

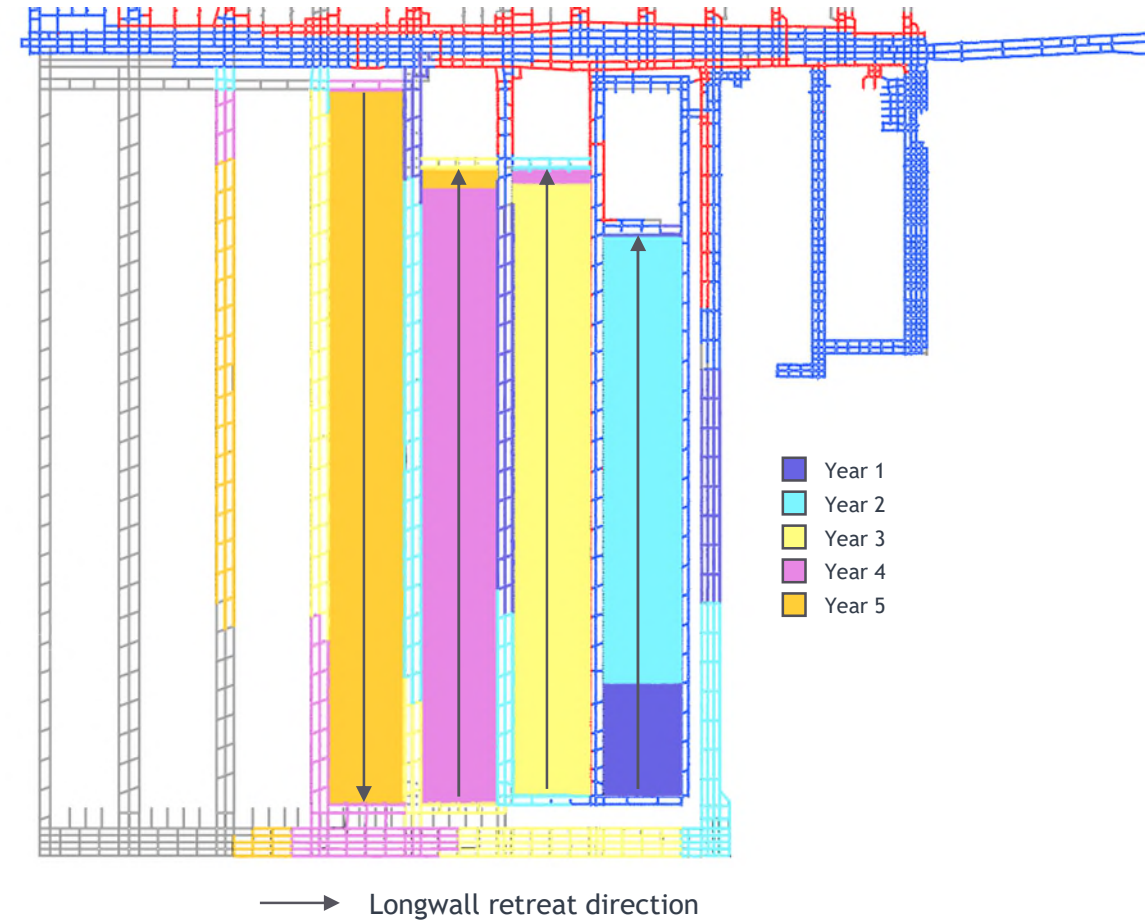


Gas Emission Review for Longwall 203 to Longwall 206

Narrabri Coal

Background

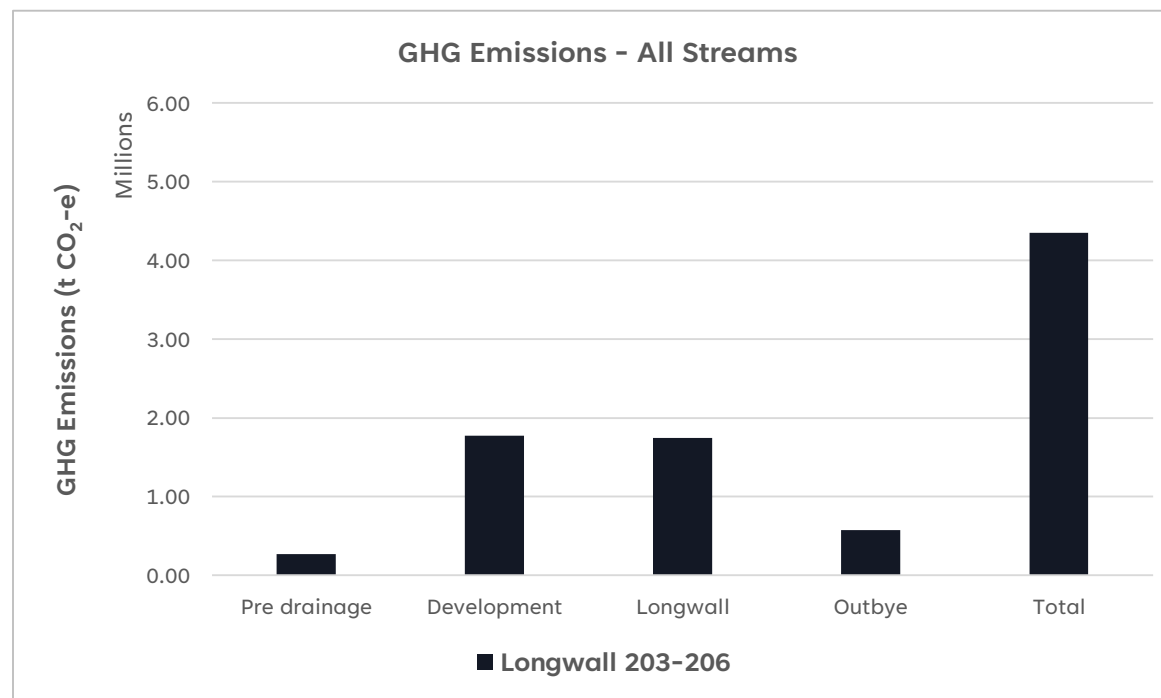
- // As part of approval for the extraction plan for Longwall 203 to 206 under the stage 2 project approval requires an assessment of greenhouse gas (GHG) emissions for these panels
- // Gap analysis for the extraction of the initial 4 longwall panels in Stage 2 area completed:
 - // Longwall 203 to 206 Stage 2 mining schedule
 - // Covers approximately 5 years of mining
 - // GHG emission profiles in the 5 year period commencing in the financial year when Longwall 203 is mined
- // GHG emission calculation was completed for the following emission streams:
 - // Gas pre-drainage stream
 - // Development mining stream
 - // Longwall mining stream
 - // Outbye sealed areas stream
- // The following streams were excluded:
 - // 100 series longwall panels
 - // Post-mining emissions



Findings - GHG Emissions

// Total gas volumes and calculated emissions arising from the extraction of Longwall 203 to 206 are as follows:

Metric	Longwall 203 - 206
