TETRA TECH WARDROP

SEABRIDGE GOLD

Appendix E3

Open Pit – Pioneering and Pre-production

File Note

From: George Dermer

To: File

Date: January 11, 2012

Re: KSM Mitchell Pit Mine Pre-Production and Start-up plan

Summary:

Pre-Production mining for the first phase of the Mitchell pit can be started with dozer mining. The high-wall can then be mined using trucks, shovels, external roads and bench splitting to mine down to the elevation of the pit's first internal ramp.

This development requires a service road to the top of the mountain to be built before mining begins. Dozers will then develop a platform large enough for trucks and shovels to begin operating on. Waste is pushed off the edge of the mountain at first, but then used to build the external haul road.

The haul road starts at the 1305 elevation. It exits the pit at the 1275 elevation and continues to OPC at the valley bottom. The haul road is designed so that the switch-backs can be used as access points into the pit. The spacing of these access points, in conjunction with the pit design, ensures that a minimum mining width of 50m is maintained in all but 2 small locations.

The external road requires 31.5 Mt of fill. It is assumed that this material can come from the pre-production waste. There is 40 Mt of waste material above bench 1125 and no ore is present until bench 1080.

A schedule shows that this pre-production plan can be accomplished in 1.5 years from when the service road is complete.

Introduction:

The KSM Mitchell pit mines both sides of a valley with steep terrain. The first phase mines on the south side of the valley and goes below the valley floor. Phase 1 is initially accessed from the top and as mining progresses a haul road is built down to the OPC. This is explained in detail below.

Pioneering Access:

The initial access to the Mitchell pit is a service road built early in the pre-production stage. This road goes to the top of the Mitchell pit area.

In this plan an equipment pad area has been added to the April 25 pioneering plan. The reason for this addition is that the area at the top of the pit is used to provide service and support to equipment and working crews for significant time spans. The equipment pad is at elevation 1360 and is approximately 100X100 meters. It is a balanced cut/fill of 220 ktonnes.

Dozer Mining:

The top benches of Phase 1 are very thin, so mining will be started by dozers clearing an area large enough to establish truck and shovel mining. The dozers mine from 1380 to 1305 by casting waste down the hillside and by pushing waste out to the eastwards to start the haul road. This represents 3 million tons.

Trucks and shovels take over on the 1305 elevation, where the benches reach 100 meters wide. Like the dozers, the trucks will cast waste down the hillside and dump waste out to the eastwards to start the haul road. Benches 1305, 1290, and 1275 will connect to the external road with a ramp built in the edge of the cast off waste.

Figure 1 shows an orthogonal view of the proposed development at the top of the pit:

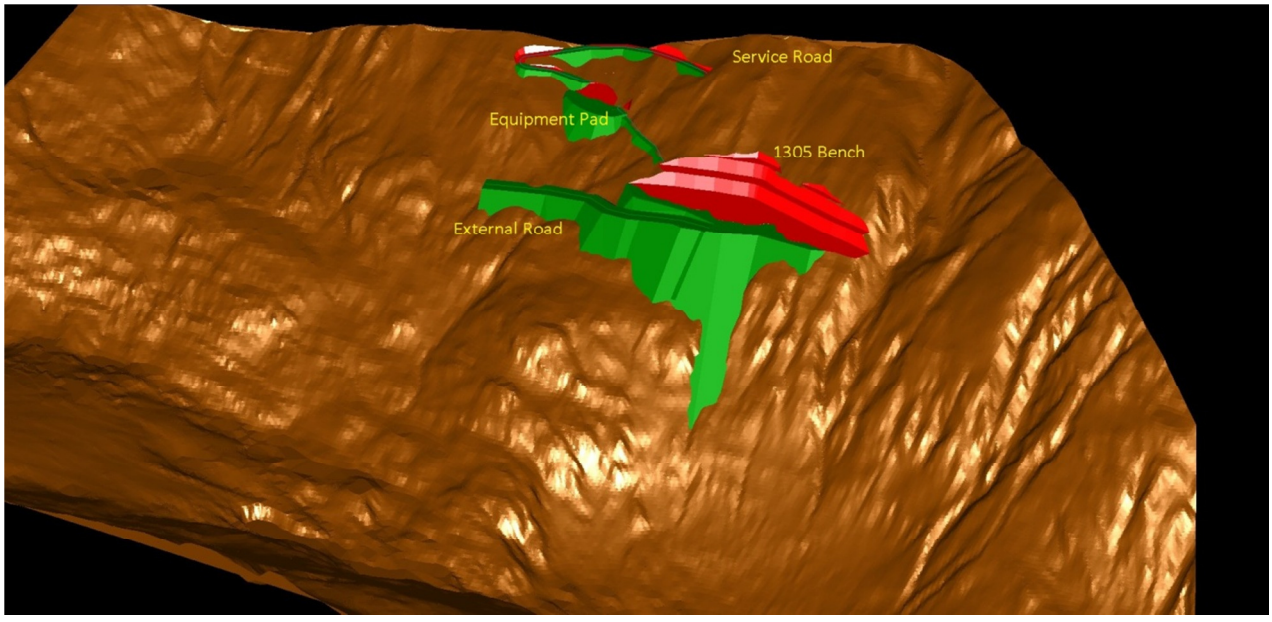

Figure 1

Bench Splitting:

The benches near the top of Phase 1 of the Mitchell pit are neither wide enough nor long enough to include a network of internal access roads. Therefore an external road is required. The external road is designed to minimize re-handle by building as much as possible outside the final pit limits. The external road design requires 31.5 Mt of fill. The design is described further in the next section of this report.

A service road is also built to connect the facilities at the top of the pit to the external haul road. A draft of this road has been designed which is a reasonably balanced cut/fill of 280 ktonnes.

Bench splitting starts with an internal road built downwards from 1275. This road crosses the mining area 3 times using switchbacks to connect again with the external road on bench 1125.

