Parks Canada Basic Impact Analysis

1. PROJECT TITLE & LOCATION

Title

Trans-Canada Highway (TCH) Rock Slope Reprofiling- Yoho National Park (YNP) - 2016 Work

Location

The Project is located in Yoho National Park (YNP) along the Trans-Canada Highway (TCH). Over the course of the four-year project, work will be completed in the same two general sections along the TCH: between kilometer km 88 and 91 and between km 114 and 128 (Tables 1 to 3) (Appendix A; Figure 1). Tender and construction will proceed each fiscal year until program completion in 2018 depending on available funding.

This Basic Impact Analysis (BIA) will focus on Project activities for 2016 work and herein will be referred to as the Project. Although 2016 Project work will include the continuation and completion of work approved in 2015, this BIA assesses only work initiated in 2016, which includes three reprofiling sites, three road side deposit sites and one access route (Tables 1 to 3). Reprofiling work, including site laydown and construction camp, approved in 2015 was assessed under separate BIAs (PCA 2015a), and work proposed for 2017 and 2018 will be assessed under separate BIAs. Some tree felling activities were considered under a separate BIA (PCA2015b) and in the 2016 BIA are only referred to in their relation to other Project activities, or for sites that were not approved for clearing in 2015 (i.e., Spiral Tunnels Hill, road side deposit sites and the access route to Big Topple).

The TCH km markers in this document are based on a station system provided by McElhanney Consulting (MCE), which is measured in km along the TCH centerline and uses the east gate of Banff National Park as Station km 0+000.

Table 1. Annual Construction Progress

Stations	Slope Name	Station Start (km)	Station End (km)	2015	2016	2017	2018	Approximate Footprint m² [a]
Km 88 to 91	Sherbrooke Soil Slope	88+200	88+480	×	×	×	×	n/a
	Sherbrooke Rock Slope [b][c]	88+530	89+050	✓	✓	-	-	3,123
	Lower Sherbrooke[b][c]	89+195	89+430	✓	✓	-	-	739
	Upper Dustin's	89+600	90+925	×	×	×	✓	n/a
	Dustin's Slide	89+925	90+220	×	×	×	✓	n/a
	Spiral Tunnels Hill	90+220	90+635	×	✓	✓	-	2,698
Km 114 to 128	Through Cut Left	114+840	115+120	×	×	×	✓	n/a
	Through Cut Right	114+900	115+050	×	×	×	✓	n/a
	Big Topple	115+370	115+600	×	✓	-	-	3,361
	Little Topple[b][c]	115+675	115+820	✓	✓	-	-	1,513
	Mount Vaux[c]	116+155	116+865	×	✓	✓	-	5,967
	Leanchoil East	123+100	123+400	×	×	×	?	n/a
	Leanchoil West	123+150	123+325	×	×	×	?	n/a
	Phyllite	124+270	124+670	✓	-	-	-	n/a
	Western Boundary	125+820	125+940	×	×	×	?	n/a

✓ = Scheduled/priorities for slope reprofiling.
× = Not scheduled for year.
- = Slope complete.
? = Slope may not progress to construction.
[a]Footprint area is based on information provided by Tetra Tech EBA. These areas reflect full slope extent proposed for reprofiling and not final footprint for 2016 work. Exact numbers subject to change with design finalization.
[b] Reprofiling at these sites is a continuation of approved 2015 work and not assessed in this BIA.
[c]Vegetation clearing assessed in PCA 2015b.

Table 2. Deposit Sites

Deposit Site	Station (km)	2015	2016	Approximate Footprint m² [a]
Welcome Station (AB/BC Storage Site)[b][c]	82+000	✓	✓	16,371
Mount Vaux Storage Site[b] [c]	119+550	✓	✓	40,651
Field Flats Road Side Deposit Site	94+916 to 96+441	×	✓	28,319
Through Cut Road Side Deposit Site	114+200 to 114+900	×	✓	26,407
Lower Mount Vaux Road Side Deposit Site	117+150 to 118+200	×	✓	32,801

✓ = Scheduled for deposit.
× = Not scheduled for year.
[a] Footprint area is based on information provided by McElhanney 2015 and Tetra Tech EBA. Exact numbers subject to change with design finalization.
[b] Disposal at these sites is a continuation of approved 2015 work and not assessed in this BIA.
[c] Vegetation clearing assessed in PCA 2015b.

Table 3. Access Routes

Access Route	Station	2015	2016	Approximate Footprint m² [a]
Big Topple	115+100	✓	✓	2,307
Little Topple[b][c]	115+500	×	✓	1,983

✓ = Scheduled for clearing
× = Not scheduled for year
[a] Footprint area is based on information provided by Tetra Tech EBA. Exact numbers subject to change with design finalization.
[b] Clearing at this site is a continuation of approved 2015 work and not assessed in this BIA.
[c] Vegetation clearing assessed in PCA 2015b.

2. PROPONENT INFORMATION

Parks Canada Agency (PCA)

Functional Manager of Project (FMP)

Zachary Boles
Highway Engineering Services (HES)
Parks Canada, Box 900
Banff, AB T1L 1K2
Email: zachary.boles@pc.gc.camailto:zachary.boles@pc.gc.ca
Telephone: 403.760.1355

BIA Author: Golder Associates Ltd. (Internal Filing #: 1540777_RP0038)

3. PROPOSED PROJECT DATES

Planned commencement: 2016-04-01
Planned completion: 2016-10-31

4. INTERNAL PROJECT FILE

2016-010Y

5. PROJECT DESCRIPTION

Project Justification:

The TCH is a key transportation route, which facilitates use by 5 million visitors to the Mountain Parks each year, with annual average daily traffic volumes near the Project area reaching 5,762 vehicles in 2014 (BC MOTI 2014). Reliability of movement through this corridor is a priority, with a need to ensure safety and minimize delays that can lengthen travel times (Government of British Columbia 2015).

The current alignment was constructed in the 1950s before the advent of controlled blasting techniques, which prevents rock damage and overbreak on mountain slopes. The slopes have performed relatively well over the years; however, in the last 5 to 10 years, slope deterioration has resulted in an increased maintenance burden for Parks Canada Agency (PCA) and has caused sections of the TCH to be closed while cleanup operations are performed. Addressing potentially unstable rock slopes using controlled blasting techniques will assist in ensuring safe and reliable road infrastructure for visitors and the general motoring public. Slope reprofiling is intended to reduce PCA's long-term maintenance burden and reduce the risk of impacts to the highway from slope failures.

Fill material from 2016 slope reprofiling has been proposed to be placed along the TCH at sites identified in McElhanney's preliminary engineering assessments as requiring fill for possible future twinning and realignment. Road side deposit would offset any future need to haul fill to these sites, reducing cost and vehicle traffic within the Project area. Use of these road side deposit sites would also reduce the burden on approved deposit sites (i.e., Welcome Station and Mount Vaux storage), which have finite storage capacity. Additionally, road side deposit sites have been designed to maximize visitor safety (e.g., wide shoulders and gradual slopes), if these areas they are used for possible future twinning and realignment.

Project Details:

Specific Project details broken down by Project phase are included in Table 4. Below is a summary of project details.

Construction is scheduled to begin late April, 2016 and to be completed by October 31, 2016. The project will have a hiatus between June 29, 2016 and September 7, 2016 to avoid construction during the heaviest visitor traffic months.

Prior to construction, temporary facilities, including a laydown area and site offices (e.g., ATCO trailer office, fuel and explosives storage area), will be set-up near the Hoodoo Creek Campground. This site is also the preferred location of a construction camp if the contractor chooses to use this site.

Site preparation, including clearing and grubbing, will be required at Spiral Tunnels Hills, the road side deposit areas, and the access routes to Little Topple and Big Topple slopes. Tree clearing associated with site preparation will be conducted before Environment Canada's General Regional Nesting Period for the Northern Rockies, Zone A4, which is before April 20, 2016. Pre-clearance nest surveys will not be required unless clearing is not competed prior to the April 20 (Environment Canada 2011). Removal of felled trees will be completed before May 6, 2016. Stockpiled organics, trees, grubbed materials, stumps, and topsoil will be segregated, hauled to disposal sites and stored independently of other materials. Access routes will be re-vegetated on completion of construction; topsoil from stripping will be placed on cleared areas and then re-seeded with a Lake Louise Yoho Kootenay Field Unit (LLYK FU) approved seed mixture and/or tree species.

The Project will involve blasting and excavating materials from the reprofilng sites, which are primarily within the TCH right-of-way (ROW). Road-way ditches will be excavated and graded to retain rock fall debris and prevent run-out onto the road. Controlled blasting (either trim blasting or production blasting) will be used on all final faces to limit damage to the rock behind the face and enhance long-term stability of the rock cuts. Scaling will be used to facilitate access to blasting locations and to remove loose rock produced by blasting. Waste will be either hauled to previously approved disposal sites (i.e., Mount Vaux or the Welcome Station); or, where required for possible future TCH twinning and realignment, aggregate will be placed and compacted on the stripped and grubbed TCH shoulders at proposed road side deposit sites. Excavation may be required for drainage, culvert replacement/ extension and ditch re-grading at these road side disposal sites.

At the time of writing this BIA, final detailed design has not been completed; however, the estimated total Project footprint for the 2016 work is expected to be approximately 10.2 hectares (ha) including the reprofiling sites, disposal sites and access route. The final size of the footprint will vary depending on environmental constraints of the Project area, which include, but are not limited to, the Kicking Horse River, riparian areas/tributaries/springs, unique and/or important wildlife habitat and/or vegetation, terrain suitability, schedule and budget. Known constraints in association with aquatic resources, vegetation, and wetlands have been mapped and will be considered for the final design of the Project. Final dimensions of the Project cannot be provided until the design is completed.

As the Project works will go out to tender after the completion of the BIA, the Environmental Protection Plan (EPP) will serve as an important document to identify specific mitigations to reduce any potential negative effects of the Project. The EPP will be based on final designs and will be developed by the successful contractor and with involvement from the LLYK FU staff. The EPP will be provided to the LLYK Environmental Assessment Coordinator (EAC) after the Project is awarded, but no later than two weeks prior commencement of work.

Table 4. Summary of the Yoho 2016 Rock Slope Reprofiling in Relation to Project Phases and Activities

Project Phases and Activities Table			
	Phases	**Associated Activities**	**Details**
Project Components	**Construction / Site Preparation**	Tender and award project	Tender advertisement by March, 2016.
			Contract Award by March, 2016.
		Preparation of Environmental Protection Plan (EPP)	Successful contractor to prepare EPP in collaboration with LLYK FU (which includes but is not limited to: Pollution Management, Erosion and Sediment Control, Waste Management, Equipment Maintenance and Fuel Management, Relics and Antiques, Noxious Weed Control, Protection of work limits, etc.).
		Mobilize Equipment	Mobilize equipment to site.
		Temporary Facility	Set-up temporary facilities for construction camp, laydown, and site offices (e.g., ATCO trailer office, fuel storage area) at Hoodoo Creek.
		Supply and storage of materials	Materials will be stored at the laydown site at Hoodoo Creek.
		Clearing and Grubbing	Clearing and grubbing will occur at the reprofiling and road side deposit sites.
			Standard heavy equipment will be used (e.g., feller/bunchers, excavators, bulldozers, rock trucks, graders, rollers).
		Stripping	Top soil will be stripped in advance of excavation activities. Stripped soil materials (including fine forest litter) will be placed and stored at approved disposal sites, for later reclamation use on graded slopes.
		Grading	Grading will be required to maintain positive drainage and natural appearance within reprofiling and deposit sites.
		Drilling/ Anchoring	Drilling will be required to install anchors into rock.
		Blasting	Blasting (either trim blasting or production blasting) will be used on all final faces to limit damage to the rock behind the face and enhance long-term stability of the rock cuts.
		Scaling	Scaling will be used to facilitate access to blasting locations and to remove loose rock produced by blasting. Equipment will include a pneumatic chipper and/or an excavator-mounted hydraulic rock breaker, scaling bars, mattocks/ pulaskis, shovels, hydraulic jacks or wedge jacks, chainsaws, and other approved equipment.
		Excavation	Reprofiling sites, ditches, access areas and culverts to be extended will require typical excavation and backfill activities. Excavation of materials utilizing machinery (e.g., excavator, bulldozer, and trucks).
		Disposal of Waste	Waste materials from the reprofiling sites will be loaded and hauled to one of the five deposit sites. Stock piled organics, trees, grubbed materials, stumps, and topsoil will be segregated and stored independently of other materials. Where practical, rock fill will be separated from bulk fill material.
			Construction, trade, hazardous and domestic waste materials will be removed to a site outside of YNP.
		Culvert Installation	Culvert replacement as directed by the Department Representative.

Table 4. Summary of the Yoho 2016 Rock Slope Reprofiling in Relation to Project Phases and Activities

Project Phases and Activities Table			
		Installation of barriers	Tri-Kon PreCast Concrete Products 810 mm Roadside Barrier or approved equal will be installed within three days of completing work in an area.
		Use of machinery	Machinery will include: excavators, bulldozer, hydraulic splitters, trucks, front-end wheel loader, feller/ bunchers, graders, rollers, and pneumatic chipper.
		Transport of materials/ equipment	Transport of construction materials to site (equipment) and removal of construction wastes.
		Use of Chemicals	Fuel and oil for construction equipment and vehicles, explosives and associated materials for blasting operations, resin grout or cementitious grout may be used for anchoring.
		Vehicle traffic/ Traffic Management	Traffic controllers and signs will be required during construction activities / equipment maneuvering.
		Drainage	Roadway ditch re-grading and culvert replacement as directed by the Departmental Representative.
		Backfilling	Backfilling for culvert repair excavations.
	Operation/Implementation Decommissioning	Maintenance	Roadway will be maintained using typical heavy equipment (e.g., snowplows, pavers) as required.
		Use/Removal of temporary facilities	Temporary facilities at Hoodoo Creek will be removed.
		Re-vegetation	Topsoil from stripping will be placed on cleared areas and re-seeded with an approved native grass seed mixture and monitored and treated post-construction for presence of invasive species. Tree and shrubs will be replanted with native species approved by PCA and Environmental Safety Officer.
		Road signs	All temporary traffic control and road signs will be removed.
		Planting	Remediation areas will be re-seeded with an approved native grass seed mixture and monitored and treated post-construction for presence of invasive species. Tree and shrubs will be replanted with native species approved by PCA and Environmental Safety Officer.

