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# Restart of Redbank Power Station and Use of Biomass (Excluding Native Forestry Residues from Logging) as a Fuel – SSD-56284960

## Verdant Earth Technologies Limited

## Environmental Impact Statement

Jackson Environment and Planning Pty Ltd
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This Environmental Impact Statement has been prepared by the following staff of Jackson Environment and Planning Pty Ltd, Suite 102, Level 1, 25-29 Berry St, North Sydney NSW 2060; in association with Acoustic Logic, Bushfire Environmental Management Consultancy (BEMC), ACOR Consultants, Environmental Risk Sciences, EMM Consulting Pty Limited, Lifecycles, Ason Group, Consulting Earth Sciences, Boiler & Power Plant Services Pty Ltd, Sustainability Workshop, HRL Technology Group Pty Ltd, Australian Economic Advocacy Solutions, Marsden Jacobs, Arriscar Risk Engineering Solutions, Social Impact Strategies Pty Ltd, Terras Landscape Architects, MJD Environmental and Muller Partnership.

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**We declare that:**

The statement has been prepared in accordance with Clause 190 of the *Environmental Planning and Assessment Regulation* 2021.

The statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and the information contained in the statement is neither false nor misleading.

| Report version | Authors | Date | Reviewer | Approved for issue | Date |
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| **Draft v1.0** | E. Larson | 28/11/2023 | Dr. M. Jackson | Dr. M. Jackson | 29/11/2023 |
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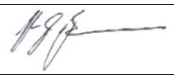
## Declaration

| | |
|---|---|
| Project details | |
| Project name | Restart of Redbank Power Station and Use of Biomass (Excluding Native Forestry Residues from Logging) as a Fuel |
| Application number | SSD-56284960 |
| Address of the land in respect of which the development application is made | 112 Long Point Road West, Warkworth NSW 2330 |
| Applicant details | |
| Applicant name | Verdant Earth Technologies Limited |
| Applicant address | GPO BOX 2537, Sydney NSW 2001 |
| Details of person by whom this EIS Report was prepared | |
| Name | Erik Larson, Rylan Loemker and Dr Mark Jackson |
| Address | Suite 102, Level 1, 25-29 Berry St, North Sydney NSW 2060 |
| Professional qualifications | Erik Larson: B.Sc. Natural Resources Planning<br>Rylan Loemker, BEnvSc (Hons), GradDipBusTech<br>Dr Mark Jackson, Director and Principal Consultant, B.Sc (Hons), PhD, Grad. Cert. Mgmt., Exec. Masters Public Admin., Certified Environmental Practitioner CEnvP (1542), Impact Assessment Specialist (IA11071), NSW Registered Environmental Assessment Practitioner REAP (R80020). |
| Declaration by registered environmental assessment practitioner | |
| Name | Dr Mark Jackson |
| Registration number | R80020 |
| Organisation registered with | Environment Institute of Australia and New Zealand (EIANZ) |
| Declaration | The undersigned declares that this EIS Report:<br>• has been prepared in accordance with the *Environmental Planning and Assessment Regulation* 2021;<br>• contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the report relates;<br>• does not contain information that is false or misleading;<br>• addresses the Planning Secretary's environmental assessment requirements (SEARs) for the project;<br>• identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments;<br>• has been prepared having regard to the Department's State Significant Development Guidelines;<br>• contains a simple and easy to understand summary of the project as a whole, having regard to the economic, environmental and social impacts of the project and the principles of ecologically sustainable development;<br>• contains a consolidated description of the project in a single chapter of the EIS Report;<br>• contains an accurate summary of the findings of any community engagement; and<br>• contains an accurate summary of the detailed technical assessment of the impacts of the project as a whole. |
| Signature |  |
| Date | 20/02/24 |

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# Executive Summary

This Environmental Impact Statement (EIS) has been prepared by Jackson Environment and Planning Pty Ltd on behalf of Verdant Earth Technologies Limited (Verdant Earth) who are seeking approval to restart the plant using biomass (excluding native forestry residues from logging) as a sustainable fuel to produce near net zero $CO_2$ emissions and enable the power station to continue to produce "green" electricity on an ongoing basis (the Proposal).

The Redbank Power Station is an approved baseload power station located at 112 Long Point Road West, Warkworth (Lot 450 DP 1119428) (the Site). Originally commissioned in July 2001, the Redbank Power Station was designed to use beneficiated dewatered coal tailings (BDT) left over from coal processing to create electricity. The power station uses FiCirc® fluidised bed combustion technology and a single 151MW steam turbine and associated equipment. The power station is designed to burn low value fuels such as coal tailings and is a preferred technology for energy generation from biomass. The technology has demonstrated excellent performance and a low emissions profile.

The power station was approved in 1994 (DA183/93) and the development consent was modified in 1997. Tailings were transferred by conveyor from the Warkworth mine to the power station as a source of fuel. The power station also relied on supplementary fuel in the form of Run of Mine (ROM) coal to assist in electricity generation. Due to the unavailability of coal tailings from Warkworth mine, the power station has been in care and maintenance since October 2014.

The power station is designed to burn low value fuels such as coal tailings and biomass and has demonstrated excellent performance and a low emissions profile. Tailings were transferred by conveyor from the Warkworth mine to the power station as a source of fuel. The power station also relied on supplementary feedstock (fuel)[1] in the form of Run of Mine (ROM) coal to assist in electricity generation. Due to the unavailability of coal tailings from Warkworth mine, the power station has been in care and maintenance since October 2014.

To address concerns expressed by the community in relation the use of native forestry residues as fuel, the Applicant has developed an alternative biomass fuel strategy which specifically excludes this fuel source. Verdant will also relinquish the current approval to use coal tailings as a fuel at Redbank.

## Surrender Existing Approval for the Use of Coal

During previous operations, the Redbank Power Station sourced only BDT and ROM from the Warkworth Mine. Since 2010 due to high export prices being realised for Australian coal, the Warkworth Mine commenced exporting coal tailings as a fuel. As a consequence, the Redbank Power Station was deprived of good quality tailings and could not access sufficient supplies at a quality originally agreed and suitable for use as the main fuel for the plant.

Given this, the Proponent is seeking approval to enable the use of additional fuel types that are more available and compatible with the existing Power Station technology.

As the Proposal seeks to operate exclusively on biomass feedstock the Proponent will seek to surrender the use of coal tailings as a fuel as permitted under the existing development consent (DA183/93).

## Sources and Supply of Biomass Fuel

The Proposal will use up to 700,000 tonnes of dry equivalent biomass per annum (approximately 850,000 tonne per annum at 25% moisture) as a fuel for conversion into electricity. It is proposed that Redbank will be fuelled with ecologically sustainable biomass (in compliance with all relevant legislative requirements and excluding native forestry

[1] A feedstock is defined as any renewable, biological material that can be used directly as a fuel, or converted to another form of fuel or energy product.

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residues from logging) to deliver near net zero $CO_2$ power generation using standard fuels[2] and eligible waste fuels[3] from the following sources:

Standard Fuels:

- Purpose grown energy plantations;
- Perennial grasses; and
- Energy crops.

Eligible Waste Fuels:

- Biomass with no higher order uses arising from invasive native species control on agricultural land[4];
- Biomass with no higher order uses from approved land clearing activities such as major infrastructure developments for approved civil infrastructure, road clearing works, right of ways and related approved projects[5];
- Agricultural waste biomass products or residues with no higher order uses;
- End of life waste woody biomass manufactured and produced into a fuel to specification ("Domestic Biomass") (subject to EPA approval as an eligible waste fuel)[6]; and
- Other sources of eligible waste fuels with no higher order uses.

Note that at the initial startup of the power station, and following boiler maintenance and restart of the boilers, a startup supplementary fuel (diesel or a similar fuel) will be used to achieve the temperature required to use biomass as fuel. Once the boiler is operating at the design temperature, the Redbank Power Station will use only approved biomass as fuel.

Fuels for the Redbank Power station will be implemented in two stages.

The first stage will involve the start-up of operations using biomass (with no higher order uses) sourced primarily from approved land clearing operations (from existing civil and road works), biomass from invasive native species on agricultural land as approved by Local Land Services NSW and potentially a limited amount of purpose grown biomass.

The second stage will involve the introduction or increased use of purpose grown biomass which will be further increased over a period of two to four years from approval, and, if approved and declared an eligible waste fuel by the NSW EPA, the introduction and use of Domestic Biomass.

Verdant will, where appropriate, seek separate Specific Resource Recovery Orders and Exemptions (RROE) and notification by the NSW EPA in the New South Wales Government Gazette as required prior to the use of the biomass fuels.

[2] A standard fuel is defined in Part 1 of Schedule 2 of the *Protection of the Environment Operations (Clean Air) Regulation* 2022 as 'an unused and uncontaminated solid, liquid or gaseous fuel that is — (c) a wood or wood-derived fuel'.

[3] An eligible waste fuel is defined as a 'waste or waste-derived materials considered by the EPA to pose a low risk of harm to the environment and human health due to their origin, low levels of contaminants and consistency over time' as per NSW EPA (2022) *Eligible Waste Fuel Guidelines*.

[4] The *Land Management (Native Vegetation) Code* 2018 under the *Local Land Services Act* 2013 sets out permitted clearing and thinning of native vegetation on agricultural land, such as invasive native species where a compliance certificate has been issued by Local Land Services NSW.

[5] Requires notification by the NSW EPA in the New South Wales Government Gazette under Section 140 of the *Protection of the Environment Operations (General) Regulation* 2022.

[6] Domestic Biomass Fuel (DBF) is not currently prescribed as an 'eligible waste fuel' under current EPA guidelines, though the applicant will seek to demonstrate this prior to its use through a post-approval Specific Resource Recovery Order and Exemption application under Clause 93 of the *Protection of the Environment Operations (Waste) Regulation* 2014.

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## Ash Handling and Management

Ash generated by the Proposal will be regularly tested and transported off-site for beneficial use as a soil amendment in agriculture in accordance with EPA requirements.

Trucks used to deliver biomass to the site will be backloaded with the ash for removal to an approved site for reuse in accordance with the *Ash from Burning Biomass Order and Exemption* 2014. Once Domestic Biomass is approved, Verdant will apply for a separate RROE for the resulting ash derived from Domestic Biomass.

## Plant and Equipment Modifications to Allow the Use of Biomass as Fuel

To enable the power station to use biomass as a primary fuel source, some modifications to the plant and operations will be required. These changes are summarised below:

- Maintenance, repair and recommissioning works within the power station to permit recommencement of electricity generation;
- Delivery of biomass in B-doubles (42-44 tonnes per load) via Long Point Road on a 24/7 basis. Deliveries will be prioritised to 16-hour shifts on Monday through Sunday between 6am and 10pm;
- The existing conveyor from the Warkworth mine for transfer of coal tailings into the plant will remain in the first instance;
- Two 28m long weighbridges to be installed along the (western) inbound lane into the Site and the (eastern) outbound lane out of the Site;
- Conversion of the power station to enable the use of up to 700,000 tonnes dry equivalent per annum of biomass as feedstock fuel for electricity generation with near net zero $CO_2$ emissions equivalent;
- Construction of a 160m sealed road at the rear of the Site to enable to delivery of biomass to the fuel storage area;
- Establishment of a new fuel delivery area adjacent to the existing stockpiling area directly south of the existing power plant. The system will incorporate two dual-lane drive over truck unloaders, two additional conveyors that supply two radial telescopic conveyors to unload the biomass. One telescopic conveyor will direct fuel to the existing fuel storage area (i.e. the area approved for storage of coal tailings), and the second to two moving floor bulk unloader bins, which directly feed existing Conveyor 76. Swales to be provided around biomass stockpile area to minimise movement of biomass fuel from the designated storage area;
- Use of the existing Conveyors 34 and 35 to supply Boilers 1 and 2 respectively with biomass fuel. An extension to Conveyor 76 and removal of the crusher house is required to enable the even transfer of fuel via Conveyors 34 and 35 to Boilers 1 and 2;
- Modifications to two reversing conveyors within the power station to transfer the biomass into each of six fuel silos that will store the biomass. These silos previously stored ROM coal for delivery into the plant's fluidised bed combustion chambers;
- Modifying of the 'trouser legs' of the six fuel silos within the power station to enable the more efficient flow of biomass into the plant's fluidized bed combustion chambers;
- Ash generated from the combustion process will be sampled, tested and potentially used as a fertiliser in accordance with the EPA's *The Ash from Burning Biomass Order* 2014. The existing ash slurry system previously used to transfer coal tailings ash back to Warkworth mine will remain in place, though it will not be used and will be removed at a later date. A Specific Resource Recovery Order and Exemption will be sought for ash from use of DBF as a fuel; and
- Other work, including landscaping, fire detection and suppression systems, and refurbishment of internal elements of the power station as required. This will also include the purchase of a water access licence, reconnection to the electricity grid, development of a spare parts inventory and purchase and storage of a fuel invention for the power station.

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## Planning Matters

The Proposal is located on land zoned RU1 under the *Singleton Local Environmental Plan* 2013. Whilst the *Singleton Local Environmental Plan* 2013 prohibits development that may be classified as a 'electricity generating works', the Proposal is permissible with consent under Clause 2.36 of the *State Environmental Planning Policy (Transport and Infrastructure)* 2021.

The Proposal is considered a State Significant Development (SSD) under Clause 20(a) of Schedule 1 of *State Environmental Planning Policy (Planning Systems)* 2021 as it involves a development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that has a capital investment value of more than $30 million. The Secretary's Environmental Assessment Requirements for the Proposal were issued by the Department of Planning and Environment (SSD-56284960) on 30th August 2023.

The Proposal requires assessment under Part 4 of the *Environmental Planning and Assessment Act* 1979 and the consent authority for the development will be the Minister for Planning. An Environmental Impact Statement (EIS) must accompany the development application. An amended licence from the NSW EPA under Schedule 1 of the *Protection of the Environment Operations Act* 1997 will also be required.

This EIS has been prepared pursuant to the Secretary's Environmental Assessment Requirements (SEARs) for the Proposal (SSD-56284960), which were issued by the NSW Department of Planning and Environment (now the Department of Planning, Housing and Infrastructure) on 30 August 2023.

## Existing Site of the Proposal

The Proposal is located in the Singleton Local Government Area, within the Hunter Valley, NSW. The Site is positioned in a suitable location in the Hunter Valley approximately 10 km to the west of Singleton, 10 km northeast of Bulga and about 8 km northwest of Mount Thorley. Four open cut coal mines are within 2.2 to 7 km of the Site. The surrounding region also includes rural and agricultural properties and industrial areas.

The area of land occupied by the power station infrastructure has been previously disturbed and cleared. The Site currently contains existing power station infrastructure and technology to support the Proposal including:

- Multiple buildings including offices, warehouses, and turbine hall;
- Road access and carparks;
- Stockpile area and conveyor belts;
- Sediment basin, detention basin and wastewater storage basin;
- Two separate existing access points to the Site from Long Point Road West; and
- Power generation infrastructure (Boiler, cooling tower, stack and turbo generator).

When fully operational the Proposal will supply the grid with approximately 1 million megawatt hours of 24/7 dispatchable or baseload electricity per year, equivalent to supplying around 200,000 homes. The Proposal will also drive significant progress towards the NSW Government's *Net Zero Plan Stage 1: 2020-2030*, the foundation for NSW's action on climate change and goal to reach net zero emissions by 2050.

## Impact Assessment

This EIS describes the environmental and social impacts of the Proposal and makes a comprehensive assessment of those impacts. Potential impacts were identified through the assessment process and through consultation with key stakeholders including the local community. The key potential impacts relate to:

- Social/Community;

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- Economic;
- Waste management;
- Lifecycle / Greenhouse gas;
- Air Quality;
- Greenhouse gas and climate change;
- Land use conflict;
- Human Health;
- Noise;
- Traffic and Transport;
- Noise;
- Soil and water;
- Hazard and Risks;
- Visual;
- Aboriginal and cultural heritage;
- Bushfire;
- Fire Safety; and
- Biodiversity.

**Social and Community**

A number of community education and engagement tools were prepared and delivered. This included print, online and media aiming to maximise participation, increase understanding and engagement prior to finalising the EIS and specialist studies.

The assessment of broader social impacts suggests that the Proposal is unlikely to have significant negative impacts, such as those related to odour or traffic, on the surrounding community. The development is surrounded by open pit mines, agricultural land and rural dwellings, and remnant bushlands. The nearest dwellings are approximately 1.6km away.

The Proposal has provided detailed assessments and integrated a set of mitigation measures detailed in this EIS to ensure the project has minimal impact on the local environment and the surrounding community in the long term.

The Proposal is expected to assist in hastening the transition to renewables and to stimulate economic activity whilst protecting environmental quality and human health with stringent monitoring and management. Assuming the Proposal is approved, licensing through the NSW EPA, monitoring and validation of performance is required.

Ongoing education and community engagement will be important to maintain during exhibition of the EIS and post approval. Working closely with the community will be important to demonstrate and prove how the facility is being managed to protect the community and the environment.

The Singleton LGA and Hunter Region will continue to be an important area for growth and industry, and that with the inevitable transition away from coal to renewables, this Proposal would assist in providing a diversity of opportunities for growth and employment, particularly in the areas of industrial trades.

**Economic**

A potentially significant economic project for both the Singleton LGA and the Hunter Region, the Proposal is expected to assist in the transition to renewable energy and stimulate economic activity whilst protecting environmental quality and human health.

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The Singleton LGA and Hunter Region will continue to be an important area for growth and industry, and that with the inevitable transition away from coal to renewables, this Proposal can provide a diverse opportunity for growth and employment, particularly in the areas of industrial trade during construction and operation.

The Proposal is expected to improve social and economic outcomes for residents through increased employment opportunities and better livelihoods, particularly in the Singleton LGA. The Proposal is expected to contribute the following to the local and regional economies:

- An estimated 331 direct full time equivalent (FTE) jobs and 504 indirect production and consumption FTEs during construction;
- A combined direct and indirect economic activity value add of $78.23 million during construction;
- Employment growth of 174.5 long term FTE jobs during operations; and
- Annual value add to the economy is estimated at $68.8 million during operations.

In total there will be 1,009.5 direct and indirect jobs created and the 25-Year Net Present Value (NPV) of the reopening of the Redbank Power Station is $901.1 million. The majority of economic activity would occur in the Hunter Region, with an estimated annual value add during operation of $34.41 million, and in the Singleton LGA alone of $20.64 million.

**Waste Management**

The power station would require minor modifications of materials handling systems to enable the use of biomass for fuel. Across all operations of the Redbank Power Station, it is estimated that more than 99% of wastes will be reused or recycled, exceeding the 80% target established by the NSW Government in the *NSW Waste and Sustainable Materials Strategy 2041: Stage 1 – 2021-2027.*

Ash would be generated at about a rate of 42,500 tonnes / year and is expected to be beneficially reused under *The Ash From Burning Biomass Order* 2014.

In the unlikely event the ash derived from the use of eligible waste fuel does not comply with the Ash Order, a Specific RROE would be sought from the NSW EPA to enable the beneficial reuse of ash in appropriate applications to ensure that human health and the environment are protected at all times.

A Specific Resource Recovery Order and Exemption will be sought when Domestic Biomass Fuel (DBF) is introduced into the fuel mixture as DBF is not permitted input into the Ash Order.

**Lifecycle and Greenhouse Gas**

The scientific evidence for climate change, and its impacts, and the need for policies consistent with the goal of the Paris Agreement, are clear and not disputed.

In the IPCC Sixth Assessment Report released in April 2022[7], it is acknowledged that Modern Bioenergy has an important role in mitigating climate change by reducing $CO_2$ emissions from traditional fossil fuel electricity generation.

The NSW Department of Planning, Industry and Environment (DPIE) released their *Net Zero Plan Stage 1: 2020-2030*, detailing the initial strategies for the state to meet net zero emissions by 2050 by delivering a 35% cut in emissions by 2030 compared to 2005 levels. As reported in the Net Zero Plan, the majority of emissions in NSW are derived from electricity generation (51 $MtCO_2$-e).

[7] Intergovernmental Panel on Climate Change (2022). *Climate Change 2022 – Mitigation of Climate Change. Working Group III contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Published by IPCC, 2022. Internet publication: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf

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Climate legislation introduced by the Federal Government in September 2022 to implement Australia's net-zero commitments is now in force. On 14 September, the *Climate Change Act* 2022 and the *Climate Change (Consequential Amendments) Act* 2022 commenced.

A Life Cycle Assessment (LCA) has been prepared to assess the full '*cradle-to-grave'* environmental impacts and benefits of products and processes associated with the Proposal. A Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan has also been prepared to address potential greenhouse gas impacts due to the Proposal and assess considerations for climate change adaptation.

Results show the emissions intensity of electricity generation for the Proposal was estimated to be 0.0182 t $CO_2$-e/MWh. This value was lower than those identified for a selection of other biomass-fuelled power stations in Australia and the UK. In NSW/ACT, at Proposal commencement in 2025 the emission intensity of the grid (for Scope 2 plus Scope 3) will be 0.53 t $CO_2$-e/MWh. By 2035 the emission intensity reduces to 0.02 t $CO_2$-e/MWh due to the closure of remaining coal-fired power stations. The emission intensity for the Proposal was therefore well below the current grid average for the state, and around 90% of the projected grid average for the state in 2035.

In quantitative terms, the production of electricity from biomass at Redbank Power Station will save 882 kg$CO_2$-eq for every MWh generated. This equates to an annual saving of 862 kt$CO_2$-eq.

The Proposal is a near net zero $CO_2$ project and a small contributor to GHG emissions in NSW. Under a 'current policy' scenario for NSW, the project represents 0.03% of state-wide emissions in 2030, and 0.08% in 2050. It will provide 24/7 reliable power for over 200,000 homes and is an exemplar of Modern Bioenergy.

Using bioenergy now (in this case from biomass), in conjunction with other renewables, is an important measure to achieve net zero. Biomass is a storable, dispatchable energy source that can support the rapid expansion of intermittent renewables (e.g. solar and wind), providing grid stability and balancing. The Proposal would thus support decarbonisation of the NSW grid and contribute to NSW's goal of Net Zero by 2050.

**Air Quality**

An air quality impact assessment (AQIA) was prepared in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA 2017) and includes a quantitative assessment of potential air quality impacts from operation of the Proposal. The AQIA considered background concentrations (existing pollutants in the ambient air) and estimated the incremental impact from the Proposal (emissions only from Proposal operations).

To assess potential air quality impacts across the surrounding area, residences and commercial/industrial locations within approximately 5km of the Proposal Site were selected as discrete assessment locations, including the adjacent Dyno Nobel facility and the nearby Mt Thorley Industrial estate.

In addition to air quality predictions at these discrete points, ground level concentrations were predicted over a 21km by 21km modelling grid with a 250m spacing. These gridded predictions were used to generate contour plots showing the extent of predicted ground level emission concentrations across the local area.

The results show that incremental concentrations for all pollutants for the boiler using biomass were below the impact assessment criterion for both the expected and regulatory worst case (RWC) scenarios.

The cumulative concentrations for all pollutants using biomass were below the impact assessment criterion for both the expected and RWC scenarios with the exception of:

- Annual average $PM_{10}$ and $PM_{2.5}$ - the existing background for annual average $PM_{10}$ and $PM_{2.5}$ was already above the impact assessment criteria for 2018. However, the contribution from the Proposal (biomass firing plus

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fugitive emissions) to annual average $PM_{10}$ and $PM_{2.5}$ was approximately 1% of the impact assessment criteria; and

- 24-hour average $PM_{10}$ concentrations in the RWC scenario - when background concentrations were added to the Proposal increment, there was one additional day over the impact assessment criteria at locations MTT2 and AR1 for $PM_{10}$ for proposed biomass operations. On the exceedance day, the 24-hour PM10 background concentration was 49.5 µg/m$^3$ (or 99% of the criterion) and the increment for MTT2 was 0.78 µg/m$^3$ and 0.72 µg/m$^3$ for AR1. Given the minor contribution of the Proposal to this result, and the conservative nature of the RWC scenario, adverse impacts as a result of the Proposal at MTT2 and AR1 are considered to be unlikely.

When comparing the modelled results for the biomass firing scenario versus the BDT firing scenario, it was generally found that:

- There was not a significant difference between $PM_{10}$ and $PM_{2.5}$ concentrations;
- $NO_2$ concentrations for BDT firing were higher than for biomass firing;
- CO and $SO_2$ concentrations for BDT firing were significantly higher than for biomass firing;
- For the other pollutants (metals, HF, HCl, VOCs and other organic and persistent organic pollutants), in some cases concentrations for BDT firing were higher and in some cases concentrations for biomass firing were higher; and
- All cumulative concentrations were well below the applicable impact assessment criterion with the exception of the $PM_{10}$ and $PM_{2.5}$ cases described above which were the result of elevated background levels.

The emission calculations from the facility account for a range of existing emission mitigation measures that are consistent with best practice measures. The expected case emission concentrations under biomass firing are calculated to be compliant with the applicable POEO emission limits. Stack emissions would be monitored and publicly reported an ongoing basis in accordance with NSW EPA specifications.

The AQIA has assessed the potential impacts to air quality from the Proposal and concluded the Proposal can meet relevant legislative and regulatory air quality criteria.

**Human Health**

A Human Health Risk Assessment (HHRA) prepared for the Proposal assesses potential impacts on the community health of populations located off-site due to potential changes in air quality from Proposal operations.

The HHRA looked at inhalation and other pathways, including pollution to soil, crops, produce and water tanks from deposition of particulates and chemicals, and the potential effects on human health.

The HHRA concluded that all risks to human health are considered negligible. There are no acute inhalation risk issues of concern, no chronic risk issues of concern, and exposure to particulates derived from the Proposal within the community are considered negligible. Additionally, all chronic risks to human health are considered negligible including all calculated risks for individual exposure pathways and all calculated risks for combined multiple pathway exposures. Emissions from the Proposal would have a negligible impact on water quality in rainwater tanks used for drinking water and on crops and produce grown in the area.

**Noise**

A Noise Impact Assessment (NIA) has been prepared for the project. The NIA uses historical data gathered during operation of the power plant prior to its closure, and sound power levels of additional equipment (i.e., equipment not previously required for coal firing operations) to model the potential noise impacts on nearby residential receivers under neutral and noise enhancing weather conditions.

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The Proposal only requires minor modifications to the power plant to allow the firing of biomass, therefore the noise generated by the plant itself is expected to be unchanged. Additional noise sources will result from the change in fuel use due to an increase in truck movements to transport fuel to the power station and greater use of the plant on-site for the unloading and stockpiling of fuel and loading of fuel for firing. This equipment includes mobile front-end loaders, bulk unloaders, conveyors and silo augers.

Inclusion of a noise barrier is proposed and to be constructed of a solid material with minimal gaps having a surface density not less than 8 kg/$m^2$. A gate leading to the access road is acceptable provided it is solid and is normally kept closed at night. The design of the barrier will be reviewed and adjusted as necessary to comply with the noise criteria, taking into account noise emissions from the actual plant installed, and practical location on site.

A validation assessment would be undertaken shortly after commencement of operation to verify compliance at the receivers based on measurements of actual noise emissions (either by direct measurement if possible, or by a calibrated acoustic model based on actual noise emissions similar to that undertaken by Heggie). The main focus would be at receiver locations 1 and 2 where noise emissions are predicted to be just compliant.

With the addition of the noise barrier, the NIA model predicts that noise emissions will comply with the project trigger levels at all times whether under both neutral and noise enhancing weather conditions. Operational noise emissions are not predicted to adversely impact any surrounding receiver, at any time of the day or night.

**Traffic and Transport**

A Traffic Impact Assessment (TIA) has been prepared for the Proposal using SIDRA modelling to assess the relevant traffic implications and potential impacts on the local road to and from the Site.

The key roads providing access for the Site and for the haulage routes heading north and south are the Golden Highway (Jerry Plains Road) and Long Point Road. The primary intersection providing access for the Site is the Golden Highway and Long Point Road West.

The Proposal will generate up to 56 trucks deliveries (or 112 movements) per day, as well as staff vehicle movements up to 70 vehicle trips per day.

Traffic modelling of a conservative development scenario of up to 15 heavy vehicle trips per hour during the peak periods, as well as staff trips occurring in those same peak hours, demonstrates that the Proposal would have no significant impact on the operation of the Golden Highway/ Long Point Road West intersection, nor on road capacity limits or existing geometry requirements.

The TIA concluded that the Proposal is supportable from an access and traffic perspective.

**Soil and Water**

A Water Cycle Impact Assessment (Appendix T) has been prepared for the Proposal to assess water quality and a Preliminary Site Investigation (PSI) has been prepared (Appendix U) to assess potential contamination arising from past activities.

The PSI determined the existing Facility has no significant contamination, all chemicals held onsite are bunded and contained, and there is an existing stormwater capture reuse/treatment system that will continue to be used and managed during operation of the Proposal.

The stormwater MUSIC model predicted three (3) runoff events in 40.5 years. On average, this is less than 1 runoff event every 10 years. The model predicts 99.7% of all runoff will be retained and reused on the site. The 0.3% of runoff that is discharged occurs during the most extreme rainfall events. Therefore the Site effectively has no “chronic” discharges.

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The existing and proposed operations at Redbank Power Station would remain, in water quality terms, effectively (99.7%) disconnected from Dights Creek. This outcome ensures that both the existing operation and the Proposal will have no adverse impacts on the adjacent creek or downstream water quality.

An operational surface and groundwater monitoring program will be implemented to ensure water quality is protected.

The Site is therefore suitable for construction and operation of the Proposal.

**Hazard and Risk**

A Preliminary Hazard Analysis (PHA) (Appendix W) has been prepared to identify key potential impacts of the Proposal, as well as potentially offensive or hazardous issues that need to be considered as part of the Development Application process.

The Proposal is based on proven technology and like plants operating overseas on biomass.

There is an existing fire detection and protection system at the Facility. Modifications to the fire protection system will be designed in the detailed design phase and informed by the Fire Safety Study and the Bushfire Assessment. The PHA recommends that the design consist of fire detection (sensors and thermal imaging), fire protection (sprinklers and water sprays within equipment where fire may occur) and hydrants and hoses in accordance with the requirements of AS 2419.1-2017.

Emissions control systems consist of dust emissions control with bag filters, and limestone injection for coal firing only into the bed of the fluidised boiler. These will be subject to performance standards and a separate environment protection licence from NSW EPA. Limestone injection is not required for biomass fuel.

The stack velocity exceeds 4.3m/s. Therefore, Form 1247 of the CASA advisory circular – Plume rise assessments needs to be submitted to CASA. A copy of the form 1247 must also be submitted to the Operators of:

- Singleton Army camp; and
- Hunter Valley Gliding Club (for Warkworth airstrip).

CASA will conduct the plume rise assessment using their software and advise Verdant Earth. This will be completed in tandem with submittal and assessment of the EIS and Proposal application.

The Considerations for Final Design identified in the PHA will be reviewed for inclusion in post-consent detailed design phase and assessed in the FSS as applicable.

The PHA found that adequate safeguards are provided, commensurate with the consequence level of the incidents. No incidents from the Proposal would have offsite consequences, therefore no societal risk results. Therefore, the Proposal is expected to be suitable for construction and operation.

**Bushfire and Fire Safety**

A Bushfire Assessment Report (BFAR) has been prepared (Appendix V) to assess the bushfire construction and planning requirements of the Proposal. A Fire Safety Study (FSS) (Appendix X) has also been prepared in consideration of the *NSW Hazardous Industry Planning Advisory Paper No 2 Fire Safety Study Guidelines* (2011) and to determine the adequacy of existing fire protection system for the modified plant and provide recommended upgrades where identified.

The Proposal falls within the Bushfire Vegetation Buffer zone on the Singleton Council Bushfire Prone Land Map. In the event of a serious bushfire threat to the Site, it is essential to ensure adequate ingress and egress, and the provision of defendable space are afforded in the design.

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Provisions are made for staff to readily evacuate in the event of a bush fire event, and separation between bush fire threats and the power station infrastructure and will not significantly limit the ability of emergency services to access the property and fight fires.

The BFAR assessment identified that the Proposal meets the broad aims and objectives in PBP 2019 with existing infrastructure. Upon establishment of additional appropriate Bushfire Protection Measures as detailed in this EIS.

Storage of biomass in the fuel silos and feedstock hoppers are considered dangerous due to the presence of combustible dust generated by attrition of the chipped wood in handling and storage. The modelled outputs generated for the FSS indicate that all fire and explosion event scenarios are contained within the property boundary and buffer zones. The FSS has recommended a suite of mitigation measures that will be implemented to complement the existing fire safety systems on site.

**Biosecurity**

The two National Priority Plant Pests that have established in Australia and that have a moderate risk of occurrence in the biomass fuel types include the serpentine leaf miner and grape phylloxera. All other National Priority Plant Pests are considered low risk as the pests are not found in the areas where fuel is likely to be sourced from, or considered nil risk as the pests are currently not present in Australia.

Although the Varroa destructor mite has been detected in bee hives in NSW within proximity to the Redbank Power Station and areas where fuel is likely to be sourced from, the risk of Varroa destructor occurring in the biomass types is low. This is due to the mite affecting bee hives (mainly commercial) and any wild hives are likely to be vacated during the processing of the biomass.

A Biosecurity Assessment and Management Plan (Appendix Z) developed for the Proposal concluded the biosecurity risk of transporting and handling the biomass is considered low with the implementation of the mitigation measures provided.

**Visual Impact**

A Visual Impact Assessment (VIA) (Appendix CC) has been prepared for the Proposal to assess landscape character and visual setting including any potential visual impacts associated with the Proposal.

The Proposal will largely blend with the existing site infrastructure of the power plant and surrounding mined landscape. The immediate proximity views from Long Point Road West and the Golden Highway are expected to be the most visually impacted.

A Landscape Plan has been prepared that will provide additional screening vegetation to the northern boundary along Long Point Road West to reduce visual impact from the immediate surrounding landscape. The landscape design has shown further consideration of site integration by introducing a native planting palette that reflect the character of the area.

**Biodiversity**

Note that clause 6.8A of the *Biodiversity Conservation Regulation* 2017 (BC Regulation) provides that a "*biodiversity development assessment report is not required to include content relating to continued development"* if the following is true:

- The report is prepared in relation to State significant development that includes continued development; and
- The existing development consent for the continued development is proposed to be surrendered under the *Environmental Planning and Assessment Act* 1979, section 4.63.

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Given that the existing consent (DA183/93) covers construction and operation of the power plant, as well as facilities on adjacent land – and given that the development proposed (e.g., changing conveyor belts to adapt to a different fuel source) is clearly within the contemplation of that existing consent –this SSD can be classed as a 'continued development' for the purposes of the BC Regulation.

Despite the above, a Biodiversity Development Assessment Report (BDAR) (Appendix Y) has been prepared for the Proposal to assess potential biodiversity impacts associated with the Proposal in accordance with the *Biodiversity Conservation Act* 2016 (BC Act) and the *Biodiversity Assessment Method* (BAM) 2020.

The BDAR also assessed the potential impacts of the Proposal to biodiversity in consideration of the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999) and the NSW *Biodiversity Conservation Act* 2016.

The BDAR has been included to provide specialist assessment of any potential impacts to biodiversity from the Proposal, and to assess whether the Proposal is located in an Environmentally sensitive area of State significance.

The existing Proposal Site is cleared and highly disturbed due to the construction and operation of the approved Redbank Power Station. Sandy Hollow Creek riparian corridor is located to the west of the Proposal. The creek is mapped on the Biodiversity Values Map (Non-EPI). This waterway is outside of the area of construction and operation of the Proposal and would not be impacted by the development. No potential Groundwater Dependent Ecosystems (GDEs) are mapped as occurring within the Site or associated with watercourses, or tributaries thereof. Therefore, the Proposal will not impact any mapped GDE's and therefore no avoidance and minimisation is required.

Singleton Council provides an online mapping system that shows Central Hunter Grey Box-Ironbark Woodland mapped over the Proposal Site. This vegetation community is listed as an EEC under Schedule 2 of the *Biodiversity Conservation Act* 2016. However, this mapping is incorrect as the Site has been historically cleared and developed under the existing consent.

One PCT was identified within the Site, PCT 3438 Hunter Escarpment Grey Box Forest. There is no EEC located in the footprint of the Proposal. The vegetation including PCT 3438 within the Site is not considered to be commensurate with any Federally listed TEC as it did not meet the minimum condition diagnostic requirements or thresholds as assessed.

No hollow-bearing trees were observed within Site during the field surveys.

The groundcover across the Site has been maintained as part of the operations of the power station, this has involved regular mowing and slashing of the area. Therefore, the composition of exotic species is high in all areas.

Vegetation within the Site holds low biodiversity value for the most part, with native vegetation accounting for 0.31 ha within the site.

The Site does contain infrastructure in the form of an existing power station which may provide suitable roosting and/or breeding habitat for threatened microbat species, which are known to use disused anthropogenic structures as roosts. Whilst the Site is unlikely to be used by these species, a set of mitigation measures is proposed to ensure potential impacts from the Proposal are minimised.

No clearing of native vegetation would occur during construction and operation of the Proposal. The existing infrastructure and proposed water quality improvement measures specified in Section 16.4 will mitigate any potential for runoff entering and impacting the nearby waterway.

Based on the nature of the proposed works and the limited works to recommission the existing plant and equipment, the Proposal is unlikely to significantly impact threatened species, populations, ecological communities or migratory species.

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No biodiversity credit liability are generated for the Proposal.

The Proposal is recommended for approval on this basis.

**Heritage**

The extensive previous ground disturbance and establishment of the existing Facility suggests that the Proposal is unlikely to harm any known Aboriginal object or items of cultural heritage value. The Proposal is unlikely to harm any known or unknown historic heritage items of non-Aboriginal origin during construction and operation.

## Justification

Verdant Earth are seeking approval to restart the Redbank Power Station using biomass (excluding native forestry residues from logging) as a sustainable fuel to produce near net zero $CO_2$ emissions and enable the power station to continue to produce "green" electricity on an ongoing basis (the Proposal).

To address concerns expressed by the community in relation the use of native forestry residues as fuel, the Applicant has developed an alternative biomass fuel strategy which specifically excludes this fuel source. Verdant will also relinquish the current approval to use coal tailings as a fuel at Redbank.

While variable renewable energy (VRE) such as utility scale wind and solar, and rooftop solar, continue to be installed at record rates in NSW their lower capacity factor, reliance on new transmission and inability to respond to demand signals mean that firm or "dispatchable" sources of generation are in critical need.

If the Proposal were to go ahead, an additional 151 MW of firm (at generator) capacity would be available in NSW that is not presently accounted for in official market projections.

The supply gap identified in the 2023 ESOO to meet the reliability standard in NSW in 2025-26 is forecast at 191 MW. Were the Proposal to be in place by then, the gap would reduce to 40 MW.

This means that over the next seven to ten years, and beyond, the Proposal could have a direct role in delivering better electricity supply reliability and security in NSW and provide support to addressing unforeseen changes in outlook.

The power station was designed to burn low value fuels such as coal tailings and is a preferred technology for energy generation from biomass. The technology has demonstrated excellent performance and a low emissions profile.

The Proposal is forecast to generate 1 million megawatt hours of baseload electricity 24/7 to support the electricity grid and replace the use of coal whilst complementing other renewable energy sources.

The Proposal is well-placed to provide almost immediate support for electricity supply reliability in an energy market subject to predicted electricity shortfalls and risks stemming from retiring coal power plants, extended periods of low wind and solar generation and higher peak demand forecasts.

The NSW Government supports thermal energy recovery as a residual waste management option where it can deliver positive outcomes for the community while protecting human health and the environment.

Key NSW government strategies, policies and plans provide strategic support for the Proposal, including the following:

- *Energy from Waste Infrastructure Plan 2021;*
- *NSW Waste and Sustainable Materials Strategy 2041;*
- *NSW Government's Net Zero Plan Stage 1: 2020 – 2030;*
- *The National Waste Policy 2018 Strategy;*
- *NSW Electricity Infrastructure Roadmap;*
- *Energy Security Safeguard;*
- *NSW Electricity Strategy;*

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- *Australia's Long Term Emissions Reduction Plan; and*
- *Hunter Regional Plan 2041.*

The Proposal will assist the Singleton and Hunter Region transition to a less carbon intensive economy and offers greater diversification of employment opportunities for its workforce.

The Proposal is predicted to generate 1,009 direct and indirect jobs. The 25-Year Net Present Value (NPV) of the Proposal is $901.1 million, and the majority of economic activity would occur in the Hunter Region, with an estimated annual value add during operation of $34.41 million, and in the Singleton LGA alone of $20.64 million.

The Proposal is permissible development on the land under the *State Environmental Planning Policy (Transport and Infrastructure)* 2021.

This EIS has assessed the Proposal and determined that the development would be designed, operated and managed in accordance with best practice and would meet all relevant legislative policy and regulatory requirements.

The Proposal is a highly suitable project for the Redbank Power Station and is recommended for approval with the implementation of the mitigation and management measures proposed in this EIS.

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# CONTENTS



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# 1. Introduction

## 1.1. Project Summary

The Redbank Power Station is an approved baseload power station located at 112 Long Point Road West, Warkworth (Lot 450 DP 1119428) (the Site). Originally commissioned in July 2001, the Redbank Power Station was designed to use beneficiated dewatered coal tailings (BDT) left over from coal processing to create electricity. The power station uses FiCirc® fluidised bed combustion technology and a single 151MW steam turbine and associated equipment. The power station is designed to burn low value fuels such as coal tailings and is a preferred technology for energy generation from biomass. The technology has demonstrated excellent performance and a low emissions profile.

The power station was approved in 1994 (DA183/93) and the development consent was modified in 1997. Tailings were transferred by conveyor from the Warkworth mine to the power station as a source of fuel. The power station also relied on supplementary fuel in the form of Run of Mine (ROM) coal to assist in electricity generation. Due to the unavailability of coal tailings from Warkworth mine, the power station has been in care and maintenance since October 2014.

The power station is designed to burn low value fuels such as coal tailings and biomass, and has demonstrated excellent performance and a low emissions profile. Tailings were transferred by conveyor from the Warkworth mine to the power station as a source of fuel. The power station also relied on supplementary feedstock (fuel)[8] in the form of Run of Mine (ROM) coal to assist in electricity generation. Due to the unavailability of coal tailings from Warkworth mine, the power station has been in care and maintenance since October 2014.

To address concerns expressed by the community in relation the use of native forestry residues as fuel, the Applicant has developed an alternative biomass fuel strategy which specifically excludes this fuel source. Verdant will also relinquish the current approval to use coal tailings as a fuel at Redbank.

It is proposed that Redbank will be fuelled with ecologically sustainable biomass (in compliance with all relevant legislative requirements and excluding native forestry residues from logging) to deliver near net zero $CO_2$ power generation using standard fuels[9] and eligible waste fuels[10] from the following sources:

<u>Standard Fuels:</u>

- Purpose grown energy plantations;
- Perennial grasses; and
- Energy crops.

<u>Eligible Waste Fuels:</u>

- Biomass with no higher order uses arising from invasive native species control on agricultural land[11];

[8] A feedstock is defined as any renewable, biological material that can be used directly as a fuel, or converted to another form of fuel or energy product.

[9] A standard fuel is defined in Part 1 of Schedule 2 of the *Protection of the Environment Operations (Clean Air) Regulation* 2022 as 'an unused and uncontaminated solid, liquid or gaseous fuel that is — (c) a wood or wood-derived fuel'.

[10] An eligible waste fuel is defined as a 'waste or waste-derived materials considered by the EPA to pose a low risk of harm to the environment and human health due to their origin, low levels of contaminants and consistency over time' as per NSW EPA (2022) *Eligible Waste Fuel Guidelines*.

[11] The *Land Management (Native Vegetation) Code* 2018 under the *Local Land Services Act* 2013 sets out permitted clearing and thinning of native vegetation on agricultural land, such as invasive native species where a compliance certificate has been issued by Local Land Services NSW.

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- Biomass with no higher order uses from approved land clearing activities such as major infrastructure developments for approved civil infrastructure, road clearing works, right of ways and related approved projects[12];
- Agricultural waste biomass products or residues with no higher order uses;
- End of life waste woody biomass manufactured and produced into a fuel to specification ("Domestic Biomass") (subject to EPA approval as an eligible waste fuel)[13]; and
- Other sources of eligible waste fuels with no higher order uses.

Note that at the initial startup of the power station, and following boiler maintenance and restart of the boilers, a startup supplementary fuel (diesel or a similar fuel) will be used to achieve the temperature required to use biomass as fuel. Once the boiler is operating at the design temperature, the Redbank Power Station will use only approved biomass as fuel.

The Proposal will use up to 700,000 tonnes of dry equivalent biomass per annum (approximately 850,000 tonne per annum at 25% moisture) as a fuel for conversion into electricity. Fuels for the Redbank Power station will be implemented in two stages.

The first stage will involve the start-up of operations using biomass (with no higher order uses) sourced primarily from approved land clearing operations (from existing civil and road works), biomass from invasive native species on agricultural land as approved by Local Land Services NSW and potentially a limited amount of purpose grown biomass.

The second stage will involve the introduction or increased use of purpose grown biomass which will be further increased over a period of two to four years from approval, and, if approved and declared an eligible waste fuel by the NSW EPA, the introduction and use of Domestic Biomass.

Verdant will, where appropriate, seek separate Specific Resource Recovery Orders and Exemptions (RROE) and notification by the NSW EPA in the New South Wales Government Gazette as required prior to the use of the biomass fuels.

Ash generated by the Proposal will be regularly tested and transported off-site for beneficial use as a soil amendment in agriculture in accordance with EPA requirements. Trucks used to deliver biomass to the site will be backloaded with the ash for removal to an approved site for reuse in accordance with the *Ash from Burning Biomass Order and Exemption* 2014. Once Domestic Biomass is approved, Verdant will apply for a separate RROE for the resulting ash derived from Domestic Biomass.

To enable the power station to use biomass as a primary fuel source, some modifications to the plant and operations will be required. These changes are summarised below:

- Maintenance, repair and recommissioning works within the power station to permit recommencement of electricity generation;
- Delivery of biomass in B-doubles (42-44 tonnes per load) via Long Point Road on a 24/7 basis. Deliveries will be prioritised to 16-hour shifts on Monday through Sunday between 6am and 10pm;
- The existing conveyor from the Warkworth mine for transfer of coal tailings into the plant will remain in the first instance;
- Two 28m long weighbridges to be installed along the (western) inbound lane into the Site and the (eastern) outbound lane out of the Site;

[12] Requires notification by the NSW EPA in the New South Wales Government Gazette under Section 140 of the *Protection of the Environment Operations (General) Regulation* 2022.

[13] Domestic Biomass Fuel (DBF) is not currently prescribed as an 'eligible waste fuel' under current EPA guidelines, though the applicant will seek to demonstrate this prior to its use through a post-approval Specific Resource Recovery Order and Exemption application under Clause 93 of the *Protection of the Environment Operations (Waste) Regulation* 2014.

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- Conversion of the power station to enable the use of up to 700,000 tonnes dry equivalent per annum of biomass as feedstock fuel for electricity generation with near net zero $CO_2$ emissions equivalent;
- Construction of a 160m sealed road at the rear of the site to enable to delivery of biomass to the fuel storage area;
- Establishment of a new fuel delivery area adjacent to the existing stockpiling area directly south of the existing power plant. The system will incorporate two dual-lane drive over truck unloaders, two additional conveyors that supply two radial telescopic conveyors to unload the biomass. One telescopic conveyor will direct fuel to the existing fuel storage area (i.e. the area approved for storage of coal tailings), and the second to two moving floor bulk unloader bins, which directly feed existing Conveyor 76. Swales to be provided around biomass stockpile area to minimise movement of biomass fuel from the designated storage area;
- Use of the existing Conveyors 34 and 35 to supply Boilers 1 and 2 respectively with biomass fuel. An extension to Conveyor 76 and removal of the crusher house is required to enable the even transfer of fuel via Conveyors 34 and 35 to Boilers 1 and 2;
- Modifications to two reversing conveyors within the power station to transfer the biomass into each of six fuel silos that will store the biomass. These silos previously stored ROM coal for delivery into the plant's fluidised bed combustion chambers;
- Modifying of the 'trouser legs' of the six fuel silos within the power station to enable the more efficient flow of biomass into the plant's fluidized bed combustion chambers;
- Ash generated from the combustion process will be sampled, tested and potentially used as a fertiliser in accordance with the EPA's *The Ash from Burning Biomass Order* 2014. The existing ash slurry system previously used to transfer coal tailings ash back to Warkworth mine will remain in place, though it will not be used and will be removed at a later date. A Specific Resource Recovery Order and Exemption will be sought for ash from use of Domestic Biomass Fuel (DBF) as a fuel; and
- Other work, including landscaping, fire detection and suppression systems, and refurbishment of internal elements of the power station as required. This will also include the purchase of a water access licence, reconnection to the electricity grid, development of a spare parts inventory and purchase and storage of a fuel invention for the power station.

When fully operational the Proposal will supply the grid with approximately 1 million megawatt hours of 24/7 dispatchable or baseload electricity per year, equivalent to supplying around 200,000 homes. The Proposal will also drive significant progress towards the NSW Government's *Net Zero Plan Stage 1: 2020-2030*, the foundation for NSW's action on climate change and goal to reach net zero emissions by 2050.

The proposed project is considered State Significant Development (SSD) under Clause 20(a) of Schedule 1 of *State Environmental Planning Policy (Planning Systems)* 2021 as it involves a development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that has a capital investment value of more than $30 million.

Therefore, the project requires assessment under Part 4 of the Environmental Planning and Assessment Act 1979 and an Environmental Impact Statement (EIS) will need to accompany the development application. An amended licence from the NSW EPA under Schedule 1 of the Protection of the Environment Operations Act 1997 will be required. The Proposal will be assessed by the Department of Planning, Housing and Infrastructure and determined by either the Minister for Planning or the Independent Planning Commission.

The Facility currently possesses an existing EPA licence (EPL 11262) under clause 17 of Schedule 1 for '*electricity generation*' works. The Facility will also require licensing for '*energy recovery'* under clause 18 of Schedule 1 of the *Protection of the Environment Operations Act* 1997.

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The Proposal is suitably located at an established power plant with existing technology in place. The Site has been previously cleared and disturbed to establish the power plant, and the nearest dwellings are over 1km away to the east.

Figure 1.1 provides a map showing the Proposal location, and Figure 1.2. shows the regional context surrounding the Redbank Power Station. Figure 1.3 shows the Proposal Site including lot boundaries. Figure 1.4 illustrates the primary site constraints in relation to the Site and Figure 1.5 shows a view of the Redbank Power Station from the south.

Verdant Earth is committed to complying with all laws that affect its operations and understands that development approval and appropriate licensing is required prior to the Proposal occurring. This EIS has been prepared to address the Secretary's Environmental Assessment Requirements (SSD-56284960) issued by the NSW Department of Planning and Environment (now the NSW Department of Planning, Housing and Infrastructure) and on 30th August 2023.

## 1.2. Applicant details

Founded in 2018, Verdant Earth Technologies Limited (Verdant Earth) is an Australian-based green energy company established to develop, and operate green hydrogen and renewable energy assets. Verdant Earth believes the foundation of a net-zero economy is net-zero infrastructure. The Redbank power station is central to this strategy and to their proposed green Energy Hub in the Hunter Valley.

The board of Verdant Earth Technologies Limited consists of five members with experience in energy and technology sectors across Australia and international markets.

See Table 1.1 for contact details regarding the Proposal.

**Table 1.1. Verdant Earth Technologies Limited contact information.**

| Company | Verdant Earth Technologies Limited |
|---|---|
| Contacts | Mr Mike Haywood<br>General Manager Feedstock Fuels and Sustainable Energy; and<br>Henry Poole<br>Commercial Manager |
| Postal Address | GPO BOX 2537, Sydney NSW 2001 |
| Phone | +61 (0) 407 400 071 (M. Haywood)<br>+61 (0) 423 695 554 (H. Poole) |
| Email | mhaywood@verdantearth.com.au<br>hpoole@verdantearth.com.au |
| Project | Restart of Redbank Power Station and Use of Biomass (Excluding Native Forestry Residues from Logging) as a Fuel<br>112 Long Point Road West<br>Warkworth NSW 2330 (Lot 450 DP 1119428) |
| ABN | Verdant Earth Technologies Limited<br>ABN 65 624 824 791 |

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## 1.3. Key features of the Site and surrounds

The Facility is located in the Singleton Local Government Area, within the Hunter Valley, NSW. Combined with an industry base, skilled labour force and location on a major transport route, Singleton LGA is an attractive business and commercial location and is home to major industries including coal mining and construction, defence, agricultural production and viticulture.

The Hunter region is comprised of ten local government areas including Cessnock, Dungog, Lake Macquarie, Maitland, MidCoast, Muswellbrook, Newcastle, Port Stephens Singleton, and the Upper Hunter. It includes Greater Newcastle, the seventh largest urban area in Australia.

The Site is positioned in a suitable location approximately 10 km to the west of Singleton, 10 km northeast of Bulga and 8 km northwest of Mount Thorley. Four open cut coal mines are within 2.2 to 7 km of the Site. The surrounding region also includes rural and agricultural properties and industrial areas. The Singleton Army base is located approximately 10 km to the southeast of the Site. Directly to the south of the Proposal Site is a railway easement, transmission line easement and the Golden Highway.

The nearest dwellings are over 1km distance toward the east. The closest National Park is Wollemi National Park approximately 11km to the west of the Facility. Other National Parks in the region include Mount Royal and Barrington Tops National Parks to the north, Yengo National Park to the south, Goulburn River National Park to the west and Belford National Park to the east.

The lot itself is about 18 hectares, and the existing Redbank Power Station comprises approximately 10 hectares on the east side of the lot on relatively flat land with a northeasterly aspect. Average gradients of the Site are in the order of 1-2%. The immediate surrounding landscapes are a mixture of uncleared bushland and cleared land and native pastures for grazing.

The area of land occupied by the power station infrastructure has been previously disturbed and cleared. The Site currently contains existing power station infrastructure and technology to support the Proposal including:

- Multiple buildings including offices, warehouses, and turbine hall;
- Road access and carparks;
- Stockpile area and conveyor belts;
- Sediment basin, detention basin and wastewater storage basin;
- Two separate existing access points to the Site from Long Point Road West; and
- Power generation infrastructure (Boiler, cooling tower, stack and turbo generator).

The existing connection to the Shortland electrical system is via a 132 kV electrical interconnect line less than one kilometre (km) in length connecting Shortland's existing 132 kV line from Singleton to Kurri Kurri. No further modifications to the electricity line are proposed.

No areas of sensitive biodiversity, flooding or other environmental constraints are located on the land area slated for construction and operation of the Proposal. A riparian area (Sandy Hollow Creek) sits to the west on the lot but is located outside of the area of construction and operation. Biodiversity Value mapped land generally follows the same riparian zone however is outside of the footprint of the Proposal and will not be affected. Part of the Facility is categorized as bushfire hazard “vegetation buffer”. Adequate area for asset protection zone has been assessed and incorporated into the Proposal.

A Site Constraints Map is provided in Figure 1.4. A full resolution map is provided in Appendix FF.

