GHG ASSESSMENT – HOLTZE URBAN AREA

1.1 Boundary and methodology

Estimates of scope 1, scope 2, and relevant material scope 3 greenhouse gas (GHG) emissions are required to be provided in a Referral to the NT EPA under the Environmental Protection Act 2019 (the EP Act) as part of the Atmospheric Processes section and are also specified under the National Greenhouse and Energy Reporting (NGER) legislation. This section provides an estimate of scope 1 and scope 2 GHG emissions associated with land clearing, construction, and utilities work for the Holtze Urban Area Project. No relevant scope 3 emissions were identified.

The boundary for the GHG estimate is the land cleared for the Holtze land release, civil and construction works, and logistics associated with installing utilities and services. Key inputs to the GHG estimates are as follows:

- Land clearing for a subdivision – 102 ha of eucalyptus woodland
- Additional land clearing for enabling infrastructure (i.e water, sewer, power) – 24 ha (assume same vegetation type)
- Trenching and backfill works for utilities – 12,000 linear meters, 216,000 m3
- Drainage earth works – 12,000 m3
- Civil and earthworks for land development – 1,280,000 m3
- Construction of sub-arterial sealed roads – 2km length (20m width)

Vegetation clearing, and fuel consumption have been included in the GHG estimate. GHG emissions calculations are based on material emissions. The calculation methodology for each identified source of GHG emissions is detailed in Section 1.1.1.

No relevant or material scope 3 emissions were identified or included in the GHG estimate.

Change in Land Use Vegetation and Soil Carbon Emissions

The estimate utilises the Department of Industry Science Environment and Resources FullCAM model. The data inputs are summarised below and provided in full in Section 1.1.3.

It is noted that a total of approximately 126 ha of ground cover, grasses, shrubs and small trees will be cleared as part of the project.

The events modelled in FullCAM were:

Initial conditions – native forest

Clearing event for the establishment of housing development

Clearing 100% of forest cover modelled on a theoretical date of 1 Jan 2024

Initial clearing: no product recovery.

It was assumed that 100% of cleared material converted to CO2 via oxidation. All soil carbon breakdown are assumed to be via oxidation.

1.1.1 Calculation methodology

The calculation methodology used in this report aligns with the following legislation, regulations, standards and guidelines:

- ISO 14064 Greenhouse gases – Part 1: Specification with guidance at the organisation level for quantification and reporting of greenhouse gas GHG emissions and removals.
- GHG Protocol Corporate Accounting and Reporting Standard.
- National and Territory GHG Legislation, regulations & policy:
    - National Greenhouse and Energy Reporting Act 2007 (NGER Act).

- National Greenhouse and Energy Reporting Regulations 2008.
- National Greenhouse and Energy Reporting (Measurement) Determination 2008.
- Greenhouse Gas Emissions Management for New and Expanding Large Emitters Policy.

- Full Carbon Accounting Model (FullCAM)

The method for calculating emission followed the following steps:

1. Establish a boundary for the GHG estimate.
2. Conduct a carbon calculation input scoping exercise to define sources within the boundaries of the estimate:
    a. Defined the activities contributing to GHG emissions occurring within each aspect of the Project.
    b. Define the required input data to calculate an estimate of GHG emissions from each activity or aspect.
    c. Identify the source of the input data.
3. Source the input data and determine appropriate assumptions where data gaps or a lack of definition existed.
4. Construct a calculation based on the inputs and assumptions sourced.

The specific methodologies applied are outlined in the sections below.

The FullCAM model utilised the Forest System including minerals with tree yield formula.

The simulation was set to run from 1/1000 to 1/3000 with monthly simulations with model output recorded annually. FullCAM models land use change over 1000 years to reduce variability in carbon sequestration before land use changes take place and to then include the life of the project including decommissioning.

The modelled location was averaged over a 100ha block located at (lat/long) -12.4751978 131.0066316 with original vegetation assumed to be *native species regeneration.*

1.1.2 Emissions from Fuel Use

The emissions calculation methodology of carbon dioxide, methane and nitrous oxide from the combustion of diesel is taken from Section 2.20 of *National Greenhouse and Energy Reporting (Measurement) Determination 2008.*

$$E_{ij} = (Q_i \times EF_{ijoxec}) / 1000$$

Where:

- E_{ij} is the emissions of gas type (j), being carbon dioxide, methane or nitrous oxide, from each fuel type (i) released from the combustion of the product measured in CO_2-e tonnes.
- Q_i is the quantity of product (i) combusted measured in gigajoules.
- EF_{ijoxec} is the emission factor for each gas type (j) released during the year (which includes the effect of an oxidation factor) measured in kilograms CO_2-e per gigajoule of fuel.