6. VALUED COMPONENTS POTENTIALLY AFFECTED

Golder conducted desktop searches for background information pertaining to components that may be potentially directly or indirectly affected by the Project and associated activities.

The list of sources searched included:

- BIA Trans-Canada Highway Rock Slope Reprofiling 2015 Works;
- BIA Vegetation Removal for 2015 Trans-Canada Highway Rock Reprofiling;
- British Columbia Conservation Data Centre(BC CDC) Species and Ecosystems Explorer;
- Parks Canada Agency Biotics Web Explorer;
- BC Ministry of Environment Habitat Wizard;
- BC Ministry of the Environment Fisheries Information Summary System (FISS) database (MOE);
- Government of Canada Species at Risk (SAR) Public Registry (Environment Canada); and
- LLYK FU provided data.

Information obtained during the background search was used to identify valued components (VCs) considered to 'carry forward' in the BIA. Rationale for the inclusion or exemption of a component to be considered as a VC is provided in the sections below. One or more key indicators were selected to focus the effects for each VC. A key indicator represents a primary feature or issue related to the VC that has the potential to change as a result of the Project and can be described as an aspect or characteristic of the VC that, if changed as a result of the Project, may represent an effect on the VC.

VCs potentially affected by the Project were identified through the Effects Identification Matrix (Appendix B). VCs were selected based on the following criteria:

- the sensitivity or vulnerability of the key indicator;
- the uniqueness or rarity of the key indicator;
- the value attributed to the key indicator by stakeholders and Aboriginal communities;
- recognition of the importance of a key indicator by a statute, policy, regulation, or court;
- risks to the health, safety or well-being of people;
- the likelihood to affect visitor experience; and
- the likelihood of an indirect effect on an associated key indicator (i.e., a link exists between the affected key indicator and another key indicator, such as water quality affecting fish habitat).

A summary of VCs and key indicators and the rationale for their selection is presented in and discussed in the following section.

Table 5: Valued Components, Key Indicators and Rationale for Selection

Valued Component	Key Indicator	Rationale for Selection
Aquatic Resources	Fish and Fish Habitat	Regulatory requirement; potential to cause serious harm to fish as defined under the federal *Fisheries Act* (Government of Canada 1985).
		Consideration of ecosystem conservation concerns; importance to ecosystem diversity and inter-relation to other environmental components (e.g., wildlife).
	Hydrology	Potential changes to the natural flow patterns and quantity, and vertical and lateral stability of watercourses.
		Potential undercutting of slopes adjacent to TCH and the proposed project footprint due to lateral migration or flooding of the Kicking Horse River.
	Water Quality	Potential for the introduction of deleterious substances that may affect other VCs (fish and fish habitat, wetlands, wildlife).
		Maintain water quality for the protection of aquatic life.
Vegetation	Vegetation Communities	Potential adverse effect on provincially listed ecological communities (BC CDC 2015).
		Potential implications to species and community level biodiversity.
	Listed Plant Species	Regulatory requirement: potential adverse effect on federally listed (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] [Environment Canada 2016a]; *Species at Risk Act* [SARA] [Environment Canada 2016a]) or provincially listed plant species of management concern (BC CDC 2015).
		Potential implications to species and community level biodiversity.

Table 5: Valued Components, Key Indicators and Rationale for Selection

Valued Component	Key Indicator	Rationale for Selection
Wildlife	Amphibians (i.e., Western Toad)	Potential change in suitable habitat, movement patterns, wildlife abundance.
		Riparian indicator species.
		Federal status: Western Toad - Schedule 1: 'Special Concern' (Environment Canada 2016a).
	Bats (i.e., Little Brown Myotis)	Potential loss of maternity sites, day roosts and foraging grounds (riparian areas).
		Federal status: Little Brown Myotis - Schedule 1: 'Endangered' (Environment Canada 2016a).
	Migratory Birds	Federal Regulation - *Migratory Birds Convention Act* (Environment Canada 1994).
		Project activities potentially occurring within Environment Canada's General Regional Nesting Period for the Northern Rockies Zone A4 is April 20 to August 12 (Environment Canada 2014).
		Project has the potential to alter habitat and breeding grounds.
		Potential implications to species and community level biodiversity.
	Olive-Sided Flycatcher	Representative of forest openings, forest edges near natural openings (such as rivers, muskeg, bogs or swamps) or human-made openings (such as logged areas), burned forest or open to semi-open mature forest stand with tall trees or snags for perching (COSEWIC 2007).
		Federal Status - Schedule 1: 'Threatened' (Environment Canada 2016a).
	Bear species	Adaptable and tolerant of anthropogenic disturbance; potential for habituation, encounters and human-caused mortality.
		Abundant in the local study area (LSA).
Terrain and Soils	General	Ecosystem conservation concern; importance to ecosystem diversity and interrelation with other components (e.g., groundwater, vegetation).
		Importance of soil productivity in maintaining forest capability.
Cultural Resources	General	The potential to disrupt or destroy historic resource sites is a concern due to its potential effect on our ability to understand the prehistory/history of the region.
		Consideration of Aboriginal and public concern.
Visitor Experience	General	Potential alteration of the existing viewscape.
		Reliability of traffic movement along the TCH.

VCs that met a minimum of one of these criteria were carried forward through the impact analysis for the Project. Spatial boundaries define the geographic extents within which the potential environmental effects of the Project are considered and are used to define the study areas for the BIA. The description of environmental setting and assessment of potential Project effects on the VCs considers the following defined study areas:

- Project footprint: 17.6 ha
- Local Study Area (LSA): 130.7 ha

The Project footprint, associated with construction and operation of the Project, assesses the potential direct effects of the Project on the local environment while the LSA was established to assess the potential, largely indirect effects of the Project within the broader, regional context. The LSA encompasses the Project footprint and extends 100 m on each side of the TCH.

Aquatic Resources

The water features within the LSA are the Kicking Horse River and tributaries to the Kicking Horse River that range in size from small, undefined drainages, to defined watercourses and therefore, vary in their ability to support fish and in their sensitivity to disturbance. The Kicking Horse River parallels the TCH and the Project LSA. Tributaries to the Kicking Horse River are located in forested, steep, mountainous watersheds. Tributaries on the south and east sides of the valley cross the TCH alignment through culverts before feeding into the Kicking Horse River. In addition to surface water drainage features, groundwater seeps and wet areas have been identified in the LSA, which are expected to be due to the daylighting of groundwater flows at the hillslope faces near the valley bottom in the LSA. Water features in the area provide a water supply to the ponded areas located within the LSA, and drain into the Kicking Horse River. The Kicking Horse River and Finn Creek were the only fish-bearing watercourses identified within the LSA (Tetra Tech 2015a; PCA 2008a).

Tetra Tech (2015a) conducted a site reconnaissance and aquatic assessment along the TCH in YNP. The assessment was conducted along the TCH at km 88 to 91 and km 114 to 128. Both ephemeral and permanent drainages were identified along the assessed reach of the TCH. These drainages generally originate at high elevations and are flow from runoff during snow melt or precipitation periods. Water flows over the steep slopes (≥20% gradient) into the roadside ditches and through culverts before entering the Kicking Horse River. A number of watercourses with gradients ranging from 4% to 10% were observed, which are a barrier to fish passage. The Field Flats road side deposit site was not included in the Tetra Tech site reconnaissance and aquatic assessment (2015a); however, it was part of the Road-Stream Crossing Assessment Report for Banff, Glacier, Kootenay, Mount Revelstoke, Waterton Lakes and Yoho National Parks (PCA 2008a).

For the purpose of this BIA, the tributary naming convention used previously by Tetra Tech (2015a) was carried through within this assessment to maintain consistency. A total of nine culverts, two ponded areas and three drainages were identified within the LSA (Table 6; Appendix A, Figure 2). A discussion of each water feature is provided below.

Table 6. Water Features and Culverts within the Local Study Area

Site	Water Feature	Culvert Diameter (mm)[a]	UTM NAD 83 (11 U)		Location
			Easting (m)	Northing (m)	(km marker on TCH)
Reprofiling Sites					
Spiral Tunnels Hill	Drainage 1 (Waypoint 14)	n/a	541964	5697981	90+200
	Culvert (Unnamed)[b]	unknown	541650	5697958	90+600
	Drainage 2 (Waypoint 15)	n/a	541617	5697949	90+600
Big Topple	Culvert (TCHYOHO_11.0)	900	528122	5679706	115+300
Mount Vaux	Ponded water (Waypoint 19)	n/a	528788	5678337	116+800
	Culvert (TCHYOHO_9.4)	900	528777	5678348	116+800
Deposit Sites					
Field Flats Deposit Site	Culvert (TCHYOHO_29.7)	unknown	536591	5695216	96+500
Though Cut Road Side Deposit Site	Finn Creek (TCHYOHO_12.1)	n/a	528555	5680591	114+200
	Culvert (TCHYOHO_11.6)	1000	528163	5680236	114+700
Lower Mount Vaux Road Side Deposit Site	Culvert (TCHYOHO_9.0/ Waypoint 20)	900	528825	5677992	117+200
	Ponded Water (Waypoint 20)	n/a	528838	5677979	117+250
	Culvert Km 117.6	900 mm	528932	5677679	117+600
	Culvert (TCHYOHO_8.1)	900	529288	5677227	118+100
	Culvert (TCHYOHO_7.9)	900	529315	5677181	118+150
Access Road					
Big Topple	Culvert (TCHYOHO_11.0)	900	528122	5679706	115+300

[a]Culvert length, slope and type are unknown except for TCHTOHO_29.7, which is a corrugated steel pipe.
[b] Culvert location is approximate and is based on a location description in TTEBA 2015a.

Reprofiling Sites

Spiral Tunnels Hill (TCH km 90+220 to 90+635)

Two unmapped drainages were identified in the vicinity of the Spiral Tunnel Site (TTEBA 2015a) (Appendix A, Figure 2). The first was identified as a small permanent drainage (Waypoint 14) with stepped pool habitat with boulder and cobble substrate at approximately km 90+200. The slope was greater than 20% and the water flowed within the ditch to a culvert located 100 m downstream (Waypoint 13). The second drainage (Waypoint 15) was identified as seepage under moss cover along a vertical rock face at approximately km 90+500. The ditch drains to an unnamed culvert approximately 40 m downstream, where numerous, small seepages were identified along the ditch between identified seepage and the culvert (Appendix A, Figure 2). The approximate location of the unnamed culvert is at km 90+450. No fish habitat was identified at this reprofiling site.

Big Topple (TCH km 115+370 to 115+600)

No drainages were identified within the vicinity of this reprofiling site (TTEBA 2015a) (Appendix A, Figure 2). A 900 mm diameter culvert (TCHYOHO_11.0) was identified at approximately km 115+300. Culvert TCHYOHO_11.0 was not assessed as part of the culvert inventory; therefore, no additional information is available for this culvert. There are no visible tributaries within the vicinity of the culvert therefore it may collect ditch runoff and slope seepage within the area. No fish habitat was identified at this reprofiling site.

Mount Vaux (TCH km 116+155 to 116+865)
Within the TCH ditchline, very little flow was observed with shallow pools (TTEBA 2015a). The Kicking Horse River flows directly along the TCH in this area and the ponded water is possibly the result of seepage through the road (TTEBA 2015a) (Appendix A, Figure 2). A 900 mm diameter culvert (TCHYOHO_9.4) was identified at approximately km 116+800. Culvert TCHYOHO_9.4 was not assessed as part of the culvert inventory; therefore, no additional information is available for this culvert. There are no visible tributaries within the vicinity of the culvert therefore it may collect ditch runoff and slope seepage within the area. No fish habitat was identified at this reprofiling site.

Deposit Sites

Field Flats Road Side Deposit Site (TCH km 94+916 to 96+441)
Within the LSA, a corrugated steel pipe culvert (TCHYOHO_29.7) is identified at approximately km 96+500, which is approximately 60 m away from the Project footprint. The culvert connects directly to the Kicking Horse River and is likely to facilitate fish access through the culvert (PCA 2008a). Fish and fish habitat the Field Flats road side deposit site are not anticipated to be affected by Project because construction activities will be restricted to the Project footprint. Therefore, activities that could affect fish habitat quality (e.g., sedimentation) or fish viability (e.g., interruption of movement or entrapment) are not anticipated at this location. The extent of fish access upstream and the fish habitat extent upstream of the TCH is unknown. Based on the imagery of the site, ponded water is visible throughout this roadside deposit site (Appendix A, Figure 2).

Though Cut Road Side Deposit Site (TCH km 114+000 to 114+900)
The site is directly adjacent to the Kicking Horse River (Appendix A, Figure 2). A tributary, Finn Creek (Watershed Code 380-600800), is located at approximately km 114+200 along the north east edge of the LSA and Bull Trout have been captured within the watercourse (TTEBA 2015a). The TCH culvert crossing for Finn Creek (watershed code 380-600800; culvert TCHYOHO_12.1) lies outside of the LSA, and therefore is not discussed, but has been included in Table 6 for reference. A 1000 mm diameter culvert (TCHYOHO_11.6) was identified at approximately km 114+700. Culvert TCHYOHO_11.6 was not assessed as part of the culvert inventory; therefore, no additional information is available for this culvert. There are no visible tributaries within the vicinity of culvert TCHYOHO_11.6; therefore, it may collect ditch runoff and slope seepage within the area. To retain drainage conveyance through culvert TCHYOHO_11.6, this culvert will have to be extended or replaced as part of the project. Fish habitat associated with the Through Cut road side deposit site LSA is not anticipated to be affected by Project activities because of it is located approximately 100 m from the Project footprint.

Lower Mount Vaux Road Side Deposit Site (TCH km 117+150 to 118+200)
A 900 mm diameter culvert (TCHYOHO_9.0; Waypoint 20) was identified at approximately km 117+200, which had pooled water in the ditch (TTEBA 2015a). No fish habitat was identified at this culvert location (TTEBA 2015a). There are no identified tributaries within the vicinity of the culvert; it may collect ditch runoff and slope seepage within the area. An additional 900 mm diameter culvert was identified at approximately km 117+600 (Anderson 2016a, pers. comm.). There are no identified tributaries within the vicinity of this culvert, and field data suggests it collects ditch runoff and slope seepage within the area and is not fish-bearing (Anderson 2016a, pers. comm.). To retain drainage conveyance through these two culverts, they will have to be extended or replaced as part of the project.

