Government of Western Australia
Department of Water and Environmental Regulation

Works Approval

Works approval number	W6620/2021/1
Works approval holder	Renergi Pty Ltd
ACN	160 694 388
Registered business address	71 Brushwood Brook Drive YALLINGUP WA 6282
DWER file number	DER2021/000557/APP-0026224
Duration	21/03/2022 to 30/06/2026
Date of amendment	18/03/2025
Premises details	Collie Pyrolysis Plant Lot 500 Gibbs Road COLLIE WA 6225 Legal description – Part of Lot 500 on Plan 76826 As defined by the coordinates in Figure 1, Schedule 1

Prescribed premises category description (Schedule 1, Environmental Protection Regulations 1987)	**Assessed production capacity**
Category 37: Char manufacturing: premises on which wood, carbon material or coal is charred to produce a fuel or material of a carbonaceous nature or of enriched carbon content.	9,000 tonnes per year
Category 61A: Solid waste facility: premises (other than premises within category 67A) on which solid waste produced on other premises is stored, reprocessed, treated, or discharged onto land.	31,000 tonnes per year
Category 62: Solid waste depot: premises on which waste is stored or sorted, pending final disposal or re-use, other than in the course of operating: (a) a refund point (as defined in the Waste Avoidance and Resource Recovery Act 2007 section 47C(1)) (a refund point); or (b) a facility or other place (an aggregation point) for the aggregation of containers that have been returned to refund points until those containers are accepted for processing or disposal.	31,000 tonnes per year

This amended works approval is granted to the works approval holder, subject to the attached conditions, on 18 March 2025, by:

Amine Fisher

Digitally signed by Amine Fisher
Date: 2025.03.18 12:43:16 +08'00'

Amine Fisher
MANAGER, PROCESS INDUSTRIES
STATEWIDE DELIVERY (ENVIRONMENT)

an officer delegated under section 20 of the Environmental Protection Act 1986 (WA)

Works approval history

Date	Ref number	Summary of changes
18/03/2022	W6620/2021/1	Works approval granted
05/10/2023	W6620/2021/1	Amendment to extend duration
18/03/2025	W6620/2021/1	Amendment to extend duration by 12-months

Interpretation

In this works approval:

(a) the words 'including', 'includes' and 'include' in conditions mean 'including but not limited to', and similar, as appropriate;

(b) where any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding meaning;

(c) where tables are used in a condition, each row in a table constitutes a separate condition;

(d) any reference to an Australian or other standard, guideline or code of practice in this works approval:

  (i) if dated, refers to that particular version; and

  (ii) if not dated, refers to the latest version and therefore may be subject to change over time;

(e) unless specified otherwise, any reference to a section of an Act refers to that section of the EP Act; and

(f) unless specified otherwise, all definitions are in accordance with the EP Act.

NOTE: This works approval requires specific conditions to be met but does not provide any implied authorisation for other emissions, discharges, or activities not specified in this works approval.

Works approval conditions

The works approval holder must ensure that the following conditions are complied with:

Construction phase

Infrastructure and equipment

1. The works approval holder must:

(a) construct the infrastructure;
(b) in accordance with the corresponding design and construction requirements; and
(c) at the corresponding infrastructure location,

as set out in Table 1.

Table 1: Design and construction requirements

	Infrastructure	Design and construction requirements	Infrastructure location
Pyrolysis plant infrastructure			
1	Pyrolysis plant	Plant must be installed with the following: • 1 x dryer that is designed to heat waste feedstock to remove moisture; • 1 x pyrolyser that must be enclosed in a heating jacket; • 1 x wood vinegar collection system that is designed to condense light condensable organics; • 1 x shredder and magnetic metal separator that is capable of removing ferrous metals from MSW and output MSW pieces < 10 cm;	As depicted in the 'Infrastructure map' in Schedule 1 – Figure 2
2	Waste gas treatment	• Must be designed with a waste gas treatment system, comprising: - 2 x cyclones designed to capture products exiting the pyrolysis reactor; - 1 x cyclone designed to remove particulates in the steam exiting the dryer; - Scrubbing system designed to treat waste gases entering the system with condensed oil as a coolant and scrubber; - 1 x burner designed to burn off waste gases with excess oxygen, long residence time and turbulence; • Waste gas treatment stack exhaust height must be at least 10 m above as-built ground level; • Waste gas treatment stack must be fitted with a sampling port that complies with the requirements of AS 4323.1, to allow periodic stack testing; • Waste gas treatment stack must be fitted with a sampling port that complies with the requirements of the CEMS Code or EN 14181:2014;	As depicted in the 'Infrastructure map' in Schedule 1 – Figure 2
3	Continuous emissions monitoring system (CEMS)	• Must install a CEMS system on the waste gas treatment stack capable of accurate and continuous monitoring of volumetric flow rate, stack temperature and process gases;	'34' as depicted in the 'Infrastructure map' in Schedule 1 – Figure 2