Gas pre-drainage stream (t CO ₂ -e)	267,314
Development stream (t CO ₂ -e)	1,772,287
Longwall stream (t CO ₂ -e)	1,742,211
Outbye stream (t CO ₂ -e)	570,427
Total (t CO₂-e)	4,352,239





Emissions Calculations

Gas Emission Sources

- // GHG emission produced from mining the Hoskissons (HSK) Seam were estimated for the period covering the extraction of Longwall 203-206

- // GHG emission forecasts have been calculated based on and underpinned by:
 - // Gas reservoir and emission modelling project WHC5175 completed by Palaris in 2019
 - // GHG emission forecast project WHC5824 completed by Palaris in 2021

- // Emission sources identified include:
 - // Gas pre-drainage stream
 - // Development mining stream
 - // Longwall mining stream
 - // Outbye sealed areas stream

- // GWP for methane (CH₄) of 28 was used

GHG Calculation Assumptions

// Gas drainage:

- // Pre-drainage of the Hoskissons (HSK) Seam only (working seam)
- // Pre-drainage of longwall blocks only (not gateroad)
- // Pre drainage where virgin gas contents $>3.5 \text{ m}^3/\text{t}$ to a remaining content of $3.5 \text{ m}^3/\text{t}$
- // Gas flared where CH_4 composition $>30\%$