During field surveys, no watercourse was identified at the deposit site (TTEBA 2015a), but mapping indicates a watercourse and two culverts at approximately km 118+100. Two 900 mm diameter culverts were identified near km 118+100. The first culvert (TCHYOHO_8.1) is identified at approximately km 118+100, and the second culvert (TCHYOHO_7.9) is located at approximately km 118+150 (Appendix A, Figure 2). Field data suggests these culverts collect ditch runoff and slope seepage within the area, and are not fish-bearing (Anderson 2016a,b pers. comm.). To retain drainage conveyance through culvert TCHYOHO_8.1 and TCHYOHO_7.9, these culverts will have to be extended or replaced as part of the project.

Access Route
Big Topple (TCH km 115+370 to 115+600)

No fish habitat or drainages were identified within the vicinity of this access route (TTEBA 2015a) (Appendix A, Figure 2). A culvert (TCHYOHO_11.0) was identified at approximately km 115+300; however, no information is available for this culvert. There are no visible tributaries within the vicinity of the culvert; therefore, it may collect ditch runoff and slope seepage within the area. No fish habitat was identified at this site.

Fish and Fish Habitat
A desktop review of existing information (i.e., database review and previous BIAs) was completed to describe fish and fish habitat within the Project area. The databases reviewed included the BC Habitat Wizard, BC Fish Inventories Data Query (BC MOE 2012), and the PCA Biotics Web Explorer (PCA 2013). Also included in the desktop review were data obtained from field surveys completed in June 2015 (TTEBA 2015a).

The Kicking Horse River (Watershed code 380) is a large fish-bearing watercourse, which generally parallels the TCH within the Project area and is a tributary of the Columbia River system. Ten fish species have been documented in the Kicking Horse River (BC MOE 2012; PCA 2015a) (Table 7). Redside Shiner have been documented in a tributary of the Kicking Horse River, and therefore are assumed to be present in the river (BC MOE 2012). Some of these species have been identified in the tributaries within the project area.

None of the above species are federally listed under SARA (Environment Canada 2016a). Bull trout are listed under COSEWIC as 'Special Concern' and provincially as 'Blue' (Special Concern) in British Columbia (BC MOE 2015). Based on the species identified, BC MOE identifies the period of least risk for instream works by fish species for the Kootenay Region (Region 4) would be August 20 to August 31 (BC MOE 2009); however, instream work (i.e., dewatering or diversion of watercourses during culvert replacement) is not anticipated for this Project.

Westslope Cutthroat Trout (O*nchorhynchus clarkii)* – British Columbia population have been documented in Yoho National Park, but not in the Kicking Horse River. They are listed under SARA and COSEWIC as 'Special Concern' (Environment Canada 2016a) and provincially as 'Blue' (Special Concern) in British Columbia (BC MOE 2015).

Table 7. Management Concerns of Fish Species documented in the Kicking Horse River

Common Name	Scientific Name	COSEWIC Status[(a)]	SARA Legal Status [(a)]	Provincial Listing [(b)]
Brook Trout	*Salvelinus fontinalis*	n/a	n/a	Exotic
Bull Trout	*Salvelinus confluentus*	Special Concern	No status	Blue
Rainbow Trout	*Oncorhynchus mykiss*	n/a	n/a	Yellow
Kokanee	*Oncorhynchus nerka*	n/a	n/a	Yellow
Mountain Whitefish	*Prosopium williamsoni*	n/a	n/a	Yellow
Pygmy Whitefish	*Prosopium coulterii*	n/a	n/a	Yellow
Redsided Shiner*	*Richardsonius balteatus*	n/a	n/a	Yellow
Torrent Sculpin	*Cottus rhotheus*	n/a	n/a	Yellow
Slimy Sculpin	*Cottus cognatus*	n/a	n/a	Yellow
Mottled Sculpin	*Cottus bairdii*	n/a	n/a	Yellow

*Recorded in a Kicking Horse River tributary (BC MOE 2012).
[(a)] Environment Canada 2016a
[(a)] BC MOE 2015; Exotic= Introduced or alien species; Blue = Special Concern; Yellow = Secure

Potential effects of the Project on fish and fish habitat include direct disturbance and alteration of the riparian area, and diversion for the culvert extensions at each location, if required. Additional potential effects of the Project on fish and fish habitat include sediment transportation downstream or to adjacent waterbodies during disturbance of the bed and banks or through surface runoff from the storage sites, resulting in increased turbidity and sedimentation. Fish and fish habitat has been selected as a VC and carried throughout the effects analysis. No specific species have been selected within the fish and fish habitat VC group as any effects as a result of the project to fish and/or fish habitat are likely to apply to all species.

Hydrology

A complete discussion of aquatic resources within the LSA is included above, with the identification of culvert crossings, identified ponds, drainages, and watercourses.

The Kicking Horse River flows continuously year-round, with the highest flows typically in June in response to snowmelt runoff. High flows are typical over the period from late May to early August. The Kicking Horse River has gauged flows, upstream of the Project location from 1912-1918 (Station 08NA007), 1912-1918 (Station 08NA008), and 1952-1953 and 1991-1998 (Station 08NA053), and downstream of the Project location near Golden from 1912-1922 and 1973-present (Station 08NA006) (Environment Canada 2016b). Near the disposal sites, the Kicking Horse River is an anabranching alluvial braided outwash river with high bed load content, a highly braided channel pattern located in the outwash plain, with an approximate slope of 0.0054 metres per metre (m/m) (Smith 1974).

Hydrology is a key indicator of the aquatic resources VC due to potential changes to the natural flow patterns and quantity, and vertical and lateral stability of watercourses associated with the installation, repair or replacement of culverts, temporary diversions, and modifications to watercourses. Potential effects to the natural flow patterns and quantity, and vertical and lateral stability of watercourses may occur during Project construction and operation, and are therefore carried throughout the effect analysis. In addition, the potential for erosion or undercutting of the Project footprint due to lateral migration or flooding of the Kicking Horse River are also discussed.

There are no expected effects to potential navigation or navigation safety in the Kicking Horse River, and all other watercourses in the LSA are non-navigable, therefore navigation is not carried through the effects assessment.

Surface Water Quality

Water quality in the Kicking Horse River upstream of Field (TCH km 98+000) is rated as “Good” by the Canadian Water Quality Index (Environment Canada 2007). This indicates that water quality measurements rarely exceed water quality guidelines and, usually, by a narrow margin.

No project-specific water quality sampling was completed for the watercourses potentially affected by the Project. The watercourses identified within the proposed reprofiling and deposit sites are primarily seepages or areas of ponding water adjacent to the highway. However, basic water quality parameters (conductivity, pH, temperature, and dissolved oxygen) were assessed at watercourses in the vicinity of the Project area during 2015 (TTEBA 2015a). Dissolved oxygen (DO) concentrations in all watercourses were between 10.5 and 12.7 milligrams per litre (mg/L) which are above the guideline of >6.5 mg/L (CCME 2008). Measured pH values were measured between 6.9 and 8.0 which are within the guideline (6.5 to 9.0) (CCME 2008). Effects of total dissolved solids (TDS) on freshwater aquatic life are considered minor and no guideline is provided (CCME 2008). TDS measured between 20 and 240 mg/L. Water temperatures measured between 3.4 and 7.7 degrees Celsius (°C). While seasonal fluctuations in temperature are expected in watercourses, water temperature increases from anthropogenic activities near watercourses can alter biological activity and increase the toxicity of certain compounds (e.g., ammonia [NH_3]) (CCME 2008).

Potential effects of the Project on water quality are most likely to include indirect effects from sediment transportation downstream in water during disturbance of the bed and banks or through soil erosion from surface runoff at the deposit sites, resulting in increased turbidity and sedimentation; therefore, surface water quality has been selected as a VC and carried throughout the effects analysis.

Vegetation

Vegetation Communities

The LSA is located primarily in the Montane Spruce (MS) biogeoclimatic zone (128 ha, or 98.1 % of the LSA), with a small portion in the Engelmann Spruce Subalpine Fir (ESSF) zone (2 ha or 1.9% of the LSA) BCMOFR 2011). The MS is found at middle elevations, generally ranging between 1,100 to 1,500 metres (m) in wetter areas of the province and between 1,250 to 1,700 m in drier areas (Meidinger and Pojar 1991). The LSA includes vegetation typical of the MS zone, with stands composed of hybrid spruce (*Picea engelmannii x glauca*) and Subalpine Fir (*Abies lasiocarpa*). Understory species that are characteristic of the MS zone include Utah Honeysuckle (*Lonicera utahensis*) and Grouseberry (*Vaccinium scoparium*). Although Lodgepole Pine (*Pinus contorta*) is not abundant within the LSA, stands of Lodgepole Pine stands are common throughout the MS zone, which is a seral species in young and mature stands originating from fire. In stands dominated by this species, hybrid spruce is a common understory species as well as low-growing herbaceous species and carpets of mosses and lichen. Douglas-fir (*Pseudotsuga menziesii*) is another common seral species on zonal sites as well as a climax species on dry south-facing slopes. Stands of Trembling Aspen (*Populus tremuloides*) are common on seral sites and Black Cottonwood (*Populus balsamifera ssp. balsamifera*) on wetter sites.

The ESSF zone is generally located at a higher elevation than the MS zone. Within British Columbia, elevations for the ESSF zone range from about 1500 to 2300 masl in the southeast. Topography is mountainous, often steep, and rugged. The ESSF zone has a relatively cold climate, typically having a short, cool growing season with long and snowy winters.

Vegetation of the ESSF zone is typically dominated by Engelmann Spruce (*Picea engelmannii*) and Subalpine Fir, whereas Lodgepole Pine is abundant as a seral species after fire. At lower elevations, trees such as Western White Pine (*Pinus monticola*), Douglas-Fir, Western Hemlock (*Tsuga heterophylla*) and Western Red Cedar (*Thuja plicata*) occur occasionally. The understory vegetation of the ESSF zone consists of species such as White-flowered Rhododendron (*Rhododendron albiflorum*), Black Huckleberry (*Vaccinium membranaceum*) and Oval-leaved Blueberry (*Vaccinium ovalifolium*) (Steen and Coupé 1997). On less productive sites, low-growing shrubs such as Crowberry (*Empetrum nigrum*), Grouseberry and Dwarf Blueberry (*Vaccinium caespitosum*) are common (Steen and Coupé 1997).

The LSA contains primarily upland vegetation communities; however, riparian vegetation communities, transitional zones between aquatic and terrestrial ecosystems (Austin et al. 2008), are ecologically important within the LSA. Riparian habitat is defined as areas adjacent to rivers and lakes, or ephemeral, intermittent, or perennial streams that differ from surrounding uplands in plant and animal diversity and productivity (Environment Canada 2013). Because riparian areas provide habitat for plants, invertebrates, fish, amphibians, birds, and mammals, they contribute substantially to local and regional biodiversity. Riparian areas also often function as regional wildlife movement corridors linking otherwise unconnected habitats.

On January 19, 2016, Golder conducted a field visit to document site conditions along the Little and Big Topple access routes, and the proposed road side deposit areas. A detailed vegetation inventory was not possible because of snow cover at the time of the survey and senescence of vegetation. Tree and shrub species were documented, and vegetation communities were confirmed to be consistent with communities found in the MS and ESSF biogeoclimatic zones described by the BC Ministry of Forest and Range (2011).

The three road side deposit footprints are adjacent to the Kicking Horse River, and have the potential to affect riparian ecosystems. Based on the January 19, 2016 survey, the proposed Field Flats road side deposit site is sparsely treed with spruce less than 2 m tall. Vegetation and vegetation communities could not be further characterized at the time of the 2016 field visit because of snow cover. Open water was present at the south portion of Field Flats; however, it is unknown if these water bodies are wetlands caused by shifting alignment of the Kicking Horse River, or pooling, caused by the original and current TCH alignments altering local drainage patterns.

The proposed Through Cut and Lower Mount Vaux road side deposit sites are adjacent to Kicking Horse River riparian areas and floodplains. Based on the January 19, 2016 survey, the vegetation within these areas included mixed stands dominated by hybrid white spruce, with small proportions of Black Cottonwood and Lodgepole Pine. The understory included willow species (*Salix spp*.), alder (*Alnus* sp.), Red Osier Dogwood (*Cornus sericea*) and Canada Buffaloberry (*Shepherdia canadensis).*

Parks Canada has documented three occurrences of invasive plant species (weeds) in the LSA. Orange Hawkweed (*Hieracium aurantiacum*) has been observed at the km 117 to 118 deposit site and at the Mout Vaux reprofiling site. Common Tansy (*Tanacetum vulgare*) was also observed at the Mount Vaux reprofiling site. Both of these species are considered noxious under the BC *Weed Control Act* (BC MOA 2013)*.* Invasive plant species can out-compete native species and reduce biodiversity (Dukes and Mooney 2004). Invasive plant species have the potential to be introduced to the Project footprint or the LSA from adjacent areas, or from construction equipment and other vehicles carrying seeds or plant propagules from other work sites.

Vegetation clearing is proposed for the Spiral Tunnels Hill, Big Topple Access route, and the road side deposit sites, which will result in losses of vegetation communities within the LSA. There may be indirect effects to adjacent riparian communities through changes in hydrology associated with road side rock deposit. Vegetation communities have been selected as a VC to carry though the effects analysis.

Vegetation Elements of Management Concern

Golder queried the Parks Canada Biotics Explorer (PCA 2013) and the BC Species and Ecosystems Explorer (BC CDC 2015) to identify vegetation elements (species and ecological communities) of management concern (VEMC) that have been previously identified or have the potential to occur within the LSA. VEMC are defined as meeting one or more of the following criteria:

- listed on the Red or Blue List (BC CDC 2015);
- assessed as 'Special Concern', 'Threatened', or 'Endangered' by the COSEWIC (Environment Canada 2016a); or
- listed as 'Special Concern', 'Threatened', or 'Endangered' by the SARA (Environment Canada 2016a).

Two federally listed species, Whitebark Pine (*Pinus albicaulis*) and Limber Pine (*Pinus flexilis*) are known to occur in YNP, but have not been observed within the LSA (Table 8). The LSA is located below or on the lower portion of the Whitebark Pine and Limber Pine elevation range and there have been no documented occurrences of these species within the Project area. Therefore, both of these federally listed plant species have not been selected to be carried forward in the impact assessment.

