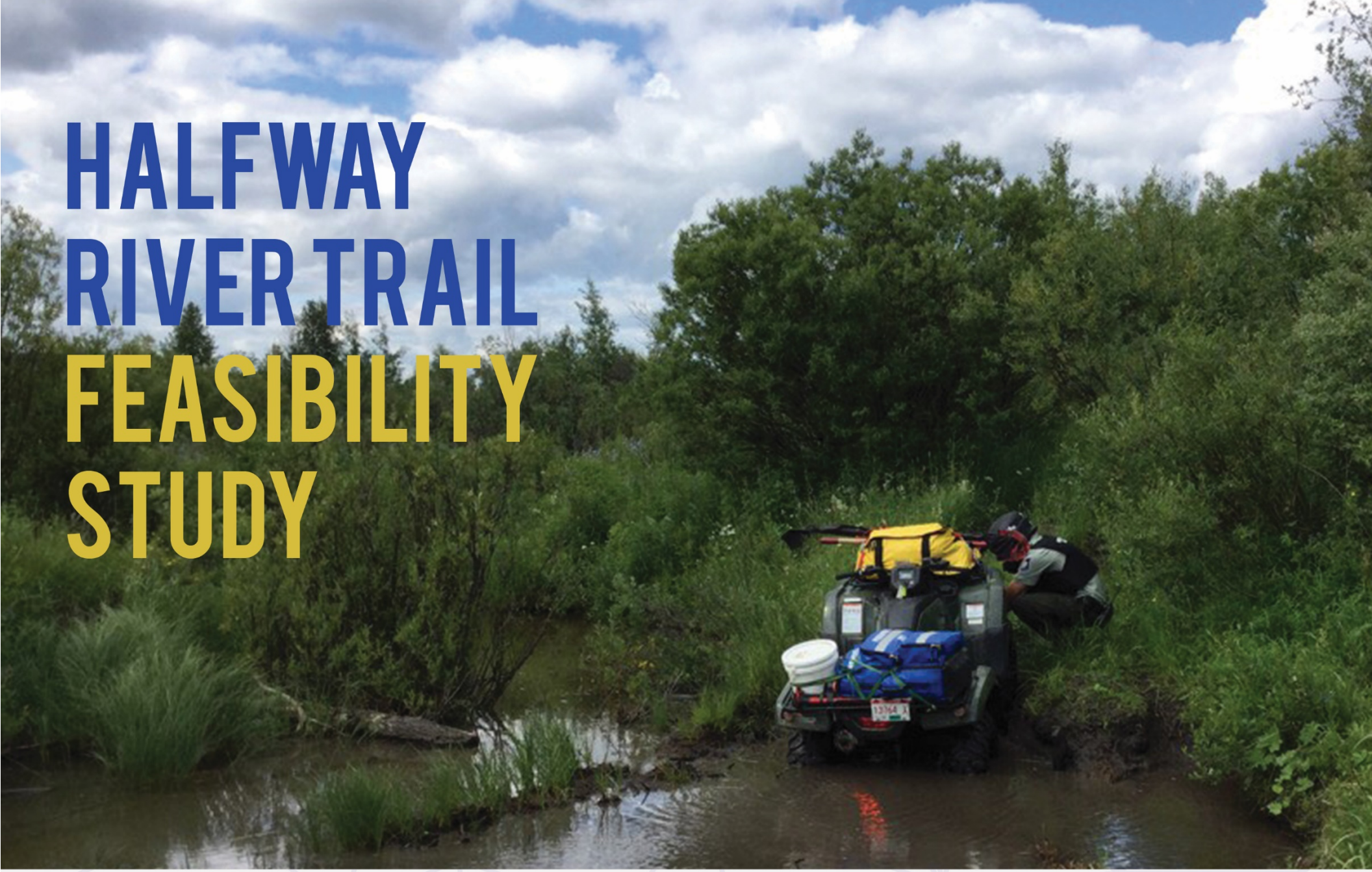
HALFWAY RIVER TRAIL FEASIBILITY STUDY



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McElhanney

RC Strategies + PERC
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RC strategies + PERC

February 15, 2019

Trevor Hann
Recreation Officer | Peace- Fort Nelson
Ministry of Forests, Lands, Natural Resource Operations & Rural Development: Recreation Sites & Trails

Halfway River Trail Feasibility Study

Dear Trevor,

On behalf of McElhanney Consulting Services Ltd (McElhanney) and RC Strategies + PERC, we are pleased to submit the final report for the Halfway River Trail Feasibility Study. We are grateful for the opportunity to work with your team to improve the quality, sustainability and safety of the Halfway River Trail. We trust this report will help provide clarity on the needs for the trail system and support Recreation Sites & Trails BC in prioritizing your next steps and future discussions. With good detail design and adequate resources, there is potential to greatly enhance the sustainability, functionality and visitor experience of the trail.

Our team looks forward to any opportunities to continue to support your team with the next steps on the Halfway River Trail.

Yours truly,

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1. Introduction

1.1. Background

The Muskwa-Kechika Management Area (MKMA) is a globally significant ecosystem and is managed for conservation. The Ministry of Forests, Lands, Natural Resource Operations & Rural Development: Recreation Sites & Trails branch (RSTBC) enable access to desirable year-round backcountry recreation opportunities in the MKMA via the Halfway River Trail. The trail is intended to serve as an efficient connection that moves visitors from the staging area into the MKMA in an efficient manner. The trail is predominantly an off-road vehicle trail (ATV's, Side by Sides that are under 165cms width) and snowmobile route in the winter. Some equestrian use also occurs on the trail. Pedestrian and cycling use are negligible.

Currently, the Halfway River Trail is unsustainable. The trail is a combination of past industrial linear accesses (roads, cutlines) that were never designed or intended to serve as a long-term sustainable, year-round ORV and snowmobile trail. The existing trail alignment is generally unmaintained, traverses' numerous riparian areas, wet areas and steep slopes and, in many cases, is impassable. Travelling the route in non-frozen conditions often results in ORV's becoming stuck in deep mud sections which necessitates considerable winching and / or the creation of informal bypass routes. The trail conditions and patterns of use are resulting in substantial rutting, trail widening, mud bogs, vegetation damage, riparian area damage including erosion and sedimentation and a reduced trail experience. The current alignment is more functional under frozen conditions for snowmobiles or winter motorized use.

A more sustainable trail route exists along the gravel Mile 147 roadway / Halfway River FSR corridor. This route is more direct for users (e.g. gets them to where they want to go more efficiently), gravelled and well established. However, it enters private land and public access, at this time, is typically not permitted unless authorized by the owner. Some recreational users in the area make arrangements with the owner to cross the land but this is an exception. The consulting team's understanding is that, despite this direct graveled road serving as the logical and more sustainable connection, the route is not a practical alternative for most public recreational trail users as it crosses private land.

1.2. Purpose

Given the public desire to access the MKMA via the Halfway River Trail, RSTBC retained McElhanney and RC Strategies + PERC to identify and evaluate the feasibility of an alternative routing for the Halfway River Trail. More specifically, RSTBC asked the consulting team to:

- Assemble and review background information regarding the trail,
- Identify and map options for alternative trail routing and determine whether a northern or southern re-routing is most feasible,
- Confirm suitability of re-routing options through a field review,
- Prepare concept trail designs of the preferred re-routing option including costs estimates,
- Identify environmental and social considerations associated with the re-routing options, including unavoidable riparian areas and options associated costs for crossing structures (if necessary),
- Identify and map suitable staging areas for equestrian and year-round motorized use on the preferred-option, and
- Identify and map general improvements required on segments of the existing trail that would be retained.

Each option was evaluated to ensure it would accommodate ORV's up to 750kg and 165 cm in width

As required by RSTBC, alternatives, improvements and recommendations identified in this report are generally aligned with:

- Chapter 10 of the Forest Recreation Manual's section 10.3.5 Guidelines for Specific Trail Classes (Four Wheel Drive Vehicles),
- NOHVCC's Great Trails Manual (2015), and
- RSTBC's Draft ORV Guidelines.

1.3. Study Area

As illustrated in Figure 1, the study area generally included:

- Existing Halfway River Trail – Km 23 of the Pink Mountain / Mile 147 Road to the west of the private property.
- Southern Route Option – Genesis Road via the Cypress Creek Road west / northwest to connect to the existing Halfway River Trail west of the private property.

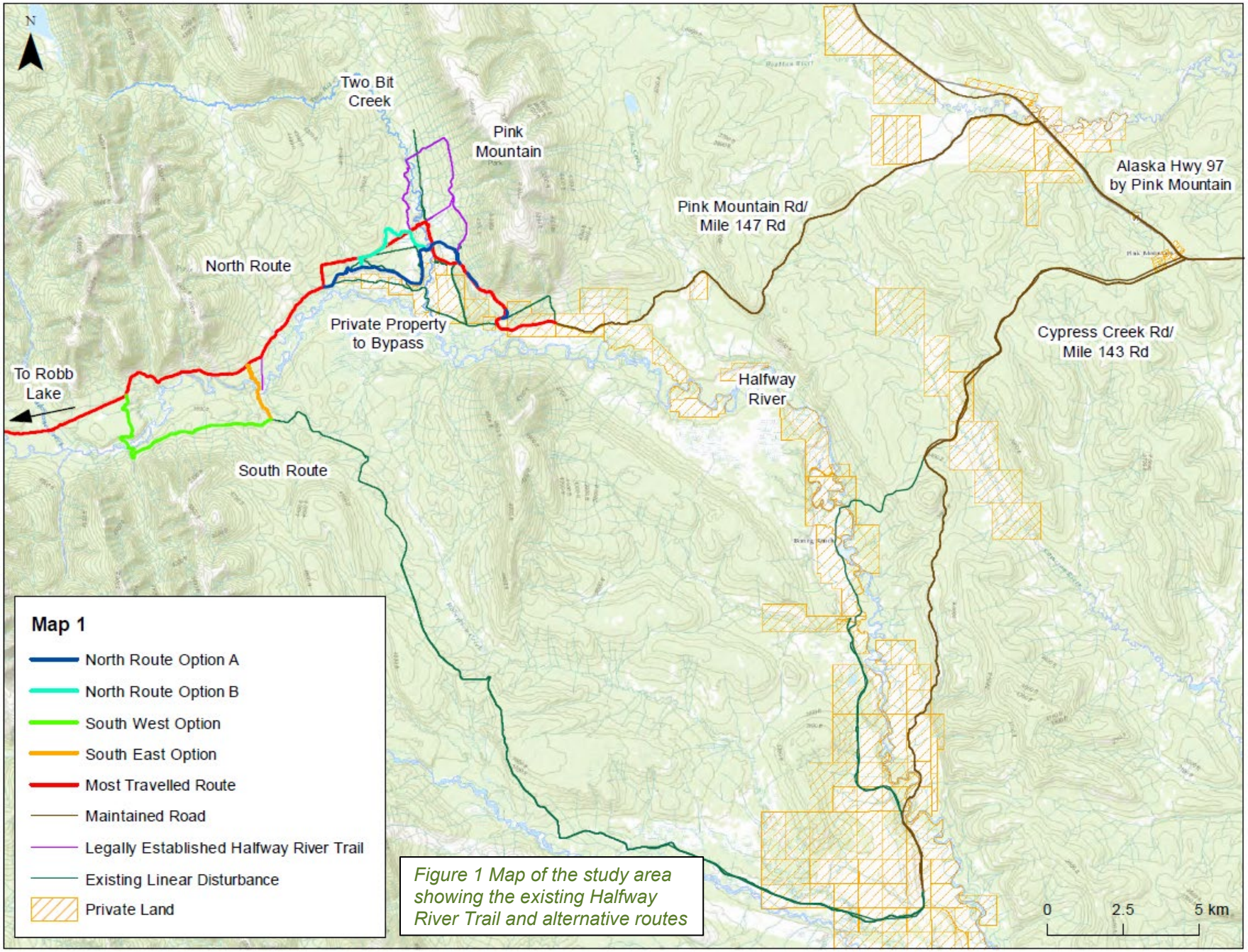

Figure 1 Map of the study area showing the existing Halfway River Trail and alternative routes

1.4. Approach & Assessment Methods

The feasibility study was completed using a combination of desktop analytics and field inventory and assessment. Available data was reviewed in GIS to identify land ownership, land tenure, ecological considerations, terrain, historic resource considerations and constraints.