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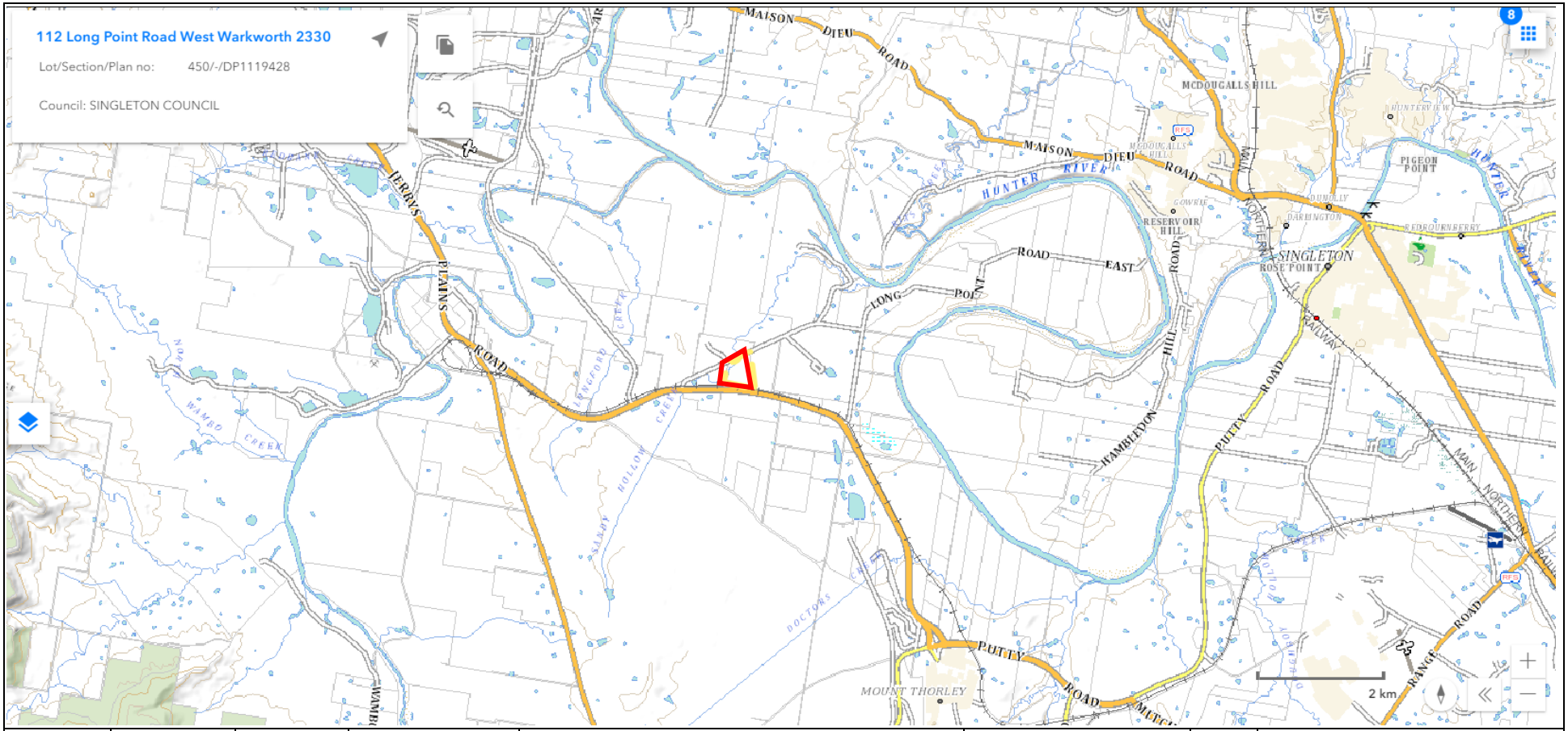
**Figure 1.1 Site location. Lot boundary shown in red.**




| Date | Revision | Drawn By | Site description |
|---|---|---|---|
| 15/09/23 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) |
| | | | |
| | | | |
| | | | |

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| Client | Verdant Earth Technologies Limited |
|---|---|
| Project | Redbank Power Station |
| Title | Site location |
| Scale | Per image |
| Source | NSW Planning Portal |

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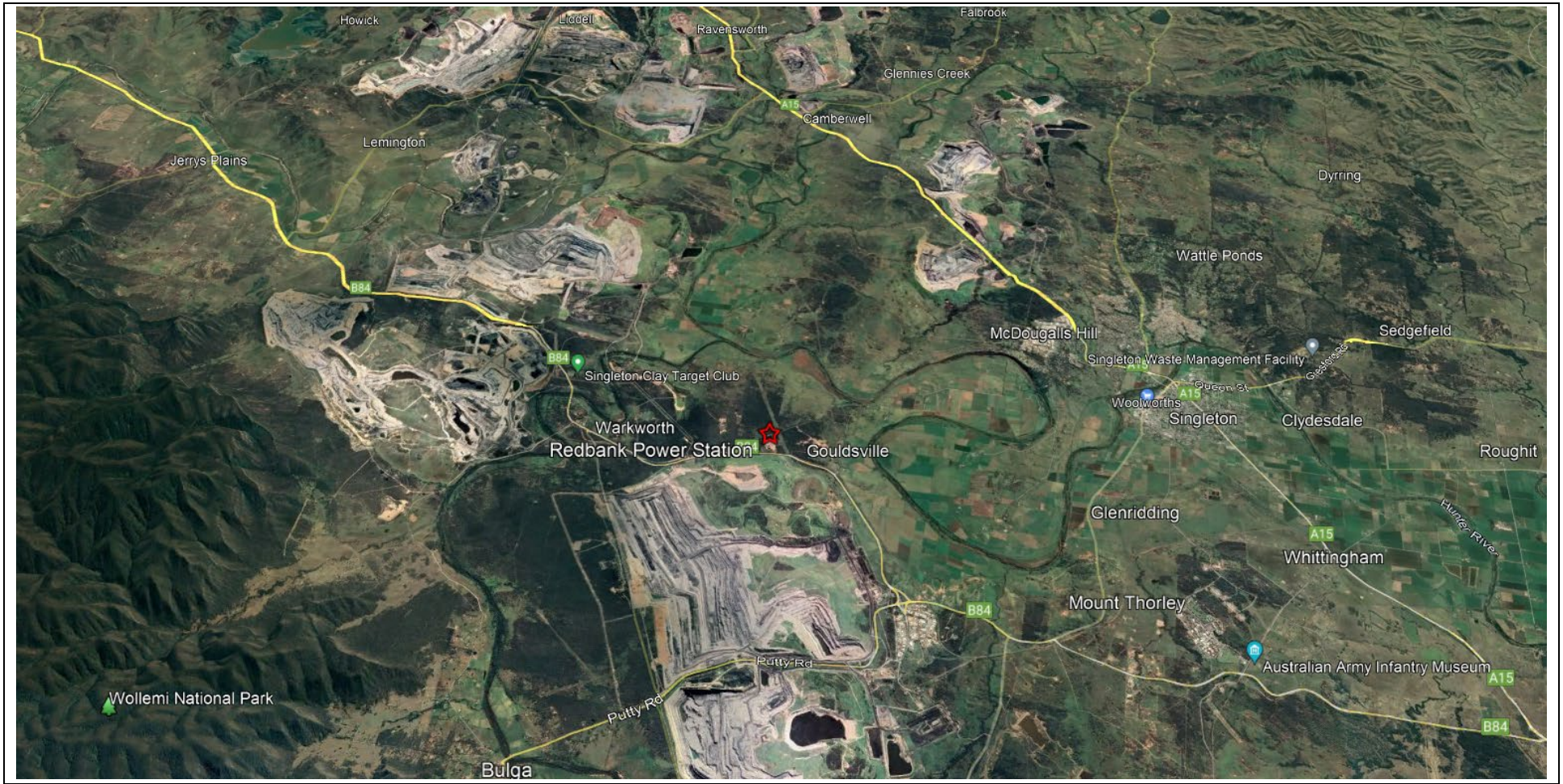
**Figure 1.2 Regional context surrounding the Redbank Power Station (red star).**




| Date | Revision | Drawn By | Site description |
|---|---|---|---|
| 15/09/23 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) |
| | | | |
| | | | |
| | | | |

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| Client | Verdant Earth Technologies Limited |
|---|---|
| Project | Redbank Power Station |
| Title | Site location |
| Scale | Per image |
| Source | NSW Planning Portal |

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**Figure 1.3. Aerial view of the Site. Lot boundary shown in red.**

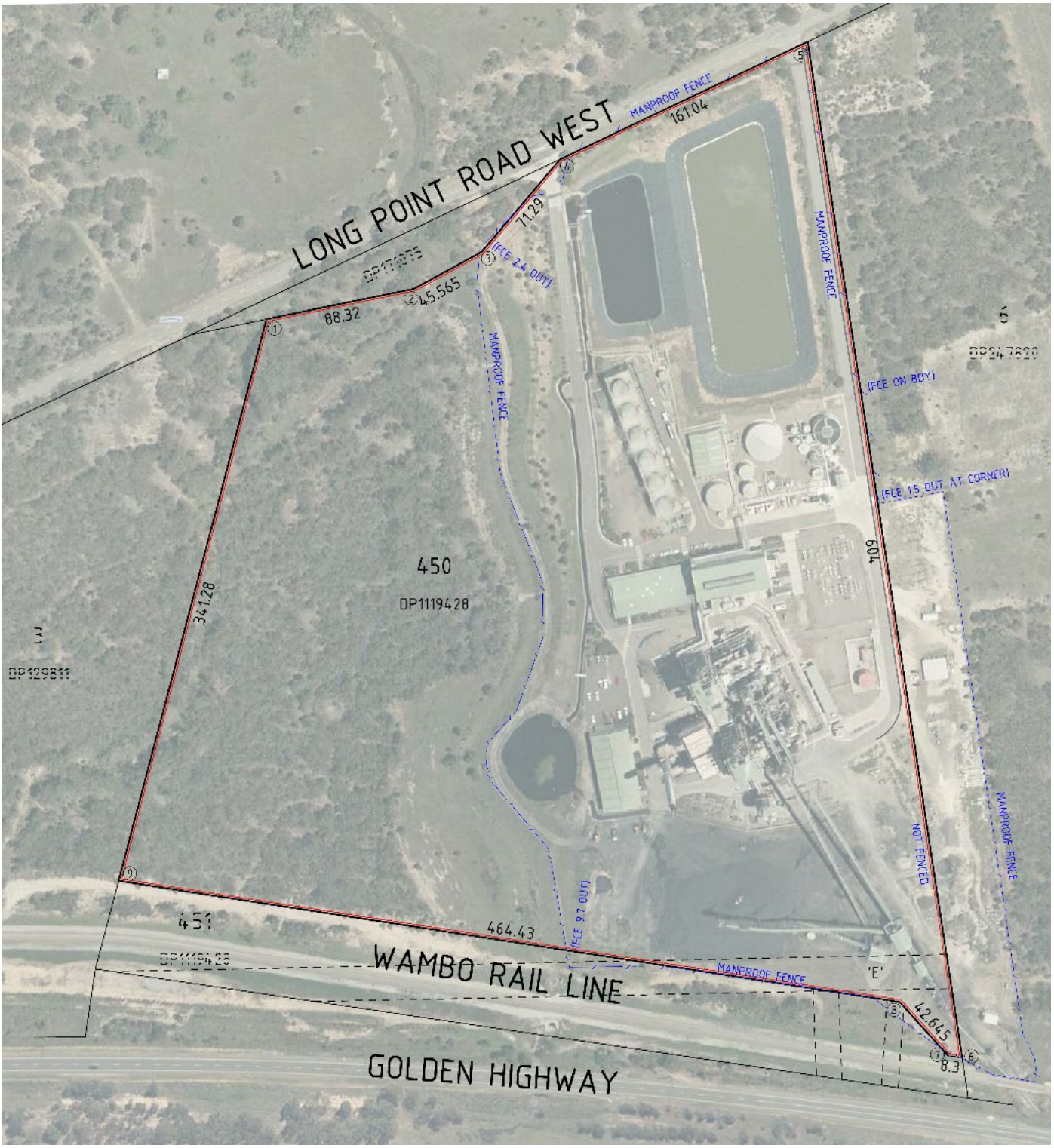


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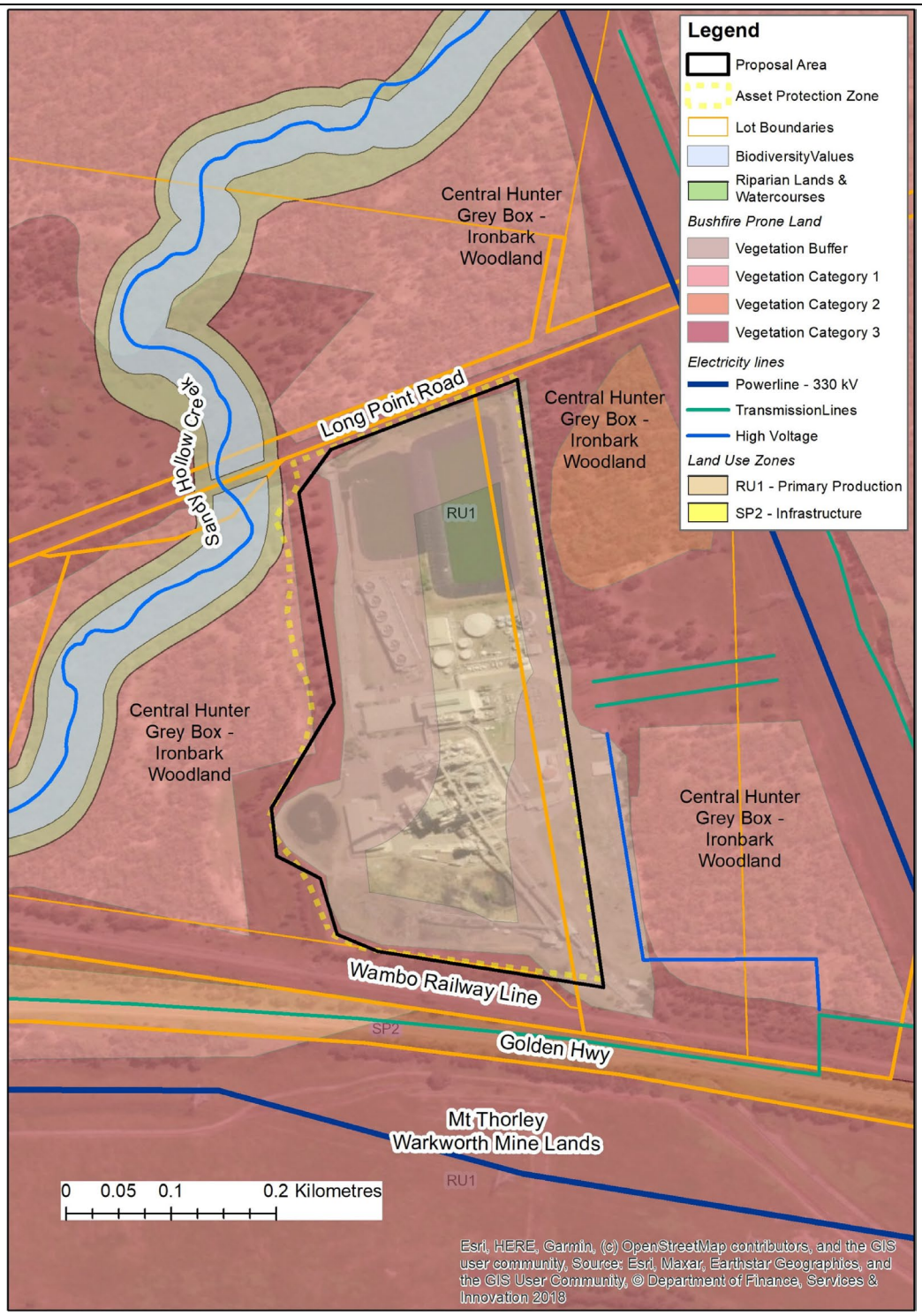
**Figure 1.4. Site constraints mapping. See Appendix FF for full resolution map.**




| Date | Revision | Drawn By | Site description | Client | Verdant Earth Technologies Limited |
|---|---|---|---|---|---|
| 29/11/23 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) | **Project** | Redbank Power Station |
| | | | | **Title** | Site Constraints Map |
| | | | | **Source** | Lethlean Fire and Environment |

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**Figure 1.5. View of Redbank Power Station from the south.**

## 1.4. Objectives of the Development

The main objective of the Proposal is to provide renewable baseload energy generation by restarting the Redbank Power Station generator using 100% biomass to fuel its operations in lieu of coal tailings. This will provide urgently needed power into the grid, lower GHGs by 93% compared to the currently approved fuel (coal) and bridge the energy reliability gap.

The facility will be one of the largest green baseload renewable energy providers in NSW and the only existing facility capable of providing continuous green 24/7 power with near net-zero CO2 emissions, adding to grid stability.

The Proposal will support meeting objectives outlined in both the *NSW Waste and Sustainable Materials Strategy 2041* and the *NSW Government's Net Zero Plan Stage 1: 2020 – 2030* and other important government policies as identified in Section 2.

In summary, the objective of the Proposal is to recommission and operate a facility that:

- Conforms with all applicable laws, regulations, and codes;
- Provides reliable electricity generation with near net zero $CO_2$;
- Generates 1,000,000 MWh of green 24/7 baseload power;
- Support NSW's transition to sustainable energy and less reliance on coal;
- Reduces greenhouse gas emissions by approximately 93% compared to the currently approved fuel (coal tailings); and
- Assists the waste recycling industry by reducing waste going to landfill.

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## 1.5. Site History and Existing Approvals

The facility was originally assessed as designated development (electricity generating station) under Part 4 of the *Environmental Planning and Assessment Act* 1979 and approved under DA183/93 to construct and operate a fluidised bed combustion power plant, fuelled from coal washery tailings supplied by the Warkworth and Lemington Mines.

The development application was submitted to Singleton Shire Council and accompanied by an Environmental Impact Statement (EIS) to demonstrate that appropriate consideration was given to the impact that the development, and to address the NSW Department of Planning and Environment impact assessment requirements.

The original EIS was lodged in December 1992. An amended EIS was prepared in November 1993 to assess any additional potential impacts associated with locating the Redbank Project adjacent to the Warkworth Mine at a site approximately 5 kilometres east of the site proposed in the original EIS. The development consent (DA183/93) was granted by Singleton Council on 23 March 1994 and on 15 April 1994 was appealed to the NSW Land and Environment Court with Greenpeace Australia the third-party objector. On 10 November 1994 the appeal was dismissed, and the development consent (DA183/93) granted by Singleton Council.

A subsequent modification to that consent was granted by the NSW Land and Environment Court on 27 March 1997 pursuant to the prepared statements of Roy Alper and Thor Hibbler containing information pertaining to the modification (circa February 1997). Table 1.2 identifies the key components of the development consent as modified in 1997.

Figure 1.6 and Figure 1.7 show two perspective photos of the south and west sides, respectively, of the existing power plant facility. The photos were taken on 28 May 2021.

**Table 1.2. Key elements of original approvals.**

| Aspect | 1994 approval | 1997 modification approval |
|---|---|---|
| Power generation | Nominal rating of 120 megawatts (MWe) (gross), approximately 1000MW net output | Nominal rating of 120 megawatts (MWe) (gross), approximately 1000MW net output |
| Fuel Type | Coal washery tailing supplied from the Warkworth and Lemington mines, augmented as necessary by existing tailing dams and supplemental fuel. | Coal washery tailing supplied from the Warkworth mine, augmented as necessary by existing tailing dams and supplemental fuel. |
| Fuel amount | 700,000 tonnes per annum. | 700,000 tonnes per annum. |
| Fuel haulage | Slurry pipeline from the Warkworth and Lemington washeries (and, as needed, from the Warkworth and Lemington tailing dams) to the site. Washery on the Redbank Power Station site. | Overland conveyor for transport of beneficially dewatered tailings from the Warkworth mine (and, as needed, from the Warkworth tailing dams) to the site. Supplemental fuel would be trucked a short distance to the Project site, where it would be stored and used as necessary to supplement the tailing fuel. Washery facility located at the Warkworth mine. |
| Plant | Two atmospheric-pressure, hybrid bubbling/ circulating bed type boilers of the "FiCirc" design and turbo-alternator generating at 11 kilovolts (kV). | Two atmospheric-pressure, hybrid bubbling/ circulating bed type boilers of the "FiCirc" design and turbo-alternator generating at 11 kilovolts (kV). |
| Grid connection | Connection to the Shortland electrical system would be via a new 132 kV electrical interconnect line of less than one kilometre (km) in length. | Connection to the Shortland electrical system would be via a new 132 kV electrical interconnect line of less than one kilometre (km) in length. |

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| Aspect | 1994 approval | 1997 modification approval |
|---|---|---|
| Stream diversion | Diversion works for Sandy Hollow Creek and the Eastern Tributary | Diversion works for Sandy Hollow Creek and the Eastern Tributary |

**Figure 1.6. View of the south side of the Redbank Power Station.**


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**Figure 1.7 View of the west side of the Redbank Power Station.**


### 1.5.1. Deemed refusal appeal through the NSW Land and Environment Court (2021/22)

An application was made to Singleton Council to modify the existing development consent to enable the use of biomass as (biomass) fuel under Section 4.56 of the *Environmental Planning and Assessment Act* 1979 on 3 November 2020.

A Class 1 appeal was brought by Hunter Development Brokerage Pty Limited trading as HDB Planning and Design against the deemed refusal by Singleton Council of an application to modify a development consent to permit biomass to be utilised as a fuel source in an existing electrical generating power plant.

The Land and Environment Court dismissed the appeal on 3 June 2022, on the basis that the proposal was not considered to be substantially the same as the original development. As a result, the Court had no power to grant consent.

### 1.5.2. Designated Development application

To mitigate planning approval and delay risks during the appeal of the Section 4.56 modification application in the NSW Land and Environment Court case, Verdant Earth prepared a scoping report seeking the Secretary's Environmental Assessment Requirements (SEARs) for a Designated Development application under Clause 18(1c) of

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Schedule 3 of the *Environmental Planning and Assessment Regulation* 2000. On 10 August 2021 the DPIE issued SEARs 1596 to assist with the preparation of an Environmental Impact Statement.

The EIS and development application was structured to enable the Hunter and Central Coast Planning Panel, as the consent authority, to conduct a full and thorough merit assessment of the proposal. It is noted that all requirements of the DPIE as outlined in SEARs 1596 were addressed to enable the Hunter and Central Coast Planning Panel to consider and determine the application.

The application was lodged for assessment with Singleton Council on 8th June 2022. Singleton Council advised they do not have the resources to assess the application. The Department of Planning and Environment advised that the project can be assessed as State Significant Development (SSD) if the capital investment value exceeds $30 million. To trigger the requirements for SSD, the designated development application will be amended to include plant restart costs. This scoping report has been prepared as directed by DPE to enable the provision of a new set of SEARs, to enable the application to be amended and resubmitted as an SSD application for assessment by DPE and determination (if required) by IPC.

### 1.5.3. Verdant Earth Technologies business

Founded in 2018, Verdant Earth Technologies is working to achieve net-zero emissions through the development of green hydrogen and renewable energy assets. Verdant believes the foundation of a net-zero economy is net-zero infrastructure. The Proposed conversion of the Redbank Power Station to use biomass as a sustainable fuel will be one of Australia's largest green baseload renewable energy providers (outside of hydro). It will generate 1,000,000 MWh of green baseload power, equivalent to supplying 200,000 homes.

Additionally, the company plans to deliver end to end hydrogen solutions, facilitating the advent of the hydrogen economy. Verdant's goal is to be the first Australian company to unlock the power of green hydrogen – to meet our growing energy needs. The application for the development of a hydrogen facility will be a separate SSD application.

### 1.5.4. Analysis of Feasible Alternatives

During operations the Redbank Power Station has only sourced BDT and ROM from the Warkworth Mine. Due to high export prices in the coal market, the Redbank Power Station was deprived of good quality tailings and could not access sufficient quality supplies to operate the plant.

Given that the existing consent is set to expire in 2031, the ability of the power station to use more available fuel types suitable with the existing technology would revive a currently stranded asset and provide reliable baseload renewable power to the electricity grid.

As detailed in the Boiler & Power Plant Services Pty Ltd (B&PPS 2021) (Appendix F) Plant Conversion Report, the existing plant consists of fluidised bed combustion steam generator units of FiCirc® design and a steam turbine. The plant is highly efficient and well-suited to biomass combustion and demonstrated excellent performance and emissions profiles with a wide range of fuels, including biomass fuel in many other parts of the world.

The biomass proposed for combustion at the Facility is allowed under the *NSW Energy from Waste Policy Statement* as they are considered low-risk to the environment and human health due to their origin, composition and consistency. Referred to as 'eligible waste fuels', use of these fuels in a responsible and appropriate manner are supported by the NSW EPA through the *NSW Energy from Waste Policy Statement* and the *NSW Eligible Waste Fuel Guidelines*.

Whilst retrofitting other existing coal fired power stations to use biomass is possible, re-purposing the existing Redbank Power Station has been identified as the most efficient and effective alternative for developing baseload power infrastructure in NSW using sustainable wood waste residues (given the technology is specifically designed for this purpose). The Proposal will involve use of a stranded asset valued at $500M, enable the state of NSW to

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decarbonize the electricity sector and make progress towards the NSW Government's net zero emissions target by 2050.

### 1.5.5. Consequences of not carrying out the development

Were the Proposal not to move forward, an immediate opportunity for supporting the transition to renewable energy (e.g. solar and wind) with green baseload power would be lost.

A significant number of permanent and temporary jobs in the Hunter Region and greater NSW would not be realised. In total there would be an opportunity cost of an estimated 331 direct full time equivalent (FTE) jobs and 504 indirect production and consumption FTEs during construction, and 174.5 long term FTE jobs in the Singleton LGA, Hunter Region and NSW.

A key priority for the Hunter Region will be developing and investing in renewable energy technology to enable substantial cuts in emissions whilst responding to increased electricity demand from population growth. Without adequate growth in renewable generation to offset the impacts of retiring coal-fired power plants, electricity prices are likely to increase, and supply will be less reliable.

Additionally, the phasing out of the Hunter Region's concentration of coal fired power stations will have a lasting impact on the regional economy and community.

While renewables such as wind and solar power continue to be installed at record rates in NSW, their lower capacity factor, reliance on new transmission and inability to respond to demand signals mean that firm or "dispatchable" sources of generation are in critical need. If the Proposal were to not go ahead, a gap of 151 MW of firm (at generator) capacity would be left in NSW that could be used to fill electricity supply gaps identified by the Australian Energy Market Operator forecast for 2025. Further discussion regarding these consequences is provided in Section 2.1 of this EIS.

Should the Proposal be rejected, the Redbank Power Station would not assist the Singleton and Hunter Regions transition to a less carbon intensive economy or offer greater diversification of employment opportunities for its workforce.

### 1.5.6. Analysis of alternatives

Electricity generation in NSW is overwhelmingly at present sourced from black coal. About 76.5% (53,500 GWh) of current electricity demand is provided by coal-fired power plants in NSW[14] and will need to be replaced progressively as coal fired power is phased out. Whilst renewables have grown considerably over the past decade, increasing by 221%, it still currently only provides about 19% of overall electricity generation[15].

Whilst coal's importance is diminishing it continues to be the largest generation source. The extent of the challenge of replacing coal fired electricity with renewables is clearly evident.

One of the most important strategic issues facing NSW is its future energy supply including the availability of reliable baseload and renewable electricity generation. Economic growth in NSW is expected to lead to sustained growth in electricity demand that if left unchecked will potentially lead to a capacity shortfall in the future.

[14] Source: Australian Energy Statistics 2019-20 Department of Industry, Science, Energy and Resources.
[15] Source: EPA, Energy Consumption accessed on 15 November 2023. Web: https://www.soe.epa.nsw.gov.au/all-themes/human-settlement/energy-consumption#:~:text=Electricity%20imports%20enable%20NSW%20to,09%20(see%20Figure%203.3).

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Redbank Power Station's fluidised bed technology is highly efficient and suitable for a transition to biomass. Of the eight major coal fired power plants in NSW, three of them were either closed or demolished by 2019. Redbank is the newest, commissioned in 2001. The surviving coal-fired power plants are older and use dated technology.

Retrofitting the existing Redbank Power Station is considered a viable, suitable and a fast pathway forward that would revive a currently stranded asset and provide reliable baseload renewable power to the electricity grid at a fraction of the cost of building a new power station or alternatively retrofitting other outdated coal-fired power stations.

The Redbank Power Station was purpose built for the use of alternative fuels but has been in care and maintenance mode due to the lack of sufficient coal tailings in the market. Biomass is a suitable alternative fuel for the existing and readily available fluidised bed technology with proven low emissions profiles.

No other coal-fired power plants in NSW have the technology to transition, quickly and cost-effectively, to the use of renewables.

The Proposal would deliver green baseload power to the electricity grid and will be the first major project of its type in NSW to help drive progress towards the NSW Government's goal of net zero greenhouse gas emissions by 2050.

## 1.6. Development that is required for the project but will be subject to a separate assessment

As outlined in Section 4.2 of this EIS, additional licences and permits would be required from the NSW EPA.

Verdant Earth Technologies Ltd has an existing water supply work approval for pumping water from the Hunter River for use at the Facility. A water access licence (WAL) and purchase or lease licence shares or purchase of water allocations from another licence holder to access water from the Hunter River will be required to extract up to 3,300 ML/year of raw water from the Hunter River to meet the water requirements of the Proposal.

The Proposal is seeking development approval to allow the use of biomass fuels that comply with specifications (outlined in this EIS) from the market. Any development consent that may be required by suppliers of biomass fuel is a matter for the suppliers and not the applicant.

No other development approvals from Singleton Council or the NSW DPE are required in order to undertake the Proposal.

## 1.7. Description of any restrictions or covenants that apply to the Site

The Proposal is within a proclaimed Mine Subsidence District under section 20 of the *Coal Mine Subsidence Compensation Act* 2017. Development in a Mine Subsidence District requires approval from Subsidence Advisory NSW. Consultation with the Mine Subsidence District has been undertaken (see Section 5).

The Proposal is within Bushfire Prone land. A Bushfire Hazard Assessment has been completed for the Proposal (see Section 16).

A railway easement for the Wambo Rail Line is located directly south and adjacent to lot. A power line easement, as shown in Figure 1.3, travels through the southeast corner of the lot. A map showing other site constraints is provided in Figure 1.4.

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## 1.8. Existing and continuing uses rights

This development application and supporting EIS requests that a new approval is granted.

The conditions of the existing consent DA183/93 (as modified) allowing the primary operations and functions of Redbank will remain. However, the development application and supporting EIS will request that a new approval is granted that incorporates relevant conditions from the previous consent and permits:

- The use of Redbank Biomass as a fuel (ie: excludes native forestry residues from logging);
- The continuing use of Redbank Biomass post 2031 when the operation of the 1994 consent (and as modified in 1997) expires; and
- The use of coal and coal tailings will be rescinded.

The existing development consent and the 1997 modification would be surrendered once the proposed development is approved, and Redbank would then operate under a single modern development consent.

## 1.9. Proposed New Consent and Surrender of DA183/93 and the 1997 modification

Verdant Earth are seeking a new Development Approval and to surrender the existing consents (DA183/93 and as modified in 1997). The current conditions of approval, where relevant, would be adopted into the new approval. Existing Condition 22 in the new approval would be removed. Post the new approval, the life of consent condition will allow the proposed development to continue to use sustainable sourced Redbank Biomass in a manner that is not time bound.

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# 2. Strategic Context

## 2.1. Addressing Electricity Shortfalls

While variable renewable energy (VRE) such as utility scale wind and solar, and rooftop solar continue to be installed at record rates in NSW, their lower capacity factor, reliance on new transmission and inability to respond to demand signals mean that firm or "dispatchable" sources of generation are in critical need.

Sources of dispatchable generation include batteries, which face duration challenges, gas peaking plants, which face emissions and fuel challenges and pumped hydro, which typically encounter engineering, transmission and cost challenges that make for long lead times.

NSW requires additional dispatchable generation able to connect to the grid to mitigate the exit of coal generators and the increased forced outage rates forecast by AEMO for those generators.

The Proposal would provide baseload 'dispatchable' power 24 hours a day, seven days a week, unlike many other alternative renewables. The reliability of the electricity grid is a matter of public importance to NSW. With increasing installation of variable renewable energy resources such as wind and solar power plants the requirement for dispatchable electricity is becoming more critical to maintaining stability and supply.

Without adequate growth in renewable generation to offset the impacts of retiring coal-fired power plants, electricity prices are likely to increase and supply to be less reliable. The Proposal would enable cuts in emissions when compared to coal fired plants, whilst responding to increased electricity demand.

Marsden Jacob Associates was engaged by Verdant to prepare an analysis of the NSW Electricity Supply Gap: Expert opinion prepared for Verdant Earth Technologies on NSW electricity market (Appendix J). The report is an independent assessment of the NSW electricity supply outlook, the issues influencing this, and the role that the 151MW Redbank Power Station can potentially play within that outlook.

### 2.1.1. Energy market reliability gap

The National Electricity Market (NEM) is a wholesale market through which generators and retailers trade electricity in Australia. It interconnects the six eastern and southern states and territories and delivers around 80% of all electricity consumption in Australia.

The NEM operates to both the market reliability standard and an Interim Reliability Measure (IRM).

The NEM reliability standard is defined as:

> *"a maximum expected unserved energy (USE) in a region of 0.002% of the total energy demanded in that region for a given financial year".*[16]

The IRM threshold for USE is a more restrictive 0.0006% of energy demanded in a region in a given financial year.

The Australian Energy Market Operator (AEMO) was established by the Council of Australian Governments to manage the NEM. Each year the AEMO undertakes a ten-year forecast of the market's ability to meet the reliability standard and IRM through an Electricity Statement of Opportunities (ESOO) report. Where it foresees a breach of the reliability standard it estimates the level of supply gap that must be filled to avoid the breach.

[16] Australian Energy Markets Commission (AEMC). Reliability Panel Fact Sheet.

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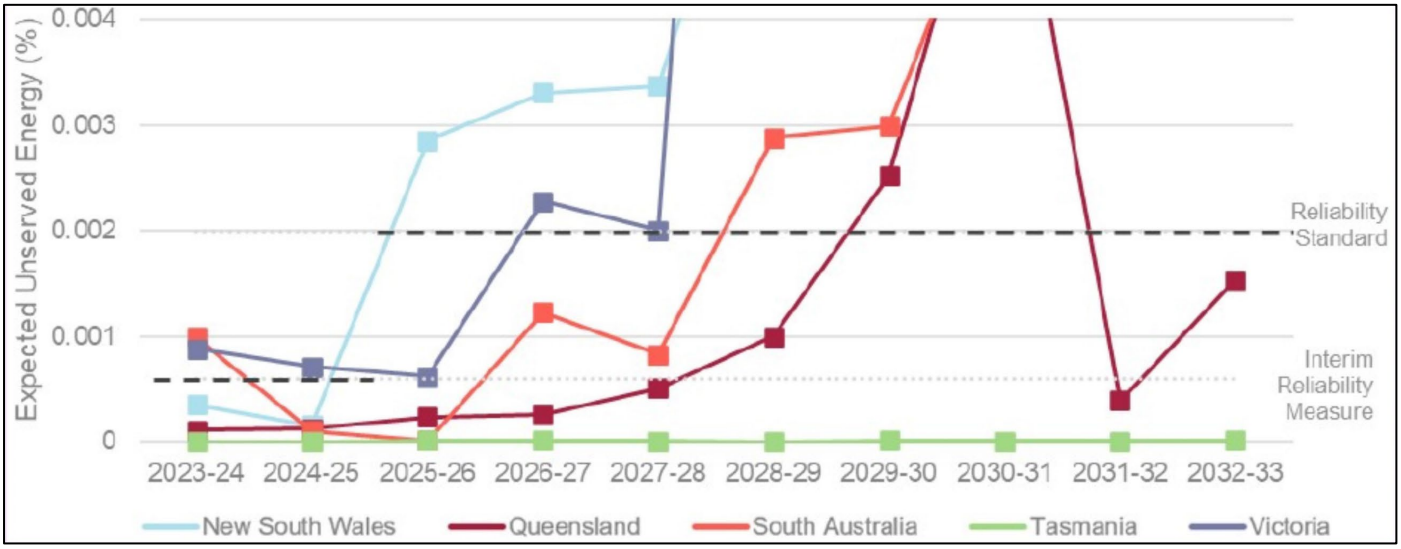
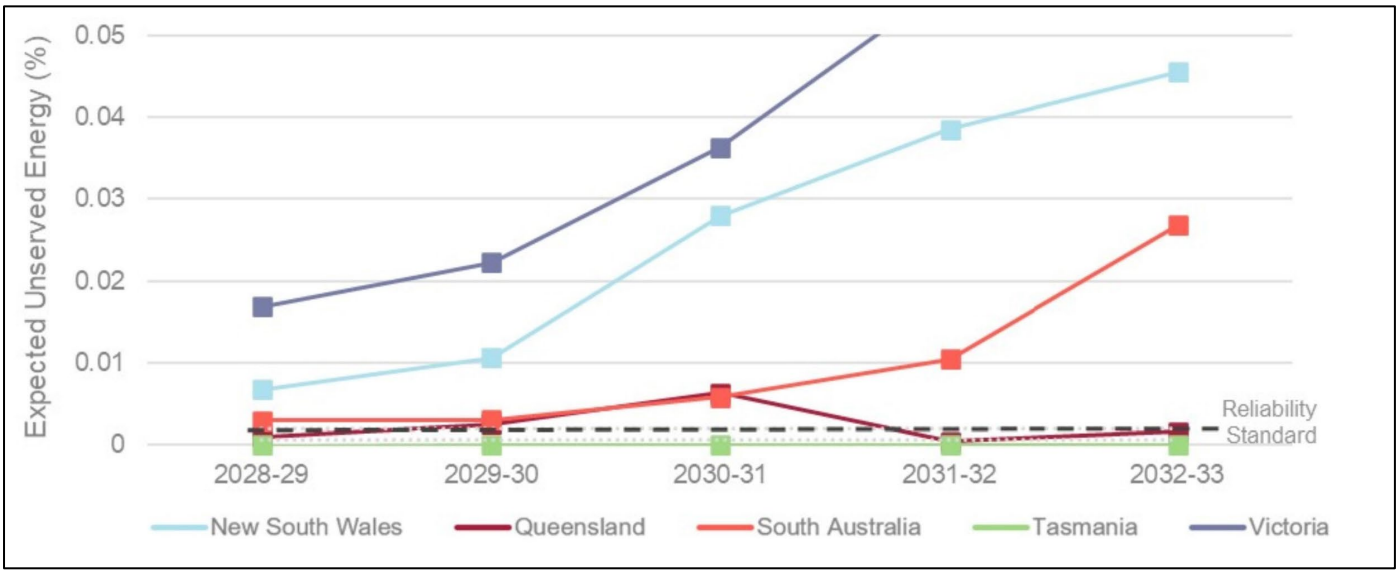
The latest forecast, which is the 2023 ESOO released in August 2023[17], projects a supply gap in NSW from 2025. Figure 2.1 below is taken from that report and shows the reliability outlook and shows the firm capacity shortfalls in each state.

**Figure 2.1. Expected unserved energy, ESOO Central scenario (Source: ESOO 2023 – Reliability Outlook).**




AEMO further notes, that based on proposed generation retirements and currently committed projects, the 2023 ESOO shows that NSW is currently projected to breach the reliability standard for the entire second half of the 10-year forecast between 2028-2033 (Figure 2.2).

**Figure 2.2. Indicative reliability forecasts, all regions, second five years (Source: ESOO 2023 – Reliability Outlook).**




The 2023 ESOO highlights the following issues in relation to the outlook for NSW.

- Snowy Hydro has stated that Snowy 2.0 will be delayed further, and a date of December 2028 is now forecast for its operations;
- The Tallawarra B gas plant is now scheduled for completion in November 2023;

[17] Australian Energy Market Operator (August 2023) 2023 Electricity Statement of Opportunities A 10-year reliability outlook for the National Electricity Market Including the 2023 Energy Adequacy Assessment Projection. Web: https://aemo.com.au/

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- The Kurri Kurri gas plant (renamed the Hunter Power project) is scheduled for completion in December 2024; and
- Forced outage rates for existing generation are forecast to be higher as are peak demand forecasts.

A temporary extension of two units of Eraring was also modelled by AEMO. The theoretical extension improved the outlook for NSW reliability and pushed back potential breaches of the reliability standard. It did not improve the outlook beyond the proposed extension period.

The AEMO also noted an increase in forced outage rates for coal plants, while the NSW Chief Scientist described coal plant unreliability as an emerging risk in its annual assessment of the preparedness of the NSW Energy Market for summer 2022-23[18].

Electricity supply reliability is therefore also subject to further risks including:

- An increasing likelihood that the coal generators in NSW will experience higher levels of forced outages than assumed as they approach the end of their operating life;
- The challenges faced by new transmission and new generation, making it likely that planned developments will be later than currently forecast by AEMO;
- A seven-to-ten-year outlook in which NSW is likely to have insufficient long duration storage and dispatchable peaking generation required to support the transformation to renewable generation;
- The risk of extended periods (days to weeks) of low wind and solar generation, and that due to a lack of data on regional renewable generation (as many are not yet operating or have been operating for a short period), such risks may not be fully understood.

### 2.1.2. Role of the Verdant Proposal

If the Proposal were to go ahead, an additional 151 MW of firm (at generator) capacity would be available in NSW that is not presently accounted for in official market projections.

The Marsden Jacob report (Appendix J) estimates the equivalent level of firm generation provided by the Proposal would require about 750 MWs of wind generation or at least 6 hours of storage over 500 MWs of 2-hour batteries. As a dispatchable generator the Proposal would do so without the duration limits of batteries, the potential for generation lulls associated with wind or the higher emissions of a gas plant. And it would be available faster than any alternative capacity.

The supply gap identified in the 2023 ESOO to meet the reliability standard in NSW in 2025-26 is forecast at 191 MW. Were the Proposal to be in place by then, the gap would reduce to approximately 40 MW.

Even if the proposed extension to Eraring removed the forecast supply gap, the Verdant Plant provides a contingency that is dispatchable.

This means that over the next seven to ten years, and beyond, the Proposal could have a direct role in delivering better electricity supply reliability and security in NSW and provide support to addressing unforeseen changes in outlook.

[18] NSW Chief Scientist and Engineer (7 November 2023), Assessment of the Preparedness of the NSW Energy Market 2022-23. Executive Summary p. 5. Web: https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0011/548525/NSW-Summer-Energy-Preparedness_2022_23.pdf

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## 2.2. International Significance of Biomass to Energy Plants

Modern Bioenergy is supported as critical to achieving Net Zero by 2050 by the world leading authorities on Climate change, the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA).

Modern Bioenergy is a critical part of the solution to the intermittency of solar and wind and cornerstone to replacing retiring coal and fossil fuel fired generation. Modern Bioenergy uses sustainable biomass sources whereby biomass is created through the absorption of $CO_2$ (from the atmosphere) and subsequently released back into the atmosphere to generate energy in a near net zero carbon cycle[19]. This is unlike fossil fuels which release $CO_2$ stored in the Earth for millions of years and have been responsible for dramatically increasing the levels of $CO_2$ in our atmosphere.

In the IPCC Sixth Assessment Report released in April 2022[20], it is acknowledged that Modern Bioenergy has an important role in mitigating climate change by reducing $CO_2$ emissions from traditional fossil fuel electricity generation:

> *Bioenergy and other bio-based options represent an important share of the total mitigation potential (Ch. 7, p.751).*

The IPCC anticipates that Modern Bioenergy use will rise significantly from 30 Exajoules (EJ) at present, to between 75 and 248 EJ by 2050, in order to avoid catastrophic climate change. This is within the body's estimate for sustainable sourcing of bio-based fuels, taking into account environmental and food security constraints (Ch.3, p.341). Furthermore, the report states:

> *Bioenergy has the potential to be a high-value and large-scale mitigation option to support many different parts of the energy system. Bioenergy could be particularly valuable for sectors with limited alternatives to fossil fuels (e.g., aviation, heavy industry), production of chemicals and products, and, potentially, in carbon dioxide removal via bioenergy with carbon dioxide capture and storage or biochar* (Ch. 6, p.643).

And the report also states:

> *Similarly, climate-smart forestry puts forward measures adapted to regional circumstances in forest sectors, enabling co-benefits in nature conservation, soil protection, employment and income generation, and provision of wood for buildings, bioenergy and other bio-based products* (Ch.7, p.800).

The International Energy Agency (IEA)[21] in 2023 has reported:

> *Modern bioenergy is the largest source of renewable energy globally, accounting for 55% of renewable energy and over 6% of global energy supply. The Net Zero Emissions by 2050 Scenario sees a rapid increase in the use of bioenergy to displace fossil fuels by 2030. Use of modern bioenergy has increased on average by about 7% per year between 2010 and 2021, and is on an upward trend. More efforts are needed to accelerate modern bioenergy deployment to get on track with the Net Zero Scenario, which sees deployment increase by 10% per year between 2021 and 2030, while simultaneously ensuring that bioenergy production does not incur negative social and environmental consequences.*

[19] The use of biomass as fuel for electricity generation involves the short-term cycling of carbon in the atmosphere, which is excluded from national carbon accounts by IPCC convention. As such, Modern Bioenergy is often referred to as having a 'net zero emission cycle'. However, when Scope 3 emissions are accounted for in the processing and transport of biomass residues as fuel, this results in a small net release of GHG's, so in the context of this proposal, the cycle is referred to as a 'near net zero emission cycle'.

[20] Intergovernmental Panel on Climate Change (2022). *Climate Change 2022 – Mitigation of Climate Change. Working Group III contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Published by IPCC, 2022. Internet publication: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf

[21] International Energy Agency (2023). *Bioenergy.* Internet publication: https://www.iea.org/fuels-and-technologies/bioenergy.

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Climate legislation introduced by the Federal Government in September 2022 to implement Australia's net-zero commitments is now in force. On 14 September, the *Climate Change Act* 2022 and the *Climate Change (Consequential Amendments) Act* 2022 commenced.

The *Climate Change Act* 2022 operates as 'umbrella' legislation to implement Australia's net-zero commitments and establishes Australia's net 2030 and 2050 GHG emission reductions targets under the Paris Agreement.

Australia now has legislated, economy-wide emission reduction targets of:

- Reducing net GHG emissions to 43% below 2005 levels by 2030 (Clause 10(1)(a) of the *Climate Change Act* 2022); and
- Reducing net GHG emissions to zero by 2050 (Clause 10(1)(b) of the *Climate Change Act* 2022).

The emissions target established under Commonwealth law will play a substantial role in shaping State and Territory climate change policy in the coming decade as progress is made towards the interim 2030 target.

The NSW Government's *Net Zero Plan Stage 1: 2020–2030 Implementation Update*[22] and the *Net Zero Plan Implementation Update 2022*[23] commit NSW to reducing emissions by 50% below 2005 levels by 2030, and 70% below 2005 levels by 2035.

The EPA in a major milestone and in a first for any environment regulator in Australia has just released a *Climate Change Policy and Action Plan*[24] for addressing climate change and protecting the environment.

This policy document states:

> *We adopt and support the delivery of the NSW Government's Climate Change Policy Framework, including the:*
>
> - *Net Zero Plan Stage 1: 2020–2030;*
> - *Net Zero Plan Stage 1: 2020–2030 Implementation Update;*
> - *Net Zero Plan Implementation Update 2022;*
> - *Climate Change Adaptation Strategy;*
> - *Waste and Sustainable Materials Strategy.*
>
> *Our climate change policy and the associated action plan (Climate Change Action Plan 2023–26) complement, support and build on the foundations set in those documents.*
>
> *Our Strategic Plan 2021–24 identifies climate change and ecologically sustainable development as two of our key focus areas.*
>
> *We are committed to:*
>
> - *taking action to reduce greenhouse gas emissions, mitigate climate change impacts and build greater environmental and community resilience aligned with the principles in the NSW Net Zero Plan*
> - *championing sustainable approaches to mitigate the cumulative impacts of industry on local communities and environments.*

[22] Department of Planning, Industry and Environment (2022). *Net Zero Plan Stage 1: 2020–2030 Implementation Update.* Published by the NSW Government. Internet publication: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Climate-change/net-zero-plan-stage-1-2020-30-implementation-update-210460.pdf

[23] Office of Energy and Climate Change (2022). *Net Zero Plan Implementation Update.* Published by the NSW Government, December 2022. Internet publication: https://www.energy.nsw.gov.au/sites/default/files/2022-12/NSW-Net-Zero-Plan-Implementation-Update-2022.pdf

[24] NSW EPA (2023). EPA Climate Change Policy. *The NSW Environment Protection Authority's policy for addressing climate change and protecting the environment.* Published by the State of NSW and the NSW Environment Protection Authority, January 2023. Internet publication: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/climate-change/23p4264-climate-change-policy.pdf

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The Proposal is a near net zero $CO_2$ project and a small contributor to GHG emissions in NSW. Under a 'current policy' scenario for NSW, the project represents 0.03% of state-wide emissions in 2030, and 0.08% in 2050. It will provide 24/7 reliable power for over 200,000 homes and is an exemplar of Modern Bioenergy.

Verdant are also actively working to deliver additional benefits to improve this even further by moving to a modular localised purpose grown biomass feedstock fuel model, creating permanent carbon sinks and a direct line between absorbing existing atmospheric $CO_2$ and its release to provide near net zero energy. Verdant believe this model will be replicable, assist to restore semi-arid and arid land, provide jobs and economic stimulus for the regions, reduce $CO_2$ levels whilst providing the base for a stable and reliable green grid.

### 2.2.1. Comparable Biomass to Energy Plants

There are many small, medium and large biomass firing plants throughout the world today.

Some use strictly pre-consumer biomass residues and some have sophisticated capacity to separate wood-based post-consumer waste for developing wood-based refuse-derived fuel.

Below is a short list of boiler rebuilds and conversions of existing plants Valmet is assisting to convert to biomass burning and/or to the use of fluidised bed technology. Some of the conversions are pending showing a delivery year of 2024.

**Table 2.1. List of similar coal-fired to biomass conversion projects around the world.**

| Delivery Year | Plant | Country | Capacity (MW*) | Type of Project | Fuels |
|---|---|---|---|---|---|
| 2004 | Pannonpower Rt., Pécs | Hungary | 145 | Coal-fired to biomass conversion | Wood chips |
| 2005 | Enel Produzione SpA, Laino Borgo | Italy | 111 | Coal-fired to biomass conversion | Wood fuel |
| 2010 | Martinská Teplárenská a.s., Martin | Slovakia | 60 | Coal-fired to biomass conversion | Wood chips |
| 2010 | Kogeneracja S.A., Wroclaw | Poland | 76 | Coal-fired to biomass conversion | Wood chips, non-forest biomass |
| 2010 | Dalkia Łódź S.A., Łódź | Poland | 129 | Coal-fired to biomass conversion | Wood chips, non-forest biomass |
| 2013 | Kuopion Energia Oy, Kuopio | Finland | 220 | Conversion to fluidised bed | Peat, wood residues, oil |
| 2020 | Biomass Energie Alizay, Alizay | France | 163 | Conversion to fluidised bed | Wood chips, bark, recycled wood |
| 2021 | Zespół Elektrowni Pątnów-Adamów- Konin SA | Poland | 157 | Conversion to fluidised bed | Wood chips, willow chips, light fuel oil |
| 2024 | HELEN Oy, Salmisaari, Helsinki | Finland | 163 | Conversion to fluidised bed | Wood pellets, light fuel oil |
| 2024 | Veolia/Ujpalotai Energia Kft., Oroszlany | Hungary | 136 | Conversion to fluidised bed | Biomass, SRF, light fuel oil |
| 2024 | Veolia/CHP-Invest Kft., Oroszlany | Hungary | 136 | Conversion to fluidised bed | Biomass, SRF, light fuel oil |

*Megawatt thermal power

It should also be noted that there are similar technologies that are successfully using post-consumer biomass via vertical waste processing integration to produce energy. The Mälarenergi power plant in Västerås, Sweden uses circulating fluidised bed technology for energy from waste, and is one of the largest integrated waste processing

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facilities and has a capacity of 480 000 tonnes per year. Commissioned in 2014, the plant is well within both Sweden's and the European Union's air pollution limit criteria in terms of emissions. The plant combusts 100% residual wood-based biomass fuel at 250,000 tonnes per year.

In Finland and in Sweden, end-of-life cycle copper chrome arsenic (CCA) timber must be combusted in hazardous waste plant at temperature >1,600°C. Over a period of time in Finland and Sweden, laws have been made that ban the CCA timber from being combusted in power plants or buried in landfills. Waste management companies (equivalent to material recovery facilities in Australia) have the responsibility to separate CCA timber from the feedstock. The power plants also sample incoming feedstocks to make sure it is accordance with the agreed supply contract.

## 2.3. Strategic Plans Supporting the Proposal

### 2.3.1. Energy from Waste Infrastructure Plan 2021

The NSW Government supports thermal energy recovery as a residual waste management option where it can deliver positive outcomes for the community while protecting human health and the environment.

The Energy from Waste Infrastructure Plan guides strategic planning for future thermal energy from waste facilities to ensure infrastructure is located in areas that best address NSW's waste management needs until 2041, and where it maximises efficiencies for waste innovation, management and energy recovery.

The Energy from Waste Infrastructure Plan aims to provide certainty and transparency to industry and the community on how the NSW Government will facilitate the establishment and operation of energy from waste infrastructure to manage genuine residual waste.

The Energy from Waste Infrastructure Plan is guided by three principles:

1. Improve certainty to communities and industry around acceptable locations and facilities;
2. Adhere to the precautionary principle where there is a greater risk of harm to human health due to proximity to high population areas (now and in the future), and in areas where there are regular exceedances to air quality standards from existing sources; and
3. Maximise efficiencies in infrastructure, waste management, innovation and energy recovery.

The plan asserts that a mix of potential infrastructure solutions are needed to meet the State's residual waste needs and identifies that over the next 20 years, waste volumes in NSW are forecast to grow from 21 million tonnes in 2021 to nearly 37 million tonnes by 2041.

Facilities that only thermally treat lower risk 'eligible waste fuels' as listed in Part 3 of the *NSW Energy from Waste Policy Statement* and defined in the *Eligible Waste Fuels Guidelines*, including biomass and residues (also referred to as biomaterial), are excluded from the *Energy from Waste Infrastructure Plan*. The Energy from Waste Infrastructure Plan acknowledges that these types of energy from waste facilities will continue to be permitted across NSW if they comply with planning and environmental legislation and policies. Therefore, the Proposal is excluded from the *Energy from Waste Infrastructure Plan*.

### 2.3.2. NSW Waste and Sustainable Materials Strategy 2041

This strategy updates NSW's previous strategy: the *Waste Avoidance and Resource Recovery Strategy* 2014–2021.

NSW Waste and Sustainable Materials Strategy 2041: Stage 1 – 2021-2027 outlines the actions NSW will take over the next six years – the first phase of the strategy – to deliver on a set of long-term objectives. The strategy is driven by $356 million in funding to help deliver priority programs and policy reforms, including:

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- Phasing out problematic single-use plastic items;
- Financial incentives for manufacturers and producers to design out problematic plastics;
- Having government agencies preference recycled content and invest in research and pilots for recycling innovation;
- Introducing tighter environmental controls for energy from waste in NSW, with further consideration of planning and infrastructure needs underway;
- Mandating the source separation of food and garden organics for households and selected businesses; and
- Incentivising biogas generation from waste materials.

Specific targets focus on the environmental benefits and economic opportunities in how we manage our waste, and includes the following:

- Reduce total waste generated by 10% per person by 2030;
- Have an 80% average recovery rate from all waste streams by 2030;
- Significantly increase the use of recycled content by governments and industry;
- Phase out problematic and unnecessary plastics by 2025;
- Halve the amount of organic waste sent to landfill by 2030;
- Reduce litter by 60% by 2030 and plastics litter by 30% by 2025; and
- Triple the plastics recycling rate by 2030.

To complement this strategy, NSW also released the following documents:

- *NSW Plastics Action Plan*, which sets out how we will phase out problematic plastics, tackle litter from plastic items like cigarette butts, and support innovation and research;
- *NSW Waste and Sustainable Materials Strategy: A guide to future infrastructure needs*, which sets out the investment pathway required for NSW to meet future demand for residual waste management and recycling.

The Proposal will assist in creating additional markets for waste biomass with no higher order uses considered eligible waste fuel, helping to deliver targets in this strategy.

### 2.3.3. NSW Government's Net Zero Plan Stage 1: 2020 – 2030

The *Net Zero Plan Stage 1: 2020-2030* is the foundation for NSW's action on climate change and goal to reach net zero emissions by 2050. It outlines the NSW Government's plan to grow the economy, create jobs and reduce emissions over the next decade.

The plan aims to enhance the prosperity and quality of life of the people of NSW, while helping the state to deliver a 35% cut in emissions by 2030 compared to 2005 levels. The plan will support a range of initiatives targeting electricity and energy efficiency, electric vehicles, hydrogen, primary industries, coal innovation, organic waste and carbon financing.

As part of the plan, the NSW Government has set as their top priority is to drive the uptake on proven emissions reduction technologies that grow the economy, create new jobs or reduce the cost of living. The NSW Government's first priority is to provide a pathway to deploy those technologies at scale over the next decade. To do this, the NSW Government will remove unnecessary barriers to entry for those technologies and make co-investments to address the high upfront capital costs that may stand in the way of their take-up.

Furthermore, the NSW Government has set a target of net zero emissions from organic waste by 2030. To deliver on this goal, the NSW Government will establish world-leading landfill diversion policies to apply to the waste industry. It will:

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- Facilitate the development of 'waste to energy' facilities in locations that have strong community support, provided those facilities meet strict environmental standards; and
- Update regulatory settings to ensure residual emissions from the organic waste industry are offset.

These policies strongly support the re-purposing of existing energy generation infrastructure to create low emissions green power for residents of NSW. The proposed project will deliver green baseload power to the electricity grid and will be the first major project of its type in NSW to help drive progress towards the NSW Government's goal of net zero greenhouse gas emissions by 2050.

