Department of Natural Resources





DIVISION OF MINING, LAND & WATER Mining Section

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January 26, 2018

Mark Huffington Environmental Superintendent Fairbanks Gold Mining, Inc. PO Box 73726 Fairbanks, AK 99709-3726

Subject: Fort Knox Mine Plan of Operations Amendment Approval F20149852POO.9 for FGMI Phase 9 Pit Expansion and Fish Creek East Waste Rock Expansion

Dear Mr. Huffington:

On December 14, 2017, the Division of Mining, Land, and Water (DMLW) received correspondence from Fairbanks Gold Mining, Inc. (FGMI), requesting approval to amend the *Fort Knox Mine Plan of Operations Amendment Approval F20149852POO (POOA)* for the expansion of the pit with a Phase 9 pit expansion and, under separate cover, to expand the site's waste rock dumps to include the proposed Fish Creek East Waste Rock Dump (FCEWRD).

The DMLW has reviewed the proposed amendment and consulted with the Alaska Department of Environmental Conservation, the Alaska Department of Fish and Game, and the Alaska Dam Safety Program.

The requested amendments to the POOA as proposed and illustrated in your December 14, 2017 submissions are hereby approved as *Fort Knox Mine Plan of Operations Amendment Approval F20149852POO.9 (POOA)* with the stipulation that no material will be placed onto tails until approved by the Alaska Dam Safety Program. Nothing in this decision changes the conditions of the original POOA Approval dated March 28, 2014. These changes should be accounted for in the next update to the Plan of Operations, the Reclamation and Closure Plan, and the closure cost estimate.

Please be advised that this authorization does not eliminate the potential need for authorization of your activity from other Federal, State, or local divisions or agencies.

A person affected by this decision may appeal it, in accordance with 11 AAC 02. Any appeal must be received within 20 calendar days after the date of "issuance" of this decision, as defined in 11 AAC 02.040© and (d) and may be mailed or delivered to the Commissioner, Department of Natural Resources, 550 W. 7th Avenue, Suite 1400, Anchorage, Alaska, 99501; faxed to 1-907-269-8918, or sent by electronic mail to <u>dnr.appeals@alaska.gov</u>. If no appeal is filed by the appeal deadline, this decision becomes a final administrative order and decision of the department on the 31st calendar day after issuance. An eligible person must first appeal this decision in accordance with 11 AAC 02 before appealing this decision to Superior court. A copy of 11 AAC 02 may be obtained from any regional information office of the Department of Natural Resources.

If you have any questions regarding this approval, please contact Brent Martellaro at 907-451-2788

Sincerely,

Russell Kirkham Acting Mining Section Chief

Enclosure: Copy of FGMI's December 14, 2017 amendment requests

Cc via email: Bartly Kleven, FGMI Brent Martellaro, ADNR Carolyn Curley, ADNR David Schade, ADNR Tim Pilon, ADEC Ellen Lyons, USACE Jennifer Pyecha, FGMI Stephanie Lovell, FGMI Kyle Moselle, ADNR Charles Cobb, ADNR Audra Brase, ADF&G



phone: (907) 488-4653 fax: (907) 490-2290

Delivery: kyle.moselle@alaska.gov

December 14, 2017

Kyle Moselle Department of Natural Resources Office of Project Management and Permitting 400 Willoughby Street Juneau, AK 99801-01019

Re: FGMI Phase 9 Pit Expansion

Dear Mr. Moselle:

Fairbanks Gold Mining, Inc. (FGMI) is requesting an amendment to the Plan of Operations for the Fort Knox Gold Mine. FGMI proposes to expand the pit with the Phase 9 pit expansion.

This submittal includes the Fort Knox Mine Plan of Operations Amendment Request, Phase 9 Pit Expansion, December 14, 2017 document.

Should you have any questions, please contact me at 970-490-2287 or mark.huffington@kinross.com.