	Infrastructure	Design and construction requirements	Infrastructure location
Pyrolysis plant infrastructure			
		• CEMS system must be installed and calibrated in accordance with requirements of the CEMS Code or EN 14181:2014	
4	Feedstock handling and storage	• Covered belt conveyor must be used to transfer biomass to storage containers in the biomass receival area. • Covered belt conveyor must be used to transfer MSW to storage containers in the MSW receival area.	'20','26' & '27' as depicted in the 'Infrastructure map' in Schedule 1 – Figure 2
By-product containment infrastructure			
1	Thermal oil storage tanks	• 1 self-bunded storage tank system, with working capacity of at least 5000 L	'4' as depicted in the 'Infrastructure map' in Schedule 1 – Figure 2
2	Char storage container	• 4 storage containers for char product with a storage capacity of at least 200 m^3.	'22' as depicted in the 'Infrastructure map' in Schedule 1 – Figure 2
3	Liquid oil storage container	• 2 self-bunded tanks must store liquid oil for sale	'23' as depicted in the 'Infrastructure map' in Schedule 1 – Figure 2
4	Wood vinegar storage	• 10 IBC containers must store wood vinegar product for sale	'24' as depicted in the 'Infrastructure map' in Schedule 1 – Figure 2

Compliance audit and reporting

2. The works approval holder must within 28 calendar days of all items of infrastructure specified in condition 1 being constructed:

(a) undertake an audit of their compliance with the requirements of condition 1 for that item of infrastructure; and
(b) prepare and submit to the CEO an Environmental Compliance Report on that compliance.

3. The Environmental Compliance Report required by condition 2, must include as a minimum:

(a) certification by a suitably qualified engineer, whether the items of infrastructure or components thereof, as specified in condition 1, have been constructed in accordance with the relevant requirements specified in condition 1;
(b) as constructed plans and a detailed site plan for each item of infrastructure or component of infrastructure specified in condition 1; and
(c) be signed by a person authorised to represent the works approval holder and contains the printed name and position of that person.

4. Subject to condition 3(a), where an item of infrastructure or component of infrastructure has been certified as not being constructed, or does not comply with the corresponding requirements, or contains material defects, the works approval holder must:

(a) correct the non-compliant or defective works, prior to re-certifying in accordance with condition 3(a); or
(b) provide to the CEO a description of, and explanation for, any departures from the requirements specified in Table 1 that do not require rectification and do not

constitute a material defect along with the Environmental Compliance Report required by condition 2.

Environmental commissioning phase

Environmental commissioning plan

5. The works approval holder must, at least 1 month prior to the commencement of environmental commissioning, provide to the CEO an environmental commissioning plan.

6. The plan required by condition 5 must include, but not be limited to:

(a) the stages, processes and expected timeframes of environmental commissioning;
(b) how accidents or malfunctions will be managed;
(c) start up and shut down procedures and how emissions will be managed during start up and shut down; and
(d) procedures for monitoring and managing emissions and discharges during environmental commissioning including, but not limited to:
    (i) details of parameters to be included in any monitoring programs;
    (ii) targets and/or trigger levels for each parameter; and
    (iii) contingency actions to be implemented if target and/or trigger levels are exceeded.

Environmental commissioning requirements

7. The works approval holder may only commence environmental commissioning once the reports required by condition 2 and condition 5 have both been submitted by the works approval holder.

8. The works approval holder must conduct environmental commissioning in accordance with the plan submitted in accordance with condition 5.

