APPENDIX Q

AIR QUALITY MODELLING REPORT

Q-1 Air Quality Modelling Report
Q-2 Air Quality Modelling Report – Addendum
Q-3 Comparison of Air Quality Assessment versus Property Changes

APPENDIX Q-1

AIR QUALITY MODELLING REPORT

AIR QUALITY ASSESSMENT REPORT
RAINY RIVER GOLD PROJECT

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EXECUTIVE SUMMARY

The Rainy River Gold Project (RRGP) is a gold exploration project situated in the Township of Chapple, approximately sixty-five kilometres (by road) northwest of Fort Frances in northwestern Ontario. The RRGP site and surrounding lands are dominantly privately held, with Rainy River Resources Ltd. (RRR) holding a considerable private land package. RRR has been exploring the RRGP property since 2005, with the objective of constructing, operating and eventually reclaiming a new open pit and underground gold mine and milling complex on the site. RRR is pursuing environmental approvals for the development of open pit and underground gold mine at this location. AMEC Environment & Infrastructure, a division of AMEC Americas Limited, was retained by RRR to prepare an Air Quality Assessment Report for the RRGP site.

RRR is required to complete a Standard Environmental Assessment pursuant to the *Canadian Environmental Assessment Act, 2012* and an Individual Environmental Assessment pursuant to the Ontario *Environmental Assessment Act*. In support of the Federal and Provincial environmental assessment, AMEC has completed a study of the potential air quality effects of the Project. The Air Quality Assessment requires the prediction of offsite effects using dispersion modelling, and the comparison of the results to applicable air quality criteria in order to determine whether potential adverse effects on the environment and human health exist.

AERMOD, a sixth generation Gaussian dispersion model, was considered to be the most appropriate model for air quality assessment as it is capable of handling multiple sources of varying types such as point and area sources, and the effects of building downwash on pollutant dispersion. The dispersion modelling with AERMOD allows for the consideration of site-specific effects, as the required input includes five years of local, hourly meteorological data and local terrain elevations.

The following emission sources were identified for the RRGP and considered in the dispersion modelling assessment:

- Emissions from blasting;
- Material handling in the open pit;
- Dust from crushing;
- Road dust emissions (re-entrained dust);
- Dust from managing mine rock, ore and overburden;
- Concrete batching;
- Underground mining activities;
- Gold ore processing; and
- Exhaust from back-up power generation.

The results of the dispersion modelling are presented in Table ES-1. This table provides a summary of the significant contaminants identified, the results of the dispersion modelling for each contaminant, and the respective air quality criterion (standard or guideline).

The findings of the air quality assessment were as follows:

- All modelled concentrations for pollutants released during the operation phase of the Project were below applicable Schedule 3 standards of O.Reg. 419 and the Ontario Ambient Air Quality Criteria, and demonstrate that the site can operate in compliance with Ontario's regulatory requirements and guidelines;

- Project-related greenhouse gas emissions (principally CO_2) will mainly derive from on site mobile heavy equipment fuel combustion, explosive detonation, and from offsite power generation, onsite diesel fuel combustion for power generation and for the operation of engines associated with the crushing and screening activities. The estimated maximum annual GHG emission (CO_2eq) occurs during year 8 of the RRGP site operation (0.145 Mt). This is equivalent to 0.02 % of Canada's 692 Mt GHG emissions in 2010. For the other operational years, GHG emissions are anticipated to range from 0.13 to 0.05 Mt of CO_2eq;

- The cumulative effect, in this case considered to be the combined effect of the background concentrations established for the vicinity of the mine and the effects predicted by the modelling, was considered for each parameter. The potential for an occasional exceedance of the $PM_{2.5}$ criteria was identified, which may occur less than one day per year. For all other contaminants, the resultant cumulative concentrations were found to be less than the respective criterion.

Based upon these findings, the RRGP is not expected to have a significant negative effect on either local or regional air quality.

Table ES-1 Summary of Air Quality Results

Compounds	CAS Number	Facility Emission Rate (g/s)	Model Used	Modelled Concentration (µg/m^3)	Averaging Period (hr)	MOE POI Limit (µg/m^3)	Limiting Effect	MOE Schedule O.Reg. 419	% of Criteria
PM_{tot}	NA	81.08	AERMOD	86.0	24	120	visibility	3	71.7%
$PM_{2.5}$	NA	4.77	AERMOD	23.9	24	25	health	Guideline *	95.6%
Nitrogen Oxides	10102-44-0	6.7	AERMOD	26.7	24	200	health	3	13.4%
		95.2	AERMOD	227	1	400	health	3	56.8%
Carbon Monoxide	630-08-0	27.0	AERMOD	2,632	0.5	6000	health	3	43.9%
		453	AERMOD	2,193	1	36200	health	3	6.1%
		27.0	AERMOD	366	8	15700	health	3	2.3%
Sulfur Dioxide	7446-09-5	2.87	AERMOD	9.3	24	275	health and vegatation	3	3.4%
		29.7	AERMOD	138	1	690	health and vegatation	3	20.0%
Hydrogen Cyanide	74-90-8	0.15	AERMOD	1.4	24	8	health	3	17.5%
CaO**	1305-78-8	0.09	AERMOD	0.80	24	13.5	corrosion	3	5.9%
CuSO4**	7758-99-8	0.09	AERMOD	0.79	24	20	health	No limit MOE limit***	4.0%
As	7440-38.2	1.12E-02	AERMOD	1.19E-02	24	0.3	health	Guideline	4.0%
Cd	7440-43-9	1.46E-03	AERMOD	1.55E-03	24	0.025	health	3	6.2%
Cr	7440-47-3	1.60E-02	AERMOD	1.69E-02	24	1.5	health	Guideline	1.1%
Hg	7439-97-6	8.11E-06	AERMOD	8.60E-06	24	0.5	health	3	0.002%
Mg	1309-48-4	2.18E+00	AERMOD	2.32E+00	24	120	particulate	3	1.9%
Mn	1336-36.3	1.18E-01	AERMOD	1.25E-01	24	0.15	health	Guideline	83.6%
Ni	7440-02-0	6.42E-03	AERMOD	6.81E-03	24	2	vegetation	3	0.3%
Pb	10099-74-8	0.018	AERMOD	1.87E-02	24	0.5	health	3	3.7%
Zn	7440-66-6	2.07E-01	AERMOD	2.19E-01	24	120	particulate	3	0.18%

NA: not applicable; POI: point of impingement
Modelled concentrations account for met anomalies as per MOE Modelling Guidance
* $PM_{2.5}$: the Canada Wide Standard is 30 µg/m^3; MOE has provided a 25 µg/m^3 single facility guideline to account for cumulative impacts (i.e. background levels)
** process plant modelled as 1 g/s with all particulate assumed to be compound and scaled by emission rate
*** all limits are MOE limits, except for $CuSO_4$ (limit derived by a certified toxicologist)

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1.0 INTRODUCTION

The Rainy River Gold Project (RRGP) is a gold exploration project situated in the Township of Chapple, approximately sixty-five kilometres (km; by road) northwest of Fort Frances in northwestern Ontario (Figure 1).

The RRGP area exhibits variable, gently undulating terrain, and is drained principally by the Pinewood River and its associated minor tributaries. The RRGP site is located in a low density rural area within the Township of Chapple (total population of 856 in 2006). There is some limited agriculture focused on cattle and fodder cropping, as well as logging activities in the area. Forested areas are mainly second growth poplar-dominated forests and wetlands.

The RRGP site and surrounding lands are dominantly privately held, with Rainy River Resources Ltd. (RRR) holding a considerable private land package. RRR has been exploring the RRGP property since 2005, with the objective of constructing, operating and eventually reclaiming a new open pit and underground gold mine and milling complex on the site. RRR is pursuing environmental approvals for the development of open pit and underground gold mine at this location. AMEC Environment & Infrastructure, a division of AMEC Americas Limited, was retained by RRR to prepare an Air Quality Assessment Report for the RRGP site.

RRR is required to complete a Standard Environmental Assessment pursuant to the *Canadian Environmental Assessment Act, 2012* and an Individual Environmental Assessment pursuant to the Ontario *Environmental Assessment Act*. In support of the Federal and Provincial environmental assessment, AMEC has completed a study of the potential air quality effects of the Project. The Air Quality Assessment requires the prediction of offsite effects using dispersion modelling, and the comparison of the results to applicable air quality criteria in order to determine whether potential adverse effects on the environment and human health exist.

The objectives of the Air Quality Assessment are as follows:

- Identify the target pollutants that are expected to be emitted in significant quantities during the operation phase;
- Prepare estimates of the air emissions from the significant sources identified for the operation phase;
- Employ dispersion modelling to predict the resultant air quality effects on ambient air in the vicinity;

- Detail mitigative measures, if required, to reduce emission rates such that resultant offsite air quality effects are below the ambient air quality standards and the regulatory standards of Ontario Regulation 419/05 and the Ontario Ambient Air Quality Criteria (AAQC);

- Provide a forecast for greenhouse gas (GHG) emissions during the site operations; and

- Provide a discussion of the significance of potential air quality effects.

2.0 PROJECT SUMMARY

RRR is planning to construct, operate and eventually reclaim a new open pit and underground gold mine at the RRGP to produce doré bars (gold and silver) for sale. The site layout proposes to place the required mine-related facilities in close proximity to the gold deposit to the extent practical, primarily on private, patented lands owned by RRR.

Ore processing will be carried out using a conventional whole ore cyanidation for gold recovery, followed by in-plant cyanide destruction using the SO_2/Air treatment process. Tailings from the process plant will be stored in a constructed tailings management area. The ore processing plant will use a very high level of water recycle. Excess water which cannot be reused in the process plant or for other appropriate uses will be discharged to the Pinewood River. This discharge will meet all applicable Federal and Provincial effluent discharge requirements, at the final point of discharge to the environment, and will be protective of receiving water aquatic life.

A truck shop, administration building and explosives factory will be developed on the site. Domestic sewage will be treated using a package sewage treatment plant or equivalent. Non-hazardous domestic solid wastes will either be deposited at a suitable offsite landfill or in an onsite landfill. Hazardous solid and liquid waste will be hauled off site by licensed contractors to licensed storage facilities.

As part of the proposed development, realignment of gravel-surfaced Highway 600 will be required. Initial construction power will be provided by the existing distribution lines connected to the Provincial electrical grid, supported by diesel power generator(s) if required. Permanent power will be provided through dedicated connection to a nearby 230 kilovolt transmission line.

The major proposed project components are expected to include:

- Open pit and underground gold mine;

- Ore processing (conventional whole ore cyanidation followed by in-plant cyanide destruction, using extensive water recycle);

- Production of gold and silver doré bars;

- Explosives manufacturing and storage facilities;
- Mineral waste management (stockpiling of overburden and mine rock; and piping and storage of tailings in a surface tailings management area);
- Other buildings, facilities and areas;
- Onsite access roads;
- Aggregate extraction;
- Water management facilities and drainage works, including ponds, watercourse diversions and a constructed wetland;
- Domestic and industrial waste handling;
- Gravel-surfaced Highway 600 realignment; and
- 230 kilovolt transmission line.

Open pit mining will occur at a rate of approximately 21,000 tonnes per day (tpd) of ore production. Over the life of the mine, approximately 110 to 120 million tonnes (Mt) of ore, 70 to 80 Mt of overburden and 350 to 400 Mt of mine rock will be extracted. As currently proposed, open pit mining would occur over an approximate 13 year period, including 2 years of pre-production.

The open pit mine will operate on two, 12-hour shifts, 365 days a year, with a typical ore output of 20,000 tpd. Rock will be broken at the face using explosives and will be loaded using a hydraulic shovel onto 225 tonne haul trucks, for transport to the primary crusher or stockpiles (ore or mine rock). Approximately 0.32 kilograms of explosives will be consumed for each tonne of ore or mine rock mined. Annual explosive consumption will range from 10,000 to 19,000 tonnes.

The primary mining fleet will consist of down hole blast drill rigs, hydraulic mining shovels, front end loader and haul trucks. This fleet will be supported by tracked bulldozers, motor graders, auxiliary excavators and other miscellaneous support equipment.

Underground mining will be used to access higher grade ore at depth that cannot be readily or reasonably extracted by open pit mining, to augment the open pit source for controlled ore blending within the process plant. The current plan is to develop the underground workings to a depth of about 800 metres (m) below the surface with a production rate of up to approximately 1,000 tpd. A contingency factor of 20% was applied to underground mining rates to allow for

flexibility, and responsiveness to further data acquisition and analysis, and in recognition of the current confidence in the engineering design.

Ore transported to the surface from the open pit and underground mines will generally be taken directly to the primary crusher. A run-of-mine ore stockpile area will be located on the opposite side of the pad from the crusher. Overburden and mine rock stripped from the open pit will be stored in stockpiles near the open pit.

All ore processing will take place within the process plant. The main processing building will house: the grinding and pebble crushing circuit, gravity circuit, cyanide leaching with carbon-in-pulp gold adsorption, carbon stripping and electrowinning to produce a gold and silver sludge, and doré gold bar production using an induction furnace, as well as reagent preparation areas and the metallurgical laboratory. The thickeners, leach tanks, lime slaking and cyanide destruction areas will be located outside the main processing area.

Following the initial crushing, the comminution, concentration, and separation steps are all performed on wet ore. The concentrated ore is treated in a thickener and subsequently processed in a series of eight tanks for leaching in a cyanide solution. Adsorption of the gold that is dissolved in cyanide solution onto activated carbon then occurs in the carbon-in-pulp circuit. Gold recovery from the loaded carbon will be achieved using a conventional (or equivalent) carbon stripping and electrowinning circuit.

The process plant will use whole ore cyanidation as the most effective means of gold recovery, and the SO_2/Air treatment process will be employed to destroy cyanide and metallo-cyanides. This is a most effective and proven process for destroying cyanide within tailings slurry before it leaves the process plant.

Mine haul roads will be established to connect the open pit to various stockpiles, the primary crusher and associated mine buildings (the maintenance shop and truck wash). The total length of the mine haul roads outside the pit limit is approximately 5,400 m. All haul roads will be designed to ensure proper visibility and to limit potential conflicts with other smaller mine-related vehicles. The haul roads will not intersect any public roads. Haul roads will be approximately 34 m wide, in order to accommodate two-way heavy equipment traffic.

3.0 ASSESSMENT METHODOLOGY

AMEC has completed an assessment of the potential air quality effects of this proposed RRGP in accordance with generally accepted air quality assessment methodologies.

The Air Quality Assessment methodology involved the following distinct steps:

- Identify the significant emissions sources associated with the RRGP operation phase;

- Identify the key, or target, pollutants released to the atmosphere from the identified sources;

- Determine the baseline ambient air quality conditions in the absence of the project for each of the target pollutants;

- Identify the relevant regulatory air quality standards and criteria, and establish the appropriate assessment criteria for the site in Ontario, noting that for some of the target pollutants there may be more than one applicable limit depending upon the averaging time;

- Estimate the air emission rates for each of the target contaminants using appropriate estimation methods and established data sources;

- Prepare a source summary table that identifies all sources at RRGP site which may release one or more of the target pollutants to the atmosphere in significant quantities and the corresponding pollutants and emission rates;

- Perform the air dispersion modelling using the U.S. Environmental Protection Agency (US EPA) AERMOD model, an approved dispersion model under Ontario Regulation (O.Reg.) 419/05; and

- Compare the dispersion modelling output to the assessment criteria, comparing predicted offsite effects on ambient air quality with the corresponding air quality standard or criterion.

3.1 Dispersion Model Selection

AERMOD, a sixth generation Gaussian dispersion model, was considered to be the most appropriate model for assessment as it is capable of handling multiple sources of varying types such as point and area sources, and the effects of building downwash on pollutant dispersion. The input data required for AERMOD includes five years of local, hourly meteorological data, terrain elevations for the site and vicinity, and the characteristics of the buildings and emission sources at the project site. The model uses these input parameters to predict the resultant air concentrations at offsite locations (receptors), and is capable of predicting these effects for each of the relevant averaging times.

The plume downwash algorithm in AERMOD was used to account for the aerodynamic effects that occur when air flows over solid structures, such as site buildings. This downwash effect affects the extent of plume dispersion and the predicted ambient concentrations.

The meteorological data used for the AERMOD modelling consisted of five years (1996 to 2000) of surface and upper air meteorological data provided by the Ontario Ministry of the Environment (MOE) from a station located in International Falls, Minnesota.

Although the immediate area surrounding the proposed facility does not have significant topographical features such as mountains, valleys, or canyons, the topography was included in the AERMOD modelling. A NAD-83 digital elevation model file was available for the RRGP site area.

4.0 EXISTING ENVIRONMENTAL CONDITIONS

4.1 Climate

4.1.1 General

Regional baseline climate data (climate normal data) were obtained from Environment Canada (EC) for Barwick, Ontario (EC ID 6020559) located approximately 23 km south of the RRGP site (EC 2012). Canadian climate normal data available for the Barwick Station are restricted to temperature and precipitation. Temperature, precipitation and wind data are available from the Fort Frances Airport climate station (EC ID 6022476) located approximately 50 km southeast of the RRGP site. Wind data, as Climate Normals for proximal weather stations, are available from the National Climate Data and Information Archive (EC 2012). Rainfall Intensity Duration Frequency data are available for Rainy River, Ontario. Rainfall plus snowmelt data are available for Fort Frances. The Ministry of Transportation (MTO) website also provides Intensity Duration Frequency (IDF) rainfall data for any site in Ontario based on geographic coordinates (MTO 2010).

A local climate station was established on the RRGP site in 2009 to supplement longer term published data. This station measures temperature, precipitation, relative humidity, wind speed and direction, barometric pressure and solar radiation. As a result of the short term nature of the record from this site, reliance for assessment purposes has been placed on climate data from the regional stations.

4.1.2 Temperature

The mean annual temperature and precipitation in the area of the RRGP site is best described by the 1971 to 2000 Canadian Climate Normals. Several climate stations are located within 30 km of the RRGP site; however, the Barwick Ontario meteorological station (Station 6020559; EC 2012) has established Canadian Climate Normals and is currently active. The Barwick Station is located approximately 20 km south of the RRGP site.

The average daily temperature (from Canadian Climate Normals) at the Barwick station is 18.8 degrees Celsius (°C) in July and -15.9°C in January. Mean monthly temperatures for Barwick and other regional climate stations are shown in Table 1.

KCB (2011) found daily average temperatures at the RRGP site from June 2009 to January 2011 closely approximated temperatures at the Barwick station (correlation coefficient of 0.98). Barwick station was typically warmer than the site by 1°C to 2°C (KCB 2011). Table 1 also includes 2011 data for Barwick and the RRGP site. In 2011, the average temperature at Barwick station was 3.8°C while the RRGP site was 3.5°C.

4.1.3 Precipitation

On average, 695 millimetres (mm) of precipitation occurs annually in the RRGP area, with 552 mm of this total falling as rain. Most precipitation occurs in the summer months and the Canadian Climate Normals show an extreme precipitation event of 152 mm of daily rainfall. The monthly mean precipitation is shown in Table 2 (EC 2012).

The MTO provides a tool which interpolates IDF data published by EC for any location in Ontario (MTO 2010). The IDF return event quantities are provided for latitude 48.83 °N, longitude -94.00 °E in Table 4.

4.1.4 Evaporation

The Climate Atlas of Canada (Canada 1988) estimates the RRGP region experiences 600 to 700 mm/year of lake evaporation and 500 to 600 mm/year of evapotranspiration. KCB (2011) predicted average evapotranspiration in the RRGP area of likely between 315 and 560 mm per year (45% to 80% of average annual precipitation). The KCB prediction was based upon regional information (National Resources of Canada Evaporation Atlas and streamflow stations) and data from the temporary climate station. Evapotranspiration varies temporally throughout the year, and spatially as surface water, soil, and vegetation conditions change across the Project area (KCB 2011).

The nearest evaporation data for the RRGP site is available from the Atikokan Climate Station (Station 6020379) located approximately 175 km east of the RRGP. Data from the Atikokan station is summarized in Table 3.

4.1.5 Wind Speed and Direction

Climate Normals

According to the EC Climate Normals for Atikokan (ID 6020379) and Kenora (ID 6034075), the average wind speed in this region ranges from 7.7 to 13.8 kilometres per hour (km/h) or 2.1 and 3.8 metres per second (m/s), with the highest average wind in fall and spring, 14.8 km/h (5.2

m/s) and 8.6 km/h (2.4 m/s), respectively; and the lowest mean wind speed in summer, 6.8 km/h (1.9 m/s). At the Kenora station the winds are predominantly from the south and at the Atikokan site predominantly west / northwest. There is no wind data available for the Barwick site.

Limited site data collected by KCB is shown as a wind rose in Figure 3. The wind rose depicts the relative frequency of wind direction on a compass (with north, east, south, and west directions going clockwise) whose value is listed adjacent to each of the compass points. The length of the shaded bars on each wind rose petal represents the frequency of wind recorded from a given direction within a certain speed range.

A summary of the Climate Normal wind speed and wind direction data is provided in Tables 5 and 6, for the 30-year period 1971 to 2000 (EC 2012).

Dispersion Modelling Data Set

Wind is a critical parameter in the dispersion of contaminants. The wind direction determines the primary direction of dispersion. At low wind speeds (or calm conditions), concentrations tend to be higher due to poor mixing and dispersion. Increasing wind speed has the effect of decreasing air concentrations of contaminants through enhanced dispersion and mixing. For particulates, this enhanced dispersion can be offset by increased emissions of particulates due to wind erosion and reduced settling.

The MOE requires facilities to use International Falls, Minnesota Meteorological Station (Station 72747) for surface parameters such as wind speed and wind direction for locations in northern Ontario (1996 to 2000). These data are summarized in Figure 4 in a wind rose. The Upper Air data used for the modelling assessment was also a data set for International Falls, Minnesota (Station 727470), as provided by the MOE. It should be noted that MOE modifies the wind speed data in the data set to replace all calm conditions with low wind speeds. As such, the wind rose does not show any calm conditions.

This wind rose shows prevailing winds from the south west (approximately 9.5%), south-southwest (approximately 8%), west-southwest (approximately 8%), northeast (approximately 8%), north-northeast (approximately 8%) and north (approximately 8%).This pattern is typical of locations in northern Ontario. The average wind speed for the data set was 3.6 m/s.

4.2 Background Air Quality

The RRGP site is remote from current major industrial emission sources with the closest such sources being Fort Frances, Ontario and International Falls, Minnesota which has pulp and paper mills. Local anthropogenic sources of air emissions generally include road traffic, agriculture and drilling associated with mineral exploration activities. There is an Oriented Strand Board (OSB) Mill located approximately 50 kilometres to the east of Rainy River in Barwick, Ontario, and 30 kilometres south of the RRGP site.

Background air quality at the RRGP area is expected to be good, given the absence of nearby large urban centres and industrial sources. Air quality in the RRGP area will; however, be influenced by long range transport of air emissions from the south and also by natural sources, such as volatile organic emissions from vegetation and natural fires. The greatest potential local influence to air quality is particulate matter from traffic and agricultural operations. For this reason, a summary of the air quality baseline conditions was developed based on published sources for most parameters.

The nearest regional background air quality and precipitation quality data were obtained from the Experimental Lakes Area station (49^{o} 39' 50^{o} N, 93^{o} 43' 15^{o} W), located approximately 95 km north of the RRGP site. The Experimental Lakes Area station operates as part of the EC Canadian Air and Precipitation Monitoring Network (CAPMoN). CapMon provides air chemistry data for chloride, potassium, sodium, ammonium, nitrite, nitric acid, sulphate, sulphur dioxide, calcium and magnesium (EC 2011). Air quality and precipitation data from the Experimental Lakes Area station is summarized in Tables 7 and 8.

The EC National Air and Pollution Surveillance (NAPS) Network operates a number of monitoring stations across the country (EC 2008). The NAPS network reports air quality data for various gases, particulate matter ($PM_{2.5}$), as well as various volatile organic compounds (VOCs) and semi-volatile organic compounds. NAPS stations are located in Winnipeg (Station 070119) and the Experimental Lakes Area (Station 64001; EC 2008). In addition, the MOE operates an Air Quality Index (AQI) station in Thunder Bay (Station 63203; MOE 2010).

The NAPS station in Winnipeg provides data on nitrogen oxides, ozone, fine particulate matter ($PM_{2.5}$) and carbon monoxide. The NAPS station at the Experimental Lakes Area collects only ozone data. The AQI station in Thunder Bay provides data on nitrogen oxides, ozone and fine particulate matter ($PM_{2.5}$). This background air quality data is presented in Tables 9 and 10.

The air quality at the Thunder Bay and Winnipeg stations are more influenced by urban emissions relative to the Experimental Lakes Area and RRGP site.

MOE air quality stations in Dorset (49010), Parry Sound (49005) and North Bay (75010) are more representative of rural locations, with minimal impact from nearby industries or urban areas. Air quality data from the above rural sites are summarized in Table 10.

Air quality monitoring was conducted by KCB (KCB 2011) in the RRGP area during 2009 and 2010, and focused on particulate matter (PM_1[1], $PM_{2.5}$[2] and PM_{10}[3]) at three locations. The baseline air quality at the air quality monitoring stations appears to meet the Ontario AAQC for airborne $PM_{2.5}$ and PM_{10} concentrations; however, results are not directly comparable because

[1] Particulate matter with a diameter of < 1 micrometres (µm)
[2] Particulate matter with a diameter of < 2.5 µm
[3] Particulate matter with a diameter of < 10 µm

reported baseline air quality was averaged over 3 hours rather than 24 hours. Standards are not available for PM_1 (Table 11).

Higher than average relative humidity during the onsite monitoring program may have contributed to greater than actual concentrations of particulate matter being recorded. The onsite data is consistent with the data summarized from the MOE and NAPS sites and indicates the lack of significant sources near the RRGP site.

Though not done to current MOE ambient monitoring requirements, the onsite data is consistent with the data summarized from the MOE and NAPs sites and indicates the lack of significant sources near the RRGP site.

5.0 ATMOSPHERIC EMISSIONS AND APPLICABLE STANDARDS

The Air Quality Assessment requires comparing the results of the dispersion modelling to applicable air quality criteria in order to determine whether there are potential adverse effects on the environment and human health. Various regulatory agencies set specific target AAQC to be protective of human health and the environment, including Ontario and Canada.

5.1 Air Pollutants from Gold Mining and Ore Processing

The significant emissions anticipated from the RRGP include the following pollutants:

- Oxides of nitrogen (NOx), reported as nitrogen dioxide (NO_2);
- Carbon monoxide (CO);
- Sulphur dioxide (SO_2) resulting from sulphur in the diesel fuel;
- Total Suspended Particulates (TSP);
- PM_{10};
- Fine particulate matter $PM_{2.5}$;
- Hydrogen Cyanide (HCN);
- Calcium Oxide;
- Copper sulphate;
- Metals; and
- GHGs.

5.1.1 Nitrogen Oxides

There are more than six forms of oxides of nitrogen; nitric oxide (NO) and NO_2 are the predominant forms found in air emissions and the most significant air pollutants. NO is a colourless gas and NO_2 is a red-brown gas and contributes to the formation of photochemical smog. Only NO, NO_2 and N_2O are found in significant amounts in the atmosphere. Collectively they are known as NO_x and are expressed as the equivalent mass concentration of NO_2.

NO_2 acts as an acute irritant and in equal concentration is more injurious than NO. Increased airway resistance is experienced at a concentration of 1 parts per million (ppm) for 15 minutes. NO does not remain stable for long periods in the atmosphere, and oxidizes to NO_2 over time. Nitrogen dioxide in the atmosphere is considered a harmful air pollutant and therefore EC and the MOE have set AAQC. There are no AAQC for NO or N_2O, though the latter is a greenhouse gas and ozone depleter. In the atmosphere, NO_2 is hydrolyzed to form HNO_3 or nitric acid, a compound estimated to form 40% of acid rain.

Emissions of NO_x are of concern in locations where, in the presence of sunlight, they combine with man-made or natural VOCs to form photochemical smog, containing ozone. In locations where there are already significant existing emissions of NO_x and volatile organic compounds, particularly in warm summer months, smog conditions that last days or weeks can be detrimental to human health, crop and vegetation growth and health.

Since NO_2 has adverse effects at much lower concentrations than NO, and NO converts to NO_2 in ambient air, the standard and AAQC for nitrogen oxides is based on the health effects of NO_2. In the assessment of ambient air quality, NO_2, not NO_x, is the reference contaminant; NO_x AAQCs and Schedule 3 standards with 1-hour and 24-hour averaging times should only be compared to monitored NO_2 data.

The AAQC for NO_2 are set as 400 µg/m^3 for a 1-hour averaging time, and 200 µg/m^3 for a 24-hour averaging times. Ontario Regulation 419/05 Schedule 3 sets standards for total nitrogen oxides at 400 µg/m^3 for a 1-hour averaging time, and 200 µg/m^3 for a 24-hour averaging times, as presented in Table 12. These standards are based upon potential health effects of exposure to NO_2, but conservatively set for total NO_x under the regulation.

5.1.2 Carbon Monoxide

CO is a colourless, odourless, tasteless gas, which is produced primarily through the combustion of fossil fuels as a result of incomplete combustion. Over 75% of the CO produced in Ontario is from the transportation sector and 25% is due to the combined effect of power generation, buildings, heating and industrial operations. Exposures at 100 ppm or greater can be dangerous to human health, and larger exposures can lead to significant toxicity of the central nervous system and heart.

The Ontario Regulation 419/05 CO standard is for the one half-hour averaging time; AAQC exist for the 1-hour and 8-hour averaging times. The standards and AAQC for CO are all based upon potential health effects, and are presented in Table 12. CO is generally not considered to be a key pollutant from surface mining operations; it is more significant for underground mines where worker potential exposure is of concern.

5.1.3 Sulphur Oxides

Sulphur oxides, or SO_x, comprise SO_2, sulphur trioxide (SO_3) and solid sulphate forms. SO_2 is a non-flammable, non-explosive colourless gas. In connection with fuel burning, where the majority is in the form of SO_2, SO_x is normally expressed in terms of the equivalent mass concentration of SO_2 and sometimes as total sulphur. Sulphur oxide (SO) has an odour threshold limit of 0.47 to 3.0 ppm, and has pungent irritating odour above 3 ppm. SO_x compounds are significant contributors to acid rain and also precursors to the formation of secondary fine particulate matter.
SO_2 is irritating to the eyes and respiratory system above 5 ppm (exposure for 10 minutes), in the form of higher airway resistance. The effects of SO_2 on human health with respect to the short term (acute) respiratory effects have been extensively studied. No clear evidence of long term or chronic effects is apparent.

Air quality standards for SO_2 have been set for the 1-hour and 24-hour averaging times, with equivalent AAQCs, as shown in Table 12. In addition, Ontario has an annual AAQC of 55 µg/m^3 for SO_2. The standards and AAQC are based upon potential health effects of SO_2, as well as potential effects on vegetation.

5.1.4 Particulate Matter

Particulate matter, which consists primarily of fugitive dusts, is generated from a variety of activities at mine sites, including crushing, screening, and material handling activities.

Airborne particles are categorized as primary (being emitted directly from the source into the atmosphere) and secondary (being formed in part by chemical and physical transformations). Particles can be chemically inert or active. Even if inert, they may adsorb chemically active substances or they may combine to form chemically active species.

It has been generally accepted since the 1970s that there is an association between respiratory health and high levels of particulate pollution. What has not been clear until more recently is that adverse health effects also occur at ambient concentrations that are routinely experienced today in North America and Western Europe. Historically, the standards were developed for the full range of particle sizes that stay airborne (typically particles less than 44 µm). These standards were developed to be protective of visibility impairment. As the scientific data evolved, it was found that the correlation between health effects and particulate was stronger at smaller particle sizes. Standards were then developed for particles with diameters of less than 10 µm and, more recently, those standards have been superseded by standards for particles sizes less than 2.5 µm.

Total suspended particulate (TSP or PM_{tot}) are generally considered to be in the particle size range of up to 44 µm in aerodynamic diameter, and includes the smaller particle size fraction of $PM_{2.5}$. It is emphasized that that particle size fractions are not separate compounds, nor are

they additive. The smaller particle sizes are a subset of the large particulate matter size fractions. The respective standards and AAQCs for particulate matter are presented in Table 12. The standard and AAQC for total particulate matter is based upon potential effects on visibility and for $PM_{2.5}$ based upon potential health impacts.

Larger particles are typically produced from material handling and crushing activities. Respirable particle $PM_{2.5}$, with particles sizes less than 2.5 µm in diameter, are produced during the combustion of fuels for power generation and equipment operation.

5.1.5 Other Parameters Associated with Ore Mining and Processing

A number of other potentially excess parameters have been considered in the Air Quality Assessment that may be released from the mining or ore processing stages of the RRGP. These parameters include: hydrogen cyanide, copper sulphate, and the metal species present in the ore.

Ore processing will be carried out using a conventional whole ore cyanidation for gold recovery, which involves the use of hydrogen cyanide. In-plant cyanide destruction using the SO_2/Air treatment process will be used. The Ontario Reg.419/05 standard for hydrogen cyanide is based upon the potential for this substance to cause both acute and chronic health impacts.

Copper sulphate does not have a standard under O.Reg 419/05, nor does it have an AAQC. A criterion of 20 µg/m^3 was established by a certified toxicologist to be protective of health.

Several metal species are present in the ore processed, and are subsequently emitted as trace constituents of the particulate matter, of which the following were considered in the assessment due to their potential presence in significant concentrations:

- Arsenic (As);
- Cadmium (Cd);
- Chromium (Cr);
- Mercury (Hg);
- Magnesium (Mg);
- Manganese (Mn);
- Nickel (Ni);
- Lead (Pb); and
- Zinc (Zn).

These metals all have criteria in Ontario based upon potential health impacts, with standards currently in effect for Cd, Hg, Mg, Ni, Pb, and Zn under Ontario Reg. 419/05. Table 12 provides a summary of the applicable standards for these contaminants.

5.1.6 GHGs

GHGs are considered as a large scale global environmental concern as opposed to a local airshed effect. There are no health based or site specific environmental impact based standards that could be used to assess the acceptability of the current emission estimates for the RRGP. Accordingly, the project design will be according to industry standards and utilize best operating practises to minimize GHGs to the extent practical. GHG emissions from combustion are currently best minimized through efficient combustion practices (i.e. minimizing fossil fuel use) and ensuring engines are well maintained for optimal performance. GHG emissions during operations will be primarily as a result of fuel use in mobile equipment.

5.2 Sources of Air Emissions

The following emission sources were identified for the RRGP and included in the dispersion modelling assessment:

- Emissions from blasting;
- Material handling in the open pit;
- Dust from crushing;
- Road dust emissions (re-entrained dust);
- Dust from managing mine rock, ore and overburden; and
- Exhaust from back-up power generation.

In addition, air emissions from gold processing (for example hydrogen cyanide and SO_2) were also assessed and modelled. NO_x emissions occur from the blasting, combustion of propane for underground mine heating and process plant heating, and from the testing of back-up generators.

5.3 Air Quality Assessment Criteria

The MOE have set AAQC and point of impingement (POI) air quality standards for various parameters, including most of the target pollutants identified for this air quality assessment. It is these criteria that have been used to assess the significance of the effects of the emissions from the RRGP.

The O.Reg, 419/05 standards and Ontario AAQC limits used for the assessment include limits for different averaging times, depending upon the pollutant. The dispersion modelling was conducted for each pollutant, and for each averaging time. These references consider the ambient air quality standard, or limit, to be the maximum concentration at offsite locations (the receptors) where potential effects and compliance are assessed. The O.Reg 419 standards are used to determine compliance levels for a facility to obtain MOE approval. The Ontario AAQC levels are not compliance standards, but set to provide guidance for acceptable ambient air quality in Ontario.

Federal air quality criteria exist as well, established by the Canadian Council of Ministers of the Environment (CCME) and the Federal government. The federal criteria are detailed in the *Canadian Environmental Protection Act* (CEPA), and the Canada Wide Standards (CWS) for particulate matter (respirable particulate matter, $PM_{2.5}$) were set by the CCME[4]. Based upon this CWS, Ontario has established an AAQC level of 30 micrograms per cubic metre ($\mu g/m^3$) for a 24-hour averaging time. However, the contribution of primary $PM_{2.5}$ from a single facility to ambient levels of $PM_{2.5}$ should be no more than 25 $\mu g/m^3$, in order to ensure the CWS ambient air target value of 30 $\mu g/m^3$ is met at locations near sources of respirable particulate matter.

The air quality standards and guidelines applicable to this assessment are summarized in Table 12.

5.4 Emission Calculations and Source Summary Table

The emission estimates from the operation phase of the RRGP have been presented in the form of source and emission summary tables (Appendix A), which include data on all emission sources at the facility that may discharge one or more of the target pollutants, data quality, source of the emission data and percent of total emissions for each source.

The diesel-fired generators will have an impact on air quality through the combustion of diesel fuel; emissions will include greenhouse gasses (primarily carbon dioxide), sulphur oxides, nitrogen oxides, carbon monoxide and fine particulate matter.

Air quality impacts for the transmission line will be limited to heavy equipment operation during the construction phase, and to a lesser extent emissions associated with that portion of grid power generated by fossil fuel combustion. Emissions from offsite, purchased power generation have not been included in the air quality assessment.

A summary of the emission calculation methodologies, emission factors used, and the associated calculations, are provided in Appendix B. Calculations are shown for all emission sources, including roadways, generators, material handling and underground mine operations.

Equipment data and specifications are presented in Appendix C.

6.0 OPERATING SCENARIOS AND ATMOSPHERIC DISPERSION MODELLING

The environmental assessment encompasses the sources of air emissions that are associated with the operation phase of the RRGP. Activities in the construction phase use similar mining equipment as during operations. Air quality impacts will be bounded by the operations phase. No specific construction phase air quality assessment was undertaken.

[4] The CWS of 30 $\mu g/m^3$ is calculated as the 98%ile over 3 years of daily data. As such, the standard is met, if the 30 $\mu g/m^3$ is exceeded no more than 22 days over the 3 years.

Activities in the active closure phase use similar mining equipment as during operations and refining operations ceased. Air quality impacts will be bounded by the operations phase. The post-closure phase is predominantly a monitoring activity, with occasional repair and maintenance. There is no significant equipment use. No air quality impacts are expected and will be significantly lower than during the operations phase. No specific closure or post-closure phase air quality assessment was completed.

For the purposes of this study, it was assumed that the mine was operating under the maximum emission scenario, which included the operation of one of the four diesel generators, one fire pump, crushing and screening, ore processing, vehicular traffic, open pit mining and underground mining all operating at maximum activity rates. The actual mine and ore processing emissions will be less than the modelled scenario.

The locations of the emission sources on the RRGP site layout are shown on Figure 5.

The offsite effects near to RRGP site were predicted using the AERMOD atmospheric dispersion model. AERMOD is a sixth generation Gaussian dispersion model, which incorporates the latest algorithms to take into account the effects of building downwash, terrain features, and five years of local meteorological data. The meteorological data set included the hourly wind speed, wind direction, atmospheric stability and mixing height information. Receptor points were located as per the requirements of O. Reg. 419 and the associated guidance documents.

The dispersion model was used to predict the offsite effects (in $\mu g/m^3$) of CO, NO_X, PM, SO_2, and the other key parameters identified in Section 4.1 at each receptor point, for each of the relevant averaging times. The location of the maximum offsite effects for a given pollutant is termed the POI (O.Reg. 419/05).

In accordance with the Air Dispersion Modelling Guideline for Ontario (MOE 2009), when determining the maximum 1-hour average concentrations, the eight highest hours per modelling year were discarded in order to remove the effects of potential meteorological anomalies on the modelling results. For assessment of the 24-hour average concentrations, the first highest 24-hour average per modelling year was discarded as a meteorological anomaly.

The results of the dispersion modelling are presented in Table 13.

Fugitive dusts have the highest potential for causing adverse, offsite effects unless rigorous and effective mitigation are implemented at the various sources. Without dust mitigation, it is probable that the air concentrations will exceed the Ontario local air quality standards for PM_{tot}, (standard of 120 $\mu g/m^3$) as well as the criteria for the fine particle size ($PM_{2.5}$) (30 $\mu g/m^3$ for a 24-hour averaging time, and 25 $\mu g/m^3$ for a 24-hour averaging time for a single facility).

Figures 6 to 9 show predicted isopleths (lines of equal concentration) for PM_{tot}, HCN and NO_x (24 and 1 hour). The shapes of the isopleths indicating the location of effects vary with direction and distance, as a result of source locations, meteorological conditions and also receptor elevation. The model assesses the effect of topography on dispersion. Nearby receptors at elevated heights typically have higher concentrations, than receptors at the same distance at lower elevations. This is shown on the isopleths as higher concentrations closer to the site.

The predicted maximum concentrations of NO_x, HCN, key metals, PM_{tot}, and $PM_{2.5}$ at the property line or near the site not currently under the control of RRR were below the respective MOE local air quality standards for the site specific emissions.

Using the Dorset MOE air quality station (Table 10) as representative of typical rural background conditions not influenced by nearby industries or urban environments, the 90th percentile background $PM_{2.5}$ is about 10 µg/m^3. Historic monitoring data from a variety of studies and MOE sites[5] have demonstrated that $PM_{2.5}$ is typically 25% of the total particulate. Background levels for the site are therefore considered to be:

- PM_{tot} - 40 µg/m^3; and
- $PM_{2.5}$ - 10 µg/m^3.

Adding these background levels to the site only impacts (Table 13), shows that $PM_{2.5}$ are below ambient air quality standards at all locations outside the RRR property area even with the conservative emission estimates and worst-case model results.

At the internal boundary (property not controlled by RRR), modelled levels up to 24 µg/m^3 are found. Even though these are below the MOE single facility criteria of 25 µg/m^3, adding a background of 10 µg/m^3 indicates a potential for an occasional exceedance of the $PM_{2.5}$ criteria. A frequency assessment indicates this may occur less than one day per year[6].

Total particulate could also occasionally exceed the MOE 120 µg/m^3 AAQC. These predicted levels for particulate matter should be considered in the context of the conservative nature of the estimates (for example all sources active at maximum all the time, activity levels for all years at the maximum year of operations) and the modelling (for example maximum meteorological day over five years of meteorological data) The modelled concentrations for particulate are at a level that is typical of many sites in Ontario. The potential area of exceedance is located at the boundary with a property that is completely surrounded by the RRGP site (internal to the site), where there are no human receptors. Modelled particulate concentrations at all other locations outside the RRGP site, including at all sensitive receptors, are all well below single facility criteria and even with inclusion of the background are well below MOE AAQC.

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[5] MOE and EC no longer collect total particulate data as part of their monitoring networks

[6] Note: the actual standard is based on 98%ile compliance over a 3 years of data. The detailed frequency assessment has not been undertaken but exceeding the 30 µg/m^3 level one day per year, would be well within the frequency of allowable exceedances of the 30 µg/m^3

The dominant source of SO_2 emissions is the cyanide destruction system located within the process plant. The 24-hour average concentrations were predicted to be below MOE criteria at all off property locations. Even with the inclusion of background levels of SO_2 (Table 10), SO_2 is still significantly below AAQC.

In the leaching process, the pH is maintained above 10.5 to minimize HCN releases; however some HCN emissions will occur. Dispersion modelling found that the HCN emissions were below the air quality standard for HCN at all off property locations. The maximum was found to be less than 18% of the standard.

There were no exceedances of CO or NO_x predicted off property, as all ground level air concentrations were determined to be lower than the respective standards for all averaging times. Even with the inclusion of background levels of NO_x (Table 10), NO_x is still significantly below AAQC.

Earth crustal levels of certain metals will be present in the particulate matter that is generated as fugitive dust on the site and dispersed offsite. The dust is assumed to have the same metals composition as the mine rock used in road construction and the unprocessed ore. Trace metals are also likely to be released from various ore processing activities such as crushing, conveying and ore handling. The measures that are designed to control fugitive dust releases and effects will also serve to control the emission and deposition of metals that are a component of the dust.

For the key metals identified (for example Pb, As, Cd and Hg), the maximum offsite effects were estimated through speciation of the particulate matter (fugitive dust), assuming that the dust is of the same composition as the ore or mine rock. Using the maximum of the 90^{th} percentile concentration of these metals in the mine rock and ore, the predicted offsite concentrations for the key metals were all less than their respective local air quality standards.

7.0 GREENHOUSE GAS EMISSIONS FORECAST

GHGs are considered a large-scale global environmental concern as opposed to a project-scale airshed impact. There are no health based or local environmental impact based standards that could be used to assess the acceptability of the proposed emissions for the RRGP. In lieu of this, the RRGP has been designed according to industry standards and best operating practises to minimize the potential for the emission of GHGs to the extent practical. The nature of the RRGP implies a relatively low carbon-footprint. GHG emissions from combustion (principally mobile heavy equipment operation) are currently best minimized through use of efficient equipment. No practical methods of capturing and sequestering GHGs from mobile heavy equipment combustion emissions currently exist. GHG emissions for power production have been reduced to the extent practicable by using grid power, as opposed to onsite diesel power generation for the operation phase.

Project-related greenhouse gas emissions (principally CO_2) will mainly derive from on site mobile heavy equipment fuel combustion, explosive detonation, and from offsite power generation. It is understood that the coal power plant in Atikokan is being converted for wood pellets (ForestTalk 2013). Additional fuel consumption and CO_2 emissions will derive from transporting persons and materials to the RRGP site, particularly during the construction phase.

Emissions forecasts for each year of operation at the facility were prepared, using the methodologies outlined in the Ontario Guidance Document to accompany Regulation 455/09, and the Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines for National Greenhouse Gas Inventories Volume 2: Energy (IPCC 2006).

The emissions forecast included direct GHG emissions from the proposed facility, specifically the combustion of diesel fuel in the standby diesel generators and the heavy construction equipment. The annual forecast diesel fuel consumption was used to estimate the maximum annual GHG emission of the project. There is currently no standard quantification method for GHG emissions from explosives detonation but this is considered a relatively small contributor. Indirect emissions for offsite purchased power and transportation of material were not considered.

The peak projected year for diesel fuel usage is year 8, with an estimated 43 million litres of fuel consumed.

The estimated maximum annual GHG emission (CO_2eq) occurs during year 8 of the RRGP site (0.145 Mt) operation. This is equivalent to 0.02 % of Canada's 692 Mt GHG emissions in 2010. Other operational years range from 0.13 to 0.05 Mt of CO_2eq.

8.0 MITIGATION MEASURES

The principal air quality elements of concern emitted from the RRGP site will be dust and associated metals associated with the following sources:

- Road dust associated with haul trucks transporting mine rock and ore from the pit;
- Dust from overburden, ore and mine rock stockpiles;
- Dust from the primary crusher; and
- Dust from mining activities within the open pit (drilling, blasting and loading of haul trucks).

A fugitive dust management plan will be prepared for the construction and operation phase to identify all potential sources of fugitive dusts, outline mitigative measures that will be employed

to control dust generation, and detail the inspection and recordkeeping required to demonstrate that fugitive dusts are being effectively managed. The plan will be consistent with industry best management practices and Ontario MOE requirements, to ensure that these management practices and active mitigation are effective in mitigating the activities which may generate fugitive dusts.

Dust emissions from roads and mineral stockpiles will be controlled through the application of water sprays. At full production, two water trucks with water sprays and cannons will be at site for this purpose. Alternatively, surfactant applications, such as calcium chloride, will be used to control dust, particularly on roads, provided that such applications are acceptable to the MOE. Water cannon sprays discharged by mobile trucks will be employed to control dust emissions from stockpiles and aggregate handling activities. If the operations and fugitive dust best management practices plan require further mitigation, dedicated water sprays at active stockpile areas will be employed. At closure, all exposed dust sources will be vegetated and progressive reclamation will be used wherever practicable to better control dust emissions from the mineral waste stockpiles and tailings management area.

All site roadways will be maintained in good condition, with regular inspections and timely repairs completed to minimize the silt loading on the roads. The road maintenance procedures will be incorporated into the RRGP fugitive dust best management practices plan.

The facility and emission points will be designed to allow for good atmospheric dispersion, and dust control equipment such as bag houses, bin vents, and water sprays, will be utilized where necessary to prevent excessive emissions at the crusher and process plant.

A preventive maintenance program will be employed that encompasses all pollution control equipment, diesel-fired engines (vehicle, equipment, and standby power generating), and all processes with the potential for significant environmental effects.

Air emissions from diesel consumption associated with mobile heavy equipment operations will be controlled through use of:

- Low sulphur diesel;
- Equipment meeting Transport Canada off road vehicle emission requirements; and
- Effective equipment maintenance.

The proposed dust control measures are based on current international best management practices, are predictably effective and are not prone to failure. The fugitive dust best management practices plan includes opportunities for adaptive management, in which the intensity of the control measures may need to be increased if site inspections and monitoring indicate that current measures are insufficient to prevent offsite dust effects. Use of low sulphur diesel is also predictably effective for reducing sulphur emissions from on site diesel fuel consumption.

9.0 RESULTS AND CONCLUSIONS

This Air Quality Assessment Report has been prepared in support of the EA for the RRGP, a proposed new open pit and underground gold mine. During the construction and operations phase, the facility will be operated in accordance with all regulatory requirements, which include the requirements of the Environmental Compliance Approvals (Air).

The findings of the air quality assessment were as follows:

- All modelled concentrations for pollutants released during the operation phase of the Project were below applicable Schedule 3 standards of O.Reg. 419 and the Ontario AAQC, and demonstrate that the site can operate in compliance with Ontario's regulatory requirements and guidelines;

- Project-related GHG emissions (principally CO_2) will mainly derive from on site mobile heavy equipment fuel combustion, explosive detonation, and from offsite power generation. Onsite diesel fuel combustion for power generation and for the operation of engines associated with the crushing and screening activities. The estimated maximum annual GHG emission (CO_2eq) occurs during year 8 of the RRGP site (0.145 Mt) operation. This is equivalent to 0.02 % of Canada's 692 Mt GHG emissions in 2010. For the other operational years, GHG emissions are anticipated to range from 0.13 to 0.05 Mt of CO_2eq; and

- The cumulative effect, in this case considered to be the combined effect of the background concentrations established for the vicinity of the mine and the effects predicted by the modelling, was considered for each parameter. The potential for an occasional exceedance of the $PM_{2.5}$ criteria was identified, which may occur less than one day per year. For all other contaminants, the resultant cumulative concentrations were found to be less than the respective study criterion.

Based upon these findings, the RRGP is not expected to have a significant negative effect on local air quality.

Should any questions arise concerning the preparation of this report or its conclusions, the undersigned should be contacted.