// Development

- // Rib emission models developed as part of WHC5175 project used to estimate development emissions
 - // Models were established using SimedWin gas reservoir simulator and a permeability of 10mD
- // Allowance made for standing panels

// Longwall

- // LW emission models for 11 gas zones developed as part of WHC5175 project were used to estimate longwall emissions
- // Post drainage gas capture not abated (historical oxygen content in post-drainage gas $>10\%$, trip level on flares is 6%)

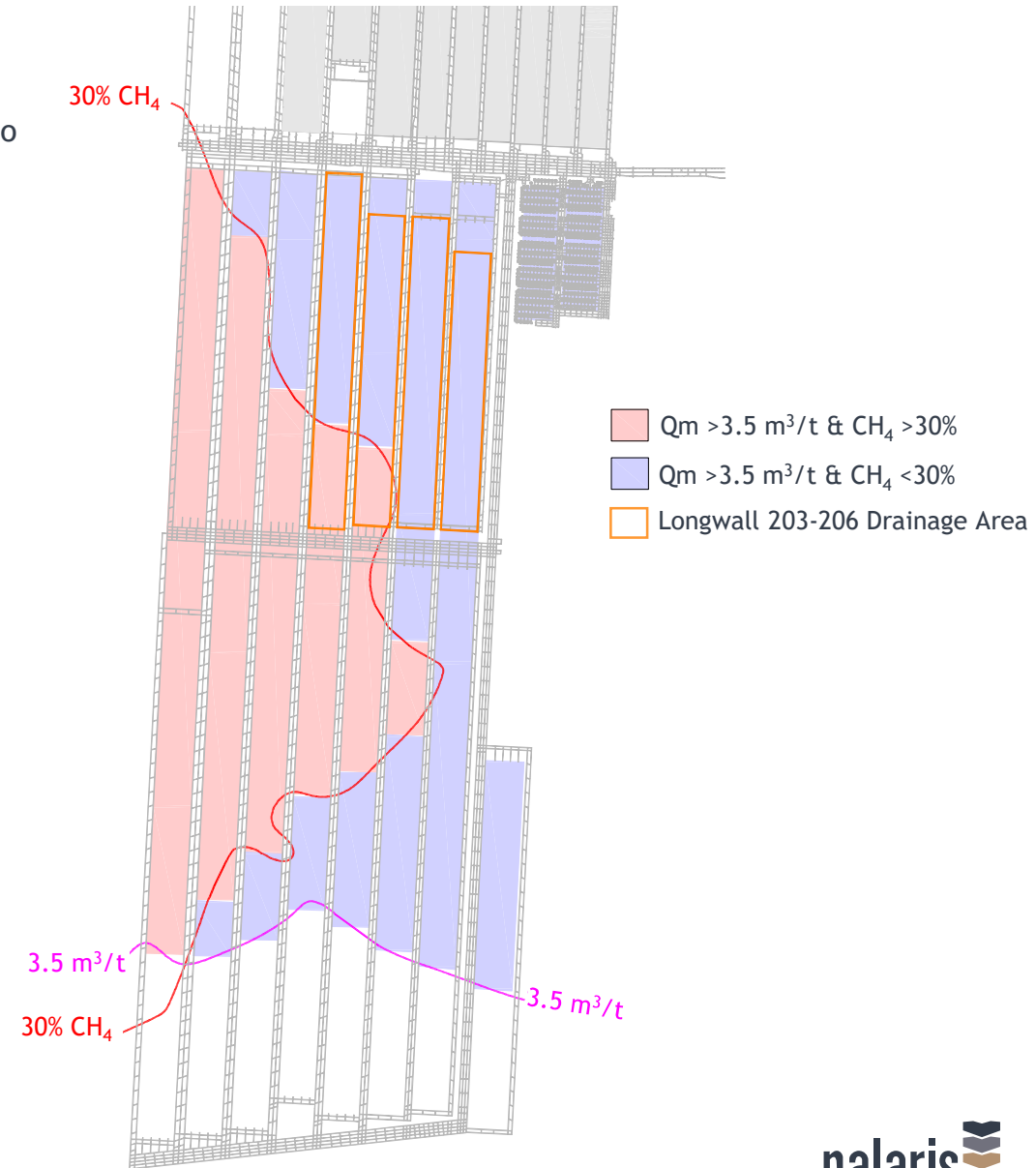
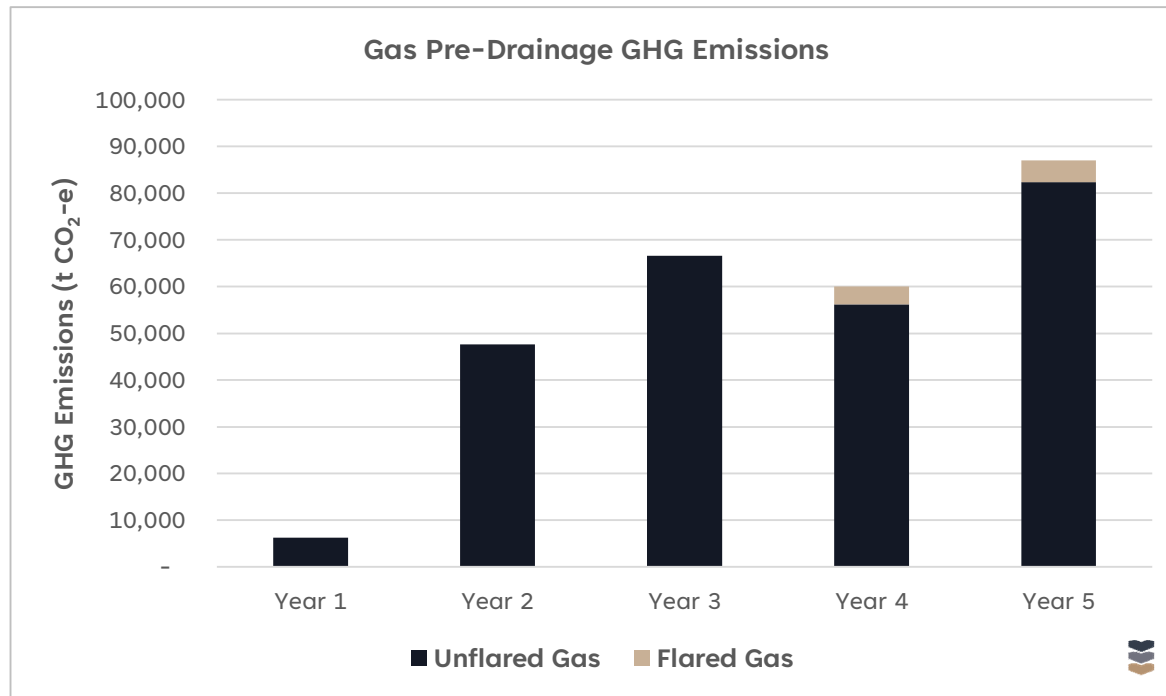
// Outbye

