Keeyask Generation Project

PRELIMINARY DRAFT

Fish Habitat Compensation Plan

Hydropower Limited Partnership

April 2013

KEEYASK GENERATION PROJECT

FISH HABITAT COMPENSATION PLAN

DRAFT

Prepared by

Keeyask Hydropower Limited Partnership

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PREFACE

KEEYASK ENVIRONMENTAL PROTECTION PROGRAM

An Environmental Protection Program (the Program) has been developed to mitigate, manage and monitor potential environmental effects described in the *Keeyask Generation Project: Response to EIS Guidelines* during the construction and operation phases of the Keeyask Generation Project (the Project) shown on Map 1(*Drafters Note: general location map to be inserted)*. The Program includes a collection of plans grouped in the following categories: Environmental Protection Plans, Environmental Management Plans, and Environmental Monitoring Plans.

Figure 1 lists all of the plans included in the Program. It also demonstrates how the Program will be managed. The Keeyask Hydropower Limited Partnership (the Partnership) has delegated authority to Manitoba Hydro to manage construction and operation of the Project including implementation of the Program. The organizational structure of the Partnership for this aspect of the Project includes a Monitoring Advisory Committee (MAC), which includes participants from each of the Keeyask Cree Nations (KCNs) and Manitoba Hydro. Manitoba Hydro will be guided on the implementation of the Program by the MAC, the Partnership Board of Directors and ongoing discussion with Regulators.

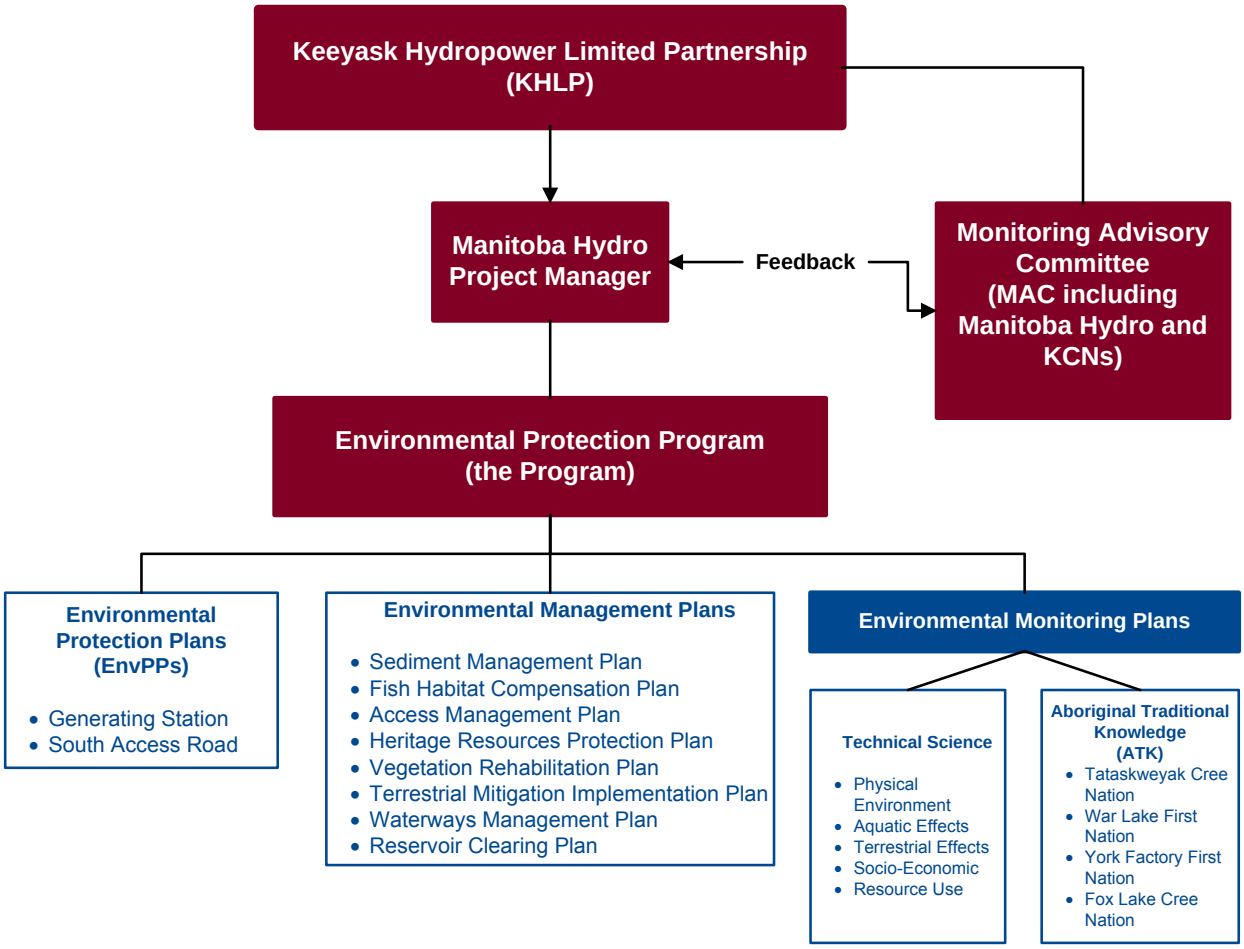

Figure 1: Environmental Protection Program

The Environmental Protection Plans (EnvPPs) provide detailed, site-specific environmental protection measures to be implemented by the contractors and construction staff to minimize environmental effects from construction of the generating station and south access road. They are designed for use as reference documents providing the best management practices to meet or exceed regulatory requirements. EnvPPs are organized by construction activity, highlighting measures to reduce the impact of a specific work activity (e.g., tree clearing or material placement in water). Contractors' compliance with the EnvPPs is a contractual obligation. Under Manitoba Hydro's construction site management, a Site Environmental Officer will be responsible for monitoring compliance and determining when corrective actions are required.