Two provincially listed plant species, McCalla's Dwarf Braya (*Braya humilis ssp. maccallae*) and Crawe's Sedge (*Carex crawei*), and have been previously observed within or adjacent to the LSA (Table 9). British Columbia Conservation Data Centre (2016a) depicts occurrence as polygons, which accommodate locational uncertainty associated with occurrence information. The polygons for the occurrences listed in Table 9, overlap with the Project LSA; however, the actual occurrence may be anywhere within the polygon, and may not be within the Project footprint or LSA (Appendix A, Figure 3). Historically, McCalla's Dwarf Braya has been

documented within the vicinity of Field Flats (BC CDC 2015). This occurrence was originally observed in 1943, and was last confirmed in 1980. An occurrence of Crawe's Sedge was documented adjacent to the Big Topple and Mount Vaux sites in 1978 (BC CDC 2015).

Red or blue listed ecological communities have not been previously identified with in the LSA (BC CDC 2015). Vegetation surveys have been completed within the broader Project area, i.e., from km 88 to km 91 and from km 114 to km 128. In 2014, a total of 104 vascular plant species were detected but no VEMC were detected during the field survey (TTEBA 2015b,c). A follow-up survey targeting Whitebark Pine and Limber Pine was completed along the Big and Little Topple access routes by Golder in January. These species were not detected.

A list of VEMCs with the potential to occur in the LSA was compiled, based on known habitat associations (Appendix C, Table 1). This summary is not intended to be an exhaustive list of all possible VEMCs that could be in the LSA; however, it was intended to help characterize high potential VEMC habitat within the LSA. Forested areas, such as those proposed for clearing, were determined to have low potential for VEMCs within the LSA; however, riparian and floodplain areas have higher potential for VEMCs based on habitat associations. To be precautionary, these riparian VEMCs, including McCalla's Dwarf Braya and Crawe's Sedge, have been selected to carry forward in the impact analysis.

Table 8. Federal Species at Risk Vegetation Elements of Management Concern within Yoho National Park

Common Name	Scientific name	COSEWIC Status[a]	SARA Schedule[a]	SARA Legal Status[a]	Habitat [b]	Potential for Presence in Project Footprint
Limber Pine	*Pinus flexilis*	Endangered	Endangered	No Status	Warm, dry sites on the lower portions of the mountains and foothills at elevations approximately 850 to 1900 masl. They generally exist on southerly or westerly aspects and gentle to steep slopes.	Nil – poor quality habitat within of Project area and not observed during field reconnaissance.
Whitebark Pine	*Pinus albicaulis*	Endangered	Endangered	Schedule 1-E	From high-elevation krummholz forests to lower elevations as part of mixed and/or closed subalpine forests. Elevations ranging from approximately 1,950 to 2,250 masl; and occasionally at lower elevations.	Nil – no habitat due to elevation of Project (~1100 masl) and not observed during field reconnaissance.

[a] COSEWIC – Committee on the Status of Endangered Wildlife in Canada; SARA = *Species at Risk Act* (Environment Canada 2016a)
[b] COSEWIC 2010; COSEWIC 2014.

Table 9. Provincially Listed Vegetation Elements of Management Concern Documented within the Local Study Area.

Common Name	Scientific name	Provincial Listing [a]	Habitat [b]	Associated Sites	Potential for Presence in LSA	Potential for Presence in Footprint
McCalla's Dwarf Braya	*Braya humilis ssp. maccallae*	Red	Sandy, gravelly riverbanks and floodplains, sometimes on slopes and glacial moraines; Moist to dry forests, river bars, scree slopes and gravelly slopes in the montane to alpine zones. Observed on stretch of sandy flats of Kicking Horse River.	Field Flats	Moderate	Moderate-potential effects to sandy flats and gravel beds associated with road side deposit at Field Flats.
Crawe's Sedge	*Carex crawei*	Blue	Moist to wet calcareous meadows and marl fens in montane zone. Gravel beds and flats of Kicking Horse River.	Big Topple Mount Vaux	Moderate	Moderate-potential effects to sandy flats and gravel beds associated with road side deposit at Field Flats.

[a] BC CDC 2015.
[b] NatureServe 2015; BC CDC 2015.
Red = At Risk; Blue = Special Concern (BC CDC 2015).

Wildlife and Wildlife Habitat

The wildlife and wildlife habitat within the LSA, is primarily within the MS biogeoclimatic zone, which is mainly affected by mountainous topography, and climatic conditions. The long, cold, snowy winters and short, warm summers have influenced wildlife survival adaptations, and the ability or decision of wildlife to move to lower elevations to avoid the more extreme weather conditions (Meidinger and Pojar 1991). Extensive Lodgepole Pine forests provide habitat for many species, including ungulates such as Moose (*Alces alces*) and Mule Deer (*Odocoileus hermionus*). These forests are also an important source of food for birds that rely on bark-inhabiting insects, such as the Three-toed and Black-backed Woodpeckers (*Picoides dorsalis*, *Picoides arcticus*)(Meidinger and Pojar 1991).

Coniferous forests of hybrid spruce and Subalpine Fir provide higher forage production than the more common and dense Lodgepole Pine forests. Some species attracted to these stands include the Fisher (*Martes pennant*), American Marten (*Martes americana*), Red Squirrel (*Tamiasciurus hudonicus*), Southern Red-backed Vole (*Clethrionomys gapperi*), Great Gray Owl (*Strix nebulosa*), Red Crossbill (*Loxia curvirostra*), Moose, and Mule Deer (Meidinger and Pojar 1991).

Avalanche chutes also provide higher forage production relative to the lodgepole pine forests and are feeding habitats for species such as Grizzly and American Black Bears (*Ursus arctos*, *Ursus americanus*), mountain goats (*Oreamnos americanus*), Elk (*Cervus elaphus*), and Moose (Meidinger and Pojar 1991). Steep south-facing grassland slopes, although not very common throughout the MS biogeoclimatic zone, provide important habitat for several species, such as Mule Deer, Golden-mantled Ground Squirrel (*Spermophilus lateralis*), Golden Eagle (*Aquila chrysaetos*) and Mountain Bluebird (*Sialia currucoides*) (Meidinger and Pojar 1991).

The higher elevation ESSF biogeoclimatic zone, present in the Spiral Tunnels Hill area, offers a variety of habitat types that are attractive to many wildlife species. Areas disturbed by avalanches and fires often have regenerating shrubby berry crops, and dense herbaceous vegetation which attract Grizzly Bears, American Black Bears and

Moose during the spring and summer months. Other ungulates such as Mountain Goat, Elk and deer (*Odocoileus* spp.) may be found in some areas. Mountain Goats tend to overwinter in these areas as well. Other mammals including American marten and wolverine (*Gulo gulo*), in addition to seed-eating birds such as Red Crossbill (*Loxia curvirostra*), White-winged Crossbill (*Loxia leucoptera*), Pine Siskin (*Carduelis pinus*) and Clark's Nutcracker (*Nucifraga columbiana*) can be found in coniferous forests within the ESSF biogeoclimatic zone (Meidinger and Pojar 1991).

Habitat within the LSA is largely altered by the TCH, adjacent right-of-way (ROW), and existing profiling sites. However, beyond this disturbance, habitat is relatively intact and characterized by coniferous forests in upland sites and riparian areas including flood plains associated with the Kicking Horse River. Habitats are diverse within the LSA and include wet areas (standing and slow-flowing) that would be suitable for amphibian breeding along the Kicking Horse River, abundant denning opportunities for small mammals within wildlife trees both in upland and riparian areas, numerous cavities and wildlife trees opportunities for perching and nesting birds and bats, as well as a wide migration corridor for small and large mammals within and along the Kicking Horse River. Although habitat could not be characterized during the field visit because of snow cover, open water associated with Field Flats, which may also be suitable for amphibian breeding or waterfowl.

Numerous wildlife species have been documented within the LSA from observational and mortality data, and include Elk, Grizzly and American Black Bear, Coyotes (*Canis latrans*), Lynx (*Lynx canadensis*), Wolves (*Canis lupus*), Wolverine, Moose, American Marten, White-tailed and Mule Deer. A potential mammal den was observed near Spiral Tunnels Hill in 2015; however it was not confirmed to be active (PCA 2015a).

Golder compiled a list of species of management concern that have been previously identified or have the potential to occur within 100 m of the Project footprint by querying the Parks Canada Biotics Web Explorer for regularly occurring species in YNP (PCA2013), the BC Species and Ecosystems Explorer (BC CDC 2015), and data supplied by LLYK FU staff. The background search revealed that a total of 21 species of management concern occur or have the potential to occur within the Project Sites. The species list included one amphibian species, 14 bird species, six mammal species (Appendix C; Table 2). Of these species, 18 are listed under COSEWIC as Special Concern, Threatened or Endangered and eight are listed under the SARA as Special Concern, Threatened, or Endangered. However, in consideration of the habitat available within the LSA, only species with moderate or high potential of occurring within the LSA were included as key wildlife indicators for the Project and are provided in Table 10. Bears have also been selected as a key indicator species due to potential interaction with the Project. Several species of migratory birds, including species listed under SARA or COSEWIC, may potentially use the Project footprint for breeding, nesting and foraging and have also been selected as key indicators due to potential interaction with the Project.

The key wildlife indicator species listed in Table 10 have the potential to be affected by the Project during construction and operations, and have been selected to carry forward through the effects analysis.

Table 10. Wildlife Key Indicator Species/ Species Groups and their Potential to be affected by the Project

Common Name	Scientific name	COSEWIC Status[a]	SARA Schedule[a]	SARA Legal Status[a]	Regularity within YNP[b]	Population[c]	Potential for Presence at Project
Amphibians							
Western Toad	*Anaxyrus boreas*	Special Concern	No Schedule	No Status	Regular	Year-round	Moderate – possible breeding habitat; foraging habitat present
Birds							
Migratory birds-guild	n/a	n/a	n/a	n/a	Regular	Breeding	High – potential habitat within the LSA
Olive-Sided Flycatcher	*Contopus cooperi*	Threatened	Schedule 1	Threatened	Regular	Breeding	Moderate – potential habitat within the LSA; observation near LSA
Bats							
Little Brown Myotis	*Myotis lucifugus*	Endangered	Schedule 1	Endangered	Regular	Year-Round	Moderate – possible roosting and maternity; generally found in low densities with patchy distribution
Carnivores/ Furbearer							
American Black Bear	*Ursus americanus*	n/a	n/a	n/a	Regular	Breeding	High – documented in LSA
Grizzly Bear	*Ursus arctos*	Special Concern	No Schedule	No Status	Regular	Year-round	High – documented in LSA

[a] **COSEWIC** – Committee on the Status of Endangered Wildlife in Canada; SARA - *Species at Risk Act* (Environment Canada 2016a)

[b] **Regularly occurring** - Occurrence of the Element is consistent in the Managed Area (e.g., it may migrate in and out of the area, but it returns on a regular basis).
Accidental/Nonregular - The Element does not persist or return regularly in the Managed Area.
Unknown/Undetermined - Regularity of the Element in the Managed Area has not been, or cannot be, determined.

[c] **Year-round** - A significant proportion of individuals of the Element are non-migratory or remain in the Managed Area throughout the year.
Breeding - Individuals of the Element occur in this Managed Area as part-time (seasonal) residents when breeding, and they are not year-round residents in any significant numbers.
Nonbreeding - Individuals of the Element occur in this Managed Area as part-time (seasonal) residents when not breeding, and they are not year-round or breeding season residents in any significant numbers.
Transient - Individuals of the Element are long distant migrants that regularly occur in the Managed Area as a transient during migration.
Unknown - The residency status of the individuals of the Element in the Managed Area has not been, or cannot be, determined.

Amphibians

The Western Toad (*Anaxyrus boreas*) (Schedule 1: 'Special Concern') is known to occur within YNP (PCA 2013). Western Toads use a wide variety of aquatic and upland habitats including shallow, sandy margins of lakes, ponds, streams, river deltas, river backwaters, river estuaries and geothermal springs (COSEWIC 2012). This species also spends a large majority of their time in terrestrial habitats, including forested areas, moist shrublands, meadows and avalanche slopes (GoC 2015). Western Toads use a variety of terrestrial habitats outside the breeding season and tend to hibernate in underground burrows within upland areas (COSEWIC 2012; Wind and Dupuis 2002). During dispersal movements, young-of-the-year will travel along wet, steep drainages (Bull 2009). Western Toads breed in spring when minimum and maximum temperatures rise above 0°C and 10°C, respectively, or in late April to late May (COSEWIC 2012). Western Toads may aggregate at any life stage, making them vulnerable to agents of mass mortality such as roadkill (COSEWIC 2012) between late April through to October. Riparian areas associated with the Kicking Horse River, including those at Field Flats, may function as suitable wetland habitat for breeding; adjacent forested areas may function as terrestrial habitat for foraging adults and dispersal habitat for juveniles during the summer and fall. Because the Project has the potential to directly impact Western Toads and their habitat, this species has been selected to carry forward through the effects analysis.

Birds

Several species of migratory birds, including federally listed species, may potentially use the Project footprint for breeding, nesting and foraging and will be directly impacted by vegetation clearing associated with Project construction (Appendix C, Table 2). Migratory birds as a group have been selected to carry forward in the effects analysis.

Olive-sided Flycatchers (*Contopus cooperi*) (Schedule 1: 'Threatened') are Neotropical migrants that are found throughout much of Canada during the summer breeding season, typically between late April and September in BC (Altman and Sallabanks 2012; COSEWIC 2007). Olive-sided Flycatchers prefer tall trees and snags adjacent to open areas, which provide individuals with perches from which they hunt flying arthropods. Olive-sided Flycatchers nest in forested stands but, because of their foraging behaviour, are associated with high contrast habitats including burned forests, logged areas, and natural forest openings such as gaps, meadows, rivers, and wetlands (Altman and Sallabanks 2012). As a result, their abundance is correlated with landscapes containing fragmented late-seral forest with high-contrast edges (Altman and Sallabanks 2012; McGarigal and McComb 1995). In western Canada, Olive-sided Flycatchers are associated with early to mid-successional post-disturbance coniferous forests with tall snags and residual live trees, mixed forests with canopy openings, and old growth forests (COSEWIC 2007).

