

Appendix E4

Open Pit – Mine Equipment

FILENOTE

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Re: Seabridge Gold: KSM – Mine support and ancillary equipment fleet

1. Introduction

The purpose of this filenote is to detail and quantify the mine support and ancillary equipment. Mine support equipment is attached to the major mining areas: drilling/blasting, loading, and hauling. The quantities of equipment are shown in Table 1: Mine Support Equipment. The ancillary equipment supports the mine site in-pit and in general maintenance functions. The quantities are shown in Table 11: Mine Ancillary Fleet.

2. Mine Support Equipment

The following table shows the support fleet quantities in year 5 and year 10:

Fleet	Major Area	Year 5	Y10
Hole Stemmer – 3 tonnes	Blasting / Drilling support	2	3
Track Dozer – 430 kW	Loading Support	6	5
Rubber Tired Dozer – 350 kW	Loading Support	3	4
Fuel/Lube Truck	Loading Support	3	2
Wheel Loader Multipurpose – 14 t	Loading Support	3	3
Water Truck – 20,000 gal	Haul support	2	2
Track Dozer – 430 kW	Haul Support	4	4
Motor Grader – 400 kW	Haul Support	4	4
Tire Manipulator	Haul Support	3	3

Table 1: Mine Support Equipment

2.1. Equipment Function and Quantity Rationale

Blast Hole Stemmers:

Function: Blast hole-stemmers with the ability to lift approximately 2 t of material are included in the fleet. After the blast holes have been loaded with blast material and charged, the hole-stemmer takes drill cuttings and fills the top portion of the blast holes. The capping contains the blast to within the hole and channels it outward through the ground, rather than out of the top of the hole.

Quantity: Drilling production is estimated to be one hole per 45min and a small volume of material is required per hole. A typical 2t stemmer can move more than the required volume of material, but the drills operate spread throughout the mine

site, so it is assumed production requirements will be met by one hole-stemmer per three drills.

Years	-5 to -1	1-5	6-10	11-15	16-20
Fleet Allocated Primary and Secondary Drills:	4	6	6	4	4
Blast hole-stemmer	1	2	3	3	3

Table 2: Blast hole-stemmer Quantity

Track Dozers:

Function: A fleet of 430kW track dozers supports both dump and shovel operations. Loading support dozers prepare drill ramps, maintain pit floors, trap load shovels, and push out haul routes as the shovels progress through the pit phases.

Haul Support, or dump dozers, maintain the operating surface of the dump and assist in spotting the trucks as they back into the dump crest. The dozers build lateral impact berms, level free-dumped material at the top surface of the dump, fill slumping or settled areas, and maintain the haul routes within the dump.

The dozers rip material as required. The productivity and required hours of ripping are not estimated since it assumed all material will be blasted. It is also assumed that the chosen fleet has required ripping hours available when needed.

Quantity:

Loading Support: It is assumed that one dozer for every two shovels are sufficient. This is based on two shovels per pit, or per pit area, as is common practice in large operations. An additional dozer is added for availability as shown in the table below:

Years	-5 to -1	1-5	6-10	11-15	16-20
# Primary Shovel	2	5	5	5	5
430kW Dozers	*6	*6	6	6	6

Table 3: Loading Support Dozers

***Note:** Year -7 to year 5 of the MMTS cost model overwrites this formula based on required dozer hours and duties during pioneering and preproduction phases.

Haul Support: Dozing requirements on the RSF surfaces are met using approximately one dozer for every two shovels below in Table 4: Haul Support Dozers.

Years	-5 to -1	1-5	6-10	11-15	16-20
# Primary Shovel	2	5	5	5	5
430kW Dozers	3	4	4	4	4

Table 4: Haul Support Dozers

Rubber-Tired Dozers:

Function: The rubber-tired dozers are primarily used to clean up spill rock around the shovel faces. Loose rock on haul routes and at the shovels cause tire failures on haul trucks and rubber-tired dozers minimize this expense.

Quantity: It is assumed that one rubber-tire dozer for every two shovels meets production requirements as shown in the table below:

Years	-5 to -1	1-5	6-10	11-15	16-20
# Primary Shovel	2	5	5	5	5
350kW Rubber Tire Dozer	1	3	3	3	3

Table 5: Rubber Tire Dozer Quantity

Motor Graders:

Function: 400 kW motor graders are used to maintain haul roads within the mining pits and on all routes to the ore crusher, ore stockpile, and waste destinations. The graders ensure the routes are free of debris and that they conform to the design parameters of the routes for cross-section and grade. The graders are also used occasionally to level benches and waste dumps that have been excavated or dumped off design targets.