Sincerely,

Mark Altuffery

Mark A. Huffington Environmental Superintendent

Cc: Brent Martellaro, ADNR, <u>brent.martellaro@alaska.gov</u> Tim Pilon, ADEC, <u>tim.pilon@alaska.gov</u> Bartly Kleven, FGMI, <u>bartly.kleven@kinross.com</u> Craig Natrop, FGMI, <u>craig.natrop@kinross.com</u>



Fort Knox Mine Plan of Operations Amendment Request



Phase 9 Pit Expansion

Table of Contents

1.0	IN	NTRODUCTION
1	.1	Site Description
2.0	P	hase 9 Pit Expansion
2	.1	Reclamation2
2	.2	Wetlands
2	.3	Groundwater Monitoring Wells
3.0	B	arnes Creek Waste Rock Dump4
3	.1	Reclamation4
3	.2	Wetlands4
4.0	Y	ellow Pup Waste Rock Dump
4	.1	Reclamation
4	.2	Wetlands4
5.0	In	1-Pit Waste Rock Dump
5	.1	Reclamation
5	.2	Wetlands5
6.0	R	eferences

Figures

Figure 1: Site Location	1
Figure 2: Mine Facilities	2
Figure 3: Parcel G Groundwater Monitoring Well Locations	3

Tables

Table 1: Phase 9 Pit Expansion Quantities	

Attachments

- 1. Fort Knox Mine with Parcel G Boundary
- 2. Phase 9 Pit Crest View
- 3. Phase 9 Facility Quantity Overview
- 4. Phase 9 Facility Elevation Overview
- 5. Phase 9 Expansion Area

Abbreviations

amsl	above mean sea level
BCHLF	Barnes Creek Heap Leach Facility
BCWRD	Barnes Creek Waste Rock Dump
су	cubic yard
DEC	Alaska Department of Environmental Conservation
DNR	Alaska Department of Natural Resources
FEMA	Federal Emergency Management Agency
ft	feet
ft ²	square feet
FGMI	Fairbanks Gold Mining, Inc.
Fort Knox	Fort Knox Mine
gpm	gallons per minute
Н	horizontal
hr	hour
lb/cf	pounds per cubic feet
LCRS	leachate collection and recovery system
М	million
Mt	million tons
PCMS	process component monitoring system
PFS	prefeasibility study
TSF	tailings storage facility
V	vertical
WCHLF	Walter Creek Heap Leach Facility
WRD	waste rock dump
YPWRD	Yellow Pup Waste Rock Dump
yr	year

1.0 INTRODUCTION

Fairbanks Gold Mining, Inc. (FGMI) is requesting a Plan of Operations amendment approval at its Fort Knox Mine (Fort Knox) for the Phase 9 expansion of the Fort Knox pit. The proposed Phase 9 expansion is located on property known as Parcel G and Parcel B. The Plan of Operations amendment request also includes expansions of the Barnes Creek Waste Rock Dump to an ultimate elevation of 2,600 feet (ft) above mean sea level (amsl) and the Yellow Pup Waste Rock Dump to an ultimate elevation of 2,400 ft amsl. The proposed waste rock dump expansions are also needed to accommodate waste rock mined with the Parcel G pit expansion.

1.1 Site Description

Fort Knox is owned and operated by FGMI, a wholly owned subsidiary of Kinross Gold USA, Inc. Fort Knox is located in the Fairbanks North Star Borough, approximately 26-road miles northeast of Fairbanks, Alaska (Figure 1). It is located along a belt of lode and placer deposits that comprise one of the highest gold-producing areas in Alaska. The deposit at Fort Knox is mined by conventional open-pit methods on a year-round basis, seven days per week. Fort Knox processes ore onsite at a carbon in-pulp mill with a daily capacity of up to 45,000 tons. In recent years, Fort Knox has produced approximately 350,000 to 400,000 ounces of gold annually. Major site facilities include the active open pit mine, mill, tailings storage facility (TSF), waste rock dumps, water storage reservoir, and the Walter Creek Valley Heap Leach Facility (Figure 2).

Figure 1: Site Location



Figure 2: Mine Facilities



2.0 PHASE 9 PIT EXPANSION

FGMI proposes to expand the Fort Knox mine pit to the area known as Phase 9. The proposed Phase 9 expansion is located on property known as Parcel G and Parcel B (Attachments 1 - 4).