Yours truly,

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Table 1: Mean Monthly Temperature (°C)

Climate Station	Distance to Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Barwick	20 km south	-15.9	-11.6	-4.4	4.2	11.7	16.2	18.8	17.8	12.1	5.5	-3.8	-12.7	3.2
Barwick (2011)	20 km south	-18.4	-12.4	-5.7	3.1	11.1	15.2	20.5	18.5	12.3	8.1	-0.5	-6.4	3.8
RRGP Site (2011)	-	-17.2	-13.1	-5.9	4.1	10.8	15.2	19.6	18.1	11.5	8.1	-1.5	-7.5	3.5
Emo Radbourne	20 km southeast	-16.5	-12.4	-5	3.6	11.1	15.7	18.3	17.4	11.5	4.9	-4.6	-13.4	2.6
Fort Frances Airport	50 km southeast	-16.2	-11.9	-4.9	3.6	11.6	16.1	18.8	17.4	12.2	5.1	-4.3	-13	2.9
Kenora Airport	110 km north	-17.3	-12.9	-5.6	3.6	11.8	16.7	19.5	18.2	11.9	5.1	-4.9	-14.1	2.7

Source: Environment Canada (2012)

Table 2: Mean Monthly Precipitation at Barwick Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation (mm)	28.3	24.1	29.7	40	68.3	113.8	99	84	80	56.2	41.7	29.7	694.7
Rainfall (mm)	0.3	3.3	11	30.4	67.3	113.8	99	84	79.4	50.4	12.8	0.8	552.4
Snowfall (cm)	28	20.8	18.7	9.6	1	0	0	0	0.6	5.8	28.9	28.9	142.3

Source: Environment Canada (2012a)

Table 3: Mean Monthly Evaporation (mm)

	May	Jun	Jul	Aug	Sep	Oct	Annual
Pan evaporation	141	149	167	133	79	45	713
Lake evaporation	111	116	129	104	63	36	560

Source: Environment Canada (2012a)

Table 4: Interpolated IDF Return Event for Rainy River Gold Project (mm)

Return Period (year)	Storm Duration								
	5 min	10 min	15 min	30 min	1 hr	2 hr	6 hr	12 hr	24 hr
2	8.5	12.3	15.2	19.8	24.2	29.4	38.1	44.6	50.8
5	10.8	15.4	19.6	24.1	29.4	33.4	40.9	44.9	50.9
10	12.9	17.7	21.8	27.8	39.4	48.7	72.2	86.7	92.5
25	13.4	20.3	26.6	39.5	49.7	62.8	80.4	93.8	102.0
50	14.7	22.6	29.8	44.6	56.7	71.4	91.0	106.0	116.0
100	16.1	25.1	33.0	49.8	63.1	80.0	101.0	118.0	129.0

Source: MTO (2010; IDF Curve Lookup)
Notes: min: minutes; hr: hours

Table 5: Climate Normals (Wind Speed) Kenora, Ontario 1971 to 2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Wind speed (km/h)	13.3	13.3	14.1	14.4	14.3	13.5	13.1	12.9	14.2	14.8	13.9	13.2	13.8
Direction	NW	S	NW	S	S	S	S	S	S	S	S	S	S
Max gust (km/h)	58	51	56	53	56	68	64	64	57	64	58	59	

Climate ID: 6034075, http://climate.weatheroffice.gc.ca/climate_normals/index_e.html

Table 6: Climate Normals (Wind Speed) Atikokan, Ontario 1971-2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Wind speed (km/h)	7.2	6.9	8.3	8.6	8.3	8.2	7.1	6.8	7.8	8.5	7.9	6.9	7.7
Direction	W	W	W	NW	NW	NW	W	S	W	S	W	W	W
Max gust (km/h)	42	42	52	44	42	43	45	42	39	58	46	42	

Climate ID: 6020379, http://climate.weatheroffice.gc.ca/climate_normals/index_e.html

Table 7: Mean Annual Regional Background Air Quality Data 2005 to 2009, Experimental Lakes Area, Ontario

Parameter ($\mu g/m^3$)	2005	2006	2007	2008	2009	Maximum for Period
Chloride (Cl^-)	0.026 (0.060)	0.016 (0.029)	0.021 (0.072)	0.072 (0.230)	0.040 (0.152)	1.760
Potassium (K^+)	0.032 (0.038)	0.030 (0.036)	0.029 (0.020)	0.028 (0.022)	0.034 (0.031)	0.306
Sodium (Na^+)	0.041 (0.066)	0.028 (0.041)	0.031 (0.062)	0.101 (0.166)	0.052 (0.105)	1.096
Ammonium (NH_4^+)	0.392 (0.509)	0.310 (0.389)	0.301 (0.473)	0.432 (0.597)	0.374 (0.457)	6.136
Nitrate (NO_3)	0.393 (0.761)	0.351 (0.697)	0.341 (1.043)	0.748 (1.619)	0.464 (1.001)	15.300
Nitric Acid (HNO_3)	0.356 (0.343)	0.290 (0.264)	0.234 (0.226)	0.281 (0.272)	0.260 (0.259)	2.007
Sulphate (SO_4^{2-})	1.072 (1.274)	0.813 (0.818)	0.779 (0.778)	0.967 (0.660)	0.983 (0.945)	9.167
Sulphur Dioxide (SO_2)	0.561 (0.751)	0.406 (0.466)	0.354 (0.564)	0.801 (0.868)	0.531 (0.798)	6.550
Calcium (Ca^{2+})	0.139 (0.199)	0.162 (0.297)	0.140 (0.181)	0.117 (0.193)	0.161 (0.287)	3.202
Magnesium (Mg^{2+})	0.032 (0.041)	0.033 (0.048)	0.032 (0.037)	0.033 (0.037)	0.039 (0.056)	0.365

Source: Environment Canada (2012)
Notes: Standard Deviations given in brackets

Table 8: Mean Regional Background Precipitation Quality Data 1983 to 2008, Experimental Lakes Area, Ontario

Parameter	Measurement	Mean Concentration	Maximum for Period
pH	pH units	5.16	3.4 to 7.63
Hydrogen ion	mg/L	0.01	0.40
Sulphate	mg/L	1.26	22.77
Nitrate	mg/L	1.76	27.05
Chloride	mg/L	0.10	2.08
Ammonium	mg/L	0.56	11.42
Sodium	mg/L	0.06	2.04
Calcium	mg/L	0.33	8.64
Magnesium	mg/L	0.07	2.59
Potassium	mg/L	0.05	1.04

Source: Environment Canada (2012)

Table 9: Mean Annual Regional Background Air Quality Data

Parameter	AAQC	AAQO (Desirable / Acceptable)	Thunder Bay, Ontario (AQI Station 63203)					Experimental Lakes Area, Ontario (NAPS Station 64001)					Winnipeg, Manitoba (NAPS Station 070119)				
			2006	2007	2008	2009	2010	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
NO_2 (ppb)	100 (24 hr) 200 (1 hr)	30 / 50	8.1	8.7	8.1	8.4	7.8	-	-	-	-	-	14 (8)	14 (8)	13 (9)	12 (8)	13 (9)
NO (ppb)	9,000 ($\mu g/m^3$)	-	6.1	5.4	5.1	5.7	4.6	-	-	-	-	-	9 (16)	9 (15)	9 (16)	8 (13)	7 (12)
O_3 (ppb)	80	50 / 80	23.5	24.2	23.0	24.2	25.7	33 (9*)	31 (11)	30 (10)	32 (11)	33 (10)	20 (11)	21 (12)	17 (10)	19 (11)	21 (12)
$PM_{2.5}$ Mean ($\mu g/m^3$)	30	-	4.8	4.4	4.2	3.8	4.1	-	-	-	-	-	6 (6)	5 (5)	4 (4)	5 (7)	5 (5)
$PM_{2.5}$ 98^{th} / 99^{th} ** Percentile ($\mu g/m^3$)	-	-	22	21	21	17	17	-	-	-	-	-	21	14	13	15	14
CO (ppm)	13 (8 hr) 30 (1 hr)	-	-	-	-	-	-	-	-	-	-	-	0.5 (0.3)	0.5 (0.3)	0.4 (0.2)	0.3 (0.2)	0.4 (0.2)

Sources: EC (2012); MOE (2010)
Notes: ppb: parts per billion
AAQC: MOE Ambient Air Quality Criteria
AAQO: National Ambient Air Quality Objectives
* Standard deviations (+/-) given in brackets
** 99^{th} percentile for Thunder Bay AQI Station, 98^{th} for Winnipeg NAPS Station

Table 10: Rural Background Air Quality Data

Station	Parameters	Unit	Year									
			2006		2007		2008		2009		2010	
			90th Percentile	24 hr Max	90th Percentile	24 hr Max	90th Percentile	24 hr Max	90th Percentile	24 hr Max	90th Percentile	24 hr Max
Dorset (49010)	$PM_{2.5}$	$\mu g/m^3$	11	25	12	33	10	19	8	27	10	22
	NO_2	ppb	-	-	-	-	-	-	-	-	-	-
	SO_2	ppb	-	-	-	-	-	-	-	-	-	-
Parry Sound (49005)	$PM_{2.5}$	$\mu g/m^3$	12	26	13	37	11	22	9	15	11	25
	NO_2	ppb	-	-	-	-	-	-	-	-	9	20
	SO_2	ppb	-	-	-	-	-					
North Bay (75101)	$PM_{2.5}$	$\mu g/m^3$	11	30	12	30	10	23	9	25	9	18
	NO_2	ppb	27	79	24	68	26	66	28	91	23	
	SO_2	ppb	2	6	-	-	-	-	-	-	-	-

Source: MOE (2010)
Notes: ppb: parts per billion
max: maximum

Table 11: Background Particulate Matter at the RRGP Site

Station	Parameter	CCME 24 hr	AAQO 24 hr 'Good' Reference Levels (µg/m^3)	24 hr AAQC (µg/m^3)	Average PM Concentration (µg/m^3)*
AQ 1 (A)	PM_1	-	-	-	5
	$PM_{2.5}$	30	15	-	5
	PM_{10}	-	25	50**	9
AQ 1 (B)	PM_1	-	-	-	14
	$PM_{2.5}$	30	15	-	15
	PM_{10}	-	25	50**	15
AQ 2	PM_1	-	-	-	11
	$PM_{2.5}$	30	15	-	11
	PM_{10}	-	25	50**	13

Source: Adapted from KCB (2011)
Notes: NAAQO: National Ambient Air Quality Objectives
CCME: Canadian Council of Ministers of the Environment
AAQC: MOE Ambient Air Quality Criteria
AAQO: National Ambient Air Quality Objectives
* Average PM concentrations were calculated over 3 hr averages and are not directly comparable to 24 hr average criteria
** Interim AAQC

Table 12: Air Quality Criteria for Target Pollutants

Parameter	Averaging Time	Ontario Air Quality µg/m^3	
		O.Reg. 419/05 POI Standards	Ambient Air Quality Criteria
NO_X (as NO_x for O.Reg 419, as NO_2 for AAQC)	1 hr	400	400
	24 hr	200	200
SO_2	1 hr	690	690
	24 hr	275	275
	Annual	-	55
CO	0.5 hr	6,000	-
	1 hr	-	36,200
	8 hr	-	15,700
PM (<44µm)	24 hr	120	120
$PM_{2.5}$ (<2.5µm)	24 hr	-	30[1] ambient 25 (single facility)
Hydrogen Cyanide	24 hr	8	-
Calcium Oxide	24 hr	13.5	-
Copper Sulphate	24 hr	-	20[3]
Arsenic	24 hr	0.3[2]	
Cadmium	24 hr	0.025	-
Chromium	24 hr	1.5[2]	
Mercury	24 hr	0.5	-
Magnesium	24 hr	120	-
Manganese	24 hr	0.15[2]	
Nickel	24 hr	2	-
Lead	24 hr	0.5	-
Zinc	24 hr	120	-

[1] Note: MOE points out these are not set AAQCs, but these are based on CCME - CWS and can assist in MOE decision making for adopted criteria. The CWS is based on meeting 30 µg/m^3 based on 98% percentile over three years

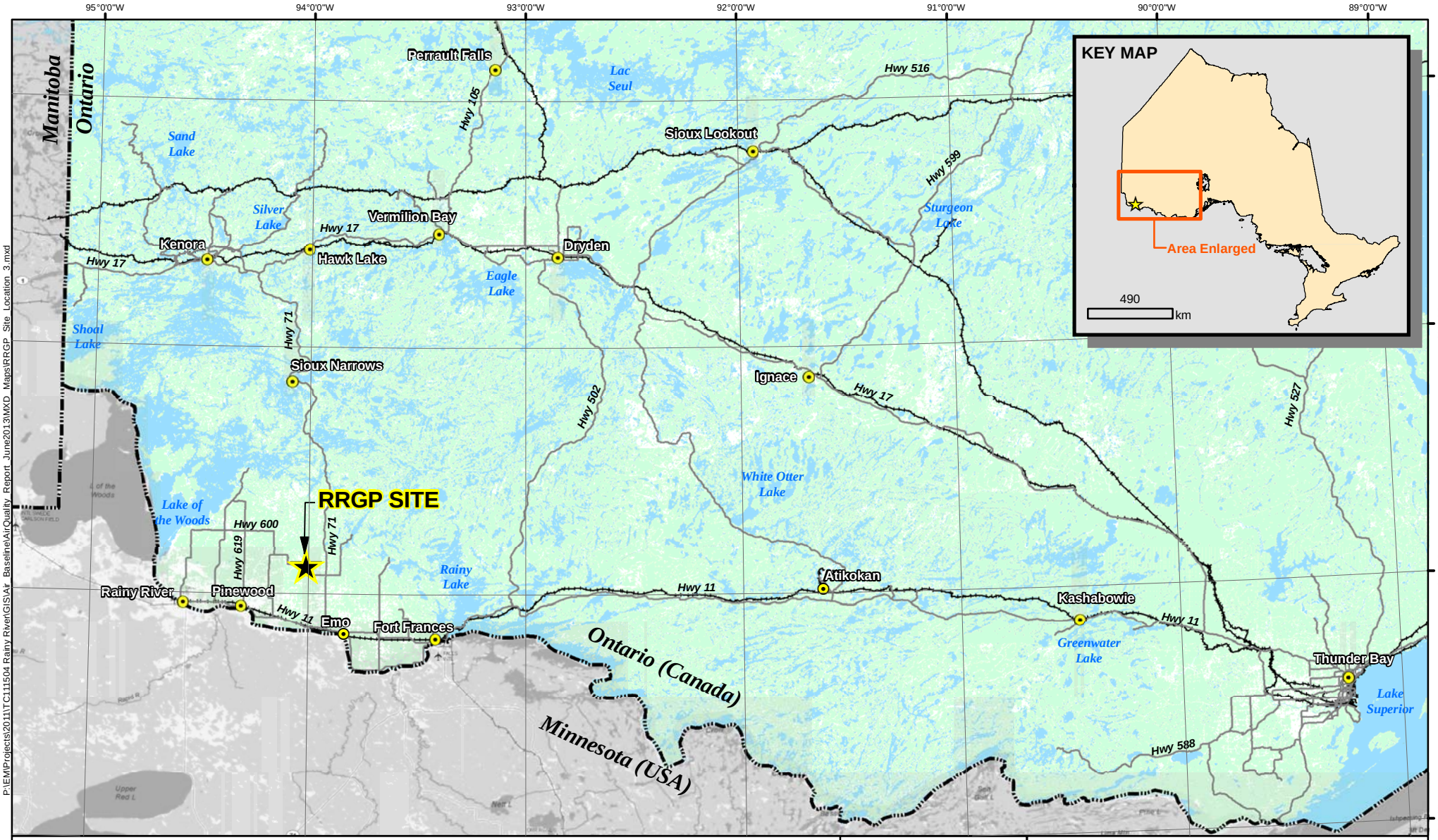
[2] These are not currently standards under O.Reg 419/05, but guidelines published by MOE for compliance assessment

[3] The 24-hour average criterion for copper sulphate (20 µg/m^3) was derived by a certified toxicologist

Table 13: Summary of Air Quality Results

Compounds	CAS Number	Facility Emission Rate (g/s)	Model Used	Modelled Concentration (µg/m^3)	Averaging Period (hr)	MOE POI Limit (µg/m^3)	Limiting Effect	MOE Schedule O.Reg. 419	% of Criteria
PM_{tot}	NA	81.08	AERMOD	86.0	24	120	visibility	3	71.7%
$PM_{2.5}$	NA	4.77	AERMOD	23.9	24	25	health	Guideline *	95.6%
Nitrogen Oxides	10102-44-0	6.7	AERMOD	26.7	24	200	health	3	13.4%
		95.2	AERMOD	227	1	400	health	3	56.8%
Carbon Monoxide	630-08-0	27.0	AERMOD	2,632	0.5	6000	health	3	43.9%
		453	AERMOD	2,193	1	36200	health	3	6.1%
		27.0	AERMOD	366	8	15700	health	3	2.3%
Sulfur Dioxide	7446-09-5	2.87	AERMOD	9.3	24	275	health and vegatation	3	3.4%
		29.7	AERMOD	138	1	690	health and vegatation	3	20.0%
Hydrogen Cyanide	74-90-8	0.15	AERMOD	1.4	24	8	health	3	17.5%
CaO**	1305-78-8	0.09	AERMOD	0.80	24	13.5	corrosion	3	5.9%
CuSO4**	7758-99-8	0.09	AERMOD	0.79	24	20	health	No limit MOE limit***	4.0%
As	7440-38.2	1.12E-02	AERMOD	1.19E-02	24	0.3	health	Guideline	4.0%
Cd	7440-43-9	1.46E-03	AERMOD	1.55E-03	24	0.025	health	3	6.2%
Cr	7440-47-3	1.60E-02	AERMOD	1.69E-02	24	1.5	health	Guideline	1.1%
Hg	7439-97-6	8.11E-06	AERMOD	8.60E-06	24	0.5	health	3	0.002%
Mg	1309-48-4	2.18E+00	AERMOD	2.32E+00	24	120	particulate	3	1.9%
Mn	1336-36.3	1.18E-01	AERMOD	1.25E-01	24	0.15	health	Guideline	83.6%
Ni	7440-02-0	6.42E-03	AERMOD	6.81E-03	24	2	vegetation	3	0.3%
Pb	10099-74-8	0.018	AERMOD	1.87E-02	24	0.5	health	3	3.7%
Zn	7440-66-6	2.07E-01	AERMOD	2.19E-01	24	120	particulate	3	0.18%

NA: not applicable; POI: point of impingement
Modelled concentrations account for met anomalies as per MOE Modelling Guidance
* $PM_{2.5}$: the Canada Wide Standard is 30 µg/m^3. MOE has provided a 25 µg/m^3 single facility guideline to account for cumulative impacts (i.e. background levels)
** process plant modelled as 1 g/s with all particulate assumed to be compound and scaled by emission rate
*** all limits are MOE limits, except for $CuSO_4$ - limit derived by a certified toxicologist



LEGEND

- RRGP Site
- Regional Communities
- Provincial / National Border
- Regional Road / Highway
- Railway

NOTES:
- Ontario base data extracted from Land Information Ontario (MNR) data warehouse, Queen's Printer for Ontario, 2011-2012
- Base data outside of Ontario extracted from ESRI DeLorme World Basemap

0 25 50 100 150 200 250 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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RRGP Project Location

PROJECT N°: TC111504	**FIGURE: 1**
SCALE: 1:1,800,000	DATE: June 2013

410000 415000 420000 425000 430000 435000 440000 445000 450000

5425000 5420000 5415000 5410000 5405000

Hwy 600
Hwy 600
Hwy 600
Hwy 600
Hwy 600
Hwy 617
Hwy 71
Hwy 71
Hwy 615
Hwy 615
Hwy 404 East Rd
Burditt Lake
Beadle Lake
Preachers Lake
Spring Lake
Little Pine Lake
Pony Lake
Boundary Lake
Off Lake
Menomin Rd
Rainy Lake IR 17b
Existing Transmission Line
Muskrat Lake
Lampi Rd
Marr Rd
Roen Rd
Clark Road
Teeple Road
Tait Road
Finewood River
Gallinger Rd
Heatwole Road
White Road
Pinewood Lake
Fleming Rd
Abbott Lake

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LEGEND

- RRGP Site
- Roads
- Existing Transmission Line
- First Nation Land

Rainy River Resources Land Tenure

- Rainy River Resources Active Dispositions (Active patent, lease or license of occupation)
- Rainy River Resources Active Unpatented Claim

NOTES:
- Road and Utility data and topographic data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Land tenure information derived from MNDM Claimap service, data extracted on Feb. 27, 2013 and RRR Land Ownership property maps

Datum: NAD83
Projection: UTM Zone 15N

0 5 10 20 30 Kilometres

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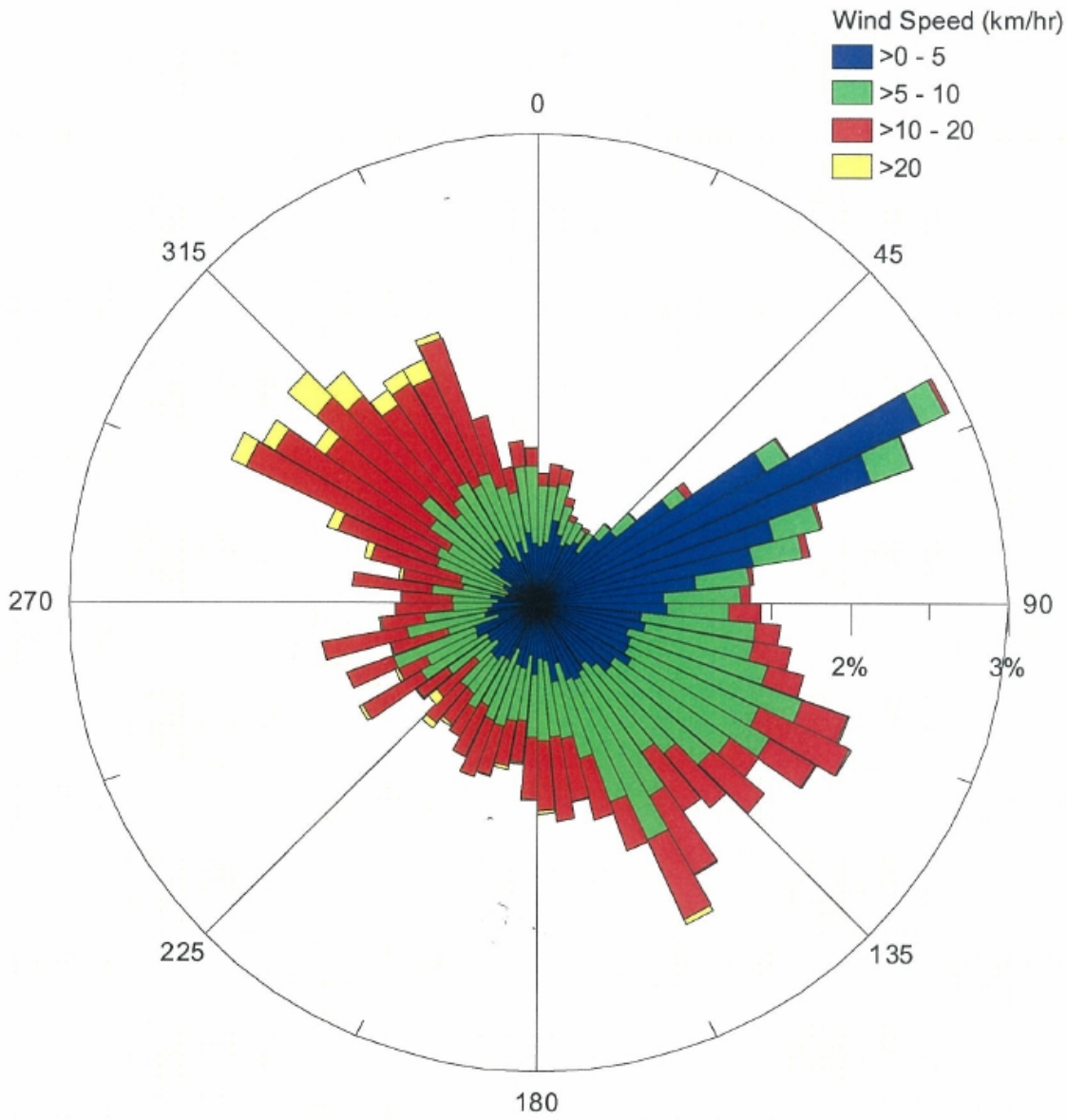
RAINY RIVER GOLD PROJECT

Local Project Area

PROJECT N°: TC111504 | **FIGURE: 2**

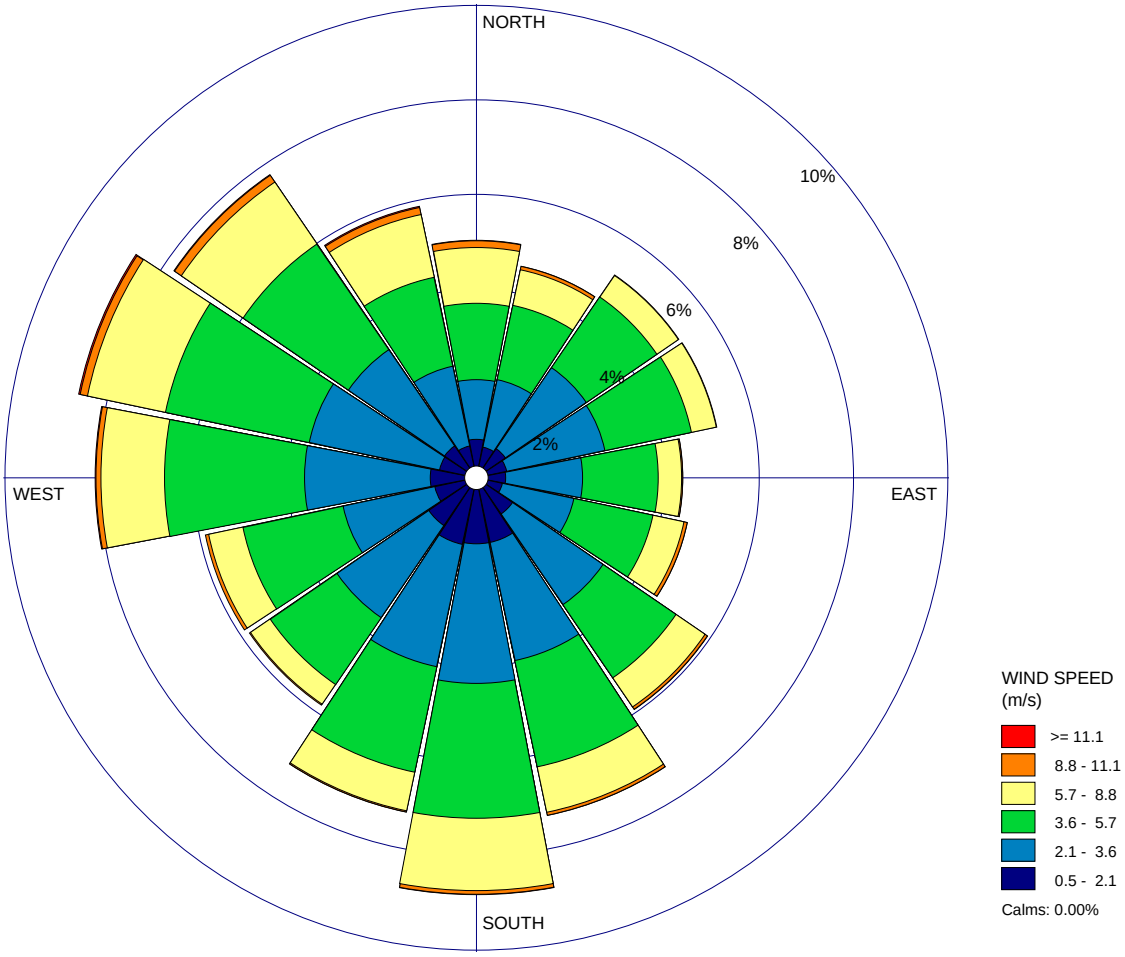
SCALE: 1:107,000 | DATE: June 2013

Figure 3: Wind Rose Diagram for RRGP Site

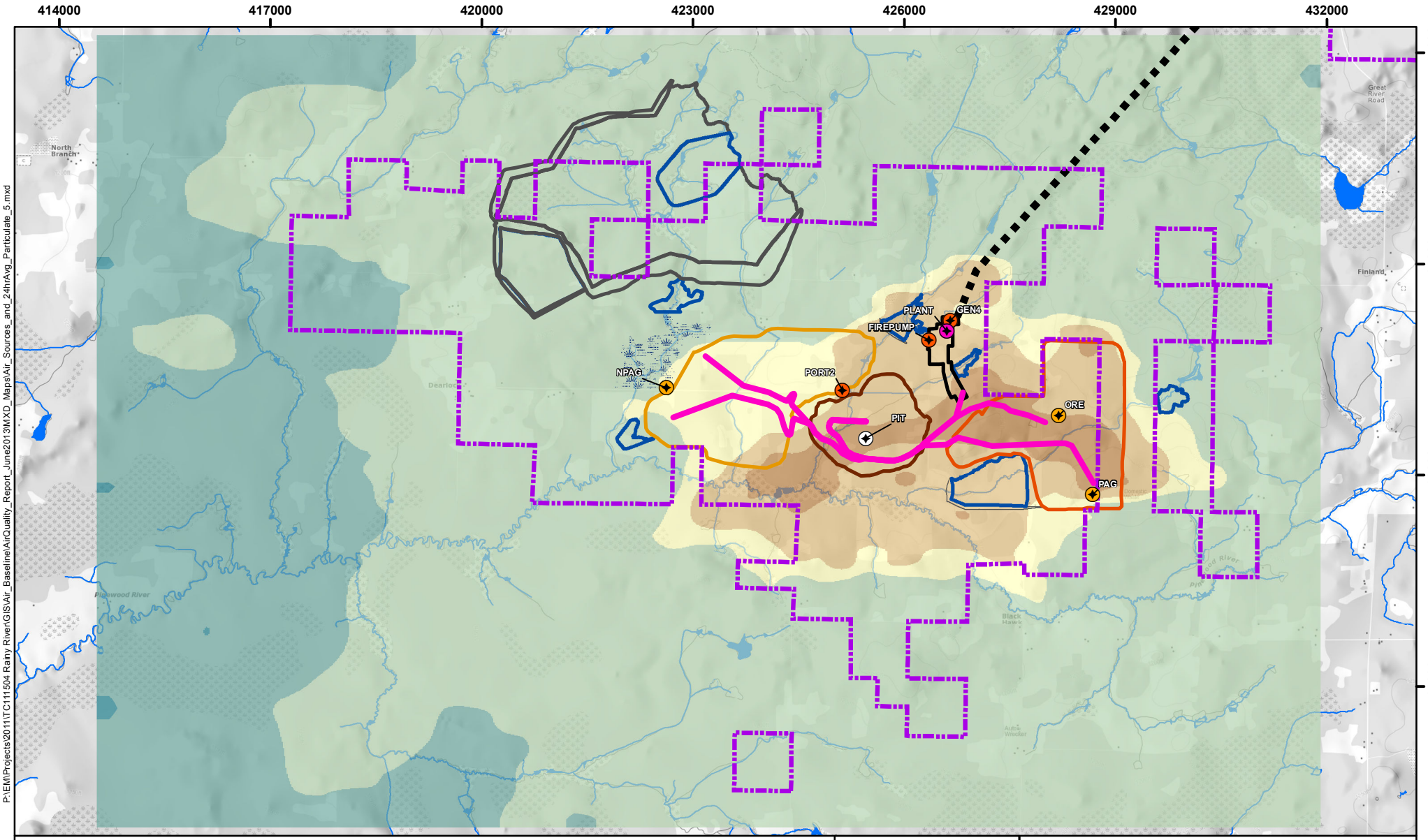


Source: KCB (2011)

Figure 4: Wind Rose Diagram for International Falls (1996-2000)



Source: Ontario Ministry of the Environment (2013), Lakes Environmental (2013)



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LEGEND

- Approximate Property Boundary

Sources (labelled with ID)

- Area
- Open Pit
- Point
- Volume
- Line Source (haul roads)

Proposed Site Features

- Open Pit
- Tailings Management Area
- Overburden / West Mine Rock Stockpile
- Ore / East Mine Rock Stockpile
- Plant Site / Ancillary Facilities
- Ponds
- Transmission Line

Total Particulate – 24 hour average * Concentrations in ug/m^3

- 0 - 5
- 5 - 10
- 10 - 40
- 40 - 50
- 50 - 70
- 70 - 100
- 100 - 120

NOTES:
* Standard is 120 ug/m^3

0 1.25 2.5 5 7.5 10 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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Dispersion Modelling Isopleth for Total Particulate Matter (24-hour)

PROJECT N°: TC111504	**FIGURE: 6**
SCALE: 1:75,000	DATE: June 2013

420000 422500 425000 427500 430000 432500

5412500 5410000 5407500

SUMP
RECLAIM BARGE
TAILINGS MANAGEMENT AREA POND
TAILINGS MANAGEMENT AREA
SUMP
Explosives Facilities
TRANSMISSION LINE
EAST ACCESS ROAD
WATER MANAGEMENT POND
WATER MANAGEMENT PIPELINE
WATER DISCHARGE POND
OUTLET CHANNEL
WEST CREEK DIVERSION
AGGREGATE PIT
WEST CREEK POND
PROCESS PLANT
SEDIMENT POND # 1
CLARK CREEK
OVERBURDEN STOCKPILE
CONSTRUCTED WETLAND
CRUSHED ORE STOCKPILE
STOCKPILE POND
CLARK CREEK POND
WEST MINE ROCK STOCKPILE
OPEN PIT
LOW GRADE ORE STOCKPILE
CLARK CREEK DIVERSION
CLARK CREEK DAM
LOSLO CREEK
SEDIMENT POND # 2
EAST MINE ROCK STOCKPILE
PINEWOOD RIVER
PIT PROTECTION BERM
PINEWOOD RIVER
WATER MANAGEMENT PIPELINE
HIGHWAY 600 RE-ALIGNMENT

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LEGEND

- UNDERGROUND PORTAL
- OPEN PIT
- PROCESS PLANT
- WATER MANAGEMENT PIPELINES
- SITE ROAD
- POND
- AGGREGATE PIT
- TRANSMISSION LINE
- DITCH
- DEPOSITED TAILINGS
- MINE ROCK STOCKPILE
- OVERBURDEN STOCKPILE

Notes from CAD Drawing:

1. ALL ELEVATIONS AND GRID COORDINATES SHOWN ON THIS DRAWING ARE IN METERS. GRID COORDINATES ARE REFERENCED TO UTM NAD 83 ZONE 15 DATUM. ELEVATIONS ARE GEODETIC.
2. GROUND SURFACE CONTOURS (2m INTERVALS) PROVIDED BY RAINY RIVER RESOURCES LTD.
3. WATERCOURSE DATA, LOCAL ROADS AND HIGHWAYS OBTAINED FROM ONTARIO DIGITAL GEOSPACIAL DATABASE (OBM), MAY 2011
4. THE FOLLOWING WERE PROVIDED BY BBA: OPEN PIT
5. PIT PROTECTION BERM REQUIRED BETWEEN THE PINEWOOD RIVER AND OPEN PIT TO BE 2.1 m HIGH MIN.
6. MINE ROCK STOCKPILE AREA SHOWN.
7. CONSTRUCTED WETLAND IS CONCEPTUAL ONLY.
8. OVERBURDEN AND ROCK STOCKPILE NOT AVAILABLE AT THIS TIME.

NOTES:
- Site Plan from AMEC CAD drawing May 3, 2013, derived from BBA drawing 3098003-003000-41-D20-0001, April 29, 2013

Datum: NAD83
Projection: UTM Zone 15N

0 1.25 2.5 5 7.5 10 Kilometres

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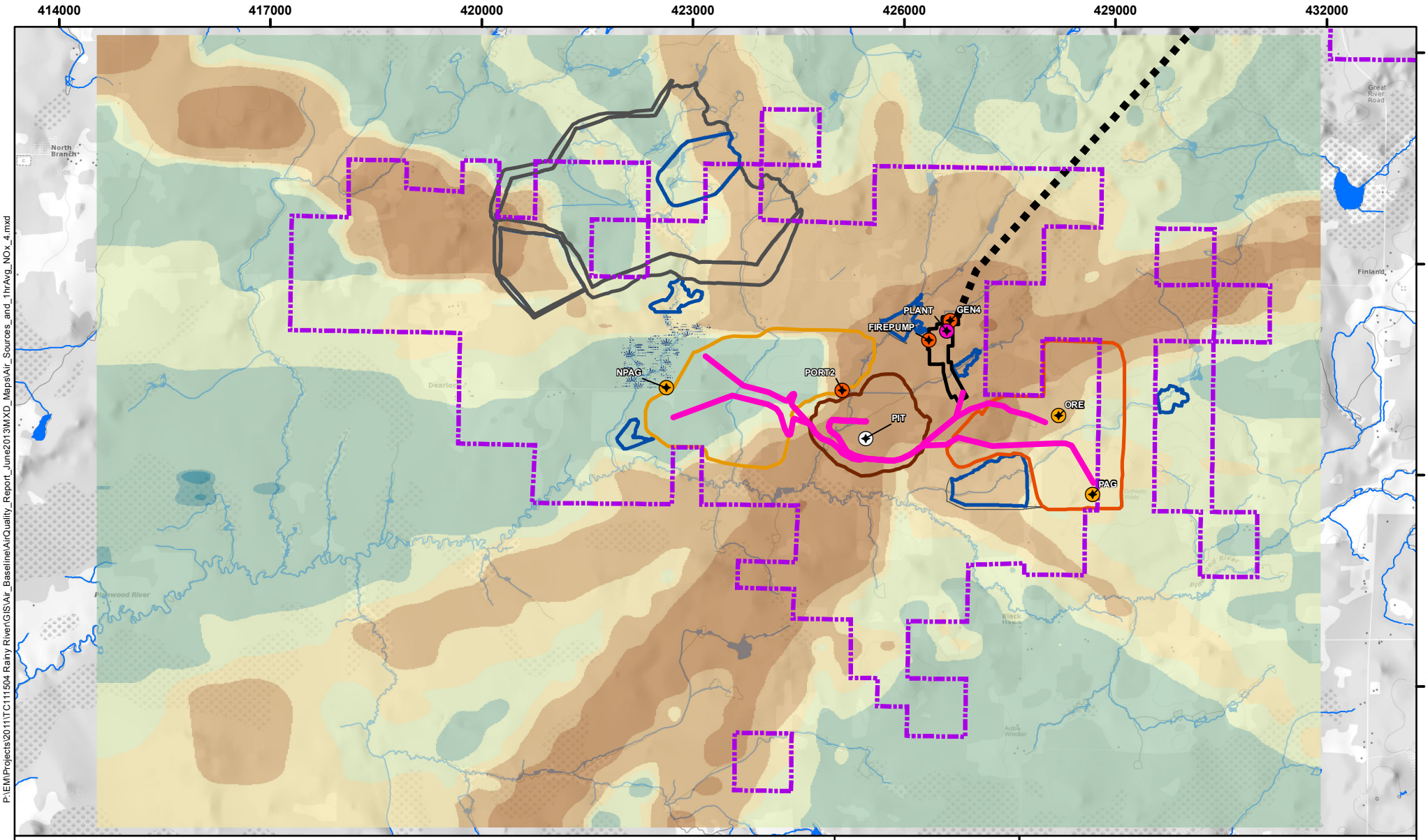
RAINY RIVER GOLD PROJECT

Site Plan

PROJECT Nº: TC111504 | FIGURE: 5

SCALE: 1:37,500 | DATE: June 2013



LEGEND

Sources (labelled with ID)

- Area
- Open Pit
- Point
- Volume
- Line Source (haul roads)
- Approximate Property Boundary

Proposed Site Features

- Open Pit
- Tailings Management Area
- Overburden / West Mine Rock Stockpile
- Ore / East Mine Rock Stockpile
- Plant Site / Ancillary Facilities
- Ponds
- Transmission Line

Nitrogen Oxides – 1 hour average*
Concentrations in ug/m^3

- 0 - 8
- 8 - 10
- 10 - 40
- 40 - 50
- 50 - 60
- 60 - 100
- 100 - 200
- 200 - 300

NOTES:
* Standard is 400 ug/m^3

0 1.25 2.5 5 7.5 10 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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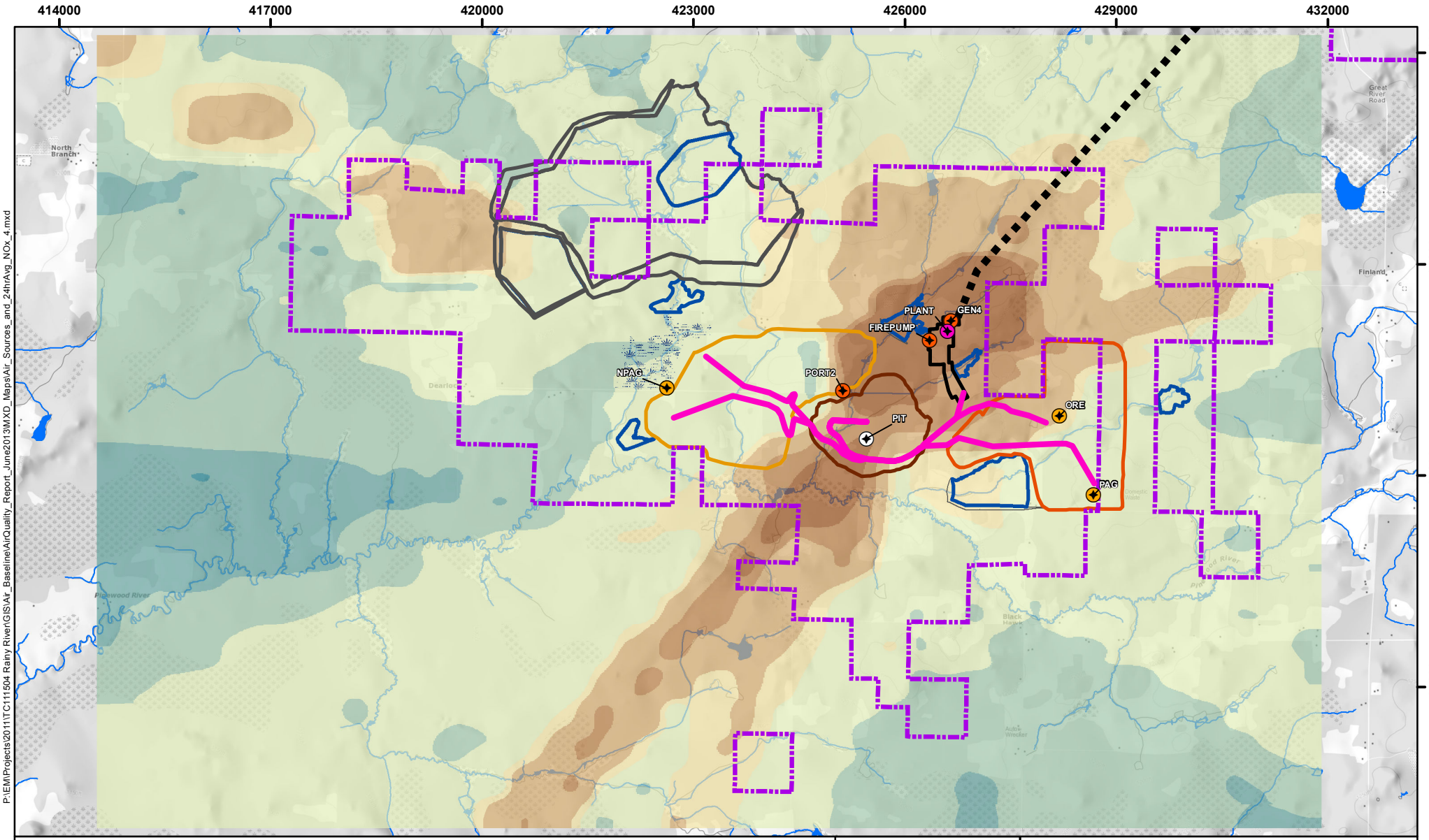
RAINY RIVER GOLD PROJECT

Dispersion Modelling Isopleth for Nitrogen Oxides (NOx) (1-hour)

PROJECT N°: TC111504	**FIGURE: 9**
SCALE: 1:75,000	DATE: June 2013



LEGEND

Sources (labelled with ID)

- Area
- Open Pit
- Point
- Volume
- Line Source (haul roads)
- Approximate Property Boundary

Proposed Site Features

- Open Pit
- Tailings Management Area
- Overburden / West Mine Rock Stockpile
- Ore / East Mine Rock Stockpile
- Plant Site / Ancillary Facilities
- Ponds
- Transmission Line

Nitrogen Oxides – 24 hour average* Concentrations in ug/m^3

- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 4
- 4 - 5
- 5 - 8
- 8 - 10
- 10 - 30

NOTES:
* Standard is 200 ug/m^3

0 1.25 2.5 5 7.5 10 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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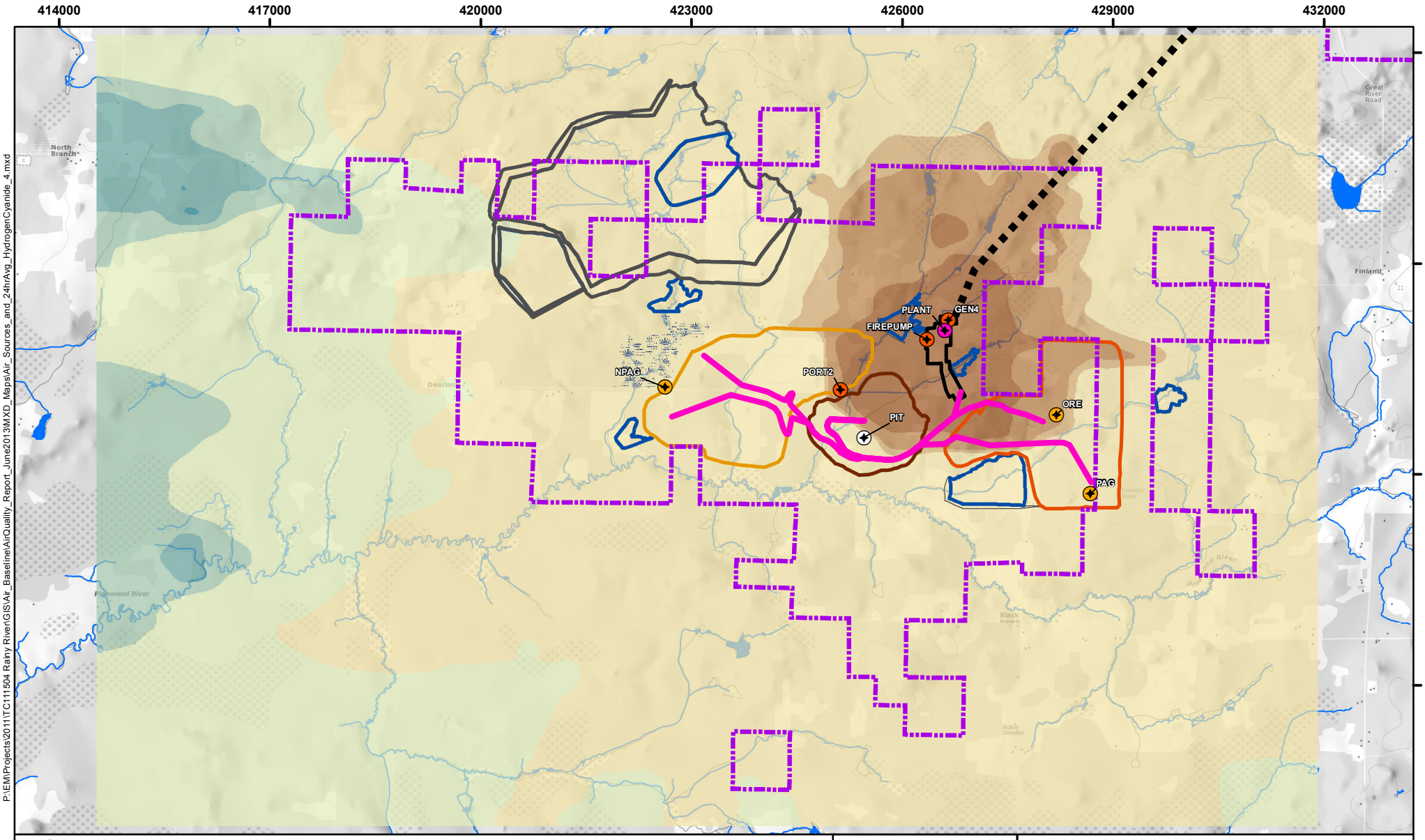
RAINY RIVER GOLD PROJECT

Dispersion Modelling Isopleth for Nitrogen Oxides (NOx) (24-hour)

PROJECT N°: TC111504	**FIGURE: 8**
SCALE: 1:75,000	DATE: June 2013



LEGEND

Sources (labelled with ID)

- Area
- Open Pit
- Point
- Volume
- Line Source (haul roads)
- Approximate Property Boundary

Proposed Site Features

- Open Pit
- Tailings Management Area
- Overburden / West Mine Rock Stockpile
- Ore / East Mine Rock Stockpile
- Plant Site / Ancillary Facilities
- Ponds
- Transmission Line

Hydrogen Cyanide – 24 hour average* Concentrations in ug/m^3

- 0 - 0.03
- 0.03 - 0.05
- 0.05 - 0.06
- 0.06 - 0.1
- 0.1 - 0.5
- 0.5 - 0.6
- 0.6 - 1
- 1 - 2

NOTES:
* Standard is 8 ug/m^3

0 1.25 2.5 5 7.5 10 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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Dispersion Modelling Isopleth for Hydrogen Cyanide (24-hour)

PROJECT N°: TC111504	**FIGURE: 7**
SCALE: 1:75,000	DATE: June 2013

APPENDIX A

SOURCE AND EMISSION DATA SUMMARIES

A1 -Rainy River Project Operations Phase - Key Data

		Potential to Emit (Maximum over Life of Project)	
Source	**Units**	**Amount**	**Basis**
Total Mineral Reserve Mined	**Mt**	**150**	
Mine Life	**years**	**16**	**(2 years pre-production not included)**
Ore Production			
	tonnes/day	24,000	design 20,000 tpd, contingency of 20%
	tonnes/hr	1,000	based on 24 hour operation
Drilling			
# drills	#	3	
shift drill time	hours	24	
# holes	#	40.0	holes per shift
hole diameter	inches	8.5	
hole diameter	m	0.216	
average depth	m	11.5	
Blasting			
frequency		3	per week
maximum daily volume moved	m3	73814	
maximum daily tonnage moved	tonnes	175,517	
rock mass	tonnes	409,539	total tonne per blast (ore and waste in pit)
density	tonnes/m^3	2.835	average ore and waste
volume blasted	m^3	172,233	per blast
area blasted	m^2	17,223	
hole depth (average)	m	10.0	depth of bench
explosive (bulk emulsion)	kg/tonne	0.245	average of 0.28 (ore) and 0.21 (mine rock)
explosive (bulk emulsion)	kg/blast	100,337	
Crushing and Milling			
Primary Crusher	tonnes/day	24,000	
	tonnes/year	8,760,000	
	tonnes/hour	1,000	assume 24 hour operation
Cement Batch Plants			
estimated truck capacity	cu. yards per truck		Trucks weigh 9,100 kg to 14,000 kg, and can carry roughly 18,000 kg of concrete although many varying sizes of Mixer Truck are currently in use. The most common truck capacity is 8 cubic yards (6 m3).
cement production per hour, plant 1	m3/hr	80	
	cu.yards	104.6	
cement density	pounds per yard	4,024	
coarse aggregate	pounds per yard	1,865	
sand	pounds per yard	1,428	
cement	pounds per yard	491	
cement supplement	pounds per yard	73	
water	pounds per yard	167	
Ore Processing Reagents			
Thickener (flocculent)	kg/t ore feed	0.08	
	kg/day	1,920	
	tonnes/year	701	
	kg/hr	80.0	
# thickener tanks	#	1	
tank diameter	m	41.0	
tank height	m		
Lime Usage	kg/t ore feed	0.82	
(90% pure)	kg/day	19,680	
	tonnes/year	7,183	
	kg/hr	820	
silo capacity	tonne	300	
truck delivery	tonne per truck	35	

