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5.4.4 Soil Quality

5.4.4.1 Introduction

The Soil Quality valued component (VC) and indicator 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 4.2** and **Section 5.4.1**.

Issues identification and scoping identified five key issues relating to soil quality: soil contamination, terrain stability and accelerated erosion, dust deposition, soil disturbance, and soil redistribution. These can be grouped into three categories: the chemical alteration of soil, the physical alteration of baseline soils, and the suitability of reclamation material.

Reclamation suitability refers to a set of soil quality parameters that define a soil's capability to support ecosystems. As such, it is considered here as being synonymous with the Soil Quality VC, with the exception that defining parameters consist only of inherent soil properties (such as texture, structure, and pH) and do not include external influences, such as contaminants. Through analysis of the effects of Project on soil quality, the effects on reclamation material suitability are discussed.

Much of the discussion in this section focuses on the reclamation suitability of soils. The preservation of soil integrity or suitability is important in terms of successful reclamation of the Project site at decommissioning/closure (D/C). Individual soil quality parameters cannot be assessed quantitatively; however, reclamation suitability ratings can be applied to baseline soil associations, and significant effects, if applicable, can then also be quantified in terms of areas of changed ratings of reclamation suitability.

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 5.4.4.1.1**). The remainder of this section includes sub-sections dealing with the following: a brief summary of baseline data on the Soil Quality VC (**Section 5.4.4.2**), potential effects and mitigation measures (**Section 5.4.4.3**), residual effects and their significance (**Section 5.4.4.4**), cumulative effects (**Section 5.4.4.5**), limitations of the assessment (**Section 5.4.4.6**), and conclusions (**Section 5.4.4.7**).

5.4.4.1.1 Relevant Legislation and Legal Framework

The legislation and legal framework for the Soil Quality VC is the same as that described for the Physiography and Topography VC. Refer to **Section 5.4.2.1.1** for details.

5.4.4.2 Valued Component Baseline

5.4.4.2.1 Information Sources and Methods

The assessment of effects for the Soil Quality VC is based on site-specific baseline 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. Project-specific information sources followed the provincial terrain mapping conventions outlined in Howes and Kenk (1997) and Resources Inventory Committee (RIC, 1996). Soil interpretations were based on Soil Classification Working Group (SCWG, 1998) and the Agriculture Canada Expert Committee on Soil Survey (1983; 1987). Determining the reclamation suitability of the soil was adopted from Soil Quality Criteria Relative to Disturbance and Reclamation (Alberta Soils Advisory Committee (ASAC), 1987). Recently acquired aerial photography and detailed Light Detection and Ranging (LiDAR)-based contours and hill-shade images were used to interpret the landscape within the Regional Study Area (RSA) and Local Study Area (LSA) of the Project.

For the Soil Quality VC, the Project footprint was superimposed on the soil map produced as part of the Baseline (**Appendix 5.1.3.2A**: Appendix 6, Map 1). Based on the Project Description, qualitative and quantitative analysis with respect to reclamation suitability was conducted to assess the effect on soil quality. Spatial analysis using a Geographic Information System (GIS) protocol was employed to determine the effect of the Project. Reclamation suitability of a soil unit was based on the thickness and chemical properties of the soils, along with the amount of coarse fragments in the profiles.

5.4.4.2.2 Interaction between Soil Quality VC and other Past, Present, or Future Projects/Activities

The Soil Quality VC is not expected to be altered as a result of past or future projects or activities. A number of projects and human activities contain spatial overlap with the proposed features of the Project. These activities include guide outfitters, logging, active and pending range tenures, and recreational activities such as hunting and fishing.

It is not expected that any residual effects will remain after the post-closure phase of the Project once all soil quality mitigations are implemented. The alteration of the soil quality as a result of other activities is only expected to occur as localized or point source disturbances. As well, no residual effects from the other activities listed above are expected, as alteration of the soil quality is not an expected effect of these activities.

5.4.4.2.3 Traditional Ecological and Community Knowledge

No traditional ecological or community knowledge comments regarding soils were raised in the context of the Soil Quality VC. However, during the review of the Application Information Requirements (AIR), both Aboriginal groups and public indicated the desire for effective reclamation of the Project site including proper soil salvage and replacement. Additional detail on comments and issues raised are presented in **Section 3**, which contains the public and Aboriginal issues tracking tables for the Project. **Section 14** through **Section 16** provide a summary of the Aboriginal background, rights, and interests for the Project.

5.4.4.2.4 Surficial Geology and Soil Cover Baseline

5.4.4.2.4.1 Mine Site

For mineral soils, reclamation suitability ratings were assigned to the soil map units (SMUs) based on the characteristics of the terrain units and the physical and chemical properties of the soils. For the baseline condition of the mine site LSA, it was determined that the majority of the soils are considered Fair (46%) to Poor (38%) in terms of reclamation suitability. This overall rating is based on the relatively high coarse fragment content of the soils and coarse textures of the soil matrix and, to a lesser extent, the soil reaction or pH. Those soils rated as Good account for 7% of the LSA. These soils have no limitations that affect suitability of the soil for reclamation. Soils rated as Unsuitable account for approximately 3% of the Project footprint. To the extent possible, reclamation material from all Good and Fair soil units will be salvaged. Soil units rated as Poor or Unsuitable will not be salvaged due to the high coarse fragment content, low pH, and coarse textured soil matrix. Previously disturbed soil units occupy less than 1% of the mine site LSA.

At full Project development, the soil types rated as Poor will undergo the greatest degree of change, at 19% of the Project LSA. Soils rated as Fair will account for an 18% change of the Project LSA. Approximately 6% of the soils within the Project LSA rated as Good will undergo alteration, while 3% comprise Unsuitable soils that will be affected.