The waste from Benches 1260 through 1125 is hauled up to the connection to the external road at elevation 1275 and then be used to fill out the external road proceeding downwards. This represents 19.5 Mt

Figure 2 shows an orthogonal view of the mining on benches 1260 through 1125:

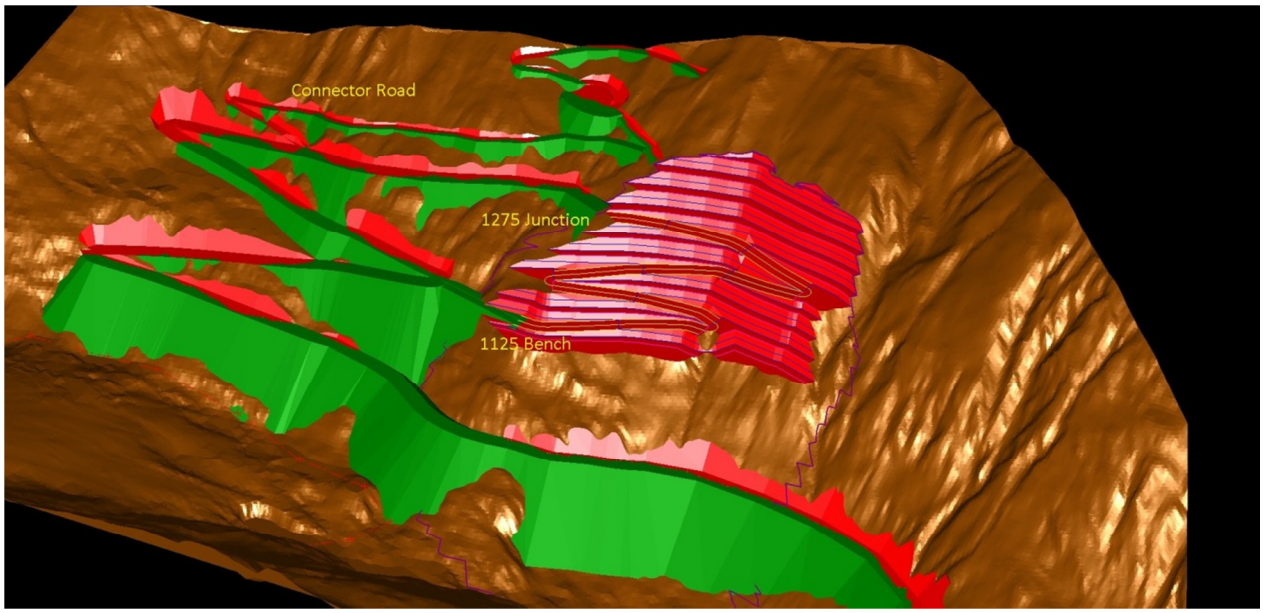

Figure 2

This first pass at bench splitting cannot be carried on further downwards than bench 1125 because minimum mining width cannot be maintained lower than this. Therefore the next stage is mining of the road previously built into benches 1260 through 1125. These benches will be mined back to the Mitchell Phase 1 final wall location. Mining will be from the top down, with waste being hauled onto and down the external road using the connection at bench 1125. This represents 18 Mt. During this stage the haul road to the OPC should be completed (see next section).

Figure 4 shows the pit after the first stage of road mining. At this stage the external road is complete to the OPC. This allows ore access to the OPC.

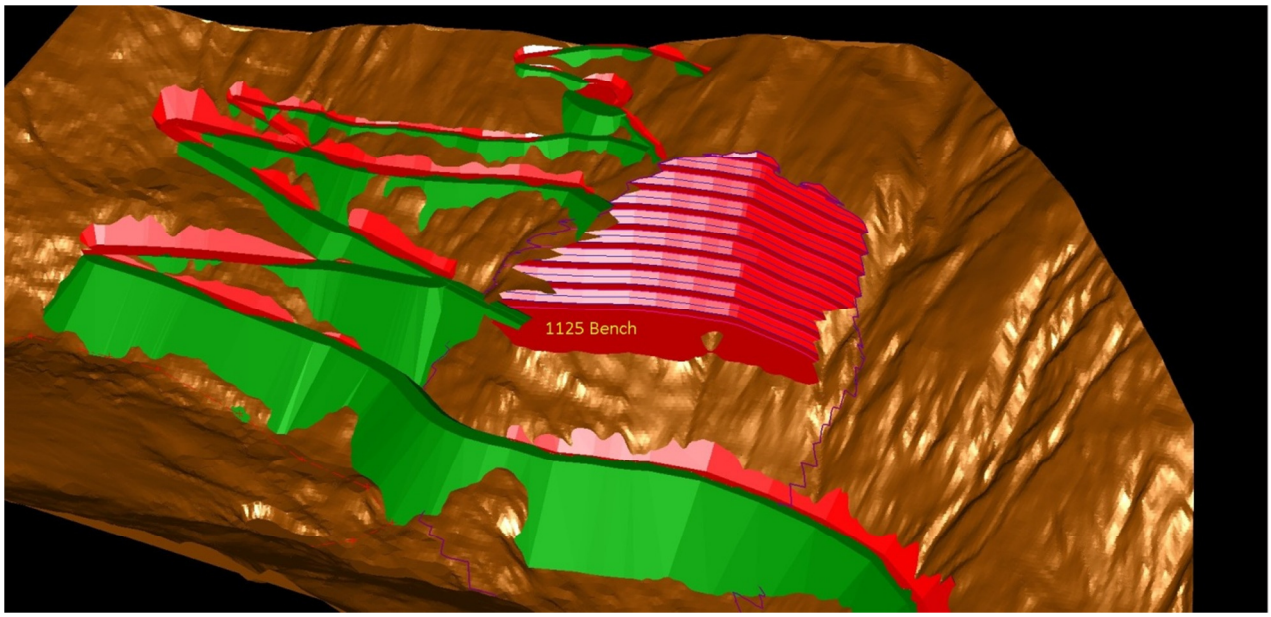

Figure 3

The bench splitting process then repeats itself for benches 1110 through 1005, as shown in figures 5 and 6. The first pass (waste hauled upwards to 1125) represents 18.2Mt of waste and 5.4 Mt of ore. The second pass (hauling downwards to 1005) represents 14.5Mt of waste and 6.3 Mt of ore. Ore is first encountered on bench 1080.

The pit's internal road network begins at bench 990.