A1 -Rainy River Project Operations Phase - Key Data

		Potential to Emit (Maximum over Life of Project)	
Source	**Units**	**Amount**	**Basis**
Sodium Cyanide Usage	kg/t ore feed	0.33	solid pellet in ISO container
	pH	11.0	alkaline leaching
	mg/L NaCN	1000	
	kg/day	7,920	
	tonnes/year	2,891	
	kg/hr	330.00	
# leach tanks	#	8	
retention	hours	30	
leach tank diameter	m	9.0	
leach tank height	m	10.5	average height - range 9.1 to 12.9 m
CIP Tanks			
# CIP tanks	#	8	
tank volume	m3	100	
Nitric Acid	kg/t ore feed	0.06	
	kg/day	1,440	
	tonnes/year	526	
	kg/hr	60.0	
Caustic Soda (NaOH)	kg/t ore feed	0.13	50% solution
	kg/day	3,120	
	tonnes/year	1,139	
	kg/hr	130.0	
Copper Sulphate	kg/t ore feed	0.07	1000 kg super sacs, 24 tonnes per load
	kg/day	1,680	
	tonnes/year	613	
	kg/hr	70.0	
SO_2 Use for CN destruction	kg/t ore feed	0.39	
	kg/day	9,360	
	tonnes/year	3,416	
	kg/hr	390	
Truck Delivery	tonnes per truck	26	
Storage Tank	tonnes	80	
	% excess	3%	
Flux	tonnes/year	10	
	kg/hr	1.14	
Propane Use	L/year	3,200,000	space heating in plant and shops
	L/hour	1778	bsaed on 5 month use/24 hrs/7 per week x 2 for cold day
Hours of Operation			
Ore Hauling	hours / year	8,760	365 days per year --- 24 hours per day
Waste Rock Hauling	hours / year	8,760	365 days per year --- 24 hours per day
Tailings Hauling	hours / year	8,760	365 days per year --- 24 hours per day
Process Plant	hours / year	8,760	365 days per year --- 24 hours per day
Haul Routes			
	width (m)	32	to support two-way uninterrupted haulage
ore and waste	length (m)	*see table F5*	
Haul Details			
Open Pit 'Truck Loads (Ore to crush)	#/hour	4	loads per hour
	tonnes/trip	220	Cat 793F or equivalent
	tonnes/hour	822	
	tonnes/day	19,726	
	tonnes/year	7,200,000	maximum year 1 to year 11 (year 7 6.6 MT to mill, 6.1 to stockpile)

A1 -Rainy River Project Operations Phase - Key Data

		Potential to Emit (Maximum over Life of Project)	
Source	**Units**	**Amount**	**Basis**
Underground Truck Loads (ore to crush	#/hour	2	loads per hour
	tonnes/trip	50	Cat 773G or equivalent
	tonnes/hour	100	
	tonnes/day	2,400	
	tonnes/year	730,000	
Truck Loads (Ore to stockpile)	#/hour	4	loads per hour
	tonnes/trip	220	
	tonnes/hour	982	
	tonnes/day	23,562	
	tonnes/year	8,600,000	
Truck Loads (overburden and NPAG)	#/hour	25	loads per hour
	tonnes/trip	220	
	tonnes/hour	5,517	
	tonnes/day	132,417	
	tonnes/year	48,332,319	
Truck Loads (Waste PAG)	#/hour	12	loads per hour
	tonnes/trip	220	
	tonnes/hour	2,716	
	tonnes/day	65,176	
	tonnes/year	23,789,209	
Open Pit Haul Trucks			
unladen weight	tonnes	170	from specs. Max weight of body
load weight	tonnes	220	Cat 793F or equivalent
width	m	8.69	
height	m	7.37	14.02 raised
length	m	15.6	
number		16	at maximum year
Underground Truck Loads (ore)			
unladen weight	tonnes	102.7	Cat 773G or equivalent
load weight	tonnes	50	
Shovel (Ore/Waste)	#	3	26 m3 hydraulic shovels
Loader	#	3	30 m3
Wheel Dozer	#	0	687 hp
Track Dozer	#	6	580 hp
Motor Grader	#	2	
Water Trucks	#	1	

TABLE A2: SOURCE AND CONTAMINANT IDENTIFICATION TABLE

Source Information				Expected Contaminants	Included in Model?
Source	Source Label*	Source Description	General Location		Significant (Yes or No?)
Drill	PIT	Open Pit Mining - Drilling	Open Pit	TSP, metals	Yes
Blast	PIT	Open Pit Mining - Blasting	Open Pit	TSP, NOx, CO,SO2, metals	Yes
Load	PIT	Open Pit Mining - Load Haul Truck (Shovel)	Open Pit	TSP, metals	Yes (TSP, Metals)
In Pit Road	PIT	Open Pit Mining - Haul trucks	Open Pit	TSP, metals	Yes (Metals)
Haul Roads	Roads (various)**	Road Emissions	On-site roads	TSP, metals	Yes (Metals)
Dozers/Graders	PIT	Dozers and Graders in pit	Open Pit	TSP, metals	Yes (TSP, Metals)
Concrete 1	BATCH1	Batch Plant 1	Concrete Batch Plant	TSP	Yes (TSP)
BagHouse2	BH2 - under crushed ore pile	baghouse for conveyor drop under stockpile feed	Reclaim & Handling	TSP, metals	Yes (TSP)
Reclaim	RECLAIM	Discharge to stockpile	Reclaim & Handling	TSP, metals	Yes (TSP)
Unload 1	PAG (and PAGN)	Drop at PAG	Pag Stockpile	TSP, metals	Yes (TSP)
Dozer WR	PAG (and PAGN)	Dozer use at PAG	Pag Stockpile	TSP, metals	Yes (TSP)
Unload 2	NPAG/OB	NPAG/OB drop	NPAG/OB Stockpile	TSP, metals	Yes (TSP)
Dozer NPAG	NPAGDoz	Dozer use at NPAG and OB	NPAG/OB Stockpile	TSP, metals	Yes (TSP)
Unload 3	ORE	Ore stockpile unloading	Ore Stockpile	TSP, metals	Yes (TSP)
Dozer Ore	OREDoz	Dozer at Ore stockpile	Ore Stockpile	TSP, metals	Yes (TSP)
Ex Portal 1	Port1	UG exhaust portal in pit	In Pit	TSP, NOx, CO,SO2, metals	Yes
Ex Portal 2	Port2	UG exhaust portal west of pit	West of Pit	TSP, NOx, CO,SO2, metals	Yes
Unload Crusher	CRUSH	Fugitive Primary Crusher Feed	Primary Crushing	TSP, metals	Yes (TSP)
BagHouse1	BH1 PCRUSH	baghouse for crusher	Primary Crushing	TSP, metals	Yes (TSP)
Grind 1	Grind	Grinding Section	Gold Recovery Area		No: wet process no emissions
Grind 2	Concentrator	Gravity Concentrator/Vibrating screen	Gold Recovery Area		No: wet process no emissions
Thick 1	Preleach Thickener	Pre-leach Thickener	Gold Recovery Area		
Thick 2	Pre-detox Thickener	Pre-detox Thickener	Gold Recovery Area		
Leach	LEACH	Leach Tanks - LT1 to LT8	Gold Recovery Area	HCN	Yes
SpaceHeat	SPACEHEAT	space heating in process building	Process building	NOx	Yes
CIP	LEACH	CIP Process	Gold Recovery Area	HCN	included in Leach tank emissions
Acid Wash	EF1	exhaust fan from acid wash and dilute acid tank	Gold Recovery Area	Nitric Acid	No: Insignificant. Dilute soln
NaOH Neutral	VENT1	exhaust vent from neutralization tank	Gold Recovery Area	NaOH	No: Insignificant. Dilute soln
Barren soln/cold	EF2	exhaust fan for barren soln tank and cold strip tank	Gold Recovery Area	neutral soln	No: Insignificant. Dilute soln

TABLE A2: SOURCE AND CONTAMINANT IDENTIFICATION TABLE

Source Information				Expected Contaminants	Included in Model?
Source	Source Label*	Source Description	General Location		Significant (Yes or No?)
C-reactivation kiln	EF3	exhaust fan for carbon reactivation kiln 1	Gold Recovery Area	electric kiln no emissions	No: no significant emissions
C-reactivation kiln	EF4	exhaust fan for carbon reactivation kiln 2	Gold Recovery Area	electric kiln no emissions	No: no significant emissions
Electro win	EF5	refinery exhaust fan for some electrowinning cells and pregnant soln tank	Gold Recovery Area	HCN emissions accounted for in leach emissions	No: no significant emissions
Electro win	EF6	refinery exhaust fan for some electrowinning cells, discharge pump box and dryer	Gold Recovery Area	HCN emissions accounted for in leach emissions	No: no significant emissions
Induction Furances	IND1	dust collector / scrubber to control furnace exhaust	Gold Recovery Area	TSP	Yes (TSP)
Lime Baghouse	BH11 Lime	exhaust for lime bin dust collector	Gold Recovery Area	TSP, CaO	Yes (TSP, CaO)
Scrubber lime slaker	LS1	scrubber for lime slaker	Gold Recovery Area	TSP, CaO	Yes (TSP, CaO)
Flocculant Dust collector	FLOC1	flocculant handling cartridge filter	Gold Recovery Area	TSP, Pb Nitrate	Yes (TSP, Pb nitrate)
CuSO4 scrubber	EF11CuSO4	scrubber to control CuSO4 from loading and mixing	Gold Recovery Area	CuSO4	Yes (TSP, CuSO4)
NaOH Tanks	EF9	caustic storage tanks	Gold Recovery Area	NaOH	no; Low VP; insignificant
SO2 Tanks	Vent4	SO2 storage tank vent	Gold Recovery Area	SO2	No; in transer closed loop. No other emissions
SO2 Tanks	Vent 5	SO2 storage tank vent	Gold Recovery Area	SO2	No; in transer closed loop. No other emissions
Nitric Storage	EF10	Nitric acid tank passive vent	Gold Recovery Area	NaOH	no; Low VP; insignificant
CN-Dest 1	HCND1	CN Destruction Tank 1	Gold Recovery Area	SO2	Yes
Emerg Gen 1	EGEN1	Emergency Diesel Generator 1	Plant Site	Combustion by-products	One generator modelled during testing. Only one unit is tested at a time. Largest 2.5 MW assumed
Emerg Gen 2	EGEN2	Emergency Diesel Generator 2	Plant Site	Combustion by-products	
Emerg Gen 3	EGEN3	Emergency Diesel Generator 3	Plant Site	Combustion by-products	
Emerg Gen 4	EGEN4	Emergency Diesel Generator 4	Plant Site	Combustion by-products	
Emerg Gen 5	EGEN5	Emergency Diesel Generator 5	Plant Site	Combustion by-products	
FuelTank1	FT1	Fire Pump Fuel Tank 1	Plant Site	VOCs	No. Minor emissions during tank filling

TABLE A2: SOURCE AND CONTAMINANT IDENTIFICATION TABLE

Source Information				Expected Contaminants	Included in Model?
Source	Source Label*	Source Description	General Location		Significant (Yes or No?)
FirePump1	FP1	Diesel Fire Pump 1	Plant Site	Combustion by-products	Pump modelled during testing.
Diesel Storage	Diesel	DIESEL FUEL STORAGE TANKs	Fuel Island or Plant Site	VOCs	No. Minor emissions during tank filling
Gasoline Day	GT1	GASOLINE STORAGE TANK	Fuel Island or Plant Site	VOCs	No. Minor emissions during tank filling
Diesel Day	DDT1	DIESEL DAY TANK	Fuel Island or Plant Site	VOCs	No. Minor emissions during tank filling
Other Fuel	OFT	OTHER FUEL TANKS	Fuel Island or Plant Site	VOCs	No. Minor emissions during tank filling
Combined Diesel/Gas	GDMISC	diesel / gasoline tank	Fuel Island or Plant Site	VOCs	No. Minor emissions during tank filling

***Source ID: only sources modelled and significant**

** Haul Road IDs are shown on Table F5

Table A3: Source Summary - Emissions (g/s)

Operations Phase

Source	Source ID	Description	Emissions (g/s)											
			PM	PM10	PM2.5	NOx		CO		SO_2		HCN	CuSO4	CaO
			24-hr	24-hr	24-hr	1-hr	24-hr	1-hr	24-hr	1-hr	24-hr	24-hr	24-hr	24-hr
TOTAL			81.08	26.53	4.77	95.19	6.73	461.82	27.00	29.66	2.87	0.15	0.09	0.09
Drill	PIT	Open Pit Mining - Drilling	0.27	0.14	0.14									
Blast	PIT	Open Pit Mining - Blasting	5.76	2.99	0.17	86	4	453	19	28	1			
Load	PIT	Open Pit Mining - Load Haul Truck (Shovel)	7.0	2.8	0.8									
In Pit Road	PIT	Open Pit Mining - Haul trucks	23.5	6.2	0.6									
Haul Roads	Roads (various)**	Road Emissions	33.1	8.8	0.9									
Dozers/Graders in pit	PIT	Dozers and Graders in pit	0.5	0.4	0.1									
Concrete 1	BATCH1	Batch Plant 1	1.291	0.372	0.060									
BagHouse2	BH2 - under crushed ore pile	baghouse for conveyor drop under stockpile feed conveyor	0.255	0.255	0.255									
Reclaim	RECLAIM	Discharge to stockpile	0.571	0.228	0.065									
Unload 1	PAG (and PAGN)	Drop at PAG	1.89	0.75	0.21									
Dozer WR	PAG (and PAGN)	Dozer use at PAG	0.25	0.19	0.03									
Unload 2	NPAG/OB	NPAG/OB drop	3.83	1.53	0.43									
Dozer NPAG	NPAGDoz	Dozer use at NPAG and OB	0.50	0.38	0.05									
Unload 3	ORE	Ore stockpile unloading	0.68	0.27	0.08									
Dozer Ore	OREDoz	Dozer at Ore stockpile	0.25	0.19	0.03									
Ex Portal 1	Port1	UG exhaust portal in pit	0.10	0.10	0.10	0.53	0.53	2.02	2.02	0.040	0.040			
Ex Portal 2	Port2	UG exhaust portal west of pit	0.29	0.29	0.29	1.58	1.58	6.07	6.07	0.119	0.040			
Unload Crusher	CRUSH	Fugitive Primary Crusher Feed	0.57	0.23	0.06									
BagHouse1	BH1 PCRUSH	baghouse for crusher	0.14	0.14	0.14									
Leach	LEACH	Leach Tanks - LT1 to LT8										0.15		
SpaceHeat	SPACEHEAT	space heating in process building				0.77	0.77							
Induction Furances	IND1	dust collector / scrubber to control furnace exhaust	0.06	0.06	0.06									
Lime Baghouse	BH11 Lime	exhaust for lime bin dust collector	0.032	0.032	0.032									0.032

Table A3: Source Summary - Emissions (g/s)

Operations Phase

			Emissions (g/s)											
Source	**Source ID**	**Description**	**PM**	**PM10**	**PM2.5**	**NOx**		**CO**		**SO_2**		**HCN**	**CuSO4**	**CaO**
Scrubber lime slaker	LS1	scrubber for lime slaker	0.0570	0.0570	0.0570									0.057
Flocculant Dust	FLOC1	flocculant handling cartridge filter	0.0076	0.0076	0.0076									
CuSO4 scrubber	EF11CuSO4	scrubber to control CuSO4 from loading and mixing tank	0.088	0.088	0.088								0.088	
CN-Dest 1	HCND1	CN Destruction Tank 1								1.63	1.63			
Emerg Gen 1	EGEN1	Emergency Diesel Generator 1	0.0504	0.0504	0.0504	6.0672	0.2528	0.7390	0.0308	0.0018	0.0001			
Emerg Gen 2	EGEN2	Emergency Diesel Generator 2	only one operating during testing; largest unit assumed											
Emerg Gen 3	EGEN3	Emergency Diesel Generator 3												
Emerg Gen 4	EGEN4	Emergency Diesel Generator 4												
Emerg Gen 5	EGEN5	Emergency Diesel Generator 5												
FirePump1	FP1	Diesel Fire Pump 1	0.018	0.018	0.018	0.400	0.02	0.08	0.003	0.002	0.00008			

Table A4: Source Summary - Data Quality and Estimating Methods

			Estimating Method and Data Quality						
Source	**Source ID**	**Description**	**PM**	**NOx**	**CO**	**SO2**	**CaO**	**HCN**	**Metals**
Drill	PIT	Open Pit Mining - Drilling	AP-42 Emission Factor C Rating Average	NA	NA	NA	NA	NA	engineering calculation average quality
Blast	PIT	Open Pit Mining - Blasting	Australian NRI Emission Factor C-rating	Vendor data from NIOSH	Vendor data from NIOSH	AP42 D- rating marginal	NA	NA	NA
Load	PIT	Open Pit Mining - Load Haul Truck (Shovel)	AP-42 Emission Factor Emission Factor B Rating Above Average	NA	NA	NA	NA	NA	engineering calculation average quality
In Pit Road	PIT	Open Pit Mining - Haul trucks	AP42 Emission Factor B Rating Above Average Data	NA	NA	NA	NA	NA	engineering calculation average quality
Haul Roads	Roads (various)**	Road Emissions	AP42 Emission Factor B Rating Above Average Data Quality	NA	NA	NA	NA	NA	engineering calculation average quality
Dozers/Graders in pit	PIT	Dozers and Graders in pit	AP-42 Emission Factor B Rating Above Average	NA	NA	NA	NA	NA	engineering calculation average quality
Concrete 1	BATCH1	Batch Plant 1	AP-4.2 Emission Factor Plant Wide; based on B to E rating; below average	NA	NA	NA	NA	NA	NA
BagHouse2	BH2 - under crushed ore pile	baghouse for conveyor drop under stockpile feed conveyor	Emission Factor Above Average	NA	NA	NA	NA	NA	engineering calculation average quality
Reclaim	RECLAIM	Discharge to stockpile	AP-42 Emission Factor C Rating Average	NA	NA	NA	NA	NA	engineering calculation average quality
BagHouse2	BH2 - under crushed ore pile	baghouse for conveyor drop under stockpile feed conveyor	Emission Factor Above Average	NA	NA	NA	NA	NA	engineering calculation average quality
Unload 1	PAG (and PAGN)	Drop at PAG	AP-42 Emission Factor C Rating Average	NA	NA	NA	NA	NA	engineering calculation average quality
Dozer WR	PAG (and PAGN)	Dozer use at PAG	AP-42 Emission Factor B Rating Above Average	NA	NA	NA	NA	NA	engineering calculation average quality
Unload 2	NPAG/OB	NPAG/OB drop	AP-42 Emission Factor C Rating Average	NA	NA	NA	NA	NA	engineering calculation average quality
Dozer NPAG	NPAGDoz	Dozer use at NPAG and OB	AP-42 Emission Factor B Rating Above Average	NA	NA	NA	NA	NA	engineering calculation average quality
Unload 3	ORE	Ore stockpile unloading	AP-42 Emission Factor C Rating Average	NA	NA	NA	NA	NA	engineering calculation average quality
Dozer Ore	OREDoz	Dozer at Ore stockpile	AP-42 Emission Factor B Rating Above Average	NA	NA	NA	NA	NA	engineering calculation average quality
Ex Portal 1	Port1	UG exhaust portal in pit	Various See table F11 and F12	Various See table F11 and F12	Various See table F11 and F12	Various See table F11 and F12	NA	NA	engineering calculation average quality
Ex Portal 2	Port2	UG exhaust portal west of pit							
Unload Crusher	CRUSH	Fugitive Primary Crusher Feed	AP-42 Emission Factor C Rating Average	NA	NA	NA	NA	NA	engineering calculation average quality
SpaceHeat	SPACEHEAT	space heating in process building	NA	Emission Factor AP42 - E	NA	NA	NA	NA	NA
Induction Furances	IND1	dust collector / scrubber to control furnace exhaust	Engineering Estimate Marginal Quality	NA	NA	NA	NA	NA	NA
Lime Baghouse	BH11 Lime	exhaust for lime bin dust collector	Emission Factor Above Average	NA	NA	NA		NA	NA

Table A4: Source Summary - Data Quality and Estimating Methods

			Estimating Method and Data Quality						
Source	**Source ID**	**Description**	**PM**	**NOx**	**CO**	**SO2**	**CaO**	**HCN**	**Metals**
Scrubber lime slaker	LS1	scrubber for lime slaker	Engineering Estimate Marginal Quality	NA	NA	NA		NA	NA
Flocculant Dust collector	FLOC1	flocculant handling cartridge filter	Emission Factor Above Average	NA	NA	NA	NA	NA	Mass Balance Above Average
CuSO4 scrubber	EF11CuSO4	scrubber to control CuSO4 from loading and mixing tank	Engineering Estimate Marginal Quality	NA	NA	NA	NA	NA	Mass Balance Above Average
CN-Dest 1	HCND1	CN Destruction Tank 1	NA	NA	NA	Engineering Calculation Average Data Quality	NA	NA	NA
Emerg Gen 1	EGEN1	Emergency Diesel Generator 1	certified engine emissions above average	certified engine emissions above average	certified engine emissions above average	AP42 D- rating marginal	NA	NA	NA
Emerg Gen 2	EGEN2	Emergency Diesel Generator 2	certified engine emissions above average	certified engine emissions above average	certified engine emissions above average	AP42 D- rating marginal	NA	NA	NA
Emerg Gen 3	EGEN3	Emergency Diesel Generator 3	certified engine emissions above average	certified engine emissions above average	certified engine emissions above average	AP42 D- rating marginal	NA	NA	NA
Emerg Gen 4	EGEN4	Emergency Diesel Generator 4	certified engine emissions above average	certified engine emissions above average	certified engine emissions above average	AP42 D- rating marginal	NA	NA	NA
Emerg Gen 5	EGEN5	Emergency Diesel Generator 5	certified engine emissions above average	certified engine emissions above average	certified engine emissions above average	AP42 D- rating marginal	NA	NA	NA
FirePump1	FP1	Diesel Fire Pump 1	certified engine emissions above average	certified engine emissions above average	certified engine emissions above average	AP42 D- rating marginal	NA	NA	NA

Table A5: Source Summary - Percent by Source

			% of Emissions by Source and Contaminant											
Source	**Source ID**	**Description**	**PM**	**PM10**	**PM2.5**	**NOx**		**CO**		**SO_2**		**HCN**	**CuSO4**
			24-hr			1-hr	24-hr	1-hr	24-hr	1-hr	24-hr	24-hr	24-hr
Drill	PIT	Open Pit Mining - Drilling	0.3	0.5	3.0								
Blast	PIT	Open Pit Mining - Blasting	7.1	11.3	3.6	90.2	53.2	98.1	69.9	94.0	40.5		
Load	PIT	Open Pit Mining - Load Haul Truck (Shovel)	8.6	10.5	16.5								
In Pit Road	PIT	Open Pit Mining - Haul trucks	29.0	23.5	13.0								
Haul Roads	Roads (various)**	Road Emissions	40.9	33.0	18.4								
Dozers/Graders in pit	PIT	Dozers and Graders in pit	0.6	1.4	1.1								
Concrete 1	BATCH1	Batch Plant 1	1.6	1.4	1.3								
BagHouse2	BH2 - under crushed ore pile	baghouse for conveyor drop under stockpile feed conveyor	0.3	1.0	5.3								
Reclaim	RECLAIM	Discharge to stockpile	0.7	0.9	1.4								
Unload 1	PAG (and PAGN)	Drop at PAG	2.3	2.8	4.5								
Dozer WR	PAG (and PAGN)	Dozer use at PAG	0.3	0.7	0.6								
Unload 2	NPAG/OB	NPAG/OB drop	4.7	5.8	9.1								
Dozer NPAG	NPAGDoz	Dozer use at NPAG and OB	0.6	1.4	1.1								
Unload 3	ORE	Ore stockpile unloading	0.8	1.0	1.6								
Dozer Ore	OREDoz	Dozer at Ore stockpile	0.3	0.7	0.6								
Ex Portal 1	Port1	UG exhaust portal in pit	0.1	0.4	2.0	0.6	7.8	0.4	7.5	0.1	1.4		
Ex Portal 2	Port2	UG exhaust portal west of pit	0.4	1.1	6.1	1.7	23.5	1.3	22.5	0.4	1.4		
Unload Crusher	CRUSH	Fugitive Primary Crusher Feed	0.7	0.9	1.4								
BagHouse1	BH1 PCRUSH	baghouse for crusher	0.2	0.5	3.0								
Leach	LEACH	Leach Tanks - LT1 to LT8										100.0	
SpaceHeat	SPACEHEAT	space heating in process building				0.8	11.4						
Induction Furances	IND1	dust collector / scrubber to control furnace exhaust	0.1	0.2	1.2								
Lime Baghouse	BH11 Lime	exhaust for lime bin dust collector	0.04	0.12	0.68								
Scrubber lime slaker	LS1	scrubber for lime slaker	0.1	0.2	1.2								
Flocculant Dust collector	FLOC1	flocculant handling cartridge filter	0.0	0.0	0.2								

Table A5: Source Summary - Percent by Source

			% of Emissions by Source and Contaminant										
Source	**Source ID**	**Description**	**PM**	**PM10**	**PM2.5**	**NOx**		**CO**		**SO_2**		**HCN**	**CuSO4**
CuSO4 scrubber	EF11CuSO4	scrubber to control CuSO4 from loading and mixing tank	0.1	0.3	1.9								100.0
CN-Dest 1	HCND1	CN Destruction Tank 1								5.5	56.7		
Emerg Gen 1	EGEN1	Emergency Diesel Generator 1	0.1	0.2	1.1	6.4	3.8	0.2	0.1	0.01	0.003		
Emerg Gen 2	EGEN2	Emergency Diesel Generator 2											
Emerg Gen 3	EGEN3	Emergency Diesel Generator 3											
Emerg Gen 4	EGEN4	Emergency Diesel Generator 4											
Emerg Gen 5	EGEN5	Emergency Diesel Generator 5											
FuelTank1	FT1	Fire Pump Fuel Tank 1											
FirePump1	FP1	Diesel Fire Pump 1	0.022	0.067	0.370	0.4	0.2	0.02	0.01	0.01	0.0026		
			100	100	100	100	100	100	100	100	100	100	100

Table A5: Source Summary - Percent by Source

Source	Source ID	Description	% of Emissions by Source and Contaminant									
			CaO	As	Cd	Cr	Hg	Mg	Mn	Ni	Pb	Zn
			24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr
Drill	PIT	Open Pit Mining - Drilling		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Blast	PIT	Open Pit Mining - Blasting		7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1
Load	PIT	Open Pit Mining - Load Haul Truck (Shovel)		8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
In Pit Road	PIT	Open Pit Mining - Haul trucks		29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
Haul Roads	Roads (various)**	Road Emissions		40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9
Dozers/Graders in pit	PIT	Dozers and Graders in pit		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Concrete 1	BATCH1	Batch Plant 1		1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
BagHouse2	BH2 - under crushed ore pile	baghouse for conveyor drop under stockpile feed conveyor		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Reclaim	RECLAIM	Discharge to stockpile		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Unload 1	PAG (and PAGN)	Drop at PAG		2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Dozer WR	PAG (and PAGN)	Dozer use at PAG		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Unload 2	NPAG/OB	NPAG/OB drop		4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Dozer NPAG	NPAGDoz	Dozer use at NPAG and OB		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Unload 3	ORE	Ore stockpile unloading		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Dozer Ore	OREDoz	Dozer at Ore stockpile		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Ex Portal 1	Port1	UG exhaust portal in pit		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ex Portal 2	Port2	UG exhaust portal west of pit		0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Unload Crusher	CRUSH	Fugitive Primary Crusher Feed		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
BagHouse1	BH1 PCRUSH	baghouse for crusher		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Leach	LEACH	Leach Tanks - LT1 to LT8										
SpaceHeat	SPACEHEAT	space heating in process building										
Induction Furances	IND1	dust collector / scrubber to control furnace exhaust										
Lime Baghouse	BH11 Lime	exhaust for lime bin dust collector	36.2									
Scrubber lime slaker	LS1	scrubber for lime slaker	63.8	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Flocculant Dust collector	FLOC1	flocculant handling cartridge filter		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table A5: Source Summary - Percent by Source

			% of Emissions by Source and Contaminant									
Source	**Source ID**	**Description**	**CaO**	**As**	**Cd**	**Cr**	**Hg**	**Mg**	**Mn**	**Ni**	**Pb**	**Zn**
CuSO4 scrubber	EF11CuSO4	scrubber to control CuSO4 from loading and mixing tank		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CN-Dest 1	HCND1	CN Destruction Tank 1										
Emerg Gen 1	EGEN1	Emergency Diesel Generator 1										
Emerg Gen 2	EGEN2	Emergency Diesel Generator 2										
Emerg Gen 3	EGEN3	Emergency Diesel Generator 3										
Emerg Gen 4	EGEN4	Emergency Diesel Generator 4		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Emerg Gen 5	EGEN5	Emergency Diesel Generator 5										
FuelTank1	FT1	Fire Pump Fuel Tank 1										
FirePump1	FP1	Diesel Fire Pump 1										
			100	100	100	100	100	100	100	100	100	100

Table A6 - List of Primary Emissions Control Equipment

Dust Collectors

Source ID	Source Description	Make & Model	Flowrate (acfm)	Flowrate (m^3/s)
	Primary Crusher Baghouse	Not yet identified. Will be consistent with specifications'	15,044	7.1
	Baghouse at under feed from stockpile	Not yet identified. Will be consistent with specifications'	27,016	12.8
	Lime silo dust collection	Not yet identified. Will be consistent with specifications'	3,420	1.61
	Furnace Exhaust	dry, cartridge type, 3060 ft^2	3,000	1.42
	Flocculant Dust collector	Dry, shaker cartridge type, 70 ft^2	800	0.38

Wet Scrubbers

Source ID	Source Description	Make & Model	Flowrate (acfm)	Flowrate (m^3/s)
	Wet scrubber on secondary and grinding areas	Not yet identified. Will be consistent with specifications'	13,100	6.18
	$CuSO_4$ Wet Scrubber	not yet specified	2,500	1.18

A7: AERMOD Dispersion Modelling Source Parameters

Sources

Type	ID	Base_Elev [m]	Height [m]	Diam [m]	Exit_Vel [m/s]	Exit_Temp [K]	Release_Type	SigmaY [m]	SigmaZ [m]	Length_Y [m]	Pit_Volume [m^3]	X1 [m]	Y1 [m]
POINT	GEN4	371	4.4	0.31	123.3	921	VERTICAL					426657.47	5411198.51
POINT	PORT2	354.48	1	4.5	11.6	290	VERTICAL					425124.90	5410209.40
VOLUME	PLANT	371.4	35					40.7	16.28			426581.94	5411041.48
VOLUME	CRUSHER	369.97	41					6.4	19.07			426778.81	5410178.74
POINT	FIREPUMP	369.79	5	0.15	41.3	740	VERTICAL				0	426352.50	5410915.47
AREA	PAG	381	7.37						3.43	100		428788.59	5408783.31
AREA	ORE	373.27	7.37						3.43	100		428196.02	5409848.03
AREA	NPAG	352.55	7.37						3.43	100		422626.60	5410239.14
AREA	PAGN	386	7.37						3.43	100		428440.72	5410557.58
OPEN_PIT	PIT	349	33							1100	100000000	424841.04	5409108.90

Note: The Plant was modelled as a volume source. Individual source characteristics are not yet available at this stage of design.

1 Emission rate (g/s for POINT and VOLUME, g/s/m2 for all AREA, OPENPIT and LINE)

APPENDIX B

EMISSION RATE CALCULATIONS

Table B1: Generator Sets (Emergency Generators for Operations Phase) and FirePump

Gen Sets (2)	2 x 1.5 MW	**Source ID: Gen1 and Gen 2**				
Emission data taken from Specification Sheets						
Fuel Use:	105	gallons per hour				
	7.001	lbs/US gallon (density (from CAT Spec sheet))				
	735.1	lbs/hour				
	18390.0	BTU/lb fuel (from CAT spec sheet)				
	13518581	BTU/hour				
	7000	BTU/hp-hour (from U.S EPA AP-42)				
Hp per unit	1931	hp-hr				
	from U.S. EPA AP 42	from Cat spec sheet				
	SOx	NOx	PM	CO	(all PM assumed to be PM2.5)	
	g/hp-hr	lb/hour	lb/hour	lb/hour		
Factor lb/hour	2.05E-03	28.98	0.2	3.95	lb/hour spec sheet	
Emission rate (g/s):	**0.001**	**3.65**	**0.03**	**0.50**	**g/s**	
Dimensions (m)	W	L	H			
	12.1	2.4	4.3	cat unit trailer w chasis from web site		

Gen Sets (1)	1 x 250 kw	**Source ID: Gen 3**				
Emission data taken from Specification Sheet Appendix G						
Fuel Use:	19	gallons per hour				
	7.001	lbs/US gallon (density (from CAT Spec sheet))				
	133.0	lbs/hour				
	18390.0	BTU/lb fuel (from CAT spec sheet)				
	2446219	BTU/hour				
	7000	BTU/hp-hour (from AP-42)				
Hp	349	hp-hr				
	250	kw-hr				
	from U.S. EPA AP 42	from Cat spec sheet				
	SOx	NOx	PM	CO	(all PM assumed to be PM2.5)	
Factor lb/hour	2.05E-03	3.17	0.14	0.6	lb/hour spec sheet	
Emission rate (g/s):	**0.00180**	**0.40**	**0.018**	**0.076**	**g/s**	
Dimensions (m)	W	L	H			
	1.50	5.10	2.60	rental unit - enclose (Cat 300 kw website)		

Gen Sets (1)	1 x 2.5 MW	**Source ID: Gen 4**				
Emission data taken from Specification Sheet Appendix G						
Fuel Use:	172	gallons per hour				
	7.001	lbs/US gallon (density (from CAT Spec sheet))				
	1204.2	lbs/hour				
	18390.0	BTU/lb fuel (from CAT spec sheet)				
	22144723	BTU/hour				
	7000	BTU/hp-hour (from AP-42)				
Hp	3164	hp-hr				
	from U.S. EPA AP 42	from Cat spec sheet				
	SOx	NOx	PM	CO	(all PM assumed to be PM2.5)	
Factor lb/hour	2.05E-03	48.11	0.4	5.86	lb/hour spec sheet	
Emission rate (g/s):	**0.00180**	**6.07**	**0.050**	**0.739**	**g/s**	
Dimensions (m)	W	L	H			
	12.1	2.4	4.3	cat unit trailer w chasis from website (1.5 MW unit)		

Table B1: Generator Sets (Emergency Generators for Operations Phase) and FirePump

Firepump 1	engine assumed same as generator set above (same horsepower engine)					
Size	350 HP					
	from U.S. EPA AP 42	from Cat spec sheet for 250 kw gen				
	SOx	NOx	PM	CO		(all PM assumed to be $PM_{2.5}$)
Factor lb/hour	2.05E-03	3.17	0.14	0.6	g/hp-hour	
Emission rate (g/s):	**0.00180**	**0.40**	**0.018**	**0.076**	**g/s**	

B2: Drilling and Blasting

Drilling emissions

	40	holes per shift				
	2	shifts				
		Emission Factors				
	TSP	PM10	PM10			
uncontrolled	0.59	0.31	0.31	kg/hole	TSP AP-42, Table 11.9-4	C-rating
control level assumed	50	50	50	%	PM10/2.5: NPRI based on Mojave Desert report	
emission rate (g/s)	**2.73E-01**	**1.44E-01**	**1.44E-01**			

Blasting - Particulate

Reference Australian NPI for Mining v 3.1 Table 2(2012)

EF(kg/blast) = 0.00022 A^1.5 C-Rating

A (blast area)	17,223	m2
Emission Rate =	497.3	kg/blast
	497.3	kg/day

	TSP	**PM10**	**PM2.5**
Emission rate (24 hour) (g/s)	**5.76**	**2.99**	**0.173**

PM2.5 Emission = 0.03 x TSP emission rate (NPRI - Env Canada)
PM10 Emission = 0.52 x TSP emission rate (Australian NPI V3.1)

Blasting NOX and CO
Reference: Data provided by Supplier..steel pipe comparable to site use

Emulsion per blast 100,337 kg from Key Data sheet

	NOX	CO	SO2	
Rating	NA	NA	D	
Emission factor	3.08	16.25	1	g/kg (emulsion)
Emission per blast	309038	1630478	100337	g/blast
Emisison rate (one hour)	**86**	**453**	**28**	g/s
Emission rate (24-hour)	**4**	**19**	**1**	g/s

Note: NOx and CO emission factors are provied by the manufacturer
SO_2 emission factor is based on US EPA AP-42 Table 13.3-1 for Explosives Detonation
NA - Not available

From Manufacturer

Det within	NOx l/kg	NOx gm/kg	NOx lb/ton	NO2 l/kg	NO2 gm/kg	NO2 lb/ton
Steel pipe	1.5	3.081027	6.162054	0.5	1.027009	2.054018
sheet metal	2.5	5.135045	10.27009	0.9	1.848616	3.697232
sheet metal	3	6.162054	12.32411	1.3	2.670223	5.340446
AVERAGE			9.585417			3.697232

Det within	CO l/kg	CO gm/kg	CO lb/ton
Steel pipe	13	16.2558	32.51161
sheet metal	14	17.50625	35.0125
sheet metal	21	26.25938	52.51875
AVERAGE			40.01429

Table B3: Material Handling

Crushing and Screening

Reference: ESDM Procedure Document Table C-1 (March 2009)

	Flowrate (m3/s)	Concentration (mg/m3)
Primary Crusher	7.10	20
Under Pile Control	12.75	20

Using Dust Collector Outlet Loading	TSP	PM10	PM2.5		
Primary Crusher Emissions	0.14	0.14	0.14	g/s	
Under Pile Control	0.26	0.26	0.26	g/s	

Material Loading and Unloading, and Drops at Stockpiles

Reference: AP 42 - Section 11.24 (based on high moisture > 4%)

Activity Data:

Material Handling	822	tonnes/hour	(ore to mill)
	2,716	tonnes/hour	(PAG)
	5,517	tonnes/hour	(NPAG and overburden)
	982	tonnes/hour	ore to stockpile
	1,000	tonnes/hour	(ore processing)

Emission Factors:

		Uncontrolled			Control Efficiency	Controlled
	SCC	kg/Mg (kg/tonne)	Size Fractior	EPA Rating	(water	kg/Mg
Material Transfer	3-03-024-08	0.005	TSP	C	50%	0.0025
		0.002	PM10	C	50%	0.001
		0.00057	PM2.5	NA	50%	0.00028

The material transfer is used for all conveyor drops, stock pile drops, ore dumps and other locations where material is allowed to fall freely…as per AP42 - Section 11.24 for TSP and PM10..NPRI ratio of PM10/PM2.5 (transfer points) used to calc PM2.5

Ore/Waste Rock/OB Loading to Haul Trucks in Open Pit			
Emission rate:	6.97	TSP	g/s
	2.79	PM10	g/s
	0.79	PM2.5	g/s
Ore Drop at Mill			
Emission rate:	0.57	TSP	g/s
	0.23	PM10	g/s
	0.06	PM2.5	g/s
PAG drop at stockpile			
Emission rate:	1.89	TSP	g/s
	0.75	PM10	g/s
	0.21	PM2.5	g/s
Ore Drop from Conveyor onto Stockpile			
Emission rate:	0.69	TSP	g/s
	0.28	PM10	g/s
	0.08	PM2.5	g/s
Overburden and NPAG drop at stockpile			
Emission rate:	3.83	TSP	g/s
	1.53	PM10	g/s
	0.43	PM2.5	g/s
Truck Dump at Ore Stockpile			
Emission rate:	0.68	TSP	g/s
	0.27	PM10	g/s
	0.08	PM2.5	g/s

B4: HCN Emissions

HCN Emissions from Leaching Process

Based on Australian NPI (version 2) Dec. 2006

HCN emission from page 28

E (kg of CN) = (0.013 * aqueous concentration of NaCN in tank +0.46) * area of tank * time * 0.96/1000 (equation 1)

aqueous concentration of HCN = concentration as mg/L of NaCN in tank * 10 ^ (9.2 - pH) (equation 2)

The leach process will be operated at a pH of 10.5 to 11, and the target NaCN concentration is 1000 ppm.

The HCN emissions for the scenario with 1000 ppm NaCN in solution was used to ensure estimates are conservative.

	Concentrate Leach			Source of Data
pH = pH in the leach/adsorption tank	> 10.5	> 10.5	> 10.5	Process Design
[NaCN] = Concentration (as mg/l) of NaCN in the leach/adsorption tank	1000	350	250	Estimated
[HCN(aq)] = [NaCN] x $10^{(9.2 - pH)}$	50.12	17.54	12.53	calculated from equation (2)
A = Surface area (m2) of the leach/adsorption tank	64	64	64	Process Design
T = Period of emissions (hours)	24	24	24	Process Design
E = Emission of CN (kg) per tank per day	1.63	1.01	0.91	calculated from equation (1)
E = emission of CN g/s per tank	**0.019**	**0.012**	**0.011**	= kg*1000/24/60/60
Total Emissions for Leach circuit overall (g/s)	0.15	0.093	0.08	Total = E (g/s per tank) x number of tanks

6.2.1 Cyanide emissions from the ore processing area

Based on research performed by CSIRO on investigating HCN emissions from process tanks, it was estimated that approximately **1%** of the total cyanide added to the circuit is lost through HCN volatilisation across all tanks (Heath *et al.*, 1998). A figure of 1% of total cyanide added to the leach circuit may therefore be used as a default value for loss of cyanide as HCN from the leach/adsorption train.

Alternatively, a site specific figure for emissions may be calculated using the equation below. The equation estimates the HCN emissions from an individual process tank and is derived from the work reported by Heath et al.

$$\mathbf{E = ([0.013 \times [HCN_{(aq)}] + 0.46\} \times A \times T \times 0.96/10^3)}$$

Where:

E	=	Emission of CN (kg)
$[HCN_{(aq)}]$	=	[NaCN] x $10^{(9.2 - pH)}$
[NaCN]	=	Concentration (as mg/l) of NaCN in the leach/adsorption tank
pH	=	pH in the leach/adsorption tank
A	=	Surface area (m^2) of the leach/adsorption tank
T	=	Period of emissions (hours)

B5: Road Dust Emissions (Haul Roads)

Table 1: Particulate Emission Coefficients for Truck Traffic on Unpaved Industrial Roads from AP42 (Chapter 13.2 - Unpaved Roads; Nov 2006)

Constant	Expressed Units	PM_{30} $(TPM)^3$	PM_{10}	$PM_{2.5}$	US EPA Data Quality
k	lb/VMT [(1)]	4.9	1.5	0.15	B
a	-	0.7	0.9	0.9	B
b	-	0.45	0.45	0.45	B
Conversion	lb/VMT to g/VKT	281.9	281.9	281.9	

Notes:

1. "lb/VMT" means pounds pre vehicle mile travelled.
2. "g/VKT" means grams per vehicle kilomtre
3. TPM means total particulate matter

Table 2: Fixed Haul Road Segments

Road Source ID Segment	Route or Area Description	Road Dimensions		Total VKT per hour per segment	Uncontrolled kg/hour			Uncontrolled (g/s)			Controlled (g/s)		
		Distance	Length		TPM Emission Rate	PM_{10} Emission Rate	$PM_{2.5}$ Emission Rate	TPM Emission per segment	PM_{10} Emission Rate	$PM_{2.5}$ Emission Rate	TPM Emission per segment	PM_{10} Emission Rate	$PM_{2.5}$ Emission Rate
		km	m										
OPIT1	Material from bottom of pit to split	1.270	1270	57.94	328.8	87.0	8.7	91.33	24.17	2.42	13.699	3.626	0.363
OP1	Ore to drop at process plant	1.013	1013	3.78	21.5	5.7	0.6	5.97	1.58	0.16	0.895	0.237	0.024
OS1	Ore to Ore Stockpile	2.031	2031	9.06	51.4	13.6	1.4	14.29	3.78	0.38	2.143	0.567	0.057
NPPit1	NPAG and OB form Split Out of Pit	0.9	900	22.57	128.1	33.9	3.4	35.58	9.42	0.94	5.337	1.413	0.141
NP1	NPAG and OB to Storage	1.954	1954	49.00	278.1	73.6	7.4	77.24	20.45	2.04	11.587	3.067	0.307
UG1	Underground Ore to process Plant	0.762	761.72	1.52	5.7	1.5	0.2	1.57	0.42	0.04	0.236	0.063	0.006
PAGPIT1	PAG and ORE from Split out of Pit	0.924	924	18.98	107.7	28.5	2.9	29.92	7.92	0.79	4.488	1.188	0.119
PAGSD	PAG To storage Daytime	0.690	690	14.17	80.4	21.3	2.1	22.34	5.91	0.59	3.351	0.887	0.089
PAGSN	PAG To storage nighttime	1.200	1200	24.65	139.9	37.0	3.7	38.86	10.29	1.03	5.828	1.543	0.154
PAGS1	PAG To storage	1.870	1870	38.41	218.0	57.7	5.8	60.55	16.03	1.60	9.083	2.404	0.240

	TSP	PM10	PM2.5
Total	56.65	14.99	1.50
Total (in-pit)	23.52	6.23	0.62
Total (outside pit)	33.12	8.77	0.88

B5: Road Dust Emissions (Haul Roads)

Table 3: Truck Details

		Tonnes per hour	Load per Truck (tonnes)	Round Trips per hour	Vehicle Weight Empty (tonnes)	Vehicle Weight Loaded (tonnes)	Mean Vehicle Weight (tonnes)	TPM Emission Factor lb/VKT	PM_{10} Emission Factor lb/VKT	$PM_{2.5}$ Emission Factor lb/VKT	TPM Emission Factor kg/VKT	PM_{10} Emission Factor kg/VKT	$PM_{2.5}$ Emission Factor kg/VKT
Material from bottom of pit to split		10,037	220	46	170.0	390.0	195.0				5.67	1.50	0.15
	imperial units						214.8	20.1	5.3	0.5			
Ore to Drop at Process	metric units	822	220	4	170.0	390.0	195.0				5.67	1.50	0.15
	imperial units						214.8	20.1	5.3	0.5			
Ore to Drop at Stockpile	metric units	982	220	4	170.0	390.0	195.0				5.67	1.50	0.15
	imperial units						214.8	20.1	5.3	0.5			
NPAG/OB from split out of pit	metric units	5,517	220	25	170.0	390.0	195.0				5.67	1.50	0.15
	imperial units						214.8	20.1	5.3	0.5			
Ore from Underground to Mill	metric units	100	50	2	102.7	152.7	76.4				3.72	0.98	0.10
	imperial units						84.1	13.2	3.5	0.3			
PAG and Ore split out of Pit	metric units	4,519	220	21	170.0	390.0	195.0				5.67	1.50	0.15
	imperial units						214.8	20.1	5.3	0.5			

Road Emission Assumptions (needed for AP42)

Mean Silt Content	5.8	%	based on AP42 Chapter 13.2 for taconite mining
Assumed average speed of trucks	50	km/hour	31.1 miles/hour (not used in calculations)
Assumed Control	85	%	based on watering, vehicle speed, lack of silt, dust suppressant

Sample Calculation Segment HR1:

Step 1: Caculation of lb/VKT (from AP42 - Chapter 13.2.2)
E (lb/vkt) (for TSP) = k x (silt %/12)^a x (mean weight/3)^b (see values for k, a, b above)
= 4.9 x (5.8/12) ^ 0.7 x (276.3/3) ^ 0.45 = 22.5 lb/VKT (in Table 3)

Step 2: convert to kg/VKT
E (kg/VKT) = 281.9 g/VKT x 22.5 lb/vkt /1000 g/kg = 6.36 kg/VKT (this is shown in Table 3)

Step 3: total VKT is obtained from distance travlled x number of round trips per hour.
Total VKT - 570.15 m x 17 trips per hour/ 1000 m/km = 9.55 VK travelled in an hour. (Table 2)
note: trips per hour is calculed from total tonnes per hour divided by load per truck

Step 4
Total emission rate (kg/hour) = 9.66 VKT/hour x 6.36 kg/VKT = 60.7 kg/hour (Table 2)

Step 5
Uncontrolled emission rate (g/s) = 60.7 kg/hour x 1000 g/kg / 3600 s/hour = 16.86 g/s (Table 2)

Step 6:
Controlled emission rate (g/s) = 16.86 g/s x (1 - efficiency) = 16.86 X (1- 0.85) = 2.53 g/s

B6: Concrete Batching

Reference: US EPA AP-42 Chapter 11.12 Concrete Batching

Activity Data:

	Concrete Processing Rate	
	m3/hr	cubic yard per hour
Batch Plant 1	80	104.6

Emission Factors: converted from lb/ton to lb/yd3 as per Eqn 11.12-2 (x0.282)

	Uncontrolled		Controlled		Rating
	PM (lb/yd3)	PM-10 (lb/yd3)	PM (lb/yd3)	PM-10 (lb/yd3)	
Aggregate delivery to ground storage (3-05-011-21)	0.00099	0.00048	0.00099	0.00048	D,D
Sand delivery to ground storage (3-05-011-22)	0.00031	0.00014	0.00031	0.00031	D,D
Mixer Loading	0.081	0.022	0.081	0.022	B,B
Cement delivery to Silo (3-05-011-07 controlled)	0.443	0.183	0.001	0.001	D,D
Cement supplement delivery to Silo (3-05-011-17 controlled)	0.102	0.068	0.000	0.001	D,E
Weigh hopper loading (3-05-011-08)	0.00073	0.00037	0.00073	0.00037	D,D
Truck mix loading (3-05-011-10)	0.1576	0.0437	0.0138	0.0037	B,B

Emission Rates:

	Batch Plant 1		
	PM	PM10	PM2.5*
Aggregate delivery to ground storage (3-05-011-21)	0.013	0.006	0.001
Sand delivery to ground storage (3-05-011-22)	0.004	0.004	0.001
Aggregate transfer to elevated storage (3-05-011-04)	1.063	0.290	0.047
Cement delivery to Silo (3-05-011-07 controlled)	0.017	0.009	0.001
Cement supplement delivery to Silo (3-05-011-17 controlled)	0.002	0.009	0.001
Weigh hopper loading (3-05-011-08)	0.010	0.005	0.001
Truck mix loading (3-05-011-10)	0.182	0.049	0.008
Total:	1.291	0.372	0.060

B7: Mill Process and Misc Sources

CN Destruction

Excess SO_2 from CN Destruction

Use of SO2	390	kg/hour	(see Key Data sheet)
Percent Excess	3	%	excess assumed to ensure reaction complete
Emission Rate	3.25	g/s	

Lime Bin Baghouse

Reference: ESDM Procedure Document Table C-1 (March 2009)

Controlled by baghouse. Data Quality "AA"

Flowrate	3420	acfm	
	1.61	am^3/s	
PM Concentration	20	mg/m^3	
Emission Rate	PM (g/s)	PM10	PM2.5
	0.0323	0.0323	0.0323

Induction Furnace

One furnace, controlled by cartridge type Emissions estimated based on flowrate and concentration

Assumed concentration	20	mg/m^3	(estimated maximum)
Flowrate from scrubber	1.4	am^3/s	
Emission Rate (per furnace)	0.028		
Emission Rate (total)	0.057	g/s	assumed same for PM10 and PM2.5

B8: Ore / Rock Handling at Stockpiles (Dozers)

Bulldozersr at Rock / Overburden / Ore Stockpiles

Reference: US EPA AP-42 Table 11.9-2

Equation:
EF(kg/hour) = k*2.6*silt^1.2*moisture^-1.3, k = 1 for TSP

Silt	5.9	assumed	AP42 Taconite mining)
Moisture	4	assumed	
EF (kg/hour)	3.61		EPA Rating
TSP	ER (g/s)	1.00	B
Control Efficiency	75	%	assumed based on watering and BMP
	0.75	scaling factor for PM10	
	0.105	factor for PM2.5	

