TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

List of Tables

List of Figures

5.4.2 Physiography and Topography

5.4.2.1 Introduction

The Physiography and Topography Valued Component (VC) and indicator, terrain stability, were selected for inclusion in the assessment, taking into consideration the baseline study findings, inputs from local stakeholders, government agencies, and regulators. The identification and selection process involved in selecting VCs and their indicators can be found in **Section 4** and **Section 5.4.1**.

The approach of the assessment follows the methodology in **Section 4** and is described though the subsections below. The Introduction describes the applicable regulatory framework for the assessment of the VC (**Section 5.4.2.1.1**). The remainder of this section includes sub-sections dealing with the following: a brief summary of baseline data on the Physiography and Topography VC (**Section 5.4.2.2**), potential effects and mitigation measures (**Section 5.4.2.3**), residual effects and their significance (**Section 5.4.2.4**), cumulative effects (**Section 5.4.2.5**), limitations of the assessment (**Section 5.4.2.6**), and conclusions (**Section 5.4.2.7**).

5.4.2.1.1 Relevant Legislation and Legal Framework

Consideration of Soils, Terrain, and Surficial Geology is included under the requirements of the British Columbia *Environmental Assessment Act* (BC *EAA*) (Government of BC, 2002). Assessment of Soils, Terrain, and Surficial Geology is also considered within the *Mines Act* (Government of BC, 1996), which requires the development of a conservation and reclamation plan to support the closure of the Project indicating the need for soil, terrain, and surficial geology baseline data. The Soils, Terrain, and Surficial Geology Baseline Report (**Appendix 5.1.3.2A**) for the Project meets the criteria of the *Mines Act* to support this assessment. As well, Part 10 of the *Health, Safety and Reclamation Code for Mines in British Columbia* (BC Ministry of Energy, Mines and Petroleum Resources (BC MEMPR), 2008) contains reclamation and closure criteria applicable to the reclamation of mining activities. As borrow sources and regrading of the site will be required, requirements under the Aggregate Operators Best Management Practices Handbook for British Columbia (BC Ministry of Energy and Mines (BC MEM), 2002) were also considered. This document presents the Best Management Practices (BMPs) for aggregate operators, including stockpiling, stormwater management, and erosion and sediment control.

5.4.2.2 Valued Component Baseline

Two key issues were identified for the Physiography and Topography VC; namely, the alteration of baseline landforms, and terrain stability and accelerated erosion. Alteration of the baseline landforms will occur throughout the Project footprint as a direct consequence of surface disturbance. The degree of alteration will vary between Project components. This interaction is expected to extend over the life of the Project, but the majority of the alterations will occur during the construction phase. The operations phase will be characterized by limited ongoing disturbance or stabilizing altered conditions. New features will be created (either positive or negative relief) during the operations phase, as facilities such as the open pit, TSF, and waste rock facilities will be continually altered during this phase. Reclamation of mine facilities will occur mostly within the closure and

decommissioning phase by re-contouring to develop final landforms, although progressive reclamation will be conducted during the mine life where possible.

Potential effects related to terrain stability and accelerated erosion may occur throughout the life of the Project on disturbed sites where native soil cover or topography has been altered from baseline conditions.

5.4.2.2.1 Information Sources and Methods

The effects assessment for the Physiography and Topography Valued Component (VC) is based on site-specific baseline mapping and reporting conducted for the Project. Provincial and regional information sources were reviewed, and provided a background to support the Project-specific terrain and soil mapping completed during the baseline assessment. Baseline mapping followed the provincial terrain mapping conventions outlined in the Terrain Classification System for BC (Howes and Kenk, (1997) and the Guidelines and Standards for Terrain Mapping in BC (Resources Inventory Committee (RIC), 1996). Recently acquired aerial photography and detailed LiDAR-based contours and hill-shade images were used to interpret the landscape within the facility areas of the Project.

To determine the Project effects on the Physiography and Topography VC, the Project footprint was superimposed on the terrain map produced for the Soil and Terrain Baseline Report (**Appendix 5.1.3.2A**). This assessment considered the effects of changing slope gradients and re-contouring. Spatial analysis using a Geographic Information System (GIS) protocol was employed to determine the effect of the Project. Specifically, slope gradients and topographic form indicators were considered as part of the effects assessment, and aerial extents of change were measured using GIS methods.

5.4.2.2.2 Physiography and Topography Baseline

In order to determine the spatial extent of changes to the baseline physiography and topography, the baseline case was compared to a full case scenario. Only the features that are expected to undergo major alteration to the baseline condition with respect to physiography and topography are presented in this baseline section. Detailed descriptions of the Project components including post-closure components that will remain in perpetuity are provided in the Project Description (**Section 2.2**). These features are referred to as mine-related landforms and include the open pit area, TSF, and waste rock dumps. Areas categorized as natural landforms will be impacted to a lesser extent than the mine-related landforms. Following closure, these natural landforms are expected to return to similar ecosystem types over time with natural recovery. Natural landforms will occur in association with low-grade ore stockpile, construction and operations camp and associated facilities, processing plant, heavy equipment maintenance shop, warehouse and administration building, and assay lab.

The proposed mine access road, extending from the existing FSR, and the Project airstrip will be new features, and are included in the assessment of the Physiography and Topography VC. Mine features that are not expected to undergo significant alterations include the proposed transmission

line and freshwater supply system, along with the proposed use of or upgrades to existing access roads (Kluskus FSR and airstrip access road).

The baseline landform diversity within each mine footprint ranges from gently undulating, sediment-controlled, to steep slopes adjacent to fluvial channels. Slope Classes identified within the Project footprint range from level Class 1 slopes to extreme Class 6 slopes, ranging up to and greater than 70%. The majority of slopes identified for all Project components are gently undulating, Class 1 to Class 3 slopes, ranging between 5% and 25%. **Table 5.4.2-1** identifies the Slope Classes used to describe the baseline conditions within the Project footprint.

Table 5.4.2-1: Summary of Slope Classes

Slope Class	Slope Range (%)
Class 1	0 to 5
Class 2	6 to 15
Class 3	16 to 26
Class 4	27 to 49
Class 5	50 to 70
Class 6	>70

Source: Howes and Kenk, 1997.

5.4.2.2.2.1 Mine Site

In terms of topography and terrain, the mine site contains areas of high relief along Davidson Creek, comprising colluvial or morainal material, and extensive areas of glaciofluvial deposits expressed in a range from relatively level plains and terraces to high relief, hummocky deposits. Under the baseline case, the most commonly mapped Slope Class in the mine site footprint is Class 4, at 36%. Class 2 (25%) and Class 3 (25%) slopes account for the majority of the Project study area. The natural landform area where extensive disturbance is not expected is identified as Class 2 to 4 slopes, accounting for approximately 86% of the baseline Slope Classes for the feature.

