

Memorandum

Date 27 January 2023
To Western Ridge Study team
From Environmental Approvals
Subject Methodology for estimating GHG emissions – Western Ridge

Purpose

The purpose of this memo is to provide a brief summary of the Greenhouse Gas (GHG) emissions forecast and the associated methodology for the Western Ridge Proposal (the Proposal).

Executive Summary (Context)

WAIO's GHG emissions are regulated by the EPA on a proposal basis. The EPA and WA State Government have established Guidelines on the assessment of GHG emissions. GHG emissions from a proposal will be assessed where Scope 1 emissions exceed 100,000 tCO₂-e per year.

The submission of the Western Ridge GHG Management Plan (GHGMP) for the Proposal is due in January 2023. The projected Proposal GHG forecast is a key input into this plan and informs WAIO's commitment to GHG emissions reduction targets in line with the Western Australian Government's aspiration of net zero emissions by 2050.

The purpose of this GHGMP is to minimise the risk of environmental harm associated with climate change and its objective is to manage GHG emissions from the Proposal and is intended to satisfy the requirements for an Environmental Management Plan and GHG Management Plan under Strategic Proposal MS1105. It has been prepared with due consideration of the Western Australian Government's Greenhouse Gas Policy for Major Projects and the Western Australian Environmental Protection Agency's (EPA) *Environmental Factor Guideline: Greenhouse Gas Emissions 2020*.

Greenhouse Gas Forecasting Methodology

Two ore transportation scenarios have been considered in planning the Proposal:

1. The 'Trucking Ore' scenario assumes that ore is transported by truck from all four deposits within the Development Envelope to the existing Mt Whaleback hub for processing, consistent with current operations.
2. The 'Conveying and Trucking Ore' scenario involves use of an overland conveyor to transport ore from Mount Helen and Silver Knight deposits to Mt Whaleback hub, while ore from the closer deposits of Eastern Syncline and Bill's Hill is transported by truck to the Mt Whaleback hub. Ore from Mount Helen and Silver Knight deposits would undergo primary crushing at a purpose-built 30 Mtpa primary crusher within the Development Envelope, prior to being transported by the overland conveyor for further secondary processing at Mt Whaleback hub.

The 'Conveying and Trucking Ore' scenario is the preferred option and has been selected for implementation. The Proposal's Scope 1 GHG emissions were forecasted utilising methods established and in use in WAIO's Business Plans (e.g. Life of Asset (LoA) cycle, Two Year Budget (2YB) and Five Year Planning (5YP)). The Proposal's GHG forecast determines GHG emissions from the underlying mine plan, which forecasts production (including Total Productive Movement which includes waste rock and ore; and Ore for Rail), and the energy associated with these plans (diesel & Scope 2 electricity-use). Figure 1 presents an overview of the inputs and processes used to estimate emissions.

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Versions

BHP engaged Environmental Technologies and Analytics (ETA) to conduct initial GHG emissions modelling which was presented in the report *Western Ridge GHG Emissions Inventory* (ETA 2021). The scope of the study can be identified within the Appendix A of the GHGMP. BHP subsequently identified that additional work was required to verify and update the GHG emissions modelling due to amendments to the mine plan. BHP included modelling for both scenarios within the GHGMP to enable fair comparison between the two scenarios. Methodology and scope remained the same across both iterations of the GHG emissions model.

Inputs & Assumptions

Diesel (97.6% Scope 1 emissions from Conveying and Trucking ore scenario – used to inform GHG target)

Diesel consumption for haul trucks and other mining equipment, including dewatering and ancillary equipment, were derived from finance utilisation calculations, availability, rate and fuel consumption records for Newman Operations in FY2022.

Other consumers of diesel, including dewatering, have been considered and compared to estimates used in WAIO's 5-Year Plan in conjunction with project specific assumptions from relevant Subject Matter Experts (SMEs).

Oils & Greases (0.003% scope 1 emissions from Conveying and Trucking ore scenario – used to inform GHG target)

Minor sources of emissions have been estimated and proportioned from recently reported NGERs values for WAIO facilities against production associated with the project.

Land Clearing (0.02% Scope 1 emissions from Conveying and Trucking ore scenario – used to inform GHG target)

The *National Greenhouse and Energy Reporting (NGER) Act 2007* does not provide a calculation methodology for GHG emissions associated with land clearing. Estimates in the Proposal GHGMP have been derived from the Full Carbon Accounting Model (FullCAM), consistent with the National Inventory reporting used by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) to determine land use, land use change and forestry (LULUCF) emissions.

Clearing is assumed to be progressive throughout life of the Proposal, with clearing of up to 4,281 ha. The indicative clearing schedule predicts that half of the clearing will occur in the first three years, with the remainder of clearing occurring throughout life of mine. Vegetation within the Indicative Footprint is predominantly Acacia shrubland and Hummock Grassland; however, Hummock grassland is not defined in the FullCAM database, so all vegetation was assumed to be Acacia shrubland for the purposes of emissions modelling.

Electricity Generation (100% Scope 2 emissions from Conveying and Trucking ore scenario – GHGMP context only, not used in targets)

The load forecast for the Proposal, assumes commissioning of a primary crusher and conveyor in FY25, with first ore later in the same year. Electricity consumption is based on the maximum power demand of this infrastructure, which supports a maximum production rate of 30 Mtpa, scaled to annual production from Silver Knight and Mount Helen orebodies.