### 2.3.4. The National Waste Policy 2018 Strategy

The 2018 National Waste Policy provides a framework for collective action by businesses, governments, communities and individuals until 2030. The 2018 National Waste Policy focuses on waste avoidance, improved material recovery and use of recovered materials.

Strategy 7 of the policy aims to increase industry capacity through identifying and addressing opportunities across municipal solid waste, commercial and industrial waste, and construction and demolition waste streams for improved collection, recycling and energy recovery, to deliver ongoing improvements in diversion from landfill, improved quality of recycled content and use of the waste hierarchy.

The Proposal's use of DBF would support this strategy and provide a suitable end use for waste that has no higher order uses.

### 2.3.5. NSW Electricity Infrastructure Roadmap

The NSW Department of Planning, Industry and Environment's *NSW Electricity Infrastructure Roadmap* (DPIE, 2020)[25] is a coordinated framework to deliver a modern electricity system using a whole of system approach to deliver new generation, transmission, long duration storage and firming. The plan is built on five foundational pillars:

1. Driving investment in regional NSW – coordinating build out of electricity infrastructure to deliver growth and long-term jobs in regional areas;
2. Delivering energy storage infrastructure – backing up renewables with long duration storage, to ensure power is available at all times when it is needed;
3. Delivering Renewable Energy Zones (REZs) – combining generation, transmission, storage and system strength services to ensure a secure, affordable and reliable energy system;
4. Keeping the grid secure and reliable – developing dispatchable electricity infrastructure to deliver electricity to the market on demand; and
5. Harnessing opportunities for industry – attracting businesses and enabling new industries to emerge and grow.

The Proposal sits within the Hunter-Central Coast REZ. By providing an alternative (to coal) dispatchable electricity source, the Proposal is well-placed to support the transition to a cleaner energy sector whilst maintaining a reliable and secure energy supply.

[25]NSW Department of Planning, Industry and Environment (2020), NSW Electricity Infrastructure Roadmap - Building an Energy Superpower Detailed Report. Web: https://www.energy.nsw.gov.au/nsw-plans-and-progress/major-state-projects/electricity-infrastructure-roadmap

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### 2.3.6. Energy Security Safeguard (NSW Government 2021)

In November 2019, the NSW Government announced the creation of the Energy Security Safeguard to incentivise the rollout of cost-effective energy savings and peak demand reduction measures. The Safeguard includes three different schemes:

- The NSW Energy Savings Scheme (ESS) provides financial incentives to install energy efficient equipment and appliances in NSW households and businesses; and
- The Peak Demand Reduction Scheme aims to reduce peak electricity demand in NSW by providing financial incentives to households and businesses to reduce energy consumption during hours of high peak demand; and
- The Renewable Fuel Scheme was established to encourage the production of green hydrogen in NSW and is expected to commence in 2024 and run until 2044.

The Peak Demand Reduction Scheme recognises that shortfall in firm capacity is most likely to occur at times of peak demand, and that peak demand reduction plays a critical role in improving reliability. The Proposal addresses the core concern of dispatchable capacity shortfalls during peak demand and replaces fossil fuel with biomass.

### 2.3.7. NSW Electricity Strategy (DPIE 2019)

The NSW Electricity Strategy is the NSW Government's plan for a reliable, affordable and sustainable electricity future. Meeting these objectives involves a three-layered approach:

- Support the market to deliver reliable electricity at the lowest price, while protecting the environment through an Energy Security Safeguard;
- Set an Energy Security Target to ensure that the State has sufficient generation capacity to cope with unexpected generator outages during periods of peak demand, such as during heat waves; and
- Ensure the State has sufficient powers to deal with an electricity emergency if one arises.

A key aim of the *NSW Electricity Strategy* is to improve the efficiency and competitiveness of the NSW electricity market and encourage investment in new price-reducing generation and energy saving technology. Investment in the Proposal is estimated to generate 1,009.5 direct and indirect jobs and a 25-Year NPV of $901.1 million. The majority of economic activity would occur in the Hunter Region, with an estimated annual value add during operation of $34.41 million, and in the Singleton LGA alone of $20.64 million.

### 2.3.8. Australia's Long Term Emissions Reduction Plan

Australia's whole-of-economy *Long-Term Emissions Reduction Plan* sets out how Australia will achieve net zero emissions by 2050 and recognises the pace and scale of renewables deployment is also creating technical challenges for our electricity systems. Key to the plan is integration of variable technologies to ensure future deployment occurs efficiently and keeps Australia's electricity supply secure, reliable, and affordable.

Longer term firming technologies, alongside an expanded transmission grid, can provide seasonal storage and protection against weather variability. The plan identifies pumped hydro, biomass, and new thermal generators combined with carbon capture and storage all play an important part of the strategy. The Proposal will assist in providing needed baseload electricity to the grid in support of the transition to renewables.

### 2.3.9. Hunter Regional Plan 2041 (HRP)

The Hunter Regional Plan 2041 (the Regional Plan) is a 20-year land use plan prepared under the EP&A Act. The Regional Plan is in effect for the nine Local Government Areas (LGAs) of the Hunter Region (including Port Stephens). The Regional Plan sets a strategic land use framework for economic growth and diversification and aims to unlock

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sustainable growth opportunities and investments, housing choice and lifestyle opportunities as a leading regional economy in Australia. The Regional Plan includes four principles:

- Growth – Support a net zero emissions economy and foster employment growth, competitiveness, and innovation;
- Community – Promote places to be together by weaving nature into our towns and cities which have welcoming and safe streets and public spaces;
- Resilience – Reduce risks associated with place-based shocks and stresses to improve the community's ability to withstand, recover from and adapt to changes and become more resilient; and
- Equity – Ensure communities are safe and healthy with residents having opportunities for economic advancement, housing choices and a secure retirement.

To support the delivery of these core principles, the Regional Plan contains nine objectives, including those of most relevance to this Proposal, Objective 1 and Objective 7:

**Objective 1: Diversify the Hunter's mining, energy, and industrial capacity:**

The objective refers leveraging opportunities created by the completion of the Hunter-Central coast Renewable Energy Zone (REZ) such as new employment in related manufacturing and energy intense industries that benefit from the proximity to the energy infrastructure within the REZ.

The creation of economic activity from the Proposal has the potential to support improved social and economic outcomes through increased employment opportunities and resulting livelihoods. The Proposal has strong potential to increase the diversification of the employment and industry profile through the Hunter Region and particularly in the Singleton LGA.

The Facility is located within the Hunter-Central Coast Renewable Energy Zone and provides an alternative (to coal) dispatchable electricity source. In support of the transition to a cleaner energy sector, the Proposal will assist in maintaining a reliable and secure energy supply to the grid.

**Objective 7: Reach net zero and increase resilience and sustainable infrastructure:**

The objective refers to reducing emissions, achieving the goal of net zero by 2050, and supporting the NSW Electricity Infrastructure Roadmap.

The Proposal aligns with these goals by supporting dispatchable electricity supplies as new renewable energy generation projects come online in the region (e.g. Upper Hunter Battery Energy Storage System).

The emission intensity for the Proposal is predicted to be well below the current grid average for NSW, and around 80% of the projected grid average for NSW in 2035. A small contributor to GHG emissions, under a 'current policy' scenario for NSW, the project would represent 0.03% of state-wide emissions in 2030, and 0.08% in 2050.

This contributes to the outcome of achieving the goal of net zero by 2050 and support the objectives set out in the NSW Electricity Infrastructure Roadmap.

### 2.3.10. Local Strategic Planning Statement 2020

The *Draft Upper Hunter Shire Council Local Strategic Planning Statement 2020* (LSPS) (UHSC 2020) is Council's vision for land use planning over a 20-year period. The LSPS gives effect to the HRP, outlining Planning Priorities for the LGA.

Four related themes identified as the community's vision for the Upper Hunter Shire include: quality living, a rural economy, a vibrant community, caring community and a sustainable environment. Planning priorities under the LSPS relevant to the Project include:

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- Avoid long-term degradation of natural environmental systems;
- Development of land and infrastructure is orderly and economical;
- Protection and rehabilitation of biodiversity and ecosystems;
- Planning for climate change; and
- Facilitate the use of renewable energy.

The LSPS aims to encourage economic diversification whilst protecting heritage and environmental values and diversifying the energy sector.

As assessed in this EIS, the Proposal would not impinge on Biophysical Strategic Agricultural Lands, or existing valuable agricultural land. The Proposal supports energy and economic diversification whilst also assisting with the transition to renewables.

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# 3. Project Description

## 3.1. Overview of Proposed Development

The Redbank Power Station is an approved baseload power station located at 112 Long Point Road West, Warkworth (Lot 450 DP 1119428) (the Site). Originally commissioned in July 2001, the Redbank Power Station was designed to use beneficiated dewatered coal tailings (BDT) left over from coal processing to create electricity. The power station uses FiCirc® fluidised bed combustion technology and a single 151MW steam turbine and associated equipment. The power station is designed to burn low value fuels such as coal tailings and is a preferred technology for energy generation from biomass. The technology has demonstrated excellent performance and a low emissions profile.

The power station was approved in 1994 (DA183/93) and the development consent was modified in 1997. Tailings were transferred by conveyor from the Warkworth mine to the power station as a source of fuel. The power station also relied on supplementary fuel in the form of Run of Mine (ROM) coal to assist in electricity generation. Due to the unavailability of coal tailings from Warkworth mine, the power station has been in care and maintenance since October 2014.

The power station is designed to burn low value fuels such as coal tailings and biomass, and has demonstrated excellent performance and a low emissions profile. Tailings were transferred by conveyor from the Warkworth mine to the power station as a source of fuel. The power station also relied on supplementary feedstock (fuel)[26] in the form of Run of Mine (ROM) coal to assist in electricity generation. Due to the unavailability of coal tailings from Warkworth mine, the power station has been in care and maintenance since October 2014.

To address concerns expressed by the community in relation the use of native forestry residues as fuel, the Applicant has developed an alternative biomass fuel strategy which specifically excludes this fuel source. Verdant will also relinquish the current approval to use coal tailings as a fuel at Redbank.

The Proposal will use up to 700,000 tonnes of dry equivalent biomass per annum (approximately 850,000 tonne per annum at 25% moisture) as a fuel for conversion into electricity.

The Facility will be fuelled using standard fuels[27] and eligible waste fuels[28] (excluding native forestry residues from logging). Verdant will, where appropriate, seek separate Specific Resource Recovery Orders and Exemptions (RROE) and notification by the NSW EPA in the New South Wales Government Gazette as required prior to the use of the biomass fuels.

Ash generated by the Proposal will be regularly tested and transported off-site for beneficial use as a soil amendment in agriculture in accordance with EPA requirements including the *Ash from Burning Biomass Order and Exemption* 2014 or a Specific RROE.

To enable the power station to use biomass as a primary fuel source, some modifications to the plant and operations will be required. These changes are summarised in Section 3.5.

[26] A feedstock is defined as any renewable, biological material that can be used directly as a fuel, or converted to another form of fuel or energy product.

[27] A standard fuel is defined in Part 1 of Schedule 2 of the *Protection of the Environment Operations (Clean Air) Regulation* 2022 as 'an unused and uncontaminated solid, liquid or gaseous fuel that is — (c) a wood or wood-derived fuel'.

[28] An eligible waste fuel is defined as a 'waste or waste-derived materials considered by the EPA to pose a low risk of harm to the environment and human health due to their origin, low levels of contaminants and consistency over time' as per NSW EPA (2022) *Eligible Waste Fuel Guidelines*.

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When fully operational the Proposal will supply the grid with approximately 1 million megawatt hours of 24/7 dispatchable or baseload electricity per year, equivalent to supplying around 200,000 homes. The Proposal will also drive significant progress towards the NSW Government's *Net Zero Plan Stage 1: 2020-2030*, the foundation for NSW's action on climate change and goal to reach net zero emissions by 2050.

A General Site Arrangement Plan is provided in Figure 3.8 showing an overview of the proposed changed to the Site. Figure 3.9 through Figure 3.12 illustrate the proposed changes to plant and equipment and 0 provides full scaled plans. High resolution drawings are provided of these in 0. A summary of the key aspects of the Proposal to enable the use of biomass as fuel is summarised in Table 3.1.

**Table 3.1. Key aspects of the development.**

| Key aspect | Description |
|---|---|
| **Project area** | • Redbank Power Station located at 112 Long Point Road West, Warkworth (Lot 450 DP 1119428);<br>• No additional land clearing required – only previously disturbed areas will be used for operations;<br>• Retrofitting of existing plant and equipment, minor excavation for weighbridges and access;<br>• No areas of sensitive biodiversity, flooding or other environmental constraints are located on the land area slated for construction and operation of the Proposal;<br>• Riparian area (Sandy Hollow Creek/Dights Creek) to the west on the lot is located outside of the area of construction and operation (see Figure 21.1);<br>• Part of the Facility is categorised as bushfire hazard "vegetation buffer". Adequate area for asset protection zone has been assessed and incorporated into the Proposal (see Figure 16.2); |
| **Existing physical layout and design** | • The existing Redbank Power Station includes the following infrastructure that will be used:<br>  ○ Multiple buildings including offices, warehouses, and turbine hall;<br>  ○ Road access and carparks;<br>  ○ Stockpile area and conveyor belts;<br>  ○ Sediment basin, detention basin and wastewater storage basin;<br>  ○ Two separate existing access points to the Site from Long Point Road West; and<br>  ○ Power generation infrastructure (Boiler, cooling tower, stack and turbo generator). |
| **Additional infrastructure proposed for construction** | • Additional infrastructure to be constructed (see 0 for full plans) includes:<br>  ○ 2 weighbridges (28m length each) at entry and exit access ways;<br>  ○ Sealed asphalt access (over existing disturbed areas) approximately 160m in length for B-Double access to bulk fuel unloaders;<br>  ○ 2 dual lane bulk fuel unloaders;<br>  ○ 2 radial arm telestackers;<br>  ○ 2 moving floor loader bins;<br>  ○ Various retrofits and modifications to the existing conveyors and fuel silos.<br>• During the course of detailed design, post-approval, there may be minor adjustments or changes required to the plans. Detailed assessments have been completed of what modifications are required to allow biomass fuel to be received, managed and used at the power plant (see 0 and Appendix F). |

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| Key aspect | Description |
|---|---|
| **Use and activities** | • Electricity generation;<br>• Receival, handling and combustion of biomass allowed under the NSW *Eligible Waste Fuel Guidelines* and the *Protection of the Environment Operations (General) Regulation* 2021;<br>• Up to 700,000 dry tonnes (850,000 tonnes at 25% moisture content) per annum biomass considered standard fuel and/or eligible waste fuel;<br>• The power plant will be operating 24/7;<br>• Licensed under EPL 11262 (to be varied to allow biomass);<br>• Approval under a Specific RROE, where relevant, for the use of biomass will be obtained from the NSW EPA;<br>• Ash management, removal and disposal under *The ash from burning biomass order 2014* or a Specific RROE;<br>• Extend operation of the power plant after 2031;<br>• Use of biomass as fuel on consent approval and ongoing as required. |
| **Stages** | Recommissioning of the Redbank Power station would occur in two distinct stages:<br>• Stage 1: start-up of operations using biomass (with no higher order uses) sourced primarily from approved land clearing operations (from existing civil and road works), biomass from invasive native species on agricultural land as approved by Local Land Services NSW and potentially a limited amount of purpose grown biomass; and<br>• Stage 2: introduction or increased use of purpose grown biomass which will be further increased over a period of two to four years from approval, and, if approved and declared an eligible waste fuel by the NSW EPA, the introduction and use of Domestic Biomass. |
| **Phases/Sequencing** | • Phase 1: Construction of plant modifications/upgrades;<br>• Phase 2: Application for Specific RROE (for eligible waste fuels);<br>• Phase 3: Variation to EPL 11262;<br>• Phase 4: Full operation;<br>• Phase 5: Application for Specific RROE (DBF trial);<br>• Phase 6: Variation to EPL 11262. |

## 3.2. Fluidised Bed Combustion Technology

A report prepared by Boiler & Power Plant Services Pty Ltd (B&PPS 2021) (Appendix F) for Verdant Earth assessed the existing technology and capability of the Redbank Power Station. The report describes the technology in detail and recommends plant and equipment modifications to allow the use of biomass as fuel.

The FiCirc™ boilers at Redbank were designed to fire coal tailings (as BDT) and Supplementary Fuel (as ROM coal). The boilers are suitable for biomass fuel firing without change as demonstrated overseas, and the following gives an overview of their performance firing biomass fuel. The existing plant consists of two fluidised bed combustion steam generator units of FiCirc® design and a single 151MW steam turbine and associated balance of plant equipment.

The plant has a number of operating modes. In normal automatic control mode with both boilers in service, the plant can accept electrical output load changes between 70% and 100%. The plant can also operate with only one boiler in service. This means that depending on the operating configuration, the normal plant operating electrical output range can be considered, as shown in Table 3.2.

FiCirc® technology (abbreviation of *Fines Circulating*) was initially developed by Combustion Power Corp of California in the 1970's to provide a low emission combustion system for a variety of fuels. The technology is characterised by two atmospheric-pressure, hybrid bubbling/circulating bed type boilers. Figure 3.1 provides an overview illustration

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of the Fluidized Bed Technology. The deep fluidised beds, configured to provide a high degree of bed fines recirculation to enhance the gas to solids contact results in a highly efficient combustion system producing low $NO_X$, $SO_X$, carbon monoxide and particulate emissions due to the ability to control the combustion chamber temperatures and the addition of sorbent material if required.

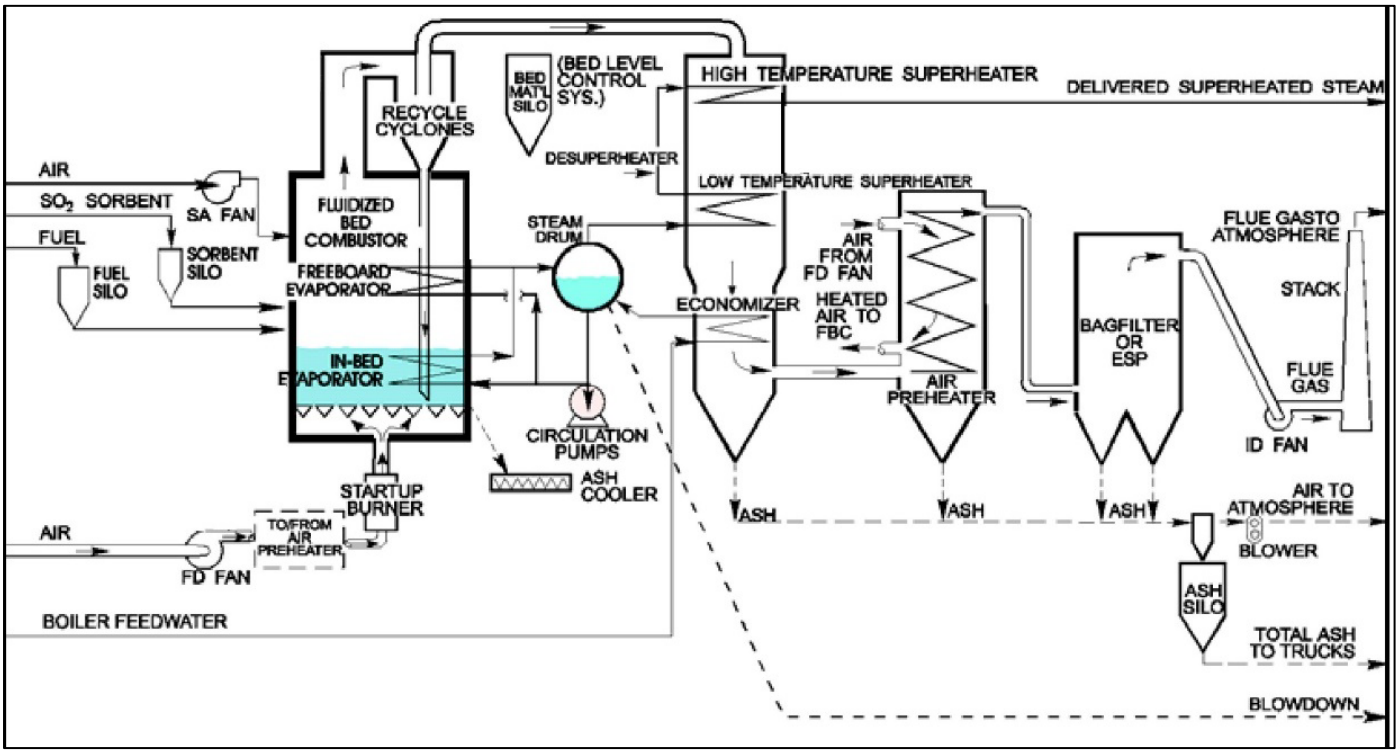
Fluidised bed combustion systems are able to reduce $SO_2$ emissions by limestone injection and can achieve a relatively low level of thermal $NO_X$ formation because of the low combustion temperature. This style of unit has demonstrated excellent performance and emissions profiles with a wide range of fuels including coal, petroleum coke, and biomass[29].

The principal components of the fluidised bed technology comprise boilers, a turbo generator, cooling tower and a stack. Figure 3.2 shows an illustration of the FiCirc™ Boilers at Redbank. No modifications are required to the boiler to fire biomass fuel.

**Table 3.2. Plant operating ranges.**

| Mode | Net Plant Electrical Output Range |
|---|---|
| **Two boilers normal operation** | 90 – 128 MW |
| **One boiler out of service operation** | 50 – 64 MW |

**Figure 3.1. Existing Fluidised Bed Process Overview.**




[29] Best Available Techniques (BAT) Reference Document for Large Combustion Plants - Industrial Emissions Directive 2010/75/EU Integrated Pollution Prevention and control. 2017. Luxembourg: Publications Office of the European Union.

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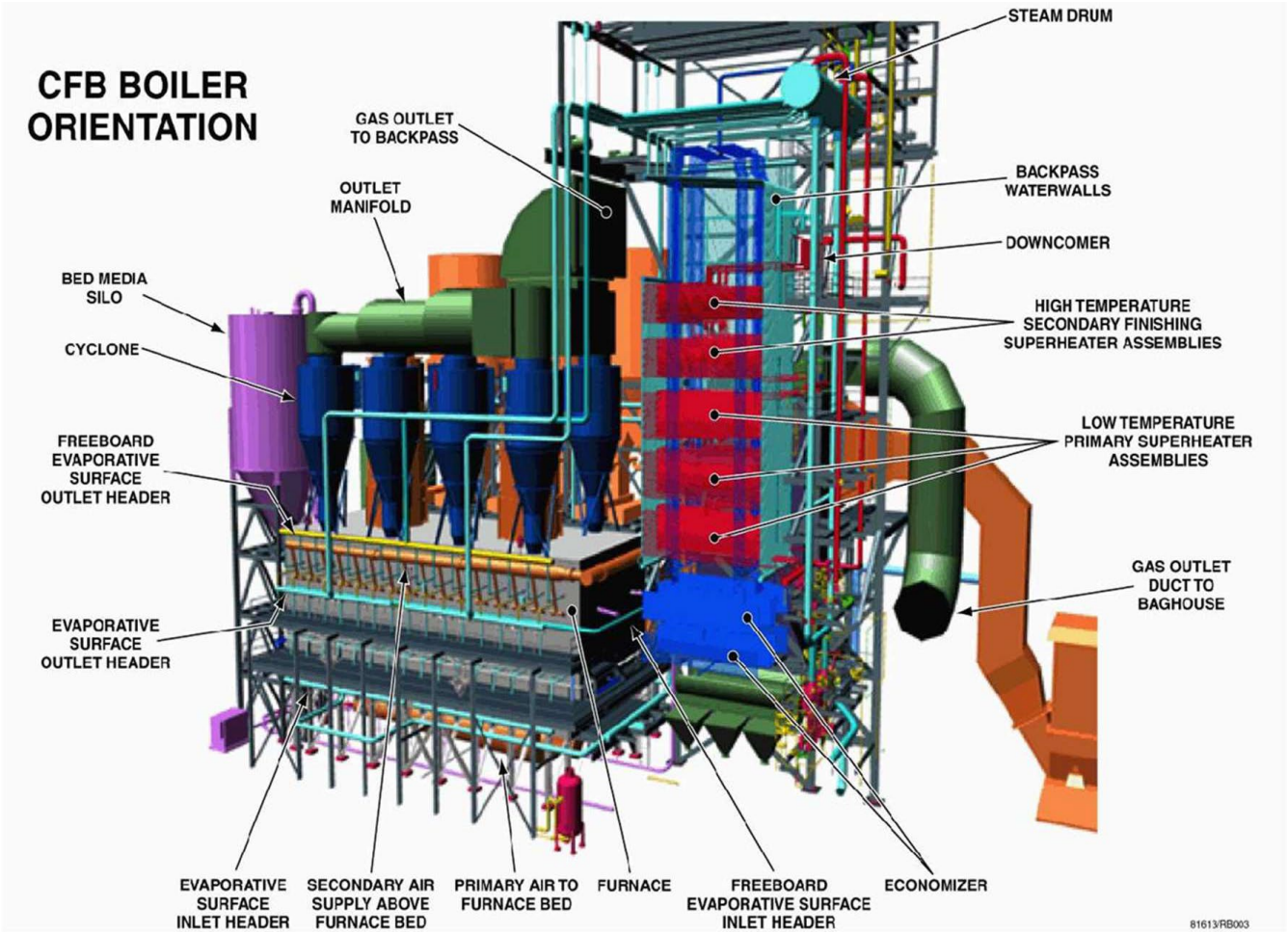
**Figure 3.2. Existing Circulating Fluidized Bed Boiler Orientation.**




The plant net electrical output will not change when firing biomass fuel, however Biomass fuel will have the effects on the plant performance as provided in Table 3.3.

**Table 3.3. Comparison of previous plant performance versus the Proposal using biomass.**

| Fuel Type | Units | 1994 Consent | 1997 Consent | Proposal |
|---|---|---|---|---|
| | - | Coal tailings | BDT | Biomass |
| Reference fuel moisture | % | dry basis[1] | 25 | 25 |
| Net Plant Output (reference) | MW | 100 | 128 | 128 |
| Fuel gross specific energy | GJ/te | 13 (dry) | 21 (wet) | 15.21 (wet) |
| Fuel energy consumption (annual) | GJ/annum | 12.7 million | 12.7 million | 12.7 million |
| Approximate fuel consumption6 | Te/annum | 975,000 (dry) | 600,000 (wet) | 850,000 (wet) |
| Approximate fuel consumption | Te/annum | 975,000 | 450,000 | 626,000 |
| Calculated efficiency (GSE basis) | % | 22.7% | 29.9% | 27.2% |

[1]Dry basis means bone dry (with no moisture).

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## 3.3. Biomass Fuel Types and Sources

A *Feedstock Supply and Characterisation Study* (the Fuel Study) has been prepared to demonstrate that all biomass used as fuel at the Facility will comply with the *Protection of the Environment Operations (General) Regulation* 2022, the *NSW EPA Eligible Waste Fuel Guidelines* 2022, and the *NSW EPA Energy from Waste Policy Statement.* The Fuel Study also characterises the biomass feedstock, describes in detail the feedstock sources and quantities available and outlines quality control that will be maintained through appropriate monitoring, sampling and fuel testing procedures.

The Facility will be fuelled with ecologically sustainable biomass (in compliance with all relevant legislative requirements and excluding native forestry residues from logging) to deliver near net zero $CO_2$ power generation using standard fuels and eligible waste fuels from the following sources:

Standard Fuels:

- Purpose grown energy plantations;
- Perennial grasses; and
- Energy crops.

Eligible Waste Fuels:

- Biomass with no higher order uses arising from invasive native species control on agricultural land;
- Biomass with no higher order uses from approved land clearing activities such as major infrastructure developments for approved civil infrastructure, road clearing works, right of ways and related approved projects;
- Agricultural waste biomass products or residues with no higher order uses;
- End of life waste woody biomass manufactured and produced into a fuel to specification (DBF) (subject to EPA approval as an eligible waste fuel);
- Other sources of eligible waste fuels with no higher order uses.

### 3.3.1. Fuel Use Staging

Note that at the initial startup of the power station, and following boiler maintenance and restart of the boilers, diesel fuel will be used to achieve the temperature required to use biomass as fuel. Once the boiler is operating at the design temperature, the Redbank Power Station will use only biomass as fuel.

Recommissioning of the Redbank Power station to operate on biomass would occur in two distinct stages:

- Stage 1: The first stage will involve the start-up of operations using biomass (with no higher order uses) sourced primarily from approved land clearing operations (from existing civil and road works), biomass from invasive native species on agricultural land as approved by Local Land Services NSW and potentially a limited amount of purpose grown biomass; and
- Stage 2: The second stage will involve the introduction or increased use of purpose grown biomass which will be further increased over a period of two to four years from approval, and, if approved and declared an eligible waste fuel by the NSW EPA, the introduction and use of DBF.

Once Stage 2 is reached, it is estimated that approximately 70% of the biomass sourced for the plant will be obtained from purpose grown biomass, 13% from invasive native species control on agricultural land, and the remainder from a mixture of waste residues with no higher use order from agriculture, approved land clearing and DBF.

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The objective of this Feedstock replacement strategy is to transition the plant to using approximately 70% purpose grown biomass.

Note that these are indicative targets and that actual feedstock mix may vary due to fuel availability, and fluctuations in market conditions. Other potential sources of eligible waste fuels with no higher order uses will also be considered.

Verdant Earth will apply to the EPA post approval in this staged approach to seek approval and Specific Resource Recovery Orders and Exemptions (RROEs, where applicable) to permit the use of these fuel types.

### 3.3.1. Feedstock Strategy

To support the restart of the Redbank Power Station, Verdant have developed a feedstock strategy to enable the continuous supply of quality biomass feedstocks to support electricity generation at the premises.

Verdant will establish contracts with growers for the production of biomass energy crops meeting power plant specification requirements. Where necessary, Verdant will seek the necessary specific Resource Recovery Orders and Exemptions from the NSW EPA under clause 93 of the *Protection of the Environment Operations (Waste) Regulation* 2014 to use eligible waste fuels.

Suppliers will be required to adhere to the following under contract with Verdant Earth:

1) Ensure that the biomass material meets an approved specification required for the power station, prior to delivery to the power station;
2) Meet all requirements under any relevant RROE issued by the NSW EPA; and
3) Adhere to Verdant Earth's quality control and assurance program requirements.

All processing including drying, chipping and screening will be performed off-site. No fuel processing to specification will occur at the Redbank Power Station.

Ash generated by the Proposal will be regularly, tested and transported off-site for beneficial use as a soil amendment in forestry and agriculture in accordance with EPA requirements. Trucks used to deliver biomass to the Site would be backloaded with the ash for removal to an approved site for reuse within the *Ash from Burning Biomass Order and Exemption* 2014, or under a Specific RROE where necessary. These details are addressed in the Waste Management Plan for the Proposal (Appendix L).

It is anticipated that the power station will be operating at maximum capacity (700,000 dry tonnes equivalent per year) of biomass in year 1. The projected mix of Feedstocks to be used in the power station is Table 3.4.

The Feedstock strategy as outlined provides an indication of the Feedstock mix to be used in the power station and is not intended to provide a 'cap' on the quantities of each type of biomass that can be used in the power station. The biomass fuel mix may change from year to year, depending on the availability and approvals obtained for the use of the biomass.

**Table 3.4.Projected feedstock quantities for pre-start, stages 1 and 2 and ongoing operations.**

| Fuel Type (dry tonnes) | Pre Start (0-8 mos) | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 and onwards |
|---|---|---|---|---|---|---|---|
| **STANDARD FUELS** | | | | | | | |
| **Purpose grown fuel crops** | 0 | 50,000 | 100,000 | 200,000 | 400,000 | 490,000 | 490,000 |
| **ELIGIBLE WASTE FUELS** | | | | | | | |
| **Biomass with no higher order uses arising from invasive native species control on agricultural land** | 0 | 500,000 | 450,000 | 350,000 | 180,000 | 90,000 | 90,000 |

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| Fuel Type (dry tonnes) | Pre Start (0-8 mos) | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 and onwards |
|---|---|---|---|---|---|---|---|
| Biomass with no higher order uses arising from agricultural waste or residues | 0 | 0 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Biomass with no higher order uses from approved land clearing activities | 0 | 150,000 | 100,000 | 50,000 | 20,000 | 20,000 | 20,000 |
| Domestic Biomass (DBF)* | 0 | 0 | 0 | 50,000 | 50,000 | 50,000 | 50,000 |
| **TOTAL** | **0** | **700,000** | **700,000** | **700,000** | **700,000** | **700,000** | **700,000** |

*Subject to EPA approval as an eligible waste fuel.

### 3.3.2. Availability of Feedstock to Meet the Needs of the Power Station

When operating at maximum capacity, the Redbank Power Station will require up to 700,000 (dry) tonnes per annum of biomass as feedstock.

Within 300km of the Redbank Power Station, the NSW Department of Primary Industries determined[30] that there is over 8 million hectares of potential suitable land for growing energy crops. Verdant Earth would require approximately 60,000 hectares of land to support 100% of the standard fuel load if it consisted entirely of short-rotation woody crops (490,000 tonnes). Whilst Verdant will consider only marginal, less productive lands for the growing of woody (e.g. mallee) energy crops, the area of land required is still less than 1% of this potential available land solely within 300km of the Redbank Power Station.

Verdant's discussions with local mine sites have revealed the potential for establishment of an 8,000 ha crop of Bana Grass which would yield an average of 50 dry tonnes/ha (approximately 400,000 tonnes per annum) which provide over half of the total feedstock requirements for the power station.

A recent review of the NSW Local Land Services (LLS) public information register for certificates issued to clear Invasive Native Species (INS) under Section 60Y of the *Land Management (Native Vegetation) Code* 2018 (under the *Local Land Services Act* 2013) has identified that between March 2018 and October 2023, 163 certificates were issues in the Central West LLS region (equivalent to 112,530 ha) and 66 in the Western LLS region (equivalent to 528,179.66 ha).

Verdant have been working with Western LLS and a local business organisation Western Regeneration, based in Cobar to enter into a supply agreement for up to 500,000 tonnes per annum of biomass from their approved INS clearing. Verdant Earth are also in discussion with in the Central West LLS about establishing similar supply agreements with local landowners in their area.

The *Australian Renewable Energy Mapping Infrastructure Project* (AREMI)[31] database provides estimates of the availability of biomass from agricultural waste. Within 300km of Singleton there is an estimated 1,023,172 dry tonnes of agricultural waste residues available.

Data from the NSW Department of Planning and Environment shows more than 74,000 hectares of woody vegetation was cleared between 2009 and 2021 for NSW infrastructure with an average of 5,700 hectares a year. For the Central West, Greater Sydney, Hunter and Western Local Land Services regions, a total of 39,000 hectares of woody vegetation

[30] Woody Biomass Crop Trials, Department of Primary Industries. Web: https://www.dpi.nsw.gov.au/forestry/science/forest-carbon/biomass-for-bioenergy/biomass-crops

[31] Available at: https://arena.gov.au/projects/aremi-project/

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was cleared between 2009 and 2021 for NSW infrastructure, representing 52% of the vegetation cleared for NSW infrastructure.

Verdant Earth have been developing supply agreements with companies that have commercial volumes available of waste biomass from approved clearing activities. It is however important to note that suppliers will change from year to year as market conditions and project development will create opportunities for feedstock fuel sources.

Verdant recognises the importance of assessing higher use orders for their potential fuel sources, and for the land that may be used for establishing specific energy crops. Prior to the use of eligible waste fuels, each source will require a market study be completed to whether these materials have other potential higher use orders. For standard fuels, land capability studies will be prepared prior to the lands use for growing energy crops.

However, in light of the significant amount of potential eligible waste fuel available, and the amount of land potentially available to be used for energy crops, Redbank Power Station could easily be supplied with 700,000 dry tonnes of biomass per year to generate electricity at maximum capacity on an ongoing basis for the life of the plant (expected to be about 30 years until refurbishment is needed).

The total biomass fuel potentially available for use annually at the Redbank Power Station is summarised in Table 3.5. Actual available will depend on up-to-date market studies of potential higher order uses for the eligible waste fuel.

**Table 3.5. Summary of the estimated fuel potentially available for Redbank Power Station.**

| Fuel Type | Stage 1 | | Stage 2 | | | Year 6 and onwards |
|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | |
| **Standard Fuels** | | | | | | |
| Purpose grown fuel crops | 50,000 | 100,000 | 200,000 | 400,000 | 490,000 | 490,000 |
| **Eligible Waste Fuels** | | | | | | |
| Biomass from invasive native species control | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 |
| Biomass from Agricultural wastes | 1,023,172 | 1,023,172 | 1,023,172 | 1,023,172 | 1,023,172 | 1,023,172 |
| Biomass from approved land clearing works | 125,799 | 125,799 | 125,799 | 125,799 | 125,799 | 125,799 |
| TOTAL (tonnes) | **1,698,971** | **1,748,971** | **1,848,971** | **2,048,971** | **2,138,971** | **2,138,971** |

Based on this information, there would be more than the annual 700,000 tonnes (dry) tonnages of fuel needed to run the Redbank Power Station at full capacity for the proposed life of the Proposal (30 years until refurbishment is required). The total available is between 250% and 300% of the total annual fuel requirements.

### 3.3.3. Biomass Fuel Characterisation

Work was undertaken by Boiler & Power Plant Services Pty Ltd (B&PPS 2021) to assess the required biomass feedstock fuel physical characteristics. A specification has been developed that must be met in order to prevent deterioration (e.g. corrosion), maintain the performance of the plant and its various components. The general biomass fuel specification target for physical properties is summarised as follows:

- Wood chipped and screened to 30 mm nominal size (+15mm - 50mm);

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- Maximum of the sum of three dimensions to be less than 150 mm (length + width + thickness);
- ~25% moisture content; and
- Typically, 4% or less as fines <1mm.

Verdant also engaged HRL Technology Group Pty Ltd (HRL 2023) to assist in developing and implementing a testing and analysis program to characterise biomass feedstock fuel for use as an alternative fuel at Redbank. The biomass sources were assessed for contaminants and characterised in accordance with the NSW EPA *Eligible Waste Fuel Guidelines*.

The results provide tolerances to low levels of chemical contaminants, including metals, which are typically found at trace levels in biomass. The results indicate that biomass types generally comply with the B&PPS (2020) current specification for Redbank Power Station and can be used at the Redbank Power Station in the existing plant with only minimal modification to the fuel feeder systems.

A comparative analysis of the woody waste biomass specification to coal tailings was also completed. The *Air Quality Impact Assessment* for the Proposal (Appendix O) provides a detailed comparison on the use of biomass versus coal.

### 3.3.4. Biomass Fuel Receival, Transportation and Storage

All preparation including drying, chipping and screening will be performed off site by suppliers. No material will be accepted at Redbank Power Station that has not been pre-validated to show that it meets biomass fuel specifications and relevant approved use conditions of the NSW EPA. Non-compliant biomass will not be accepted.

Verdant Earth will work directly with contractors of operations to bulk haul biomass that meets specifications directly to the Redbank Power Station.

It is estimated that 42 tonne capacity B-doubles would make 20,238 trips per year, or about 112 movements (56 trips) per day to haul the required biomass feedstock. Trucks hauling feedstock will enter the site via the western gate, and empty trucks leaving the Site will exit via the eastern gate along Long Point Road. Two weighbridges will be established, one will be located at entry and one on exit.

Truck roads will use the Golden Highway (Jerry Plains Road) and Long Point Road West to access to and from the Site from the West. The New England Highway and the Pacific Highway will be the primary route of travel from the North Coast and Sydney Metro.

Up to approximately 7,680 tonnes of biomass (meeting required specifications), equal to approximately 24,000$m^3$, may be stockpiled at Redbank Power Station in the approved location and in accordance with operational management plans.

### 3.3.5. Sampling, Testing and Monitoring for Quality Assurance and Control

Prior to delivery to Redbank Power Station, all biomass feedstock will be pre-tested and assessed for full compliance with the chemical and physical specifications of a Specific Resource Recovery Order and Exemption as issued by the EPA. Only Feedstocks that have been tested and validated for compliance will be permitted to be received at the power station.

Each biomass feedstock supplier will be contractually required to maintain appropriate quality control/quality assurance procedures and records to ensure that Feedstocks supplied to the Redbank Power Station meet requirements of Redbank Power Station's Feedstock specifications, the General Regulation, and the NSW *Eligible Waste Fuels Guidelines*.

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Verdant Earth has prepared a *Quality Assurance and Control Procedure for Receipt and Use of Biomass Feedstock for the Redbank Power Station* (Appendix D of the Fuel Study). The procedures detail a standard approach for ensuring the aforementioned requirements are met.

Contracts will be required from all suppliers and a register of pre-approved delivery vehicles will be maintained by Verdant Earth and only such approved vehicles will be permitted to weigh-in at the Facility. Only drivers who have successfully completed the relevant site safety and operations induction will be permitted to weigh-in and discharge feedstock at Redbank Power Station.

Non-compliant biomass will not be accepted. For those loads not accepted, the manufacturing facility will be notified in writing and the load will be directed to return to the supplier. The return of such loads will be the responsibility of the supplier. As Redbank will have either close contact or ownership of the processing facility it is not envisaged that loads will be rejected.

There will be an auditable chain of custody of biomass fuel feedstock from the supplier's facility to the Redbank Power Station. Each vehicle load of feedstock despatched from the supplier's facility will be assigned a transport certificate. The manufacturer's procedures will be independently audited on an annual basis in order to demonstrate that the Manufacturer is complying with these procedures.

An initial audit of the Manufacturer quality control system will be conducted prior to the commencement of the supply of feedstock to the power station by the supplier. Audits will be conducted in accordance with *AS 19011-2014 Guidelines for Auditing Management Systems*.

### 3.3.6. Higher Use Orders

Verdant recognises the need for assessing the potential for higher order use of all eligible waste fuel biomass sources to be used at the Redback power station in accordance with the Waste Hierarchy which is ordered by most preferable to least preferable (avoid and reduce; reuse; recycle; recover energy; treat; and dispose of waste).

Higher order uses for potential sources of eligible waste fuel may include such uses as mulch production for urban/public landscaping and nurseries, particle board manufacturing and poultry and animal bedding.

Prior to the first use of eligible waste fuel sources, and annually thereafter, each potential source will require an independent market study be completed to show whether these materials have other potential higher use orders.

These independent market studies will be based, in part, on the methodology contained in a NSW EPA report[32]. The structure identified in the report study identifies markets such as urban amenity, agriculture and land rehabilitation. These markets will be considered in the independent market studies.

Only eligible waste fuel with no higher order uses will be sourced as fuel for the Power Station.

For standard fuels, a higher order use assessment is not required. However, energy crops should not be grown on land that is productive for other high-quality markets such as food and fibre. Land capability studies will therefore be prepared for land prior to it becoming designated for use in growing energy crops to ensure the land is considered marginal land not suitable for these markets.

[32] Department of Environment and Conservation NSW (2006), Analysis of Markets for Recycled Organic Products. Web: Analysis of Markets for Recycled Organic Products (Revised Sept 2006) (nsw.gov.au)

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### 3.3.7. Quantities of Biomass to be Received and Stored at the Facility

Up to 850,000 (at 25% moisture content) tonnes of biomass sourced to specification from the market as fuel will be required for electricity generation. The proposal will involve minor modifications of material handling systems of the power station to enable the use of biomass.

"Biomass" means primarily woodchips and/or synthesized wood-pellets. All preparation including drying, chipping and screening will be performed off site. Biomass fuel will be delivered within the specification required for the plant and will be required to meet all requirements under an RROE issued by the NSW EPA.

A capacity of 3 days storage will be required, equal to a stockpile in the order of 24,000 $m^3$. At an assumed density of 320kg/$m^3$ in a stored pile of wood chips (25% moisture content), this would equal approximately 7,680 tonnes.

The boiler fuel storage consists of three (3) silos for each of the two boilers. Based on steady unit operation and six (6) silos averaging a nominal 4.5 hours of storage (depending on the fuel storage density), this equals an approximate rate of 225$m^3$/hour of wood chips for 40 minutes per silo for continuous reclaim and silo when operating at full load.

## 3.4. Biomass Fuel Haulage, Receival and Handling Arrangements

The B&PPS report (Appendix F) recommends specific plant and equipment modifications to allow the use of biomass as fuel. The following sections summarise the proposed changes and additions that form part of the development application and EIS.

The power station will accept approximately 850,000 tonnes of biomass at a 25% moisture content per annum in mostly B-Double rated semi-trailer configurations averaging 42-44 tonnes per load. To meet operational needs feedstock deliveries will occur 24/7. However, deliveries will be prioritised to 16-hour shifts on Monday through Sunday between 6am and 10pm.

An overview of the proposed biomass receival process is summarised in Figure 3.3.

It is estimated that 112 movements (56 trips) per day would be needed to haul the required biomass using primarily B-double trucks.

The key roads providing access for the Site and for the haulage routes heading north and south are the Golden Highway (Jerry Plains Road) and Long Point Road West.

Trucks hauling biomass to the Site will enter the Site via the eastern gate, and empty trucks leaving the Site will exit via the western gate along Long Point Road. Refer to Figure 3.4.

All biomass will be stored in the existing supplementary fuel storage areas on the southern side of the power plant. This is shown in the site plan given in Figure 3.4.

A substantial portion of the existing stockpile reclaiming equipment will be re-purposed for biomass. The modified fuel delivery area includes the installation of mobile equipment to facilitate the unloading of B-Double trucks adjacent to the biomass fuel stockpile area. The system would incorporate two dual-lane drive over truck unloaders and two additional conveyors that supply two radial telescopic conveyors to unload the biomass. One telescopic conveyor will direct fuel to the existing fuel storage area (i.e. the area approved for storage of coal tailings), and the second to two moving floor bulk unloader bins, which directly feed existing Conveyor 76 (Figure 3.5).

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**Figure 3.3. Summary of the biomass fuel receival, handling and storage process.**

Trucks will be programmed into the site to spread the access primarily throughout a 12-16 hour acceptance window, Redbank will have an entrance and an exit gate and traffic will flow through the Site in a forward motion. 24 hour deliveries will be accepted when required.

All loads will be weighed on a weighbridge and gross weight, source and transport company will be recorded

The driver will be directed to the tipping area and advised if his load will be sampled for QA/QC purposes

Materials will be sampled. Sampling will be done by a trained employee and will be assessed for the following characteristics and others as required in a Specific Resource Recovery Order to be obtained from the EPA (post-approval): Moisture content, grading and contamination

Feedstock is accepted and driver proceeds to unload

The truck tips its feedstock into the receival hopper where the feedstock is directed according to the needs of the power station

The driver exits via the outbound weighbridge, tare weights recorded and exits the site

The feedstock will be transported by a series of telescopic conveyors to the storage bins for recovery when required by the power station, stock will be rotated to ensure that no materials are sitting on site for long periods, estimated turn over every 4 days

A wheel loader will recover the stockpiled feedstock and drop it into a feed hopper where the feedstock will be transported to the power station via the existing drop down feed system

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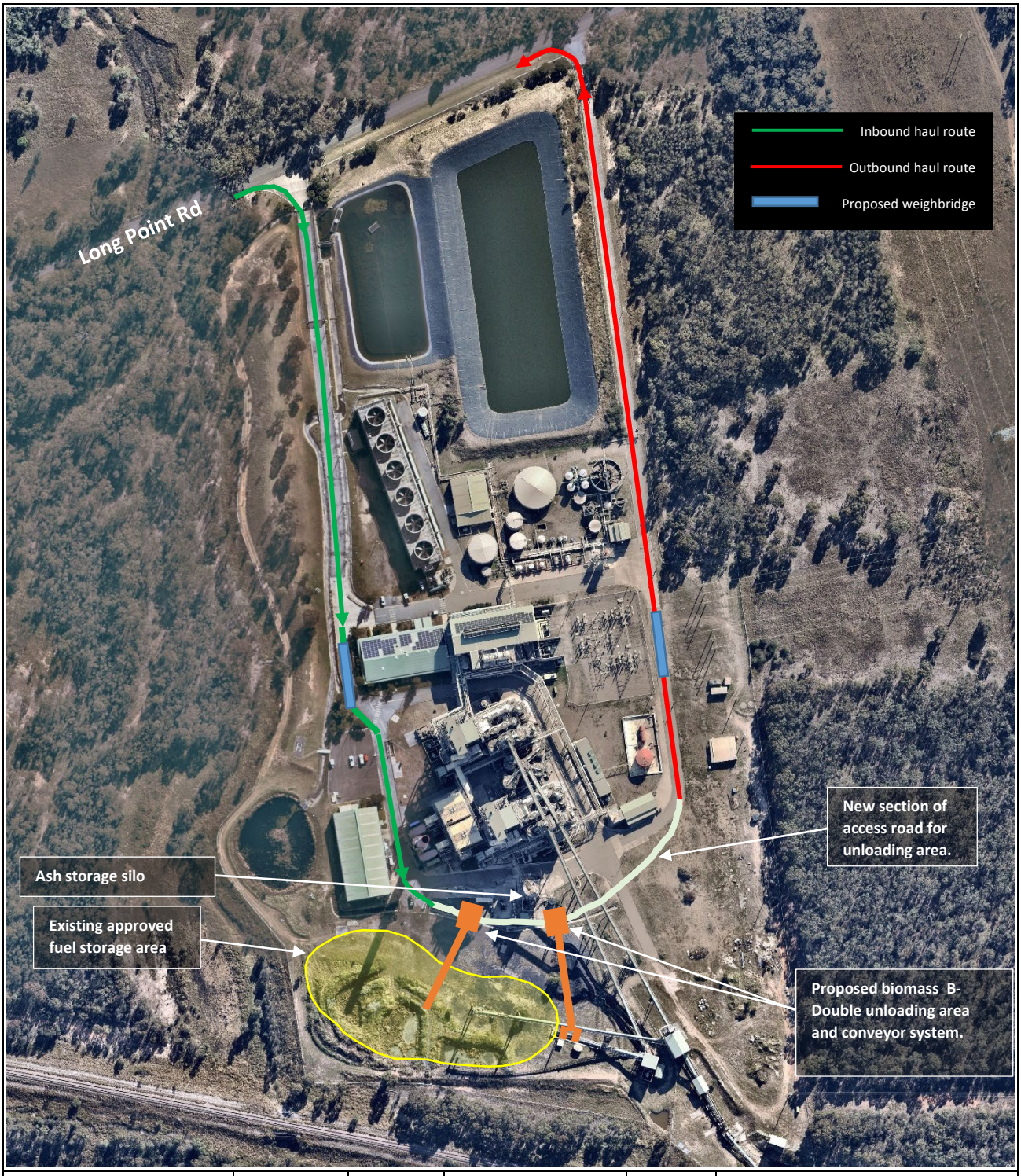
**Figure 3.4. Proposed site access and internal haul route arrangements.**




| Date | Revision | Drawn By | Site description | Client | Verdant Earth Technologies Limited |
|---|---|---|---|---|---|
| 08/11/23 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) | Project | Redbank Power Station |
| | | | | Title | Access to site and operational areas |
| | | | | Source | Near Maps |

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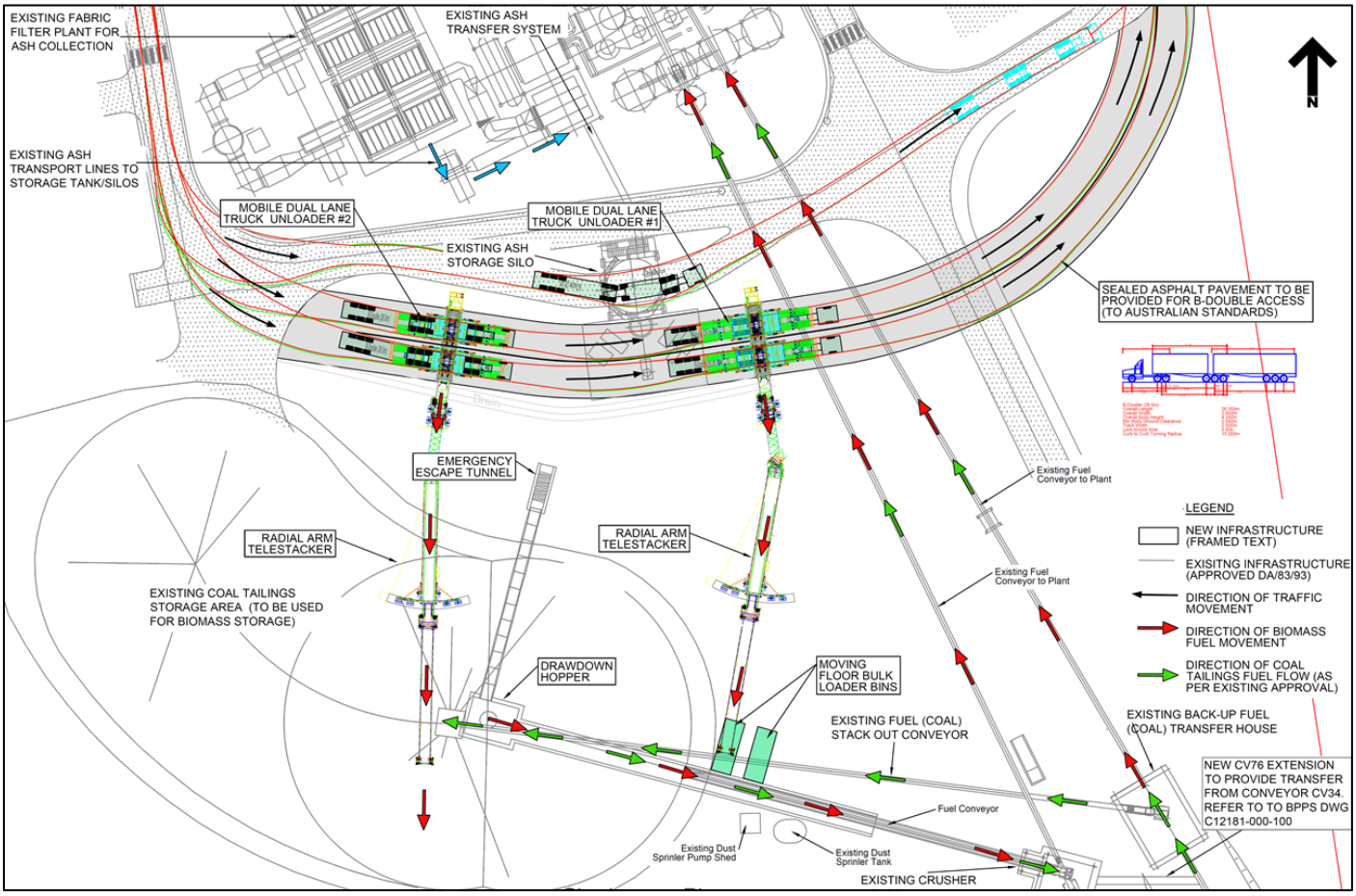
**Figure 3.5. Proposed biomass fuel receival, fuel handling and stockpiling area (Source: HDB, October 2021).**




## 3.4.1. Operational Plant and Equipment

The primary plant and equipment operating at the Facility are shown in the Site and civil drawings in 0 of this EIS. Most of this plant and equipment is existing and approved under the original consent. A summary is as follows:

- Boiler Island Plant;
- Turbine Island;
- Fuel handling plant and equipment including conveyors, moving floor bins, and front end loaders;
- Water treatment facility;
- Air pollution control plant;
- Switchyard;
- Cooling water system;
- Fire fighting system; and
- Haulage trucks and light vehicles.

Some of the plant and equipment is proposed to be modified under the Proposal as described in the next section.

# 3.5. Proposed Plant and Equipment Modifications

The Facility requires modifications of materials handling systems of the power station to enable the use of biomass as fuel for electricity generation. The modifications are necessary as biomass is much less dense than coal, has a lower calorific value, and tends to arch or bridge over outlet openings and cause blockages. Additional conveyor volume

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capacity is required, and some modification to silos and transfer systems. Existing equipment that is not required for biomass firing will be left in-situ or stored on the Site to enable future re-use.

The existing conveyor from the Warkworth for transfer of coal tailings into the plant would remain, however, use of coal tailings as a fuel is not proposed.