The majority of baseline landform alteration will occur through the development of the open pit, the TSF, including the north and south embankments, and the East and west waste rock dumps. The baseline landforms for the open pit, the TSF, and the east waste rock dump will not be re-established during mine decommissioning and closure but will remain as new reclaimed features on the landscape. Portions of the open pit and the TSF will be transformed into open waterbodies. Both waste rock dumps will be constructed as positive relief features with scarps and a tread, which will be constructed at 3:1 (H:V) slope or regraded at closure to promote reclamation and slope stability.

The open pit projected surface area is approximately 238 hectares (ha). Of this, 109 ha (46% of the pit) was mapped as anthropogenic disturbance from exploratory mining activities. The slopes were not rated in these disturbed areas and were assigned a rating of *Not Rated* (NR). The area occupied by the open pit consists of undulating morainal deposits, with gentle to moderate slopes. Low relief, localized areas of organics occur in the open pit area, with Class 1 slopes commonly identified. The majority of the open pit area comprises Class 3 and Class 4 slopes, accounting for

119 ha (50% of the open pit area). The projected surface area for the TSF area, including the south and north embankments, tailings beaches, and associated ponds, is approximately 1,116 ha. The baseline topographic conditions of the TSF area include: moderately-sloped morainal deposits (47% of the TSF), overlying undulating bedrock topography, with Class 3 to 4 slopes commonly identified; gently-undulating (Class 3) to hummocky (Class 4) glaciofluvial deposits (21%), including near-level terraces along drainage channels; and fluvial deposits (16%), with variable slope classes ranging from Class 3 to Class 6 slopes. Approximately 11% of the TSF area comprises colluvial deposits that occur on slopes ranging from Class 3 to Class 6, while low-relief organic wetlands are associated with open water (5% of the TSF); less than 1 ha of the TSF was classified as anthropogenic, resulting from the existing access road.

The projected disturbed surface area for the east waste rock dump is approximately 159 ha (includes area of stockpiled overburden to be reclaimed for reclamation), and the west waste rock dump is approximately 172 ha . Baseline topographic conditions for both features consist of Class 2 to 4 slopes overlying both sediment and bedrock-controlled topography. The east waste rock dump is predominantly characterized as Class 4 slopes (54%), with Class 2 (25%) and Class 1 (10%) accounting for the majority of the rest of the area. Approximately 10% of the east waste rock dump is NR, due to existing disturbances at the site. The west waste rock dump comprises 52% Class 4 slopes, with an additional 40% Class 2 slopes. Class 1 and Class 3 slopes combined account for approximately 4% of the area.

The low-grade ore stockpile (LGS) is approximately 76 ha. Baseline topographic conditions consist of low- to medium-relief Class 2 (45%) to Class 4 (55%) terrain composed of organic and morainal deposits.

5.4.2.2.2.2 Mine Access Road

The proposed mine access road is a separate feature, with a LSA and footprint separate from the mine site feature. The construction of the mine access road is expected to cause permanent changes to the physiography and topography of the area. The surface area for the mine access road is approximately 27 ha (**Table 5.4.2-2**) and mainly comprises Class 2 slopes (75%), with the remaining area comprising Class 1 slopes (19%).

5.4.2.2.2.3 Airstrip

The proposed airstrip is a separate feature within the RSA that is expected to cause extensive changes to the physiography and topography of the area. The proposed airstrip feature contains the landing strip and associated access road. The landing strip, approximately 16 ha, is entirely located on a relatively level Class 2 glaciofluvial terrace. The airstrip access road is an existing feature, which is not expected to undergo any major alterations to the present condition.

5.4.2.2.3 Baseline and Project Case Feature Slope Classes

To determine the spatial extent of changes to the baseline physiography and topography, the baseline case was compared to the Project case scenario. Assumptions based on the Project Description were made with respect to the anticipated slope gradients with each of the Project facilities (**Table 5.4.2-2**).

Under the baseline case, the majority of the site facilities are Class 2, 3, and 4, accounting for 85% of the area, with approximately 191 ha (6%) of Class 1 slopes identified. At full Project extent, 35% of the slopes will be Class 1, resulting in lower slope gradients than at baseline. Class 4 slopes will account for 11% of the Project footprint, and Class 5 slopes (open pit) will account for 3% of the Project footprint. The remaining area will be water from the TSF pond, and open water within the open pit.

The interaction of the Project with the distribution of the baseline topography is presented on **Figure 5.4.2-1**. This figure depicts the Project development overlaid on the baseline Slope Classes defined for the LSA.

Table 5.4.2-2: Summary of Alterations to Terrain Units within the Mine Site

Facility	Slope Class	Baseline Case (ha)	Project Case (ha)	Change in Topography (ha)	% Change of LSA
Natural Landform Area	1	76.1	0.0	0.0	0.0
	2	331.1	0.0	0.0	0.0
	3	184.7	0.0	0.0	0.0
	4	332.1	0.0	0.0	0.0
	5	45.6	0.0	0.0	0.0
	6	14.0	0.0	0.0	0.0
	NR	6.2	0.0	0.0	0.0
	Water	1.3	0.0	0.0	0.0
Subtotal		989.9	0		
LGS					
	1	0.4	76.0	75.6	2.6
	2	34.0	0.0	-34.0	1.2
	4	41.5	0.0	-41.5	1.4
Subtotal		76.0	76.0		
Open Pit					
	1	0.9	0.0	-0.9	<0.1
	2	9.5	0.0	-9.5	0.3
	4	118.8	0.0	-118.8	4.0
	5	0.0	77.2	77.2	2.6
	NR	108.8	0.0	-108.8	3.7
	Water	0.0	160.8	160.8	5.5
Subtotal		238.0	238.0		
TSF					
	1	69.0	588.4	519.4	17.7
	2	205.6	146.8	-58.8	2.0
	3	517.6	0.0	-517.6	17.6
	4	264.7	130.4	-134.3	4.6
	5	43.4	0.0	-43.4	1.5
	6	11.3	0.0	-11.3	0.4
	NR	2.9	0.0	-2.9	0.1
	Water	1.1	250.0	248.9	8.5
Subtotal		1,115.6	1,115.6		
West Waste Rock Dump					
	1	6.6	85.7	79.1	2.7
	2	68.6	0.0	-68.6	2.3
	3	7.5	0.0	-7.5	0.3
	4	88.9	86.0	-2.9	0.1
Subtotal		171.7	171.7		
East Waste Rock Dump					
	1	15.9	79.0	63.1	2.1
	2	39.2	0.0	-39.2	1.3
	3	3.1	0.0	-3.1	0.1

