Manitoba Hydro

360 Portage Ave (17) • Winnipeg Manitoba Canada • R3C 0G8
Telephone / *N° de téléphone :* 204-360-4773 • Fax / *N° de télécopieur :* 204-360-6138
dbowen@hydro.mb.ca

2018 10 09

Siobhan Burland Ross
A/Director - Environmental Approvals Branch
Manitoba Sustainable Development
1007 Century Street
Winnipeg, MB R3H 0W4

Dear Ms. Burland Ross:

RE: KEEYASK GENERATION PROJECT – NOTICE OF ALTERATION, SHORT TERM RELEASE OF SEEPAGE WATER WITH ELEVATED TSS AT THE SOUTH DAM COFFERDAM ENVIRONMENT ACT LICENCE NO. 3107, CLIENT FILE 5550.00

Manitoba Hydro, in its delegated authority to manage construction of the Keeyask Generation Project on behalf of the Keeyask Hydropower Limited Partnership, is submitting a notice of alteration to Environment Act Licence (EAL) No. 3107 to temporarily release seepage water from the South Dam Cofferdam (SDCD) directly to the Nelson River, when the end-of-pipe Total Suspended Solids (TSS) concentration is greater than 50 mg/L. The duration of this request is until repairs to the upstream South Dam Cofferdam have been completed, which are anticipated to be completed by the middle of November 2018.

Dewatering of the South Dam Cofferdams started on September 16, 2018. After the fish rescue was completed on September 26, it became apparent that the foundation of the upstream SDCD was experiencing seepage at a rate higher than designed. This appears to be attributed to unforeseen geological conditions and/or alluvial deposits along the river bed.

The seepage is currently being managed with diesel pumps but will be difficult to maintain in the winter months and during construction of the South Dam. Steps are being taken to reduce the flows. A repair option was developed and should be executed before continuous freezing conditions occur. Based on past experience, it is likely that the end of pipe TSS concentration will increase above 50 mg/L during execution of cofferdam seepage repairs with short term spikes up to 1000 mg/L. To reduce the risk of schedule delays, a notice of alteration to EAL No. 3107 is being submitted to temporarily release impounded water from within the South Dam Cofferdams directly to the Nelson River in the Spillway Channel, even if TSS is greater than 50 mg/L.

Please refer to the attached description for details. If additional information is required, please contact Jodine MacDuff at 204-360-5539.

Yours truly,

Dave Bowen, P. Eng, M.Sc
Director, Keeyask Project
Generation & Wholesale

Att.

Notice of Alteration Form

Manitoba
Sustainable Development

Client File No. : 5500.00	Environment Act Licence No. : 3107

Legal name of the Licencee: Keeyask Hydropower Limited Partnership

Name of the development: Keeyask Generation Project

Category and Type of development per Classes of Development Regulation:

Energy Production and Waste Conversion — Electrical generating facilities >100 MW

Licencee Contact Person: Dave Bowen
Mailing address of the Licencee: 360 Portage Avenue, 17th Floor
City: Winnipeg Province: Manitoba Postal Code: R3C 0G8
Phone Number: (204) 360-4773 Fax: Email: dbowen@hydro.mb.ca

Name of proponent contact person for purposes of the environmental assessment (e.g. consultant):
Jodine MacDuff

Phone: (204) 360-5539	Mailing address: 360 Portage Avenue, 17th Floor
Fax:	Winnipeg, MB R3C 0G8

Email address: jmacduff@hydro.mb.ca

Short Description of Alteration *(max 90 characters):*

Short release of seepage water from the South Dam Cofferdam with elevated TSS.

Alteration fee attached: Yes: ☐ No: ☑

If No, please explain: As per previous discussions with Darrell Ouimet.