The proposed expansion includes approximately 173.4 million tons of rock of which 63.4 million tons is ore for processing and 110 million tons is waste rock (Attachment 3). The proposed Phase 9 expansion disturbance is approximately 91.6 acres (Attachment 5).

Table 1 – Phase 9 Pit Expansion Quantities

Facility	Ore Processing (million tons)	Waste Rock (million tons)
Mill	1.4	
Walter Creek Heap Leach	24	
Barnes Creek Heap Leach	38	
Barnes Creek Waste Rock Dump		73
Yellow Pup Waste Rock Dump		27
In-Pit Waste Rock Dump		10

2.1 Reclamation

Reclamation of the Phase 9 Pit Expansion is included as an amendment to the *Fairbanks Gold Mining*, *Inc.*, *Reclamation Plan and Closure Plan*, *November 2013*, *Rev 2*. The amendment is provided as a separate document.

2.2 Wetlands

A wetlands delineation was performed by Michael Baker International in 2015 for Parcel G. No wetlands were identified in the Phase 9 Pit Expansion area.

2.3 Groundwater Monitoring Wells

Parcel G includes three existing groundwater monitoring wells located west of the Phase 9 pit expansion (Figure 3). The monitoring wells are designated EXMW-1, EXWM - 2, and EXWM-4. These three monitoring wells will be continued to be monitored on a periodic schedule.

Figure 3 – Parcel G Groundwater Monitoring Well Locations



3.0 BARNES CREEK WASTE ROCK DUMP

The current Barnes Creek Waste Rock Dump (BCWRD) is authorized for an ultimate height of 2,400 ft amsl, and FGMI is requesting for the BCWRD ultimate height be increased 200 ft to 2,600 ft amsl. The figure of Attachment 4 identifies the increased ultimate height of 2,600 ft amsl. The BCWRD will increase in size by approximately 90 acres (Attachment 5) with the 200-foot height increase. The expansion will accommodate approximately 73 Mt waste rock from mining of the Phase 9 expansion.

3.1 Reclamation

Reclamation of the BCWRD expansion is included in the Phase 9 Pit Expansion amendment to the *Fairbanks Gold Mining, Inc., Reclamation Plan and Closure Plan, November 2013, Rev 2.* The amendment is provided as a separate document.

3.2 Wetlands

There are no wetlands identified in the expansion area.

4.0 YELLOW PUP WASTE ROCK DUMP

The current Yellow Pup Waste Rock Dump (YPWRD) is authorized for an ultimate height of 2,350 ft amsl, and FGMI is requesting an expansion for the YPWRD for the ultimate height be increased 50 ft to 2,400 ft amsl. The figure of Attachment 4 identifies the increased height to 2,400 ft amsl. The increased height will accommodate approximately 27 Mt of waste rock from mining of the Phase 9 expansion. The YPWRD expansion request increases the size by approximately 48.6 acres (Attachment 5).

4.1 Reclamation

Reclamation of the YPWRD expansion is included in the Phase 9 Pit Expansion amendment to the *Fairbanks Gold Mining, Inc., Reclamation Plan and Closure Plan, November 2013, Rev 2.* The amendment is provided as a separate document.

4.2 Wetlands

Wetlands associated with the YPWRD expansion were mitigated with in-lieu fee compensatory mitigation for impacts with the US Army Corps of Engineers (ACOE) POA-1992-574-M22 in 2013 and POA-1992-574-M24 in 2014.

5.0 IN-PIT WASTE ROCK DUMP

The proposed In-Pit Waste Rock Dump identified in Attachments 2 through 4 will accommodate approximately 10 Mt of waste rock from mining of the Phase 9 expansion.

5.1 Reclamation

Reclamation of the In-Pit Waste Rock Dump is included in the Phase 9 Pit Expansion amendment to the *Fairbanks Gold Mining, Inc., Reclamation Plan and Closure Plan, November 2013, Rev 2.* The amendment is provided as a separate document.

5.2 Wetlands

There are no wetlands identified in the area for the In-Pit Waste Rock Dump.