The following outlines the key plant and equipment changes required:

- Maintenance, repair and recommissioning works within the power station to permit recommencement of electricity generation;
- Delivery of biomass in B-doubles (42-44 tonnes per load) via Long Point Road on a 24/7 basis. Deliveries will be prioritised to 16-hour shifts on Monday through Sunday between 6am and 10pm;
- The existing conveyor from the Warkworth mine for transfer of coal tailings into the plant will remain in the first instance;
- Two 28m long weighbridges to be installed along the (western) inbound lane into the site and the (eastern) outbound lane out of the site;
- Conversion of the power station to enable the use of up to 700,000 tonnes dry equivalent per annum of biomass as feedstock fuel for electricity generation with near net zero $CO_2$ emissions equivalent;
- Construction of a 160m sealed road at the rear of the site to enable to delivery of biomass to the fuel storage area;
- Establishment of a new fuel delivery area adjacent to the existing stockpiling area directly south of the existing power plant. The system will incorporate two dual-lane drive over truck unloaders, two additional conveyors that supply two radial telescopic conveyors to unload the biomass. One telescopic conveyor will direct fuel to the existing fuel storage area (i.e. the area approved for storage of coal tailings), and the second to two moving floor bulk unloader bins, which directly feed existing Conveyor 76. Swales to be provided around biomass stockpile area to minimise movement of biomass fuel from the designated storage area;
- Use of the existing Conveyors 34 and 35 to supply Boilers 1 and 2 respectively with biomass fuel. An extension to Conveyor 76 and removal of the crusher house is required to enable the even transfer of fuel via Conveyors 34 and 35 to Boilers 1 and 2;
- Modifications the two units fuel silos (three on each unit) tops to include two reversing conveyors on each unit and associated chute work to store the feedstock. These silos previously stored supplementary fuel for delivery into the plant's fluidized bed combustion chambers;
- Modifying of the 'trouser legs' of the six fuel silos within the power station to enable the more efficient flow of biomass into the plant's fluidized bed combustion chambers;
- Ash generated from the combustion process will be sampled, tested and potentially used as a fertiliser in accordance with the EPA's *The Ash from Burning Biomass Order* 2014. The existing ash slurry system previously used to transfer coal tailings ash back to Warkworth mine will remain in place, though it will not be used and will be removed at a later date. A Specific Resource Recovery Order and Exemption will be sought for ash from use of DBF as a fuel; and
- Other work, including landscaping, fire detection and suppression systems, and refurbishment of internal elements of the power station as required. This will also include the purchase of a water access licence, reconnection to the electricity grid, development of a spare parts inventory and purchase and storage of a fuel invention for the power station.

### 3.5.1. Weighbridge operations and internal roads

Two 28m long weighbridges will be placed internally along the entrance road and the exit roads which will enable the accurate gross weight and tare weights to be recording allowing for recording of biomass weights utilised on the Site.

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As shown in Figure 3.5, an additional section of sealed asphalt pavement access will be provided to allow B-Double access to the two dual lane fuel unloaders.

### 3.5.2. Biomass Fuel Stockpiling and Reclaim

Biomass fuel feedstock will be delivered by B-Double vehicles via two dual-lane truck unloading stations near the existing ash silo. The stations will feed the biomass fuel onto mobile stacker feed conveyors from the delivery area to either:

- The stockpile stacker unit, with an elevated discharge chute and with stockpile reclaim via front-end loader to “moving floor bulk unloader bins”; or
- A separate unloading conveyor to feed the CV76 reclaim conveyor directly via “moving floor bulk unloader bins”.

Figure 3.6. shows an example of a front-end loader feeding moving floor bulk unloader bins.

The biomass fuel stockpile will occupy the area dedicated historically to supplementary fuel storage, and its tonnage capacity is reduced due to the lower density of the Biomass fuel compared to coal. The stockpile area accommodates 3 days storage capacity.

The existing dust collection equipment associated with the fuel handling system will be reused and where the new transfer points are proposed, new dust filter systems will be provided.

**Figure 3.6. Moving floor bulk unloader bin.**

### 3.5.3. Conveyor System Changes

A portion of the existing stockpile reclaiming equipment will be repurposed for biomass feedstock. To provide sufficient system capacity, both existing conveyors CV34 and CV35 (shown in Figure 3.7) will be run in parallel to feed boiler units 1 and 2 simultaneously.

A diagrammatic overview of plant changes is shown in Figure 3.7 illustrating the proposed changes to the conveyor and biomass delivery system to accommodate biomass fuel unloading and delivery to the silos that feed the boilers.

A plan view of the proposed changes to the fuel delivery and handling system are shown in Figure 3.9.

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### 3.5.4. Internal Plant Changes

To accommodate the change of fuel type to biomass, minor modifications to the fuel delivery conveyors and fuel feeding devices within the power station will be required. To transport the necessary quantity of biomass fuel from the stockpile to the boilers, it is necessary to use both conveyors CV34 and CV35 simultaneously. Conveyor CV34 (previously the tailings conveyor) will be used to feed boiler 1, and CV35 (previously the supplementary fuel conveyor) will be used to feed boiler 2.

Detailed elevations of the proposed changes are shown in the B&PPS report (Appendix F) and elevation views of the proposed changes shown in Figure 3.10, Figure 3.11 and Figure 3.12.

A full set of diagrams and layouts of the proposed changes to plant and equipment are provided in the B&PPS report in Appendix F of this EIS. In summary, the changes involve the following:

- Maintenance, repair and recommissioning works within the power station to permit recommencement of electricity generation;
- The existing conveyor from the Warkworth mine for transfer of coal tailings into the plant will remain in the first instance;
- Two 28m long weighbridges to be installed along the (western) inbound lane into the site and the (eastern) outbound lane out of the site;
- Construction of a 160m sealed road at the rear of the site to enable to delivery of biomass to the fuel storage area;
- Establishment of a new fuel delivery area adjacent to the existing stockpiling area directly south of the existing power plant. The system will incorporate two dual-lane drive over truck unloaders, two additional conveyors that supply two radial telescopic conveyors to unload the biomass. One telescopic conveyor will direct fuel to the existing fuel storage area (i.e. the area approved for storage of coal tailings), and the second to two moving floor bulk unloader bins, which directly feed existing Conveyor 76. Swales to be provided around biomass stockpile area to minimise movement of biomass fuel from the designated storage area;
- Use of the existing Conveyors 34 and 35 to supply Boilers 1 and 2 respectively with biomass fuel. An extension to Conveyor 76 and removal of the crusher house is required to enable the even transfer of fuel via Conveyors 34 and 35 to Boilers 1 and 2;
- Modifications of the two units fuel silos (three on each unit) tops to include two reversing conveyors on each unit and associated chute work to store the feedstock. These silos previously stored supplementary fuel for delivery into the plant's fluidized bed combustion chambers;
- Modifying of the 'trouser legs' of the six fuel silos within the power station to enable the more efficient flow of biomass into the plant's fluidized bed combustion chambers;
- The existing ash slurry system previously used to transfer coal tailings ash back to Warkworth mine will remain in place, though it will not be used and may be removed at a later date; and
- Other work, including landscaping, fire detection and suppression systems, and refurbishment of internal elements of the power station as required. This will also include the purchase of a water access licence, reconnection to the electricity grid, development of a spare parts inventory and purchase and storage of a fuel invention for the power station.

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**Figure 3.7. Modified conveyor and feed system to accommodate the use biomass at the power station. Process and plant changes proposed are shown in the purple box. Dust collection and management equipment is shown in the green box. Existing equipment shown in black (Source: B&PPS, 2021).**

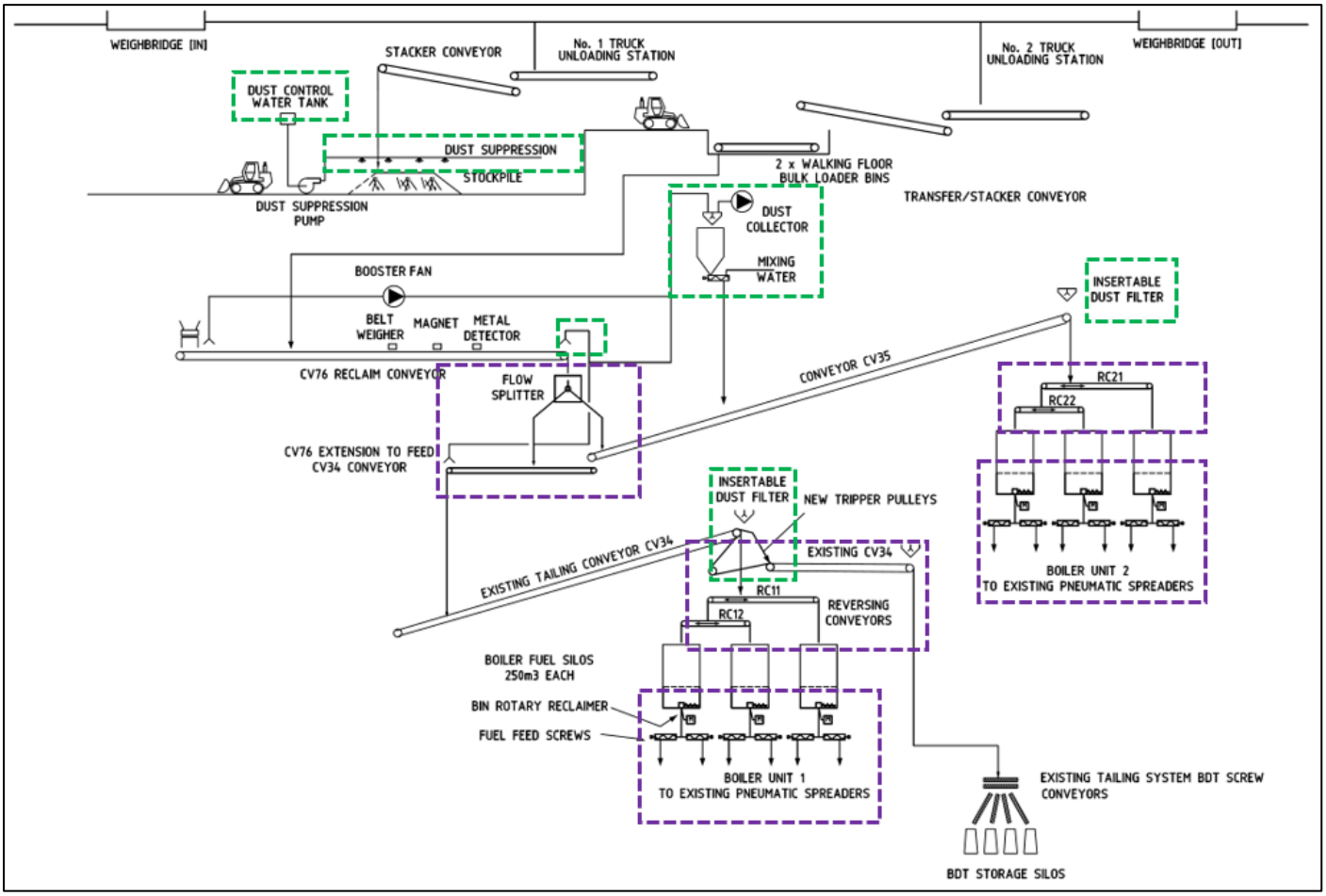


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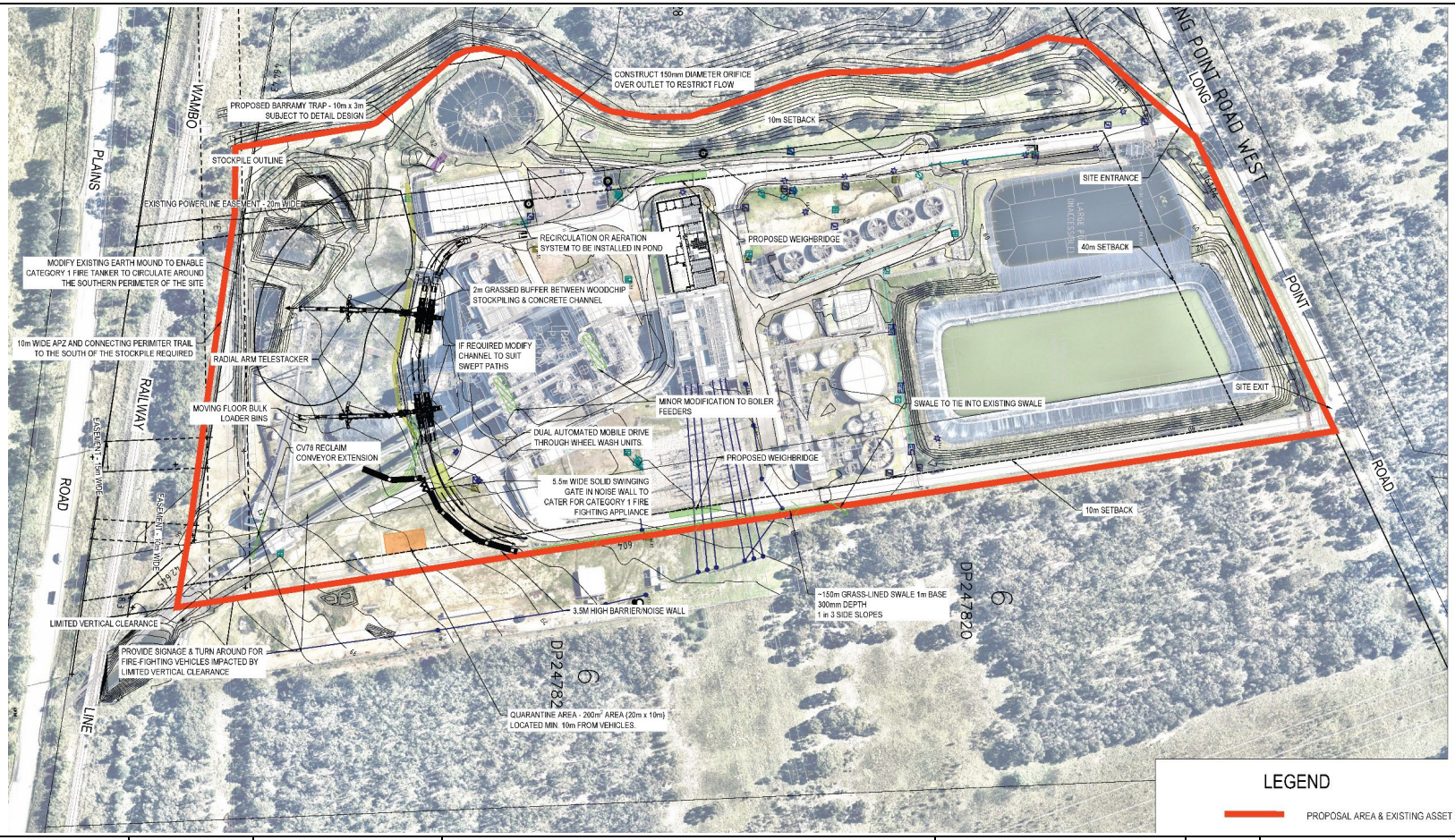
**Figure 3.8. General Site Arrangement Plan for the Proposal. Source: Sustainability Workshop Site Plan (see 0 for high resolution plan).**




| Date | Revision | Drawn By | Site description | Jackson Environment and Planning Pty Ltd | | Client | Verdant Earth Technologies Limited |
|---|---|---|---|---|---|---|---|
| 15/11/23 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) | **Strategy \| Infrastructure \| Compliance \| Procurement**<br>**A:** Suite 102, Level 1, 25-29 Berry St, North Sydney NSW 2060<br>**E:** admin@jacksonenvironment.com.au<br>**T:** 02 8056 1849<br>**W:** http://www.jacksonenvironment.com.au | JACKSON ENVIRONMENT AND PLANNING STRATEGY \| INFRASTRUCTURE \| COMPLIANCE \| PROCUREMENT | Project | Redbank Power Station |
| | | | | | | Title | General Arrangement Plan |
| | | | | | | Scale | Per image |
| | | | | | | Source | Sustainability Workshop |

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**Figure 3.9. Proposed changes to the fuel delivery and handling system (shown in green). Refer to 0 for high resolution plan.**

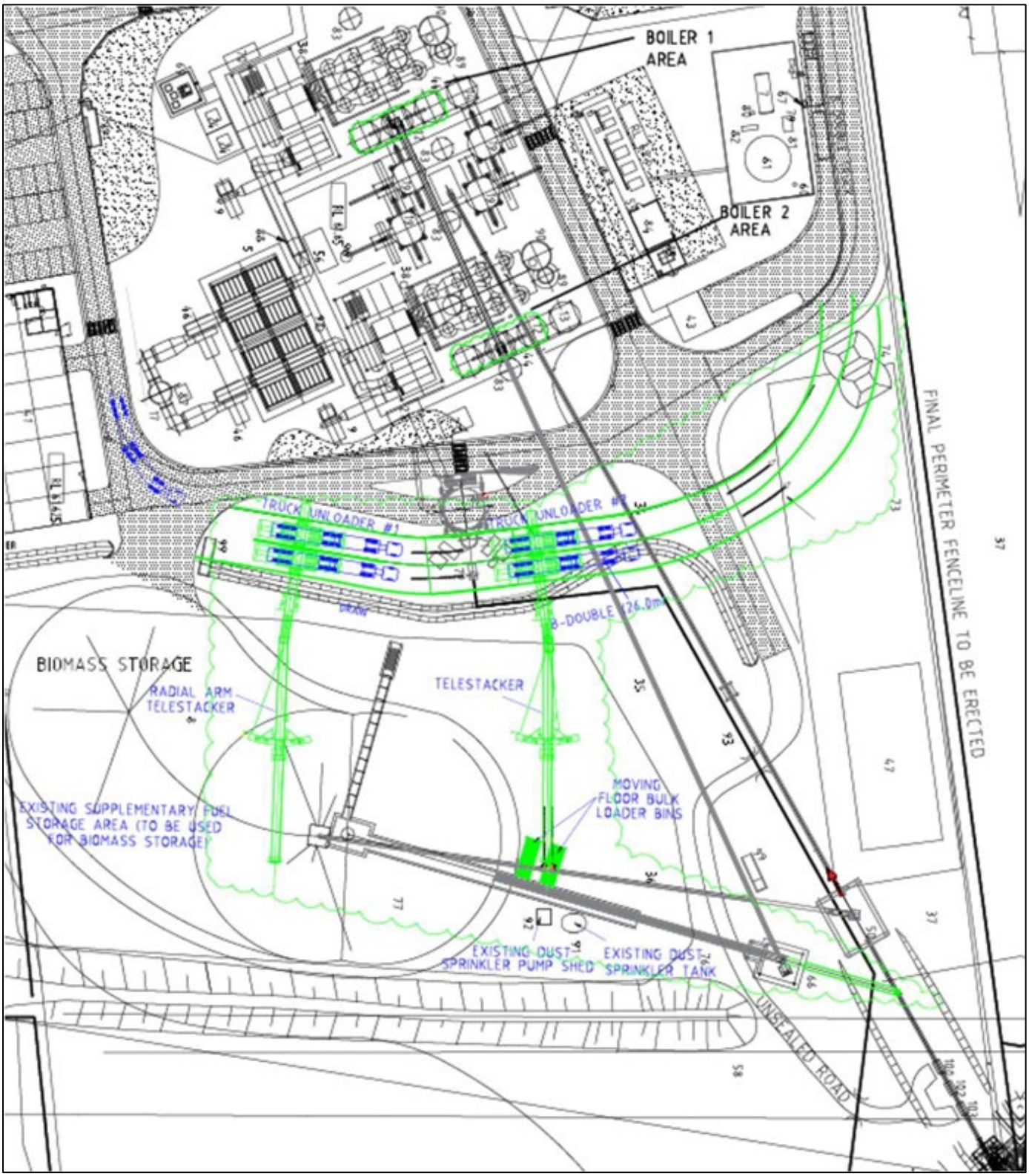


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**Figure 3.10. Biomass receival and handling showing additional plant/equipment in green. East elevation view. Refer to 0 for high resolution plan.**

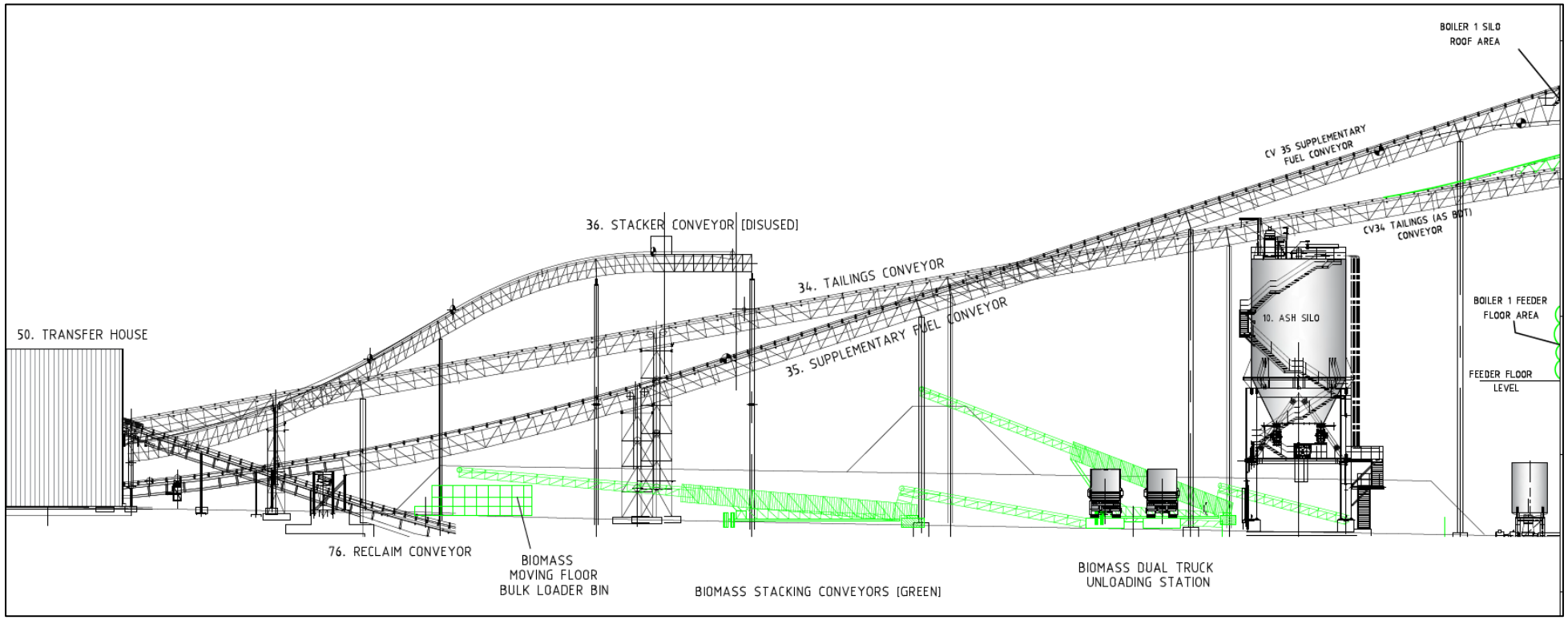


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**Figure 3.11. Biomass receival and handling showing additional plant/equipment in green. South elevation view. Refer to 0 for high resolution plan.**

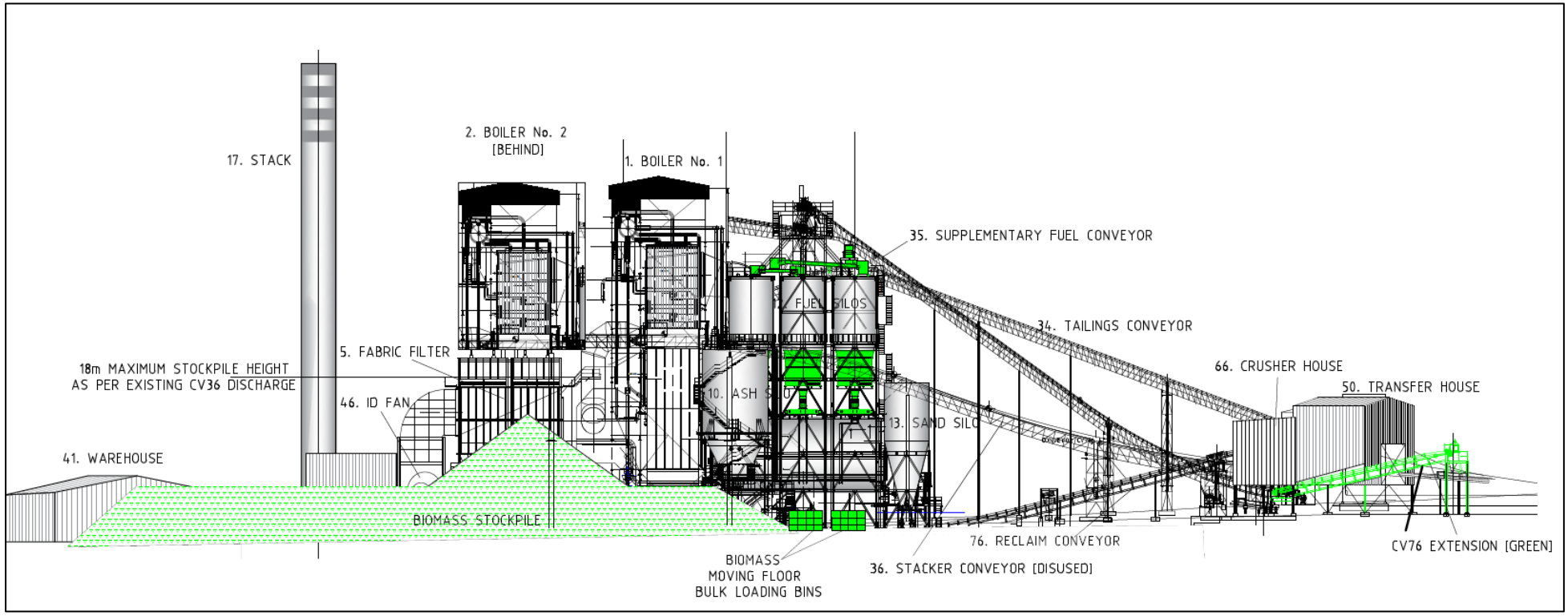


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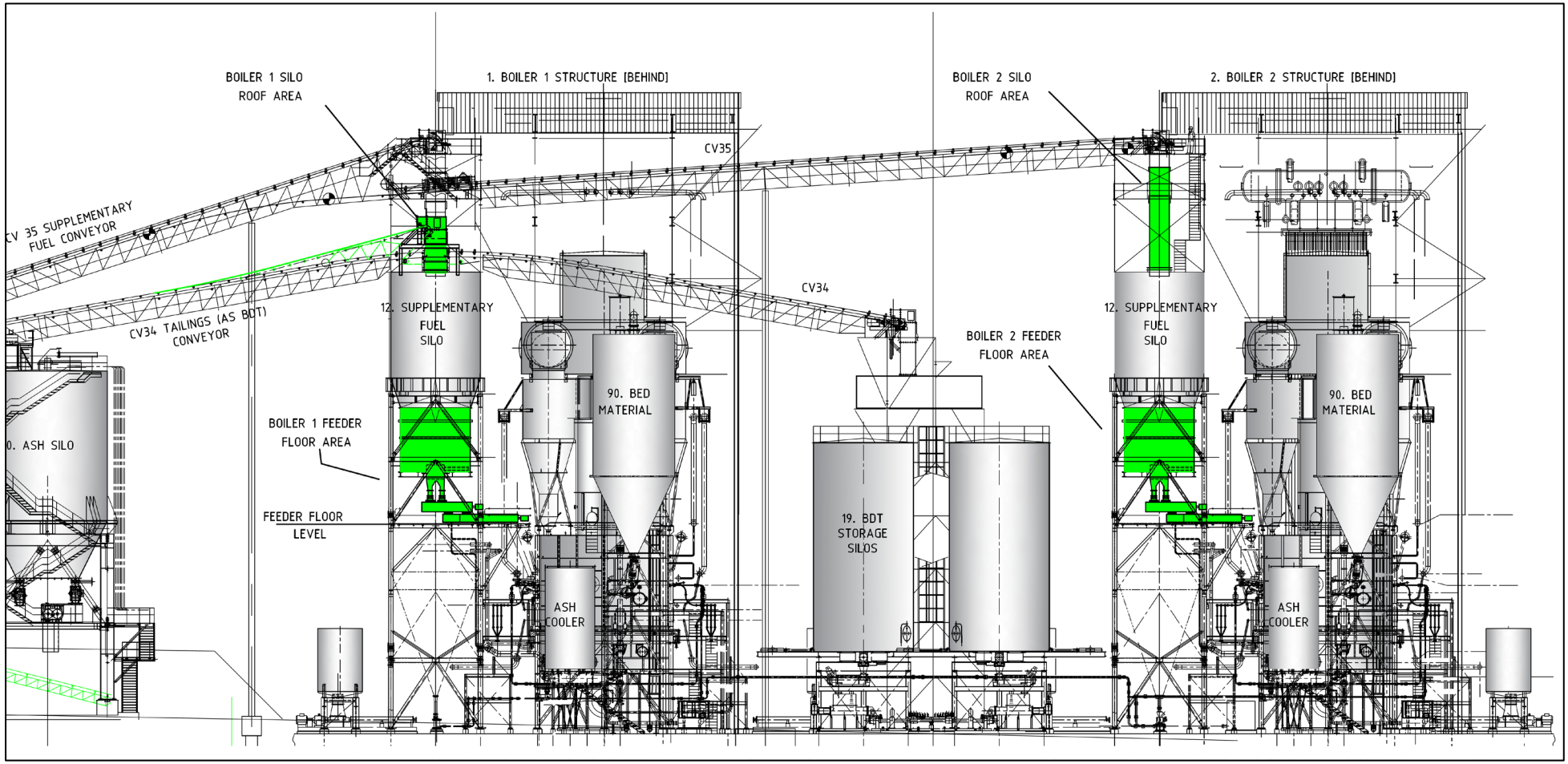
**Figure 3.12. Boiler plant area proposed plant/equipment changes in green. East elevation view. Refer to 0 for high resolution plan.**

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## 3.6. Modified Ash Management Arrangements

Ash generated from the combustion process will be sampled, tested and potentially used as a fertiliser in accordance with the EPA's *The Ash from Burning Biomass Order* 2014, or a Specific RROE. This ash will be stored in the existing storage silo for this purpose in the plant and will be trucked off-site for reuse.

The existing ash slurry system previously used to transfer coal tailings ash back to Warkworth mine will remain in place, though it will not be used and will be removed at a later date.

Further details of ash waste collection, management and removal are provided in Section 8 of this EIS and in the Waste Management Plan (Appendix L).

## 3.7. Utility Requirements

### 3.7.1. Water

Water is required for the cooling towers in amounts similar to when BDT coal was used as fuel. The existing stormwater detention basins are often used for supply when adequate rainfall is available.

Verdant Earth owns an offtake on the Hunter River, but will require purchase or lease licence shares or purchase water allocations from another licence holder to access water from the Hunter River to extract up to 3,300 megalitres per year (ML/year) of raw water from the Hunter River to supply the power plant in accordance with the *Water Management Act* 2000.

The raw water storage pond has a volume of 6,000 cubic metres which equates to 6ML. This water is used in the power plant and a significant volume of raw water is used to cool the steam to condense it. The steam is ultra-high-quality demineralised water, and this form of water is simply recycled as it is expensive to make demineralised water.

Daily demand for raw water is 24 X 366.3 = 8,791.2kl/day or 8.791 ML/day. Annual demand is 3,200 ML/year. A Soil and Water Impact Assessment is included in Appendix T and summarised in Section 15.

### 3.7.2. Power

All power requirements are provided for at the Redbank Power Station.

### 3.7.3. Sewerage

Sewage disposal at the Site is provided by an onsite septic tank and wastewater system. All sewerage requirements are existing and met on site, no additional sewerage connections or disposal is required.

Staff facilities on the Site are serviced by an existing Kelair package aerated wastewater treatment plant. The treatment plant has a septic tank, macerator pump and rotating disc aerator. Treated wastewater is applied to garden beds on the Site.

There is no predicted change in human resources required to operate the site and therefore the existing treatment plant, as previously approved, would have sufficient capacity.

### 3.7.1. Connection to the Grid

The existing configuration includes a turbo-alternator power generating unit at 11 kilovolts (kV). The existing connection to the Shortland electrical system is via a 132 kV electrical interconnect line less than one kilometre (km) in length connecting with Shortland's existing 132 kV line from Singleton to Kurri Kurri. No further modifications are proposed.

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A *Design Information Package Asset Connection Brief*[33] provides support that the transmission grid has capacity to re-connect the power station and an indicative layout of connection points is provided.

Verdant Earth notes that the 132KV has a limit of 175MW and Redbank have limited their Generator to 160 MW, however the maximum it can generate is 150 MW.

## 3.8. Landscaping

Additional landscaping will be required to ensure adequate and appropriate vegetation is used for a linear buffer between the stockpile area and the concrete stormwater drain. An additional stormwater drainage swale will be installed on the eastern edge of the Site. This swale will also need planting. Additional landscaping is also planned for the entrance of the Facility.

The Landscape Plan is provided in Appendix E.

## 3.9. Operational Hours and Access

The power plant will continue to operate on a 24/7 basis in accordance with the existing approval.

It is envisioned most deliveries will be accepted between 6am and 10pm seven days per week although the Site operates 24/7 and therefore deliveries of feedstock materials will be managed to ensure feedstock availability to meet the operational needs of the power station and utilisation of the transport fleet.

Up to 30 operational and maintenance staff would be employed per day shift (6:00am – 6:00pm) and 5 staff per night shift.

## 3.10. Construction

The construction phase will occur over approximately 6 to 10 months. Prior to the commencement of works on-site a complete services search including a Dial Before You Dig (DBYD) search will be undertaken to identify any services which could be affected by the construction works.

**Site mobilisation:**

- Services search;
- Establishment of environmental management measures including erosion and sediment controls;
- Establish site access, laydown areas; and
- Establishment of site shed and stockpile sites.

**New road works:**

- Remove existing ash transfer pumps and equipment;
- Prepare road base;
- Form new road surfaces;
- Relocate existing weighbridge to truck exit;
- Install new weighbridge in truck entry;
- Install pedestrian crossings;
- Install traffic & warning signage;
- Connect electrical & control equipment; and

[33] Ausgrid (July 2021), Design Information Package Asset Connection Brief AN-14023 Redbank 150MW Power Station Connection.

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- Test and commission weighbridges.

**Truck Unloading Equipment:**

- Prepare location & surface for mobile equipment;
- Place mobile truck unloading equipment;
- Place mobile transfer conveyor to conveyor 76 hopper;
- Place mobile stacker & reclaimer conveyors;
- Install protection devices;
- Connect electrical & control equipment; and
- Test and commission unloading equipment.

**Boilers 1 and 2**

Biomass Silos (existing coal silos):

- Install scaffold and secure structure;
- Remove bracing;
- Cut & remove bottom section of existing silos;
- Replace & weld new bottom sections;
- Replace bracing;
- Remove existing coal feeders;
- Install new augers;
- Install protection devices;
- Connect electrical & control equipment; and
- Test and commission augers.

**Boiler 2 Silo Transfer Installation:**

- Install Scaffold;
- Remove existing chutes;
- Install reversable conveyors;
- Install protection devices;
- Connect electrical & control equipment; and
- Test and commission biomass conveyors.

**Boiler 1 Silo Transfer Installation:**

- Install Scaffold;
- Raise conveyor 34 to accommodate reversable conveyors;
- Install biomass diverter;
- Remove existing chutes;
- Install reversable conveyors;
- Install protection devices;
- Connect electrical & control equipment; and
- Test and commission biomass conveyors.

**Conveyor 76:**

- Remove coal crusher;
- Install hopper and diverter chute;

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- Install extension conveyor to conveyor 34;
- Install loading hopper/walking floor to conveyor 76;
- Install protection devices;
- Connect electrical & control equipment; and
- Test and commission biomass conveyors.

**Fire Detection & Protection**

- Extend existing fire systems to new conveyors & equipment;
- Install fire detection to biomass silos & link to existing fire system;
- Connect electrical & control equipment; and
- Test and commission fire system.

**Dust Extraction & Suppression**

- Optimise existing dust extraction equipment to accommodate new installation;
- Optimise existing fire suppression to accommodate new installation; and
- Test and commission extraction & suppression systems.

**Services for the construction phase will be supplied via the existing site infrastructure including:**

- Telecommunications;
- Electricity; and
- Sewer.

Minimal truck movements (including all deliveries of equipment and materials) are expected during construction of the proposed facility. Movements will primarily be related to delivery of materials and movements on-site for a short-term period. Some light vehicles for construction workers travelling to and from the Site are also expected.

*No oversize and/or overmass (OSOM) vehicles and loads are envisaged to be required during construction. All plant and equipment components required for modifications to allow biomass fuel use at the Redbank Power Station will be delivered in segments and modules. If future changes to the construction strategy require OSOM vehicles, relevant approvals will be sought and consultation with TfNSW will occur.*The construction works would be undertaken in accordance with the Interim Construction Noise Guideline (DECCW 2009) and would typically occur during the standard working hours between:

- 0700 to 1800 hrs Monday to Friday; and
- 0800 to 1300 hrs on Saturdays.

There will be no construction works on Sundays or public holidays.

### 3.10.1. Construction Plant and Equipment

The construction phase will utilise the plant and equipment described in Table 3.6.

**Table 3.6. Construction plant and equipment proposed during construction.**

| Equipment | Estimated days on site | Use |
|---|---|---|
| Small excavator | 14 | Site services connections and detailed excavation |
| Large Excavator | 14 | Bulk earthworks for new road section and weighbridges |
| Bobcat | 14 | Site services connections and detailed excavation |
| Water truck | 14 | Road construction & bulk earthworks |
| Grader | 14 | Road construction & bulk earthworks |
| Scraper | 14 | Road construction |

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| Equipment | Estimated days on site | Use |
|---|---|---|
| Compactor | 14 | Road construction |
| Paver | 5 | Pavement wearing course |
| Crane | 14 | Removal of old and installation of new plant/equipment - biomass retrofit |

# 4. Statutory Context

## 4.1. Approval Pathway

The development will occupy land that is already cleared and contains the existing Redbank Power Plant facility.

The proposed project is considered a state significant development (SSD) under Clause 20(a) of Schedule 1 of *State Environmental Planning Policy (Planning Systems)* 2021 as it involves a development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that has a capital investment value of more than $30 million.

Pursuant to Part 2, Schedule 3 of the *Environmental Planning and Assessment Regulation* 2021, Secretary's Environmental Assessment Requirements (SEAR 1596) were originally issued to Verdant Earth Technologies Limited on 10 August 2021. A revised set of SEARs (SSD-56284960) was issued by the Department of Planning and Environment (now the Department of Planning, Housing and Infrastructure) on 30 August 2023 and are addressed in this EIS.

The Proposal will be assessed by the Department of Planning, Housing and Infrastructure and determined by either the Minister for Planning or the Independent Planning Commission.

The Proposal is considered integrated development and requires an amended Environment Protection License under the *Protection of the Environment Operations Act* 1997 and a Water Access License under the *Water Management Act* 2000.

A summary of permissibility and approvals is provided in the statutory compliance table in Appendix B.

## 4.2. Licenses and permits required

The Facility currently possesses an existing EPA licence (EPL 11262) under clause 17 of Schedule 1 for 'electricity generation' works. The Facility will also require licensing for 'energy recovery' under clause 18 of Schedule 1 of the *Protection of the Environment Operations Act 1997*.

The Proposal will use water during the combustion of biomass for stack cooling and for steam generation and therefore requires a Water Access License from Water NSW to ensure the Proposal's water requirements will be met.

Eligible waste fuels will be thermally treated at the Facility therefore requiring a Specific RROE be granted in accordance with EPA's *Energy from Waste Policy Statement* and *Eligible Waste Fuel Guidelines*. A summary of licenses and approvals requirement for the Proposal are provided in Table 4.1.

**Table 4.1. Licences and approvals required for the Redbank Power Station.**

| Licence/Approval Required | Government Authority | Activity |
|---|---|---|
| Environment Protection Licence (EPL) | NSW Environment Protection Authority (EPA) | Electricity generation (existing licensed activity under EPL 11262)<br>Energy recovery (new activity) |

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| Licence/Approval Required | Government Authority | Activity |
|---|---|---|
| **Specific Resource Recovery Order and Exemption (RRO/E)** | NSW Environment Protection Authority (EPA) | Combustion of eligible waste fuel |
| **Water access licence (WAL)** | Water NSW | Purchase or lease licence shares or purchase water allocations from another licence holder to access water from the Hunter River. |
| **Certification to Development Guideline 2 – Potential subsidence risk non-active workings (Subsidence Advisory NSW, May 2018)** | Subsidence Advisory NSW | Development within a Mine Subsidence District (MSD) |

## 4.3. Commonwealth Legislation

### 4.3.1. Climate Change Act 2022

The Australian Government's Climate Change Act has five key elements:

1) Legislating an emissions reduction target of 43% from 2005 levels by 2030 and net zero emissions by 2050;
2) Requiring the Minister for Climate Change (Minister) to deliver an annual progress statement to Parliament;
3) Establishing a Climate Change Authority to advise the Minister on the annual climate change statement;
4) Providing that the Climate Change Authority advise the Minister at least every five years in relation to the setting of future emissions reduction targets; and
5) Implementing periodic reviews of the operation of the Climate Change Act.

The Climate Change Act codifies Australia's updated 2022 Nationally Determined Contribution (NDC) under article 4 of the Paris Agreement[34]

While the Climate Change Act imposes obligations on the Federal government and its agencies (not on corporations and private sector entities), achieving these targets will require a concerted effort between the public and private sectors.

The Proposal provides near-net zero dispatchable electricity in support of achieving the goals of the *Climate Change Act* 2022 and the transition to renewables.

### 4.3.2. Climate Change (Consequential Amendments) Act 2022

Both the Climate Change Act 2022 and the *Climate Change (Consequential Amendments) Act* 2022 took effect in September 2022. These Acts legislate Australia's emissions reduction targets, including a 43 per cent emissions reduction by 2030 and net zero by 2050.

Under the Climate Change (Consequential Amendments) Act 2022, the main object of the *Australian Renewable Energy Agency Act* 2011 (ARENA Act) has been expanded to include an additional object – 'to 'facilitate the achievement of Australia's greenhouse gas emissions reduction targets.'

In addition to the Climate Change Act, the *Climate Change (Consequential Amendments) Act 2022* embeds this emissions reduction target into the functions of key governmental agencies including:

- Clean Energy Finance Corporation;

[34] The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016. Its overarching goal is to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels." Web: https://unfccc.int/process-and-meetings/the-paris-agreement

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- Australian Renewable Energy Agency (ARENA);
- Infrastructure Australia;
- Northern Australia Infrastructure Facility (NAIF); and
- Export Finance Australia.

### 4.3.3. Environment Protection and Biodiversity Conservation Act 1999

Relevant Commonwealth legislation includes the *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act). There are some High Value Biodiversity lands associated with the riparian corridor along Sandy Hollow Creek to the west of the Site within the parcel. However, this area is outside of the power plant footprint and no clearing of bushland or native vegetation is required for the Proposal. The riparian corridor will not be impacted as there is existing stormwater capture and treatment on the Site and the development will be maintained within the existing footprint of the power station.

The Site is mapped as Central Hunter Grey Box-Ironbark Woodland on Singleton Council's online map viewer, which is listed as an Endangered Ecological Community (EEC) under Schedule 2 of the *Biodiversity Conservation Act* 2016, however, as this site has been commissioned to operate as a Power Station since 2001, the threatened ecological community that was potentially present has been historically cleared. Furthermore, there are no records of any threatened species within the site boundary.

A Biodiversity Development Assessment Report has been prepared with the results of an ecological appraisal of the Site (Appendix Y). The BDAR concludes that with the implementation of the recommended mitigation measures no biodiversity values or EPBC matters are likely to be affected by the Proposal.

## 4.4. NSW State Legislative Requirements

### 4.4.1. Environmental Planning and Assessment Act 1979

The Proposal is consistent with the overall objectives of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Section 5 of the *Environmental Planning and Assessment Act 1979* and the accompanying *Environmental Planning and Assessment Regulation 2021* provide the framework for environmental planning in NSW and include provisions to ensure that proposals which have the potential to impact the environment are subject to detailed assessment, and to provide opportunity for public involvement.

The Proposal is consistent with the nominated objectives of the EP&A Act and is considered capable of fulfilling all statutory requirements. The site investigations have determined that the Proposal will not result in any significant negative impacts that cannot be adequately mitigated or managed.

The Proposal is considered state significant development and this EIS provides for the assessment requirements under Part 4 of the *Environmental Planning and Assessment Act* 1979. The Proposal will be assessed by the Department of Planning, Housing and Infrastructure and determined by either the Minister for Planning or the Independent Planning Commission.

The Proposal is also considered *integrated development* under section 4.46 of the EP&A Act as the project will require licensing and permitting under the *Protection of the Environment Operations Act* 1997 and the *Water Management Act* 2000.

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### 4.4.2. Environmental Planning and Assessment Regulation 2021

While the EP&A Act provides the overarching framework for the planning system in NSW, the *Environmental Planning and Assessment Regulation* 2021 (EP&A Regulation) supports the day-to-day requirements of this system. It also contains key operational provisions relating to the development assessment and consent process, and requirements associated with public participation.

The Proposal is considered an SSD under Clause 20(a) of Schedule 1 of *State Environmental Planning Policy (Planning Systems)* 2021 as it involves a development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that has a capital investment value of more than $30 million.

As an SSD project, Clause 4.12(8) of the *Environmental Planning and Assessment Act* 1979 applies, this EIS has been prepared to accompany the development application in the form prescribed by the Regulations.

### 4.4.3. Protection of the Environment Operations Act 1997

The *Protection of the Environment Operation Act* 1997 (POEO Act) prohibits any person from causing pollution of waters, or air and provides penalties for air, water and noise pollution offences. Section 48 of the Act requires a person to obtain an Environment Protection License (EPL) from the NSW Environment Protection Authority before carrying out any of the premise-based activities described in Schedule 1 of the Act.

Schedule 1 of the Act details what constitutes a 'scheduled activity' and therefore requires an EPL. The relevant activities that apply to this development are Clause 17 and Clause 18:

- 'Electricity generation' (Clause 17), meaning the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power; and
- 'Energy recovery from general waste' (Clause 18), meaning the receiving from off site of, and the recovery of energy from, any waste (other than hazardous waste, restricted solid waste, liquid waste or special waste).

The NSW Government describes energy from waste as a process through which energy and resources are retrieved from waste through thermal treatment. Thermal treatment is defined in Schedule 1 of the *Protection of the Environment Operations Act* 1997 as 'the processing of waste by burning, incineration, thermal oxidation, gasification, pyrolysis, plasma or other thermal treatment processes'.

The Facility currently possesses an existing EPA licence (EPL 11262) under clause 17 of Schedule 1 for 'electricity generation' works. The Facility will also require licensing for 'energy recovery' under clause 18 of Schedule 1 of the Protection of the Environment Operations Act 1997.

### 4.4.4. Protection of the Environment Operations (General) Regulation 2022

The *Protection of the Environment Operations (General) Regulation 2022* [POEO (General) Regulation] provides for the administration of environment protection licences, and establishes the method of calculating licence fees, including load based licence fees, and environmental protection notice fees.

The burning of bio-material for electricity generation is regulated under Part 3 of the *General Regulation*, clauses 138 to 141. Clause 139 expressly prohibits the use of *native forest bio-material* to generate electricity and provides penalties for corporations and individuals guilty of the offense. Clause 140 provides exemptions for certain types of native vegetation or woody waste from the definition of native forest biomaterials.

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The bio-material as specifically permitted and defined under clauses 138 to 140 would be a legal source of native forest bio-material for use as feedstock fuel at the Facility.

However Verdant has determined that it will **not** seek to use the native bio-material sourced from native forestry operations to use as a feedstock fuel at the Facility even though it is exempted from the provisions of the *General Regulation* and could be used lawfully for electricity generation.

Note that some native forest biomaterial from, as previously noted, from approved land clearing activities such as major infrastructure developments for approved civil infrastructure, road clearing works, right of ways and related approved projects will be used as fuel (when the bio-material has no other higher order uses).

Note that Verdant intends to use specifically grown fuel crops (defined as 'standard fuel' under the *Protection of the Environment Operations (Clean Air) Regulation* 2022) for 70% of the fuel used at Redbank Power Station.

This Study has been prepared to assess in detail how the Proposal will comply with the requirements and definitions under Clauses 138 to 141 of the *General Regulation*.

A Fuel Supply and Characterisation Study (Appendix M) has been prepared to accompany this EIS and the development application. The Fuel Supply and Characterisation Study assesses in detail how the Proposal will comply with the requirements and definitions under Clauses 138 to 141 of the *POEO (General) Regulation*.

### 4.4.5. Protection of the Environment Operations (Clean Air) Regulation 2022

*The Protection of the Environment Operations (Clean Air) Regulation* 2022 (Clean Air Regulation) prescribes standards for certain groups of plant and premises to regulate industry's air impurity emissions. Plant and certain activities belong to one of six (6) Groups, depending on the year in which the plant or activity commenced operations. The Clean Air Regulation includes emission standards for a range of pollutants that apply to each Group and these standards become stricter moving from Group 1 through to Group 6. Industry has an obligation to ensure compliance with the requirements specified in the Clean Air Regulation.

Schedule 3 of the POEO Clean Air Regulation sets out the emissions standards for electricity generation (for any boiler operating on a fuel other than gas). Group 5 emissions standards apply to premises which commenced on or after 1 August 1997, and are therefore relevant to Redbank. Group 6 emissions standards apply to premises which commenced on or after 1 September 2005.

Group 5 premises become Group 6 if development consent is modified after 1 September 2005 and the effect of the modification is to increase, intensify or change the nature of emissions to air. This would not be the case for the Proposal, with emission expected to be similar or lower than existing.

An Air Quality Impact Assessment (AQIA) has been prepared for the Proposal and is included in Appendix O of this EIS.

### 4.4.6. Protection of the Environment Operations (Waste) Regulation 2014

The *Protection of the Environment Operations (Waste) Regulation 2014* (the Waste Regulation) improves the EPA's ability to protect human health and the environment and paves the way for a modern and fair waste industry in NSW.

The Waste Regulation is supported by the Waste levy guidelines. These guidelines specify how to measure waste to calculate waste levy liability, the deductions waste operators can claim, and the EPA's requirements for records,

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surveys and reports. All licensed processing, disposal, recycling and storage facilities within the metropolitan levy area or regional levy area are subject to the levy system.

As a licensed facility for electricity generation and recovery of energy from waste materials, the Facility will be required to accurately measure all waste received and leaving the facility. Two certified weighbridges will be installed as part of the Proposal. The amount of biomass received and ash from the burning of biomass transported off-site will be reported to the EPA through the Waste and Resource Reporting Portal (WARRP).

Wood and wood derived waste including biomass from agriculture, forestry and sawmilling residues, and uncontaminated wood waste are defined by the EPA's *Energy from Waste Policy Statement* as 'eligible waste fuels.'

Eligible waste fuels, further outlined in the NSW EPA's *Eligible Waste Fuel Guidelines 2016*, may be thermally treated using a range of treatment technologies, provided a Resource Recovery Order and Exemption (RRO/E) has been granted by the EPA. The origin, composition and consistency of these wastes must ensure that emissions from thermal treatment will be known and consistent over time.

Under Clause 93 of the Waste Regulation, a specific RROE will be sought to lawfully permit the use of biomass materials defined as 'eligible waste fuels' to be used in electricity generation in the project. A Fuel Supply and Characterisation Study (Appendix M), included with this EIS, assesses the fuel characteristics of the bio-material that would be used as fuel at the Facility.

The land application of waste as defined in the *POEO Act* 1997 triggers various regulatory requirements, such as the need to hold an environment protection licence and to pay a waste levy. In some cases, however, the EPA has the power to give exemptions from certain regulatory requirements that would otherwise apply to the land application of a material that is produced wholly or partly from waste.

One of the major waste streams that will be produced by the Facility is ash, being the mineral residual component after the thorough combustion of an organic fuel material, typically containing plant nutrients such as calcium, iron, potassium, magnesium and trace metals. In NSW, only waste materials (including ash) that comply with a general or specific RRO/E can be recycled and used in the environment as a fertiliser or fill material. The Proposal intends to facilitate the reuse of ash generated at the Facility (from the burning of biomass) as a soil amendment or fertiliser on land in accordance with the *Ash From Burning Biomass Order and Exemption* 2014. If the ash is found not to be compliant with the Order, the waste ash material will be temporarily landfilled, and a Specific RROE sought from the NSW EPA (to enable its recovery and recycling).

A Waste Management Plan (Appendix L) has been prepared to accompany this EIS and the development application. The Waste Management Plan assesses the how waste from operation of the Facility, including the ash waste stream, will be managed.

### 4.4.7. Water Management Act 2000

The object of the *Water Management Act* 2000 is the sustainable and integrated management of the state's water for the benefit of both present and future generations. The *Water Management Act* 2000 recognises the need to allocate and provide water for the environmental health of our rivers and groundwater systems, while also providing licence holders with more secure access to water and greater opportunities to trade water through the separation of water licences from land.

The Facility will use water during the use of biomass for stack cooling and for steam generation.

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An assessment of water requirements against the relevant water sharing plan and availability and access to water from the relevant water source(s) has been prepared including details of water usage and water licensing requirements under the *Water Management Act* 2000.

Verdant Earth Technologies owns an offtake on the Hunter River and will need to obtain a water access licence and purchase or lease licence shares or purchase of water allocations from another licence holder to extract up to 3,300 megalitres per year (ML/year) of raw water from the Hunter River to supply the Facility.

### 4.4.8. Coal Mine Subsidence Compensation Act 2017

The Site is located within the Patrick Plains Mine Subsidence District (MSD). The MSDs are administered by Subsidence Advisory NSW under the *Coal Mine Subsidence Compensation Act* 2017 to help protect homes and other structures from potential mine subsidence damage.

Districts are proclaimed in areas where there are potential subsidence risks from underground coal mining that has occurred or may take place in the future.

Subsidence Advisory NSW regulates building and subdivision works within districts to ensure structures are built to an appropriate standard that reduces the risk of damage should subsidence occur.

Subsidence Advisory NSW records indicate that historical mine workings are not present in proximity to the existing power station infrastructure. However, the Proposal is located within a declared MSD and within a mining title. All applications for development within a declared MSD require SA NSW approval to be eligible for compensation under the Coal Mine Subsidence Compensation Act 2017.

Section 91 of the *Environmental Planning and Assessment Act* 1979 specifies that all development within an MSD (excluding exempt development) is considered 'integrated development', and approval from Subsidence Advisory NSW is required.

Compliance with *Development Guideline 2 – Potential subsidence risk non-active workings (Subsidence Advisory NSW, May 2018)* is a requirement for development within an MSD that has been assigned Guideline 2.

Following construction, a certifier will be engaged to certify that an improvement has been constructed in accordance with Guideline 2, and a copy of this certification will be provided to Subsidence Advisory NSW.

Consultation with the coal title holder and the Department of Mining, Energy and Geoscience regarding the proposed additional infrastructure has also been undertaken as part of Subsidence Advisory NSW's assessment process.

### 4.4.9. Rural Fires Act 1997

The Rural Fires Act 1997 establishes the NSW Rural Fire Service, defines its functions and makes provision for the prevention, mitigation and suppression of rural fires.

The objects of this Act include the:

a) Prevention, mitigation and suppression of bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fire districts, and
b) Coordination of bush fire fighting and bush fire prevention throughout the State, and
c) Protection of persons from injury or death, and property from damage, arising from fires, and
d) Protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires, and

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e) Protection of the environment by requiring certain activities to be carried out having regard to the principles of ecologically sustainable development described in section 6 (2) of the Protection of the Environment Administration Act 1991.

The Proposal falls within the Bushfire Vegetation Buffer zone on the *Singleton Council Bushfire Prone Land Map*. A Bushfire Assessment Report (BFAR) has been prepared (Appendix V) for the Proposal to assess the bushfire construction and planning requirements.

As the Proposal is an SSD, a bushfire safety authority under section 100B of the Rural Fires Act 1997 is not required.

## 4.5. Other Relevant Policies and Guidelines

### 4.5.1. NSW Energy from Waste Policy Statement

The NSW EPA *Energy from Waste Policy Statement 2015* (revised in June 2021) identifies the relevant policy framework and principal criteria that apply to facilities in NSW that propose to thermally treat waste or waste-derived fuels for the recovery of energy. Schedule 1 of the POEO Act 1997 defines thermal treatment as '*the processing of waste by burning, incineration, thermal oxidation, gasification, pyrolysis, plasma or other thermal treatment processes*.'

Part 3 of the EPA's *Energy from Waste Policy Statement* specifies that eligible waste fuels are those that are considered by the EPA to pose a low risk of harm to human health and the environment due to their origin, composition and consistency. The policy requires that facilities proposing to use eligible waste fuels must meet the following criteria:

- Ability to demonstrate to the EPA that the proposed waste consistently meets the definition of an EPA-approved eligible waste fuel;
- Confirm there are no practical, higher order reuse opportunities for the waste;
- Fully characterise the waste and/or undertake proof of performance; and
- Meet the relevant emission standards as set out in the *Protection of the Environment Operations (Clean Air) Regulation* 2010.