Number of Dozers

NPAG	1	key data	but split between areas
Overburden	1	key data	
PAG	1	key data	
Ore Stock Pile	1	key data	
In Pit	2	key data	

		TSP	PM10	PM2.5	
Emissions:	NPAG	0.25	0.188	0.026	g/s
	Overburden	0.25	0.188	0.026	g/s
	PAG	0.25	0.188	0.026	g/s
	Ore Stock Pile	0.25	0.188	0.026	g/s
	In Pit	0.50	0.376	0.053	g/s

B9: Metal Content of Mine Rock and Ore

		Mine Rock / Ore Analyses				Maximum PM Concentration µg/m³
		Hg ppb	As ppm	Cd ppm	Pb ppm	
ALL WASTE ROCK	Min	5.00	5.00	1.00	2.00	86
	Max	2050	848	12.0	977	
	Mean	**32.8**	**8.01**	**1.92**	**10.6**	
	Median	12.0	5.00	1.00	2.0	
	Mode	5.0	5.0	1.00	2.0	
	No. of Samples	980	980	980	980	
	95th Percentile	111	12.0	4.00	22.1	

		Hg ppb	As ppm	Cd ppm	Pb ppm
ALL ORE DOMAIN ROCK	Min	5	5.00	1.00	2.00
	Max	1425	274	5.00	191
	Mean	**19**	**7.64**	**1.27**	**6.03**
	Median	5	5.00	1.00	2.00
	No. of Samples	146	146	146	146
	95th Percentile	22	11.3	3.00	11.8

Metal Concentration µg/m³				POI Limit µg/m³				% of limit			
Hg	**As**	**Cd**	**Pb**	**Hg**	**As**	**Cd**	**Pb**	**Hg**	**As**	**Cd**	**Pb**
2.82E-06	0.0007	0.000166	0.0009	2	0.3	0.025	0.5	0.0001%	0.23%	0.66%	0.18%

B10: Metal Content of Mine Rock and Ore

	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li
Unit	**ppm**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**	**ppm**
Average Crustal Abundance*	0.075	8.23	1.8	10	425	3	0.0085	4.15	0.15	66.5	25	102	3	60	5.63	19	1.5	3	0.085	0.25	2.085	39	20
Ten Times Average Crustal	**0.75**	**82.3**	**18**	**100**	**4250**	**30**	**0.085**	**41.5**	**1.5**	**665**	**250**	**1020**	30	**600**	**56.3**	**190**	**15**	**30**	**0.85**	**2.5**	**20.85**	**390**	**200**

Mine Rock Samples Summary

Count	362	362	362	143	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362
Minimum	0.02	0.17	0.50	20.0	2.00	0.10	0.02	0.08	0.01	0.90	3.00	12.0	0.13	3.70	0.59	1.00	0.10	0.05	0.01	0.01	0.01	0.50	1.80
Maximum	6.00	6.07	345	50.0	3220	3.70	27.7	10.1	34.6	271	66.9	1160	59.7	938	11.5	16.3	0.50	0.90	2.4	1.22	3.46	130	215
Average	0.68	1.79	16.9	34.6	59.6	0.68	0.59	2.36	0.83	27.8	18.7	98.0	3.10	74.4	3.52	5.66	0.12	0.24	0.08	0.04	0.19	13.5	43.7
Median	0.40	1.48	8.70	30.0	29.0	1.00	0.20	1.82	0.11	25.0	9.50	59.0	1.59	38.3	2.32	5.00	0.10	0.20	0.05	0.02	0.12	12.0	36.7
Standard Deviation	0.76	1.08	26.7	5.79	196	0.44	1.73	1.72	3.46	28.2	15.5	139	4.77	101.8	2.51	3.25	0.06	0.16	0.22	0.10	0.30	13.7	30.3
25th Percentile	0.20	0.94	4.70	30.0	20.0	0.20	0.10	1.24	0.10	13.8	7.90	43.0	0.80	18.6	1.78	3.00	0.10	0.10	0.01	0.01	0.09	6.00	23.3
75th Percentile	0.80	2.54	20.0	40.0	40.0	1.00	0.49	2.82	0.40	30.0	31.5	76.0	3.58	88.0	4.67	7.60	0.10	0.30	0.05	0.03	0.18	15.0	57.5
90th Percentile	1.60	3.17	36.8	40.0	84.7	1.00	1.30	4.85	1.19	44.9	43.9	154	7.34	183	7.81	10.0	0.20	0.44	0.10	0.06	0.39	22.0	78.9

Ore Rock Samples Summary

Count	509	909	903	525	904	193	656	909	453		909	906		909	909						909		705
Minimum	0.29	0.13	1.00	10.0	10.00	0.34	0.02	0.11	0.04		2.00	1.0		3.00	0.35						0.01		1.00
Maximum	284.00	8.64	7430	74.0	930	75.00	135.0	8.7	76.0		72.0	614		3357	13.6						3.76		196
average	4.36	2.53	105	37.2	101	2.43	10.5	1.7	8.1		12.7	85		144	3.6						0.57		34
90%ile	8.20	6.93	138.6	55.0	320.0	2.00	25.00	3.68	18.00		35.0	197.0		329.6	8.33						1.93		69.0

Maximum of Both (fraction)

90%ile	8.E-06	7.E-06	1.E-04	6.E-05	3.E-04	2.E-06	3.E-05	5.E-02	2.E-05	4.E-05	4.E-05	2.E-04	7.E-06	3.E+00	8.E-06	1.E-05	2.E-07	4.E-07	1.E-07	6.E-08	2.E-02	2.E-05	8.E-05

Screening

assume maximum TSP concentration (i.e. at standard) 120 µg/m^3

insignificant as per ESDM Guidance V3 0.1 µg/m^3

scaling of maximum TSP x concentration

NOTE: compounds that are also at or below the average crustal levels have been screened out as background

	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li
average	0.0005	3.038917492	0.012543	0.004468	0.0120725	0.0003	0.00126	2.827	0.00098	0.0033	0.0022	0.0118	0.0004	0.0173	4.3348	6.8E-04	1.5E-05	2.9E-05	9.4E-06	4.6E-06	0.7	0.00162	0.00525
90%ile	0.0010	8.3208	0.016632	0.0066	0.0384	0.0002	0.003	4.416	0.00216	0.003	0.0042	0.0236	0.0002	0.0396	9.9984	6.0E-04	1.2E-05	2.4E-05	6.0E-06	2.4E-06	2.3	0.00144	0.00828
Insign	0.0052	30.38917492	0.125425	0.044681	0.1207248	0.0029	0.01265	28.27	0.00978	0.0333	0.0225	0.1176	0.0037	0.1725	43.348	0.00679	0.00015	0.00029	9.4E-05	4.6E-05	6.789175	0.0162	0.0525
if > 1	0.0098	83.208	0.16632	0.066	0.384	0.0024	0.03	44.16	0.0216	0.03	0.042	0.2364	0.0019	0.3955	99.984	0.006	0.00012	0.00024	0.00006	2.4E-05	23.208	0.0144	0.0828
Crustal	0.0070	0.369248784	0.006968	0.000447	2.841E-05	1E-04	0.14881	0.6812	0.00652	5E-05	9E-05	0.0001	0.0001	0.0003	0.77	3.6E-05	9.9E-06	9.6E-06	0.00011	1.8E-05	0.32562	4.2E-05	0.00026

avereage is above crustal average (note: all are at or less than crustal average)

Compound Carried Forward: Considered a "KEY" metal (often a concern with public) or above insignficant level and not at crustal average. highlighted

B10: Metal Content of Mine Rock and Ore

	Lu	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	Sb	Sc	Se	Sn	Sr	Ta	Tb	Te	Th	Ti	Tl
Unit	**ppm**	**%**	**ppm**	**ppm**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppb**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**
Average Crustal Abundance*	-	2.33	950	1.2	2.355	20	84	1050	14	90	0.7	0.20	22.00	0.05	2.30	370.00	2.00	1.2	-	9.60	0.57	0.85
Ten Times Average Crustal	-	**23.3**	**9500**	**12**	**23.55**	**200**	**840**	**10500**	**140**	**900**	**7**	**2**	**220**	**0.5**	**23**	**3700**	**20**	**12**	-	**96**	**5.65**	**8.5**

Mine Rock Samples Summary

Count	143	362	362	362	362	362	362	362	362	362	219	362	362	362	362	362	362	143	362	362	362	362
Minimum	0.01	0.10	63.0	0.09	0.01	0.05	2.40	120.00	0.10	0.20	5.00	0.05	0.30	0.50	0.10	6.00	0.05	0.05	0.05	0.10	0.01	0.02
Maximum	0.21	6.39	2860	46.2	0.55	0.70	491	5640	555	185	25.0	18.8	33.5	5.50	2.00	1840	0.10	2.54	11.3	17.1	0.51	1.75
Average	0.06	1.25	754	1.25	0.07	0.12	35.8	534	13.1	7.51	5.23	0.41	3.91	0.75	0.23	65.4	0.08	0.22	0.48	1.65	0.05	0.12
Median	0.04	0.92	606	0.60	0.04	0.10	11.6	430.00	3.80	3.95	5.00	0.23	1.30	0.50	0.20	45.0	0.10	0.15	0.20	1.50	0.02	0.10
Standard Deviation	0.04	1.00	509	3.03	0.06	0.07	55.8	426	45.9	13.4	1.61	1.08	5.10	0.41	0.17	106	0.02	0.24	1.03	1.77	0.06	0.13
25th Percentile	0.02	0.66	391	0.40	0.03	0.08	9.10	372.50	1.75	2.50	5.00	0.10	0.80	0.50	0.10	28.3	0.05	0.12	0.10	0.73	0.01	0.06
75th Percentile	0.08	1.32	1020	1.04	0.09	0.10	49.1	550	8.25	7.25	5.00	0.43	5.35	1.00	0.30	73.0	0.10	0.25	0.50	1.90	0.07	0.10
90th Percentile	0.13	2.69	1458	2.30	0.14	0.20	79.2	769	22.1	17.2	5.00	0.80	11.2	1.00	0.30	124	0.10	0.44	1.10	2.59	0.12	0.23

Ore Rock Samples Summary

Count		909		598	905		870	859	883			409		220	108	909						266
Minimum		0.01		0.16	0.01		1.00	35.00	1.0			0.33		1.00	0.30	6						0.01
Maximum		5		54.5	1.5		233	2898.0	7590			53.0		29.00	96.0	660						0.99
average		1		5.1	0.1		18	464.5	103			5.7		6.40	7.1	63.7						0.10
90%ile		2.2		12.00	0.23		44.5	630.4	217.6			11.00		17.00	22.00	130.2						0.24

Maximum of Both (fraction)																						
90%ile	1.E-07	3.E-02	1.E-03	1.E-05	2.E-03	2.E-07	8.E-05	8.E-04	2.E-04	2.E-05	5.E-06	1.E-05	1.E-05	2.E-05	2.E-05	1.E-04	1.E-07	4.E-07	1.E-06	3.E-06	1.E-03	2.E-07

Screening

assume maximum TSP concentration (i.e. at standard)	120	µg/m^3
insignificant as per ESDM Guidance V3	0.1	µg/m^3
scaling of maximum TSP x concentration		

NOTE: compounds that are also at or below the average crustal levels have been screened out as background

	Lu	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	Sb	Sc	Se	Sn	Sr	Ta	Tb	Te	Th	Ti	Tl
average	7E-06	1.4978	0.09	6E-04	0.1337	1.4E-05	0.0043	0.064084	0.0123	0.0009	0.00063	7E-04	0.0004695	0.0007685	0.0008549	0.0078471	9.63E-06	2.678E-05	5.759E-05	0.0001979	0.0543945	1.448E-05
90%ile	5E-06	2.6256	0.073	0.001	0.276	1.2E-05	0.0053	0.075648	0.0261	0.0005	0.0006	0.001	0.000156	0.00204	0.00264	0.015624	0.000012	0.000018	0.000024	0.00018	0.0192	0.0000282
Insign	7E-05	14.978	0.905	0.006	1.3366	0.00014	0.0429	0.64084	0.1233	0.009	0.00627	0.007	0.0046949	0.0076855	0.0085489	0.0784714	9.63E-05	0.0002678	0.0005759	0.0019787	0.5439448	0.0001448
if > 1	5E-05	26.256	0.727	0.014	2.76	0.00012	0.0534	0.75648	0.2611	0.0047	0.006	0.013	0.00156	0.0204	0.0264	0.15624	0.00012	0.00018	0.00024	0.0018	0.192	0.000282
Crustal		0.6428	1E-04	5E-04	0.0568	7E-07	5E-05	6.1E-05	0.0009	1E-05	0.0009	0.003	2.134E-05	0.0153709	0.0003717	2.121E-05	4.815E-06	2.231E-05		2.061E-05	0.0962734	1.704E-05

avereage is above crustal aver

Compound Carried Forward: Considered a "KEY" metal (often a concern with public) or above insignficant level and not at crustal average. highlighted

B10: Metal Content of Mine Rock and Ore

	U	V	W	Y	Yb	Zn	Zr
Unit	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**
Average Crustal Abundance*	2.70	120.00	1.25	33.00	3.20	70.00	165.00
Ten Times Average Crustal	**27**	**1200**	**12.5**	**330**	**32**	**700**	**1650**

Mine Rock Samples Summary

Count	362	362	362	362	143	362	362
Minimum	0.05	2.00	0.10	0.60	0.10	7.00	0.40
Maximum	2.10	668	94.9	40.8	1.50	6930	50.3
Average	0.26	52.3	0.97	4.23	0.38	241	9.20
Median	0.20	13.0	0.10	2.87	0.20	91.0	7.40
Standard Deviation	0.23	75.7	5.66	3.63	0.30	689	6.97
25th Percentile	0.10	6.00	0.10	2.10	0.20	56.0	5.03
75th Percentile	0.30	78.8	0.20	5.23	0.50	183	11.8
90th Percentile	0.40	160	1.28	9.30	0.80	340	17.0

Ore Rock Samples Summary

Count	460	897	277	680		909	909
Minimum	0.22	1.00	0.20	1.00		2.0	2.0
Maximum	1115.0	613.0	149.0	27		16867	16867
average	29.6	40.3	16.1	4		881	881
90%ile	20.00	102.40	37.40	8.0		2550.0	2550.0

Maximum of Both (fraction)							
90%ile	2.E-05	2.E-04	4.E-05	9.E-06	8.E-07	3.E-03	3.E-03

Screening

assume maximum TSP concentration (i.e. at standard) 120 µg/m^3

insignificant as per ESDM Guidance V3 0.1 µg/m^3

scaling of maximum TSP x concentration

NOTE: compounds that are also at or below the average crustal levels have been screened out as background

	U	V	W	Y	Yb	Zn	Zr
average	0.0035559	0.0062718	0.0019333	0.0005073	4.506E-05	0.1057027	0.1057027
90%ile	0.0024	0.012288	0.004488	0.00096	0.000024	0.306	0.306
Insign	0.0355591	0.0627182	0.0193334	0.005073	0.0004506	1.0570271	1.0570271
if > 1	0.024	0.12288	0.04488	0.0096	0.00024	3.06	3.06
Crustal	0.001317	5.227E-05	0.0015467	1.537E-05	1.408E-05	0.00151	0.0006406

avereage is above crustal aver

Compound Carried Forward: Considered a "KEY" metal (often a concern with public) or above insignficant level and not at crustal average. highlighted

References

EarthTech (2003) Guidelines for Compiling Emission Inventories for the Ontario Mining

Table 4-1 Uncontrolled Emission Factor Equations for Various Surface Operations at Mines

OPERATION/ACTIVITY	PM EQUATION	PM_{10} EQUATION	$PM_{2.5}$ EQUATION	UNITS	RATING			REFERENCE
					PM	PM_{10}	$PM_{2.5}$	
Draglines	$EF=k*0.0046*d^{1.1}*M^{-0.3}$, Where k=1	Same as PM, using k= 0.75	Same as PM, using k= 0.017	kg/bcm	B	D	D	USEPA, AP-42, Table 11.9-2
Excavators/ Shovels/Front-end loaders (on overburden)	$EF=k*0.0016*(U/2.2)^{1.3}*(M/2)^{-1.4}$, Where k=1	Same as PM, using k= 0.35	Same as PM, using k= 0.11	kg/t	A	A	A	USEPA, AP-42, Page 13.2.4-3 Equation 1
Bulldozer on material	$EF=k*2.6*s^{1.2}*M^{-1.3}$, Where k=1	Same as PM, using k= 0.75	Same as PM, using k= 0.105	Kg/h	B	D	D	USEPA, AP-42, Table 11.9-2
Surface Drilling	0.59	0.3	0.15	Kg/hole	C	N/A	N/A	USEPA, AP-42, Table 11.9-4
Surface Blasting	$EF=k*344*A^{0.8}*M^{-1.9}*D^{-1.8}$, Where k=1	Same as PM, using k= 0.52	N/A	Kg/blast	C	C	N/A	Australian NPI, Emission Estimation Technique Manual for Mining, Version 2.3, Table 1
Unpaved Roads – Wheels[1,2]	$EF = k*(s/12)^{a}*(W/3)^{b}/(M/0.2)^{c}$, Where k = 2.82	Same as PM, using k= 0.733	Same as PM, using k= 0.107	Kg/VKT	B	B	C	USEPA, AP-42, Section 13.2.2, Equation 1
Paved Roads – Wheels[3]	$EF=k*(L/2)^{0.65}*(W/3)^{1.5}$ k=0.024	Same as PM, using k= 0.0046	Same as PM, using k= 0.0011	Kg/VKT	N/A	N/A	N/A	USEPA, AP-42, Section 13.2.1, Equation 1
Scrapers	0.029	N/A	N/A	Kg/t	E	N/A	N/A	USEPA, AP-42, Table 11.9-4
Graders	$EF = k*0.0034*S^{2.5}$, Where k=1	Same as PM, using k= 0.60	Name as PM, using k= 0.031	Kg/VKT	C	D	D	USEPA, AP-42, Table 11.9-2
Miscellaneous transfer point	$EF = k*0.0016*(U/2.2)^{1.3}*(M/2)^{-1.4}$, Where k = 1	Same as PM, using k = 0.35	Same as PM, using k= 0.11	Kg/t	A	A	A	USEPA, AP-42, Page 13.2.4-3, Equation 1
Wind Erosion	See Section 4.5.4	See Section 4.5.4	See Section 4.5.4					

TABLE 11.12-5 (ENGLISH UNITS)
PLANT WIDE EMISSION FACTORS PER YARD OF TRUCK MIX CONCRETE [a]

	Uncontrolled		Controlled	
	PM (lb/yd^3)	PM-10 (lb/yd^3)	PM (lb/yd^3)	PM-10 (lb/yd^3)
Aggregate delivery to ground storage (3-05-011-21)	0.0064	0.0031	0.0064	0.0031
Sand delivery to ground storage (3-05-011-22)	0.0015	0.0007	0.0015	0.0007
Aggregate transfer to conveyor (3-05-011-23)	0.0064	0.0031	0.0064	0.0031
Sand transfer to conveyor (3-05-011-24)	0.0015	0.0007	0.0015	0.0007
Aggregate transfer to elevated storage (3-05-011-04)	0.0064	0.0031	0.0064	0.0031
Sand transfer to elevated storage (3-05-011-05)	0.0015	0.0007	0.0015	0.0007
Cement delivery to Silo (3-05-011-07 controlled)	0.0002	0.0001	0.0002	0.0001
Cement supplement delivery to Silo (3-05-011-17 controlled)	0.0003	0.0002	0.0003	0.0002
Weigh hopper loading (3-05-011-08)	0.0079	0.0038	0.0079	0.0038
Truck mix loading (3-05-011-10)	See Equation 11.12-2			

References

Canada

Under *Sulphur in Diesel Fuel Regulations* (SOR/2002-254), the sulphur content of diesel fuel produced or imported was reduced to 15 ppm after 31 May 2006. This was followed by the reduction of sulphur in diesel fuel sold for use in on-road vehicles after 31 August 2006. For the designated Northern Supply Area, the deadline for reducing the sulfur content of diesel fuel for use in on-road vehicles was 31 August 2007.

An amendment titled *Regulations Amending the Sulphur in Diesel Fuel Regulations* (SOR/2005-305) added following deadlines:

--concentration of sulphur in diesel fuel produced or imported for use in off-road engines shall not exceed 500 ppm from 1 June 2007 -until 31 May 2010, and 15 ppm after that date.

--concentration of sulphur in diesel fuel sold for use in off-road engines shall not exceed 500 ppm from 1 October 2007 until 30 September 2010, and 15 ppm after that date.

--concentration of sulphur in diesel fuel sold in the northern supply area for use in off-road engines shall not exceed 500 ppm from 1 December 2008 until 30 November 2011, and 15 ppm after that date.

--concentration of sulfur in diesel fuel produced or imported for use in vessel engines or railway locomotive engines shall not exceed 500 parts per million (ppm) from 1 June 2007 until 31 May 2012, and 15 ppm after that date.

An amendment titled *Regulations Amending the Sulphur in Diesel Fuel Regulations* (SOR/SOR/2006-163) allowed diesel with sulfur content up to 22 ppm to be sold for onroad vehicles between 1 September 2006 and 15 October 2006, then 15 ppm after that date. This amendment facilitated the introduction of 15 ppm sulfur diesel fuel for on-road use in 2006, by lengthening the period between the dates that the production/import limit and the sales limit come into effect. It provided additional time to fully turn over the higher-sulfur diesel fuel inventory for on-road use in the distribution system. The requirements of the Regulations were aligned, in level and timing, with those of the U.S. EPA.

B11: Mine Emissions

Propane Emissions

From Chapter 1.5 AP42…Liquefied Petroleum Gas Combustion: July 2008

Table 1.5-1. EMISSION FACTORS FOR LPG Combustion

EMISSION FACTOR RATING: E — Emission Factor Rating: E

Pollutant	Propane Emission Factor(lb/10^3 gal) Industrial Boilers (SCC 1-02-010-01) 10 to 100 MMBTU/hr	Commercial Boilers (SCC 1-03-010-02) 0.3 to 10 MMBTU/hour
PM, Filterable	0.2	0.2
SO_2	0.10S	0.10S
Nox	13	13
CO	7.5	7.5

NOTE: No difference in AP42 for small or large heaters/boilers for propane combustion

S equals the sulfur content expressed in gr/100 ft3 gas vapour.

Other conversion	9.15E+07	BTU/1000 gallons of propane
	0.12	lb/gal to kg/1000 L

Sulfur Calculation

For commercial propane, the requirement for odorant is 185 ppmw as S (254 ppmv as S, 239 ppmv as H2S) (SBCAPDC web site)

To convert ppm to mg/m3	1.31	1 ppmv = 1.31 mg/m3	
Concentration in propane	332.74	mg/m3	
Concentration in propane	14.5	grains/100 ft3	
Emission factor for SO2	1.45	lb/10^3 gallon	(from AP42 above SO2 = 0.1 S

Estimated Propane use for mine: 78.00 MMBTU/hour
8.52E+02 gallons/hour
0.24 gallons/second

	lbs/sec	g/s	Rating
PM, Filterable	4.74E-05	2.15E-02	E
SO_2	3.44E-04	1.56E-01	E
Nox	3.08E-03	1.40E+00	E
CO	1.78E-03	8.06E-01	E

Vehicles — See Worksheet (Underground Vehicles)

Underground Material Handling

Underground operations are extremely wet. Primary crusher is controlled by baghouse (for OH&S purposes). Very little particulate is expected to be emitted.

Estimated airborne concentration in mine	1	mg/m3	estimated based OMA recommendation (0.86 mg/m3)
Air flow through mine:	334	m3/s	design
Emission Rate:	0.334	g/s	

Total Mine Emissions	Propane Use	Mine Vehicles (from Worksheet)	Underground Handling	Total	Pit Portal	Surface Raise
PM, Filterable	2.15E-02	0.036	0.334	3.91E-01	0.098	2.93E-01
SO_2	1.56E-01	0.0019		1.58E-01	0.040	1.19E-01
Nox	1.40E+00	0.71		2.11E+00	0.527	1.58E+00
CO	8.06E-01	7.29		8.09E+00	2.023	6.07E+00

Number of Portals (exhaust points): 1 into pit (1/4 of flow)
1 west of pit (3/4 of flow)

B12: Underground Mine Fleet Emissions

Tier 4 Emission Standards—Engines Up To 560 kW, g/kWh (g/bhp-hr)

Engine Power	Year	CO	NO_x	PM
kW < 8 (hp < 11)	2008	8.0 (6.0)	-	0.4[a] (0.3)
8 ≤ kW < 19 (11 ≤ hp < 25)	2008	6.6 (4.9)	-	0.4 (0.3)
19 ≤ kW < 37	2008	5.5 (4.1)	-	0.3 (0.22)
(25 ≤ hp < 50)	2013	5.5 (4.1)	-	0.03 (0.022)
37 ≤ kW < 56	2008	5.0 (3.7)	-	0.3[b] (0.22)
(50 ≤ hp < 75)	2013	5.0 (3.7)	-	0.03 (0.022)
56 ≤ kW < 130 (75 ≤ hp < 175)	2012-2014[c]	5.0 (3.7)	0.40 (0.30)	0.02 (0.015)
130 ≤ kW ≤ 560 (175 ≤ hp ≤ 750)	2011-2014[d]	3.5 (2.6)	0.40 (0.30)	0.02 (0.015

rate 2000 tpd

VENTILATION REQUIREMENTS

	MAX EQUIPMENT FLEET	kW/Unit	Max Fleet	Brake HP	Expected Utilisation
	Development Jumbo	110	2	295	33.0%
	Development Bolter	110	1	148	33.0%
	Development LHD	220	1	295	33.0%
	Development Truck	375	1	503	100.0%
	Production Jumbo	110	3	443	33.0%
	Production Bolter	110	3	443	33.0%
	Production LHD	220	4	1180	33.0%
	Production Truck	375	6	3017	100.0%
	Backfill Truck	375	1	503	100.0%
	Scissor Lifts	110	4	590	25.0%
	Crane Trucks	110	3	443	25.0%
	Grader	110	1	148	50.0%
	Personnel Carrier	110	4	590	25.0%
	Anfo Loader	110	1	148	25.0%
	Diamond Drill	110	1	148	25.0%
				0	
	Total	**2,665**		**8,891**	184.5 from west portal
Ventilation	**DESIGN Cu m/sec**				**246** (from BBA design)

Emission Estimates		kw	g/kwh (Tier 4) CO	NOx	PM	Max Fleet	g/s (total) CO	NOx	PM	SO2
	Development Jumbo	110	5	0.4	0.02	2	0.306	0.024	0.001	
	Development Bolter	110	5	0.4	0.02	2	0.306	0.024	0.001	
	Development LHD	220	3.5	0.4	0.02	2	0.428	0.049	0.002	
	Development Truck	375	3.5	0.4	0.02	5	1.823	0.208	0.010	
	Production Jumbo	110	5	0.4	0.02	2	0.306	0.024	0.001	
	Production Bolter	110	5	0.4	0.02	4	0.611	0.049	0.002	
	Production LHD	220	3.5	0.4	0.02	2	0.428	0.049	0.002	
	Production Truck	375	3.5	0.4	0.02	2	0.729	0.083	0.004	
	Backfill Truck	375	3.5	0.4	0.02	1	0.365	0.042	0.002	
	Scissor Lifts	110	5	0.4	0.02	2	0.306	0.024	0.001	
	Crane Trucks	110	5	0.4	0.02	4	0.611	0.049	0.002	
	Grader	110	5	0.4	0.02	4	0.611	0.049	0.002	
	Personnel Carrier	110	5	0.4	0.02	1	0.153	0.012	0.001	
	Anfo Loader	110	5	0.4	0.02	1	0.153	0.012	0.001	
	Diamond Drill	110	5	0.4	0.02	1	0.153	0.012	0.001	
	Total Emissions						7.286	0.712	0.036	0.002

Fuel use	1800000	l/year	from design
Sulphur in diesel	0.0015	%	(15 ppm as per Federal off-road fuel requirements ..see references)
SO2 emission	0.02826	kg/1000 L	AP42 -C1.3 (conversion of S in fuel to SO2 emission)
	50868	g/year	
Emission rate	0.0019	g/s	340 days per year, 22 hours per day

B13: Material Movement by Year

	Maximum Year	Total	2014	2015	2016	2017	2018	2019	2020
OPEN-PIT (OP)									
Mine to Mill (Mt)	7 200 000	68 700 000			6 400 000	7 200 000	7 200 000	7 000 000	6 600 000
Mine COG1	700 000	5 850 000		600 000	700 000	550 000	500 000	500 000	500 000
Mine to Stockpile (Mt)	7 900 000	40 700 000		1 000 000	7 900 000	4 000 000	3 900 000	4 900 000	5 800 000
Stockpile to Mill (Mt)	7 300 000	40 600 000							
Overburden (Mt)	20 900 000	71 600 000	7 200 000	12 300 000	10 700 000	20 000 000	20 900 000	500 000	
NPAG	27 432 319	204 509 789	2 372 626	8 514 916	15 789 226	21 507 038	20 415 973	20 059 178	18 069 384
PAG	23 789 209	145 115 064	405 838	1 785 048	7 792 565	11 356 592	8 918 115	13 380 520	23 789 209
Overburden and NPAG	41 507 038	276 109 789	9 572 626	20 814 916	26 489 226	41 507 038	41 315 973	20 559 178	18 069 384
Mine to COG and Stockpile	8 600 000	46 550 000		1 600 000	8 600 000	4 550 000	4 400 000	5 400 000	6 300 000
UNDERGROUND (UG)									
Underground to Mill (Mt)	730 000	6 810 000					100 000	300 000	730 000
Total Milled (OP + UG) (Mt)	7 300 000	116 000 000			6 400 000	7 200 000	7 300 000	7 300 000	7 300 000

Truck Movements to specific areas

Round trips ("loads x 2")

PER YEAR

Mine to Mill (Mt)	65455	624545			58182	65455	65455	63636	60000
Mine to Stockpile and COG	78182	423182		14545	78182	41364	40000	49091	57273
Overburden (Mt) + NPAG	377337	2510089	87024	189227	240811	377337	375600	186902	164267
PAG	216266	1319228	3689	16228	70842	103242	81074	121641	216266
UNDERGROUND (UG)									
Underground to Mill (Mt)	29200	272400					4000	12000	29200

PER DAY

Round Trips ("loads x 2") PER DAY 365 days

Mine to Mill (Mt)	179				159	179	179	174	164
Mine to Stockpile and COG	214			40	214	113	110	134	157
Overburden (Mt) + NPAG	1034		238	518	660	1034	1029	512	450
PAG	593		10	44	194	283	222	333	593
UNDERGROUND (UG)									
Underground to Mill (Mt)	80						11	33	80

PER HOUR

daily hours 22 nes 2 hours of change over and 12 hour shifts)

Mine to Mill (Mt)	8.2				7.2	8.2	8.2	7.9	7.5
Mine to Stockpile and COG	9.7			1.8	9.7	5.2	5.0	6.1	7.1
Overburden (Mt) + NPAG	47.0		10.8	23.6	30.0	47.0	46.8	23.3	20.5
PAG	26.9		0.5	2.0	8.8	12.9	10.1	15.1	26.9
UNDERGROUND (UG)									
Underground to Mill (Mt)	3.6						0.5	1.5	3.6

B13: Material Movement by Year

	2021	2022	2023	2024	2025	2026	2027	2028	2029
OPEN-PIT (OP)									
Mine to Mill (Mt)	6 600 000	6 600 000	6 600 000	6 600 000	6 600 000	1 300 000			
Mine COG1	550 000	450 000	450 000	450 000	300 000	300 000			
Mine to Stockpile (Mt)	6 100 000	3 600 000	3 100 000	400 000					
Stockpile to Mill (Mt)						5 200 000	6 600 000	6 700 000	7 300 000
Overburden (Mt)									
NPAG	22 992 688	27 432 319	22 537 694	15 110 490	7 061 081	2 289 183	357 993		
PAG	23 080 941	18 692 985	15 540 379	11 363 990	5 822 901	2 634 112	551 869		
Overburden and NPAG	22 992 688	27 432 319	22 537 694	15 110 490	7 061 081	2 289 183	357 993		
Mine to COG and Stockpile	6 650 000	4 050 000	3 550 000	850 000	300 000	300 000			
UNDERGROUND (UG)									
Underground to Mill (Mt)	730 000	730 000	730 000	730 000	730 000	730 000	730 000	570 000	
Total Milled (OP + UG) (Mt)	7 300 000	7 300 000	7 300 000	7 300 000	7 300 000	7 300 000	7 300 000	7 300 000	7 300 000

Truck Movements to specific areas

PER YEAR

Mine to Mill (Mt)	60000	60000	60000	60000	60000	11818			
Mine to Stockpile and COG	60455	36818	32273	7727	2727	2727			
Overburden (Mt) + NPAG	209024	249385	204888	137368	64192	20811	3254		
PAG	209827	169936	141276	103309	52935	23946	5017		
UNDERGROUND (UG)									
Underground to Mill (Mt)	29200	29200	29200	29200	29200	29200	29200	22800	

PER DAY

Mine to Mill (Mt)	164	164	164	164	164	32			
Mine to Stockpile and COG	166	101	88	21	7	7			
Overburden (Mt) + NPAG	573	683	561	376	176	57	9		
PAG	575	466	387	283	145	66	14		
UNDERGROUND (UG)									
Underground to Mill (Mt)	80	80	80	80	80	80	80	62	

PER HOUR

Mine to Mill (Mt)	7.5	7.5	7.5	7.5	7.5	1.5			
Mine to Stockpile and COG	7.5	4.6	4.0	1.0	0.3	0.3			
Overburden (Mt) + NPAG	26.0	31.1	25.5	17.1	8.0	2.6	0.4		
PAG	26.1	21.2	17.6	12.9	6.6	3.0	0.6		
UNDERGROUND (UG)									
Underground to Mill (Mt)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	2.8	

B13: Material Movement by Year

	2030	2031	2032
OPEN-PIT (OP)			
Mine to Mill (Mt)			
Mine COG1			
Mine to Stockpile (Mt)			
Stockpile to Mill (Mt)	7 300 000	7 300 000	200 000
Overburden (Mt)			
NPAG			
PAG			
Overburden and NPAG			
Mine to COG and Stockpile			
UNDERGROUND (UG)			
Underground to Mill (Mt)			
Total Milled (OP + UG) (Mt)	7 300 000	7 300 000	200 000

Truck Movements to specific areas

PER YEAR

Mine to Mill (Mt)			
Mine to Stockpile and COG			
Overburden (Mt) + NPAG			
PAG			
UNDERGROUND (UG)			
Underground to Mill (Mt)			

PER DAY

Mine to Mill (Mt)			
Mine to Stockpile and COG			
Overburden (Mt) + NPAG			
PAG			
UNDERGROUND (UG)			
Underground to Mill (Mt)			

PER HOUR

Mine to Mill (Mt)			
Mine to Stockpile and COG			
Overburden (Mt) + NPAG			
PAG			
UNDERGROUND (UG)			
Underground to Mill (Mt)			

B13: Material Movement by Year

Volume Per Year (m^3)

(density found in F0 - Key Data)

	Maximum Year	Total	2014	2015	2016	2017	2018	2019	2020
Mine to Mill (Mt)		23 937 282			2 229 965	2 508 711	2 508 711	2 439 024	2 299 652
Mine COG1		2 038 328		209 059	243 902	191 638	174 216	174 216	174 216
Mine to Stockpile (Mt)		14 181 185		348 432	2 752 613	1 393 728	1 358 885	1 707 317	2 020 906
Stockpile to Mill (Mt)		14 146 341							
Overburden (Mt)		39 777 778	4 000 000	6 833 333	5 944 444	11 111 111	11 611 111	277 778	
NPAG		73 039 210	847 366	3 041 041	5 639 009	7 681 085	7 291 419	7 163 992	6 453 351
PAG		51 826 809	144 942	637 517	2 783 059	4 055 926	3 185 041	4 778 757	8 496 146
Overburden and NPAG		112 816 988	4 847 366	9 874 375	11 583 454	18 792 196	18 902 530	7 441 770	6 453 351
Mine to COG and Stockpile		16 219 512		557 491	2 996 516	1 585 366	1 533 101	1 881 533	2 195 122
Total material out of Pit - Yearly	26 942 198	204 800 591	4 992 309	11 069 383	19 592 993	26 942 198	26 129 383	16 541 085	19 444 271

Cumulative (m^3)

Adjusted volume

Ore Stockpile		High Grade		348 432	3 101 045	4 494 774	5 853 659	7 560 976	2 874 564
COG Stockpile		Low Grade		209 059	452 962	644 599	818 815	993 031	1 167 247
NPAG			847 366	3 888 408	9 527 417	17 208 502	24 499 921	31 663 913	6 453 351
PAG			144 942	782 459	3 565 518	7 621 444	10 806 485	15 585 242	24 081 388
Overburden			4 000 000	10 833 333	16 777 778	27 888 889	11 611 111	11 888 889	11 888 889
			4 992 309	16 061 692	33 424 720	57 858 208	53 589 991	67 692 051	46 465 440

Stockpile Area (m^2)

Adjusted area

Ore Stockpile		High Grade		448 930	448 930	448 930	448 930	448 930	428 572
COG Stockpile		Low Grade		644 896	644 896	644 896	644 896	644 896	644 896
NPAG			2 097 258	2 097 258	2 097 258	2 097 258	2 097 258	2 097 258	1 733 369
PAG			2 171 750	2 171 750	2 171 750	2 171 750	2 171 750	2 171 750	2 171 750
Overburden			1 858 453	1 858 453	1 858 453	1 858 453	1 426 998	1 426 998	1 426 998

Stockpile Area Height (m)

	Max Bench Ht.								
Ore Stockpile	15	High Grade		.7 761 389	6.9 076 366	10.0 121 924	13.0 391 342	16.8 422 151	6.7 073 081
OS Cumulative Height (m)				0.8	6.9	10.0	13.0	16.8	21.7
COG Stockpile	15	Low Grade		.3 241 751	.7 023 794	.9 995 399	1.2 696 859	1.5 398 318	1.8 099 777
COG Cumulative Height (m)				0.3	0.7	1.0	1.3	1.5	1.8
NPAG	15		.4 040 354	1.8 540 436	4.5 427 969	8.2 052 385	11.6 818 823	15.0 977 673	3.7 230 108
NPAG Cumulative Height (m)			0.4	1.9	4.5	8.2	11.7	15.1	18.7
PAG	15		.0 667 398	.3 602 898	1.6 417 719	3.5 093 56	4.9 759 342	7.1 763 519	11.0 884 716
PAG Cumulative Height (m)			0.1	0.4	1.6	3.5	5.0	7.2	11.1
Overburden	15		2.1 523 278	5.8 292 21	9.0 278 193	15.0 065 075	8.1 367 396	8.3 313 984	8.3 313 984
Overburden Cumulative Height (m)			2.2	5.8	9.0	15.0	23.1	23.3	23.3

Open Pit Depth (m)

Total material out of Open Pit (m3) - Cumulat		4 992 309	16 061 692	19 592 993	26 942 198	26 129 383	16 541 085	19 444 271
Open Pit Area (m2)		1544764	1544764	1469154	1397856	1124155	923918	744462
Depth of Open Pit (m)		3.2 317 613	10.3 975 052	13.3 362 421	19.2 739 442	23.2 435 767	17.9 031 955	26.1 185 541
Cumulative Depth (m)		3.2	10.4	23.7	43.0	66.3	84.2	110.3
		4 992 309	21 054 000	40 646 994	67 589 192	93 718 575	110 259 660	129 703 931

B13: Material Movement by Year

	2021	2022	2023	2024	2025	2026	2027	2028	2029
Volume Per Year (m^3)									
Mine to Mill (Mt)	2 299 652	2 299 652	2 299 652	2 299 652	2 299 652	452 962			
Mine COG_1	191 638	156 794	156 794	156 794	104 530	104 530			
Mine to Stockpile (Mt)	2 125 436	1 254 355	1 080 139	139 373					
Stockpile to Mill (Mt)						1 811 847	2 299 652	2 334 495	2 543 554
Overburden (Mt)									
NPAG	8 211 674	9 797 257	8 049 176	5 396 604	2 521 815	817 565	127 855		
PAG	8 243 193	6 676 066	5 550 135	4 058 568	2 079 608	940 754	197 096		
Overburden and NPAG	8 211 674	9 797 257	8 049 176	5 396 604	2 521 815	817 565	127 855		
Mine to COG and Stockpile	2 317 073	1 411 150	1 236 934	296 167	104 530	104 530			
Total material out of Pit - Yearly	21 071 592	20 184 124	17 135 897	12 050 990	7 005 603	2 315 811	324 951		
Cumulative (m^3)									
Ore Stockpile	5 000 000	6 254 355	864 111	1 003 484	1 003 484	- 808 362	-3 108 014	-5 442 509	-7 986 063
COG Stockpile	1 358 885	1 515 679	1 672 474	1 829 268	1 933 798	2 038 328	2 038 328	2 038 328	2 038 328
NPAG	14 665 026	24 462 283	6 439 341	11 835 945	14 357 759	15 175 325	15 303 179	15 303 179	15 303 179
PAG	32 324 581	6 676 066	12 226 201	16 284 769	1 663 686	2 604 440	2 801 536	2 801 536	2 801 536
Overburden	11 888 889	11 888 889	11 888 889	11 888 889	11 888 889	11 888 889	11 888 889	11 888 889	11 888 889
	65 237 381	50 797 272	33 091 017	42 842 356	30 847 616	30 898 619	28 923 918	26 589 423	24 045 869
Stockpile Area (m^2)									
Ore Stockpile	428 572	428 572	259 114	259 114	259 114	259 114	259 114	259 114	259 114
COG Stockpile	644 896	644 896	644 896	644 896	644 896	644 896	644 896	644 896	644 896
NPAG	1 733 369	1 733 369	1 280 867	1 280 867	1 280 867	1 280 867	1 280 867	1 280 867	1 280 867
PAG	2 171 750	1 114 117	1 114 117	1 114 117	637 507	637 507	637 507	637 507	637 507
Overburden	1 426 998	1 426 998	1 426 998	1 426 998	1 426 998	1 426 998	1 426 998	1 426 998	1 426 998
Stockpile Area Height (m)									
Ore Stockpile	11.6 666 511	14.5 934 765	3.3 348 7	3.8 727 522	3.8 727 522	-3.1 197 171	-11.9 947 743	-21.0 043 02	-30.8 206 531
OS Cumulative Height (m)	26.7	29.6	33.3	33.9	33.9	26.9	18.0	9.0	-0.8
COG Stockpile	2.1 071 382	2.3 502 696	2.5 934 009	2.8 365 322	2.9 986 198	3.1 607 073	3.1 607 073	3.1 607 073	3.1 607 073
COG Cumulative Height (m)	2.1	2.4	2.6	2.8	3.0	3.2	3.2	3.2	3.2
NPAG	8.4 604 177	14.1 125 649	5.0 273 3	9.2 405 728	11.2 094 069	11.8 476 975	11.9 475 163	11.9 475 163	11.9 475 163
NPAG Cumulative Height (m)	23.5	29.1	35.0	39.2	41.2	41.8	41.9	41.9	41.9
PAG	14.8 841 172	5.9 922 486	10.9 738 936	14.6 167 497	2.6 096 749	4.0 853 517	4.3 945 186	4.3 945 186	4.3 945 186
PAG Cumulative Height (m)	14.9	21.0	26.0	29.6	32.6	34.1	34.4	34.4	34.4
Overburden	8.3 313 984	8.3 313 984	8.3 313 984	8.3 313 984	8.3 313 984	8.3 313 984	8.3 313 984	8.3 313 984	8.3 313 984
Overburden Cumulative Height (m)	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
Open Pit Depth (m)									
Total material out of Open Pit (m3) - Cumulat	21 071 592	20 184 124	17 135 897	12 050 990	7 005 603	2 315 811	324 951		
Open Pit Area (m2)	633892	539050	282252	195176.0	131479.0	92470	28305.0		
Depth of Open Pit (m)	33.2 416 125	37.4 438 814	60.7 113 4	61.7 442 219	53.2 830 591	25.0 439 162	11.4 803 291		
Cumulative Depth (m)	143.5	181.0	241.7	303.4	356.7	381.7	400.0		
	150 775 523	170 959 647	188 095 544	200 146 535	207 152 138	209 467 949	209 792 900		

B13: Material Movement by Year

	2030	2031	2032

Volume Per Year (m^3)

	2030	2031	2032
Mine to Mill (Mt)			
Mine COG_1			
Mine to Stockpile (Mt)			
Stockpile to Mill (Mt)	2 543 554	2 543 554	69 686
Overburden (Mt)			
NPAG			
PAG			
Overburden and NPAG			
Mine to COG and Stockpile			
Total material out of Pit - Yearly			

Cumulative (m^3)

Ore Stockpile	-10 529 617	-13 073 171	-13 142 857
COG Stockpile	2 038 328	2 038 328	2 038 328
NPAG	15 303 179	15 303 179	15 303 179
PAG	2 801 536	2 801 536	2 801 536
Overburden	11 888 889	11 888 889	11 888 889
	21 502 315	18 958 761	18 889 075

Stockpile Area (m^2)

Ore Stockpile	259 114	259 114	259 114
COG Stockpile	644 896	644 896	644 896
NPAG	1 280 867	1 280 867	1 280 867
PAG	637 507	637 507	637 507
Overburden	1 426 998	1 426 998	1 426 998

Stockpile Area Height (m)

Ore Stockpile			
OS Cumulative Height (m)			
COG Stockpile	3.1 607 073	3.1 607 073	3.1 607 073
COG Cumulative Height (m)	3.2	3.2	3.2
NPAG	11.9 475 163	11.9 475 163	11.9 475 163
NPAG Cumulative Height (m)	41.9	41.9	41.9
PAG	4.3 945 186	4.3 945 186	4.3 945 186
PAG Cumulative Height (m)	34.4	34.4	34.4
Overburden	8.3 313 984	8.3 313 984	8.3 313 984
Overburden Cumulative Height (m)	23.3	23.3	23.3

Open Pit Depth (m)

Total material out of Open Pit (m3) - Cumulat			
Open Pit Area (m2)			
Depth of Open Pit (m)			
Cumulative Depth (m)			

APPENDIX C

EQUIPMENT DATA AND SPECIFICATIONS

GEN SET PACKAGE PERFORMANCE DATA [DM8260]

DECEMBER 04, 2009

For Help Desk Phone Numbers Click here

Performance Number: DM8260 **Change Level:** 01

Sales Model: 3512CDITA **Combustion:** DI **Aspr:** TA

Engine Power:

1500 W/F EKW	1560 W/O F EKW	**Speed:** 1,800 RPM	**After Cooler:** ATAAC
2,206 HP			

Manifold Type: DRY **Governor Type:** ADEM3 **After Cooler Temp(F):** 122

Turbo Quantity: 4 **Engine App:** GP **Turbo Arrangement:** Parallel

Hertz: 60 **Application Type:** PACKAGE-DIE **Engine Rating:** PGS **Strategy:**

Rating Type: STANDBY **Certification:** EPA TIER-2 2006 -

General Performance Data 1

GEN W/F EKW	PERCENT LOAD	ENGINE POWER BHP	ENGINE BMEP PSI	FUEL BSFC LB/BHP-HR	FUEL RATE GPH	INTAKE MFLD TEMP DEG F	INTAKE MFLD P IN-HG	INTAKE AIR FLOW CFM	EXH MFLD TEMP DEG F	EXH STACK TEMP DEG F	EXH GAS FLOW CFM
1,500	100	2206	307.34	0.33	104.85	121.64	78	4,573.25	1,150.7	763.52	11,060.56
1,350	90	1983	276.3	0.34	95.31	116.42	72.64	4,382.55	1,105.7	728.6	10,294.24
1,200	80	1768	246.28	0.34	86.7	113.54	67.37	4,184.79	1,071.86	710.06	9,655.04
1,125	75	1662	231.48	0.35	82.13	111.92	63.96	4,050.6	1,054.94	701.78	9,277.17
1,050	70	1556	216.83	0.35	77.48	110.48	60.17	3,898.74	1,037.66	694.4	8,867.52
900	60	1349	187.97	0.35	67.95	107.42	51.56	3,542.06	1,002.38	683.06	7,970.53
750	50	1144	159.4	0.36	58.07	107.6	41.07	3,082.97	965.3	682.52	6,935.81
600	40	943	131.41	0.36	48.34	108.32	30.59	2,627.41	923.9	683.42	5,908.15
450	30	737	102.69	0.37	38.65	107.24	21.14	2,203.64	858.56	668.66	4,894.62
375	25	632	88.04	0.37	33.87	106.34	17.09	2,016.47	811.58	649.04	4,407.27
300	20	526	73.25	0.39	29.09	105.26	13.39	1,846.96	755.78	621.86	3,930.53
150	10	310	43.22	0.44	19.58	103.28	7.31	1,578.57	609.8	526.46	3,040.6

Engine Heat Rejection Data

GEN W/F EKW	PERCENT LOAD	REJ TO JW BTU/MN	REJ TO ATMOS BTU/MN	REJ TO EXHAUST BTU/MN	EXH RCOV TO 350F BTU/MN	FROM OIL CLR BTU/MN	FROM AFT CLR BTU/MN	WORK ENERGY BTU/MN	LHV ENERGY BTU/MN	HHV ENERGY BTU/MN
1,500	100	35,031.9	7,051.9	75,466.3	35,316.2	11,260.2	27,411.3	93,551.0	225,034.1	239,706.5
1,350	90	32,757.1	6,710.6	68,357.6	30,766.6	10,236.6	24,965.9	84,110.5	204,561.0	217,925.4
1,200	80	30,652.9	6,369.4	62,841.2	27,809.4	9,326.7	22,463.6	74,954.5	186,078.2	198,248.4
1,125	75	29,515.5	6,255.7	59,827.1	26,273.9	8,814.8	20,871.2	70,461.8	176,296.6	187,784.3
1,050	70	28,378.1	6,085.1	56,699.3	24,738.4	8,303.0	19,222.0	66,025.9	166,287.5	177,149.7
900	60	25,818.9	5,800.7	50,273.0	21,610.6	7,279.3	15,639.2	57,211.1	145,814.4	155,368.5
750	50	23,146.0	5,516.4	43,562.3	18,767.1	6,255.7	11,658.3	48,510.0	124,601.9	132,734.3
600	40	20,359.4	5,288.9	36,908.6	16,037.3	5,175.2	7,734.3	39,979.5	103,730.7	110,498.2
450	30	17,402.2	4,833.9	29,970.4	12,795.7	4,151.5	4,663.3	31,278.4	82,916.3	88,375.8
375	25	15,866.7	4,549.6	26,501.4	10,975.9	3,639.7	3,525.9	26,785.7	72,679.7	77,399.9
300	20	14,274.3	4,265.2	22,918.6	9,042.3	3,127.8	2,559.1	22,293.0	62,386.3	66,480.9

150	10	10,805.3	3,810.3	15,696.1	4,947.7	2,104.2	1,251.1	13,136.9	42,026.8	44,756.6