The Environmental Management Plans focus on minimizing effects on specific environmental parameters. They outline specific actions that must be taken during construction and in some cases into the operational phase to mitigate Project effects. The management plans include monitoring to determine success of the actions taken and to determine other actions that need to be undertaken (adaptive management). Implementation of these plans will involve Manitoba Hydro's staff, the KCNs, specialized consultants and contractors under the direction of the Project Manager.

The Environmental Monitoring Plans are designed to measure the actual effects of the Project, test predictions or identify unanticipated effects. During the course of the environmental assessment, numerous requirements for monitoring were identified. There will be both technical science monitoring and Aboriginal

Traditional Knowledge (ATK) monitoring undertaken. The technical science monitoring will be conducted by Manitoba Hydro and specialized consultants contracted by Manitoba Hydro, who will in turn hire members of the KCNs to work with them to fulfil the monitoring activities. Manitoba Hydro will also have contracts with each of the KCNs to undertake ATK monitoring of the project.

The activities that occur and the results generated from the Environmental Protection Program will be discussed at MAC meetings. The MAC is an advisory committee to the Partnership Board of Directors and will review outcomes of the programs and, if appropriate provide advice and recommendations to the Partnership on additional monitoring or alternative mitigation measures that may be required. The MAC will provide a forum for collaboration among all partners. On behalf of the Partnership, the MAC will also ensure that the outcomes of the Environmental Protection Program are communicated more broadly on an annual basis to Members of the KCNs, regulators and the general public.

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1.0 INTRODUCTION

This document describes the Fish Habitat Compensation Plan (FHCP) for the Keeyask Generation Project (the Project), a 695 megawatt hydroelectric generating station (GS) that will be constructed by the Keeyask Hydropower Limited Partnership (KHLP)[1] at Gull Rapids on the lower Nelson River (Map 1). *The Keeyask Generation Project: Response to EIS Guidelines*, completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the aquatic environment, including a description of the environmental setting, effects and mitigation (including creation of replacement habitats), and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project: Aquatic Environment Supporting Volume* (AE SV).

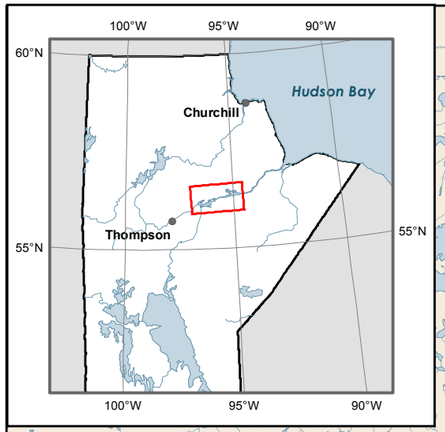
Drafting note: standard introductory text describing the Environmental Protection Program is being prepared by Manitoba Hydro (Environmental Licensing and Protection) and will be inserted here.

The FHCP contains the following components:

- A description of the expected effects to fish habitat, and the risk those effects may pose to fish populations, which together have guided the development of proposed mitigation and habitat compensation activities and works (Section 2);
- A summary of effects to habitat and required compensation (Section 3); and
- A description of proposed fish habitat compensation plans and activities (Section 4).

The Project will alter fish habitat in the Nelson River between Long Rapids and Stephens Lake, an area of approximately 4,500 ha of river and lake habitat, comprising the future reservoir and the immediate downstream environment. Over several decades, conditions in the reservoir, including the 4,800 ha of flooded terrestrial area, will evolve to become productive fish habitat. However, 128 ha of habitat in Gull Rapids will be permanently lost due to the footprint of the principle structures of the Generating Station, construction of intake and tailrace channels, and dewatering of the south channel of Gull Rapids. The intent of this document is to summarize the compensation plan for the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat as per Section 35(2) of the Federal Fisheries Act.

[1] The Keeyask Hydropower Limited Partnership is comprised of four limited partners and one general partner. The limited partners are Manitoba Hydro, Cree Nation Partners Limited Partnership (CNP; controlled by TCN and WLFN), York Factory First Nation Limited Partnership (controlled by YFFN), and Fox Lake Cree Nation Keeyask Investments Inc. (controlled by FLCN). The four communities together are referred to as the Keeyask Cree Nations (KCNs). The general partner is 5900345 Manitoba Ltd., a corporation wholly owned by Manitoba Hydro.



KEEYASK Hydropower Limited Partnership

0 10 20 30 Kilometres
0 8 16 Miles

Projection: UTM Zone 15, NAD 83
Data Source: NTS base 1:50 000,
Stephens Lake Shoreline-Quickbird@Digitalglobe, 2006
Nelson River Shoreline modelled by Manitoba Hydro

Aquatic Environment Study Area

Map 1

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The objectives of the FHCP are as follows:

- To provide habitat to support all life history functions for key fish species (lake sturgeon, walleye, northern pike, and lake whitefish) in the Keeyask reservoir and Stephens Lake. These species are important for domestic, recreational, and commercial fisheries;
- To maintain the productive capacity for fish in this region of the Nelson River, as specified in Fisheries and Oceans Canada's (DFO) 1986 Policy for the Management of Fish Habitat; and
- To assist in the recovery of lake sturgeon populations in the region. Lake sturgeon have been assessed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are being considered for listing under the federal *Species at Risk Act* (SARA).

