Gates are proposed at the start of the winter road near Fort Smith, and at the Twin Gorges site, among other mitigation.

***Monitoring***

Environmental monitors will record all observations of non-Project vehicles on the winter road, or evidence of such. This may include snowmachine trails, or evidence of hunting, fishing or firewood harvesting.

***Schedule/Timing***

Throughout the winter road season for the three years when the winter road from Fort Smith to Twin Gorges and Nonacho Lake will be active.

***Thresholds***

Should there be any evidence of non-Project use of the winter roads, efforts will be made to improve the mitigation. This may include upgrades or repairs to the gates, signage, community announcements, community consultation, and closure of winter roads and/or efforts to make the trails inaccessible by blocking them. Individuals using the winter road will also be interviewed.

## 5.3 Operations Monitoring

### 5.3.1 Water Quantity

***Monitoring***

Water quantity changes during operations are related to the change in hydrograph from the revised flow control at Nonacho Lake. To monitor this, the Basin Model will be periodically revised to reflect new water survey gauge information prior to construction, and will be maintained throughout operations to continually test and learn and adapt flow controls to best manage negative environmental effects while maintaining power generation.

In addition to the Basin Model, flow and water level recorders will be maintained within the Taltson Basin as follows:

Flow and level recorders:

- Porter Lake
- Nonacho Lake
- Nonacho control structure outflow
- Tazin River
- South Valley Spillway
- Turbine flows
- Taltson River downstream of tailrace

Water level loggers will be maintained at the following additional sites:

- Tronka Chua Lake
- Trudel Creek Reach 3
- Trudel Lake (or a select lake within Trudel system)

***Schedule/Timing***

Recorders will be real time, and continuous throughout operations, or until the hydrology has is understood at that site.

## 5.3.2 Ice Regime

***Monitoring***

Ice monitoring was identified as an item of concerns for Nonacho Lake and Trudel Creek. Therefore, an ice monitoring program will be initiated for these two sites. Of greatest concern is the shoreline ice structure at Nonacho, and the depth of ice in Trudel. The monitoring program will be designed to preferably have local land users access the sites. At Noancho Lake, the focus will be on the structure of the ice around the shoreline, and indication of animal or snowmachine avoidance of crossing broken shoreline ice. At Trudel Creek, the focus will be on ice depths at select sites (riverine and lake sections).

As winter dissolved oxygen will be monitored at Tronka Chua Lake (see Water Quality), ice depths will also be taken during that program as supplemental data.

In addition to the ice monitoring program, Dezé also recognizes that one subject of interest to local land users is the effect to ice during a plant shutdown and startup event, when water patterns through the turbine could temporarily change. This change may affect ice downstream of Twin Gorges where people may use the ice as a travel corridor. Therefore, Dezé intends to work with people that travel on the Taltson River ice between Tsu Lake and Twin Gorges to develop a communication system to advise users of the potential changes to the ice structure as a result of a shutdown/startup event.

***Schedule/Timing***

Ice monitoring will be conducted in late winter (March/April) when ice would be the thickest and exposed to the most winter drawdown in Nonacho Lake. Monitoring will occur pre-construction to gain better understanding of the natural ice process in these locations, and during operations for a defined period to obtain adequate information to verify the model.

## 5.3.3 Water Quality and Mercury

### 5.3.3.1 Dissolved Oxygen

During normal operations of the proposed Taltson Hydroelectric Expansion Project, flows over the South Valley Spillway would be reduced, resulting in lower waterline elevations and shallower depth conditions in Trudel Creek system. In order to understand the effects of decreased flows to winter dissolved oxygen (DO) concentrations, a model was prepared to predict the winter DO levels under baseline and the two operation scenarios.

The inputs into the DO model did not account for inflows over the SVS. As such, the predictions of the model indicate that the CCME guidelines for DO concentrations in cold water bodies is not being met under baseline conditions and would not be met during either operation scenario. No baseline information on winter DO levels in Trudel Creek is available to validate the outputs of the model.

***Monitoring Program***

In order to test the predications of the Trudel Creek and Tronka Chua Lake dissolved oxygen model, a winter DO and ice monitoring assessment will be conducted. The assessment will be conducted in Trudel Creek and Tronka Chua Lake in March/April, when dissolved oxygen levels may be low and lake ice is expected to be thick. Sites within Trudel Creek and lakes will be selected to represent different hydrological characteristics (i.e. lake and riverine sections), and access. Dissolved oxygen and ice thickness sites will be established in both the upstream and downstream sections of the lake, where at each location, ice thickness will be measured and a dissolved oxygen and temperature profile will be collected from the water surface to the lake bottom.

***Schedule/Timing***

DO monitoring will be conducted in late winter (March/April) when ice would be the thickest and DO lowest. Monitoring will occur pre-construction to gain better understanding of the baseline DO conditions in these locations, and during operations for a defined period to obtain adequate information to verify the model.

***Data Gaps***

Dissolved oxygen and temperature profiles have been collected in Trudel Lake during summer months; however, no baseline data exists on the DO concentrations during the winter.