An extensive field program was undertaken to inform the identification and evaluation of alternative routing options as well as upgrades, staging areas and infrastructure needs. The field program took place October 22-23, 2018 with two trails specialists. ESRI Collector App and ruggedized iPads were used to complete the inventory and assessment, map routing alternatives and identify infrastructure needs and staging area opportunities. The trail specialists documented the following along each route alternative:

- Trail Problems – tread roughness, steepness, rutting, erosion, water management etc.
- Tread surfacing
- Grades
- Infrastructure
- Safety concerns
- Areas of sustainable trail building potential

TRAIL MANAGEMENT OBJECTIVE

The main purpose of the trail will be as access to backcountry recreation for mixed summer and winter use.

Spatial data was captured, and geo-referenced photos were taken of all prominent issues and options. When the field team returned to the office, routing options and improvements were further refined, and the report was prepared.

1.5. Evaluation Criteria

Recognizing there are multiple re-routing options, a set of clear criteria were needed to enable the consulting team to evaluate each option objectively and select a preferred option. The following criteria were used to determine the preferred option. The preferred option is an option that:

- Avoids private land.
- Allows users to conveniently travel into the MKMA by requiring minimal extra distance or time for summer or winter travel compared to the existing route.
- Minimizes rutting, trail braiding, mudding, watercourse crossings and further environmental degradation or impacts (e.g. further habitat fragmentation),
- Avoids avalanche terrain.
- Avoids areas prone to slumping.
- Maintains or improves the safety of visitors using the trails when compared to current risks on the existing route.
- Can meet the established trail management objective and design guidelines (e.g. clearing heights, widths, tread widths, tread surfacing, grades).
- Requires lower operational demands (e.g. maintenance) than is currently required by the existing route.
- Can be implemented generally within the capital budget that is available or can be obtained.

2. Critical Design Parameters & Trail Management Objective

Before attention was placed on identifying route alternatives and addressing identified problems, it was necessary to clearly articulate the vision for the trail through the completion of a Trail Management Objective (TMO). A TMO synthesizes and documents, in a single form, the management intention for the trail in a clear, consistent and understandable way. The TMO should guide all future trail planning, design, construction, maintenance and management decisions for the trail. However, it is important to recognize that the TMO is not set in stone. The TMO is a critical piece of documentation that should be updated, as needed, throughout the trail design and construction process as well as during the operations of the trail as management issues arise. RSTBC should work to ensure key elements of the TMO content (e.g. permitted / prohibited use, level of challenge, season of operation, trail length etc.) are incorporated into the trail's signage as well as trip planning information available online and through other channels to help visitors prepare for the trail and to help manage risk to RSTBC. RSTBC should retain the TMO on file as it can become important documentation should any legal actions, as a result of injury on the trail, occur in the future.

> **"Quality** is never an accident; it is always the result of high intention, sincere effort, intelligent direction and skillful execution; it represents the wise choice of many alternatives." - William A. Foster

The TMO was prepared based on a) RSTBC staff input, b) current management decisions for the trail and c) trail upgrade recommendations in this report. The TMO for the Halfway River Trail is presented in Figure 2&3.

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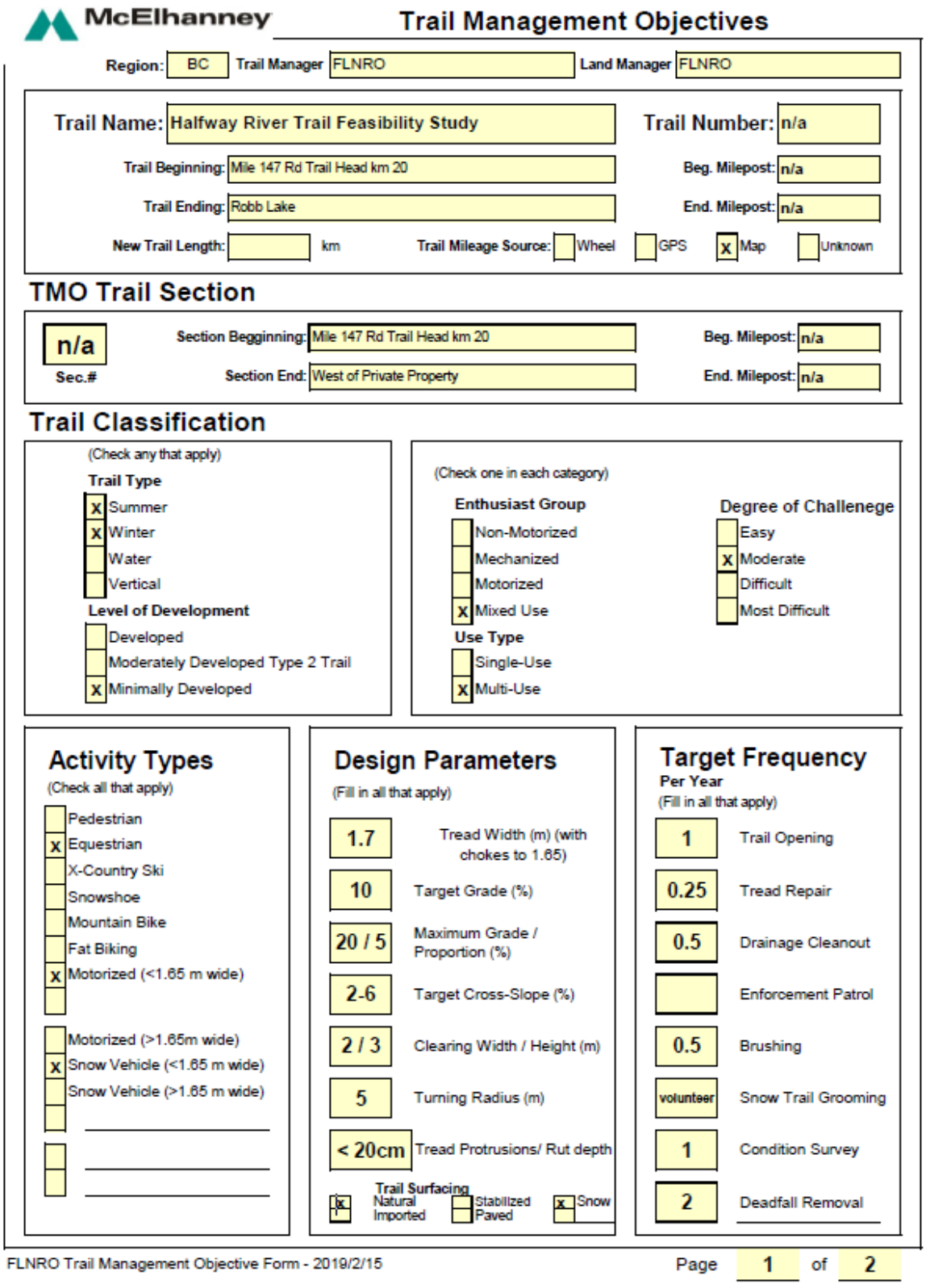

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Trail Management Objectives

Region: BC | Trail Manager: FLNRO | Land Manager: FLNRO

Trail Name: Halfway River Trail Feasibility Study | Trail Number: n/a

Trail Beginning: Mile 147 Rd Trail Head km 20 | Beg. Milepost: n/a

Trail Ending: Robb Lake | End. Milepost: n/a

New Trail Length: ____ km | Trail Mileage Source: [ ] Wheel [ ] GPS [X] Map [ ] Unknown

TMO Trail Section

n/a (Sec.#)

Section Begginning: Mile 147 Rd Trail Head km 20 | Beg. Milepost: n/a

Section End: West of Private Property | End. Milepost: n/a

Trail Classification

(Check any that apply)

Trail Type

- [X] Summer
- [X] Winter
- [ ] Water
- [ ] Vertical

Level of Development

- [ ] Developed
- [ ] Moderately Developed Type 2 Trail
- [X] Minimally Developed

(Check one in each category)

Enthusiast Group

- [ ] Non-Motorized
- [ ] Mechanized
- [ ] Motorized
- [X] Mixed Use

Use Type

- [ ] Single-Use
- [X] Multi-Use

Degree of Challenege

- [ ] Easy
- [X] Moderate
- [ ] Difficult
- [ ] Most Difficult

Activity Types

(Check all that apply)

- [ ] Pedestrian
- [X] Equestrian
- [ ] X-Country Ski
- [ ] Snowshoe
- [ ] Mountain Bike
- [ ] Fat Biking
- [X] Motorized (<1.65 m wide)
- [ ] Motorized (>1.65m wide)
- [X] Snow Vehicle (<1.65 m wide)
- [ ] Snow Vehicle (>1.65 m wide)
- [ ] _____
- [ ] _____
- [ ] _____

Design Parameters

(Fill in all that apply)

1.7	Tread Width (m) (with chokes to 1.65)
10	Target Grade (%)
20 / 5	Maximum Grade / Proportion (%)
2-6	Target Cross-Slope (%)
2 / 3	Clearing Width / Height (m)
5	Turning Radius (m)
< 20cm	Tread Protrusions/ Rut depth

Trail Surfacing

[X] Natural / Imported [ ] Stabilized / Paved [X] Snow

Target Frequency

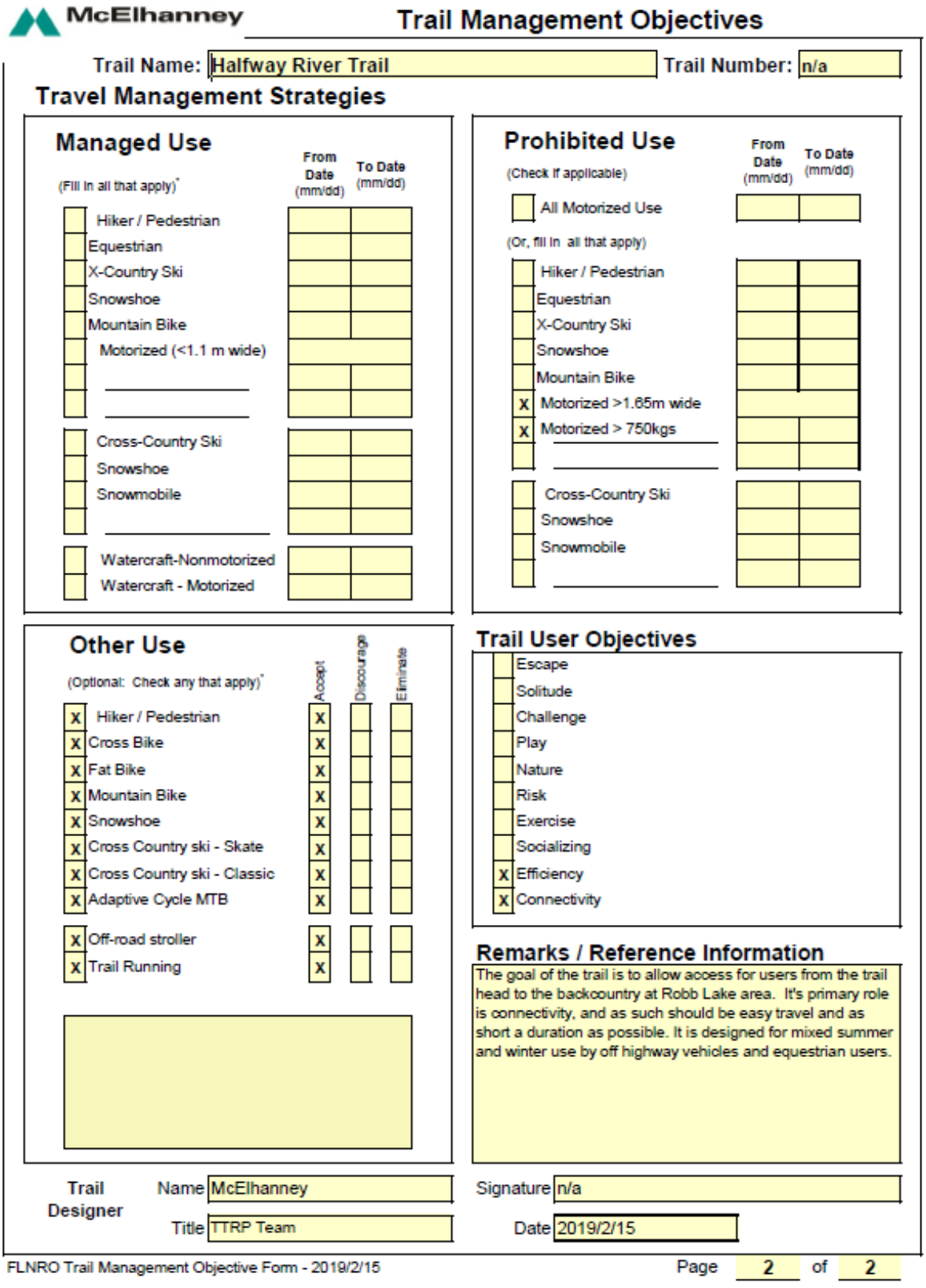
Per Year

(Fill in all that apply)