Table 1. Emissions factors for liquid fuels

Activity	Purpose	EF CO_2 $kgCO_2$-e/GJ	EF CH_4 $kgCO_2$-e/GJ	EF N_2O $kgCO_2$-e/GJ
Diesel oil consumption	Transport Fuel Emission	73.6	0.07	0.6

Note: All emission factors sourced from NGER (Measurement) Determination 2008, Compilation 13, Schedule 1 Emissions Factor (Items 38, 54). See also assumptions for diesel EF

1.1.3 FullCAM inputs

The following inputs were utilised for the project GHG emissions calculations for areas cleared for the project.

FullCAM version 6.20.03.0827

- Location 12.469601 South 131.026468 E
- Point source model output per ha
- Forest System inc soil and minerals
- Tree yield formula
- Step, monthly, output over 12 steps, yrs Jan 1000 -Jan 3000
- Location as above, average over 1ha
- Forest Category - ERF Method
- Native Species Regeneration >500mm
- SA2=Howard Springs (71031)
- NPI region = Northern Territory
- Growth Region = 1
- Apply downloaded spatial data
- Water, temperature and productivity cycle table data across all time
- Max above ground biomass 86.4022 tdm/ha
- Point model output in t/ha
- 17.9815% soil that is clay by weight
- Forest thin, 100% site 1/1/2024
- Initial clearing: no product recovery
- Standard values used for all affected portions

1.2 GHG estimate results

The Holtze Urban Area GHG estimate provides a coarse quantification, to understand the nature and scale of GHG emissions to inform the referral under the *Northern Territory Environmental Protection Act 2019*. All numbers quoted below are estimates based off a prefeasibility level of detail and are in the order of +/- 50% definition. Due to the high level of design definition a 20% uplift has been added to all diesel fuel GHG emissions in line with good industry practice. The numbers below should be considered with this level of accuracy in mind. The accuracy of the estimate will increase as the project definition increases. It is recommended that as the project engineering design develops, the design and construction contractor incorporates a GHG estimate and considers opportunities to reduce emissions in their scope of work.

No material scope 2 or scope 3 emissions were identified for the project.

Scope 1 emissions for the construction and land release phase of the project are detailed in Table 1 and shown in Figure 1.

Total emissions including construction (1 year), land release (1000 years) are approximately 47,000 TCO_2-e. The detailed output of the estimate is included in Table 2.

Construction accounts for 7% of emissions, and land release 93% (Figure 1). The majority of emissions is the result of changes in land use with soil carbon and vegetation breaking down in an assumed oxidising manner, releasing ~38,000TCO_2-e over the life of the project (Table 2). As per the NT EPA guidelines, emissions thresholds caused by changes in land use (clearing vegetation and soil carbon loss) are calculated over the life of the project rather than annually. The other sources of emissions are from the burning of fuel for civil works, construction, logistics, and temporary power supply. As per the NT EPA guidelines, emissions thresholds caused by burning fuel are calculated annually rather than over the life of the project.

Overall project emissions are largely driven by vegetation and soil carbon loss emissions. Emissions peak at ~6,000 TCO_2-e/yr during the first year of operations, thereafter, GHG emission gradually reduce over the life of the project (Figure 2). These emissions peak in the first year of operations as soil carbon is lost after clearing

during construction. It is noted that approximately 100 years after initial construction of the Holtze Urban Area the soil carbon originally bound to the site has completely degraded and emission are in effect zero thereafter.

Table 2. Construction and land release GHG emissions by phase (total TCO_2-e)

	Scope 1	Scope 2	Scope 3	Total
Construction	3,000	-	-	3,000
Land Release	38,000	-	-	38,000
Total	41,000	-	-	41,000

Table 3. Construction and land release GHG emissions by activity

Source	TCO2e	% of Total
Civil and Construction	2, 440	6.0%
Logistics	31	0.1%
Temporary power	265	0.7%
Vegetation and soil carbon loss	37,827	93.3%
Total	40,563	100.0%