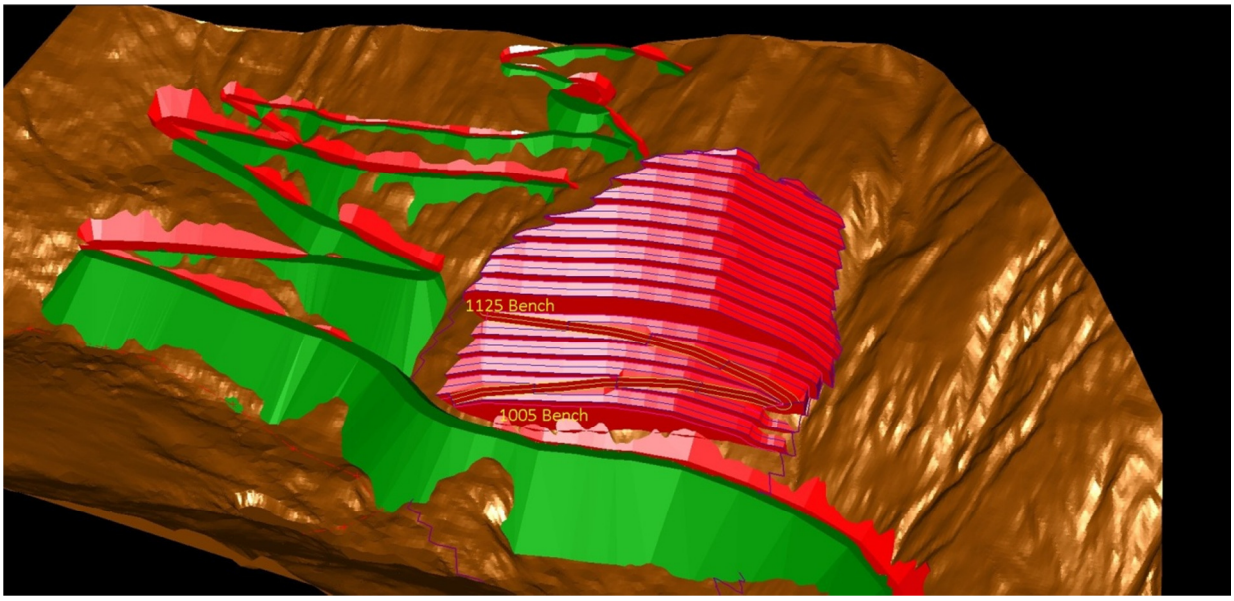

Figure 4

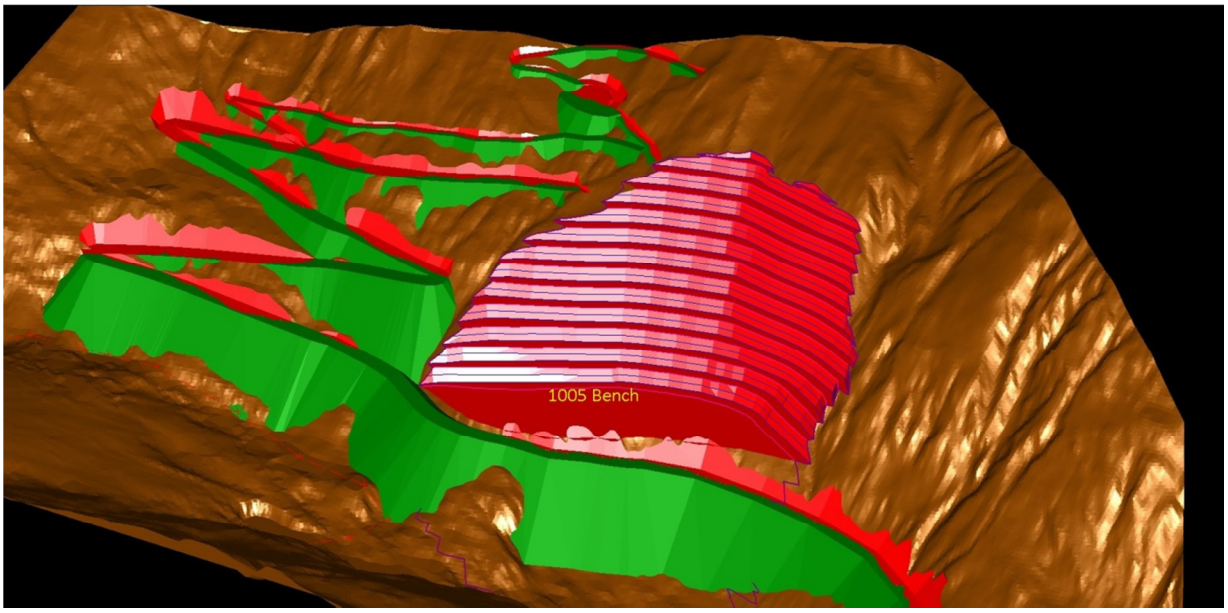

Figure 5

Table 1 summarizes the tons and type of material in each stage of the proposed bench splitting process. Note that Stage 2 includes re-handling the waste from the dozer mining.

Table 1

Stage	Waste Mt	Ore Mt
1. Initial Dozer Mining	1.81	0
2. First Bench Split Pass 1	22.63	0
3. First Bench Split Pass 2	18.01	0
4. Second Bench Split Pass 1	18.17	5.4
5. Second Bench Split Pass 2	14.56	6.34

Most of the mining in this plan is in width's greater than 100 meters. Some exceptions occur in stages 2 and 3. In Stage 2 there are benches with thin edges. The worst of these is shown in Figure 6, which shows a plan view of bench 1200. The radius of the cursor is 50 meters, showing that some portions of the western edge of the bench are 30 meters wide. In Stage3 there are sections of retreat road mining that are only 35 meters wide. This is shown in figure 8. Mining these widths is not ideal, but should not present a significant challenge for the Ex5500 shovels which will be used here.