- // Outbye emissions are not historically assessed
- // Can account for up to 50-60% of total emissions (depending on adjacent seams)
- // Due to few overlying/underlying coal seams across most of the mining area and seam gas composition in Narrabri North being predominately CO_2 , it is unlikely that GHG emissions from outbye sealed areas will ever be in the order of 50%, rather more likely in the range of ~10-30% of the total GHG estimate
- // Outbye emissions of 25% of total longwall emissions was used

Pre-Drainage Stream

- // GHG emissions were calculated using Method 4 for unflared and Method 2 for flared
- // Southern end of Longwall 205 and 206 exhibit the gas conditions that have potential to undertake flaring based on currently available technology

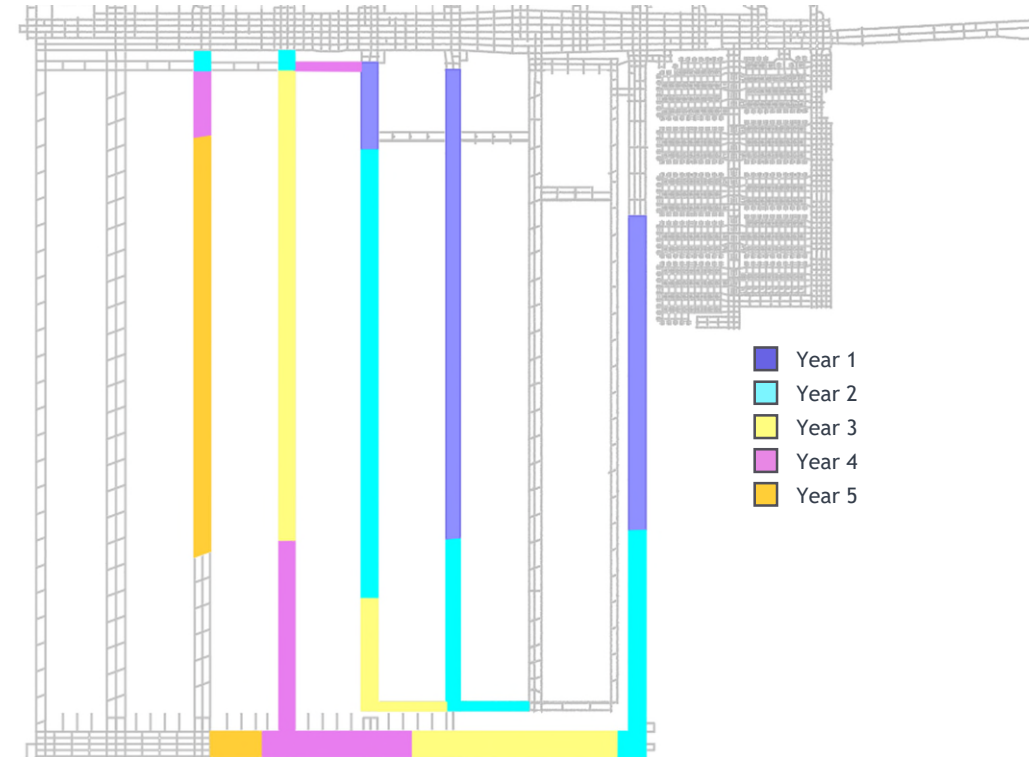
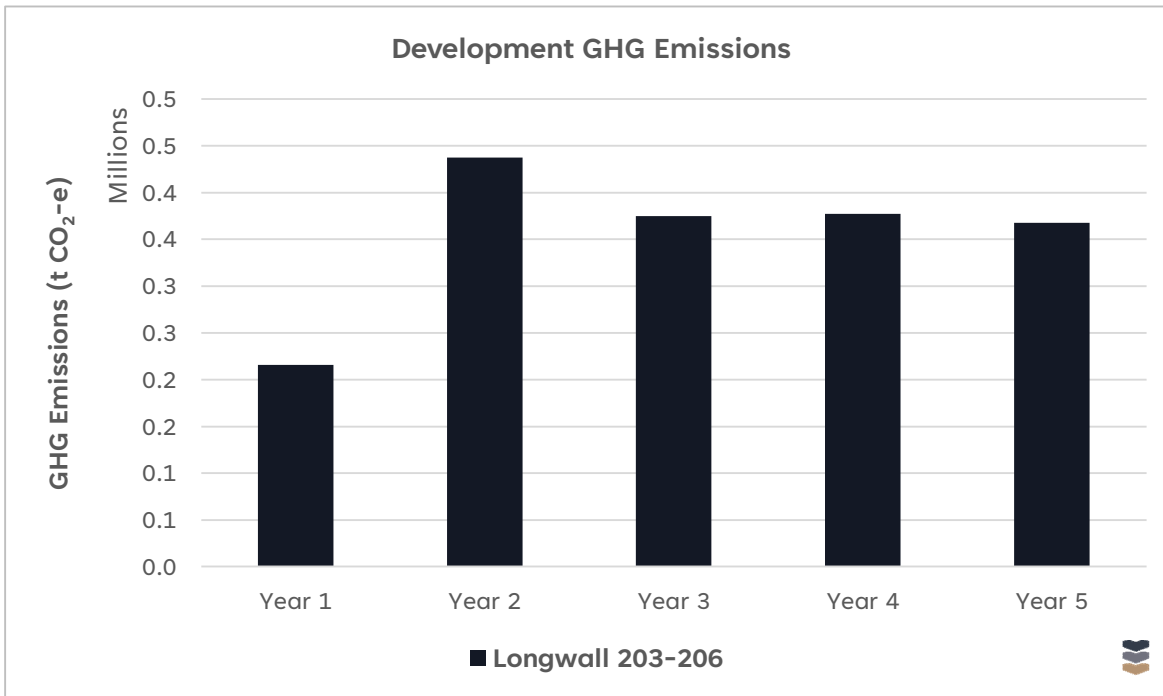
Metric	Longwall 203-206
Total volume CO ₂ (m ³)	50,746,678
Total volume CH ₄ unable to be flared (m ³)	8,959,842
Total volume CH ₄ able to be flared (m ³)	1,469,869
Flared case emissions (t CO ₂ -e)	267,314