1	Trail Opening
0.25	Tread Repair
0.5	Drainage Cleanout
	Enforcement Patrol
0.5	Brushing
volunteer	Snow Trail Grooming
1	Condition Survey
2	Deadfall Removal

FLNRO Trail Management Objective Form - 2019/2/15 Page 1 of 2

Figure 2 Trail Management Objective form for the Halfway River Trail, Pg 1



McElhanney

Trail Management Objectives

Trail Name: Halfway River Trail Trail Number: n/a

Travel Management Strategies

Managed Use

(Fill in all that apply)*

	From Date (mm/dd)	To Date (mm/dd)
Hiker / Pedestrian		
Equestrian		
X-Country Ski		
Snowshoe		
Mountain Bike		
Motorized (<1.1 m wide)		
Cross-Country Ski		
Snowshoe		
Snowmobile		
Watercraft-Nonmotorized		
Watercraft - Motorized		

Prohibited Use

(Check if applicable)

	From Date (mm/dd)	To Date (mm/dd)
All Motorized Use		
(Or, fill in all that apply)		
Hiker / Pedestrian		
Equestrian		
X-Country Ski		
Snowshoe		
Mountain Bike		
X Motorized >1.65m wide		
X Motorized > 750kgs		
Cross-Country Ski		
Snowshoe		
Snowmobile		

Other Use

(Optional: Check any that apply)*

	Accept	Discourage	Eliminate
X Hiker / Pedestrian	X		
X Cross Bike	X		
X Fat Bike	X		
X Mountain Bike	X		
X Snowshoe	X		
X Cross Country ski - Skate	X		
X Cross Country ski - Classic	X		
X Adaptive Cycle MTB	X		
X Off-road stroller	X		
X Trail Running	X		

Trail User Objectives

- Escape
- Solitude
- Challenge
- Play
- Nature
- Risk
- Exercise
- Socializing
- X Efficiency
- X Connectivity

Remarks / Reference Information

The goal of the trail is to allow access for users from the trail head to the backcountry at Robb Lake area. It's primary role is connectivity, and as such should be easy travel and as short a duration as possible. It is designed for mixed summer and winter use by off highway vehicles and equestrian users.

Trail Designer: Name McElhanney; Title TTRP Team; Signature n/a; Date 2019/2/15

FLNRO Trail Management Objective Form - 2019/2/15 Page 2 of 2

Figure 3 Trail Management Objective form for the Halfway River Trail, Pg 2

3. Existing Conditions

Based on data and observations collected through the field assessment, the following section details the conditions and issues associated with the existing Halfway River Trail alignment as well the "southern route option" considered by RSTBC staff. It should be recognized that the reported conditions and issues are limited to season in which the field assessment occurred (October 2018) which followed a long and hot summer season with minimal precipitation. The findings and conditions described below may or may not be fully present or applicable year-round (e.g. frozen / snow conditions, summer season following prolonged dry periods). The issues may be better or worse pending future weather conditions. However, given the lack of precipitation throughout the summer and fall of 2018, the consulting team suggests that RSTBC anticipate that the conditions observed in 2018 are a best-case scenario in terms of the presence of water on the trail, ground saturation and water levels in the watercourse crossings.

3.1. Existing Halfway River Trail Conditions

The existing Halfway River Trail alignment is comprised of remnants of old resource roads joined by segments of seismic lines and other linear disturbance. The current alignment has evolved into a recreational "trail". The current alignment was never intended, planned, designed or engineered to serve as a sustainable year-round motorized trail. Few of the linear disturbances received ground treatment at the time of clearing and they regularly cross muskeg, streams, riparian's areas and wetlands. Motorized use in non-frozen conditions is creating deeply rutted areas on many segments of the trail. Meanwhile, other segments are sited directly on the fall line. These segments are too steep, don't shed water and are eroding.

The frequency and magnitude of the trail problems make the current Halfway River Trail alignment an inappropriate summer ORV trail.

Though there are many trail design and management issues with the current alignment, the most pressing issue is the trail's alignment through wet areas and riparian areas. Many of these wet areas require users to winch or select an alternative route leading to trail braiding. Meanwhile, other segments of the trail that are in wet areas but remain passable, are only passable due to the lower volumes of use. However, with ongoing use, the root mat in these areas will break down and expose the clay or deeper layers of organics, which will lead to increased erosion as vehicles start to sink into the deeper layers. The frequency and magnitude of trail problems make the current Halfway River Trail alignment an unsustainable and inappropriate summer ORV trail unless the trail is rerouted, and enhancement are made to address the trail tread and water management issues.

Table 1 outlines the conditions and major issues observed along the existing alignment. The importance of addressing each identified issue is also provided where applicable. The conditions and issues have been correlated to kilometer distances from the trailhead as shown on Figure 4.

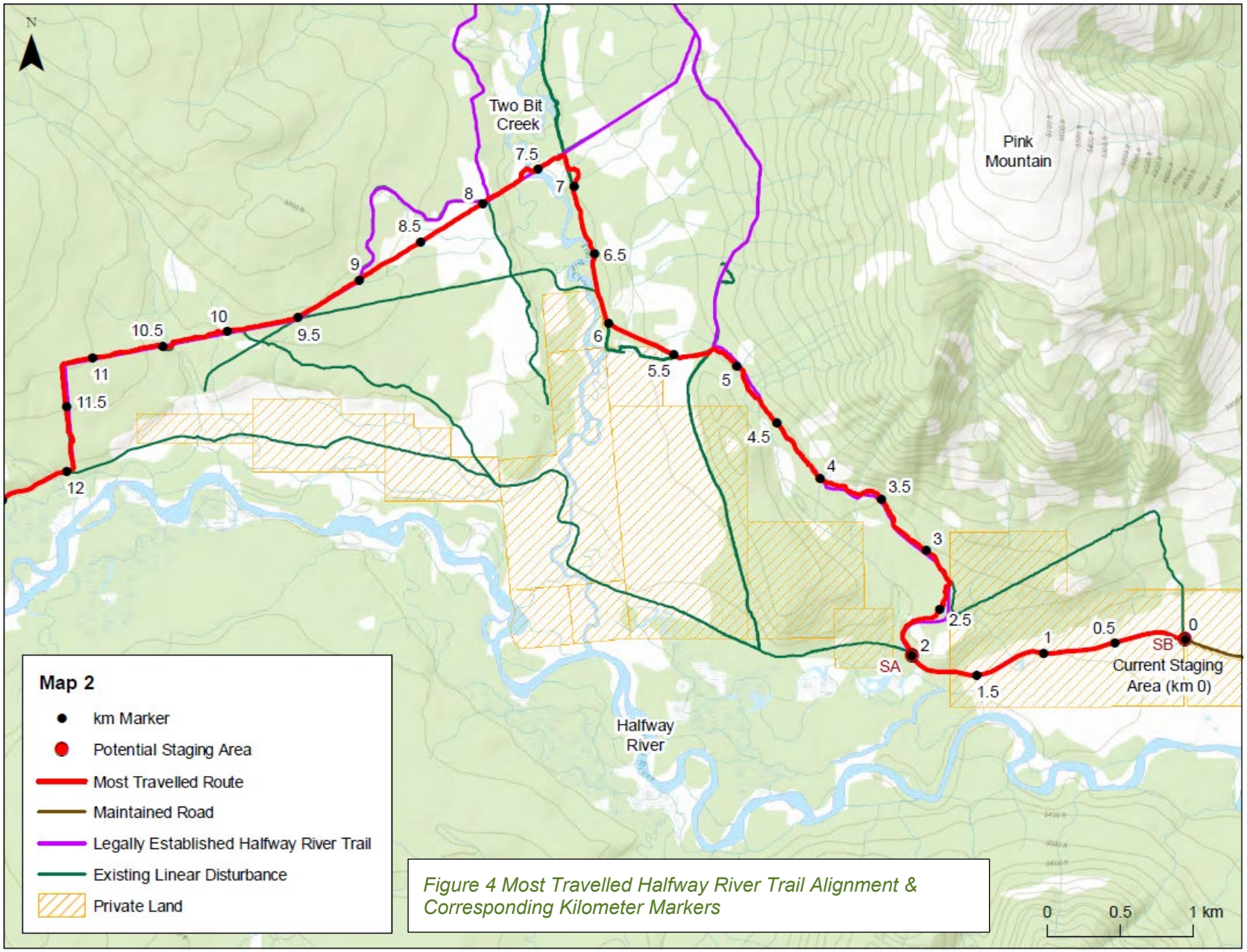


Figure 4 Most Travelled Halfway River Trail Alignment & Corresponding Kilometer Markers

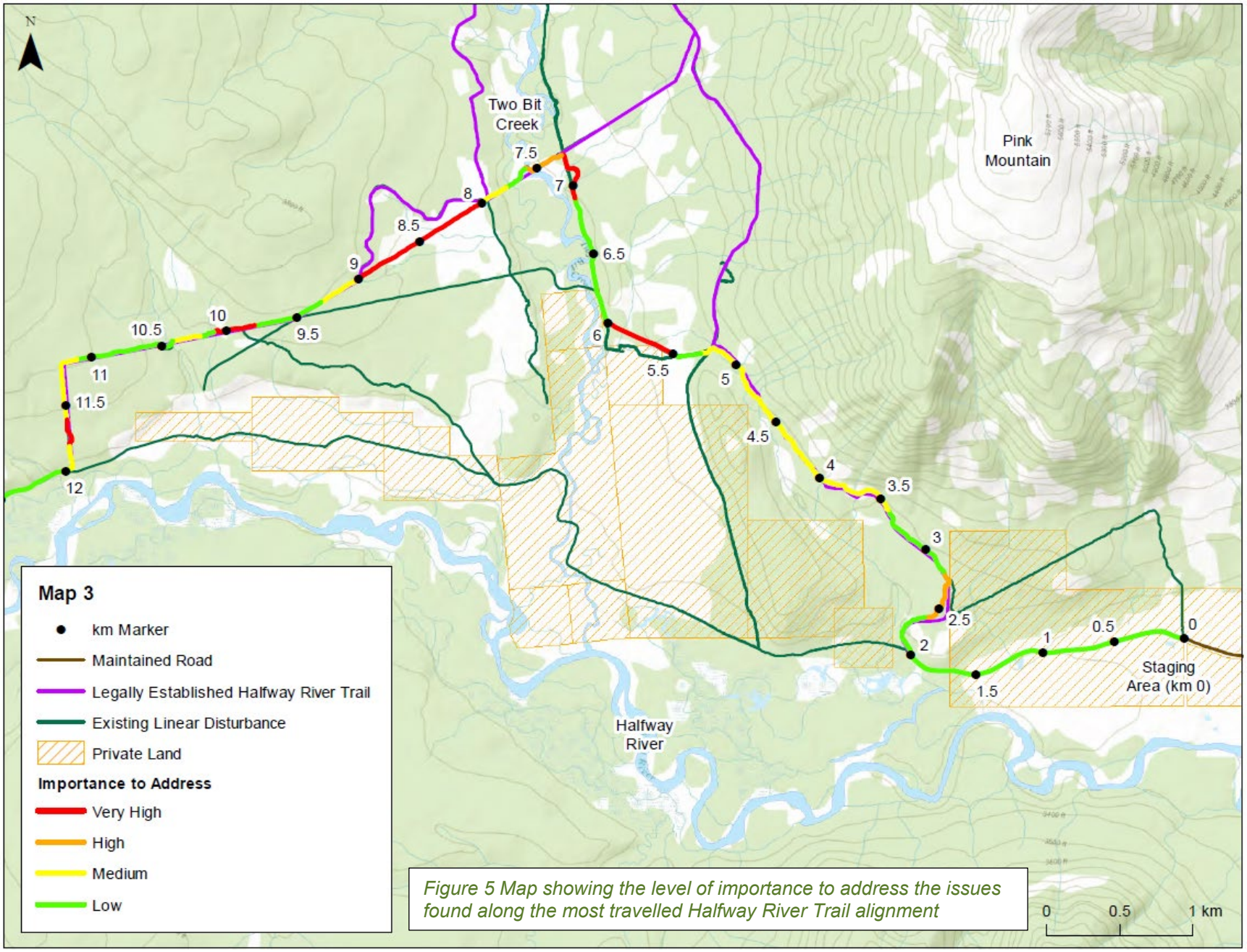


Figure 5 Map showing the level of importance to address the issues found along the most travelled Halfway River Trail alignment