Quantity: Table 6: Road and Grader Quantities show the estimated number of graders. This was determined from first principles.

Years	-5 to -1	1-5	6-10	11-15	16-20
400 kW Graders	2	4	4	4	4

Table 6: Road and Grader Quantities

Tire Manipulator:

Function: Wheel loaders fitted with tire manipulators are used to change tires on the rubber tired fleet and move tires where required throughout the mine site.

Quantity: Estimated based on an approximate number of large-tired equipment hours per year.

Years	-5 to -1	1-5	6-10	11-15	16-20
FEL - Tire Manipulator	1	2	3	3	3

Table 7: Tire Manipulator Quantity

Multipurpose Wheel Loader:

Function: Wheel loaders with a capability of approximately 14 t per bucket are included in the fleet. The wheel loaders will come with a variety of quick-coupling attachments such as a bucket, cable reeler, fork tines, and cleaning brush. These attachments allow the wheel loaders to move earth, assist in electric shovel and drill moves, move equipment and supplies, and clean and clear shop and office areas. The wheel loader also feeds blasted rock to the crusher for road grading material.

Quantity: Assume a one loader stationed at the maintenance shop, and other loaders at separate locations for miscellaneous duties as shown in the table below:

Years	-5 to -1	1-5	6-10	11-15	16-20
FEL – Multi-purpose	1	3	3	3	3

Table 8: Quantity of Multi-purpose Wheel Loaders

Fuel Lube Trucks:

Function: Articulated trucks outfitted with fuel/lube arrangements are included in the mine operations support fleet. These fuel/lube trucks are used to provide lubrication maintenance to mining equipment while in the pit and in other working areas on site. The articulated trucks are chosen for navigation into working areas that may not be possible with standard flatbed semi-trucks. The size of the trucks is dictated by the fuel/lube arrangement that is included to support the large hydraulic and cable shovels, large haul trucks, large track and wheel dozers, and large motor graders.

Quantity: Assume two trucks are sufficient throughout the LoM for fueling and lubrication of major equipment as shown in Table 9: Quantity of Fuel/Lube Trucks.

Years	-5 to -1	1-5	6-10	11-15	16-20
Fuel/Lube Truck	1	3	2	2	2

Table 9: Quantity of Fuel/Lube Trucks

Water Trucks:

Function: Rigid-frame trucks outfitted with 20 000gal water bodies are included in the fleet. Airborne dust kicked up along haul routes creates visibility and environmental issues. To minimize this, the water trucks spray the road surfaces routinely. The size of the water bodies are chosen to correspond to the width of the roads and the distance of the road to the waste dump.

Quantity:

Years	-5 to -1	1-5	6-10	11-15	16-20
Water Trucks:	1	2	2	2	2

Table 10: Quantity of Water Trucks

3. Mine Ancillary Fleet

Fleet	Function	Y-01	Y05	Y10
Track Dozer – 430 kW	Pit Support	2	2	2
Float Tractor/Trailer – 189 t	Float Tractor & Trailer	1	1	1
Hydraulic Excavator – 382 kW	Utility Excavator	2	2	2
Sump Pump – 110 kW	Pit Sump Dewatering	3	6	6
Light Plant - 20 kW	Lighting Plant	4	6	10
250 t Crane	Utility Crane	1	2	2
Crew Cab	Supervision and Crew Transportation	15	18	18
Ambulance	Ambulance	1	1	1
Hydraulic Excavator – 283 kW	Utility Excavator	4	4	3
Mine Rescue Truck	Rescue Truck	1	1	1
Crew Bus	Crew Bus	3	4	4
Maintenance Truck – 1 t	Maintenance Truck	3	5	5
Fire Truck	Fire Truck	1	1	1
Screening & Crushing Plant - 12" max.	Road Crush & Stemming	1	1	1
Picker Truck	Maintenance + Overhauls	1	2	2
Scraper – 345kW	Snow removal, road maintenance	3	5	5
Crane 40 t Hydraulic Extendable	Utility Crane	2	2	2
Wheel Loader – 373 kW	Crusher (Road Crush) Loader	1	1	1
Snowcat	Winter Off Road Crew Transport	3	6	6
100 t Crane	Utility Crane	1	2	2
Forklift – 30 t	Forklift	1	1	1
Forklift – 10 t	Forklift	2	2	2
Service Truck	Service Truck	2	5	3
Welding Truck	Welding Truck	2	4	4
Powerline Truck	Powerline Maintenance	2	2	2

Table 11: Mine Ancillary Fleet

3.1. Ancillary Fleet Function and Quantity Rationale

Track Dozer 430kW:

Function: The 433 kW dozers will be used for pit utility work including road maintenance, road construction, towing vehicles, dozing snow, and cutting ditches.