Date: 10/09/2018	Signature: 
	Printed name: Dave Bowen

A complete Notice of Alteration **(NoA)** consists of the following components:

- ☑ **Cover letter**
- ☑ **Notice of Alteration Form**
- ☐ **4 hard copies and 1 electronic copy of the NOA detailed report** (see "Information Bulletin - Alteration to Developments with Environment Act Licences")
- ☐ **$500 Application fee, if applicable** (Cheque, payable to the Minister of Finance)

Submit the complete NOA to:

Director
Environmental Approvals Branch
Manitoba Sustainable Development
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:

Phone: (204) 945-8321
Fax: (204) 945-5229
http://www.gov.mb.ca/conservation/eal

Keeyask Generation Project
Notice of Alteration - Environment Act Licence No. 3107
Short Term Release of Seepage Water with Elevated Total Suspended Solids at the South Dam Cofferdam

Manitoba Hydro, in its delegated authority to manage construction of the Keeyask Generation Project on behalf of the Keeyask Hydropower Limited Partnership, is requesting an alteration to Environment Act Licence (EAL) No. 3107 to temporarily release seepage water from the South Dam Cofferdam (SDCD) directly to the Nelson River, when the end-of-pipe Total Suspended Solids (TSS) concentration is greater than 50 mg/L. The duration of this request is until repairs to the upstream South Dam Cofferdam have been completed, which are anticipated to be completed by the middle of November 2018.

Background

The Keeyask Generation Project Environmental Protection Plan (EnvPP), section 7.21.2 #5, states:

> *Impounded water will be tested for total suspended solids (TSS) before release. If TSS concentration is < 25 mg/L, the water can be released directly to the Nelson River. If the water does not meet these criteria, it will be treated prior to release.*

In July 2017, approval was received to add the following clause to the EnvPP:

> *At designated discharge locations, as shown in Figures 1 and 2, impounded water with total suspended solids (TSS) concentration up to 50 mg/L can be discharged directly to the Nelson River. When TSS concentrations exceed 25 mg/L, water discharge volumes along with corresponding TSS concentrations will be recorded and included in the annual Environmental Protection Plan report.*

The Keeyask Generation Project South Dam will be located in the south channel of the Nelson River, Figure 1 and construction will occur in the summer of 2019. To prepare for this, excavation; surface/foundation preparations and installation of the grout curtain will occur in the fall/winter of 2018/2019 and must be conducted in the dry; therefore, the South Dam cofferdam needs to have a well-managed seepage plan.

Dewatering of the South Dam Cofferdams started on September 16. After the fish rescue was completed on September 26, it became apparent that the foundation of the upstream SDCD was experiencing seepage at a rate higher than designed at approximately 500 L/s (0.5 cms or 8,000 USgpm). This appears to be attributed to unforeseen geological conditions and/or alluvial deposits along the river bed. Although a cleaning operation was completed on the toe of the upstream SDCD to remove alluvial deposits on the river bed, it appears there is a bedrock low which was beyond the reach of the

equipment used for cleaning.

The seepage is currently being managed with diesel pumps but will be difficult to maintain in the winter months and during construction of the South Dam, therefore steps are being taken to reduce the flows. As well, removal of unclassified material within the footprint of the upstream and downstream SDCDs would increase the seepage rate to levels that could become unmanageable. A repair option has been developed for the northwest corner of the upstream SDCD and should be executed before continuous freezing conditions occur. During the first week of October 2018, the day temperatures at the Keeyask site have been below 5^{o}C and overnight temperatures have been between -5 to 0^{o}C.

Based on past experience, it is likely that the end of pipe TSS concentration will increase above 50 mg/L during execution of cofferdam seepage repairs with short term spikes up to 1000 mg/L. At the current seepage rates it is not feasible or practical to pump or transport the water by truck to the settling pond. Diverting this water to settling ponds for treatment would require running heated lines across the currently flowing spillway for a distance of 3.0 km to an existing settling pond north of the tailrace channel or running a heated line for a distance of at least 3.7 km south to the borrow site S2a. Therefore to meet the TSS concentration limits as stated in the EnvPP, pumping of the seepage water would need to be suspended until sediments settle. This could result in flooding of the South Dam footprint which would delay the South Dam foundation excavation and curtain grouting activities. There is also a risk that if pumping of seepage water is stopped due to high TSS levels that the downstream SDCD would be overtopped. The crest of the downstream SDCD is at elevation 145.6 m, the crest of the upstream SDCD is 152.2 m and current upstream water level is approximately 148 m. With the upstream water level approximately 2.4 m above the crest of the downstream SDCD the risk of uncontrolled overtopping of the cofferdam exists and needs to be avoided. A delay due to flooding in the South Dam channel would jeopardize activities scheduled for both the winter of 2018/2019 and summer of 2019.