Table 1 Conditions on the Halfway River Trail

Existing Conditions on the Halfway River Trail Alignment *Note: Refer to Figure 4 & 5, for the location of report conditions.*				
Segment	**Approx. width (m)**	**Observed Conditions & Issues**	**Importance to Address**	**Representative Photo**
km 0	20	Existing Trail head – an informal trailhead is available. Parking occurs in an open and rough grassy field. An old trail kiosk sign is present as well as a gate identifying private property ahead.	Med	
km 0 - 2	4 – 6	Graded gravel road	Low	No image available
km 2 - 2.4	3-4	Minor ruts and trail is on the fall line. Small mud holes at the crest of the hill.	Low	No image available
km 2.4 - 2.8	1.2	20cm deep ruts, very tight and twisty, water trapped on trail	High	
km 2.8 - 3.4	2-3	Generally ok. Water is trapped on trail due to cupping and poor drainage in isolated locations.	Low	No image available
km 3.4 - 3.75	2-3	Numerous small seeps cross the trail. Tread is wet but has a hard gravel bottom, so rutting is minor / absent. A local user described these seeps as challenging for	Med	No image available

		snowmobilers as they do not freeze or fill in with snow until late in the season.		
km 3.75 -5.3	2-3	Trail is passable. Numerous incidents of rutting and standing water in the ruts where the trail flattens at the bottom of the hill. Ruts in this area have somewhat of a firm base	Med	
km 5.3 - 5.5	3-4	Alignment is on an old resource road and is in good condition.	Low	No image available
km 5.5 - 6	4-20	Alignment crosses a large area of deep muskeg. There is clear evidence that users frequently become stuck, winch out and seek an alternative route. Alignment is highly braided and crosses a small drainage through the muskeg. A user created secondary route to the south crosses a creek at a fairly deep location and the exit onto the north bank is very steep and difficult to navigate safely.	Very high	
km 6 - 6.9	1.5-2.5	Alignment is generally in good condition with some silt and gravel mix as the tread base.	Low	No image available

km 6.9 - 7.3	1.2 - 75	Alignment crosses a large area of deep muskeg. There is clear evidence that users frequently become stuck, winch out and seek an alternative route. The alignment is highly braided.	Very high	
km 7.3 - 7.6	1.2- 4	Tread consists of a silt/organic mix through the flood plain. Deep ruts characterize this segment with the ruts typically deep enough to bottom out a standard ATV. The creek ford is passable and has a gravel base.	High	
km 7.6 - 7.8	1.2-4	The alignment is generally passable currently. Tread consists of a silt/organic base.	Low	No image available

km 7.8 – 8	1.2-2	Alignment exists on the fall line of a steep hill. The tread currently contains 15cm deep ruts and will experience considerable erosion and channelization with increased traffic or a large water runoff event.	Med	
km 8 – 9	6	Alignment crosses an area of deep muskeg. There is clear evidence that users become stuck, winch out and seek an alternative route. The alignment is highly braided.	Very high	No image available
km 9 – 9.3	6	The alignment is currently passable though it traverses a very wet area. Standing water remains on the trail (even following a very dry summer) and rutting is expanding. Portions of this have a clay base below the organics while others are just muskeg.	Med	
km 9.3 – 9.8	6	The alignment descends approximately 20 m along a side hill. The side hill alignment is currently allowing water to drain off the tread in this segment.	Low	No image available

km 9.8 – 10.1	6-45	Alignment crosses an area of deep muskeg. There is clear evidence that users become stuck, winch out and seek an alternative route. The alignment is highly braided.	Very high	
km 10.1 – 10.2	6	The current alignment is generally passable. No major issues were observed.	Low	No image available
km 10.2-10.4	3-4	The alignment in this segment is passable and in reasonable condition. The segment to the east of the creek is a steep 35m vertical descent to a creek crossing. The crossing has not been improved or hardened and is prone to tire and/or water created erosion. The exit of the creek on the south west side is steep and is prone to erosion.	Med	
km 10.4 – 11.1	6	This segment is generally passable. Some portions of the segment are rutted. Water is remaining on the trail as the tread has lost is shaping and does not shed water effectively.	Low	No image available

km 11.1 – 11.6	6	This segment experiences a steep 40 m vertical descent through deep and wet organic soils. Shallow ruts have formed and will continue to expand as trail use continues. Due to its steepness and rutting, this segment is also prone to rapid erosion during a large water runoff event.	Med	
km 11.6 – 11.8	6 - 70	This segment is a flat area at the bottom of the hill that collects and holds surface run-off water. It is extremely wet with deep ruts. There is clear evidence that users frequently become stuck, winch out and seek an alternative route. Alignment is highly braided.	Very high	

km 11.8 - 12	6	This segment is generally passable. The alignment is fall line and is prone to erosion in a large water runoff event. Shallow ruts have formed and will continue to grow through use and erosion.	Med	
km 11.8 – 20.5	3 - 5	This segment is in reasonable condition. The alignment is on an old resource extraction road that appears to have been built using gravel pits along the corridor. As such, it generally has a very good base and users do not typically become stuck while travelling along it. However, maintenance appears to have been limited to non-existent on this segment. As a result, the tread is experiencing frequent cupping and deep holes with standing water are common on the tread. The condition of this segment would easily be repaired, and sedimentation of adjacent watercourses minimized if the crowning of the trail tread was reinstated and effective culverts installed to drain the trail. Approximately 5 locations were observed where users have built small “bridges” to cross small permanent watercourses. The bridges are constructed from squared timbers and placed lengthwise across the watercourse. The crossing do not have any decking or fasteners. In many cases, the beams have shifted and are either blocking the bridge or have gaps between them. Consequently, users are now driving around the structures and through the watercourses. These bridges should be either repaired or replaced.	Low	 

3.1.1. Trail Management Objective Alignment

The current conditions of the trail were contrasted against the intentions for the trail as presented in the Trail Management Objective (Section 2) as well as the associated critical design parameters. Overall, the existing Halfway River Trail alignment is not congruent with the Trail Management Objective (see Table 2). The trail tread is unsuitable for the intended uses, grades exceed targets, and, in summer months, the trail does not serve as an efficient year-round means of recreational transportation into the MKMA

Table 2 Existing Conditions Contrasted Against TMO

	Trail Design Parameters					TMO Alignment
	Clearing Height	**Clearing Width**	**Max Grade**	**Typical Grade**	**Tread Surface**	• TMO is not achieved. Trail is unsustainable and is an inefficient transportation corridor.
	3 m	2 m	35%	10%	Muskeg organics or thick clay	
Design Consistent with Design Guidelines	Yes	Yes	No	Yes	No	
Visitor Experience Problems	• Frequent areas at which to become stuck • Frequent winching • Slow Travel • Damaging to horses, humans, equipment and the environment					
Sustainability Problems	• Muskeg is soft to travel though, and users are creating mud bogs or trail braiding to bypass wet areas. • Siting in riparian areas • Alignment captures water • Steep hills show erosion ruts					
Safety & Risk Management Problems	• Frequent areas at which to become stuck requiring winch or perhaps flipping over					

3.2. Southern Route Option

RSTBC staff identified a potential reroute option on the south side of the Halfway River Trail (see Figure 6). This option, known as the "Southern Route Option", would allow users to bypass the private land and the major problem areas associated with the existing Halfway River Trail alignment. The consulting team was tasked to evaluate the feasibility of this route as an alternative to the existing Halfway River Trail alignment.

3.2.1. Southern Route Option Description

The southern route option, as shown in Figure 6, would access the high-grade Cypress Creek Road from Highway 97 and follow the road until it crosses the Halfway River. In winter conditions, the Cypress Creek Road is plowed to approximately 3.5km west of the Halfway River crossing. In the winter months, a staging area would need to be developed and a the southern reroute would need to begin close to this location unless agreement with the plow service providers and additional funding for plowing could be established to plow the road further. Just after the bridge, the Cypress Creek Road becomes a rough resource road characterized by large cobble, clay, steep eroded descents and deep ruts. In the summer months, users can driver the resource road for an additional 20-25 km. However, the road becomes increasingly difficult to travel until it eventually becomes impassable to on-highway vehicles due to deep ruts and wet conditions. A "summer" based staging area would need to be developed where users would then stage their vehicles and continue northwest along the resource road. However, this route would require a crossing of the Halfway River before connecting to the exist Halfway River Trail alignment. As shown in Figure 6, RSTBC staff identified two potential existing linear disturbances that could potentially be used to access the river and a potential crossing location. The re-route would then rejoin the existing Halfway River Trail near km 20 (from the trail head). This Southern Route Option would require users to travel approximately 72kms instead of the current 40km on the Halfway River Trail to reach the same spot.

The Southern Route Option would require users to travel approximately 72 kms instead of the current 40km on the Halfway River Trail to reach the same spot.

3.2.2. Existing Conditions

To help evaluate the feasibility of the Southern Route Option, the consulting team travelled and assessed the conditions along the route and worked to identify a location to cross the Halfway River that is safe, practical, environmentally sustainable and aligned with the TMO. Table 3 outlines the conditions and major issues observed along the Southern Route Option.

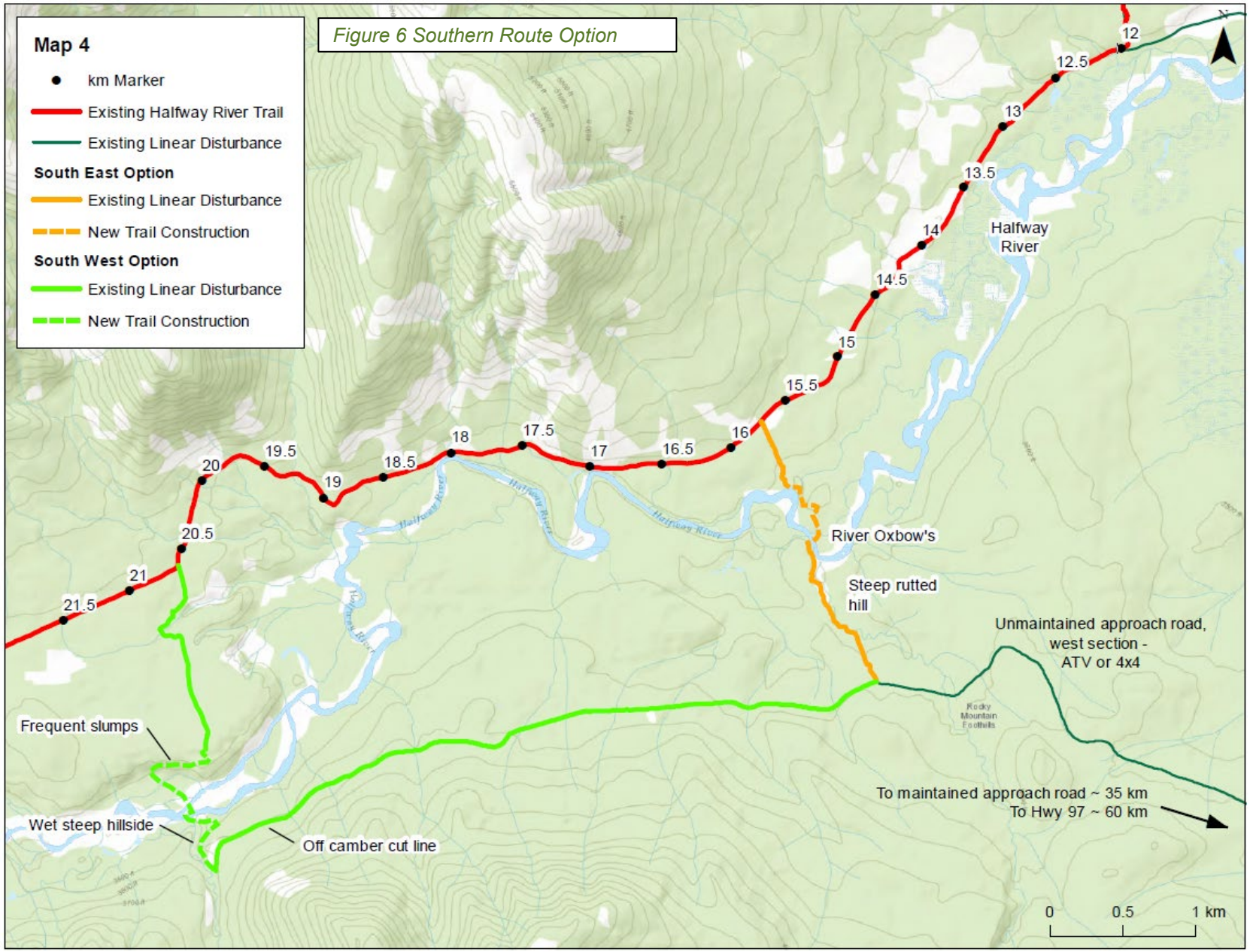


Figure 6 Southern Route Option
Map 4
km Marker
Existing Halfway River Trail
Existing Linear Disturbance
South East Option
Existing Linear Disturbance
New Trail Construction
South West Option
Existing Linear Disturbance
New Trail Construction
12
12.5
13
13.5
14
14.5
15
15.5
16
16.5
17
17.5
18
18.5
19
19.5
20
20.5
21
21.5
Halfway River
River Oxbow's
Steep rutted hill
Unmaintained approach road, west section - ATV or 4x4
Frequent slumps
Wet steep hillside
Off camber cut line
To maintained approach road ~ 35 km
To Hwy 97 ~ 60 km
0
0.5
1 km