9. The works approval holder must notify the CEO:

(a) at least 7 days prior to, the commencement date of environmental commissioning; and
(b) within 7 days after, the completion date of environmental commissioning.

10. The works approval holder must, within 60 calendar days of the completion of environmental commissioning, submit to the CEO an Environmental Commissioning Report.

11. The report required by condition 10 must include, but not be limited to:

(a) a summary of environmental commissioning activities undertaken, including timeframes and the amount of feedstock processed, total amount of feedstock processed per type of feedstock and volumes of by-products produced;
(b) a summary of the environmental performance of all plant and equipment as installed, including air emissions monitoring conducted on all point sources;
(c) a review of the plant's performance against the design specifications;
(d) where they have not been met, measures proposed to meet the design specification, together with timeframes for implementing the proposed measures.

Time limited operational phase

Commencement and duration

12. The works approval holder may only commence time limited operations once the Environmental Commissioning Report required by condition 10 has been submitted by the works approval holder.

13. The works approval holder may conduct time limited operations for the infrastructure and equipment specified in condition 14:

(a) for a period not exceeding 180 calendar days from the completion date of environmental commissioning; or
(b) until such time as a licence is granted in accordance with Division 3, Part V of the *Environmental Protection Act 1986*,

whichever is sooner.

Infrastructure and equipment

14. During time limited operations, the works approval holder must ensure the premises infrastructure listed in Table 2 is maintained and operated in accordance with the corresponding operational requirement set out in that table.

Table 2: Infrastructure and operational requirements during time limited operations

	Site infrastructure	Operational requirement
1	Pyrolysis plant and waste gas treatment	• Dried solid waste feedstock and steam exiting the dryer must be at a temperature of at least 100°C; • Cyclone removing particles in the steam exiting the dryer must operate at a temperature >100°C; • Pyrolysis reactor must operate at a temperature between 300°C - 600°C; • Waste gases exiting the pyrolysis reactor must be directed through the two cyclones, scrubber, wood vinegar collection system and burner prior to exiting via the stack; • Two cyclones must be used to separate char particles from volatile particles exiting the pyrolysis reactor; • Liquid oil product, excluding during start up periods, must circulate in the scrubbing system to cool the oil vapour entering the scrubber to liquid oil; • Waste gases exiting the scrubber must enter the wood vinegar collection and liquid wood vinegar, excluding during start up periods, must be circulated to condense light condensable organics that remain in the waste gases; • The burner must operate at a temperature greater than 850°C; • Waste gases must be subject to a temperature of 850°C for at least two seconds prior to exiting via the stack; • The pyrolysis plant must not operate when the burner is not operational.

Waste acceptance

Acceptance of feedstock

15. The works approval holder must only accept onto the premises waste of a type, which meets the acceptance specifications set out in Table 3.

Table 3: Waste types authorised to be accepted onto the premises

	Waste type	Quantity limit	Acceptance specification
1	Vegetative waste	27,000 tonnes per year	Must only accept forestry waste or plantation biomass, excluding any contaminated biomass or wood treated with chemicals containing heavy metals.
2	Putrescible waste	4,000 tonnes per year	Must only accept municipal solid waste (MSW), consisting of household domestic waste that is set aside for kerb-side collection, excluding asbestos, green waste, scrap metal, paint & chemicals, waste oil, fluorescent tubes and globes, batteries, aerosols, mobile phones & E-waste, gas bottles, recycling, mattresses and tyres. Minor contamination of green waste that may be present in MGB bins is permitted.

Processing of feedstock

16. The works approval holder must ensure the waste types specified in Table 3 are handled and processed in accordance with the requirements set out in Table 4.

Table 4: Authorised waste processing

	Waste type	Process(es)	Process limits and specifications
1	Vegetative waste	Receipt, handling, storage prior to treatment by pyrolysis	• Must only be received within the designated 'biomass receival area'; • Must be transferred into storage containers via a covered belt conveyor.
2	Putrescible waste		• Must only be received within the designated 'MSW receival area'; • Must be transferred into enclosed storage containers via a covered belt conveyor; • Must be passed through the magnetic metal separator, prior to entering the dryer.

Emissions and discharges

Authorised emission points to air

17. The works approval holder must ensure the emissions listed in Table 5 are only emitted from the corresponding emission point and location specified in that table.

