Keeyask Generation Project

Reservoir Clearing Plan

KEEYASK

Hydropower Limited Partnership

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KEEYASK GENERATION PROJECT

RESERVOIR CLEARING PLAN

Prepared by

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Winnipeg, Manitoba

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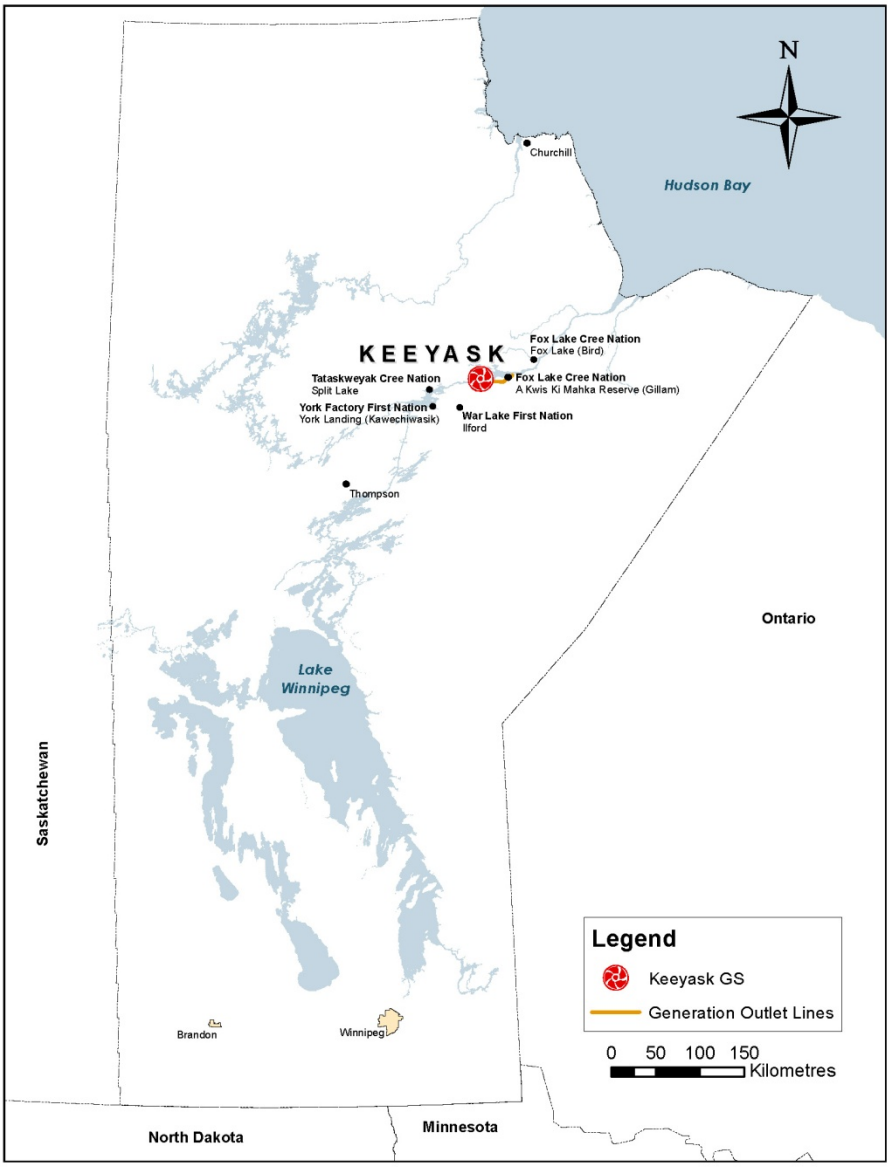
PREFACE

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. The Program includes a collection of plans grouped in the following categories: Environmental Protection Plans, Environmental Management Plans, and Environmental Monitoring Plans.



Map1: Location of Keeyask Generation Project

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.

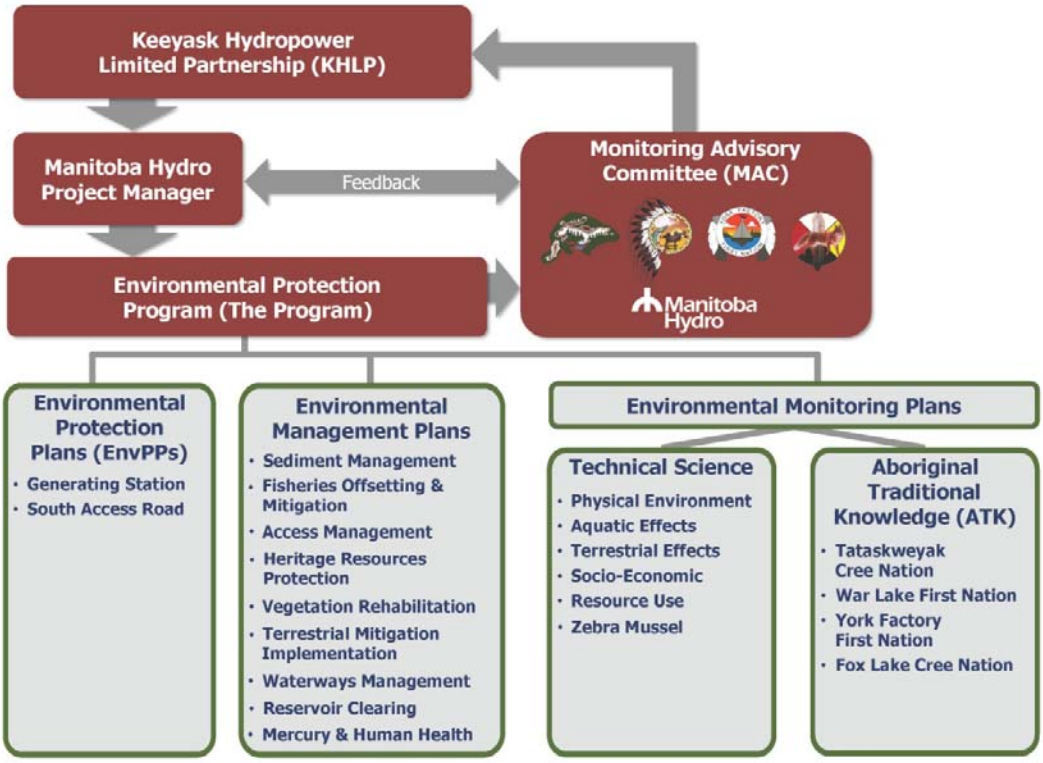


Figure 1: Environmental Protection Program

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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ACRONYMS & UNITS

ACRONYMS:	
ASL	above sea level
EIS	Environmental Impact Statement
EPP	Environmental Protection Program
FLCN	Fox Lake Cree Nation
FSL	full supply level
GIS	geographic information systems
GS	generating station
GS EnvPP	Keeyask Generating Station Environmental Protection Plan
JKDA	Joint Keeyask Development Agreement
KHLP	Keeyask Hydropower Limited Partnership
LIDAR	light detection and ranging
PESV	Physical Environment Supporting Volume
TCN	Tataskweyak Cree Nation
TESV	Terrestrial Environment Supporting Volume
UTM	Universal Transverse Mercator
WLFN	War Lake First Nation
YFFN	York Factory First Nation
UNITS:	
ha	hectares
km	kilometres
m	metres

1. INTRODUCTION

1.1 BACKGROUND

In April, 2003 a Keeyask Forebay Clearing Sub-Committee (the Committee) was formed to develop a forebay clearing plan. The Committee was comprised of Members and advisors from each of the Keeyask Cree Nations (Tataskweyak Cree Nation, War Lake First Nation, York Factory First Nation and Fox Lake Cree Nation), Manitoba Hydro representatives, and consultants from the Keeyask Generation Project environmental studies team. The Committee developed a framework to guide the approach for reservoir clearing that would take into account human safety and social concerns, environmental protection, as well as Project engineering and cost considerations. The Committee prepared an initial Forebay Clearing Plan in 2006, which included recommended standards and guidelines for clearing the future Keeyask reservoir area (Keeyask Forebay Clearing Sub-Committee, 2005).

In 2009, Manitoba Hydro and the partner First Nations signed the Joint Keeyask Development Agreement (JKDA), which included the Keeyask Hydropower Limited Partnership's (KHLP) Reservoir Clearing Plan in Schedule 11-1 of the agreement (TCN et.al. 2009; Appendix A). This plan was based on the initial 2006 forebay clearing plan but, since the plan in the JKDA forms part of the legal agreement between the Project partners, the JKDA version is assumed to take precedence. As noted in the JKDA, the objectives for reservoir clearing are:

a) minimize impacts of reservoir creation and operation on the fishery by minimizing the effects of standing trees and shrubs on fishing in selected areas within the reservoir;

b) minimize the impacts of reservoir creation and operation on human access to shore locations by creating shore access locations through selective clearing of trees and shrubs;

c) minimize hazards to boating safety and fishing resulting from large floating debris by minimizing the source of such debris; and

d) minimize aesthetically offensive landscapes.

1.2 2014 RESERVOIR CLEARING PLAN UPDATE

This reservoir clearing plan is based largely upon the previous clearing plans and is not intended to duplicate or replace the work that was previously done. Rather, this updated plan builds on the previous plans, taking into consideration the additional information developed through studies conducted to prepare the 2012 Keeyask Generation Project Environmental Impact Statement (EIS): Response to EIS Guidelines (KHLP 2012b). Sources of information that were not previously available for developing an approach to reservoir clearing include:

- data/mapping from terrestrial studies on wetlands and vegetation,
- results of shoreline erosion and peatland disintegration studies,
- results of water and ice regime studies,

- recommendations for mitigation of Project effects on aquatic and terrestrial wildlife,
- information on environmentally sensitive sites, and
- an updated study of timber and peat salvage opportunities.

This reservoir clearing plan provides greater detail on clearing requirements and priorities within the future Keeyask reservoir area. Information is presented in both tabular format and in more extensive maps showing reservoir clearing requirements.

In addition to the above considerations, a comprehensive Environmental Protection Program (EPP) has been developed for the Keeyask Generation Project as discussed in the Preface. To varying degrees, these plans have a bearing on reservoir clearing as they may include specifications or restrictions that apply to clearing activities such as burning restrictions referenced in the Keeyask Generating Station Environmental Protection Plan (GS EnvPP). Some, but not all, restrictions are noted within this clearing plan, and it is ultimately up to the clearing contractor to be familiar with the relevant requirements of the GS EnvPP and other relevant plans.

1.3 CLEARING PLAN LIMITATIONS

The 2014 reservoir clearing plan is based on data produced for the 2012 Keeyask EIS such as water level predictions, elevations from aerial surveys (e.g., air photo interpretation, LIDAR data) and other data mapped in geographic information systems (GIS) such as terrestrial vegetation types. While information presented in the GIS maps appears precise, such as the boundaries between different vegetation types or clearing methods, the underlying data has varying degrees of uncertainty. Therefore, the actual physical boundaries for any of the environmental data presented and all clearing requirements are subject to verification on the ground.

Additionally, this clearing plan is based on the terrestrial vegetation information presented in the 2012 Keeyask Generation Project Terrestrial Environment Supporting Volume (TESV; KHLP 2012c). However, as noted in the JKDA Reservoir Clearing Plan (TCN et.al., 2009), conditions in the area can change quickly due to natural factors such as forest fires. In 2013, a large forest fire burned much of the future reservoir area north of the Nelson River, which has likely changed some of the clearing requirements. This clearing plan assumes that, despite the fire, clearing requirements will be similar to what would have been required without the fire, since vegetation will not have been completely eliminated in all burned areas. For example, treed areas would still have standing or fallen trees that require removal, although now they may be burned. An assessment of the terrestrial habitat changes caused by the fire is underway (using updated aerial imagery from summer 2014), but has not yet been completed.

Due to the uncertainty in underlying data and changes that have occurred since EIS data were collected, all information presented in this updated clearing plan is subject to verification in the field by the contractor prior to reservoir clearing.

Clearing requirements identified in this plan are based on information that was current up to the end of July, 2014. As construction proceeds, revisions to the GS EnvPP may be issued in accordance with procedures set out in Appendix A of the GS EnvPP (e.g., identification of new sensitive sites). The clearing contractor will be responsible for incorporating any such revisions and adjusting clearing work accordingly.

2. PRE-IMPOUNDMENT

2.1 WHERE TO CLEAR

2.1.1 Reservoir Flooded Area

Reservoir clearing will involve the removal of specified vegetation (see Section 2.2) from the area that will be inundated between the existing Nelson River shoreline and the location of the initial reservoir shoreline following impoundment. Two general boundaries were used to delineate the area in which clearing will be required and a clearing buffer around this area was defined, as described in Section 2.1.2.

Along the existing Nelson River, the inner boundary for reservoir clearing was assumed to be represented by the terrestrial habitat shoreline, which "was defined as the visible historical extent of water and ice regime effects boundary defined for the assessment of Project effects on the terrestrial environment" (KHLP 2012c, Section 2.2.4.4). The terrestrial habitat shoreline is considered to be generally representative of the ordinary high water mark that represents the transition between upland terrestrial vegetation types on the inland side and wetland vegetation types on the river side. Although this approach is used to define the inner clearing boundary, any vegetation above the existing water level that meets the requirements for removal in Section 2.2 will need to be cleared.

The outer boundary for clearing, without consideration of an additional clearing buffer, is the future reservoir shoreline after initial impoundment. The initial flooded area and water level increases for the 50th percentile flow are shown in

Map 1. Immediately upstream of the Keeyask Generating Station (GS) and in the Gull Lake area, to approximately 20 km upstream of the GS, this area includes all lands from the existing Nelson River up to the reservoir Full Supply Level (FSL) at an elevation of 159 m above sea level (ASL). Further upstream in the riverine area, the elevation of the initial shoreline will be somewhat higher due to Project backwater effects and water surface slope, and is dependent on river flow. Project effects on upstream water levels were estimated and reported in the Keeyask EIS Physical Environment Supporting Volume (PESV; KHLP 2012a, Section 4). Predicted effects at the 50th and 95th percentile flows with the reservoir at FSL are summarized below in Table 1.

Table 1: Predicted Open-Water Levels (m ASL) Upstream of Keeyask GS with Reservoir at FSL

Location	Flow Percentile	
	50th	95th
Reservoir	159.0	159.0
Portage Creek	159.1	159.3
Two Goose Creek	159.3	159.8
Downstream of Birthday Rapids	159.6	160.4

For construction purposes, the reservoir clearing area was subdivided into five main clearing zones (Map 2). Clearing Zones 1, 2 and 3 cover the reservoir area around Gull Lake where the bulk of clearing work will be required. Each of these was further subdivided into sections covering the clearing areas on the north and south sides of the lake. Clearing Zone 4 encompasses the upstream riverine area to just downstream of Two Goose Creek. These four clearing zones encompass almost all of the area that needs to be cleared. Clearing Zone 5 extends from Clearing Zone 4 to just downstream of Birthday Rapids and only a little more than a hectare is identified for clearing in this area. Clearing is not identified upstream of Birthday Rapids as post-Project 95th percentile open water levels are generally within the normal high water mark represented by terrestrial environment shoreline.

Based on the predicted effects of the Project on water levels, clearing to the initial reservoir shoreline is recommended up to the following elevations:

- **Zones 1 to 3**: Up to an elevation of 159.0 m or up to the dyke line in the reservoir area from the dam to just upstream of the reservoir, about 2 km downstream of Portage Creek (to a UTM Zone 15 easting of approximately 344000).
- **Zone 4**: Up to an elevation of 159.3 m in the riverine reach upstream of the main reservoir area (Gull Lake), from about 2 km downstream of Portage Creek to about 0.8 km downstream of Two Goose Creek (between eastings of approximately 344000 to 337000). This elevation is approximately the predicted 95th and 50th percentile post-Project open-water levels at Portage Creek and Two Goose Creek, respectively.
- **Zone 5**: Up to an elevation of 159.6 m, from about 0.8 km downstream of Two Goose Creek to just downstream of Birthday Rapids (between UTM Zone 15 eastings of approximately 337000 and 331500). This is somewhat lower than the 95th percentile post-Project open-water level near Two Goose Creek and approximately the 50th percentile level just downstream of Birthday Rapids.

The clearing elevations were selected to provide clearing to at least the 50th percentile water level in Clearing Zones 4 and 5. However, upstream shorelines in these two zones generally have steeper slopes so that the locations of the water's edge for 50th and 95th percentile flows may be relatively close together. In some areas, the buffer to be cleared lateral to the elevations specified above may cover the difference between the 50th and 95th percentile water levels. It should be noted that maps of the flooded area and estimated areas to be cleared are based on the predicted 95th percentile water level. The reservoir clearing areas by zone and location north or south of the river are summarized in Table 2. Based on the 95th percentile post-Project shoreline the reservoir clearing area of approximately 3,772 hectares (ha), including the reservoir buffer area described below in Section 2.1.2, is comprised of approximately 3,669 ha in Clearing Zones 1 through 3, 102 ha in Zone 4, and 1 ha is in Zone 5 (approximately 1.3 ha rounded to 1 ha).

For illustrative purposes, the clearing maps focus on Clearing Zones 1 to 4 to allow for a larger map scale while still showing the majority of the clearing area. More detailed maps of clearing requirements by method and vegetation classification for all the clearing zones are provided in Appendix B, with the last map in Appendix B showing the clearing required in Clearing Zone 5.

Table 2: Clearing Areas by Clearing Zone

Zone	North (ha)	South (ha)	Total (ha)
1	680	394	1,074
2	954	1,157	2,111
3	173	311	484
4	102		102
5	1		1
Total			**3,772**

2.1.2 Initial Reservoir Shoreline Buffer Area

The JKDA Reservoir Clearing Plan noted that a buffer above the initial reservoir shoreline would be cleared, in addition to the reservoir area. Once the reservoir is impounded, the new shorelines will be subject to erosion. The purpose of clearing a buffer area above the initial shoreline would be to reduce the amount of potentially hazardous woody debris that could enter the waterway due to shoreline erosion in the initial years of Project operation. This will lessen the potential for impacts of debris on resource users and the level of effort required to manage debris in the first few years of operation.

There are two conflicting considerations with respect to clearing a buffer area around the initial reservoir shoreline. Vegetation removal from a buffer area is desirable as it supports the objective of reducing the potential generation of hazardous woody debris in the waterway. However, vegetation along a shoreline generally helps to reduce shoreline erosion rates by absorbing wave energy, while the roots help bind the soil. Removing vegetation from the shoreline can potentially result in more rapid erosion, which is undesirable. Therefore, it is preferable to avoid over-clearing a buffer as that may result in faster reservoir expansion. Although vegetation helps stabilize the shoreline soils, when larger trees on the shore fall over they may cause a large amount of soil to be displaced into the waterway. Consideration of clearing a shoreline buffer area attempts to balance the competing objectives of reducing the generation of large debris in the early years of operation while avoiding over-clearing to reduce the potential for accelerating erosion.

Shoreline erosion and peatland disintegration studies performed for the Keeyask EIS predicted the amount of reservoir expansion and shoreline recession to year 30 of operation (i.e., 30 years after initial impoundment) as well as intermediate years (KHLP 2012A, Section 6). Across much of the future reservoir shoreline, the predicted shoreline recession after year 5 of operation is in the range of 8-10 metres (m). Some localized areas have less erosion while other, generally more exposed areas may have 2-3 times this amount of recession.

To balance between clearing to reduce the initial generation of debris while still limiting clearing to minimize the potential to accelerate erosion, the following approach for clearing a buffer area above the initial reservoir shoreline is recommended:

a) A lateral 5 m clearing buffer will be defined around the initial reservoir shoreline clearing boundary (i.e., five metre on-the-ground offset) defined in Section 2.1.1, items a-d;

b) Standing dead and living trees 1.5 metres (5 feet) tall or taller within the buffer will be cut down and removed;

c) Tall shrubs and other vegetation within the buffer area will be left in place;

d) Trees will be removed in manner to minimize disturbance to surface soils and other vegetation by cutting them off above ground level, either by hand clearing under frozen ground conditions or using mechanical equipment that can cut and remove the trees without entering the buffer area (e.g., feller buncher);

e) Machinery will not be operated in the buffer area to minimize disturbance to the ground surface and vegetation, except as required to cross over the buffer area for access purposes; and

f) Burning is not permitted in the buffer area to prevent disturbance to the ground surface and other vegetation; instead, trees will be moved into the main reservoir clearing area, within the initial reservoir shoreline, to be burned.

The initial shoreline buffer is not included for Clearing Zone 5. The amount of flooding in this area is limited and predicted future erosion rates are low in this reach. Any additional need for clearing will be managed through the Waterways Management Program (JKDA, Schedule 11-2). The buffer area around the initial shoreline for Clearing Zones 1-4 amounts to approximately 105 ha in total as noted in the discussion of clearing methods in Section 2.3.1. The reservoir buffer is shown on the detailed clearing maps (Appendix B) as the hand clearing area that forms an outer boundary to the entire reservoir clearing area.

The 5 m buffer distance represents about half the predicted shoreline erosion in the first five years around a large portion of the reservoir, which will help reduce the generation of large woody debris in the first several years of operation. The buffer distance is not so large that excessive over clearing is likely, reducing the risk of substantially increasing the initial rate of reservoir expansion. Selective removal of only the trees will minimize disturbance to surface soils, shrubs and other vegetation that will be retained to provide the benefits of stabilizing the soil and impeding erosion. In addition, cutting trees above ground level will leave stumps and roots in place, which will also help bind the soil.

There will be some areas where greater erosion may occur and debris may be generated relatively quickly. These areas will need to be monitored and managed through the post-impoundment implementation of the Waterways Management Program. Management may include removal of fallen trees and debris or additional tree removal inland of the shoreline over time. The necessary debris management and prevention activities required would depend on and address the actual erosion and debris conditions in the reservoir as they develop over time.

2.2 WHAT TO CLEAR

2.2.1 Vegetation to be Cleared

The requirements for vegetation to be removed during reservoir clearing are the same as those specified in the clearing plan presented in the JKDA, plus additional consideration of clearing specifications for the reservoir buffer area above the initial shoreline, as noted in Section 2.1.

Within the initial reservoir shoreline, all:

a) standing dead and living trees 1.5 metres (5 feet) tall or taller,

b) standing dead and living shrubs 1.5 metres (5 feet) tall or taller,

c) fallen trees 1.5 metres (5 feet) or more in length with a diameter of 15 centimeters (6 inches) or greater at its largest point, and

Within the reservoir clearing buffer area, all:

d) standing dead and living trees 1.5 metres (5 feet) tall or taller.

In general, clearing is not required in areas of low vegetation, however where machine clearing takes place, most of the vegetation will be removed regardless of size.

Information prepared for the assessment of Project effects on the terrestrial environment included classification and mapping of vegetation types in the Project area (KHLP 2012c, Section 2.3). Based on this information, areas within the future reservoir that are classed as treed, tall shrub or low vegetation were identified and corresponding areas were calculated (Map 3, Table 3). These classifications describe the predominant vegetation type in an area and are not exclusive. For example, areas classified as low vegetation may include some trees or tall shrubs that will need to be cleared.

Table 3: Clearing Area by Vegetation Class

Vegetation Class	Area (ha)
Low Vegetation	637
Tall Shrub	58
Treed	3,077
Total	3,772

2.2.2 Shoreline Stabilization

The earlier clearing plans noted that some treed areas within the future reservoir could be retained to potentially provide some measure of shoreline protection by reducing wave energy reaching the shoreline. It was also noted that these areas could potentially have some habitat benefits for wildlife.