6.0 REFERENCES

Michael Baker International, 2015, *Preliminary Jurisdictional Determination and Functional Assessment Report. Fort Knox Gold Mine Gilmore Exploration Area*, December 23, 2015.



Fairbanks Gold Mining, Inc., Fort Knox Mine Phase 9 POO Amendment

Attachment 2













Fort Knox Mine Plan of Operations Amendment Request



Fish Creek East Waste Rock Dump

Table of Contents

1.0 INTRODUCTION	1
1.1 Site Description	1
2.0 Fish Creek East Waste Rock Dump	2
2.1 Reclamation	5
2.2 Wetlands	5
3.0 References	6

Figures

Figure 1: Site Location	1
Figure 2: Mine Facilities	2
Figure 3: Summary of Limit Equilibrium Slope Stability Analysis Results	5

Attachments

- 1. Proposed Fish Creek East Waste Dump Layout
- 2. Proposed Fish Creek East Waste Rock Dump Cross Sections
- 3. Fish Creek East Waste Rock Dump Geologic Map
- 4. Phase 8 East Wall Expansion

Abbreviations

amsl	above mean sea level
BCHLF	Barnes Creek Heap Leach Facility
BCWRD	Barnes Creek Waste Rock Dump
cy	cubic yard
DEC	Alaska Department of Environmental Conservation
DNR	Alaska Department of Natural Resources
FEMA	Federal Emergency Management Agency
ft	feet
ft^2	square feet
FCEWRD	Fish Creek East Waste Rock Dump
FGMI	Fairbanks Gold Mining, Inc.
Fort Knox	Fort Knox Mine
gpm	gallons per minute
Н	horizontal
hr	hour
lb/cf	pounds per cubic feet
LCRS	leachate collection and recovery system
М	million
Mt	million tons
PCMS	process component monitoring system
PFS	prefeasibility study
TSF	tailings storage facility
V	vertical
WCHLF	Walter Creek Heap Leach Facility
WRD	waste rock dump
YPWRD	Yellow Pup Waste Rock Dump
yr	year

1.0 INTRODUCTION

Fairbanks Gold Mining, Inc. (FGMI) is requesting a Plan of Operations amendment approval at its Fort Knox Mine (Fort Knox) for the Fish Creek East Waste Rock Dump. FGMI proposes to expand the site's waste rock dumps to include the proposed Fish Creek East Waste Rock Dump (FCEWRD). The proposed FCEWRD extends from the north side of the Yellow Pup Waste Rock Dump, the east side of the Fish Creek Waste Rock Dump/Fish Creek low-grade stockpiles, and on the southwest corner of the tailings storage facility's North Pond (Attachment 1).

1.1 Site Description

Fort Knox is owned and operated by FGMI, a wholly owned subsidiary of Kinross Gold USA, Inc. Fort Knox is located in the Fairbanks North Star Borough, approximately 26-road miles northeast of Fairbanks, Alaska (Figure 1). It is located along a belt of lode and placer deposits that comprise one of the highest gold-producing areas in Alaska. The deposit at Fort Knox is mined by conventional open-pit methods on a year-round basis, seven days per week. Fort Knox processes ore onsite at a carbon in-pulp mill with a daily capacity of up to 45,000 tons. In recent years, Fort Knox has produced approximately 350,000 to 400,000 ounces of gold annually. Major site facilities include the active open pit mine, mill, tailings storage facility (TSF), waste rock dumps, water storage reservoir, and the Walter Creek Valley Heap Leach Facility (Figure 2).

Figure 1: Site Location



Figure 2: Mine Facilities



2.0 Fish Creek East Waste Rock Dump

FGMI proposes to expand the site's waste rock dumps to include the proposed Fish Creek East Waste Rock Dump (FCEWRD). The proposed FCEWRD extends from the north side of the Yellow Pup Waste Rock Dump, the east side of the Fish Creek Waste Rock Dump/Fish Creek low-grade stockpiles, and on the southwest corner of the tailings storage facility's North Pond. Attachments 1 through 3 identify the location, cross-section, and the geologic conditions of the waste rock dump.