Table 5: Authorised emission points to air

Emission	Emission point	Min. stack height (m)[1]	Max. stack internal diameter (m)[2]	Emission point location[3]
Pyrolysis plant waste off gases	Pyrolysis plant waste gas stack	10.0	0.4	"Stack", as depicted in Figure 2 in Schedule 1

Note 1: Height from ground level to emission exit point of stack.
Note 2: Inner diameter of discharge point.
Note 3: Emission point location reference Schedule 1: Map of emission points.

Emissions to air – limits

18. The works approval holder must ensure that waste off gases discharged in accordance with condition 17 does not exceed the limits specified in Table 6 for each of the corresponding parameters set out in that table.

Table 6: Stack specified emission limits

Emission point	Parameter	Units[1]	Limit	Averaging period
Pyrolysis plant waste gas stack	SO_2	mg/m^3	200.0	30 minutes
	NO_x		400.0	
	CO		100.0	
	Total Organic Carbon (TOC)		20.0	
	Particulates		30.0	
	HCl		60.0	60 minutes
	HF		4.0	
	Cd and Tl		Total 0.05	120 minutes
	Hg		0.05	
	Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V		Total 0.5	
	Dioxins and Furans	ng/m^3	0.1	360 minutes

Note 1: Concentration results must be provided on a dry basis, corrected to STP at 11% O_2.

Monitoring

CEMS reporting

19. The works approval holder must, within 30 calendar days of completing successful calibration and verification of the installed CEMS, submit to the CEO a CEMS calibration report.

20. The report required by condition 19 must include, but not be limited to:

(a) details of the CEMS specifications and location, as determined prior to the initial operation of the pyrolysis plant in accordance with Phase I and II;
(b) the Quality Assurance plan, as required under section 2;
(c) details of the successful calibration and verification of the installed CEMS system, as conducted within 500 operational hours of the pyrolysis plant in accordance with Phase III;
(d) details of the ongoing calibration and verification of the installed CEMS system, as conducted in accordance with Phase IV,

of the CEMS Code, where relevant.

Monitoring – general

21. The works approval holder must ensure that all monitoring equipment used on the premises to comply with conditions of this works approval is calibrated in accordance with the manufacturer's specifications.

22. The works approval holder must, where the requirements for calibration cannot be practicably met, or a discrepancy exists in the interpretation of the requirements, bring these issues to the attention of the CEO accompanied with a report comprising details of any modifications to the methods.

Monitoring of point source air emissions

23. The works approval holder must monitor point source air emissions in accordance with the requirements specified in Table 7 and Table 8.

Table 7: Continuous monitoring of point source air emissions

Monitoring point location	Parameter	Frequency	Reporting averaging period	Reporting Unit	Method
"CEMS", as depicted in Figure 2 in Schedule 1	CO, O_2, SO_2, NO_x	Continuous[1]	30 minutes	mg/m^3	In accordance with CEMS Code or EN 14181:2014
	TOC				
	Velocity			m/s	
	Temperature			°C	
	Volumetric flow rate			Nm^3/s	Calculated from velocity and temp

Note 1: Following successful calibration and verification of the installed CEMS.

Table 8: Manual stack testing of point source air emissions

Monitoring point	Parameter	Frequency and timing	Monitoring duration (minimum)	Reporting Unit[1]	Method[2]
"Stack sample port", as depicted in Figure 2 in Schedule 1	Particulates	At least once for each type of feedstock during: - commissioning; - within the first 8 weeks of time limited operations; and - after 6 months of continuous operation	60 mins	mg/m^3 g/s	USEPA Method 5 or USEPA Method 17
	HCl/HF				USEPA Method 26
	Cd and TI		120 mins		USEPA Method 29
	Total mercury				
	Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V				
	Dioxins and furans		360 mins		USEPA Method 23

Note 1: All volumes to be referenced to STP on a dry basis at 11% oxygen.
Note 2: Where a USEPA method refers to USEPA Method 1 for the sampling plane, this can be read as a referral to AS/NZS 4323.1.

24. The works approval holder must record the results of all monitoring activity required by condition 23.

25. The works approval holder must ensure the equipment used for continuous monitoring in accordance with Table 7 is available for at least 90% of operational time in a calendar month during time limited operations.