The policy also states that eligible waste fuels that also fall under the definition of a 'standard fuel' as defined in the *Protection of the Environment Operations (Clean Air) Regulation* 2010 would not need to meet the above criteria but still require appropriate approval for their use. Under the Clean Air Regulation:

> ***standard fuel*** *means any unused and uncontaminated solid, liquid or gaseous fuel that is—*
>
> *(a) a coal or coal-derived fuel (other than any tar or tar residues), or*
>
> *(b) a liquid or gaseous petroleum-derived fuel, or*
>
> *(c) a wood or wood-derived fuel, or*
>
> *(d) bagasse.*

Further details are provided in the EPA's *Eligible Waste Fuels Guidelines* including how to apply for a specific RROE for the use of an eligible waste fuel and definitions for each of the listed eligible waste fuels.

Verdant Earth proposes to use a combination of standard fuels and eligible waste fuels and meet all relevant emission standards and monitoring requirements as required under an EPL and the Clean Air Regulation.

A breakdown of the key *NSW Energy from Waste Policy Statement* requirements and how they are addressed is provided in the Fuel Supply and Characterisation Study included in this EIS (Appendix M).

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### 4.5.2. Eligible Waste Fuels Guidelines

The *NSW Energy from Waste Policy Statement* allows for certain low-risk wastes or waste-derived materials to be thermally treated. These low-risk wastes are referred to in the *NSW Energy from Waste Policy Statement* as eligible waste fuels.

Eligible waste fuels are those that the EPA considers pose a low risk of harm to the environment and human health due to their origin, composition and consistency.

Eligible waste fuels may be thermally treated using a range of treatment technologies, provided a Specific RROE has been granted by the EPA. The origin, composition and consistency of these wastes must ensure that emissions from thermal treatment will be known and consistent over time.

The *Eligible Waste Fuel Guidelines* and the *NSW Energy from Waste Policy Statement* define eligible waste to include:

- Biomass from agriculture;
- Forestry and sawmilling residues; and
- Uncontaminated wood waste.

The listing of a waste or waste-derived material as an eligible waste fuel does not constitute an approval to use that material at a particular facility. A proponent must first apply to the EPA for a Specific RROE in accordance with Part 4 of the Eligible Waste Fuel Guidelines.

A combined Eligible Waste Fuel and Resource Recovery Order and Exemption (RROE) application will be submitted to the NSW EPA by Verdant Earth post approval for the biomass proposed for use at the Facility in accordance with the Eligible Waste Fuel Guidelines (Part 4).

A Waste Characterisation Methodology will be prepared to help inform an application for specific RROE. The NSW EPA will be consulted to ensure that the methodology for sampling, testing and monitoring of the eligible waste fuels are sufficient to inform a detailed Specific RROE application. The RROE will set out the quality specifications for biomass fuel to ensure that only quality and fit for purpose fuels are used for electricity generation.

### 4.5.3. The Ash from Burning Biomass Order 2014

*The Ash From Burning Biomass Order* 2014 (the Order), issued by the Environment Protection Authority (EPA) under clause 93 of the *Protection of the Environment Operations (Waste) Regulation* 2014 (Waste Regulation), imposes the requirements that must be met by suppliers of ash to which *The Ash From Burning Biomass Exemption* 2014 applies. The requirements in the Order apply in relation to the supply of ash for application to land as a soil amendment.

Application of ash (from the burning of biomass) as a soil or fertiliser amendment on land is permitted in accordance with the Order. The Order permits the reuse of ash from biomass fuels defined under Part 1 of the *Eligible Waste Fuels Guidelines* (EPA 2016) including biomass from agriculture, forestry and sawmilling residues, uncontaminated wood waste and/or organic residues from virgin paper pulp activities.

Verdant Earth Technologies Limited would aim to supply ash from the Facility for agricultural application to land in accordance with the testing and reporting requirements of the Order. Ash from the burning of the proposed biomass as fuel will be sampled and tested in accordance with Section 4 of the Order, to ensure that the ash meets all chemical requirements under Table 1 of the Order.

If ash were not to meet the Order, a Specific RROE would be sought.

Additional details on the management and reuse of ash from the Facility is provided in the Waste Management Plan (Appendix L) in this EIS.

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### 4.5.4. Fire and Rescue NSW – Fire Safety Guidelines

Fire & Rescue NSW (FRNSW) published guidelines to provide guidance on fire safety in waste facilities that receive combustible waste material, including provisions for fire safety and safe fire brigade intervention to protect life, property and the environment.

The guidelines detail the requirements of FRNSW for waste facilities including:

- Consideration of fire safety including site selection, planning, design, assessment and operation;
- Fire safety systems to be adequate to special hazards identified within a waste facility and which also meet the operational needs of firefighters;
- Safe storage and stockpiling of combustible waste material based on expected combustibility and maximum pile size; and
- Workplace fire safety and fire safety planning, including procedures for the event of fire or emergency incident.

The guidelines apply to the Proposal as it would be a facility receiving, storing and processing potentially combustible woody biomass. Fire safety has been assessed for adequacy in this EIS and a Fire Safety Study has been prepared to provide guidance to design and planning of the Proposal, and to accompany the development application (see Appendix X).

## 4.6. Environmental Planning Instruments and Policies

### 4.6.1. State Environmental Planning Policy (Transport and Infrastructure) 2021

The aim of the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP) is to facilitate the effective delivery of infrastructure across NSW by improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services, and by providing greater flexibility in the location of infrastructure and service facilities.

Other key aims of the Infrastructure SEPP are to allow for the efficient development, redevelopment or disposal of surplus government owned land, and identify the environmental assessment category into which different types of infrastructure and services development fall. This includes identifying certain development of minimal environmental impact as exempt development. The Infrastructure SEPP also seeks to help proponents identify matters to be considered in the assessment of development adjacent to particular types of infrastructure development including consultation with relevant public authorities during the assessment process or prior to development commencing.

Section 2.36(1) of the Transport and Infrastructure SEPP sets out that 'Electricity generating works' are permissible in RU1 Primary Production zones, as:

- Under Section 2.35 of the Transport and Infrastructure SEPP, RU1 Primary Production is a 'prescribed rural, industrial or special use zone' for 'Electricity generating works or solar energy systems'.
- Under Section 2.36(1)(b) of the Transport and Infrastructure SEPP, 'Electricity generating works' are permissible in a 'prescribed rural, industrial or special use zone'.

In addition, 2.36(5) states that '*Development for the purpose of, or resulting in, a change of fuel source of an existing coal or gas fired generating works by a proportion of more than 5 per cent in any 12-month period may only be carried out with consent*.'

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"Electricity generating works' defined under the Standard Instrument include a building or place used for the purpose of making or generating electricity. Therefore, the Proposal is permissible with consent in RU1 zoning under Section 2.35 and 2.36 of the Transport and Infrastructure SEPP.

It is also noted that under Section 2.171 of the *State Environmental Planning Policy (Transport and Infrastructure)* 2021, thermal energy from waste development is prohibited if it—

*a) Involves, or is carried out to enable, the thermal treatment of waste involving or resulting in energy recovery from the waste, and*
*b) Is on land identified on the Thermal Energy from Waste Prohibition Map—Greater Sydney, and*
*c) Is prohibited by the Protection of the Environment Operations (General) Regulation 2022, Chapter 9, Part 4.*

The Proposal is not on land identified on the Thermal Energy from Waste Prohibition Map—Greater Sydney. Further, the Redbank Power Station is an existing power station proposing only the use of standard fuel and eligible waste fuel (including DBF subject to EPA approval).

The *NSW Energy from Waste Policy Statement* (EfW Policy) provides that any facility proposing to thermally treat a waste or waste-derived material that is not a listed eligible waste fuel (Section 3) must meet the requirements to be an energy recovery facility.

The Redbank Power Station will only thermally treat lower risk 'eligible waste fuels' as listed in Part 3 of the EfW Policy and defined in the *Eligible Waste Fuels Guidelines* (2022), including biomass and residues (also referred to as biomaterial). These fuels are excluded from the *Energy from Waste Infrastructure Plan* 2021, which acknowledges that these types of energy from waste facilities will continue to be permitted across NSW if they comply with planning and environmental legislation and policies.

### 4.6.2. State Environmental Planning Policy (Planning Systems) 2021

The aims of the *State Environmental Planning Policy (Planning Systems)* 2021 (Planning Systems SEPP) are:

(a) To identify development that is State Significant Development.
(b) To identify development that is State Significant Infrastructure and critical State Significant Infrastructure.
(c) To identify development that is regionally significant development.

Under Part 2.2, Section 2.6 of the Planning Systems SEPP, development is declared to be State Significant Development (SSD) if the development is specified in Schedule 1 or 2. A development is declared a Regionally Significant Development if the development is specified in Schedule 6. Schedules 2 through 5 do not apply to the Proposal.

Under Clause 20(a) of Schedule 1, "Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that has a capital investment value of more than $30 million" is considered SSD.

The Capital Investment Value (CIV) of the Proposal is over $30 million, therefore Clause 20(a) under the Planning Systems SEPP applies and the Proposal is considered an SSD.

As the Proposal is an SSD, under Section 3.10 of the Planning Systems SEPP the Proposal is not considered a regionally significant development.

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## 4.6.3. State Environmental Planning Policy (Resilience and Hazards) 2021

### *4.6.3.1. Contaminated Lands*

Under *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP) applicants for consent must carry out a preliminary site investigation for any development consent sought on land previously used for activities that may cause contamination.

Specifically, Clause 4.6 of the Resilience and Hazards SEPP requires the approval authority to have regard to certain matters before granting approval. These matters include:

- Whether the land is contaminated.
- Whether the land is, or would be, suitable for the purpose for which development is to be carried out.
- If remediation is required for the land to be suitable for the proposed purpose, whether the land will be remediated before the land is used for that purpose.

The Resilience and Hazards SEPP also imposes obligations to carry out any remediation work in accordance with relevant guidelines, developed under the *Contaminated Lands Management Act* 1995 and to notify the relevant council of certain matters in relation to any remediation work.

The Proposal does not seek to significantly modify the existing power plant site layout. The Proposal includes only changes to the conveyor and fuel management equipment, with minor ground disturbance for weighbridge installation and a section of access road over previously disturbed land between the existing approved fuel storage area and the power plant.

In January 2015, a pre-purchase due diligence site contamination assessment was prepared for the Redbank Power Station. The report assessed the Site is a clean, low risk site with low levels of existing contamination that pose a negligible risk of pollution of surface waters.

A separate preliminary site assessment (PSI) has been prepared for the Proposal and is provided in Appendix U. The PSI concluded that the Site is considered suitable for the Proposal.

### *4.6.3.2. Hazardous and Offensive Development*

The Resilience and Hazards SEPP outlines the requirements for a Preliminary Hazard Analysis screening test, required to be undertaken for hazardous and potentially hazardous industries.

A potentially hazardous industry is defined within the Resilience and Hazards SEPP as a development for the purpose of any industry which, if the development were to operate without employing any measures to reduce or minimise its impact, would pose a significant risk to human health, life or property, or to the biophysical environment.

Part 3 of the Resilience and Hazards SEPP applies to:

*a) development for the purposes of a potentially hazardous industry, and*
*b) development for the purposes of a potentially offensive industry, and*
*c) development notified, for the purposes of this Part, by the Director in the Gazette as being a potentially hazardous or potentially offensive development.*

Development that is potentially hazardous and/or offensive is permissible under the Resilience and Hazards SEPP if the facility is capable of securing an Environment Protection Licence (EPL) from the NSW Environment Protection Authority.

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A preliminary hazard analysis (PHA) has been prepared as part of the EIS (Appendix W) and operations of the Proposal have been determined to be "potentially hazardous" as per the definitions in Part 1 of the Hazards SEPP.

Upon further evaluation, no incidents from the Proposal have offsite risk impacts, therefore no societal risk would result from implementation of the Proposal.

The PHA found that adequate safeguards have been provided, commensurate with the consequence level of the incidents to ensure that adequate safeguards are provided, commensurate with the consequence level of the incidents. No incidents from the Proposal would have offsite consequences, therefore no societal risk results.

The stack velocity exceeds 4.3m/s. Therefore, Form 1247 of the CASA advisory circular – Plume rise assessments needs to be submitted to CASA. A copy of the form 1247 must also be submitted to the Operators of:

- Singleton Army camp; and
- Hunter Valley Gliding Club (for Warkworth airstrip).

Casa will conduct the plume rise assessment using their software and advise Verdant Earth. This will be completed in tandem with submittal and assessment of the EIS and Proposal application.

The Considerations for Final Design identified in the PHA will be reviewed for inclusion in post-consent detailed design phase and assessed in the Fire Safety Study (Appendix X) as applicable.

The PHA demonstrated that the Proposal is a potentially hazardous industry but is not a hazardous industry within the meaning of SEPP (Resilience and Hazards).

With considerations of the above, the Proposal is suitable for construction and operation.

### 4.6.4. State Environmental Planning Policy (Industry and Employment) 2021

The relevant aim of *State Environmental Planning Policy (Industry and Employment)* 2021 (Industry SEPP) is to ensure that signage is compatible with the desired amenity and visual character of an area, provides effective communication in suitable locations and is of a high-quality finish and design. This Policy does not regulate the content of signage and does not require consent for a change in the content of signage.

Part 3.2 of the Industry SEPP details the requirements that a consent authority must be satisfied with prior to granting development consent:

> *A consent authority must not grant development consent to an application to display signage unless the consent authority is satisfied:*
>
> *(a) that the signage is consistent with the objectives of this Policy as set out in clause 3.1 (1) (a), and*
> *(b) that the signage the subject of the application satisfies the assessment criteria specified in Schedule 5.*

Part 3.7 of the Industry SEPP details advertisements to which this Part applies and states:

This Part applies to all signage to which this Policy applies, other than the following:

> *(a) business identification signs,*
> *(b) building identification signs,*
> *(c) signage that, or the display of which, is exempt development under an environmental planning instrument that applies to it,*

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*(d) signage on vehicles*

Signage is proposed to be installed as part of the development to identify the facility. The proposed signage is defined as a 'business identification sign' and therefore the Industry SEPP does not.

## 4.7. Singleton Local Environmental Plan 2013

The following section provides the local planning and legislative framework for the Proposal. The purpose of this section is to outline the approval process and identify the applicable local planning controls that relate to the Singleton Local Environmental Plan 2013 (Singleton LEP).

### 4.7.1. Zone Objectives

The objectives of RU1 Primary Production are to:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- To encourage diversity in primary industry enterprises and systems appropriate for the area;
- To minimise the fragmentation and alienation of resource lands; and
- To minimise conflict between land uses within this zone and land uses within adjoining zones.

### 4.7.2. Land Use Permissibility

The development is located on land zoned as RU1 Primary Production under the Singleton Local Environmental Plan 2013.

Under the dictionary of the Singleton LEP, "*Electricity generating works'* is defined as '*a building or place used for the purpose of making or generating electricity*.'

Whilst the LEP prohibits development that may be classified as a 'Electricity generating works', this development is considered permissible with consent in RU1 zoning under Clause 2.36(1) of the *State Environmental Planning Policy (Transport and Infrastructure)* 2021.

## 4.8. Singleton Development Control Plan 2014

The objectives of the *Singleton Development Control Plan 2014* are to:

- To provide clear and concise guidance on Council's minimum requirements for building, subdivision and land development,
- To provide detailed criteria to assist Council in assessing development applications as required by the provisions of the *Environmental Planning and Assessment Act* 1979,
- To achieve high quality design outcomes,
- To protect and conserve the environmental and cultural heritage of Singleton, and
- To provide for the orderly and economic use and development of land in Singleton.

The development is required to demonstrate compliance with the *Singleton Development Control Plan 2014*. Relevant sections and provisions are described in Table 4.2.

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**Table 4.2. Relevant provisions of the Singleton Development Control Plan 2014 (v4).**

<table>
<tr><th>Section or Chapter</th><th>Description of Relevant Provisions</th><th>How the DCP element have been addressed</th></tr>
<tr><td rowspan="2">2.4</td><td>Stormwater drainage system.<br>(1) The development must ensure stormwater is disposed of suitably and does not contribute to adverse downstream impacts or overload the public stormwater drainage system.</td><td>A Soil and Water Impact Assessment (Appendix T) has assessed the existing stormwater infrastructure at the Site, including MUSIC modelling, and determined the Proposal would not contribute to adverse downstream water quality impacts.</td></tr>
<tr><td>(3) Development consent should not be granted to development that would result in an increase or concentration in the amount of stormwater being discharged to the public stormwater drainage system unless the consent authority is satisfied that:<br>(a) the post-development runoff from the land will not exceed the predevelopment runoff for all storm durations for the 5 year, 20 year and 100 year ARI;<br>(c) the design of the stormwater drainage and discharge system must be sustainable and must not be prone to failure as a result of normal human influence;<br>(d) the design of the stormwater drainage and discharge system must comply with the Council's Engineering Design Specifications and be consistent with the approaches adopted by the Engineers Australia publications titled Australian Guide to Water Sensitive Urban Design.<br><br>(e) the design of the stormwater drainage and discharge system should achieve the stormwater quality outcomes outlined in the following table:
<table>
<tr><th>Pollutant</th><th>System intent</th><th>Treatment required</th></tr>
<tr><td>Suspended solids</td><td>To protect ambient water quality.</td><td>The stormwater management system is to reduce the average annual load by at least 80%.</td></tr>
<tr><td>Total Phosphorus</td><td>To protect ambient water quality.</td><td>The stormwater management system is to reduce the average annual load by at least 45%.</td></tr>
<tr><td>Total Nitrogen</td><td>To protect ambient water quality.</td><td>The stormwater management system is to reduce the average annual load by at least 45%.</td></tr>
<tr><td>Oil and grease</td><td>To protect the receiving system from hydrocarbons.</td><td>The stormwater management system is to be designed to ensure that there are no visible oils for flows up to 50% of the one year ARI peak flow in areas with concentrated hydrocarbon deposition.</td></tr>
<tr><td>Coarse sediment</td><td>To limit the sediment loads entering the system.</td><td>The stormwater management system is to be designed such that sediment coarser than 0.25mm Ø is retained for</td></tr>
<tr><td></td><td></td><td>flows up to 50% of the 1 year ARI peak flow.</td></tr>
<tr><td>Litter</td><td>To protect the receiving system from anthropogenic litter.</td><td>The stormwater management system is to be designed such that litter greater than 50mm Ø is retained for flows up to 50% of the 1 year ARI peak flow.</td></tr>
</table>
</td><td>A Soil and Water Impact Assessment (Appendix T) has assessed the existing stormwater infrastructure at the Site. The existing stormwater drainage system includes 7.5 ML of storage via the raw water pond and the water quality pond, which is greater than the 1 in 10-year, 24 Hour Storm Event (6.8ML for the entire site).<br><br>MUSIC modelling for the Site predicted 3 runoff events in 40.5 years. On average, this is less than 1 runoff event every 10 years.<br><br>The model predicts 99.7% of all runoff will be retained and reused on the Site. On average, this is less than 1 runoff event every 10 years occurring during the most extreme rainfall events.<br><br>The required water quality and quantity treatments would be met via attenuation of runoff and reuse of water for operations at the Facility.</td></tr>
<tr><td>2.16</td><td>(4) In deciding whether to grant consent to development on land, the consent authority must have regard to:<br>(a) the impact of the proposed clearing and/or pruning,<br>(b) whether the proposed development triggers the Biodiversity Offset Scheme,<br>(c) how the development proposes to avoid impacts on biodiversity,<br>(d) how the development proposes to prevent land degradation, and<br>(e) how the development will ensure no net loss of vegetation.</td><td>No additional clearing of bushland vegetation is proposed.<br><br>No impacts to Biodiversity are expected and the BOS is not triggered by the Proposal.<br><br>An BDAR is provided in Appendix Y.</td></tr>
</table>

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| Section or Chapter | Description of Relevant Provisions | How the DCP element have been addressed |
|---|---|---|
| | (5) Development consent should not be granted to development on land unless the consent authority is satisfied that:<br>(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact,<br>(b) the application reasonably demonstrates how the principles of avoid and minimise have been incorporated, and<br>(c) the development achieves no net loss of vegetation, with replacement planting to be incorporated at a ratio of 2:1 using endemic species to the local area or species of the same community type. | |
| **2.18** | Landscaping | A Landscape Plan is provided in Appendix E that shows proposed vegetation in the buffer strip between the fuel storage and the concrete channel, and the additional stormwater drain. Some additional landscaping is also proposed at the front of the Site. |
| **2.19** | Heritage conservation | No known heritage is located on the existing Proposal Site or will be disturbed, and no heritage impacts are expected. |
| **2.21** | Earthworks and retaining | Minimal earthworks are required for the Proposal (weighbridge installation and internal access reconfiguration). |
| **2.23** | Building appearance | No additional buildings are proposed. A visual impact assessment (Appendix CC) has considered the Proposal and concluded no visual impacts would occur due to the Proposal. |
| **2.25** | Accessible design | Existing access and parking at the Facility will be used. No additional parking or access is proposed aside from the addition of B-Double unloading facilities as detailed in this EIS. |
| **2.26** | Driveway access | |
| **2.27** | Minimum number of car parking spaces | |
| **2.28** | Design of car parking areas, loading docks and vehicle manoeuvring areas.<br>Design must ensure suitably designed vehicle manoeuvring areas. Onsite parking spaces must meet the requirements in Schedule 1. | B-Double Swept Path Assessment of the Traffic Impact Assessment (Appendix S of the EIS). |
| **2.29** | Waste storage and collection areas.<br>The development must minimise adverse environmental impacts and ensure the suitable management and storage of waste onsite. | Receival, storage and management of biomass and management of on-site generated waste is included in a Waste Management Plan (Appendix L). |
| **2.30** | Sheds in certain rural, residential and environment protection zones | No additional sheds are proposed. |
| **2.32** | Outdoor signage | Business signage is proposed as part of the Facility. |
| **2.34** | Views and visual impact | No additional buildings and only minor plant/equipment modifications are proposed. A visual impact assessment (Appendix CC) prepared for the EIS concluded no impacts would occur. |

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| Section or Chapter | Description of Relevant Provisions | How the DCP element have been addressed |
|---|---|---|
| 4.1 | Operational details.<br>The land use should not generate any significant adverse impacts as a result of:<br>(a) hours of operation,<br>(b) employee numbers,<br>(c) customer or patron numbers,<br>(d) waste management,<br>(e) traffic generation,<br>(f) chemical use or storage, and<br>(g) emissions. | Operational details are provided in this EIS and include any potential impacts and associated mitigation measures proposed.<br>Section 3 Project Description.<br>Section 8 Waste Management<br>Section 14 Traffic and Transport<br>Section 17 Hazard and Risk<br>Section 10 Air Quality |
| 4.3 | Site planning.<br>The development must consider whether the site is suitable for the development taking into account the following:<br>(a) road layout and design, and<br>(b) lot size, shape and dimensions, and<br>(c) access, and<br>(d) drainage requirements, and<br>(e) utilities and services, and<br>(f) sewage disposal, and<br>(g) natural hazards, and<br>(h) character of the locality, and<br>(i) heritage and archaeological conservation, and<br>(j) tree preservation, and<br>(k) soils. | These details are provided in the EIS. An assessment of the suitability of the Site for the proposal has been provided, including any potential impacts to neighbouring properties, the community and environmental and heritage values and utilities. See Section 1 and Section 3 of this EIS. |

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# 5. Community Engagement

## 5.1. Engagement carried out

To help inform the development and delivery of a consultation program for the Proposal, the following legislative requirements and best practice guidance have been considered:

- *Environmental Planning and Assessment Act* 1979;
- *Undertaking Engagement Guidelines for State Significant Projects (Department of Planning and Environment, 2022);*
- *Social Impact Assessment Guideline for State Significant Projects (NSW Department of Planning and Environment, July 2021)*; and
- *Community Participation Plan* (Department of Planning, Industry and Environment, 2019).

During the development of the original modification proposal to restart the Redbank Power Station using biomass (SEAR 1596), a number of community education and engagement tools were prepared and delivered. These were undertaken between November and December 2021. A range of print, online, media and online meetings were chosen to maximise participation, increase understanding and maximise engagement.

To address concerns expressed by the community in relation the use of native forestry residues as fuel, Verdant Earth developed an alternative biomass fuel strategy for the current Proposal which specifically excludes native forestry residues from logging. Verdant also now proposes to relinquish the current approval to use coal tailings as a fuel at the Redbank Power Station.

Pursuant to the revised SEARs issued by the NSW Department of Planning and Environment on 30 August 2023 (SSD-56284960), further engagement has been carried out between October and November 2023, as summarised in Table 5.1.

The SEARs included the requirement to consult with key government agencies, Council and local residents and properties. The consultation program included outreach to local residents and businesses within 5km of the Proposal Site. A number of local and regional community and environmental groups were also identified for engagement.

The full list of stakeholders consulted during outreach activities is included in the Consultation Report provided in Appendix H of this EIS.

**Table 5.1. Community education and engagement tools used as part of the community consultation project.**

| Stakeholder group | Tools used to engage group, build understanding and seek feedback | Outcome sought |
|---|---|---|
| **Neighbours within 5km of Redbank Power Station** | + Introductory letter via mail/letterbox drop<br>+ Fact sheet via mail / letterbox drop<br>+ Web site (including link to the detailed Scoping Report) | Build relationships, build understanding, document issues and feedback on additional mitigation measures proposed |
| **Interested Organisations** | + Introductory letter via mail / email<br>+ Fact sheet via mail / email<br>+ Web site (including link to the detailed Scoping Report) | Build understanding, document issues and feedback on additional mitigation measures proposed |
| **Government Stakeholders** | + Introductory letter via email<br>+ Fact sheet (via email) | Build relationships, build understanding, document issues and feedback on additional mitigation measures proposed |

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| Stakeholder group | Tools used to engage group, build understanding and seek feedback | Outcome sought |
|---|---|---|
| **Objectors and supporters of the previous Redbank proposal (development modification)** | + Introductory letter via mail / email<br>+ Fact sheet via mail / email<br>+ Web site (including link to the detailed Scoping Report) | Build understanding of the change in fuel strategy of the Proposal, document issues and feedback on additional mitigation measures proposed |

## 5.2. Community views

The consultation program highlighted that there is concern in the local community over potential impacts on to air quality, human health, road safety, forest health and climate change. As coal fired power plants still retain a prominent place in energy generation in NSW and are often used by the community as a comparison to this Proposal, these concerns are understandable.

A summary of the results of the community consultation and engagement program is provided below:

- 64 households and businesses within 5km of the Proposal received a fact sheet and a letter introducing the Proposal;
- Over 400 objectors and supporters of the previous proposal (SEAR 1596) also received this information and a request for additional feedback;
- Nine (9) members of local and/or regional communities provided specific feedback;
- 40 different local and regional organisations received the fact sheet and a letter introducing the Proposal, and specific feedback was received from 7 organisations;
- 15 government agencies were provided additional opportunity to provide feedback (in addition to the SEARs already provided, if applicable). No significant specific feedback was received outside of that already received in the SEARs, although TfNSW issued an additional letter for consideration, which is addressed in the Community Consultation Report (Appendix H); and
- Numerous unique visitors to the Jackson Environment and Planning Pty Ltd web page between October and November 2023.

Feedback from those community engagement activities has informed the following summary of general community understanding of the project:

- Community understanding of the Proposal was considered variable, ranging from low to moderate;
- There is acknowledgement that the Proposal commits to excluding native forestry residues from logging, but is still concerned over use of biomass from approved land clearing;
- Organisations conveyed concerns over the Proposal incentivising deforestation and causing greenhouse gas emissions contributing to climate change and loss of biodiversity;
- There was concern over the availability of suitable waste biomass and the viability of the Proposal, and the enforcement and monitoring of biomass fuel acceptability under NSW legislation and guidelines;
- Concern over storage of biomass and ash and potential that this will contaminate and harm ecosystem health and biodiversity;
- Interest of types and amounts of fuel required and where they will be sourced from causing potential land use conflicts;
- A common perception was that the project will worsen air quality and greenhouse gas emissions with potential for significant environmental and health impacts on local communities;
- The potential fuel source locations and use of roads and B-Doubles to transport fuel raised significant concerns over degradation of road conditions, safety and dust;

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- There was some concern over economic benefits and accuracy of job creation estimates including the social costs / benefits to the wider community; and
- Storage would burn treated wood and contaminated waste material that would have significant emissions.

Supporting the consultation effort are a range of specialist reports that aim to address the very concerns that are raised by the community. These include assessments on the following matters:

- Management of noise and vibration;
- Air quality and odour;
- Greenhouse gases;
- Sustainability of fuel supply;
- Traffic and transport;
- Waste quantities and management;
- Consider impacts from the life of the development;
- Mitigation measures;
- Quality control, measuring, monitoring, and reporting criteria;
- Stormwater and water quality controls;
- Singleton DCP requirements;
- Economic and social impacts to be addressed;
- Fire Safety and Incident Management;
- Hazards; and
- Visual impact.

The full results of the consultation program undertaken is included in the Consultation Report in Appendix H of this EIS.

## 5.3. Engagement to be carried out

Ongoing education and community engagement has been identified as a very important process that will need to be maintained during exhibition of the EIS and post approval. Working closely with the community will be important to demonstrate and prove how the facility is being managed to protect the community and the environment. Regular engagement with neighbours and the community will help build trust and confidence over time. The following community engagement activities in Table 5.2 are recommended during exhibition of the EIS and post approval.

**Table 5.2. Planned approach for ongoing community engagement during exhibition of the EIS and post approval.**

| Community engagement activity | Stakeholder group reached | Frequency / measure | Engagement sought |
|---|---|---|---|
| **Community Consultative Committee with independent chair** | Representatives of Singleton Council, NSW EPA, the Verdant Earth, and two community representatives approved by Council. | Condition 32 of existing DA183/93 requires "the applicant is to set up a community consultative committee prior to the commissioning of the plant."<br><br>It is recommended that this committee would continue under the new state significant development consent. | The committee is to consider any impacts which the power plant may have on residences and the local environment as a result of its operations.<br><br>The committee is to meet as required by Council. |

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| Community engagement activity | Stakeholder group reached | Frequency / measure | Engagement sought |
|---|---|---|---|
| **Publication of ongoing environmental monitoring** | + Neighbours/businesses<br>+ residents<br>+ organisations<br>+ Broader Hunter community | + Publication of results from environmental monitoring of the site on a monthly basis (including noise and air quality)<br>+ Results published on the Verdant Earth website | + Provision of information on independent monitoring results for review by the community |
| **School and Community Group tours** | + Primary and high school children<br>+ Members of key community groups | + Minimum of 3 on-site tours or events per year | + Direct engagement with the community through inspection of the site and operations<br>+ Build community understanding of the transition to renewables its contribution to the environment / net-zero objectives in NSW. |

## 5.4. Conclusion

A number of community education and engagement tools were prepared and delivered. This included print, online and media aiming to maximise participation, increase understanding and engagement prior to finalising the EIS and specialist studies.

The Proposal is expected to assist in hastening the transition to renewables and to stimulate economic activity whilst protecting environmental quality and human health with stringent monitoring and management. Assuming the Proposal is approved, licensing through the NSW EPA, monitoring and validation of performance is required.

Ongoing education and community engagement will be important to maintain during exhibition of the EIS and post approval. Working closely with the community will be important to demonstrate and prove how the facility is being managed to protect the community and the environment.

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# Assessment and Mitigation of Impacts

# 6. Social Impact Assessment

A Social Impact Assessment (SIA) has been prepared to describe and assesses the social benefits and impacts arising from the construction and operation of the Proposal. The SIA has been prepared for the Project in accordance with the NSW DPE *Social Impact Assessment Guideline for State Significant Projects* 2023.

The SIA was informed by the information and specialist studies completed for and forming part of the EIS.

## 6.1. Existing Environment

### 6.1.1. Site and Surrounds

Located in the Singleton Local Government Area, within the Hunter Valley, the Site is located approximately 10 km to the west of Singleton, 10 km northeast of Bulga and 8 km northwest of Mount Thorley (Figure 1.2).

The immediate surrounding landscapes are a mixture of uncleared bushland and cleared land and native pastures for grazing. The surrounding region also includes rural and agricultural properties and industrial areas. Four open cut coal mines are within 2.2 to 7 km of the Site.

The nearest dwellings are over 1 km distance toward the east. The village of Warkworth lies approximately 4 km to the west, and Gouldsville 2.5 km to the northeast.

The Singleton Army base is located approximately 10 km to the southeast of the Site. The closest National Park is Wollemi National Park approximately 11km to the west of the facility.

Directly to the south of the Site is a railway easement, transmission line easement and the Golden Highway.

### 6.1.2. Social Locality

This Social Locality is defined as within the area shown in Figure 6.1. This area covers the geographical communities that have the greatest potential to experience changes to socio-economic conditions as a result of the Proposal.

This area is the Local Government Authority (LGA) of Singleton. In addition to this Social Locality the SIA considers demographic data for the small number of residents living closest to the Site, represented generally by suburbs of Warkworth and Gouldsville.

### 6.1.3. Population and Demographics

In 2021 the Social Locality was home to 24,577 people. This population is primarily clustered in key towns and village centres and along main road corridors. Forty per cent of the LGA area is made up of National Parks, some of which are world heritage-listed. Agriculture is an important rural land use. There are also areas of ‘lifestyle living’ (otherwise known as rural residential). Key areas are around Branxton, Wattleponds and Sedgefield.

The LGAs growth has been steady since 2016, when the population was 22,987, increasing at around 1.3% per year, which is at a similar rate to the NSW average. The rate of growth has quickened from preceding years, when for example between 2006 and 2011 the rate of population growth was around 0.7% per year.

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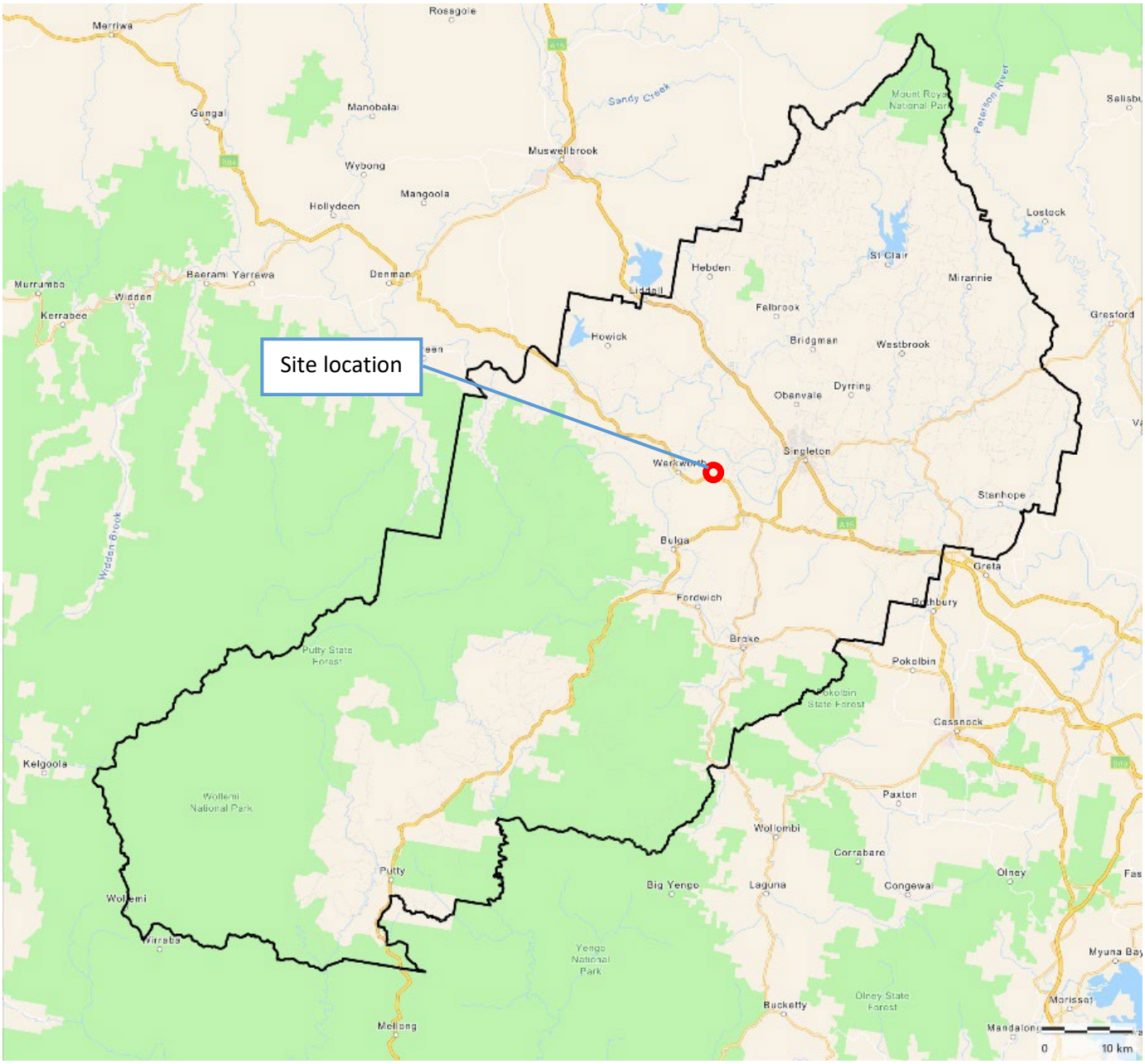
**Figure 6.1. Social Locality. Source: Singleton Council online mapping.**




Located over 8 kilometres to the east of the Site, is the town of Singleton[35] has a population of 17,018, or almost 70% of the LGAs population. The town of Singleton is the main commercial and retail centre for the lower half of the Hunter Valley, supporting strong mining, military, agricultural and tourism industries. Positioned in the heart of the Hunter Valley, Singleton is strategically located on the junction of the New England Highway and the Golden Highway, the main inland route between Newcastle and Central West New South Wales (NSW).

The Wanaruah, Wonnarua people are the custodians of the land in the Singleton Local Government Area. A relatively significant proportion of the Social Locality identified as Aboriginal or Torres Strait Islander in the 2021 Census (8.3% of the population, compared to 3.4% in NSW). The Aboriginal and Torres Strait Islander population in the LGA is much

[35] The Hunter River to the east defines the boundary of the ABS Singleton Significant Urban Area (SUA). SUA's are used by the ABS to delineate concentrations of urban development with a population of 10,000 people or more, and represent a community that interacts together socially and economically. They must share the same labour market.

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younger than the population overall (with a median age of 21). Aboriginal and Torres Strait Islander people experience a disproportionate level of disadvantage compared to the general population, in areas of health, education, mortality, employment, and housing among others (Singleton Council, 2022)[36].

Only 3% of LGA residents are people from a non-English speaking country. 90% of households speak only English at home. These are significantly lower proportions than the NSW average (67.6%)

### 6.1.4. Housing and Affordability

The predominant housing type is large, detached houses with three or more bedrooms (87.7% of the housing stock is detached houses). Rural housing makes up 30% of housing, and lifestyle living areas such as those near the Site comprise approximately 14%.

Housing demand in the Singleton LGA has historically catered to a temporary workforce tied closely to peaks in mining which can influence demand for housing particularly as rental stock (Singleton Council, 2022). The unprecedented expansion of the mining industry between 2010 and 2012 placed extraordinary pressure of housing demand[37][38], significantly impacting housing affordability. There has since been a major readjustment in housing demand with housing becoming more affordable as a result[39].

The proportion of rental affordable for low-income households has declined across the Hunter, with every LGA having a lower proportion of affordable rental for low-income households in 2022 than in 2017.

A vacancy rate of 3% is considered by the NSW Government to represent a balance between supply and demand. According to Real Estate Institute of NSW (REINSW) data, vacancy rates were below 3% for Newcastle and the rest of the Hunter for most of the period from 2006 through to 2022. For the Singleton town area, this has been the case since 2017.

Singleton Council expects that 92 additional dwellings are required each year in the LGA. This is comfortably within the average[40] of around 130 dwellings approved each year in the LGA. Future housing supply will generally be provided within and around Singleton town or further to the east at Branxton.

### 6.1.5. Employment

The key industry of employment in the LGA is mining, which significantly alters the LGA's industrial profile and occupation profile.

The expansion of the mining industry experienced by Singleton LGA has had a significant impact on the economic growth of the region, and this is reflected in Census statistics. For example, median household income is $2,016 per week in the LGA, compared to $1,829 in NSW. The proportion of low-income households41 in Singleton LGA is lower than NSW (13.8% compared to 15.3%).

[36] Singleton Council (2022) Singleton Community Development Strategy 2022-2026. Web: https://www.singleton.nsw.gov.au/Council/Integrated-Planning-and-Reporting/Plans-and-Strategies
[37] Scott Carver (2015) Singleton Housing and Accommodation: Strategy & Action Plan Prepared for Singleton Council.
[38] House prices increased at 10%+ pa., rents by 15% pa. and short stay accommodation options were at 90%+ occupancy (Scott Carver April 2015).
[39] Scott Carver (2015) identified that in 2013 there was a rental reduction in the order of 15%, and a reduction in average detached and duplex house purchase prices in the order of 10%.
[40] Over the period 2000-2020 (Singelton Council 2022)
[41] Earning less than $650 per week

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This was also reflected in the low unemployment rate (3.7% in the LGA compared to 4.9% in NSW). The rate of participation in the labour force in the LGA (64.5%) is notably higher than the NSW average (58.7%). The unemployment rate amongst 15-24 year olds remains above the regional average, however.

### 6.1.6. Business

A range of industries are present within the Singleton LGA, including viticulture, education, engineering, fabrication, trades services, tourism, hospitality, mining, power generation, agriculture and retail. However, the major driver for growth has been mining activity, driving jobs growth in mining operations and support services.

With 20 operating coal mines, mining is Singleton's largest employment sector, supporting an estimated 6,817 jobs and generating substantial mining royalties. Overall, Singleton supports 18,480 jobs (5.67% of employment with the Hunter region) and has an annual economic output of $14.291 billion (10.7% of the Hunter region)[42].

Mining support services are an important employer in the town of Singleton, with industrial areas at Maison Dieu/ McDougall's Hill and at Mount Thorley. McDougalls Hill is the engineering support and freight hub for the Mining Industry and requires direct access to the Ports in Newcastle.

Other key industries in the LGA include:

- Agriculture, predominately in the dairy and cattle farming and meat processing industries, but also including olive, citrus and mushroom growing, viticulture, and horse studs. Singleton has a long agricultural heritage, and operates the Singleton Regional Livestock Market and Saleyards;
- The Australian Army School of Infantry, located on the outskirts of Singleton town to the south of the Golden Highway. There are approximately 300 permanent personnel and civilian staff with approximately 1,000 students at the military base at any one time. Sixty (60) percent of staff live locally with their families and 6% own a local home. Current defence housing policy is to provide 'off base' rental housing for singles, couples and family accommodation in rental subsidised accommodation;
- Tourism; and.
- Retail sector.

Tourism in the LGA is mainly associated with Singleton's proximity to the Hunter Valley wine region. Although Cessnock captures most of this market, Singleton LGA has more than 40 vineyards and wineries. The LGA has no major tourist attraction which is a year-round destination in its own right

### 6.1.7. Vulnerable or Marginal Groups

Rural and regional areas of NSW are typically more disadvantaged than the Sydney metropolitan area, and this influence. However, this is not the case with Singleton LGA. Singleton LGA ranks in the best 20% of LGA's both nationally and for the state. The locality is similar to or more advantaged in comparison to the rest of NSW. However, there are some residential locations within the LGA which can be categorised as significantly disadvantaged. These are not near the Site but located further west and north-west.

## 6.2. Impact Assessment

A summary of the findings from the SIA is presented in Table 6.1. The summary identifies the potential social impacts associated with the principal issues of concern and provides an assessment of the significance of each impact with consideration given to the management and/or mitigation measures to be implemented.

[42] https://app.remplan.com.au/singleton/economy/summary?state=vNX6FmlKOuJGoYzT4AqJQLivfMfONA

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The principal issues of concern relate to:

- **Way of life**, including how people live, how they get around, how they work, how they play, and how they interact each day;
- **Community**, including composition, cohesion, character, how the community functions, resilience, and people's sense of place;
- **Accessibility**, including how people access and use infrastructure, services and facilities, whether provided by a public, private, or not-for profit organisation;
- **Culture**, both Aboriginal and non-Aboriginal, including shared beliefs, customs, practices, obligations, values and stories, and connections to Country, land, waterways, places and buildings;
- **Health and wellbeing**, including physical and mental health especially for people vulnerable to social exclusion or substantial change, psychological stress resulting from financial or other pressures, access to open space and effects on public health;
- **Surroundings**, including ecosystem services such as shade, pollution control, erosion control, public safety and security, access to and use of the natural and built environment, and aesthetic value and amenity;
- **Livelihoods**, including people's capacity to sustain themselves through employment or business;
- **Decision-making systems**, including the extent to which people can have a say in decisions that affect their lives, and have access to complaint, remedy and grievance mechanisms;

The SIA evaluates the likely significance of positive and negative impacts, considering their likelihood and magnitude of impacts.

Overall, the proposal is expected to result in long term benefits to the environment and economy of NSW, the Hunter Valley region, and the LGA. Some of the main benefits include:

- Generating jobs from the economic activity it enables;
- Assisting to maintain the reliability of energy supply; and
- Supplying the grid with approximately 1 million megawatt hours of 24/7 dispatchable or baseload electricity per year, equivalent to supplying around 200,000 homes;

Unique to this Proposal is the achievement of these outcomes whilst at the same time achieving considerable environmental benefits, including:

- Assistance in driving progress towards the NSW Government's Net Zero Plan Stage 1: 2020-2030; and
- Reuse of ash byproducts for soil benefits;

The area is also largely distinguishable by it mined landscape, dominated by surrounding collieries including Warkworth Mine, Wambo Colliery and Lemington Mine. The character, cohesion, function, and sense of place of the area will not change. There will be negligible direct impacts on demographic characteristics and community structure, either during operation or construction.

Only minor physical changes are proposed. Potential impacts, such as around amenity, are further mitigated due to the nature of proposed works and the separating distance to nearby residences.

In terms of air quality, the use of biomass as a fuel will result in a positive change to the air quality impacts associated with Redbank in comparison to the use of coal. Historical odour from the power station was due to coal combustion, which is primarily caused by the high sulphur content of coal. The sulphur content of wood waste residues is very low ,eliminating possible odour impact.

The Proposal would create a number of direct and indirect employment opportunities. The multiplier effects on the local employment would act to stimulate local jobs and local businesses. There would be indirect benefits for

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employment and expenditure through the provision of the goods and services required for construction, operation, or by the workforce.

The operational workforce will likely be drawn from within the population already living within the LGA or the Hunter Valley, although the proposal provides an opportunity to attract people to move to the LGA in line with Council strategies. Verdant Earth will implement a number of strategies to maximise the level of local employment on the Proposal.

Given the relatively small number of construction workers likely to temporarily relocate to the social locality, and the identified availability of various types of accommodation there, any impact on either short-term or long-term accommodation prices or availability would be minimal and short term in nature.

However, given the number of concurrent infrastructure projects which are underway in the area it is considered prudent for the Social Impact Management Plan (SIMP) to monitor accommodation availability and respond if required

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**Table 6.1. Summary of potential social impacts and assessment of the significance of the impacts.**

| Impact Category | Project Phase/ Duration (C/O)* | Impact Description | Stakeholders | Impact Rating before Mitigation/ enhancement | Project Design, Mitigation/Enhancement measure implemented | Residual Impact Rating |
|---|---|---|---|---|---|---|
| **Way of life** | C | Construction activities may negatively impact local amenity, due to changes to noise and vibration, air quality (dust or odour) or changes in visual appearance, unless appropriate mitigation measures are adopted. | Residents of Warkworth and Gouldsville | Low (D3) | General best practice construction management measures have been recommended in the EIS. Operation of a complaints mechanism. Ongoing communication with community providing information on upcoming activities which may affect amenity, along with publicising the complaints procedure. | Low (E1) |
| **Way of life, Accessibility** | C/O | Heavy vehicle/ truck movements involved in construction and operations may potentially:<br>• Increase traffic congestion;<br>• Decrease property access;<br>• Reduce air quality from dust or waste falling from truck beds; and<br>• Negatively affect road safety outcomes, primarily at the Highway intersection.<br>Potentially impacts way of life, accessibility and livelihoods for surrounding residents, businesses and workers unless appropriate mitigation measures are adopted (such as leading to some inconvenience, annoyance or changes in behaviour). | Residents of Warkworth and Gouldsville; Users of Highway | Low (D1) | The traffic assessment concludes that the additional traffic generated by the Proposal will have no significant impact. A Construction Traffic Management Plan (CTMP) and an Operational Traffic Management Plan have been prepared to manage access and ensure suitable work zone speed limits are applied. Contractor and employee adherence to a 'Driver Code of Conduct'. | Low (E1) |
| **Way of life, Accessibility** | O | Potential loss of social amenity due to increased noise from power station operation or heavy vehicle traffic associated with project operation | Residents of Warkworth and Gouldsville | Low (D1) | Noise Impact Assessment predictions indicate that all noise levels are complaint with the assessment criteria for all locations and periods. Any noise increase would be minor and well below relevant guidelines. The nearest residence is approximately | Low (D1) |

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| Impact Category | Project Phase/ Duration (C/O)* | Impact Description | Stakeholders | Impact Rating before Mitigation/ enhancement | Project Design, Mitigation/Enhancement measure implemented | Residual Impact Rating |
|---|---|---|---|---|---|---|
| | | unless appropriate mitigation measures are adopted. | | | 1.75km from roads which would be utilised by the proposal. Contractor and employee adherence to a 'Driver Code of Conduct'. | |
| **Way of life, Surroundings, Health and wellbeing** | O | Operations could produce emissions that impact human health or offensive odour emissions and impacts unless appropriate mitigation measures are adopted. | Residents of Warkworth and Gouldsville | Low (D2) | Adverse impacts as a result of the Proposal are considered by the Air Quality Impact Assessment to be unlikely. The use of biomass as a fuel will result in a positive change to the air quality impacts associated with Redbank. The incremental concentrations for all pollutants for the boiler using biomass were below the impact assessment criterion.<br>Community members have identified odour as an issue of concern. This concern is based on historical site odour from coal combustion, which is primarily caused by the high sulphur content of coal. Relative to coal, the sulphur content of wood waste residues is very low. | Low (D2) |
| **Surroundings** | C/O | Concerns over the Proposals demand for feedstock incentivising deforestation and causing greenhouse gas emissions contributing to climate change and loss of biodiversity. | Various | High (A3) | Only eligible waste fuel with no higher order uses will be sourced as fuel for the Power Station. | Low (A1) |
| **Community, Livelihoods** | O | Supporting diversification of the LGAs economy away from mining. | LGA residents, businesses, Council | High (A3) (positive) | None necessary. | High (A3) (positive) |
| **Community, Accessibility** | O | The operation workforce will access social infrastructure such as parks, health services, community facilities, childcare, and commercial and public facilities. | Workforce, LGA residents | Low (A1) | The Site currently has an approval, and historically operated, with a substantial workforce, for which provision for social infrastructure demand was made under the relevant approval (about 60 FTEs). | Low (A1) |
| **Community** | O | The community raised concerns as to whether the Hunter Valley Gliding | Hunter Valley Gliding Club | Low (D1) | As the Site was previously operated as a power station at the same time as gliding club operation, it | Low (D1) |

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| Impact Category | Project Phase/ Duration (C/O)* | Impact Description | Stakeholders | Impact Rating before Mitigation/ enhancement | Project Design, Mitigation/Enhancement measure implemented | Residual Impact Rating |
|---|---|---|---|---|---|---|
| | | Club operations would be affected by gas plumes. | | | is expected that this can again occur. CASA and the local airstrips will be notified as per CASA requirements. | |
| **Community** | C/O | Housing and Accommodation | LGA residents, businesses, Council | Minor (C2) | Given the relatively small number of construction workers likely to temporarily relocate to the social locality, and the identified availability of various types of accommodation there, it is assessed that any impact on either short-term or long-term accommodation prices or availability would be minimal and short term in nature. | Low (D2) |
| **Accessibility** | C/O | Emergency services access or responsiveness may potentially be affected during construction or operation. | Emergency services | Low (D1) | Access will be maintained to all during construction and operation.<br>An Emergency Response Plan is in affect for the Facility.<br>All staff on site should be appropriately trained.<br>Implementation of bushfire management measures in consultation with RFS. | Low (E1) |
| **Culture** | C/O | Aboriginal cultural heritages sites could be subject to direct disturbance from the Project. | Indigenous Communities, Social locality and LGA residents | Low (E1) | No identified significant Aboriginal cultural heritages sites would be subject to direct disturbance from the Project. An unexpected finds policy is part of the mitigation measure requirements. | Low (E1) |
| **Culture** | O | Facilitating learning experiences about net zero and sustainability is to be part of the operational model for the Project. | School students<br>TAFE and University students<br>LGA residents | n/a | The Proponent intends to host organised tours for school students, university students or corporate events. The resultant environmental awareness and education would be a benefit of the Proposal, building community understanding of the transition to renewables, as well as its contribution to the environment / net zero objectives in NSW. | Medium (B2) (positive) |

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| Impact Category | Project Phase/ Duration (C/O)* | Impact Description | Stakeholders | Impact Rating before Mitigation/ enhancement | Project Design, Mitigation/Enhancement measure implemented | Residual Impact Rating |
|---|---|---|---|---|---|---|
| | | | | | Access is to be controlled for safety. A management plan to be developed to manage operations during periods of public access. | |
| **Surroundings** | O | Improved Environmental Sustainability | NSW | Very High (A4) (positive) | Unique to this Proposal is the achievement of economic outcomes whilst at the same time achieving considerable environmental benefits. The project will drive significant progress towards the NSW Government's Net Zero Plan Stage 1: 2020-2030, being the foundation for NSW's action on climate change and goal to reach net zero emissions by 2050. The conversion of Redbank Power Station to operate on fuel will result in the first major green baseload power station for Australia. Environmental benefits would also accrue from the reuse of Ash by-products. | Very High (A4) (positive) |
| **Livelihoods** | O | Improved reliability of energy supply. | NSW | Very High (A4) (positive) | Without reliable supply, households and businesses experience significant and ongoing negative disruptions from blackouts (in terms of lifestyle, employment, livelihood, communications, health and wellbeing. | Very High (A4) (positive) |
| **Livelihoods** | C/O | Creation of direct and indirect employment opportunities for local communities supporting these residents and their households | LGA residents and Business, Council | Medium (A2) (positive) | Verdant will implement a number of strategies to increase the level of local employment on the Proposal, including:<br>• Prioritising local recruitment;<br>• Targeting recruitment towards personnel who could be attracted to live in the LGA; and<br>• Maximising employment opportunities for women and Indigenous people. | Medium (A3) (positive) |
| **Livelihoods** | C/O | Opportunities for training the workforce. | LGA residents | Medium (C2) (positive) | Verdant will implement a number of strategies to increase the level of local employment on the Proposal, including providing traineeships, | High (A3) (positive) |

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| Impact Category | Project Phase/ Duration (C/O)* | Impact Description | Stakeholders | Impact Rating before Mitigation/ enhancement | Project Design, Mitigation/Enhancement measure implemented | Residual Impact Rating |
|---|---|---|---|---|---|---|
| | | | | | apprenticeships and scholarships to attract young people to the industry. | |
| **Livelihoods** | C/O | Increased Economic Activity | LGA residents and businesses | Medium (A2) (positive) | Implementing a local procurement policy and collaborating with local business groups to maximise local employment and sourcing from local communities. (i.e. a policy to preference local providers where offers are substantively similar). | Medium (A2) (positive) |

* Construction / Operation

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## 6.3. Mitigation Measures

With the implementation of the additional mitigation and management measures provided in Table 6.2, the Proposal is expected to assist in ensuring potential social impacts from the Proposal remain neutral and positive.