To reduce the risk of schedule delays, an alteration to EAL No. 3107 is requested to temporarily release impounded water from within the South Dam Cofferdams directly to the Nelson River in the Spillway Channel, even if TSS is greater than 50 mg/L.

Description of Construction of South Dam Cofferdam Repair

Construction activities to decrease the seepage of the upstream SDCD includes constructing a rock groin upstream of the current upstream SDCD, widening the existing key-in to the Spillway Cofferdam and placing additional impervious material between the existing upstream SDCD and the proposed rock groin, Figures 2a and 2b. All this work will be within the footprint identified in the Notice of Alteration to Environment Act Licence which was approved on August 9, 2018.

Potential Environmental Effects

Repairs to the upstream SDCD will involve the placement of impervious material (clayey silt – Class A)

which will be sourced from one of the current borrow sources, most likely from S2a located 3.5 km south of this site, Figure 3. Currently, cofferdam seepage water is “clean” and the TSS concentration is similar to the levels in the Nelson River. During the repair, it is anticipated that the material that is being placed will be suspended in the seepage water. Based on past experience, it is likely that the end of pipe TSS concentration will increase above 50 mg/L during execution of cofferdam seepage repairs with short term spikes up to 1000 mg/L. It is proposed to discharge this water directly to the Nelson River in the Spillway channel.

To determine potential effects of discharging water with elevated TSS, sediment plume modeling was conducted with a TSS concentration of 2,000 mg/L at a rate of 600 L/s (9,500 USgpm), which produces a sediment loading rate of 1.2 kg/s. Previous analyses investigated the same loading rate at the spillway for a flow of 3,500 cms in the Nelson River. The modeled sediment plume (Figure 4) showed in stream TSS increases of >5 mg/L were confined to a highly localized area at the point of discharge while the plume of TSS increase from 1-5 mg/L did not extend beyond the end of the discharge channel. Although the current river flow of about 2,700 cms is lower than the 3,500 cms used in the model, it can be expected that TSS increases >5 mg/L would similarly remain confined to a highly localized area near the point of discharge due to rapid mixing in the turbulent flow of the discharge channel. The area with TSS increases of 1-5 mg/L would likely affect a similarly narrow part of the flow but extending somewhat further downstream within the area of high flow velocities and turbulent conditions. River flows were projected to increase to about 3,300 cms (50th percentile estimate) by mid-November, bringing flow conditions closer to those represented in Figure 4.

Based on the models, the increase in TSS concentration will not be greater than 5 mg/L above background downstream of the Spillway Discharge Channel. Releasing seepage water with elevated TSS in the Spillway channel is expected to have negligible effects to fish.

Monitoring and Reporting

Monitoring TSS will continue to be performed by Manitoba Hydro Environmental Inspectors and the Contractor’s environmental and water management team. A summary of the volume of water pumped and the TSS concentrations will be submitted to the Environment Officer, Environmental Approvals Branch once the repairs are complete.

The sampling location is at the pump station, these are sampled at least twice per day. Real-time monitoring of TSS cannot occur, therefore the relationship between turbidity and TSS that is provided in the *Sediment Management Plan for In-stream Construction* will be utilized which is:

TSS (mg/L) = 0.79 Tu (NTU) – 2.86

It should be noted that the SMP stations have been removed for the shoulder season, therefore monitoring SMP downstream at SMP 2 and 3 will not be possible.

Summary of Potential Effects

Model results for a moderate river flow showed that the sediment load from dewatering has a negligible, highly localized effect on in-stream TSS even if the end-of-pipe limit is increased to 2000 mg/L. The source of the sediment load will be from raw impervious material that is sourced within the project site. The effects on downstream sedimentation would not be measurable.