Additional mine waste capacity will be needed for operations of the Fort Knox pit including the pit's east wall, which is an extension of mining Phase 8 (Attachment 4). Approximately 85 million tons of waste rock will be placed on the FCEWRD. The ultimate elevation of the FCEWRD is 1950 ft amsl. Knight Piésold Consulting (KP) completed geotechnical investigations and engineering analysis of the proposed layout of the *Fish Creek East WRD and presented their findings in the FCEWRD Geotechnical Evaluation of Dump Construction over Existing Tailings*, September 29, 2017, which is provided with this amendment request. The KP investigation and engineering analysis consisted of two distinct areas, which the KP report reflects (large pyramidal zone and narrow cross-valley zone; however, only the large pyramidal zone is proposed for construction at this time at the current Fish Creek East area. A summary of the KP report is discussed below.

During the period from February 28, 2017 through March 10, 2017, the geotechnical site investigation was completed comprising CPT and sonic drilling with direct sampling of tailing material impounded within the TSF. This program consisted of nine locations where CPTs were advanced and adjacent sonic drill holes were also advanced for the purpose of sample collection. A subset of samples were sent to the Knight Piésold geotechnical laboratory in Denver for index and moisture content testing. In general, it was found that the tailing in the vicinity of the Fish Creek East waste rock dump

characterized in a similar way to the coarse grained tailing located in the vicinity of the Yellow Pup waste rock dump; however, numerous layers of uncharacteristically stiff material were identified within the deposit in this area. These layers were often overlain and underlain by softer layers similar to what has been identified elsewhere within the facility. Substantial zones of excess pore pressures (in excess of hydrostatic conditions) were also identified during the current site investigation. This finding viewed in conjunction with the finding of stiff layers within the deposit indicated that there may be semi-continuous layers of frozen tailing buried within the deposit in the vicinity of the Fish Creek East WRD. These stiff zones were generally not taken into account for subsequent geotechnical engineering analyses because it is possible that these layers will not remain frozen in the future. The excess pore pressures identified due to the existence of the frozen layers were taken into account.

Geotechnical material properties were developed for the tailing, mine waste rock and bedrock foundation based on a combination of: (1) current site investigation and laboratory testing and site investigation data, (2) historic laboratory testing and site investigation data, and (3) literature values and experience with similar materials. Unit weights and failure criterions were developed for limit equilibrium slope stability analyses. Stress-strain relationships were also developed for the earthquake-induced deformation analyses.

Limit equilibrium slope stability analyses were performed on the critical sections for both the pyramidal and cross valley portions of the WRD. The slope stability analyses were conducted under static, post-construction, and post-earthquake loading conditions. Appropriate undrained shear strength parameters were utilized for the tailing under post-construction and post-earthquake slope stability analyses. It was assumed that the mine waste rock and foundation bedrock would not lose strength due to undrained loading due to the nature of those materials. Static and post-construction factors of safety were shown to meet applicable minimum acceptable factors of safety for all of the cases considered. Post-earthquake stability analyses indicated factors of safety of less than 1.0 upon the occurrence of the maximum design earthquake (MDE). It must be understood that such results do not necessarily indicate unacceptable performance of the facility but rather that some permanent earthquake-induced deformations of the slope are anticipated. Acceptable performance is then based on the estimated magnitude and anticipated consequence of such movements. As such, finite-difference earthquake-induced deformation analyses were performed to quantify those anticipated movements (Figure 3, Summary of Limit Equilibrium Slope Stability Analysis Results).

The earthquake-induced deformation analyses were performed at the full build-out configurations on the critical sections for the pyramidal and cross valley portions of the WRD. The models were first built up in stages to achieve an accurate representation of the in-situ total and effective stresses prior to earthquake shaking. Each model was then subject to the loading associated with the occurrence of the MDE. Three separate acceleration time histories were utilized as recommended in the seismic hazard assessment developed for the Fort Knox site.

The results of the earthquake-induced deformation analyses show a maximum settlement observed within the pyramidal portion and cross valley portion of the waste rock dump of approximately 4 feet and 10 feet, respectively. Horizontal displacements observed within the pyramidal portion and cross valley portion of the waste rock dump are approximately 4 feet and 17 feet, respectively. The displacement histories recorded during earthquake loading indicate a gradual increase in the displacements that stop shortly after shaking. These displacements, while significant, are not likely to

impact the operation, capacity or freeboard of the TSF and are considered acceptable for this type of facility.