Table 3 Existing Conditions on the Southern Route Option

Existing Conditions on the South Route Option			
Segment	**Approx. length (km)**	**Observed Conditions & Issues**	**Representative photo**
Approach Road	48	The Cypress Creek Road is a high-grade gravel and well-maintained for about 25kms from Highway 97. Following the Halfway River cross, the road continues to degrade. The road surface is a clay surface with large cobbles and is most suitable for dry weather. Deep ruts and potholes become more frequent the further the road is travelled as the tread evolves to mostly clay and organics. It is understood that plowing in the winter stops at approximately 25km from the Alaska Hwy – just after the Halfway River Crossing. There is a suitable location for a staging area 5 at km 48 for summer use. See Figure 8	
Unmaintained Approach Road – West Section	12	The next 12km of the route remains on resource road but requires significant maintenance work. On the flats, this segment is deeply rutted with many wet areas and non-functioning ditches. Braiding is frequent as users attempt to find more preferable lines. In addition, many sections of this road / route are fall line for several hundred meters and do not contain any rolling grade dips or appropriate cross sloping to shed water. As such, the route is capturing water and experiencing significant erosion. These 12kms are only suitable for off-road vehicle use.	

South East Option Descent of South Bank to Halfway River	1.3	This option utilizes an old linear disturbance to descend to the Halfway River. The route option descends a very wet and steep hillside where the trees are showing signs of slumping and root movement. The “trail” is rutted deep enough that the skid plate on an ATV drags. In one location, surface water has gained volume and velocity and created an erosion channel that is approximately 70cms deep. The route is very difficult, and unsafe, to pass. Users are braiding the route as they look for easier options to descend to the river. The soil is a clay or silt in this area and offers very poor traction and poor stability for a trail surface. Once user descend, the reach a flat terrace where the trail is in reasonable conditions until they reach the river. Visual evidence shows that users are travelling southeast along the riparian area. There is a nice rock outcrop and pool that appears to be the desired destination for these users.	
South East Option River Crossing	0.8	This segment of the river appears to meander and collect significant wood debris which forces the river out of the main channel. As a result, the river is very braided with numerous oxbows and back channels. Despite being highly divided amongst the back channels and oxbows, the river appears to be too deep to cross safely with an ATV even in October following a very hot and dry summer. Crossing the 950m wide series of river channels would involve constructing new trail and installing watercourse crossing between river channels. Given the obvious evidence of frequent movement and re-channelization, any new trail or watercourse crossing infrastructure developed in this location would likely have a short lifespan.	

South East Option, Ascent of North Bank from Halfway River	2.7	Ascending the North bank at this location would be possible. The existing linear disturbance on the north side of the Halfway River Trail should not be used. Instead, a sustainable bench cut trail would be required to ascend out of the river valley to the existing Halfway River Trail alignment.	

South West Option Approach	5	To reach the South West Option Descent, the route continues along the resource road for another 3.7km. This segment contains more bench cutting and is dryer. Rutting and wet areas are infrequent. However, there are a number of small permanent water course crossing. The road tread and cut / fill eventually stop. However, it appears the resource company planned to extend the road as tree and vegetation clearing was completed. Where the cut/fill and road tread stop, the route continues along a steep cross slope that is off camber. The current route requires more advanced ORV riding abilities to navigate the cross-slope. This segment would require a trail bench surface to be constructed. There may be bedrock near the surface at this location which would complicate trail construction.	
South West Option Descent of South Bank to Halfway River	0.7	To reach the river requires a 40m vertical descent. The hillside is characterized by black spruce and a thick layer of sphagnum moss (both of which like moist environments). Much of the descent shows obvious signs of small slump and extensive water retention. Stability and trail sustainability in this area is highly questionable and should be avoided.	

South West Option River Crossing	0.4	In this location, the Halfway River is confined to a single channel at the east, and multiple channels upstream to the west. The river in this area is too deep to safely and sustainably ford with an ATV except for during perhaps the few driest weeks of the year. The summer water line as shown by the coloring on the rocks and the algae growth was roughly 20-30cms higher up the river bank than the level observed during the field assessment (October 2018) which followed a hot, dry summer. What appears to be typical water levels for the river would certainly be impassable by fording to all but the largest ORV's. The construction of a bridge to facilitate crossing the river would be cost prohibitive. If the river was crossed here, it would require the trail to travel an additional 200m of silty flood plain which is very flat, appears to be wet in some locations and is erosion and slumping prone, not to mention fragmenting important wildlife habitat.	

South West Option Ascent of North Bank of Halfway River	1	Ascending the North bank (south facing) the landscape is slightly drier probably due to the aspect. However, the soil still shows signs of frequent small slumps, with one landslide having run roughly 30 of the 40 vertical meters down the hillside (shown to the right). This hillside is very steep, and it is not anticipated that a 1.8m wide trail bench cut would last over the long term due to natural or human caused slumps.	

4. Recommendations & Costs

The consulting team was asked to assess the feasibility of the Southern Route Option, identify the pros and cons of the route option and determine the feasibility of the route and recommend whether the Southern Route or Existing Halfway River Trail should be used. In addition, the consulting team was asked to identify the upgrades, and any re-routes that would be required along the preferred route option to align with the TMO and to provide Class D cost estimates for completing the recommendations. The following sections summarize the options and present recommendations that should be implemented to improve the sustainability, safety, functionality of the Halfway River Trail into the MKMA.

4.1. Recommended Route Option

The evaluation criteria presented in section 1.5 were used to compare and contrast the merits of the existing Halfway River Trail against those of the Southern Route Option. As presented in Table 4, upgrading and enhancing the existing Halfway River Trail alignment meets many more criteria than enhancing and building the Southern Route Option. The consulting team confidently recommends that RSTBC does not pursue the Southern Route Option.

The consulting team confidently recommends that RSTBC does not pursue the Southern Route Option.

Though there are numerous reasons not to pursue the Southern Route Option, the biggest rational is the difficulty associated with crossing of the Halfway River. Crossing this river from its south side simply isn't practical nor is it cost effective. The consulting team was in the field during October, following an abnormally hot and dry summer, and even then, most of the crossings were too deep for ORV's to safely and consistently ford the river. The fording of the river by ORVs raises serious environmental impact concerns as the Halfway River is a major fish bearing watercourse and such a crossing would require considerable trail development within the riparian area which is wet, poorly drained and prime wildlife habitat inappropriate for ORV trail development. In locations where ORVs may be able to ford the channel, the river was extensively braided and showed signs of frequently meandering and new channel development. These areas were also locations of large log jams which reemphasize the erosive nature of this river and confirms that the river will continue to meander. Establishing a crossing in these locations would almost certainly require ongoing crossing reroutes and likely the loss of infrastructure during freshet and other highwater events. This would mean that frequent trail rerouting and repairs would be required on a regular basis if a reasonable routing could even be established. The consulting team did not find any suitable routes through these areas. In addition, the flood plain is characterized by frequent gravel bars. Though users may not be able to easily cross the river, they would be able to easily travel up and down the floodplain on the extensive network of gravel bars. Enhancing access to the river in these locations would almost certainly result in a growing public access management issues. There is little evidence of ORV use on the gravel bars currently.

The consulting team concludes that the only way to cross the Halfway River from the south sustainably, and in a way that ensures users can cross consistently, would be to design and install a major bridge crossing. Recognizing the consulting team did not involve a bridge or geotechnical engineer, the

trails technologists believe that given the width of the river, it's shifting nature, gravel base and silt banks, and the signs of flood debris, a highway style bridge, similar to the bridge on the Cypress Creek Road (see Figure 7), is the likely crossing structure that would be required. Further study by a bridge engineer and geotechnical engineer is required if the consulting team recommendation to avoid the Southern Route Option is not accepted.

In addition to the inability to sustainably, safely and cost effectively cross the Halfway River and to further emphasize the undesirable nature of the Southern Route Option, the consulting team found that:

- The Southern Route Option greatly extends the distance and length of time it would take users to access the MKMA.
- The Southern Route Option (construction and operations) within the Halfway River floodplain and riparian area would likely contribute to greater habitat fragmentation, wildlife displacement and potential increased mortality in an area that is important to ungulates and large mammal species (e.g. Grizzly Bears).
- By creating additional new trail, the Southern Route Option may further introduce and expand the extent of invasive species.
- The Southern Route Option will require the removal of vegetation within the riparian area and may enhance the erosion and sedimentation of the river and aquatic habitat.

Figure 7 Bridge over the Halfway River on the Cypress Creek Rd

- The Southern Route would require maintenance of approximately 41kms of trail vs the Northern Route roughly 18kms to reach the same point, thereby increasing ongoing operational budgets.
- The Southern Route would require investment in and construction of two new staging areas (one for winter and one for summer).
- Additional costs would be incurred to ensure the Cypress Creek Road and resource road was plowed to the staging area.

Table 4 Route Option Evaluation

Evaluation Criteria	Existing Halfway River Trail Alignment Improvements	Southern Route Option
Meets the established TMO		
Avoids private land.		
Allows users to conveniently travel into the MKMA with minimal extra distance.		
Minimizes rutting, trail braiding, mudding, watercourse crossings and further environmental degradation or impacts (e.g. further habitat fragmentation).		
Avoids avalanche terrain.		
Avoids wet areas prone to slumping.		
Maintains or improves the safety of visitors compared to current risks on the existing route.		
Requires lower operational demands than is currently required by the existing route.		
Can be implemented within the capital budget that is available or can be obtained.		

Legend

Criteria Achieved

Criteria Partially Achieved

Criteria Not Achieved

4.2. Common Options to Resolve Common Issues

With the preferred route option selected, the consulting team turned its attention to determining how the Halfway River Trail alignment could be enhanced to address the observed issues.

As presented in section 3.1, the existing Halfway River Trail alignment contains a number of common issues that need immediate repair and upgrading. In general, there are three common issues that occur across much of the existing alignment. These include:

- Wet area crossings – bottomless holes in the muskeg
- Fall line alignment
- Trail tread reinstatement – erosion, cupping, and rutting

Common solutions are presented below for each general issue.

