MEMORANDUM

MINERAL RESOURCES

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RE: **GHG Emission Estimate Calculations for Lamb Creek**

[1] Executive Summary

Summary of GHG emission attributable to diesel consumption can be found in the table below, along with emissions attributable to vegetation clearing. A table of total emissions from all sources combined is also provided. The emission estimates for diesel consumption has been categorised into three main sources:

- Power generation which supplies power to crushing facilities, non-process infrastructure (NPI) and camp
- Onsite Haulage which includes diesel consumption of all Heavy Mining Equipment (HME).
- Offsite Haulage which includes diesel consumption of all road train haulage from mine to port via private haul/access road and Great Northern Highway (GNH).

Key assumptions and estimation methodology will be explained in the subsequent sections of this memo.

		FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Annual Average
Power Generation	Diesel (L)	1,219,639	3,814,156	3,801,276	3,874,300	1,960,316	2,933,937
	Tonne CO_2 eq	3,305	10,335	10,300	10,498	5,312	7,950
HME	Diesel (L)	5,063,644	11,204,548	10,734,524	9,807,675	4,917,780	8,345,634
	Tonne CO_2 eq	13,762	30,452	29,175	26,656	13,366	22,682
Offsite Haulage (Scope 3)	Diesel (L)	12,780,059	58,741,675	58,836,395	60,404,164	31,193,578	44,391,174
	Tonne CO_2 eq	34,734	159,650	159,907	164,168	84,779	120,647
Total (diesel consumption source)	Diesel (L)	19,063,342	73,760,378	73,372,195	74,086,140	38,071,674	55,670,746
	Tonne CO_2 eq	**51,801**	**200,437**	**199,382**	**201,322**	**103,456**	**151,280**
Vegetation Clearing (diesel use+lost carbon sink)	Tonne CO_2 eq	28,998	20,299	8,699	--	--	19,332 (FY 2023 to FY 2025 only)
Vegetation Clearing (Scope 3)	Tonne CO_2 eq	27	19	8	--	--	18 (FY 2023 to FY 2025 only)
Total (vegetation clearing source)	Tonne CO_2 eq	**29,025**	**20,318**	**8,707**	--	--	**19,350** (FY 2023 to FY 2025 only)

		FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Annual Average
Total GHG Emissions – all sources	Tonne CO_2 eq	**80,826**	**220,755**	**208,089**	**201,322**	**103,456**	**170,630**

[2] Mine Plan

Mine plan was used as basis to calculate the diesel consumption of each emission source (power generation, heavy mining equipment & road haulage). GHG emission from each source is proportional to the key metrics summarised in the table below.

	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
Total Expit [wmt]	8,303,480	17,304,187	13,612,917	11,681,810	5,113,115
Total Crusher Feed [wmt]	2,251,367	8,012,376	7,998,726	8,211,719	3,859,074
Haulage [wmt]	1,777,129	8,191,566	8,177,612	8,395,368	4,378,520
Manning [pax]	104	113	111	109	82

[3] Power Generation (Diesel)

- Manning/Camp
  An average load of 1.5kW per pax was used based on operating experience/data of other MLR's site.

- Non-Process Infrastructure
  An average load of 150kW was used based on operating experience/data of other MLR's site with similar capacity as Lamb Creek.

- Crushing
  An average energy consumption of 1.4kWh/tonne was used based on operating experience/data of other MLR's site with similar crushing facility as Lamb Creek.

- Heat rate
  All facilities at Lamb Creek will be powered by diesel generators. Generator's heat rate and diesel energy content used for diesel consumption calculation are 10,500 kJ/kWh (conservative) and 38.6GJ/kL respectively.

[4] Heavy Mining Equipment

Fleet's unit for onsite loading, hauling and ancillary was determined based on amount of material to be moved on site.

Diesel consumption of each unit was calculated based on its operating hours and fuel consumption rate from plant and operating data.

[5] Road Haulage

Crushed products from Lamb Creek will be hauled to Port Hedland (Utah Point) via road train. The first 16 km (mine to GNH intersection) on a private access/haul road, then 320 km on the GNH to the Utah Point berths.

Number of trips required was estimated based on 120 tonnes per trip.

An average round trip fuel consumption of 26,216 L per month per road train was used based on operating experience/data of other MRL's site with similar distance to port.

Offsite haulage to port will be an outsourced service and its emissions should be considered as Scope 3. The battery limits for the Lamb Creek Project approvals are the intersection of the private access/haul road with the GNH. The proportion of road train GHG emissions attributable to use of the access/haul road (16 km) versus haulage on the GNH is provided in the table below.

		FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Annual Average
Offsite Haulage - Mine to GNH Intersection (Scope 3)	Diesel (L)	608,574	2,797,223	2,801,733	2,876,389	1,485,408	2,113,865
	Tonne CO_2 eq	1,654	7,602	7,615	7,818	4,037	5,745
Offsite Haulage - GNH Intersection to port (Scope 3)	Diesel (L)	12,171,485	55,944,452	56,034,662	57,527,775	29,708,170	31,193,578
	Tonne CO_2 eq	33,080	152,048	152,292	156,350	80,742	114,902
Total Offsite Haulage (Scope 3)	Diesel (L)	12,780,059	58,741,675	58,836,395	60,404,164	31,193,578	44,391,174
	Tonne CO_2 eq	34,734	159,650	159,907	164,168	84,779	120,648

[6] Emission Factor

Emission factors used in the calculation above were taken from National Greenhouse Accounts Factors 2021 (Table 3 and Table 4).

https://www.industry.gov.au/sites/default/files/August%202021/document/national-greenhouse-accounts-factors-2021.pdf

Emission factor was converted from kG CO_2-e/GJ to kG CO_2-e/L of diesel before being used in the calculation. Emission factor used for both power generation and haulage are 2.71 kg CO_2-e/L.

Fuel combusted	Purposes	Energy content GJ/kL	Emission factor (CO_2 + CH_4 +N_2O) kG CO_2-e/GJ	Emission factor (CO_2 + CH_4 +N_2O) kG CO_2-e/L
Diesel oil	Stationary energy	38.6	70.2	2.70972
Diesel oil	Transport energy	38.6	70.41	2.717826

[7] Vegetation Clearing and Loss of Sequestration Potential

Lamb Creek Project – GHG Emissions Estimates for Vegetation Clearing and Loss of Sequestration Potential

GHG emission estimates attributable to vegetation clearing activities for the Lamb Creek Project have been derived following the methodology used by Main Roads WA, as outlined in *Greenhouse Gas Assessment Workbook for Road Projects* (Carbon Gauge Workbook 2013). This methodology accounts for GHG emissions from the physical activity of clearing the vegetation (equipment fuel consumption) as well as the loss of future carbon sequestration by the vegetation removed. Standard default factors are used for equipment fuel consumption (vegetation clearing) as well as standard default factors for sequestration loss varying by broad vegetation classes. GHG emission estimates using the Carbon Gauge Workbook are provided in carbon dioxide equivalents (CO_2e). This methodology is considered to provide a conservative estimate (Carbon Gauge 2013).

For the Lamb Creek Project, the Carbon Gauge workbook was only used to estimate the GHG emissions for the clearing of vegetation and not any other subsequent or related operational activities (e.g. mining, processing, camp) as GHG estimates for these activities have been estimated by other means as described elsewhere in this report.

Key inputs, assumptions and reporting rationale used for estimating vegetation clearing GHG contributions with the Carbon Gauge worksheet are:

- Total proposed vegetation clearing (seeking approval under Part IV, EP Act) over life of mine (LOM) = 646 hectares
- GHG estimate calculated based on total vegetation area cleared over LOM, with emissions spread over the LOM to reflect progressive nature of clearing as follows:
    - 50% year 1 (FY23)
    - 35% year 2 (FY24)
    - 15% year 3 (FY25)
- Only diesel fuel used for vegetation clearing equipment (light vehicles, heavy equipment)
- Maximum Potential Biomass Class (Appendix A, Carbon Gauge 2013) = Class 1: 0 – 50 tonnes dry matter/ha
- Carbon Gauge Vegetation Classes to be cleared at Lamb Creek Project (classes selected based on 2020-2021 flora/vegetation surveys conducted for MRL):

Vegetation Class (Carbon Gauge)	Hectares
D – (Open Woodland)	387
F - (Mallee & Acacia woodlands)	249
I – (Grasslands)	10

- Estimate includes allowance for site vehicles (light vehicles) and temporary on-site office (as per Carbon Gauge default factors) for clearing over a nominal (cumulative) 6 months
- Estimate prepared for vegetation clearing as a standalone activity as GHG emissions from other activities at Lamb Creek have been included in other estimates

A summary of the GHG estimates for vegetation clearing as derived using the Carbon Gauge worksheet is provided below:

GHG emission by source	Scope 1 (tonnes CO_2e)	Scope 3 (tonnes CO_2e)	Total (tonnes CO_2e)
Fuel combustion - site vehicles	10	1	11

Fuel combustion – vegetation removal	693	53	746
Vegetation removal – lost carbon sink	57,294		57,293
Total	57,996	54	**58,050**

GHG emission estimate (for vegetation clearing) by calendar year of Lamb Creek Project:

GHG Emissions (tonnes CO_2e)	Year 1 (FY 2023)	Year 2 (FY 2024)	Year 3 (FY 2025)
Scope 1	28,998	20,299	8,699
Scope 3	27	19	8
Total	**29,025**	**20,318**	**8,707**

References:

Carbon Gauge Workbook 2013 - *Gree*nhouse Gas Assessment Workbook for Road Projects, Transport Authorities Greenhouse Group, February 2013.

National Greenhouse Accounts Factors – Australian National Greenhouse Accounts, August 2021 https://www.industry.gov.au/sites/default/files/August%202021/document/national-greenhouse-accounts-factors-2021.pdf