Facility	Slope Class	Baseline Case (ha)	Project Case (ha)	Change in Topography (ha)	% Change of LSA
	4	84.9	79.5	-5.4	0.2
	NR	15.5	0.0	-15.5	0.5
Subtotal		158.5	158.5		
Associated Mine Facilities	1	17.3	170.5	153.2	5.2
	2	56.5	0.0	-56.5	1.9
	3	10.8	0.0	-10.8	0.4
	4	71.0	19.0	-52.0	1.8
	5	30.5	0.0	-30.5	1.0
	6	2.6	0.0	-2.6	0.1
	NR	0.9	0.0	-0.9	<0.1
Subtotal		189.5	189.5		
	Total	2,939.1	2,939.1		
Mine Site Access Route	**1**	**5.2**	**27.3**	**22.1**	**11.1**
	2	20.5	0.0	-20.5	10.3
	3	0.1	0.0	-0.1	<0.1
	NR	1.5	0.0	-1.5	0.8
Subtotal		27.3	27.3		
Airstrip					
	1	0.0	15.5	15.5	7.4
	2	15.5	0.0	-15.5	7.4
Subtotal		15.5	15.5		

Note: All assumed Slope Classes are at full Project construction.
Natural Landform Area is not anticipated to undergo any significant changes to the baseline condition.
Mine access route will not exceed 5% after construction.
The airstrip will not exceed 5% after construction.
Open pit will have a final slope class of Class 4 for pit walls, and 161 ha (68%) of open water.
The east and west waste rock dumps will contain 50% Class 1 slopes, and 50% Class 4 slopes.
The TSF will consist of 53% Class 1 slopes, 13% Class 2 slopes, 12% Class 4 slopes, and 22% water.
The LGS will consist of 100% Class 1 slopes once ore has been processed.
All access roads and diversion ditches will not exceed 5%.
The associated mine facilities will consist of 90% Class 1 slopes, and 10% Class 4 slopes.
ha = hectare; LGS = low grade (ore) stockpile; NR = Not Rated; % = percent; TSF = Tailings Storage Facility.

370000 372500 375000 377500 380000 382500

5900000 5897500 5895000 5892500

Proposed Transmission Line

Proposed Mine Access Road

Davidson Creek

Snake Lake

Proposed Fresh Water Pipeline

Creek 700

Creek 636713

Creek 688328

Creek 146920

Creek 543585

Creek 661

Exploration Road

Creek 705

Davidson Creek

Creek 705439

Creek 716920

Creek 704458

N

Legend

Existing Road
Contour (20 m)

Project Components

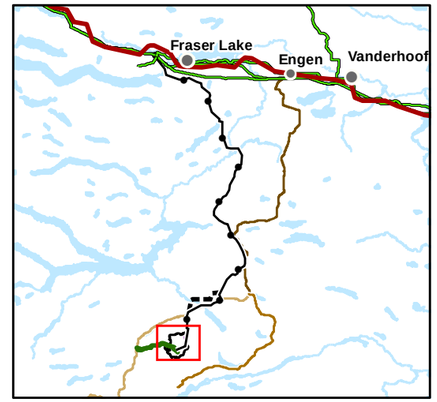
Proposed Mine Access Road
Exploration Road
Proposed Transmission Line
Proposed Fresh Water Pipeline
Proposed Mine Site

Terrain, Soils, and Vegetation

Local Study Area

Slope Class

Slope Class	*Slope Range (%)*
Class 1	0 to 5
Class 2	6 to 15
Class 3	16 to 26
Class 4	27 to 49
Class 5	50 to 70
Class 6	>70
LA - Water	
NR - Not Rated	



Scale:1:45,000

0 0.5 1 2

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Proposed Project Development Overlaid on the Baseline Slope Classes Defined for LSA

DATE:	ANALYST:	
April, 2014	MY	**Figure 5.4.2-1**
JOB No: VE52277	QA/QC: SC	PDF FILE: 05-200-004_Slope_LSA_v3.pdf
GIS FILE: 05-200-004_Slope_LSA_v3.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\05_terrain-geology-soils\EIA\05-200-004_Slope_LSA_v3.mxd

5.4.2.2.4 Interaction between Physiography and Topography VC and other Past, Present, or Future Projects/Activities

A number of projects and human activities overlap with the RSA for physiography and topography. These activities include mining exploration and forestry logging, guide outfitters, active and pending range tenures, and recreational activities such as hunting and fishing.

The alteration of the physiography and topography as a result of the Project is only expected to occur within the mine site, mine access road, and airstrip footprints. Within the study areas corresponding to these Project components, three specific activities are identified: the Dykam Ranch & Woodlot Ltd. and Barry Mills active range tenures, Lyle Barsby guide outfitters, and John Blackwell guiding operation.

It is not expected that the alteration of the baseline physiography and topography caused by the Project will have extensive effects on the activities that use the area. The creation of new residual features as a result of the Project is not expected to alter the functioning of the landscape as a whole as the disturbance is localized spatially (i.e., limited to the mine site and mine access road footprint). As well, no residual effects from the other activities listed above are expected, as alteration of physiography and topography is not an expected effect of these activities.

5.4.2.2.5 Traditional, Ecological, and Community Knowledge

Local residents and Aboriginal groups and their members have expressed interest in the proposed Project's potential effects on physiography and topography. Comments provided during the engagement and consultation process have provided insights into traditional, ecological, or community knowledge, which is defined as a body of knowledge built up by a group of people through generations of living in close contact with nature. This includes unique knowledge about the local environment, how it functions, and its characteristic ecological relationships.

With respect to changes in the Physiography and Topography VC, both Aboriginal and non-Aboriginal peoples use landmarks such as mountains, valleys, slide locations, and other features to orient themselves while hiking or undertaking in other activities. Traditional knowledge points out that mountains and other topographic features provide a foundation for diverse wildlife habitats, used through different seasons by wildlife such as moose, caribou, and grizzly bear. Valleys and other features provide locations for trails, and, in the case of water features, canoe or boat routes (Interview with Lhoosk'uz First Nation, 2013). Diverse topographic features provide for diversity of landscapes and views, as well as create unique topography to support diversity of plant species.

Additional detail on comments and issues raised is provided in **Section 3**, which contains the detailed public and Aboriginal issues tracking tables for the Project. **Sections 14** through **Section 18** provide a summary of the Aboriginal background, rights, and interests for the Project.