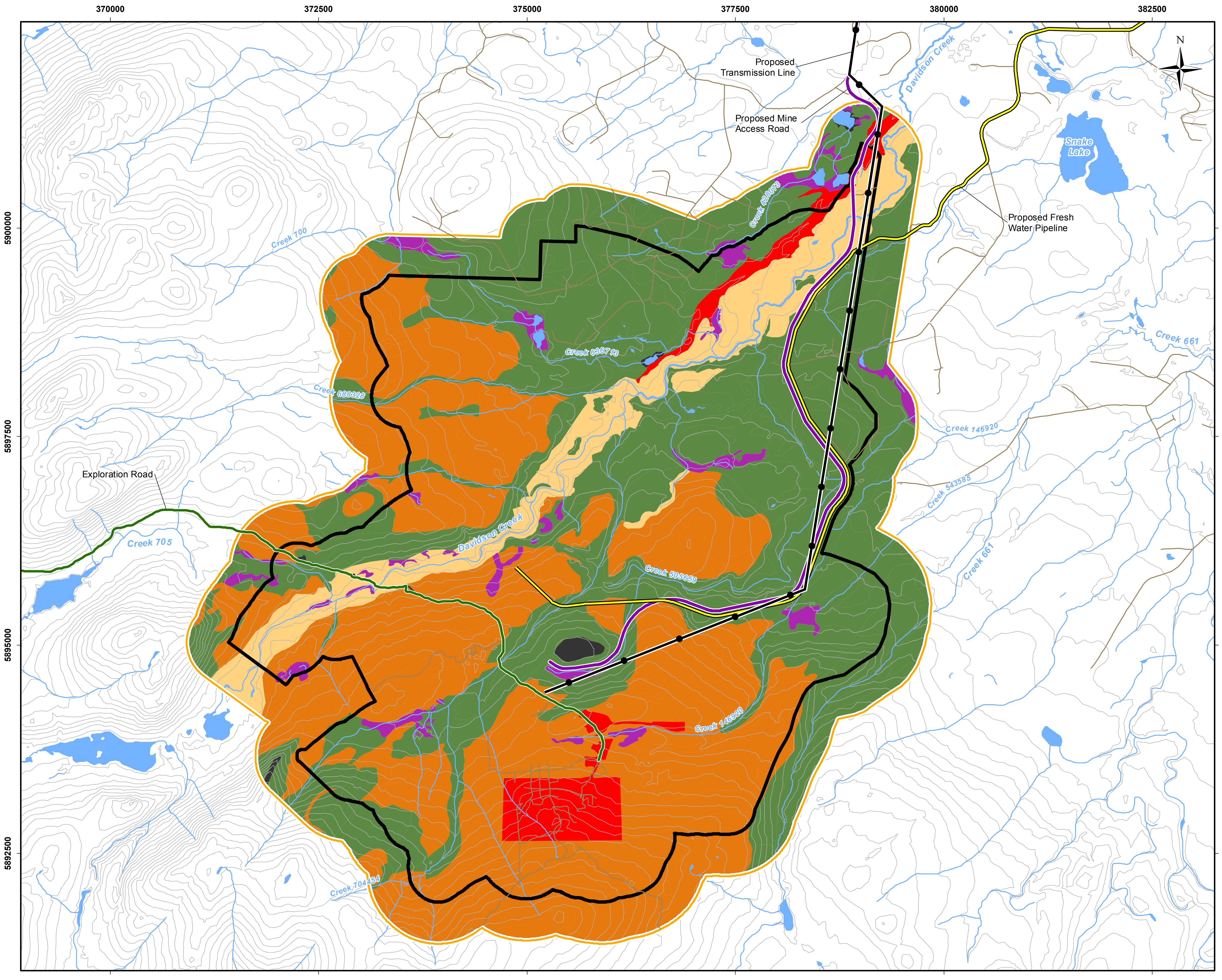
Organic soils are not rated for reclamation suitability, but rather are classed simply as an organic category. Organic materials, however, are a valued material in the reclamation process, as a soil amendment with ability to improve available water-holding capacity and nutrient content. To the extent possible, especially where present to reasonable depth, all organic material encountered within the Project footprint will be salvaged (to a depth of one metre) and stored with the other reclamation material. As shown in **Table 5.4.4-1**, organic soils account for approximately 51 hectares (ha) (1% of LSA) of the development area associated with the Project.

The effect of the Project on the reclamation suitability of the baseline soils is presented in **Figure 5.4.4-1**. This figure depicts the Project development overlaid on the baseline reclamation suitability ratings.

Table 5.4.4-1: Alterations to Reclamation Suitability Ratings within the Proposed Project LSA and Project Footprint

Reclamation Suitability	Baseline Extent		Proposed Project		Change in Baseline LSA Distribution	
	(ha)	% of LSA	(ha)	% of LSA	(ha)	% of LSA
Mine Site						
Good	437.0	7.1	81.9	1.3	355.1	5.8
Fair	2,839.4	46.4	1,726.1	28.2	1,113.3	18.2
Poor	2,325.1	38.0	1,182.5	19.3	1,142.6	18.7
Unsuitable	190.3	3.1	18.4	0.3	171.9	2.8
Organic	261.7	4.3	123.9	2.0	137.8	2.3
NR	56.4	0.9	50.8	0.8	5.6	0.1
Water	12.8	0.2	-	-	-	-
Open pit	0.0	0.0	238.0	3.9	-	-
TSF	0.0	0.0	1,115.6	18.2	-	-
East waste rock dump	0.0	0.0	158.5	2.6	-	-
West waste rock dump			171.7	2.8	-	-
LGS	0.0	0.0	76.0	1.2	-	-
Associated mine facilities	0.0	0.0	189.5	3.1	-	-
Natural landform area	0.0	0.0	989.9	16.2	-	-
Total	**6,122.8**	**100.0**	**6,122.8**	**100.0**	**2,939.1**	**48.0**

Note: A Not Rated (NR) value is given to disturbed or anthropogenic areas; LSA = Local Study Area; ha = hectare; % = percent; LGS = low-grade ore stockpile; TSF = Tailings Storage Facility



Legend

Existing Road
Contour (20 m)

Project Components

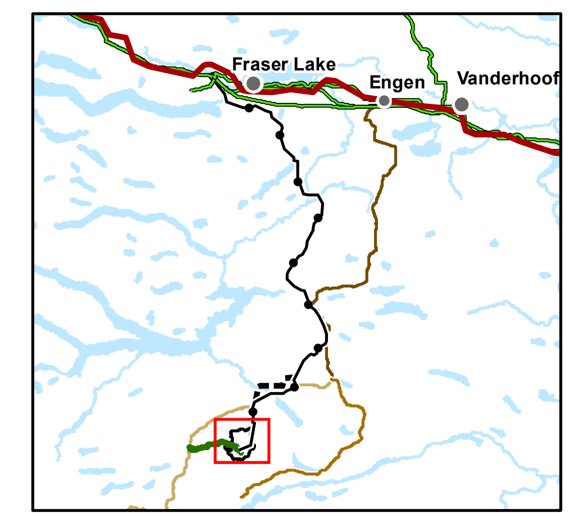
Proposed Mine Access Road
Exploration Road
Proposed Transmission Line
Proposed Fresh Water Pipeline
Proposed Mine Site

Terrain, Soils, and Vegetation

Local Study Area

Reclamation Suitability Ratings

Fair
Good
Poor
Organic
NR
Unsuitable



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 Reclamation Suitability Ratings

DATE: April, 2014	ANALYST: MY	**Figure 5.4.4-1**
JOB No: VE52277	QA/QC: SC	PDF FILE: 05-200-008_Suitability_Reclaim_minesite_v3.pdf
GIS FILE: 05-200-008_Suitability_Reclaim_minesite_v3.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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5.4.4.2.4.2 Mine Site Access Road

Reclamation suitability ratings were assigned to the SMUs based on the physical and chemical properties of the soils. For the baseline condition of the mine site access road LSA, the majority of the soils were determined to be Fair (90%) to Good (7%) in terms of reclamation suitability. This overall rating is based on the relatively high coarse fragment content of the soils, and on the coarse textures of the soil matrix, and, to a lesser extent, the soil reaction or pH. Soils rated as Unsuitable account for approximately 3% of the Project LSA. To the extent possible, reclamation material from all soil units will be salvaged and windrowed for subsequent reclamation activities, except for soils rated as Unsuitable or Not Rated (NR). Previously disturbed soil units occupy 2% of the mine site access road LSA, and no soil units were rated as Poor.

At full Project development, the soil types rated as Fair will undergo the greatest degree of change, at 13% of the Project LSA. Minor areas with soil units rated as Organic and NR each account for less than 1% of the change in the baseline distribution of the LSA from Project.