KEEYASK

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada;
Image Source: ESA Sentinel 2 Satellite; August 19th, 2018

CREATED BY:
Manitoba Hydro - GIS Studies

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	05-OCT-18	
0 0.15 0.3 Kilometres / 0 0.15 0.3 Miles	VERSION NO: 1.0	QA/QC:

Legend

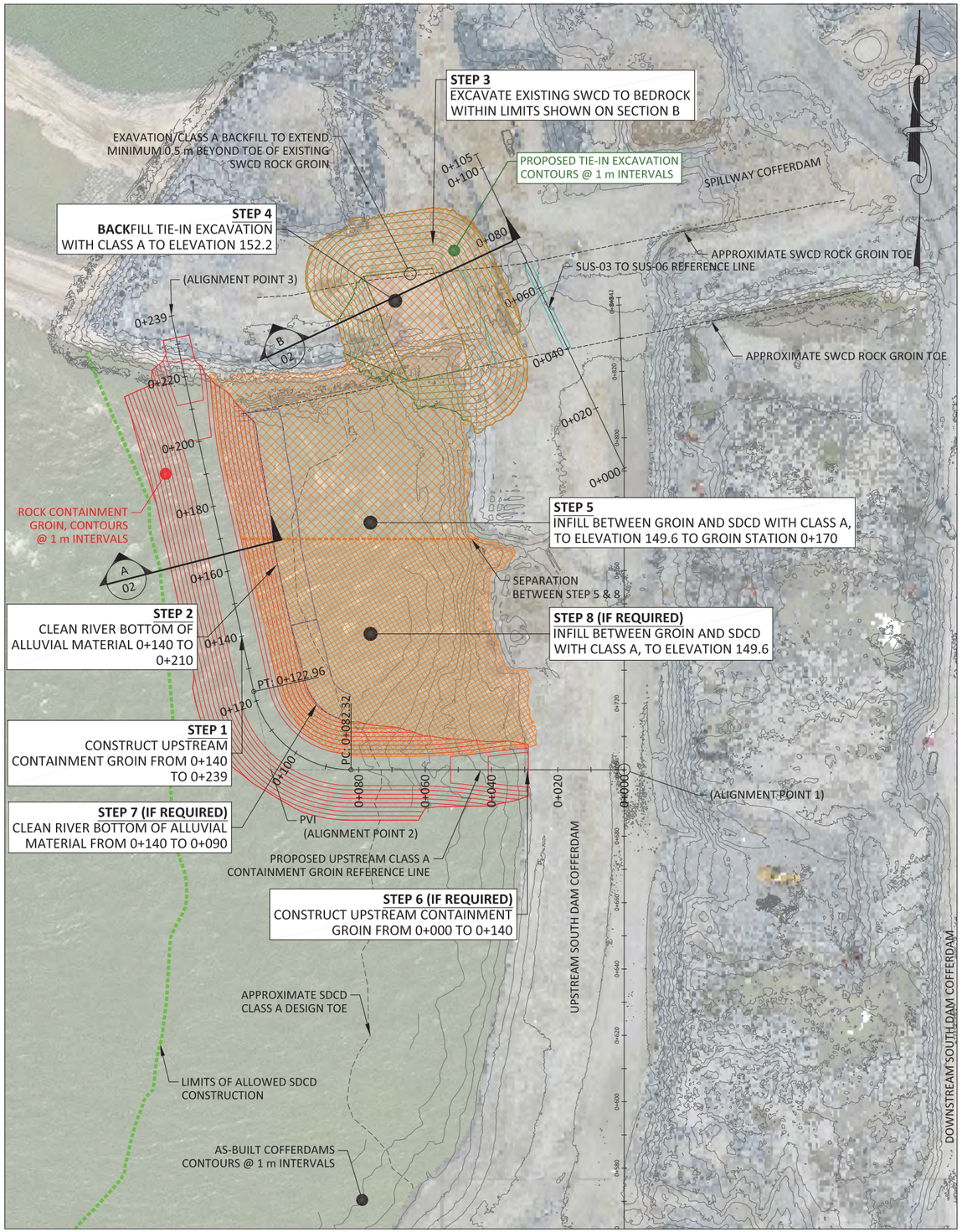
Active Construction Areas

- Cofferdam
- Haul & Site Road

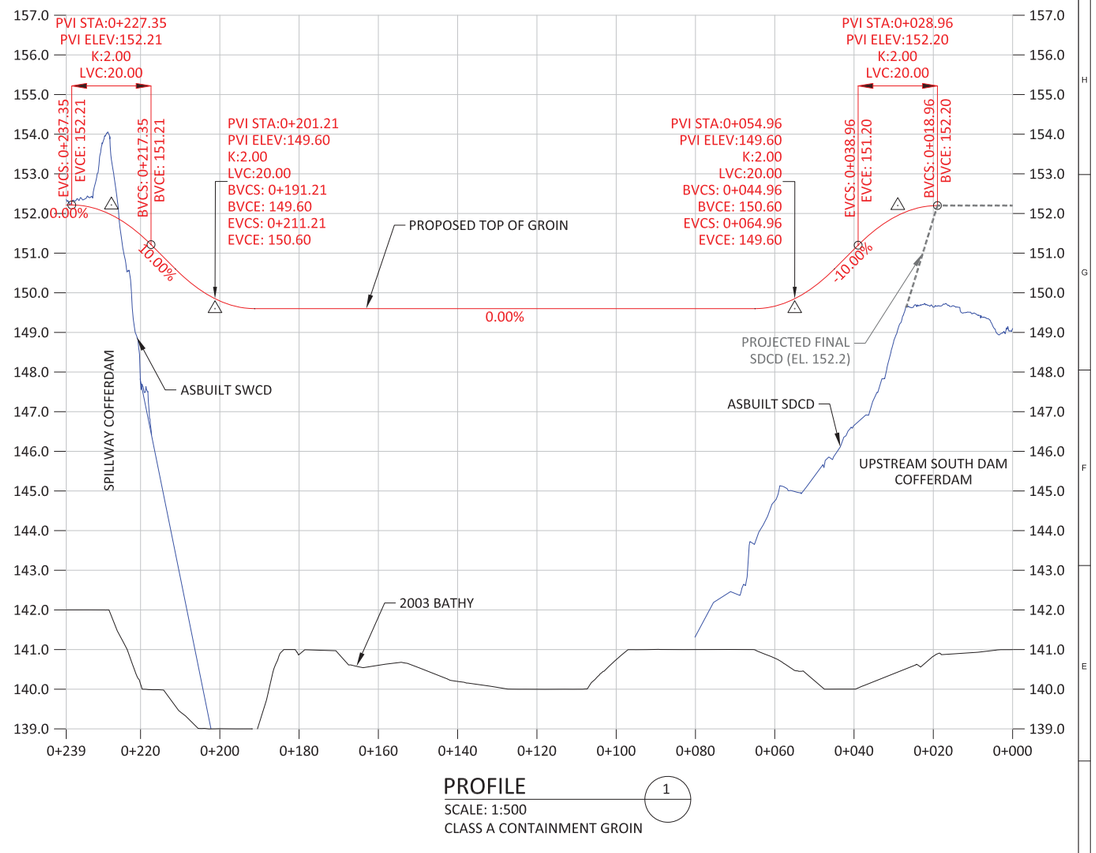
Keeyask Construction Area

Figure 1

Satellite Imagery - August 19th, 2018



PLAN
SCALE: 1:500



PROFILE
SCALE: 1:500
CLASS A CONTAINMENT GROIN

STAGING VOLUMES

STEP #	DESCRIPTION	EXCAVATION cu.m	ROCKFILL cu.m	CLASS A cu.m
STEP 1	*CONTRUCT PARTIAL ROCK GROIN*	-	15641	-
STEP 2	CLEAN DS RIVER BOTTOM FROM PARTIAL CONTAINMENT GROIN	-	-	-
STEP 3	*EXCAVATE SWCD FOR TIE-IN*	14465	-	-
STEP 4	*FILL TIE-IN EXCAVATION WITH CLASS A*	-	-	14465
STEP 5	*PARTIAL INFILL BETWEEN CONTAINMENT GROIN AND SDCD*	-	-	23432
STEP 6	*CONSTRUCT REMAINING CONTAINMENT GROIN*	-	15276	-
STEP 7	*CLEAN DS RIVER BOTTOM FROM PARTIAL ROCK GROIN*	-	-	-
STEP 8	*INFILL REMAINING AREA BETWEEN CONTAINMENT GROIN AND SDCD*	-	-	27514
	TOTALS	14465	30917	65411