5.4.2.3 Potential Effects of the Proposed Project and Proposed Mitigation

This section presents the likelihood that different Project components and activities will have a direct or indirect effect on Physiography and Topography VC during the construction, operations,

closure/decommissioning, and post-closure phases of the Project. The types of interactions that activities have in relation to the Physiography and Topography VC are classified as: key interactions, moderate interactions, or negligible interactions (**Table 4.3-2** Project Component and Activity Interaction Matrix for Selected VCs, **Section 4**). The focus of the effects assessment on the Physiography and Topography VC deal with the key interactions as there is a direct interaction between the activity and the VC. Moderate interactions have the potential to result in effects and are mitigated for the VC during the different Project phases. These interactions are not carried forward into the residual effects assessment.

The likelihood that Project components and activities will have on the VC is determined by:

- Identifying each potential direct or indirect effect on the Physiography and Topography VC that may occur during each phase of the Project;
- Identifying any direct or indirect effects on physiography and topography that may indirectly affect other VCs (e.g., Vegetation VC), including other Soil, Terrain, and Surficial Geology VCs;
- Identifying any potential direct or indirect effects on physiography and topography that are eliminated through implementation of changes to the Project design; these potential effects are not carried forward in the assessment; and
- Identifying and rating the likelihood of successful mitigation measures that would be implemented to reduce or eliminate potential direct or indirect effects on physiography and topography; potential effects where mitigation measures are determined to break the linkage between the Project component or activity and the VC are not carried forward in the assessment.

The effects of past and present projects and activities that are present in the RSA, if present and when measurable, are captured in the baseline characterization presented in **Section 5.1.3.2** Soils and Terrain (Baseline Summary). As the extent of the Project's effect on the VC is local in nature, the alteration of the baseline physiographic and topographic condition is not expected to cause any adverse interactions with any identified historical, existing, or foreseeable future projects (**Section 4**), If the residual effect of the proposed Project on the VC is determined to be other than negligible and a potential temporal or spatial interaction with a project or activity is identified, then a cumulative effects assessment will be conducted taking into account past, present, certain and reasonably foreseeable future project or activities. The cumulative effects assessment is discussed in **Section 5.4.2.5**.

5.4.2.3.1 Identification and Analysis of Potential Project Effects

The following definitions were used in this assessment to identify potential direct, indirect, and cumulative effects of the Project on the Soil, Terrain, and Surficial Geology VCs:

- Direct effects are interactions between Project components and the Soil, Terrain, and Surficial Geology VCs; activities that alter or remove the baseline conditions are expected to occur in the construction, operation, decommissioning/closure, and post-closure phases of the Project;
- Indirect effects are interactions between Soil, Terrain, and Surficial Geology VCs and Project components and activities that are necessary for construction, operation, and decommissioning of the mine, and that have the potential to affect other terrestrial attributes through the alteration of the baseline landscape; and
- Cumulative effects are interactions between residual effects from the Project that have the potential to combine cumulatively with residual effects from other past, present, or reasonably foreseeable projects.

Potential direct effects were assessed within the LSA. Potential indirect effects were assessed within the RSA. Potential cumulative effects of the Project with other past, present, or reasonably foreseeable projects were assessed in the Cumulative Effects Study Area (CESA).

Mitigation measures to reduce or eliminate potential Project effects on each Soil, Terrain, and Surficial Geology VC were identified during each phase of the Project. These included mitigation measures already integrated into the Project Description, including the Erosion and Sediment Control Plan (ESCP), the Landscape, Soils, and Vegetation Management and Restoration Plan (LSVMRP), and the Reclamation and Closure Plan (RCP). Mitigation measures are described in **Section 13 and 20** of this Application and the RCP is included in **Section 2.6**.

Potential direct or indirect effects for physiography and topography carried forward in the effects assessment are presented and rated for their significance in the sections below.

5.4.2.3.2 Potential Direct Effects on Physiography and Topography

The following section presents the likelihood that different Project components will have a direct effect on the Physiography and Topography VC. The nature of the expected effect and the likelihood of its occurrence are presented. **Table 5.4.2-3** presents a summary of the likelihood of direct effects occurring.

Table 5.4.2-3: Potential Direct Project Effects on Physiography and Topography

Project Component	Project Level Interaction	Project Phase	Potential Direct Project Effect	Likelihood of Occurrence
Mine Site	Site clearing, grading, soil salvage, development of borrow pits, construction of main and ancillary facilities, water diversion / collection / treatment, storage and management of construction materials and waste. Workforce accommodations	C, O, D/C	Alteration of baseline landscape. Terrain stability and accelerated erosion	Likely
	Drilling, blasting, ore and waste rock loading, hauling, and dumping, ore crushing, ore processing, tailings deposition, maintenance of equipment, management of materials, workforce accommodation, waste and sewage treatment, management of soil stockpiles	O	Alteration of baseline landscape. Terrain stability and accelerated erosion	Likely
	Decommissioning and demolition of facilities, recontouring and revegetation, reclamation of TSF, replacement of reclamation material	D/C	Alteration of baseline landscape. Terrain stability and accelerated erosion	Likely
Mine Access Road	Site clearing, grading and road construction, including stream crossings. Transportation of workforce and materials	C, O, D/C	Alteration of baseline landscape. Terrain stability and accelerated erosion	Likely
	Transportation of workforce and materials and maintenance	O	Terrain stability and accelerated erosion	Unlikely
	Maintenance	D/C, PC	Alteration of baseline landscape. Terrain stability and accelerated erosion	Unlikely
Freshwater Supply System	Site clearing and grading, construction of intake, construction of road, installation of water pipeline and freshwater reservoir	C, O	Alteration of baseline landscape. Terrain stability and accelerated erosion	Unlikely
	Pumping of water and maintenance of system	O	Terrain stability and accelerated erosion	Unlikely
	Pumping of water and maintenance of system, decommissioning of freshwater reservoir	D/C, PC	Alteration of baseline landscape	Unlikely

Project Component	Project Level Interaction	Project Phase	Potential Direct Project Effect	Likelihood of Occurrence
Airstrip	Site clearing and grading, construction of runway, airstrip, and ancillary facilities. Transportation of workforce	C, O, D/C	Terrain stability and accelerated erosion. Alteration of baseline landscape	Likely
	Maintenance and occasional use for transportation of workforce or materials	O	Terrain stability and accelerated erosion	Unlikely
	Decommissioning and demolition of facilities, recontouring and revegetation	D/C	Alteration of baseline landscape. Terrain stability and accelerated erosion	Likely
Transmission Line	Site clearing and grading, construction of access roads and towers, and installation of cables	C	Alteration of baseline landscape. Terrain stability and accelerated erosion	Unlikely
	Maintenance	O	Terrain stability and accelerated erosion	Unlikely
	Decommissioning and demolition of facilities, recontouring and revegetation	D/C	Alteration of baseline landscape. Terrain stability and accelerated erosion	Unlikely
Kluskus FSR	Road upgrades and transportation of workforce and materials	C	Alteration of baseline landscape. Terrain stability and accelerated erosion	Unlikely
	Maintenance and transportation of workforce and material	O	Terrain stability and accelerated erosion	Unlikely
	Maintenance	D/C, PC	Terrain stability and accelerated erosion	Unlikely