In identifying habitat compensation priorities, the KHLP considered the Fisheries Management Objectives (FMOs) that Manitoba Conservation and Water Stewardship (MCWS) Fisheries Branch has developed for this region (see Appendix A).

The development of the FHCP also considered the preference of the Keeyask Cree Nations (KCNs) partners of the KHLP that compensation projects for the Project be located within the lower Nelson River or adjacent waters, as such projects will improve the fishery in an area used by members of the KCNs and help address negative effects of past and existing developments on the river environment.

Baseline data were collected as part of the Keeyask environmental studies, with the majority of work conducted between 1999–2006. Modelling was used to predict physical, chemical, and biological changes to the existing environment that are expected to result from Project construction and operation (see AE SV for more details). Changes that are likely to negatively affect fish and fish habitat were identified and, where possible, mitigation measures to either avoid or minimize the effect(s) were identified and will be implemented. In those cases where the effect(s) could not be avoided or fully mitigated, the residual effects to habitat were determined and plans to offset the HADD have been developed. Planned compensation measures have been designed to target specific HADDs that are expected to occur. However, in practice it will not be possible to replace each specific habitat type and area affected on a hectare by hectare basis. The intent is that overall Project compensation measures will compensate for overall Project adverse effects on fish habitat productive capacity.

The success of mitigation and compensation measures will be monitored; detailed descriptions of monitoring programs for the measures described in this document are provided in the Aquatic Effects Monitoring Plan (AEMP). As part of the AEMP, monitoring of the fish habitat compensation measures will be conducted to:

- Determine the effectiveness of the habitat compensation works and determine if works need to be modified and/or additional ones added as per the Project's Authorization under the *Fisheries Act*;
- Confirm the effectiveness of the stocking program on lake sturgeon populations and modify as appropriate; and

- Confirm that the post-Project effects are as predicted in the environmental assessment and, if not, determine what other mitigation or compensation measures may be required.

The adaptive management will involve an ongoing process of engagement between KHLP, DFO and MCWS. Some specific elements in the process will be the following:

- Annual monitoring reports by KHLP;
- Annual meetings between KHLP, DFO and MCWS to review and discuss annual monitoring results, and stewardship and monitoring plans for the upcoming year; and
- An initial formal review of the fish habitat compensation works four years post-impoundment to determine whether installed works are functioning as intended and whether additional mitigation and/or compensation are required. A second review 10 years post-impoundment would determine whether reservoir conditions are evolving as anticipated, or whether other works are required.

2.0 SUMMARY OF EFFECTS TO HABITAT

Assessments of the effects of Project construction and operation on fish and fish habitat have been previously completed and are described in the AE SV. This section provides a summary of habitat alterations where a HADD is considered likely; activities that were assessed as being of low risk to fish habitat where a HADD was not expected (based on design information currently available) are not included (e.g., crossings on the south access road, upstream and downstream boat launches). The KHLP will provide DFO with information regarding these activities and an assessment of the potential risk to habitat when complete design information is available.