CONTAINTMENT GROIN ALIGNMENT COORDINATES

1 - START (0+000): 48134.51, 19258.64
2 - PVI (RADIUS 30m): 48134.51, 19152.19
3 - END (0+239): 48271.18, 19122.20

SWCD EXCAVATION TOE COORDINATES

NW TOE: 48283.11, 19180.13
NE TOE: 48285.51, 19200.81
SE TOE: 48255.28, 19211.98
SW TOE: 48251.67, 19193.73

NOTES

1. THE TIE-IN EXCAVATION SHALL BE BACKFILLED WITH MATERIALS APPROVED BY THE ENGINEER TO ENSURE CONTINUITY OF THE IMPERVIOUS MATERIALS BETWEEN THE SOUTH DAM COFFERDAMS, SPILLWAY COFFERDAM AND THE UPSTREAM SADDLE DAM.

2. EXCAVATION INTO THE EXISTING SDCD CLASS A SHALL BE AT MINIMUM ANGLE TO PREVENT SLUMPING

3. ADDITIONAL CLASS A SHALL BE PLACED ON THE SDCD TO PROVIDE A CONSISTENT SEAL TO EL. 152.20

DRAWING NOTES:

1. DIMENSIONS AND ELEVATIONS ARE IN METERS

2. ELEVATION ARE BASED ON CGVD28, 1929 ADJUSTMENT

3. TOPOGRAPHIC INFORMATION BASED ON MANITOBA HYDRO & BBE ASBUILT SURVEY DATA FROM 2018

4. BACKGROUND AERIAL DATED STITCHED TOGETHER FROM JUNE 2018 AERIAL AND SEPTEMBER 27 DRONE DATA

REV.	DATE	DESCRIPTION	BY	CKD.	APP.

Manitoba Hydro

DRAWN: B.POSTLETHWAITE | CHECKED: T.JANSEEUW | SCALE: AS NOTED
DESIGNED: MH / HATCH | DATE: 2018-10-05

KEEYASK GENERATION PROJECT

AUTHENTICATION FOR CURRENT REVISION

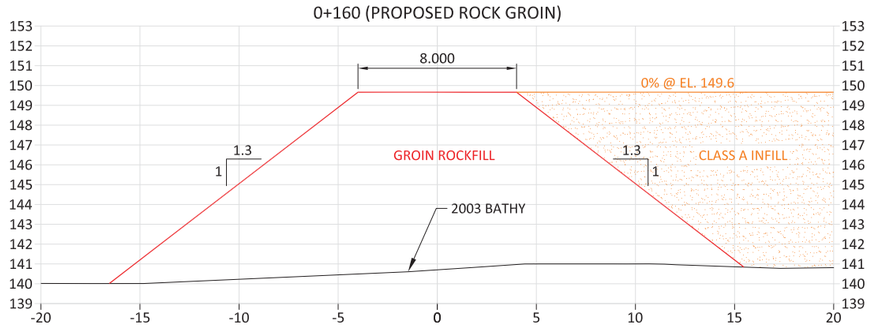
SOUTH DAM COFFERDAM UPSTREAM ALTERNATE TIE-IN & CONTAINMENT GROIN PLAN AND VOLUMES