Note: C = construction; D/C = decommissioning and closure; FSR = Forest Service Road; O = operations; PC = post-closure

The alteration of the baseline landscape, effects on terrain stability, and potential for accelerated erosion are each considered potential direct effects of the Project on the Physiography and Topography VC. Based on the expected Project components listed above, alteration of the baseline landscape is anticipated to occur. This alteration is required to support the Project development, and would occur throughout each Project phase.

Terrain stability and accelerated erosion are also affected by similar Project components. The disturbance or alteration of any slope has the potential for increased rates of erosion due to loss of stabilizing cover, exposure of soil or overburden to the elements, or increased slope gradients. Using Project controls and design, including specific mitigations, it is unlikely that terrain stability and accelerated erosion effects would occur, and unforeseen occurrences can be mitigated.

Project effects on the Physiography and Topography VC are provided below. The Project is subdivided into six components for ease of description: mine site (including the open pit and other associated mine facilities); mine access road; transmission line; Project access roads (Kluskus FSR); airstrip; and freshwater supply system.

5.4.2.3.2.1 Mine Site Effects on Physiography and Topography

Assumptions based on the Project Description were made with respect to the anticipated slope gradients associated with each of the Project facilities. Within the mine site footprint, various facilities are expected to undergo major alteration from the baseline condition, with both positive and negative relief features being created.

The baseline topographical conditions for the associated mine site facilities and infrastructure will undergo varying degrees of alteration. Some activities (such as the dam and esker borrow sources, construction laydown, truck shop, and plant site) will have a larger effect on the baseline due to associated cut-and-fill activities. Other facilities (including the camps and administration complex, explosives storage areas, service and site access roads, and pipeline infrastructure) will require minor cut-and-fill to level the grade of the site; however, these alterations will be localized within the mine footprint. These facilities will have limited grading of the surface to facilitate level placement of infrastructure or anchoring into bedrock. Within the mine access road footprint, the landscape is expected to be altered to produce a level surface for access; the airstrip Project footprint will be completely levelled at the landing strip, with no changes expected for the existing access road.

Except for the main access road, all site access roads and surface water diversions, including pipelines, are considered temporary disturbances and will be removed and reclaimed at the time of mine closure. It is expected that NAG/non-ML waste rock and overburden mining waste will be used for the construction of the haul roads. Water diversions will consist of either constructed drainage ditches or installed pipelines that will be removed and reclaimed. Where waste rock cannot be used for construction purposes, borrow sources may be required.

The majority of baseline landform alteration will occur through the levelling and development of the mine site facilities area, which includes the open pit, TSF, associated mine facilities, and waste rock dumps. The largest aerial extent of change to the landscape will occur in the TSF area. The mine site is 2,939 ha, of which approximately 36% will be Class 4 slopes, with Class 2 (25%) and Class 3 (25%) slopes accounting for the majority of the rest of the mine site. At full Project extent, it is expected that level topography (Class 1 to 2) will be needed for the mining operation. Class 4 and 5 slopes are expected to remain at Project closure, due to the creation of new features on the landscape, namely the pit open waterbody and waste rock dumps. The open pit will be constructed with the final slopes of the pit graded to Class 5 slopes. Upon completion of mining activities, this area will be transformed into a pit lake of approximately 161 ha. Both waste rock dumps will remain as positive-relief features on the landscape. As interpreted from the Project Design, approximately half of the new features will contain Class 1 slopes (scarp), and half Class 4 slopes (tread), to create a stable feature. The LGS stockpile will be processed near the end of the mine lifecycle and then the area reclaimed upon closure. It is expected that no significant changes to the baseline physiography and topography will be encountered once site reclamation has been completed. The remainder of the disturbed facility areas will be re-contoured to blend into the surrounding landscape.

5.4.2.3.2.2 Mine Site Access Road Effects on Physiography and Topography

The mine access road development will require the construction of a new road segment near the mine. The mine access right-of-way (ROW) is approximately 27 ha, of which 21 ha (75%) is identified as Class 2 slopes. Class 1 slopes account for an additional 5 ha (19%) of the ROW. It is anticipated that the access road will be graded and levelled to contain a higher proportion of Class 1 slopes upon completion.

5.4.2.3.2.3 Transmission Line Effects on Physiography and Topography

Construction of the transmission line is not anticipated to cause major disturbances to the baseline condition. Although it is anticipated that localized point disturbances will occur with the construction of towers and access into the line, these disturbances will not alter the functioning of the landscape in terms of physiography and topography. Therefore, the assessment of this feature is not included in the Physiography and Topography VC.

It is expected that there will be a low degree of disturbance to the Soil, Terrain, and Surficial Geology VCs within the transmission line (including rerouting options) and road access route RSA. Limited, localized surface disturbance is anticipated through the construction of these linear facilities; however, mass earthworks involving the disturbance of physiography and topography, surficial material deposits, and soil cover is not expected. BMPs and mitigation strategies related to the soil and surficial geology disturbances mentioned within this report, or within the Environmental Management System (EMS) in **Section 12.1**, will apply to the road access route and transmission line linear features. For additional information pertaining to the transmission line access roads refer to **Section 2.2.4.4**.

5.4.2.3.2.4 Project Access Road (Kluskus FSR) Effects on Physiography and Topography

Project access road development will require upgrading a section of the existing FSR, specifically between KM 102 and KM 124. The Kluskus FSR is scheduled to undergo widening to accommodate the increased two-way traffic. The segment of the road to be upgraded will occur in areas with slopes mainly in the Class 2 to Class 3 range, with minor areas of Class 4. The construction of the upgraded section of access road will involve minor earthwork activities; however, it is not expected to alter the functioning of the landscape in terms of physiography and topography. Therefore, the assessment of this feature is not included in the Physiography and Topography VC.