EXHAUST Sound Data: 4.92 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,500	100	117	107	122	118	110	108	109	109	107
1,350	90	116	106	121	117	109	107	108	108	106
1,200	80	115	105	120	116	108	106	107	107	105
1,125	75	114	104	119	115	107	106	107	107	105
1,050	70	114	104	119	115	107	105	106	106	104
900	60	112	103	117	113	105	104	105	105	103
750	50	111	101	116	112	104	103	104	104	102
600	40	110	100	115	111	103	101	103	103	101
450	30	108	99	113	109	101	100	101	101	99
375	25	108	98	113	109	101	99	100	100	98
300	20	107	97	112	108	100	98	99	99	97
150	10	104	95	109	105	97	96	97	97	95

EXHAUST Sound Data: 22.97 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,500	100	103	95	111	106	97	95	96	96	93
1,350	90	102	94	110	104	96	94	95	95	92
1,200	80	101	93	109	103	95	93	94	94	91
1,125	75	101	92	109	103	94	93	93	93	91
1,050	70	100	92	108	102	94	92	93	93	90
900	60	99	90	107	101	93	91	92	92	89
750	50	98	89	106	100	91	90	91	90	88
600	40	97	88	105	99	90	89	89	89	86
450	30	95	86	103	97	89	87	88	88	85
375	25	94	86	102	96	88	86	87	87	84
300	20	93	85	101	95	87	85	86	86	83
150	10	91	83	99	93	85	83	84	84	81

EXHAUST Sound Data: 49.21 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,500	100	97	88	105	99	90	89	89	89	86
1,350	90	96	87	104	98	89	88	88	88	85
1,200	80	95	86	103	97	88	87	87	87	84
1,125	75	94	85	102	96	88	86	87	87	84
1,050	70	94	85	102	96	87	86	86	86	83
900	60	92	84	100	95	86	84	85	85	82
750	50	91	83	99	93	85	83	84	84	81
600	40	90	81	98	92	83	82	83	82	80
450	30	88	80	96	91	82	80	81	81	78
375	25	88	79	96	90	81	80	80	80	77
300	20	87	78	95	89	80	79	79	79	76
150	10	84	76	92	87	78	76	77	77	74

MECHANICAL Sound Data: 3.28 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,500	100	115	118	127	118	109	102	101	98	102
1,350	90	115	118	127	118	109	102	101	98	102
1,200	80	115	118	127	118	109	102	101	98	102
1,125	75	115	118	127	118	109	102	101	98	102
1,050	70	115	118	127	118	109	102	101	98	102
900	60	115	118	127	118	109	102	101	98	102
750	50	115	118	127	118	109	102	101	98	102
600	40	115	118	127	118	109	102	101	98	102
450	30	115	118	127	118	109	102	101	98	102
375	25	115	118	127	118	109	102	101	98	102
300	20	115	118	127	118	109	102	101	98	102
150	10	115	118	127	118	109	102	101	98	102

MECHANICAL Sound Data: 22.97 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCJ 8000HZ DB
1,500	100	101	104	113	104	95	89	89	86	90
1,350	90	101	104	113	104	95	89	89	86	90
1,200	80	101	104	113	104	95	89	89	86	90
1,125	75	101	104	113	104	95	89	89	86	90
1,050	70	101	104	113	104	95	89	89	86	90
900	60	101	104	113	104	95	89	89	86	90
750	50	101	104	113	104	95	89	89	86	90
600	40	101	104	113	104	95	89	89	86	90
450	30	101	104	113	104	95	89	89	86	90
375	25	101	104	113	104	95	89	89	86	90
300	20	101	104	113	104	95	89	89	86	90
150	10	101	104	113	104	95	89	89	86	90

MECHANICAL Sound Data: 49.21 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,500	100	95	98	107	98	89	83	83	81	84
1,350	90	95	98	107	98	89	83	83	81	84
1,200	80	95	98	107	98	89	83	83	81	84
1,125	75	95	98	107	98	89	83	83	81	84
1,050	70	95	98	107	98	89	83	83	81	84
900	60	95	98	107	98	89	83	83	81	84
750	50	95	98	107	98	89	83	83	81	84
600	40	95	98	107	98	89	83	83	81	84
450	30	95	98	107	98	89	83	83	81	84
375	25	95	98	107	98	89	83	83	81	84
300	20	95	98	107	98	89	83	83	81	84
150	10	95	98	107	98	89	83	83	81	84

EMISSIONS DATA

EPA TIER-2 2006 - ********** B5

Gaseous emissions data measurements are consistent with those described in EPA 40 CFR PART 89 SUBPART D and ISO 8178 for measuring HC, CO, PM, and NOx

Gaseous emissions values are WEIGHTED CYCLE AVERAGES and are in compliance with the following non-road regulations:

LOCALITY	AGENCY/LEVEL	MAX LIMITS - g/kW-hr		
U.S. (incl Calif)	EPA/TIER-2	CO:3.5	NOx + HC:6.4	PM:0.2

REFERENCE EXHAUST STACK DIAMETER	8 IN
WET EXHAUST MASS	21,100.4 LB/HR
WET EXHAUST FLOW (762.80 F STACK TEMP)	11,071.16 CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	4,321.00 STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	3,958.78 STD CFM
FUEL FLOW RATE	105 GAL/HR

RATED SPEED "Not to exceed data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	PART MATTER LB/HR	OXYGEN IN EXHAUST PERCENT	DRY SMOKE OPACITY PERCENT	BOSCH SMOKE NUMBER
1,500	100	2206	28.9800	3.9500	.7100	.2000	10.2000	.8000	1.2800
1,125	75	1662	14.7100	2.4400	.7800	.2000	11.5000	.9000	1.2800
750	50	1144	9.6800	3.3200	.7400	.3000	12.2000	1.9000	1.2800
375	25	632	7.2600	4.0700	.5800	.3800	13.2000	3.3000	1.2800
150	10	310	5.6300	3.8300	.6700	.2300	15.2000	2.0000	1.2800

RATED SPEED "Nominal Data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	TOTAL CO2 LB/HR	PART MATTER LB/HR	OXYGEN IN EXHAUST PERCENT	DRY SMOKE OPACITY PERCENT	BOSCH SMOKE NUMBER
1,500	100	2206	24.1500	2.1900	.5300	2,262.3	.1400	10.2000	.8000	1.2800
1,125	75	1662	12.2600	1.3600	.5900	1,764.4	.1400	11.5000	.9000	1.2800
750	50	1144	8.0700	1.8400	.5500	1,242	.2100	12.2000	1.9000	1.2800
375	25	632	6.0500	2.2600	.4400	720	.2700	13.2000	3.3000	1.2800
150	10	310	4.6900	2.1300	.5000	410.8	.1600	15.2000	2.0000	1.2800

Altitude Capability Data(Corrected Power Altitude Capability)

Ambient Operating Temp. / Altitude	50 F	68 F	86 F	104 F	122 F	NORMAL
0 F	2,205.98 hp	2,205.98 hp	2,205.98 hp	2,205.98 hp	2,205.98 hp	2,205.98 h
984.25 F	2,205.98 hp	2,205.98 hp	2,205.98 hp	2,205.98 hp	2,205.98 hp	2,205.98 h
1,640.42 F	2,205.98 hp	2,205.98 hp	2,205.98 hp	2,205.98 hp	2,197.93 hp	2,205.98 h
3,280.84 F	2,205.98 hp	2,205.98 hp	2,205.98 hp	2,134.9 hp	2,069.19 hp	2,205.98 h
4,921.26 F	2,205.98 hp	2,145.63 hp	2,074.56 hp	2,008.85 hp	1,945.82 hp	2,141.61 h
6,561.68 F	2,087.97 hp	2,016.89 hp	1,951.18 hp	1,888.16 hp	1,830.49 hp	2,035.67 h
8,202.1 F	1,961.91 hp	1,894.86 hp	1,833.17 hp	1,774.17 hp	1,719.19 hp	1,933.75 h
9,842.52 F	1,842.56 hp	1,779.53 hp	1,720.53 hp	1,665.55 hp	1,614.59 hp	1,835.86 h
10,498.69 F	1,795.63 hp	1,735.28 hp	1,677.62 hp	1,623.98 hp	1,573.02 hp	1,798.31 h

The powers listed above and all the Powers displayed are Corrected Powers

Identification Reference and Notes

Engine Arrangement:	2673949	**Lube Oil Press @ Rated Spd(PSI):**	--
Effective Serial No:	EBG00100	**Piston Speed @ Rated Eng SPD (FT/Min):**	2,173.2
Primary Engine Test Spec:	0K7015	**Max Operating Altitude(FT):**	3,937.0
Performance Parm Ref:	TM5739	**PEEC Elect Control Module Ref**	
Performance Data Ref:	DM8260	**PEEC Personality Cont Mod Ref**	
Aux Coolant Pump Perf Ref:			
Cooling System Perf Ref:	DM1298	**Turbocharger Model**	GTB4708 52T/50EI-0.96
Certification Ref:	EPA TIER 2	**Fuel Injector**	2664387
Certification Year:	2006	**Timing-Static (DEG):**	--
Compression Ratio:	14.7	**Timing-Static Advance (DEG):**	--
Combustion System:	DI	**Timing-Static (MM):**	--
Aftercooler Temperature (F):	122	**Unit Injector Timing (MM):**	64.3
Crankcase Blowby Rate(CFH):	2,203.6	**Torque Rise (percent)**	--
Fuel Rate (Rated RPM) No Load (Gal/HR):	9.9	**Peak Torque Speed RPM**	--
Lube Oil Press @ Low Idle Spd(PSI):	--	**Peak Torque (LB/FT):**	--

Reference Number: DM8260 EPA TIER-2 2006 B5

Parameters Reference: TM5739

GEN SET - PACKAGED - DIESEL
TOLERANCES:
AMBIENT AIR CONDITIONS AND FUEL USED WILL AFFECT THESE VALUES. EACH OF THE VALUES MAY VARY IN ACCORDANCE WITH THE FOLLOWING TOLERANCES.

ENGINE POWER	+/-	3%
EXHAUST STACK TEMPERATURE	+/-	8%
GENERATOR POWER	+/-	5%
INLET AIR FLOW	+/-	5%
INTAKE MANIFOLD PRESSURE - GAGE	+/-	10%
EXHAUST FLOW	+/-	6%
SPECIFIC FUEL CONSUMPTION	+/-	3%
FUEL RATE	+/-	5%
HEAT REJECTION	+/-	5%
HEAT REJECTION EXHAUST ONLY	+/-	10%

CONDITIONS:
ENGINE PERFORMANCE IS CORRECTED TO INLET AIR STANDARD CONDITIONS OF 99 KPA (29.31 IN HG) AND 25 DEG C (77 DEG F).

THESE VALUES CORRESPOND TO THE STANDARD ATMOSPHERIC PRESSURE AND TEMPERATURE IN ACCORDANCE WITH SAE J1349. ALSO INCLUDED IS A CORRECTION TO STANDARD FUEL GRAVITY OF 35 DEGREES API HAVING A LOWER HEATING VALUE OF 42,780 KJ/KG (18,390 BTU/LB) WHEN USED AT 29 DEG C (84.2 DEG F) WHERE THE DENSITY IS 838.9 G/L (7.002 LB/GAL).

THE CORRECTED PERFORMANCE VALUES SHOWN FOR CATERPILLAR ENGINES WILL APPROXIMATE THE VALUES OBTAINED WHEN THE OBSERVED PERFORMANCE DATA IS CORRECTED TO SAE J1349, ISO 3046-2 & 8665 & 2288 & 9249 & 1585, EEC 80/1269 AND DIN70020 STANDARD REFERENCE CONDITIONS.

ENGINES ARE EQUIPPED WITH STANDARD ACCESSORIES; LUBE OIL, FUEL PUMP AND JACKET WATER PUMP. THE POWER REQUIRED TO DRIVE AUXILIARIES MUST BE DEDUCTED FROM THE GROSS OUTPUT TO ARRIVE AT THE NET POWER AVAILABLE FOR THE EXTERNAL (FLYWHEEL) LOAD. TYPICAL AUXILIARIES INCLUDE COOLING FANS, AIR COMPRESSORS, AND CHARGING ALTERNATORS.

RATINGS MUST BE REDUCED TO COMPENSATE FOR ALTITUDE AND/OR AMBIENT TEMPERATURE CONDITIONS ACCORDING TO THE APPLICABLE DATA SHOWN ON THE PERFORMANCE DATA SET.

GEN SET - PACKAGED - DIESEL
ALTITUDE:
ALTITUDE CAPABILITY - THE RECOMMENDED REDUCED POWER VALUES FOR SUSTAINED ENGINE OPERATION AT SPECIFIC ALTITUDE LEVELS AND AMBIENT TEMPERATURES.

COLUMN "N" DATA - THE FLYWHEEL POWER OUTPUT AT NORMAL AMBIENT TEMPERATURE.

AMBIENT TEMPERATURE - TO BE MEASURED AT THE AIR CLEANER AIR INLET DURING NORMAL ENGINE OPERATION.
NORMAL TEMPERATURE - THE NORMAL TEMPERATURE AT VARIOUS SPECIFIC ALTITUDE LEVELS IS FOUND ON TM2001.

THE GENERATOR POWER CURVE TABULAR DATA REPRESENTS THE NET ELECTRICAL POWER OUTPUT OF THE GENERATOR.

GENERATOR SET RATINGS
EMERGENCY STANDBY POWER (ESP)

OUTPUT AVAILABLE WITH VARYING LOAD FOR THE DURATION OF AN EMERGENCY OUTAGE. AVERAGE POWER OUTPUT IS 70% OF THE ESP RATING. TYPICAL OPERATION IS 50 HOURS PER YEAR, WITH MAXIMUM EXPECTED USAGE OF 200 HOURS PER YEAR.

STANDBY POWER RATING

OUTPUT AVAILABLE WITH VARYING LOAD FOR THE DURATION OF AN EMERGENCY OUTAGE. AVERAGE POWER OUTPUT IS 70% OF THE STANDBY POWER RATING. TYPICAL OPERATION IS 200 HOURS PER YEAR, WITH MAXIMUM EXPECTED USAGE OF 500 HOURS PER YEAR.

PRIME POWER RATING

OUTPUT AVAILABLE WITH VARYING LOAD FOR AN UNLIMITED TIME. AVERAGE POWER OUTPUT IS 70% OF THE PRIME POWER RATING. TYPICAL PEAK DEMAND IS 100% OF PRIME RATED EKW WITH 10% OVERLOAD CAPABILITY FOR EMERGENCY USE FOR A MAXIMUM OF 1 HOUR IN 12. OVERLOAD OPERATION CANNOT EXCEED 25 HOURS PER YEAR.

CONTINUOUS POWER RATING

OUTPUT AVAILABLE WITH NON-VARYING LOAD FOR AN UNLIMITED TIME. AVERAGE POWER OUTPUT IS 70-100% OF THE CONTINUOUS POWER RATING. TYPICAL PEAK DEMAND IS 100% OF CONTINUOUS RATED EKW FOR 100% OF OPERATING HOURS.

GEN SET PACKAGE PERFORMANCE DATA [DM8266]

Performance Number: DM8266

Sales Model: 3516CDITA	**Combustion:** DI	**Aspr:** TA
Engine Power: 2500 W/F EKW 2593 W/O F EKW 3,622 HP	**Speed:** 1,800 RPM	**After Cooler:** ATAAC
Manifold Type: DRY	**Governor Type:** ADEM3	**After Cooler Temp(F):** 122
Turbo Quantity: 4	**Engine App:** GP	**Turbo Arrangement:** Parallel
Hertz: 60	**Engine Rating:** PGS	**Strategy:**
Rating Type: STANDBY	**Certification:** EPA TIER-2 2006 -	

General Performance Data

GEN W/F EKW	PERCENT LOAD	ENGINE POWER BHP	ENGINE BMEP PSI	FUEL RATE LB/BHP-HR	FUEL RATE GPH	INTAKE MFLD TEMP DEG F	INTAKE MFLD P IN-HG	INTAKE AIR FLOW CFM	EXH MFLD TEMP DEG F	EXH STACK TEMP DEG F	EXH GAS FLOW CFM
2,500.0	100	3604	333	0.337	173.3	122.0	78.2	6,992.3	1,236.7	921.9	19,048.8
2,250.0	90	3256	301	0.337	156.7	119.3	71.3	6,600.3	1,190.3	889.0	17,516.1
2,000.0	80	2911	269	0.341	141.9	117.0	64.3	6,183.6	1,159.0	871.0	16,167.1
1,875.0	75	2738	253	0.344	134.6	115.9	60.8	5,961.1	1,145.8	864.7	15,506.7
1,750.0	70	2566	237	0.347	127.3	114.6	57.1	5,731.6	1,133.6	859.6	14,846.3
1,500.0	60	2223	205	0.355	112.8	112.8	49.6	5,254.8	1,112.0	853.0	13,522.0
1,250.0	50	1880	174	0.366	98.4	111.0	41.5	4,739.2	1,091.7	848.5	12,144.7
1,000.0	40	1545	143	0.375	82.8	109.4	31.8	4,075.3	1,062.9	848.1	10,439.0
750.0	30	1203	111	0.387	66.5	108.0	22.0	3,404.3	1,012.8	837.9	8,627.4
625.0	25	1029	95	0.396	58.2	107.2	17.4	3,086.5	970.9	818.2	7,702.1
500.0	20	854	79	0.406	49.5	106.3	12.9	2,772.2	905.7	782.2	6,723.9
250.0	10	496	46	0.443	31.4	104.2	4.8	2,193.0	702.9	643.5	4,693.3

Heat Rejection Data

GEN W/F EKW	PERCENT LOAD	REJ TO JW BTU/MN	REJ TO ATMOS BTU/MN	REJ TO EXHAUST BTU/MN	EXH RCOV TO 350F BTU/MN	FROM OIL CLR BTU/MN	FROM AFT CLR BTU/MN	WORK ENERGY BTU/MN	LHV ENERGY BTU/MN	HHV ENERGY BTU/MN
2,500.0	100	47,202	9,156	140,924	75,921	18,596	43,392	152,866	371,872	396,156
2,250.0	90	44,245	8,587	127,047	67,163	16,833	38,046	138,080	336,328	358,280
2,000.0	80	41,458	8,303	115,901	60,566	15,241	33,155	123,408	304,481	324,386
1,875.0	75	40,093	8,189	110,555	57,609	14,445	30,767	116,128	288,899	307,780
1,750.0	70	38,672	8,076	105,266	54,766	13,649	28,321	108,792	273,260	291,117
1,500.0	60	35,885	7,791	94,916	49,420	12,113	23,601	94,233	242,152	257,962
1,250.0	50	32,871	7,564	84,566	44,074	10,578	18,824	79,732	211,101	224,864
1,000.0	40	29,515	7,336	72,566	37,762	8,872	13,478	65,514	177,718	189,320
750.0	30	25,648	6,881	59,258	30,823	7,109	8,474	51,012	142,743	152,070
625.0	25	23,544	6,597	52,150	26,729	6,256	6,426	43,676	124,886	133,019
500.0	20	21,156	6,142	44,245	22,009	5,289	4,550	36,169	106,119	113,057
250.0	10	15,867	5,118	27,525	11,601	3,355	1,763	21,042	67,277	71,656

EXHAUST Sound Data: 6.6 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
2,500.0	100	119	109	124	120	112	110	112	111	109
2,250.0	90	118	108	123	119	111	109	111	110	108
2,000.0	80	117	107	122	118	110	108	109	109	107
1,875.0	75	116	106	121	117	109	107	109	109	107
1,750.0	70	115	106	120	116	108	107	108	108	106
1,500.0	60	114	104	119	115	107	106	107	107	105
1,250.0	50	113	103	118	114	106	104	106	105	103
1,000.0	40	111	102	116	112	104	103	104	104	102
750.0	30	110	100	115	111	103	101	102	102	100
625.0	25	109	99	114	110	102	100	101	101	99
500.0	20	108	98	113	109	101	99	100	100	98
250.0	10	105	95	110	106	98	97	98	98	96

EXHAUST Sound Data: 23.0 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
2,500.0	100	105	97	113	108	99	97	98	98	95
2,250.0	90	104	96	112	107	98	96	97	97	94
2,000.0	80	103	95	111	105	97	95	96	96	93
1,875.0	75	103	94	111	105	96	95	95	95	92
1,750.0	70	102	93	110	104	96	94	95	95	92
1,500.0	60	101	92	109	103	94	93	93	93	91
1,250.0	50	99	91	107	102	93	91	92	92	89
1,000.0	40	98	89	106	100	92	90	91	90	88
750.0	30	96	88	104	98	90	88	89	89	86
625.0	25	95	87	103	97	89	87	88	88	85
500.0	20	94	86	102	96	88	86	87	87	84
250.0	10	92	83	100	94	85	84	84	84	82

EXHAUST Sound Data: 49.2 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
2,500.0	100	99	90	107	101	92	91	91	91	89
2,250.0	90	98	89	106	100	91	90	90	90	88
2,000.0	80	97	88	105	99	90	89	89	89	86
1,875.0	75	96	87	104	98	90	88	89	89	86
1,750.0	70	95	87	103	98	89	87	88	88	85
1,500.0	60	94	86	102	96	88	86	87	87	84
1,250.0	50	93	84	101	95	86	85	85	85	83
1,000.0	40	91	83	99	93	85	83	84	84	81
750.0	30	90	81	98	92	83	82	82	82	79
625.0	25	89	80	97	91	82	81	81	81	78
500.0	20	88	79	96	90	81	80	80	80	77
250.0	10	85	77	93	87	79	77	78	78	75

MECHANICAL Sound Data: 3.3 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
2,500.0	100	117	121	130	121	111	104	102	100	103
2,250.0	90	117	121	130	121	111	104	102	100	103
2,000.0	80	117	121	130	121	111	104	102	100	103
1,875.0	75	117	121	130	121	111	104	102	100	103
1,750.0	70	117	121	130	121	111	104	102	100	103
1,500.0	60	117	121	130	121	111	104	102	100	103
1,250.0	50	117	121	130	121	111	104	102	100	103
1,000.0	40	117	121	130	121	111	104	102	100	103
750.0	30	117	121	130	121	111	104	102	100	103
625.0	25	117	121	130	121	111	104	102	100	103
500.0	20	117	121	130	121	111	104	102	100	103
250.0	10	117	121	130	121	111	104	102	100	103

MECHANICAL Sound Data: 23.0 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCJ 8000HZ DB
2,500.0	100	103	107	116	107	98	91	90	88	92
2,250.0	90	103	107	116	107	98	91	90	88	92
2,000.0	80	103	107	116	107	98	91	90	88	92
1,875.0	75	103	107	116	107	98	91	90	88	92
1,750.0	70	103	107	116	107	98	91	90	88	92
1,500.0	60	103	107	116	107	98	91	90	88	92
1,250.0	50	103	107	116	107	98	91	90	88	92
1,000.0	40	103	107	116	107	98	91	90	88	92
750.0	30	103	107	116	107	98	91	90	88	92
625.0	25	103	107	116	107	98	91	90	88	92
500.0	20	103	107	116	107	98	91	90	88	92
250.0	10	103	107	116	107	98	91	90	88	92

MECHANICAL Sound Data: 49.2 FEET

GEN W/F EKW	PERCENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
2,500.0	100	97	100	110	100	91	85	85	82	86
2,250.0	90	97	100	110	100	91	85	85	82	86
2,000.0	80	97	100	110	100	91	85	85	82	86
1,875.0	75	97	100	110	100	91	85	85	82	86
1,750.0	70	97	100	110	100	91	85	85	82	86
1,500.0	60	97	100	110	100	91	85	85	82	86
1,250.0	50	97	100	110	100	91	85	85	82	86
1,000.0	40	97	100	110	100	91	85	85	82	86
750.0	30	97	100	110	100	91	85	85	82	86
625.0	25	97	100	110	100	91	85	85	82	86
500.0	20	97	100	110	100	91	85	85	82	86
250.0	10	97	100	110	100	91	85	85	82	86

EMISSIONS DATA

EPA TIER-2 2006 - ********** B5

Gaseous emissions data measurements are consistent with those described in EPA 40 CFR PART 89 SUBPART D and ISO 8178 for measuring HC, CO, PM, and NOx.

Gaseous emissions values are WEIGHTED CYCLE AVERAGES and are in compliance with the following non-road regulations:

LOCALITY	AGENCY/LEVEL	MAX LIMITS - g/kw-hr		
U.S. (incl Calif)	EPA/TIER-2	CO:3.5	NOx + HC:6.4	PM:0.20

EXHAUST STACK DIAMETER	12 IN
WET EXHAUST MASS	32,253.6 LB/HR
WET EXHAUST FLOW (921.20 F STACK TEMP)	19,059.34 CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	6,611.00 STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	6,056.47 STD CFM
FUEL FLOW RATE	172 GAL/HR

RATED SPEED "Nominal Data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	TOTAL CO2 LB/HR	PART MATTER LB/HR	OXYGEN IN EXHAUST PERCENT	DRY SMOKE OPACITY PERCENT	BOSCH SMOKE NUMBER
2,500.0	100	3604	40.09	3.25	0.80	3,715.1	0.280	9.30	1.5	1.28
1,875.0	75	2738	24.68	1.55	0.81	2,871.2	0.190	10.40	1.3	1.28
1,250.0	50	1880	12.36	1.31	0.88	2,088.2	0.200	11.30	1.7	1.28
625.0	25	1029	6.37	1.81	0.67	1,225.7	0.220	12.20	2.5	1.28
250.0	10	496	5.54	2.50	0.71	642.6	0.220	14.30	3.6	1.28

RATED SPEED "Nominal Data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BKW	TOTAL NOX (AS NO2) G/HP-HR	TOTAL CO G/HP-HR	TOTAL HC G/HP-HR	PART MATTER G/HP-HR	OXYGEN IN EXHAUST PERCENT	DRY SMOKE OPACITY PERCENT	BOSCH SMOKE NUMBER
2,500.0	100	2,687.7	5.05	0.41	0.10	0.04	9.30	1.5	1.28
1,875.0	75	2,042.0	4.09	0.26	0.13	0.03	10.40	1.3	1.28
1,250.0	50	1,401.8	2.98	0.31	0.21	0.05	11.30	1.7	1.28
625.0	25	767.6	2.81	0.80	0.29	0.10	12.20	2.5	1.28
250.0	10	369.8	5.06	2.29	0.64	0.20	14.30	3.6	1.28

RATED SPEED "Not to exceed data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	PART MATTER LB/HR	OXYGEN IN EXHAUST PERCENT	DRY SMOKE OPACITY PERCENT	BOSCH SMOKE NUMBER
2,500.0	100	3604	48.11	5.86	1.07	.400	9.30	1.5	1.28
1,875.0	75	2738	29.62	2.78	1.08	.260	10.40	1.3	1.28
1,250.0	50	1880	14.84	2.35	1.17	.280	11.30	1.7	1.28
625.0	25	1029	7.65	3.25	0.89	.310	12.20	2.5	1.28
250.0	10	496	6.64	4.50	0.94	.300	14.30	3.6	1.28

RATED SPEED "Nominal Data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	TOTAL CO2 LB/HR	PART MATTER LB/HR	OXYGEN IN EXHAUST PERCENT	DRY SMOKE OPACITY PERCENT	BOSCH SMOKE NUMBER
2,500.0	100	3604	40.09	3.25	0.80	3,715.1	0.280	9.30	1.5	1.28
1,875.0	75	2738	24.68	1.55	0.81	2,871.2	0.190	10.40	1.3	1.28
1,250.0	50	1880	12.36	1.31	0.88	2,088.2	0.200	11.30	1.7	1.28
625.0	25	1029	6.37	1.81	0.67	1,225.7	0.220	12.20	2.5	1.28
250.0	10	496	5.54	2.50	0.71	642.6	0.220	14.30	3.6	1.28

RATED SPEED "Nominal Data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BKW	TOTAL NOX (AS NO2) G/HP-HR	TOTAL CO G/HP-HR	TOTAL HC G/HP-HR	PART MATTER G/HP-HR	OXYGEN IN EXHAUST PERCENT	DRY SMOKE OPACITY PERCENT	BOSCH SMOKE NUMBER
2,500.0	100	2,687.7	5.05	0.41	0.10	0.04	9.30	1.5	1.28
1,875.0	75	2,042.0	4.09	0.26	0.13	0.03	10.40	1.3	1.28
1,250.0	50	1,401.8	2.98	0.31	0.21	0.05	11.30	1.7	1.28
625.0	25	767.6	2.81	0.80	0.29	0.10	12.20	2.5	1.28
250.0	10	369.8	5.06	2.29	0.64	0.20	14.30	3.6	1.28

GEN SET PACKAGE PERFORMANCE DATA [DM8501]

SEPTEMBER 21, 2009

For Help Desk Phone Numbers Click here

Performance Number: DM8501

Change Level: 01

Sales Model: C9 DITA **Combustion:** DI **Aspr:** TA

Engine Power:
250 W/F EKW 265 W/O F EKW
398 HP

Speed: 1,800 RPM **After Cooler:** ATAAC

Manifold Type: DRY **Governor Type:** ELEC **After Cooler Temp(F):** 120

Turbo Quantity: 1 **Engine App:** GP **Turbo Arrangement:**

Hertz: 60 **Application Type:** PACKAGE-DIE **Engine Rating:** PGS **Strategy:**

Rating Type: STANDBY **Certification:** EPA TIER-3 2005 - ----

General Performance Data 1

GEN W/F EKW	PERCENT LOAD	ENGINE POWER BHP	ENGINE BMEP PSI	FUEL BSFC LB/BHP-HR	FUEL RATE GPH	INTAKE MFLD TEMP DEG F	INTAKE MFLD P IN-HG	INTAKE AIR FLOW CFM	EXH MFLD TEMP DEG F	EXH STACK TEMP DEG F	EXH GAS FLOW CFM
250	100	398	326.05	0.34	19.36	122.36	77.94	879.34	1,145.48	853.88	2,242.48
225	90	359	294.14	0.35	17.73	121.64	74.33	854.62	1,096.88	824.9	2,129.48
200	80	321	262.81	0.35	16.25	122.18	70.86	829.9	1,052.06	801.32	2,023.53
187.5	75	302	247.58	0.36	15.53	122.54	69.15	815.77	1,031	791.42	1,974.09
175	70	284	232.21	0.36	14.77	122.36	66.75	798.11	1,012.1	784.22	1,914.06
150	60	247	202.04	0.37	13.18	122.18	60.77	748.67	974.84	770.18	1,776.33
125	50	211	172.45	0.38	11.57	121.82	53.36	688.64	938.48	756.5	1,613.88
100	40	177	144.6	0.39	9.93	121.28	43.5	607.41	902.66	743.18	1,412.59
75	30	142	116.03	0.4	8.16	120.92	32.6	519.13	861.08	728.78	1,190.11
62.5	25	124	101.38	0.41	7.26	120.56	27.04	473.22	837.86	720.86	1,077.1
50	20	106	86.44	0.42	6.31	120.38	21.38	423.78	813.02	712.76	957.03
25	10	69	56.13	0.45	4.36	120.38	11.99	346.08	669.2	610.52	716.89

Engine Heat Rejection Data

GEN W/F EKW	PERCENT LOAD	REJ TO JW BTU/MN	REJ TO ATMOS BTU/MN	REJ TO EXHAUST BTU/MN	EXH RCOV TO 350F BTU/MN	FROM OIL CLR BTU/MN	FROM AFT CLR BTU/MN	WORK ENERGY BTU/MN	LHV ENERGY BTU/MN	HHV ENERGY BTU/MN
250	100	5,971.3	1,950.6	15,184.3	8,189.3	2,223.6	4,515.5	16,890.4	41,799.4	44,529.1
225	90	5,516.4	1,768.7	14,103.7	7,450.0	2,035.9	4,145.8	15,241.1	38,273.4	40,775.7
200	80	5,175.2	1,666.3	13,136.9	6,824.4	1,865.3	3,764.8	13,591.9	35,031.9	37,306.6
187.5	75	5,004.5	1,592.4	12,682.0	6,540.0	1,780.0	3,565.7	12,795.7	33,439.5	35,657.4
175	70	4,833.9	1,495.7	12,170.2	6,255.7	1,694.7	3,349.6	12,056.4	31,790.3	33,894.4
150	60	4,492.7	1,319.4	11,146.5	5,687.0	1,512.7	2,849.2	10,464.1	28,434.9	30,254.8
125	50	4,151.5	1,165.8	9,952.2	5,061.4	1,325.1	2,303.2	8,928.6	24,909.0	26,558.2
100	40	3,867.1	1,199.9	8,587.3	4,265.2	1,137.4	1,632.2	7,506.8	21,383.1	22,747.9
75	30	3,412.2	1,160.2	7,108.7	3,525.9	932.7	1,012.3	6,028.2	17,572.8	18,710.2
62.5	25	3,184.7	1,057.8	6,369.4	3,127.8	830.3	745.0	5,232.0	15,582.3	16,606.0
50	20	2,900.4	887.2	5,630.1	2,729.8	722.2	506.1	4,492.7	13,535.0	14,445.0
25	10	2,388.5	716.6	3,810.3	1,592.4	500.5	170.6	2,900.4	9,383.5	9,952.2

EMISSIONS DATA

EPA TIER-3 2005 - ---- ********** G5

Gaseous emissions data measurement are consistent with those described in in 40 CFR, EU 97/68/EC, ECE Regulation No. 96 and ISO 8178 for measuring HC, CO, PM and NOx.

Gaseous emissions values are WEIGHTED CYCLE AVERAGES and are in compliance with the following non-road regulations:

LOCALITY	AGENCY/LEVEL	MAX LIMITS - g/kw-hr		
U. S. (incl Calif)	EPA/Tier 3	CO:3.5	NOx + HC:4.0	PM:0.2
Europe	EU/Stage-IIIA	CO:3.5	NOx + HC:4.0	PM:0.2

REFERENCE EXHAUST STACK DIAMETER	--
WET EXHAUST MASS	4,012.4 LB/HR
WET EXHAUST FLOW (852.80 F STACK TEMP)	2,245.31 CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	841.00 STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	770.57 STD CFM
FUEL FLOW RATE	19 GAL/HR

RATED SPEED "Not to exceed data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	PART MATTER LB/HR	OXYGEN IN EXHAUST PERCENT
250	100	398	3.1700	.6000	.1700	.1400	10.1000
187.5	75	302	1.8000	.6000	.2200	.1500	11.5000
125	50	211	1.1200	.4800	.2300	.1100	12.7000
62.5	25	124	.6900	.6100	.1800	.1000	13.6000
25	10	69	.5400	.5900	.1800	.0700	15.0000

RATED SPEED "Nominal Data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	TOTAL CO2 LB/HR	PART MATTER LB/HR	OXYGEN IN EXHAUST PERCENT
250	100	398	2.6200	.3200	.0900	427.3	.0700	10.1000
187.5	75	302	1.4800	.3200	.1200	343.1	.0700	11.5000
125	50	211	.9300	.2500	.1200	255.3	.0600	12.7000
62.5	25	124	.5700	.3200	.1000	156.4	.0500	13.6000
25	10	69	.4500	.3200	.0900	93.8	.0400	15.0000

Altitude Capability Data(Corrected Power Altitude Capability)

Ambient Operating Temp. / Altitude	50 F	68 F	86 F	104 F	122 F	NORMAL
0 F	398.28 hp	398.28 hp	398.28 hp	398.28 hp	398.28 hp	398.28 hp
984.25 F	398.28 hp	398.28 hp	398.28 hp	398.28 hp	398.28 hp	398.28 hp
1,640.42 F	398.28 hp	398.28 hp	398.28 hp	398.28 hp	388.9 hp	398.28 hp
3,280.84 F	398.28 hp	398.28 hp	390.24 hp	378.17 hp	366.1 hp	398.28 hp
4,921.26 F	392.92 hp	379.51 hp	367.44 hp	355.37 hp	344.64 hp	379.51 hp
6,561.68 F	370.12 hp	356.71 hp	344.64 hp	333.91 hp	323.19 hp	360.73 hp
8,202.1 F	347.32 hp	335.26 hp	324.53 hp	313.8 hp	304.41 hp	341.96 hp
9,842.52 F	325.87 hp	315.14 hp	304.41 hp	295.02 hp	285.64 hp	324.53 hp
11,482.94 F	305.75 hp	295.02 hp	285.64 hp	276.25 hp	268.2 hp	308.43 hp
13,123.36 F	286.98 hp	276.25 hp	268.2 hp	258.82 hp	250.77 hp	292.34 hp
14,763.78 F	268.2 hp	258.82 hp	250.77 hp	242.72 hp	234.68 hp	277.59 hp

The powers listed above and all the Powers displayed are Corrected Powers

Identification Reference and Notes

Engine Arrangement:	2575707	**Lube Oil Press @ Rated Spd(PSI):**	49.5
Effective Serial No:	S9L00001	**Piston Speed @ Rated Eng SPD (FT/Min):**	1,592.5
Primary Engine Test Spec:	0K6612	**Max Operating Altitude(FT):**	3,280.8
Performance Parm Ref:	TM5739	**PEEC Elect Control Module Ref**	
Performance Data Ref:	DM8501	**PEEC Personality Cont Mod Ref**	
Aux Coolant Pump Perf Ref:			
Cooling System Perf Ref:		**Turbocharger Model**	S310-1.25 VTF
Certification Ref:	EPA TIER 3	**Fuel Injector**	
Certification Year:	2005	**Timing-Static (DEG):**	--
Compression Ratio:	16.1	**Timing-Static Advance (DEG):**	--
Combustion System:	DI	**Timing-Static (MM):**	--
Aftercooler Temperature (F):	120	**Unit Injector Timing (MM):**	--
Crankcase Blowby Rate(CFH):	--	**Torque Rise (percent)**	--
Fuel Rate (Rated RPM) No Load (Gal/HR):	--	**Peak Torque Speed RPM**	--
Lube Oil Press @ Low Idle Spd(PSI):	42.5	**Peak Torque (LB/FT):**	--

Reference Number: DM8501 EPA TIER-3 2005----G5

Parameters Reference: TM5739

GEN SET - PACKAGED - DIESEL
TOLERANCES:
AMBIENT AIR CONDITIONS AND FUEL USED WILL AFFECT THESE VALUES. EACH OF THE VALUES MAY VARY IN ACCORDANCE WITH THE FOLLOWING TOLERANCES.

ENGINE POWER	+/-	3%
EXHAUST STACK TEMPERATURE	+/-	8%
GENERATOR POWER	+/-	5%
INLET AIR FLOW	+/-	5%
INTAKE MANIFOLD PRESSURE - GAGE	+/-	10%
EXHAUST FLOW	+/-	6%
SPECIFIC FUEL CONSUMPTION	+/-	3%
FUEL RATE	+/-	5%
HEAT REJECTION	+/-	5%
HEAT REJECTION EXHAUST ONLY	+/-	10%

CONDITIONS:
ENGINE PERFORMANCE IS CORRECTED TO INLET AIR STANDARD CONDITIONS OF 99 KPA (29.31 IN HG) AND 25 DEG C (77 DEG F).

THESE VALUES CORRESPOND TO THE STANDARD ATMOSPHERIC PRESSURE AND TEMPERATURE IN ACCORDANCE WITH SAE J1349. ALSO INCLUDED IS A CORRECTION TO STANDARD FUEL GRAVITY OF 35 DEGREES API HAVING A LOWER HEATING VALUE OF 42,780 KJ/KG (18,390 BTU/LB) WHEN USED AT 29 DEG C (84.2 DEG F) WHERE THE DENSITY IS 838.9 G/L (7.002 LB/GAL).

THE CORRECTED PERFORMANCE VALUES SHOWN FOR CATERPILLAR ENGINES WILL APPROXIMATE THE VALUES OBTAINED WHEN THE OBSERVED PERFORMANCE DATA IS CORRECTED TO SAE J1349, ISO 3046-2 & 8665 & 2288 & 9249 & 1585, EEC 80/1269 AND DIN70020 STANDARD REFERENCE CONDITIONS.

ENGINES ARE EQUIPPED WITH STANDARD ACCESSORIES; LUBE OIL, FUEL PUMP AND JACKET WATER PUMP. THE POWER REQUIRED TO DRIVE AUXILIARIES MUST BE DEDUCTED FROM THE GROSS OUTPUT TO ARRIVE AT THE NET POWER AVAILABLE FOR THE EXTERNAL (FLYWHEEL) LOAD. TYPICAL AUXILIARIES INCLUDE COOLING FANS, AIR COMPRESSORS, AND CHARGING ALTERNATORS.

RATINGS MUST BE REDUCED TO COMPENSATE FOR ALTITUDE AND/OR AMBIENT TEMPERATURE CONDITIONS ACCORDING TO THE APPLICABLE DATA SHOWN ON THE PERFORMANCE DATA SET.

GEN SET - PACKAGED - DIESEL
ALTITUDE:
ALTITUDE CAPABILITY - THE RECOMMENDED REDUCED POWER VALUES FOR SUSTAINED ENGINE OPERATION AT SPECIFIC ALTITUDE LEVELS AND AMBIENT TEMPERATURES.

COLUMN "N" DATA - THE FLYWHEEL POWER OUTPUT AT NORMAL AMBIENT TEMPERATURE.

AMBIENT TEMPERATURE - TO BE MEASURED AT THE AIR CLEANER AIR INLET DURING NORMAL ENGINE OPERATION.
NORMAL TEMPERATURE - THE NORMAL TEMPERATURE AT VARIOUS SPECIFIC ALTITUDE LEVELS IS FOUND ON TM2001.

THE GENERATOR POWER CURVE TABULAR DATA REPRESENTS THE NET ELECTRICAL POWER OUTPUT OF THE GENERATOR.

GENERATOR SET RATINGS
EMERGENCY STANDBY POWER (ESP)

OUTPUT AVAILABLE WITH VARYING LOAD FOR THE DURATION OF AN EMERGENCY OUTAGE. AVERAGE POWER OUTPUT IS 70% OF THE ESP RATING. TYPICAL OPERATION IS 50 HOURS PER YEAR, WITH MAXIMUM EXPECTED USAGE OF 200 HOURS PER YEAR.

STANDBY POWER RATING

OUTPUT AVAILABLE WITH VARYING LOAD FOR THE DURATION OF AN EMERGENCY OUTAGE. AVERAGE POWER OUTPUT IS 70% OF THE STANDBY POWER RATING. TYPICAL OPERATION IS 200 HOURS PER YEAR, WITH MAXIMUM EXPECTED USAGE OF 500 HOURS PER YEAR.

PRIME POWER RATING

OUTPUT AVAILABLE WITH VARYING LOAD FOR AN UNLIMITED TIME. AVERAGE POWER OUTPUT IS 70% OF THE PRIME POWER RATING. TYPICAL PEAK DEMAND IS 100% OF PRIME RATED EKW WITH 10% OVERLOAD CAPABILITY FOR EMERGENCY USE FOR A MAXIMUM OF 1 HOUR IN 12. OVERLOAD OPERATION CANNOT EXCEED 25 HOURS PER YEAR.

CONTINUOUS POWER RATING

OUTPUT AVAILABLE WITH NON-VARYING LOAD FOR AN UNLIMITED TIME. AVERAGE POWER OUTPUT IS 70-100% OF THE CONTINUOUS POWER RATING. TYPICAL PEAK DEMAND IS 100% OF CONTINUOUS RATED EKW FOR 100% OF OPERATING HOURS.

ACI - CANEFCO

A DIVISION OF ADVANCED COMBUSTION INC.

CANEFCO

MINE AIR HEATING

MINE AIR HEATING

ACI-CANEFCO, (a Division of Advanced Combustion Inc.), designs and manufactures complete mine air heating and ventilation solutions with airflow capacities ranging from 20,000 to 2,500,000 SCFM.

The turn-key approach to an **ACI-CANEFCO** supplied solution typically consists of the Mine Air Heater, Main Supply and Exhaust Fans, Interconnecting Ductwork, Silencers and Plenums, Complete Fuel Storage and Supply Systems (Propane and Oil), On Site Commissioning and Training. The complexity of an **ACI-CANEFCO** control system varies from simple, local temperature and modulation control to fully automated PLC control with customized HMI screens and remote communications.

ACI-CANEFCO provides complete Mine Air Heaters in the following configurations: Portable, Permanent, Direct Fired, Indirect Fired, Horizontal Discharge, Vertical Discharge, Single Fan and Multi-Fan. **ACI-CANEFCO** heaters are capable of burning everything from Natural Gas and Propane to Waste Oil!

Dependability, Reliability, Premium Efficiency, Serviceability, and *Low Emissions* are key considerations in the proper design of a mine shaft heating system. **ACI-CANEFCO** combines its decades of engineering experience with state-of-the-art combustion and heat transfer technologies to provide optimum heating solutions that are dependable, reliable, efficient, easy to maintain and service and are environmentally friendly. **ACI-CANEFCO** ensures that every heater is designed to operate safely and effectively in harsh environments like the Canadian Arctic that require careful consideration of every detail.

350,000 SCFM Indirect Fired Mine Air Heater - Waste Oil

Custom Control Systems and Valve Train Design

800,000 SCFM Direct Fired, Horizontal Discharge Mine Air Heater – Propane

1,000,000 SCFM Direct Fired, Vertical Discharge Mine Air Heater – Natural Gas

350,000 SCFM Indirect Fired Mine Air Heater - Artic Diesel

ACI-CANEFCO sets the standard for Heating North of 60°

ACI - CANEFCO

DIVISION OF ADVANCED COMBUSTION INC.

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Concord, Ontario,
L4K 5A2, Canada
Tel: (905) 417-0036
Fax: (905) 417-4772
www.aci-ca.com

Emulsion

EMISSION FACTORS USING NIOSH DATA

Det within	NOx l/kg	NOx gm/kg	NOx lb/ton	NO2 l/kg	NO2 gm/kg	NO2 lb/ton
Steel pipe	1.50	3.081027	6.162054	0.5	1.027009	2.054018
sheet metal	2.50	5.135045	10.27009	0.9	1.848616	3.697232
sheet metal	3.00	6.162054	12.32411	1.3	2.670223	5.340446
AVERAGE			9.585417			3.697232

Det within	CO l/kg	CO gm/kg	CO lb/ton
Steel pipe	13.00	16.2558	32.51161
sheet metal	14.00	17.50625	35.0125
sheet metal	21.00	26.25938	52.51875
AVERAGE			40.01429

773G

Off-Highway Truck

Engine (Tier 4 Final)		
Engine Model	Cat® C27 ACERT™	
Gross Power – SAE J1995	578 kW	775 hp
Net Power – SAE J1349	534 kW	717 hp
Engine (Tier 2 Equivalent)		
Engine Model	Cat® C27 ACERT™	
Gross Power – SAE J1995	578 kW	775 hp
Net Power – SAE J1349	546 kW	733 hp
Weights – Approximate (Tier 4 Final)		
Maximum Gross Vehicle Weight	102 740 kg	226,503 lb
Weights – Approximate (Tier 2 Equivalent)		
Maximum Gross Vehicle Weight	102 740 kg	226,503 lb

Operating Specifications (Tier 4 Final)		
Nominal Payload Class (100%)	55.3 tonnes	61.0 tons
Maximum Working Payload (110%)	60.8 tonnes	67.0 tons
Not to Exceed Payload (120%)*	66.3 tonnes	73.1 tons
Body Capacity – SAE 2:1	35.75 m^3	46.75 yd^3
Operating Specifications (Tier 2 Equivalent)		
Nominal Payload Class (100%)	56.0 tonnes	61.7 tons
Maximum Working Payload (110%)	61.5 tonnes	67.8 tons
Not to Exceed Payload (120%)*	67.1 tonnes	74.0 tons
Body Capacity – SAE 2:1	35.75 m^3	46.75 yd^3

• Capacity with dual slope body – no liner.

* Refer to the Caterpillar 10/10/20 Payload Guidelines for maximum gross machine weight limitations.

G Series is our commitment to your safety, people and prosperity.

Contents

G Series represents a new era for the 773, and with your long-term success as our goal, we've developed this truck to be more productive and economical. It offers your operators the confidence, comfort and control to run at peak efficiency, and it can feed your crushers and haul material at a lower cost per ton. When you also consider its performance and fuel efficiency, the 773G is the right truck for our generation.

Safety

Connecting people and equipment safely

A Focus on Personnel

The 773G is designed to minimize hazards associated with working on and around this truck.

- Ground level daily check points
- Low effort, integrated access system with hand rails for three points of contact
- Aggressive tread plate on all step areas, and lighting for after dark
- Folding windshield washing platform offers solid footing for cleaning the windshield

Confidence and Control

Confident operators will move material quickly, efficiently and profitably.

- Brake design updates increase slope holding capability and include a brake wear indicator
- Wet disc braking for rear wheels; dry disc braking on the front
- Automatic Retarding Control for downhill grades
- New traction control system

Visibility

The 773G supports your site safety plan with excellent visibility to the job site.

- Work Area Vision System (WAVS) is a camera system that enhances visibility behind the truck
- Lighting and mirror packages are available to suit your site conditions

Key Features

The 773G is solidly constructed for safety.

- Rollover and Falling Object protection is part of the cab structure
- Emergency egress is available through the right-side hinged window
- Laminated glass is used in the front and left side windows
- Ground level engine shutdown for convenience and safety
- A back up alarm gives advance warning of truck movement

Operator Safety

The 773G provides operators with full shift comfort and safety features.

- Fully adjustable and suspended seat
- Integrated three point safety belt
- A trainer's seat with lap belt facilitates on-the-job task training
- Audible warnings signal events, and fluid level monitoring is available from inside the cab
- In some instances, the truck will automatically derate engine power for safety

Job Site Safety

- Speed limiting on the haul is new and more efficient than gear limiting
- Secondary steering in the event of power loss
- Speed limiting during body up operations

Comfort

The comfort of your crew will contribute to their productivity and awareness on the job.

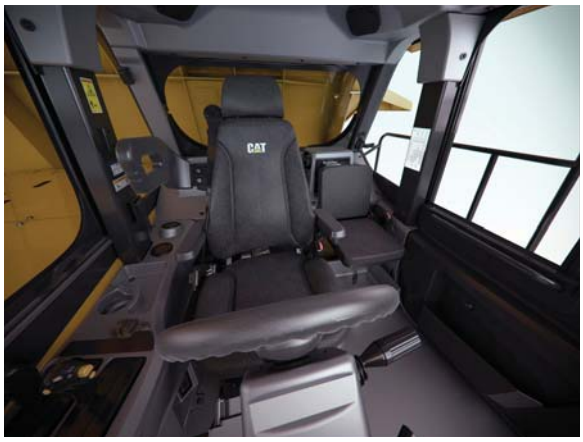
- Easy, low effort access to the cab
- Ergonomic, intuitive controls
- Left side power window
- Automatic temperature control inside the cab
- Throttle lock convenience for long uphill climbs
- The cab is spacious with window area that supports visibility
- An integrated footrest provides comfort and support
- Sound suppression provides a quieter work environment
- The cab is isolation mounted reducing noise and vibration
- Lighting package options to meet operation needs
- Automotive quality shifting from new APECS transmission controls

Confidence and Control

Strong, predictable performance will help your operators achieve the lowest cost per ton.

- Automatic Retarding Control reduces operator effort and controls braking on downhill grades
- Performance and health information at a glance using well lit gauges and the Advisor Message Display
- Steering performance from a design that maintains tire alignment
- Stopping power from fade-resistant brakes – purpose built for off road applications and the loads carried by the 773G
- Traction control is now steering sensitive and uses the service brakes to control wheel slip. The result: faster activation and improved response to wheel slip
- Visibility is excellent with extensive mirror options, large window areas

Cab layout subject to change with optional equipment.