### 5.3.3.2 Trudel Creek Water Temperature

Modelling used the DAR for water temperature indicates that Trudel Creek may experience an increase of 2˚C on average in the summer months, which would remain well below the lethal temperature limits and within the optimum temperature regimes documented in the literature for the identified indicator species. However, interest has been expressed during the EA review period on the maximum daily temperatures, as should these be considerably greater thn the average, the temperatures may exceed sub-lethal and lethal thresholds. Dezé has installed tidbit

temperature loggers at two sites in Trudel Creek in 2007 to monitor baseline temperatures year round.

***Monitoring Program***

Due to this interest, Dezé will monitor temperatures in Trudel Creek through maintenance of existing tidbit temperature loggers and installation of new temperature loggers at specific locations that may experience localized temperatures (eg: still lake water; riverine sections, refuge areas, etc.). The temperature monitoring plan will be adapted to reflect the revised hydrology of Trudel Creek based on lower flows if an expansion scenario is approved

***Schedule/Timing***

Dezé will install the additional temperature loggers pre-construction, set for recording year round. The temperature loggers will remain in situ during operations for a defined period to obtain adequate information to verify or refine the model.

***Data Gaps***

In addition to the monitoring program, pre-construction, Dezé will:

- Review literature for sub-lethal temperature thresholds and effects from a northern perspective for the species in Trudel Creek,
- Review literature for additional information on causes of temperature increases and/or temperature changes from other projects with flow reductions,
- Review predictions based on outcome of literature reviews and discuss with DFO

***Thresholds***

Dezé will discuss monitored temperatures with DFO and identify if temperature change is acceptable for fish species in Trudel. Based on outcome of monitoring, Dezé will identify with DFO if additional monitoring, operational changes, or mitigation/ adaptive management is required to protect fish populations.

#### 5.3.3.3 Mercury

***Monitoring Program***

As a result of the interest in mercury, two sites have been selected for mercury monitoring. Through literature reviews, the most effective method for monitoring for the Taltson Project hydrological changes is sediment monitoring.

The two sites selected are Nonacho Lake and Trudel Creek. Sediment samples will be collected from three deep water locations on Nonacho Lake and one deep water location on Gertrude Lake with the Trudel system.

***Schedule/Timing***

Samples will be collect pre-construction, then once annually during operations for a defined period to obtain adequate information to verify the mercury model.

***Data Gaps***

Mercury sampling was conducted in the Taltson River as part of the existing Twin Gorges aquatics monitoring program. Mercury was testing in water quality samples from Trudel Creek in 2008; however, no mercury sediment samples exist for Trudel Creek.

### 5.3.4 Riparian Habitat in the Taltson River

Key component of the monitoring will be ongoing assessment of riparian habitats. These are the habitats found on the shoreline and they extend between clearly terrestrial habitat and open water – i.e. beyond emergent and aquatic plant occurrence. The program is based on revegetation and monitoring plans developed and successfully implemented for BC Ministry of Transportation, for large-scale littoral vegetation impacts along the Skeena and Nass rivers (White 1988, 1997 & 2000; White & Miles, 2002).

The program will set up 5 to 10 monitoring sites in strategic locations in the Taltson River basin where the greatest alterations in water levels are anticipated and it can be reasonably expected that ecosystem changes will occur first and foremost. It is intended that the program will be adapted in response to changes – if/when those changes are observed.

The method of assessment will be repeated and sequential mapping of riparian habitats (by area, type and distribution) throughout the sites.

***Monitoring Program***

There are two phases which will be used to determine where these ecosystem assessment sites should be located. The first phase is at the strategic level - where do we anticipate that there could be habitat changes induced by the project; and the second is at a tactical level – what characteristics do we need within a site in order to be able to assess such changes if they are occurring.

Phase 1: the sites would be located in areas where the hydrological model shows that the greatest changes in seasonal water levels will occur. In general terms, this would be:

- 1 – 10 km downstream of the Twin Gorges Powerhouse, upstream of the first major constriction,
- Trudel Creek, upstream of the first lake;
- Trudel Lake;
- Nonacho Lake, near the outlet; and
- Tronka Chua Lake, near Tronka Chua Gap.

Phase 2: specific geomorphic and biotic criteria would be identified which are necessary so that any changes can be observed and measured. These include:

- 1+ km long shoreline with well established and consistent vegetation communities.
- Relatively shallow slope across the shoreline throughout the site.

- Total width between terrestrial vegetation and offshore limit of aquatic vegetation should be 50 and 100 m.
- Vegetation communities should include terrestrial, meadow, riparian, emergent, aquatic and there should be bare aquatic substrate outside the aquatic community.
- Site that contains several obvious landmarks/features which can be reliably located on the ground and identified from the air, and/or satellite imagery, in all seasons.

The data collected will be riparian vegetative character, distribution and slope location throughout the sites with concurrent water level and shoreline profile data.