5.4.2.3.2.5 Airstrip Effects on Physiography and Topography

The construction of the proposed airstrip will involve the construction of the landing strip and all associated facilities. The proposed use of an existing logging road to access the airstrip area will allow for the reduction of the Project footprint, as no new construction is anticipated for the airstrip access road feature. The proposed airstrip is located on a glaciofluvial terrace with low relief (Class 2) and coarse textured material. Construction of the feature will involve the removal of topsoil for use in subsequent reclamation activities, as well as levelling the surface to produce the Class 1

landing strip. The landing strip will be graded to a Class 1 slope. At decommissioning, the airstrip will be re-contoured to blend into the surrounding landscape.

5.4.2.3.2.6 Freshwater Supply System Effects on Physiography and Topography

The construction of the freshwater supply system will entail the removal of topsoil and surficial material to install the underground pipeline. The water supply system access road is expected to follow landscape contour. Grading and levelling of the pipeline ROW is not expected during any phase of the Project feature. Alteration of the baseline landscape will not occur, as topography changes will be restored after reclamation. Therefore, the assessment of this feature is not included in the Physiography and Topography VC.

5.4.2.3.3 Potential Indirect Effects of Physiography and Topography

The potential for effects of the Project on physiography and topography to become indirect effects on other environmental components is summarized in **Table 5.4.2-4**. Based on the Project Description (**Section 2.2**), alteration of the baseline landscape is expected to have an indirect effect on other terrestrial environmental components, including vegetation, wildlife, hydrology, and aquatic resources. As a result of this expected interaction, this effect is carried forward into the assessment. Although terrain stability and accelerated erosion may affect other environmental components, including surface water, BMPs and other mitigation measures will be implemented and therefore no further assessment is required.

Alteration of baseline landscape will be a consequence of clearing, removal, and contouring of surficial sediments, such that these materials will be redistributed over the landscape. A level landscape will be developed through much of the Project area by cut-and-fill of surficial materials. Positive relief features will also be created by the construction of the two waste rock dumps and embankment fills and dams for the TSF area. Effects of the Project include both the removal of terrain materials and the addition of new terrain features, resulting in landform and drainage characteristics differing from the pre-disturbance terrain. These Project changes are therefore assessed further as to how they affect the landscape, with potential indirect effects, as indicated in the previous section.

Terrain stability is identified as an issue for further discussion, due to the presence of relatively steep slopes in the Project footprint. Wind and water erosion are a concern in terms of loss of surficial and soil materials, especially topsoil in stockpiles. Appropriate mitigation measures (e.g., developing vegetation cover) or other means (e.g., use of erosion control mats) can reduce issues related from erosion to a negligible level. This effect, however, has potential to indirectly influence other biophysical attributes, with the potential for sediment transport into waterbodies identified as a primary concern. It is therefore carried forward for further analysis.

Table 5.4.2-4: Potential Indirect Project Effects on Other Valued Components

Direct, Indirect, or Combined Project Effects (adverse or positive) on VCs	Project Phase	Potential Indirect Project Effect on Other VCs	Carried Forward (yes / no)	Rationale
Alteration of baseline landscape	C, D/C, O, PC	Changes in landscape may affect vegetation, wildlife, and surface water conditions	Yes	Changes to slope gradients and direction may affect land capability to support vegetation, thereby changing habitat characteristics.
Terrain stability and accelerated erosion	C, D/C, O, PC	Potential instability and erosion may affect vegetation and surface water conditions	No	Severe erosion can remove vegetation. It can potentially increase sedimentation in adjacent water bodies, thus affecting water quality and aquatic species. However mitigation measures will be implemented.

Note: C = construction; D/C = decommissioning and closure; O = operations; PC = post-closure

Table 5.4.2-5 presents a summary of the potential effects of the Project to be carried forward into the assessment for physiography and topography.

Table 5.4.2-5: Summary of Potential Project Effects to be Carried Forward into the Assessment for Physiography and Topography

Adverse / Neutral / Positive Effects	Project Phase	Direction
Alteration of baseline landscape	C, O, D/C	Neutral
Terrain stability and accelerated erosion	C, O, D/C, PC	Negative

Note: C = construction; D/C = decommissioning and closure; O = operations; PC = post-closure

5.4.2.3.4 Mitigation Measures

The RCP incorporates measures to develop the irreversible landscape alterations into new features that are physically and functionally integrated with the adjacent, undisturbed landscape. Through proper implementation of mitigation techniques, the effects on the Physiography and Topography VC within the Project footprint can be minimized and managed to effectively reduce any negative effects. **Table 5.4.2-6** summarizes the mitigation measures identified for the Project by phase. These techniques include:

- Footprint minimization;
- Slope gradient maintenance;
- Erosion control measures; and
- Site reclamation following mine closure.

Table 5.4.2-6: Potential Project Effects by Project Phase on Physiography and Topography VC and Mitigation Measures

Project Effect	Project Phase	Mitigation/Enhancement Measure	Mitigation Success Rating
Alteration of baseline landscape	All phases	Footprint minimization, and site reclamation following mine closure	Reduction
Terrain stability and accelerated erosion	All phases	Erosion control measures and slope gradient maintenance	Reduction/ prevention

Note: C = construction; O = operations; D/C = decommissioning and closure; PC = post-closure

5.4.2.3.4.1 Footprint Minimization

A clearly defined, compact Project footprint will minimize the overall impact on terrain and landscape features. Specific key measures incorporated into the Project include:

- Facility location planning: grouping facilities in centralized areas and development of a functional Project footprint, especially for the TSF;
- Use of overburden and NAG/low ML waste rock from the open pit as construction material on the mine site whenever technically feasible;
- Sourcing aggregate for construction within areas of anticipated disturbance where possible during development of additional Project activities or components; and
- Using existing disturbance areas (access roads) as a foundation for expansion of new facilities.

At the mine site, the administrative buildings, processing facilities and support buildings, infrastructure, open pit, waste rock dumps, and TSF are all grouped as closely as possible to minimize the aerial extent of disturbance. Use of overburden and waste rock in construction indirectly reduces the extent of both borrow source areas and out-of-pit waste dumps required for the Project.

5.4.2.3.4.2 Slope Gradient Maintenance

The disturbance or alteration of any slope has the potential for increased erosion due to loss of stabilizing cover or exposure of soil or overburden to the elements. Maintenance of exposed slopes is required to prevent accelerated erosion of soils and surficial materials until permanent vegetation is established. As a result of Project controls and design, it is unlikely that terrain stability and accelerated erosion effects would occur, and unforeseen occurrences can be mitigated.