Wet Area Crossings

The general repair for wet areas within muskeg is very expensive and engineering intensive. Products such as geotextile and geogrid covered with free-draining large rock and surfaced with pit run is considered an appropriate solution to "float" the trail on top of the muskeg. Historically these roads or trails were constructed using the corduroy technique, which is still an acceptable method for locations where suitable trees need to be removed already. There are ORV specific rigid geocell surfaces that can be installed and driven directly on; however, the long-term durability of these products in an environment such as the Halfway River region is questionable. Despite the options presented here, in a location like the Halfway River Trail where the

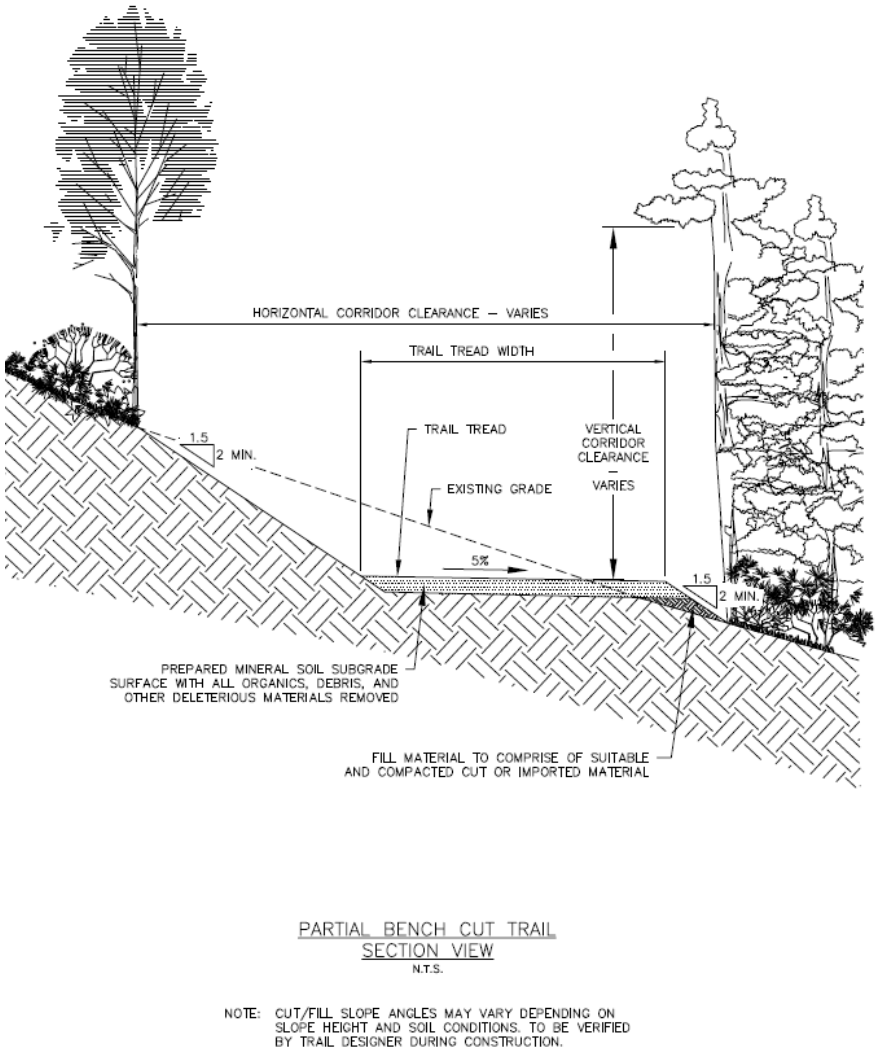


Figure 8 Partial Bench Cut Trail

existing route is so braided, undefined and of such poor quality, re-routing the trail to avoid muskeg is considered a better initial and long-term solution. Fortunately, there is a dry south facing ridge that would allow a sustainable bench cut trail (see Figure 8) to be constructed to bypass much of the wet area problems. Further details on the reroute options are provided below.

Fall Line Alignment

Trails that aligned directly up or down the steepest part of a hill are considered to be sited on the "fall line". This siting is unstainable as water collects on the tread in the tire ruts and flows down the trail gaining volume and velocity and eventually displaces soil, rock particles, and vegetation. Options to reduce erosion while maintaining an existing fall line trail are to shed water from the trail by crowning and out sloping the surface or by "dumping" water off the trail by constructing rolling grade dips. The success of these solutions diminishes with the steepness of the alignment, water "catchment" of the alignment, and poor soil quality. Current ruts and erosion channels in most of the area assessed were not very deep, yet. This suggests that the soil can withstand some erosion, but this is not a long-term sustainable design. The longer fall line segments of trail should be re-routed to a bench cut trail as shown in Figure 8. Further details on how fall line segments should be rerouted are provided below.

Trail Tread Reinstatement

When trail tread degradation occurs on a firm surface (i.e. where the organics have been removed during construction) it can be repaired by reinstating the trail tread and out sloping. This often requires trail managers to remove the "curb" of organics/sediment that builds up on the low edge of a trail to allow water to shed, or by constructing raised tread. Removing the curb or organics or sediment will only work if the trail has some out slope, or somewhere for the water to go. If the trail is already the lowest point, raised tread (figure 9 & 10) will be required to raise the trail tread above the surrounding terrain such that water will not pool on the trail.

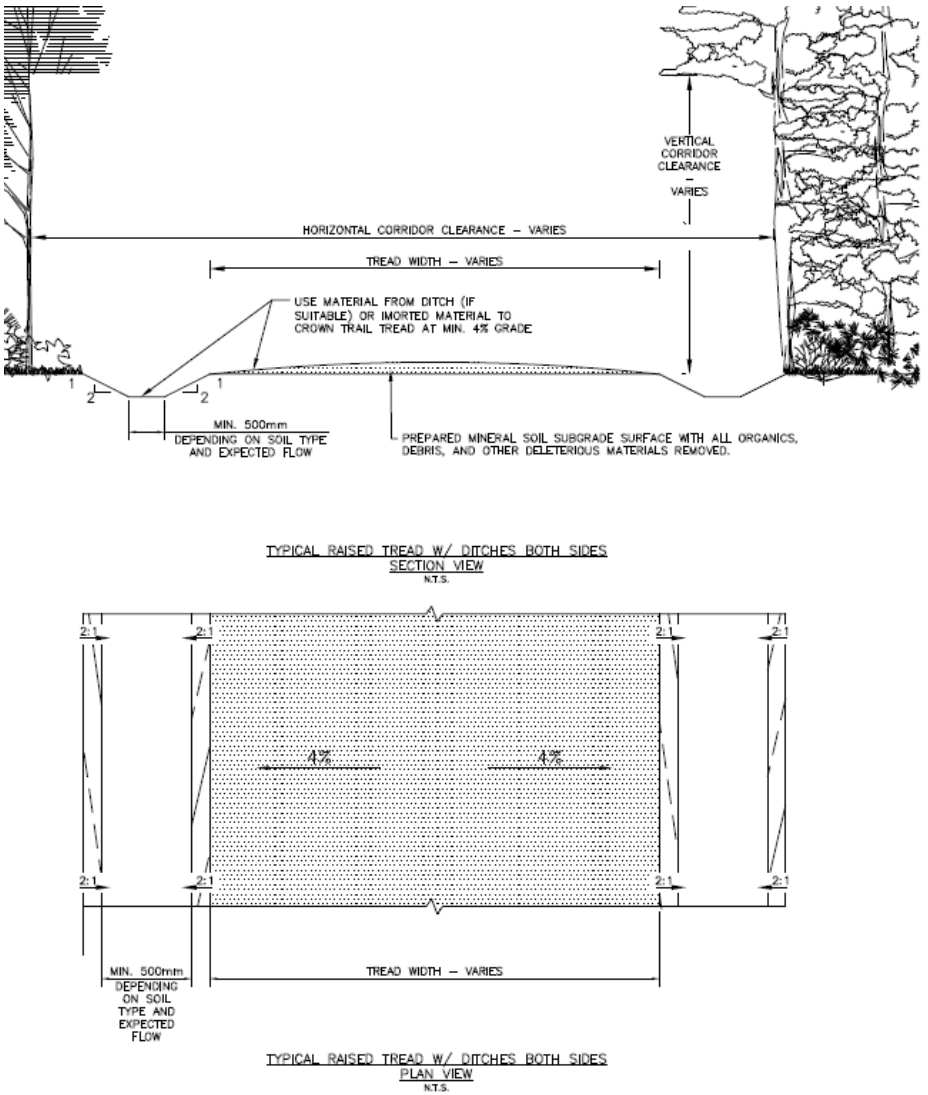


Figure 9 Raised Tread

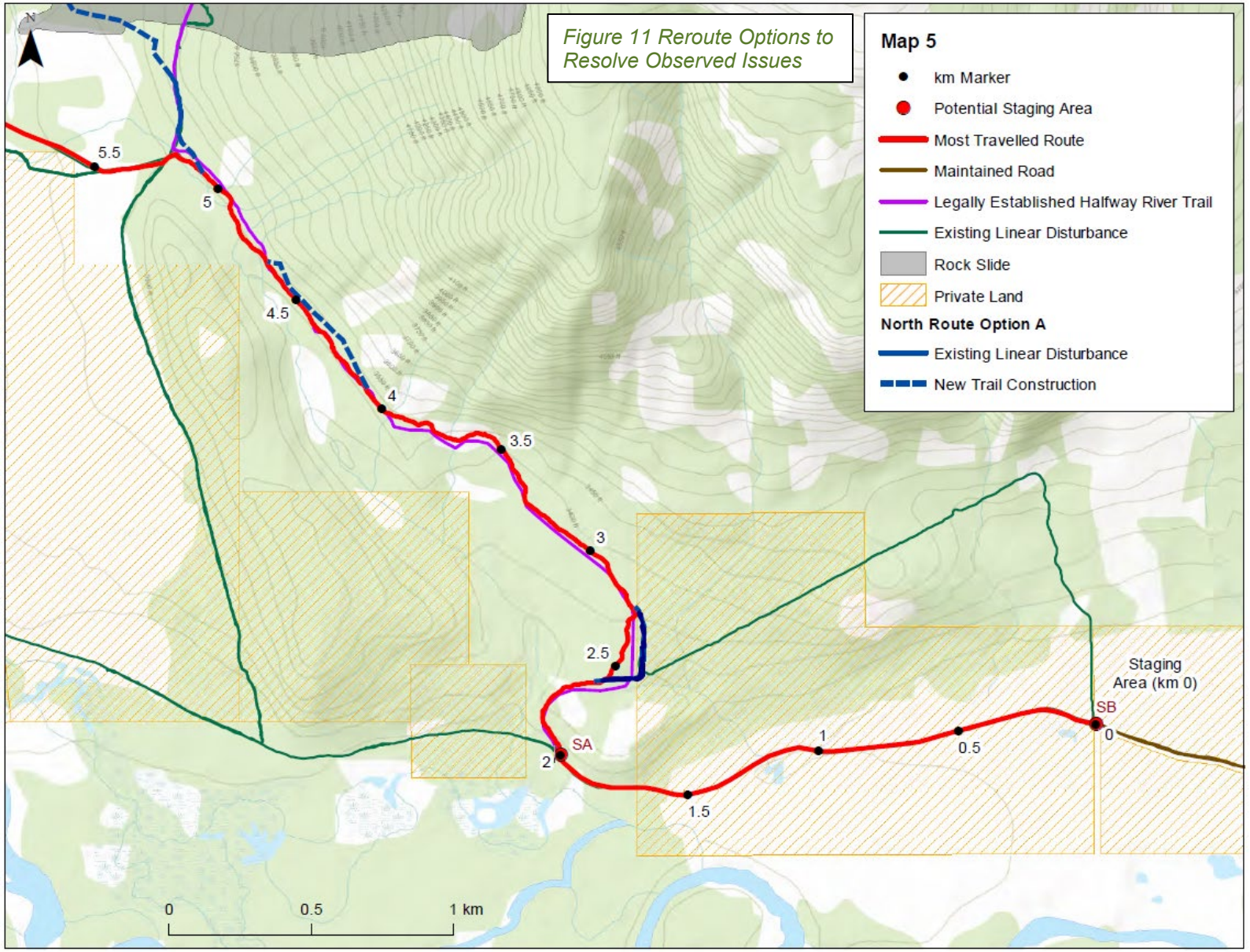
Suitable material should be used to crown the trail tread surface so that water flows off the trail. Raised tread can be constructed without ditches if enough suitable material is transported to site from borrow sources, nearby bench cuts, or by hauling to site to raise the tread sufficiently above the adjacent terrain such that the soil does not act as a sponge and remain saturated.

Figure 10 Raised tread construction on the High Rockies Trail using geotextile and no ditches. Culverts are to prevent the trail from the acting like a dam and becoming saturated.

4.3. Recommendations

Options, preferred options and Class D (+/- 30%) cost estimates to resolve specific observed problems along the trail are presented in the following section and organized by trail segment. The consulting team recommends that the preferred option be implemented in order to ensure the trail meets the TMO and safety and sustainability are improved.

4.3.1. Segment on the Southern Slopes of Pink Mountain (Eastern Segment) (Km 2 – 2.8)



Segment	Km 2 – 2.8	**Segment on the Southern Slopes of Pink Mountain (eastern segment)**
Trail Condition	Passable	

Defect Summary: Current trail is passable however there are numerous sections where it is built in the flat area and holds water and has developed ruts. There is a bottom to these ruts, so users are still able to travel though this area however some trail widening, or braiding is already occurring to avoid the wet areas. Note, the Legally Established Halfway River Trail near km 2.5 is just a line drawn on a map, users currently travel east of it though the wet area or west of it in the private land.

Recommendations:	Realign existing trail where needed using Option A and confine and harden wet areas (Figure 11)	**Length (m)**	**Class D Cost Estimate**
Option A	**Description**: Realign km 2.4 – 2.8 onto the private land if possible. The route to the west is through a flat wet area. **Pros:** • This existing route follows the contour to take the trail onto a small hillside where proper drainage can be established vs short cutting though the flat wet area.		
	Cons: • Involves land owner discussions and agreements.	890	$3,600
Option B	**Description:** Repair existing alignment with raised trail tread and ditching. **Pros:** • Avoids land owner discussions.	800	$32,000
	Cons: • Crosses a flat wet area which will require significant construction to create a dry and sustainable trail tread.		