Initial set up will include:

- location of 4 to 8 transects within overall site, each transect permanently marked on the ground and located by GPS
- shoreline profile surveys for each transect
- water level data recorder installation

Data Collection will include:

- Daily water level data
- Vegetation community type and position (i.e. slope distance and elevation) along each transect. Vegetation communities will be defined by visual dominance. Community types anticipated to be terrestrial, meadow, riparian, emergent and aquatic.
- Species lists for each vegetative community type present. Multiple data plots within each community so that community structure and composition can be compared between sites.
- Air photos of the site (i.e. the 1+ km shoreline length) at two elevations: approximately 250 m and 460 m.

Data Analysis will:

- Determine total area within the site for each riparian vegetative habitat type.
- Compare habitat species composition, distribution and location throughout the site with similar data from previous years.
- Relate observed habitat changes to changes in water level.
- Determine whether or not physical changes are occurring to the shoreline by comparing shoreline profiles year to year.
- Assess whether observed changes in VEC population/use can be related to changes in vegetation communities area.

***Schedule/Timing***

Monitoring would be started prior to the implementation of the altered hydrograph with one year of detailed site assessments, as vegetation would not change form one year to the next. This

would allow for assessment of pre-existing variability and trends in both the physical shoreline, the riparian habitats on the shoreline and utilization of those habitats by VEC's.

The assessment would continue after project operations for years 1, 3 and 5 after commencement of operations, conducted at peak growth (i.e. August/Sept). After year 5, sufficient information should be generated to reasonably re-assess the efficacy of the existing program. As changes are going to be gradual, with the exception of Trudel Creek, riparian habitat will not change considerably in the initial 5 years of operations.

***Thresholds***

The need for additional or changes to the monitoring program or for other forms of adaptive management will be assessed as information is obtained from the study program and compared to predicted effects.

***Data Gaps***

Site information profiles pre-construction have not been collected.

## 5.3.5 Aquatic Resources

***Monitoring Program***

For each riparian habitat site, benthic invertebrates will be collected within the riparian/littoral zone. The program will based on the following approach:

- Within each riparian site, 11 sample locations will be defined to develop one composite benthic sample;
- GPS coordinates, dominate substrate type, photographs, and shoreline flagging for each of the 11 composite sites will be undertaken;
- An estimate of the littoral zone slope will be made prior to sample collection;
- Samples will be collected using a D-frame net of 500 micron mesh by disturbing the bottom material for 30 seconds to produce a sample from a quadrat of $1m^{2;}$
- Littoral zones dominated by macrophytes will be sampled by a "sweeping method" to disturb the vegetation and sweeping the dislodged material over the same 1 m2 for the same time duration;
- Identification will be to genus-level or lowest practical for some groups;
- Lab QA/QC will be as per normal laboratory standards; and
- Data to be reported will include biodiversity, relative taxa abudance and an estimate of biomass (i.e. productivity).

***Schedule/Timing***

Benthic samples will be collect annually at the height of the benthic growing season (August), in conjunction with the riparian monitoring program.

***Data Gaps***

Benthic invertebrates have been collected for the effects assessment in the DAR, however, pre-construction sampling at the riparian sites have not been collected.

## 5.3.6 Fish and Fish Habitat

Fish and fish habitat monitoring includes assessing general hydrological changes relative to the predicted changes, and subsequently the effects on fish habitat from those changes, in combination with the riparian program.

### 5.3.6.1 Taltson Basin Fish Monitoring at Riparian Monitoring Sites

***Monitoring Program***

For each riparian habitat site, fish assessment will be conducted to within the near shore / littoral zone habitat. The program will be developed to gain an understanding of the fish use of the habitat. Data will be gathered by establishing observation transects from the edge of water extending out beyond vegetation growth, and conducting area sampling. Specific assessment techniques are under development, but would likely include a combination of snorkel surveys and sampling using nets (seine and/or gill), electroshocking, traps, or other techniques.

***Schedule/Timing***

The schedule and timing for fish assessments would be the same as presented for the Riparian Habitat Monitoring.

***Data Gaps***

Pre-construction fish assessments at the riparian sites have not been collected.

### 5.3.6.2 Tronka Chua Lake Monitoring Program

During normal operations of the proposed Taltson Hydroelectric Expansion Project, flows through Tronka Chua Gap and into Tronka Chua Lake would be reduced. This change in flow could result in changes to the fish habitat structure, cover and food supplies in Tronka Chua Lake. Limited environmental data are available for Zone 2, specifically Tronka Chua Lake, and assumptions on baseline fish and fish habitat conditions were made to complete the effects assessment associated with the Developers Assessment Report (DAR).

***Monitoring Program***

The intent of the monitoring program is to test the predication of the DAR, that the alterations of flow through Tronka Chua Gap will not result in a significant level effect to fish populations in Tronka Chua Lake.

To assist in monitoring the effects of flow reductions through Tronka Chua Gap, a series of three assessments are proposed as listed, and further discussed below:

- Lake depths assessment;
- Fish species and habitat characteristics assessment; and
- Winter dissolved oxygen and ice thickness characteristics assessment.