5.4.2.3.4.3 Erosion Control Measures

The ESCP developed for the Project is expected to mitigate the effect of both terrain stability and accelerated erosion effects of the Project. The development and implementation of the ESCP will ensure that surface water and slope gradients within the Project footprint are managed. The

primary approach to this mitigation is the incorporation of erosion control measures into Project design. These include stable slope gradients, contouring of the surface to discourage concentrated water flow, and engineering structures to reduce surface water velocities. As a secondary approach, sediment controls will be implemented. These approaches would include both temporary and permanent sediment control structures. Revegetation of open areas, including soil stockpiles, will be carried out to control erosion, with application of erosion control mats and similar materials as required. A detailed description of the ESCP is included in the EMS (**Section 12.1**).

5.4.2.3.4.4 Site Reclamation Following Mine Closure

The development of a conceptual RCP (**Section 2.6**) is an important step associated with the closure and decommissioning activities of mining developments. The RCP outlines the intended reclamation activities, accounts for allocation of materials, and identifies targets for reclamation.

The primary objective of the RCP is to achieve a post-closure condition that is, to the extent feasible, functionally similar to pre-disturbance or baseline conditions in terms of land usage and productivity and will meet the final land use objectives. Closure and reclamation activities will employ previously proven closure approaches and technologies. Adaptive management techniques may be implemented during the life of the Project to respond to reclamation requirements.

As noted, BMPs and industry standards exist for mining closure and reclamation activities, and the Project currently incorporates these practices into its overall design, closure plan, and EMS.

5.4.2.3.4.5 Effectiveness of Mitigation

Table 5.4.2-7 provides ratings for effectiveness of mitigation measures to avoid or reduce potential effects on physiography and topography during mine site development. Mitigation measures will be based on site-specific information and construction engineering and are therefore preliminary at this stage.

When describing the effectiveness of the mitigation rating, low success rating means mitigation has not been proven successful, moderate success rating means mitigation has been proven successful elsewhere, and high success rating means mitigation has been proven effective.

The effectiveness of mitigation measures for the alteration of the baseline landscape and for terrain stability and accelerated erosion are generally described as having a high success rating. This is because the proposed mitigation measures are technologies that are widely used in mining and other industries and proven over a long period of time at reducing erosion and reclaiming the landscape. The effectiveness rating for adaptive management techniques was given a low rating, as the techniques that may be required during the life of the mine are unknown at this time. If effective standard practices and BMPs are used as adaptive management techniques, then a higher level of success rating may apply.

Table 5.4.2-7: Mitigation Measures and Effectiveness of Mitigation to Avoid or Reduce Potential Effects on Physiography and Topography during Mine Site Development

Likely Environmental Effect	Project Phase	Mitigation/Enhancement Measure	Effectiveness of Mitigation Rating
Alteration of baseline landscape	Construction, Operations, Closure, Post-closure	Footprint minimization through facility location planning: grouping facilities in centralized areas and development of a functional Project footprint, especially for the TSF	High
		Footprint minimization through use of overburden and NAG/low ML waste rock from the open pit as construction material on the mine site whenever technically feasible	High
		Footprint minimization through sourcing aggregate for construction within areas of anticipated disturbance where possible during development of additional Project activities or components	High
		Footprint minimization through using existing disturbance areas (access roads) as a foundation for expansion of new facilities	High
		Adaptive management techniques may be implemented during the life of the Project to respond to reclamation requirements.	Low
		As noted, BMPs and industry standards exist for mining closure and reclamation activities, and the Project currently incorporates these practices into its overall design, closure plan, and EMS	High
	Closure	The development of a conceptual RCP (**Section 2.6**)	High
		Closure and reclamation activities will employ previously proven closure approaches and technologies	High
Terrain stability and accelerated erosion	Construction, Operations, Closure, Post-closure	The SECP developed for the Project is expected to mitigate the effect of both terrain stability and accelerated erosion effects of the Project	High
		Erosion control measures will be incorporated into Project design including stable slope gradients, contouring of the surface to discourage concentrated water flow, and engineering structures to reduce surface water velocities	High
		Sediment controls will be implemented including both temporary and permanent sediment control structures	High
		Revegetation of open areas, including soil stockpiles, will be carried out to control erosion, with application of erosion control mats and similar materials as required	High

Note: BMP = Best Management Practice; EMS = Environmental Management System; ML = metal leaching; NAG = non-acid generating; RCP = Reclamation and Closure Plan; SECP = Sediment and Erosion Control Plan; TSF = Tailings Storage Facility

5.4.2.4 Residual Effects and their Significance

5.4.2.4.1 Potential Residual Effects after Mitigation

The development of the Project will have a residual effect on the Physiography and Topography VC as a result of the permanent alteration of the baseline landscape. The landscape will differ from the baseline condition with the construction of Project facilities, including the two waste rock dumps, the TSF, and the open pit features (including the construction of two waterbodies at closure). The construction of the airstrip and mine site access road, along with other associated mine facilities, will involve alteration of the landscape. It is expected that the landscape will function in a similar manner to the baseline condition and will meet final land use objectives. Mitigation measures identified in the Project Description, closure plan, and EMS will minimize the extent of these alterations.

The RCP incorporates measures to develop the irreversible alterations to the landscape into new features that are physically and functionally integrated in the post-closure landscape. There are three key features that will be created as a result of the Project:

- A new water feature, or lake, approximately 161 ha, will be developed through mining and filling of the open pit;
- The construction of the TSF, including the construction of new residual waterbodies (250 ha), embankments, and tailings beaches; and
- The construction of the east and west waste rock dumps will be positive relief features on the landscape.

A functioning and variable landscape is proposed in the RCP, although the landscape is different from baseline conditions. The conceptual plan indicates reclamation and revegetation of the TSF to support upland and wetland landscapes. The waste rock dumps will be re-sloped and covered with a minimum of 30 cm of overburden to promote the establishment of new vegetation. For other facilities with limited site grading, the surficial material will be replaced where required once a facility has been decommissioned, but a significant change to the topography is not expected.

5.4.2.4.2 Significance of Potential Residual Effects

The significance rating for the identified physiography and topography residual effects are summarized in **Table 5.4.2-8**. The context of the alteration of baseline landscapes is rated *Medium*, as changes to physiography and topography directly influence the development of habitats and ecological niches through variability. The effect is considered *Local* in geographic extent, and *Non-reversible*. The likelihood of the alteration of baseline landscapes is considered *High* throughout all phases of the Project as the residual effect is expected to occur as the alteration of baseline condition will be permanent and non-reversible. The level of confidence in the significant rating is considered *High* as the VC is well understood and mitigations from previous projects have found to be effective. This Project effect on physiography and topography is rated as *Not Significant* (Moderate) for the residual effect.