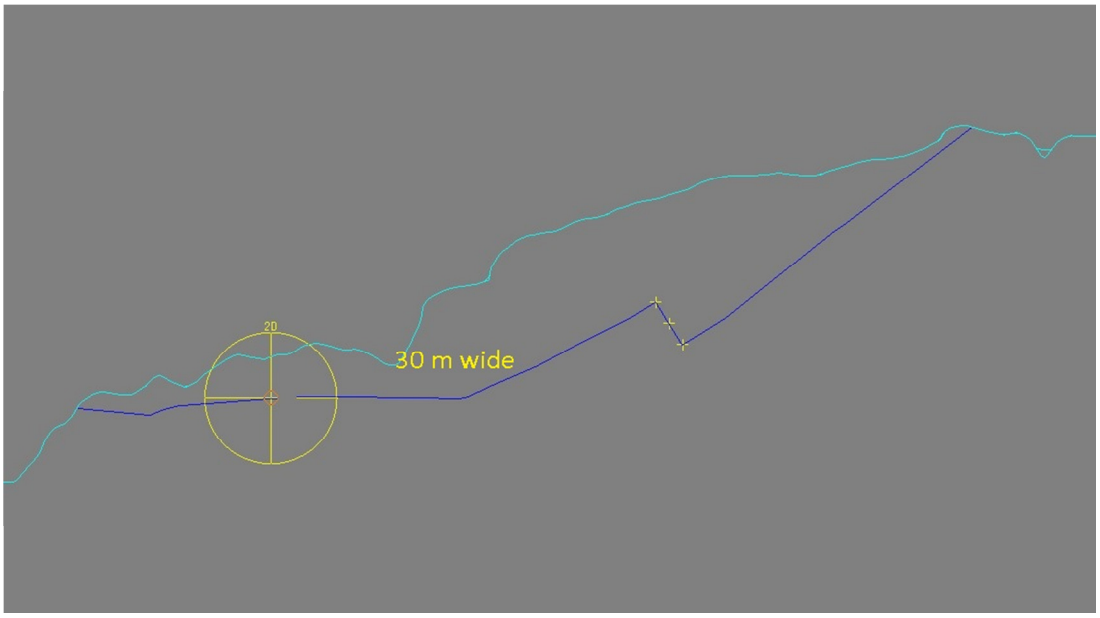

Figure 6- Bench 1200

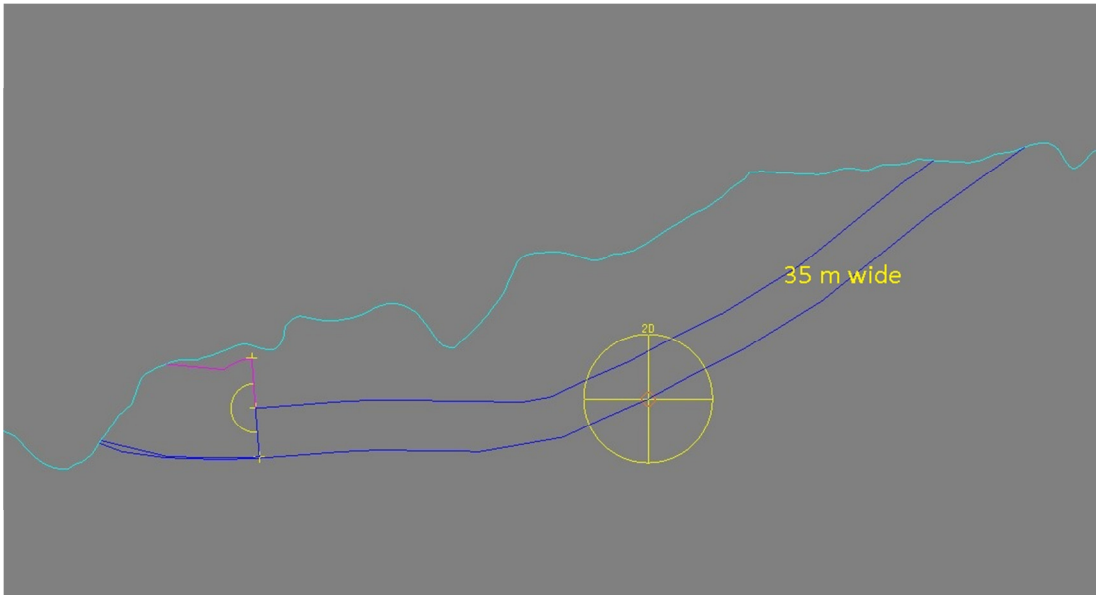

Figure 7- Bench 1230

The External Road:

The external road matches the project design basis specifications for a haul road: 38.2 meters wide, maximum grade of 8%. The cut and fill angles also come from the project design basis.

To be conservative the switch-backs are drawn flat. The road requires 31.5 million tonnes of fill. This quantity of waste will have been mined when Stage 3 is complete. The toe of the external road does not fill out onto the glacier. The max fill height is 180 meters, with many areas requiring 150 meters. The max cut height is 67 meters, with many areas requiring 40-50 meters. 3.7M tonnes of cut are required. Figure 7 shows a plan view of the road.

Figure 7 shows a plan view of the road.

