



Keeyask Generation Project Terrestrial Effects Monitoring Plan

Habitat Loss and Disturbance Monitoring Report

TEMP-2017-01



KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2017- 01

HABITAT LOSS AND DISTURBANCE

MONITORING REPORT

A Report Prepared for

Manitoba Hydro

By

ECOSTEM Ltd.

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SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014. Before the government issued a licence to construct the Project, the Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the generating station on the terrestrial environment. Monitoring results will help the KHLP, government regulators, members of local First Nation communities, and the general public understand how construction and operation of the generating station are affecting the environment, and whether or not more needs to be done to reduce harmful effects.

This report describes the results of terrestrial habitat loss and disturbance monitoring conducted during the third summer of Project construction.

Why is the study being done?

Habitat is the place where a plant, animal or its population lives. Terrestrial habitat includes all land habitat for all species. The habitat for a given species is named for the species that may use it (e.g., moose habitat, rusty blackbird nesting habitat or jack pine habitat).

Changes to terrestrial habitat can affect many species and types of ecosystems. Plants and animals need habitat to survive and raise their young. The partner First Nations have said that all terrestrial habitats are important. Because changes to terrestrial habitat can have such wide-ranging effects across the terrestrial environment, monitoring terrestrial habitat provides the single best way to recognize important changes, and to find any unexpected effects on that environment.

What was done?

Project clearing and physical disturbance were mapped from satellite imagery that was captured on June 22 and September 21, 2016, and from helicopter surveys that took place on August 20 and 21, and September 7, 2016.

What was found?

Monitoring in 2016 showed that approximately 3,561 ha of terrestrial habitat have been cleared or physically disturbed for the Project as of September 2016. Most (86%) of the additional clearing between September 2015 and 2016 was in the future reservoir area.

About 93% of the area cleared or disturbed as of September 2016 was in the portion of the Project footprint that includes the permanent infrastructure and future reservoir. In the rest of the licensed footprint, about 96% of the area was still undisturbed, and most of this area was expected to remain undisturbed by the Project. While there was 4.60 ha of inadvertent clearing

outside the areas approved for Project use, this area was very small compared with the 4,930 ha of licensed Project area that has not yet been impacted.

What does it mean?

To date, the Project has not created any major unanticipated removal or alteration of terrestrial habitat. The inadvertent clearing outside the areas approved for Project use was not a concern from the terrestrial habitat and ecosystems perspectives. The Priority Habitats, Wetland Function and Priority Plant studies did not identify any major concerns with the specific sites affected. Additionally, the amount of additional clearing was only 0.05% of the portion of the licensed Project footprint that has not yet been disturbed, and it is expected that the Project will not impact most of this undisturbed area.

What will be done next?

Monitoring to document the amount and locations of terrestrial habitat affected by the Project will continue in 2017.

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STUDY TEAM

Dr. James Ehnes was the project manager and study designer.

Fieldwork in 2016 was conducted by Alex Snitowski and Ryan Sheffield.

Data analysis and report writing in 2016 were completed by Brock Epp and James Ehnes. GIS analysis and cartography was completed by Alex Snitowski and Brock Epp.

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1.0 INTRODUCTION

Construction of the Keeyask Generation Project (the Project), a 695 megawatt hydroelectric generating station (GS) and associated facilities, began in July 2014. The Project is located at Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake, 35 km upstream of the existing Kettle GS.

The *Keeyask Generation Project Response to EIS Guidelines* (the EIS), completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the terrestrial environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement Terrestrial Supporting Volume* (TE SV). The *Terrestrial Effects Monitoring Plan* (TEMP) was developed as part of the licensing process for the Project. Monitoring activities for various components of the terrestrial environment were described, including the focus of this report, habitat loss and disturbance, during the construction and operation phases.

Habitat is the place where an organism or a population lives. Because all natural areas are habitat for something, “terrestrial habitat” refers to all land habitat for all species. Habitat for a particular species is identified with the species name of interest, such as moose habitat, rusty blackbird nesting habitat or jack pine habitat. Terrestrial habitat is a keystone driver for ecosystems and, for many reasons, provides the best single indicator for Project effects on terrestrial ecosystems.

As described in the Project's TEMP, two studies are monitoring terrestrial habitat effects. During construction, the Terrestrial Habitat Loss and Disturbance study is focusing on Project-related effects on stand level habitat composition due to terrestrial habitat loss and disturbance. During operation, the Long-Term Effects on Habitat study will monitor indirect Project effects on terrestrial habitat. This latter study will also monitor recovery to native habitat in Project-affected areas and in areas where trails intersect the Project Footprint.

The goal of the Habitat Loss and Disturbance study, which is the focus of this report, is to determine direct Project effects on terrestrial habitat composition during construction. The associated objectives are to:

- Quantify and situate terrestrial habitat loss and physical disturbance; and,
- Quantify and situate Project effects on terrestrial habitat composition during construction.

A previous monitoring study and report (ECOSTEM 2015) documented clearing and disturbance from the Keeyask Infrastructure Project (KIP), which ended in June 2014. Monitoring for this study was conducted in 2015 and 2016. ECOSTEM (2016) provides results for the habitat loss and disturbance monitoring conducted in 2015. The following presents the monitoring conducted during 2016.

2.0 METHODS

2.1 INTRODUCTION

Section 2.1.2 of the TEMP details methods for this study. The following summarizes the methods employed in 2016. The methods were the same as in 2015 except that clearing or physical disturbance boundaries within the Project footprint were mapped more precisely.