Quantity: Assume one dozer roaming and one available at shop as shown in the table below:

Years	-5 to -1	1-5	6-10	11-15	16-20
TRACK DOZER - 430kW	2	2	2	2	2

Table 12: Track Dozer Quantity

Float Tractor and Trailer:

Function: One rigid frame tractor and flatbed trailer is included in the fleet. This unit is utilized for transporting tracked equipment throughout the various mining pits and working areas. Whenever possible, all long distance movement of tracked equipment is accomplished with the flatbed.

Quantity: Assume 1 unit for life of mine is sufficient.

Hydraulic Excavator 382 kW:

Function: Hydraulic excavators with approximately 7-9 t bucket size are included in the fleet. This equipment digs ditches along the haul routes for dewatering of the routes as described in the section on haul route design, helps to construct small earth structures and ramps within the pits and mine operations areas, and assists with the excavation of sumps and other small excavations where required.

Quantity: Assume 2 excavators roaming for miscellaneous duties.

Years	-5 to -1	1-5	6-10	11-15	16-20
HYDRAULIC EXCAVATOR – 382 kW	2	2	2	2	1

Table 13: Excavator Quantity**Sump Pump 110kW:**

Function: Pumps standing water from pits, dumps, roads or miscellaneous excavations as required.

Quantity: Assume 2 pumps per pit; add 2 for miscellaneous excavations, availability and severe weather backup, as shown in Table 14: Sump Pump Quantities:

Years	-5 to -1	1-5	6-10	11-15	16-20
SUMP PUMP - 110kW	3	6	6	6	6

Table 14: Sump Pump Quantities**Light Plant:**

Function: Light plants will be required to provide lighting on the dumps and intermittently in the pits for road construction, and field maintenance.

Quantity: Assume 1.5 light plants per haul support dozer, plus two roaming as shown in the table below:

Years	-5 to -1	1-5	6-10	11-15	16-20
LIGHT PLANT - 20kW	4	6	10	10	10

Table 15: Light Plant Quantity**Mobile Cranes:**

Function: Two mobile cranes with the ability to lift 250 t components at least 20 m in height and two mobile cranes with the ability to lift 100 t components at least 20 m in height are included in the fleet. The cranes are required to lift equipment components for the initial field erection of the equipment and for major component change-out, especially for the shovels. The cranes are also used to lift the equipment itself in order to block it off for maintenance work. Mobile extension cranes with the ability to lift up to 40 t will be used for field maintenance in-pit.

Quantity: Assume two of each crane type generally for the LoM.

Years	-5 to -1	1-5	6-10	11-15	16-20
MOBILE CRANE - 250t	1	2	2	2	2
MOBILE CRANE - 100t	1	2	2	2	2
MOBILE CRANE - 40t	2	2	2	2	2

Table 16: Mobile Crane Quantity

Diesel Crew Cabs:

Function: Diesel crew cabs are used for transportation of mine maintenance, technical, and managerial personnel around the mine site.

Quantity: Assume approximately one truck per ten maintenance personnel and one truck per five technical and managerial personnel. The quantity is shown in the table below.

Years	-5 to -1	1-5	6-10	11-15	16-20
CREW CAB	15	18	18	18	18

Table 17: Diesel Crew Cab Quantity

Mine Safety Fleet:

Function: One ambulance, one fire truck, and one mine rescue truck are used to maintain the safety of personnel and equipment working at the mine site. The quantities in the table below do not include units required for other areas of the operation.

Years	-5 to -1	1-5	6-10	11-15	16-20
AMBULANCE	1	1	1	1	1
MINE RESCUE TRUCK	1	1	1	1	1
FIRE TRUCK	1	1	1	1	1

Table 18: Mine Safety Fleet

Crew Bus:

Function: Crew busses transport personnel during shift changes from the mine dry to the operating areas of the mine.

Quantity: Assume all salary personnel are dayshift, all other mine areas split for day and night shift in Table 19: Crew Bus Quantity:

Years	-5 to -1	1-5	6-10	11-15	16-20
CREW BUS	3	4	4	4	4

Table 19: Crew Bus Quantity

Maintenance Truck:

Function: 1-ton pickup maintenance trucks are used to transport maintenance items and miscellaneous goods throughout the mine site, also commonly known as a warehouse truck.

Quantity: Assume one per shop, one per operating pit, and one roaming for LoM as shown in the table below.