Development Stream

// GHG emissions were calculated using Method 4

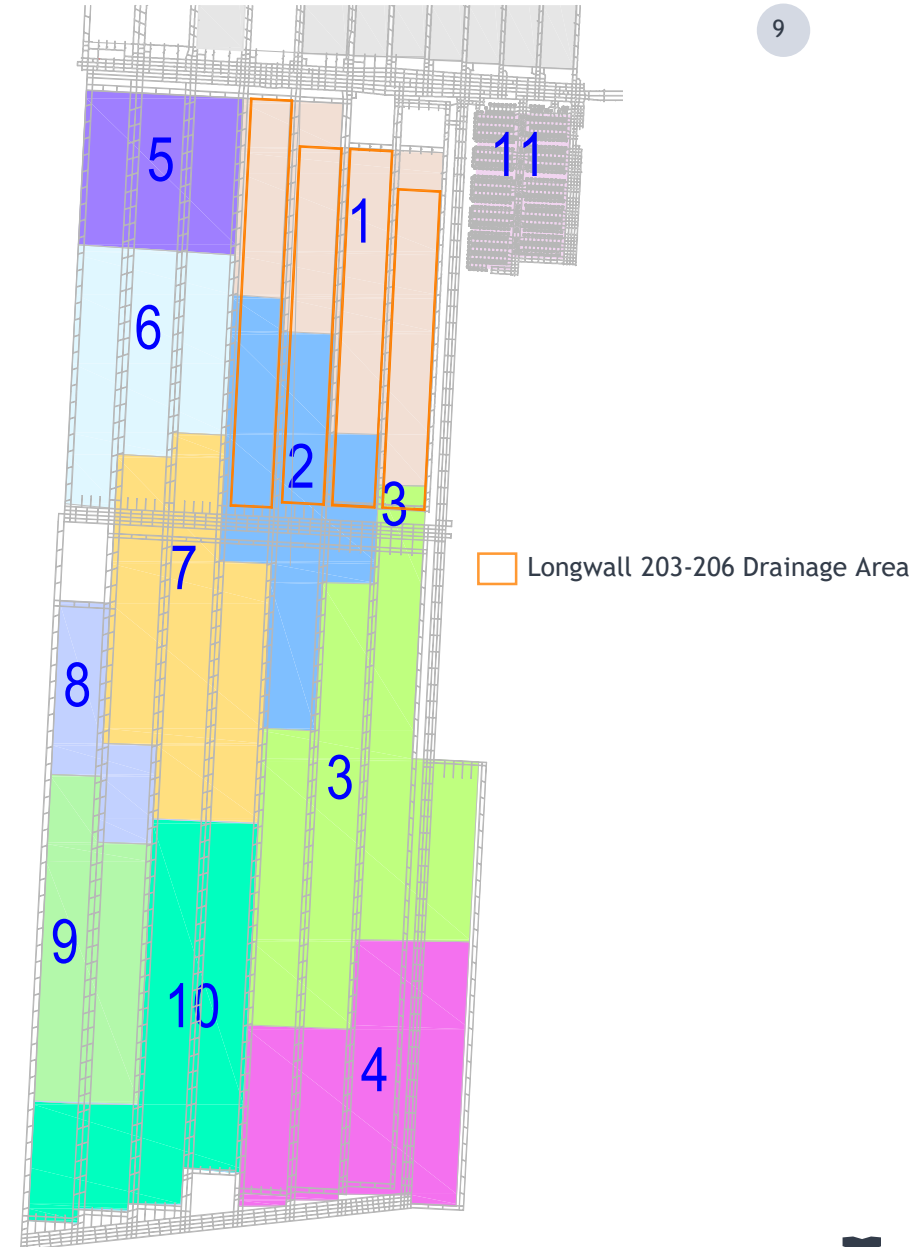
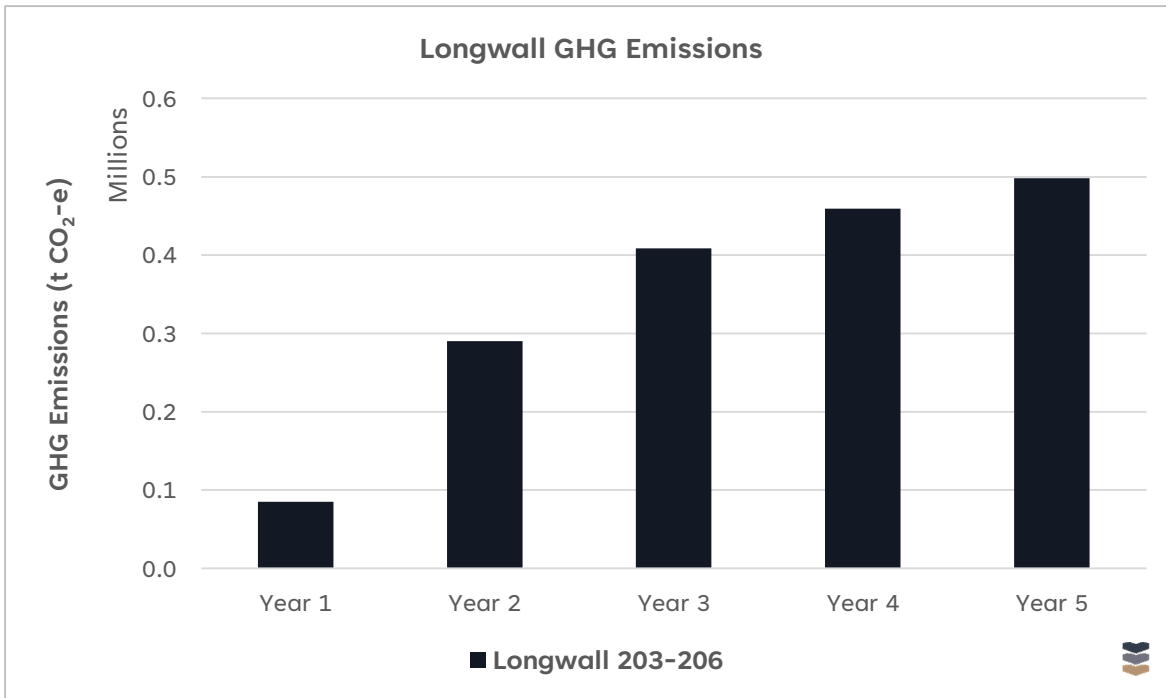
Metric	Longwall 203-206
Total volume CO ₂ (m ³)	113,813,424
Total volume CH ₄ (m ³)	82,151,280
Total emissions (t CO ₂ -e)	1,772,287