**Table 6.2. Social impact mitigation measures.**

| Measure | Description |
|---|---|
| SI1 | Prepare a Community Engagement Plan (CEP). The CEP is to include a process to carry out regular and ongoing engagement with Council, residents, and businesses in the LGA, providing them with timely, accurate, relevant and accessible information about construction and operation as relevant. |
| SI2 | Maintain a community complaints telephone line and online contact methods, advertised via the project website, for the purpose of receiving community complaints, or enquiries. The complaints register will include:<br>• the date and time of the complaint;<br>• the method by which engagement was made;<br>• any personal details provided or, if no such details were provided, a note to that effect;<br>• the nature of the complaint; and<br>• any actions (if any required) taken in relation to the complaint.<br>Investigations into complaints will commence within 24 hours of receipt, or as soon as practical with justification for the delay logged in the complaints register.<br>The cause of the complaint will be analysed and actions to attempt to address the complaint taken as soon as reasonably possible. Complainants will be contacted with a resolution within 48 hours.<br>In complex cases where resolution will take more than 48 hours, Verdant will contact them within 48 hours and commit to a timeframe for updating the community member (which will be logged in the register). |
| SI3 | Verdant will establish a Community Consultative Committee to foster dialogue between Verdant, the community, and key stakeholders regarding the Project. Convened by an independent chair, it will contain representatives of Singleton Council, NSW EPA, Verdant Earth, and two community representatives approved by Council. The committee is to consider any impacts which the power plant may have on residences and the local environment as a result of its operations. |
| SI4 | Verdant will undertake monthly environmental monitoring of the site (including noise and air quality) and publicise the results on the Verdant Earth website for review by the community. |
| SI5 | Verdant will develop and implement a Local Content Plan (LCP) to encourage local business participation in project procurement. The LCP should align with the Australian Government's Australian Industry Participation Plan. Wherever possible, Project supply and workforce requirements will be matched with existing capabilities in the LGA.<br>Verdant will develop, and regularly update, a register of local businesses which will be notified about relevant Project procurement opportunities.<br>Verdant will participate in LGA industry events to engage stakeholders and local businesses.<br>Verdant will develop and implement an IPP for the Project in consultation with the relevant stakeholders. A register of Indigenous businesses will be maintained. Appropriate training and development programs will be outlined to support increased Indigenous participation. |

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| Measure | Description |
|---|---|
| SI6 | Verdant will develop and implement a Recruitment and Training Strategy (RTS) to encourage a higher rate of local labour force participation, or the in-migration of new hires to the LGA. This strategy would include engagement with key training providers (e.g., TAFE) in the aim of further defining and improving available training resources and capacity in the provision of apprenticeships, training programs and skill development opportunities<br><br>The strategy will:<br>• Demonstrate how the construction phase workforce accommodation demand will be monitored.<br>• Demonstrate how workforce accommodation requirements will be managed during periods of high demand.<br>• Enable the coordinated placement of the workforce in tourism accommodation throughout the LGA in a way that coexists with tourism sector demand. |

## 6.4. Conclusion

The assessment of broader potential social impacts suggests that the Proposal is likely to have a positive impact on the surrounding community and NSW. The Proposal will support the transition away from fossil fuels to a more sustainable electricity generation network which will have flow on effects for the environment, economy and human health. With the implementation of mitigation measures and ongoing monitoring of operations, the Proposal is expected to have either neutral or positive and nil negative impacts on the local environment and surrounding community.

The implementation of the proposed environmental mitigation and management measures identified in the EIS and this SIA are key to ensuring the proposal avoids or minimises impacts to the greatest extent practicable.

Following the proposed mitigation measures, there are no predicted negative impacts which would be considered above low significance.

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# 7. Economic Impact Analysis

An Economic Impact Assessment (EIA) (Appendix K) has been prepared for the Proposal and includes a discussion of any potential economic and social benefits to the local and broader community.

The EIA focusses on the Singleton LGA and the Hunter Region where potential impacts, both positive and negative, of the Proposal's construction and operation would primarily be experienced. The EIA also describes social, environmental and energy related issues of the local and regional area and an assessment of their sensitivity and significance from an economic perspective.

## 7.1. Existing Environment

The Singleton LGA was founded on agriculture, driven by coal and sustained by the Hunter River. Combined with an industry base, skilled labour force and location on a major transport route, Singleton is an attractive business and commercial location and is home of major industries including coal mining and construction, defence, agricultural production and viticulture.

The Hunter region is comprised of ten local government areas including Cessnock, Dungog, Lake Macquarie, Maitland, MidCoast, Muswellbrook, Newcastle, Port Stephens Singleton, Upper Hunter. It includes Greater Newcastle - the seventh largest urban area in Australia.

The region is situated on Australia's main east coast transport corridor and has sophisticated infrastructure, and international gateways including an airport and deep seaport.

The Hunter Region combines an innovative economic and business environment with a high standard of living, proximity to Australia's largest city, Sydney and easy connections to Australia's other capital cities. The Hunter Region has an economic output of around $59.5 billion per annum and a population of over 705,000 people.

Mining is by the far the largest economic contributor to the Singleton LGA comprising 66.1% of all industry value add. The three largest industries in the Hunter Region in 2021-22 were Mining ($3,983 million or 66.1%) but also Public Administration and Safety ($327 million or 5.4%); and Rental, Hiring and Real Estate ($304 million or 12.0%). These three industries account for just over three in every four dollars of the total value added by industry in the Hunter Region.

The economy of the Hunter Region enjoys a number of strengths and makes a significant contribution to the Australian economy. The region is rich in resources and underpinned by the world's best quality coal, natural water resources, significant electricity generation capacity, an innovative manufacturing sector and a progressive business culture.

The Hunter regional economy has undergone substantial structural changes over the past two decades, including considerable diversification in industry sectors and expansion in broad service sectors. The same level of diversification has not yet occurred for the Singleton LGA and further diversification is required for the Hunter Region where its concentrated industry mix is still readily apparent.

The Singleton LGA currently comprises 0.9% of economic activity in New South Wales, with estimated regional output of $5.8 billion. The Hunter Region currently comprises over 9.0% of economic activity in New South Wales, with estimated regional output of over $59.1 billion — making it Australia's largest regional economy.

With sustained growth over the past decades, both the Singleton LGA and the Hunter region have experienced an upward trend in employment. Before this period, unemployment rates were significantly higher than NSW and national averages.

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The Singleton LGA has 62.1% of its overall population in employment with 38.7% in full-time work and 18.4% in a part-time role. This is higher than the Hunter Region's 55.9% and the NSW average of 55.8%.

The Singleton LGA has over the past decade experienced low population growth and is forecast to experience low population growth over the next two decades. It is only recently that Singleton LGA has experienced more promising population growth.

The implications of the economic overview indicate a considerable dependency of both the Singleton LGA and the Hunter Region on mining that highlights vulnerability for its community in terms of lost economic activity and employment as Australia inevitably transitions to a less carbon intensive economy.

## 7.2. Impact Assessment

### 7.2.1. Estimated Construction Contribution

A Capital Investment Valuation is provided in Appendix G of this EIS. Construction is expected to take between 6 to 10 months. This process and expenditures will create a number of direct and indirect economic impacts which would benefit the Singleton LGA, the Hunter Region and NSW.

The skills required to support construction would mainly be construction industry skills such as labourers, plant and machine operators, and tradespeople, with a small number of specialist workers required for specific activities. Where possible, the construction workforce will be sourced by Verdant Earth from the Hunter Region, helping to maximise employment benefits for local and regional communities.

The Proposal would indirectly provide employment in local and regional businesses providing goods and services that support construction activities and the expenditure of wages in surrounding businesses. As shown in Table 7.1, an estimated 331 direct full time equivalent (FTE) jobs and 504 indirect production and consumption FTEs would likely be created as a result of the Proposal.

**Table 7.1. Direct and Indirect Jobs Created During Construction Stage (FTEs).**

| Impact | Singleton LGA | Hunter Region (not including Singleton) | NSW (outside of Hunter Region) | Interstate & Overseas | Total |
|---|---|---|---|---|---|
| Direct Jobs Created | 100 | 165 | 66 | 0 | 331 |
| Indirect Jobs Created | 151 | 252 | 101 | 0 | 504 |
| Total Jobs Created | **251** | **417** | **167** | **0** | **835** |

During construction, potential benefits for businesses would mainly be associated with provision of goods and services associated with, for example, equipment hire, specialty trades, supplies, transportation, and administrative services. The direct value add of construction is estimated at $28.64 million as shown in Table 7.2.

The reopening stage would likely result in increased demand for services such as accommodation, supermarkets, restaurants and cafes, licensed hotels and outlets, and sporting/entertainment facilities within Singleton LGA and the Hunter Region. The indirect value add of construction is estimated at $49.59 million as shown in Table 7.2.

The combined direct and indirect economic activity are expected to create an increase in value-added to the Singleton LGA, broader Hunter Region, and NSW of an estimated $7.4 million during construction.

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**Table 7.2. Direct and indirect value added ($ millions) during construction.**

| Impact | Singleton LGA | Hunter Region (not including Singleton) | NSW(outside of Hunter Region) | Interstate & Overseas | Total |
|---|---|---|---|---|---|
| Direct Value Added | $7.16 | $14.32 | $4.30 | $2.86 | **$28.64** |
| Indirect Value Added | $14.88 | $24.80 | $7.44 | $2.48 | **$49.59** |
| Total Value Added | **$22.04** | **$39.12** | **$11.74** | **$5.34** | **$78.23** |

## 7.2.1. Estimated Operational Contribution

Verdant Earth intends to maximise the use of local labour wherever possible, and it is expected that many of these workers will be sourced directly from the Singleton LGA and the Hunter Region.

The Proposal represents an important potential employment opportunity for local job seekers. The employment estimates for the operation phase are shown in Table 7.3. Employment growth is estimated to be 174.5 long term FTE jobs in the Singleton LGA, Hunter Region and NSW.

**Table 7.3. Total direct and indirect jobs created (FTEs) during operations.**

| Impact | Singleton LGA | Hunter Region (not including Singleton) | NSW (outside of Hunter Region) | Interstate | Total |
|---|---|---|---|---|---|
| Direct Jobs Created – at the Facility | 26.5 | 40 | 0 | 0 | **66.5** |
| Direct Jobs Created – Head Office | 0 | 0 | 12 | 0 | **12** |
| Indirect Jobs Created | 10 | 17 | 7 | 0 | **34** |
| Haulage Contractors | 25 | 37 | 0 | 0 | **62** |
| Total Jobs Created | **61.5** | **94** | **19** | **0** | **174.5** |

The Redbank Power Station will require around $46 million in expenditure per annum to operate together with $14.1 million in employee wages and salaries. These expenditures will directly and beneficially impact the economies of the Singleton LGA and the Hunter Region.

In the first full year of operation the Redbank Power Station is expected to directly create $39.23 million worth of value-add in the Singleton and Hunter Regional Economies. The indirect economic activity from the Proposal's annual operations is estimated at $29.6 million. The total annual value add to the economy in the operation of the power station is estimated at $68.8 million, as shown in Table 7.4.

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**Table 7.4. Direct and Indirect Value Added ($ millions) During Operational Stage – Annual.**

| Impact | Singleton LGA | Hunter Region (not including Singleton) | NSW (outside of Hunter Region) | Interstate & Overseas | Total |
|---|---|---|---|---|---|
| Direct Value Added | $11.77 | $19.62 | $5.88 | $1.98 | **$39.23** |
| Indirect Value Added | $8.88 | $14.79 | $4.44 | $1.48 | **$29.59** |
| Total Value Added | **$20.65** | **$34.41** | **$10.32** | **$3.46** | **$68.82** |

## 7.2.2. Renewable Energy Transition Contribution

Electricity generation in NSW is overwhelmingly at present sourced from black coal. While it continues to be the largest generation source, its importance is diminishing. The electricity sector in NSW is undergoing a significant transformation towards renewable generation.

Renewables have grown considerably over the past decade, but they still only provide 29.8% of overall electricity generation (Table 7.5). The growth in renewable generation reflects government climate change policies, the retirement of coal-fired plants, and decreasing costs for renewable generation.

**Table 7.5. NSW Electricity Generation by Source 2010-11 to 2019-20. All units are in gigawatt hours (GWh).**

| | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 |
|---|---|---|---|---|---|---|---|---|---|---|
| Non-renewable | | | | | | | | | | |
| Black coal | 56,798.6 | 55,819.5 | 52,562.2 | 55,334.5 | 55,967.1 | 57,022.2 | 57,734.9 | 53,566.7 | 50,790.8 | 46,958.8 |
| Natural gas | 5,168.7 | 5,528.3 | 4,528.4 | 4,628.6 | 3,330.8 | 3,045.8 | 2,360.3 | 2,870.9 | 1,903.2 | 3,210.7 |
| Oil products | 190.9 | 170.7 | 284.3 | 289.5 | 321.6 | 324.4 | 322.6 | 337.3 | 340.6 | 458.1 |
| Other | - | - | - | - | - | - | - | - | - | - |
| Total non-renewable | **62,158.2** | **61,518.5** | **57,374.9** | **60,252.6** | **59,619.5** | **60,392.3** | **60,417.8** | **56,774.9** | **53,034.6** | **50,627.6** |
| Renewable | | | | | | | | | | |
| Bagasse, wood | 425.4 | 461.7 | 551.1 | 601.7 | 696.5 | 765.0 | 758.8 | 716.2 | 686.1 | 568.3 |
| Biogas | 413.4 | 420.6 | 472.1 | 444.6 | 406.2 | 424.4 | 418.8 | 387.4 | 411.0 | 398.5 |
| Wind | 832.6 | 899.2 | 1,376.0 | 1,898.8 | 1,872.0 | 2,431.6 | 3,739.7 | 4,574.3 | 4,805.9 | 5,973.4 |
| Hydro | 3,298.1 | 2,721.1 | 1,771.0 | 3,170.2 | 3,290.6 | 2,915.5 | 2,160.3 | 2,110.1 | 2,964.2 | 3,315.5 |
| Large-scale solarPV | - | 10.6 | 60.2 | 399.5 | 567.6 | 700.0 | 1,348.2 | 2,084.6 | 3,368.0 | 5,014.4 |
| Small-scale solar PV | 857.6 | 964.9 | 1,211.2 | 1,461.9 | 1,706.8 | 2,095.8 | 2,717.1 | 3,417.3 | 4,892.9 | 6,201.3 |
| Total renewable | **5,827.1** | **5,478.1** | **5,441.6** | **7,976.8** | **8,539.7** | **9,332.3** | **11,143.0** | **13,289.8** | **17,128.2** | **21,471.6** |
| Total all | **67,985.3** | **66,996.6** | **62,816.4** | **68,229.4** | **68,159.2** | **69,724.6** | **71,560.8** | **70,064.7** | **70,162.8** | **72,099.2** |

A key priority for the Hunter Region will be the development and investment in renewable energy technology to enable substantial cuts in emissions but at the same time responding to increased energy demand. Of even a greater challenge

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will be the Hunter Region's concentration of coal fired power stations that are inevitably to be phased out and the impact this will have on the regional jobs, the economy and community. The Proposal will help transition the Hunter to a lower carbon future.

The Proposal would use existing access to the transmission network and help replace jobs lost through the closure of coal fired power stations. The Proposal may also catalyse further renewable energy projects in the region (e.g. hydrogen).

A potentially significant economic project for both the Singleton LGA and the Hunter Region, the Proposal is expected to assist in the transition to renewable energy and stimulate economic activity whilst protecting environmental quality and human health.

The Singleton LGA and Hunter Region will continue to be an important area for growth and industry, and that with the inevitable transition away from coal to renewables, this Proposal can provide a diverse opportunity for growth and employment, particularly in the areas of industrial trade during construction and operation.

The Proposal is expected to improve social and economic outcomes for residents through increased employment opportunities and better livelihoods, particularly in the Singleton LGA.

## 7.3. Mitigation Measures

No additional mitigation measures are recommended above those provided in Appendix C.

## 7.4. Conclusion

The Proposal is expected to contribute the following to the local and regional economies:

- An estimated 331 direct full time equivalent (FTE) jobs and 504 indirect production and consumption FTEs during construction;
- A combined direct and indirect economic activity value add of $78.23 million during construction;
- Employment growth of 174.5 long term FTE jobs during operations; and
- Annual value add to the economy is estimated at $68.8 million during operations.

In total there will be 1,009.5 direct and indirect jobs created and the 25-Year NPV of the reopening of the Redbank Power Station is $901.1 million. The majority of economic activity would occur in the Hunter Region, with an estimated annual value add during operation of $34.41 million, and in the Singleton LGA alone of $20.64 million.

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# 8. Waste Management

A Waste Management Plan (WMP) has been prepared for the Proposal. A brief summary of the plan is provided in this section, and the full WMP is provided as Appendix L.

The waste management plan was compiled using the following steps:

1. Estimate waste stream types and amounts based on the site activities – during both construction and operational phases;
2. Identify management options for each waste stream suitable within the regulatory framework;
3. Select most appropriate waste management option for each waste stream, aiming to recover as much waste as possible; and
4. Address ash derived from the burning of biomass management requirements, including ash from standard fuel, eligible waste fuel and DBF.

## 8.1. Existing Environment

The current Site is the existing Redbank Power Station, which has been in care and maintenance since October 2014. Current waste management systems exist on the Site for waste and recycling of materials generated from the office and care and maintenance of existing (non-operating) plant and equipment. A full description of the Facility is provided in Section 1.3.

## 8.2. Impact Assessment

### 8.2.1. Demolition phase

The power station would require minor modifications of materials handling systems to enable the use of up to 850,000 tonnes per annum of biomass as fuel for electricity generation.

To accommodate the change of fuel type to use biomass, modifications to the fuel delivery conveyors and fuel feeding devices within the power station will be required. This will involve:

- Maintenance, repair and recommissioning works within the power station to permit recommencement of electricity generation;
- The existing conveyor from the Warkworth mine for transfer of coal tailings into the plant will remain in the first instance;
- Two 28m long weighbridges to be installed along the (western) inbound lane into the Site and the (eastern) outbound lane out of the Site;
- Construction of a 160m sealed road at the rear of the site to enable to delivery of biomass to the fuel storage area;
- Establishment of a new fuel delivery area adjacent to the existing stockpiling area directly south of the existing power plant. The system will incorporate two dual-lane drive over truck unloaders, two additional conveyors that supply two radial telescopic conveyors to unload the biomass. One telescopic conveyor will direct fuel to the existing fuel storage area (i.e. the area approved for storage of coal tailings), and the second to two moving floor bulk unloader bins, which directly feed existing Conveyor 76. Swales to be provided around biomass stockpile area to minimise movement of biomass fuel from the designated storage area;
- Use of the existing Conveyors 34 and 35 to supply Boilers 1 and 2 respectively with biomass fuel. An extension to Conveyor 76 and removal of the crusher house is required to enable the even transfer of fuel via Conveyors 34 and 35 to Boilers 1 and 2;

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- Modifications to the two units fuel silos (three on each unit) tops to include two reversing conveyors on each unit and associated chute work to store the feedstock. These silos previously stored supplementary fuel for delivery into the plant's fluidized bed combustion chambers;
- Modifying of the 'trouser legs' of the six fuel silos within the power station to enable the more efficient flow of biomass into the plant's fluidized bed combustion chambers;
- The existing ash slurry system previously used to transfer coal tailings ash back to Warkworth mine will remain in place, though it will not be used and may be removed at a later date; and
- Other work, including landscaping, fire detection and suppression systems, and refurbishment of internal elements of the power station as required. This will also include the purchase of a water access licence, reconnection to the electricity grid, development of a spare parts inventory and purchase and storage of a fuel invention for the power station.

No major building demolition is required for the Proposal. Only removal, replacement and recycling or disposal of discrete pieces of plant and equipment as summarised above and as described in detail in Section 3.5 of this EIS.

### 8.2.2. Construction phase

The addition of two weighbridges will require excavation of foundations for the load cells and some grading for the additional section of access road, approximately 160m long, for the unloading of feedstock (see Figure 3.5). Very little soil disturbance will be required to retrofit the existing Facility to allow biomass to be used as fuel (see Figure 8.1). Soil material will be re-used for landscaping and/or filling on site.

Some waste during construction will be generated to allow retrofitting of the existing plant, conveyors and silos. The quantities of wastes expected to be generated and recycled during the demolition and construction phase is given in Table 8.1.

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**Table 8.1. Estimated waste generation during the demolition / construction phase.**

| Waste Type | Waste Identified | Waste Description | Reuse/recycling/ Disposal Method | Suggest Receiving Facility | Tonnes | Recycling rate |
|---|---|---|---|---|---|---|
| **General Solid Waste (non-putrescible)** | Excavated Natural Material | Topsoil, subsoil, fill removed for weighbridge footings and 160m section of access road construction. | Re-use onsite | On-site | 1000 | 100% |
| | Construction waste – "heavy" | Asphalt/concrete removal for weighbridges. | Off-site recycling | Central Waste Station (EPL13013) | 100 | 100% |
| | Construction waste - metal | Ferrous metal from widening of trouser legs and removal of chutes during retrofit. | Off-site recycling | Central Waste Station (EPL13013) | 10 | 100% |
| | Construction waste – "light" | Timber, packaging, glass, plastic, rubber, plasterboard, and ceramics | Off-site disposal | Central Waste Station (EPL13013) | 2 | 0% |
| | Grit, sediment, litter and gross pollutants | Collected in, and removed from, stormwater treatment devices and/or stormwater management systems | Re-use onsite<br>Off-site disposal | On-site<br>Singleton Waste Management Facility (EPL5927) | 2 | 50% |
| | Site office waste | Paper, cardboard and co-mingled recycling. | Off-site recycling | Singleton Waste Management Facility (EPL5927) | 1 | 100% |
| **Hazardous** | Waste oils, fuels, lubricants and chemicals | Waste oils and containers that previously contained Class 1, 3, 4, 5 or 8 substances used for construction plant | Off-site recycling / disposal | Cleanaway Rutherford (EPL11383) | 0.1 | 50% |
| **General Solid Waste (putrescible)** | Site office waste | Generated from worker's lunches. | Off-site disposal | Singleton Waste Management Facility (EPL5927) | 0.1 | 0% |
| **TOTAL Amount of waste generated (tonnes)** | | | | | 1,115 | |
| **TOTAL Amount of waste recycled (tonnes)** | | | | | 1,112 | |
| **Overall recycling rate** | | | | | 99.7% | |

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**Figure 8.1. Areas to be excavated during construction in yellow boxes. Placement of waste storage and recycling bins during the construction phase in red boxes.**


| Date | Revision | Drawn By | Site description | Client | Verdant Earth Technologies Limited |
|---|---|---|---|---|---|
| 27/11/23 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) | Project | Redbank Power Station |
| | | | | Title | Construction works |
| | | | | Source | Nearmaps |

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## 8.3. Operational Phase

Operational phase generation of solid waste has been estimated. Each waste stream is classified in accordance with the EPA's *Waste Classification Guidelines* and quantities of wastes that are anticipated to be separated, reused and recycled are estimated. Lawful facilities for receiving the waste for reuse, recycling and disposal have also been identified.

### 8.3.1. Waste and Recycling Measures - Office and Maintenance Operations

The office operations associated with the Proposal will generate waste from office administration and staff lunch activities. Waste generation from these activities are considered minor, but need to be appropriately managed to ensure that waste is minimised and recycled in accordance with the waste hierarchy in the NSW Government's *Waste Avoidance and Resource Recovery Strategy 2014-2021* and the *Waste Avoidance and Resource Recovery Act* 2011.

Maintenance of the Facility during operations will also generate waste. A recycling system is already in place at the Facility and will be managed and used post retrofit of the Facility for the use of biomass for fuel. Co-mingled recycling, general waste and maintenance waste will be stored in separate bins as shown in Figure 8.2.

An overview of waste generation and recycling estimates as part of the office operations is provided in Table 8.2. Waste generation and recycling estimates are taken from NSW EPA (2012) *Better Practice Guidelines for Waste Management and Recycling in Commercial and Industrial Facilities*, estimates from the Facility's operations manager, and best practice industry standards.

The assessment found that just over 144 tonnes of waste would be generated on an annual basis, with approximately 123 tonnes on an annual basis being recycled on-site or off-site at licensed recycling facilities. Overall, 85.4% of waste generated through office and maintenance activities would be recycled.

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**Table 8.2. Waste and recycling measures for waste generated by office and maintenance operations per annum.**

| Key Waste Stream | Avg. volume of waste generated per day per 100m² floor area (for offices) (m³) | Weekly waste generation (based on a 5.5-day working week and office floor area of approx. 1,344m²) (m³) | Bulk density (t/m³) | Estimated tonnes per year | Segregation Areas / Containers | Reuse / Recycling / Disposal Method | Waste Type (NSW EPA Pre-classified Waste) | Suggested Receiving Facility | Recycling rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Operational maintenance waste oils, oily rags, fuels, lubricants | NA | NA | NA | 20.00 | 20 x 44 gallon drums in bunded/covered shed | Off-site recycling | J100 Trackable Waste | Remondis Thornton (EPL12297) | 75% |
| Operational maintenance metals, electrical switches, fuses from damaged equipment parts and components | NA | NA | NA | 60.00 | 1 x 20ft general waste skip<br>1 x 20ft metal skip bin | Off-site recycling | General waste (non-putrescible) | Central Waste Station (EPL13013) | 90% |
| Co-mingled recycling: plastic / glass containers / metal cans / paper and cardboard | 0.006 | 0.444 | 0.63 | 14.53 | 5 x 140 L wheelie recycling bin (emptied weekly) | Off-site recycling | General waste (non-putrescible) | Singleton Waste Management Facility (EPL5927) | 100% |
| General waste | 0.008 | 0.591 | 1.3 | 39.98 | 5 x 140 L wheelie general waste bin (emptied weekly) | Off-site recycling | General waste (non-putrescible) | Singleton Waste Management Facility (EPL5927) | 75% |
| Food waste | 0.005 | 0.370 | 0.5 | 9.61 | 4 x 120 L wheelie food waste bin (emptied weekly) | On-site recycling | General waste (putrescible) | Worm Bins (onsite) | 100% |
| Waste generated (tonnes per year) | | | | 144.12 | | | | | |
| Waste recycled (tonnes per year) | | | | 123.12 | | | | | |
| Overall recycling rate | | | | 85.4% | | | | | |

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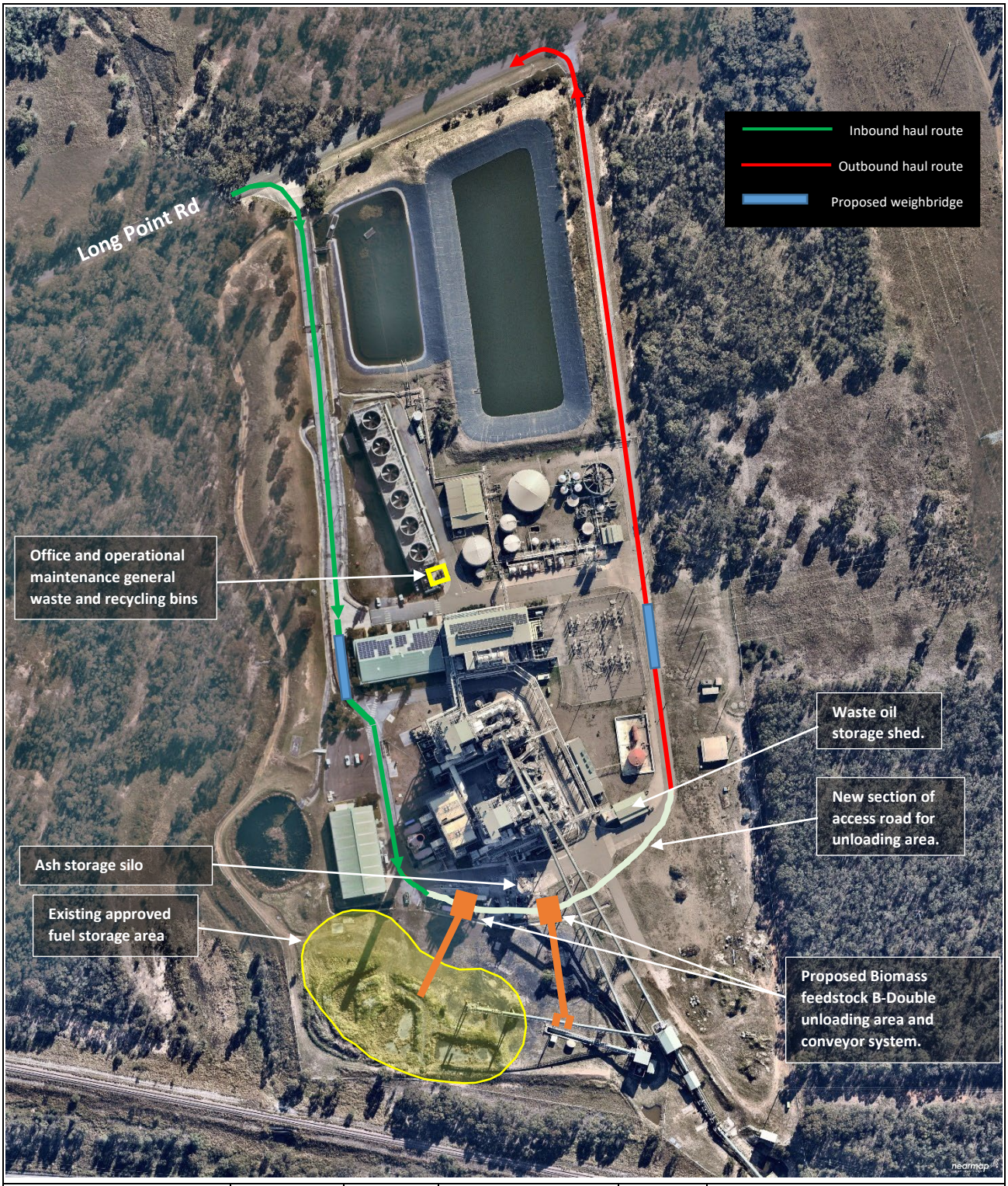
**Figure 8.2. Site Access to Redbank Power Station and internal access arrangements and waste storage locations.**




| Date | Revision | Drawn By | Site description | Client | Verdant Earth Technologies Limited |
|---|---|---|---|---|---|
| 08/06/21 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) | Project | Redbank Power Station |
| 15/10/21 | Revision B | M. Jackson | | Title | Access to site and operational waste areas |
| 15/10/23 | Revision C | E. Larson | | Source | Near Maps |

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### 8.3.2. Biomass Ash Management

Combustion of biomass in the Facility will produce a residual ash of approximately 3-5% of the feedstock by weight. Using a worst-case scenario 5% estimate there will be a requirement to remove 42,500 tonnes of ash from the Site per year. Average daily ash generation will therefore be 116.4 tonnes per day.

The existing ash silo is large enough to hold 3 days of ash production at the Facility. This silo receives ash transferred in an enclosed pipeline from the furnaces and is deposited into the top of the fully sealed ash storage silo where the ash is stored. The location of the ash storage silo is shown in Figure 8.2. Ash is discharged from the silo via an overhead telescopic chute, such that the ash is deposited under gravity into the body of a tanker truck positioned beneath the chute in a controlled manner to avoid dust formation. A photo of the existing ash storage silo and chute arrangements for ash collection and off-site truck transport is shown in Figure 8.3.

The ash can also be transferred from the telescopic chute into a mobile puddle mixer, where water is added so that the moistened ash can be easily transferred into an open top truck. The truck is then tarped prior to leaving the ash loading area.

Any spillages under the ash silo are collected in a blind pit not connected to stormwater and is emptied when required and placed in the trucks that dispose of the ash.

No additional ash handling arrangements are required, and no additional plant or equipment is required to be retrofitted at the Facility above those already existing ash handling arrangements for coal tailings.

The ash is classified as General Solid Waste (non-putrescible) in accordance with the EPA's *Waste Classification Guidelines.*

No biochar is produced or used on the Site.

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**Figure 8.3. Photo of the existing ash storage silo (left), and overhead telescopic chute arrangement (right, circled in red) which enables ash to be discharged under gravity into a tanker truck for off-site transport.**

### 8.3.3. The ash from burning biomass order 2014

*The Ash From Burning Biomass Order* 2014 (the Ash Order), issued by the Environment Protection Authority (EPA) under clause 93 of the *Protection of the Environment Operations (Waste) Regulation* 2014 (Waste Regulation), imposes the requirements that must be met by suppliers of ash to which *The Ash From Burning Biomass Exemption* 2014 (the Ash Exemption) applies. The requirements in the Ash Order apply in relation to the supply of ash for application to land as a soil amendment.

Application of ash (from the burning of biomass) as a soil amendment or fertiliser on land is permitted in accordance with the Ash Order. The Order permits the reuse of ash from biomass-based fuels defined under Part 1 of the *Eligible Waste Fuels Guidelines* (EPA 2016) including biomass from sources eligible waste fuel sources.

Ash from the burning of the proposed biomass as fuel will be sampled and tested in accordance with Section 4 of the Ash Order, to ensure that the ash meets all chemical requirements under Table 1 of the Ash Order.

If found to be compliant with the Ash Order, the ash will be transported and used as a soil amendment in energy cropping and/or agriculture in accordance with the Ash Exemption. Application of ash and incorporation into soils at appropriate application rates as permitted in the Ash Exemption will be performed to ensure that the ash is supplied to soils at agronomic rates that support land productivity and avoids impacts on soils and water quality.

Characterisation of the ash will be undertaken for the chemicals and other attributes listed in in the Ash Order to confirm that the ash from the Redbank Power Station is suitable for reuse.

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With 56 B-Double semi-trailers delivering biomass to the Site per day, those vehicles when required will back load the ash to approved sites for use as a soil amendment. The proposed strategy for managing ash will provide for the sustainable reuse and recycling of nutrients that are otherwise lost from soil when biomass or agricultural crops are harvested. The strategy will also prevent the disposal of ash in landfill or more commonly on-site ash dams, which typically occurs at all other power stations in NSW.

It is expected that 100% of the ash generated will be beneficially reused. The ash reuse program will be guided by site specific investigations to ensure the method of application and rates of application of ash to forest soils is done to maximise soil benefits, whilst protecting soils and water quality.

### 8.3.4. Biomass ash contingency

If the ash is found not to be compliant with the Ash Order, the waste ash material will be temporarily landfilled, and a Specific RROE sought from the NSW EPA (to enable its recovery and recycling). Upon approval and use of DBF as an eligible waste fuel, a Specific RROE will be sought from the NSW EPA (to enable its recovery and recycling).

### 8.3.5. Specific RROE for Domestic Biomass Fuel-Derived Ash

The use of DBF will create ash that does not fall into the scope of *The Ash From Burning Biomass Order* 2014. A Specific RROE will be required for DBF and resulting ash from its use as fuel at the Facility. This is true even if only small amounts of DBF are used with standard fuel only due to mixing of the two types of fuel.

A Waste Characterisation Methodology will need to be prepared to help inform an application for a Specific RROE. The NSW EPA will be consulted to ensure that the methodology for sampling, testing and monitoring of the ash derived from the burning of DBF (and eligible waste fuels where ash characteristics do not meet the *The Ash From Burning Biomass Order* 2014) are sufficient to inform a detailed Specific RROE application. The Specific RROE will set out the quality specifications for ash to ensure that only quality and fit for purpose ash are used for application to land.

### 8.3.6. Locations for ash reuse

Where the ash meets the requirements of the Ash Order sampling and testing requirements, the preferred method of reuse will be to backload the ash as a soil amendment to the locations where energy crops have been grown for fuel or where biomass has been grown or other approved agricultural lands. The ash will be returned and beneficially applied to land as a soil amendment to return nutrients to soils.

This use in accordance with the Ash Exemption does not warrant (or require) further assessment. This is analogous to a council organic waste composting facility not being required to assess potential soil impacts of compost (processed lawfully in accordance with EPA requirements and that meets *the Compost Order 2016*) that is applied to land.

It is expected that 100% of the ash generated will be beneficially reused. The ash reuse program will be guided by site specific investigations to ensure the method of application and rates of application of ash to productive soils is done to maximise soil benefits, whilst protecting soil and water quality.

Ash generation will reduce from an estimated 115,776 tonnes per year when coal tailings were used, to 42,500 tonnes per year when biomass is used. As a result of the proposed fuel conversion to biomass, ash generation will reduce by an estimated 63% when compared to the existing approval. The reduction in ash generation when biomass is used is because biomass has a much lower ash content compared to coal tailings.

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### 8.3.7. Assessment of waste generation and recycling rate during the operational phase

An overall assessment of waste generation during the operational phase of the Power Station as currently approved and for the use of biomass is provided in Table 8.3. The results suggest that on an annual basis, total waste generation from operations will reduce from 115,920 tonnes on an annual basis, reducing to 42,644 tonnes on an annual basis when biomass is used as a fuel.

Across all operations of the Redbank Power Station, it is estimated that more than 99% of wastes will be reused or recycled, exceeding the 80% target established by the NSW Government in the *NSW Waste and Sustainable Materials Strategy 2041: Stage 1 – 2021-2027.*

**Table 8.3. Summary of operational waste generation and recycling as currently approved with coal tailings and biomass (proposed).**

| Key Waste Stream | Total waste generation (tonnes per year) | Total waste reused / recycled (tonnes per year) | Total waste disposed (tonnes per year) | Recycling rate (%) |
|---|---|---|---|---|
| **Development as currently approved (coal tailings as fuel)** | | | | |
| **Office and maintenance operations** | 144.12 | 123.12 | 21 | 85.4% |
| **Ash (coal tailings)** | 115,776 | 115,776 | 0 | 100% |
| **Totals** | **115,920** | **115,899** | **21** | **99.98%** |
| **Proposed development (biomass as fuel)** | | | | |
| **Office and maintenance operations** | 144 | 123 | 21 | 85.4% |
| **Ash (from biomass)** | 42,500 | 42,500 | 0 | 100% |
| **Totals** | **42,644** | **42,623** | **21** | **99.95%** |

## 8.4. Mitigation Measures

With the implementation of the waste mitigation and management measures provided in Table 8.4, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential waste impacts and is therefore suitable for construction and operation.

**Table 8.4. Waste management mitigation measures.**

| Measure | Description |
|---|---|
| **WM1** | A Specific Resource Recovery Order and Exemption for ash derived from the use of Domestic Biomass Fuel (DBF) will be sought prior to the use of DBF (and eligible waste fuel that does not meet the requirements of the Ash Order 2014). |
| **WM2** | Waste management and minimisation will form part of the both the demolition/construction and operational induction programs (which includes environmental due diligence training). All Project and site personnel, and contractors will be trained in the requirements of this document including minimising wastes, recognising which types of materials are recyclable and their obligations to use recycling facilities provided on site. |
| **WM3** | Clearly assign and communicate responsibilities to ensure that those involved in demolition/construction are aware of their responsibilities in relation to the Site Waste Minimisation and Management Plan. |
| **WM4** | Engage and educate personnel on how the various elements of the Site Waste Minimisation and Management Plan will be implemented. |

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| Measure | Description |
|---|---|
| WM5 | Specific locations for waste management (e.g. sorting area locations, recycling bin locations, material stockpile locations) will be established on site and signposted appropriately. |
| WM6 | Waste management areas will be managed to prevent sediment runoff and dust generation. |
| WM7 | Construction Method Statements (CMS) will include practices to minimise waste generation and to maximise recycling and reuse of materials including oils, greases, lubricants, timber, glass, and metal. |
| WM8 | Packaging minimisation and reuse initiatives will be implemented as part of procurement. |
| WM9 | An unexpected finds environmental procedure will be developed in case any contamination should be found during construction works. |
| WM10 | Spill kits to be established on site in the case any fuel leaks should occur from plant and equipment during the construction phase of the development. |
| WM11 | Segregated waste disposal containers will be provided onsite for the collection and recycling/disposal of all waste streams generated during the demolition/construction and operation phases. Waste disposal containers will have clear signage and instructions for use to avoid cross-contamination. No rubbish shall be disposed of on site. |
| WM12 | Waste will be disposed to an appropriate licensed facility. A Waste Management Register of all waste collected for disposal and / recycling, including amounts, date and time, and details and location of disposal will be maintained at all times. |
| WM13 | Ensure that all ash generated from the combustion of biomass is tested and meets the requirements of The Ash From Burning Biomass Order 2014 and is used as a fertiliser in forestry or agriculture in accordance with The Ash From Burning Biomass Exemption 2014. |
| WM14 | Should the plant used coal tailings, ensure that all ash generated from the combustion of coal tailings is tested and meets the requirements of The Coal Ash Order 2014 and is used as a fertiliser or fill material in accordance with The Coal Ash Exemption 2014. |
| WM15 | All waste being transported off site must be covered. All transportation must be appropriately licensed to carry that material. |
| WM16 | Storage of all hazardous substances and dangerous goods will be in accordance with SDS requirements and located in a bunded area. Solid and hazardous wastes will be contained and separated from inert waste. |
| WM17 | Any hazardous materials will be managed and handled by an appropriately licensed contractor and transported for disposal to a licensed facility. |
| WM18 | Any material contaminated by spills (e.g., fuel, oil, lubricants) – including empty fuel, oil and chemical containers – will be stored in a sealed secure container within a bunded area and will be transported to a waste disposal site approved by the NSW EPA to accept such material. |
| WM19 | Incompatible wastes will not be mixed. |
| WM20 | Bunding and/or appropriate stormwater filters to be placed around/in stormwater pits to prevent entry of pollutants into stormwater drainage system. |
| WM21 | Stormwater pits to be inspected regularly for litter build-up and signs of leaks or spills. Pits to be cleaned weekly or as required. |
| WM22 | Biodegradable products will be used wherever practicable. |
| WM23 | Regular collection of wastes will ensure overfilling of bins and associated air/water pollution is minimised/prevented. |
| WM24 | Conduct regular litter patrols to ensure litter is effectively controlled on site. |
| WM25 | Implement the procedures for ash management and biomass outlined in the Redbank Power Station QA/QC, Supply Chain and Material Handling (Verdant Earth, 2021). |
| WM26 | Any spills of ash around the storage silo that may occur during loading of vehicles for off-site transfer of ash shall be swept and cleaned up immediately to avoid tracking of ash onto road surfaces within the Site and potentially impacting on stormwater. |
| WM27 | A flexible curtain is to be fitted around the discharge chute if needed to prevent ash being blown out of the vehicle during loading. |
| WM28 | The blind pit is to be inspected daily and cleaned to remove any ash spilled onto the hardstand beneath the ash storage silo to avoid dust formation. |
| WM29 | All ash collection trucks shall be fully enclosed (e.g. tankers) or tarped after loading and prior to leaving the Site to avoid dust impacts during transport. |

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## 8.5. Conclusion

The power station would require minor modifications of materials handling systems to enable the use of biomass for fuel. Across all operations of the Redbank Power Station, it is estimated that more than 99% of wastes will be reused or recycled, exceeding the 80% target established by the NSW Government in the *NSW Waste and Sustainable Materials Strategy 2041: Stage 1 – 2021-2027.*

Ash would be generated at about a rate of 42,500 tonnes / year and is expected to be beneficially reused under *The Ash From Burning Biomass Order* 2014.

In the unlikely event the ash derived from the use of eligible waste fuel does not comply with the Ash Order, a Specific RROE would be sought from the NSW EPA to enable the beneficial reuse of ash in appropriate applications to ensure that human health and the environment are protected at all times.

A Specific Resource Recovery Order and Exemption will be sought when Domestic Biomass Fuel (DBF) is introduced into the fuel mixture as DBF is not permitted input into the Ash Order.

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# 9. Life Cycle Assessment

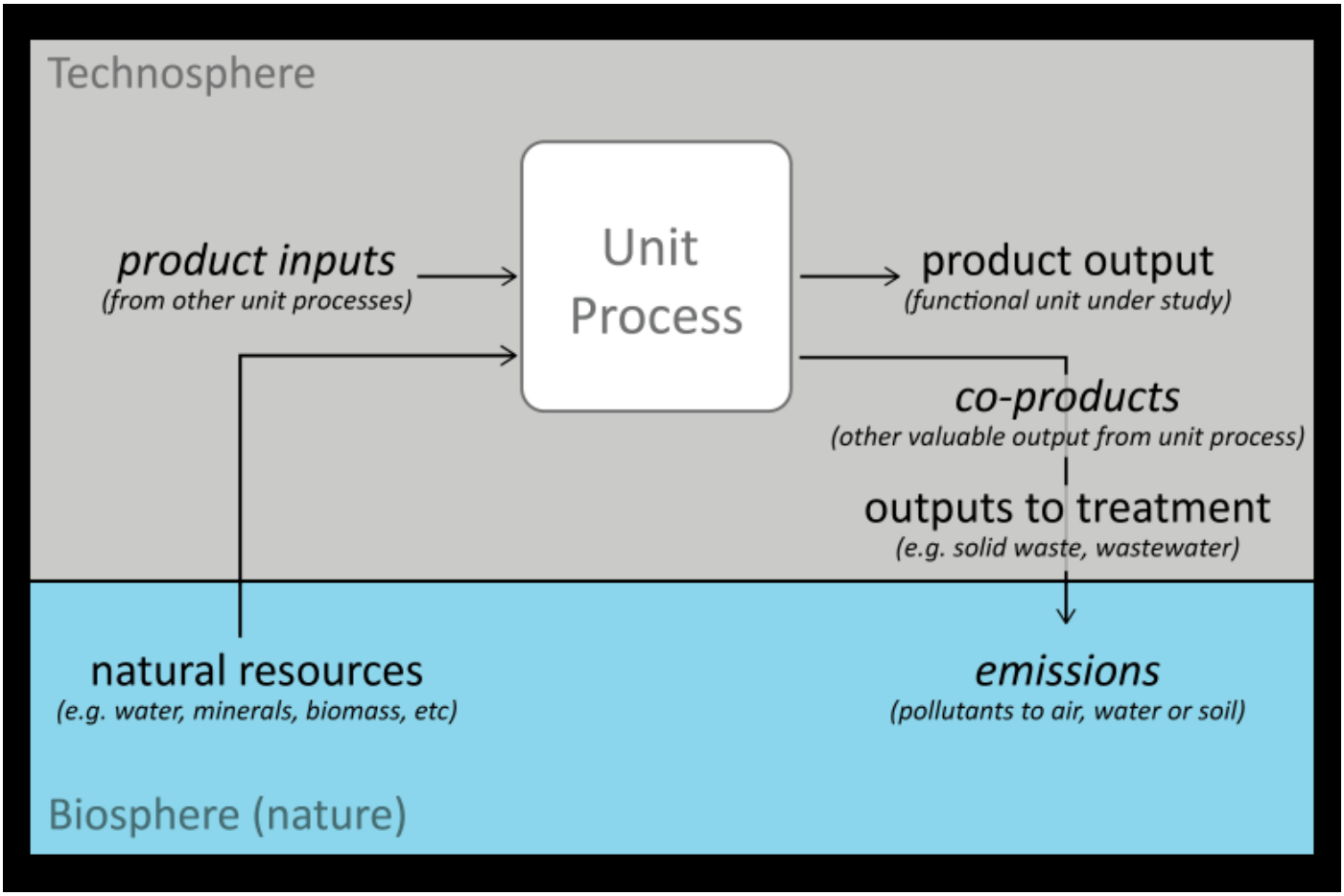
A Life Cycle Assessment (LCA) has been prepared to assess the full '*cradle-to-grave*' environmental impacts and benefits of products and processes associated with the Proposal. The LCA considers the environmental flows (i.e. impacts) at each stage of the life cycle and aims to avoid shifting impacts from one life cycle stage to another or from one environmental impact to another. The full study is provided in Appendix N.

The LCA follows the methods and guidance developed by the Australian Renewable Energy Agency (ARENA) for bioenergy products, including the framework, principles and specific requirements defined in both of the international standards ISO 14040:2006 and ISO14044:2006.

The LCA aims at measuring the exchange between the natural world (the 'biosphere') and human activities (the 'technosphere'), either via the extraction of natural resources or the emissions of pollutants to air, water and soil.

The measurement is done at a systems level, which is broken down into a series of unit processes. A single unit process is illustrated in Figure 9.1. It includes flows to and from the 'biosphere' as well as flows to and from other the 'technosphere'.

**Figure 9.1. Inputs and outputs of a unit process in LCA.**

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## 9.1. Biomass Sourcing

### 9.1.1. Energy crops

The production of feedstock from energy crops will involve the cultivation of purpose-grown biomass within managed plantations. These energy crops will be planted in annual rotations and will take approximately four years before they contain enough above ground biomass to be harvested. This will be done using coppicing to allow the harvest biomass to regrow during the following four years. Once harvested, the plant material will be air dried, chipped and screened before being transported to the power station for combustion.

Whilst several species are under investigation, the most likely crops to consist of quick-rotation coppicing are eucalypts and mallees. For the quick-rotation eucalypts and mallees, seedlings will be planted on an annual basis over four years, from which point harvest will begin, with four years of growth between each harvest. Bana grass may also be used. Bana grass cuttings are planted and allowed to grow for 1 year, after which the tops are harvested and the cuttings replanted to thicken the crop or for energy feedstock. After 3 to 4 years, the plants are coppiced on a regular rotation.

In terms of land use, Verdant Earth are seeking to use areas that currently have no alternative economic value to farmers and landowners. For example, they will target buffer zones of mines in the area, semi-arable land parcels without other economically viable economic agricultural uses.

### 9.1.2. Residues from land clearing of invasive species on agricultural land

Verdant Earth have been working with the Civil Industries and Local Landcare Services LLS NSW as well as landowners who have trees and shrubs that are classified as noxious weeds and may be cleared from land for agricultural uses. This includes native scrub vegetation that has reached unnatural densities and dominate an area on agricultural land. Current practice for weed control is the removal of trees, which are then left to dry for a few weeks before being pushed into a pile and burnt in situ.

For the Proposal, they would be harvested in accordance with land management codes, then chipped on site and transported to the Facility.

### 9.1.3. Approved land clearing for infrastructure works

Verdant Earth is also targeting residues from approved land clearing as a result of major infrastructure development (in accordance with native vegetation land management codes), such as road clearing works, road maintenance, and extensions. This biomass is typically mulched or mixed with soils and buried. This fuel source will be chipped on site before being collected and transported to Redbank Power Station.

### 9.1.4. Agricultural residues

Agricultural waste from biomass will include plant or crop residues produced directly from agricultural practices and will include non-putrescible natural organic fibrous materials and organic residues from harvest activities including fibres, roots, stalks, stubble, leaves, seed pods, nut shells and some waste from agricultural processing such as cotton and cane trash. The majority of available sources consist of straws from different cereal crops (e.g. wheat, barley, oat etc.). Current practices for managing agricultural residues vary, but may include burning, degradation on site, or collection for use in products or energy. For Verdant Earth, agricultural residues collected will be ground and pelletised off-site before being transported to the power station.

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### 9.1.5. Domestic biomass fuel

The domestic biomass fuel (DBF) Verdant Earth are targeting as potential fuel includes wood waste from Construction and Demolition (C&D) and Dry Sorted Commercial and Industrial (C&I) waste sourced primarily from industry skip and bulk bin collection, and demolition works, where this material is presently destined for landfill.

The production of electricity from biomass involves their combustion and the conversion of the heat generated into electricity. This operation requires further inputs and produces emissions. The power station site itself also consumes electricity and other inputs.

## 9.2. Lifecycle Modelling

While hundreds of background processes contribute to the LCA. The most important processes to this LCA include those such as chipping fuel sources, operation of the conveyor belts, ash to landfill, electricity production, plant and process changes, and fuel feedstock to landfill.

The production of electricity from biomass displaces the consumption of electricity from other generation sources.

The combustion of biomass produces ash as a by-product. This is primarily fly ash from the boiler and is collected by the bag filters. The ash collected at Redbank Power Station may be used as fertiliser in cropping and agriculture. If this is the case, it can avoid the production of fertilisers containing potassium, phosphorous and calcium.

A ‘system boundary’ describes the processes and life cycle stages included and excluded in the LCA. System boundaries should include everything that is substantially affected by demand for electricity. This includes extraction and production processes and any additional activities required to make each option functionally equivalent, such as the manufacturing of inputs or the production of heat and electricity. It also includes the effects of co-products along the supply chain.

There are system boundary diagrams for the two scenarios modelled.

In the reference scenario (Figure 9.2), electricity is generated from black coal, the biomass are sent to their current fates, and fertiliser is produced.

In the biomass scenario (Figure 9.3), the equivalent amount of electricity is generated at Redbank Power Station using 100% biomass. Ash is produced an applied as a fertiliser, which displaces the production of conventional fertilisers.

The impacts associated with electricity distribution do not change between the two scenarios and are therefore excluded from the system boundary. The impacts associated with land clearing, forestry operations, and manufacturing of timber products are not included within the system boundary.

The modelling assumptions used for the LCA are provided in detail in the full LCA report (Appendix N). The LCA prepared a life cycle inventory that lists in detail all parameters used within the model. The inventory is broken down into the foreground data, which were collected specifically for the study (primarily from Verdant Earth and secondary sources) and background data which were sourced from existing databases.

The foreground data is derived from the three main sources of biomass fuel: residues from forestry and approved land clearing, sawmill residues, and uncontaminated wood waste. The chemical properties of the biomass feedstock are used to determine flows of materials through the system, as well as inform the calculations for values such as energy production, ash production, and emissions.