26. The work approval holder must ensure all non-continuous sampling and analysis is undertaken in accordance with Table 8 is undertaken by a holder of NATA accreditation for the relevant methods of sampling and analysis.

Monitoring of ambient noise levels

27. The works approval holder must conduct monitoring of ambient noise levels at the location specified in Table 9 in accordance with the corresponding requirements set out in that table.

Table 9: Validation noise monitoring requirements

Monitoring point location	Parameter	Sound measuring equipment	Units	Frequency	Duration
Location in the vicinity of the "north" boundary of the premises, in a location readily accessible to the works approval holder that can be used to predict the noise levels received at sensitive receptors to the north of the premises	$L_{AS\ 90,30min}$ $L_{AS\ 10,\ 30min}$ Audio recording	Non-directional system	dB(A)	At commencement of time limited operations	Continuous, for 14 days

28. The works approval holder must ensure that all noise measurements are carried out in accordance with Part 3 of the Environmental Protection (Noise) Regulations 1997 (as applicable).

29. The works approval holder must ensure that all monitoring equipment used to comply with condition 27 is operated and calibrated in accordance with the manufacturer's specifications.

Compliance reporting

30. The works approval holder must, within 30 calendar days of the completion date of time limited operations or 90 calendar days before the expiration date of the works approval, whichever is sooner, submit to the CEO a Time Limited Operations Report.

31. The report required by condition 30 must include, but not be limited to:

(a) a summary of the time limited operations, including timeframes and amount of feedstock processed (reported per feedstock type);
(b) a summary of monitoring and sampling results conducted in accordance with condition 23, including an appraisal of the results against the predicted air emission rates and expected emission control efficiencies;
(c) an appraisal of the relationship between feedstock composition and air emissions;
(d) a summary of noise monitoring results conducted in accordance with condition 27, including a review of compliance with the Noise Regulations; and
(e) a review of performance and compliance against the conditions of the works approval.

Records and reporting (general)

32. The works approval holder must record the following information in relation to complaints received by the works approval holder (whether directly from a complainant or forwarded to them by the department or another party) about any alleged emissions from the premises:

(a) the name and contact details of the complainant (if provided);
(b) the time and date of the complaint;
(c) the complete details of the complaint and any other concerns or issues raised; and
(d) the complete details and dates of action(s) taken by the works approval holder to investigate or respond to any complaint.

33. The works approval holder must maintain accurate and auditable books including the following records, information, reports and data required by this works approval:

(a) the works conducted in accordance with condition 1;
(b) any maintenance of infrastructure that is performed in the course of complying with condition 14;
(c) results of all monitoring activity required by conditions 23 and 27;
(d) records to demonstrate availability of continuous monitoring required by condition 25; and
(e) complaints received under condition 32.

34. The books specified under condition 33 must:

(a) be legible;
(b) if amended, be amended in such a way that the original version(s) and any subsequent amendments remain legible and are capable of retrieval;
(c) be retained by the works approval holder for the duration of the works approval; and
(d) be available to be produced to an inspector or the CEO as required.

Definitions

In this works approval, the terms in Table 10 have the meanings defined.