DRAWING NUMBER: KS-432 | SHEET: 01 | REVISION: 00

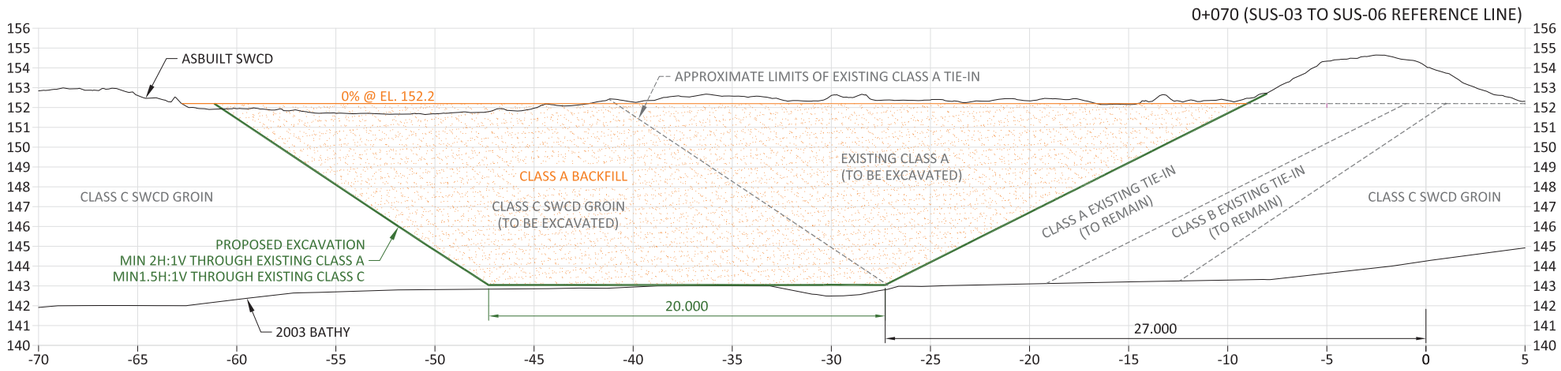
Figure 2a

ISO A1 (1189 x 841)

C:\Users\bpostleth\Desktop\Tasks\181002 - SDCD Leak Groin (KS-430)\KS-432 SOUTH DAM UPSTREAM COFFERDAM LEAK TIE-IN & GROIN-181005.dwg 10/5/2018 11:35 AM



SECTION A
SCALE: 1:100
PROPOSED ROCK GROIN



SECTION B
SCALE: 1:100
PROPOSED SWCD TIE-IN

DRAWING NOTES:

1. DIMENSIONS AND ELEVATIONS ARE IN METERS

2. ELEVATION ARE BASED ON CGVD28, 1929 ADJUSTMENT

3. TOPOGRAPHIC INFORMATION BASED ON MANITOBA HYDRO & BBE ASBUILT SURVEY DATA FROM 2018

REV.	DATE	DESCRIPTION	BY	CKD.	APP.