This species is known from the greater Project area; in June 2015, an Olive-sided Flycatcher was heard in the Mount Vaux deposit site, which is approximately one km south of the LSA (TTEBA 2015c). The LSA may function as relatively high-quality Olive-sided Flycatcher habitat with mid-seral stage coniferous forests adjacent to natural openings created by the Kicking Horse River and the anthropogenic opening created by the TCH. Because of high-quality habitat, and the potential for this species being found within the LSA, the Olive-sided Flycatcher has been selected to carry forward through the effects analysis.

Bats

Four species of bats have been documented in YNP (PCA 2013), three of which are not listed and are not discussed further. This includes the Little Brown Myotis (*Myotis lucifugus*), which is listed as Schedule 1: 'Endangered' under the *Species at Risk Act*. This species uses a variety of human- made structures (e.g., mine shafts, warm attics) as well as caves and hollow trees for maternity sites and day roosts (COSEWIC 2013; BC CDC 2016b). A preference of large-diameter old growth forest, with increased snag availability, appears more important to roosting rather than type of forest (COSEWIC 2013). The Little Brown Myotis is a nocturnal aerial predator, focusing on flying terrestrial and aquatic insects in forested areas near water. The types of invertebrates consumed include mosquitoes, midges, caddisflies, moths, various hoppers, smaller beetles, and sometimes spiders. The Little Brown Myotis typically hunts over water or along the edges of lakes and streams, consuming insects or other invertebrates

(BC CDC 2016b). Although the LSA contains few human-made structures, portions of the LSA contain suitable forest for roosting, and the Kicking Horse River may function as high-quality foraging habitat.

Because Little Brown Myotis roosting and/or forage sites may be affected by clearing associated with the Project, Little Brown Myotis has been selected to carry forward in the effects analysis.

Carnivores/ Furbearers

Although American Black Bears are considered a forest species, they forage in a variety of habitats, including forests (conifer swamps, hardwoods), shrublands, ridgetops, shorelines, and riparian areas (Hatler et al. 2008). The American Black Bear has demonstrated a high behavioral resilience to anthropogenic disturbances, such as highways, where they often forage on ditch vegetation (Apps et al. 2006). American Black Bears are opportunistic omnivores with variable diet of plants and animals which the LSA provides.

Grizzly Bears are capable of occupying a diverse array of habitats and exploiting a wide range of food resources (Mace et al. 1999). Although Grizzly Bears are considered carnivores and are unable to digest plant fibre, they behave as opportunistic omnivores and can survive and even prosper on a vegetarian diet (Rode et al. 2001). Some studies show that Grizzly Bears spend more time near roads than expected by chance, especially roads with low traffic volume. Presumably, this relationship occurs because high quality food resources can be found near roads (Chruszcz et al. 2003, Roever et al. 2008, Roever et al. 2010).

The Project will have minimal direct impacts on American Black Bear and Grizzly Bear habitat; however, construction activities (e.g., human garbage) have the potential of attracting bears to the area. Bears that become conditioned to human foods or that persist in areas where humans frequent may have to be destroyed. Bears have been selected to carry forward through the effects analysis.

Terrain and Soils

Soils occupying the upper slopes of the Project are generally derived from calcareous sedimentary parent material. Soils are typified by thin (<50 cm), well drained, weakly developed, medium to coarse textured profiles with high percentages of coarse fragments occurring throughout the soil stratum. Soil type is influenced by slope position and percentage, climate, and vegetation type. Soils below 1,600 masl typically express Brunisolic characteristics (Coen and Kuchar 1982). Above 1,600 masl, soils are generally classified as Podzols. Fluvial deposits occupy the lower river valley floodplains. These soils are typically silt textured with little coarse fragment content and weak to non-existent horizon formation. These soils are generally identified as being Regosolic (i.e., having no soil horizons) or imperfectly or poorly drained Gleysolic soils.

Terrain and soils will be carried through the effects analysis stage, considering the location of the Project in relation to the Kicking Horse River, the erosive potential of exposed soils and the risk of sedimentation to drainages, wetlands and tributaries. These activities are anticipated to affect soils and/or landforms and therefore have been selected to be carried forward throughout the analysis.

Air Quality

Existing anthropogenic impacts to air quality in YNP are mainly a result of vehicle traffic along TCH, including heavy-duty and light-duty diesel and gasoline vehicles. Railway emissions also have a limited contribution to decreased air quality within YNP. Overall, the concentrations of emissions are located along the TCH corridor (Province of British Columbia 2015-Air Emissions [1 km Grid]).

The project is anticipated to have a limited, incremental contribution to air quality within the LSA during construction. Effects associated with increased traffic and vehicle use are expected to extend beyond the LSA as vehicles, and machinery are mobilized to and from the Project site. Dust produced by blasting and traffic associated with construction is expected to be limited and restricted to the LSA. These effects will be limited to the construction phase; during operation/maintenance phases, equipment and truck use are likely to be equivalent to existing conditions; therefore, air quality has not been selected to carry forward though the effects analysis.

Cultural Resources

The entire LSA falls within the Kicking Horse Pass National Historic Site (NHS), which follows the railway corridor from Field, BC to Lake Louise, AB. This NHS was designated in 1971, recognizing the historic importance of this area connecting the east and west coasts of Canada, as well as connecting Canada to international communication and commerce (Parks Canada 2012). The Kicking Horse River was designated as a Canadian Heritage River in 1989, because it is an excellent example of a glacier-fed river and the river valley has played a major role in the exploration and development of the Canadian West (CHRS 2011).

Archaeological Overview Assessments (AOA) were completed by the Archaeology and History Branch of Parks Canada for 2015 project work (Appendix D-1), and 2016 Project (Appendix D-2). Results of the 2015 and 2016 AOAs, a desktop assessment, and January 2016 field visit, determined that there are at least two known archeological sites in the LSA, and several in the Project area. Within the LSA, Site 438T includes an historic railway location, related train wreckage and an associated rail spur. These are located approximately located 80 m from the Spiral Tunnels Hills reprofiling site footprint, and will not be directly impacted by proposed construction (Appendix A, Figure 4). A second site, Site 439T, is the historic highway grade, which traverses the upper slopes of the Big and Little Topple reprofiling sites (Appendix A, Figure 4), crosses the existing TCH alignment in the Through-Cut road side deposit site and may cross the TCH in the Lower Mount Vaux road side deposit site. The historic highway grade at Big Topple has been proposed as an access route to the reprofiling site and has the potential of being affected by vegetation clearing, soil stripping, erosion and compaction. Portions of the historic highway grade that pass through the Through Cut and Lower Mount Vaux road side deposit sites will be affected by tree clearing and subsequent rock deposit. Although additional archeological sites were not identified for the other deposit and reprofiling sites, there is the potential for undiscovered artifacts to be identified at all construction site. Because of these potential effects to the historic highway alignment, cultural resources have been selected to carry forward though the analysis.

Visitor Experience

High quality visitor experience has been identified as a priority for YNP (PCA 2008b). Visitor experiences vary widely, and include those who seek solitude and adventure in back-country experiences, to those who seek good opportunities for driving and sightseeing at popular front-country attractions (PCA 2008b). Visitor experience has been considered in relation to the Project for the following indicators: traffic pattern changes and visual aesthetics. Each of these indicators is expected to have an effect on visitor experience.

Traffic patterns on the TCH between Field and Golden are highly seasonal with monthly average daily traffic (MADT) ranging from 3,094 vehicles in January to 11,541 vehicles in August (BC MOTI 2014) (Appendix E). July and August are considered peak season, receiving higher volumes of traffic than the rest of the year. Monthly average weekday traffic (Monday to Thursday) versus monthly average weekend traffic (Friday to Sunday) alternates highs and lows through the year but generally remains closely equal except in July and August when average weekend traffic is higher by approximately 1,000 vehicles. The construction phase of the Project will require temporary traffic control for equipment maneuvering, and blasting that will lead to disruptions in traffic flow and increase travel times through the park and reduced access to some sites (e.g., Spiral Tunnels Hill viewpoint); however, the

Project will be on hiatus between June 29, 2016 and September 7, 2016 to prevent delays during the heaviest visitor traffic months.

Construction noise may also affect visitor experience at the campgrounds and chalet at the bottom of Yoho Valley Road; however, these sites are in close proximity to existing sources of year-round noise; large transport trucks use the TCH and the CP Rail line is adjacent to the TCH.

Sight-seeing and appreciation of natural aesthetics is a major attraction to YNP (PCA 2010). Although the construction phase of the project will include vegetation clearing, rock deposit and the presence of machinery along the TCH ROW, construction will occur largely within existing disturbances, which have low visual quality.

The operations phase of the project of the will improve highway safety and reliability along the TCH and improve visitor access to YNP. Visitor experience has been selected to carry forward through the effects analysis.

7. EFFECTS ANALYSIS

For this BIA, potential effects were analyzed with the information available at the time of writing (Feb 16, 2016) and based on professional judgment. Effects were characterized using direction (positive, negative or neutral), expected magnitude (e.g., negligible to high), geographic extent (i.e., spatial extent of the effect), duration/ reversibility (i.e., reversible in the short-term to permanent effects), frequency (i.e., number of times the effect happens per unit time) and probability (i.e., likelihood the effect will happen).

The effects analysis considers the possible interactions between the Project infrastructure components and activities and the VCs within the identified spatial boundaries, prior to the implementation of mitigation measures. Project interactions may be direct (e.g., as a result of vegetation clearing for the Project affecting a VC), or indirect (i.e., as a result of a change to one VC affecting another VC). Potential effects of the Project on the key indicators are determined by comparing the existing conditions to those which are expected to result from the implementation of the Project.

A preliminary identification of potential Project interactions was undertaken to focus the assessment on the issues of key importance (Appendix B). The interactions identified in the matrix were used to focus the description of the effects analysis (Section 7) and mitigations (Section 8). All relevant Project activities were analyzed individually to determine if there was a plausible mechanism for an effect on each VC during normal Project conditions. The analyses were based on professional judgment and experience of the BIA team.

Potential effects of the Project on VCs are described in the paragraphs below and are summarized in Table 11. Significance of these effects after the implementation of mitigation is provided in Section 10.

Aquatic Resources

Diversion activities associated with construction may affect instream fish habitat quality and quantity. Effects to instream habitat are predicted to be negative in direction because flow paths will be temporarily modified from their natural course. The magnitude of the effect is considered negative and negligible because diversion is not anticipated for the few culverts that require extension, and flow patterns will be maintained. The geographic extent is local as the instream disturbance will be limited to the culverts extension footprint within the LSA. The effect is considered to be of short-term duration, because any diversion activity will be restricted to the construction phase of the Project.

Increased surface run-off within the road side deposit sites is predicted to increase sedimentation and increase turbidity within the Kicking Horse River and result in a negative effect on fish habitat quality and surface water quality. The introduction of fine sediment to watercourses from runoff from the deposit sites, and slope or channel

erosion, can have sub-lethal (e.g., irritation of gill tissue) and lethal (e.g., suffocation of developing embryos) effects on fish (CCME 2002). This fine sediment can also result in downstream sediment deposition that alters substrate composition and modifies the suitability of habitat for spawning, overwintering, and rearing. Without mitigation, moderate magnitude, short-term, effects are expected because of sedimentation. The Project footprint is expected to be within 20 m of the Kicking Horse River in areas. Effects will be localized and continuous; however, reversible within the short-term.

Operations of the Project are not anticipated to affect fish habitat quality and quantity and surface water quality.

Without mitigation, the Project is anticipated to have a negative effect on the natural flow pattern and water quantity due to watercourse diversion during culvert replacement and construction around watercourses during construction. An isolated or dry open-cut method is planned for installation, replacement, repair, or extension of culverts in the proposed rock-deposit areas. This method has the potential to cause changes in natural flow patterns when water is present in the watercourse. During construction, temporary diversions may be required (i.e., isolation construction techniques such as flumes, instream diversions, or pumps) to divert the water flow around the isolated construction area, if construction is completed during high-flow periods. Without mitigation, the predicted effect of Project construction on the natural flow patterns of the crossed watercourses is described as negative because the flow path will be temporarily modified from their natural course. The magnitude of the effect is considered low because a limited number of culverts will be replaced within the road side deposit sites, flow patterns will be maintained and diversions are not anticipated for any fish-bearing streams. The geographic extent is considered local, as diversions will be limited to the Project footprint. The effect is considered to be short-term in duration because the diversion or dewatering activity will be restricted to the construction phase of the Project.

During Project operation, there may also be alteration of natural flow patterns of water courses in the LSA. Changes to channel gradient, channel capacity, flow paths, or the culvert inlet or outlet conditions may create preferential flow paths, alter the natural flow patterns within the LSA and potentially reduce the quantity of surface water in the LSA.

Vegetated areas adjacent to a watercourses are important in stabilizing stream banks and preventing erosion. Without mitigation, vegetation clearing and road side rock deposition along the Kicking Horse River may contribute to a reduction in the lateral and vertical bank stability of this watercourse within the LSA and a reduction in the ecological value of riparian habitat. Additionally, the lateral or vertical bank stability of the Kicking Horse River may be affected by natural changes in channel cross-section, bed contours, riparian vegetation, or flow regime. Without mitigation, the Project could have a negative effect on the vertical and lateral stability of watercourses in the form of potential localized scour or bank erosion, which would occur continuously through construction and operations until stream bed and banks have stabilized. The predicted effect of Project construction on the lateral and vertical stability of the Kicking Horse River is described as negative because disturbance to riparian vegetation and modification of natural channel geometry will increase the potential for erosion at watercourses until re-vegetation is complete. Without mitigation, including design features, the magnitude of the effect is considered moderate, because potential exists for progression beyond minor scour or bank erosion over winter (i.e., low flow or frozen) conditions. The geographic extent is considered local, as the disturbance will be limited to watercourse crossings along the Project footprint. The effect is considered to be of long-term duration and reversible, because the disturbed areas will be re-vegetated; however, it may take several years for the vegetation to be considered fully established.