A lake depth assessment will be conducted to identify the range of depths occurring throughout Tronka Chua Lake under baseline conditions. It is not the intent of the assessment to produce a detailed bathymetric map of Tronka Chua Lake; however, to identify the proportion and location of deep-water and shallow reef areas. This will be accomplished through a desktop exercise to review lake configuration (satellite and aerial photo review) and select potential lake transects. Lake depths will be collected in the field through a combination of depth sounding equipment and physical measurements.

A fish and fish habitat characteristics assessment will be conducted to identify the fish species and habitat units of Tronka Chua Lake. In order to identify the fish species present, an assessment of select shallow reef and deep water habitats will be conducted. This will include a combination of visual observations, seine netting and electro-shocking in the shallow reef habitats and gill netting and angling in the deep water habitats. The fish presence assessment is not intended to provide population level estimates, but rather an indication of the array of fish species and habitat utilization in Tronka Chua Lake. The fish habitat assessment will be conducted at each shallow reef site where fish sampling efforts were conducted. At each site, a series of depth profile transects will be established. Along each transect, a combination of visual surveys and physical measurements will be used to generate a habitat unit map of the depth, cover, substrate and water quality conditions (i.e. dissolved oxygen profile). In addition to collecting information along the depth profile transects, snorkel surveys may be conducted to ensure specific habitat units were not missed during the mapping exercise.

The winter dissolved oxygen and ice monitoring assessment would be conducted in March/April, when dissolved oxygen levels may be low and lake ice will be thick. Dissolved oxygen and ice thickness assessments will be conducted in two deep water areas and two shallow reef areas, as identified by the lake depth assessment. At each location, ice thickness will be measured and a dissolved oxygen and temperature profile will be collected from the water surface to a maximum depth of 30 m or the lake bottom.

### *Data Gaps*

Limited, if any, information is available on lake depths, fish and fish habitat characteristics and winter dissolved oxygen levels within Tronka Chua Lake. The methods, as outline in the Tronka Chua Lake Monitoring Program, have been designed to establish a baseline condition for each of these parameters.

### *Schedule/Timing*

The Tronka Chua Lake monitoring program will be implemented pre-construction. Fish monitoring during operations will be conducted as part of the fish monitoring at riparian monitoring sites. DO and ice conditions will be conducted during operations for a defined period to obtain adequate information to verify the model.

***Thresholds***

The need for adaptive management will be assessed upon completion of the Tronka Chua Lake monitoring program; however, as the hydrological model is refined and the knowledge base of the Taltson River system increases, a more detailed flow management control system may be implemented to meet power needs and offset environmental negative effects.

### 5.3.6.3 Lake Trout Monitoring Program

During normal operations of the proposed Taltson Hydroelectric Expansion Project, the waterline elevation in Nonacho Lake will experience a 0.86 m (36 MW scenario) to 0.50 m (56 MW scenario) on average, drawdown between September and April on an annual basis, a change from the current drawdown of 0.35 m and the 1964 through 1986 drawdown of 0.67m . In addition, a one-time drawdown during construction of 0.85 m to the spillway sill is required also between September and April. The drawdown period coincides with lake trout spawning and egg incubation periods. Primary literature indicates that lake trout spawn in a wide range of depths from 0.12 m to 55 m over rocks and cobbles free of sands, silts and clay. Therefore, depending on the power generation scenario, as waterline elevations within Nonacho Lake decrease from September to April, lake trout eggs spawned in 0.86 m or less, could become dewatered.

***Monitoring Program***

The need for, and development of, a monitoring program for lake trout spawning and/or egg incubation would be determined after testing of the assumptions made during the effects assessment.

Key assumptions that need to be tested, in order to determine the need or scope of a monitoring program, include:

- the range of depths lake trout currently use to spawn;
- the preferred spawning habitat conditions (i.e. substrate);
- a relative comparison of shallow reef spawners to deep water spawners; and

Once the assumptions are verified or adjusted based on study outcomes, the effect of drawdown on overwintering eggs would be reviewed, and the need for ongoing monitoring can be determined.

The assumption testing consists of a two-phase approach, as listed and further discussed below:

- Phase 1 – Desktop program: identification of potential lake trout spawning locations within Nonacho Lake; and
- Phase 2 – Field study program: analysis and assessment of fish use/habitat values of the identified spawning locations.

The desktop analysis associated with Phase 1 has commenced and identified both shallow reef habitats and deep water habitats for assessment. In consultation with Myles Carter, a guide for the existing fishing lodge on Nonacho Lake, shallow reef habitats previously observed to support lake trout spawning were identified and mapped. At each shallow reef site identified, Mr Carter also provided information regarding fish holding and spawning depths, substrate sizes and

estimated quantities of fish. Deep water habitats were selected directly adjacent to the known shallow reef habitat sites. The selection of deep water habitats adjacent to the shallow reef sites is to allow for comparisons of habitat conditions and estimated quantities of fish using these areas for spawning. The shallow reef habitats and deep water habitat locations identified as part of the field program are summarized on the attached map.