2.1 CONSTRUCTION AND REMOVAL OF COFFERDAMS AND ROCK GROINS

2.1.1 Description

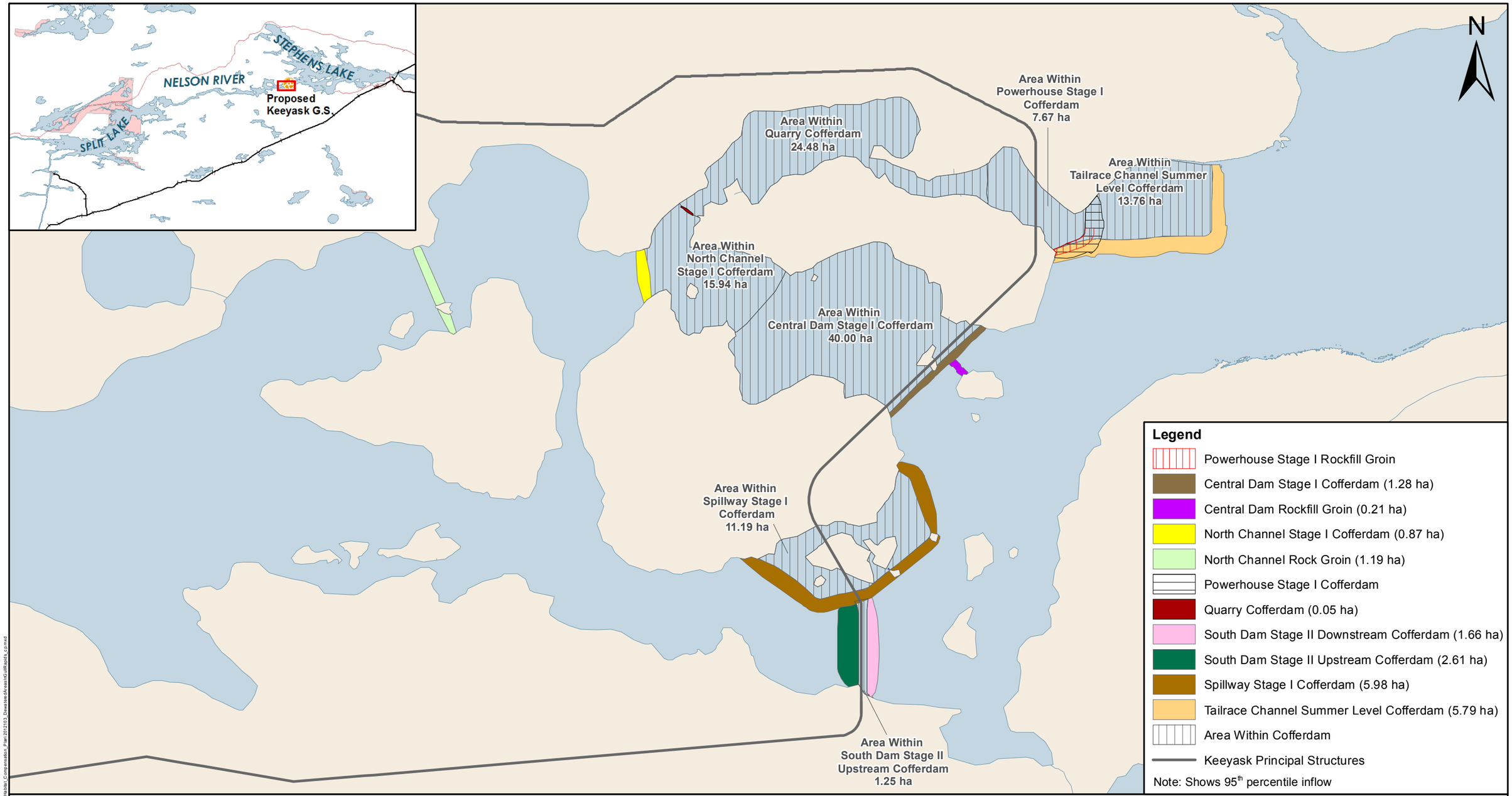
Construction of cofferdams to isolate work areas for subsequent construction of principal structures and quarry development will result in the temporary loss or disruption and permanent alteration of riverine fish habitat. Details of cofferdam construction are provided in the PD SV.

2.1.2 Potential Effects and Mitigation

Gull Rapids provides fast-water foraging habitat that is seasonally utilized (during the six months of open water each year) by several species of fish (including walleye, lake sturgeon, longnose sucker, northern pike and lake whitefish). Walleye, lake whitefish and lake sturgeon are known or suspected to spawn in portions of Gull Rapids. Several species of large-bodied fish (walleye, lake sturgeon and lake whitefish) occasionally move up- and downstream through the rapids; however, based on more than 10 years of monitoring, movements do not appear to be associated with spawning migrations.

Cofferdam construction will result in the disruption and alteration of 89.5 ha of aquatic habitat at Gull Rapids (excluding areas that will be permanently dewatered which are addressed in Section 2.10; Map 2). The affected habitat includes habitat disruption and alteration from cofferdam construction, dewatering and subsequent re-watering following the removal (or partial removal) of cofferdam structures, and river impoundment.

As indicated in the AE SV, mortality of fish due to stranding would be avoided through conduct of fish salvage operations during and after cofferdam construction.



KEEYASK
Hydropower Limited Partnership

0 0.5 1 Kilometres
0 0.25 0.5 Miles

Projection: UTM Zone 15, NAD 83
Data Source: NTS base 1:50 000
Stephens Lake Shoreline-Quickbird@Digitalglobe, 2006
Nelson River Shoreline modelled by Manitoba Hydro

Dewatered Areas In Gull Rapids
Construction Phase

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Map 2

Proposed area-specific timing windows for restricted in-water construction activities are as follows: May 15 – July 15 for spring and summer spawning fish and September 15 – May 15 for fall spawning fish (see AE SV Appendix 1A-Part 1 Section 1A.2.1 for rationale for modifications to the timing restrictions provided by DFO). As a consequence, the scheduling of construction activities that require working in water has been developed and modified to the extent practicable to avoid or minimize the potential for disturbance to fish in the Project area during spawning as well as egg and fry development periods. When avoidance of both spring and fall spawning periods was not possible due to critical construction sequences, avoidance of spring spawning periods was given priority over avoidance of the fall spawning period.

Additional mitigation of potential disturbances to fish and fish habitat will be gained by constructing each cofferdam in a sequence that minimizes the exposure of readily-transported fines to flowing water (PD SV).