In the terrestrial habitat, ecosystems and plant studies, clearing refers to complete vegetation removal in a patch that was at least 400 m² in size. Disturbance refers to either physical disturbance in intact vegetation (e.g., machinery trail, test pits), use of a pre-existing trail or a clearing smaller than 400 m².

A cleared area often also included topsoil or overburden excavation (e.g., in a borrow area). In the reported results and maps, total clearing also includes excavated material piles as the vegetation clearing was no longer visible.

2.2 DATA COLLECTION

In 2016, all areas cleared or disturbed for the Project were surveyed while flying in a Bell 206 helicopter around the perimeter of the cleared or disturbed areas. Project-related clearing, physical disturbance and other relevant conditions were documented with geo-referenced aerial photographs, marked-up maps and notes.

In the office, digital orthorectified imagery (DOI) obtained by Manitoba Hydro was also used to identify the spatial extents of Project clearing or physical disturbance.

2.3 MAPPING

The TEMP indicates that precise mapping of Project clearing or disturbance will occur at the end of the construction phase (Section 2.1.2). On this basis, the previous annual report mapped the approximate maximum extent of clearing and disturbance boundaries from the GPS tracklog gathered while flying the perimeter of the cleared or disturbed areas. However, boundaries for cleared or disturbed areas that were potentially outside of the licensed Project footprint were precisely digitized using high resolution DOIs and geo-referenced aerial photographs.

Precise mapping of Project clearing or disturbance was completed for this report (rather than at the end of construction), and going forward, for two reasons. The planned mapping approach complicated the analysis of clearing and disturbance, as well as that completed for the Priority Habitats study (ECOSTEM 2016, Section 3). While these complications did not alter the

planned nature of the analyses, it made them more time consuming than anticipated. Additionally, the majority of Project clearing outside of the future reservoir area had been completed when the 2016 field data and remote sensing were acquired.

Clearing or disturbance boundaries as of September 2016 were precisely digitized from high resolution DOIs and the aerial survey data. A DOI created from September 21, 2016 Worldview 2 imagery was the primary data source for clearing or disturbance boundaries. However, this DOI did not provide coverage for the western two-thirds of the North Access Road (NAR) or for the western portion of the future reservoir area. A DOI created from June 22, 2016 Worldview 2 imagery as well as the September 2016 aerial survey photos were used for the areas lacking September DOI coverage.

Places with unclear information or gaps in the above noted data sources were interpreted using DOIs from prior years as well as the georeferenced aerial survey photos and other field data gathered to date. Worldview 2 images for the prior year DOIs were acquired on: July 17, 2014; September 24, 2014; June 21, 2015; and, August 28 to September 11, 2015. All clearing or disturbance was digitized at a scale of 1 inch = 30 metres.

To provide comparisons of changes from 2015 to 2016 based on consistent mapping methods, clearing or disturbance as of September 2015 were also mapped using the 2016 approach. The high resolution DOI created from the August/September, 2015 Worldview 2 imagery was the primary data source for digitizing clearing or disturbance boundaries to September 2015. Places with unclear information or gaps in the preceding data sources were interpreted using prior year DOIs as well as the georeferenced aerial survey photos and other field data gathered to date.

In a GIS, the 2016 clearing/disturbance boundaries dataset was subdivided to identify the September 2015 clearing or disturbance limits. In some locations, the 2015 clearing limits appeared to fall slightly outside of the 2016 limits, which was not physically possible. These situations arose from slight differences in the orthorectification of the various DOIs. On this basis, the 2016 clearing boundaries were used.

The more precise 2015 clearing or disturbance polygons created for this report resulted in some revisions to the results presented in the previous annual report (ECOSTEM 2016). Given that the original mapping approach for areas inside of the licensed Project footprint was an approximation, it intentionally erred on the side of overestimating the area impacted when digitizing boundaries. For this reason, the more precise digitizing of 2015 clearing boundaries completed for this report slightly lowered the total amount of 2015 clearing compared with what was reported last year. These area reductions were only within the planned and possibly disturbed portions of the Project footprint as the clearing outside of these Project areas had already been precisely digitized.

2.4 PROJECT FOOTPRINT ZONES AND APPROVED AREAS

The terrestrial habitat clearing and disturbance analyses subdivided the licensed Project footprint into two distinct areas: the planned footprint and the possibly disturbed areas. The planned footprint – designated as green areas in the Project's Environmental Protection Plans (EnvPPs) maps - is largely comprised of permanent features, which means there is little to no opportunity to reduce Project impacts in these areas. The possibly disturbed areas – designated as yellow areas in the EnvPPs - provided for some of the unknown components of the Project design at the time the Project was being licensed (e.g., the actual volume of suitable material available in each borrow area, or the actual area needed for each of the Excavated Material Placement Areas [EMPAs]).

There is some flexibility in locating clearing, disturbance or material placement within the possibly disturbed areas. For this reason, the EnvPPs include provisions to minimize clearing or disturbance to the extent practicable within the possibly disturbed areas of the licensed Project Footprint. On this basis, this document reports on where clearing or disturbance occurred within the distinct Project footprint areas.

To identify whether the clearing or disturbance fell within or outside of the possibly disturbed areas, the GIS polygons for the planned and possibly disturbed footprint areas were used to subdivide the actual clearing or disturbance into the relevant Project zone. Any resulting long slivers along linear features that were less than 1 m wide were deleted on the basis that they fell within the spatial accuracy of the DOIs used to digitize clearing.