The GHG emissions forecast representative of electricity from further processing of ore from Mount Helen and Silver Knight deposits outside the Development Envelope at the Mt Whaleback hub to form the final product is included within this GHGMP. This informs a holistic overview of both scenarios but is considered exclusive of the Proposal and net emissions forecast. The load forecast for the Trucking Ore scenario, which assumes all processing activities will occur at existing infrastructure within Mt Whaleback hub, has been gathered from previously reported activity and subsequent rates within the hub.

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Electricity for the Proposal will be supplied by the existing Yarnima Power Station, a natural gas fired power generation plant that supplies power to BHP's iron ore operations within the Pilbara region and operated in accordance with the Part V Environmental Licence L8803/2015/1. Future short and long-term decarbonisation projects associated with inland electricity generation are not factored into estimates.

Emissions factors utilised for modelling all parameters above have been sourced from the NGER Measurement Determination 2008, Compilation #13 as released on 1 July 2021.

Estimated GHG Emissions

The Conveying and Trucking Ore scenario is predicted to result in the avoidance of 513,059 tCO₂-e of Scope 1 emissions, representing a 14% reduction over the life of mine when compared to the Trucking Ore Scenario. Both options are summarised in detail in Table 1 below. **Error! Reference source not found.**

Table 1 Summary of estimated GHG emissions (tCO₂-e/annum) for the Conveying and Trucking Ore scenario and Trucking Ore scenario

Emissions estimate	Scope 1 emissions tCO ₂ -e		Scope 2 emissions tCO ₂ -e	
	Conveying and Trucking ore	Trucking Ore	Conveying and Trucking ore	Trucking Ore
Maximum annual emissions	263,715	317,096	41,765 (59,370)	N/A (71,833)
Total emissions over life of Proposal	3,195,293	3,708,352	362,279 (652,050)	N/A (793,980)
Average annual emissions ¹	138,926	161,233	15,751 (28,350)	N/A (34,521)

¹ Emissions estimates used information current as at June 2022.

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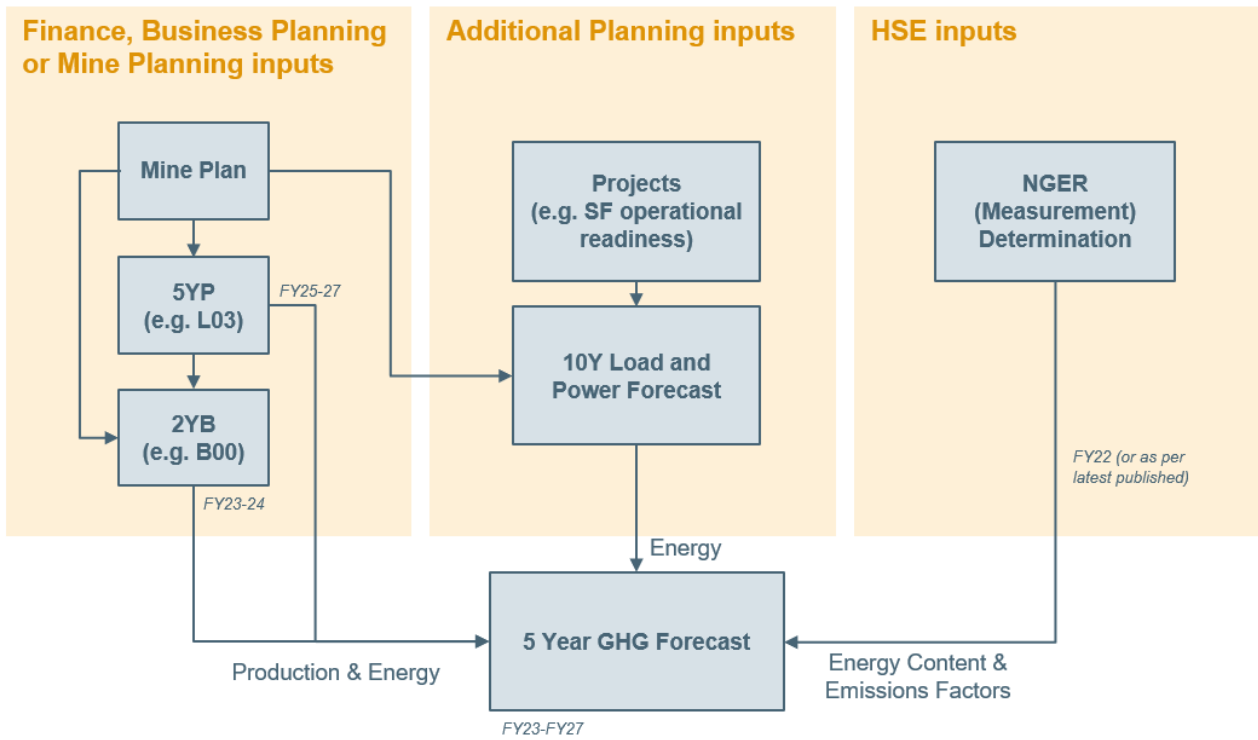


Figure 1 GHG Emissions Forecasting