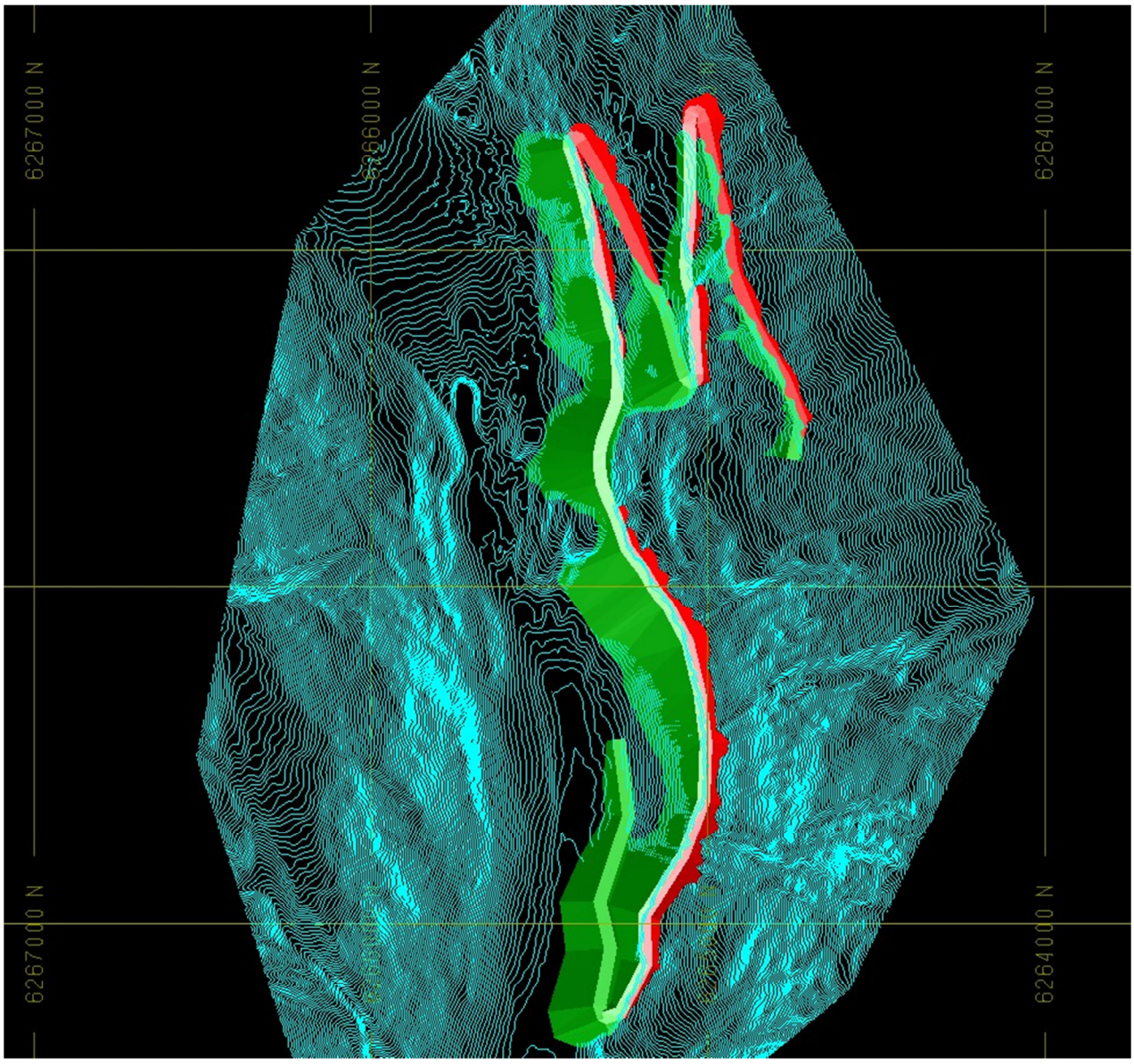

Figure 8

The design of the external road has an important role in dictating the mining plan. Following is a list of considerations that went into the design of the external road:

The bench splitting sequences must reach from one switchback in the external road to the next, but the vertical limit of each sequence is limited by the width of the designed benches. Therefore, for the given pit design, the road's switchbacks cannot me spaced any further apart in elevation.

The terrain is very steep, and steeper than the road's fill angle in many areas. Adding switch-backs to the external road would substantially increase the amount of fill required.

The road's fill cannot spread out over the glacier in Mitchell Valley, therefore the eastern switch backs must be built as cuts. This is also another reason why more switchbacks cannot easily be added to the road.

Pre-Production Schedule:

A preliminary schedule shows that the pre-production sequence described in this report will take approximately 1.5 years from when the initial service road to the top of the mountain is complete.

The following major equipment is used:

- 3 D10R Dozers
- 2 Ex5500 Shovels
- 1 Rh400 Shovel

The following assumptions were made:

- The critical path is determined by constraints on dozing and loading (shovel) performance.
- Ex-pit road construction will not delay the schedule.
- 24 hour/day, 365 day/year work schedule are in effect for the whole pre-production period.
- Production rates have not been de-rated to account for start-up inefficiencies or thin mining areas.
- There will be enough haul trucks available to maintain optimum loading rates.

The next table explains the schedule. Note that the Stage 5 is not part of the pre-strip. Ore access is achieved at the end of Stage 4. At the end Stage 4 the shovels will have built a 5Mt ore stockpile and be on a bench with a strip ratio of 0.4

Table 2

Stage	Start Bench	End Bench	Total kTons	Equipment	Days required
Dozer Mining	1380	1320	1811	3X D10R Dozers	46
First Bench Split	1305	1125	22630	2X Ex5500 Shovels	187
2nd Pass	1305	1125	18007	2X Ex5500 Shovels	149
Second Bench Split	1110	1005	23562	1 Rh400 and 1 Ex5500 Shovel	144
Total			**66010**		**526**
2nd Pass	*1110*	*1005*	*20901*	*1 Ex5500 Shovel*	*244*

File Note

From: Blair Woodhurst

To: Jesse Aarsen

Date: December 20, 2011

Re: KSM Kerr Pit Mine Pre-Production and Start-up plan

Introduction

The following document presents a pre-production development-sequence design of the Kerr Pit. The development sequence borrows some road/pioneering access designs from previous work, as well as incorporating new design work on the initial access for large mine equipment to the top most benches of the Kerr Pit. Material quantities and access road lengths are provided, and in the case of the initial "pre-strip" pit, equipment productivities are applied to material quantities in order to arrive at a basic estimate of the length of time needed for these pre-production activities.

Pioneer Access

Access to the Kerr Pit area is to be established via a service road as described in previous work (MM Filenote - Pioneering and pre-production for KSM pits – 110509).

The top most benches of the Kerr Pit must be stripped in order to provide a large enough mining area for large mining production shovels and trucks to begin moving material. This "pre-stripping" will be done with bulldozers. The bulldozers will achieve access to the top benches via a pioneer road. Additionally, this pioneer road is to provide access for drilling, blasting, and fueling equipment.

The pioneer access will be established in two sections; a lower portion established at a grade of 8% and an upper portion at 12%. The lower portion will later be widened and improved to function as a part of the large haul equipment access.