2.1.3 Requirement for Habitat Compensation

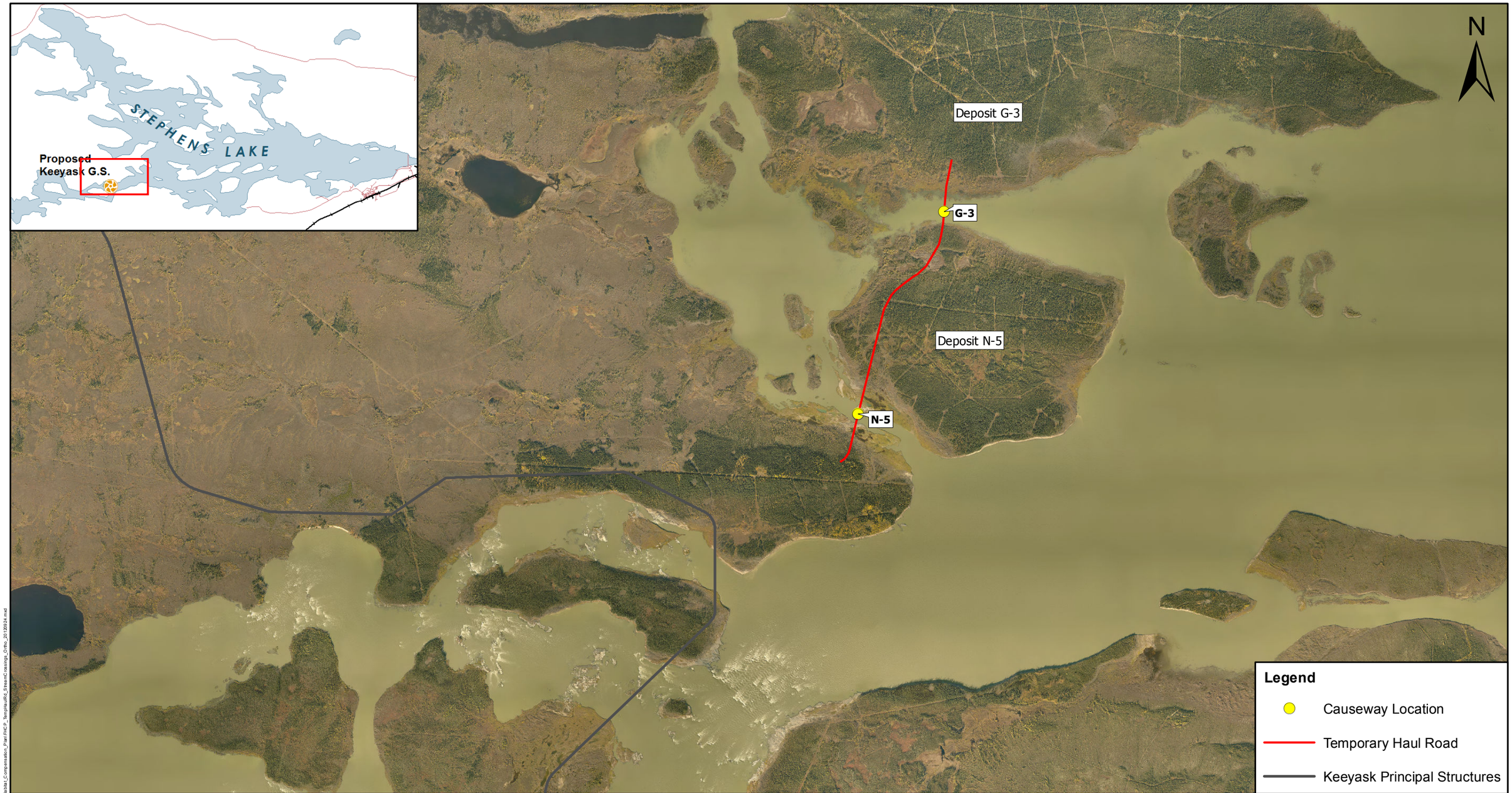
Given that areas that will be permanently lost as a result of construction are addressed in Section 2.10, no additional compensation is planned for the temporary disruption of cofferdam construction.

2.2 TEMPORARY CAUSEWAYS TO ACCESS N-5 AND G-3 BORROW AREAS

2.2.1 Description

Borrow areas N-5 and G-3 have been identified (Map 3) as two primary sources of material for the construction of the Keeyask GS. Temporary haul roads are required to access these borrows. A detailed description of the design of these causeways will be provided in the HADD application.

During the past decade (2002-2012), both the south channel adjacent to Deposit N-5 and the creek that flows from Pond 13 and enters O'Neil Bay to the north (west of Deposit G-3) have become enlarged due to back-flooding from Stephens Lake. The back-flooding was caused by winter ice dams that form on the Nelson River at the entrance to Stephens Lake downstream of Gull Rapids. This has resulted in the erosion of mineral soil banks, creating year-round connectivity between the Nelson River to the south and O'Neil Bay to the north through Pond 13.



KEEYASK
Hydropower Limited Partnership

0 0.5 1 Kilometres
0 0.25 0.5 Miles

Projection: UTM Zone 15, NAD 83
Image Source: Manitoba Hydro, 2010

Haul Road Alignment Showing Locations of Temporary Causeways

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Map 3

Two temporary rockfill causeways will be built to access the N-5 and G-3 deposits (Map 3); the southern causeway will permit access to Deposit N-5, and the northern causeway will connect deposits N-5 and G-3. They will be in place for most of the construction phase (approximately 7 years). Two 1.0 m and one 1.5 m diameter culverts will be installed in the southern causeway to allow fish movement between the embayment (Pond 13) and the Nelson River. A channel will be excavated on the west side of the northern causeway to permit fish access at all anticipated water levels to and from fish habitat west of the causeway.

Design of Causeways

The design of the proposed causeways is based on the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (MDNR 1996) and the Guidelines for Mine Haul Road Design (Tannant 2001).

The crossings lengths will be approximately 70 m for the causeway to Deposit N-5 and 200 m for the causeway to Deposit G-3. The average water depth at each causeway site is 1.2 m at Stephens Lake FSL (141.1 m ASL).