The Project may result in erosion or undercutting of the Project footprint by the Kicking Horse River if the Project footprint is constructed in the potential lateral migration path or the floodplain of the Kicking Horse River. Construction of the Through Cut and Lower Mount Vaux road side deposit sites is expected to be within a distance of 20 m from the Kicking Horse River top of bank in some portions of the alignment, based on a desktop analysis. At these deposit sites, where the Project footprint is located between the TCH and the Kicking Horse River, potential effects to the Project footprint include erosion and undercutting, leading to increased sedimentation and

potential instability. Near the deposit sites, the Kicking Horse River is an anabranching alluvial braided outwash river with high bed load content. The river has a highly braided channel pattern located in the outwash plain, with an approximate slope of 0.0054 metres per metre (m/m) (Smith 1974). Within the outwash plain the river is laterally active with low lateral stability. Without design mitigation, the predicted effect of development within the potential lateral migration path or floodplain extent is described as negative and moderate magnitude because it will increase the potential for erosion or undercutting of the Project footprint. The geographic extent is considered local, as the effects will be limited to the Project footprint at locations where the Kicking Horse River and the Project footprint converge. The effect is considered to be of long-term duration, as future potential migration and flooding may cause the potential effect.

Vegetation

In the absence of fine-scale vegetation community mapping and descriptions, a qualitative approach was used to assess the potential effects of the Project on vegetation and vegetation elements of management concern. Project activities with potential effects on vegetation are expected during Project construction and operation phases (Table 10).

Project activities are anticipated to have a negative effect on vegetation community habitat quality and quantity, VEMC habitat quality and quantity and VEMC abundance associated with clearing, rock deposition, and accidental damage associated with laydown areas. The Project may result in direct effects on both upland and riparian vegetation communities during construction and operation through clearing for the Project footprint associated with Spiral Tunnels Hill, the Big Topple Access route and the three road side deposit sites. Vegetation clearing involves timber harvesting and removal of understory vegetation. During grading, indirect effects on vegetation result from disturbance of soil and terrain in graded areas due to stripping of vegetation roots with the uppermost organic layer of soil, including associated herbaceous and non-vascular layers, and propagules. The effect is expected to be low magnitude and local, because direct losses will primarily be in early to mid- seral stage forests, which are relatively common within the LSA and are considered to have low potential for containing VEMC. Losses to vegetation communities are expected to be long-term for areas that have the potential to vegetate (e.g., access routes), because forest stands will regrow over time. However, areas proposed for road side deposit are expected to result in a permanent reduction to riparian communities. Similarly, rare plant occurrences and rare plant habitat might be lost because of road side rock deposit, particularly in association with the Field Flats road side deposit site.

The Project is predicted to have a negative effect on vegetation community and VEMC habitat quality, through changes to hydrology and the introduction of deleterious substances (i.e., spills). Changes in water flow and quantity because of road side deposit areas may also influence plant species composition, community structure, biological diversity (Vale et al. 2015), and riparian ecosystem function. Long-term water flow reductions in riparian areas would likely cause changes in riparian community composition from moisture-dependent species to more generalist species (Vale et al. 2015). Accidental spills or leaks of hydrocarbons (e.g., gasoline and diesel fuel) could occur during equipment operation, maintenance, fueling, or fuel storage during clearing, construction, and operation, resulting in local contamination of vegetation and soil. Without mitigation, long-term, low magnitude effects to riparian vegetation communities from changes in hydrology may occur because the Project footprint is expected to be within 20 m of the Kicking Horse River in areas, which may result in local changes to hydrology, moisture regimes and community composition. Effects to vegetation community and VEMC habitat quality would be continuous and occur over the long-term.

Operation of the Project is not anticipated to have an effect on vegetation community habitat quality and quantity, VEMC habitat quality and quantity and VEMC abundance.

The Project is anticipated to have a negative effect on vegetation community composition and VEMC abundance, resulting from the introduction of invasive plant species. Vegetation community diversity may also be affected by

the introduction of invasive plant species on construction equipment and other vehicles carrying seeds or plant propagules from other work sites. Project activities including the movement of machinery or equipment from and to the site, ground disturbance and vegetation clearing could introduce invasive plants to or add to existing infestations within the study area. Bare soil, where reclamation has not been initiated or is unsuccessful, is susceptible to encroachment by invasive plant species. Although invasive species are likely to only be introduced during construction, any species that become established on available soil may persist through operations. Invasive plant species are able to colonize quickly and proficiently adjacent to areas of disturbance; therefore, the magnitude is predicted to be moderate. It is expected that invasive plant species will remain within and adjacent to existing disturbance, and effects on vegetation community composition and VEMC abundance will be local and primarily limited to terrestrial vegetation communities. Therefore, during the operation of the Project a low magnitude effect is predicted; effects on community composition would be long-term and continuous. The Project might affect riparian VEMC abundance through the introduction of invasive species. Although noxious plant species observed in the LSA (i.e., Orange Hawkweed and Common Tansy) are not necessarily typically associated with wet habitats, they have the potential to compete with riparian VEMC given their locations within riparian habitat of the LSA.

Operation of the Project is not anticipated to increase the potential for invasive plant species, thereby increasing long-term effects on vegetation community composition and VEMC abundance.

Wildlife and Wildlife Habitat

The following species and/or guilds were selected to be carried forward in the impact assessment based on ecological importance, national status and the availability of baseline wildlife data in the LSA:

- Western Toad;
- Little Brown Myotis;
- birds including migratory birds and species of management concern (i.e., Olive-sided Flycatcher); and
- bears (i.e., American Black Bear and Grizzly Bear).

Amphibians

The LSA is located in both upland and riparian vegetation communities, which are potential Western Toad breeding and overwintering habitat. Vegetation clearing and rock deposit are anticipated to have a negative effect on Western Toad habitat quality and quantity within the LSA. Additional residual effects on habitat quality and quantity are anticipated from increased suspended sediment load in small water courses.

Clearing and rock deposit in riparian areas will permanently remove local potential Western Toad habitat. Loss of habitat is considered continuous and permanent. The magnitude for effects of clearing and deposit on Western Toad habitat quality and quantity and abundance is predicted to be low, because primarily terrestrial habitats will be affected, which are not limited for this species.

Without mitigation, short-term, moderate magnitude effects on Western Toad habitat quality are expected because of sedimentation; the Project footprint will result in increased suspended sediment load in small water courses, negatively affecting Western Toad breeding habitat. Effects on Western Toad habitat will be localized and continuous; however, reversible within the short-term.

Operation of the project is not anticipated to have an effect on Western Toads, or Western Toad habitat.

Birds

The project is anticipated to have a negative effect on migratory bird habitat quantity and quality and abundance due to vegetation clearing. Vegetation clearing will result in the direct loss of nesting and foraging habitat for several species of migratory birds including the Olive-Sided Flycatcher. There is also a high potential for sensory disturbance which may lead to displacement from suitable habitat during construction.

Vegetation clearing can have both positive and negative effects on Olive-sided Flycatcher habitat. Vegetation clearing can improve habitat around the disturbance perimeter by creating edge habitats that are positively associated with species abundance (McGarigal and McComb 1995). However, vegetation clearing can also result in a net loss of habitat when the edge to open area ratio is small. Overall, disturbances tend to have positive effects when they result in small forest openings and tend to have negative effects when the disturbance is large. The project is anticipated to have localized effects on the species and individuals with territories near the LSA may move to unaffected adjacent habitats.

Migratory birds are highly mobile and adults can typically avoid interactions with Project activities that could result in direct mortality, although permanent losses to hatchlings and early fledglings may also occur if clearing were to occur during the nesting period. Most tree clearing associated with the project is considered to be permanent losses to forest communities; therefore, effects to migratory bird habitat quantity and quality, as well as abundance are expected to be permanent. These are anticipated to be low magnitude and local in extent because of the relatively small size of the footprint.

Operation of the project is not anticipated to have an effect on migratory birds, or the Olive-sided Flycatcher.

Bats

The Project is anticipated to have a negative effect on Little Brown Myotis habitat quantity and quality and abundance due to vegetation clearing. Large diameter trees and snags were identified within the LSA, particularly areas adjacent to the Kicking Horse River. These areas may provide maternity and/or day roost sites for Little Brown Myotis, and may be removed by vegetation clearing. Although the project may result in the localized loss of some Little Brown Myotis feeding grounds, these habitats will still be abundant within the LSA. Bats may also be attracted to artificial light sources during construction which may affect foraging success (Stone et al. 2015).

Effects to Little Brown Myotis habitat quantity and quality are expected to be local and low in magnitude but permanent in the long-term because of clearing and deposit in road side disposal areas and reprofiling sites. Some habitat associated with the access routes is expected to regenerate in the long-term. Despite these disturbances, Little Brown Myotis is a highly mobile species and is able to use alternate roosting sites, which are likely abundant in the vicinity of the LSA. Given the limited extent of artificial lighting associated with construction, effects of temporary lighting during construction are expected to be local and low in magnitude.

Operation of the Project is not anticipated to have an effect on the Little Brown Myotis.

Carnivores/ Furbearers

Construction of the Project will have minimal direct impacts on bear habitat; however, considering the species' opportunistic nature, activities associated with construction (e.g., waste generation) have the potential of attracting bears to the Project area. This may increase the potential for vehicle-bear collisions related to onsite traffic and public highway traffic. Bears that become conditioned to human foods or that persist in areas where humans frequent may have to be destroyed. Once construction is complete, the Project will no longer have an effect on bears within the LSA. Planned mitigations will reduce the likelihood of adverse effects.

Operation of the Project is not anticipated to have an effect on American Black Bears and Grizzly Bears.

Terrain and Soils

The Project is anticipated to have a negative effect on soils and terrain, through an increase in erosion, and sedimentation prior to the implementation of mitigation measures.

Erosion potential is determined by:

- rainfall and runoff;
- soil erodibility (i.e., texture, structure, permeability);
- slope length and gradient;
- vegetation cover; and
- erosion control mitigations.

Erosion risk will increase once vegetation is removed from the Project areas. A reduction in soil quality also may be associated with compaction and spills during the construction phase of the Project. The long and sometimes steep slopes within the LSA will increase erosion potential within tree-clearing areas; therefore, the Project is anticipated to have a moderate magnitude, local and long-term effect on soil quality primarily associated with erosion. Changes to soil quality would be continuous though construction and persist through operations until slopes revegetated and stabilized.

Cultural Resources

Because of the limited footprint of the Project, construction and operations of the Project area are not anticipated to have an effect on overall integrity of the Kicking Horse Pass NHS, or the Kicking Horse River as heritage sites.

Two sites were identified within the LSA that have historical value. The project is not anticipated to affect Site438T, near Spiral Tunnels Hill. Construction will affect the historic highway grade. The historic highway grade at Big Topple has been proposed for vegetation clearing to access this site for reprofiling, and has the potential of being affected by construction equipment. There will be localized effects to the portion of the alignment that crosses the road-side deposit sites.

Without mitigation, effects to the historic highway grade are predicted to be likely, local, negative and low magnitude because the portion of the grade within the Project footprint might be affected, and effects will be continuous and persist through operations.

Operation of the Project is not anticipated to have additional effects on the historic highway grade.

Visitor Experience

During construction, there may be temporary effects on visitor experience through traffic delays and temporary loss of natural aesthetic within the LSA. Temporary traffic delays to accommodate equipment mobilization, construction/ blasting or demobilization may affect visitor experience. The predicted effect of this Project in conjunction with other planned construction projects on the TCH may result in a cumulative impact to visitor experience because of multiple highway delays within the Parks road system.

Construction noise may also affect visitor experience along the TCH. Sites where the construction noise (i.e., equipment and blasting) may be perceived are already in close proximity to existing sources of year-round noise; large transport trucks use the TCH and the CP Rail line is adjacent to the TCH.

Visibility of construction equipment, cleared vegetation and waste rock along the TCH will have a negative effect on the natural aesthetic of TCH. However, the reprofiling sites and deposit are largely within the existing disturbed TCH ROW, which have low visual quality.

Therefore, although effects to visitor experiences are expected to be negative, they will be relatively minor and largely restricted to the construction phase of the project within the LSA; i.e., reversible on operations.

Operations of the Project will likely have a positive impact on visitor experience by reducing TCH closures in the long term as a result of future rock-slope maintenance activities.

SARA-listed Species Summary

Paragraph 83(1)(a) and subsection 83(2) of the SARA provide that under specific circumstances, the protection of human beings can take precedence over the protection of listed species to the extent that the decision-maker determines and is able to demonstrate that:

1. The proposed activities contravene SARA prohibitions;
2. The activities are necessary for the protection of public safety;
3. They are or could be authorized by or under another Act of parliament; and
4. In making his/her decision, the decision maker respects SARA purposes to the greatest extent possible.

Three SARA listed species and/or associated habitats could be associated with the Project and include Western Toad, Olive-sided Flycatcher and Little Brown Myotis. Adverse residual effects are not anticipated for these species, provided mitigation measures identified in Section 8 are followed. Therefore, an exemption under Subsection 83(1) and 83(2) will not be required.