Clearing observed during the field surveys that was associated with other projects only was not considered in this report. These were areas cleared for the Keeyask Infrastructure Project (KIP; which was completed under a separate license) that had no additional Project-related clearing or disturbance (effects on these areas had been assessed in the final KIP monitoring report (ECOSTEM 2015)). Similarly, clearing solely for the Keeyask Transmission Project (KTP) that overlapped the approved Project footprint was not included in these totals as this is a separate and independently licensed project. The cumulative effects of these and other projects with the Project will be evaluated in the updated terrestrial habitat cumulative effects assessment completed as a component of the Long-Term Effects on Habitat study.

After the Project was licensed, several additional areas were approved for Project use by Manitoba Conservation and Water Stewardship (MCWS; now Manitoba Sustainable Development). These primarily included the former KIP start-up camp (which was originally planned as only a temporary camp for the KIP) and pre-existing trails that were used to access reservoir clearing areas. The pre-existing trails were evaluated for potential effects by terrestrial specialists prior to their addition, and their locations modified to alleviate any ecological concerns that were identified at that time. Following modifications recommended by terrestrial specialists, the areas subsequently approved by the Province were not a concern from the terrestrial ecosystem health perspective.

Important considerations for the evaluations of the proposed additional areas were changes to cumulative effects and the amount of the licensed Project footprint that was expected to remain undisturbed at the end of construction. It was expected that a large proportion of the licensed Project footprint would remain unimpacted because the EIS intentionally erred on the side of overestimating the amount of habitat loss and disturbance. As of September 2015, the vast majority (96%) of the possibly disturbed area had not been impacted by the Project (ECOSTEM 2016).

This report treats the licensed and subsequently approved areas as approved Project footprint areas. To facilitate future comparisons with EIS predictions, clearing or disturbance in subsequently approved areas is tracked separately when amounts are reported for clearing or disturbance outside of the planned footprint.

Adding new areas to the overall approved Project footprint areas altered the previously reported amounts of clearing or disturbance outside of Project approved areas in September 2015 (ECOSTEM 2016). Some of these have now declined. These changes are noted below where they apply.

3.0 RESULTS

This section begins with an overview of Project clearing or disturbance. Subsequent sections detail clearing or disturbance in the various Project components.

3.1 OVERVIEW

As of September 2016, Project clearing or disturbance totaled 3,561 ha, or 28% of the originally licensed area. This was an increase of 2,205 ha from that documented as of September 2015 (Table 3-1), with approximately 85% of it in the reservoir area.

Table 3-1: Cumulative actual Project clearing or disturbance area as of September 2016, by footprint type.

Footprint Type ¹	Total Area (ha)			Change from Previous Year ³	
	2014 (existing from KIP)	2015 ²	2016	2015	2016
North access road	192	192	193	1	0
South access road	-	300	326	300	26
Camp and work areas	187	229	232	43	3
Borrow areas	49	269	359	220	89
North dyke and associated areas	19	134	185	115	51
South dyke and associated areas	-	25	122	25	97
Generating station and river works	11	198	221	187	23
Reservoir clearing and access trails	2	9	1,923	7	1,915
All cleared or disturbed areas	459	1,356	3,561	897	2,205

Notes: a "-" indicates no area, a 0 indicates an area less than 0.5 ha.

¹ Footprint types are coarse groupings of components. In general, they include adjacent EMPAs, and dykes include associated borrow areas.

² Areas for 2015 differ than those presented in the 2015 annual report because 2015 mapping was refined within the planned project footprint.

³ Due to rounding, some of the amounts are slightly different than what results from subtracting the numbers in the table.

Up to September 2015, clearing or disturbance had been concentrated in the river works area, the north dyke and associated features (e.g., borrow areas), the South Access Road (SAR) and associated features, Borrow Areas G-1, G-3 and N-5, and excavated material placement area D16 (north of the batch plant).

As of September 2016, clearing or physical disturbance were observed in the following Project components: entire NAR and SAR; main camp; borrow areas along both access roads; north

dyke, south dyke; excavated material placement areas; short access roads used for dyke construction; north reservoir area; camp well access road; cofferdam and cleared/dewatered area; and all work areas.

The photos in Figure 3-1 to Figure 3-14 show examples of clearing or physical disturbance in these areas at the time of the 2016 surveys (these photos are discussed in the relevant Project footprint sections below). As an informal means of demonstrating change, these photos can be compared with photos of the same locations in 2012, 2013, 2014 and 2015, as photographed during the KIP monitoring surveys and the 2015 TEMP survey (see previous monitoring reports: ECOSTEM 2013, 2014, 2015, 2016).

About 1,886 ha, or 86%, of the area cleared or disturbed between September of 2015 and 2016 was situated in the future reservoir area north of the Nelson River. Other footprint components with major contributions to the additional clearing or disturbance during this period were the south dyke, excavated material placement and borrow areas associated with the south dyke, north dyke, Borrow Area G-1, G-3 and N-5, SAR and several borrow areas associated with the SAR.

The start-up camp (*i.e.*, initially developed under the KIP as a temporary camp) was an additional approved Project area (Section 2.4) included in 2016. Staff working on the Project stayed in the trailers situated within this site. While there was no additional clearing in this footprint, vehicle traffic and other forms of activity created additional physical disturbance.

Borrow Area G-5, and most of Borrow Area KM-4 and KM-9 are not discussed in this report since aerial surveys and information provided by Manitoba Hydro indicated they had not been incrementally cleared or used by the Project as of September, 2016 (*i.e.*, observed clearing or disturbance was from previous projects or activities such as the KIP).



North Access Road/PR 280 junction (looking north) on August 20, 2016



Approximately halfway along the North Access Road (looking north) on August 20, 2016

Figure 3-1: Clearing and other impacts along the North Access Road



Bridge at Looking Back Creek (looking south) on August 20, 2016



Near the south end of the North Access Road (looking north) on August 20, 2016

Figure 3-1: Continued...