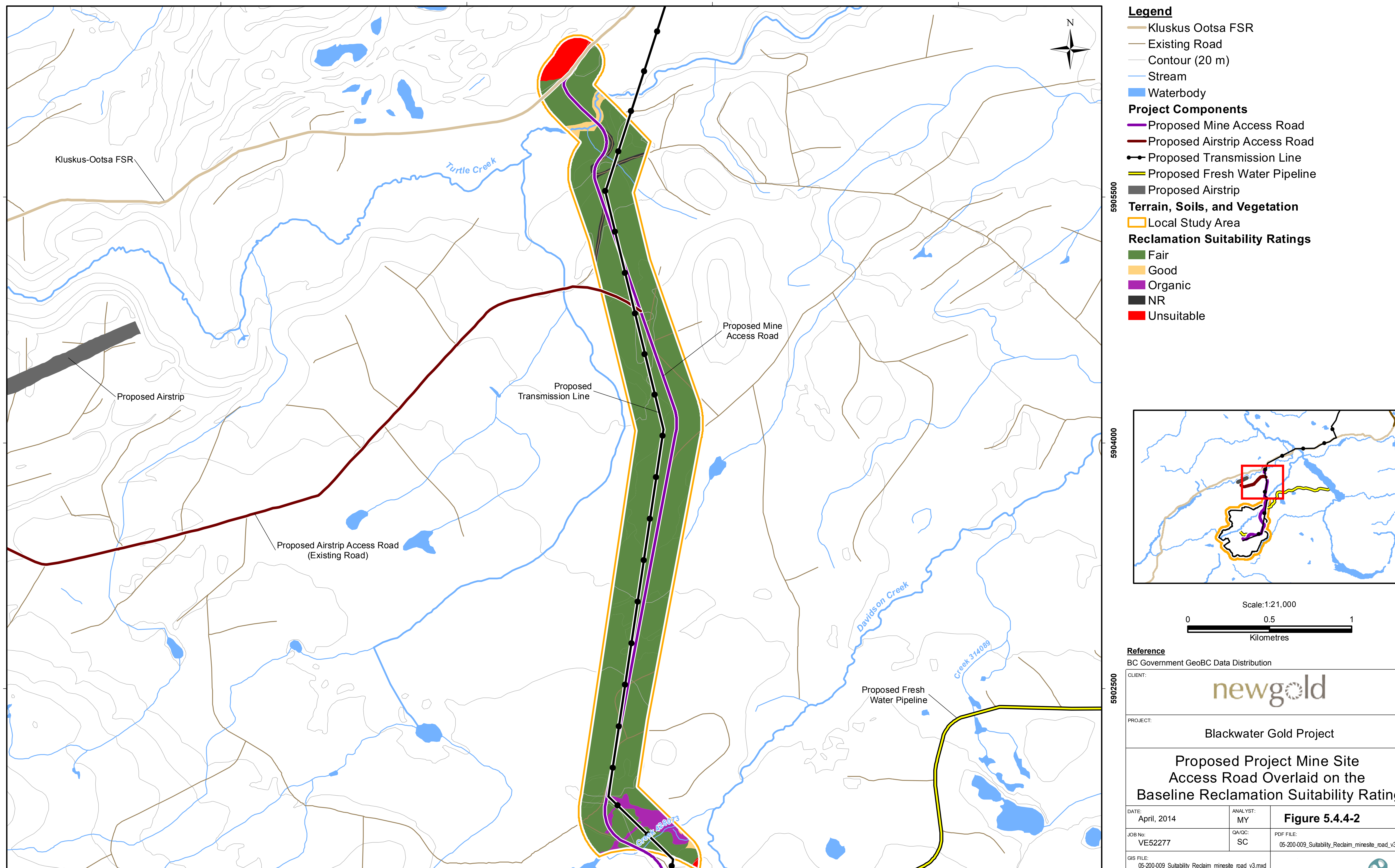
Table 5.4.4-2 presents the baseline and Project case scenarios of the reclamation suitability of the soil units within the mine site access road.

Table 5.4.4-2: Alterations to Reclamation Suitability Ratings within the Mine Site Access Road LSA and Proposed Project Footprint

Reclamation Suitability	Baseline Extent		Proposed Project		Change in Baseline LSA Distribution	
	(ha)	% of LSA	(ha)	% of LSA	(ha)	% of LSA
Good	3.7	7.1	3.7	1.9	0.0	0.0
Fair	179.6	90.3	154.3	77.6	25.3	12.7
Poor	0.0	0.0	0.0	0.0	0.0	0.0
Unsuitable	5.1	2.6	5.1	2.6	0.0	0.0
Organic	6.3	3.2	5.9	3.0	0.4	0.2
NR	4.1	2.0	2.5	1.3	1.6	0.8
Water	0.0	0.0	-	-	-	-
Mine access ROW	0.0	0.0	27.3	13.7	-	-
Total	**198.8**	**100.0**	**198.8**	**100.0**	**27.3**	**13.7**

Note: A Not Rated (NR) value is given to disturbed or anthropogenic areas; LSA = Local Study Area; ha = hectare; % = percent; ROW = right-of-way

The effect of the Project on the reclamation suitability of the mine site access road baseline soils is presented in **Figure 5.4.4-2**. This figure shows the Project development overlaid on the baseline reclamation suitability ratings.



Reference
BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Proposed Project Mine Site Access Road Overlaid on the Baseline Reclamation Suitability Rating

DATE: April, 2014	ANALYST: MY	Figure 5.4.4-2	
JOB No: VE52277	QA/QC: SC	PDF FILE: 05-200-009_Suitability_Reclaim_minesite_road_v3.pdf	
GIS FILE: 05-200-009_Suitability_Reclaim_minesite_road_v3.mxd			
PROJECTION: UTM Zone 10	DATUM: NAD83	amec	

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5.4.4.2.4.3 Airstrip

For mineral soils identified within the Project airstrip feature, reclamation suitability ratings were assigned to the SMUs based on the physical and chemical properties of the soils. For the baseline condition of the airstrip LSA, the majority of the soils were determined to be Fair (85%), Organic (7%), or NR (6%) in terms of reclamation suitability. The overall Fair rating is based on the relatively high coarse fragment content of the soils, on the coarse textures of the soil matrix, and, to a lesser extent, the soil reaction or pH. To the extent possible, reclamation material from all soil units will be salvaged, except for soils rated as Unsuitable.

At full Project development, the soil units rated as Fair will undergo the greatest degree of change (7% of the airstrip LSA). The airstrip is located entirely in one SMU, while no other development is expected.