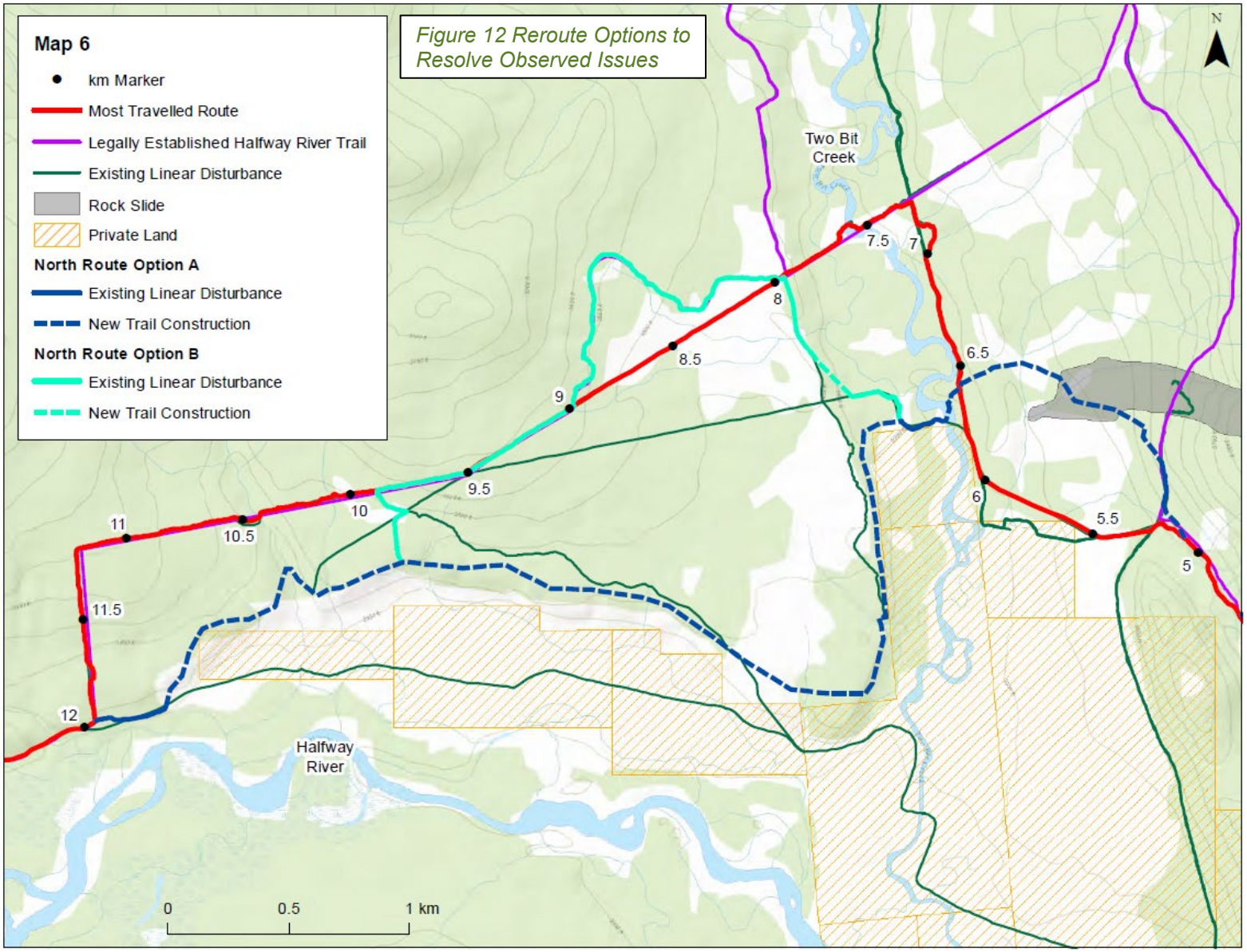
4.3.2. Segment on Southern Slopes of Pink Mountain (Km 2.8 – 5.3)

Segment	Km 2.8 - 5.3	**Segment on Southern Slopes of Pink Mountain**
Trail Condition	Passable	

Defect Summary: Current trail alignment is reasonable and generally follows the toe of the slope from Pink Mountain. There are some cupped areas that hold water and a series of small drainages which flow and cause grief for snowmobilers as they do not freeze very quickly in the winter.

Recommendations:	Realign existing trail where needed using Option A and confine and harden wet crossings (Figure 11)	**Length (m)**	**Cost Estimate**
Option A	**Description**: Realign km 4 - 4.6 and 5.2 - 5.5 up onto the hillside as a bench cut trail. Add ditching and rock crossings or culverts at the drainages where necessary. **Pros:** • Lower capital cost to construct bench cut and lower level of maintenance. • Allows for easier snowmobile use providing culverts are sized and located properly to minimize icing.		
	Cons: • Higher capital cost than doing nothing. • Segments of new linear disturbance which will require closing existing alignments.	2500	$36,000
Option B	**Description:** Repair existing alignment with raised trail tread and ditching. **Pros:** • No new linear disturbance.		
	Cons: • Higher maintenance cost due to requirement to clean out ditches.	2500	$ 40,000

4.3.3. Approach to Two Bit Creek (Km 5.3 – 6.5)



Segment	Km 5.3 – 6.4	**Approach to Two Bit Creek**
Trail Condition	Bottomless Muskeg	

Defect Summary: Current trail alignment follows old cut lines that never had any ground work. Part of the segment is a series of mud holes and is very widely braided and shows signs of users frequently becoming stuck. Note, the Legally Established Halfway River Trail that travels north shows next to no use.

Recommendations: Realign existing trail using Option A, partially on existing road and construct new trail as necessary (Figure 12)		**Length (m)**	**Cost Estimate**
Option A	**Description**: From km 5.3 head north on a fairly well-built road. When the grades make sense construct a new trail as a bench cut with sidehill drainage out onto the debris from the rock slide off Pink Mountain. Use this debris material with a high rock content and some fines as the trail tread as opposed to the nearby muskeg. There may still be a segment of muskeg to cross or a small drainage that will need proper trail construction. The final approach to Two Bit Creek can follow a series of ridges to stay high and dry. **Pros:** • This will avoid the need for costly raised tread for 500m on the current alignment • Final product will provide reduced maintenance due to removing fall line and extensive raised tread. • Avoids private property.	1250	$38,000
	Cons: • May require a small avalanche risk assessment (perhaps even internal staff could confirm safety of the slope, field reviews and mapping data show the slope to be a maximum of 27deg.) • Segments of new linear disturbance which will require closing existing alignments.		
Option B	**Description:** Repair existing alignment though muskeg with raised trail tread and ditching. **Pros:** • No new linear disturbance	1200	$ 31,000
	Cons: • Crosses private property • Higher maintenance cost • 400m of this is in the flood plain and could change/erode due to flooding		

4.3.4. Two Bit Creek Crossing & Muskeg Plateau (Km 6.4 – 9.5)

Segment	Km 6.4 – 9.5	**Two Bit Creek Crossing and Muskeg Plateau**		
Trail Condition	Bottomless Muskeg & Deep ruts			
Recommendations:	Realign existing trail using Option A, mostly by constructing new trail (Figure 12)		**Length (m)**	**Cost Estimate**
Option A	**Description**: From km 6.4 the current trail heads north and is not worth repairing as there are better options. Option A and B both minimize time spent in the wet valley bottom. They cross Two Bit creek at a very shallow gravel bar and then follow the high points of land towards the hillside to the west. It should be noted that there is extensive beaver activity in this entire area, so opportunities and challenges could change. At the west hillside (east facing), Option A would head south, and Option B would head north, both with newly constructed bench cut. This hillside has a large bog sitting on the top of it, seeping water to the entire area. A bench cut with a high sided ditch would be required to gain this hill at a 10% grade, a grade that both summer and winter vehicles can safely climb and a grade to minimize erosion. On Option A, new bench cut trail construction would follow the crest of the slope, which was the only actually dry landscape found. As shown in the image below, this south facing slope was fairly dry. The water table was near the surface in the muskeg uphill of the break in the slope (uphill of the blue line), and water table at the surface again at the bottom of the slope. At the crest of the ridge the water table is farther underground. When examining the mapping available it shows how the water is confined to small drainages on this slope, vs uphill, there is standing water covering vast expanses. The green line represents the ideal trail location, with a steep enough outslope to provide sidehill drainage off of the rolling contour trail. 		3,900	$ 150,000

	Pros: • Dry trail tread due to crest of slope location allowing for natural drainage and south facing exposure sun and wind evaporating moisture • Bench cut trail (as opposed to raised tread, which is costlier to construct and maintain) • Option with lowest maintenance requirements • Views of the landscape from the ridge crest		
	Cons: • Unknown soil conditions at SE corner where private property pushes the trail back into terrain that may have muskeg for 200-500m. • High capital cost of construction • New linear disturbance in a landscape that is very disturbed by humans already • Slight duplication of the ORV trail that is upslope of it, but too far into the bog so it is wet and has no-where to drain and no sun exposure		
Option B	**Description:** From Two Bit Creek, Option B would head north with a bench cut and join with an existing linear disturbance that is close to the crest of the slope. This section would require repair of one wet area. Option B would then cross the existing Halfway River Trail route at km 8 and follow the "twisty trail" that it appears someone built in an attempt to consciously follow dry terrain. The east end of this route would need raised tread, which could be costly depending on the depth of the organics and proximity of good material. The western half of this trail is in quite good shape, however increased traffic might create ruts and require a raised tread or bench cut with a high side ditch to be constructed along here. For winter use, it could stay on the compass straight linear disturbance which is currently being used from km 8-9. At km 9 – 9.7 Option B and the existing trail would share the same alignment. Here raised tread would be required for roughly 300m, some of it over muskeg. From km 9.7 it would zig and zag on existing linear disturbance to join Option A. Roughly 150m at the south end of this would be raised tread on muskeg. It should be noted that this option could be driven with minimal new trail construction and then driven how it is on the alignment as laid out. However, over time without constructing a proper trail base, many sections of muskeg would punch out and the mud hole related problems would come back. The price as calculated is for roughly the same level of finish or even slightly less than Option A. **Pros:** • Minimal new linear disturbance	4360	$ 141,000
	Cons: • High capital construction cost • Higher maintenance cost • Longer • Many junctions and turns – more confusing for users and more signage		

4.3.5. West Descent to Halfway River Trail (Km 9.7 – 12)

Segment	Km 9.7 – 12	**West descent to Halfway River Trail**		
Trail Condition	Bottomless Muskeg & Deep ruts			
Recommendations:	Realign existing trail using Option A, new trail construction (Figure 12).		**Length (m)**	**Cost Estimate**
Option A	**Description**: Option A involves continuing the new trail along the crest of the slope like explained above and in the image above. The trail would have to follow a bench cut into and out of a small un-named creek, which could be at 10% grade or less. It would then have to stay far enough north to bypass the corner of private property. The soil conditions at this point are unknown and divert far enough away from the crest of the slope to require raised tread. Option A would then descend the contour to re-join the original Half Way River trail where it is constructed like a road with a solid gravel base. It would re-join just east of km 12. **Pros:** • Dry trail tread due to crest of slope location allowing for natural drainage and south facing exposure sun and wind evaporating moisture • Bench cut trail (as opposed to raised tread, which is costlier to construct and maintain) • low maintenance requirements • Views of the landscape from the ridge crest		1620	$ 79,000
	Cons: • Unknown soil conditions at SW corner where private property pushes the trail back into terrain that may have muskeg for 250m.			
Option B	**Description:** The issues with the existing trail are described in detail in Table 1. To summarize, the existing trail descends 40m of vertical along the fall line with multiple wet areas at the top and part way down the hill. It is prone to fall line erosion and the bogs appear to be deep. Repairing the existing trail is not considered a feasible option.			

4.4. Staging Area Options

4.4.1. Staging Areas on the Northern Route

The consulting team sought out potential staging areas along Pink Mountain Road near the beginning of the trail. Based on consultation with RSTBC staff, the preferred site was chosen to be at km 2 of the currently most travelled route (km 22 hwy marker as shown on Figure 4 & 17). Either staging area shown on the map, Staging Area A (SA) or Staging Area B (SB), will require the gate that is across the Pink Mountain Road to be opened (Figure 16).