Northwest end of South Access Road (looking south) on August 20, 2016



View of the South Access Road camp (looking south) on August 20, 2016

Figure 3-2: Clearing and other impacts along the South Access Road



Crossing at the Butnau River (looking east) on August 20, 2016



Near the east end, junction with the old Butnau Road route (looking north) on August 20, 2016

Figure 3-2: Continued...



Main camp and helicopter pad (looking south) on August 21, 2016



Well road (looking south) on August 21, 2016

Figure 3-3: Main camp, helicopter pad and well road



Figure 3-4: Cemetery site along the North Access Road (August 21, 2016)



Work Area A (looking west) on August 21, 2016



Work Area B (looking north) on August 20, 2016

Figure 3-5: Work areas



Work Area C (looking northeast) on August 20, 2016



Work Area N-22 (west) on August 21, 2016

Figure 3-5: Continued...



Borrow Area G-1 at KM-15 (looking southwest) on August 21, 2016



Borrow Area G-1 at KM-17 (looking southwest) on August 21, 2016

Figure 3-6: Clearing and excavation in borrow areas north of the Nelson River



Borrow Area G-3 (looking southwest) on August 21, 2016



Borrow Area N-5 (looking east) on August 21, 2016

Figure 3-6: Continued...



Borrow Area S-2a (looking north) on August 20, 2016



Borrow Area B-2 (looking north) on August 20, 2016

Figure 3-7: Clearing and excavation in borrow areas south of the Nelson River



Borrow Area Q-9 (looking north) on August 20, 2016



Borrow Area B-3 (looking north) on August 20, 2016

Figure 3-7: Continued...



Borrow Area B-5 (looking north) on August 20, 2016



Borrow Area B-6 west portion (looking north) on August 20, 2016

Figure 3-7: Continued...



Borrow Area B-6 east portion (looking north) on August 20, 2016



Borrow Area B-8 (looking north) on August 20, 2016

Figure 3-7: Continued...



Borrow Area G-3 (looking north) on August 20, 2016

Figure 3-8: Sedimentation into adjacent undisturbed habitat at borrow area G-3



North dyke, east end (looking east) on August 21, 2016



North dyke, west end (looking northeast) on August 21, 2016

Figure 3-9: North dyke



South dyke, southwest end (looking west) on August 20, 2016



South dyke, central area (looking northwest) on August 20, 2016

Figure 3-10: South dyke



EMPA D16 (looking south) on August 21, 2016



EMPA D17 (looking northeast) on August 20, 2016

Figure 3-11: Excavated material placement areas in use



EMPA D19-I (looking north) on August 20, 2016



Portion of EMPA D12 (looking southwest) on August 21, 2016

Figure 3-11: Continued...



EMPA D3-E (looking west) on August 20, 2016



EMPA D9-I (looking west) on August 20, 2016

Figure 3-11: Continued...



Powerhouse construction (looking west) on August 20, 2016



Spillway construction (looking west) on August 20, 2016

Figure 3-12: Features in the river works footprint component



Spillway laydown area (looking south) on August 20, 2016

Figure 3-12: Continued...



Reservoir clearing (looking southwest) on August 21, 2016



Reservoir clearing, close-up view on September 7, 2016

Figure 3-13: Reservoir clearing



Pre-existing cutline for access to reservoir clearing (looking west) on August 21, 2016



Cutline for geotechnical exploration work (looking northeast) on July 7, 2016

Figure 3-14: New and pre-existing cutlines used for the project

Of the 3,561 ha of total clearing or disturbance, 93% was within the planned areas of the Project footprint. Clearing or disturbance within these areas had increased by 2,048 ha since September 2015 (Table 3-2).

Clearing or disturbance in the possibly disturbed portion of the Project footprint (Table 3-2; Map 3-1) amounted to approximately 193 ha as of September 2016. This was an increase of 128 ha over 2015. Most of this area was situated in excavated material placement areas along the north and south dykes, and north of Work Area A.

As described in Section 2.4, the approved Project footprint areas included all areas that were either licenced or subsequently approved for use by MCWS (now Manitoba Sustainable Development).

As of September 2016, 56 ha of the clearing or disturbance was in areas subsequently approved by MCWS, with the more than half of this area (52%) being in areas previously cleared for the KIP. These subsequently approved areas included the KIP start-up camp near PR 280, and portions of Borrow Area KM-4 and KM-9, which had previously been used for the KIP, a cemetery site adjacent to the NAR, and several pre-existing and newly cleared cutlines utilized for accessing the north-side reservoir clearing area. A portion of the area that was cleared during the KIP fell outside of the planned and possibly disturbed areas for both KIP and the Project (access to G-1 at KM-17). This area was addressed in the KIP report (ECOSTEM 2015), and while it is still being used by the Project, it was not re-assessed in this report.

Clearing or disturbance outside of the approved Project footprint areas totalled 4.60 ha (Table 3-2; Map 3-1), or 0.13% of total impacted area as of September 2016. As illustrated in Map 3-1, this 4.60 ha of impacts was very small (0.05%) relative to the 9,238 ha of undisturbed area within the planned or possibly disturbed components of the Project footprint. Most of the area that was undisturbed in 2016 was expected to remain undisturbed by the Project.

Over half of the area cleared or disturbed outside of the approved Project footprint areas (2.75 ha) was an extension of the Borrow Area G-1 footprint (some of this increase from 2015 resulted from better quality imagery becoming available for the area). The majority (1.44 ha) of the remaining 1.91 ha was for vegetation clearing in the future reservoir area, and in existing or new trails used to access the reservoir clearing.