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**Figure 9.2. System boundary diagram, reference scenario.**

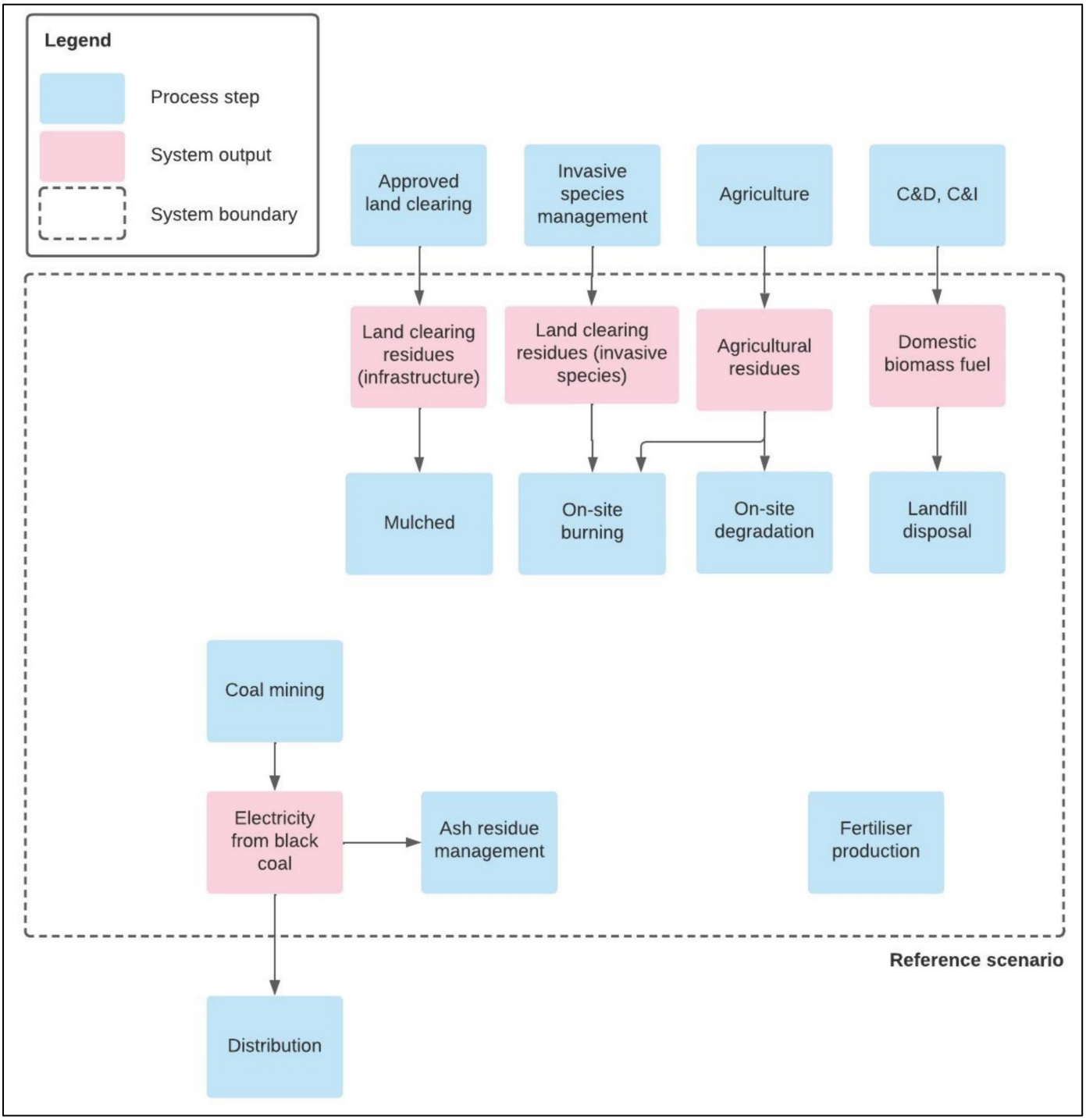


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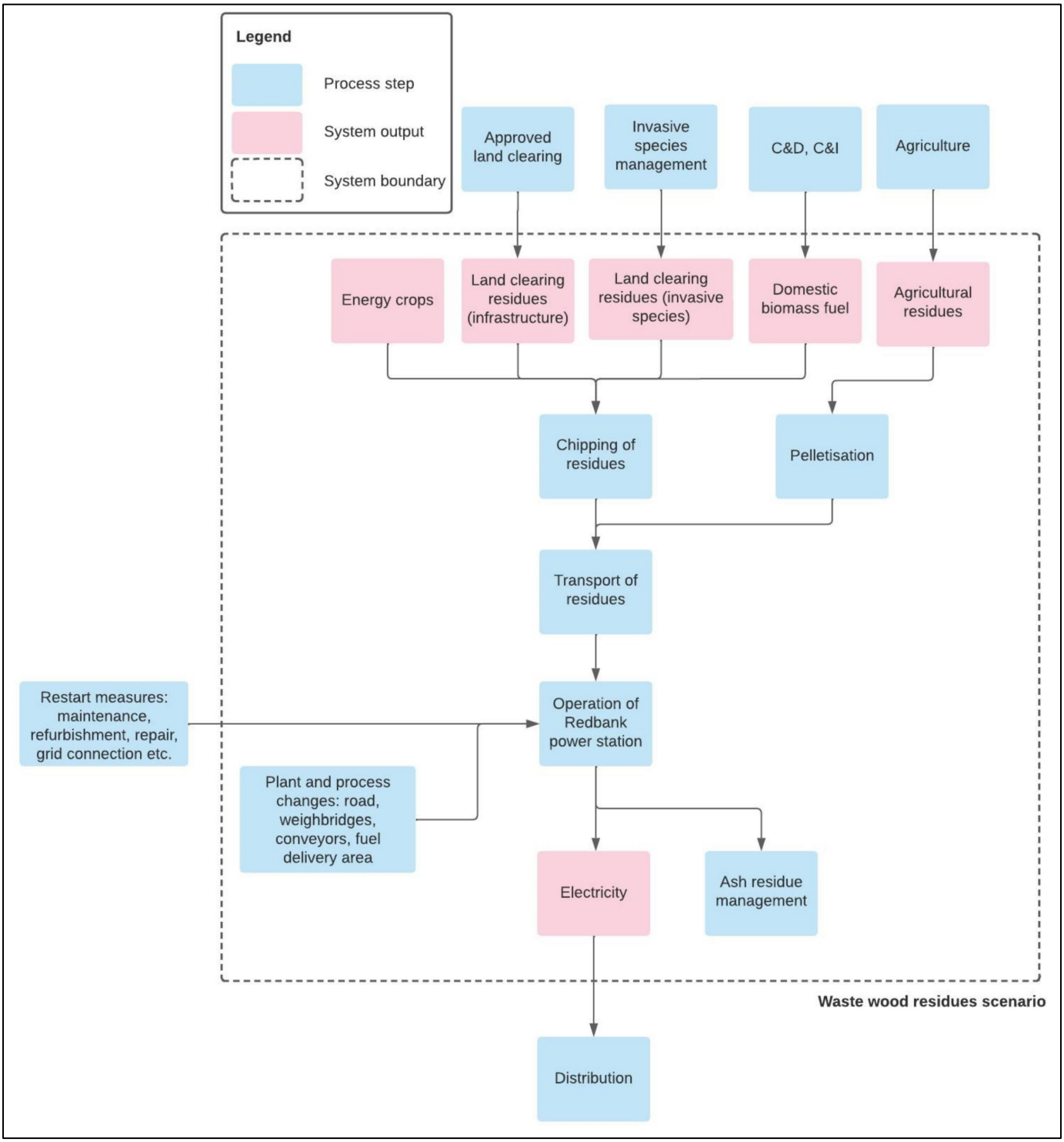
**Figure 9.3. System boundary diagram, biomass scenario.**




## 9.3. Impact Assessment

A summary of the LCA results is shown in Table 9.1. The reference scenario represents the production of 1MWh of electricity from black coal in NSW, including the current fates of the biomass. The biomass scenario represents the same production amount from biomass at Redbank Power Station.

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The LCA assessed the contribution by group to identify the sources of environmental impacts. The groups chosen for the contribution analysis include coal feedstock, biomass (including current fates), transport, net emissions, and other (e.g. construction and operation of power station, waste, water consumption).

The difference between the two scenarios represents the impacts of a shift from the reference scenario to the biomass scenario. Environmental savings are seen in most of the impact categories as a result of this shift, with the exception of ozone layer depletion and water scarcity.

The results show that the production of electricity from biomass at Redbank Power Station will save 882 kg$CO_2$-eq for every MWh generated (Table 9.1). Based on estimated annual production, this equates to an annual saving of 862 kt$CO_2$-eq.

**Table 9.1. Results summary, per MWh.**

| Impact category | Unit | Reference scenario | Biomass scenario | Difference between scenarios | Difference between scenarios (%) |
|---|---|---|---|---|---|
| Climate change | kg $CO_2$ eq | 944 | 62 | -882 | -93% |
| Fossil fuel depletion | MJ NCV | 10,224 | 1,162 | -9,062 | -89% |
| Ozone layer depletion | mg CFC- 11 eq | 1.6 | 8.8 | 7.2 | 458% |
| Photochemical oxidation | kg $C_2H_4$ eq | 0.5 | 0.04 | -0.5 | -93% |
| Acidification | kg $SO_2$ eq | 1.4 | 0.8 | -0.6 | -43% |
| Eutrophication | kg $PO_4^{3-}$ eq | 0.4 | 0.3 | -0.1 | -26% |
| Particulate matter | kg $PM_{2.5}$ | 0.13 | 0.04 | -0.09 | -67% |
| Water scarcity | m3 eq | 0.93 | 2.21 | 1.28 | 137% |
| Land use | kg C deficit | 159.03 | -52.93 | -211.96 | -133% |

The contribution analysis of the reference scenario shows that the majority of climate change impacts are caused by coal combustion (>95%), with a smaller portion associated with the coal feedstock itself (6%).

In the biomass scenario, the climate change impacts are considerably lower, primarily due to low impacts associated with biomass combustion at the plant. The carbon dioxide emitted was previously absorbed as the biomass was grown, resulting in lower net emissions. Approximately 36% of the climate change burdens come from the transport of feedstock to the power station, with a similar portion (36%) linked to processing the biomass. These processing impacts are driven by the combustion of diesel for wood chipping. The majority of the remaining impacts (26%) are associated with the emissions that occur at the power station such as nitrous oxide and methane.

The main results of the LCA showed that the production of electricity with biomass results in environmental savings in all impact categories except for ozone layer depletion and water scarcity. Ozone layer depletion is considered irrelevant since the emissions contributions are small and come from deep within the transport supply chain. Additionally, the water consumption was modelled conservatively, without considering potential use of stormwater.

The normalisation results presented in Figure 9.4 show that the biomass scenario results in significant environmental savings in the impact categories which hold the largest shares of global impacts (climate change, fossil fuel depletion,

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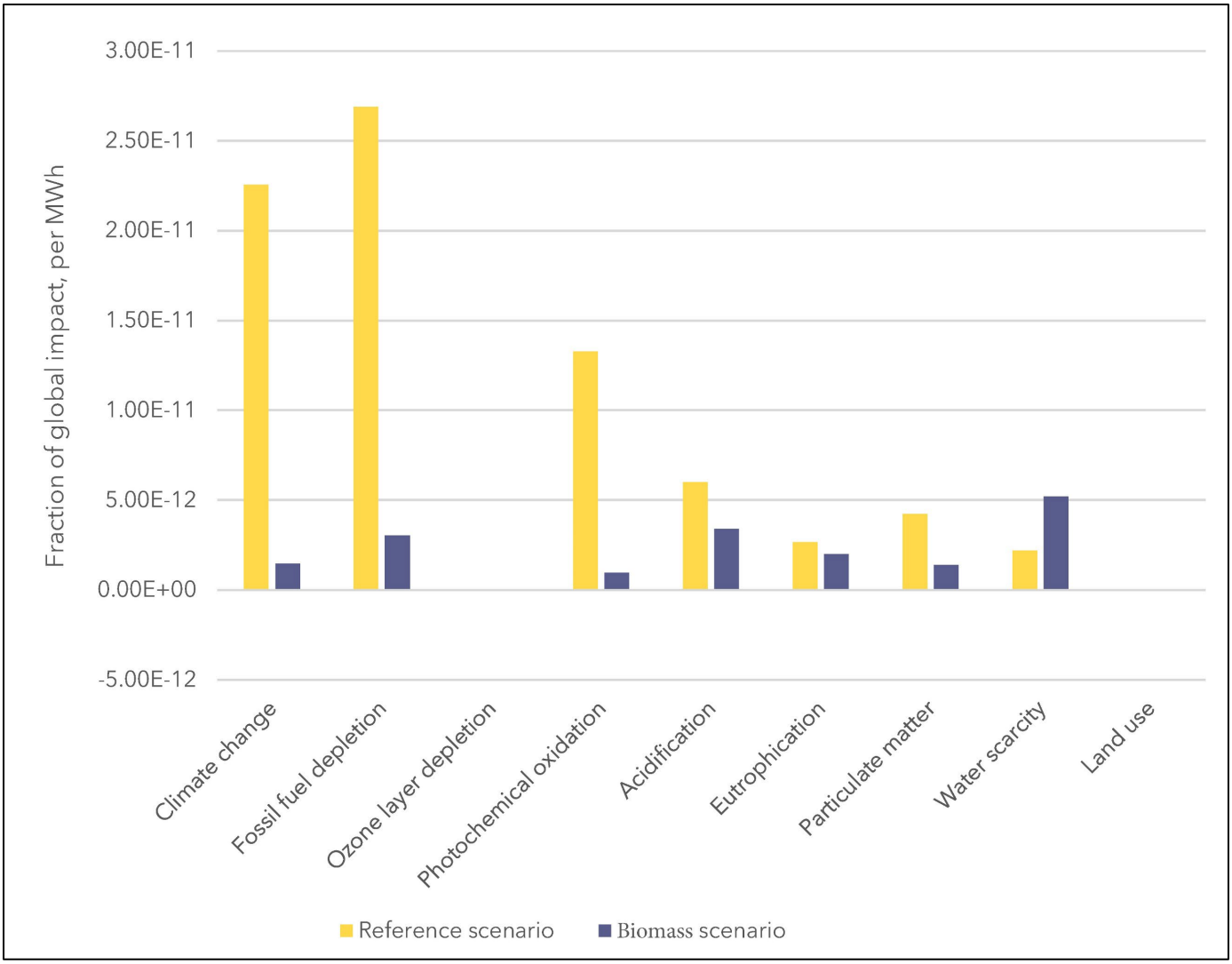
and photochemical oxidation). So, while the conversion of Redbank Power Station to a biomass facility may result in environmental effects in some impact categories, the magnitude of these effects is small in comparison to global impacts and other impact categories.

**Figure 9.4. LCA results, normalised.**




The results of the LCA assume, on average, a distance of 300km from the site of collection to Redbank Power Station, excluding the energy crops, which are assumed to be located 50km from the power station. An additional 50km is assumed for the pelletisation of agricultural residues.

Impacts from diesel consumption for transport and shipping are prevalent across several impact categories. Smaller transport radius would result in lower impacts in all impact categories.

In terms of climate change, halving transport distance allows to reduce impacts of the biomass scenario by 12%. A similar trend is observed on all other indicators. Introducing biofuels for chipping and transport has a significant effect on climate change impacts, resulting in a 67% reduction.

Combining these two strategies results in a 72% reduction in climate change impacts. When biofuels are introduced, the impacts of the biomass scenario reduces for climate change, fossil fuel depletion and ozone layer depletion. However, an increase in impacts is seen in the remaining indicators. This affects the preferred scenario for

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eutrophication and land use, meaning that for these two categories, the use of biofuels means that the coal reference scenario performs better.

However, normalisation of the results would show that total land use impacts are insignificant on a global scale. Eutrophication was also not identified as a key impact category.

## 9.4. Mitigation Measures

In order to maximise the environmental benefits of the production or electricity with biomass at Redbank Power Station, steps should be made, where reasonable and feasible, to minimise transport distances and implement a switch to biodiesel for chipping and transport.

No further mitigation measures are recommended by the LCA outside of those already provided for in Appendix C of this EIS.

## 9.5. Conclusion

The LCA compared two scenarios: a reference scenario representing a 'business-as-usual' approach, with continued reliance on coal-fired power stations. The biomass scenario is the conversion of Redbank Power Station to produce electricity for the NSW grid using 100% biomass. The difference between the two scenarios represents the impacts of a shift from the reference scenario to the biomass scenario.

The results show that the Proposal would result in in environmental savings to climate change, fossil fuel depletion, photochemical oxidation, acidification eutrophication, particulate matter and land use impacts. Ozone layer depletion and water scarcity were the only impact category where the impacts of a shift are increased. However, ozone layer depletion is considered irrelevant since the emissions contributions are small and come from deep within the transport supply chain. Additionally, the water consumption was modelled conservatively, without considering potential use of stormwater.

The biomass scenario results in significant environmental savings in the impact categories which hold the largest shares of global impacts (climate change, fossil fuel depletion, and photochemical oxidation).

In quantitative terms, the production of electricity from biomass at Redbank Power Station will save 882 kg$CO_2$-eq for every MWh generated. This equates to an annual saving of 862 kt$CO_2$-eq.

The majority of this saving is due to the absorption of carbon through the growth phase of feedstocks – the products of which ultimately forms the wastes which enter the combustion process. The physical emissions of carbon dioxide from the power station is negated by this earlier absorption.

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# 10. Air Quality and Odour

An air quality impact assessment (AQIA) has been prepared for the Proposal (Appendix O) and includes a quantitative assessment of potential air quality impacts from construction and operation of the Proposal.

Dispersion modelling assessment was carried out in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA 2022) and with the SEARs (SSD-56284960). The atmospheric dispersion modelling for this assessment used the CALMET/CALPUFF model. The Commonwealth Scientific and Industry Research Organisation (CSIRO) prognostic meteorological model TAPM was used to generate gridded upper air data for each hour of the model run period, for input into CALMET.

## 10.1. Impact Assessment Criteria

The assessment approach and criteria are taken from NSW EPA 2022. The impact assessment criteria for common or 'criteria' air pollutants are presented in Table 10.1.

These assessment criteria are applied at the nearest existing or likely future sensitive receptors, with the incremental impact (i.e. predicted impact due to the project alone) and total impact (i.e. incremental impact plus the existing background concentration) reported. The exception is the criteria for hydrogen fluoride, which is applied across areas where land use may be sensitive to fluoride (e.g. vineyards).

**Table 10.1. Impact assessment criteria – 'criteria' pollutants.**

| Pollutant | Averaging period | Impact assessment criteria |
|---|---|---|
| **Total Suspended Particles (TSP)** | Annual | 90 µg/m$^3$ |
| **$PM_{10}$ (Particulate matter less than10 micrometres in aerodynamic diameter)** | 24-hour | 50 µg/m$^3$ |
| | Annual | 25 µg/m$^3$ |
| **$PM_{2.5}$** | 24-hour | 25 µg/m$^3$ |
| | Annual | 8 µg/m$^3$ |
| **Nitrogen Dioxide ($NO_2$)** | 1-hour | 164 µg/m$^3$ |
| | Annual | 31 µg/m$^3$ |
| **Sulfur dioxide ($SO_2$)** | 1-hour | 215 µg/m$^3$ |
| | 24-hour | 57 µg/m$^3$ |
| **Carbon monoxide (CO)** | 15-minute | 100 mg/m$^3$ |
| | 1-hour | 30 mg/m$^3$ |
| | 8-hour | 10 mg/m$^3$ |
| **Lead (Pb)** | Annual | 0.5 µg/m$^3$ |
| **Hydrogen fluoride (HF)*** | 24-hour | 2.9 µg/m$^3$ |

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| Pollutant | Averaging period | Impact assessment criteria |
|---|---|---|
| | 7 days | 1.7 µg/m$^3$ |
| | 30 days | 0.84 µg/m$^3$ |
| | 90 days | 0.5 µg/m$^3$ |

* The IAC for general land use has been applied

Impact assessment criteria for principal and individual toxic air pollutants are listed in Table 10.2. These criteria are applied at and beyond the boundary of the emitting source. Incremental impacts are reported as the 99.9$^{th}$ percentile concentration for an averaging period of 1-hour. There are no impact assessment criteria for total Volatile Organic Compounds (VOCs), however impact assessment criteria are prescribed for various individual toxic and odorous VOCs, and a few of the more commonly assessed substances.

**Table 10.2. Impact assessment criteria – principal and individual toxic air pollutants.**

| Pollutant | Averaging period (99.9th percentile) | Impact assessment criteria |
|---|---|---|
| **Trace elements** | | |
| Antinomy | 1-hour | 9 µg/m$^3$ |
| Arsenic | 1-hour | 0.09 µg/m$^3$ |
| Beryllium | 1-hour | 0.004 µg/m$^3$ |
| Cadmium | 1-hour | 0.018 µg/m$^3$ |
| Chromium III | 1-hour | 9.0 µg/m$^3$ |
| Chromium VI | 1-hour | 0.09 µg/m$^3$ |
| Copper | 1-hour | 18 µg/m$^3$ |
| Manganese | 1-hour | 18 µg/m$^3$ |
| Mercury organic | 1-hour | 0.18 µg/m$^3$ |
| Mercury inorganic | 1-hour | 1.8 µg/m$^3$ |
| Nickel | 1-hour | 0.18 µg/m$^3$ |
| **Individual VOCs and toxic air pollutants** | | |
| Benzene | 1-hour | 29 µg/m$^3$ |
| Formaldehyde | 1-hour | 20 µg/m$^3$ |
| Toluene | 1-hour | 360 µg/m$^3$ |
| Ethylbenzene | 1-hour | 8000 µg/m$^3$ |
| Xylene | 1-hour | 190 µg/m$^3$ |
| Hydrogen Chloride | 1-hour | 140 µg/m$^3$ |
| PAH (as benzo(a)pyrene) | 1-hour | 0.4 µg/m$^3$ |
| Dioxins and furans | 1-hour | 2.0 e-6 µg/m$^3$ |

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## 10.2. Existing Environment

To assess potential air quality impacts across the surrounding area, residences and commercial/industrial locations within approximately 8 km of the Proposal site have been selected as discrete assessment locations, including the adjacent Dyno Nobel facility (noted by DN prefix) and the nearby Mt Thorley Industrial estate (noted by MTI and MTW prefix). The assessment locations are shown in Figure 10.1.

In addition to predictions at these discrete points, ground-level concentrations were predicted over a 21 km by 21 km modelling grid with a 250 m grid spacing. These gridded predictions were used to generate contour plots showing the extent of predicted ground-level concentrations across the local area.

The NSW Department of Planning and Environment (DPE) operates a number of air quality monitoring stations (AQMSs) within 10 km of the site, all of which measure meteorological parameters including wind, temperature and relative humidity. Analysis of meteorology for the region is presented based on the closest DPE AQMS. These were used in establishing baseline conditions.

Regional wind roses for the meteorological monitoring stations show a consistent regional pattern of dominant wind direction alignment along the northwest-southeast axis, typical of the Hunter Valley.

The data capture rate for the DPE AQMSs was excellent between 2015 and 2020. For example, at Warkworth, data capture was greater than 95% for all parameters in each of the six years. At Maitland Airport, 2018 was the only year with a data capture rate >90% for cloud height and cloud amount.

Unprecedented bushfire events from November 2019 to February 2020 resulted in elevated levels of $PM_{10}$ and $PM_{2.5}$. In 2019, exceptional events led to poor air quality on 127 days, compared with 50 days in 2018 and 18 days in 2017. $PM_{10}$ concentrations for 2018 were also elevated, primarily due to intensifying drought conditions. Due to the reduced cloud data availability for 2016 and 2017, the calendar year 2018 was selected for modelling.

**Background $PM_{10}$ and $PM_{2.5}$ concentrations**

The annual mean $PM_{10}$ concentrations for the period 2016 to 2020 are presented in Figure 10.2. The annual mean $PM_{10}$ concentration was above the impact assessment criterion (IAC)(red dotted line) in 2019 across all sites, and above the impact assessment criterion in 2018 at Maison Dieu, Mt Thorley and Warkworth. The annual mean $PM_{10}$ concentrations increased each year between 2016 and 2019 due to intensifying drought conditions, culminating with the unprecedented bushfire events between November 2019 and February 2020.

These resulted in higher-than-normal background air quality across much of NSW.

The annual mean $PM_{2.5}$ concentrations for the period 2016 to 2020 at Singleton and Camberwell are presented in Figure 10.3.

The annual mean $PM_{2.5}$ concentration was above the impact assessment criterion at Singleton for the last four years, and above the impact assessment criterion at Camberwell in 2018 and 2019. Noticeably higher concentrations were measured in 2019 at both sites.

There were no days above the impact assessment criterion for 24-hour average $PM_{2.5}$ in 2018.

Whilst there were 20+ days over the 24-hour average $PM_{2.5}$ at both sites in 2019, there were no days above the impact assessment criterion for 24-hour average $PM_{2.5}$ in 2018.

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**Figure 10.1. Air quality assessment locations (source: EMM 2023).**

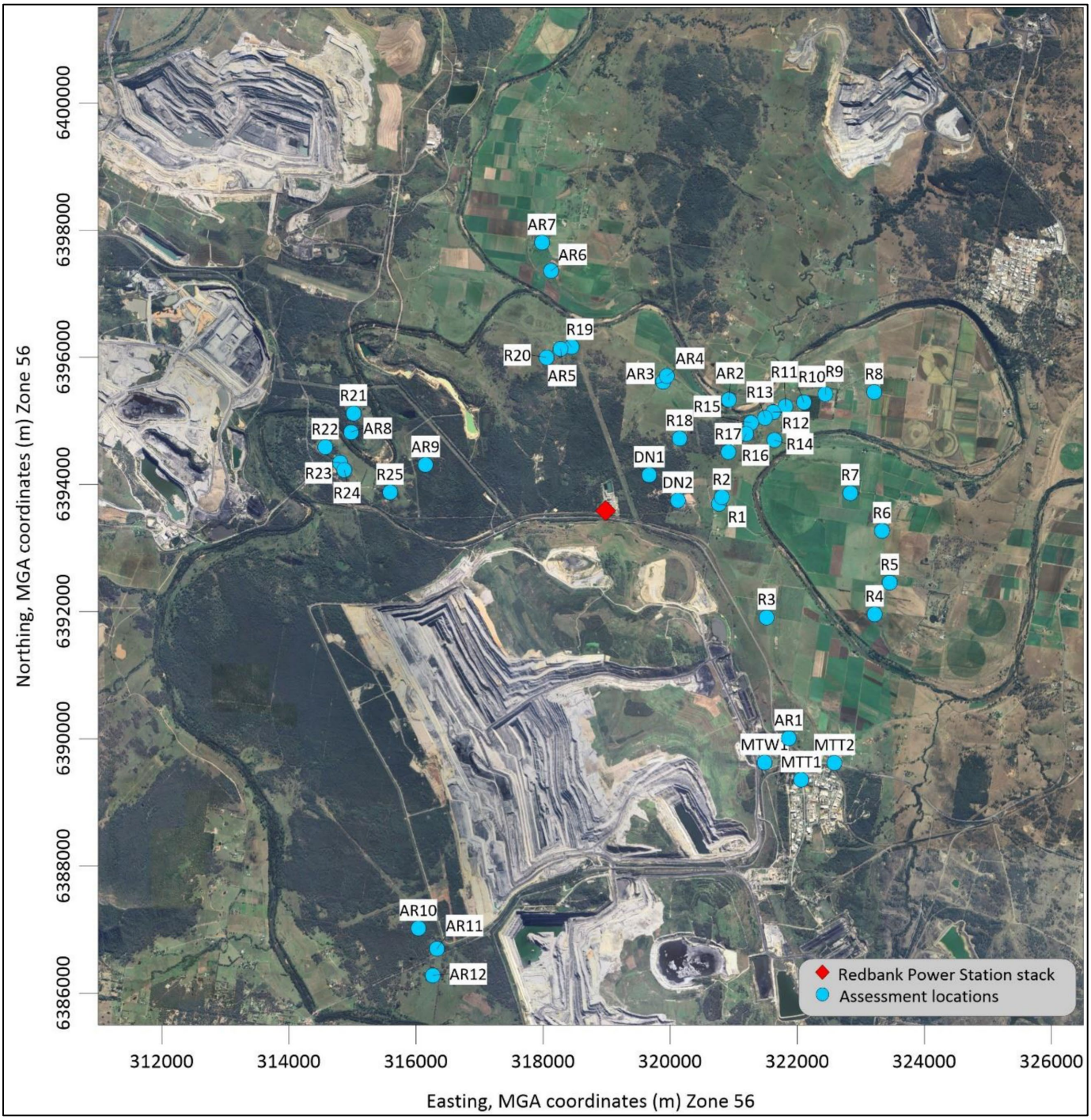


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**Figure 10.2. Annual average $PM_{10}$ concentrations 2016-2020. IAC is the red dotted line. (source: EMM 2023).**

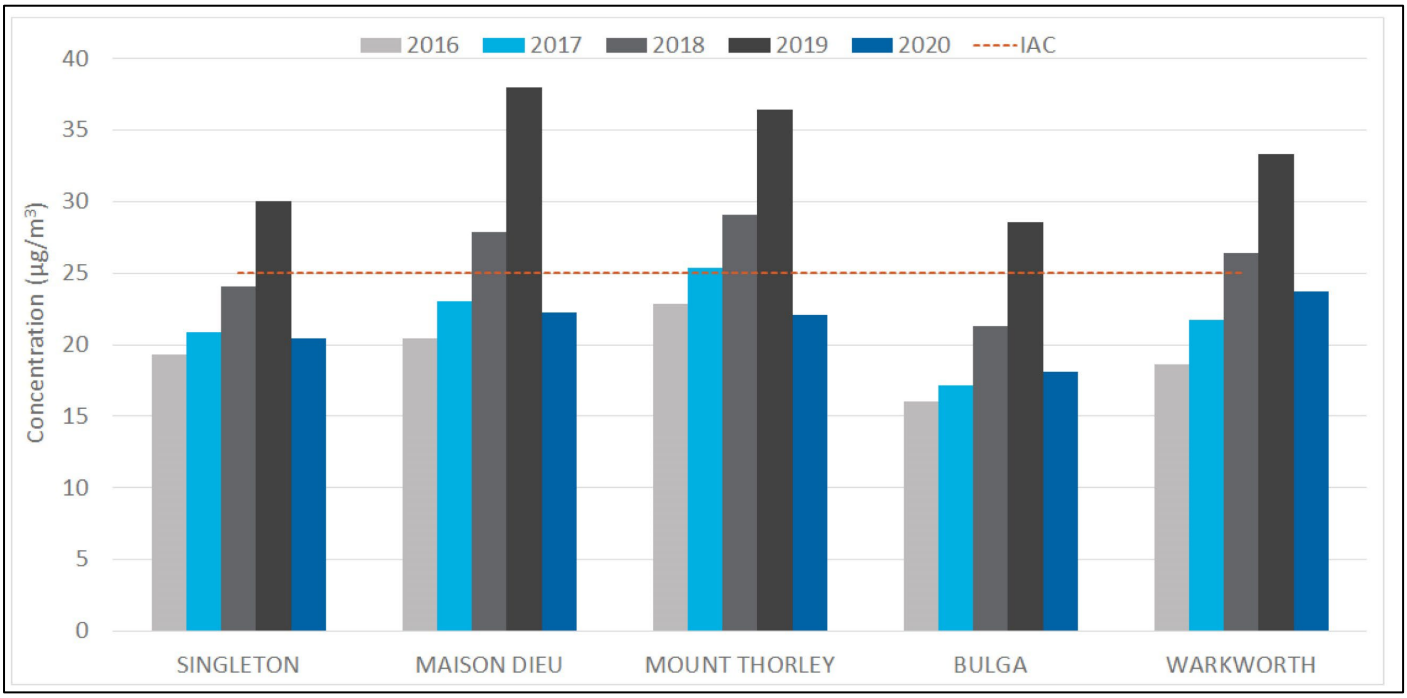
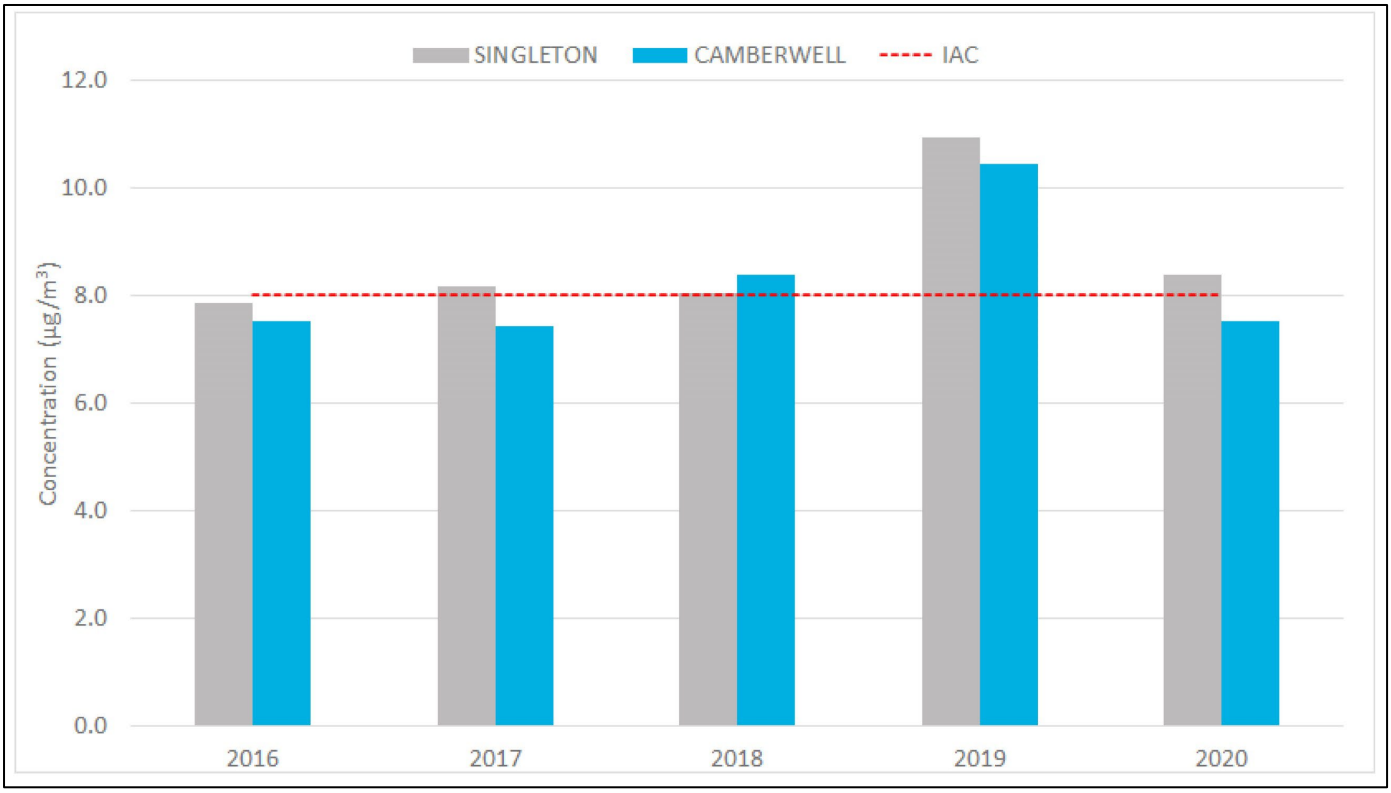



**Figure 10.3. Annual average $PM_{2.5}$ concentrations 2016-2020 (source: EMM 2023).**

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**Background CO, NO2 and SO2 concentrations**

Summary statistics for $NO_2$ and $SO_2$ at the Singleton AQMS are presented in Table 10.3. On average over the past five years, the maximum 1-hour $NO_2$ concentration was 40% of the impact assessment criterion, while the maximum 1-hour $SO_2$ concentration was 96% of the impact assessment criterion. The annual mean $NO_2$ concentration was 50% of the impact assessment criterion. The maximum 24-hour average $SO_2$ concentration was 51% of the impact assessment criterion.

CO was not measured at any of the Hunter Valley AQMSs, with the closest monitoring location being at Newcastle. Ambient concentrations of CO in the vicinity of the Proposal were expected to be very low, and cumulative impacts were not considered to be a key issue. For example, the maximum 1-hour CO concentration recorded at Newcastle between 2016 and 2020 was, on average, approximately 7% of the impact assessment criterion.

**Table 10.3. Summary statistics for background NO2, SO2 and CO (µg/m³).**

| Year | $NO_2$ | | $SO_2$ | | CO |
|---|---|---|---|---|---|
| | Max 1-hour (IAC=164 µg/m3) | Annual average1 (IAC=31 µg/m3) | Max 1-hour (IAC=215 µg/m3) | Max 24-hour (IAC=57 µg/m3) | Max 1-hour (IAC=30,000 µg/m3) |
| 2016 | 60.2 | 15.7 | 201.7 | 26.2 | 2,415 |
| 2017 | 67.7 | 15.5 | 259.4 | 26.2 | 1,610 |
| 2018 | 65.8 | 15.4 | 175.5 | 34.1 | 1,380 |
| 2019 | 69.6 | 15.7 | 251.5 | 31.4 | 2,185 |
| 2020 | 62.0 | 15.0 | 144.1 | 28.8 | 3,680 |

## 10.3. Emissions Control Systems of the Existing Power Plant

The use of a biomass fuel is not expected to require any change to the existing emission controls. A review of best practice for biomass combustion was based on the European Union Best Available Techniques (BAT) Reference Document (BREF) for Large Combustion Plants[43] (European Union, 2017). Measures identified in the BREF that already exist or will be employed for biomass combustion are summarised in Table 7.10.

Proposed management measures for fugitive emissions associated with fuel handling and storage are consistent with the Dust Management Plan (Appendix DD) prepared for the Proposal.

[43] Publications Office of the European Union, 2017 (European Union, 2017), Best Available Techniques (BAT) Reference Document for Large Combustion Plants. Web: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/JRC_107769_LCPBref_2017.pdf

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**Table 10.4. Summary of the best practice techniques employed at the Facility.**

| Category | Activity/Measure | Technique employed at Redbank | Achieved benefit |
|---|---|---|---|
| **Fuel** | Fuel source and quality | Use of biomass as alternative fuel | Provides significant emission benefit over BDT firing, particular for emissions of $SO_2$. |
| | | Fuel specification in supplier contract | Stable combustion conditions, resulting in lower NOx, and CO emissions and minimal $SO_2$ and HCl emissions due to low sulphur and chlorine content of fuel. |
| | | Use of uncontaminated wood waste | Reduction in emission of metals, VOCs, PAH and chlorinated compounds. |
| | | Fuel testing and validation | Compliance with fuel specification with associated reduced emissions |
| | | Fuel drying | Maintenance of fuel moisture content to design specification to achieve desired calorific value and associated thermal efficiency. |
| **Furnace stack** | Type of boiler | Use of the existing FiCirc fluidised bed boiler | Fluidised bed combustion (FBC) is a combustion technology especially suited for burning biomass fuels. NOx emissions are usually noticeably lower than conventional pulverised fuel combustion and do not require additional flue gas treatment. |
| | Process control | Combustion conditions (temperature, excess air) | Reduced thermal NOx formation due to combustion temperatures of 800-900 degC, while also avoiding low temperatures associated with VOC and PAHs formation, and conditions conducive to the formation of PCDD/F. |
| | Flue gas treatment | High efficiency cyclones | Cyclones used to capture fines and return to the combustion bed, provide some initial particle control before the flue gas passes to the steam generating units1 |
| | | Bag filter | Reduction of particle emissions, including fine dust ($PM_{2.5}$ and $PM_{10}$) with control efficiency >99%.<br>Co-benefit of reducing particle-bound mercury and other heavy metals. |
| | | Condition of bag house filters to be monitored and replaced in accordance with manufacturer recommendations | |
| **Fugitive emissions** | Wheel generated dust | Travel routes for trucks are paved and kept clean | Reduction in fugitive dust emissions (TSP, PM10 and PM2.5) |
| | | Street cleaner or water truck to be deployed as required, to maintain silt level (<2 $g/m^2$) and avoid visible track-out onto public roads. | |
| | | Site speed limits are enforced | |
| | Fuel handling and storage | Existing spray nozzles used moisten the surface of the biomass stockpile to suppress dust when required | |

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| Category | Activity/Measure | Technique employed at Redbank | Achieved benefit |
|---|---|---|---|
| | | Spray nozzles on conveyers to wet material and at conveyor transfer points | |
| | | Pre-wetting material prior to processing on hot and/or windy days. | |
| | | Minimise drop heights when handling materials | |
| | | All trucks hauling material are only uncovered before tipping into the bulk unloading hopper bins | |
| | | Centralised dust collection system for fuel handling in the fuel receival and reclaim areas (CV34, CV35 tail, CV36, and CV76) | |
| | Ash handling | Ash loading of trucks by either:<br>– Dry loading through a specially designed telescopic chute to a sealed container truck; or<br>– Via a puddle miser which pre-conditions the ash with sufficient moisture to prevent dust generation (typically 12 to 15% moisture). | |
| | | All trucks hauling material should be covered before exiting the Site and should maintain a reasonable amount of vertical space between the top of the load and top of the trailer | |

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### 10.3.1. Stack Emission Rates

Emission rates for biomass combustion for the expected case scenario were calculated based on emission factors taken from the *National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Combustion in Boilers* (NPI 2011). The calculated emission rates are summarised in Table 10.6. For the $PM_{10}$ and $PM_{2.5}$ emission rates, an additional control of 99% was added for the baghouse filters installed at Redbank. A control efficient of 99% is a conservative assumption, with performance specifications for the baghouse filters indicating a control efficiency of 99.5%.

Emission rates for biomass combustion for the RWC scenario were calculated by adopting the standard of concentration (or emission limits) provided for electricity generation, Group 6, in the Clean Air Regulation 2022.

**Table 10.5 Emissions rates for combustion sources – expected case.**

| Pollutant | Emission rate (g/s) | Source | Type | Notes |
|---|---|---|---|---|
| **CO** | 20.7 | NPI 2011, Table 32 | Bark fired boiler, fluidised bed combustion | Selected from Table 32 for the fluidised bed combustion option. |
| **NOx** | 29.5 | NPI 2011, Table 32 | Bark fired boiler, fluidised bed combustion | Selected from Table 32 for the fluidised bed combustion option. |
| **$SO_2$** | 5.0 | NPI 2011, Table 32/Table 33 | Wood/bark fired boilers | - |
| **$PM_{10}$** | 1.0 | NPI 2011, Table 32 | Wood/bark fired boilers, uncontrolled | Selected from Table 33 as the fuel will be a mixture of wood and bark. 99% control applied for the upstream baghouse filter. |
| **$PM_{2.5}$** | 0.8 | NPI 2011, Table 32 | Wood/bark fired boilers, uncontrolled | |
| **TSP** | 1.0 | NPI 2011, Table 32 | Wood/bark fired boilers, uncontrolled | As there was no emission rate for TSP, PM10 was selected. |
| **Hydrogen fluoride** | 0.94 | Fuel specification | 0.94 | Refer to Section 7.3 for details on fuel specification and emission rates for individual organic compounds and trace elements |
| **Hydrogen chloride** | 31.2 | Fuel specification | 31.2 | |
| **VOC** | 3.5 | NPI 2011, Table 32 | Wood/bark fired boilers, uncontrolled | |

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## 10.4. Impact Assessment

Atmospheric dispersion modelling was used to assess three firing scenarios:

- Approved operations (firing using BDT);
- Proposed operations with 100% firing on biomass for an 'expected case' scenario (i.e. expected operations); and
- Proposed operations with 100% firing on wood for a 'regulatory worst-case' scenario (RWC scenario) using NSW *Protection of the Environment Operations (Clean Air) Regulation* 2022 (Clean Air Regulation) emission limits.

BDT firing is no longer proposed for the Proposal and as such, these results are shown for reference only.

Fugitive emissions associated with fuel handling (BDT and biomass) were also considered. A fugitive emissions inventory was developed for biomass and coal handling, for activities including:

- Wheel generated dust on sealed access road from trucks delivering fuel to site (biomass only);
- Trucks unloading to hopper (biomass only);
- Conveyors / transfers to stockpile / silos (biomass and coal);
- Wheeled dozer / front end loader (FEL) on stockpile – rehandle to hopper and wheel generated dust from FEL movements (biomass and coal);
- Diesel emissions from wheeled dozers / front end loaders; and
- Wind erosion from stockpile (biomass and coal).

Furnace stack emissions for the expected case scenario are of burning biomass are provided in detail in the AQIA (Appendix O).

Emission rates for biomass combustion for the expected case scenario were calculated based on emission factors taken from the National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Combustion in Boilers (NPI 2011). The emission rates for BDT combustion were estimated from historical monitoring data for the facility. The calculated emission rates are summarised in the AQIA (Appendix O).

### 10.4.1. POEO Clean Air Regulation 2022 Requirements

Schedule 3 of the POEO Clean Air Regulation sets out the emissions standards for electricity generation (for any boiler operating on a fuel other than gas). These are summarised in Table 10.6. Group 5 emissions standards apply to premises which commenced on or after 1 August 1997 and are therefore relevant to the Proposal. Group 6 emissions standards apply to premises which commenced on or after 1 September 2005.

The existing EPL limits are largely consistent with Group 5 limits. Group 5 premises become Group 6 if development consent is modified after 1 September 2005 and the effect of the modification is to increase, intensify or change the nature of emissions to air. This would not be the case for the Proposal with emission expected to be similar or lower than existing (approval). Notwithstanding, the more stringent Group 6 limits have been adopted for biomass combustion.

Adopting Group 6 limits for biomass combustion would tighten the existing limits and would, as the most stringent limits in the POEO Clean Air regulation, reflect proper and efficient operation for the Facility.

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**Table 10.6. Clean Air Regulation 2022 standards of concentrations for electricity generation.**

| Pollutant | EPL limit (mg/Nm$^3$) | POEO Clean Air Regulation limit (mg/Nm$^3$) | |
|---|---|---|---|
| | | Group 5 | Group 6 |
| Solid particles | 82 | 100 | 50 |
| NOx (as $NO_2$ equivalent) | 799 | 800 | 500 |
| $SO_2$ | 649 | NA | NA |
| Type 1 and Type 2 substances | 2.5 | 5 | 1 |
| Fluoride | 50 | 50 | 50 |
| Cadmium or Mercury | NA | 1 | 0.2 |
| Dioxins or furans | NA | | 0.1 |
| VOCs (as n-propane equivalent) | NA | NA | 40 |

## 10.4.2. Expected Case Emissions

### *10.4.2.1. Incremental concentrations – expected case*

**Incremental $PM_{10}$ and $PM_{2.5}$ concentrations– expected case**

The incremental ground-level $PM_{10}$ concentrations for the Proposal for the expected case scenario are presented in Table 10.7.

The highest incremental 24-hour average $PM_{10}$ concentration for the furnace stack alone was 0.26 µg/m$^3$ for biomass firing. The highest incremental annual average $PM_{10}$ concentration for the furnace stack alone was 0.03 µg/m$^3$ for biomass firing.

For BDT firing, the highest 24-hour and annual average $PM_{10}$ concentrations were 0.40 µg/m$^3$ and 0.04 µg/m$^3$, respectively.

When fugitive emissions were also included, the highest incremental 24-hour average $PM_{10}$ concentration was 2.2 µg/m$^3$ for biomass and 0.93 µg/m$^3$ for BDT. The highest incremental annual average $PM_{10}$ concentration was 0.3 µg/m$^3$ for biomass and 0.1 µg/m$^3$ for BDT.

**Table 10.7. Predicted incremental ground-level concentrations for $PM_{10}$ (µg/m$^3$) – expected case.**

| Receptor ID | Furnace stack alone | | | | Furnace stack plus fugitive | | | |
|---|---|---|---|---|---|---|---|---|
| | Biomass firing | | BDT firing | | Biomass firing | | BDT firing | |
| | 24-hour | Annual | 24-hour | Annual | 24-hour | Annual | 24-hour | Annual |
| Receptor max (AR9) | 0.26 | 0.03 | 0.40 | 0.04 | 2.2 | 0.3 | 0.93 | 0.11 |
| as % of IAC | 0.5% | 0.1% | 0.8% | 0.2% | 4.5% | 1.1% | 1.9% | 0.5% |

The incremental ground-level $PM_{2.5}$ concentrations are presented in Table 10.8. The highest incremental 24-hour average $PM_{2.5}$ concentration for the furnace stack alone was 0.21 µg/m$^3$ for biomass firing and 0.13 µg/m$^3$ for BDT

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firing. The highest incremental annual average $PM_{2.5}$ concentration for the furnace stack alone was 0.02 µg/m$^3$ for biomass firing and 0.015 µg/m$^3$ for BDT firing.

When fugitive emissions were also included, the highest incremental 24-hour average $PM_{2.5}$ concentration was 0.5 µg/m$^3$ for biomass and 0.24 µg/m$^3$ for BDT, while the highest incremental annual average $PM_{2.5}$ concentration was 0.07 µg/m$^3$ for biomass and 0.03 µg/m$^3$ for BDT.

**Table 10.8. Predicted incremental ground-level concentrations for $PM_{2.5}$ (µg/m$^3$) – expected case.**

| Receptor ID | Furnace stack alone | | | | Furnace stack plus fugitive | | | |
|---|---|---|---|---|---|---|---|---|
| | Biomass firing | | BDT firing | | Biomass firing | | BDT firing | |
| | 24-hour | Annual | 24-hour | Annual | 24-hour | Annual | 24-hour | Annual |
| Receptor max (AR9) | 0.21 | 0.02 | 0.13 | 0.015 | 0.5 | 0.07 | 0.24 | 0.03 |
| as % of IAC | 0.8% | 0.3% | 0.5% | 0.2% | 2.0% | 0.8% | 0.9% | 0.4% |

**Incremental CO and $NO_2$ Concentrations– expected case**

The incremental ground-level concentrations of CO, $NO_2$ and $SO_2$ for biomass firing are presented in Table 10.9, and those for BDT firing are presented in Table 10.10. Results are not presented separately for the furnace stack and fugitive emissions, as the furnace stack is the dominant source of these pollutants. Annual mean $SO_2$ concentrations are for information only, as there is no corresponding impact assessment criterion.

For biomass firing, the maximum incremental ground-level concentrations of CO for the 15-minute, 1-hour and 8-hour periods were all less than 1% of the corresponding impact assessment criteria. A qualitative assessment of risk was made based on approaches used in other jurisdictions for screening out insignificant impacts[44]. Based on these screening criteria, the incremental ground-level concentrations for CO for biomass were determined to be insignificant. The largest risks were for $NO_2$, and $SO_2$:

- For $NO_2$, the concentration was 22% of the 1-hour criterion and 1% of the annual average criterion; and
- For $SO_2$ the concentration was 1.6% of the 1-hour criterion and 0.6% of the 24-hour criterion.

The ground-level concentrations of CO, $NO_2$ and $SO_2$ were higher for BDT than for biomass. In particular, CO and $SO_2$ were significantly higher for BDT.

**Table 10.9. Predicted incremental ground-level concentrations CO, $NO_2$ and $SO_2$ (µg/m$^3$) Biomass – expected case.**

| Receptor ID | CO | | | $NO_2$ | | $SO_2$ | | |
|---|---|---|---|---|---|---|---|---|
| | 15-min | 1-hour | 8-hour | 1-hour | Annual | 1-hour | 24-hour | Annual |
| Receptor max (R17) | 51.1 | 38.7 | 12.4 | 55.1 | 0.6 | 9.3 | 1.3 | 0.1 |
| as % of IAC | 0.1% | 0.1% | 0.1% | 22.4% | 1.0% | 1.6% | 1.6% | N/A |

[44] For example, in Western Australia the Department of Water and Environmental Regulation has proposed screening concentrations (SC) to identify emission sources as insignificant (DWER 2019). The SC are expressed as a percentage of the air quality guidelines values (AGVs). For annual averages, the SC are <1% of the AGV, for 24-hour averages, the SC are <3% of the AGV and for 1-hour averages, the SC are <10% of the AGV. This approach is consistent with that used in the UK for permitting, where the Environment Agency (2011) defines 1% of the annual standard and 10% of the short-term standard.

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**Table 10.10. Predicted incremental ground-level concentrations CO, $NO_2$ and $SO_2$ (µg/m³) BDT.**

| Receptor ID | CO | | | $NO_2$ | | $SO_2$ | | |
|---|---|---|---|---|---|---|---|---|
| | 15-min | 1-hour | 8-hour | 1-hour | Annual | 1-hour | 24-hour | Annual |
| Receptor max (R17) | 509.0 | 385.8 | 120.3 | 89.7 | 2.0 | 399.8 | 55.4 | 6.1 |
| as % of IAC | 0.5% | 1.3% | 1.2% | 54.7% | 6.5% | 186.0% | 97.2% | N/A |

**Incremental Other Pollutants (Metals, Volatile Organic Carbon-VOCs and Hydrogen Fluoride-HF) – expected case**

The modelling predictions for biomass and BDT firing were below the impact assessment criteria for all pollutants. In some cases, concentrations were higher for biomass (e.g. antimony, beryllium, cadmium) and in some cases, concentrations were higher for BDT firing (e.g. arsenic, mercury, and nickel). All modelling predictions were well below the impact assessment criteria.

**Incremental Odour– expected case**

Odour in the past has been an issue of concern, based on historical odour issues from coal combustion. Relative to biomass, the sulphur content of coal is high and produces significantly higher emissions and ground level concentrations of $SO_2$. Firing with biomass achieves a 97% reduction in ambient concentrations of $SO_2$. Reported[45] odour thresholds for $SO_2$ range from 1,175 µg/m³ to ~12,500 µg/m³.

The predicted ground level concentrations of $SO_2$ from biomass combustion are well below odour detection thresholds (in the order of 11 µg/m³), therefore odour impacts are unlikely to occur.

#### *10.4.2.2. Cumulative concentrations – expected case*

**Cumulative $PM_{10}$ and $PM_{2.5}$ concentrations – Expected Case**

Cumulative ground-level results are presented by adding the modelled increment (furnace stack plus fugitive) to the background concentrations.

When background concentrations were added to the Proposal increment, there were no additional days above the 24-hour average impact assessment criterion for $PM_{10}$ and $PM_{2.5}$, for either the approved (BDT) or proposed (biomass) operations.

The existing background for annual average $PM_{10}$ and $PM_{2.5}$ was already above the impact assessment criteria for 2018. However, the contribution from the Proposal (biomass firing plus fugitive emissions) to annual average $PM_{10}$ and $PM_{2.5}$ was approximately 1% of the impact assessment criteria and could be considered insignificant based on the approaches used in other jurisdictions for screening out insignificant impacts (DWER 2019; Environment Agency 2011).

[45] National Research Council (US) Committee on Acute Exposure Guideline Levels. Washington (DC): National Academies Press (US); 2010. Acute Exposure Guideline Levels for Selected Airborne Chemicals: Volume 8. Website: https://www.ncbi.nlm.nih.gov/books/NBK219999/

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**Table 10.11. Predicted cumulative ground-level concentrations for $PM_{10}$ and $PM_{2.5}$ ($\mu g/m^3$) – expected case.**

| Receptor ID | $PM_{10}$ | | | | $PM_{2.}$ | | | |
|---|---|---|---|---|---|---|---|---|
| | Biomass firing | | BDT firing | | Biomass firing | | BDT firing | |
| | 24-hour | Annual | 24-hour | Annual | 24-hour | Annual | 24-hour | Annual |
| Receptor max (DN1) (R3 for $PM_{2.5}$) | 49.6 | 26.2 | 49.6 | 26.0 | 21.0 | 8.3 | 20.9 | 8.2 |
| as % of IAC | 50 | 25 | 50 | 25 | 25 | 8 | 25 | 8 |

**Cumulative CO, $NO_2$ and $SO_2$ Concentrations – Expected Case**

The cumulative modelling results for CO were based on a conservative approach whereby the highest 1-hour average background concentration was added to the highest 1-hour average modelled concentration. The cumulative modelling predictions, presented in Table 10.12, show that the air quality risk for CO was minimal, for both the approved (BDT) or proposed (biomass) operations, with cumulative concentrations being less than 5% of the impact assessment criterion.

**Table 10.12. Predicted cumulative ground-level concentrations for 1-hour average CO ($\mu g/m^3$) – expected case.**

| | Biomass | BDT |
|---|---|---|
| IAC | 30,000 | 30,000 |
| Highest increment | 51.1 | 385.8 |
| Background | 1,380 | 1,380 |
| Cumulative | 1,431 | 1,766 |
| Cumulative as % of IAC | 5% | 6% |

The cumulative modelling predictions for $NO_2$ and $SO_2$ are presented in Table 10.13. Emissions from the furnace stack were modelled as NOx while the impact assessment criteria are applicable to $NO_2$. The predicted NOx concentrations were added to the background NOx concentrations and then converted to $NO_2$ using the ambient ratio method. Cumulative modelling predictions for $SO_2$ were derived by adding each hourly modelling prediction for each receptor to the corresponding hourly background. Again, the annual mean $SO_2$ concentrations are presented for information only.

The results show that, for biomass firing, there would be no exceedances of the impact assessment criteria for $NO_2$ or $SO_2$.

For BDT firing, there would be no exceedances of the $NO_2$ criteria, but both the 1-hour and 24-hour $SO_2$ criteria would be exceeded. The cumulative 1-hour $SO_2$ exceedances for BDT combustion occurred at 15 of the 42 assessment locations. A cumulative 24-hour $SO_2$ exceedance occurred at one of the 42 assessment locations.

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**Table 10.13. Predicted cumulative ground-level concentrations for $NO_2$ and $SO_2$ (µg/m³) – expected case.**

| Receptor ID | NO2 | | | | SO2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Biomass | | BDT | | Biomass | | | BDT | | |
| | 1-hour | Annual | 1-hour | Annual | 1-hour | 24-hour | Annual | 1-hour | 24-hour | Annual |
| Receptor max (variable) | 90.0 | 16.0 | 89.9 | 17.4 | 175.6 | 32.1 | 3.9 | 410.9 | 57.9 | 9.8 |
| IAC | 164 | 31 | 164 | 31 | 215 | 57 | N/A | 215 | 57 | N/A |

**Other Pollutants (Metals, Volatile Organic Carbon-VOCs and Hydrogen Fluoride-HF) – expected case**

The impact assessment criteria for individual toxic air pollutants were assessed against the incremental impact from the Proposal alone, and therefore cumulative concentrations do not need to be reported. Background concentrations for other pollutants, such as lead and hydrogen fluoride, in the local area were expected to be negligible, and therefore cumulative concentrations would be minimal.

## 10.4.1. Regulatory Worst-Case Scenario (RWC)

Air quality modelling for the RWC case scenario demonstrates that, based on the modelled emission rates, the health and amenity of the surrounding community would be protected.

### *10.4.1.1. Incremental concentrations – regulatory worst case*

**$PM_{10}$ and $PM_{2.5}$ concentrations - RWC**

The highest incremental 24-hour average $PM_{10}$ concentration for the furnace stack alone was 1.96 µg/m³ for biomass firing. The highest incremental annual average $PM_{10}$ concentration for the furnace stack alone was 0.22 µg/m³.

When fugitive emissions were also included, the highest incremental 24-hour average $PM_{10}$ concentration was 2.75 µg/m³ and the annual average was 0.32 µg/m³ for biomass firing.

**Table 10.14. Predicted incremental ground-level concentrations for $PM_{10}$ (µg/m³) – RWC.**

| Receptor ID | Furnace stack alone | | Furnace stack plus fugitive | |
|---|---|---|---|---|
| | Biomass firing | | Biomass firing | |
| | 24-hour | Annual | 24-hour | Annual |
| Receptor max (AR9) | 1.96 | 0.22 | 2.75 | 0.32 |
| as % of IAC | 3.9% | 0.9% | 5.5% | 1.3% |
| IAC | 50 | 25 | 50 | 25 |

The incremental ground-level $PM_{2.5}$ concentrations are presented in Table 10.15. The highest incremental 24-hour average $PM_{2.5}$ concentration for the furnace stack alone was 1.83 µg/m³ for biomass firing. The highest incremental annual average $PM_{2.5}$ concentration for the furnace stack alone was 0.20 µg/m³.

When fugitive emissions were also included, the highest incremental 24-hour average $PM_{2.5}$ concentration was 1.83 µg/m³ and the annual average was 0.21 µg/m³ for biomass firing.