Aside from mitigation of Project effects on the olive-sided flycatcher, retention of trees within the future reservoir was not identified in the Keeyask EIS as a necessary measure to mitigate Project effects on other wildlife. In the case of the olive-sided flycatcher, leaving some standing trees in the reservoir could mitigate the loss of perching habitat for this bird species (KHLP 2012b, Section 6.5.7.4.3). However, subsequent to the filing of the EIS, a forest fire in 2013 resulted in the creation of a large amount of perching habitat (i.e., standing dead trees) for the olive sided fly-catcher in the Project area, making it unnecessary to retain trees in the reservoir as a mitigation measure (KHLP 2014b).

Based on information and understanding obtained through technical studies of shoreline erosion and peatland disintegration processes, as well as terrestrial habitat studies, the retention of trees within the reservoir area is not recommended as a shoreline protection measure. Proxy area studies of past effects of reservoir creation in several other Manitoba Hydro reservoirs, including Stephens Lake, suggests that trees

retained in exposed areas do not remain in place very long and would provide little benefit in terms of erosion control. Trees retained in more sheltered areas may last longer where they are rooted in suitable soil to reduce the likelihood of displacement. Ice effects (pushing, uplift) are likely the main driver causing standing trees in the reservoir to be broken off or displaced. Considering the characteristics of vegetation type and density, soils and exposure in the future Keeyask reservoir area, there are likely very few suitable candidate areas where trees could be retained. Potentially suitable stands would be scattered throughout the future reservoir area, and the size of any individual stand would likely be relatively small; as such, these stands would be unlikely to offer any meaningful protection to nearby shorelines across a range of wind directions.

Additionally, any trees retained within the reservoir would eventually generate potentially hazardous debris that would need to be managed. Where trees are broken off, there may be stumps left behind that can also become a hazard to navigation on the water or travel across the ice. Removing the flooded trees at a later time to reduce these hazards may not be possible due to technical and regulatory constraints. Retaining trees in the reservoir would therefore not be desirable in terms of minimizing hazards to users of the waterway. Furthermore, stands of flooded, dead trees in the reservoir would create the types of aesthetically offensive landscapes that partner First Nations have indicated as being undesirable and preferable to avoid.

Due to the limited potential benefits and the certainty of eventual negative consequences of retaining trees within the reservoir, vegetation specified in Section 2.2.1 will be cleared from the initial flooded area outlined in Section 2.1.

2.3 HOW TO CLEAR

2.3.1 Clearing Methods

Reservoir clearing will involve a combination of hand (manual) and machine clearing procedures. The recommended methods for clearing are the same as those specified in the clearing plan presented in the JKDA, which are:

a) Machine clearing will be performed using an appropriate shearing blade (e.g., KG-blade) that shears vegetation off at ground level, accumulates woody and other material on the forest floor, and piles material into windrows in one operation.

b) Hand clearing will be performed using equipment such as chainsaws, brush cutters, etc. in specific locations, as noted in Section 2.3.2. Hand clearing may also be employed in other areas where conditions are such that machine clearing cannot be performed (e.g., steep slopes).

As noted above, the preferred method of machine clearing involves the use of an appropriate shearing blade that will remove all vegetation by shearing it off as close as possible to ground level and may also remove material accumulated on the forest floor. This will help minimize the presence of stumps in the reservoir area. Hand clearing will involve cutting material down as close to ground level as possible but will result in stumps of trees and shrubs remaining in place in these areas. Note that any areas designated for mechanical clearing could also be cleared by hand. Sections 2.3.2 and 2.3.3 provide additional details on the delineation of areas for hand and machine clearing.

The areas in which hand and mechanical clearing are specified were mapped and corresponding areas were calculated (Map 4, Table 4). A breakdown of the components that make up the hand clearing areas is also provided in Table 4.

Table 4: Clearing Areas by Clearing Method

Clearing Method	Area (ha)
Hand	
Heritage site 30 m buffers	13
Initial reservoir shoreline 5 m buffer	105
Nelson River 10 m buffer	146
Inland water/wetland 5 m buffer	185
Floating peat/machine free zones	253
Total Hand	**703**
Machine	**3,069**
Total	**3,772**

2.3.2 Hand Clearing Areas

Consistent with clearing recommendations in the JKDA clearing plan, hand clearing methods will be used in the riparian areas along the Nelson River and along tributary streams and other waterbodies. In addition to riparian areas, hand clearing is also specified for all hand clearing sites and machine-free zones (i.e., where machines should not operate), as identified on the GS EnvPP maps. Requirements for hand clearing are:

a) within 10 metres (33 feet) of the existing normal high water mark on the Nelson River,

b) within 5 metres (16 feet) of tributary stream banks,

c) within 30 metres (100 feet) of identified heritage sites, and

d) within the 5 m (16 feet) clearing buffer around the initial reservoir shoreline.

These offset distances will be measured horizontal ground distances from the referenced boundaries. Hand clearing within the buffer areas will minimize disturbance to the ground surface and retained shrubs and low vegetation. Mechanical removal of trees within hand clearing areas may be possible at some locations using appropriate equipment that can reach into the clearing area to remove the material without disturbing the ground and other vegetation (e.g., feller buncher). Heritage and other sensitive sites require special considerations as specified in the GS EnvPP, the Construction Heritage Resources Protection Plan and other plans included in the EPP.

The Keeyask terrestrial environment EIS studies identified different ecosite types (a classification based on the soils and vegetation present at a site) within the future reservoir area, including delineation of wetland areas (KHLP 2012c, Section 2.8). This information was used to specify areas in which hand clearing would be required. Specifically, areas classified as 'fen' wetlands were assumed to require hand clearing as they are not safe for equipment operation. These wetlands are generally present along tributary streams. In general, the

banks of small tributary stream channels are not accurately mapped. Therefore, it was assumed that the fen areas comprised part of the tributary stream and that hand clearing would be required within a 5 m buffer around these areas (i.e., buffer (b) above). These areas overlap substantially with the machine free zones identified in the GS EnvPP. For small water bodies in the flooded area a 5 m offset from the shoreline was created. To define the riparian hand clearing area along the Nelson River, a 10 m inland offset was implemented from the terrestrial habitat shoreline described in Section 2.1.1.

In addition to the hand clearing areas described above, hand clearing may be required in other areas such as steeply sloped locations where machinery may not be able to operate. These areas have not been mapped for this clearing plan as they would need to be identified by the clearing contractor based on site-specific conditions and equipment capabilities.

2.3.3 Machine Clearing Areas

Any areas that do not specifically require hand clearing, as described above in Section 2.3.2, are assumed to be machine clearing areas. However, hand clearing can occur within the machine clearing areas if required. Previous clearing plans indicated that existing islands would be cleared by hand as it was assumed these areas were inaccessible to machinery. For the purposes of this updated clearing plan, the wetland classifications were used to determine if hand or machine clearing could be used in different areas. As a result, some islands were classified as machine clearing areas and may be cleared by machine if the contractor determines it is possible to bring equipment to these islands. Where it is not possible, hand clearing would be employed instead. Similarly, machine clearing is designated in some parts of the reservoir clearing area where it is possible that hand clearing may be more logistically practical, such as relatively narrow strips to be cleared along upstream shorelines.

2.4 WHEN TO CLEAR

2.4.1 Timing and Seasons

Reservoir clearing will be performed in the three years prior to reservoir impoundment, as specified in the JKDA clearing plan. It is recommended that all shrubs should be removed as late as possible prior to reservoir impoundment in order to reduce the amount of re-growth before the reservoir is filled. However, logistical considerations may require earlier removal of tall shrubs to ensure that reservoir clearing is completed prior to impoundment.

The GS EnvPP includes a number of specific conditions pertaining to clearing activities that are relevant to the timing for reservoir clearing and burning, particularly Tables 7-1 and 7-2 and Section 7.10.

All machine clearing will be performed in winter months after the ground is sufficiently frozen to support the weight of heavy equipment, both to reduce ground disturbance and for safety. Additionally, all hand clearing will be performed in the winter. Based on wetland classifications, much of the hand clearing area is wet and unsuitable or unsafe for workers when the ground is not frozen.

2.4.2 Early Clearing for Construction Purposes

A number of construction activities will require the clearing of trees and vegetation from areas within the initial reservoir shoreline, either before or during the 3-year period in which reservoir clearing will take place. Earlier clearing may be required to facilitate construction of supporting infrastructure and principal structures such as cofferdams and dykes. Additionally, early clearing will be necessary to implement some mitigation works required during construction, or to allow construction of mitigation works prior to impoundment. For example, clearing may be required to create colonial water-bird (gull, tern) nesting areas on some islands to mitigate construction effects. Specific areas in need of earlier clearing remain to be identified and will be defined as construction proceeds and mitigation plans are finalized. It is expected that the amount of area that may need to be cleared early will be relatively small.

2.4.3 Priorities Considering Water Level Staging

Construction of the Keeyask GS will involve two stages of river management ((Source: KHLP 2012a, Map 4.4-4)

Map 5) to divert flows in the Gull Rapids area to allow for the construction of the powerhouse, spillway, dams and other structures. Stage I river diversion will include construction of a rock groin across the north channel of the rapids just downstream of Gull Lake. Additional cofferdams will be constructed downstream and all the river flow will be diverted to the south channel of Gull Rapids. Stage II river diversion will occur when the south channel of Gull Rapids is closed off and all of the river flow is passed through the partially completed spillway. An ice boom will also be in place just upstream of Gull Rapids to promote the early development of an upstream ice cover during construction. River management and the ice boom will result in water level increases within and upstream of Gull Rapids.

2.4.3.1 Gull Rapids Area

As noted above, the two stages of river diversion will cause water level increases in the Gull Rapids area ((Source: KHLP 2012a, Map 4.4-4)

Map 5), which is in the downstream end of Clearing Zone 1. The north channel rock groin, which diverts river flow to the south channel of Gull Rapids, will cause upstream water level increases. Under high flow conditions, this would cause some flooding of shorelines between the rock groin and the Gull Lake area upstream of the ice boom. Staging upstream of the north channel rock groin is the same for both Stage I and II river diversion.

From the north channel rock groin to approximately 1 kilometre (km) upstream of the ice boom, water level staging at the 95th percentile flow will cause levels to rise to an elevation of approximately 154 m ASL, with lower water levels occurring at lower flows. The terrestrial habitat shoreline in this area is generally near an elevation of 154 m and the amount of vegetated area affected would be limited. Clearing in this area should be done from the river level to an elevation of 154 m as soon as practicable within the clearing period as water level conditions permit. This will help avoid the possibility of high water levels preventing the areas from being cleared if left until later in the clearing period..

Downstream of the north channel rock groin to the downstream dams/cofferdams, the expected water levels during construction generally remain below the terrestrial habitat shoreline boundary even at the 95th

percentile high flow. At lower flows it can be expected that levels will be below the terrestrial habitat shoreline.

Aside from initial clearing recommended between Gull Lake and the north channel rock groin, the remainder of the area that will be flooded around Gull Rapids should be cleared in the three years prior to reservoir impoundment.

2.4.3.2 Gull Lake Area

Open water levels upstream of the north channel rock groin and on Gull Lake (Clearing Zones 1-3) will increase approximately 0.4 m above existing levels for the post-Project 95th percentile all season flow (KHLP 2012a, Table 4.4-1). The increases upstream of the north channel rock groin are the same for Stage I and II river diversion, except in the latter part of Stage II during rollway construction (in the spillway prior to impoundment by which time all reservoir clearing should be completed). In the Gull Lake area, the terrestrial habitat shoreline is generally near an elevation of 154 m and between 154-155 m in most locations. Assuming 0.4 m of staging occurs at all flows, it is expected that the open water level would be below the terrestrial habitat shoreline boundary and the clearing area for most open water flows (i.e., flows less than approximately the 85th percentile).

In winter, the development of an ice cover causes water levels to rise on Gull Lake. Staging is not steady over the winter. As ice develops early in the winter, the water levels gradually increase from their open water level to a maximum level that is sustained for some time and then levels de-stage back to open-water levels towards the end of winter. The progression of staging depends on flow and weather conditions each year. However, based on staging estimates for 5th, 50th, and 95th percentile flows and typical weather conditions, levels show a small increase initially followed by a period of rapid increase to a peak, which occurs after initiation of an ice bridge that allows rapid upstream progression of the ice cover (Manitoba Hydro 2011, Figures 38-40). The time when the rapid increase in water level begins may range from about early December to early January for existing conditions, beginning earlier at lower flows and later for high flows. The duration of peak or near peak winter water levels may be a month or two.

With the ice boom in place, the ice cover and associated staging will occur sooner than under existing conditions. For low flow conditions, it may occur about 3-4 weeks sooner and up to 6-8 weeks earlier for high flow conditions (KHLP 2012a, Section 4.4.1.3.1). The result is that, with the ice boom, winter water level staging could begin to occur around mid-November, although actual timing will depend on weather and flow conditions. The combined staging due to the north channel rock groin and effects of the ice boom will cause winter water levels to increase by about 1.1 m above existing levels on Gull Lake.

On Gull Lake, the maximum 50th to 75th percentile water levels in winter with an additional 1.1m of staging range from 155.2-155.7 m, which is generally above the terrestrial habitat shoreline. Thus, some of the reservoir clearing area may be affected by ice and staging. The maximum monthly 95th percentile winter level is approximately 156.8 m with 1.1 m of staging, which encompasses a relatively large area of the future reservoir. Even at a low 25th percentile winter level, the effects of ice and staging on Gull Lake would likely affect areas in the elevation range of 154-155 m that require clearing.

Due to the potential for ice and water level staging to affect areas around Gull Lake, the following clearing priorities considering elevation are recommended to try ensuring that areas of lower elevation are cleared within the 3-year clearing period. In general, areas at the lowest elevation have the highest priorty for

vegetation removal. For the reservoir area in Clearing Zones 1, 2 and 3, to approximately 15 km upstream of the GS (i.e., to a UTM Zone 15 easting of approximately 344600) the clearing priorities are:

a) Perform clearing below the 156 m elevation when possible;
b) Perform clearing in the 156-157 m elevation range when possible and clearing below 156 m is not possible or no longer required;
c) Perform clearing above elevation 157 m when possible and clearing below 157 m not possible or no longer required; and
d) Windrows/stockpiles of cleared material should not be left in areas below the 156 m elevation but should be disposed of as soon as possible to prevent displacement due to ice and water level staging.

Within this area approximately 1,000 ha is below 156 m, 700 ha ranges from 156-157 m, and 2,000 ha is above 157 m (Table 5).

Table 5: Clearing Area by Elevation Range and Method

Elevation Range[1]	Hand (ha)	Machine (ha)	Total (ha)
<156 m	248	753	1,001
156-157 m	61	633	694
>157 m	328	1,646	1,974
Zone 4	65	37	102
Zone 5	1	0	1
Total	703	3,069	3,772

[1]Areas for elevation ranges <156 m, 156-157 m, and >157 m are calculated for Clearing Zones 1, 2, and 3 combined.

2.4.3.3 Upstream of Gull Lake

In Clearing Zones 4 and 5 (upstream from a UTM Zone 15 easting of approximately 344600) the effects of construction on water levels are the same for both Stage I and II river diversion. The amount of staging due to construction under open-water conditions decreases in the upstream direction, going from a 0.4 m increase at Gull Lake to no increase downstream of Birthday Rapids. Without the Project, winter staging and ice effects impact the shorelines and vegetation in this reach to a greater degree than open water levels. In this area the ordinary high water mark defined by the terrestrial shoreline is generally in the range of about 159-160 m or higher, and is likely above the highest open water levels that occur along this reach. Therefore, it is not expected that open-water levels would impact the designated clearing area even for very high open-water flows.

The degree of winter staging is somewhat higher in the upstream area than on Gull Lake, increasing from about 1.1 m at Gull Lake to about 1.4 m at Birthday Rapids (KHLP 2012a, Table 4.4-1). While this staging is for the 95th percentile all-season flow, it is assumed the same level of staging occurs across the range of winter levels even though staging may be less at lower flows. To simplify considerations of winter staging, it is assumed that 1.4 m of staging occurs upstream of Gull Lake to Birthday Rapids.

Clearing requirements in the riverine reach upstream of Gull Lake are limited in area, totalling approximately 103 ha, of which only about 1 ha is in Clearing Zone 5 (Table 5). Most of the upstream area is designated for hand clearing. The largest area to be cleared is in the large bay on the north side of the river. Within this upstream reach, the locations identified for clearing above the terrestrial shoreline are generally within the elevation range of about 158-160 m. Based on winter maximum levels in this area with 1.4 m of staging, the 50th to 75th percentile levels range from about 159.1-159.8 m at Portage Creek and 161.8-162.2 m at Two Goose Creek. Levels in the large bay would be between these two, likely in the 160-161 m range. The limited areas identified for clearing along the main channel and other small bays are likewise generally in the 159-160 m elevation range. Thus, even at average winter levels, the staging due to ice is likely to be a factor impeding clearing activity in this river reach. Ice and staging may be an issue even at the 25th percentile maximum winter level of about 159 m with 1.4 m of staging during construction. Because of the potential for ice and staging effects, the following is recommended:

a) Perform clearing in the upstream clearing area as soon as possible in the winter to minimize risks of being unable to clear due to ice and water level staging; and
b) Windrows/stockpiles of cleared material should be disposed of as soon as possible to prevent displacement due to ice and water level staging.

2.5 DISPOSAL OF CLEARED MATERIAL

2.5.1 Burning

Burning is the preferred method for disposal of cleared material. The JKDA clearing plan indicated that machine cleared material would be deposited in windrows and left to dry to be burned the following winter, which could result in a more complete burn. However, any material cleared in the winter preceding reservoir impoundment would need to be burned as it is cleared since it cannot be left in the reservoir. Additionally, as noted above, material cleared in areas that may be subject to ice and water level staging should also be disposed of as it is removed.

The Keeyask Infrastructure Project, which involved developing the Keeyask north access road and other initial camp infrastructure, included winter clearing activities. As part of this work, burning the material immediately after it was cleared resulted in satisfactory disposal of the material, rather than leaving it to dry for a year prior to burning.

Based on the necessity for burning some material as it is cleared, and recent experience from burning materials on the Keeyask Infrastructure Project, it is recommended that all material cleared in winter be burned as it is cleared to provide for immediate disposal.

2.5.2 Wood Salvage

Studies conducted as part of the development of the initial 2006 clearing plan considered the potential to salvage merchantable timber for commercial use and also timber salvage for local use (e.g., firewood). An updated study was completed in 2013 (Manitoba Hydro, 2013), which found that salvaging merchantable timber from the reservoir is not economically viable as the cost far exceeds the value of the wood. Therefore, salvage of merchantable timber will not occur. The study also found that salvaging firewood from the most

suitable areas of the reservoir would cost more per cord than the likely market value for a cord of wood (i.e., could potentially purchase wood from another source at lower cost). While the 2013 salvage study considered a number of different scenarios for wood salvage, it ultimately concluded that the least expensive option was to burn the material being removed from the reservoir. However, as noted in the GS EnvPP, the Construction Manager may designate some mainland locations for small-scale timber salvage where practical.

2.6 ADDITIONAL CONSIDERATIONS

2.6.1 Marking Clearing Boundaries

Successful implementation of the reservoir clearing plan will require clear marking of the appropriate clearing boundaries, in particular:

a) Limits for reservoir clearing need to be surveyed and clearly marked to prevent the removal of vegetation from areas that do not need to be cleared; and

b) Boundaries for all hand clearing areas must be identified and clearly marked to prevent heavy equipment from operating in the riparian areas, buffer zones, and other areas designated for hand clearing.

2.6.2 Access Routes

In order to clear the reservoir area, it will be necessary to develop access routes to the different clearing areas. The GS EnvPP (Section 7.13) includes specifications for temporary access roads/trails that need to be considered in the reservoir clearing work. In particular note that the Construction Manager or delegate will consult Environmental Licensing and Protection regarding the routing of all access trail locations. Additionally, for reservoir clearing, access routes will:

a) Be constructed to the extent possible within the reservoir clearing boundary;

b) Use existing access trails to the extent possible outside of the clearing area;

c) Not be constructed within riparian hand clearing buffer areas or in the buffer area above the initial reservoir shoreline, except where necessary to cross over these areas; and

d) Not be constructed across areas that will become islands in the future reservoir in order to protect these islands as future caribou calving habitat.

2.6.3 Landing (Access) Sites

The JKDA reservoir clearing plan noted that there will be an on-going need for resource users to access shorelines for resource harvesting and other activities. To facilitate resource access, a number of landing sites will be developed at locations along the future reservoir shoreline. These access sites will be developed after impoundment as an activity under the Waterways Management Program and not as part of the reservoir clearing work. Developing access sites post-impoundment will allow for the identification of the most suitable landing sites taking into consideration actual reservoir conditions, such as near shore depth and shoreline material type.

2.7 SUMMARY

The preceding sections have presented issues and considerations to define the clearing requirements for the future Keeyask reservoir, including:

- *Where to clear* – initial flooded area plus a buffer above the initial shoreline;
- *What to clear* – standing dead and living trees and shrubs 1.5 metres (5 feet) tall or taller, and fallen trees 1.5 metres (5 feet) long with a diameter of 15 cm (6 inches) or more at its largest point;
- *How to clear* – either by hand (manual) using equipment such as chainsaws, brush cutters, etc., or mechanically, preferably using an appropriate shear blade that can shear material off at ground level as well as accumulate material from the forest floor; and
- *When to clear* – in the three years prior to impoundment during the winter, with clearing priorities identified due to potential influences of ice and water level staging.

The preferred method for disposing of material is burning on site as clearing occurs for immediate disposal, although the Construction Manager may designate some areas for salvage where practical.

Clearing requirements were identified using data and analyses from the 2012 Keeyask EIS including water regime and ice information, elevation data, and wetland and vegetation classifications. The plan also takes things such as sensitive sites into consideration. In addition to requirements specified in this plan, the clearing contractor is obligated to perform work in accordance with other plans comprising the EPP (see Preface) including the GS EnvPP and the Construction Heritage Resources Protection Plan.

Based on the available information, considerations of where, what, how and when to clear have been combined to produce detailed maps showing the clearing requirements across the reservoir. In total, the area to be cleared is approximately 3,772 ha, most of which is classified as treed (3,077 ha) and will be cleared by mechanical means (3,069 ha). Table 6 provides a breakdown of the clearing areas based on clearing method, elevation considerations and vegetation type. Detailed maps showing clearing requirements by method and vegetation type are provided in Appendix B. A detailed breakdown of reservoir clearing areas considering vegetation classification, clearing method, clearing zone, and elevation range is provided in Appendix C.

Table 6: Reservoir Clearing Areas by Method, Vegetation Class and Elevation Range

	Low Veg. (ha)	Tall Shrub (ha)	Treed (ha)	Total (ha)
Hand Clearing				
<156 m	103	7	138	248
156-157 m	26	2	34	61
>157 m	140	4	184	328
Zone 4	36	5	25	65
Zone 5	0	0	1	1
Hand Clearing sub-total	*305*	*17*	*381*	*703*
Mechanical Clearing				
<156 m	132	8	613	753
156-157 m	46	4	583	633
>157 m	151	13	1,481	1,646
Zone 4	3	16	18	37
Zone 5	0	0	0	0
Mechanical Clearing sub-total	*332*	*41*	*2,696*	*3,069*
Total	637	58	3,077	3,772

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3. POST-IMPOUNDMENT

The Keeyask reservoir is predicted to increase in size by about 7-8 km^2 during the first 30 years of operation due to shoreline erosion and peatland disintegration (**Error! Reference source not found.**, Map 8). Expansion of the reservoir has the potential to contribute substantial amounts of woody debris into the reservoir that could pose a hazard to navigation and result in negative impacts to the resource users from the partner First Nation communities and others using the waterway. Areas that will convert from land to water over time as a result of reservoir expansion will be cleared on an ongoing basis through the implementation of the Waterways Management Program (JKDA, Schedule 11-2). The Waterways Management Program, including post impoundment management of woody or other debris, is not part of the Reservoir Clearing Plan.