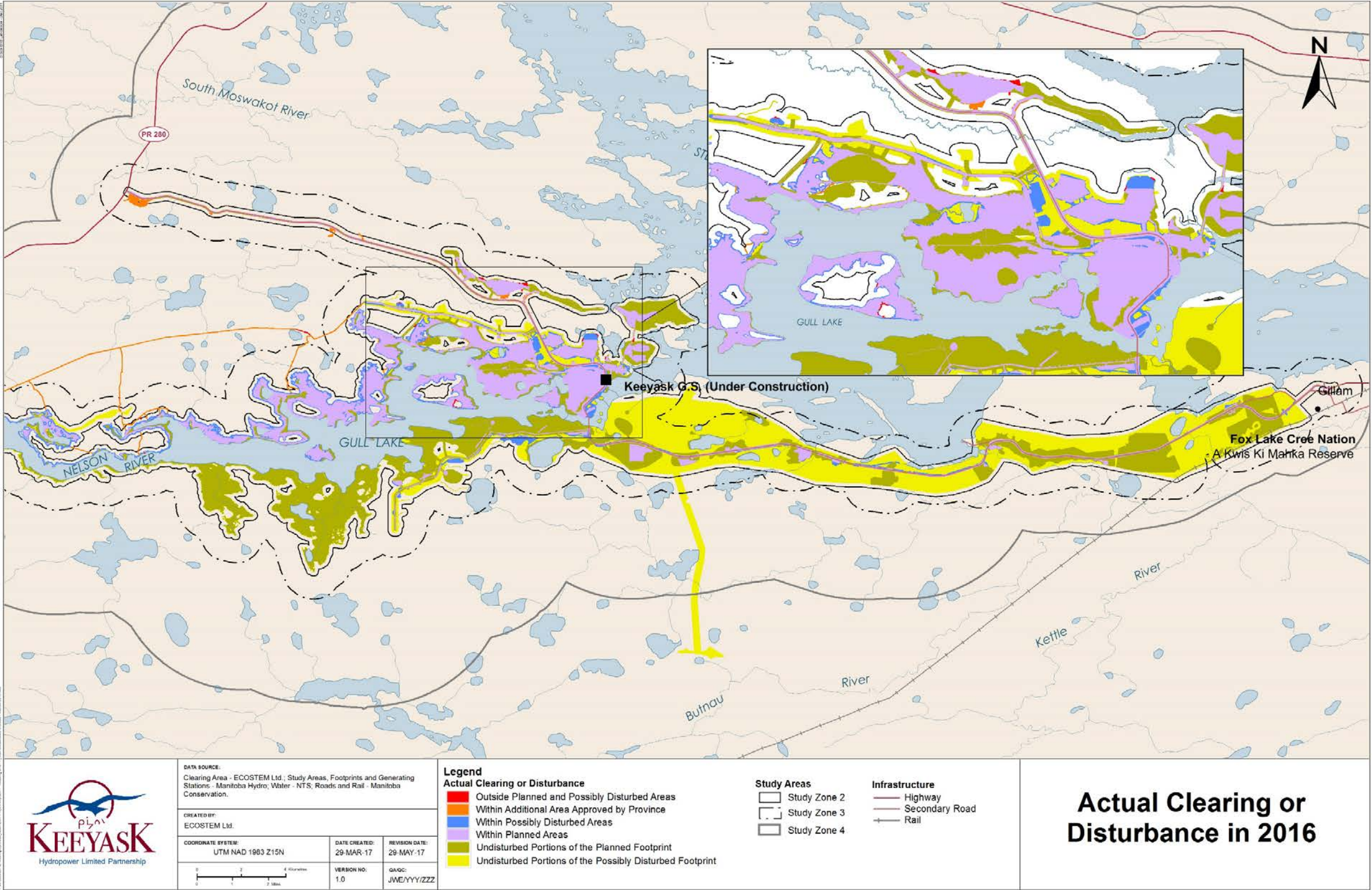
Table 3-2 includes two revisions to the amounts reported in the 2015 annual report (ECOSTEM 2016). For Borrow Area N-5, the slight increase in area was due to additional area being identified after better quality imagery became available (see below for details). Additionally, the total amount of clearing or disturbance outside of the approved Project footprint areas as of September 2015 is lower. Most of this decrease was related to approval for three cutline segments being received after the 2015 annual report was prepared.

Table 3-2: Cumulative actual Project clearing or disturbance area as of September, 2016, by footprint zone.

Footprint Zone	Total Area Approved	Total Area (ha)			Change from Previous Year ¹	
		2014 (existing from KIP)	2015	2016	2015	2016
Planned Areas	7,616	420	1,260	3,307	839	2,048
Possibly Disturbed Areas	5,123	10	65	193	55	128
Approved Areas Outside of Planned and Possibly Disturbed Areas ²	n/a	29	29	56	0	27
Outside of Planned and Possibly Disturbed Areas	n/a	-	2	5	2	3
All	12,738	459	1,356	3,561	897	2,205

Notes:

¹ Due to rounding, some of the change values are slightly different than obtained from subtracting the numbers in the table.² Subsequently approved by MCWS (now Manitoba Sustainable Development).



Map 3-1: Actual Project clearing or physical disturbance as of early September 2016

3.2 ACCESS ROADS

All North Access Road (NAR) clearing observed in September 2016 was within the planned Project footprint boundary, and was unchanged from September 2015 (Figure 3-1).