Operator Work Environment

Productivity from comfort, confidence, control

Information

The Advisor display and VIMS™ software are important reporting tools that help you analyze:

- Productivity, haul road efficiency, operator skill
- Fuel use, cycle times, idle time
- Machine health and events

As you work for a more sustainable business model, the Cat® 773G can contribute in more ways than one.

Fuel and Emissions

- There are multiple fuel saving strategies on the 773G, two are economy modes that are adjustable to meet your unique production needs
- For the U.S., Tier 4 Final emission controls are conveniently low maintenance and are transparent to the operation of the truck

Sound

- Operator noise is reduced by 50% using sound suppression technology in the cab
- A rubber liner option for truck bodies reduces noise levels for both the operator and spectators

Component Life

- Cat Reman parts are an economical alternative to new
- You can extend tire life using TKPH/TMPH, a feature that calculates tire loading
- Castings and box section frame construction absorb shocks and distribute loads
- A new rear axle housing holds new, robust differential gears that compliment the power and torque increases of the truck
- Hydraulic oil filter life is extended to 1,000 hours under normal conditions
- Autostall enables quick operating temperatures for best performance and life
- Delayed engine shutdown prevents hot shutdowns that can reduce component life

Tier 4 Final

Caterpillar's simple solution is transparent to your operators, controls emissions and increases fuel efficiency.

- Two engine-mounted diesel oxidation catalyst canisters control particulate matter
- Our NRS Technology replaces a portion of intake air with exhaust gas to control combustion temperatures and No_x production
- Precise, extremely fine atomization of fuel under all load conditions

Sustainability

The benefits are far reaching and economical

Cutting Your Fuel Costs

A strategy for lowering your cost per ton

The 773G introduces several key fuel conservation features:

- **Auto Neutral Idle** – as the 773G idles in a forward gear, the transmission will automatically slip in and out of a neutral state to avoid stalling the torque converter and increasing fuel consumption.
- **Engine Idle Shutdown** – when your G Series truck is in park and idles for more than a preset time, the truck will initiate engine shutdown to conserve fuel. This feature can be time adjusted or turned on or off according to your specific needs.
- **Speed Limiting** – while you can continue to gear limit your G Series trucks, Caterpillar offers speed limiting that allows the truck to travel at a more fuel efficient engine speed and gear selection.
- **Transmission Controls** – New APECS transmission controls increase fuel efficiency by maintaining momentum and speed on grade.

Economy Modes

- **Standard Economy Mode** – G Series has the ability to adjust engine power based on your site, fleet and economic conditions. You can manually control fuel burn by adjusting the power down between 0.5 and 15 percent.
- **Adaptive Economy Mode** – New for G Series – this economy mode requires a baseline for production from you using the Advisor display. As the truck transits the haul cycle, it is constantly evaluating its ability to meet your baseline in a reduced power setting. Where full power is needed, full power is applied, where reduced power works, reduced power is applied. It's fully automatic with no special operation required.

Performance

Efficient application of power and technology

The 773G will haul your material faster and more efficiently with increases in power and new APECS transmission controls.

- A 5% increase in power improves cycle times and grade climbing performance
- New APECS transmission controls carry more torque through the shifts, producing faster cycle times and the possibility of climbing grades in a higher gear

Traction Control

G Series introduces benefits to your fleet when running in wet conditions by introducing a more responsive traction controls system.

- The system is steering sensitive to determine slip from high speed turns
- The system engages at slower speeds returning traction sooner
- The system engages sooner in the slip, potentially reducing tire wear
- The system modulates instantly between the two wheel groups for control
- Using the hydraulic service brakes facilitates the instant modulation and responsiveness

At Caterpillar, we know that our truck is critical to your business, that's why we use industry leading technology to ensure maximum machine availability and reliability.

Structural Strength

The backbone of the 773G is its frame. Our frames are designed for off-road integrity and more than one life cycle. The 773G, with its new power and performance increases, has updated final drive gears and a new rear axle housing to support this new level of work.

- Caterpillar strategically applies castings with box section construction to manage off-road stresses
- A new front frame design increases the approach angle on ramps and grades
- New heavy duty gears compliment the updates in power and torque
- A new robust rear axle housing also supports the truck's performance

Suspension

- Front struts use our proven king pin design for effective absorption of haul road shocks
- Rear suspension cylinders have been inverted to minimize contamination

Planetary Powershift Transmission with APECS Controls

New APECS controls improve performance with the following:

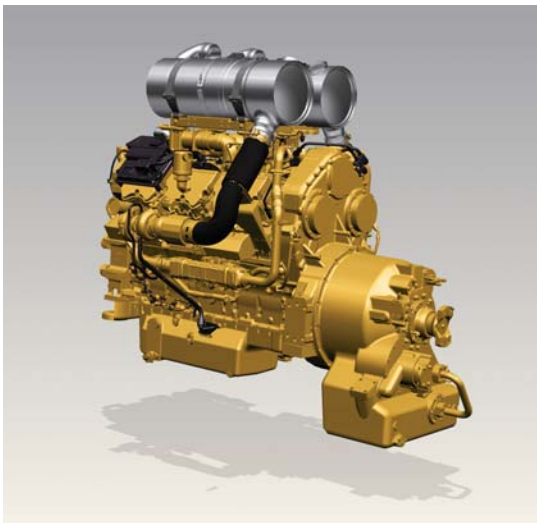
- Torque shift management – allows the truck to power through shift points
- Part throttle shifting – provides an exceptionally smooth ride
- ECPC – electronically controls clutch pressures for long life

Cat C27 ACERT

- 5% more power gives the truck new performance levels and quick haul cycles
- Cat MEUI™ injectors provide high pressure, fine atomization under all load conditions for fuel efficiency and responsiveness
- Low pressure fuel lines from the tank to the engine simplify service
- The C27 is carefully balanced with vibration controls that reduce noise and protect against unnecessary harmonics
- Cooling is provided by either a demand fan (standard for Tier 4 Final machines) or a conventional cooling fan
- Ground level engine shutdown switch for safety
- Excellent high-altitude capability (see specifications for details)

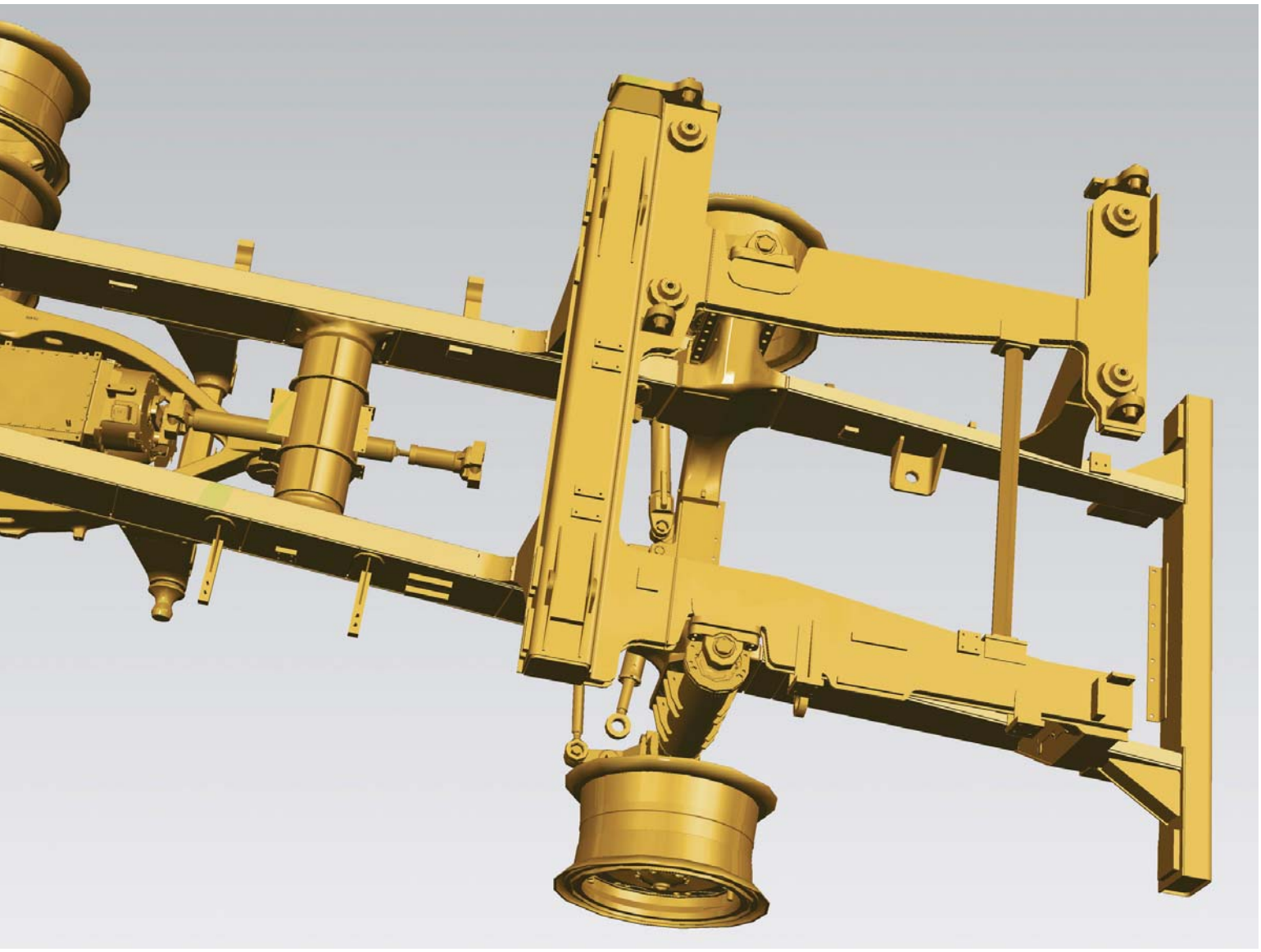
Steering

- The steering linkage is designed to provide feedback to the operator
- The Cat king pin front suspension system maintains steering tolerances and tire alignment



Long Term Value and Durability

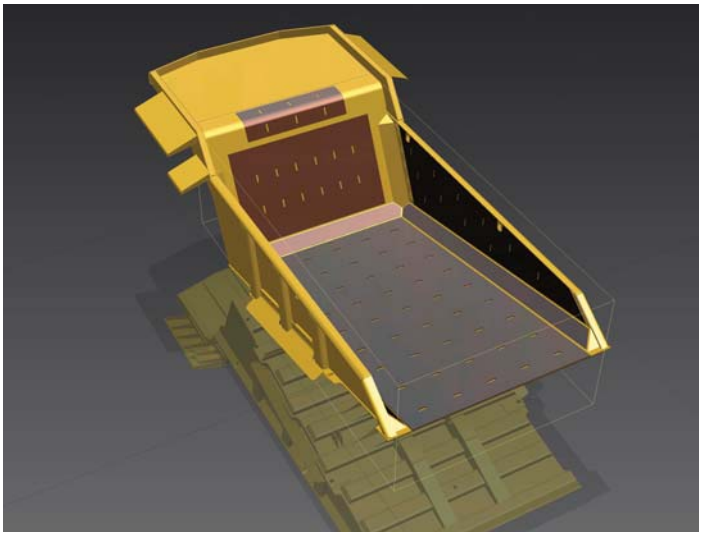
Proven components for reliable performance

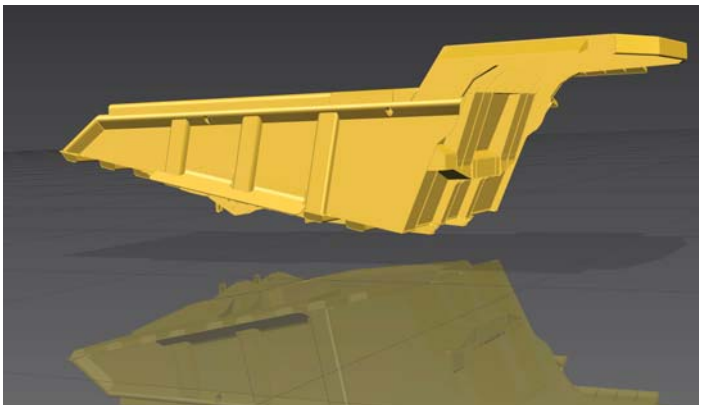


Brake Performance

Cat trucks provide powerful, fade-resistant braking for off road applications, and G Series introduces new ways to extend your brake life.

- Rear brakes are wet disc while the front are dry, caliper type
- Slope holding capability benefits from all wheel parking brake actuation
- Brake life can be extended by choosing the optional Cat Engine Brake
- Additional springs in the design reduce wear and increase service life
- A brake wear indicator keeps you informed of maintenance timing
- Extended life brake material is available for extreme applications





Our truck bodies are engineered to compliment the chassis and built to haul your material for years of trouble-free performance. In fact, Cat truck bodies are designed to let the truck perform at peak efficiency by correctly centering and distributing the load. Outfitting your truck body with a steel or rubber liner may be advisable based on material type and application. If you have questions about body selection or applying liners, your Cat dealer has the tools and knowledge to help you with this decision process.

The Rubber Liner

This important factory-installed option will prolong body life in hard rock applications.

- Available for the dual slope and flat floor bodies
- It will reduce shock loading for both the operator and truck
- It absorbs noise, reducing both spectator and operator sound levels
- The rubber liner is not a good option for wet, sticky material
- The rubber liner should not be used with our body heat option

Side Boards

In the event that your material is light weight, we offer factory-installed 150 mm (6 in) sideboards to help you achieve rated capacities.

You can use our “Body Selection Guide” as a reference for selecting the correct body type and liner package. Cat dealers can order this document using reference number AEXQ0673.

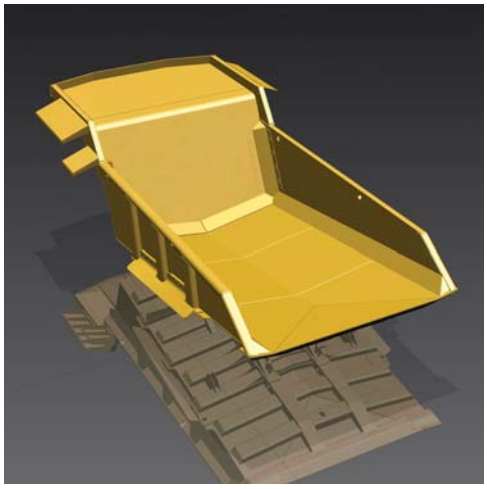
Body Options

For your applications and material types

Dual Slope Body

If your haul profile includes steep slopes, the dual slope body offers excellent material retention.

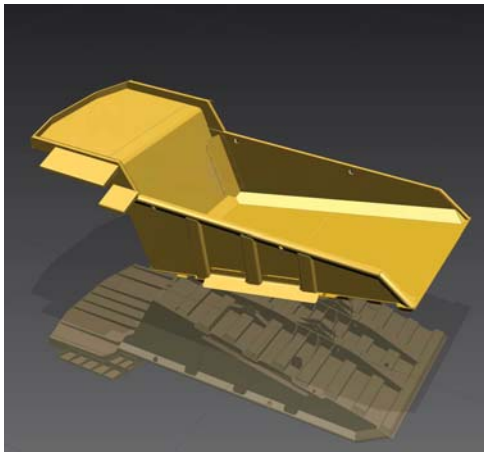
- The dual slope has a SAE 2:1 heaped capacity of 35.20 m^3 (46 yd^3) with a steel liner configuration
- 400 BNH steel on interior surfaces offers excellent wear characteristics
- Material is carried low and centered for stability
- A single 16 mm (0.62 in) steel liner option is available for this body
- A single rubber liner is available for this body

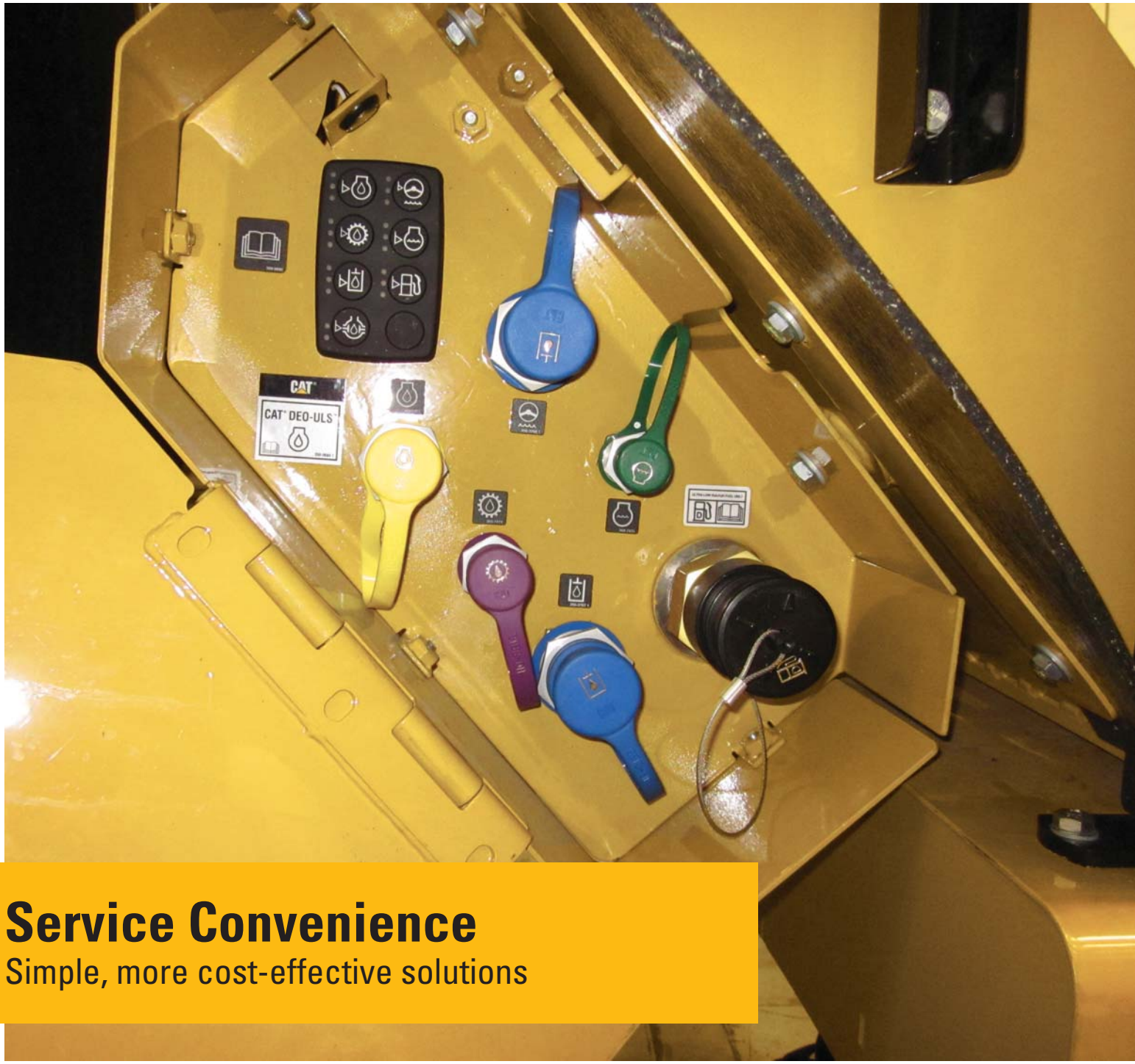


Flat Floor Body

If you're feeding a crusher, the flat floor body is an excellent choice for metering material.

- The flat floor body also offers excellent material retention and stability
- 400 BNH steel is used on internal surfaces for wear protection
- A single steel liner option is available
- A rubber liner is also available for this body





Service Convenience

Simple, more cost-effective solutions

Service Centers – Fluid Fill

You will save both time and money using the optional fluid fill service center.

- Fill and extraction for all fluids in one location
- Key pad indicates existing fluid levels
- Includes all oils, coolant and fuel
- Conveniently located at ground level
- Lighted for night time use

Service Centers – Electrical Connections

This bumper-mounted electrical service center provides the convenience and safety of ground level access to important service tasks.

- Ground level access to VIMS data
- Ground level access to an ET port
- Includes a master disconnect switch
- Engine lockout switch
- Hydraulics lockout switch
- Breaker access

Brake Monitoring

G Series introduces updates that will increase the life of your brakes.

- A brake wear indicator is new and standard
- Design improvements are increasing separation forces to lessen wear and increase brake life

Filter Life

- With all new hydraulic system efficiency, your filter life is extended to 1,000 hours
- Cab air filter life can also be extended with the optional cab precleaner.
- Our engine oil filters are improved, and in some cases extending life beyond 500 hours

Product Link™

For comprehensive fleet management, Caterpillar offers Product Link solutions. This solution is a combination of machine-mounted hardware and software called Vision Link. You can access fleet information either through cellular or satellite channels. These channels may be restricted and unavailable in some countries.

Customers who use Product Link are remotely monitoring machine health and organizing service requirements.

773G Off-Highway Truck Specifications

Engine (Tier 4 Final)

Engine Model	Cat C27 ACERT	
Rated Engine Speed	1,800 rpm	
Gross Power – SAE J1995	578 kW	775 hp
Net Power – SAE J1349	534 kW	717 hp
Net Power – ISO 9249	540 kW	724 hp
Net Power – 80/1269/EEC	540 kW	724 hp
Engine Power – ISO 14396	568 kW	762 hp
Peak Torque Speed	1,200 rpm	
Net Torque	3992 N·m	2,944 lb-ft
Bore	137 mm	5.4 in
Stroke	152 mm	6 in
Displacement	27 L	1,648 in^3

Engine (Tier 2 Equivalent)

Engine Model	Cat C27 ACERT	
Rated Engine Speed	2,000 rpm	
Gross Power – SAE J1995	578 kW	775 hp
Net Power – SAE J1349	546 kW	733 hp
Net Power – ISO 9249	552 kW	741 hp
Net Power – 80/1269/EEC	552 kW	741 hp
Engine Power – ISO 14396	569 kW	763 hp
Peak Torque Speed	1,300 rpm	
Net Torque	3646 N·m	2,689 lb-ft
Bore	137 mm	5.4 in
Stroke	152 mm	6 in
Displacement	27 L	1,648 in^3

- Power rating applies at 2,000 rpm when tested under the specified condition for the specified standard.
- Ratings based on SAE J1995 standard air conditions of 25° C (77° F) and 100 kPa (29.61 Hg) barometer. Power based on fuel having API gravity of 35 at 16° C (60° F) and an LHV of 42 780 kJ/kg (18,390 BTU/lb) when engine used at 30° C (86° F).
- No engine derating required up to 3048 m (10,000 ft) for Tier 4 Final and 3810 m (12,500 ft) for Tier 2 Equivalent.
- Not regulated under EU Stage IV regulations due to power rating above 560 kW (750 hp).

Transmission (Tier 4 Final)

Forward 1	10.6 km/h	6.6 mph
Forward 2	15.0 km/h	9.3 mph
Forward 3	20.3 km/h	12.6 mph
Forward 4	27.0 km/h	16.8 mph
Forward 5	36.7 km/h	22.8 mph
Forward 6	49.4 km/h	30.7 mph
Forward 7	66.9 km/h	41.6 mph
Reverse	14.0 km/h	8.7 mph

Transmission (Tier 2 Equivalent)

Forward 1	10.8 km/h	6.7 mph
Forward 2	15.1 km/h	9.4 mph
Forward 3	20.4 km/h	12.7 mph
Forward 4	27.4 km/h	17.0 mph
Forward 5	37.0 km/h	23.0 mph
Forward 6	50.1 km/h	31.1 mph
Forward 7	67.6 km/h	42.0 mph
Reverse	14.1 km/h	8.8 mph

- Maximum travel speeds with standard 24.00R35 (E4) tires.

Final Drives

Differential Ratio	3.64:1
Planetary Ratio	4.80:1
Total Reduction Ratio	17.49:1

Brakes

Brake Surface – Front	655 cm^2	257 in^2
Brake Surface – Rear	61 269 cm^2	9,497 in^2
Brake Standards	ISO 3450:1996	

Body Hoists (Tier 4 Final)

Pump Flow – High Idle	448 L/min	118 gal/min
Relief Valve Setting – Raise	17 250 kPa	2,502 psi
Relief Valve Setting – Lower	3450 kPa	500 psi
Body Raise Time – High Idle	10.0 seconds	
Body Lower Time – Float	14.0 seconds	
Body Power Down – High Idle	14.0 seconds	

Body Hoists (Tier 2 Equivalent)

Pump Flow – High Idle	448 L/min	118 gal/min
Relief Valve Setting – Raise	17 250 kPa	2,502 psi
Relief Valve Setting – Lower	3450 kPa	500 psi
Body Raise Time – High Idle	9.5 seconds	
Body Lower Time – Float	13.0 seconds	
Body Power Down – High Idle	13.0 seconds	

Capacity – Dual Slope – 100% Fill Factor

Struck	26.86 m^3	35.13 yd^3
Heaped 2:1 (SAE)	35.75 m^3	46.76 yd^3

Capacity – Flat Floor – 100% Fill Factor

Struck	26.25 m^3	34.33 yd^3
Heaped 2:1 (SAE)	35.49 m^3	46.41 yd^3

Weight Distributions – Approximate

Front Axle – Empty	53%
Front Axle – Loaded	35%
Rear Axle – Empty	47%
Rear Axle – Loaded	65%

Suspension

Empty Loaded Cylinder Stroke Front	234 mm	9.2 in
Empty Loaded Cylinder Stroke Rear	149 mm	5.8 in
Rear Axle Oscillation	8.1°	

Sound

Sound Standards

- The operator Equivalent Sound Pressure Level (Leq) is 76 dB(A) when SAE J1166 FEB2008 is used to measure the value for an enclosed cab. This is a work cycle sound exposure level. The cab was properly installed and maintained. The test was conducted with the cab doors and the cab windows closed.
- The exterior sound pressure level for the standard machine measured at a distance of 15 m (49 ft) according to the test procedures specified in SAE J88:2008, mid-gear moving operation is 86 dB(A).
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in a noisy environment.

Service Refill Capacities

Fuel Tank	795 L	210 gal
Cooling System	171 L	45 gal
Crankcase	90 L	24 gal
Differentials and Final Drives	145 L	38 gal
Steering Tank	36 L	9.5 gal
Steering System (includes tank)	54 L	14 gal
Brake/Hoist Hydraulic Tank	176 L	46.5 gal
Brake Hoist System	322 L	85 gal
Torque Converter/Transmission System HRC	70 L	18 gal
Torque Converter/Transmission System LRC	61 L	16 gal

Steering

Steering Standards	SAE J1511 FEB94 ISO 5010:1992	
Steer Angle	31°	
Turning Diameter – Front	23.5 m	77 ft 1 in
Turning Circle Clearance Diameter	26.1 m	85 ft 8 in

Tires

Standard Tire	24.00R35 (E4)

- Productive capabilities of the 773G truck are such that, under certain job conditions, TKPH (TMPH) capabilities of standard or optional tires could be exceeded and, therefore, limit production.
- Caterpillar recommends the customer evaluate all job conditions and consult the tire manufacturer for proper tire selection.

ROPS

ROPS/FOPS Standards

- ROPS (Rollover Protective Structure) for cab offered by Caterpillar meets ISO 3471:2008 ROPS criteria.
- FOPS (Falling Objects Protective Structure) meets ISO 3449:2005 Level II FOPS criteria.

Weight/Payload Calculation – Tier 4 Final Examples

773G – Flat Floor		354-7800 Base Body	377-6300 Base Body/Liner	377-6302 Rubber Liner
Floor/Sidewall/Frontwall	mm (in)	**20/10/12 (0.79/0.39/0.47)**	**36/18/22 (1.42/0.71/0.87)**	**102/8/8 + 20/10/12 (4.0/0.31/0.31) + (0.79/0.39/0.47)**
Payload Capacity	m^3 (yd^3)	**35.5 (46.4)**	**35.0 (45.8)**	**33.3 (43.6)**
	mm (in)	**20 (0.787)**	**36 (1.42)**	**102 (4.0)**
Target Gross Machine Weight	kg (lb)	102 740 (226,503)	102 740 (226,503)	102 740 (226,503)
Empty Chassis Weight	kg (lb)	34 522 (76,107)	34 522 (76,107)	34 522 (76,107)
Body System Weight	kg (lb)	11 423 (25,183)	15 217 (33,547)	15 997 (35,267)
Empty Machine Weight	kg (lb)	45 945 (101,290)	49 739 (109,654)	50 519 (111,374)
Attachments				
Fuel Tank Size	L (gal)	795 (210)	795 (210)	795 (210)
Fuel Tank – 100% Fill	kg (lb)	669 (1,474)	669 (1,474)	669 (1,474)
Empty Operating Weight**	kg (lb)	46 614 (102,764)	50 407 (111,128)	51 188 (112,848)
Target Payload*	kg (lb)	56 126 (123,739)	52 333 (115,375)	51 552 (113,655)
Target Payload*	tonnes (tons)	56.1 (61.9)	52.3 (57.7)	51.6 (56.8)
10/10/20 Policy*				
Target Payload – 100%	kg (lb)	56 126 (123,739)	52 333 (115,375)	51 552 (113,655)
Target Payload – 110%	kg (lb)	61 739 (136,112)	57 566 (126,912)	56 708 (125,020)
Target Payload – 120%	kg (lb)	67 352 (148,486)	62 799 (138,449)	61 863 (136,385)
Maximum Gross Machine Weight*	kg (lb)	113 965 (251,251)	113 207 (249,578)	113 050 (249,234)

773G – Dual Slope		354-7810 Base Body	377-6310 Base Body/Liner	No Rubber Liner Offered
Floor/Sidewall/Frontwall	mm (in)	**20/10/12 (0.79/0.39/0.47)**	**36/18/22 (1.42/0.71/0.87)**	
Payload Capacity	m^3 (yd^3)	**35.8 (46.8)**	**35.2 (46.0)**	
	mm (in)	**20 (0.787)**	**36 (1.42)**	
Target Gross Machine Weight	kg (lb)	102 740 (226,503)	102 740 (226,503)	
Empty Chassis Weight	kg (lb)	34 522 (76,107)	34 522 (76,107)	
Body System Weight	kg (lb)	11 049 (24,358)	14 776 (32,575)	
Empty Machine Weight	kg (lb)	45 570 (100,464)	49 298 (108,683)	
Attachments				
Fuel Tank Size	L (gal)	795 (210)	795 (210)	
Fuel Tank – 100% Fill	kg (lb)	669 (1,474)	669 (1,474)	
Empty Operating Weight**	kg (lb)	46 239 (101,939)	49 967 (110,158)	
Target Payload*	kg (lb)	56 501 (124,564)	52 773 (116,345)	
Target Payload*	tonnes (tons)	56.5 (62.3)	52.8 (58.2)	
10/10/20 Policy*				
Target Payload – 100%	kg (lb)	56 501 (124,564)	52 773 (116,345)	
Target Payload – 110%	kg (lb)	62 152 (137,020)	58 051 (127,980)	
Target Payload – 120%	kg (lb)	67 802 (149,477)	63 328 (139,614)	
Maximum Gross Machine Weight*	kg (lb)	114 040 (251,416)	113 295 (249,772)	

*Refer to Caterpillar 10/10/20 overload policy.

**Includes weight of all attachments.

Weight/Payload Calculation – Tier 2 Equivalent Examples

773G – Flat Floor		354-7800 Base Body	377-6300 Base Body/Liner	377-6302 Rubber Liner
Floor/Sidewall/Frontwall	mm (in)	**20/10/12 (0.79/0.39/0.47)**	**36/18/22 (1.42/0.71/0.87)**	**102/8/8 + 20/10/12 (4.0/0.31/0.31) + (0.79/0.39/0.47)**
Payload Capacity	m^3 (yd^3)	**35.5 (46.4)**	**35.0 (45.8)**	**33.3 (43.6)**
	mm (in)	**20 (0.787)**	**36 (1.42)**	**102 (4.0)**
Target Gross Machine Weight	kg (lb)	102 740 (226,503)	102 740 (226,503)	102 740 (226,503)
Empty Chassis Weight	kg (lb)	33 867 (74,663)	33 867 (74,663)	33 867 (74,663)
Body System Weight	kg (lb)	11 423 (25,183)	15 217 (33,547)	15 997 (35,267)
Empty Machine Weight	kg (lb)	45 290 (99,846)	49 084 (108,210)	49 864 (109,930)
Attachments				
Fuel Tank Size	L (gal)	795 (210)	795 (210)	795 (210)
Fuel Tank – 100% Fill	kg (lb)	669 (1,474)	669 (1,474)	669 (1,474)
Empty Operating Weight**	kg (lb)	45 959 (101,322)	49 752 (109,684)	50 533 (111,406)
Target Payload*	kg (lb)	56 781 (125,181)	52 988 (116,819)	52 207 (115,097)
Target Payload*	tonnes (tons)	56.8 (62.6)	53.0 (58.4)	52.2 (57.5)
10/10/20 Policy*				
Target Payload – 100%	kg (lb)	56 781 (125,181)	52 988 (116,819)	52 207 (115,097)
Target Payload – 110%	kg (lb)	62 460 (137,699)	58 287 (128,500)	57 428 (126,607)
Target Payload – 120%	kg (lb)	68 138 (150,217)	63 585 (140,182)	62 649 (138,116)
Maximum Gross Machine Weight*	kg (lb)	114 096 (251,539)	113 338 (249,867)	113 181 (249,522)

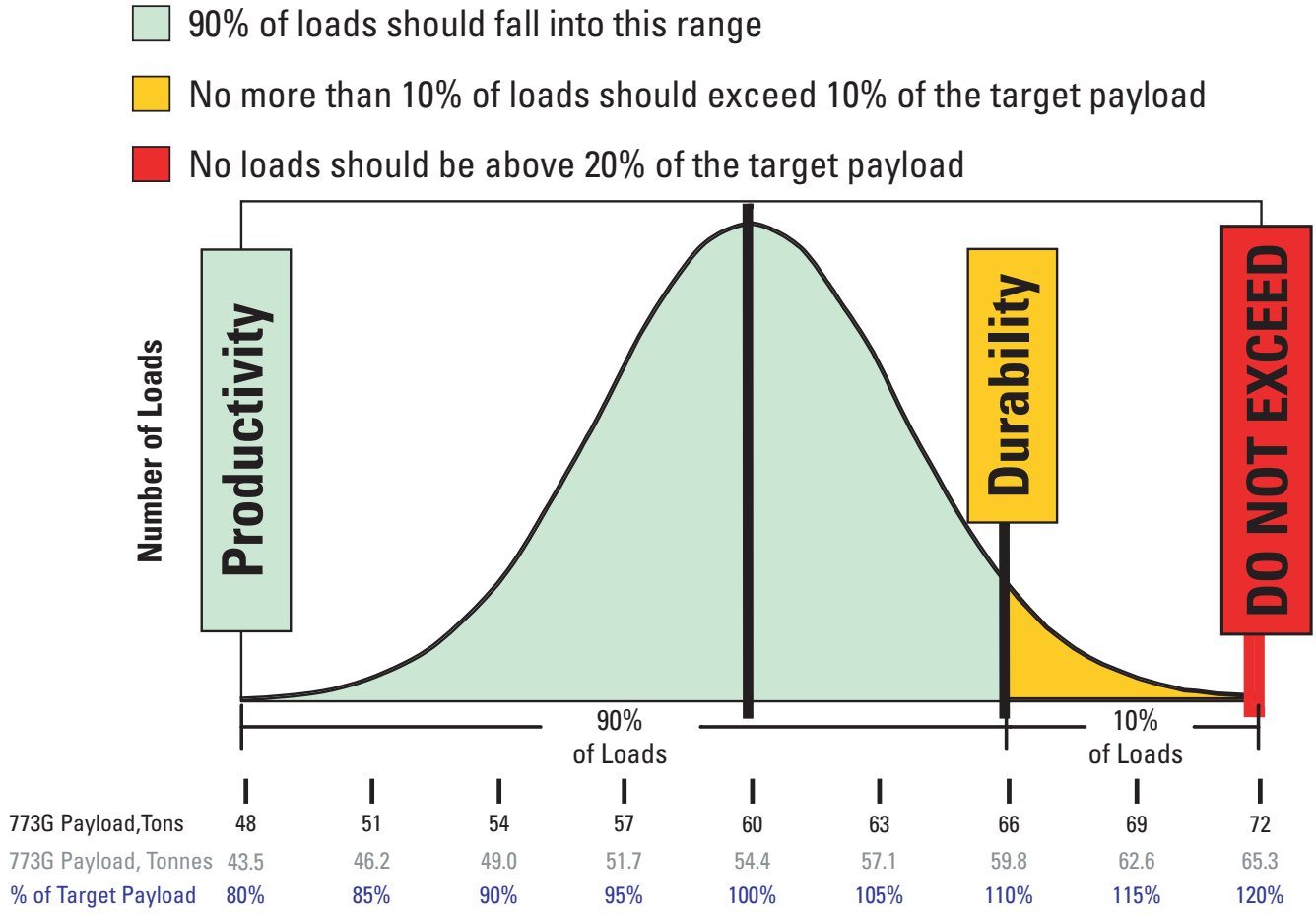
773G – Dual Slope		354-7810 Base Body	377-6310 Base Body/Liner	No Rubber Liner Offered
Floor/Sidewall/Frontwall	mm (in)	**20/10/12 (0.79/0.39/0.47)**	**36/18/22 (1.42/0.71/0.87)**	
Payload Capacity	m^3 (yd^3)	**35.8 (46.8)**	**35.2 (46.0)**	
	mm (in)	**20 (0.787)**	**36 (1.42)**	
Target Gross Machine Weight	kg (lb)	102 740 (226,503)	102 740 (226,503)	
Empty Chassis Weight	kg (lb)	33 867 (74,663)	33 867 (74,663)	
Body System Weight	kg (lb)	11 049 (24,358)	14 776 (32,575)	
Empty Machine Weight	kg (lb)	44 916 (99,022)	48 643 (107,239)	
Attachments				
Fuel Tank Size	L (gal)	795 (210)	795 (210)	
Fuel Tank – 100% Fill	kg (lb)	669 (1,474)	669 (1,474)	
Empty Operating Weight**	kg (lb)	45 585 (100,497)	49 312 (108,714)	
Target Payload*	kg (lb)	57 155 (126,006)	53 428 (117,789)	
Target Payload*	tonnes (tons)	57.2 (63.0)	53.4 (58.9)	
10/10/20 Policy*				
Target Payload – 100%	kg (lb)	57 155 (126,006)	53 428 (117,789)	
Target Payload – 110%	kg (lb)	62 871 (138,607)	58 771 (129,568)	
Target Payload – 120%	kg (lb)	68 586 (151,207)	64 114 (141,347)	
Maximum Gross Machine Weight*	kg (lb)	114 171 (251,704)	113 426 (250,061)	

*Refer to Caterpillar 10/10/20 overload policy.

**Includes weight of all attachments.

10/10/20 Payload Management Policy for Optimal Machine Life

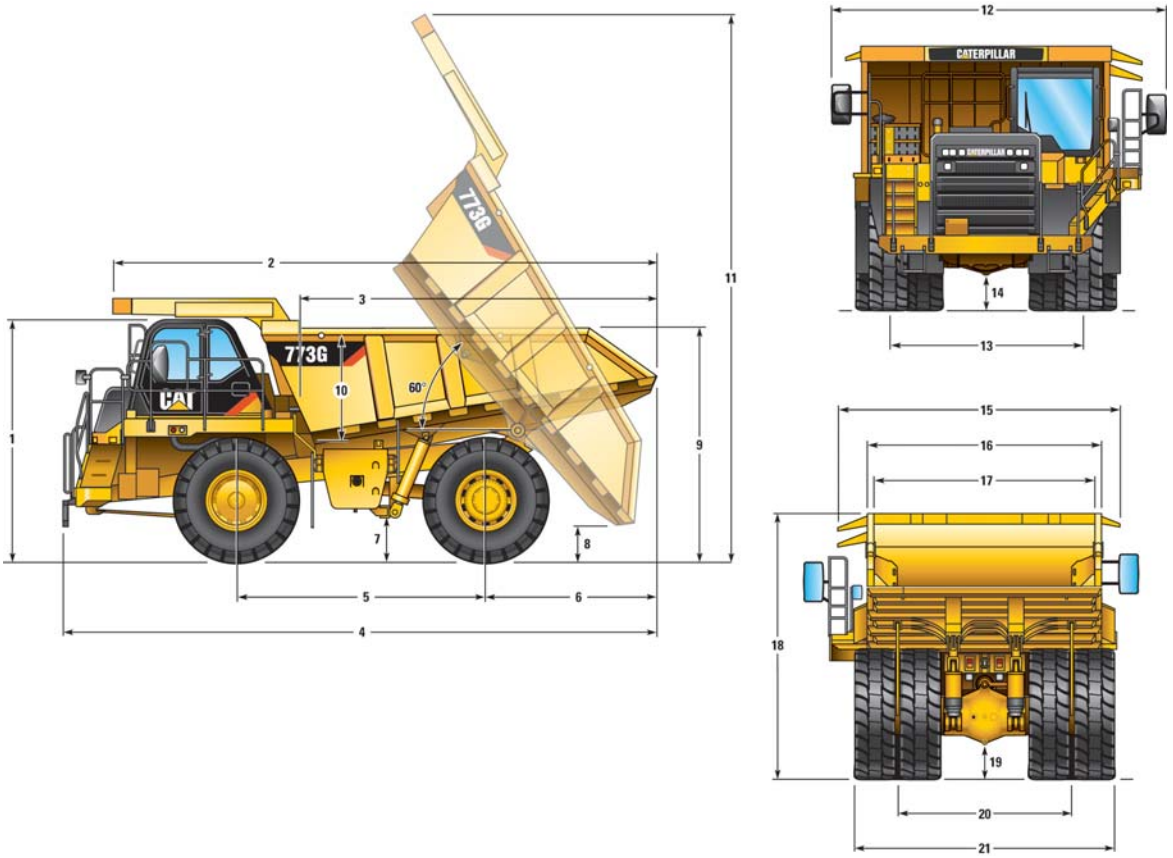
The ideal hauling strategy that maximizes machine and machine component life is to *keep the* **mean** *of all payloads* **at or below the machine's rated target payload**.



773G Payload,Tons	48	51	54	57	60	63	66	69	72
773G Payload, Tonnes	43.5	46.2	49.0	51.7	54.4	57.1	59.8	62.6	65.3
% of Target Payload	80%	85%	90%	95%	100%	105%	110%	115%	120%

Dimensions

All dimensions are approximate.

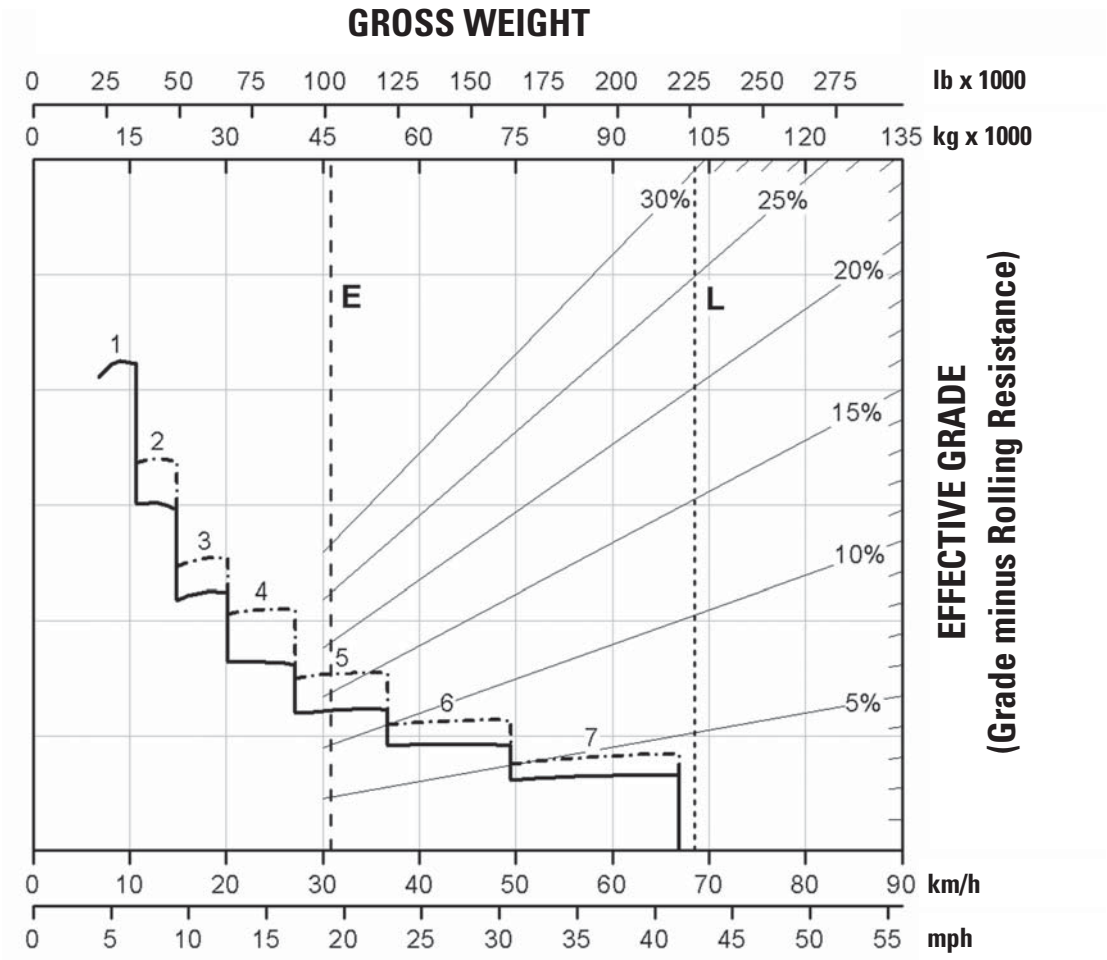


		Dual Slope		Flat Floor	
1	Height to Top of ROPS	4108 mm	13.48 ft	4108 mm	13.48 ft
2	Overall Body Length	9216 mm	30.24 ft	9293 mm	30.49 ft
3	Inside Body Length	6100 mm	20.01 ft	6100 mm	20.01 ft
4	Overall Length	10 070 mm	33.04 ft	10 146 mm	33.29 ft
5	Wheelbase	4215 mm	13.83 ft	4215 mm	13.83 ft
6	Rear Axle to Tail	2925 mm	9.60 ft	3006 mm	9.86 ft
7	Ground Clearance	759 mm	2.49 ft	759 mm	2.49 ft
8	Dump Clearance	639 mm	2.10 ft	640 mm	2.10 ft
9	Loading Height – Empty	3771 mm	12.37 ft	3771 mm	12.37 ft
10	Inside Body Depth – Maximum	1773 mm	5.82 ft	1727 mm	5.67 ft
11	Overall Height – Body Raised	9284 mm	30.46 ft	9280 mm	30.45 ft
12	Operating Width	5673 mm	18.61 ft	5673 mm	18.61 ft
13	Centerline Front Tire Width	3205 mm	10.52 ft	3205 mm	10.52 ft
14	Engine Guard Clearance	703 mm	2.31 ft	703 mm	2.31 ft
15	Overall Canopy Width	4886 mm	16.03 ft	4886 mm	16.03 ft
16	Outside Body Width	3922 mm	12.87 ft	3922 mm	12.87 ft
17	Inside Body Width	3654 mm	11.99 ft	3654 mm	11.99 ft
18	Front Canopy Height	4459 mm	14.63 ft	4459 mm	14.63 ft
19	Rear Axle Clearance	560 mm	1.84 ft	560 mm	1.84 ft
20	Centerline Rear Dual Tire Width	2929 mm	9.61 ft	2929 mm	9.61 ft
21	Overall Tire Width	4411 mm	14.47 ft	4411 mm	14.47 ft

Retarding Performance (Tier 4 Final)

To determine retarding performance: Add lengths of all downhill segments and, using this total, refer to proper retarding chart. Read from gross weight down to the percent effective grade. Effective grade equals actual % grade minus 1% for each 10 kg/t (20 lb/ton) of rolling resistance. From this weight-effective grade point, read horizontally to the curve with the highest obtainable gear, then down to maximum descent speed brakes can properly handle without exceeding cooling capacity. The following charts are based on these conditions: 32° C (90° F) ambient temperature, at sea level, with 24.00R35 (E4) tires.

NOTE: Select the proper gear to maintain engine rpm at the highest possible level, without overspeeding the engine. If cooling oil overheats, reduce ground speed to allow transmission to shift to the next lower speed range.