4. REFERENCES

Keeyask Forebay Clearing Sub-Committee, 2005. Keeyask GS Project Recommended Forebay Clearing Plan Standards And Guidelines, submitted to the Keeyask Project Description Technical Committee. November 16, 2005. Winnipeg, Manitoba.

Keeyask Hydropower Limited Partnership, 2012a. Keeyask Generation Project: Physical Environment Supporting Volume. June 2012. Winnipeg, Manitoba.

Keeyask Hydropower Limited Partnership, 2012b. Keeyask Generation Project Environmental Impact Statement: Response to EIS Guidelines. June 2012. Winnipeg, Manitoba.

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Manitoba Hydro, 2011. Keeyask Generation Project Stage IV Studies: Physical Environment. Existing Environment Ice Processes (Design Memorandum GN 9.1.6). Report prepared by KGS Acres for Manitoba Hydro. March 2011. Winnipeg, Manitoba.

Manitoba Hydro, 2013. Keeyask Generation Project Stage IV Studies: Economic Assessment of Timber and Peat Salvage in the Reservoir (Design Memorandum GN 9.8.34). October 18, 2013. Winnipeg, Manitoba.

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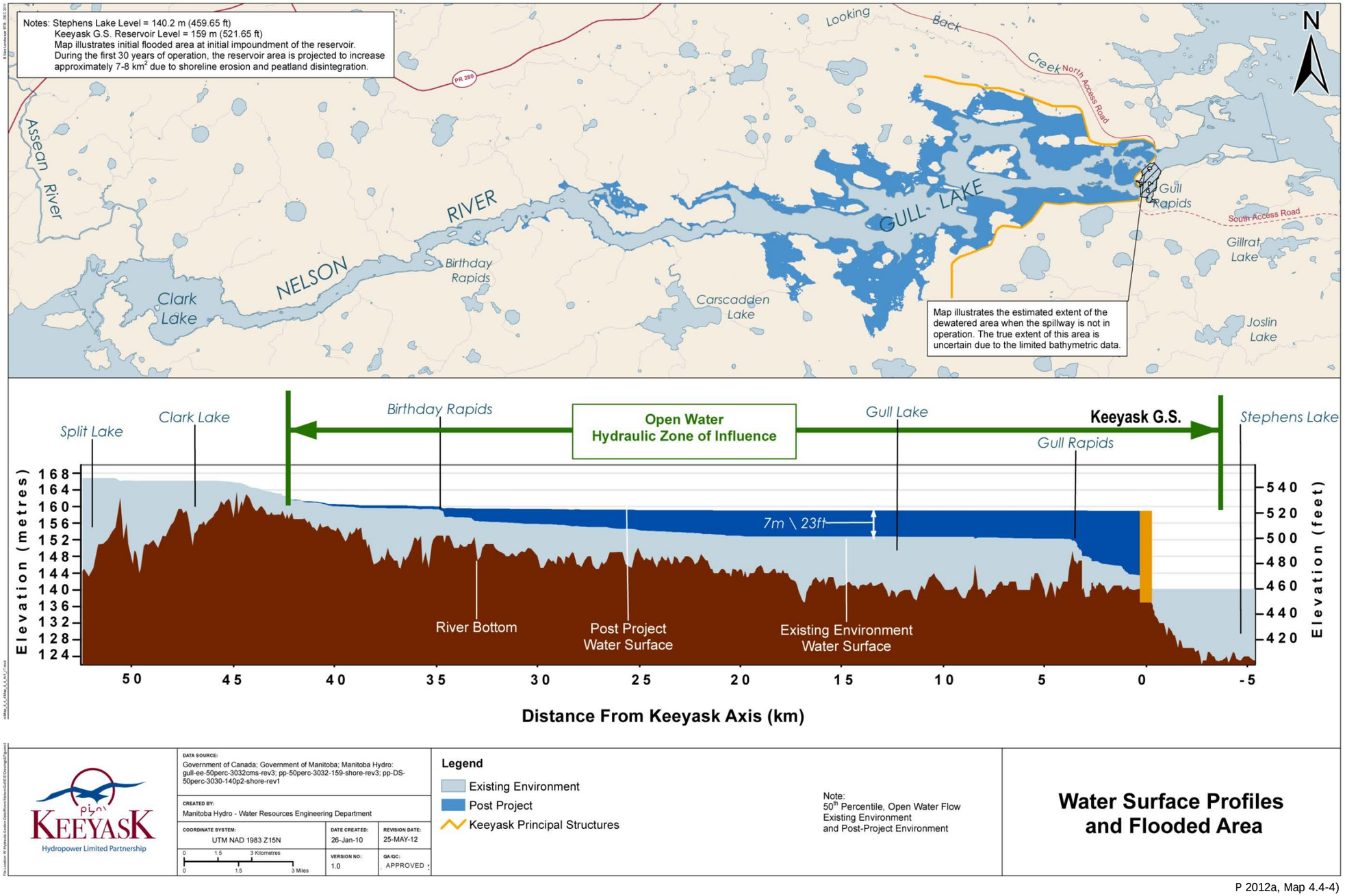
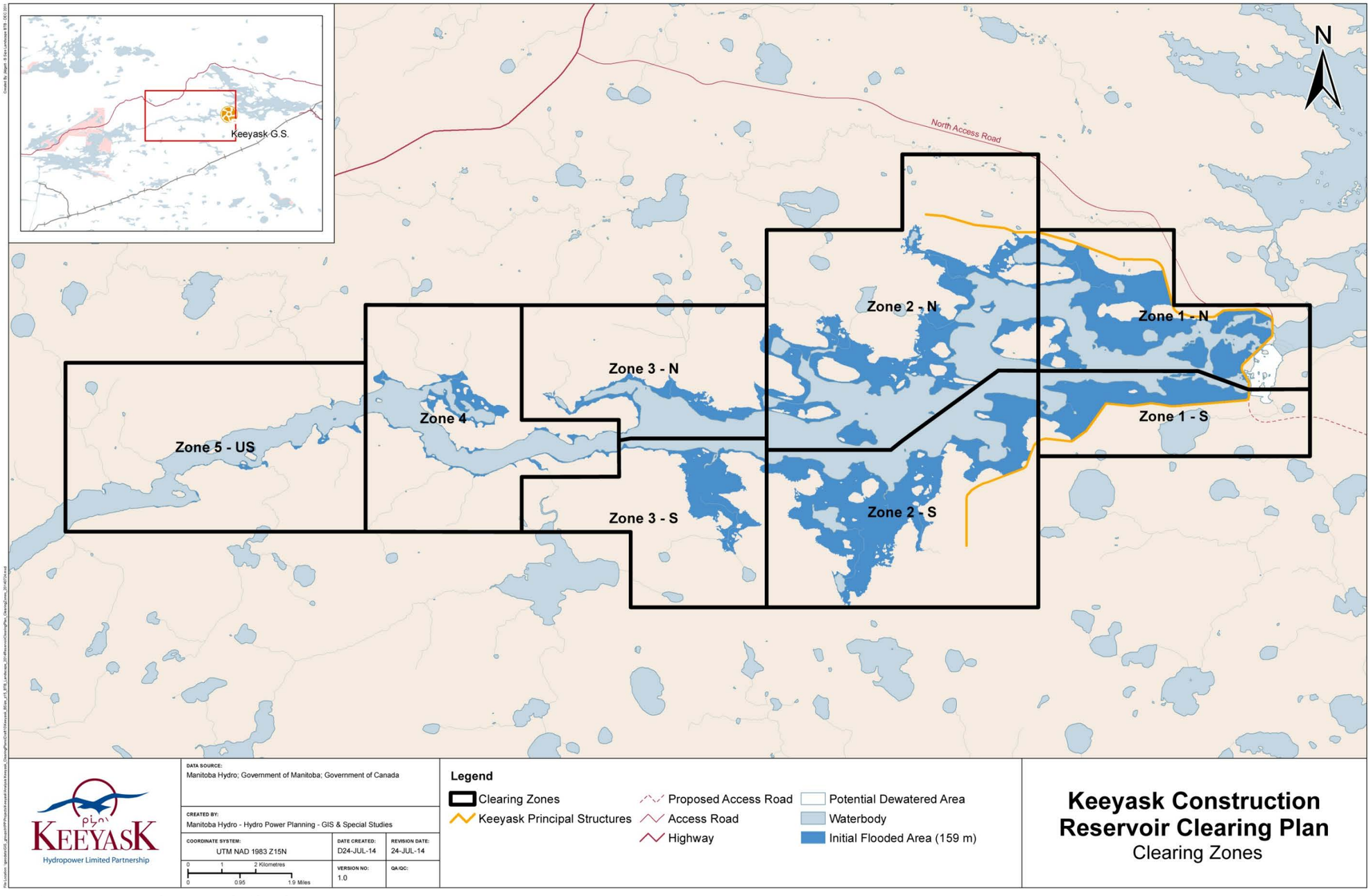
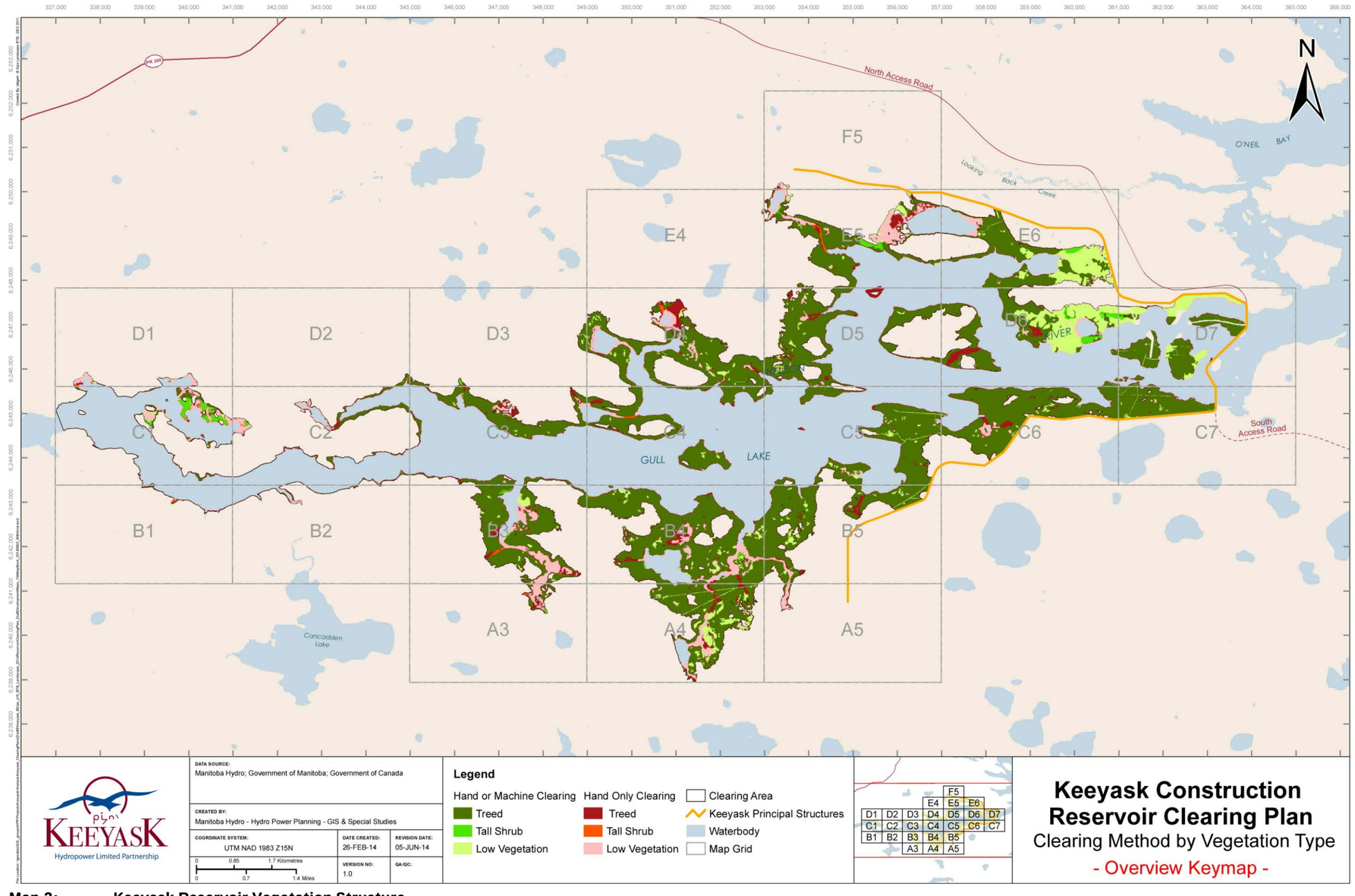


P 2012a, Map 4.4-4)

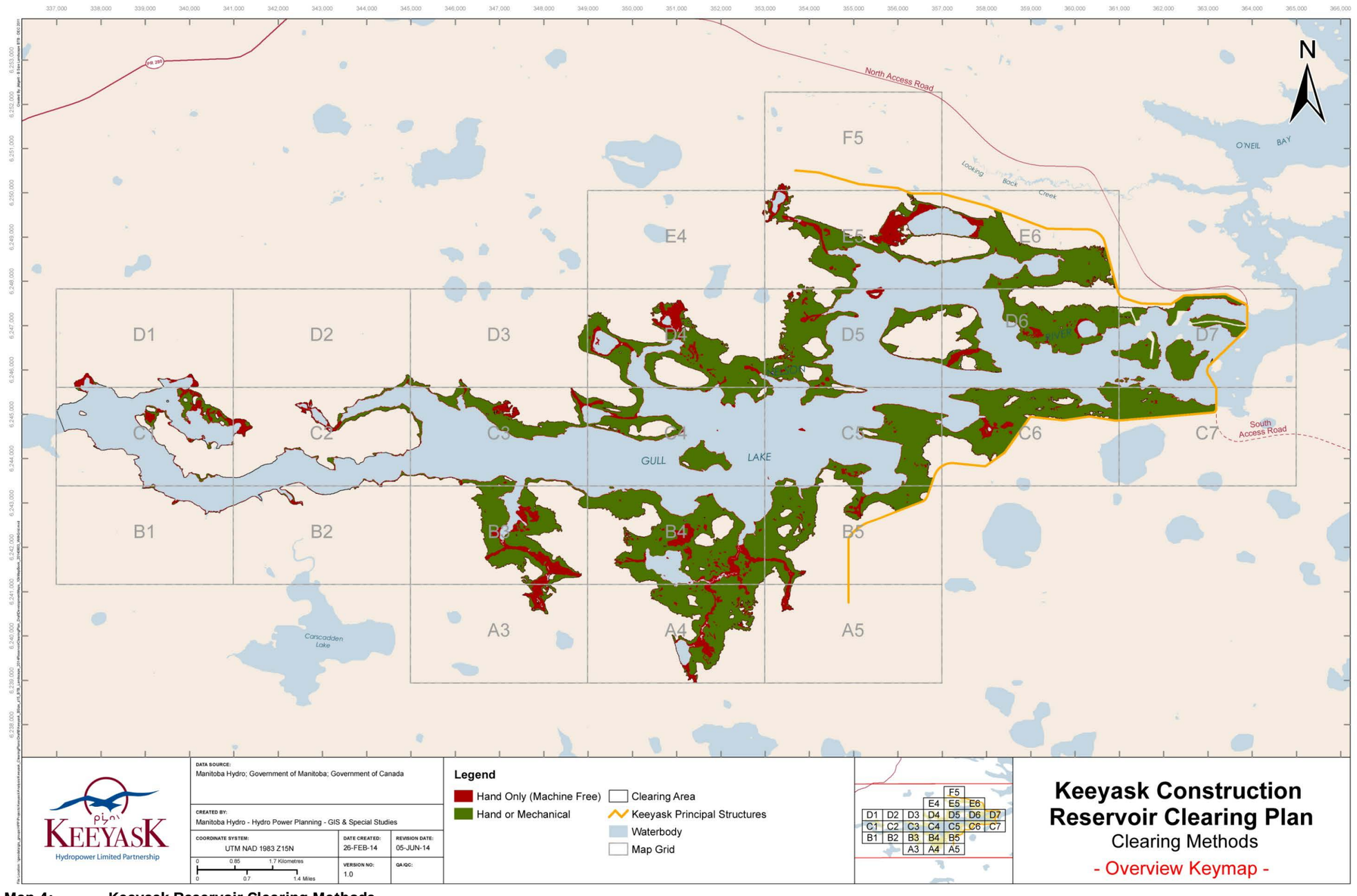
Map 1: Water Surface Profiles and Flooded Area