Dozer/Pioneer Road	Length	Grade
	(m)	(%)
Lower Section	1,951	8%
Upper Section	4,585	12%
Total Length	6,536	

Table 3 - Pioneer road length and grade by section

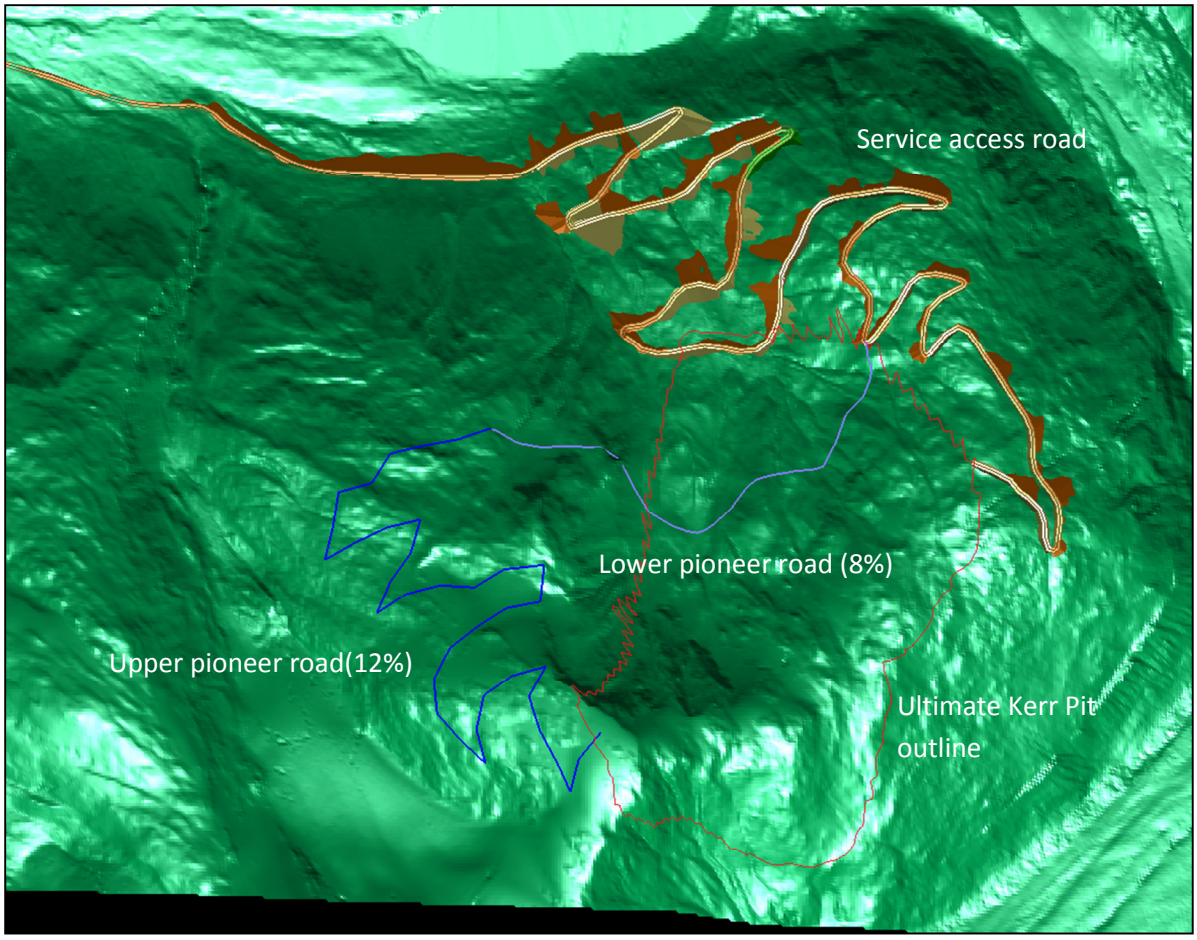

Figure 3 - Kerr Pit service and pioneer access road layout

Pre-Strip Pit

Once the pioneer-access to the top benches of the Kerr pit has been established, pit material will be drilled and blasted, and pushed out of the pit area by bulldozer. The top six and half benches of the final Kerr Pit design will be stripped in this way. The material removed will form the fill section of a wider road that will establish access for the large load/haul equipment. This initial pre-strip work establishes a mining area that is large enough to allow suitable working room for the large production equipment, at which point conventional large shovel and truck mining can proceed.

Pre-strip Pit	Cut Volume	Cut Tonnage
	(BCM)	*(tonnes)*
Totals	3,955,266	10,916,535