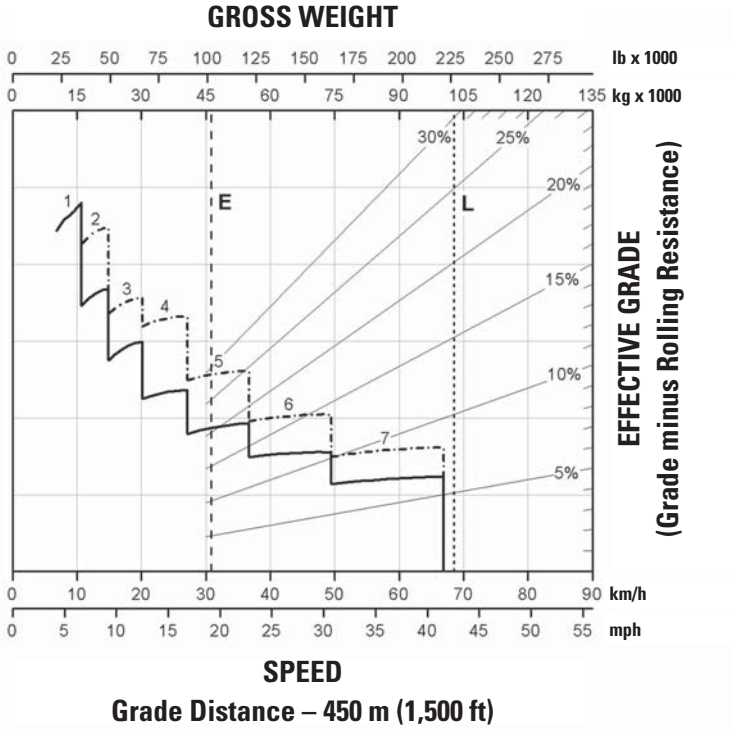
——— with ARC only

-·—·—·— ARC and Engine Brake

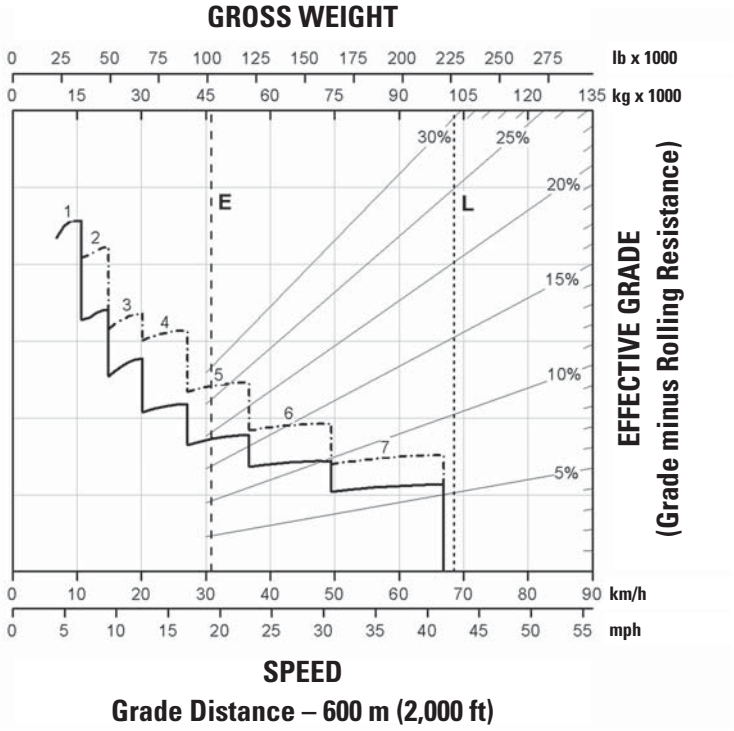
E – Typical Field Empty Weight

L – Target Gross Machine Operating Weight 102 739 kg (226,500 lb)

Retarding Performance (Tier 4 Final)



Grade Distance – 450 m (1,500 ft)



Grade Distance – 600 m (2,000 ft)

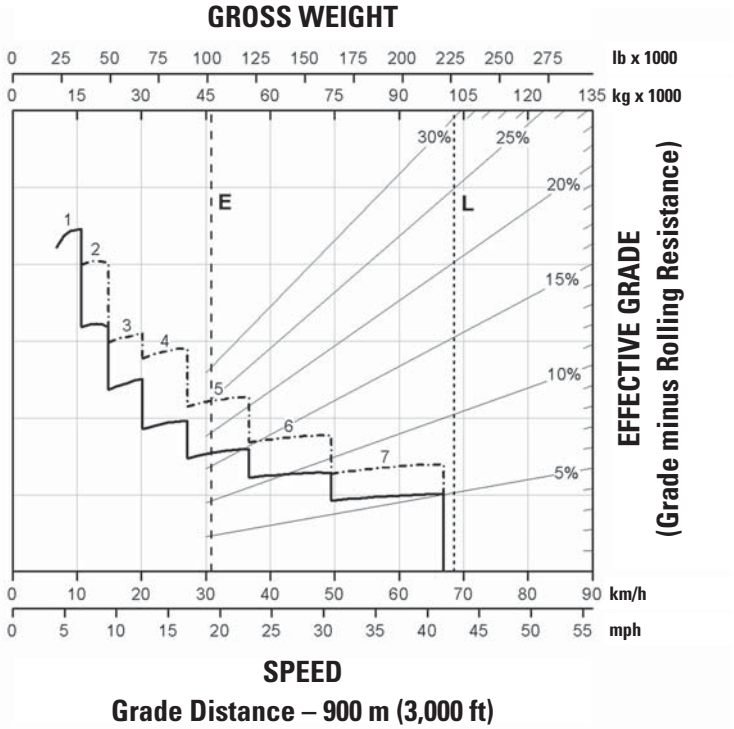
——— with ARC only

- — - — - — ARC and Engine Brake

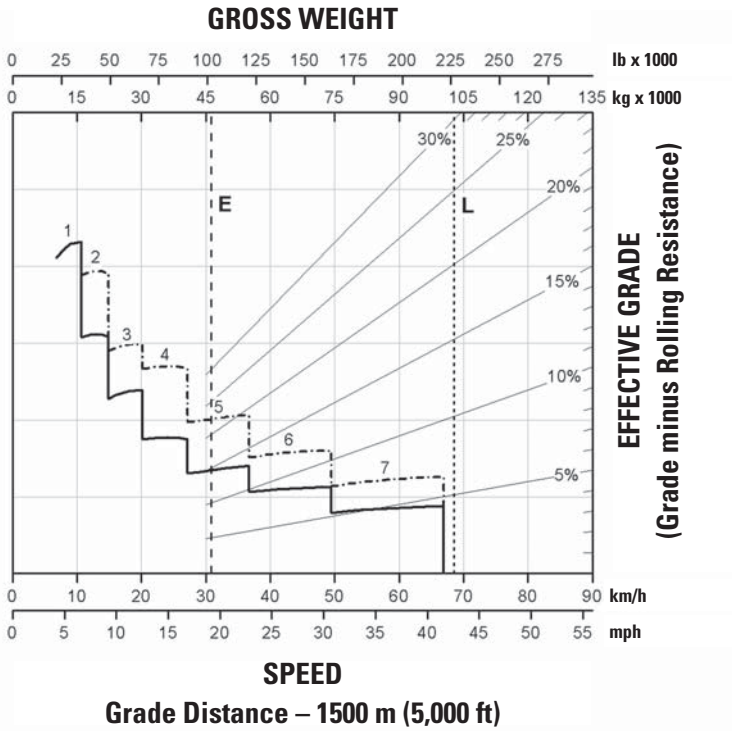
E – Typical Field Empty Weight

L – Target Gross Machine Operating Weight 102 739 kg (226,500 lb)

Retarding Performance (Tier 4 Final)



Grade Distance – 900 m (3,000 ft)



Grade Distance – 1500 m (5,000 ft)

——— with ARC only

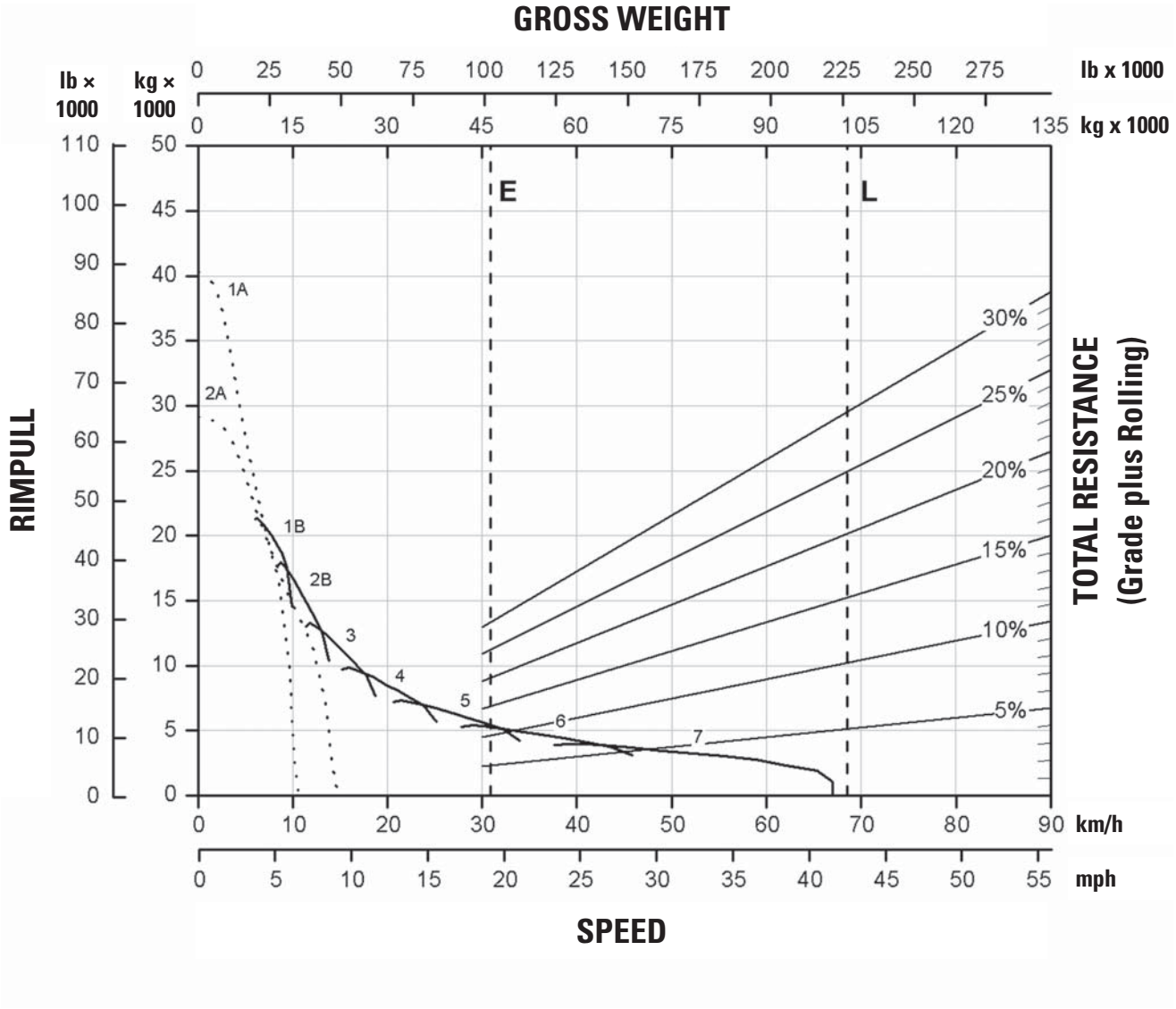
·—·—· ARC and Engine Brake

E – Typical Field Empty Weight

L – Target Gross Machine Operating Weight 102 739 kg (226,500 lb)

Gradeability/Speed/Rimpull (Tier 4 Final)

To determine gradeability performance: Read from gross weight down to the percent of total resistance. Total resistance equals actual percent grade plus 1% for each 10 kg/t (20 lb/ton) of rolling resistance. From this weight-resistance point, read horizontally to the curve with the highest obtainable gear, then down to maximum speed. Usable rimpull will depend upon traction available and weight on drive wheels.



——— with ARC only

- - - - - - ARC and Engine Brake

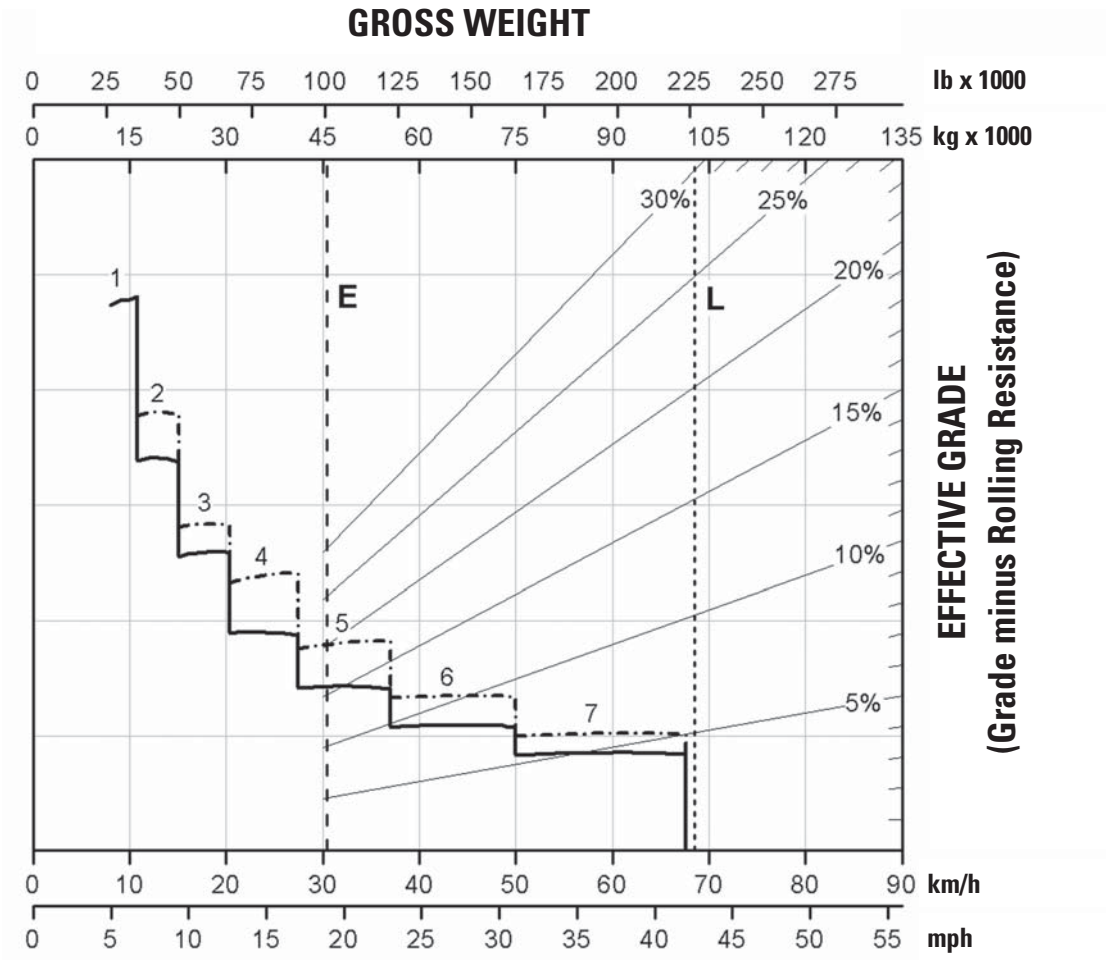
E – Typical Field Empty Weight

L – Target Gross Machine Operating Weight 102 739 kg (226,500 lb)

Retarding Performance (Tier 2 Equivalent)

To determine retarding performance: Add lengths of all downhill segments and, using this total, refer to proper retarding chart. Read from gross weight down to the percent effective grade. Effective grade equals actual % grade minus 1% for each 10 kg/t (20 lb/ton) of rolling resistance. From this weight-effective grade point, read horizontally to the curve with the highest obtainable gear, then down to maximum descent speed brakes can properly handle without exceeding cooling capacity. The following charts are based on these conditions: 32° C (90° F) ambient temperature, at sea level, with 24.00R35 (E4) tires.

NOTE: Select the proper gear to maintain engine rpm at the highest possible level, without overspeeding the engine. If cooling oil overheats, reduce ground speed to allow transmission to shift to the next lower speed range.



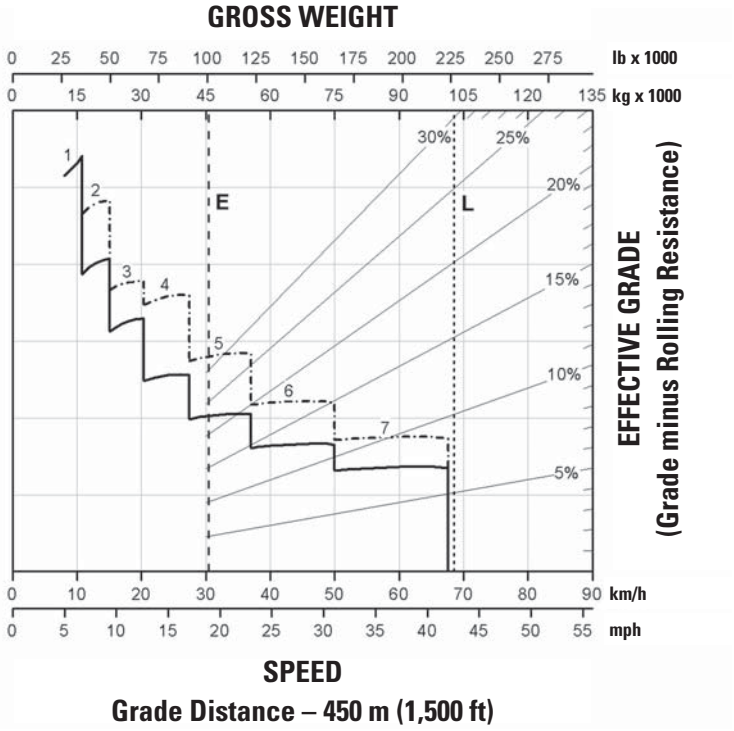
——— with ARC only

-·—·—·— ARC and Engine Brake

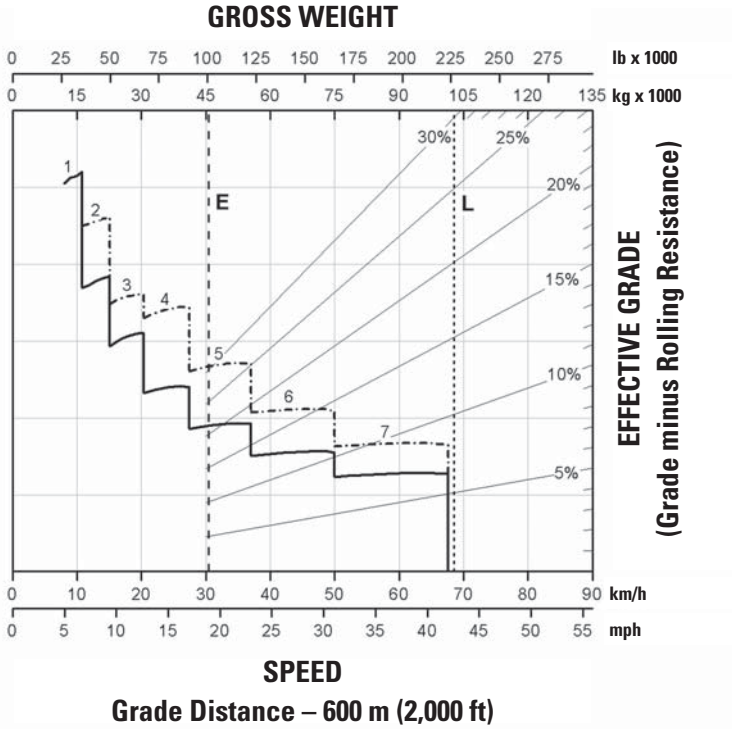
E – Typical Field Empty Weight

L – Target Gross Machine Operating Weight 102 739 kg (226,500 lb)

Retarding Performance (Tier 2 Equivalent)



Grade Distance – 450 m (1,500 ft)



Grade Distance – 600 m (2,000 ft)

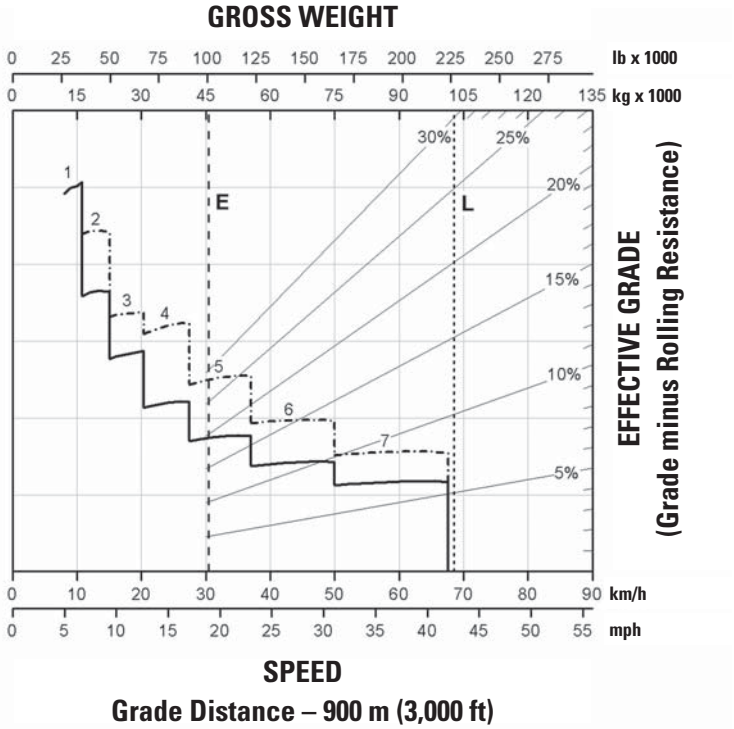
——— with ARC only

- — - — - — ARC and Engine Brake

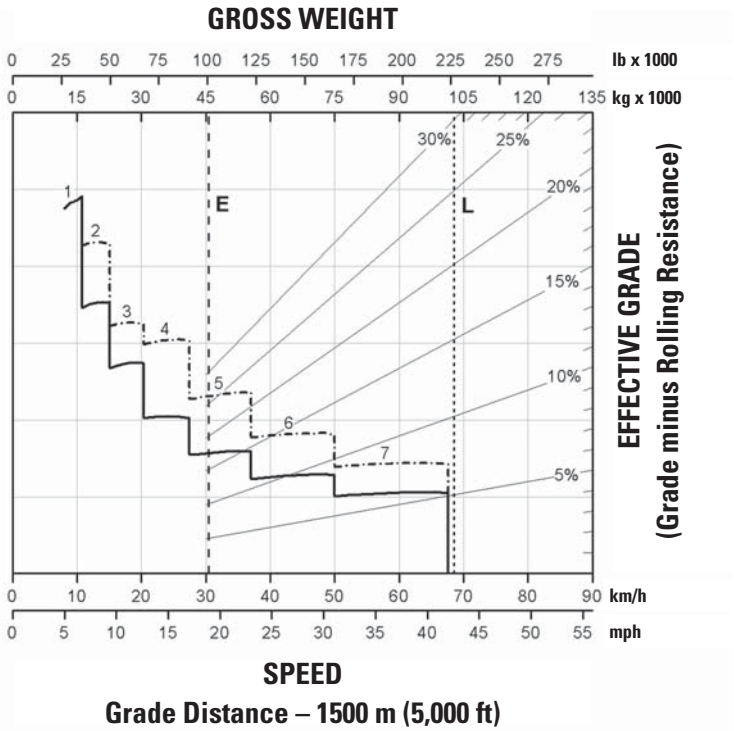
E – Typical Field Empty Weight

L – Target Gross Machine Operating Weight 102 739 kg (226,500 lb)

Retarding Performance (Tier 2 Equivalent)



Grade Distance – 900 m (3,000 ft)



Grade Distance – 1500 m (5,000 ft)

——— with ARC only

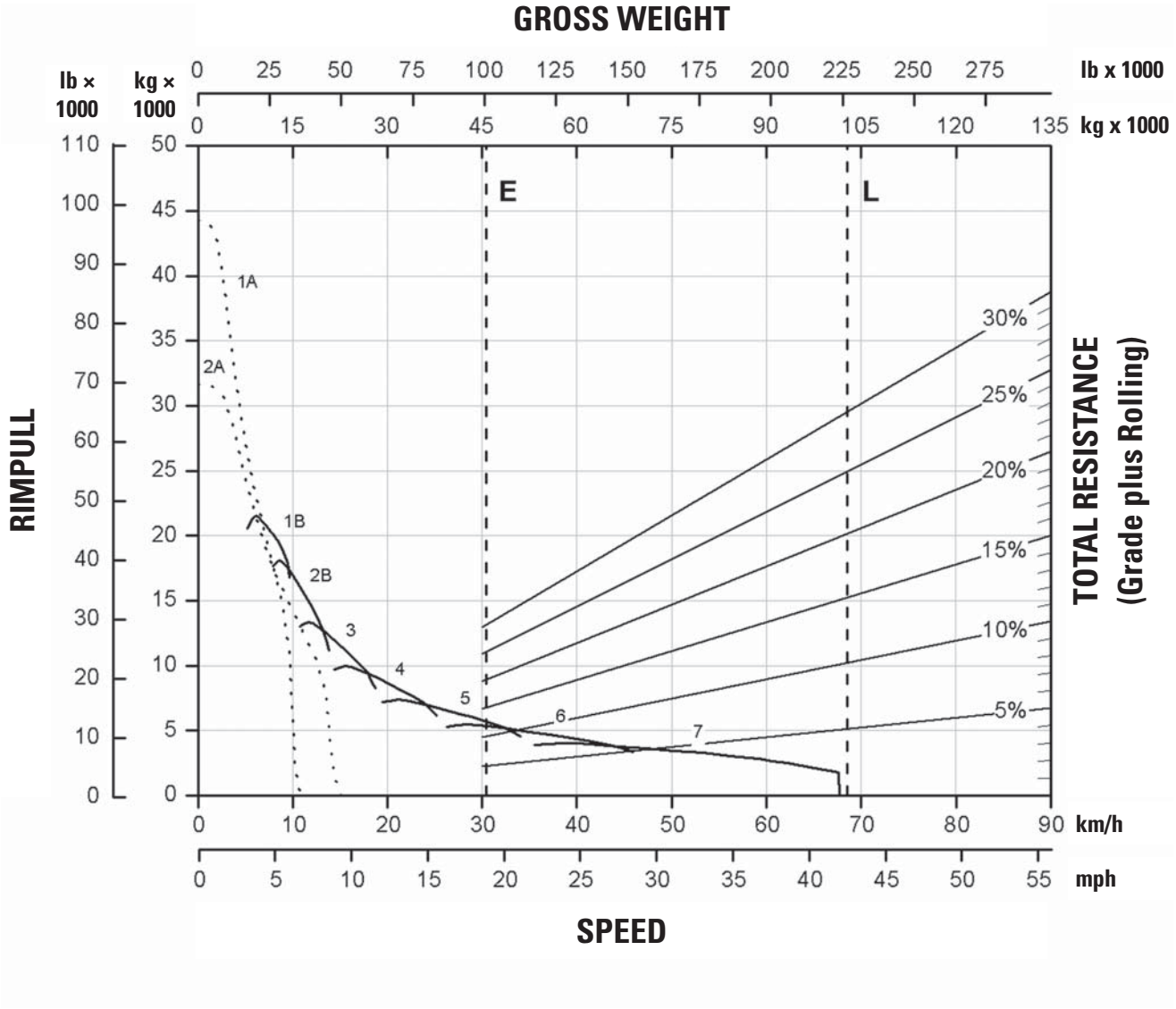
·—·—·— ARC and Engine Brake

E – Typical Field Empty Weight

L – Target Gross Machine Operating Weight 102 739 kg (226,500 lb)

Gradeability/Speed/Rimpull (Tier 2 Equivalent)

To determine gradeability performance: Read from gross weight down to the percent of total resistance. Total resistance equals actual percent grade plus 1% for each 10 kg/t (20 lb/ton) of rolling resistance. From this weight-resistance point, read horizontally to the curve with the highest obtainable gear, then down to maximum speed. Usable rimpull will depend upon traction available and weight on drive wheels.



——— with ARC only

- - - - - - ARC and Engine Brake

E – Typical Field Empty Weight

L – Target Gross Machine Operating Weight 102 739 kg (226,500 lb)

773G Standard Equipment

Standard Equipment

Standard equipment may vary. Consult your Cat dealer for details.

POWER TRAIN

- Cat C27 ACERT Tier 4 Final diesel engine:
  - Air cleaner with precleaner (2)
  - Air-To-Air Aftercooler (ATAAC)
  - Electric start
  - Engine idle shutdown
  - Ether starting aid
  - Exhaust muffler
- *For Tier 4 regions only (U.S./Canada):*
  - Aftertreatment system
    - NO_X Reduction System (NRS)
    - Diesel Oxidation Catalyst (DOC)
  - Demand fan
  - MEUI-C fuel system
- *For non-regulated regions only:*
  - Direct drive fan
  - MEUI-A fuel system
- Braking system:
  - Automatic Retarder Control (ARC)
  - Manual retarder (utilizes rear oil cooled, multiple disc brakes)
  - Brake release motor (towing)
  - Dry disc brakes (front)
  - Front brake disconnect switch (front)
  - Oil-cooled multiple disc brakes (rear)
  - Brake wear indicator (rear)
  - Parking brake
  - Secondary brake
  - Service brake
- Transmission:
  - 7 speed automatic powershift with
    - Electronic Clutch Pressure Control (ECPC)
    - Advanced Productivity Electronic Control Strategy (APECS)
  - Automatic neutral idle
  - Autostall
  - Second gear start

SUSPENSION SYSTEMS

- Suspension, front and rear (EU compliant)

ELECTRICAL

- Alarm backup
- Alternator, 120 Amp
- Autolube power supply ready
- Batteries, maintenance-free, 12V (2), 1,400 CCA combined
- Electrical system, 25 Amp, 24V to 12V converter
- Lighting system:
  - Backup light (halogen)
  - Directional signals/hazard warning (front and rear LED)
  - Engine compartment light
  - Headlights, (halogen) with dimmer
  - Operator access courtesy lights
  - Side profile lights
  - Stop/tail lights (LED)
- Service center containing:
  - Battery jump start
  - Breakers with spare fuses
  - Lock out switch
  - Ports, ET and VIMS
  - Service lockout switch (power without engine start)

TECHNOLOGY PRODUCTS

- Economy Modes, standard and adaptive
- Product Link, cellular or satellite
- Traction Control System (TCS)
- Truck Production Management System (TPMS)
- Vital Information Management System (VIMS)

OPERATOR ENVIRONMENT

- Advisor display:
  - Fluid level monitoring
  - Fuel level monitoring
  - Display languages (market based)
- Air conditioning/heat
- Automatic temperature control
- Ashtray and cigarette lighter
- Coat hook
- Cup holders (4)
- Diagnostic connection port, 24V
- Entertainment radio ready:
  - 5 amp converter
  - Speakers
  - Antenna
  - Wiring harness
- Foot rest
- Gauges/indicators:
  - Brake oil temperature gauge
  - Coolant temperature gauge
  - Engine overspeed indicator
  - Fuel level
  - Hour meter
  - Speedometer with odometer
  - Tachometer
  - Transmission gear indicator
- Hoist lever
- Horn
- Light – courtesy
- Light – dome
- Mirrors, non-heated
- Power port, 24V and 12V (2)
- Rollover Protection (ROPS)/Falling Object Protection (FOPS)
- Seat, Cat Comfort Series III:
  - Full air suspension
  - Retractable 3-point seat belt with shoulder harness
- Seat, training with lap belt
- Steering wheel, padded, tilt and telescopic
- Storage compartment
- Sun visor
- Throttle lock
- Window, hinged, right side (emergency exit)
- Window, powered, left side
- Windshield wiper intermittent and washer

773G Standard Equipment

Standard Equipment (cont'd)

Standard equipment may vary. Consult your Cat dealer for details.

GUARDS
- Driveline
- Engine crankcase
- Fan

FLUIDS
- Antifreeze
- Extended life coolant to –34° C (–30° F)
- Grouped ground-level filters

OTHER STANDARD EQUIPMENT
- Body down indicator
- Body safety pin (secures body in up position)
- Center mounted rims
- Fuel tank, 795 L (210 gal)
- Ground level battery disconnect
- Ground level engine shutdown
- Ground level grease fittings
- Operator Maintenance Manual (OMM)
- Rims 17 × 35
- Rock ejectors
- Secondary steering (electric)
- Tie down eyes
- Tow hooks (front)/tow pin (rear)
- Vandalism protection locks

773G Optional Equipment

Optional Equipment

Optional equipment may vary. Consult your Cat dealer for details.

- Body heat
- Body liner
- Body side boards
- Cab precleaner
- Cat Engine Brake
- Clustered grease fittings
- Cold weather packages
- Extended Life Brakes
- Fluid fill service center
- HID lights
- Mirrors, convex
- Mirrors, heated
- Rockford fan attachment for LRC machines
- Spare rim
- Visibility package (meets ISO 5006 requirements)
- Wheel chocks
- Work Area Vision System (WAVS)

Notes

773G Off-Highway Truck

For more complete information on Cat products, dealer services, and industry solutions, visit us on the web at **www.cat.com**

AEHQ6881 (09-2012)
Replaces AEHQ6342-02

793F

Mining Truck

Engine		
Engine Model	Cat® C175-16	
Gross Power – SAE J1995	1976 kW	2,650 hp
Net Power – SAE J1349	1848 kW	2,478 hp

Operating Specifications	
Nominal Payload Capacity	226.8 tonnes 250 tons
Gross Machine Operating Weight	386 007 or 390 089 kg (851,000 or 860,000 lb)

793F Features

High Performance Engine
The Cat® C175-16 engine offers you the perfect balance between power, robust design and economy.

Enhanced Serviceability
Improved serviceability points and grouped service locations mean your truck spends more time on the haul road than in the shop.

Power Shift Transmission
A smooth shifting six speed transmission using ECPC gives operators a comfortable ride, constant power and improved fuel efficiency.

Reliable Mechanical Drive System
The 793F's power train gives you the fastest truck on steep grades, poor underfoot conditions and on haul roads with high rolling resistance.

Robust Braking
Cat oil-cooled, multiple disc brakes on all four corners offer you exceptional, fade-resistant braking.

Comfortable Cab
Operators find the large, spacious cab offers unmatched visibility and exceptional comfort.

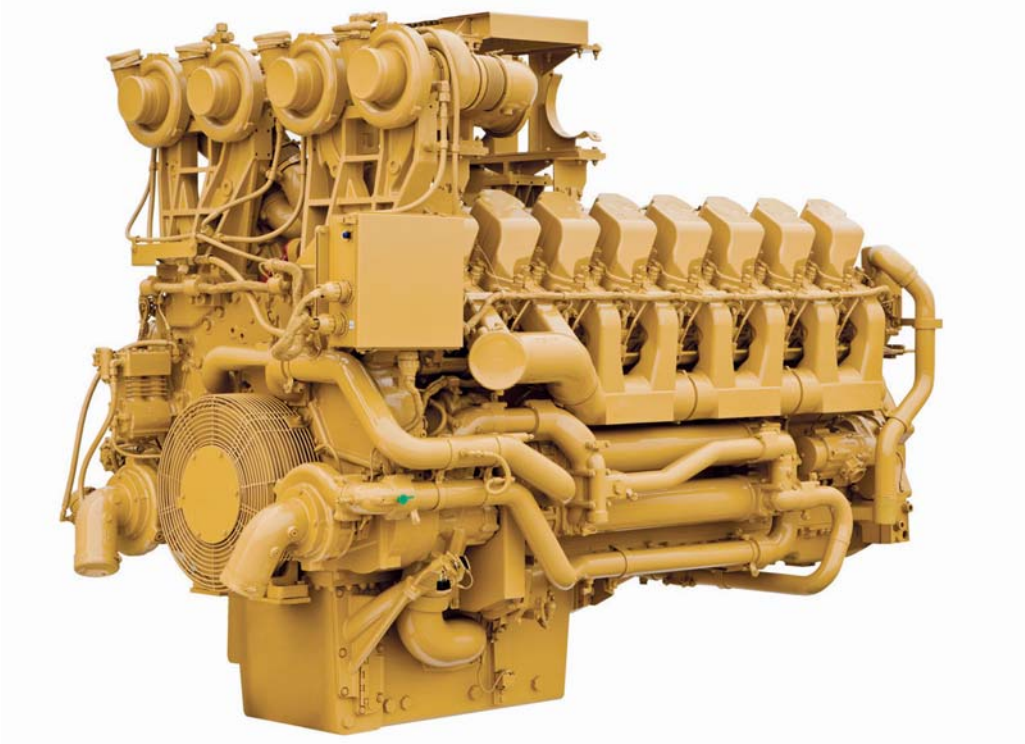
Truck Body
A variety of Caterpillar designed and built bodies provide you optimal performance and reliability.

Contents

Whether you're hauling copper, coal, gold, iron ore or overburden the 793F provides you with the best in class cost per unit of production. Including the improvements in safety, productivity, serviceability and comfort you will see why the 793F is the industry leader of its class. Combine these features with unmatched dealer support and you will see why more mine sites choose Cat Mining Trucks for their production needs.

Power Train – Engine

Power, reliability and efficiency for your most demanding mining applications.



Cat® C175-16 Engine

The 793F has a Cat C175-16 quad turbocharged air-to-air aftercooled diesel engine that has enhanced power management capability for maximum hauling performance in your most demanding mining applications.

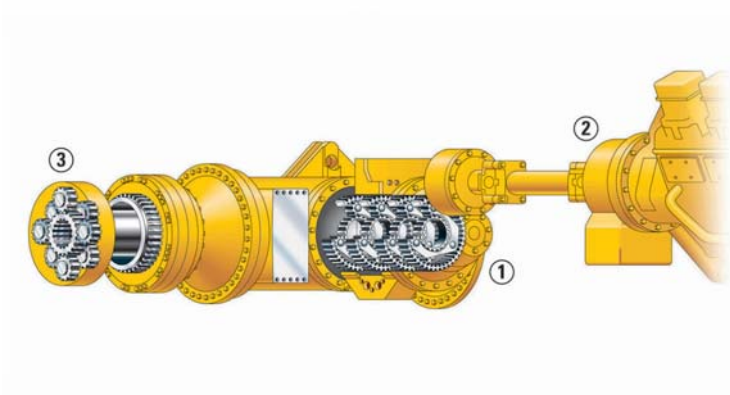
- The C175-16 is a 16-cylinder, four-stroke design that uses long, effective power strokes for optimum efficiency.
- Is compliant with U.S. Environmental Protection Agency emission requirements.
- The 20 percent net torque rise of the C175-16 provides unequalled lugging force during acceleration on steep grades and in rough underfoot conditions. Torque rise effectively matches transmission shift points for maximum efficiency and fast cycle times.
- High displacement, low rpm rating and conservative horsepower ratings mean more time on the haul roads and less time in the shop.
- The Cat Common Rail Fuel System is an electronically-controlled system senses operating conditions and regulates fuel delivery for optimum fuel efficiency. This precise and flexible fuel system gives the engine the ability to meet emission regulations without sacrificing performance, reliability or durability.
- The flexible core design of the MESABI radiator means easier serviceability along with long life and high durability.
- You have two starter options: The tank on the standard air start system is ground level serviceable, while the electric start option allows the air system to be totally removed from the truck.

Power Train – Transmission

More power to the ground means greater productivity for you.

Mechanical Power Train

The 793F gives you the fastest truck on grade in its class. The Cat mechanical drive power train and power shift transmission provides you unmatched operating efficiency and control on steep grades, in poor underfoot conditions and on haul roads with high rolling resistance.



1 – Transmission with Electronic Clutch Pressure Control

The Cat six-speed planetary power shift transmission is matched with the direct-injection C175-16 diesel engine to deliver constant power over a wide range of operating speeds.

The proven planetary power shift transmission is built tough and is designed for the higher power of the C175-16 engine.

A dedicated oil tank and circuit provides cooler, cleaner oil for maximum performance and longer component life.

Electronic Clutch Pressure Control (ECPC) provides maximum performance, smooth shifting, long clutch life and a more comfortable ride.

2 – Lock-Up Torque Converter

Combines maximum rimpull and cushioned shifting of torque converter drive with the efficiency and performance of direct drive. The lock-up torque converter engages at approximately 8 km/h (5 mph), delivering more power to the wheels.

3 – Final Drives

Cat final drives work as a system with the planetary power shift transmission to deliver maximum power to the ground. Built to withstand the forces of high torque and impact loads, double reduction final drives provide high torque multiplication to further reduce drive train stress.

Power Train Options

Two power train options to match your applications/conditions.

Extended Life Wheel Stations

Developed for uphill hauling applications, this arrangement is designed to extend wheel life and hauling performance on long, uphill hauls. Extended life wheel stations are built with larger, more durable components, including larger spindles, wider wheel bearing spacing, a larger braking surface and additional discs in the front for longer brake life and more time between overhauls.

Additional Retarding

Developed for downhill-loaded applications, this option typically delivers an extra gear of retarding capability or 25 percent more speed on downhill grades. Additional retarding is achieved by adding larger brakes and additional brake cooling capability. This option requires the use of Extended Life Wheel Stations.

Engine/Power Train Integration

Reduced operating costs through electronically combined power train components.

Cat Data Link

Reduces operating costs through electronically integrating machine computer systems to optimize overall power train performance, increase reliability and component life.

Controlled Throttle Shifting

Regulates engine rpm during shifting to reduce power train stress and clutch wear by controlling engine speed, torque converter lock-up and transmission clutch engagement for smoother shifts and longer component life.

Directional Shift Management

Regulates engine speed during directional shifts to prevent damage caused by high speed, directional changes.

Body-Up Shift Inhibitor

Prevents the transmission from shifting above the pre-programmed gear without the body fully lowered.

Overspeed Protection

The transmission control electronically senses engine conditions and automatically up-shifts one gear to prevent overspeeding. If overspeeding occurs in top gear, the lock-up clutch is disengaged.

Programmable Top Gear

Transmission top gear maximum can be set using the Cat ET service tool to help the operator maintain speed limits.

Downshift Inhibitor

Prevents engine overspeeding by keeping the transmission from downshifting until engine speed reaches the downshift point.

Rapid Downshift Function

Does not allow a turnaround shift until approximately 2.3 seconds after a shift occurs.

Reverse Speed Inhibitor

Prevents shifts into reverse when forward ground speeds are in excess of 5 km/h (3 mph).

Cat Braking Systems

Superior braking control lets operators focus on productivity.

Integrated Braking System

Reliable performance and control in extreme haul road conditions is important for operator safety. The Cat oil-cooled braking system provides this. Integrated systems combine the service, secondary, parking brakes and retarding functions for optimum braking efficiency that does not burn fuel while retarding.

Oil-Cooled Multiple Disc Brakes

Cat four-wheel, forced oil-cooled, multiple disc service brakes are continuously cooled by water-to-oil heat exchangers for exceptional, non-fading braking and retarding performance.

Brake Design

Cat oil-cooled disc brakes are designed with large discs and plates for reliable, adjustment-free operation and performance. Brakes are completely enclosed and sealed to prevent contamination and reduce maintenance.

Long Life

An oil film prevents direct contact between the discs. This design absorbs the braking forces by shearing the oil molecules and carrying heat away to extend brake life.

Parking Brake

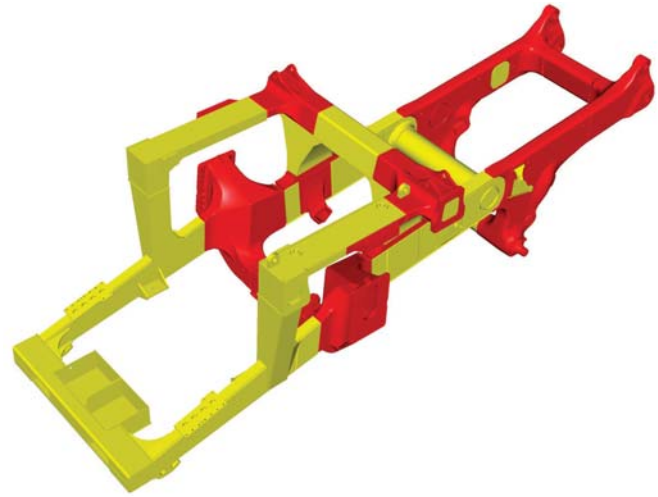
Oil-cooled, spring-applied, hydraulically released parking brake is applied to all four wheels for superior parking capability on all grades up to 15 percent.

Hydraulic Automatic Retarder Control (ARC)

Hydraulically activated, automatic retarder control system electronically controls retarding on grade to maintain optimum engine rpm and brake system performance. ARC is now adjustable in each gear.

Structures

Superior Cat structures in the 793F give you durability and long life.



Yellow – Fabrications, Red – Castings

Box Section Design

The 793F frame uses a box-section design, incorporating two forgings and 14 castings in high stress areas with deep penetrating and continuous wrap-around welds to resist damage from twisting loads without adding extra weight.

- **Steel Structures** – Mild steel used throughout frame provides flexibility, durability and resistance to impact loads, even in cold climates and allows for easy field repairs.
- **Castings** – Castings have large radii with internal reinforcing ribs to dissipate stress in areas of high stress concentration. Castings move welds to lower stress areas for greater frame life.

Integral Four-Post ROPS Cab

Resiliently mounted to the main frame to reduce vibration and sound, the integral ROPS is designed as an extension of the truck frame.

Suspension System

Designed to dissipate haul road and loading impacts for longer frame life and a more comfortable ride.

- **Durable Design** – Rugged cylinders utilize large diameter bore and low pressure nitrogen/oil design for long life with minimal maintenance.
- **Front** – Front cylinders with preset caster and camber are mounted to the frame and serve as steering kingpins for a tight turning radius with excellent maneuverability and low maintenance.
- **Rear** – Rear cylinders allow axle oscillation and absorb bending and twisting stresses caused by uneven and rough haul roads rather than transmitting them to the main frame.

Four-bar Link Rear Suspension

The Four-bar Link Suspension directs stress to be more evenly distributed than an A-frame design and allows more service area around the transmission.

Steering System

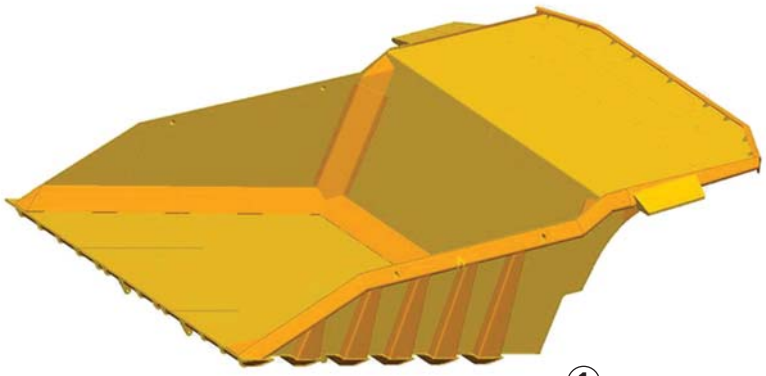
Hydraulic steering control system is designed for exceptional smoothness and precise control. A separate circuit prevents cross contamination for long life.

Truck Body Systems

Designed and built for rugged performance and reliability.

Cat Truck Bodies

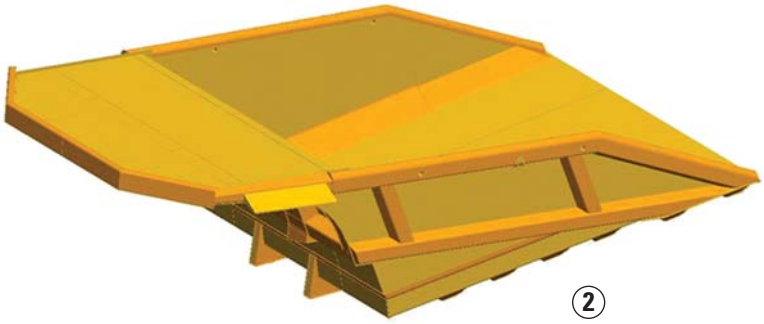
You have three body options with the 793F: X Body, MSD II (Mine Specific Design) and Gateless Coal Body. These bodies are specifically designed to work with the Cat frame for superior structural performance.



1

1 – X Body

If you have a new mine or are a contract miner the X Body is designed for you. It uses the Cat Mine Specific Design process to create a body that is properly sized and configured to meet the specific requirements of heavy-duty applications. The X Body design offers a larger volume with no weight penalty.



2

2 – MSD II

The MSD II bodies are intended for established mines and are customized to suit your specific mining applications based on a mine site evaluation. The MSD II is the best lightweight body ever built for mining applications and achieves excellent payload performance.

3 – Gateless Coal Body

The Gateless Coal Body is intended for dedicated coal haulage applications. It can be loaded to achieve target payload across the full range of coal densities. The body is designed and built using the MSD II Body concept, ensuring superior durability and reliability.

3

Monitoring System

Keeping your production at peak levels.

VIMS™ 3G Monitoring System

The third generation VIMS monitoring system provides you with critical health and payload data in real-time to keep the 793F performing at top production levels. Data from VIMS can be used to lower your operating costs by improving the effectiveness of scheduled maintenance programs improve machine availability and improve the effectiveness of scheduled maintenance programs. Sensors throughout the machine enable VIMS to quickly exchange and monitor information from all systems. Users can view up to 10 different machine parameters at a time. Your service technicians can quickly download data by connecting directly to the system or through its own web address and generate reports in the office, shop or cab.

Production and Payload Management

Information is available to monitor and enhance truck/loading tool effectiveness, improve fleet productivity and help extend the life of truck frames, tires, rims and power train components, while lowering your operating and maintenance cost.

External Payload Indicators

External lights signal loading tool operators when to cease loading for optimum payloads without overloading. Optional payload displays with digital numeric monitor are available.

Road Analysis Control

Optional system monitor your haul road conditions by measuring frame rack, bias and pitch to improve cycle times, frame life, tire life and fuel efficiency.

VIMSpc

An Off-board software reporting program that allows your service personnel to download a complete record of machine health and productivity data. Health and payload reports can be generated for more effective machine management, which reduces downtime and lowers operating costs.

Advisor Display

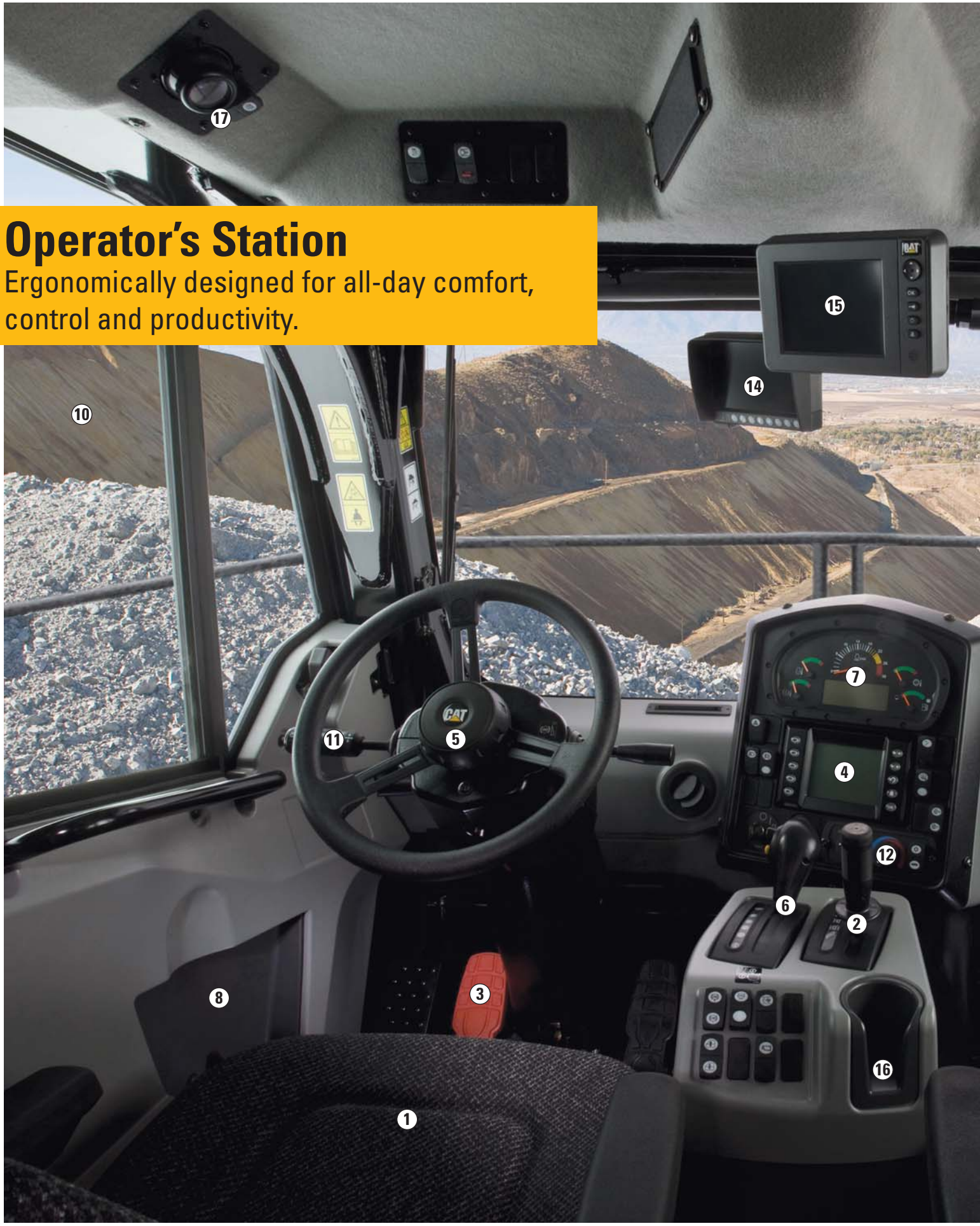
The Advisor display provides real-time machine performance and basic trip, maintenance and diagnostic data. Various machine parameters can be viewed on the display including coolant temperature, oil pressure, current gear selection, current payload and more.

VIMS Supervisor

Optional software allows your mine personnel to easily manage and interpret VIMS data for optimum fleet management and productivity.

Operator's Station

Ergonomically designed for all-day comfort, control and productivity.