Table11: Likely Project Effects

Valued Components	Measurement Indicator	Project Phase	
		Construction/ Installation	Operation/ Maintenance
Aquatic Resources	Fish and Fish Habitat	Change in habitat quality and/or quantity due to alteration of instream fish habitat.	n/a
		Change in habitat quality and/or quantity due to increase in suspended sediment load and sediment deposition.	n/a
	Hydrology	Changes in natural flow patterns and water quantity due to changes in channel morphology and/or preferential flows paths from culvert inlets/outlets.	Changes in natural flow patterns and water quantity due to changes in channel morphology and/or preferential flows paths from culvert inlets/outlets.
		Changes in the lateral and vertical stability of the Kicking Horse River.	Changes in the lateral and vertical stability of the Kicking Horse River.
		Potential erosion and undercutting of slopes adjacent to TCH and the proposed Project footprint due to lateral migration or flooding of the Kicking Horse River.	Potential erosion and undercutting of slopes adjacent to TCH and the proposed Project footprint due to lateral migration or flooding of the Kicking Horse River.
	Surface Water Quality	Change in water quality due to increase in suspended sediment load and sediment deposition.	n/a

Table11: Likely Project Effects

Valued Components	Measurement Indicator	Project Phase	
		Construction/ Installation	**Operation/ Maintenance**
Vegetation	Vegetation Communities	Change in habitat quantity and / or quality due to disturbance and removal of vegetation.	n/a
		Change in habitat quantity and / or quality due to deleterious substances from construction equipment.	n/a
		Change in habitat quality and/ or quantity due to changes in hydrology.	n/a
		Changes in community composition due to increased invasive plant species.	n/a
	Vegetation Elements of Management Concern	Change to VEMC habitat quantity and/ or quality due to vegetation clearing, deleterious substances, and changes in hydrology.	n/a
		Change in VEMC abundance due to loss of individuals.	n/a
		Change in VEMC abundance due to increased invasive plant species.	n/a
Wildlife	Amphibians- Western Toad	Change in habitat quantity and / or quality due to vegetation clearing/ rock deposition.	n/a
		Change in habitat quality and/or quantity due to increase in suspended sediment load and sediment deposition.	n/a
	Birds - migratory birds and Olive-sided Flycatcher	Change in habitat quantity and / or quality due to vegetation clearing Reduction in migratory bird abundance due to tree clearing.	n/a
	Bats	Change in habitat quantity and / or quality due to vegetation clearing. Attracting bats to artificial light sources during construction	n/a
	Carnivores/ Furbearers - American Black Bears and Grizzly Bears	Change in bear abundance occurrence due to human-bear encounters.	n/a
Soils and Landform	General	Change in soil quality through compaction, erosion, and contamination by spills.	Change in soil quality though erosion.
Cultural Resources	Historic Resources	Loss/ alteration of historical resources.	n/a
Visitor Experience	General	Temporary traffic delays due to traffic control during construction. Temporary loss of natural aesthetic appeal during construction.	n/a

In general, the majority of negative impacts as a result of the Project are considered to be minor and associated with construction and therefore, short-term. Where Project effects cannot be avoided, mitigations will be applied and are discussed in Section 8. It is anticipated that the proposed mitigation measures will provide positive impacts on visitor experience as a result of overall improvements in public safety and for socio-economic costs associated with road closures.

8. MITIGATION MEASURES

Reprofiling, tree removal and deposition of waste rock were approved for several sites where construction was initiated in 2015, and will continue in 2016 (Tables 1 to 3) (PCA 2015a, b, c). All conditions proposed in these approvals will be adhered to for the continuation of construction at these sites.

In general, the Parks Canada National Best Management Practices: Roadway, Highway, Parkway and Related Infrastructure BMP (PCA 2015c) will be applied. Considering the BMPs (2015c), Project effects and Project requirements, general mitigation measures, which apply to more than one VC, and mitigation measures specific to VCs have been compiled below to reduce Project effects.

General Mitigations

1. The Contractor is required to prepare an Environmental Protection Plan (EPP) in accordance with Parks Canada Environmental Procedures before initiation of construction. The EPP will outline:

    a. Details on how the work limits will be marked and procedures to ensure operations will remain within the clearing boundaries to minimize damage to vegetation and soil damage.

    b. A Spill Response Plan will be prepared and will detail the containment and storage, security, handling, use and disposal of empty containers, surplus fuels or other hydrocarbon products to the satisfaction of the Departmental Representative and LLYK ESO and in accordance with all applicable federal and provincial legislation. The Spill Response Plan will include a list of products and materials to be used or brought to the work site that are considered or defined as hazardous or toxic to the environment. Such products may include, but are not limited to fuels and lubricants. The Material Safety Data Sheets (MSDS) for all chemicals used will be made available on- site. Appropriately sized and stocked spill kits will be on site capable of dealing with 110% of the largest potential spill. All Contractor's staff must be aware of their location(s) on site and must be trained on spill response procedures.

    c. An Emergency Response Plan that outlines procedures to follow in the case of an emergency (e.g., wildlife encounter, equipment malfunction/failure, fire).

    d. A Fire Prevention Plan which describes the fire prevention equipment (e.g., fire extinguishers) and procedures on-site in the event of a fire. Should a fire occur, Banff Dispatch and the Fire Duty Officer must be notified immediately.

2. The Contractor will ensure that works are completely contained such that deleterious substances (e.g., sediment, spills or leaks, etc.) will not be released into the environment.

    a. Prior to use on the Project sites and during daily use, equipment and fuel lines will be inspected for leaks and structural integrity, and inspections will be recorded. Any detected leaks will be addressed immediately, and spills over 5 L or any spill quantity in water are to be reported to Banff Dispatch and the LLYK Environmental Surveillance Officer (ESO) immediately.

    b. Hazardous or toxic products (fuels, lubricants etc.) will be stored no closer than 100 m from any watercourse. Do not refuel closer than 100 m from a water-body. Store all fuels and hazardous liquids in 110% capacity secondary containment vessels.

    c. Any absorbent materials used in spill clean-up or soils contaminated by a spill will be disposed of in the appropriate facilities and transported in accordance with the Transportation of Dangerous Goods Regulations.

3. A qualified Environmental Professional will create a detailed revegetation plan on finalization of the Project design. This will include bioengineering measures, such as willow staking, joint planting, and/ or live pole drains to help increase bank stability, maintain water runoff patterns, restore integrity and quality of riparian habitat, and improve ecological value of any armoring or rock deposition adjacent to the Kicking Horse River. This plan will also include direction for revegetation of exposed soil and stockpile to reduce erosion and introduction of invasive species. Revegetation will include use of an approved LLYK seed mixture and other approved plant species.

4. All equipment will be stored either on the road or on previously hardened surfaces in order to avoid trampling roadside vegetation and compaction of soils.

5. Vegetation removal will occur outside the breeding bird restricted activity period for the Northern Rockies Zone A4 (April 20 to August 12) (Environment Canada 2014). The breeding bird window coincides with the bat breeding period.

    a. Where removal of vegetation cannot occur outside of the RAP, pre-clearance nest surveys should be conducted by Qualified Environmental Professionals with an appropriate level of experience identifying birds and conducting nest sweeps. Should active nests be detected during surveys, consultation will occur with LLYK FU staff to determine the appropriate course of action. Most migratory birds, their nests and eggs are protected under the Migratory Birds Convention Act, 1994 (MBCA) (GoC 1994).

    b. Where removal of vegetation cannot occur outside of the RAP, a pre-disturbance bat assessment will be conducted by qualified environmental professionals. Survey will first determine whether there are trees that would function as high-potential roosting habitat within the LSA. If high-potential habitat is identified, then a follow-up survey will be completed to determine whether bats are present. Should active bat roosts be detected during surveys, consultation will occur with LLYK FU staff to determine the appropriate course of action.

6. Qualified Environmental Professionals will develop and implement an Erosion and Sediment Control Plan for the site that minimizes risk of sedimentation during all phases of the project. The plan will include:

    a. Installation of appropriate erosion and sediment control methods before starting work to protect sensitive aquatic habitats and riparian areas.
    b. Use of sediment fencing and/or other appropriate erosion control materials to prevent sediment transport to the Kicking Horse River or watercourses flowing to the river. The intended end result is to avoid the release of sediments into any watercourse in levels that may cause harm to fish. The target is 0 mg/L of TSS over background levels, with a maximum allowable instantaneous increase of 25 mg/L over background levels when background levels are <250 mg/L or a maximum allowable instantaneous increase of 10% over background levels where background levels are >250 mg/L (CCME 2002).
    c. Maintenance of erosion and sediment control measures until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear.
    d. Management of water flowing onto the sites such that sediment is settled or filtered out prior to the water entering a waterbody.
    e. Follow-up monitoring requirements, including schedule, criteria for inspection, and timelines.

Aquatic Resources

7. Before construction commences, McElhanney will finalize riprap protection details associated with the Through Cut and Lower Mount Vaux road side deposit areas to minimize likelihood of undercutting and erosion.

8. The Project will be designed to ensure beds and banks of watercourses are restored to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that maintains water runoff patterns will be developed.

9. Qualified Environmental Professionals will conduct on-the-ground assessment of culverts that require extension to confirm these are not permanent water courses, or fish-bearing. The information collected in the field will facilitate any required DFO Request for Review needed for the culvert extensions or installations.

    a. If required, any culverts that channel permanent or fish-bearing streams will be extended during dry or frozen conditions (low-flow), or in isolation of flowing water and only after the work zone has been isolated and a fish salvage has been completed by the ESO or Departmental Representative. Water diversion will require a water diversion permit. The site shall be isolated from flows by pumping flow around the work zone to ensure downstream habitat is not dewatered. Pumping will require a Restricted Activity Permit (RAP) and must include screened intakes to eliminate potential entrainment and harm to fish. Culverts for roadside drainage that do not have seasonal flow patterns will not be limited to replacement during low-flow periods, and can be extended as directed by the Department Representative.

10. Culverts extension will be designed and constructed (i.e., with proper size and gradient) such that flows and flow paths maintain or improve connectivity. Parks Canada will be consulted during the development of designs for any culvert modifications. and

11. If required, timing for any instream work will be confirmed with the LLYK Aquatics specialist and Fisheries and Oceans Canada in advance of construction.

    a. Activities modifying water features will be scheduled to occur outside high flow periods and in consideration of bull trout timing restrictions for the Kootenay (June 1 to August 31) (BC MOE 2009). High flows are typical in May and June during snowmelt runoff, and in response to fall and summer rainfall events.

12. Mitigation measures will be in accordance with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2015).

13. If diversion is required, during construction, water intakes or outlet pipes will be screened to prevent entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself. Measures for freshwater design and installation of intake end-of-pipe-fish screens will be followed to protect fish where water is extracted from fish-bearing waters (DFO 2015).

14. Construction activities at culvert TCHYOHO_29.7 will not be undertaken without approval from the LLYK FU. Temporary fencing will be installed at the southwest boundary of the Project footprint adjacent to culvert TCHYOHO_29.7 at the Field Flats road side deposit site. This fencing will ensure construction activities stay within work limits and that construction activities do not contribute to a reduction of fish habitat quality through sedimentation, and that uninterrupted fish passage will be maintained at the site.

15. All work activities shall meet or exceed the standards outlines in the Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998).

Vegetation

16. If schedule allows, Qualified Environmental Professionals will complete appropriately timed surveys for VEMC within the Footprint, focusing on high potential VEMC habitat (i.e., Field Flats and riparian areas). If observed, the LLYK will be notified and appropriate mitigation measures (e.g., transplant) will be taken.

17. Efforts will be made to ensure the minimum amount of vegetation is cleared or disturbed at each site. Mature trees (DBH >30 cm), and wildlife trees will be avoided, when possible.

18. The Contractor will control/restrict the spread of invasive plant species within the construction and staging areas.

    a. Permanent and/or mobile cleaning stations will be set up on site to remove soil and plant material from vehicles and equipment before being moved. Cleaning stations will be inspected, photographed, documented, and approved by the Field Unit, where possible and appropriate, during setup and prior to entry/exit. Materials removed from the vehicles and equipment, and the water used for cleaning will be collected and disposed in a manner dictated by the LLYK field unit.

    b. Construction staff and others entering the project site will be required to scrape mud off their boots and brush seeds and dirt from their clothing before entering the project site.

    c. Discussion about sites of concern where special attention must be paid to invasive species control will take place between the contractor and the Field Unit before work commences.

19. Qualified Environmental Professionals will complete a pre- and post-construction invasive plant survey will be completed, which will identify the presence and distribution and invasive plant species. If observed, the LLYK will be notified and appropriate control measures will be taken. If invasive plant species are identified and presence is suspected to have occurred during construction, the LLYK FU will be notified and appropriate control measures will be taken.

Wildlife and Wildlife Habitat

20. Qualified Environmental Professionals will monitor the potential mammal den at Spiral Tunnels Hill before and during construction to determine if it is active.

21. Western Toad activity and migration may occur into September/October. Qualified Environmental Professionals will complete pre-disturbance surveys until this time to assess the LSA for Western Toad/ Western Toad habitat. All amphibian habitat will be flagged along the route. If eggs, tadpoles or toads are found, the LLYK will be notified to develop an avoidance or mitigation plan. Surveys will include a pre-construction survey at Field Flats, and a pre-remediation survey of all catchment ditches with standing water.

22. Prior to blasting, the Contractor will "sweep" the work area and maintain a continuous watch for wildlife that might be present. If wildlife is observed, work will be stopped until the wildlife has passed through the area and/ or has been hazed out of the area by the ESA, or appropriately qualified biologist.

23. Wildlife will be prevented from obtaining food, garbage or other domestic wastes by the Contractor and contract staff. Wildlife attractants will be stored away from animal access and will not be stored at the work site overnight. Existing Parks Canada waste receptacles will not be used for disposal of such wastes without prior arrangement with PCA. Incidents involving wildlife accessing garbage or attractants will be reported immediately to the ESO or Resource Conservation staff.

24. Wildlife encountered at or near Project locations will be allowed to passively disperse without undue harassment.

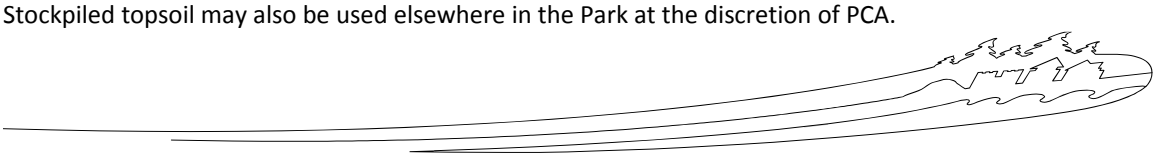
25. Parks Canada will be notified in the event of human-wildlife interactions, or activity or encounters with bears, Lynx, Wolves, Cougars (*Puma concolor*), Wolverines, and any species at risk, dens and/or nests. Work will be stopped and the following should be reported immediately to Banff dispatch and the ESO:

    a. aggressive encounters involving any species,
    b. sightings of large carnivores,
    c. toad migration,
    d. snake hibernaculum,
    e. bat roost,
    f. bird rest, or
    g. observations of carcasses.

Terrain and Soils

26. Work will be scheduled to avoid rainy periods. Topsoil salvage will not occur during high precipitation, high wind or runoff events. Contingency plans for isolating worksites during high precipitation, high wind and runoff events will be identified in the EPP.

27. Topsoil will be retained to facilitate recovery of construction areas, staging areas or rock storage areas. Stockpiled topsoil may also be used elsewhere in the Park at the discretion of PCA.



Cultural Resources

28. An AOA for the 2016 Project will be developed, and an Archeological Impact Assessment (AIA) may be required; the Project will incorporate recommendations and mitigations provided in these assessments. Construction will be stopped if artifacts or features are encountered and the LLYK FU will be notified to determine the appropriate mitigation.