Phase 2 of the field program will occur pre-construction and ideally during the peak spawning period of lake trout (anticipated to be September 1 to September 15, based on a personal communication with Myles Carter) and will involve an on-site assessment of select shallow reef and deep water sites identified in Phase 1. At each selected shallow reef site and adjacent deep water site, a series of depth profile transects will be established that extend from the shoreline to a determined point in the deep water habitat. Along each transect, a fish habitat and fish usage assessment will be conducted.

The fish habitat assessment will be conducted to map the habitat units (cover and substrate conditions) associated with the selected shallow reef and deep water habitat sites. Along the shallow reef sites, the fish habitat assessments will involve a combination of visual surveys and physical measurements to document the cover/substrate conditions. Information gathered along each transect will be used to generate a habitat unit map of each surveyed shallow reef site. In addition to collecting information along the depth profile transects, snorkel surveys will be conducted to ensure specific habitat units were not missed during the mapping exercise. Along the deep water habitats, the fish assessment may involve grab samplers or an underwater camera.

An assessment of relative fish use of shallow reef and deep water habitats will be conducted. As active spawning will be occurring during the assessment period, non-lethal methods of sampling are proposed. This will include a combination of snorkel surveys, visual observations and angling in the shallow reef sites and fish finders, visual observations (underwater camera), and angling in the deep water sites. Each captured fish will be processed (length and weight) and a visual assessment of sexual maturation will be conducted.

In addition to the fish habitat and fish usage assessments, temperature data loggers will be installed at two selected sites. At each of the two-selected sites, a series of temperature loggers will be established at various depths. Information collected in this process could be used to assist in determining incubating egg survivability under baseline and operation conditions.

### *Data Gaps*

Limited information is available on the relative use of shallow reef habitats and deep water habitats for lake trout spawning in Nonacho Lake. The methods presented in Phase 2 of the monitoring program have been designed to provide the necessary information to assess this question.

### *Schedule/Timing*

The Lake Trout study program will be implemented pre-construction. As the program consists of two-phases, each phase would be initiated at different times. Phase 1 (desktop analysis) has already been completed and Phase 2 (field analysis and assessment) will be implemented pre-construction and during the peak lake trout spawning window (September 1 to September 15).

### 5.3.6.4 Entrainment Monitoring Program

Fish passage through the turbines may result in fish mortality and injuries due to various stresses. These stress-inducing mechanisms include cavitations, sudden shifts in water pressure, rapid changes in water acceleration or deceleration rates, and collisions with stationary or moving turbine parts. Effects from entrainment include short-term injuries and mortalities as well as long-term effects on fish health, survival and reproduction abilities.

Common mitigation techniques available to prevent fish entrainment and mortality at hydroelectric facilities fall into one of two categories: physical or behavioural deterrents and turbines that are designed to reduce fish mortality.

Mitigation strategies for the Taltson Hydroelectric Project would include both of the above categories. The North Gorge canal would be designed as a 1,250 m blasted-rock channel with no in-stream submergent or emergent vegetation, woody debris or other in-stream complexities. The creation of canals void of habitat features is anticipated to discourage fish use and lower the potential for fish entrainment. Of the fish that choose to enter and use the canal in the North Gorge, the likelihood of entrainment is further reduced because the intake velocities are designed between 0.3 to <1 m/s, which is less than burst speeds of large fish, allowing them to swim out of the canal.

Low-head Kaplan turbines will be installed in the new powerhouse. Kaplan turbines have been shown to result in lower fish mortality and will be the preferred turbine subject to technical and economic feasibility.

***Monitoring Program***

The intent of the monitoring program is to test the DAR predictions that fish use of the North Gorge intake canal will be low and that fish can escape the canal should they swim into it. In addition, the monitoring program will also investigate the operationally feasibility of fish screens with a mesh size <100 mm.

The fish use assessment associated with the North Gorge canal will require a safety first approach. As the North Gorge canal is bound by vertical bedrock walls and deep water (5 m) conditions, the feasibility of certain fish sample/capture techniques may not be safe to conduct (i.e. snorkel surveys, netting). Therefore, fish use within the North Gorge canal will likely be assessed through a combination of recording (video) and pre-fabricated capture devices (i.e. fyke net or similar) as well as visual observations. Where feasible, information regarding fish species, length, life-stage and behavioural characteristics will be documented. Specific sampling techniques, timing and effort incorporated into the monitoring program will be reviewed with Fisheries and Oceans Canada (DFO) prior to implementation of the field assessments.

In order to assess the ability of fish to swim out of the intake canal, documentation of velocity conditions is required. As part of the field program, velocity stations will be established within the North Gorge canal, and extending perpendicular into the Twin Gorge Forebay. At each station, the velocity conditions will be recorded across the channel. The measured velocity conditions will be compared to the burst speeds of juvenile and adult life-stages of the indicator species to determine the potential for fish to swim out of the canal. Additionally, information

gathered on fish behaviour and swimming capabilities by the recording devices and visual observations will be used to validate the results of the velocity assessment.