RSTBC should establish formal agreement with the adjacent landowner to ensure the gate across the Pink Mountain Road remains open or is redesigned to only permit the desired width vehicles to travel through the gate and along the roadway to the trailhead. Signage should be installed to ensure trail users know they are permitted to cross the gate to the trailhead. If the gate is currently closed to due to cattle grazing, a new cattle guard should be installed such that the gate can be kept open.

Staging area SA would offer the most logical staging area for the following reasons:

- Ample crown land to develop a full staging area
- The route changes to a narrower road at this point – would be a logical place for a choke/filter to ensure only specified vehicle widths will fit
- Nearby water for equestrian users from the various river channels

Figure 13 Potential Staging Area SA, located where users leave the graveled and graded Pink Mountain Road and head north onto smaller roads and trails.

Features the design should incorporate are:

- Gravelled pad
- Angled parking for trucks with trailers
- Pull through access and egress to allow easy exit and entry onto the road for trucks with trailers
- Warming shelter for winter use (pending anticipated level of winter use)
- Pit Toilets (pending anticipated levels of use)
- Trailhead kiosk with wayfinding, regulatory, responsible use and interpretive signage

Staging Area SB is the second option for staging on the North Route. It is at the existing informal staging area at km 0 of Halfway River Trail (see Figure 4). This site is located outside of the current gate and has a strip of public land to accommodate summer and winter users. Data available to the consultant team did not identify any major environmental constraints or land tenure constraints. However, the area is within private land, as such, consultation with the landowner will be essential to ensure support for and appropriate design of the Staging Area. The informal staging areas contains some signage which is in poor condition and almost illegible.

The area has desirable development characteristics as it is a large, relatively flat area, with minimal trees or mature vegetation, easy access and egress from the road and good sightlines along the road. This site is less desirable than SA due to the extra distance to be travelled along the Pink Mountain Road by ORV or Horse, the narrower strip of crown land, and the lack of water nearby.

Figure 14 Current informal trailhead site.

Figure 15 Current trailhead sign

Figure 16 Trailhead sign and closed gate with no trespassing sign at the start of the current and proposed trail alignment.

4.4.2. Staging Areas on the Southern Route Option

Though the consulting team has recommended that RSTBC does not pursue the Southern Route Option, suitable staging area locations were identified and are identified (Figure 17). In total, 6 Staging Area Options were identified. Staging Area Options 1 – 4 are more suited as winter use staging areas as they are closer to where plowing currently ends. Staging Area Options 1, 2 and 4 are preferable to option 3 which is located on the air field. However, while staging in these locations will reduce costs associated with snow plowing / removal, each of the sites significantly increases the distance winter users will need to travel on their snowmobiles. During summer months, Staging Area Option 5 is most desirable as it is located immediately adjacent to the resource road / potential trail and users are already camping in this area. Staging Area Option 6 enables users to travel further along the road in their on-highway vehicles, but the site is located on an old well site that is 580m off of the main road / trail. For many users, the road conditions are such that travel via ORV on the road / trail is faster than on-highway vehicles can travel. Other active well sites exist along the route and may serve as tempting staging areas but should be avoided to protect public safety and minimize conflicts between industry and recreational users (e.g. damage to equipment).

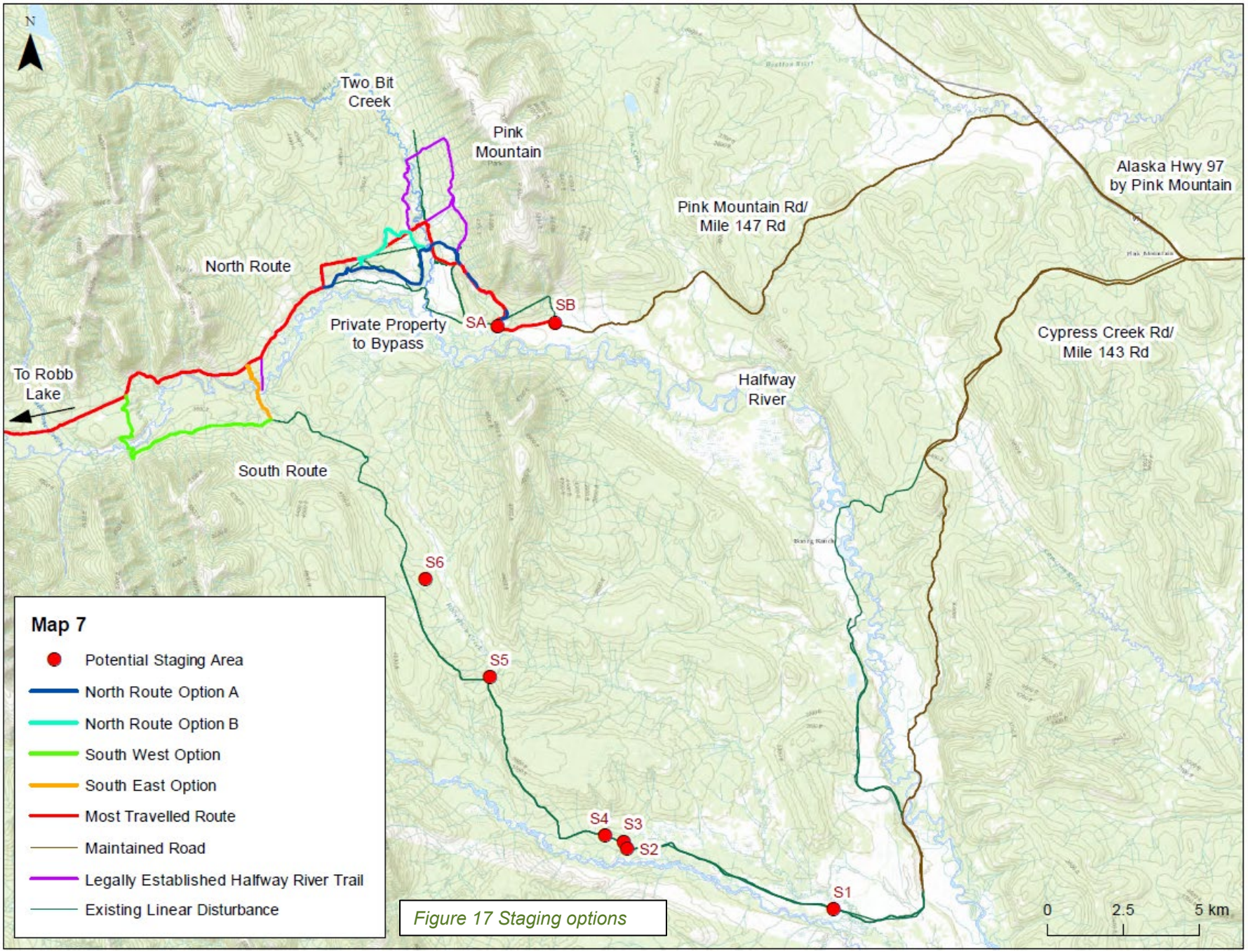


Figure 17 Staging options

Potential Staging Areas

Staging Area Option # 1

Staging Area # 2

Staging Area # 3

Staging Area # 4

Staging Area # 5

Staging Area # 6

4.5. Signage

Only one official sign was observed on the existing Halfway River Trail. As shown in Figure 18, the sign is a trail head sign and is in poor condition. The sign contains basic wayfinding, responsible use and interpretive information.

Recognizing that preparation of a detailed signage plan for the trial was outside of the scope of work for this project, the consulting team has of general recommendations that should be implemented to help users travel the trail safely, efficiently and in a way the helps them minimize the impacts of their use. RSTBC should:

Figure 18 Existing trailhead sign

- Prepare a detailed signage plan for the trail.

  A signage plan should be to ensure all essential trailhead, regulatory, wayfinding, caution / warning and interpretive signage is provided and appropriately sited. Specific attention should be paid to ensuring:

  - That signage is kept to the minimum in order to maintain the Mid-country to backcountry recreation setting that is desired for this trail experience.
  - Trailhead signage is available and includes essential information about the trail (length, difficulty level, challenges, risks, equipment to be taken), regulations, trail etiquette and stewardship (e.g. Leave No Trace).
  - Wayfinding signage is available at all intersections and decision points.
  - Signs are sited in visible locations and in locations that give ample warnings of approaching corners, obstacles and risks.
  - Interpretive signage could be established to help increase seat time, enhance the visitor experience and improve responsible use.
- Update the trailhead signage to ensure it includes essential visitor information taken from the Trail Management Objective. This information will help users prepare for the trail conditions, be prepared while also helping to manage risk to RSTBC.
- Consider developing a unique trail brand and integrating the brand all trailhead, wayfinding, stewardship and interpretive signage.

To assist RSTBC with project planning, approximate sign costs have been estimated and included in summary of costs in section 5. The costs were based on an assumption that, at minimum, the trail head sign would be upgraded, and directional signage would be installed at each intersection. Signage design and engineering costs were not factored.

4.6. Restoration

The general area around the Halfway River Trail contains extensive linear disturbance. Even with a new hardened surface and well signed trail, some users will choose to explore any obvious linear disturbance they can drive. This will continue to trample and damage vegetation and prevent natural reclamation. The northern climate and acidic muskeg environment result in slow growth of vegetation and exceptionally slow natural reclamation of cut lines or an old road.

Active decommissioning of these linear disturbances should be considered if RSTBC wants to decrease vehicle caused erosion, environmental destruction (braiding), and to mitigate habitat fragmentation and restore large habitat patches. For some users, a few boulders or logs and a road closed sign is more like an invitation to explore than it is an effective closure. As shown in figure 19, effective reclamation should involve loosening and roughening any compacted surface to look like natural terrain or rougher, covering it with organics harvested from nearby new construction, blocking it off with logs and other debris, and planting a screen of both fast-growing hardwoods and slower growing conifers so the view is blocked both in the summer and winter. Decommissioning should continue down the disturbance as far as affordable, but at a minimum until out of sight from the last intersection. The consulting team recommends that, RSTBC reclaim all segments of the existing trail that are not included the revised Halfway River Trail as the new segments of trail are constructed / upgraded.

Figure 19 Example of a decommissioned road with all signs of ditches and road shape removed. The roughened surface and debris prevent easy travel allowing vegetation to succeed.

5. Cost Summary

Table 5 Summary of Class D Cost Estimates by Recommendation for re-routes and repairs to the North Route from km 0 to km 12

Summary of Class D Cost Estimates by Recommendation	
Segment	**Cost estimate (Class D)**
Trail on southern slopes of Pink Mountain (east portion)	$ 3,600
Trail on southern slopes of Pink Mountain	$ 36,000
Approach to Two Bit Creek	$ 38,000
Two Bit Creek and Muskeg Plateau	$ 150,000
West descent to Halfway River Trail	$ 79,000
Detailed design & Tender drawings	$ 50,000
Signage (design not included)	$ 25,000
Subtotal	$ **381,600**
Contractor Living Out Allowance	$ 38,160
Mobilization & Demobilization	$ 20,000
Subtotal	$ **439,760**
Contingency (30%)	$ 132,000
Total	$ **571,760**

6. Construction Plan

6.1. Construction Sequencing & Logistics

Ensuring an efficient approach to construction is vital to saving construction costs and optimizing the use of equipment. The consulting team recommends that RSTBC apply the following sequencing and logistics when implementing the construction:

- Tender the construction before April so trail contractors have time to schedule and prepare – February is ideal.
- Tackle all the issues that are deemed important within a given area at once. Construction equipment travels very slowly and there is no sense repeatedly paying mobilization and de-mobilization fees.
- Allow contractors to “build their way into an area”. Construction equipment needs a level enough surface to drive over to not flip over or sink in, so repairing issues along the way leads to overall efficiency.
- Brush new build trails well before the migratory bird window or plan for construction after the nesting season.
- If decommissioning of linear disturbance is to be conducted – do it at the same time as construction so that the organics from the new build can be used to rehabilitate the old disturbance.

References

The following reference material informed the recommendations and designs applied in this report:

- British Columbia Ministry of Forests Recreation Manual Chapter 10: Recreation Trail Management
- Exceptional Trails: A Guide to Planning, Classification, Design, Construction and Management of Trails on Alberta's Public Lands. Alberta Environment and Parks. 2018
- Great Trails: Providing Quality OHV Trails and Experiences, Dick Dufourd & NOHVCC, 2015
- Guidelines for a Quality Trail Experience: Mountain Bike Trails, Bureau of Land Management & IMBA
- Trail Fundamentals, US Forest Service
- Trail Planning, Design, and Development Guidelines, Minnesota Department of Natural Resources
- Trail Solutions: IMBA's Guide to Building Sweet Singletrack, IMBA
- Standard Trail Plans & Specifications, US Forest Service

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