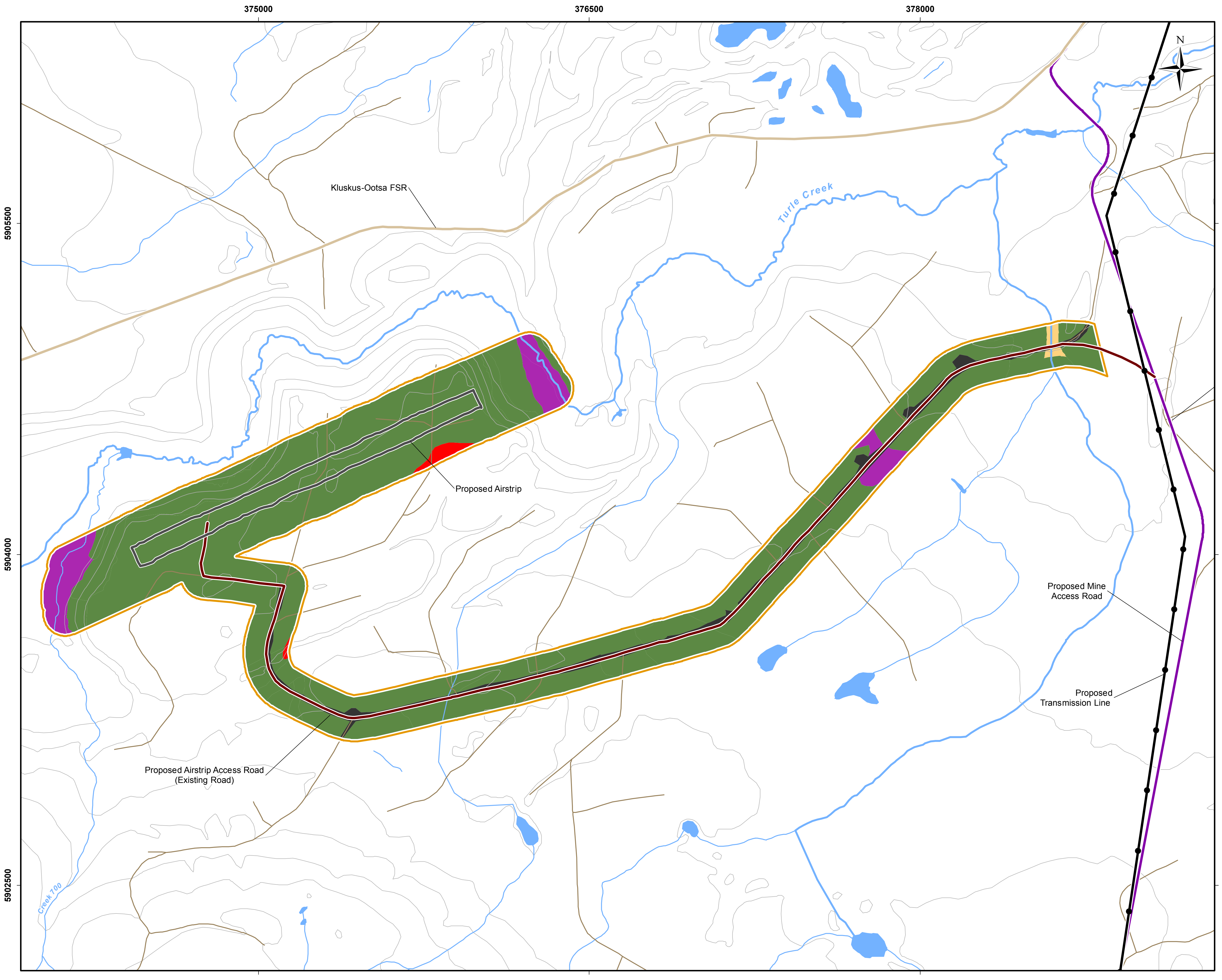
As shown in **Table 5.4.4-3**, *Fair* soil units account for approximately 178 ha (85% of LSA) and will undergo the only change in distribution as a result of Project.

Table 5.4.4-3: Alterations to Reclamation Suitability Ratings within the Proposed Project Airstrip LSA and Project Footprint

Reclamation Suitability	Baseline Extent		Proposed Project		Change in Baseline LSA Distribution	
	(ha)	**% of LSA**	**(ha)**	**% of LSA**	**(ha)**	**% of LSA**
Good	1.3	0.8	1.3	0.8	0.0	0.0
Fair	177.9	85.4	162.4	78.0	15.5	7.4
Poor	0.0	0.0	0.0	0.0	0.0	0.0
Unsuitable	1.7	0.8	1.7	0.8	0.0	0.0
Organic	14.1	6.8	14.1	6.8	0.0	0.0
NR	13.3	6.4	13.3	6.4	0.0	0.0
Water	0.0	0.0	-	-	-	-
Airstrip ROW	0.0	0.0	15.5	3.9	-	-
Total	**208.2**	**100.0**	**208.2**	**100.0**	**15.5**	**7.4**

Note: A Not Rated (NR) value is given to disturbed or anthropogenic areas; LSA = Local Study Area; ha = hectare; % = percent; ROW = right-of-way

The effect of the Project airstrip on the reclamation suitability of the baseline soils is presented in **Figure 5.4.4-3**. This figure depicts the proposed Project airstrip development overlaid on the baseline reclamation suitability ratings.



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Legend

- Kluskus Ootsa FSR
- Contour (20 m)
- Stream
- Waterbody

Project Components

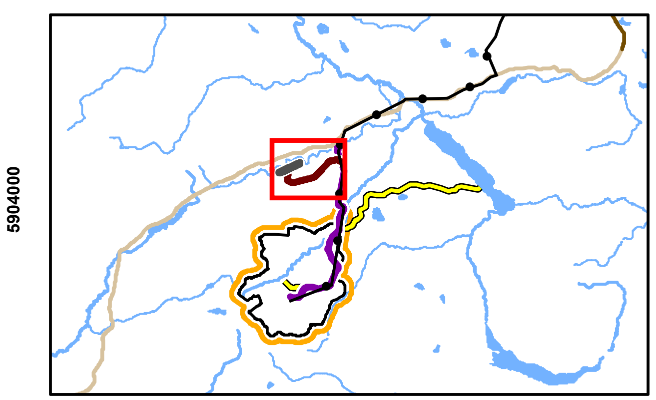
- Proposed Mine Access Road
- Proposed Airstrip Access Road
- Proposed Transmission Line
- Proposed Airstrip

Terrain, Soils, and Vegetation

- Local Study Area

Reclamation Suitability Ratings

- Fair
- Good
- Organic
- NR
- Unsuitable



Scale:1:17,000

0 0.5 1

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Proposed Airstrip Project Development Overlaid on the Baseline Reclamation Suitability Ratings

DATE: April, 2014	ANALYST: MY	**Figure 5.4.4-3**
JOB No: VE52277	QA/QC: SC	PDF FILE: 05-200-010_Suitability_Reclaim_Airstrip_v3.pdf
GIS FILE: 05-200-010_Suitability_Reclaim_Airstrip_v3.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

5.4.4.3 Potential Effects of the Proposed Project and Proposed Mitigation

The potential effects of Project on the Soil Quality VC were identified using the information sources and regulatory requirements presented in previous sections. The Project Description and development plans, including the closure plan, were reviewed in the context of the landscape and soils to determine the potential effects. The types of interactions that Project components and activities have in relation to the Soil Quality VC are classified as: key interactions, moderate interactions, or negligible interactions. The focus of the effects assessment on the Soil Quality VC deal with the key interactions as there is a direct interaction between the activity and the VC. Moderate interactions, which have the potential to result in effects, are mitigated during the different Project phases and 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 Soil Quality VC that may occur during each phase of the Project;
- Identifying any direct or indirect effects on the soil quality 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 soil quality 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 soil quality; 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, when measurable, are described in terms of Reclamation Suitability Ratings in **Section 5.1.3.2** Soils and Terrains Baseline Summary. As the extent of the Project's effect on the VC is local in nature, the alteration of soil quality parameters 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 5.4.4.5**.

Five potential direct effects that could result in the chemical or physical alteration of soil or in changes to soil quality were identified: soil contamination (spills and leaks); terrain stability and accelerated erosion; contamination by dust deposition; soil disturbance; and soil redistribution. These are described in greater detail below.

As noted above, reclamation suitability of soil root zone (upper 50 cm of mineral soil) materials is considered to be generally synonymous with overall soil quality. With the exception of contamination by spills and leaks or by dust deposition, the direct effects listed above will change overall soil quality, directly affecting the reclamation suitability ratings of the local soils.

5.4.4.3.1 Soil Contamination

The potential contamination of the baseline soils is a direct effect corresponding to accidental spills and releases. Accidental spills and releases are primarily associated with machinery and equipment operation, although they are also associated with hazardous and other materials handling and storage. They include the potential contamination of baseline soils, reclamation material (soil stockpiles), and cover soils (redistributed reclamation material) through accidental spills or releases. There is potential for this interaction to occur throughout the Project lifespan and throughout the Project footprint, as equipment operation is an ongoing activity. However, accidental releases are localized in nature, and, with appropriate mitigation, the effects are not anticipated to be residual. The Proponent will develop and implement an Emergency and Spill Preparedness Response Management Plan (ESPRMP) (**Section 12.2.1.18.4.13**) to minimize the effect of any accidental releases.