Construction of the South Access Road (SAR) roadbed appeared to be complete as of the 2016 surveys. The SAR right-of-way (ROW) had been cleared, and road construction completed from the Gillam access road to the south shore of Gull Rapids (Figure 3-2). The visible clearing outside of the access road ROW was completed by the Keeyask Transmission Project (KTP) and, as such, is not included in the results except where a Project borrow area overlaps the same area.

A small access road from the end of the Butnau dyke to the SAR, as well as portions of the access road ROW created 4.45 ha of clearing within the possibly disturbed area of the Project footprint (Table 3-3). No clearing fell outside of the planned and possibly disturbed SAR footprint.

3.3 MAIN CAMP, NORTH SHORE WORK AREAS AND WELL AREA

The extent of clearing for the main camp, well road and helicopter pad in September 2016 remained unchanged from 2015 (Figure 3-3). The extent of clearing or disturbance in the remaining work areas north of the Nelson River remained unchanged since 2015 (Figure 3-5).

A TCN cemetery site, approximately 0.7 ha in size, was cleared and developed near KM 10 of the NAR (Figure 3-4). This area is one of the areas that was subsequently approved by the Province.

No new clearing or disturbance within the possibly disturbed area of the Project footprint since 2015 was observed for the main camp, north shore work areas or well area footprint components.

3.4 BORROW AREAS

Since September 2015, vegetation clearing in Borrow Area G-1 at KM-15 was extended to the northwest by approximately 10 ha. This additional cleared area had not yet been excavated as of September 2016 (Figure 3-6).

At Borrow Area KM-17, clearing since 2015 included an additional 20 ha along the north, east and west boundaries. Most of the north and east extensions were excavated at the time of the survey.

Portions of Borrow Area KM-4 and KM-9, which were cleared for KIP, were accessed and used to store equipment and materials. Gravel stockpiles in the KM-9 area were accessed and utilized. No additional clearing or disturbance outside of the 2015 boundaries occurred.

Table 3-3: Clearing and physical disturbance within the possibly disturbed areas and outside of the combined planned, possibly disturbed and subsequently approved areas as of September 2016, by main Project component.

Project Component	Clearing or Disturbance (ha)					
	Within Possibly Disturbed Areas			Outside of Combined Planned and Possibly Disturbed Areas		
	2015 ¹	2016	Change	2015	2016	Change
South Access Road	3.83	4.45	0.62	-	-	-
Camp & Work Areas	2.32	2.53	0.22	-	0.01	0.01
Generating Station Area	8.65	12.62	3.97	-	-	-
Borrow Areas	1.53	5.68	4.15	1.51 ²	2.95	1.44
EMPAs	19.90	59.10	39.19	0.15	0.20	0.05
Dykes	18.88	21.12	2.23	-	-	-
Reservoir Clearing	0.07	77.55	77.48	0.09 ³	1.44	1.35
Total	55.19	183.06	127.87	1.74	4.60	2.85

Notes: a "-" indicates no area, a 0 indicates a very small (negligible) area.

¹ Areas for 2015 differ than those presented in the 2015 annual report because 2015 mapping was refined within the possibly disturbed areas. The difference from the previously reported total area is 0.25 ha.

² Area increased from 2015 report because 2016 mapping identified additional area that was cleared in 2015.

³ Area shown in 2015 report removed because it had since been formally approved.

Borrow Area G-3 and N-5 (Figure 3-6) were further developed and under heavy use in September 2016. Borrow Area G-3 had expanded by approximately 8 ha. A new 16 ha area in N-5, to the south of the portion that had already been used, was cleared of vegetation but had not yet been excavated. Construction of the haul roads from these two areas was complete. Quarry Q-7 was unchanged since the 2015 surveys.

On the south side of the Nelson River, Borrow Area S-18, S-17a and S-2b had not been further developed since the 2015 surveys. Excavation had expanded in Borrow Area S-2a, but there had been no additional clearing (Figure 3-7). The rock quarry Q-9 area expanded approximately 1.5 ha since 2015. Small portions of Borrow Area B-2, B-3, B5, B6 and B8 were cleared and

excavated. In Borrow Area B6 and B8, pre-existing excavated areas were utilized and expanded. Most of that footprint fell within the Keeyask Transmission Project ROW.

In total, 5.7 ha of borrow area clearing along the SAR fell within the possibly disturbed area of the Project footprint as of September 2016 (Table 3-3). Borrow area clearing outside of the approved Project footprint areas increased from 1.51 ha in 2015, to 2.96 ha in 2016. All of this additional clearing (1.45 ha) occurred at the northwest corner of Borrow Area G-1 (Figure 3-6; Map 3-1; Appendix 1: Table 5-1).

During the 2016 surveys, erosion had caused sedimentation from Borrow Area G-3 into the adjacent uncleared forest toward a waterway connected to Stephens Lake. In this case, flowing sediment broke through a silt fence (Figure 3-8).

3.5 DYKES

The north dyke footprint was cleared from the north shore of Gull Rapids to the western end of the dyke at the time of the 2016 surveys, and was under active construction. Borrow materials had been deposited along segments of its entire length, with the east end being most developed by September 2016 (Figure 3-9). By this time, clearing was present along the entire south dyke in the form of a cutline. Narrow strips of clearings were connected parallel to the cutline (Map 3-1; Figure 3-10). No portions of the footprint were gravelled beyond what was present in 2015.

Dyke clearing within the possibly disturbed area of the Project footprint in September 2016 totalled 21.1 ha (Table 3-3). Most of this clearing was along the north dyke (19.7 ha), with several small segments of cutline along the south dyke.

3.6 EXCAVATED MATERIALS PLACEMENT AREAS

The EMPA north of the batch plant in Work Area A (D16) expanded by 1.6 ha since 2015 (Figure 3-11). The EMPA north of Work Area B (D17) expanded by 0.7 ha.