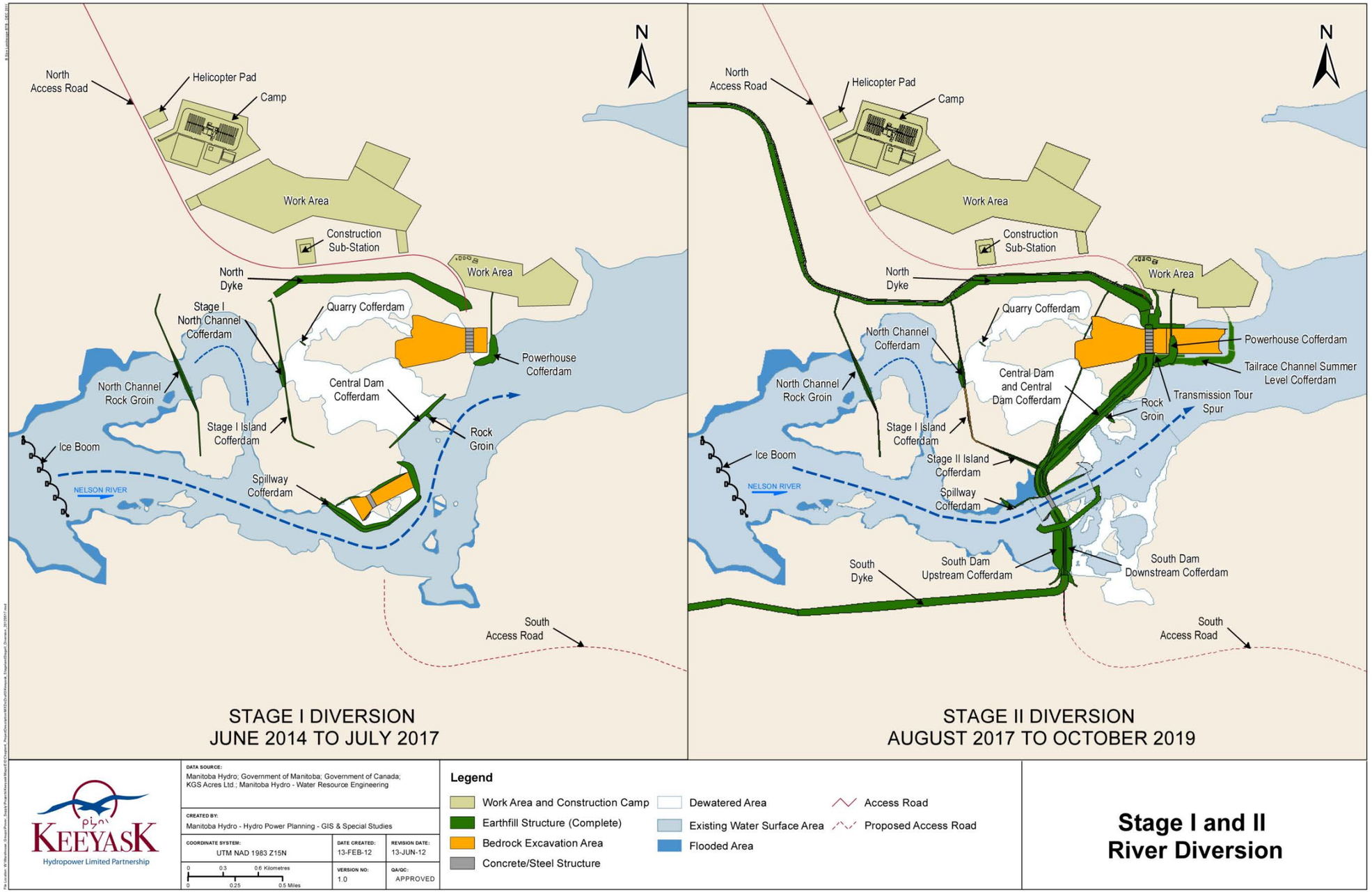
Map 2: Keeyask Reservoir Clearing Zones



Map 3: Keeyask Reservoir Vegetation Structure

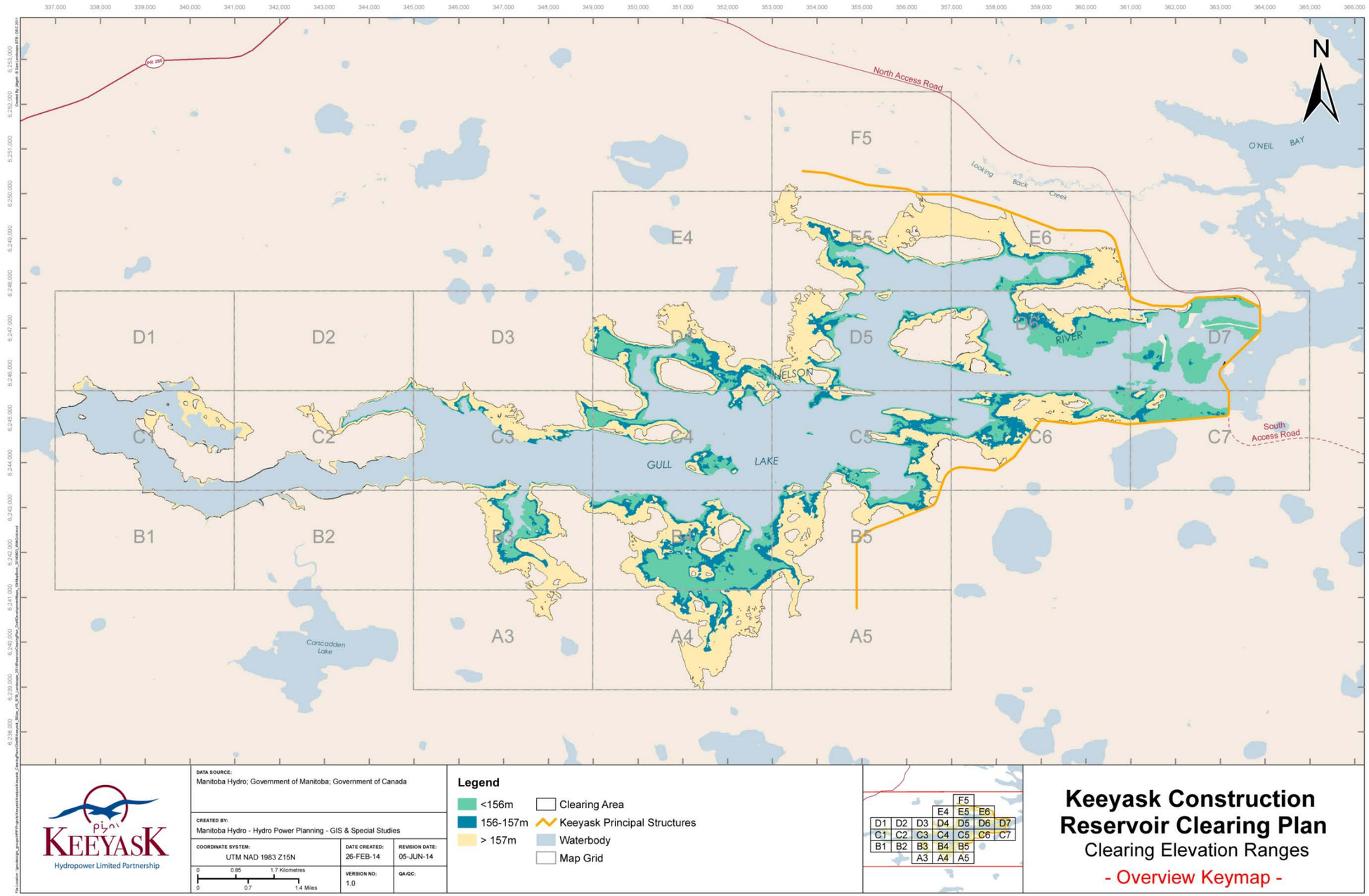


Map 4: Keeyask Reservoir Clearing Methods

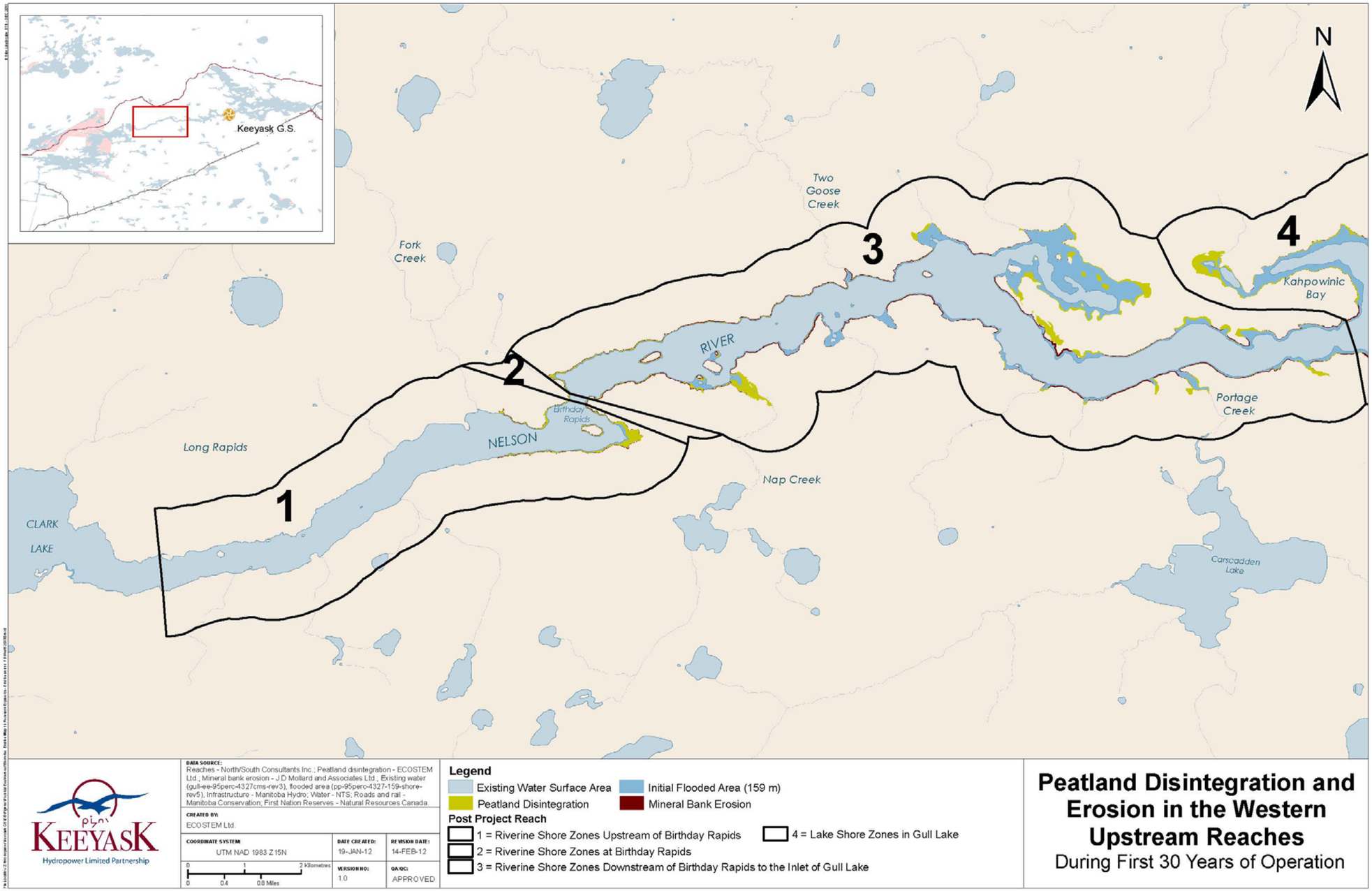


(Source: KHLP 2012a, Map 4.4-4)

Map 5: Stage I and II River Diversion

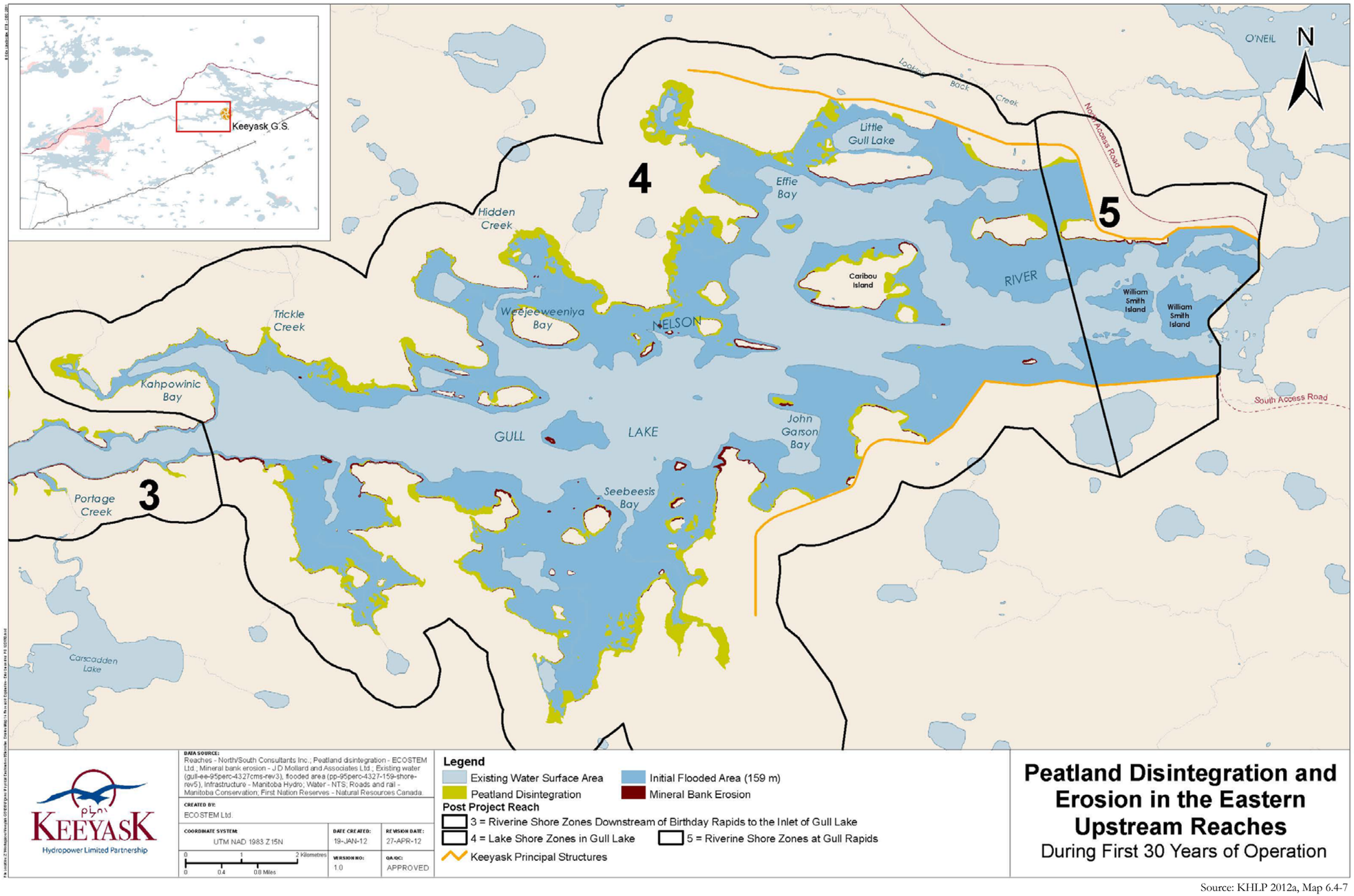


Map 6: Keeyask Reservoir Clearing Elevation Ranges



Source: KHLP 2012a, Map 6.4-6

Map 7: Predicted 30 Year Reservoir Expansion (Western upstream reaches)



Source: KHLP 2012a, Map 6.4-7

Map 8: Predicted 30 Year Reservoir Expansion (Eastern upstream reaches)

APPENDIX A

JKDA Schedule 11-1

Keeyask Hydropower Limited Partnership

Reservoir Clearing Plan

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SCHEDULE 11-1

KEEYASK HYDROPOWER LIMITED PARTNERSHIP

RESERVOIR CLEARING PLAN

This Reservoir Clearing Plan reflects current conditions in the area of the Keeyask Project. Conditions can change quickly, as has been evidenced by numerous forest fires over the last decade, affecting the northeast part of the reservoir area, Caribou Island and most of the south of the Keeyask Project.

This Reservoir Clearing Plan is subject to the provisions of any license issued by a Regulatory Authority affecting the Keeyask Project, including the Closing Licenses, and will be modified, as necessary, in order to comply with the terms of any such license.

1. OBJECTIVES

The objectives of the Reservoir Clearing Plan for the Keeyask Project are as follows:

(a) minimize impacts of reservoir creation and operation on the fishery by minimizing the effects of standing trees and shrubs on fishing in selected areas within the reservoir;

(b) minimize the impacts of reservoir creation and operation on human access to shore locations by creating shore access locations through selective clearing of trees and shrubs;

(c) minimize hazards to boating safety and fishing resulting from large floating debris by minimizing the source of such debris; and

(d) minimize aesthetically offensive landscapes.

2. RESERVOIR CLEARING

The clearing of vegetation from the reservoir area is divided into two phases:

(a) pre-flooding, which affects the area within the 159 metres (521.7 feet) ASL flood elevation at the dam; and

(b) post-flooding, which includes areas that may be affected by erosion or peat land disintegration after the reservoir has been filled with water.

These two phases are discussed in greater detail and are accompanied by separate Figures 1 and 2, attached.

2.1 Pre-Flooding

Clearing of the reservoir area prior to flooding will address many of the goals for safety and environmental sustainability. Recommended clearing methods and associated activities include areas for hand clearing, areas where hand or machine clearing are suitable, and the creation of access and safe landing sites along the reservoir shoreline. Consideration is given to both wood salvage and environmentally sensitive areas that may require specific treatment during clearing operations. Flagging of clearing boundaries and on-site supervision are critical to the successful implementation of all aspects of the reservoir clearing plan (Figure 1).

2.1.1 Areas to be Cleared

The surface elevation of the reservoir up to at least 159 metres (521.7 feet) ASL, and some level above as a buffer, will be surveyed and staked to define the extent of area to be cleared. This area is shown on Figure 1.

2.1.2 What is to be Cleared

All standing woody material, which includes dead and living trees and shrubs 1.5 metres (5 feet) tall or taller, as well as all fallen trees 1.5 metres (5 feet) or more in length with a diameter of 15 centimeters (6 inches) or greater at its largest point will be cleared.

2.1.3 Timing of Clearing Activities

Reservoir clearing will be undertaken in the three (3) years preceding reservoir impoundment, except for areas that will be underwater as a result of coffer dam construction. These areas will be cleared prior to the flooding caused by these works.

2.1.4 Methods of Clearing

2.1.4.1 Mechanical Clearing

The preferred method of clearing is mechanical clearing by shear blading during the winter when the ground is frozen. Using this method, the cleared material is deposited in windrows or piles and left to dry. Cleared material is burned during the following winter season.

Machine clearing has the advantage of shearing stumps off at ground level, along with all other vegetation that is there. It also accumulates all of the loose and dead woody debris that is on the forest floor, along with hummocks of sphagnum moss, making for a very efficient and effective operation. Maximizing machine clearing will minimize the amount of woody and organic debris that would remain on site and enter the water following flooding.

All areas designated for mechanical clearing on Figure 1 will be cleared using this method, with the following exceptions:

(a) cultural or heritage sites known or discovered to exist within the areas identified for mechanical clearing will receive special treatment, as appropriate, as determined on a case by case basis;

(b) selected mainland locations as may be designated by the Project Manager, where practical, for tree salvage (for use as firewood, saw-logs, cabins, etc.) will be hand cleared; and

(c) selected locations as may be identified by the Project Manager, where tree and shrub density is sufficient to reduce wave energy, may not be cleared, leaving trees and shrubs standing in shallow water to provide protection to the shoreline from wave energy, thereby reducing erosion rates and providing a more stable shoreline for the new growth of riparian shrubs and trees.

2.1.4.2 Hand Clearing

The areas requiring hand clearing are approximately as shown on Figure 1. Clearing will be done using chain saws and brush cutters and other tools as may be appropriate in the circumstances.

Generally, hand clearing will take place at locations within 10 metres (33 feet) of the existing normal high water mark on the Nelson River and within 5 metres (16 feet) of tributary stream banks, due to the higher potential for disturbance of sensitive sites in these areas (for example, riparian areas and heritage sites).

In addition, hand clearing methods will be used where it is not possible to operate mechanical clearing equipment because of site location (inaccessible islands) or condition (steep slopes).

Typically, areas cleared by hand will contain stumps of trees and shrubs approximately 6 inches (15 cm) in height. In addition, most of the smaller shrubs and forest floor debris (if covered by snow) will remain on site.

The final extent of each area to be cleared using hand clearing methods will be determined in the field and will be clearly marked, within one kilometre (0.6 miles) of the area to be cleared by hand, prior to mechanical clearing taking place.

2.1.5 Landing (Access) Sites

There will be an on-going need for user access to the reservoir area from land and access to land from the reservoir for reasons of resource harvesting, recreational enjoyment or emergency purposes. A number of landing sites will be identified along the future reservoir shorelines and these sites will be cleared pursuant to the Waterways Management Program. Clearing at these sites may consider the removal of stumps and peat, along with the above ground vegetation, to ensure safe access/egress to the shoreline. Hand clearing will be considered at landing sites above the high water mark to minimize environmental effects and maximize recreational, aesthetic and cultural opportunities.

2.1.6 Consideration of Environmental Sensitivities/Valuable Sites

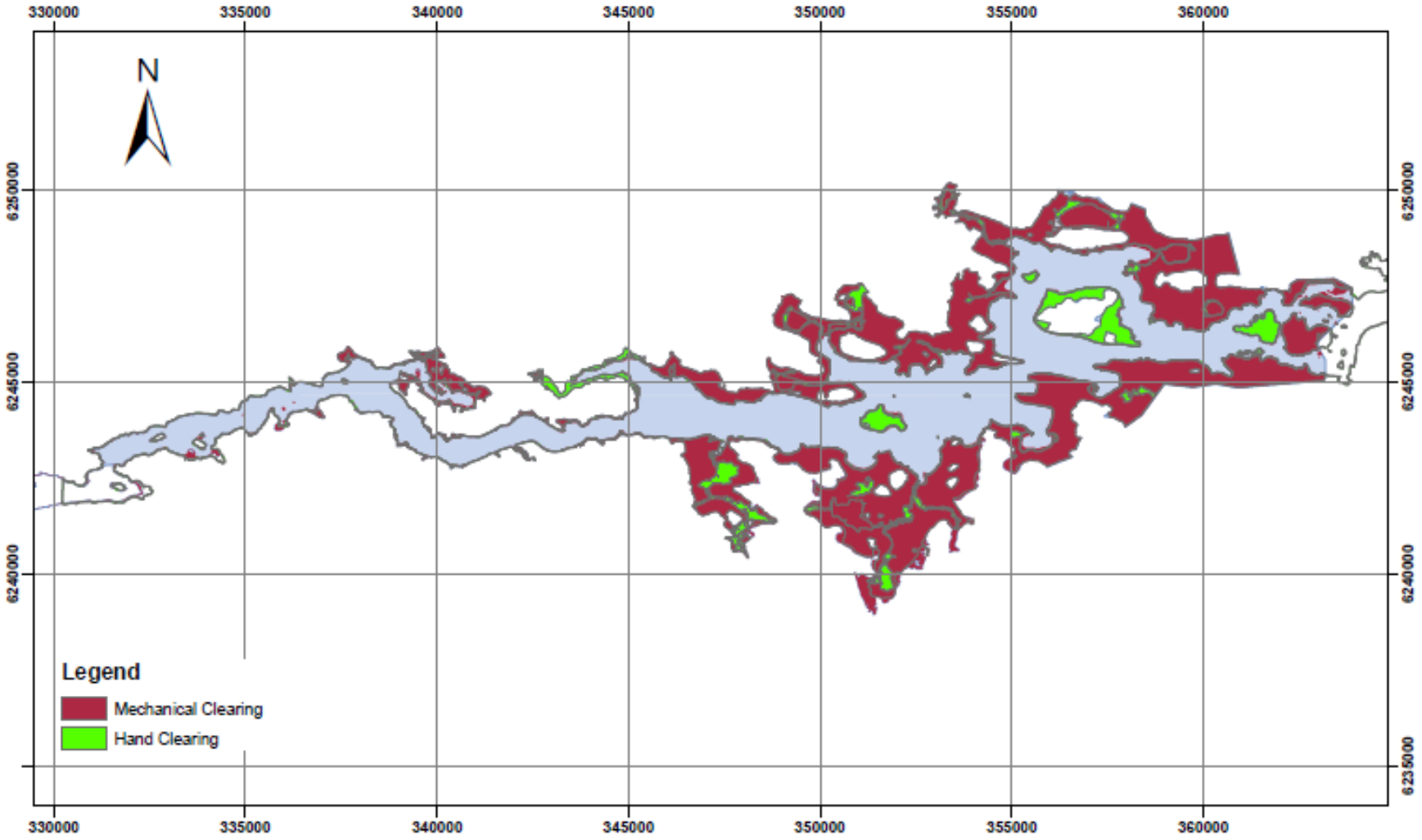
Information is still being collected and analyzed to identify very specific environmental sensitivities and environmentally valuable sites that may be managed to support the protection of the environment. It is anticipated that such sites will be relatively small in size, possibly experimental in nature and may require long-term study. Consideration of these issues will be undertaken in the environmental protection plan for the Keeyask Project.

2.2 Post-Flooding

Areas beyond the initial impoundment of 159 metres (521.7 feet) ASL are at risk of erosion and peat land disintegration after flooding (Figure 2). It is also anticipated that erosion and peat land disintegration will continue over a prolonged period of time after reservoir impoundment and if left unchecked has the potential to contribute substantial amounts of woody debris into the reservoir, thereby jeopardizing human safety and resulting in negative impacts to the Keeyask Cree Nations.

Areas that will convert from land to water over time as a result of peat land disintegration and shoreline erosion will be cleared on an ongoing basis through the implementation of the Waterways Management Program.

The objective of the debris prevention work set out in the Waterways Management Program is to prevent trees and other large woody debris from entering the water by removing them before they fall into the water dragging soil material with them.



RESERVOIR CLEARING PLAN
AREA TO BE CLEARED PRIOR TO FLOODING

Figure 1

JKDA Schedule 11-1

APPENDIX B

DETAILED RESERVOIR CLEARING MAPS

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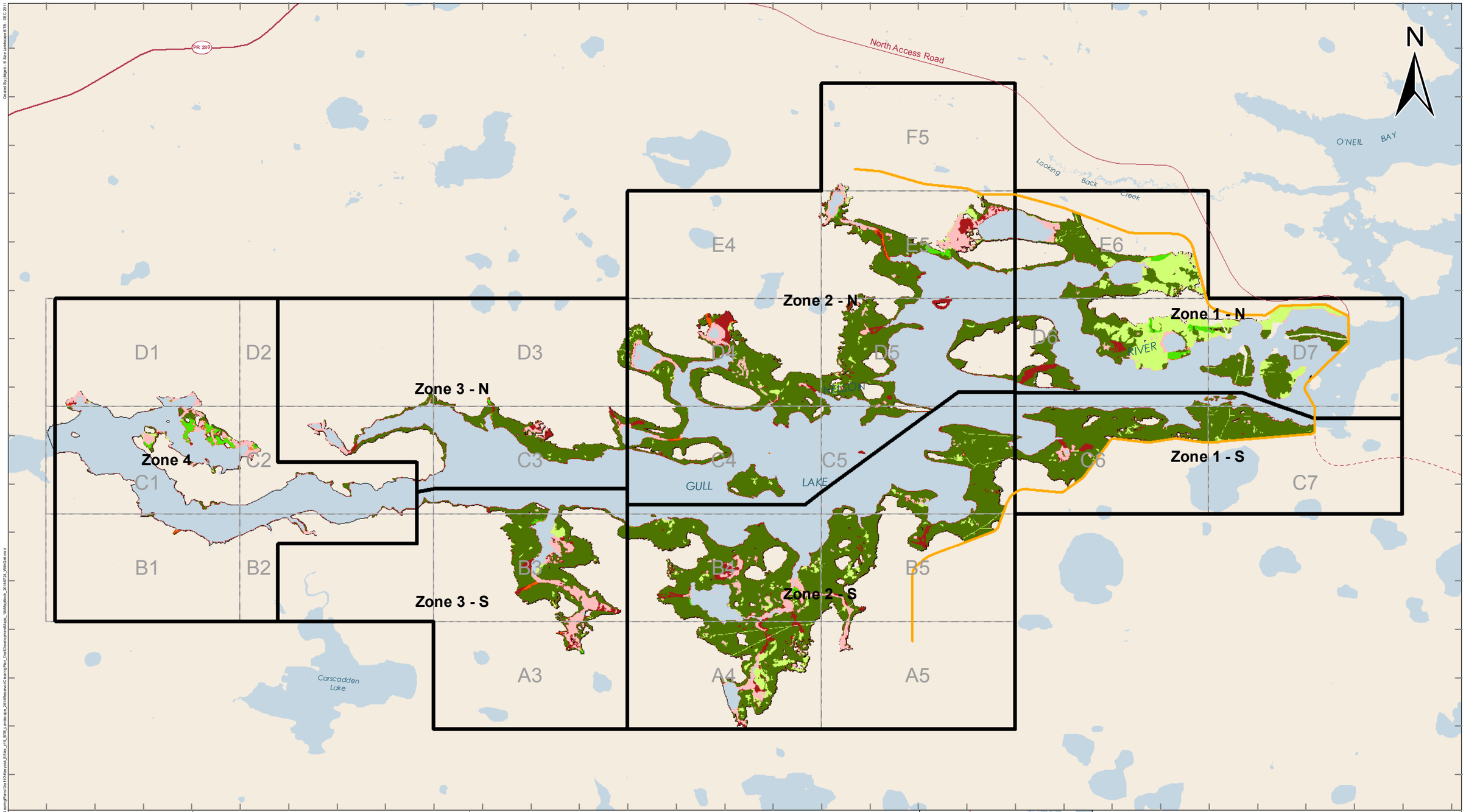


DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.85 1.7 Kilometres / 0 0.7 1.4 Miles	VERSION NO: 1.0	QA/QC:

Legend

Hand or Machine Clearing
- Treed
- Tall Shrub
- Low Vegetation

Hand Only Clearing
- Treed
- Tall Shrub
- Low Vegetation

- Clearing Zones
- Clearing Area
- Keeyask Principal Structures
- Waterbody
- Map Grid