***Data Gaps***

In addition to the operational monitoring program, Dezé will continue to investigate design mitigation measures that could be incorporated into the detained design. These include:

- Investigating if screen sizes <100 mm are effective in preventing applicable fish species and life stages from being entrained and if they are operationally feasible;
- Incorporating a screen on the intake facilities for the Nonacho turbine, and investigating an operationally feasible mesh size that assists with fish entrainment mitigation; and
- Investigating technical feasibility of utilizing turbines with the least impact to fish (i.e. minimal blades etc.).

***Schedule/Timing***

The entrainment monitoring program would be conducted during the first year of operations.

***Thresholds***

The need for additional monitoring or mitigation / adaptive management to protect fish populations will be assessed upon completion of the proposed monitoring program.

### 5.3.6.5 Fish Stranding Monitoring Program

The potential for isolation or stranding of fish could occur in three general areas; the South Gorge Spillway channel, within Trudel Creek, and the Taltson River downstream of the tailrace.

As a result of diverting flows through the South Gorge Spillway during a controlled or uncontrolled shutdown, fish could migrate into the spillway channel. Velocities in the channel would be high, obstructing fish from migrating upstream from Elsie Falls; however, fish that moved into the spillway channel from the Twin Gorge Forebay may be able to hold in a natural pool located immediately upstream of the channel confluence with the existing Twin Gorges tailrace. Fish that do not move downstream of this pool and into the habitats above Elsie Falls could become isolated when the spillway gates are closed and flows are stopped.

Fish in Trudel Creek could become stranded as a result of ramping. Fish that utilize littoral zone habitats could move into the newly-wetted habitats associated with an elevated waterline. During the plant start-up and subsequent decrease in waterline elevation, littoral zone users could become isolated on embankments as the water recedes. Although isolation in pools may occur, this is less likely in Trudel as the shoreline features would likely drain.

Fish in the Taltson River downstream of the tailrace (upstream of Tsu Lake) could become stranded or isolated as a result of ramping. Fish that utilize littoral zone habitats could move into the newly-wetted habitats associated with an elevated waterline. During the plant start-up and subsequent decrease in waterline elevation, littoral zone users could become isolated or stranded in off-channel habitats or pools.

### *Proposed Mitigation Measures*

The Expansion Project design incorporates a multiple power plant generating facility as opposed to a single plant design. Having two power-generating facilities that can feed two different transmission lines (existing line to communities and proposed line to mines) decreases the potential for un-controlled plant shutdowns from accidental generator and line outages, thereby decreasing the potential for ramping events in Trudel Creek.

To mitigate the potential effects during a scheduled and/or unscheduled shut down, and all start-ups, flow would be managed as presented in DAR Chapter 17, which describes the proposed step up and down procedures for the turbines for scheduled outages and start-ups, to minimize the increases or decreases of flows in Trudel Creek and Taltson River downstream of the plant. This will provide a more gradual change to the flow as compared to a full on/off scenario.

In addition, the Expansion Project would incorporate a bypass spillway (referred to as the South Gorge Spillway) with a 30 $m^3$/s capacity and staged gate control. The spillway would assist in reducing the increases/decreases of flow in Taltson River, and reduce ramping flow to Trudel Creek, thereby lessen the potential for fish displacement and/or stranding during an unscheduled shutdown and subsequent ramping event. The design of the bypass spillway control gate would allow for graduated closure, to slowly reduce flows through the spillway.

### *Monitoring Program*

The intent of the monitoring program, as outlined below, is to assess the effectiveness of the proposed mitigation measures; to conduct field studies to confirm the predictions in the DAR that the potential for stranding within the South Gorge Spillway, the Taltson River downstream of the tailrace and within Trudel Creek is low; and to determine if the mitigation is adequate or if adaptive management to reduce effects of stranding/isolation is required.

<u>South Gorge Spillway</u>

To better understand the likelihood of fish stranding within the South Gorge Spillway channel, a trial opening and closing of the spillway gate will be initiated prior to operation of the power generating facility.

Under baseline conditions, the identified holding pool within the spillway channel remains wetted throughout the year; however, the pool has not been observed to be connected to the habitats above Elsie Falls. No assessments on depth, dissolved oxygen levels, icing characteristics or any other parameters have been conducted within the pool. Prior to the opening of the spillway gate, a fish presence assessment of the holding pool in the spillways channel will be conducted. The assessment will involve the use of an electro-shocker, seine net and rod. Any fish collected during the assessment will be processed (length and weight) and transported from the isolated holding pool in the spillway channel to the habitats above Elsie Falls.

During the diversion of flows (30 $m^3$/s), velocities within the spillway channel will be estimated and any visually observable changes in fish behaviour adjacent to the spillway intake will be documented. If possible, a visual estimate of the number of fish entering the spillway channel will be made. Upon closure of the spillway gate, a follow-up fish presence assessment within the spillway channel will be conducted to determine if fish remain in the holding pool.