Portions of all the D12 EMPAs along the north dyke were in use by September 2016. All of EMPA D12 (2) was in use. EMPAs D9-I and D3-E along the north dyke were cleared and in use. EMPA D19-I was the only one in use on William Smith Island within Gull Rapids.

South of the river, several EMPAs along the south dyke had been cleared, but were not yet in use. These included D23, D27, D28 and two D31 areas.

Clearing for the EMPAs along the north and south dykes was mainly within the possibly disturbed area, and covered an area of approximately 59.1 ha by September 2016 (Appendix 1: Table 5-1). In EMPA D16 north of the batch plant, a small amount of the expansion (1.24 ha) was in the possibly disturbed area. Most of the remaining EMPA clearing was within the planned portions of the Project footprint.

A 0.01 ha portion of EMPA D17 was outside of the approved Project footprint areas (Map 3-1). Some very small portions of the EMPAs along the dykes also fell outside the planned and possibly disturbed areas, but amounted to less than 0.05 ha in total.

3.7 RIVER WORKS AREA

Construction of the spillway laydown area, spillway cofferdam, and dewatering area had been completed since the time of 2015 surveys. Construction of the powerhouse and spillway structures were also underway as of September 2016 (Figure 3-12).

In 2016, an additional 4.0 ha of river works development, including parts of the dam and spillway cofferdam, occurred within the possibly disturbed areas of the Project footprint, increasing the total to 12.6 ha. None of the river work areas were outside of the approved Project footprint areas.

3.8 RESERVOIR CLEARING

Reservoir clearing north of the Nelson River was completed during the winter, prior to the 2016 surveys (Figure 3-13). This footprint component accounted for 1,886 ha of the clearing since 2015, or the majority (86%) of all new clearing. There had been no clearing in the reservoir area south of the Nelson River as of September 2016.

Approximately 77.4 ha of the reservoir clearing was within the possibly disturbed areas, situated around the perimeter of the reservoir clearing footprint (Table 3-3). A further 26 ha was in areas subsequently approved for the Project, which included access trails (some pre-existing, and some newly created) required for the reservoir clearing.

Approximately 0.71 ha of reservoir clearing was outside of the approved Project footprint areas. This area was very small (0.03%) relative to the extensive reservoir clearing area that was covered; most was in numerous scattered, small patches, primarily on Caribou Island.

3.9 TRAILS OR CUTLINES

Several access trails were used for reservoir area clearing or to conduct geotechnical investigations near Little Gull Lake (Figure 3-14; Map 3-1). Some were along existing cutlines, while others were newly cleared. By September 2016, the total impacted area was 29 ha. Of this total, six hectares were newly cleared trails.

Approximately 0.14 ha of cutline clearing or disturbance fell within the possibly disturbed portions of the Project footprint (Appendix 1: Table 5-1). A total of 0.73 ha of the clearing or disturbance for access trails fell outside of the approved Project footprint areas. These included

two segments or pre-existing cutlines that were disturbed during reservoir clearing, but were not among the segments approved by the Province.

Three short segments totalling approximately 0.5 ha were classified as being outside of the approved Project footprint areas in the 2015 annual report. These segments have since been approved for use by the Province, and combined with the approved Project area (see footnote 3 in Table 3-3).

4.0 SUMMARY AND CONCLUSIONS

The Habitat Loss and Disturbance study is monitoring the actual extent of Project-related clearing and disturbance during construction. This is the largest direct Project effect on terrestrial habitat and ecosystems.

The licensed Project footprint includes the planned footprint and the possibly disturbed areas. The approved Project footprint includes the areas originally licensed for the Project as well as areas subsequently approved by MCWS (now Manitoba Sustainable Development). The need for additional areas arose since, at the time the EIS was licensed, not everything could be known and new issues or considerations surfaced. The subsequently approved areas primarily included existing KIP footprints and trails that were used to access reservoir clearing areas (some of which were existing cutlines).

The additional approved Project areas were not of substantial concern from the terrestrial ecosystem health perspective. These areas had been evaluated for potential effects by terrestrial specialists prior to their submission to MCWS for approval, and their locations were modified to alleviate ecological concerns that were identified at that time. Important considerations for these evaluations were changes to cumulative effects and the amount of the licensed Project footprint that was expected to remain undisturbed at the end of construction. In this regard, the Project assessment intentionally erred on the side of overestimating impacts. At the time when the additional proposed areas were evaluated, monitoring had shown that the vast majority (99%) of the possibly disturbed area had not been impacted as of September, 2015 (ECOSTEM 2016). It was expected that much of this area would remain undisturbed given the status of infrastructure construction in summer 2015. Subsequent monitoring found that 96% was still undisturbed in September, 2016.

Monitoring in 2016 documented approximately 3,561 ha of clearing or physical disturbance as of September 2016. This area was far below the total area included in the licensed Project Footprint (only 28% of total licensed area). By 2016, most of the planned clearing had been completed. The primary exceptions were the south reservoir area and the Ellis Esker borrow area.

The planned footprint primarily includes Project infrastructure, which has limited flexibility for modification (shown as “green zones” in the Project EnvPPs). The possibly disturbed areas of the licensed Project footprint (shown as “yellow zones” and “red zones” in the Project EnvPPs) are situated outside of the permanent infrastructure or reservoir and, as such, have some flexibility for being relocated or having their boundaries adjusted. Additionally, the Project EnvPPs include measures to minimize clearing and disturbance outside of the planned footprint to the extent practicable.