			F5			
			E4	E5	E6	
D1	D2	D3	D4	D5	D6	D7
C1	C2	C3	C4	C5	C6	C7
B1	B2	B3	B4	B5		
		A3	A4	A5		

Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Overview Keymap -

345,000 346,000 347,000 348,000

6,241,000

6,240,000

6,239,000

N

Zone 3 - S

KEEYASK
Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

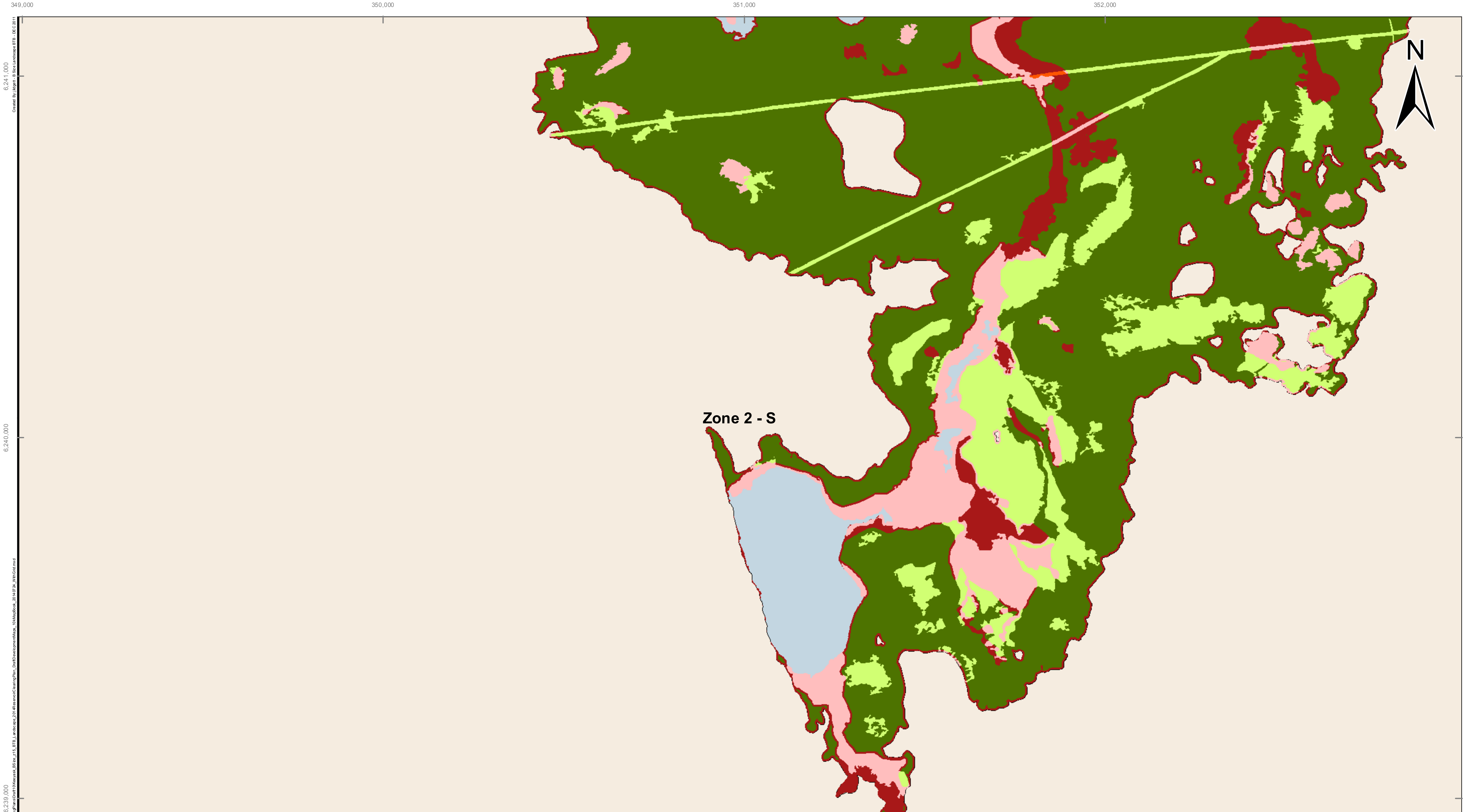
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

			F5			
			E4	E5	E6	
D1	D2	D3	D4	D5	D6	D7
C1	C2	C3	C4	C5	C6	C7
B1	B2	B3	B4	B5		
		A3	A4	A5		

Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map A3 -



DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM: UTM NAD 1983 Z15N

DATE CREATED: 26-FEB-14

REVISION DATE: 24-JUL-14

VERSION NO: 1.0

QA/QC:

0 0.1 0.2 Kilometres

0 0.095 0.19 Miles

KEEYASK Hydropower Limited Partnership

Legend

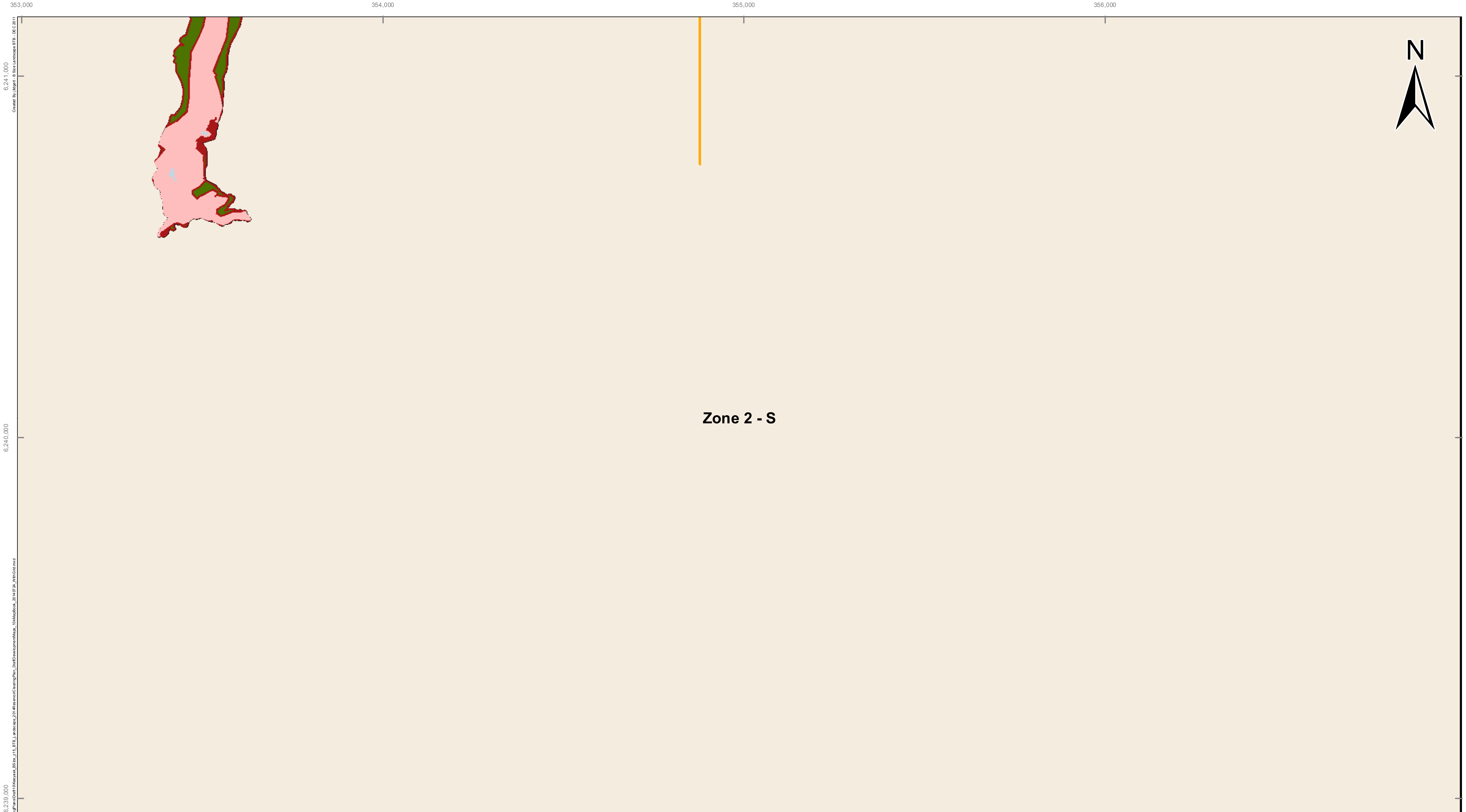
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

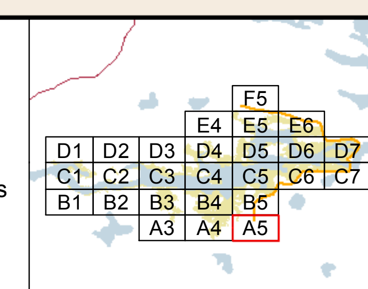
				F5		
			E4	E5	E6	
D1	D2	D3	D4	D5	D6	D7
C1	C2	C3	C4	C5	C6	C7
B1	B2	B3	B4	B5		
		A3	A4	A5		

Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map A4 -





Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map A5 -

Legend

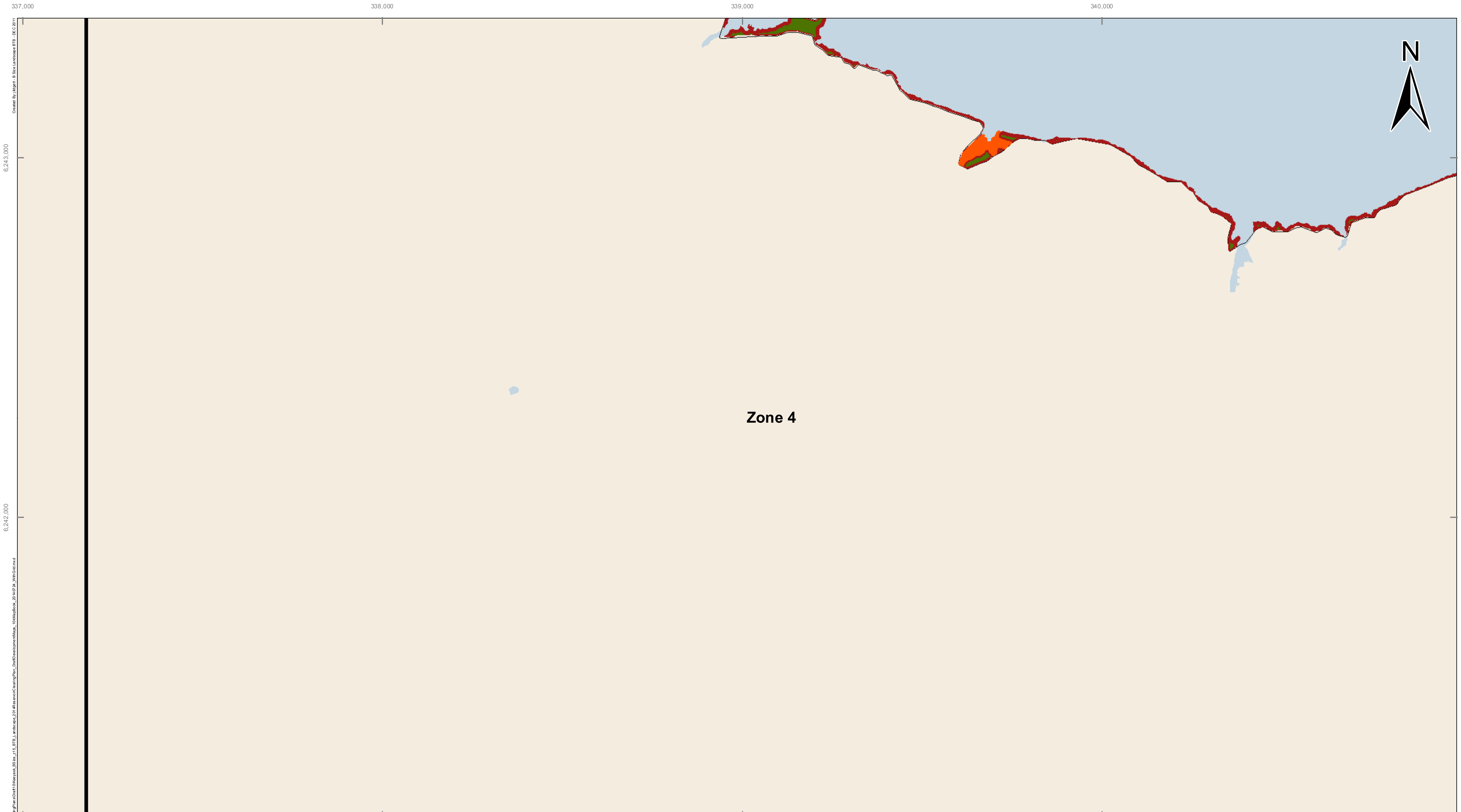
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

KEEYASK Hydropower Limited Partnership



Keeyask Hydropower Limited Partnership

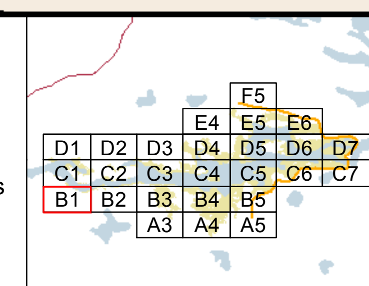
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 – 0.1 – 0.2 Kilometres; 0 – 0.095 – 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

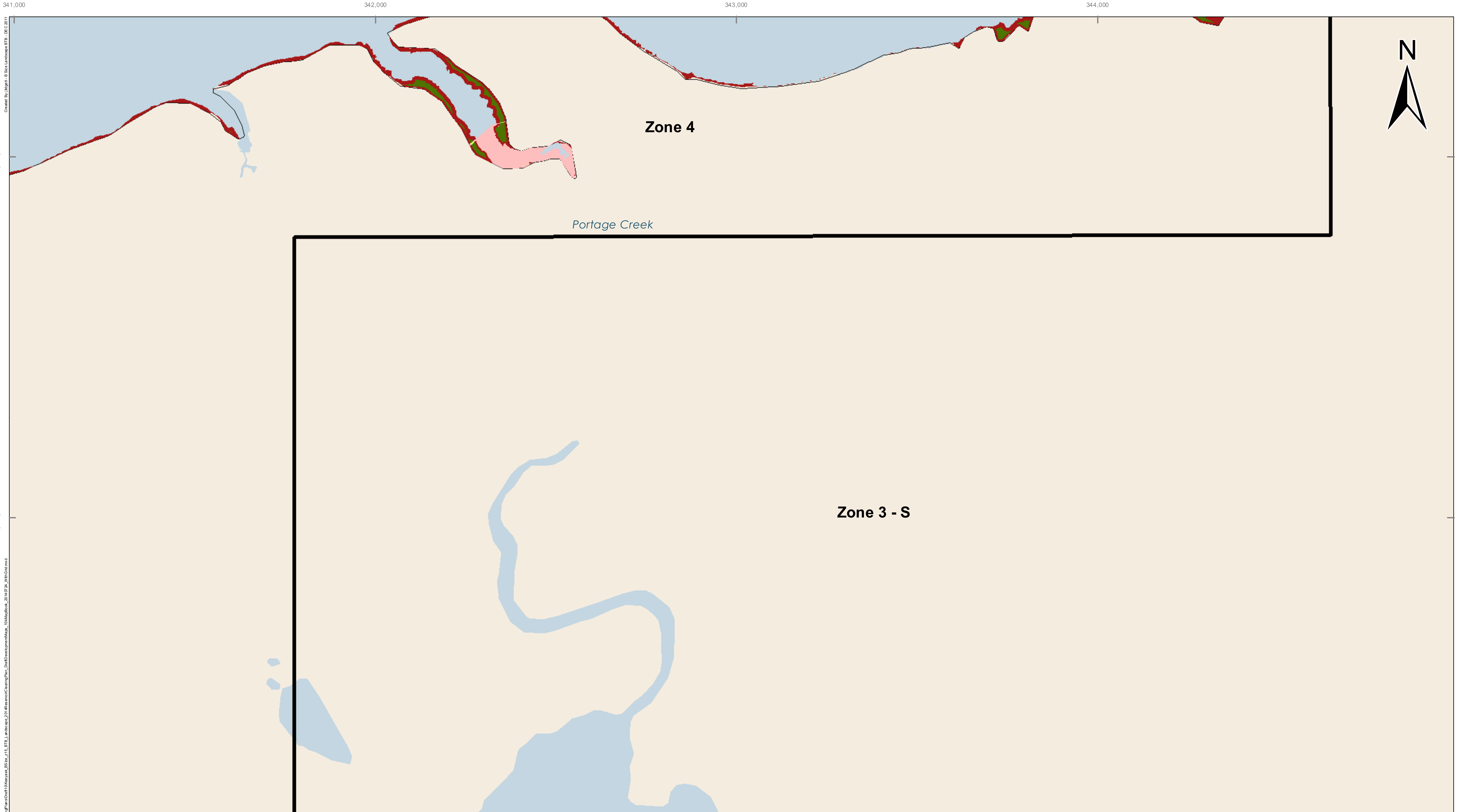
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map B1 -



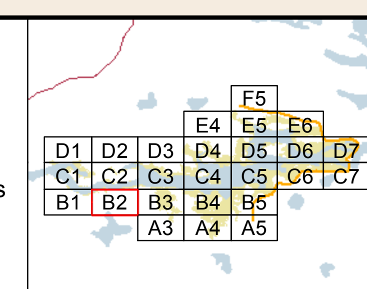
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

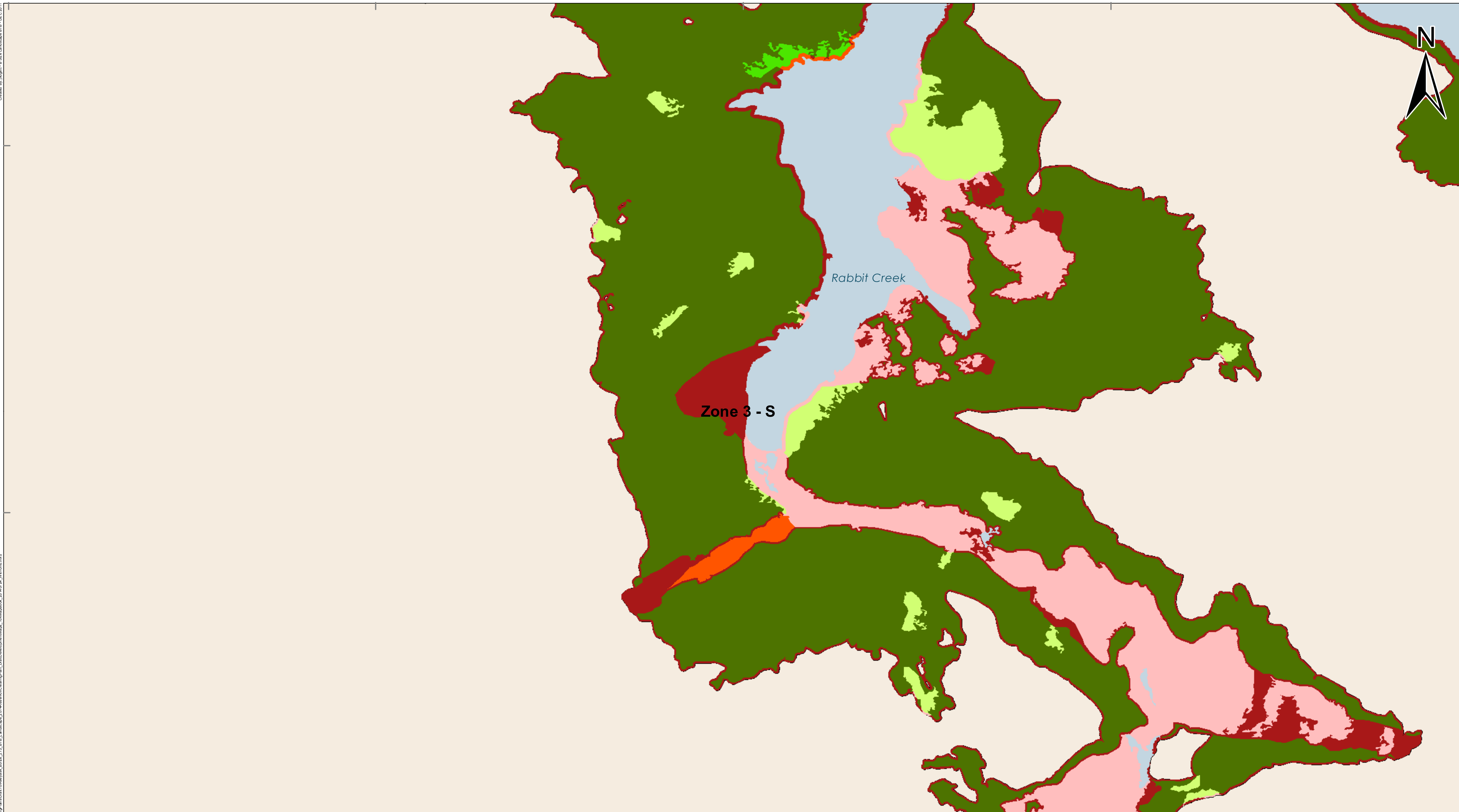
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map B2 -



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map B3 -

KEEYASK Hydropower Limited Partnership

DATA SOURCE: Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM: UTM NAD 1983 Z15N

DATE CREATED: 26-FEB-14

REVISION DATE: 24-JUL-14

VERSION NO: 1.0

QA/QC:

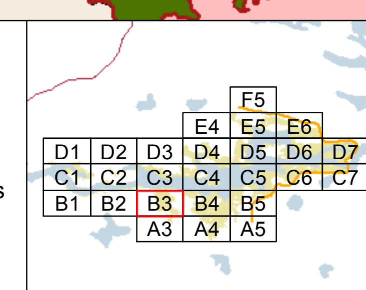
0 0.1 0.2 Kilometres
0 0.095 0.19 Miles

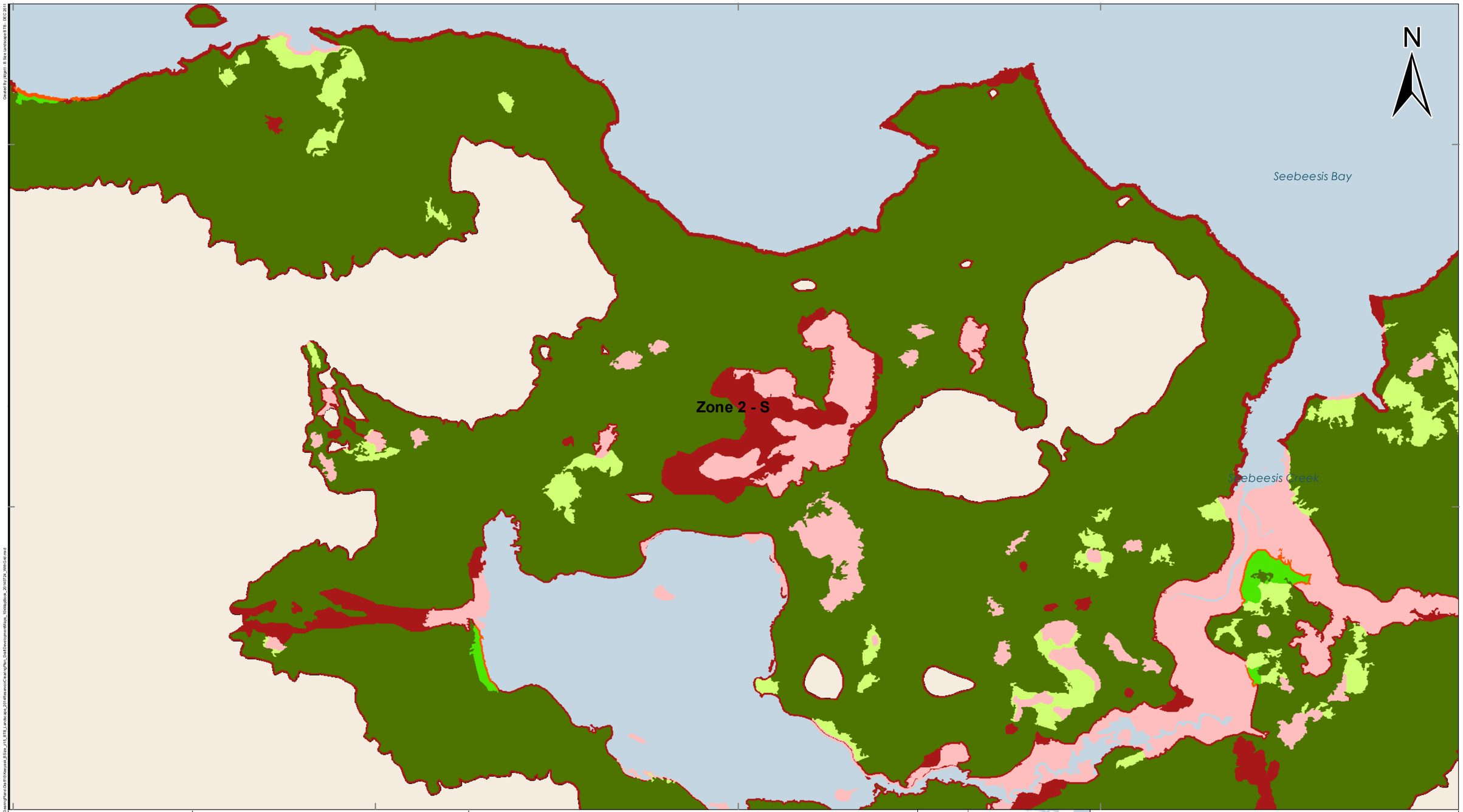
Legend

Hand or Machine Clearing
- Treed
- Tall Shrub
- Low Vegetation

Hand Only Clearing
- Treed
- Tall Shrub
- Low Vegetation

- Clearing Zones
- Clearing Area
- Keeyask Principal Structures
- Waterbody





KEEYASK
Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

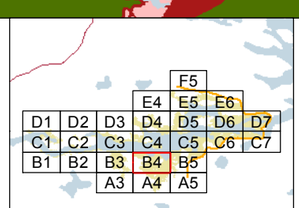
COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

Hand or Machine Clearing
- Treed
- Tall Shrub
- Low Vegetation

Hand Only Clearing
- Treed
- Tall Shrub
- Low Vegetation

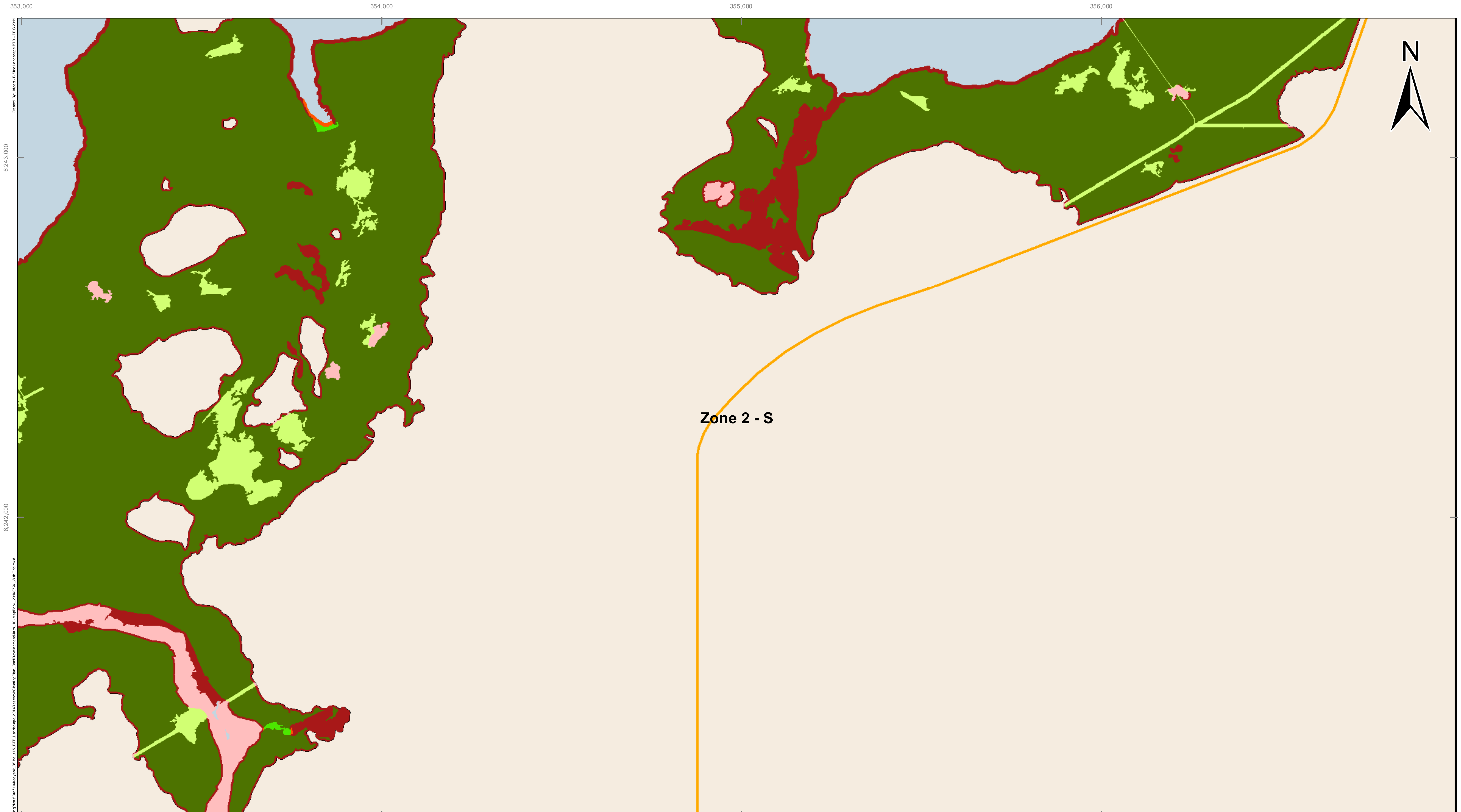
- Clearing Zones
- Clearing Area
- Keeyask Principal Structures
- Waterbody

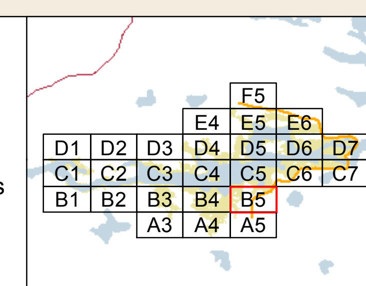


Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map B4 -





Keeyask Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

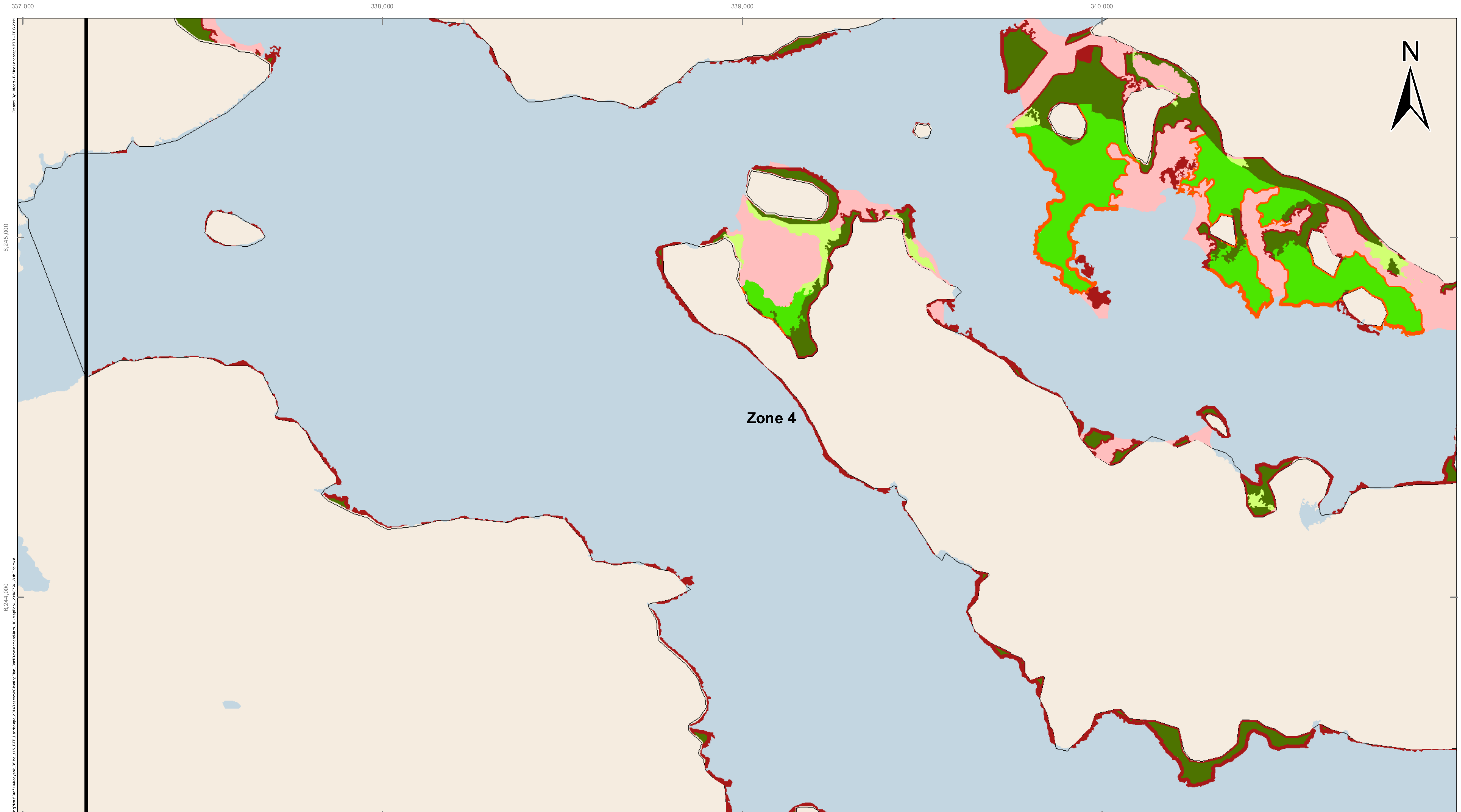
Legend

Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map B5 -



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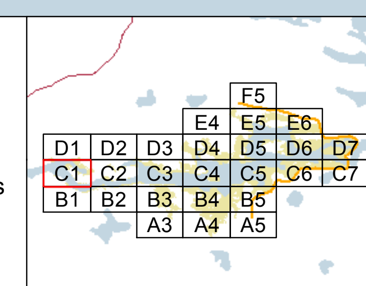
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

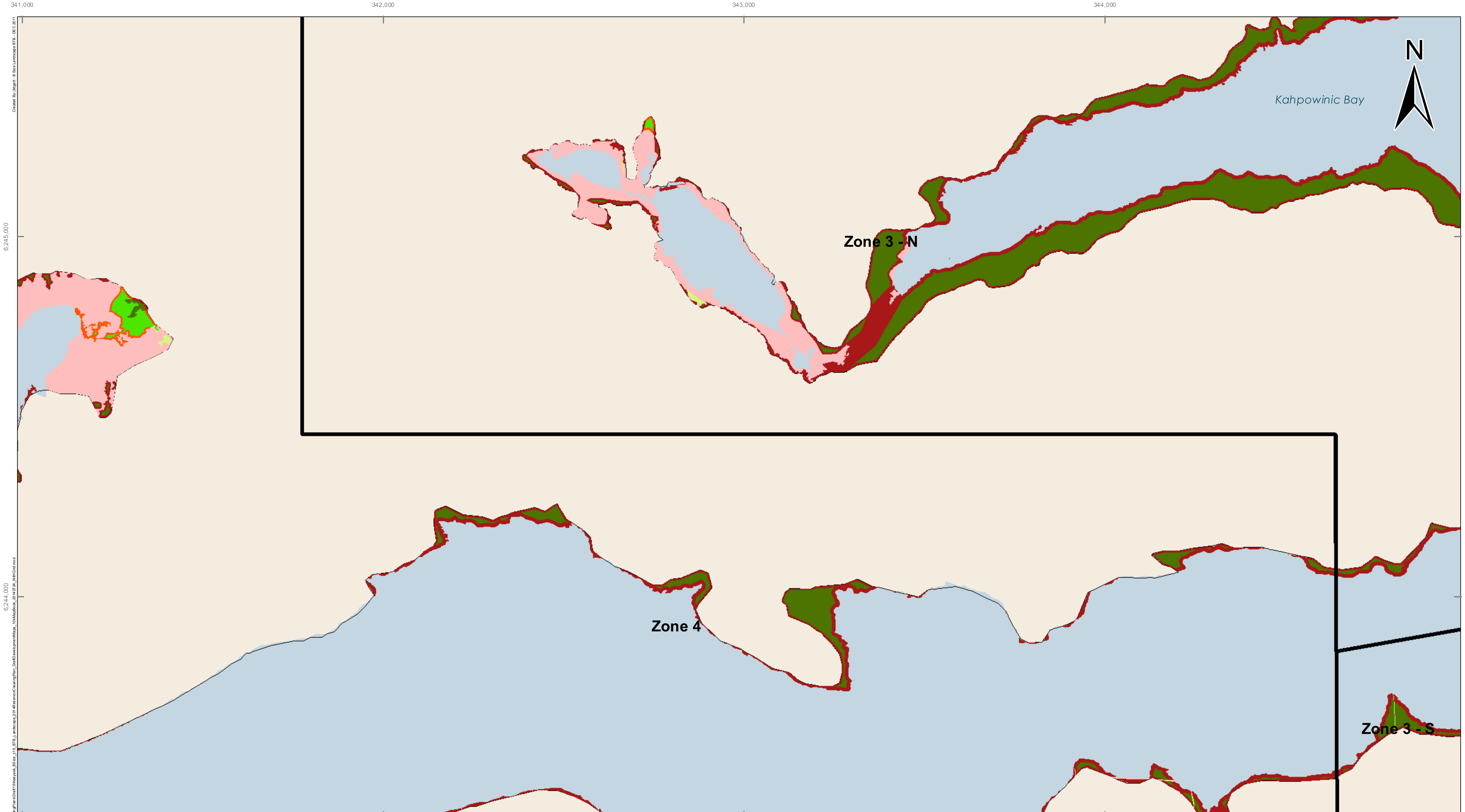
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map C1 -



DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
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0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

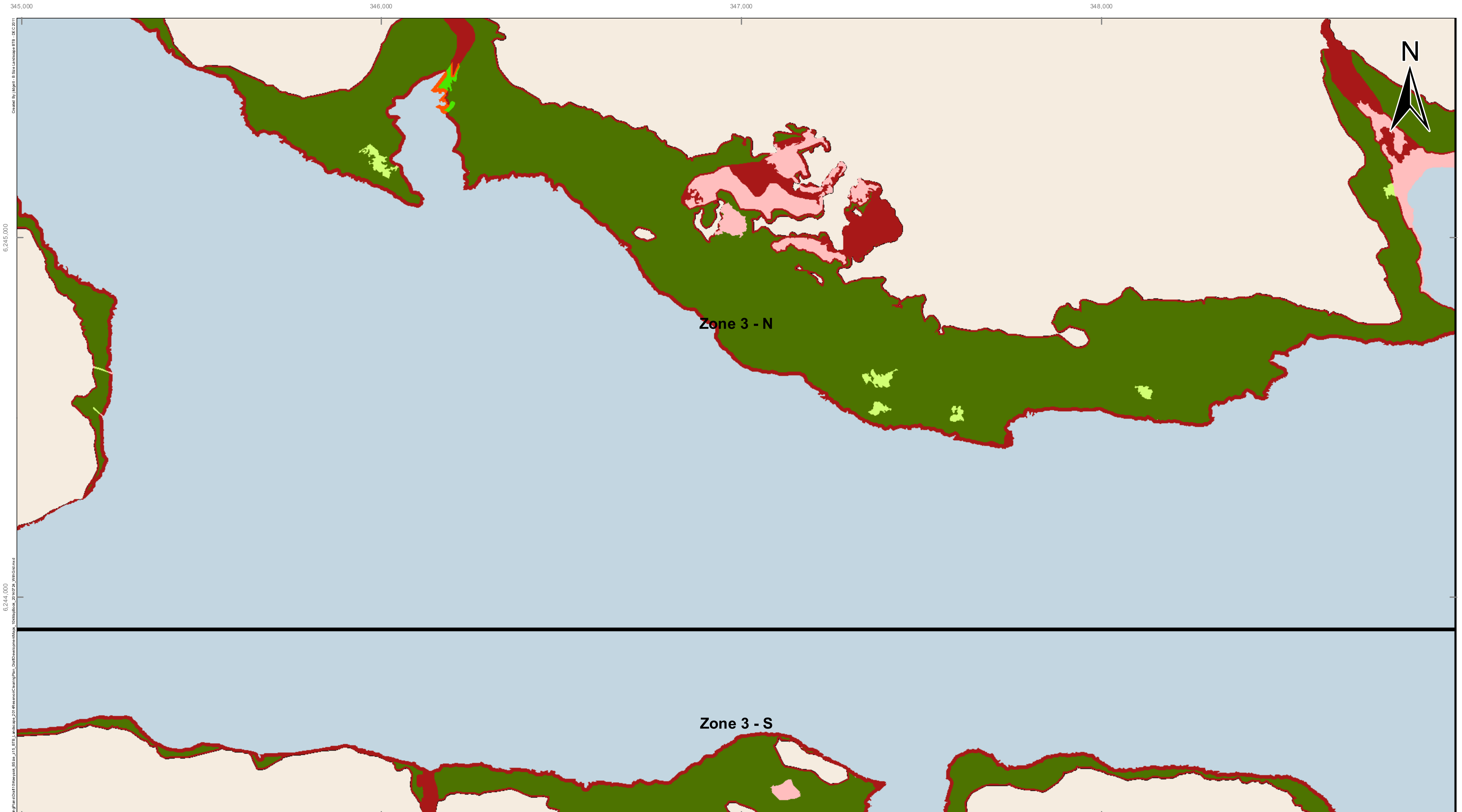
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

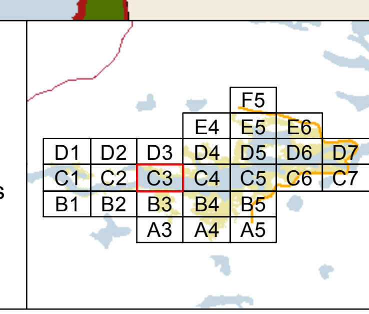
				F5		
			E4	E5	E6	
D1	D2	D3	D4	D5	D6	D7
C1	C2	C3	C4	C5	C6	C7
B1	B2	B3	B4	B5		
		A3	A4	A5		

Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map C2 -





Keeyask Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map C3 -

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

CREATED BY:
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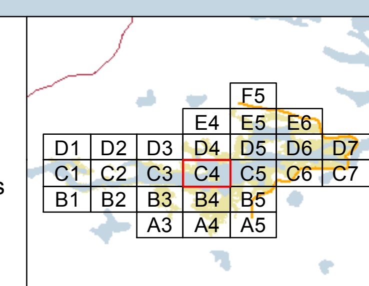
COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map C4 -

KEEYASK
Hydropower Limited Partnership

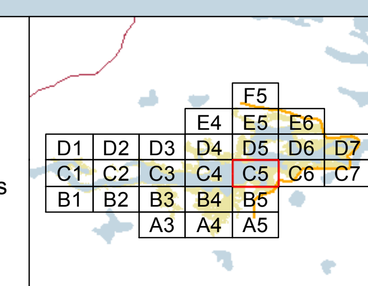
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 – 0.1 – 0.2 Kilometres; 0 – 0.095 – 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

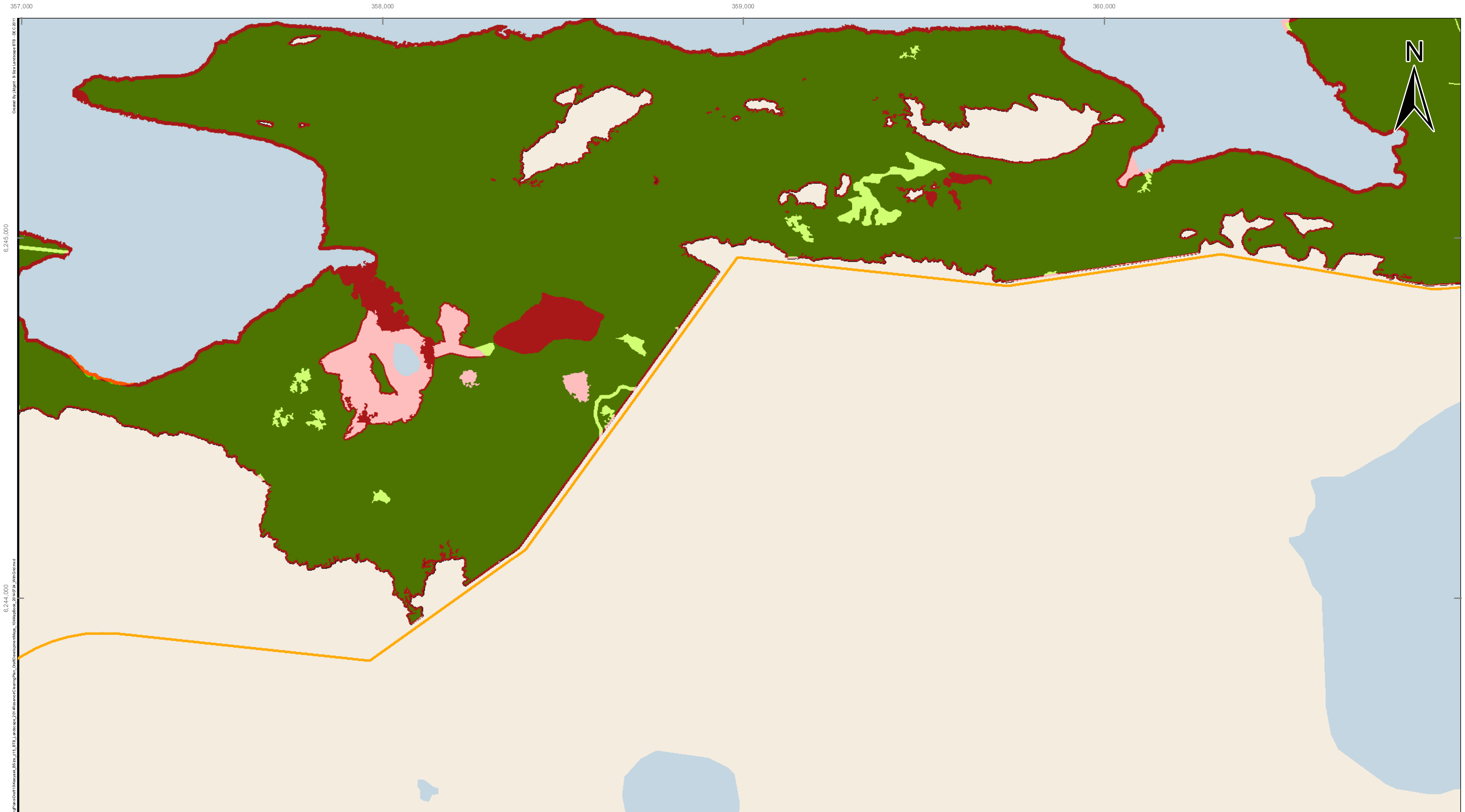
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map C5 -



DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

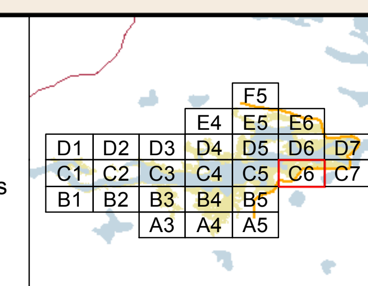
COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14

Scale: 0 – 0.1 – 0.2 Kilometres; 0 – 0.095 – 0.19 Miles

VERSION NO:	QA/QC:
1.0	

Legend

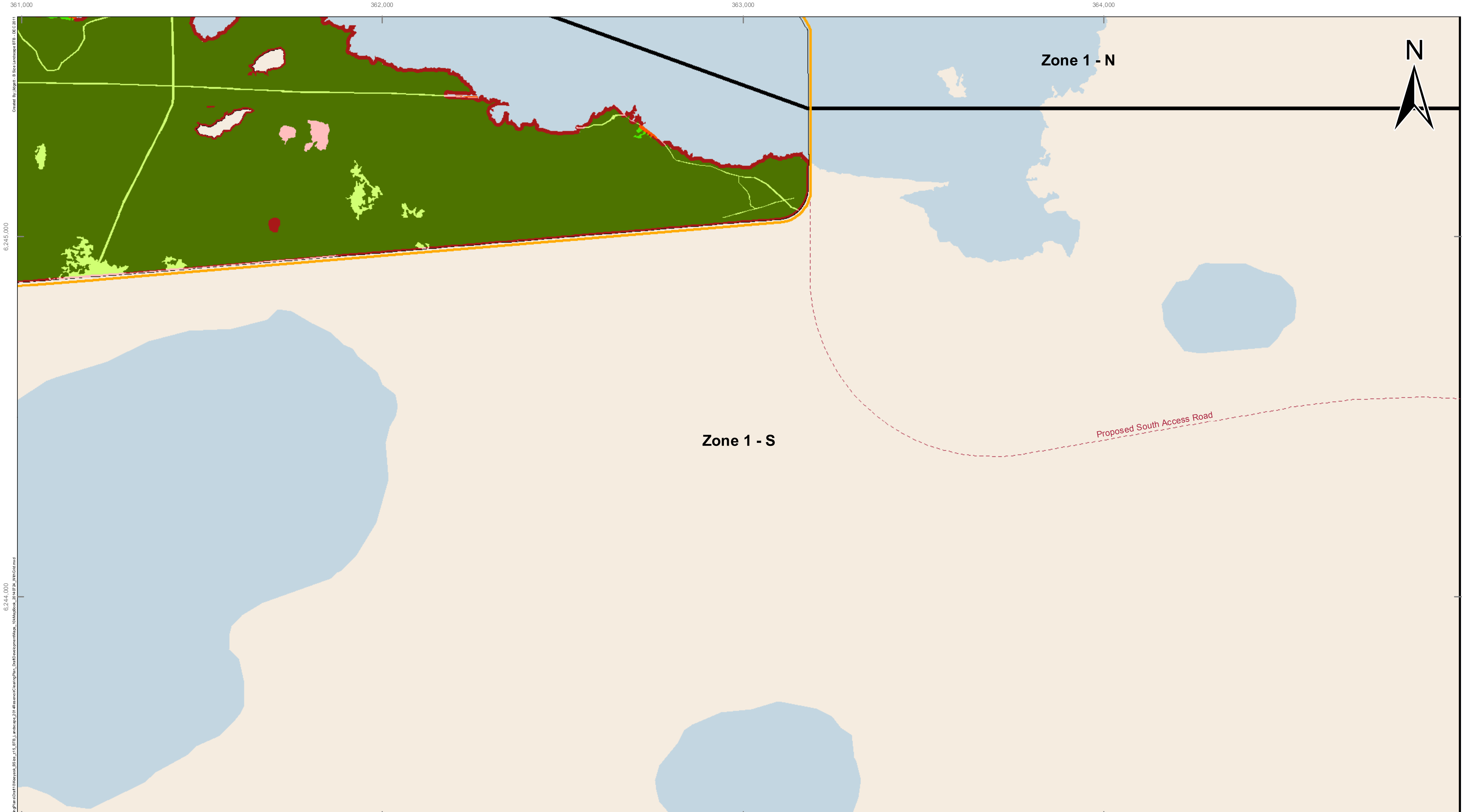
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map C6 -



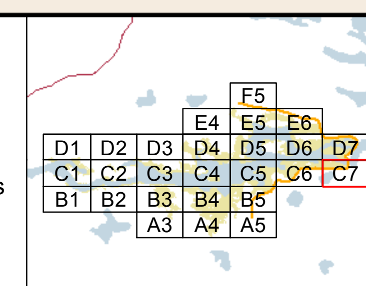
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

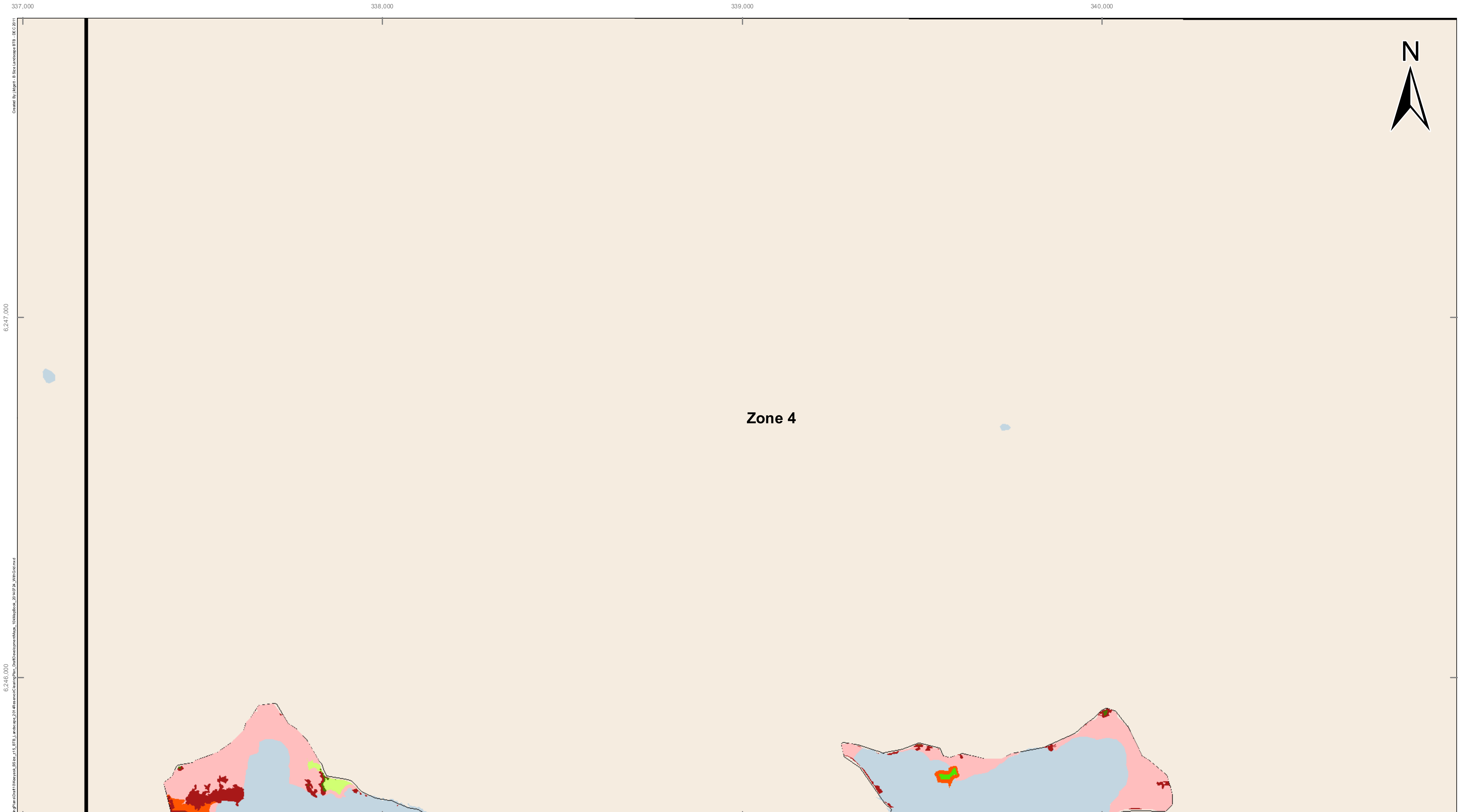
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map C7 -



KEEYASK
Hydropower Limited Partnership

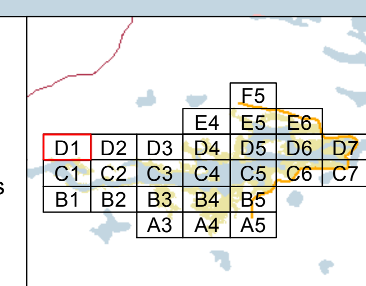
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

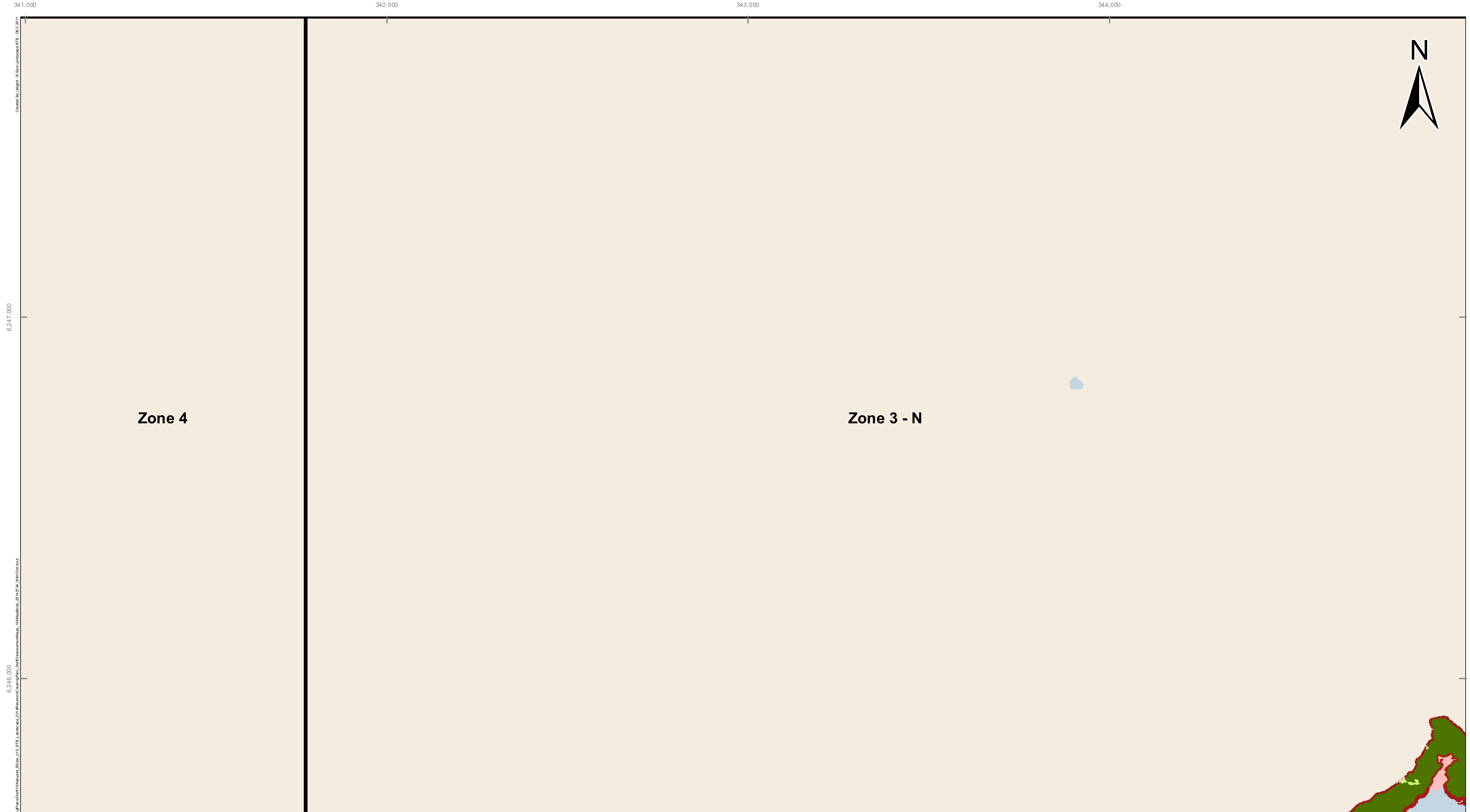
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map D1 -



Keeyask Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

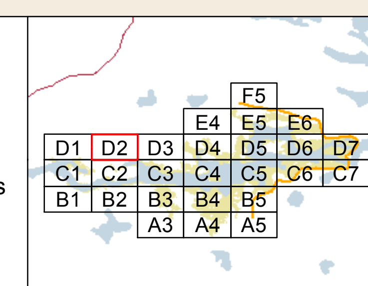
CREATED BY:
Manitoba Hydro - Hydro Power Planning - GIS & Special Studies

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14

Scale	VERSION NO:	QA/QC:
0 – 0.1 – 0.2 Kilometres; 0 – 0.095 – 0.19 Miles	1.0	

Legend

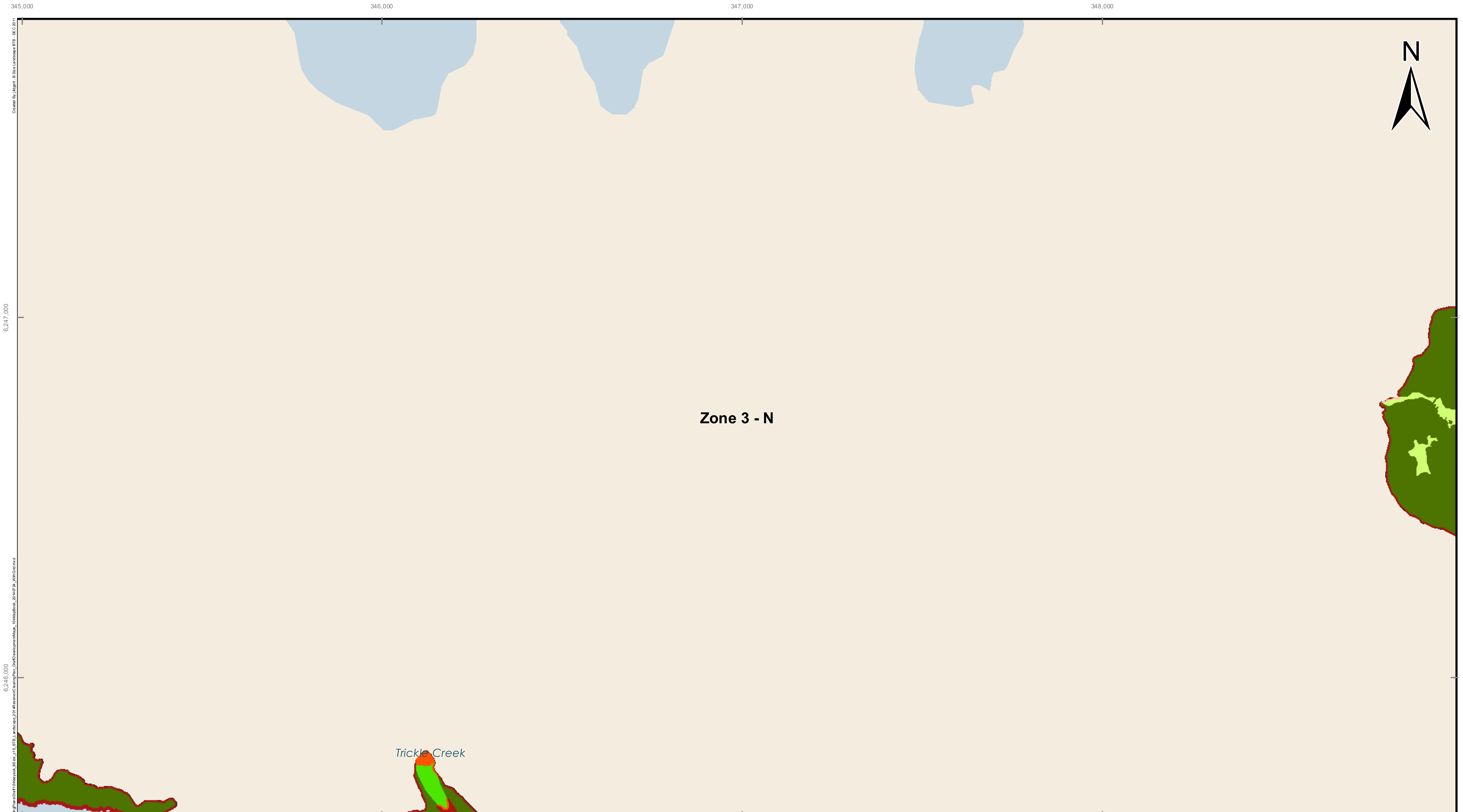
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

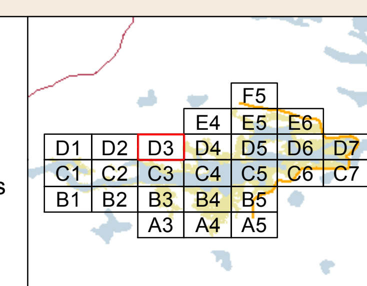


Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map D2 -





Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map D3 -

Legend

Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

KEEYASK Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Keeyask Hydropower Limited Partnership

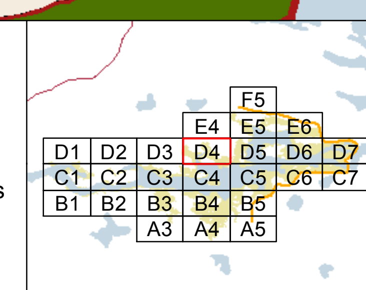
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map D4 -

Keeyask Hydropower Limited Partnership

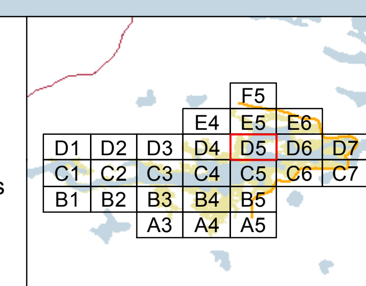
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 – 0.1 – 0.2 Kilometres; 0 – 0.095 – 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

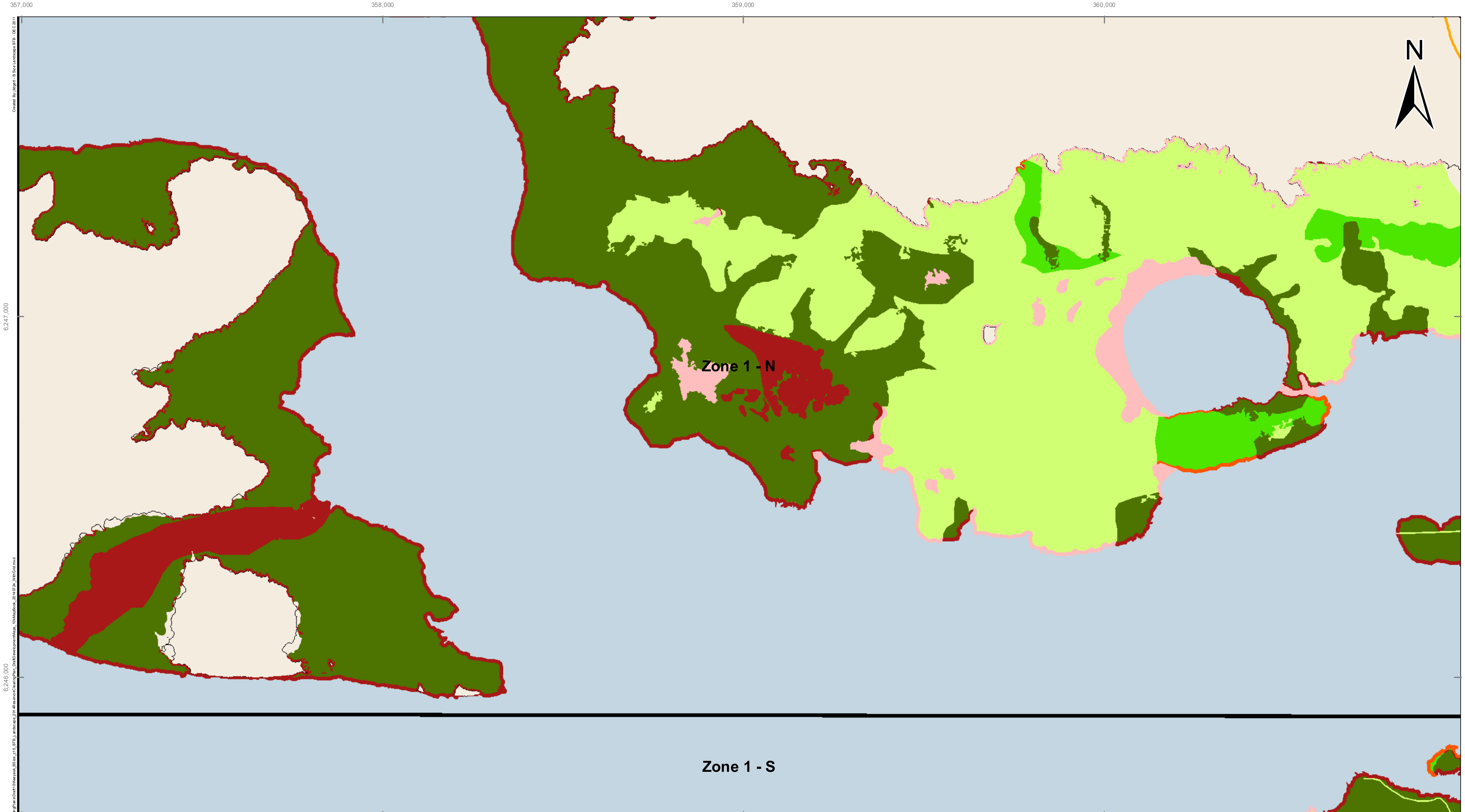
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

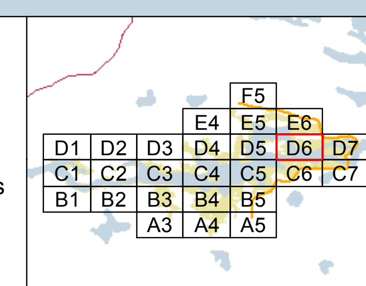


Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map D5 -





Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map D6 -

Keeyask Hydropower Limited Partnership

DATA SOURCE: Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM: UTM NAD 1983 Z15N