5.4.4.3.2 Alteration and Loss of Soil due to Terrain Stability and Accelerated Erosion

Accelerated erosion affects soil quality through the loss of material via wind or water erosion. Erosion alters the physical composition of the soil by sorting and transporting the finer particles and organic matter, leaving behind coarser, heavier particles. In terms of soil quality, erosion-related issues associated with the stockpiling of reclamation material will be of greatest concern. Direct physical alteration of a reclamation material stockpile will affect the overall soil quality.

5.4.4.3.3 Contamination due to Dust Deposition

The accumulation of dust deposits from mine activities can have an effect on the chemical composition of the soil. Accumulations of dust over the Project lifespan may alter the chemical properties of the receiving soil, depending on the composition of the dust particles. Detailed information on the effects of dust is presented in Air Quality, **Section 5.2.4**. No physical change to the soil is typically expected from dust deposition.

5.4.4.3.4 Physical Alteration due to Soil Disturbance

Soil disturbance is a direct physical effect on both the Surficial Geology and Soil Cover VC (as described above) and Soil Quality VC. Specific physical alterations of soils may include soil admixing of topsoil and subsoil, and localized areas of soil compaction, rutting, or puddling.

Baseline soil conditions within the mine footprint identified topsoil horizon depths (A horizons) of less than 10 cm deep with previously disturbed areas that contain no salvageable reclamation material. It is anticipated that a reclamation material deficit will occur as a result of Project development. In order to account for this deficit, the planned approach to soil salvage during construction, will be the collection and storage of the upper 50 cm of the soil profile to act as growth medium material during reclamation. This 50 cm lift will include all surface organics (litter) and A and B horizons. In some cases, upper C horizons or overburden will also be collected. This approach is expected to maintain the relative soil quality conditions given that the upper 50 cm of the soil profile contains similar physical and chemical properties regardless of defined soil horizon. Admixing of the upper 50 cm is not expected to affect the overall soil quality rating at reclamation. Where a distinct difference in properties, such as coarse fragment content, occurs within the 50 cm lift, efforts will be made to ensure proper separation and handling of that unsuitable material to reduce risks associated with admixing.

The susceptibility of baseline soils to compaction, puddling, and rutting depends on a number of factors, including soil texture, organic matter content, and moisture status. In general, the higher the clay content, the higher the susceptibility to compaction, especially when soils are moist. Conversely, the higher the organic matter content, the less susceptible soils are to permanent compaction. The textural characteristics of the soils, combined with the high coarse fragment content, suggest that only minor, localized areas within the Project footprint would be affected by soil compaction, puddling, and rutting.

5.4.4.3.5 Physical Alteration due to Soil Redistribution

Physical alteration of the reclamation material may affect soil quality during cover soil redistribution. Common issues associated with cover soil replacement include compaction following replacement and accelerated erosion resulting in loss of reclamation material. Commonly, replaced soils will be compacted, which can directly affect the quality of the material. Where compaction is identified, mitigation measures will be required to ensure successful reclamation.

5.4.4.3.6 Identification and Analysis of Potential Project Effects

The potential direct effects of the Project were assessed in terms of the likelihood of occurrence, given the different Project components and phases. All of the identified effects are considered likely; however, with Project controls and mitigations, terrain stability / accelerated erosion and dust deposition effects are considered to change to unlikely. **Table 5.4.4-4** indicates the likelihood of potential direct effects occurring.

Details of how the baseline landscape would be altered from Project development are provided below. Project is subdivided into six components for ease of description: the mine site (including the open pit and other associated mine facilities); mine access road; transmission line; Project access road (Kluskus Forest Service Road (FSR)); airstrip; and the freshwater supply system.

Table 5.4.4-4: Potential Direct Project Effects on Soil Quality VC

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; and workforce accommodations	C, O	• soil contamination • terrain stability and accelerated erosion • dust deposition • soil disturbance	Likely
	Drilling; blasting; ore and waste rock loading, hauling, and dumping; ore crushing and processing; tailings deposition; maintenance of equipment; management of materials; workforce accommodation; waste and sewage treatment; and management of soil stockpiles	O	• soil contamination; • terrain stability and accelerated erosion • dust deposition	Likely
	Decommissioning and demolition of facilities; re-contouring and revegetation; reclamation of TSF; and replacement of reclamation material	D/C	• soil contamination • terrain stability and accelerated erosion; • dust deposition • soil replacement	Likely
Mine Access Road	Site clearing and grading; road construction, including stream crossings; transportation of workforce and materials	C, O, D/C	• soil contamination • terrain stability and accelerated erosion • dust deposition • soil disturbance	Likely
	Transportation of workforce; and materials and maintenance	O	• soil contamination • dust deposition	Likely
	Maintenance	D/C, PC	• soil contamination • dust deposition	Likely
Freshwater Supply System	Site clearing and grading; construction of intake and road; and installation of water pipeline and freshwater reservoir	C, O	• soil contamination • terrain stability and accelerated erosion • dust deposition • soil disturbance • soil replacement	Likely
Airstrip	Site clearing and grading; construction of runway and airstrip ancillary facilities; and transportation of workforce	C, O	• soil contamination • terrain stability and accelerated erosion • dust deposition	Likely

Project Component	Project Level Interaction	Project Phase	Potential Direct Project Effect	Likelihood of Occurrence
			• soil disturbance	
	Maintenance; and occasional use for transportation of workforce or materials	O	• soil contamination • dust deposition	Likely
	Decommissioning and demolition of facilities; and re-contouring and revegetation	D/C	• soil contamination • terrain stability and accelerated erosion • soil replacement	Likely
Transmission Line	Site clearing and grading; construction of access roads and towers; and installation of cables	C	• soil contamination • terrain stability and accelerated erosion • dust deposition • soil disturbance	Likely
	Maintenance	O	• soil contamination	Likely
	Decommissioning and demolition of facilities; and re-contouring and revegetation	D/C	• soil contamination • terrain stability and accelerated erosion • soil replacement	Likely
			Table continues…	
Kluskus FSR	Road upgrades; and transportation of workforce and materials	C	• soil contamination • terrain stability and accelerated erosion • dust deposition • soil disturbance	Likely
	Maintenance; and transportation of workforce and materials	O	• soil contamination • dust deposition	Likely
	Maintenance	D/C, PC	• soil contamination • dust deposition	Likely

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

5.4.4.3.6.1 Mine Site Effects on Soil Quality

Mine site effects on soil quality can occur during all phases of Project, although the phases of greatest potential effect include the construction (C), operations (O), and D/C phases. The reclamation suitability ratings of soils in the mine site area consist of 1,143 ha with a Poor rating, 1,113 ha with a Fair rating, and 355 ha with a Good rating. At full Project extent, it is expected that where feasible, areas rated as Good and Fair will have soil (reclamation material) stripped (except for areas considered Poor, Unsuitable, or Not Rated) to a maximum depth of 50 cm. The general objective in salvaging reclamation material will be to maximize salvage of topsoil and suitable upper subsoil while minimizing compaction, rutting, puddling, and loss of soil by burial or erosion.

Once the soil is stripped, the maintenance of quality in stockpiles may be an issue. Erosion is the most likely factor to reduce quality, and mitigation may be implemented through means such as vegetating the stockpiles or using erosion prevention aids as necessary (e.g., erosion blankets).

The physical and chemical alteration of soil placed long term in stockpiles can also affect the quality of the soil. Loss of organic matter or the acidification of the soil are possible effects on the soil, which may alter the success of reclamation at Project closure. Corrective actions, such as the addition of soil amendments, may be required to mitigate soil degradation.