29. Work around a known cultural resource, including the old highway grade, will be conducted in a manner to minimize potential disturbance. This may include:

    a. Care must be taken to not impact the old highway grade with heavy machinery or tracked vehicles without mitigating the effects on the road grade.
    b. Designing access roads and slope profiles to minimize area of disturbance while accomplishing safety/maintenance objectives.
    c. Visibly delineating boundaries of work areas to prevent unintentional disturbances.
    d. Conduct an "artifact sweep" prior to physical disturbances. Parks Canada should be contacted to assess whether it is feasible or desirable to salvage artifacts.

Visitor Experience

30. Construction will have a hiatus between June 29, 2016 and September 7, 2016 to avoid construction during the heaviest visitor traffic months.

31. Construction activities will take place within the designated hours which will be determined in consultation with PCA. These timing restrictions will be determined to reduce impacts to vehicle traffic and visitor experience.

32. The Contractor will maintain a minimum of one travelling lane 4 m wide at all times to provide for safe movement of travelling public through work area. The delay due to single lane alternating traffic will not exceed 30 minutes.

33. Traffic closures for blasting will have the following limitations:

    a. Short, full closures for a maximum of 30 minutes will be permitted by the Departmental Representative, provided the delay to motorists does not exceed 45 minutes.

    b. Two 60 minute site-wide closures per day between 7:00 hrs and 11:00 hrs.

    c. One 60 minute site-wide closure per day between 19:00 hrs and 7:00 hrs.

    d. 30 minute elapse time between full closures.

    e. No full closures between 11:00 hrs and 19:00 hrs.

    f. Full closures are only permitted on Monday, Tuesday, Wednesday and Thursday.

    g. Traffic will not be stopped for construction work on: Sundays, Alberta or BC statutory holiday long weekends, including one day before and one day after (i.e., no work from Thursday 19:00 through Tuesday 7:00 if the holiday falls on a Monday).

34. The Departmental Representative reserves the right to stop work in the case of excessive traffic delays during peak travel times.

35. Construction noise is not permitted above 85 dB(A) as measured at the Monarch and Kicking Horse (Yoho Valley Road) campsites between 23:00 hrs and 07:00 hrs seven (7) days a week.

36. The Contractor will keep the Departmental Representative apprised of construction advisories for posting to the Drive BC website and Official Alberta Traffic Advisor website and update advisories regularly to reflect the current and planned construction activities and highway closures.

37. The Contractor is responsible for posting road signage (e.g., trucks turning, reduced speed) to ensure public safety.

38. Construction equipment will be turned off when not in use, equipment and vehicles will be operated at optimal efficiency and performance, and carpooling of personnel to staging areas and Project sites will be encouraged.

39. The LLYK FU will develop traffic restrictions in conjunction with Mount Revelstoke, Glacier and Banff National Parks to ensure the project does not compound slow-downs through the Parks system.

9. PUBLIC/STAKEHOLDER ENGAGEMENT & ABORIGINAL CONSULTATION

9 a) Indicate whether public/stakeholder engagement was undertaken in relation to potential adverse effects of the proposed project:

☒ No

☐ Yes (describe the process to involve relevant parties and indicate how comments were taken into consideration).

9 b) Indicate whether Aboriginal consultation was undertaken in relation to potential adverse effects of the proposed project:

☒ No

☐ Yes (describe the process to involve relevant parties and how the results were taken into consideration).

10. SIGNIFICANCE OF RESIDUAL ADVERSE EFFECTS

For each VC, a determination of significance was made based on the residual effects characterization (Table 11). Residual adverse effects are defined as effects remaining after the mitigation measures are applied (Section 8). Residual effects were characterized using direction (positive, negative or neutral), expected magnitude (e.g., negligible to high), geographic extent (i.e., spatial extent of the effect), duration/ reversibility (i.e., reversible in the short-term to permanent effects), frequency (i.e., number of times the effect happens per unit time) and probability (i.e., likelihood the effect will happen). These criteria were considered together, along with context identified within Section 6, to estimate the overall effects from the Project on each VC.
Definition and ranking of the above listed criteria are provided in Appendix F.

Significance was predicted to be either significant, or not-significant. For natural resource-valued components (e.g., aquatic resources, vegetation), the residual effect was determined to be significant if the VC was expected to be altered to a point where it was no-longer self-sustaining. For cultural resources, the residual effect was determined to be significant if the VC was expected to be altered to a point where the resource is highly modified or destroyed.

Project impacts that can be avoided or completely mitigated were not considered to have a residual impact, and therefore, were not been rated or incorporated into the Signification of Residual Adverse Effects Table (Table 12), below.

Overall, it is anticipated that there will be no significant adverse residual effects because of the Project, provided mitigation measures are implemented (Table 12).

Table 12: Significance of Residual Adverse Effects

Valued Component	Key Indicator	Potential Effects Considered to be Residual	Residual Impact Criteria Rating						Significance
			Direction	Magnitude	Geographic Extent	Duration/ Reversibility	Frequency	Probability	
Aquatic Resources	Fish and Fish Habitat	Change in habitat quality and/or quantity due to alteration of instream fish habitat	Negative	Low	Local	Permanent	Continuous	Certain	Not Significant
		Change in habitat quality due to increase in suspended sediment load and sediment deposition.	Negative	Low	Local	Short-term	Continuous	Possible	Not Significant
	Hydrology	Potential lateral stability of the Kicking Horse River	Negative	Low	Local	Medium-term	Continuous	Unlikely	Not Significant
		Potential erosion or undercutting of the Project footprint by the Kicking Horse River	Negative	Low	Local	Permanent	Continuous	Unlikely	Not Significant
		Changes to natural flow pattern and water quantity	Negative	Low	Local	Short-term	Continuous	Certain	Not Significant
	Surface Water Quality	Change in water quality due to increase in suspended sediment load; and sediment deposition.	Negative	Low	Local	Short-term	Continuous	Possible	Not Significant
Vegetation	Vegetation Communities	Change in habitat quantity and/ or quality due to disturbance and removal of vegetation	Negative	Low	Local	Permanent	Continuous	Certain	Not Significant
		Change in habitat quantity and / or quality due to deleterious substances from construction equipment	Negative	Low	Local	Short-term	Infrequent	Unlikely	Not Significant
		Change in habitat quality and / or quantity due to changes in hydrology	Negative	Low	Local	Long-term	Continuous	Possible	Not Significant
		Change in vegetation community composition due to increased invasive plant species	Negative	Low	Local	Long-term	Continuous	Unlikely	Not Significant
	Vegetation Elements of Management Concern	Change to VEMC habitat quantity and/ or quality due to vegetation clearing, deleterious substances, and changes in hydrology	Negative	Low	Local	Long-term	Continuous	Possible	Not Significant
		Change in VEMC abundance due to loss of individuals	Negative	Low	Local	Permanent	Continuous	Possible	Not Significant
		Change in VEMC abundance due to increased invasive plant species	Negative	Low	Local	Long-term	Continuous	Unlikely	Not Significant

Table 12: Significance of Residual Adverse Effects

Valued Component	Key Indicator	Potential Effects Considered to be Residual	Residual Impact Criteria Rating						Significance
			Direction	Magnitude	Geographic Extent	Duration/ Reversibility	Frequency	Probability	
Wildlife	Western Toad	Change in habitat quantity and / or quality due to vegetation clearing/ rock deposition	Negative	Low	Local	Permanent	Continuous	Possible	Not Significant
		Change in habitat quality and/or quantity due to increase in suspended sediment load and sediment deposition	Negative	Low	Local	Short-term	Continuous	Possible	Not Significant
	Birds- Migratory Birds and Olive-Sided Flycatcher	Change in habitat quantity and / or quality due to vegetation clearing	Negative	Low	Local	Permanent	Continuous	Certain	Not Significant
		Decreased abundance due to vegetation clearing/ rock deposition	Negative	Low	Local	Permanent	Continuous	Unlikely	Not Significant
	Little Brown Myotis	Change in habitat quantity and / or quality due to vegetation clearing	Negligible	Low	Local	Permanent	Continuous	Possible	Not Significant
	Bears	Change in bear abundance occurrence due to human-bear encounters	Neutral	n/a	n/a	n/a	n/a	n/a	n/a
Soils and Landform	General	Change in soil quality through compaction, erosion, and contamination by spills	Negative	Low	Local	Medium-term	Continuous	Likely	Not Significant
Visitor Experience	General	Changes in traffic flow though YNP	Positive	n/a	n/a	n/a	n/a	n/a	n/a
		Aesthetics of YNP	Neutral	n/a	n/a	n/a	n/a	n/a	n/a
Cultural Resources	General	Loss/ alteration of historical resources	Negative	Low	Local	Permanent	Continuous	Likely	Not Significant

Note: If a residual effect was identified as positive or neutral, no additional assessment criteria other than likelihood were summarized for that key indicator. See Appendix F for Residual Effects Definitions.

11. SURVEILLANCE

☐ Surveillance is not required

☒ Surveillance is required (provide details such as the proposed schedule and the focus of inspections)

12. FOLLOW-UP MONITORING

Follow-up monitoring is:

☒ not required

☐ required by legislation or policy (indicate basis of requirement – e.g., required by the *Species at Risk Act*; *Fisheries Act*, or the *Parks Canada Cultural Resource Management Policy*)

☐ required to evaluate effectiveness of mitigation measures and/or assess restoration success

13. SARA NOTIFICATION

Notification is:

☒ not required

☐ required under the *Species at Risk Act* (outline the nature of and response to any notification).

14. EXPERTS CONSULTED

Include Parks Canada experts. Add as many entries as necessary for the project.

Department/Agency/Institution: McElhanney Consulting Services Ltd.	Date of Request: 2015-12 and ongoing
Expert's Name & Contact Information: Shane Anderson 100 – 780 Beatty Street, Vancouver BC V6B 2M1 Telephone: 604 683 8521 Email: sanderson@mcelhanney.com	Title: Project Manager/ Engineer
Expertise Requested: Clarification on project design and requirements.	
Response: Provided engineering drawings and clarification on Project design and requirements.	
Department/Agency/Institution: Parks Canada Agency, Highway Services Engineering (HSE)	Date of Request: 2015-12 and ongoing
Expert's Name & Contact Information: Trevor Kinley P.O. Box. 220, Radium Hot Springs, BC V0A 1M0 Telephone: 250-347-6634 Email: trevor.kinley@pc.gc.ca	Title: Environmental Assessment Scientist
Expertise Requested: Clarification on BIA requirements for the Project.	
Response: Provided reports, data and clarification on BIA requirements for Project.	
Department/Agency/Institution: Golder Associates Ltd.	Date of Request: 2015-12 and ongoing
Expert's Name & Contact Information: Mark Goldbach #200-2920 Virtual Way Vancouver BC V5M 0C4 Telephone: 604 297 4634 Email: mark_goldbach@golder.com	Title: Senior Geotechnical Engineer
Expertise Requested: Clarification on project design and requirements.	
Response: Provided clarification on Project design and requirements.	

Department/Agency/Institution: Tetra Tech EBA Consultants Ltd.	Date of Request: 2016-01 and ongoing
Expert's Name & Contact Information: Anders Frappell 1066 W Hastings Street Vancouver BC V6E 3X2 Telephone: 778-945-5833 Email: anders.frappell@tetratech.com	Title: Rock Engineer
Expertise Requested: Clarification on project design and requirements.	
Response: Provided engineering drawings and clarification on Project design and requirements.	

15. DECISION

Taking into account implementation of mitigation measures outlined in the analysis, the project is:

- ☒ not likely to cause significant adverse environmental effects.
- ☐ likely to cause significant adverse environmental effects.

NOTE: If the project is identified as likely to cause significant adverse effects, CEAA 2012 prohibits approval of the project unless the Governor in Council (Cabinet) determines that the effects are justified in the circumstances. A finding of significant effects therefore means the project CANNOT go ahead as proposed.

FOR SARA REQUIREMENTS:

- ☒ There are no residual adverse effects to species at risk and therefore the SARA-Compliant Authorization Decision Tool was not required

OR, the SARA-Compliant Authorization Decision Tool (Appendix 2) was used and determined:

- ☐ There is no contravention of SARA prohibitions
- ☐ Project activities contravene a SARA prohibition and CAN be authorized under SARA
- ☐ Project activities contravene a SARA prohibition and CANNOT be authorized

16. RECOMMENDATION AND APPROVAL

Prepared by: EIA author: Marcie Plishka, Terrestrial Biologist EIA Reviewers: Martin Jalkotzy, Senior Wildlife Biologist Valerie Coenen, Senior Terrestrial Ecologist	Date: 2016-02-22
Recommended by: Functional manager of the project: Zachary Boles	Date: 2015-12-10
Approved by: Name & position: (*Field Unit Superintendent, Director of a Waterway*):	Date: YYYY-MM-DD 2016/04/15
Signature:	

17. ATTACHMENTS

Appendix A – Figures

Figure 1 - Overview Project Location

Figure 2 – Aquatic Resources within the Project LSA

Figure 3 – Vegetation Elements within the Project the LSA

Figure 4 – Cultural Resources within the Project LSA

Appendix B – Environmental impact Analysis Tools: Effects Identification Matrix

Appendix C – Vegetation and Wildlife Elements of Management Concern with Potential to Occur Near Project Sites

Table C-1 – Vegetation Elements of Management Concern with Potential to Occur Near Project Sites

Table C-2 – Wildlife Species of Management Concern with Potential to Occur Near Project Sites Project Sites

Appendix D-1 Cultural Resources Report: Archaeological Overview Assessment TCH Rock Reprofiling Yoho National Park. February, 2015.

Appendix D-2 Archeological Overview Assessment TCH Rock Slope Reprofiling Yoho National Park, 2016 TCH Km 88-91 and 114-128. March 2016.

Appendix E – Visitor Experience Report: BC Ministry of Transportation and Infrastructure – Annual Day of Week Summary for 2014

Appendix F – Definition of Criteria Used to Describe Predicted Residual Effects for Valued Components and/or Key Indicators

18. NATIONAL IMPACT ASSESSMENT TRACKING SYSTEM

☐ Project registered in tracking system

☐ Not yet registered *(CEAA 2012 requires PCA submit a report to Parliament annually. EIAs must be entered in the tracking system **by the end of April** to enable reporting*.

19. REFERENCE LIST

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