Fish Passage Design

Two 1.0 m and one 1.5 m diameter culverts will be installed in the southern causeway to Deposit N-5 to allow fish passage. The three culverts range in length between 38 m and 44 m and will be installed at different elevations to allow fish passage when the water level fluctuates. Due to the temporary nature of the crossings, the culverts will not be designed to mimic the natural river bed environment. The culverts will have either mitred or flared ends to improve flow and fish passage success.

Under 95th percentile conditions, the velocity through the culverts is estimated to range from 0.0–0.1 m/s. Plans specify that the 1.0 m diameter culverts will be installed at elevations of 140.3 m and 140.4 m ASL, and the 1.5 m diameter culvert will be installed in the lowest part of the channel at an elevation of 139.35 m ASL. The depths of water in the culverts will vary with the water level in Stephens Lake, which typically ranges from the normal minimum operating level (MOL; 5th percentile) of 139.1 m ASL to the normal FSL (95th percentile) of 141.1 m ASL. Based on the bathymetry available, it is understood that the culverts may be perched when water levels on Stephens Lake are below 139.35 m ASL, and the 1.5 m diameter culvert will be full when water level on Stephens Lake is above 140.85 m ASL. The 1.0 m diameter culverts installed at 140.3 m and 140.4 m ASL will have maximum water depths of 0.8 m and 0.7 m, respectively.

Culverts are not planned for the northern causeway to Deposit G-3 as fish are believed to only infrequently move into Pond 13 from this location during high water events. To prevent fish stranding behind (i.e., to the west of) the causeway, a channel will be excavated from just west of the causeway to connect to Pond 13. The channel will have a 2 m base width, 4H:1V side slopes, and will be excavated from an elevation of 142 m ASL to 137.5 m ASL.

Construction Methods and Scheduling

Generally, the causeways will be constructed by placing the fill material in the river "in-the-wet" up to an elevation of approximately 1 m above the prevailing water level at the time of construction. Each culvert will be installed as the causeway is advanced. Once the culvert is placed, rockfill will be placed around and over the culvert.

To the extent possible, the construction and removal of the causeways (in-water works) will occur outside of the following sensitive periods:

- May 15 to July 15 – spring and summer spawning periods; and
- September 16 to May 15 – fall spawning period.

It is expected that construction will occur during the summer months between July 28th and September 3rd.

Based on the current construction schedule, the service life of the causeways is approximately 6 years, until October 2019. Once Deposits N-5 and G-3 are no longer required, the three culverts and approximately 80% of the rockfill will be removed. The remaining 20% of the rockfill material will be used to create compensatory fish habitat (Section 4.2.1).

2.2.2 Potential Effects and Mitigation

Potential HADD of fish habitat at the temporary causeway crossings will be mitigated through adherence to the directives contained within the Keeyask GS Environmental Protection Plan (EnvPP).

The construction and removal of the temporary causeways is expected to result in the disruption (temporary loss) of approximately 1.13 ha of fish habitat (0.29 and 0.84 ha for the N-5 and G-3 causeways, respectively). These habitat disruptions cannot be avoided as access to the two deposits is essential to Project completion. The footprints of the two causeways have been designed to be as small as possible given the constraints imposed by the size of vehicles that will be using them.

Risk Assessment – South Channel Causeway to Deposit N-5

The N-5 south channel is now a perennial watercourse whose main channel is scoured bedrock, providing a movement corridor for fish between Pond 13 and the Nelson River below Gull Rapids. The floodplain near the causeway crossing location may be suitable for northern pike spawning and rearing, depending on water levels at spawning time. Fish species that have been captured in the channel include walleye, northern pike, spottail shiner, rainbow smelt, lake whitefish, white sucker, trout-perch, lake cisco, sauger and emerald shiner (NSC *in prep.*).

Pathways of potential effects related to the construction and removal of the temporary N-5 causeway include:

- Temporary loss (disruption) of habitat;

- Alteration of fish habitat;
- Introduction of suspended sediments and localized sediment deposition;
- Change in hydraulics, and
- Change in fish movements and access to habitats.

Fish habitat disruption associated with the footprint of the causeway amounts to the temporary (between six and seven years) loss of 0.29 ha of shallow-water habitat characterized by bedrock substrate and an absence of instream vegetation. Banks are stable (bedrock and coarse mineral soils) and riparian vegetation consists mostly of grasses and sedges interspersed with shrubs.

The installation of three culverts with low internal water velocities (0.0–0.1 m/s) will prevent the causeway from becoming a barrier to fish movements between Stephens Lake and Pond 13.

Overall, the scale of negative effects associated with the construction of the N-5 south channel causeway is rated as LOW (DFO 2010b). This assessment is based on a determination that:

- The extent of the affected habitat is small, amounting to the temporary loss of 0.29 ha of scoured bedrock habitat at the crossing site;
- Disturbances related to causeway construction will be short-lived (less than one month) and construction activities are scheduled to comply with the DFO operational statement for timing of work in water (DFO 2010a). Habitat disruptions caused by placement of the causeway will persist for a period of six to seven years at which time the causeway will be removed; and
- Placement of the causeway at the proposed location will have minimal impact on area hydraulics and have minor and manageable effects on sediment introductions in a localized area, suggesting a low intensity of effect.