Years	-5 to -1	1-5	6-10	11-15	16-20
MAINTENANCE TRUCK - 1t	3	5	5	5	5

Table 20: Maintenance Truck Quantity

Screening and Crushing Plant:

Function: A Screening plant and crusher is included in the fleet with the ability to produce ¾” and 3” material for road grading material and blast hole stemming. The screening plant will be fed by a hydraulic excavator or front end loader.

Quantity: Assume up to two plants during peak activity periods.

Years	-5 to -1	1-5	6-10	11-15	16-20
Screening and Crushing Plant	1	1	1	1	1

Table 21: Screening and Crushing Plant Quantity

Picker Truck:

Function: Two trucks outfitted with picker arms are included in the fleet. They are used by maintenance personnel to lift components into equipment in the field. They are also used to lay small pipeline and transport heavier goods into the field that require lifting to larger heights than can be achieved by the wheel loader.

Quantity: Assume two picker trucks are sufficient for LoM. See Table 22:

Years	-5 to -1	1-5	6-10	11-15	16-20
PICKER TRUCK	2	2	2	2	2

Table 22: Picker Truck Quantity

Scraper 345kW:

Function: Scrapers with the ability to haul 37 t are required to haul and spread crushed rock material along the roads after heavy snowfall to ensure adequate traction. The scrapers also remove large amounts of snow from the haul roads and mine working areas as necessary. If required, they can also be used for earth moving and grading.

Quantity: A function with variables for the blade width, number of haul road and access road passes per day including availability and efficiency factors is used to determine a length of road per day that one scraper serves. Table 23 below shows the quantity of scrapers required:

Years	-5 to -1	1-5	6-10	11-15	16-20
345kW Scraper	3	5	5	5	5

Table 23: Scraper Quantity

Wheel Loader – 373kW:

Function: One wheel loader with an approximately 14 t bucket is included in the fleet. The wheel loader is utilized during snowfall periods to clear snow from the plant area and truck shop, as well as ancillary routes within the mine. The wheel loader is also used to load the crusher described above.

Quantity: Assume one loader stationed at maintenance shop meets production requirements. See Table 24 below.

Years	-5 to -1	1-5	6-10	11-15	16-20
WHEEL LOADER - 14t	1	1	1	1	1

Table 24: Wheel Loader Quantity

Snow-Cat:

Function: Snowcats with the ability to transport up to eight passengers are included in the fleet. The snowcat is used to transport operators to equipment that is in a location that is inaccessible to the crew bus or vans because of heavy snowfall.

Quantity: Assume up to six snowcats over the LoM.

Years	-5 to -1	1-5	6-10	11-15	16-20
SNOWCAT - 8 passenger	3	6	6	6	6

Table 25: Snowcat Quantity

Forklifts:

Function: One forklift with a 30 t capacity and two forklifts with a 10 t capacity are included in the fleet. The forklifts are used in the warehouse and around the maintenance shop to assist in the transportation of machine components and other goods. Many machine components exceed the 10 t weight limit of the smaller forklift, thus the need for the larger one. Most stocked items are under the 10 t limit of the smaller forklift.

Quantity: Assume one 30t forklift and two 10t forklifts for LoM.

Years	-5 to -1	1-5	6-10	11-15	16-20
FORKLIFT - 30t	1	1	1	1	1
FORKLIFT - 10t	2	2	2	2	2

Table 26: Forklift Quantity

Service Truck:

Function: Service trucks outfitted with service units are included in the fleet. These units include the tooling required for maintenance personnel to perform service of other equipment in the field and will be used by maintenance personnel to perform service of other equipment in the field.

Quantity: Assume one truck for every two shovels, one for maintenance shop, and one roaming as shown in Table 27.

Years	-5 to -1	1-5	6-10	11-15	16-20
SERVICE TRUCK	2	5	3	3	3

Table 27: Service Truck Quantity

Welding Truck:

Function: The welding truck is used in support of maintenance personnel's needs for welding equipment and equipment items such as truck bodies, dozer blades, shovel buckets, etc.

Quantity: One truck for every two shovels, plus one roaming. It is assumed that any welding required at the maintenance shop does not require an additional mobile unit. See Table 28:

Years	-5 to -1	1-5	6-10	11-15	16-20
WELDING TRUCK	2	4	4	4	4

Table 28: Welding Truck Quantity

Powerline Trucks:

Function: Power line trucks with a man-lift basket are included in the fleet. The power line trucks are required for the safe movement of all power lines on and to site, as well as maintenance on the lines.

Quantity: Assume two for LoM meets production requirements in Table 29:

Years	-5 to -1	1-5	6-10	11-15	16-20
POWERLINE TRUCK	2	2	2	2	2

Table 29: Powerline Truck Quantity