Table 4 - Pre-strip pit material quantities

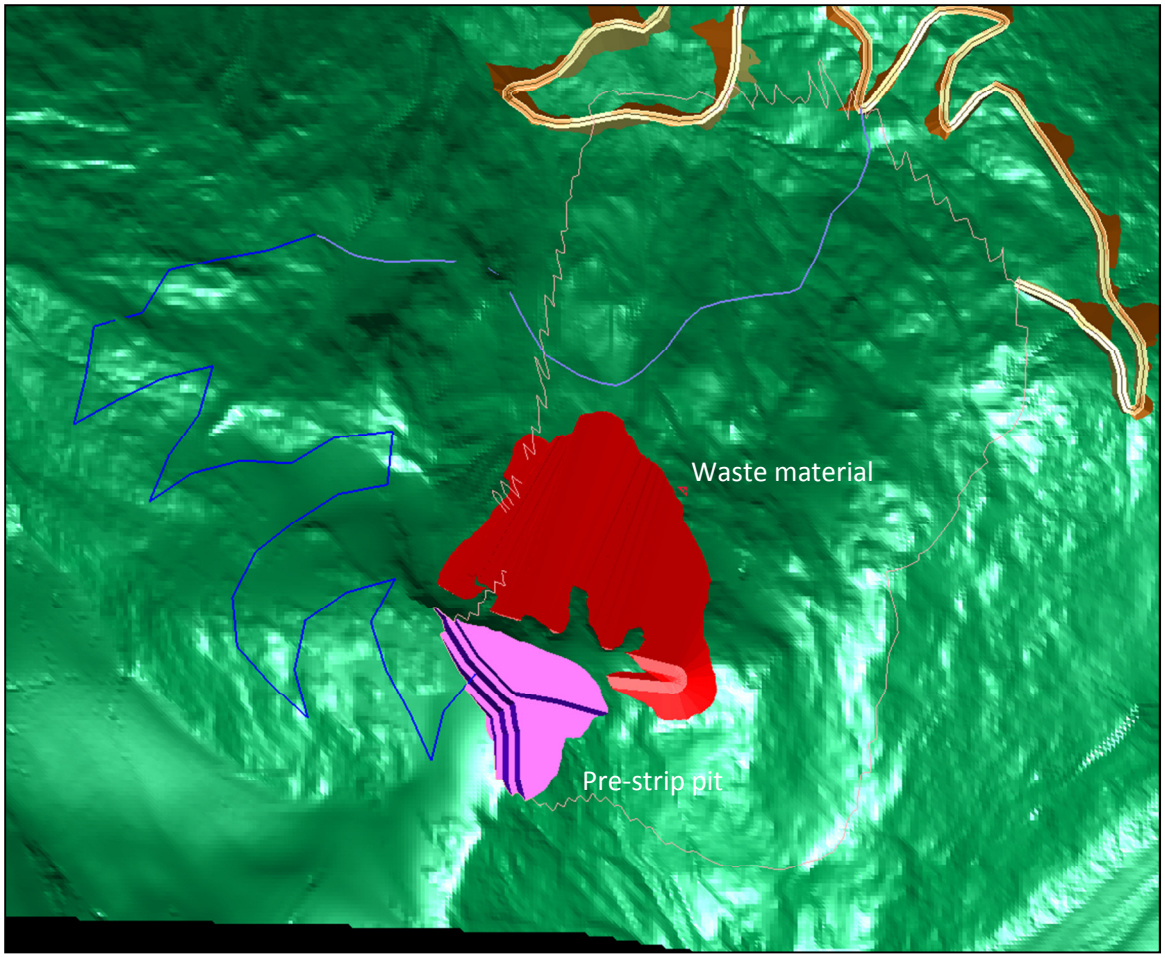

Figure 4 - Pre-strip pit and waste design

Road Cut Development

During the initial dozer stripping of the top benches, the dozing equipment will also cut a switch back across the north side of the peak allowing final full access.

Road Cut Volume	Cut Volume	Cut Tonnage
	(BCM)	*(tonnes)*
Totals	1,652,214	4,560,111

Table 5 - Road cut material quantities

Waste Fill	Cut Volume	Cut Tonnage
	(LCM)	*(tonnes)*
Totals	6,660,859	15,319,977

Table 6 - Waste fill material quantities

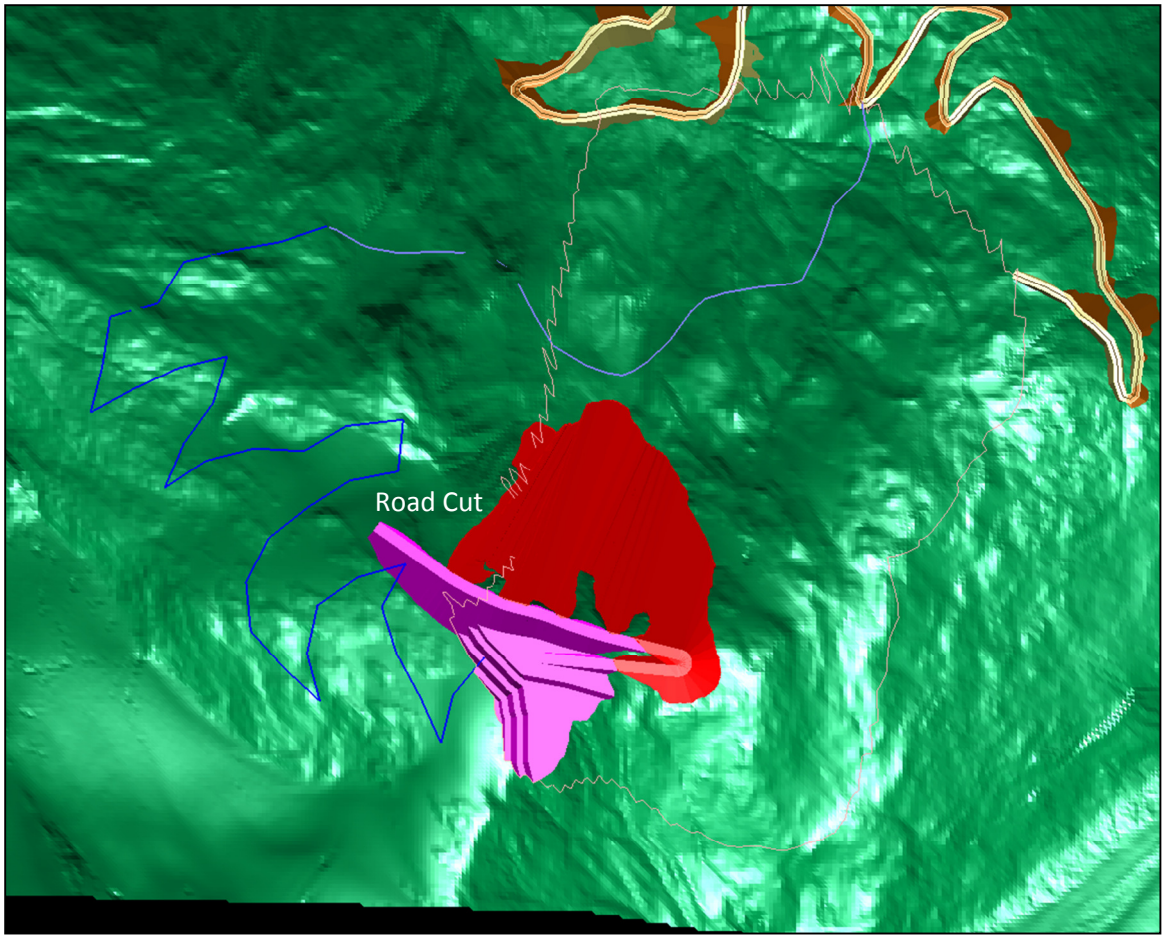

Figure 5 - Road cut and large equipment pit access

Haul Road Access

A haul road will need to be established for regular production equipment to have access. The construction of this external haul road could be performed in parallel with the pre-stripping activities or conducted subsequently, depending on the required development timeline. It should be noted however that the cast material from the upper benches is expected to travel down the slope and end up close to the area of the lower section of this haul road. Precise construction timing of that section of road is needed to accommodate this hazard.