The sensitivity of fish and fish habitat present at the proposed N-5 south channel causeway location is rated as MODERATE. This assessment is based on the understanding that:

- The species expected to be more abundant (walleye, shiners, rainbow smelt and northern pike) are considered to be moderately sensitive to the temporary disturbances expected during the late-summer construction phase (localized, short-term increase in suspended solids);
- Fish species' dependence on the directly affected habitat is low. However, there is potential for negatively affecting the movement of fish through the channel to access Pond 13 and its connection to O'Neil Bay to the north;
- The directly affected bedrock habitat is not a common and widespread feature of the Stephens Lake reservoir, however habitat features characteristic of Pond 13 are common in the area; and
- The affected bedrock habitat is resistant to the modest changes in hydraulic conditions that would be caused by causeway construction.

Based on the foregoing assessments that a LOW scale of negative effects is likely to occur in an area where fish and fish habitat have a potentially MODERATE sensitivity to the anticipated disturbances, the causeway construction and placement at this location is expected to result in a LOW to MEDIUM risk to Stephens Lake fish populations and fish habitats.

Risk Assessment – North Channel Causeway to Deposit G-3

The causeway to Deposit G-3 crosses the upper (western) end of a small, shallow bay on Stephens Lake which receives flow from an unnamed creek that drains Pond 13. The flow from Pond 13 into the bay appears to be sporadic and dependent on Stephens Lake water level. Field observations suggest that the majority of water exchange between Pond 13 and Stephens Lake occurs through the expanded south channel and the northern connection to O'Neil Bay. High water events during winter frequently inundate the floodplain of the unnamed creek.

The area where the causeway is proposed provides sheltered backwater habitat on Stephens Lake. Fish species that have been observed at the causeway location include northern pike, trout-perch, spottail shiner, emerald shiner and walleye (NSC *in prep.*).

Pathways of potential effects related to the construction and removal of the temporary G-3 causeway include:

- Temporary loss (disruption) of habitat;
- Alteration of fish habitat;
- Introduction of suspended sediments and localized sediment deposition;
- Change in hydraulics; and
- Change in fish movements and access to habitats.

The footprint of the causeway will result in the temporary (between six and seven years) disruption of 0.84 ha of shallow-water habitat. The substrate in this area is characterized by a soft, silty veneer over inundated terrestrial organics and possibly clay soils. The shoreline is gently sloping and subject to erosion. Riparian vegetation consists mostly of grasses and sedges interspersed with shrubs.

The placement of the G-3 causeway at the proposed location is not expected to alter water level and flow conditions between Pond 13 and Stephens Lake. No culvert installations are planned for this causeway. To avoid the potential for stranding fish in the confined/isolated portion of the bay to the west of the causeway, a channel will be constructed between the isolated bay and Pond 13 to permit fish movement between the bay and Pond 13 under the full range of Stephens Lake water levels. Fish movements through the channel will be monitored for the first three years following its construction.

Overall, the scale of negative effects associated with the construction of the G-3 causeway is rated as LOW (DFO 2010b). This assessment is based on a determination that:

- The extent of the affected habitat is small, and represents the temporary loss of 0.84 ha of a habitat type that is a common and widespread feature of the Stephens Lake reservoir. The excavated channel between Pond 13 and the otherwise intermittently isolated bay will create 0.5 ha of permanently wetted fish habitat and an additional 0.6 ha of intermittently exposed habitat, depending on water levels in Stephens Lake;
- Disturbances related to causeway construction will be short-lived (less than one month) and construction activities are scheduled to comply with the site-specific instream construction timing windows listed in the AE SV Appendix 1A. Habitat disruptions caused by placement of the causeway will persist for a period of six to seven years, at which time the causeway will be removed; and
- Placement of the causeway at the proposed location will have a minimal impact on area hydraulics and have minor and manageable effects on sediment introductions in a localized area, suggesting a low intensity of effect.

The sensitivity of fish and fish habitat present at the proposed G-3 causeway location is rated as LOW. This assessment is based on the understanding that:

- The species known to be present (shiners, northern pike and walleye) or that may be present (suckers and rainbow smelt) are considered to be moderately sensitive to the temporary construction disturbances expected during the late-summer construction phase (localized, short-term increase in suspended solids);
- Fish species' dependence on the affected habitat is low and no discernible population effects are anticipated;
- The affected habitat is a common and widespread feature of the Stephens Lake reservoir; and
- The affected habitat is resilient to the modest changes in hydraulic conditions that will be caused by causeway construction. The construction of a channel to avoid fish stranding and maintain fish access to and from Pond 13 (and thereby to and from Stephens Lake) will mitigate potential effects of causeway construction on fish movements and will provide fish access to a greater range of additional habitats.

Based on the foregoing assessments that a LOW scale of negative effects is likely to occur in an area where fish and fish habitat have a LOW sensitivity to the anticipated disturbances, the causeway construction and placement at this location is expected to result in a LOW risk to Stephens Lake fish populations and fish habitats.

2.2.3 Requirement for Habitat Compensation

The construction of the N-5 and G-3 causeways will result in the disruption of 0.29 and 0.84 ha of fish habitat, respectively. Habitat compensation to offset habitat alterations associated with the temporary causeways is outlined in Section 4.2.