DATE CREATED: 26-FEB-14

REVISION DATE: 24-JUL-14

VERSION NO: 1.0

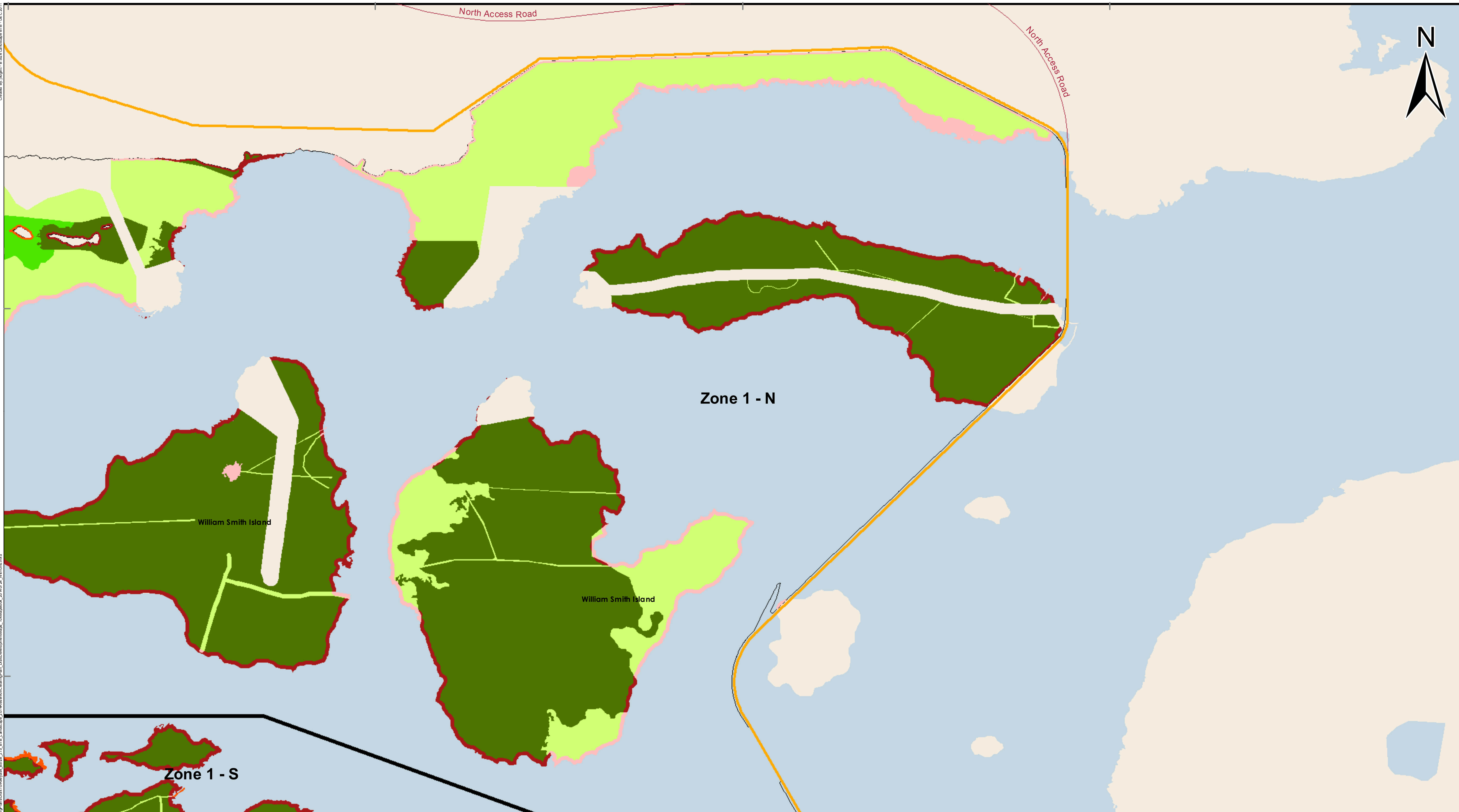
QA/QC:

0 0.1 0.2 Kilometres

0 0.095 0.19 Miles

Legend

Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



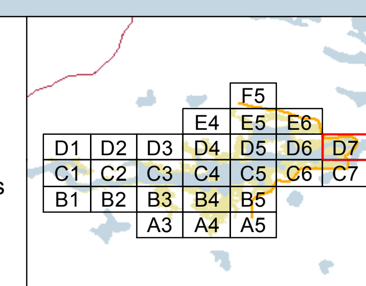
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody

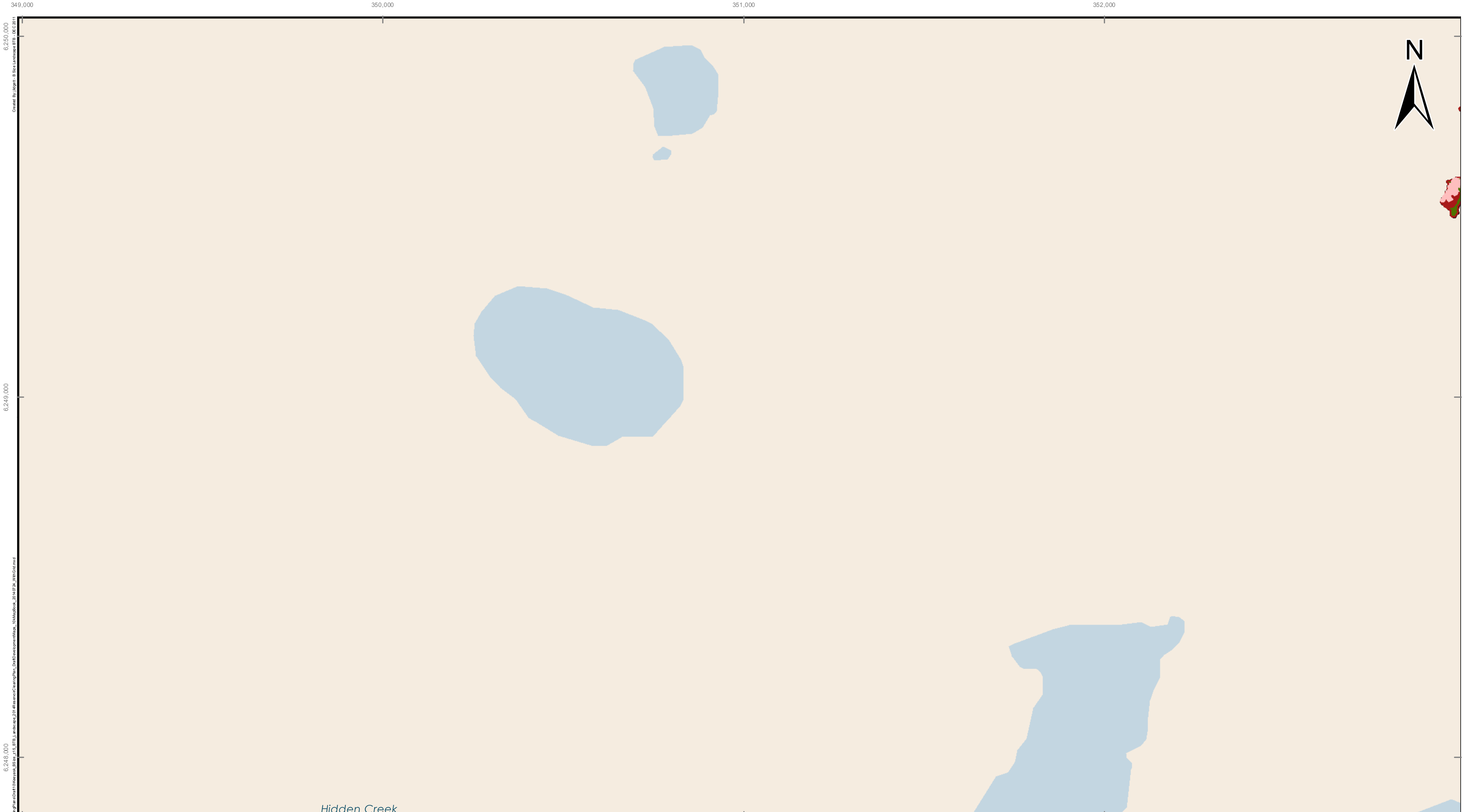


KEEYASK Hydropower Limited Partnership

Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map D7 -



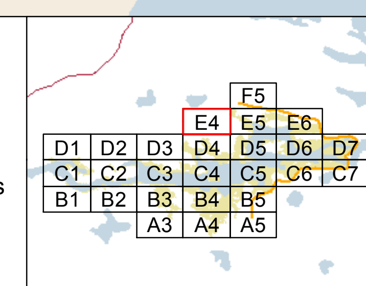
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

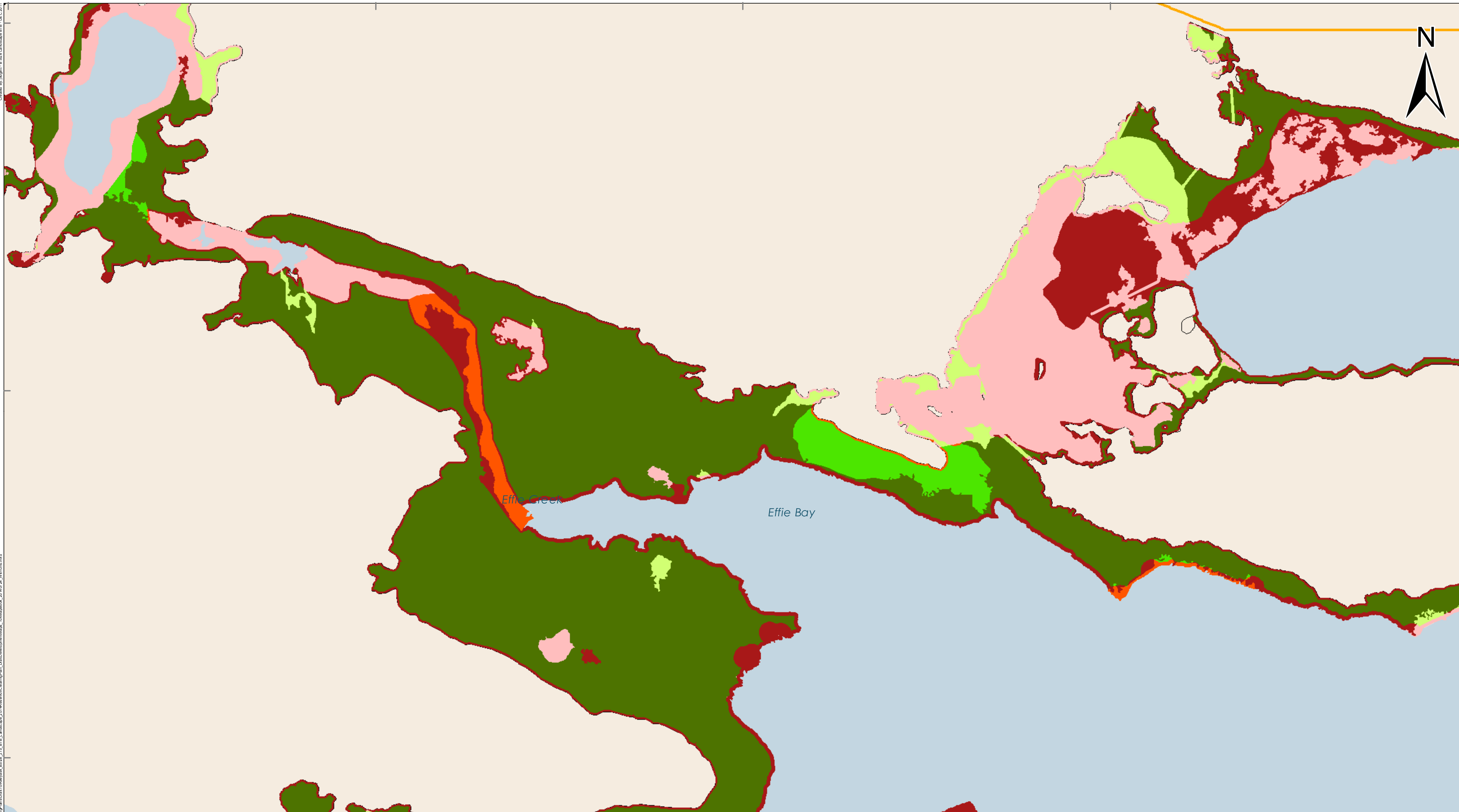
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map E4 -



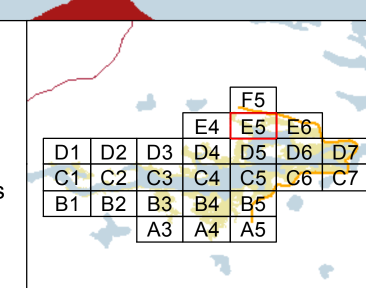
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 0.1 0.2 Kilometres / 0 0.095 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

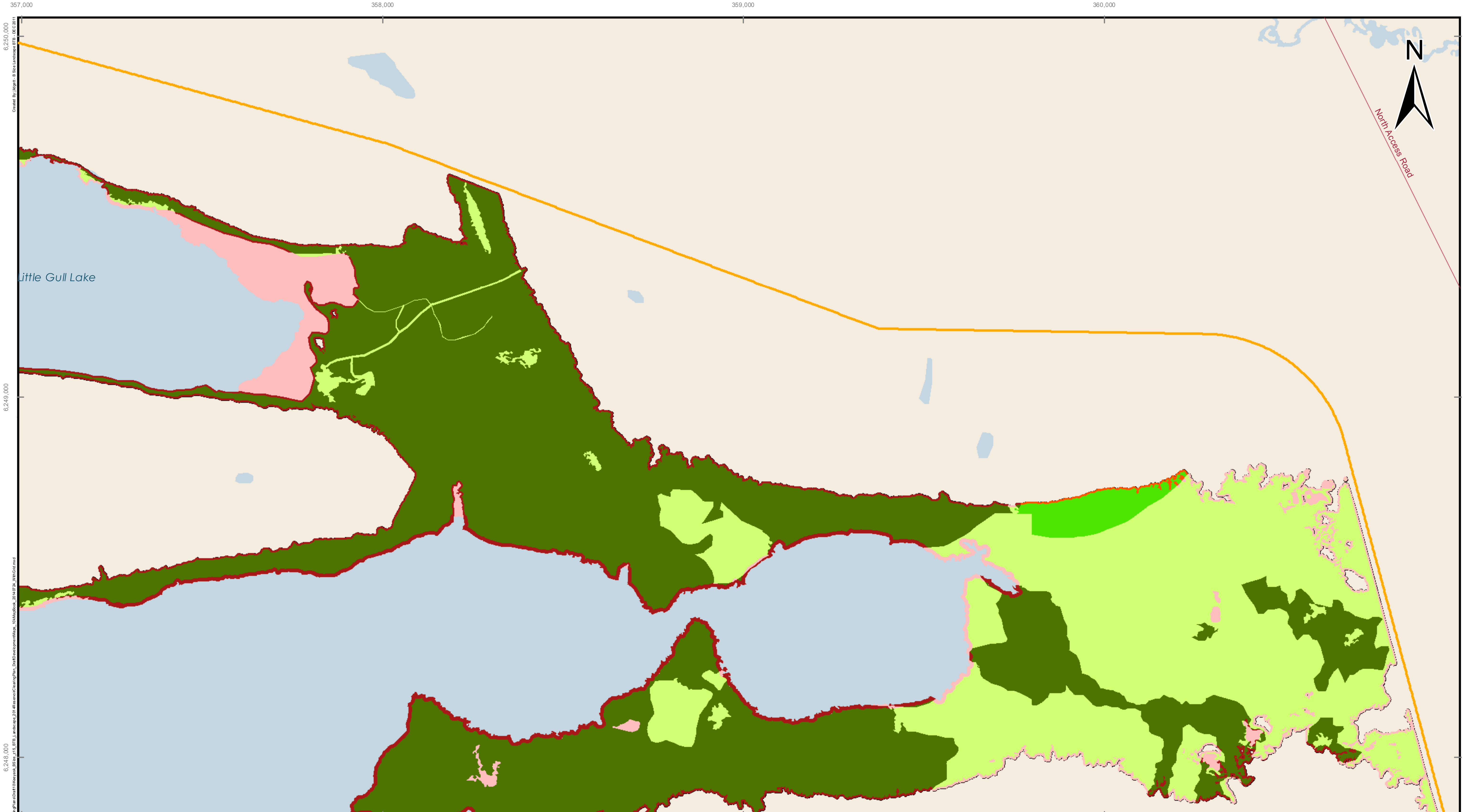
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map E5 -



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map E6 -

KEEYASK Hydropower Limited Partnership

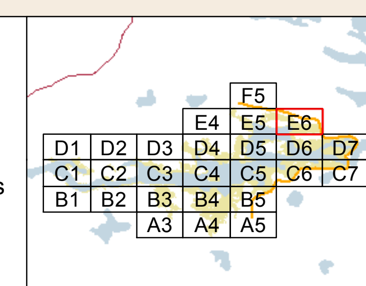
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-14	24-JUL-14
0 – 0.1 – 0.2 Kilometres; 0 – 0.095 – 0.19 Miles	VERSION NO: 1.0	QA/QC:

Legend

Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM: UTM NAD 1983 Z15N

DATE CREATED: 26-FEB-14

REVISION DATE: 24-JUL-14

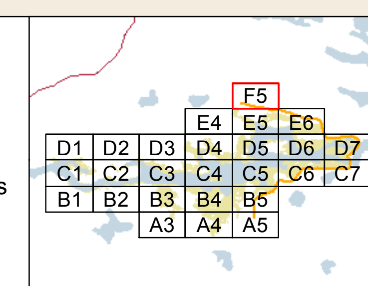
VERSION NO: 1.0

QA/QC:

0 0.1 0.2 Kilometres
0 0.095 0.19 Miles

Legend

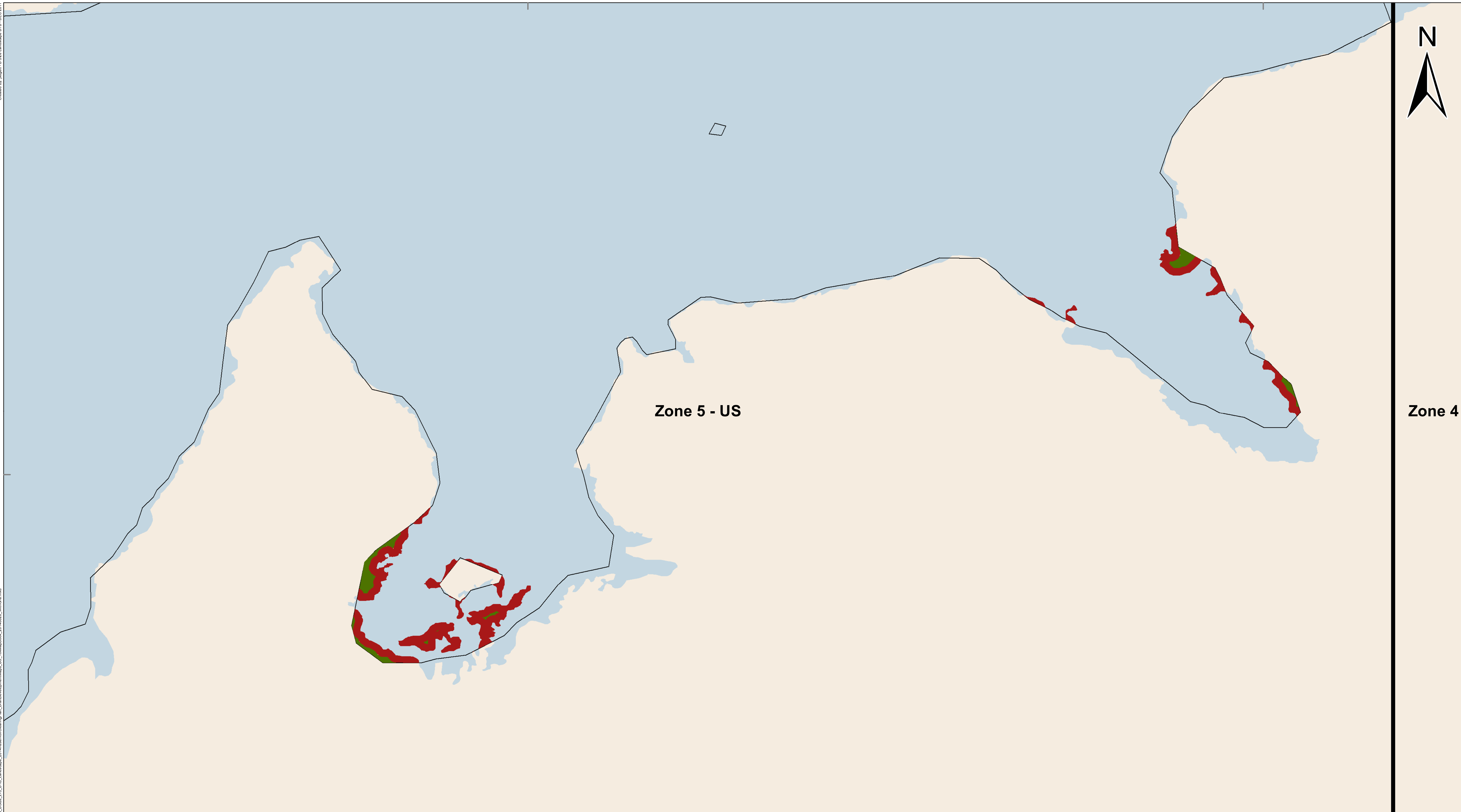
Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction Reservoir Clearing Plan

Clearing Method by Vegetation Type

- Map F5 -



KEEYASK
Hydropower Limited Partnership

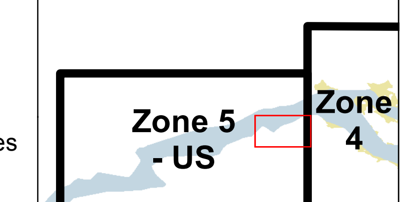
DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

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

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	04-SEP-14	26-AUG-14
0 0.055 0.11 Kilometres / 0 0.045 0.09 Miles	VERSION NO: 1.0	QA/QC:

Legend

Hand or Machine Clearing	Hand Only Clearing	
Treed	Treed	Clearing Zones
Tall Shrub	Tall Shrub	Clearing Area
Low Vegetation	Low Vegetation	Keeyask Principal Structures
		Waterbody



Keeyask Construction
Reservoir Clearing Plan
Vegetation Structure
- Upstream -

APPENDIX C

DETAILED TABLE OF CLEARING AREAS

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Appendix C : Detailed Table of Clearing Areas in Hectares

Clearing Zone, Location and Elevation Range	Clearing Method and Vegetation Classification								Sub-Total
	Hand			Hand Total	Mechanical			Mechanical Total	
	Low Vegetation	Tall Shrub	Treed		Low Vegetation	Tall Shrub	Treed		
Zone 1									
North									
<156m	17	0	28	45	101	5	173	279	324
156-157m	0	0	2	2	30	3	56	90	92
>157m	15	0	19	34	91	7	131	230	264
South									
<156m	7	1	17	24	2	0	120	122	146
156-157m	1	0	4	5	2	0	80	82	87
>157m	0	0	7	8	3	0	151	153	161
Zone 2									
North									
<156m	19	4	42	64	6	1	110	117	181
156-157m	9	1	11	21	2	1	169	173	193
>157m	58	2	70	130	16	5	429	450	579
South									
<156m	43	1	37	81	17	2	181	200	282
156-157m	10	0	9	20	10	0	225	235	255
>157m	26	0	43	69	37	0	515	552	621
Zone 3									
North									
<156m	1	0	5	6	0	0	4	4	10
156-157m	2	0	6	7	1	0	19	20	27
>157m	11	0	20	31	1	1	104	105	136
South									
<156m	16	1	10	27	6	1	25	32	58
156-157m	4	1	2	7	0	0	33	34	40
>157m	31	1	25	57	3	0	152	155	212
Zone 4	36	5	24	65	3	16	18	37	102
Zone 5	0	0	1	1	0	0	0	0	1
Sub-Total	**305**	**17**	**383**	**704**	**332**	**41**	**2,696**	**3,069**	
								Grand Total	**3,772**