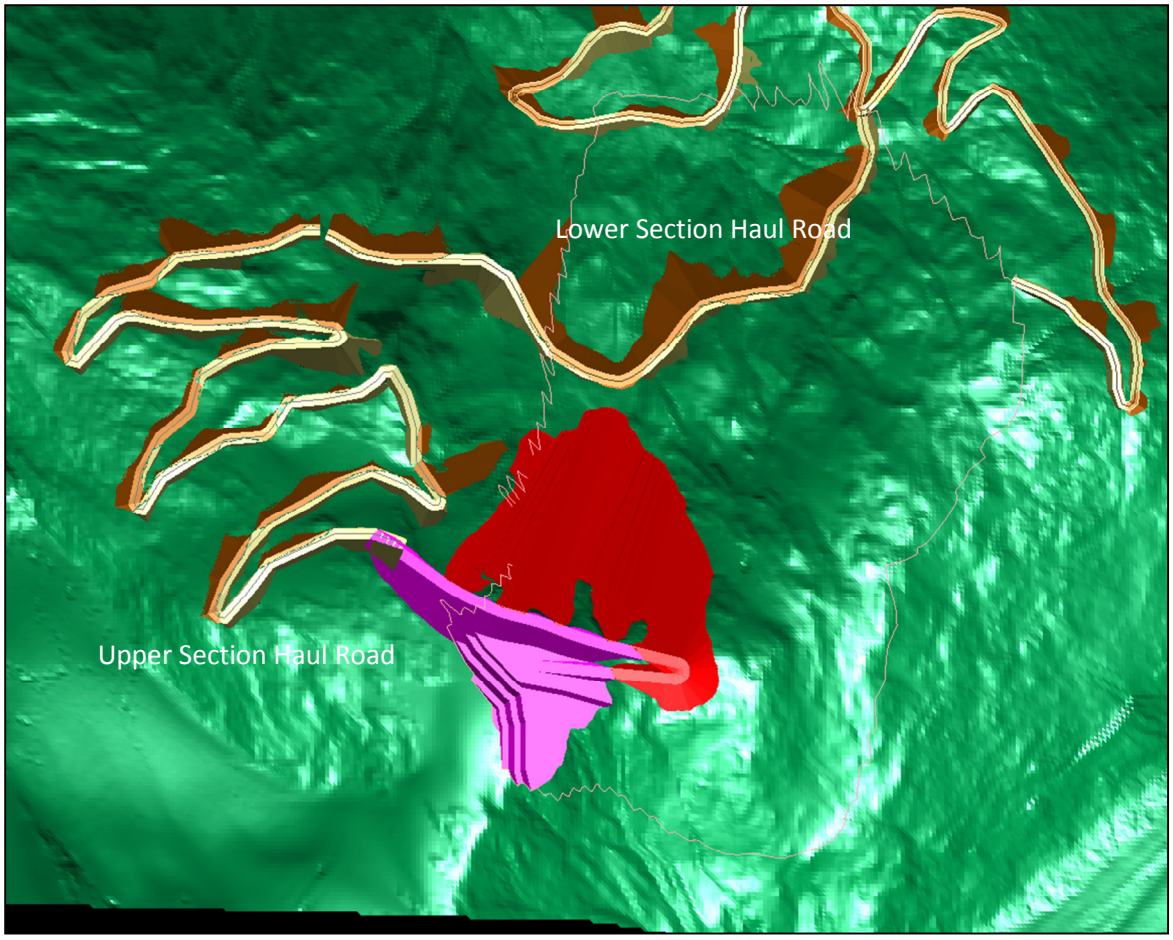

Figure 6 - Established large load/haul equipment to the top benches of the Kerr Pit

Single Lane Haul Road		
Width	28.5	(m)
Grade	8%	
Fill angle	37	(deg.)
Cut angle	50	(deg.)
Road cut	1,620,093	(BCM)
	4,471,458	(tonne)
Road fill	1,878,081	(LCM)
	1,565,068	(BCM)
	4,319,587	(tonne)
Length		
Upper section	4,825	(m)
Lower section	1,951	(m)
Total length	6,776	(m)

Figure 7 - Haul road design parameters and quantities

Pre-strip Pit Equipment Activity

Previously derived large bulldozer productivities (2012 KSM PFS - dozer prods.xlsx) are used here to calculate an estimated time needed to complete the material movement in the pre-strip pit. The productivity numbers used in this calculation are de-rated for a number of factors;

Productivity De-Rates Accounted for in Productivity Calculation		
Parameter	Value	
Availability	85%	(%)
Altitude	1067	(m)
Job Efficiency	83%	(%)
Skill Level	85%	(%)

Table 7 - Productivity de-ratings accounted for in equipment productivity simulation

Pre-Strip Development:								
Bench Toe Elevation	Cut Volumes	Cut Tonnage	Avg. Push Dist.	Productivity	Equip. Hr.	# Dozer	Hr. per Day	Implied days
(m)	*(BCM)*	*(tonnes)*	*(m)*	*(BCM/hr)*	*(hr)*	*(-)*	*(hr/day)*	*(day)*
1905	81,846	225,895	80	170	481	2	48	10
1890	405,507	1,119,201	100	138	2,938	2	48	61
1875	557,688	1,539,218	100	138	4,041	4	96	42
1860	725,025	2,001,069	120	115	6,305	4	96	66
1845	772,525	2,132,170	120	115	6,718	4	96	70
1830	909,200	2,509,391	120	115	7,906	4	96	82
1815	503,475	1,389,591	60	223	2,258	4	96	24
Sub-Total	3,955,266	10,916,535			30,647			355
Road Cut Volume	1,652,214	4,560,111	20	570	2,899	2	48	60
Total:	5,607,481	23,508,868	Total Equipment Hours:		33,546		Total Days:	415