Following the trial scenario, a technical memo will be prepared that compares the outcome of the monitoring to the predicted effects in the DAR, and will be reviewed with Fisheries and Oceans Canada (DFO). Based on the outcomes of the monitoring program, the potential for stranding within the spillway channel and need for adaptive management would be assessed. The need for adaptive management would be based on the effect of isolation on the fish population. If revised mitigation would be necessary, the type of mitigation would depend on the results of the monitoring program and project-environmental component interaction, such as numbers of fish isolated, species, location, season, etc.

Taltson River and Trudel Creek

To assist in monitoring the effects of ramping in Trudel Creek and the Taltson River downstream of the power plant, a three-phase monitoring program is proposed as listed, and further discussed below:

- Phase 1 – Desktop analysis of potential isolation/stranding locations
- Phase 2 – Field analysis and prioritization of identified isolation/stranding locations; and
- Phase 3 – Monitoring program during the initial scheduled shutdown event

The desktop analysis associated with Phase 1 of the program has been completed. The desktop analysis involved a review of aerial and field photographs to identify potential isolation/stranding locations within Trudel Creek and the Taltson River downstream of the tailrace. Potential sites were identified as any off-channel habitats, benches with pools/depressions and/or other stream complexities that could result in fish not moving out of an area that could become isolated. The desktop analysis was intended to identify the majority of isolation/stranding locations; however, additional sites likely exist that are not indicated on the map. As such, additional sites may be identified in Phase 2.

Phase 2 of the monitoring program will occur pre-construction and will involve an on-site assessment of each of the identified sites associated with Phase 1. The on-site assessment will involve an analysis of potential fish and fish habitat values (i.e. in-stream vegetation, pools, cover, substrate conditions), likelihood of use by the indicator species, accessibility by fish during a ramping event, and the ultimate potential for stranding as the waterline elevation decreases. Additional areas not mapped in Phase 1 that were identified during the field program to potential result in isolation/stranding will also be assessed. Based on the results of the assessment, a priority ranking of high, medium or low will be applied to each identified site. High, medium and low rankings are described as:

- High – Site is likely to provide ample cover and habitat values, is easily accessible (good connectivity to the mainstem channel) during ramping event, and could result in stranding of one or more of the indicator species
- Medium – Site provides fair cover and habitat values, will likely be connected to the mainstem channel during a ramping event and has enough complexities that fish may become stranded as the waterline elevation decreased; and

- Low – Site likely to provide poor habitat values, would have limited (if any) connectivity to the mainstem channel during a ramping event and has limited potential for stranding.

For sites identified as high priority, additional on-site information will be collected, including: appropriate salvage techniques (i.e. seine net, electroshock, angle), access to the site (i.e. foot, boat, helicopter), and release locations of salvaged fish. The end deliverable for Phase 2 of the program would be an annotated map, identifying all the high, medium and low sites within Trudel Creek and the Taltson River downstream of the tailrace and the necessary salvage information for high priority sites.

Phase 3 of the program will involve on-site monitoring of a representative selection of high and medium priority sites during the first scheduled shutdown. At each site, the quantity, species and life-stage information will be gathered for fish identified to be stranded and/or isolated from the mainstem channel. Fish will be salvaged using the equipment and techniques indicated in Phase 2, and will be released back into the mainstem channel.

Following completion of the on-site monitoring, a technical memo will be prepared that compares the outcome of the monitoring program with the predictions of the DAR, and will be reviewed with DFO. Based on the outcome of the monitoring program, the potential for stranding within Trudel Creek and the Taltson River downstream of the tailrace, and the need for adaptive management will be assessed on the same parameters as discussed for the South Gorge Spillway. The need for adaptive management would be based on the effect of isolation on the fish population. If revised mitigation would be necessary, the type of mitigation would depend on the results of the monitoring program, such as numbers of fish isolated, species, location, season, etc.

### *Data Gaps*

Limited information relating to the biophysical conditions and fish and fish habitat values of the identified isolation/stranding sites exists. This information will be gathered during Phase 2 of the monitoring program.

### *Schedule/Timing*

The Fish Stranding Monitoring Program will be implemented pre construction; however, would extend into the first year of operation. As the program consists of three-phases, each phase would be started at a different time. Phase 1 (desktop analysis) has already been completed; Phase 2 (Field Program) will be implemented pre-construction; and Phase 3 (Monitoring Program) will occur during the first scheduled shutdown in the operation stage of the Project.

### *Thresholds*

Dezé will discuss monitoring program outcome with DFO to decide if stranding/isolation risk level is acceptable, and/or identify additional monitoring, operational changes and/or mitigation (adaptive management) that could be applied, depending on the issues identified.

## 5.3.7 Wildlife and Terrestrial Habitats

### 5.3.7.1 Caribou

There have been questions from stakeholders regarding the possible effects of a transmission line to caribou. Currently, there is very little information available on this subject. Although there were efforts to describe Bathurst caribou movements near the Yellowknife to Snare Hydro transmission lines during baseline studies, there exists a high degree of uncertainty as to how caribou will respond to the presence of the transmission line in a tundra environment. Mitigation included in the Project design to reduce effects to caribou include the relocation of the proposed transmission line route away from the important migratory areas at the east end of Lac de Gras and MacKay Lake.