Longwall Stream

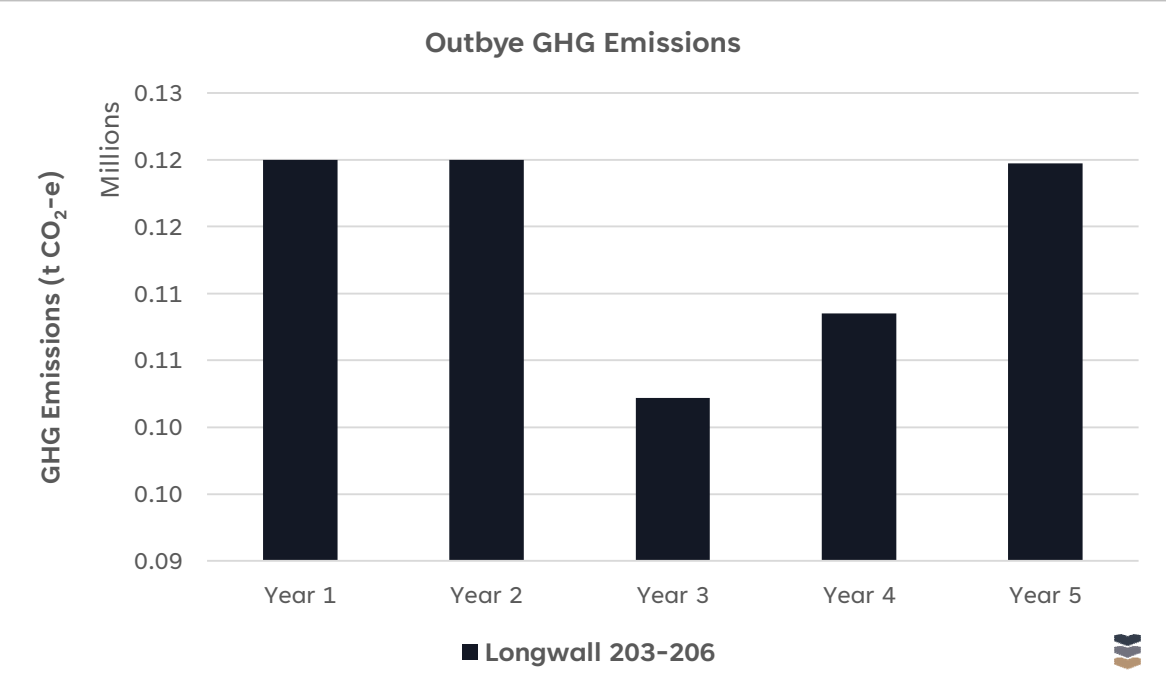
- // GHG emissions were calculated using Method 4
- // Longwall emission zones shown (1-11) from WHC5175

Metric	Longwall 203-206
Total volume CO ₂ (m ³)	267,625,553
Total volume CH ₄ (m ³)	65,498,631
Total emissions (t CO ₂ -e)	1,742,211



Outbye Stream

// Total outbye emissions for Longwall 203-206 are approximately 570,427 t CO₂-e





Decarbonisation

Decarbonisation Pathway

- // Narrabri Coal are currently working with Palaris to develop a Decarbonisation Pathway
 - // Includes assessment of GHG abatement opportunities for the longwall 203-206 mining area as well as the Narrabri mine in general
 - // Southern portion of longwall 205 and 206 exhibit gas conditions that have potential to undertake flaring based on currently available technology
- // This is a three phased approach developed to ensure that all abatement opportunities are identified and screened, with financial and technical analysis applied to prioritise the pathway, in order to implement the abatement projects selected to implement
- // Phase 1: Mapping the Carbon Footprint
 - // The first step is to map an operation's carbon footprint. Emission sources are categorised into 4 emission types (fugitive, mobile combustion, stationary combustion, and process) to develop a comprehensive emissions profile
 - // This phase is now complete
- // Phase 2: Identifying Abatement Opportunities
 - // The second phase in this process is to identify the abatement opportunities available to the Narrabri Coal Extension Stage 3 with recommendations as to which technologies are most suited to take forward to prioritisation
 - // This is through identifying and reviewing all significant abatement opportunities that can reduce scope 1 and 2 emissions, and evaluating these opportunities using an assessment framework
 - // Opportunities with viable emissions reduction potential are taken through to phase 3
- // Phase 3: Pathway Prioritisation
 - // Prioritisation is done via a Marginal Abatement Cost (MAC) Curve to quantify the emissions reduction potential of abatement opportunities
 - // This phase will detail the potential abatement projects for Narrabri Extension and will include estimates of associated costs (CAPEX and OPEX), and recommendations for a forward pathway



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