The results of the geotechnical engineering analyses indicate that the performance of the proposed configurations of the pyramidal and cross valley portions of the WRD should be acceptable provided that the conditions modeled are representative of those in the field; however, due to the variation in site conditions observed in the vicinity of the proposed WRD compared with what has been observed elsewhere, there is additional uncertainty regarding the anticipated behavior of the tailing deposit in this location with respect to the propensity for pore pressure dissipation during construction or following an earthquake event. Because of this, FGMI should pay close attention to the performance of the slope faces during construction. To maintain a safe working environment, frequent inspections of the advancing face and emplaced mine waste rock should be made. Consideration should be given to any signs of distress (e.g., tension cracking parallel to the advancing face, bulging of the slope above the toe, water or tailing ejected on the surface of the mine waste rock fill, etc.) before work proceeds in that vicinity. Once the initial lift of mine waste rock is in place, it is strongly recommended that vibrating wire piezometers be installed via drill holes through the mine waste rock into the underlying tailing to monitor excess pore pressures induced by ongoing construction, which could be indicative of a pending undrained failure. It is possible that pore pressures will take longer to dissipate in this area due to the layers of frozen tailing indicated by the site investigation program. Installation of the piezometers should allow for optimized sequencing of mine waste rock placement to reduce the risk of undrained slope failure during construction. It would also be advisable to install survey monuments to monitor settlement and horizontal movement near and along the slope of the WRD.

Analysis Type	Section	Description	Computed Factor of Safety
Static	Α	Full Build Out Downstream	2.4
Static	В	Full Build Out Downstream	3.0
Post Farthquake	А	Full Build Out Downstream	0.7
i ost-Lartiquake	В	Full Build Out Downstream	0.3
		Lift #1 Downstream	1.0
		Lift #2 Downstream	1.1
		Lift #3 Downstream	1.2
	•	Lift #4 Downstream	1.2
	A	Lift #5 Downstream	1.2
		Lift #6 Downstream	1.2
Dest Construction		Lift #7 Downstream	1.2
Post-Construction		Lift #8 Downstream	1.2
	В	Lift #1 Downstream	1.0
		Lift #1 Upstream	1.0
		Lift #2 Downstream	1.2
		Lift #2 Upstream	1.2
		Lift #3 Downstream	1.2
		Lift #3 Upstream	1.2

Figure 3: Summary of Limit Equilibrium Slope Stability Analysis Results

Notes:

1. Sections A & B are shown on Attachment 1, Proposed Waste Rock Dump Layout

2. SLOP/W output plots included in Appendix D, FCEWRD Report on Geotechnical Evaluation of Dump Construction Over Existing Tailing, September 29, 2017

2.1 Reclamation

Reclamation of the FCEWRD is included in the Phase 9 Pit Expansion amendment to the *Fairbanks Gold Mining, Inc., Reclamation Plan and Closure Plan, November 2013, Rev 2.* The amendment is provided as a separate document.

2.2 Wetlands

The FCEWRD location is in the mine's disturbed area, which does not include any wetlands.

3.0 REFERENCES

Knight Piésold Consulting, 2017, Fairbanks Gold Mining Inc. Fort Knox Project Fish Creek East Waste Rock Dump Report on Geotechnical Evaluation of Dump Construction over Existing Tailing, September 29, 2017.

Knight Piésold Consulting, 2013, Fairbanks Gold Mining Inc. Fort Knox Project Yellow Pup Waste Rock Dump Report on Geotechnical Evaluation of Dump Expansion over Existing Tailing, November 4, 2013.



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1,537.1	175	
1,544.2	250	
1,539.8	255	
1,536.7	260	
1,534.4	305	
1,530.1	315	
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HOMOGENEOUS, UNCONSOLIDATED ROM HILLS TO LOWER SLOPES AND ORGANIC MATERIAL AND DVERLIE ITTOMS.
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