Maintenance of quality in off-site, undisturbed soils adjacent to the Project footprint is also of importance. Spills, leaks, or off-site discharges will require prevention/minimization. Dust from mine activities could accumulate in off-site soils over the lifespan of the Project, with potential effects on soil chemical composition.

Environmental Management Plans (EMPs) designed to mitigate effects on soil quality that are pertinent to the mine site feature include the Air Quality and Emissions Management Plan (AQEMP), ESCP, LSVMRP, and ESPRMP.

5.4.4.3.6.2 Mine Site Access Road Effects on Soil Quality

The construction of a new proposed mine access road will involve soil quality effects issues similar to those described in the mine site effects on soil quality section above. The disturbance and removal of soil cover as part of the construction of the road will affect the soil quality. Salvaged soil windrowed within the access road may experience alterations that affect the quality of the material for use in reclamation. Dust deposition and other effects are expected to affect the off-site soils surrounding the access road. Appropriate EMPs will be used to mitigate any potential effects to the soil quality as a result of the mine access road.

5.4.4.3.6.3 Transmission Line Effects on Soil Quality

Although it is anticipated that localized point disturbances will occur with the construction of transmission towers and access roads into the line corridor, it is expected that any detrimental effect to the soil quality within this feature will be mitigated with the Project EMPs. Specifically, the EMP for issues related to compaction or admixing is the LSVMRP, the ESPRMP deals with accidental spills and releases, and the ESCP covers maintaining soil integrity. Small scale point disturbances and vegetation removal rather than large scale disturbance to the soil by construction equipment altering the soil is anticipated through the construction of the transmission line. For additional information pertaining to the transmission line access roads refer to **Section 2.2.4.4**.

5.4.4.3.6.4 Project Access Road (Kluskus FSR) Effects on Soil Quality

Project access road development will require upgrading a section of the existing FSR. For the Project access road, dust deposition is the largest anticipated effect to soil quality. Implementation of the AQEMP, along with other EMPs such as the ESPRMP for potential chemical spills during transportation, will mitigate any effects to the soil quality.

5.4.4.3.6.5 Airstrip Effects on Soil Quality

The construction of the proposed airstrip will involve the alteration of baseline conditions for the airstrip and associated facilities, but not the access road. The proposed use of an existing forestry road to access the airstrip area will allow for reduction of the Project footprint, as no new construction is anticipated. The use of heavy construction equipment, stockpiling of soil, and redistribution of the soil can all affect soil quality. EMPs used during all other mitigations appropriate for the airstrip area include the LSVMRP for soil salvage and storage during construction and operations, the ESPRMP for accidental spills and releases, the AQEMP, and the ESCP to maintain soil integrity during all phases of Project.

5.4.4.3.6.6 Freshwater Supply System Effects on Soil Quality

The construction of the freshwater supply system will entail the removal of topsoil and surficial material and subsequent replacement to install the underground pipeline. It is expected that any detrimental effect to the soil quality, such as admixing of the topsoil and lower subsoil, or the compaction of the soil from construction equipment, will be mitigated by implementing appropriate EMPs, namely the LSVMRP for soil salvage and storage during construction and the ESRMP for accidental spills and releases.

5.4.4.3.7 Potential Indirect Effects of Soil Quality

The potential indirect effects on the Soil Quality VC are indicated in **Table 5.4.4-5**. The potential effect of dust deposition on soils is considered an indirect effect, as the primary pathway is air quality. However, this effect has also been listed above as a potential direct effect because, with respect to soils, dust deposition can be considered as a potential combined emission/deposition/ contaminant effect on soil chemical composition. The main issue concerns the possibility of introducing trace elements to the soil, particularly heavy metals or toxic elements.

Terrain stability is an issue identified to be carried forward for the assessment, as potential indirect effects can affect other terrestrial disciplines such as vegetation or aquatics. Increased erosion and loss of topsoil can lead to sediment loading in streams and waterbodies or can affect the growth or attenuation of vegetation within the Project footprint. Terrain stability and accelerated erosion can occur during all phases of Project; however, mitigations in place will minimize any detrimental effects of erosion.

Soil disturbance will primarily affect the vegetation discipline within the Project footprint through the removal of vegetation to support soil salvage. This will occur primarily during the construction phase of Project, when soil is being salvaged for use in subsequent reclamation activities.

Table 5.4.4-5: Potential Indirect Project Effects on Other VCs

Direct Project Effect (Adverse or Positive)	Project Phase	Potential Indirect Project Effect	Carry Forward (Yes / No)	Rationale
Terrain stability and accelerated erosion	C, O, D/C, PC	Potential instability and erosion may affect vegetation and surface water conditions.	No	Project design and mitigation measures are in place.
Soil disturbance	C	Removal of soil will affect vegetation communities.	Yes	Salvaged soil resources will affect landscape conditions and vegetation communities.
Soil contamination	C, O, D/C, PC	Contamination of soil may affect vegetation and wildlife communities.	No	EMS will contain and mitigate all accidental releases.
Dust deposition	C, O, D/C, PC	Accumulation of dust may affect the chemical properties of soil.	No	Project design and mitigation measures are in place to manage dust deposition.
Soil redistribution	C, D/C	Changes in soil distribution may affect vegetation.	Yes	Changes in reclamation material distribution may occur, resulting in different vegetation composition.
Quality of reclamation material	C, O, D/C, PC	Changes in the chemical or physical composition of the soil may affect vegetation.	Yes	Changes in reclamation material may occur resulting in different vegetation communities.

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

Soil contamination is a potential effect to soil quality throughout all phases of Project, as contamination in many forms can affect the quality of the soil. Hydrocarbons from mechanical equipment have the potential to contaminate the soil any time the equipment is used. Other forms of contamination may occur, such as from waste products of mine operations, like chemicals used in the extraction of gold and spills of tailings. Through proper use of Project EMPs, it is expected that any detrimental effects to the soil can be mitigated.

Dust deposition will be a consequence of mining activities throughout all phases of Project. The use and maintenance of haul roads, construction and decommissioning of site facilities, and excavation of the open pit will all contribute to dust deposition on native soils within the mine site

RSA. The effect on the Soil Quality VC from dust is the change in chemical composition of the soil, including the possibility of increasing the trace metals content in the soil profile.

Soil redistribution will use heavy equipment to replace the soil initially salvaged and stockpiled during the construction and operations phases of the Project. The placement of the soil during reclamation is important, in that other terrestrial components (e.g., vegetation, wildlife) will depend on proper soil placement so that other reclamation activities can occur and the reclamation objectives can be met.

Quality of the reclamation material will be an issue throughout all phases of the mine life cycle. The salvage and storage of soil will alter the soil, which may affect the quality of the material used in reclamation. The redistribution of the soil may also affect the quality of the material, which can act as a pathway to other terrestrial components.

Table 5.4.4-6 presents a summary of the potential Project effects to be carried forward.

Table 5.4.4-6: Summary of Potential Project Effects to be Carried Forward into the Assessment for Soil Quality VC

Adverse Effects / Positive Effects	Project Phase	Direction
Salvaged soil resources may affect landscape conditions and vegetation communities.	C, O	Negative
Replacement of growth medium and reclamation material throughout the Project footprint will promote reclamation and revegetation.	D/C	Neutral

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

5.4.4.3.8 Mitigation Measures

Mitigation of Project effects is addressed through development and implementation of various EMPs, which are a component of the overall Environmental Management System (EMS) for the Project. The development of the EMS and associated EMPs incorporate industry standard Best Management Practices (BMPs) proven to be effective in similar situations. Six mitigation measures, including some of the EMPs, were identified as part of the Project with respect to maintaining the integrity of soil quality, as follows:

- Footprint minimization;
- Landscape, Soil, Vegetation and Restoration Management Plan (LSVRMP) (**Section 12.2.1.18.4.4**);
- ESRMP (**Section 12.2.1.18.4.13**);
- Sediment and Erosion Control Plan (SECP) (**Section 12.2.1.18.4.1**);
- Air Quality and Emissions Management Plan (AQEMP) (**Section 12.2.1.18.4.9**); and
- Reclamation and Closure Plan (RCP) (**Section 2.6**).