Manitoba Hydro

DRAWN: B.POSTLETHWAITE | CHECKED: T.ANSEEUW | SCALE: AS NOTED
DESIGNED: MH / HATCH | DATE: 2018-10-05

KEEYASK GENERATION PROJECT

AUTHENTICATION FOR CURRENT REVISION

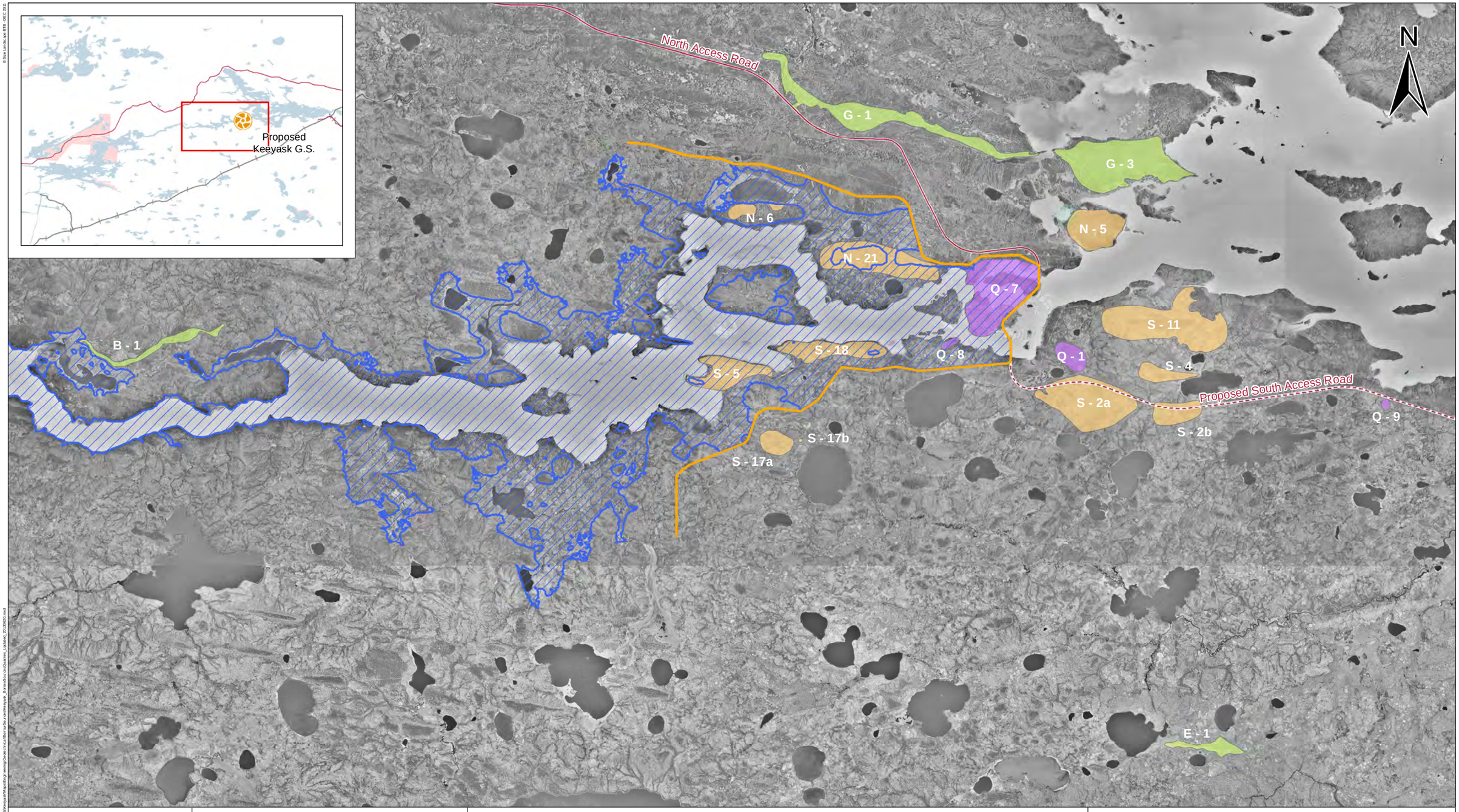
SOUTH DAM COFFERDAM UPSTREAM ALTERNATE TIE-IN & CONTAINMENT GROIN SECTIONS

Figure 2b

DRAWING NUMBER: KS-432 | SHEET: 02 | REVISION: 00

ISO A0 (1189 x 841)

C:\Users\bpostlethh\Desktop\Tasks\181002 - SDCD Leak Groin (KS-430)\KS-432 SOUTH DAM UPSTREAM COFFERDAM LEAK TIE4N & GROIN-181005.dwg 10/5/2018 11:37 AM



DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada; KGS Acres; Manitoba Hydro 1999 1m Black & White DOI

CREATED BY:
Manitoba Hydro - Hydro Power Planning - GIS & Special Studies

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	09-FEB-12	20-JUN-13
0 1 2 Kilometres 0 0.85 1.7 Miles	VERSION NO: 3.0	QA/QC: JCL/MES/ZZZ

Legend

Material Sources
- Granular Borrow
- Impervious Borrow
- Rock Quarry

- Access Road
- Proposed Access Road
- Keeyask Principal Structures
- Initial Flooded Area (159 m)

Revised Keeyask Borrow Sources and Quarries

Figure 3

The size of the plume shown is effectively at an equilibrium state that is reached about 3 hours after pumping and the downstream extents of effects remain largely the same if pumping continues for more than 3 hours.

SMP-2L

SMP-2R

TRCD1

PHCD1

CDCD1

SDCD1

SMP-1

6246435
6246335
6246235
6246135
6246035
6245935
6245835
6245735
6245635
6245535
6245435
6245335
6245235
6245135
6245035

362800 363000 363200 363400 363600 363800 364000 364200 364400

KEEYASK

DATA SOURCE:
Manitoba Hydro

CREATED BY:
Water Resources Engineering - Hydraulic Engineering

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	05-OCT-18	05-OCT-18
0 0.55 1.1 Kilometres 0 0.45 0.9 Miles	VERSION NO: 1.0	QA/QC: XXX/YYY/ZZZ

Legend

TSS Increase (mg/l)

- >200
- 100 - 200
- 25 - 100
- 5 - 25
- 1 - 5

Nelson River Flow = 3500cms
Stephens Lake Water Level = 141m
South Dam Coffer Dam pumping:
600 l/s @ TSS = 2000 mg/l
Routine seepage pumping at other locations:
TSS = 50mg/l

Keeyask GS

Analysis of Pumping Discharge with High TSS from the South Dam Cofferdam

Figure 4