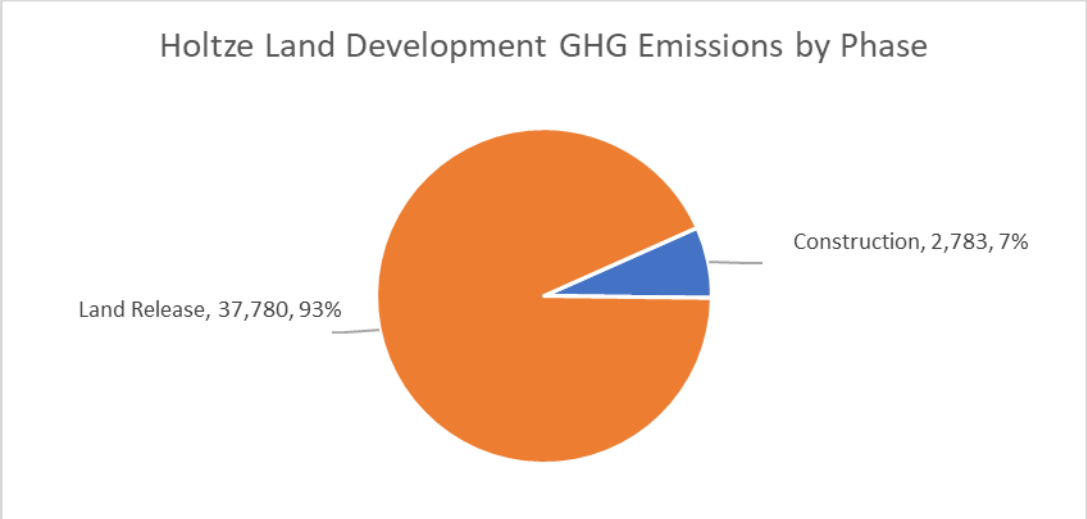

Figure 1. GHG emissions by phase (total TCO_2-e)

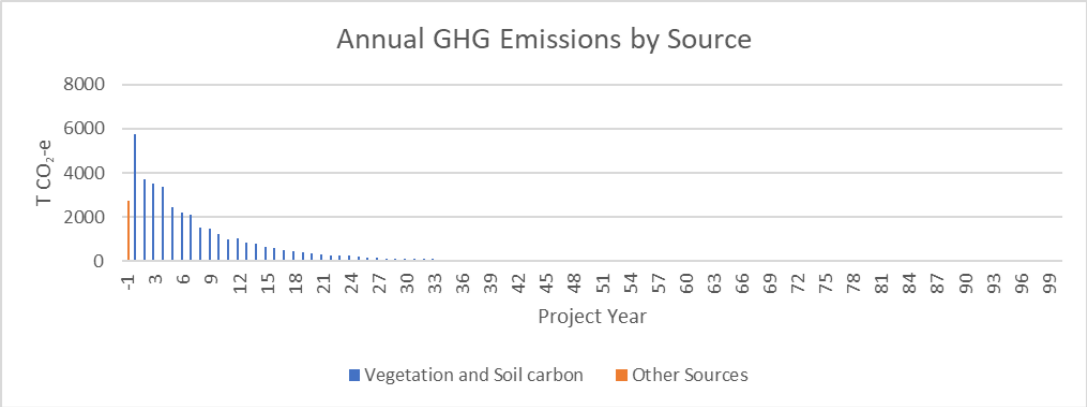

Figure 2. Annual GHG emissions by source

1.3 Impact assessment

The scope of this impact assessment is to estimate GHG emissions of the Holtze Urban Area project and review these emissions against the NT GHG policy and legislation. The below section describes the relevant requirements under the NT EP Act.

The NT EPA has incorporated the Northern Territory Government's net zero greenhouse gas emissions by 2050 target into the environmental objective for the NT EPA's Environmental Factor: Atmospheric Processes.

The NT EPA has released a draft Environmental factor guidance: Atmospheric processes, Greenhouse Gas Emissions. This policy and technical guidelines are currently in Draft and undergoing stakeholder consultation.

The draft guideline states that under the Environmental Factor: Atmospheric Processes a proponent is to refer a proposed action to the NT EPA if its emissions exceed:

- Industrial project threshold: Estimated scope 1 emissions of 100 000 T CO2e in any financial year over the life cycle of a project, not counting emissions generated from land clearing directly associated with the Project.
- Land use project threshold: Estimated scope 1 emissions of 500 000 T CO2e generated from a single land clearing action OR cumulatively from multiple land clearing actions on a 'property' over time.

The NT EPA proposes to adopt the thresholds as a guide to when a proposed action requires referral to the NT EPA for consideration under the EP Act

The Holtze Urban Area project does not trigger these thresholds and as such GHG is not a significant factor to consider in the referral.

This GHG Assessment was undertaken by Stacey Kopf, Senior Environmental Consultant - EcOz, with assistance from Steve Hart, Environmental Engineer - Current Environmental for the Holtze Urban Area Referral on 6 October 2022.