Operator Environment

You now have the choice to select a cab with the features you desire. There are three choices based on popular arrangements. Available offerings include a Standard Cab, Deluxe Cab or Deluxe Cold Weather Cab.

Ergonomic Layout

To minimize operator fatigue and maximize productivity the all new F Series operator station is ergonomically designed for total machine control in a comfortable, productive and safe environment. Controls, levers, switches and gauges are positioned for ease of use.

Viewing Area

Designed for excellent all-around visibility and clear sight lines to the haul road, the large viewing area offers exceptional visibility, allowing the operator to maneuver with confidence for high productivity. The air cleaners have been relocated to the front of the truck, allowing the operator increased visibility.

1) Air Suspension Seat with Three-Point Operator Restraint
2) Hoist Lever
3) Secondary Brake Pedal
4) Monitoring System
5) Steering Column
6) Transmission Console
7) Gauges
8) Storage Compartment
9) Trainer Seat
10) Operator Window
11) Operator Controls
12) Heating/Air Conditioning
13) Four-Post ROPS
14) Camera System Monitor (optional)
15) MineStar Monitor (optional)
16) Cup Holder
17) Dome Courtesy Lights

Customer Support

Keeping you running with the most experienced dealer network.

Commitment Makes the Difference

Cat dealers offer a wide range of solutions, services and products that help you lower costs, enhance productivity and manage your operation more efficiently. From the time you select a piece of Cat equipment until the day you trade or sell it, the support you get from your Cat dealer makes the difference.

Dealer Capability

Cat dealers provide the level of support you need, on a global scale. Dealer expert technicians have the knowledge, experience, training and tooling necessary to handle your repair and maintenance needs, when and where you need them.

Product Support

When Cat products reach the field, they are supported by a worldwide network of parts distribution facilities, dealer service centers and technical training facilities to keep your equipment up and running. Cat customers rely on prompt, dependable parts availability through our global dealer network, ready to meet your needs 24/7.

Service Support

Every piece of Cat equipment is designed and built to provide maximum productivity and operating economy throughout its working life. Cat dealers offer a wide range of service plans that will maximize uptime and return on your investment, including:

- Preventive Maintenance Programs
- Diagnostic Programs, such as Scheduled Oil Sampling and Technical Analysis
- Rebuild and Reman Option
- Customer Support Agreements

Operation

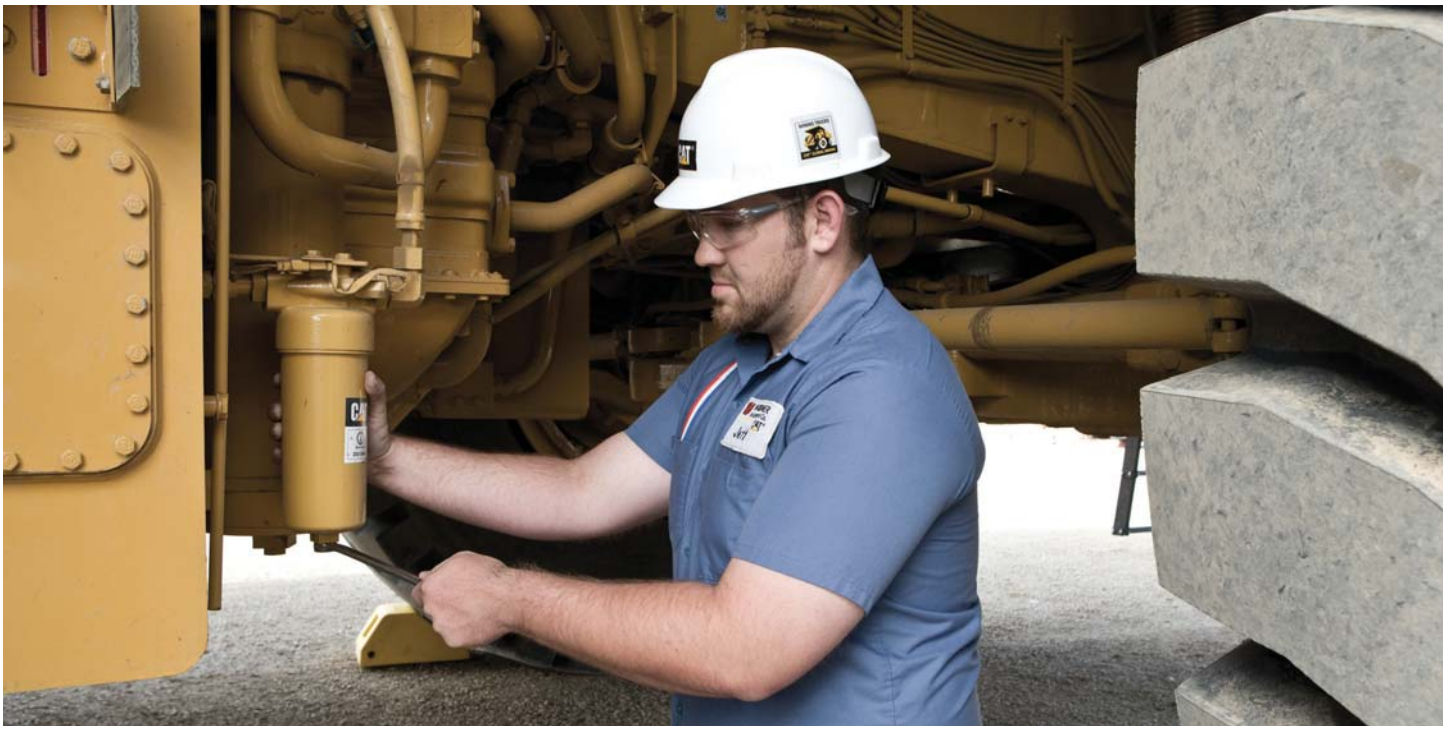
Your Cat dealer can arrange training programs to help operator's improve productivity, decrease downtime, reduce operating costs and enhance safety.

Application Awareness

Operating and maintenance costs are influenced by many application and site-specific factors, such as: material density, loading position, payload, grades, speeds, haul road design and maintenance. Your Cat dealer can provide you with an understanding of the effects application characteristics and operating techniques have on maintenance and operating costs.

Serviceability

Reduced maintenance time results in more productivity.



Servicing Ease

Easy access to daily service points simplifies servicing and reduces your time spent on regular maintenance procedures. Enhanced serviceability and long service intervals are designed to increase machine availability and productivity.

In-Frame Access

Gives you easy access to major components for easy servicing and removal.

Ground Level Access

Grouped ground level points allow you convenient servicing of tanks, filters, drains, batteries, AutoLube system, pressure taps, screens, fluid sight gauges and engine shutdown. Ground level VIMS data port permits easier downloading of information.

AutoLube

Automatic lubrication system reduces your maintenance time by automatically lubricating necessary components on a regular basis.

Scheduled Oil Sampling

S·O·S℠ sampling valves speed sampling and analysis reliability.

Pressure Test Points

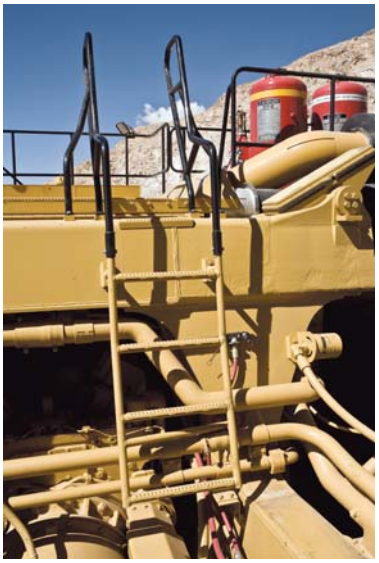
Disconnect valves are conveniently located throughout the hydraulic systems for easy pressure testing.

Sealed Electrical Connectors

Electrical connectors are sealed to lock out dust and moisture. Harnesses are braided for protection. Wires are color-coded for easy diagnosis and repair.

Safety

Designed with safety as the first priority.



Product Safety

Caterpillar is concerned about your safety and has been and continues to be proactive in developing mining machines that meet or exceed safety standards. Safety is an integral part of all machine and system designs.

Cat Detect System

Knowing what's around your 793F at all times is important. The Cat Detect system is factory installed as standard equipment on 793F Mining Trucks. The full Cat Detect system, RADAR AND CAMERA, provides both audible and visual indications of detected objects. This system uses a combination of short and medium range radars which surround the machine, along with cameras on each side to allow the operator to confirm the detected object. The cameras supplement the radar alerts and are selectable by touch screen menus through an intuitive interface.

Integral ROPS Cab

Resiliently mounted to the main frame to reduce vibration and sound, the integral ROPS structure is an extension of the truck frame and exceeds SAE requirements.

Access/Egress

Improvements for machine level access and egress include a standard 600 mm (24 in) diagonal stairway across the front of the machine. Improvements for ground level access include an optional powered access stairway.

Brake Systems

Four corner oil braking system provides excellent control in slippery conditions. The system assures braking in the event of complete hydraulic failure.

Overload Policy

Safety is integral to maintaining the highest productivity in mining operations. The Caterpillar 10/10/20 Overload Policy assures that steering and braking systems have sufficient capacity to perform, even at 20 percent overload.

Other Safety Features

• Slip resistant surfaces • 76 mm (3 in) wide orange three-point operator restraint • Wide angle mirrors • Body raised indicator • Double body retaining cables • Guard rails • Reverse neutralizer when dumping • Low interior sound level

Isolation Box

Lockout tagout box mounted on front bumper includes engine shutdown switch, battery lockout, starter lockout and transmission lockout.

SAFETY.CAT.COM™

Sustainability

A variety of features improve sustainability in areas of decreasing waste, extending component life and lowering emissions levels.

Sustainability Features

The 793F Mining Truck offers continuous rear axle filtration, extended life filters and extended maintenance intervals, which aid in decreasing the amount of waste contributed to our environment.

Engines with Advanced Technology

Engines with advanced technology contribute fewer emissions to the environment while maintaining fuel efficiency.

Advanced Surface Technology (AST)

Advanced Surface Technology (AST) is a replacement for hard chrome coatings on some steel parts, including suspension and hoist cylinder rods. This technology improves wear resistance and reduces repair time. Chrome has been eliminated to reduce environmental impact.

Fuel Efficiency

The engine provides additional retarding by running against compression on downhill hauls. During retarding applications the engine ECM does not inject fuel into the cylinders for exceptional fuel economy.

793F Mining Truck Specifications

Engine

Engine Model	Cat C175-16	
Gross Power – SAE J1995	1976 kW	2,650 hp
Net Power – SAE J1349	1848 kW	2,478 hp
Torque Rise	20%	
Bore	175 mm	6.9 in
Stroke	220 mm	8.7 in
Displacement	85 L	5,187 in^3

- Power ratings apply at 1,750 rpm when tested under the specified condition for the specified standard.
- Ratings based on SAE J1995 standard air conditions of 25° C (77° F) and 99 kPa (29.61 Hg) dry barometer. Power based on fuel having API gravity of 35 at 16° C (60° F) and an LHV of 42.780 kJ/kg (18,390 Btu/lb) when engine used at 30° C (86° F).
- No engine derating required up to 3353 m (11,000 ft) altitude.
- EPA Compliant. Where applicable, the Cat C175-16 engine is compliant with U.S. Environmental Protection Agency emission requirements.

Weights – Approximate

Chassis Weight	122 300 kg	270,000 lb
Body Weight Range	26 862- 47 627 kg	59,220- 105,000 lb

- Chassis weight with 100 percent fuel, hoist, body mounting group, rims and 40.00R57 tires.
- Body weight varies depending on how body is equipped.

Operating Specifications

Nominal Payload Capacity	226.8 tonnes	250 tons
Top Speed – Loaded	60 km/h	37.3 mph
Steer Angle	36 Degrees	
Turning Diameter – Front	28 m	93 ft
Turning Circle Clearance Diameter	33 m	107 ft
Gross Machine Operating Weight	386 007 or 390 089 kg	851,000 or 860,000 lb

- Refer to the Cat Mining Truck 10/10/20 Overload Policy for maximum gross machine weight limitations.

Final Drives

Differential Ratio	1.8:1
Planetary Ratio	16:1
Total Reduction Ratio	28.8:1

Transmission

Forward 1	12.9 km/h	8 mph
Forward 2	17.4 km/h	10.8 mph
Forward 3	23.8 km/h	14.8 mph
Forward 4	32.1 km/h	19.9 mph
Forward 5	43.6 km/h	27.1 mph
Forward 6	60 km/h	37.3 mph
Reverse	11.8 km/h	7.3 mph

Suspension

Effective Cylinder Stroke – Front	130.5 mm	5.1 in
Effective Cylinder Stroke – Rear	105.5 mm	4.2 in
Rear Axle Oscillation	±4.9 degrees	

Body Hoists

Pump Flow – High Idle	846 L/min	224 gal/min
Relief Valve Setting – Raise	20 370 kPa	2,955 psi
Body Raise Time – High Idle	19 Seconds	
Body Lower Time – Float	20 Seconds	
Body Power Down – High Idle	17.5 Seconds	

- Twin, two-stage hydraulic cylinders mounted outside main frame, double-acting cylinders in second stage.
- Power raise in both stages, power down in second stage.
- Automatic body lower modulation reduces impact on frame.

Brakes

Outside Diameter	874.5 mm	34.5 in
Brake Surface – Front	89 817 cm^2	13,921 in^2
Brake Surface – Rear	34 500 cm^2	20,847 in^2
Standards	J-ISO 3450 JAN88, ISO 3450:1996	

Weight Distributions – Approximate

Front Axle – Empty	48%
Rear Axle – Empty	52%
Front Axle – Loaded	33%
Rear Axle – Loaded	67%

Capacity – MSD II – 100% Fill Factor

Struck	112-142 m^3	146-186 yd^3
Heaped (SAE 2:1)	159-190 m^3	209-250 yd^3

- Contact your local Cat dealer for body recommendation.

Service Refill Capacities

Fuel Tank	2839 L	750 gal
Fuel Tank (optional)	4922 L	1,300 gal
Cooling System	1074 L	284 gal
Crankcase	312 L	82 gal
Rear Axle Housing	984 L	260 gal
Steering System (Includes Tank)	290 L	77 gal
Brake/Hoist System (Includes Tank)	1315 L	347 gal
Torque Converter/Transmission Sump	102 L	27 gal
Torque Converter/Transmission System (Includes Sump)	209 L	55 gal

ROPS

ROPS Standards

- ROPS (Rollover Protective Structure) for cab offered by Caterpillar meets ISO 3471:1994 ROPS criteria.
- FOPS (Falling Objects Protective Structure) meets ISO 3449:1992 Level II FOPS criteria.

Sound

Sound Standards

- The operator sound pressure level measured according to work cycle procedures specified in ISO 6394 and 6396 is 76 dB(A) for cab offered by Caterpillar, when properly installed and maintained and tested with doors and windows closed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in a noisy environment.

Steering

Steering Standards	SAE J15111 OCT90, ISO 5010:1992

Weight/Payload Calculation

(Example)

	793F, SLWS, 29", 40R57*		793F, XLWS, 29", 40R57		793F, XLWS, 32", 50/80R57**	
Truck Body MSD II (209 yd^3/160 m^3)	MSD Body		MSD Body		MSD Body	
	kg	lb	kg	lb	kg	lb
Gross Machine Operating Weight	386 008	851,000	386 008	851,000	390 090	860,000
Basic Machine Weight[1]	42 638	94,001	42 638	94,001	42 638	94,001
Attachments	78 956	174,068	81 463	179,595	85 145	187,712
Body Weight – Fully Lined MSD II (230 yd^3/160 m^3)	33 102	72,977	33 102	72,977	33 102	72,977
Operating Machine Weight	154 766	341,200	157 273	346,727	165 783	365,489
3% Debris Allowance[2]	4643	10,238	4718	10,404	4829	10,647
Empty Operating Machine Weight (EOMW)[1]	159 409	351,436	161 991	357,129	165 783	365,489
	Tonnes	Tons	Tonnes	Tons	Tonnes	Tons
Potential Target Payload[3]	227	250	224	247	225	247

*793F Standard includes: common arrangement, 100% fuel (2,840 L/750 gal), hoist, body mounting group, mandatory attachments, standard wheel station, 29" rims and 40.00R57 Tires.

**793F XLWS includes: common arrangement, 100% fuel (2,840 L/750 gal), hoist, body mounting group, mandatory attachments, extended life wheel station, 32" quick change rims and 50/80R57 Tires.

[1] Weights will vary dependent on configuration and may include ± 2% variation due to standard material tolerances.

[2] Calculations include (3% OMW) debris allowance. However, actual debris allowance should be considered based upon known site conditions.

[3] It is recommended to work with your Global Mining representative to calculate target payload per specific site.

Caterpillar recommends the customer evaluate all job conditions and consult the Cat dealer and tire manufacturer for proper tire selection.

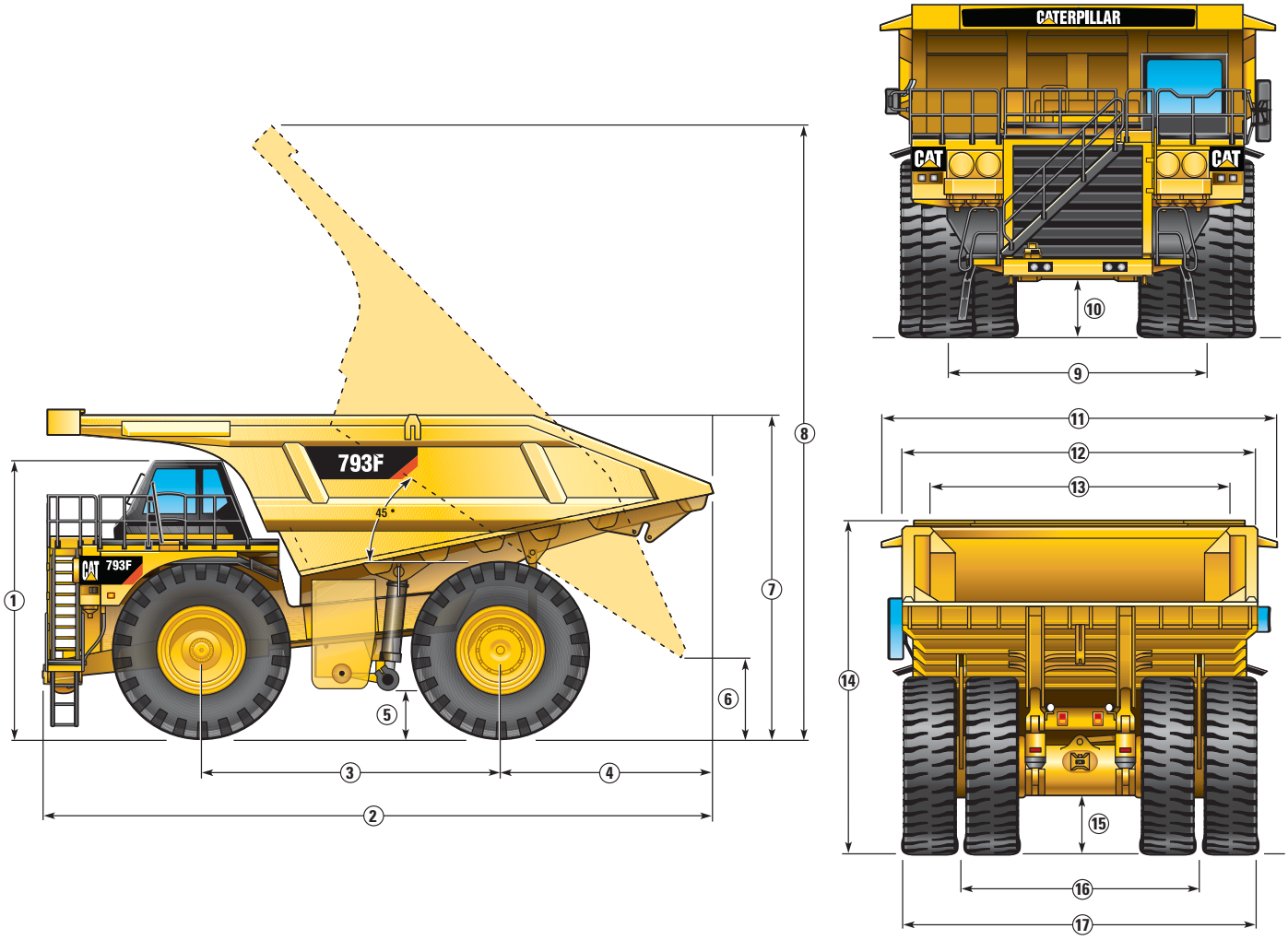
Reference tire limitations with your local tire distributor concerning details of the tires being considered.

Productive capabilities of the 793F are such that, under certain job conditions, TKPH (TMPH) capabilities of standard or optional tires could be exceeded and, therefore, limit production.

793F Mining Truck Specifications

Dimensions

All dimensions are approximate.
Shown with 176 m³ (230 yd³) MSD II Body.



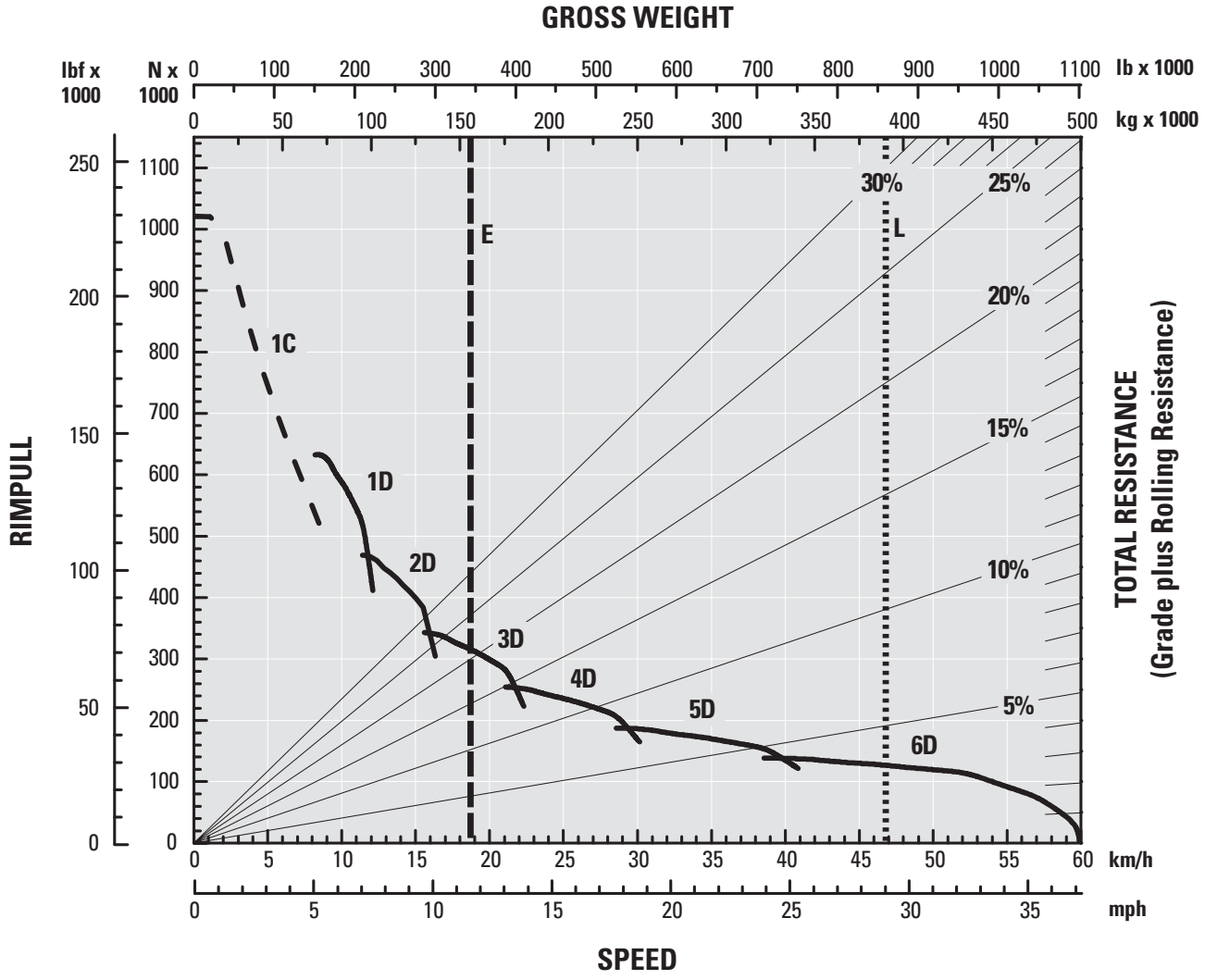
1	Height to Top of ROPS	5597 mm	18 ft 4 in
2	Overall Length	13 702 mm	44 ft 11 in
3	Wheelbase	5905 mm	19 ft 5 in
4	Rear Axle to Tail	4257 mm	13 ft 11 in
5	Ground Clearance	990 mm	3 ft 3 in
6	Dump Clearance	1301 mm	4 ft 3 in
7	Loading Height – Empty	6533 mm	21 ft 5 in
8	Overall Height – Body Raised	13 878 mm	45 ft 6 in
9	Centerline Front Tire Width	5630 mm	18 ft 6 in
10	Engine Guard Clearance	1217 mm	4 ft 0 in
11	Overall Canopy Width	8295 mm	27 ft 3 in
12	Outside Body Width	7626 mm	25 ft 0 in
13	Inside Body Width	6946 mm	22 ft 9 in
14	Front Canopy Height	6603 mm	21 ft 8 in
15	Rear Axle Clearance	1006 mm	3 ft 4 in
16	Centerline Rear Dual Tire Width	4963 mm	16 ft 3 in
17	Overall Tire Width	7605 mm	24 ft 11 in

793F Gradeability/Speed/Rimpull*

To determine gradeability performance: Read from gross weight down to the percent of total resistance. Total resistance equals actual percent grade plus 1% for each 10 kg/t (20 lb/ton) of rolling resistance. From this weight-resistance point, read horizontally to the curve with the highest obtainable gear, then down to maximum speed. Usable rimpull will depend upon traction available and weight on drive wheels.

Typical Field Empty Weight

Gross Machine Operating Weight
390 089 kg (860,000 lb)



1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear
5 – 5th Gear
6 – 6th Gear

E – Empty
L – Loaded
*** at sea level**

Torque Converter Drive
Direct Drive

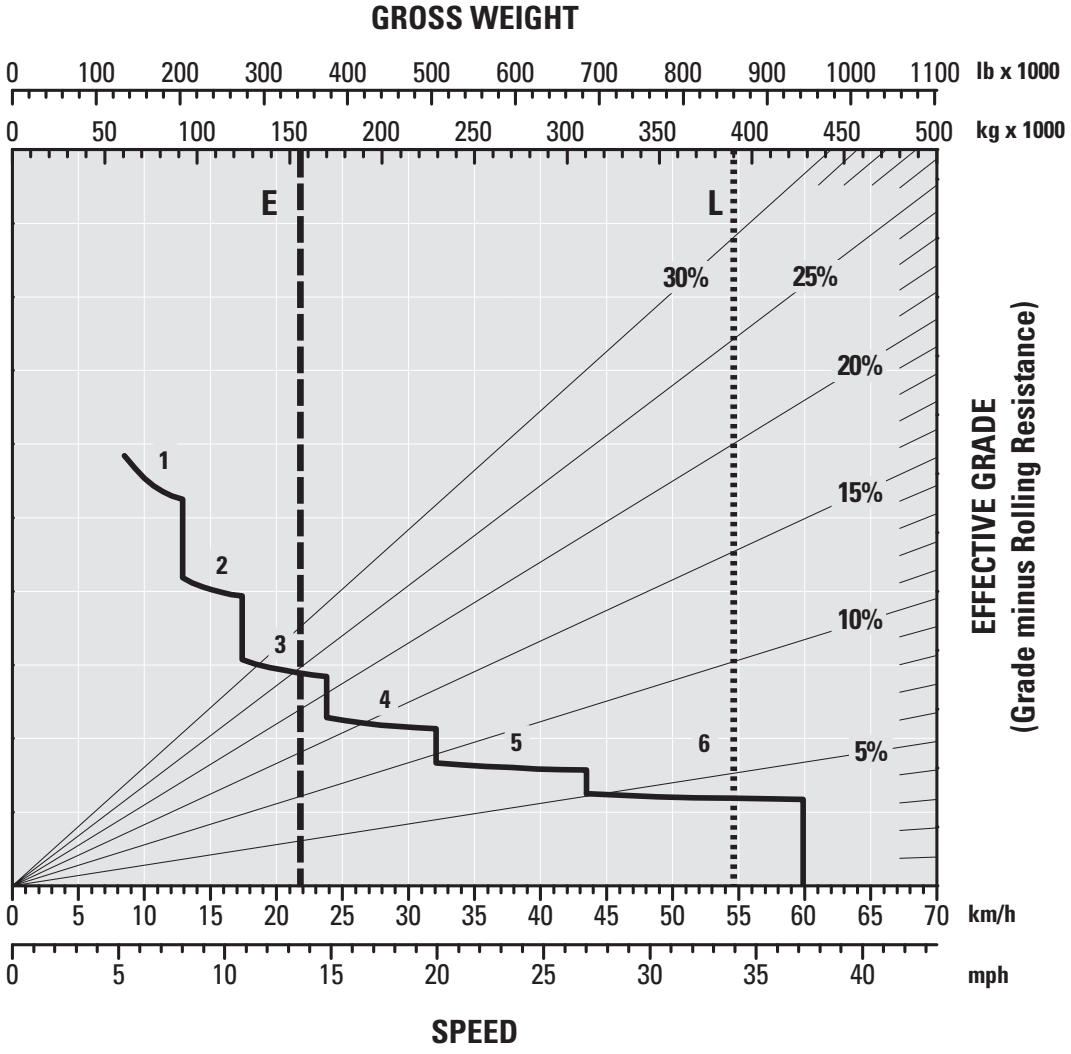
793F Standard Retarding – Continuous*

To determine retarding performance: Add lengths of all downhill segments and, using this total, refer to proper retarding chart. Read from gross weight down to the percent effective grade. Effective grade equals actual % grade minus 1% for each 10 kg/t (20 lb/ton) of rolling resistance. From this weight-effective grade point, read horizontally to the curve with the highest obtainable gear, then down to maximum descent speed brakes can properly handle without exceeding cooling capacity. The following charts are based on these conditions: 32° C (90° F) ambient temperature, at sea level, with 46/90R-57 tires.

NOTE: Select the proper gear to maintain engine rpm at the highest possible level, without overspeeding the engine. If cooling oil overheats, reduce ground speed to allow transmission to shift to the next lower speed range.

– – – – – Typical Field Empty Weight

····· Gross Machine Operating Weight 390 089 kg (860,000 lb)



1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear
5 – 5th Gear
6 – 6th Gear

E – Empty
L – Loaded
*** at sea level**

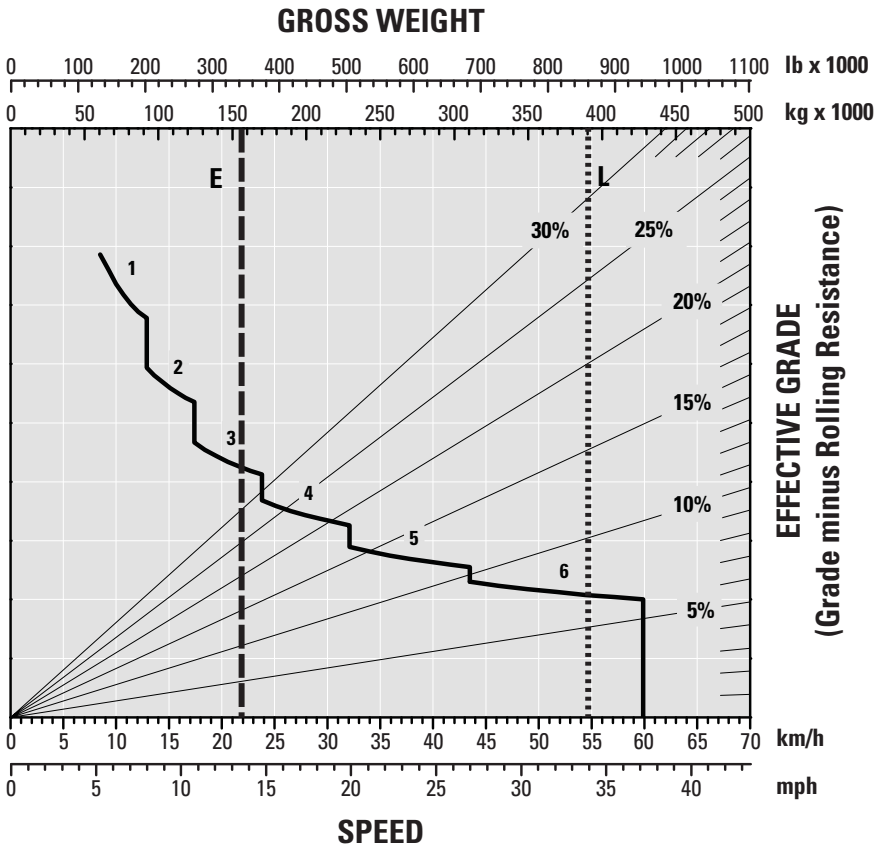
793F Standard Retarding – 450 m (1,475 ft)*

Typical Field Empty Weight

Gross Machine Operating Weight
390 089 kg (860,000 lb)

1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear
5 – 5th Gear
6 – 6th Gear

*** at sea level**



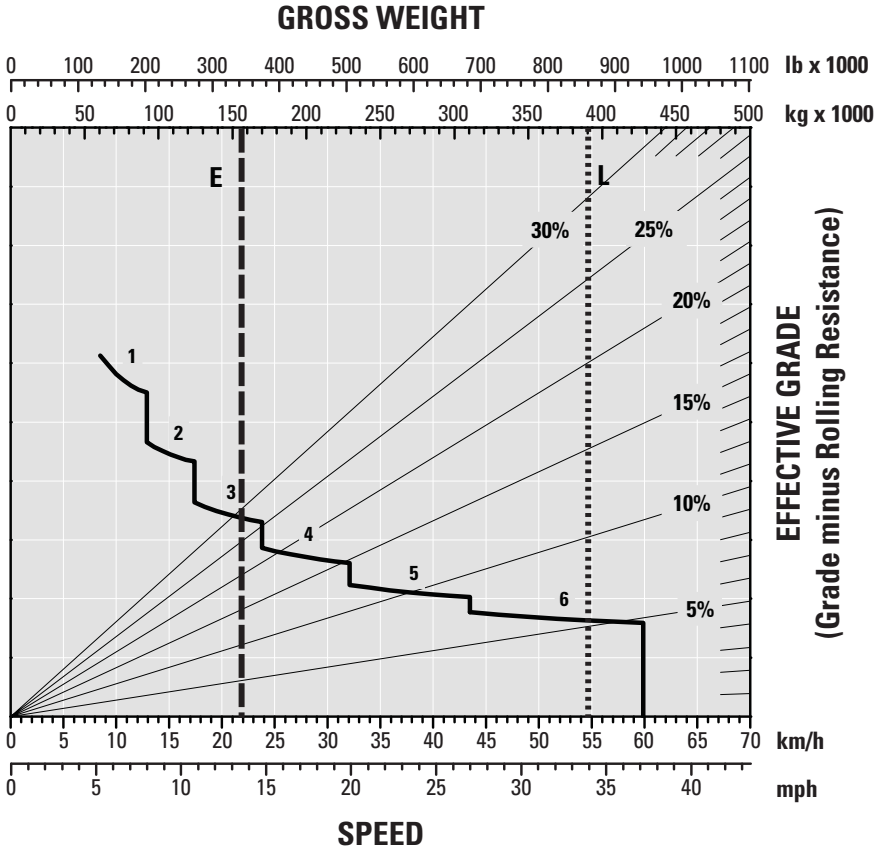
793F Standard Retarding – 1500 m (4,900 ft)*

Typical Field Empty Weight

Gross Machine Operating Weight
390 089 kg (860,000 lb)

1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear
5 – 5th Gear
6 – 6th Gear

*** at sea level**



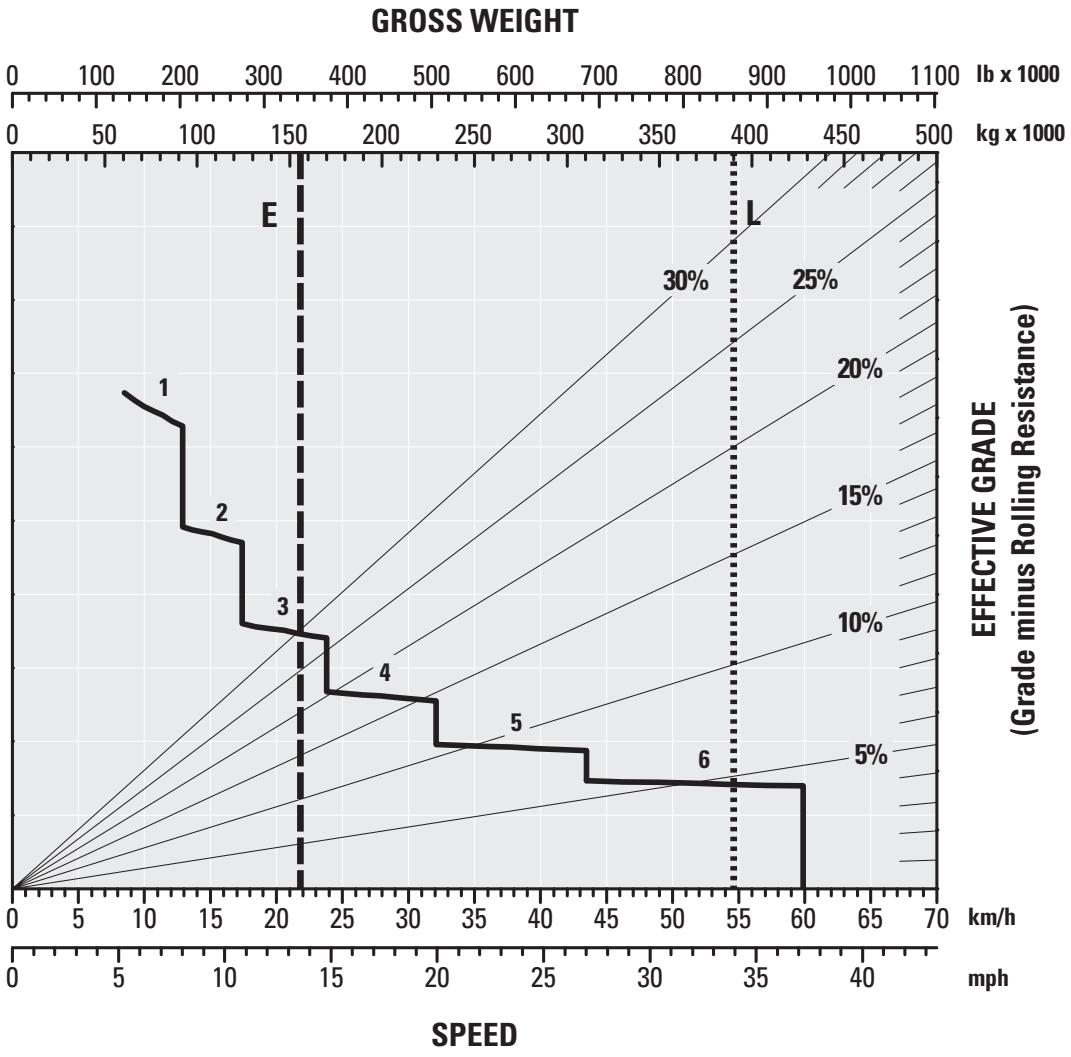
793F Additional Retarding – Continuous*

To determine retarding performance: Add lengths of all downhill segments and, using this total, refer to proper retarding chart. Read from gross weight down to the percent effective grade. Effective grade equals actual % grade minus 1% for each 10 kg/t (20 lb/ton) of rolling resistance. From this weight-effective grade point, read horizontally to the curve with the highest obtainable gear, then down to maximum descent speed brakes can properly handle without exceeding cooling capacity. The following charts are based on these conditions: 32° C (90° F) ambient temperature, at sea level, with 46/90R-57 tires.

NOTE: Select the proper gear to maintain engine rpm at the highest possible level, without overspeeding the engine. If cooling oil overheats, reduce ground speed to allow transmission to shift to the next lower speed range.

– – – – – Typical Field Empty Weight

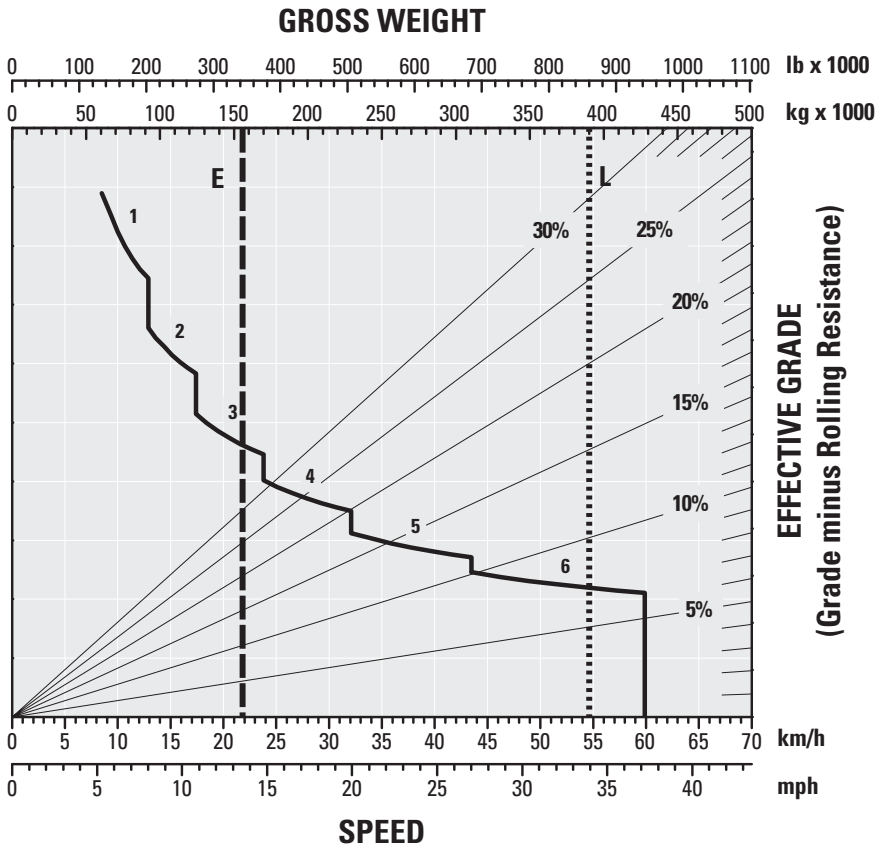
····· Gross Machine Operating Weight 390 089 kg (860,000 lb)



1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear
5 – 5th Gear
6 – 6th Gear

E – Empty
L – Loaded
*** at sea level**

793F Additional Retarding – 450 m (1,475 ft)*



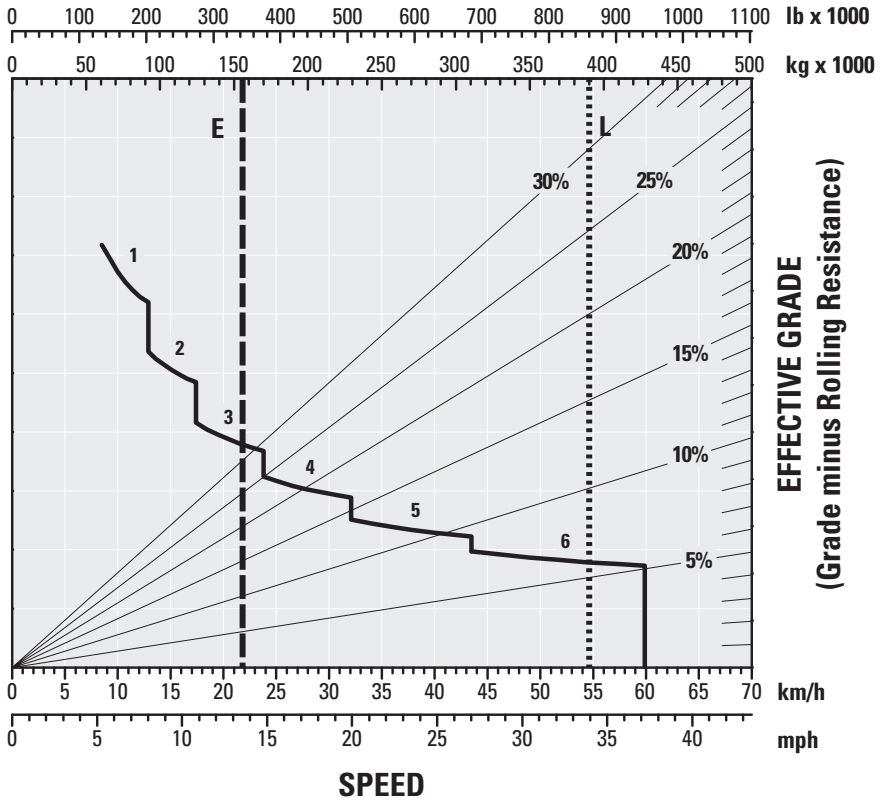
Typical Field Empty Weight

Gross Machine Operating Weight
390 089 kg (860,000 lb)

1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear
5 – 5th Gear
6 – 6th Gear

* at sea level

793F Additional Retarding – 1500 m (4,900 ft)*



Typical Field Empty Weight

Gross Machine Operating Weight
390 089 kg (860,000 lb)

1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear
5 – 5th Gear
6 – 6th Gear

* at sea level

793F Standard Equipment

Standard Equipment

Standard equipment may vary. Consult your Cat dealer for details.

ELECTRICAL

- Alarm, Back-up
- Brushless Alternator, 150 ampere
- Batteries, 93-amp hour, low maintenance, 12-volt (2)
- Converter, 12-volt electrical
- Electrical System, 24-volt, 10, 15 and 20 amp
- Battery Charge Receptacle
- Lighting System
  - Back-up and Hazard Lights
  - Directional Signals (front and rear LED)
  - Front Stair Access/Service Deck
  - Stop/Tail Lights (LED)
  - Engine Compartment
  - VIMS, Blue Light (LED)
  - Headlights, with Lo-Hi Beam Selector

OPERATOR ENVIRONMENT

- Air Conditioner with Automatic Climate Control
- 12-volt DC Power Supply (3)
- Coat Hook
- Cup Holder
- Diagnostic Connection Port
- Dome Courtesy Light
- Entertainment Radio Ready
  - 5 amp Converter, Speakers and Wiring Harness
- Gauge/Indicators
  - Gauge Panel:
    - Transmission Fluid Temperature
    - Brake Oil Temperature
    - Engine Coolant Temperature
    - Fuel Level
    - Torque Converter Oil Temperature
  - Electric Engine Control Fault Indicator
  - Electric Hour Meter
  - Speedometer
  - Tachometer
- Heater/Defroster, 11 070 kCal (45,930 Btu)
- Hoist, Body Control (electric)
- Horn
- Integrated Object Detection System
- Mirrors, Right and Left
- ROPS Cab, Insulated/Sound Suppressed
- Seat, Operator, Air Suspension
- Seatbelt, Operator, Three Points, Retractable
- Seatbelt, Trainer, Two Points, Retractable
- Stairway and Walkway Access, 600 mm (23.6 in)
- Steering Wheel, Tilt, Padded, Telescopic
- Storage Compartments
- Tinted Glass
- Transmission Gear Indicator
- VIMS Message Center with Advisor
- Window, Operator, Electric Powered
- Windshield, Wiper Intermittent Control and Washer

POWER TRAIN

- Cat C175-16 Tier 2 Emissions Compliant Engine
  - Air Cleaner with Precleaner (4)
  - Air-to-Air Aftercooler (ATAAC)
  - Automatic Starter Protection
  - Ether Starting Aid (automatic)
  - Multi-Point Oil Pressure Sensing
  - Turbocharging (4)/Aftercooled
- Braking System
  - Automatic Retarder Control, Adjustable
  - Brake Release Motor (towing)
  - Engine Overspeed Protection
  - Extended Life Brake Disc Material
  - Oil-cooled, Multi-disc (front and rear)
    - Service, Retarding, Parking, Secondary
  - Park Brake Integrated with Gear Selector
  - Secondary, Emergency
- Transmission
  - 6-speed, Automatic Powershift with Electronic Control (ECPC)
  - Body-up Reverse Neutralizer
  - Body-up Shift Inhibitor
  - Controlled Throttle Shifting
  - Directional Shift Management
  - Downshift/Reverse Shift Inhibitor
  - Individual Clutch Modulation
  - Lock-up Torque Converter
  - Neutral Coast Inhibitor
  - Neutral Start Switch
  - Programmable Top Speed
- Pre-lubrication/Engine
- Rear Axle Continuous Lubrication/ Filtration

OTHER STANDARD EQUIPMENT

- Automatic Lubrication System
- Aux "Buddy" Dumping Quick Connect
- Aux Steering Quick Connect (towing)
- Driveline Guard
- Fast Fill Fuel System
- Fuel Filter with Water Separator
- Ground Level Battery Lockout
- Ground Level Engine Shut-down
- Ground Level Engine Start Lockout
- Ground Level Transmission Lockout
- Ground Level VIMS Data Port
- Hi-speed Crankcase Oil Change
- Hydraulic Filters, 1,000 hour
- Reservoirs (3 separate)
  - Brake/Hoist, Steering/Fan, Transmission/Converter
- Rock Ejectors
- Service Points, Ground Level
- Sight Level Gauges for Hydraulic/ Engine Oil
- S·O·S Sample Ports
- Supplemental Steering (automatic)
- Tie Down Eyes
- Tow Hooks (front)/Tow Pin (rear)
- Traction Control System
- Vandalism Protection Locks
- Vital Information Management System (VIMS)
  - Includes VIMS Payload Monitor with MAX Payload and Speed Manager
    - Recommend using download cable 127-9797 and PC based software JERD2175. Supplemental software "VIMS Supervisor" YERA1403. Order separately. Computer not provided.

ANTIFREEZE

- Extended Life Coolant to –35° C (–30° F)

Optional Equipment

Optional equipment may vary. Consult your Cat dealer for details.

- Additional Lighting
- Additional Retarding for Downhill Hauls
- Body Heat
- Cat Comfort Air Suspension Trainer Seat
- Antifreeze/Coolant Protects to –50° C (–58° F)
- Brake Wear Indicator Gauge
- Cabin Air Precleaner
- Center Tow Bumper Attachment
- Electric Powered Window, Right Side
- Electric Starting System
- Engine Coolant and Oil Heater for Cold Weather Starts
- Engine Delay Shutdown Timer
- Extended Life Wheel Stations
- External Digital Payload Display
- External Heated Mirrors
- Fast Fill Service Center
- Fuel Tank (4920 L/1,300 gal)
- Cat Comfort Heated Operator Seat
- High Intensity Discharge (HID) Lighting (front and rear)
- Hub Odometer (km and miles)
- Portable Fire Extinguisher
- Rear Axle Lubrication Cooler
- Retractable Front Sun Visor
- Rim Guard
- Rims (813 mm/32 in)
- Road Analysis Control (RAC)
- SL-V Grease Injectors
- Throttle Lock
- Walkway and Handrail for Rear Cab Access
- Wheel Chocks
- Work Area Vision System (WAVS)

793F Mining Truck

For more complete information on Cat products, dealer services, and industry solutions, visit us on the web at **www.cat.com**

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