2.3 ALTERATION OF FORAGING HABITAT UPSTREAM OF THE GS

2.3.1 Description of Habitat Alteration

As described in the AE SV, a model was developed to estimate the availability of aquatic habitat types to fish and lower trophic levels at various time steps after impoundment. Habitat types were defined based on site-specific characteristics of aquatic habitat that described each location where fish and lower trophic level samples were collected, i.e., water depth, velocity, substrate (compaction and composition) and the presence/absence of macrophytes. The model inputs included:

- Existing environment habitat conditions in the reach between the outlet of Clark Lake and Gull Rapids;
- Year 30 post-impoundment habitat area and distribution predictions based on model outputs as described in AE SV Section 3.4;
- Predictions of reservoir area expansion and peat transport rates;
- Aquatic plant bed destruction/development; and
- Mode of operation effects on habitat availability.

The main components of the model were developed in sequence as follows:

1. Perform area calculations of each habitat type in the existing environment;
2. Develop area estimates of the habitat types in the Year 30 post-impoundment upstream environment;
3. Modify the Year 30 habitat areas in the downstream, more lacustrine portion of the reservoir for intermediate time steps (Years 1, 5, and 15) to account for reservoir expansion over time, peat disintegration and transport, and loss and subsequent establishment of plant beds; and
4. Estimate useable habitat areas in the Intermittently Exposed Zone (IEZ).

A detailed description of the modeled effects on the availability of forage habitat types is provided in AE SV Appendix 5B (Section 5B.2; Steps 2, 3, 4 and 5).

2.3.2 Potential Effects and Mitigation

As described in the AE SV, a habitat evaluation model was developed to estimate potential fish use of habitats at various time steps after impoundment for comparison with habitat use in the existing environment. The before-and-after comparison was based on the change in area and proportion of aquatic habitat types and associated CPUE of each of the Valued Environmental Component (VEC)

fish species and fish communities. The main steps in model development and application, in sequence, were:

1. Estimate fish use of different habitat types in the existing environment;
2. Calculate the area of each habitat type in the Upstream Keeyask Area existing environment;
3. Estimate the area of the habitat types in Year 30 post-impoundment;
4. Year 30 habitat areas for intermediate time steps (Years 1, 5, and 15);
5. Estimate useable habitat areas in the Intermittently Exposed Zone (IEZ);
6. Modify fish use metrics at the intermediate time steps; and
7. Model potential fish use of habitats and change habitat value and area in the Upstream Keeyask Area at each time step.

A detailed description of the habitat evaluation model and estimates of potential fish use at the various time steps is provided in the AE SV. Results indicate that habitat alterations and new aquatic habitat resulting from the creation of the forebay and reservoir will benefit both large- and small-bodied fish community species over the range of possible modes of operation even in the absence of mitigation measures which are proposed to address specific potentially harmful effects (AE SV Appendix 1A-Part 1).

2.3.3 Requirement for Compensation

There is no requirement to develop or implement habitat compensation plans as a net gain of productive capacity in fish community foraging habitat upstream of the GS is expected.

2.4 ALTERATION OF FISH COMMUNITY SPAWNING HABITAT UPSTREAM OF THE GS

2.4.1 Description of Spawning Habitat

Habitat that is suitable for northern pike, walleye and lake whitefish spawning currently exists within the reach of the Nelson River between Birthday and Gull rapids (AE SV Section 5.3.2.3). Northern pike typically spawn in calm, shallow-water areas where vegetation is present. Walleye typically spawn over gravel, boulder or rubble substrate in water that is less than 2 m deep, while lake whitefish generally spawn over substrates ranging from large boulders to gravel and sand in water that is less than 5 m deep.

2.4.2 Potential Effects and Mitigation

Impoundment of the Keeyask reservoir will result in alterations to northern pike, walleye and lake whitefish habitat due to increased water depth over existing spawning sites. No feasible opportunities to mitigate the effects on existing spawning habitats were identified and efforts were therefore focused on replacing lost habitat.

2.4.3 Requirement for Habitat Compensation

Impoundment will approximately double the area within the newly created reservoir where depth criteria (depth less than1.0 m) for potential northern pike spawning habitat are met (increase from 447 ha to 971 ha). It is expected that there will be a more than sufficient amount of shallow-water spawning habitat consisting of flooded terrestrial vegetation (small trees, bushes and peat [AE SV Section 3.4.2.2]) available for northern pike. As reservoir aquatic habitats develop, the abundance of aquatic macrophytes will increase. No requirement for habitat compensation measures is anticipated to offset alterations to northern pike spawning and rearing habitat.

Rocky shoal development will be undertaken to increase the certainty that spawning habitats are available for walleye and lake whitefish early in the development of the reservoir environment (Section 4.3).

2.5 LOSS OF ACCESS TO TRIBUTARY STREAMS

Debris created by flooding of the reservoir may accumulate at the mouths of flooded tributaries and obstruct fish movement into these tributaries. Debris management measures will mitigate this potential loss of habitat.

2.5.1 Description

The mouths of Nap, Portage, Rabbit, Trickle and Two Goose creeks, and several unnamed small tributaries to the Nelson River, will be inundated to a greater or lesser extent when the Keeyask reservoir is created (Map 4). Woody debris generated by flooding has the potential to accumulate in the mouths of these creeks, thus creating barriers to fish movements to and from creek habitats.

2.5.2 Potential Effects and Mitigation

The potential post-impoundment loss of fish access to tributary streams due to debris accumulation will be mitigated through forebay clearing and the monitoring and removal of debris during the construction and operation phases as described in the Forebay Clearing Plan (Schedule 11-1 in the Joint Keeyask Development Agreement [JKDA] Project Description) and the waterways management plan.