The residual effect for the alteration of baseline landscape was evaluated to be *Not Significant* (Moderate) using the criteria described in the assessment methodology (**Section 4**). Functionality of the landscape is expected to be consistent with baseline conditions.

Nevertheless, the change in form and the addition of new landscape features (e.g., reject piles, TSF) is permanent, and the *Not Significant* (Moderate) rating is therefore assigned. This rating was applied as the geographic extent is *Local* (within the LSA), *Medium* in context and magnitude, *Non-reversible* and *Chronic* in duration. Residual effect significance ratings are described in **Section 4**. For the post-closure phase, the rating is *Not Significant* (Moderate), because the main activity that could cause landscape alteration involves application of erosion control measures, which are site-specific, very small in extent, and readily mitigated.

The residual effect for terrain stability and accelerated erosion is rated as *Not Significant* (Negligible), because effects will be site-specific, and mitigation measures are expected to be highly successful.

Table 5.4.2-8: Residual Effects Assessment by Project Development Phase for Physiography and Topography VC

Parameter	Stage of Development / Rating			
	Construction	**Operations**	**Decommissioning and Closure**	**Post-Closure**
Alteration of Landscape from Baseline Condition				
Effect Attribute				
Context	Medium	Medium	Medium	Medium
Magnitude	Medium	Medium	Medium	Low
Geographic extent	Local	Local	Local	Local
Duration	Chronic	Chronic	Chronic	Chronic
Reversibility	No	No	No	No
Frequency	Continuous	Continuous	Continuous	Intermittent
Likelihood Determination	High	High	High	High
Level of Confidence for Likelihood	High	High	High	High
Significance Determination	Not significant (moderate)	Not significant (moderate)	Not significant (moderate)	Not significant (moderate)
Level of Confidence for Significance	High	High	High	High
Terrain Stability and Accelerated Erosion				
Effect Attribute				
Context	Low	Low	Low	Low
Magnitude	Low	Low	Low	Low
Geographic extent	Point	Point	Point	Point
Duration	Short-term	Short-term	Short-term	Short-term
Reversibility	Yes	Yes	Yes	Yes
Frequency	Intermittent	Intermittent	Intermittent	Intermittent
Likelihood Determination	Low	Low	Low	Low
Level of Confidence for Likelihood	High	High	High	High
Significance Determination	Not significant (negligible)	Not significant (negligible)	Not significant (negligible)	Not significant (negligible)
Level of Confidence for Significance	High	High	High	High

Note: Each identified residual effect was subjected to nine rating criteria to determine significance; these criteria are described in **Section 4**.

5.4.2.5 Cumulative Effects

As a result of the Project, changes at the landscape level will occur. The Project will have direct effects on slope gradients and topographic function of the landscape. The development of a compact Project footprint and the eventual reclamation of the site will reduce the overall effect of the Project on the Physiography and Topography VC. The original distribution of baseline topographic conditions will not be re-established; however, upon reclamation, a fully functional landscape will be developed to support the end land use objectives. Following all mitigation measures, residual effects, in the form of new topographic features and waterbodies, are expected to remain for the Physiography and Topography VC.

The residual effect of alteration of the baseline landscape for the Physiography and Topography VC will be carried forward into the CEA, as this effect has not been determined to be negligible. **Table 5.4.2-9** presents the rationale for carrying the effect forward into the CEA.

Table 5.4.2-9: Project-Related Residual Effects; Rationale for Carrying Forward into the CEA

Project Component	Project Phase	Residual Effect	Rationale	Carried Forward in Cumulative Effects Assessment
All	C, O, D/C	Alteration of baseline landscape	Due to the changes in the baseline landscape	Yes

Note: C = construction; O = operations; D/C = decommissioning and closure.

5.4.2.5.1 Mitigation Measures

No additional mitigation measures are required to address the cumulative effects. Mitigation measures defined as part of the Project and presented above will mitigate the anticipated cumulative effects.

5.4.2.5.2 Potential Residual Cumulative Effects and their Significance

Alteration of baseline landscape will occur due to the Project, but reclamation activities will return the land to equivalent capability similar to baseline conditions and meet end land use objectives, with functionality restored.

A number of projects and human activities overlap with the RSA for physiography and topography. These activities include mining exploration and forestry logging, guide outfitters, active and pending range tenures, and recreational activities such as hunting and fishing. These activities have only a marginal potential to affect the physiography or topography in the RSA due to the creation of access roads; therefore, the potential for interaction with the residual effects of the Project is minimal. The residual effect of the alteration of the baseline landscape is considered Not Significant (Minor). The rating of Neutral is used as there may be both positive and negative effects to the area as a result of the alteration of the baseline landscape. **Table 5.4.2-10** presents the summary for the residual cumulative effect for the Physiography and Topography VC.

Table 5.4.2-10: Residual Cumulative Effects Assessment on Physiography and Topography VC by Project Development Phase

Parameter	Current / Future Cumulative Environmental Effect(s) without Project	Cumulative Environmental Effects with Project	Project Phase
Alteration of Baseline Landscape			
Effect attribute			
Context	Low	Low	PC
Magnitude	Low	Medium	PC
Geographic extent	Local	Local	PC
Duration	Chronic	Chronic	PC
Frequency	Continuous	Continuous	PC
Reversibility	Yes	Yes	PC
Likelihood Determination	High	High	PC
Level of Confidence for Likelihood	High	High	PC
Significance Determination	Not Significant (Minor)	Not Significant (Minor)	PC
Level of Confidence for Significance	High	High	PC

Note: PC = post-closure

5.4.2.6 Limitations

The effects assessment for the Physiography and Topography VC is based on the information presented within the current Project Description. Changes to the Project Description following the completion of this assessment may affect the results of the quantitative assessment of the Project effects on the Physiography and Topography VC. Slope gradients associated with certain Project components were assumed, based on the current Project Description and Project understanding. Results from the detailed design phase of the Project may affect the results of the assessment; however, it is believed the assumptions contained herein are suitable in the context of the overall assessment.

5.4.2.7 Conclusion

Direct effects are expected to occur on the Physiography and Topography VC throughout all phases of the Project. As a result of the Project, changes at the landscape level will occur. The Project will have direct effects on slope gradients and topographic function of the landscape. The development of a compact Project footprint and the eventual reclamation of the site will reduce the overall effect of the Project on the Physiography and Topography VC. The original distribution of baseline topographic conditions will not be re-established; however, upon reclamation, a fully functional landscape will be developed to support the end land use objectives. Following all mitigation measures, residual effects, in the form of new topographic features and waterbodies, are expected to remain for the Physiography and Topography VC. The anticipated significance of those residual effects is rated as *Not Significant* (Moderate).