All of these proposed mitigations will reduce, prevent, or eliminate the potential effects of the Project. **Table 5.4.4-7** outlines the proposed mitigation measures applicable for each Project phase with regard to soil quality effects. Each mitigation measure is discussed below, and further details are provided in **Section 12.2.1**.

Table 5.4.4-7: Potential Project Effect by Project Phase on Soil Quality VC and Mitigation Measures

Project Effect	Project Phase	Mitigation / Enhancement Measure	Mitigation Success Rating
Soil contamination	C, O, D/C, PC	Emergency and Spill Response Management Plan	Reduction or elimination
Terrain stability and accelerated erosion	C, O, D/C, PC	Erosion and Sediment Control Plan; footprint minimization	Reduction or prevention
Dust deposition	C, O, D/C, PC	Air Quality and Emissions Management Plan; dust suppression and watering	Reduction
Soil disturbance	C	Footprint minimization	Reduction or prevention
	O	Soil Management Plan; Erosion and Sediment Control Plan	Reduction or prevention
	D/C	Reclamation and Closure Plan	Reduction or enhancement
Soil redistribution	D/C	Reclamation and Closure Plan	Enhancement
	PC	Soil erosion and vegetation monitoring programs	Enhancement

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

5.4.4.3.8.1 Soil Contamination

The effect of soil contamination on soils will be reduced or eliminated by the implementation of some interrelated EMPs. Management of hazardous materials during all phases of Project will refer to the Hazardous Materials Management Plan (HMMP) (**Section 12.2.1.18.4.12**). This plan is designed to prevent contamination of the environment, including on-site soil materials, soils stored for later use, and off-site soils. In the event of accidental contamination, emergency and spill response management will refer to the ESPRP (**Section 12.2.1.18.4.13**), which will be in effect for all phases of Project. All phases have similar potential emergency and spill response requirements associated with heavy machinery operating at a mine site. Emergencies such as vehicle accidents, fuel spills from vehicles, and chemical spills during transport are examples of incidents that could occur during any phase. Contamination of on-site materials, off-site soils, and soil stockpiles will be minimized through immediate response, containment, and removal of the contaminated materials as necessary.

5.4.4.3.8.2 Terrain Stability and Accelerated Erosion

Mitigation measures are discussed for the Soil Quality VC in **Section 5.4.4.3.8**, with applicable measures, including footprint minimization, and techniques to prevent or minimize erosion.

5.4.4.3.8.3 Dust Deposition

Dust mitigation is important for air quality and human and ecosystem health. Dust suppression techniques, such as watering, will be considered for dust control. For a detailed description of the AQEMP, refer to the EMP (**Section 12.2.1.18.4.9**).

5.4.4.3.8.4 Soil Disturbance

As discussed in **Section 5.4.4.4.1**, the principal approaches for mitigation of potential impacts on soil quality due to disturbance are minimization of disturbances through optimization of the Project footprint and design features, and conformance to the LSVMRP. These considerations are incorporated into the Project design.

Proper salvage and storage techniques of the reclamation material are key components to mitigate against the loss of soil quality. Wherever feasible, the upper 50 cm of soil and overburden will be collected prior to the installation of site facilities, and stored in a manner to prevent erosional loss or other degradation for use during reclamation, as described in the RCP (**Section 2.6**).

The handling of soils during salvage and stockpiling, maintaining suitable stockpile conditions, and handling during reclamation are important in preserving the quality of the reclamation material. The primary effects on reclamation material quality will be from admixing of soils during salvage operations and from chemical alterations of soil stockpiles from long-term storage. The principal mitigation measure for admixing is to reduce the amount of upper subsoil that is salvaged with the topsoil where possible. Inclusion of these materials is a direct consequence of technical limitations. As such, soil admixing cannot be fully eliminated or mitigated. The principal mitigation related to the chemical alteration of the reclamation material entails implementing monitoring programs to verify that the redistributed soil functions as a growth medium and to identify any persistent quality issues and ameliorative measures.

Where possible, alternative mitigation measures will be applied in an effort to increase the reclamation suitability of the material, namely:

- Organic material, where available, will be salvaged as part of the overall reclamation material salvage. The inclusion of surface organics will add organic matter to the salvaged soil material;
- Fertilizers will be added where needed to the reclaimed site to improve the nutrient content of the soil to support vegetation regrowth. At the time of closure, fertilizer and seeding techniques will be reviewed to ensure adherence to applicable guidelines; and

- Soil quality can be affected during any phase of Project, including post-closure, when site monitoring will be carried out. Minimizing vehicle and heavy equipment use of reclaimed lands will be important in preventing soil compaction, especially when soils are wet. Minimizing traffic will also reduce potential for spills and leaks. Compacted soils will be ripped to alleviate compaction issues during reclamation activities.

The above procedures and mitigation methods are specified in the LSVMRP (**Section 12.2.1.18.4.4**). The RCP and the Project Description (Decommissioning and Closure Activities) provide more detailed descriptions of reclamation activities as they pertain to salvage and redistribution of soils. BMPs and industry standards exist for mining closure and reclamation activities, and Project currently incorporates these practices into its overall design and EMP.

5.4.4.3.8.5 Soil Redistribution

Soil reclamation refers to the redistribution of salvaged soils, which will be carried out during the closure phase of the Project. Salvaged reclamation material will be redistributed, graded, and contoured as part of reclamation activities. Due to the expected topsoil deficit, salvaged soils will be prioritized for reclamation of the natural landform areas to provide better opportunities for the establishment of vegetation similar to pre-disturbance conditions (refer to the RCP, **Section 2.6**).

Progressive reclamation will begin during the operations phase to reclaim those facilities no longer required as part of the Project. It is expected that the majority of the soil reclamation will occur at the end of operations, and soil reclamation is considered in the closure phase of the Project although some reclamation of TSF cell C and the West waste rock dump will be completed during operations (refer to the RCP, **Section 2.6**).

Similar to soil disturbance, the RCP and the Project Description provide a more detailed description of reclamation activities as they pertain to salvage and redistribution of soils. BMPs and industry standards exist for mining closure and reclamation activities, and the Project currently incorporates these practices into its overall design and EMP.

The key components of the RCP will involve the redistribution of the soil and overburden over decommissioned facilities, and the contouring of slopes to allow for stable slopes to promote the regeneration of vegetation on the slopes.

5.4.4.3.8.6 Effectiveness of Mitigation

Table 5.4.4-8 provides ratings for effectiveness of mitigation measures to avoid or reduce potential effects on soil quality during mine site development. Mitigation measures will be based on site-specific information and construction engineering and are therefore preliminary at this stage.