Although it is possible to detect changes to caribou behaviour near the transmission line, understanding the mechanisms underlying this (such noise, smells, and vegetation differences) would be very difficult. As such, this study is not anticipated to identify new mitigation and will not provide useable information to the adaptive management process. However, this monitoring component will be conducted because of the importance of caribou to northern communities and the participation by communities.

***Monitoring***

Dezé plans to host a caribou monitoring camp with community representatives where observations of caribou behaviour and movements across transmission lines are recorded. Ground based behavioural monitoring, similar to that conducted at Ekati, Diavik and Snap Lake, will also be conducted, in an attempt to document changes in caribou behaviour as they approach and cross the transmission line. Behavioural monitoring would attempt to simultaneously document caribou behaviour both near the transmission line and in a reference area.

A possible scenario is for the monitoring crew to stay at the Lac de Gras hunting camp, and use boats and a helicopter to travel to areas where there are caribou in the vicinity of the transmission line. Monitors would then observe caribou movements from a nearby hill.

A second monitoring program will involve analysis of GPS collared movement in the vicinity of the transmission line, both before and after construction. GPS collars have been deployed by the GNWT on Bathurst caribou since 2008, and provide more frequent and accurate data than the older satellite collar technology. It is anticipated that this technology will provide sufficient accuracy and frequency of data to determine if there are movement changes in the vicinity of the transmission line.

***Timing/Schedule***

Timing of this camp would be triggered by evidence of approaching caribou (from movements of collared caribou or incidental reports). Typically, caribou reach the Lac de Gras region from the calving grounds in late July. Up to four days per year would be dedicated to this monitoring. Monitoring would continue until sufficient data has been collected to adequately describe any changes to caribou behaviour near the transmission line.

Analysis of the GPS collared caribou movements (provided by the GNWT) will be initiated when sufficient data is available. It is anticipated that this will require two to four years following construction.

***Thresholds***

This monitoring is proposed as research, to add to our understanding of how caribou react to transmission lines, and to provide communities an opportunity for meaningful input. This research would be conducted when the transmission line is operational, and the research can only reveal if caribou are affected by transmission lines, not why. As such, this research would not lead to mitigative or management actions that could reduce the effect. Thus, effect thresholds are not relevant.

### 5.3.7.2 Waterfowl

Changes to water levels associated with operations are expected to affect nest density, location, and success. This would most likely result from the anticipated changes to wetlands and associated vegetation and invertebrates.

***Monitoring***

Monitoring of nest density, location, and success in Trudel Creek will be conducted, and compared to a reference area. Results will be compared to the changes in water level, flow rates, and associated changes in vegetation.

***Timing/Schedule***

Four years of studies are proposed: two years of monitoring waterfowl nesting and nest success under existing conditions, and two years of monitoring in the operational phase, after the changes to hydrology have been implemented.

***Data Gaps***

In order to assess effects due to operations, specific pre-construction information on waterfowl nesting success in Trudel Creek is required.

***Thresholds***

These studies are proposed as research rather than monitoring. Since its conception, the Taltson Project has been designed to avoid new flooding, and maintain the current hydrology regime. As such, changes to Project operation are not anticipated to result from these studies. Any changes to Project hydrology for environmental reasons would be driven by the more sensitive receptors of fish and other aquatic species. Thus, effect thresholds related to waterfowl are not relevant. Rather, these studies are proposed to address uncertainty in the effects, and to confirm that large-scale changes to the Trudel Creek ecosystem do not occur.

### 5.3.7.3 Beaver and Muskrat

During operations, changes to water levels are expected to affect the abundance, location, and activity of beaver and muskrat.

***Monitoring***

Beaver and muskrat activity will be surveyed annually during operations in Trudel Creek, and in a reference area on the Taltson River that is not subject to significant water level changes.

***Timing/Schedule***

Four years of studies are proposed: two years of monitoring beaver and muskrat activity under existing conditions, and two years of monitoring in the operational phase, after the changes to hydrology have been implemented.

***Data Gaps***

In order to assess effects due to operations, specific pre-construction information on beaver and muskrat abundance in Trudel Creek is required.

***Thresholds***

These studies are proposed as research rather than monitoring. Since its conception, the Taltson Project has been designed to avoid new flooding, and maintain the current hydrology regime. As such, changes to Project operation are not anticipated to result from these studies. Any changes to Project hydrology for environmental reasons would be driven by the more sensitive receptors of fish and other aquatic species. Thus, effect thresholds related to beaver and muskrat are not relevant. Rather, these studies are proposed to address uncertainty in the effects, and to confirm that large-scale changes to the Trudel Creek ecosystem do not occur.

# 6 Reporting

Dezé will produce an annual monitoring program report, to be circulated to regulatory agencies, Aboriginal groups, communities and other interested stakeholders. Dezé will be available to discuss the reporting outcomes with interested groups. A component of the reporting and discussion will be to review the monitoring program to identify if changes should be made to monitoring, or if adaptive management, including changes to mitigation measures should be developed or initiated.

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