Table 10: Definitions

Term	Definition
AS 4323.1	means the most recent version and relevant parts of the Australian Standard AS 4323.1 *Stationary source emissions – selection of sampling positions*
averaging period	means the time over which a limit or target is measured or a monitoring result is obtained
books	has the same meaning given to that term under the EP Act
CEO	means Chief Executive Officer of the Department CEO for the purposes of notification means: Director General Department administering the *Environmental Protection Act 1986* Locked Bag 10 JOONDALUP DC WA 6919 info@dwer.wa.gov.au
CEMS	Continuous Emissions Monitoring System
CEMS Code	means the document *Continuous Emission Monitoring System (CEMS) Codes for Stationary Source Air Emissions*, March 2016, Department of Environment Regulation, Perth WA
condition	means a condition to which this works approval is subject under s.62 of the EP Act
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act
discharge	has the same meaning given to that term under the EP Act
emission	has the same meaning given to that term under the EP Act
EN 14181:2014	means the European Standard EN 14181:2014 *Stationary source emissions. Quality assurance of automated measuring systems*
environmental commissioning	means an activity or sequence of activities undertaken after pre-commissioning has demonstrated the integrity of the plant and equipment. The purpose of commissioning is to test equipment, infrastructure, and processes after the input of raw materials, to confirm design specifications, optimise process conditions, and to monitor/validate emissions or discharges in order to establish a steady-state operation
Environmental Commissioning Report	means a report on any commissioning activities that have taken place and a demonstration that they have concluded, with focus on emissions and discharges, waste containment and other environmental factors
Environmental Compliance Report	means a report to satisfy the CEO that the conditioned infrastructure has been constructed in accordance with the works approval
EP Act	*Environmental Protection Act 1986* (WA)
$L_{AS\ 90,30min}$ and $L_{AS\ 10,30min}$	means the A-weighted level exceeded for more than 90% and 10%, respectively, of the time over 30 minutes with the sound level meter set to 'Slow' time weighting
MSW	municipal solid waste
NATA	National Association of Testing Authorities, Australia
NATA accreditation	means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis
Noise Regulations	Environmental Protection (Noise) Regulations 1997 (WA)

Term	Definition
non-directional system	means single microphone sound measuring equipment compliant with Schedule 4 of the Noise Regulations and capable of recording overall and one-third octave band statistical noise levels based on the A-weighted sound pressure level with 'Slow' time weighting (L_{AS})
normal operating conditions	means the operation of infrastructure (including abatement equipment) excluding start up, shut down and upset conditions
NO_X	means oxides of nitrogen, calculated as the sum of nitric oxide and nitrogen dioxide and expressed as nitrogen dioxide
PM	means total particulate matter including both solid fragments of material and miniscule droplets of liquid
pre-commissioning	means an activity or sequence of activities undertaken after construction (but prior to commissioning) to test equipment and infrastructure for functionality, and for any installation defects or failures. Examples include hydraulic pump, pipeline and valve testing; hydrostatic testing of vessels, tanks and ponds; electrical component testing; and liner integrity tests for storage facilities and wastewater containment ponds
premises	the premises to which this works approval applies, as specified at the front of this works approval and as shown on the map in Schedule 1 to this works approval
prescribed premises	has the same meaning given to that term under the EP Act
STP, dry	means standard temperature and pressure (0°Celcius and 101.325 kilopascals, respectively), dry
suitably qualified engineer	means a person who: a. holds a tertiary academic qualification in engineering; and b. has a minimum 5 years of experience working in their area of expertise; c. or is otherwise approved by the CEO to act in this capacity
time limited operations	means operation of the infrastructure identified under this works approval that is authorised for that purpose, subject to the relevant conditions
TOC	total organic carbon
USEPA Method 5	means USEPA Method 5 *Determination of particulate matter emissions from stationary sources*
USEPA Method 17	means USEPA Method 17 *Determination of particulate matter emissions from stationary sources (In-stack particulate)*
USEPA Method 23	means USEPA Method 23 *Determination of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans from stationary sources*
USEPA Method 26	means USEPA Method 26 *Determination of hydrogen halide and halogen emissions from stationary sources*
USEPA Method 29	means USEPA Method 29 *Determination of metals emissions from stationary sources*
VOCs	Volatile organic compounds
works approval	refers to this document, which evidences the grant of the works approval by the CEO under s.54 of the EP Act, subject to the conditions
works approval holder	refers to the occupier of the premises being the person to whom this works approval has been granted, as specified at the front of this works approval

END OF CONDITIONS

Schedule 1: Maps

Premises map

The boundary of the prescribed premises is shown in the map below (Figure 1).