Table 5.4.4-8: Mitigation Measures and Effectiveness of Mitigation to Avoid or Reduce Potential Effects on Soil Quality during Mine Site Development

Likely Environmental Effect	Project Phase	Mitigation/Enhancement Measure	Effectiveness of Mitigation Rating
Soil contamination	Construction, Operations, Closure, Post-closure	Emergency and Spill Response Management Plan	Moderate
Terrain stability and accelerated erosion	Construction, Operations, Closure, Post-closure	Erosion and Sediment Control Plan	High
		Footprint minimization	High
Dust deposition	Construction, Operations, Closure, Post-closure	Air Quality and Emissions Management Plan	High
		Dust suppression and watering	High
Soil disturbance	Construction	Footprint minimization	High
	Operations	Soil Management Plan	High
		Erosion and Sediment Control Plan	High
	Closure	Soil Salvage; Reclamation and Closure Plan	High
Soil redistribution	Closure	Redistribution of salvaged soils (Reclamation and Closure Plan)	High
		Progressive reclamation of the West Dump, TSF Site C and topsoil stockpiles when feasible	High
	Post-closure	Contouring of slopes to allow for stable slopes to promote the regeneration of vegetation on the slopes	High

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 issues surrounding soil quality 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. A moderate rating was given to the ESRMP mitigation as this involves a high degree of participation from all parties involved. With a high level of diligence, a properly implemented spill response plan should be effective in mitigating any adverse effects.

5.4.4.4 Residual Effects and their Significance

5.4.4.4.1 Potential Residual Effects after Mitigation

Any potential residual effects related to the Soil Quality VC are expected to be short term and point source in nature depending on the material used for reclamation activities. With the use of proper mitigations (amendments, time for natural recovery), it is expected that no residual effects will remain. In soil units rated as *Good* and *Fair* in terms of reclamation suitability, salvage of the upper 50 cm of reclamation material will occur. This material will subsequently be used to reclaim specific areas within the mine site (**Section 2.6**). The use of standard mitigations to promote soil integrity is expected to alleviate any residual effects to this reclamation material.

In areas where overburden is the primary reclamation material, short-term loss of soil quality is expected. This overburden material will require time and specific amendments to allow for the formation of soil with equivalent capability to the baseline condition. This situation is expected to occur until the establishment of a functioning vegetative cover, allowing for natural soil inputs and pedogenesis.

Following the successful implementation of the mitigation measures indicated above, it is expected that no residual effects related to the Soil Quality VC will remain. All Project effects are expected to be mitigated and are not carried forward as part of the assessment.

The implementation of the RCP, along with the other identified mitigation measures, will effectively limit the potential for residual effects related to the Soil Quality VC. All Project effects related to soil quality will either be directly addressed at the time of occurrence or addressed within the final closure plan of the Project. Mitigation measures will minimize the overall effect that the redistribution of surficial materials will have on the landscape. Therefore, upon completion of mitigation measures, residual effects for the Soil Quality VC are considered to be Not Significant (Negligible) (**Table 5.4.4-9**).

5.4.4.4.2 Significance of Potential Residual Effects

The significance rating for the identified soil quality residual effects are summarized in **Table 5.4.4-9**. The ecological context of the all effects related to soil quality are rated as *Low* or *Negligible*, as mitigations for the effects are expected to return the soil function to a similar manner to baseline conditions. Except for the distribution of dust throughout the RSA, the effects are considered *Point Source* or *Local* in geographic extent and *Reversible* in nature. Except for soil contamination from dust and the chemical and physical alteration due to soil disturbance, the effects are considered *Short-term*. Soil contamination from dust is *Chronic* as long as dust is being generated from the Project, and the chemical and physical alteration due to disturbance is considered Long-term until time for natural recovery is allowed. The likelihood for spills and leaks, physical alteration of disturbance, and alteration from soil distribution effects on the Soil Quality VC is considered *High* throughout all phases of the Project as the residual effect is expected to occur from past experiences. The likelihood of erosion and dust contamination effects are considered *Moderate* as the effects are likely to occur, but not necessarily within the Project. The level of confidence in the significant rating for all effects is considered *High* as the VC is well understood and mitigations from previous projects have found to be effective. This Project effect on the VC is rated as *Not Significant* (Negligible) for the residual effect.

Functionality of the soil material is expected to be consistent with baseline conditions (with mitigations). The rating was applied based on the geographic extent, context and magnitude. Residual effect significance ratings are described in **Section 4**.

Table 5.4.4-9: Residual Effects Assessment by Project Development Phase for Soil Quality

Parameter	Stage of Development / Rating			
	Construction	**Operations**	**Decommissioning and Closure**	**Post-Closure**
Soil Contamination due to Spills and Leaks				
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	High	High	High	High
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
Alteration and Loss of Soil due to 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
Soil Contamination due to Dust Deposition				
Effect Attribute				
Context	Low	Low	Low	n/a
Magnitude	Negligible	Negligible	Negligible	n/a
Geographic extent	Regional	Regional	Regional	n/a
Duration	Chronic	Chronic	Chronic	n/a

Parameter	Stage of Development / Rating			
	Construction	**Operations**	**Decommissioning and Closure**	**Post-Closure**
Reversibility	Yes	Yes	Yes	n/a
Frequency	Intermittent	Continuous	Intermittent	n/a
Likelihood Determination	Low	Low	Low	n/a
Level of Confidence for Likelihood	High	High	High	High
Significance Determination	Not significant (negligible)	Not significant (negligible)	Not significant (negligible)	n/a
Level of Confidence for Significance	High	High	High	n/a
Chemical and Physical Alteration due to Soil Disturbance				
Effect Attribute				
Context	Low	Low	n/a	n/a
Magnitude	Low	Low	n/a	n/a
Geographic extent	Local	Local	n/a	n/a
Duration	Long-term	Long-term	n/a	n/a
Reversibility	Yes	Yes	n/a	n/a
Frequency	Continuous	Intermittent	n/a	n/a
Likelihood Determination	High	High	n/a	n/a
Level of Confidence for Likelihood	High	High	n/a	n/a
Significance Determination	Not significant (negligible)	Not significant (negligible)	n/a	n/a
Level of Confidence for Significance	High	High	n/a	n/a
Physical Alteration due to Soil Redistribution				
Effect Attribute				
Context	n/a	n/a	Low	n/a
Magnitude	n/a	n/a	Low	n/a
Geographic extent	n/a	n/a	Local	n/a
Duration	n/a	n/a	Chronic	n/a
Reversibility	n/a	n/a	Yes	n/a
Frequency	n/a	n/a	Once	n/a
Likelihood Determination	n/a	n/a	High	n/a
Level of Confidence for Likelihood	n/a	n/a	High	n/a
Significance Determination	n/a	n/a	Not significant (negligible)	n/a
Level of Confidence for Significance	n/a	n/a	High	n/a

Note: n/a = not applicable

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

5.4.4.5 Cumulative Effects

All Project related effects to soil quality will either be directly addressed at the time of occurrence or during the closure phase of the Project. The implementation of the RCP, along with the other identified mitigation measures (**Section 5.4.4.3.8**), will effectively mitigate any residual effects related to the Soil Quality VC. Following the successful implementation of mitigation measures, it is expected that no residual effects related to the Soil Quality VC will remain. As such, residual effects for the Soil Quality VC are considered to be Not Significant (Negligible) and are not carried forward as part of the assessment.

5.4.4.6 Limitations

The effects assessment for the Soil Quality VC is based on the information presented within the Project Description, including description of specified EMPs.

5.4.4.7 Conclusion

Direct and indirect Project effects are expected to occur on the Soil Quality VC throughout all phases of the Project. The salvage and preservation of reclamation material during the construction and operations phases of the Project will minimize the overall effect of the Project on soil quality. Localized and accidental releases will be mitigated through the relevant EMPs to ensure no long-term residual effects on soil quality occur. With the implementation of all mitigation measures, no residual effects are expected to remain for the Soil Quality VC.