Of the total area cleared or disturbed to 2016, 93% was within the planned footprint (shown as “green zones” in the Project EnvPPs). Project clearing or disturbance within the possibly

disturbed portion of the Project footprint amounted to 193 ha by September 2016, which was only 3.8% of the 5,123 ha included for this distinct area of the Project footprint.

Clearing within the possibly disturbed footprint was mostly associated with reservoir clearing, EMPAs along the dykes, and the north dyke. The remaining clearing was in a few small areas along the SAR, within SAR borrow areas and within the river works area.

Most of the 4.60 ha of clearing or disturbance outside of the combined planned and possibly disturbed areas was located at Borrow Area G-1, in the reservoir clearing area, and in four segments of new and pre-existing trails used to access the reservoir clearing area. Overall, this 4.60 ha area was very small relative to the 4,930 ha of still undisturbed area in the possibly disturbed portion of the Project footprint. As illustrated in Map 3-1, the area cleared or disturbed outside of the approved Project footprint was only 0.05% of the remaining portions of the planned or possibly disturbed footprint that have not yet been disturbed. Additionally, most of the still undisturbed area within the planned or possibly disturbed areas in 2016 was expected to remain undisturbed by the Project. The only footprints expected to have substantial clearing after September 2016 are the south reservoir area and the Ellis Esker borrow area.

At this time, there are no recommendations for additional mitigation, modifications to the EnvPPs or modifications to the study methods based on results from this study.

4.1 NEXT STEPS

Monitoring fieldwork for the Habitat Clearing and Disturbance study will continue in 2017. No major changes to field methods are anticipated.

5.0 LITERATURE CITED

- ECOSTEM 2013. Keeyask Infrastructure Project: Terrestrial habitat, ecosystem and plant monitoring during construction: activities from July, 2011 to March, 2013. Monitoring Program Report #12-01.
- ECOSTEM 2014. Keeyask Infrastructure Project: Terrestrial habitat, ecosystem and plant monitoring during construction: Annual report 2013 - 2014. Monitoring Program Report #13-01.
- ECOSTEM 2015. Keeyask Infrastructure Project: Terrestrial plant, habitat and ecosystem monitoring during construction: Annual report 2014 - 2015.
- ECOSTEM 2016. Terrestrial Effects Monitoring Plan Annual Report 2015 – 2016: Keeyask Generation Project: Terrestrial Plant, Habitat, and Ecosystem Monitoring: Annual Report 2015-2016. A report prepared for Manitoba Hydro by ECOSTEM Ltd., June 2016.

APPENDIX 1: DETAILED RESULTS

Table 5-1: Clearing and physical disturbance within the possibly disturbed areas and outside of the combined planned, possibly disturbed and subsequently approved areas as of September 2016, by main Project component and footprint.

Project Component	Footprint Name	Clearing or Disturbance (ha)					
		Within Possibly Disturbed Areas			Outside of Combined Planned and Possibly Disturbed Areas		
		2015 ¹	2016	Change	2015	2016	Change
Access Roads	South Access Road	3.83	4.45	0.62	-	-	-
Camp & Work Areas	Main Camp	0.00	0.00	-	-	-	-
	Work Area A	0.75	0.75	-	-	-	-
	Work Area B	0.20	0.42	0.22	-	0.01	0.01
	Work Area C	0.19	0.19	-	-	-	-
	N-22	0.11	0.11	-	-	-	-
	Portage Route	1.07	1.07	-	-	-	-
River Works Area	Generating Station	0.09	0.09	-	-	-	-
	Spillway & Cofferdam	8.56	12.53	3.97	-	-	-
Borrow Areas	B-2	0.40	0.40	-	-	-	-
	B-3	1.13	2.55	1.42	-	-	-
	B-5	-	0.75	0.75	-	-	-
	B-6	-	0.05	0.05	-	-	-
	B-8	-	1.79	1.79	-	-	-
	G-1	-	-	-	1.31	2.75	1.44
	N-5	-	-	-	0.20 ²	0.20	-
	Q-9	-	0.14	0.14	-	-	-
	D12(1)-E	0.01	0.01	-	-	-	-
EMPAs	D12(2)-E	6.06	6.06	-	-	-	-
	D16(1)-E	13.83	15.07	1.24	0.15	0.15	-
	D17-E	0.00	0.00	-	-	0.01	0.01
	D23(1)-E	0.02	1.56	1.54	-	-	-
	D27(4)-E	-	26.06	26.06	-	0.01	0.01
	D28(1)-E	-	5.85	5.85	-	-	-
	D31(1)-E	-	1.28	1.28	-	-	-
	D31(2)-I	-	0.12	0.12	-	0.00	0.00
	D3-E	-	3.08	3.08	-	0.03	0.03
	D9-I	-	0.01	0.01	-	-	-
	D9-I	-	0.01	0.01	-	-	-
Dykes	North Dyke	17.90	19.73	1.82	-	-	-
	South Dyke	0.98	1.39	0.41	-	-	-
Reservoir Clearing	Reservoir Clearing	0.04	77.41	77.38	-	0.71	0.71
	Cutlines	0.04	0.14	0.10	0.09 ³	0.73	0.64
Total		55.19	183.06	127.87	1.74	4.60	2.85

Notes: a "-" indicates no area, a 0 indicates a very small (negligible) area.

¹ Areas for 2015 differ than those presented in the 2015 annual report because 2015 mapping was refined within the possibly disturbed areas. The difference from the previously reported total area is 0.25 ha.

² Area increased from 2015 report because 2016 mapping identified additional area that was cleared in 2015.

³ Area present in 2015 report removed because it had since been formally approved.