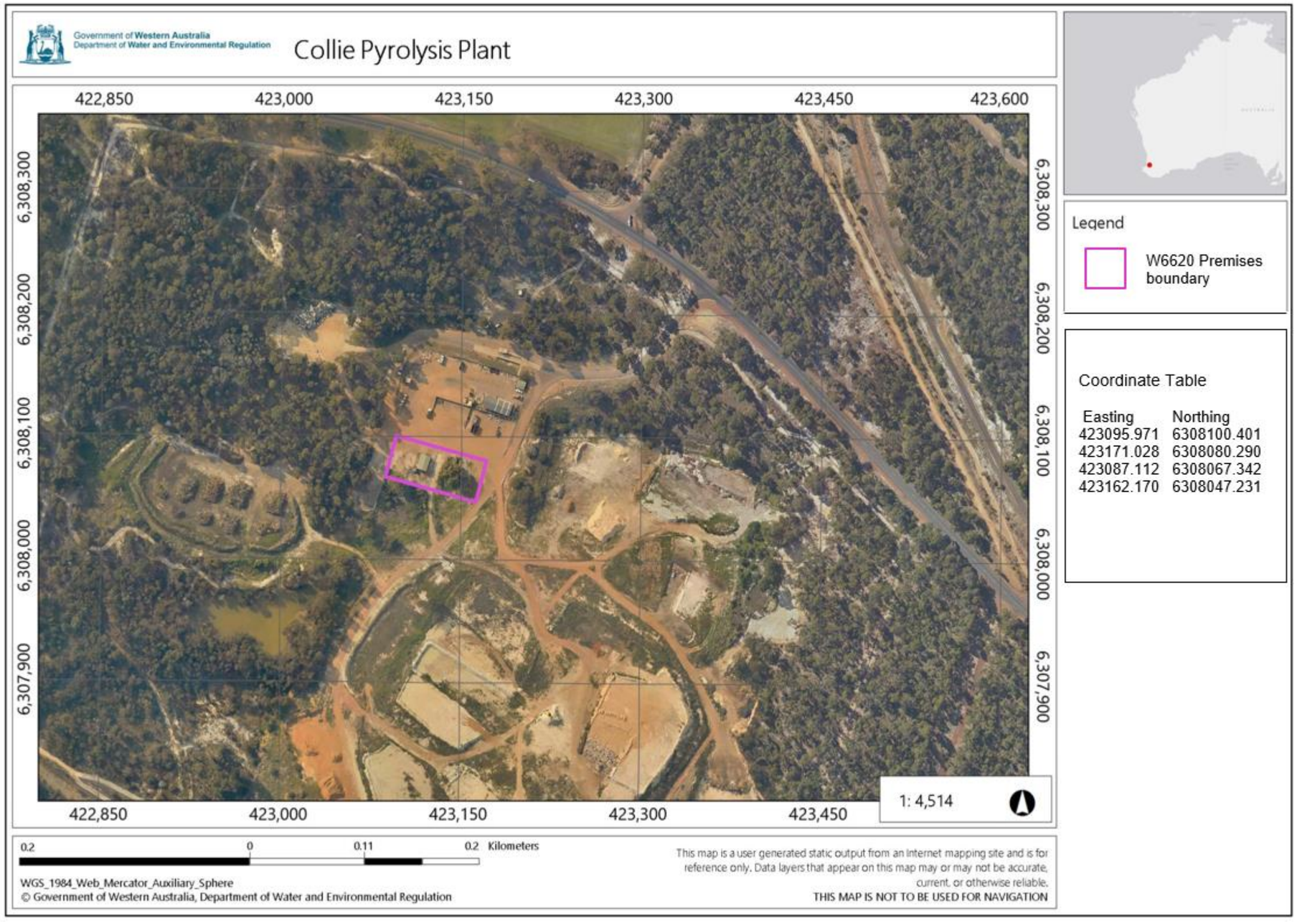
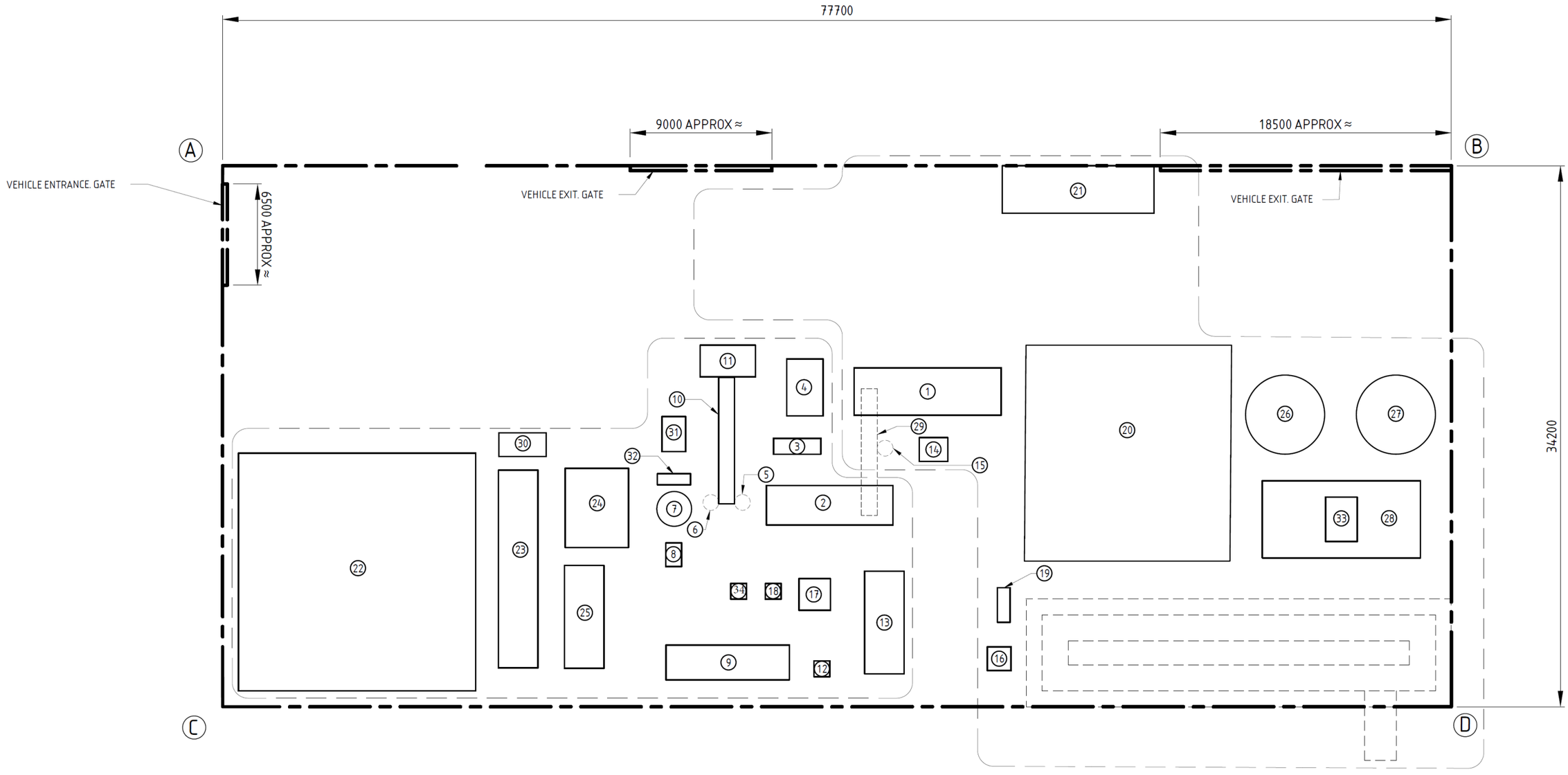


Figure 1: Map of the boundary of the prescribed premises

Infrastructure map

The location of key grinding pyrolysis plant infrastructure is shown in the map below (Figure 2)



Equipment no. and name	Equipment no. and name	Equipment no. and name	Equipment no. and name	Equipment no. and name	Equipment no. and name
1. Dryer	7. Scrubber	13. Burner	19. Air compressor & receiver	25. Bio-oil storage	31. Heat exchanger
2. Pyrolyser	8. Wood vinegar collection	14. (Optional) Bag filter	20. Feedstock storage	26. Biomass receiving area	32. Bio-oil recycle pump
3. Thermal oil heat exchanger	9. Air cooling heat exchanger	15. Cyclone	21. Control room	27. MSW receiving area	33. Shredder
4. Thermal oil storage	10. Biochar cooling screw	16. Root blower	22. Biochar storage	28. Shredding area	34. CEMS
5. Cyclone	11. Biochar silo	17. ID fan	23. Bio-oil storage	29. Screw conveyor	
6. Cyclone	12. Gas booster	18. Stack	24. Wood vinegar storage	30. Pump station	

Figure 2: Map of the Collie Pyrolysis Plant infrastructure