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**Table 10.15. Predicted incremental ground-level concentrations for $PM_{2.5}$ (µg/m³) – RWC.**

| Receptor ID | Furnace stack alone | | Furnace stack plus fugitive | |
|---|---|---|---|---|
| | Biomass firing | | Biomass firing | |
| | 24-hour | Annual | 24-hour | Annual |
| Receptor max (AR9) | 1.83 | 0.20 | 1.83 | 0.21 |
| as % of IAC | 7.3% | 3.3% | 7.3% | 2.7% |
| IAC | 25 | 8 | 25 | 8 |

**Incremental CO and $NO_2$ Concentrations - RWC**

The incremental ground-level concentrations of CO and $NO_2$ for biomass firing are presented in Table 10.16. Results are not presented separately for the furnace stack and fugitive emissions, as the furnace stack is the dominant source of these pollutants. As there is no NSW POEO limit for $SO_2$ for electricity generation, $SO_2$ concentrations have not been presented for the RWC scenario.

For biomass firing, the maximum incremental ground-level concentrations of CO for the 15 minute, 1 hour and 8 hour periods were all less than 1% of the corresponding impact assessment criteria. A qualitative assessment of risk was made based on approaches used in other jurisdictions for screening out insignificant impacts18. Based on these screening criteria, the incremental ground-level concentrations for CO for biomass firing were determined to be insignificant.

The highest incremental 1-hour average $NO_2$ concentration was 86.94 µg/m³ for biomass firing. The highest incremental annual average $NO_2$ concentration was 1.58 µg/m³.

**Table 10.16. Predicted incremental ground-level concentrations for CO and $NO_2$ (µg/m³) – RWC.**

| Receptor ID | Biomass firing | | | Biomass firing | |
|---|---|---|---|---|---|
| | CO | | | $NO_2$ | |
| | 15-min | 1-hour | 8-hour | 1-hour | Annual |
| Receptor max (R17) | 47.40 | 35.92 | 11.46 | 86.94 | 1.58 |
| as % of IAC | 0.05% | 0.1% | 0.1% | 53.0% | 5.1% |
| IAC | 100,000 | 30,000 | 10,000 | 164 | 31 |

**Other Pollutants (Metals, Volatile Organic Carbon-VOCs and Hydrogen Fluoride-HF) - RWC**

The criteria for toxic and individual air pollutants are applied at and beyond the boundary of the emitting source, with the incremental impact reported as the 99.9th percentile concentration for an averaging period of 1 hour. All modelling predictions were well below the impact assessment criteria.

#### *10.4.1.1. Cumulative concentrations – regulatory worst case*

**Cumulative $PM_{10}$ and $PM_{2.5}$ concentrations – RWC**

Cumulative ground-level results are presented by adding the modelled increment (furnace stack plus fugitive) to the background concentrations. These results are presented in Table 10.17.

When background concentrations were added to the Proposal increment, there was one additional day over the impact assessment criteria at locations at two locations (MTT2 and AR1) for $PM_{10}$ for biomass operations. On the

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exceedance day, the 24-hour $PM_{10}$ background concentration was 49.5 µg/m$^3$ (or 99% of the criterion) and the increment for MTT2 was 0.78 µg/m$^3$ and 0.72 µg/m$^3$ for AR1. Given the minor contribution of the Proposal to this result, and the conservative nature of the RWC scenario, adverse impacts at MTT2 and AR1 due to the Proposal are considered to be unlikely.

The existing background for annual average $PM_{10}$ and $PM_{2.5}$ was already above the impact assessment criteria for 2018. However, the contribution from the Proposal (biomass firing plus fugitive emissions) to annual average $PM_{10}$ and $PM_{2.5}$ was less than 1.3% of the impact assessment criteria.

**Table 10.17. Predicted cumulative ground-level concentrations for $PM_{10}$ and $PM_{2.5}$ (µg/m$^3$) – RWC.**

| Receptor ID | $PM_{10}$ | | | | $PM_{2.}$ | | | |
|---|---|---|---|---|---|---|---|---|
| | Biomass firing | | BDT firing | | Biomass firing | | BDT firing | |
| | 24-hour | Annual | 24-hour | Annual | 24-hour | Annual | 24-hour | Annual |
| Receptor max (various) | 50.2 | 26.2 | 21.3 | 8.4 | 50.2 | 26.2 | 21.3 | 8.4 |
| as % of IAC | 100.5% | 104.5% | 85.4% | 105.0% | 100.5% | 104.5% | 85.4% | 105.0% |
| IAC | 50 | 25 | 25 | 8 | 50 | 25 | 25 | 8 |

**Cumulative CO and $NO_2$ Concentrations – RWC**

The cumulative modelling results for CO were based on a conservative approach whereby the highest 1-hour average background concentration was added to the highest 1-hour average modelled concentration. The cumulative modelling predictions, presented in Table 10.18, show that the air quality risk for CO was minimal, for both the approved (BDT) or proposed (biomass) operations, with cumulative concentrations being less than 5% of the impact assessment criterion.

**Table 10.18. Predicted cumulative ground-level concentrations for 1-hour average CO (µg/m$^3$) – expected case.**

| | Biomass |
|---|---|
| IAC | 30,000 |
| Highest increment | 36 |
| Background | 1,380 |
| Cumulative | 1,415 |
| Cumulative as % of IAC | 5% |

The cumulative modelling predictions for $NO_2$ are presented in Table 10.19. Emissions from the furnace stack were modelled as NOx while the impact assessment criteria are applicable to $NO_2$. The predicted NOx concentrations were added to the background NOx concentrations and then converted to $NO_2$ using the ambient ratio method.

The results show that for biomass firing there would be no exceedances of the impact assessment criteria for $NO_2$.

**Table 10.19. Predicted cumulative ground-level concentrations for $NO_2$ (µg/m$^3$) – RWC.**

| ID | Biomass | |
|---|---|---|
| | 1-hour | Annual |
| Receptor max | 90.0 | 17.0 |

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| ID | Biomass | |
|---|---|---|
| | 1-hour | Annual |
| as % of IAC | 54.9% | 54.9% |
| IAC | 164 | 31 |

**Cumulative Other Pollutants (Metals, Volatile Organic Carbon-VOCs and Hydrogen Fluoride-HF) – Expected Case**

As for the expected case, the impact assessment criteria for individual toxic air pollutants were assessed against the incremental impact from the Proposal alone, and therefore cumulative concentrations do not need to be reported. Background concentrations for other pollutants, such as lead and hydrogen fluoride, in the local area were expected to be negligible, and therefore cumulative concentrations would be minimal.

## 10.5. Mitigation Measures

With the implementation of the air quality mitigation and management measures provided in Table 10.20, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential air quality impacts and is therefore suitable for construction and operation.

**Table 10.20. Air quality management and mitigation measures.**

| Measure | Description |
|---|---|
| AQ1 | All existing emission controls at Redbank Power Station will be retained for the Proposal. |
| AQ2 | The monitoring requirements for the Facility are outlined in condition P1 and M2 of existing EPL 11262. These monitoring requirements would continue for the Proposal and will be modified if required following consultation with the NSW EPA. |
| AQ3 | A Dust Management Plan (see Appendix DD) will be implemented for construction and operation of the Facility. |
| AQ4 | An Air Quality Management Plan will be prepared and implemented that incorporates the monitoring requirements outlined in EPL 11262 and any other air quality monitoring requirements from associated approvals, permits and licences. |

## 10.6. Conclusion

The incremental concentrations for all pollutants for the boiler using biomass were below the impact assessment criterion for both the expected and RWC scenarios.

The cumulative concentrations for all pollutants using biomass were below the impact assessment criterion for both the expected and RWC scenarios with the exception of:

- Annual average $PM_{10}$ and $PM_{2.5}$ - the existing background for annual average $PM_{10}$ and $PM_{2.5}$ was already above the impact assessment criteria for 2018. However, the contribution from the Proposal (biomass firing plus fugitive emissions) to annual average $PM_{10}$ and $PM_{2.5}$ was approximately 1% of the impact assessment criteria; and
- 24-hour average $PM_{10}$ concentrations in the RWC scenario - when background concentrations were added to the Proposal increment, there was one additional day over the impact assessment criteria at locations MTT2 and AR1 for $PM_{10}$ for proposed biomass operations. On the exceedance day, the 24-hour PM10 background concentration was 49.5 µg/m$^3$ (or 99% of the criterion) and the increment for MTT2 was 0.78 µg/m$^3$ and 0.72

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µg/m$^3$ for AR1. Given the minor contribution of the Proposal to this result, and the conservative nature of the RWC scenario, adverse impacts as a result of the Proposal at MTT2 and AR1 are considered to be unlikely.

When comparing the modelled results for the biomass firing scenario versus the BDT firing scenario, it was generally found that:

- There was not a significant difference between $PM_{10}$ and $PM_{2.5}$ concentrations;
- $NO_2$ concentrations for BDT firing were higher than for biomass firing;
- CO and $SO_2$ concentrations for BDT firing were significantly higher than for biomass firing;
- For the other pollutants (metals, HF, HCl, VOCs and other organic and persistent organic pollutants), in some cases concentrations for BDT firing were higher and in some cases concentrations for biomass firing were higher; and
- All cumulative concentrations were well below the applicable impact assessment criterion with the exception of the $PM_{10}$ and $PM_{2.5}$ cases described above which were the result of elevated background levels.

The emission calculations from the facility account for a range of existing emission mitigation measures that are consistent with best practice measures. The expected case emission concentrations under biomass firing are calculated to be compliant with the applicable POEO emission limits. Stack emissions would be monitored and publicly reported an ongoing basis in accordance with NSW EPA specifications.

The AQIA has assessed the potential impacts to air quality from the Proposal and concluded the Proposal can meet relevant legislative and regulatory air quality criteria.

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# 11. Greenhouse gas and climate change

An expert report on Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan has been prepared to address potential greenhouse gas impacts due to the Proposal and assess considerations for climate change adaptation (Appendix P).

Scope 1 (on-site) and Scope 3 (off-site) GHG emissions1 from the operation of the Proposal were calculated on an annual basis, and for its estimated 30-year lifetime (from 2025/26 to 2054/55). As the Proposal would be a generator of electricity, Scope 2 emissions were not calculated.

Scope 1 emissions were calculated for fuel combustion (for electricity generation) using the biomass fuel, and for on-site diesel consumption associated with biomass handing and Proposal start-up. Scope 3 emissions were calculated for fuel combustion associated with biomass processing and transport to Redbank, as well as for on-site diesel use.

Redbank is not currently operational. Any 'business-as-usual' scenario would therefore have zero emissions. One operational scenario for the Proposal was considered. This scenario involved the operation of Redbank with no measures to avoid or reduce GHG emissions. Emissions were estimated based on the planned maximum operational throughput of biomass (25% moisture content) fuel of 850,000 tpa.

## 11.1. Existing Environment

The Intergovernmental Panel on Climate Change (IPCC)[46] has quantified the carbon budget for several global temperature limits and various levels of probability. Like a household budget, climate science sets a carbon budget for the amount of greenhouse gases that can be 'spent' (emitted) for a given level of global warming. If we exceed this budget, global temperatures will become higher.

The carbon budget for 1.5°C, 1.7°C and 2.0°C, with 83% likelihood of success, is 300, 550 and 900 Gt $CO_2$, respectively. For reference, 1 Gigatonne (Gt) = 1 billion tonnes. The values with 67% likelihood of success are 400, 700 and 1150 $GtCO_2$, respectively. The IPCC has not interpreted these findings to show that there are 7.5 years remaining at current rate of emissions before the budget for 1.5°C is exceeded. There are many uncertainties around the quantification of the carbon budget, particularly the trajectories of non-$CO_2$ greenhouse gases such as methane, that impact the size of the carbon budget.

The IPCC recognises that higher or lower reductions in accompanying non-$CO_2$ emissions can increase or decrease the values by 220 $GtCO_2$ or more. The IPCC has modelled many pathways for achieving the long-term temperature goal, many of which include "overshoot" and subsequent deployment of carbon dioxide removal, to meet the 1.5 or 2°C goal.

NSW DPIE released their Net Zero Plan Stage 1: 2020-2030, dated 14 March 2020, providing detail on initial strategies for NSW to meet net zero emissions by 2050 by delivering a 35% cut in emissions by 2030 compared to 2005 levels. As reported in the Net Zero Plan, the majority of emissions in NSW are derived from electricity generation (51 $MtCO_2$-e[47]) (i.e. megatonnes carbon dioxide equivalent).

For reference, carbon dioxide equivalent, or $CO_2$-e, means the number of metric tons of $CO_2$ emissions with the same global warming potential as one metric ton of another greenhouse gas.

[46] https://www.ipcc.ch/

[47] https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Climate-change/net-zero-plan-2020-2030-200057.pdf?la=en&hash=D65AA226F83B8113382956470EF649A31C74AAA7

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## 11.2. Impact Assessment

The GHG-generating activities for the Proposal are listed in Table 11.1. These include on-site activities that are categorised as Scope 1, and off-site activities that are categorised as Scope 3. The table shows the corresponding sources in the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) *National Greenhouse Accounts Factors* (NGAF) workbook (DCCEEW 2023a). These NGAF sources were used in the GHG emission calculations. Specific emission factors for each can be found in the *Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan* (Appendix P).

**Table 11.1. Proposed activities generating GHG emissions.**

| Scope | Activity(a) | IPCC sector | IPCC sub-sector | NGAF[1] source used in emission calculations |
|---|---|---|---|---|
| Scope 1 (on-site) | 1A: Electricity generation | Electricity (public electricity generation) | Other | Stationary combustion of solid fuels (dry wood/green and air dried wood) with fuel energy content of 20.2 GJ/t applied. |
| | 1B: Biomass handling | Electricity (public electricity generation) | Other | Stationary combustion of liquid fuels (diesel) |
| | 1C: Start-up | Electricity (public electricity generation) | Other | Stationary combustion of liquid fuels (diesel) |
| Scope 3 (off-site) | 3A: Biomass processing | Electric utilities | Fuel-and-energy-related activities | Stationary combustion of liquid fuels (diesel) |
| | 3B: Biomass transport | Electric utilities | Upstream transportation and distribution | Transport fuel combustion (diesel Euro III truck) |
| | 3C: Biomass handling (associated with on-site diesel use) | Electric utilities | Fuel-and-energy-related activities | Stationary combustion of liquid fuels (diesel) |
| | 3D: Start-up (associated with on-site diesel use) | Electric utilities | Fuel-and-energy-related activities | Stationary combustion of liquid fuels (diesel) |

[1] Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) National Greenhouse Accounts Factors (NGAF)

In accordance with conventions and reporting guidelines (e.g. IPCC 2006[48], 2019[49]; DCCEEW 2023[50]), the emission factor for $CO_2$ from the combustion of biogenic carbon was taken to be zero. The actual direct $CO_2$ emission at the point of biomass combustion would not be zero. However, there is a simplifying assumption in the guidelines that the amount of $CO_2$ released during combustion is balanced by the $CO_2$ taken up by the biomass during its life. These emission and removal mechanisms for $CO_2$ are therefore accounted for in the land use, land use change and forestry (LULUCF) sector, through an understanding of changes in biomass stock. In this GHG assessment, if the direct $CO_2$ emissions from burning the biomass had been included in the calculations, then there would effectively been a double counting of emissions in carbon accounting.

[48]Intergovernmental Panel on Climate Change (IPCC 2006), Guidelines for National Greenhouse Gas Inventories. Web: https://www.ipcc.ch/report/2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/

[49]Intergovernmental Panel on Climate Change (IPCC 2019), 2019 Refinements to the 2006 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories. Web: https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/

[50] Australian Government Department of Climate Change, Energy, the Environment and Water, (DCCEEW 2023), National Greenhouse Accounts Factors, Canberra. Web: https://www.dcceew.gov.au/climate-change/publications/national-greenhouse-accounts-factors-2023

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## 11.2.1. Scope 1 Emissions

The Scope 1 emissions for the Proposal, and for the two on-site activities, are given in Table 11.2. The total Scope 1 emission at capacity was calculated to be 21,241 t CO2-e/year, with the combustion of biomass for electricity generation being responsible for 97% of the total.

It is worth reiterating that the estimated GHG emissions from dry wood combustion were based on $CH_4$ and $N_2O$ only, and the emission factor for $CO_2$ was taken to be zero. Other studies have shown that even if $CO_2$ emissions from the burning of wood are included, there are life-cycle benefits associated with energy production from biomass in NSW (DPI 2017[51]; Cowie 2021[52]).

Plant startup will occur at the beginning of operating the power plant, however, start-up also occurs annually if the plant must shut down for maintenance etc.

In the first 3-4 years of ramp up of the Facility, there is a period where emissions are less than those shown in the table.

**Table 11.2. Summary of scope 1 emissions burning biomass at full capacity.**

| At Full Capacity | $CO_2$ | $CH_4$ | $N_2O$ | TOTAL |
|---|---|---|---|---|
| | (t $CO_2$-e/year) | (t $CO_2$-e/year) | (t $CO_2$-e/year) | (t $CO_2$-e/year) |
| **Electricity generation** | 0 | 1,717.0 | 18,887.0 | 20,604.0 |
| **Biomass handling** | 472.2 | 0.7 | 1.4 | 474.2 |
| **Plant start-ups** | 161.9 | 0.2 | 0.5 | 162.6 |
| **TOTAL** | **634.1** | **1,717.9** | **18,888.8** | **21,240.8** |

## 11.2.2. Scope 1 Emissions Intensity

The emissions intensity of electricity generation is expressed as the Scope 1 emission (in tonnes of $CO_2$-e) per net unit of electricity produced (in MWh).

The normal operational capacity of Redbank will be 146 MW. On the assumption that the power station would be operating at full capacity for 8,000 hours of the year, this equates to an electricity generation rate of 1,168,00 MWh/year. Given that the total Scope 1 emission for the Proposal at capacity is 21,241 t $CO_2$-e/year, the energy intensity of the Proposal is 0.0159 t $CO_2$-e/MWh.

In Table 11.3, the Proposal's emissions intensity (0.0182 t $CO_2$-e/MWh, or 18.2 t $CO_2$-e/GWh) is compared with the emission intensity values for a selection of other biomass-fuelled power stations in Australia and the UK. It can be seen that the value for the Proposal is lower than the values for the other facilities.

The NSW electricity grid is undergoing rapid decarbonisation. In NSW/ACT, in 2025 the emission intensity of the grid (for Scope 2 plus Scope 3) will be 0.53 t $CO_2$-e/MWh (530 t CO2-e/GWh). By 2035 the emission intensity reduces to 0.02 t $CO_2$-e/MWh (20 t $CO_2$-e/GWh) due to the closure of remaining coal-fired power stations. The emission intensity for the Proposal is therefore well below the current grid average for the state, and around 90% of the projected grid average for the state in 2035.

[51] Department of Primary Industries (DPI 2017), North Coast Residues: A project undertaken as part of the 2023 North Coast Forestry Project. Web: https://www.dpi.nsw.gov.au/forestry/science/forest-carbon/north-coast-residues-project#:~:text=This%20project%20investigated%20the%20potential,%3A%20Bulahdelah%2C%20Kempsey%20and%20Grafton.

[52] Cowie, A. 2021, Ecologically Sustainable Development assessment, Land and Environment Court Proceedings 2021/00128111, September 2021. Web: https://www.verdantearth.tech/wp-content/uploads/2022/03/Combined-ESD-report.pdf

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**Table 11.3. Examples of emissions intensity for biomass-fueled power stations.**

| Country | Facility | Capacity (MW, elec) | Fuel | Status | Emission intensity (Scope 1) (t CO2-e/GWh) | Source |
|---|---|---|---|---|---|---|
| Australia | Proposal | 146 | Biomass | Proposed | 18.2 | This report |
| | Broadwater Power Plant | 30 | Bagasse | Operational | 27.9 (2021-2022) | CER (2023) |
| | Condong Power Plant | 30 | Bagasse | Operational | 32.1 (2021-2022) | CER (2023) |
| | FPC Green Energy | N/A | Bagasse | Operational | 40.3 (2021-2022) | CER (2023) |
| UK | Drax Power Station | 2,640 | Wood pellets | Operational | 23 | UK DBEIS 2022; Drax web site(a) |

## 11.2.3. Scope 3 Emissions

The Scope 3 emissions for the two off-site activities, and the total for the Proposal, are given by year in Table 11.4.

**Table 11.4. Scope 3 emissions by source.**

| | 3A: Off-site processing | 3B: Off-ste transport | 3C: On-site handling | 3D: On-site start-up | Total |
|---|---|---|---|---|---|
| At Full Capacity | Diesel | Diesel | Diesel | Diesel | |
| | (t CO2-e/year) | (t CO2-e/year) | (t CO2-e/year) | (t CO2-e/year) | (t CO2-e/year) |
| | 567.6 | 4,255.1 | 116.9 | 40.1 | 4,979.6 |

## 11.2.4. GHG Mitigation Plan

In order to align with the NSW trajectory the minimum emission reductions for the Proposal are given in Table 11.5. It should be noted that these calculations assume that the electricity generation of the Proposal remains at capacity from 2029 onwards. Where there is a reduction in output in a future year, the emission-reduction target would reduce accordingly.

**Table 11.5. Scope 1 emission reduction targets for the Proposal.**

| Financial year | Scope 1 emission reduction (t CO2-e/year) | Financial year | Scope 1 emission reduction (t CO2-e/year) |
|---|---|---|---|
| 2025/26 | 685 | 2040/41 | 14,389 |
| 2026/27 | 1,370 | 2041/42 | 15,074 |
| 2027/28 | 2,056 | 2042/43 | 15,759 |
| 2028/29 | 2,741 | 2043/44 | 16,444 |
| 2029/30 | 3,426 | 2044/45 | 17,130 |
| 2030/31 | 4,111 | 2045/46 | 17,815 |
| 2031/32 | 5,481 | 2046/47 | 18,500 |
| 2032/33 | 6,852 | 2047/48 | 19,185 |
| 2033/34 | 8,222 | 2048/49 | 19,870 |
| 2034/35 | 9,593 | 2049/50 | 20,556 |
| 2035/36 | 10,963 | 2050/51 | 21,241 |

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| Financial year | Scope 1 emission reduction (t CO2-e/year) | Financial year | Scope 1 emission reduction (t CO2-e/year) |
|---|---|---|---|
| 2036/37 | 11,648 | 2051/52 | 21,241 |
| 2037/38 | 13,019 | 2052/53 | 21,241 |
| 2038/39 | 13,704 | 2053/54 | 21,241 |

Around 97% of the Proposal's Scope 1 emissions are due to the burning of biomass for electricity generation. However, there are currently no viable technologies for reducing these emissions at source. The remaining 3% of Scope 1 emissions are due to material handling. These emissions – and similarly the Scope 3 emissions from biomass processing and transport – could potentially be reduced to zero through the use of, for example, electric equipment and vehicles. Verdant will periodically review technological developments and will prioritise emission-reduction measures that are technically and commercially feasible.

Realistically, the main mechanism for addressing GHG emissions in the near future will be carbon offsetting. In other words, it is proposed that carbon offsetting will be used to achieve the targets above.

Verdant will use an offsetting agent that is accredited and regulated as per Recommendation 12 of the *Chubb Review of the Australian Carbon Credit Unit* (ACCU) Scheme. In accordance with Recommendation 9 of the Chubb Review, avoided deforestation projects will not be used. It is also expected that the carbon offsetting approach will give due regard to the integrity standards set out in the *Commonwealth Carbon Credits (Carbon Farming Initiative) Act 2011*. Moreover, it is noted that NSW prefers proponents to use carbon offsets that conserve, preserve, protect, enhance, and manage the NSW environment. Where appropriate offset projects cannot be identified in NSW, offset projects in other Australian locations may be used.

As the Proposal's Scope 1 emissions will not exceed 100,000 t $CO_2$-e per year at any time over its operational life, there is no requirement for the offsetting approach to be verified by an independent expert reviewer.

### 11.2.5. Safeguard Mechanism obligations

The Safeguard Mechanism is the Australian Government's policy for reducing GHG emissions at Australia's largest industrial facilities. In general terms, the Safeguard Mechanism applies to facilities with Scope 1 emissions of more than 100,000 tonnes of $CO_2$-e per year. However, the Safeguard Mechanism applies to the electricity sector in a different way by applying a single 'sectoral' baseline across all electricity generators connected to one of Australia's main electricity grids.

Upon recommencement of operations, the Facility will be considered as a new facility and a grid-connected electricity generator. As a grid-connected electricity generator, the Facility would fall under the sectoral baseline for electricity generation, meaning that:

- The Facility will not have an individual facility baseline; and
- Emissions from the Facility will be absorbed within the sectoral baseline, even if Redbank's annual emissions exceed 100,000 tonnes of $CO_2$-e.

The Safeguard Mechanism would only apply to Redbank if the sectoral baseline were to be exceeded (and Redbank's annual emissions exceed 100,000 tonnes of $CO_2$-e), and in this case Redbank would be required to comply with its own individual facility baseline, to be defined by the Clean Energy Regulator.

The national sectoral baseline for electricity generation is set at 198 million tonnes of $CO_2$-e per year. At around 21,241 t $CO_2$-e per year, the emissions from the Proposal represents a negligible contribution (0.011%) to the sectoral baseline. The Proposal therefore does not increase the risk of non-compliance with the sectoral baseline.

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## 11.3. Climate Change Adaptation Plan

A Climate Change Adaptation Plan (CCAP) has been prepared for the Proposal within Appendix P. The CCAP includes the following:

- A climate change risk assessment that addresses the potential impacts of climate hazards on the Proposal and its environmental performance, taking into account measures to reduce climate risk;
- The approach to monitoring and reporting; and
- The approach to reviewing the Climate Change Adaptation Plan.

The broad impacts of the changes in the climate variables on the Proposal and the environment. The changes can be summarised as follows:

- Temperature: Increase in maximum and mean temperature;
- Fire danger: Increase in high fire danger days;
- Rainfall: Increase in annual rainfall; and
- Storms: Decrease in frequency of storms, but increase in intensity in warmer months.

The effects of these changes were considered in relation to potential impacts on project assets or functions, including areas such as physical structures, transport and worker safety. In total, 17 potential impacts were identified.

The residual risk of climate change related impacts is generally low for the Proposal. The effectiveness of site management strategies and design will be reviewed on an ongoing basis throughout the life of the Proposal, in line with annual environmental reporting requirements for the Site. Where environmental monitoring (e.g. water, dust) indicate that breaches of environmental licence conditions have occurred and the likely contributing factors are a response to changes in climate (e.g. excessive water runoff, exceedance of dust deposition criteria), the relevant management strategies would be reviewed and amended as required.

The need to review the climate change impact risk assessment will be considered in alignment with the release of revisions to the NSW NARCliM modelling dataset (e.g. NARCliM 2.0). A first step of this review would be the interpretation of the general changes in climate for the Hunter Valley region relative to the projections applied in the current climate change risk assessment. Should significant variation be identified in the projections for future NARCliM datasets relative to NARCliM 1.0, the climate change risk assessment would be revisited.

## 11.4. Mitigation Measures

With the implementation of the greenhouse gas mitigation and management measures provided in Table 11.6, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential greenhouse gas impacts and is therefore suitable for construction and operation

**Table 11.6. Air quality management and mitigation measures.**

| Measure | Description |
|---|---|
| GHG1 | The Greenhouse Gas Mitigation Plan will be reviewed annually. Scope 1 and 3 GHG emissions will be calculated on an annual basis through fuel-based calculations and/or direct emissions monitoring. Mitigation measures, emission reduction strategies and emission offset commitments implemented during the reporting period would be detailed as part of the annual review. The review will address any relevant significant changes to the Proposal and its relationship to the Safeguard Mechanism. |
| GHG2 | The effectiveness of site management strategies and design will be reviewed on an ongoing basis throughout the life of the Proposal, in line with annual environmental reporting requirements for the Site. The need to |

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| Measure | Description |
|---|---|
| | review the Climate Change Adaptation Plan risk assessment will be considered for major revisions to NSW climate modelling. |

## 11.5. Conclusion

The total Scope 1 emission for the Proposal at capacity was calculated to be 21,241 t $CO_2$-e/year, with the combustion of biomass for electricity generation being responsible for 97% of the total.

The emissions intensity of electricity generation for the Proposal was estimated to be 0.0182 t $CO_2$-e/MWh. This value was lower than those identified for a selection of other biomass-fuelled power stations in Australia and the UK. In NSW/ACT, at Proposal commencement in 2025 the emission intensity of the grid (for Scope 2 plus Scope 3) will be 0.53 t $CO_2$-e/MWh. By 2035 the emission intensity reduces to 0.02 t $CO_2$-e/MWh due to the closure of remaining coal-fired power stations. The emission intensity for the Proposal was therefore well below the current grid average for the state, and around 90% of the projected grid average for the state in 2035.

The Proposal will be a small contributor to GHG emissions in NSW. Under a 'current policy' scenario for NSW, the project would represent 0.03% of state-wide emissions in 2030, and 0.08% in 2050.

The total Scope 3 emission for the Proposal at capacity was 4,980 t $CO_2$-e/year.

The Proposal is therefore justifiable based on the estimated low contribution to GHG emissions in NSW.

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# 12. Human Health and Risk

A Human Health Risk Assessment (HHRA) has been prepared for the Proposal (see Appendix Q) to assess potential impacts on community health for populations located off-site from potential changes in air quality due to the Proposal.

The HHRA has not addressed risks to workers involved in construction or operation of the Proposal. Workers involved in construction and operation of the Proposal would be managed under the *Work Health and Safety Act* 2011 and *Work Health and Safety Regulation* 2017 and all other relevant codes of practice as detailed by Work Safe NSW and Safe Work Australia.

## 12.1. Existing Environment

The HHRA identified the following sensitive land uses in the areas surrounding the Proposal:

- Urban residential areas in the surrounding towns and associated suburbs which include schools, preschools and aged care facilities; and
- Rural residential and agricultural areas, assumed to include:
    - Growing of homegrown produce for consumption (fruit and vegetables and eggs);
    - Raising livestock for home consumption and sale (including milk, beef and lamb); and
    - Growing of crops for sale.

The HHRA considers the community surrounding the Proposal, particularly those key residential and commercial/industrial receptor locations modelled in the AQIA (Appendix O). The location of sensitive receptors, specifically rural residential properties and commercial/industrial premises within 5 km of the Proposal are shown on Figure 10.1 in this EIS.

These receptors are within the suburbs of Warkworth, Gouldsville, Long Point, Wylies Flat, Hambledon Hill, Mount Thorley, Lemington and Jerrys Plain. These suburbs are located within the larger statistical area of the Singleton Region (which excludes the more urban areas of Singleton) and are included in the broader Singleton local government area (LGA). Demographic data was used for these larger areas (as statistics for the suburbs are limited) and are considered representative of the community surrounding the site.

Overall, the demographics data do not suggest the population surrounding the Proposal would have any significant increased vulnerability to potential Proposal related impacts.

The Site is located within the Hunter New England Health District. This district covers a region of 131,785 square kilometres from Newcastle in the south to Tenterfield in the north, and past Narrabri in the west. There are more than 920,000 people residing in the district, including residents of a major metropolitan centre (Newcastle) and regional communities. The population of Singleton LGA represents approximately <5% of the total population in the Hunter New England Health District.

Health indicators statistics reviewed in the HHRA found that, in contrast to general demographic statistics, the population in the area may be more vulnerable to potential health-related impacts associated with the Proposal, compared with the general population of NSW. The underlying reasons for this increased vulnerability are expected to be complex, and may include a broad range of lifestyle, behaviour and environmental factors.

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# 12.2. Impact Assessment

## 12.2.1. Assessed pollutants and exposure pathways

The HHRA presents a detailed assessment of potential risks to human health as a result of emissions to air from the proposed operations, where the fuel is 100% biomass. The assessment of risk has relied on the air modelling presented in the AQIA (Appendix O) and provides an assessment of:

- How people may be exposed to the emissions to air over short-term (acute) and long-term (chronic) (i.e. exposure assessment);
- The hazards posed by (or toxicity of) the chemicals present in the emissions (i.e. hazard or toxicity assessment); and
- Calculation of potential risks to health or risk characterisation.

For some of the emissions to air, inhalation is considered the only route of exposure. These include gases such as nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), carbon monoxide (CO), hydrogen chloride (HCl), formaldehyde, benzene, toluene, ethylbenzene and xylenes as well as suspended fine particulate matter (particulates less than 2.5 micrometres, or $PM_{2.5}$). Emissions to air considered for the operation of the power station relate to the furnace (or boiler) stack emissions. But they also include fugitive emissions from vehicles, plant and equipment operations, and from wind erosion of stockpiles.

Other emissions may be inhaled, but also may be deposited on the ground/surfaces with the deposition of dust. These emissions can then be ingested either directly through accidental consumption of soil, indirectly through food/produce grown or raised in the soil (fruit, vegetables, eggs, meat or milk), or deposited onto a roof where it may be washed into and affect water quality in rainwater tanks. Skin contact with the soil and water in rainwater tanks is also possible. Metals, PAHs and dioxins/furans that are bound to the heavier particulate matter that may fall out and deposit onto the ground could be considered in this class.

Table 12.1 lists the pollutants and chemicals evaluated in the emissions to air from the Proposal and the exposure pathways of potential concern.

**Table 12.1. Substances and routes of exposure.**

| Substance | Route of exposure |
|---|---|
| **Nitrogen dioxide** | Inhalation only as these are gases |
| **Sulfur dioxide** | |
| **Hydrogen chloride** | |
| **Carbon monoxide** | |
| **Formaldehyde** | |
| **Benzene, toluene, ethylbenzene and xylenes** | |
| **$PM_{10}$** | **Inhalation relevant for particulates based on particle size** as these particulates are very small and will remain suspended in air. It is noted that other exposure pathways have also been assessed for the individual chemical substances bound to these particles that may be deposited to the ground. These other pathways relate to the individual chemical substances, rather than the physical size of the particulates, however they do relate to the coarser fractions of dust in $PM_{10}$ (rather than $PM_{2.5}$) as some PM10 will deposit to the ground |
| **$PM_{2.5}$** | |
| **Antimony** | **Inhalation** of these pollutants adhered to fine particulates<br>**Ingestion and dermal contact** with these pollutants deposited to soil, deposited to a roof where they wash into and impact on water quality in rainwater tanks. It is recognised that the surrounding rural residential areas would include likely rainwater tanks that are used for drinking water/potable water. |
| **Arsenic** | |
| **Beryllium** | |
| **Cadmium** | |
| **Chromium VI** | |

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| Substance | Route of exposure |
|---|---|
| Copper | **Ingestion** of produce grown in soil potentially impacted by these pollutants. For this assessment the surrounding rural residential areas may include homegrown fruit and vegetables, eggs, home consumed milk, beef and lamb as well as crops. Metals, dioxins/furans and PAHs can be taken up/bioaccumulated into plants and animal products that may be consumed. |
| Lead | |
| Manganese | |
| Mercury | |
| Nickel | |
| Dioxins / furans | |
| Polycyclic aromatic hydrocarbons (PAHs) as benzo(a)pyrene toxicity equivalents (TEQ) | |

The AQIA modelling provides data relevant to emissions from the stack alone, and emissions from the stack combined with fugitive emissions. The HHRA has used and assessed data relevant to the Proposal and other sources such as cumulative emissions from all sources relevant to the Proposal. Where relevant, background air concentrations have been included.

## 12.2.2. Inhalation exposures

### *12.2.2.1. Particulates*

Fine particulates, namely $PM_{2.5}$, are small enough to reach deep into the lungs and have been linked with and cause a wide range of ill health effects. Health impacts are considered relative to the NEPM air guideline for $PM_{2.5}$ (NEPC 2016, 2021). The NSW Government is a signatory to the National Environment Protection Measures (NEPM), with the $PM_{2.5}$ NEPM standards adopted as impact assessment criteria for NSW (NSW EPA 2017).

The HHRA found that maximum concentration of $PM_{2.5}$ at all off-site receptors (commercial/industrial or rural residential) from the Proposal makes a very small contribution to existing background concentrations and only makes up a small fraction of the air guideline. Background concentrations of $PM_{2.5}$ are already elevated above the NEPM guideline. Elevated background levels of $PM_{2.5}$ are the result of emissions from other regional sources. The AQIA identified that emissions from the Proposal do not change the number of exceedances of the NEPM guideline, and the contribution from the Proposal is considered insignificant.

For the regulatory worst caste (RWC), as described in the AQIA, background concentrations plus the Proposal may result in one additional day of exceedance, however given the low contribution of the Proposal to the potential for impacts from the Proposal is considered unlikely.

The maximum incremental increase in $PM_{2.5}$ from the Proposal for all receptors in the surrounding community regardless of land use, for both the expected and RWC, results in a risk level that is considered negligible.

Changes in $PM_{2.5}$ from the Proposal are considered to have a negligible impact on the health of the off-site community.

### *12.2.2.2. Sulfur dioxide*

Sulfur oxides are formed during combustion when chemicals present in fuels (such as coal, gas, petrol etc) containing sulfur react with oxygen to form sulfur oxides. Sulfur dioxide ($SO_2$) is the main sulfur oxide that can have impacts on people. Exposure to elevated levels can result in irritation of the respiratory system and can make breathing difficult.

Emissions estimates of $SO_2$ from the Proposal are well below the relevant air guidelines that relate to the assessment of short and long-term exposures. On this basis there are no risk issues of concern for community health in relation to $SO_2$ emissions from the Proposal.

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#### *12.2.2.3. Nitrogen dioxide*

Nitrogen oxides (NOx) refer to a collection of highly reactive gases containing nitrogen and oxygen, most of which are colourless and odourless. Nitrogen oxide gases form when fuel is burnt including when residual waste is used as fuel. Motor vehicles, along with industrial, commercial and residential (e.g., gas heating or cooking) combustion sources, are primary producers of nitrogen oxides. Exposure to elevated levels of nitrogen dioxide has been associated with increased mortality, particularly related to respiratory disease, and with increased hospital admissions for asthma and heart disease patients.

Emissions of $NO_2$ from the Proposal are well below the relevant air guidelines that relate to the assessment of short and long-term exposures. The cumulative concentrations predicted at in the off-site community are lower than the relevant air guidelines. On this basis there are no risk issues of concern for community health in relation to $NO_2$ emissions from the Proposal.

#### *12.2.2.4. Carbon monoxide*

Motor vehicles are the dominant source of carbon monoxide in the air. Carbon monoxide is produced during combustion when there is a limited supply of oxygen. The Facility's technology is designed to optimise the oxygen available in the combustion zone so the production of carbon monoxide should be very low.

Exposure to CO is linked with carboxyhaemoglobin (COHb) in blood – i.e. where CO replaces oxygen in the blood preventing oxygen from being transported around the body. In addition, there is an identified association between exposure to carbon monoxide and cardiovascular hospital admissions and mortality, especially in the elderly for cardiac failure, myocardial infarction and ischemic heart disease; and some birth outcomes (such as low birth weights).

Emissions of CO from the Proposal are a very small contribution (<1%) to the relevant air guidelines. On this basis there are no risk issues of concern for community health in relation to CO emissions from the Proposal.

#### *12.2.2.5. Acute and chronic risks*

The assessment found that there are no acute or chronic risk issues of concern in relation to inhalation exposures to emissions from the Proposal.

### 12.2.3. Multiple pathway exposures

When pollutants bound to particulates (as TSP) are persistent in the environment and have the potential to bioaccumulate in plants or animals, it is appropriate to assess potential exposures that may occur as a result of particulates depositing to the environment where a range of other exposures may then occur. These include:

- Deposition to water - Rainwater tanks, where water may be used as potable/drinking water where ingestion and dermal contact is possible;
- Deposition to soil, including:
    - Incidental ingestion and dermal contact with soil (and dust indoors that is derived from outdoor soil or deposited particulates);
    - Ingestion of homegrown fruit and vegetables where chemicals may deposit onto the plants and is also present in the soil where the plants are grown, and where chemicals are taken up into these plants;
    - Ingestion of eggs where chemicals may deposit onto pasture and be present in soil (which is the same soil present where backyard chickens are kept and ingested during feeding), and the chemicals are taken up into the eggs; and
    - Ingestion of other produce at a rural residential property, that may include milk (from dairy cows), beef from cattle and lamb.

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Risks set forth in the HHRA were calculated on the basis of the maximum predicted deposition rate for all of the sensitive receptors in the surrounding community. The HHRA found that risks associated with each individual exposure pathway as well as a combination of multiple exposure pathways, remain below the target risk levels considered representative of negligible/acceptable risks.

The HHRA found that there are no chronic risk issues of concern in relation to multiple pathway exposures that may be relevant to the off-site community.

### 12.2.4. Residential drinking water exposures

Where there may be deposition of persistent chemicals in areas where rainwater tanks are used for collecting and storing water used for drinking and/or potable water, there is the potential for these chemicals to accumulate and impact on water quality. For many of the rural properties surrounding the Site, drinking water is sourced from rainwater tanks. Hence it is important to evaluate potential impacts of the Proposal on the quality of water in rainwater tanks.

The deposition of chemicals to a roof, and accumulation in rainwater has been estimated for the maximum impacted receptor location (based on deposition derived from the Proposal), assuming the average rainfall for Cessnock Airport (from the Bureau of Meteorology), a roof that is consistent with a 4 bedroom Australian home and the use of a first-flush device (noting that outcomes do not change if this device is not included).

The HHRA found that the predicted water concentrations in rainwater tanks are all well below drinking water guidelines. This is particularly relevant to the maximum dissolved phase concentration which is representative of concentrations that would be accessed and used from the rainwater tank. The total concentration only reflects a peak, where sediment is disturbed (unlikely to occur unless disturbed during cleaning).

Based on the HHRA, there are no risk issues of concern in relation to potential exposures of persistent and bioaccumulative chemicals that may be present in rainwater tanks surrounding the Site.

### 12.2.5. Risk issues relevant to soil, crops and produce

Emissions from the Proposal are considered to be negligible in terms of their contribution to existing background levels in cereal products consumed in the market or produce sold from farms in the area.

The predicted concentrations in crops and produce, as a result of emissions from the Proposal, would not be detectable in any analysis. In addition, emissions from the Proposal would not have any measurable change in soil quality in the area. Hence the Proposal would not change existing conditions, result in impacts on crops grown on farms with organic farming status or result in impacts on crops grown on any farms with organic farming status.

Worst-case cumulative emissions derived from the Proposal would not be detectable in soil and would not make any measurable change to existing soil concentrations in areas surrounding the Proposal. Hence impacts to soil from the Proposal are considered to be negligible.

## 12.3. Mitigation Measures

No additional mitigation measures have been identified above those identified in Appendix C of this EIS.

## 12.4. Conclusion

The HHRA concluded that all risks to human health are considered negligible. There are no acute inhalation risk issues of concern and no chronic risk issues of concern. Exposure to particulates derived from the Proposal within the community are considered negligible. Additionally, all chronic risks to human health are considered negligible including

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all calculated risks for individual exposure pathways and all calculated risks for combined multiple pathway exposures. Emissions from the Proposal would have a negligible impact on water quality in rainwater tanks used for drinking water and on crops and produce grown in the area.

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# 13. Noise and Vibration

A Noise Impact Assessment (NIA) (Appendix R) has been prepared to assess the potential noise and vibration impacts associated with the construction and operation of the Proposal. The NIA was prepared in consideration of the following guidelines:

- NSW EPA – Interim Construction Noise Guideline ("IGNG") July 2009;
- NSW EPA – Noise Policy for Industry (NPfI) October 2017; and
- NSW EPA – Road Noise Policy (RNP) March 2011.

The NIA also reviewed four previously noise assessments prepared for the Redbank Power Station, one report from 1993, two reports from 2001, and a more recent report from August 2021. The previous assessments used for the NIA are collated in the appendices to the NIA, and include:

- Redbank Power Station Noise Impact Assessment (appendix D of the Original EIS) (1993) Nigel Holmes and Associates. ("Holmes Report"). Refer Appendix A to the NIA;
- Redbank Power Station at Singleton NSW – Compliance Emission Study (Nov 2001) (Ref: 10-1072-R1) Richard Heggie Associates ("Heggie Report") Refer Appendix B to the NIA;
- Redbank Power Station Project – Site Plant and Equipment Noise Emissions (June 2001) Richard Heggie Associates ("Heggie Noise Survey") Refer Appendix C to the NIA; and
- Verdant (Redbank) Power Station – Noise Impact Assessment (Aug 2021) (Ref: MAC 211387-01RP1V3) Muller Acoustic Consulting ("Muller Report") Refer Appendix D to the NIA.

Ambient noise monitoring was conducted for the previous 2021 report at the two nearest residences to the Proposal.

## 13.1. Existing Environment

### 13.1.1. Existing Plant and Equipment

The existing plant is bespoke and the only way of accurately modelling the noise emissions is to undertake measurements of the actual plant. The use of actual measured data to calibrate an acoustic model represents the most accurate way of assessing noise emissions of what is a unique operation and noise source.

Because the facility is no longer operational, attended measurement of actual, current noise emissions (whether at source or at the receivers) is not possible now.

However, this was undertaken by Heggie in 2001. They measured noise levels from individual plant, produced a computer model based on that information. They verified the model by predicting noise levels around the Site, and comparing the model predictions with actual measured noise levels.

The Heggie assessment was a comprehensive and professional study that provides a best practice prediction of receiver noise impact from the existing plant and equipment already in place at the Facility.

Therefore, the Heggie assessment data was used in combination with the proposed new plant and equipment to predict noise impacts as part of the this AQIA.

### 13.1.2. Ambient Noise Monitoring

The Muller report includes the results of recent ambient noise monitoring conducted at the two nearest residences. The nearest residences noise monitoring locations are indicated in that report, as shown in Figure 13.1 below.

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Attended monitoring indicates that daytime noise levels were due to birds, distant traffic and wind generated noise. From this, it is concluded that there is negligible existing "industrial" noise impacting the measurement locations.

The Rating Background Level (RBL) is obtained from noise monitoring and used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period. Table 13.1 summarises the rating background noise levels(RBLs) determined for the day, evening and night periods as defined in the NPfI.

**Table 13.1. Adopted Rating Background Noise Levels (dB(A)).**

| Location | Day | Evening | Night |
|---|---|---|---|
| Logger 1 (applied to Receivers 3 to 10) | 35 (32)* | 31 | 30 |
| Logger 2 (applied to Receivers 1 and 2) | 35 (34)* | 32 | 31 |

* As per NPI Guidance the minimum RBL for daytime is 35dBA, bracketed value represents measured value.

The assessment of RBL's are conservative because it does not consider the power station's long-term influence on the background noise. The power station is not currently operating, and therefore does not currently influence the surrounding ambient noise levels.

When assessing noise, "intrusiveness" criteria is intended to limit the audibility of noise emissions at residential receivers only. Noise emissions measured using the $L_{eq}$ descriptor should not exceed the background noise level by more than 5dB(A).

"Amenity" criteria are intended to limit the absolute noise level from all "industrial" noise sources so that it is consistent with the general environment.

The NPfI sets out acceptable noise levels for various land uses. There are 3 categories for residential receivers - rural, suburban, urban. The receivers surrounding the Site are most appropriately categorised as 'rural'. The applicable amenity goals for the Proposal are provided in Table 13.2.

**Table 13.2. Amenity Noise Levels.**

| Type of Receiver | Time of day | NPfI Recommended Amenity Noise Level dB(A)$L_{eq(period)}$ | Amenity Noise Level dB(A)$L_{eq(period)}$ | Project Amenity Noise Level dB(A)$L_{eq(15\ minute)}$ |
|---|---|---|---|---|
| Residential – Rural | Day (7am-6pm) | 50 | 45 | 48 |
| | Evening (6pm-10pm) | 45 | 40 | 43 |
| | Night (10pm-7am) | 40 | 35 | 38 |

Project trigger levels have been determined using the adopted RBLs and the NPfI methodology. The applicable assessment criteria and trigger levels are summarised in Table 13.3. These criteria must be satisfied.

**Table 13.3. Summary of noise emissions criteria.**

| Location | Time Period | Project Amenity Criteria dB(A) $L_{eq,15min}$ | Intrusiveness Criteria dB(A) $L_{eq,15min}$ | Maximum Noise Trigger Levels dB(A) $L_{eq,15min}$ / $L_{max}$ |
|---|---|---|---|---|
| Residences 1,2 | Day* | 48 | 40 | - |
| | Evening | 43 | 37 | - |
| | Night | 38 | 36 | 41/52 |
| Residences 3-10 | Day* | 48 | 40 | - |
| | Evening | 43 | 36 | - |
| | Night | 38 | 35 | 40/52 |

* Day is 7am to 6pm Monday to Saturday, 8am to 6pm Sundays.

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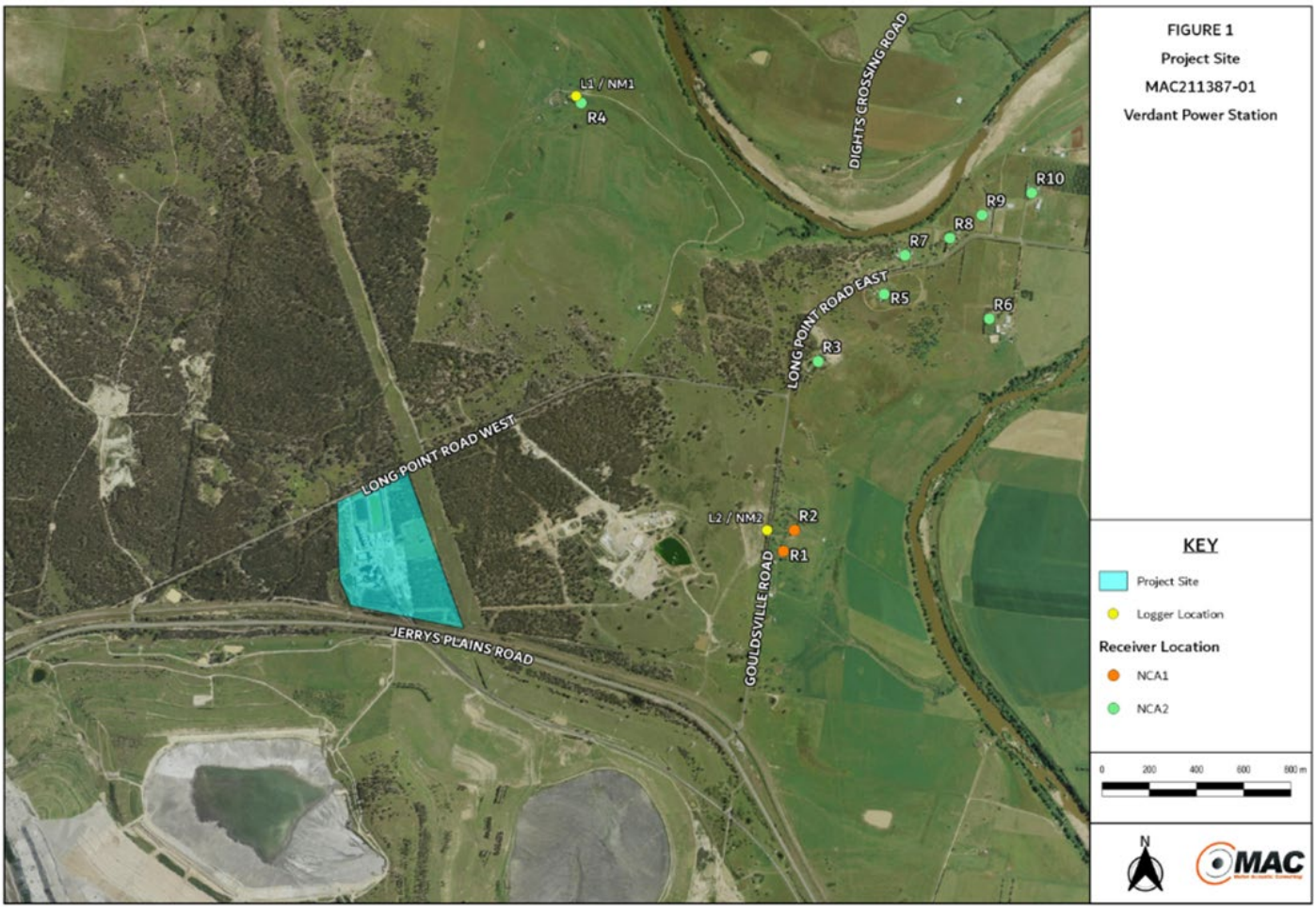
**Figure 13.1 Site plan showing monitoring locations and surrounding receivers (Source: Muller 2021).**




## 13.2. Impact Assessment

The following primary noise emission sources have been identified:

- Truck movements around the site;
- Unloading equipment and conveyors used to stockpile the fuel;
- Plant used to load the fuel from the stockpiles; and
- Noise emissions from the power generating (and associated) plant.

The first three dot points in the previous list include “new” sources that are required due to the change in fuel. Per the *Noise Policy for Industry* (NSW EPA 2017), daytime period is 7am to 6pm, evening period is 6pm to 10pm and nighttime period is 10pm to 7am.

Sound power levels are a measure of the acoustic energy emitted from a source of noise, expressed in decibels, or dB(A). New plant and equipment (and associated sound power levels) are summarised as follows:

- Heavy vehicle driving at 10 km/hr – 106 dB(A);
- Idling Trucks – 95 dB(A) each;
- Unloaders – 2 x Masaba Drive Over Unloader – 114 dB(A) each;
- Conveyors/Stackers – 95 dB(A) for drive unit and 83 dB(A) for conveyor (each);
- Silo Augers – 22 kW drives 2 x 75 dB(A);
- Feeder – Titan Mobile Truck Unloader – 83 dB(A) (2 unloaders); and

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- Wheeled Loader – Volvo L50H 102 dB(A).

## 13.2.1. Noise Amenity

Three operating scenarios were modelled for the site, as follows:

- Between 7am and 6pm –all equipment may be operating with four (4) B-Double trucks entering and leaving in a 15 minute period;
- Between 6pm to 7am – wheeled (front end) loader loading biomass to moving floor bins with conveyors feeding the power plant, and no B-Double trucks entering the Site; and
- Between 6pm to 7am – one truck unloader including conveyors/stackers in operation, wheeled (front end) loader loading biomass to moving floor bins with conveyors feeding the power plant, and one (1) B-Double trucks entering and leaving in a 15 minute period.

The sound power levels and data sources adopted in the assessment are provided in the NVIA (Appendix R).

All plant are assumed to be emitting the nominated sound power level for whole of 15 minutes except for trucks. Each truck is assumed to drive to the unloading point at 10 km/hr, idle while at weighbridges or awaiting sampling, unload and leave the site at 10 km/hr. It has been assumed each truck will idle for 5 minutes when it is not moving or tipping. Note that the existing crusher plant will no longer be used.

The cumulative noise levels under enhancing weather conditions are summarised in the following tables for the most impacted receivers. The two most impacted receivers will be the two closest residences to the east of the site.

During the daytime period, all receivers are clearly compliant with the adopted noise criteria. During the evening and night-time periods, if there are no truck deliveries then all receivers are compliant with the adopted noise criteria, as shown in Table 13.4.

**Table 13.4. Predicted Noise Levels (dB(A) Leq) – Combined All Sources with no evening and night trucks.**

| Receiver | Day | | Evening | | Night | |
|---|---|---|---|---|---|---|
| | Predicted | Criterion | Predicted | Criterion | Predicted | Criterion |
| R1 | 38 | 40 | 36 | 37 | 36 | 36 |
| R2 | 38 | 40 | 36 | 37 | 36 | 36 |
| R4 | 34 | 40 | 30 | 36 | 30 | 35 |

t

With the inclusion of evening and night deliveries of biomass as proposed, the predictions indicate a minor (1 dB(A)) exceedance at R1 and R2 during the night period as shown in Table 13.5.

**Table 13.5. Predicted Noise Levels (dB(A) Leq) – Combined All Sources with evening and night trucks.**

| Receiver | Day | | Evening | | Night | |
|---|---|---|---|---|---|---|
| | Predicted | Criterion | Predicted | Criterion | Predicted | Criterion |
| R1 | 38 | 40 | 37 | 37 | 37 | 36 |
| R2 | 38 | 40 | 37 | 37 | 37 | 36 |
| R4 | 34 | 40 | 31 | 36 | 31 | 35 |

Inclusion of a noise barrier is proposed as provided in Figure 13.2. The barrier will be constructed of a solid material with minimal gaps having a surface density not less than 8 kg/m$^2$. A gate leading to the access road is acceptable provided it is of a solid material and is normally kept closed at night (it may be left open between 7am and 10pm). The design of the barrier should be reviewed and adjusted as necessary to comply with the noise criteria, taking into account noise emissions from the actual plant installed, and practical location on site.

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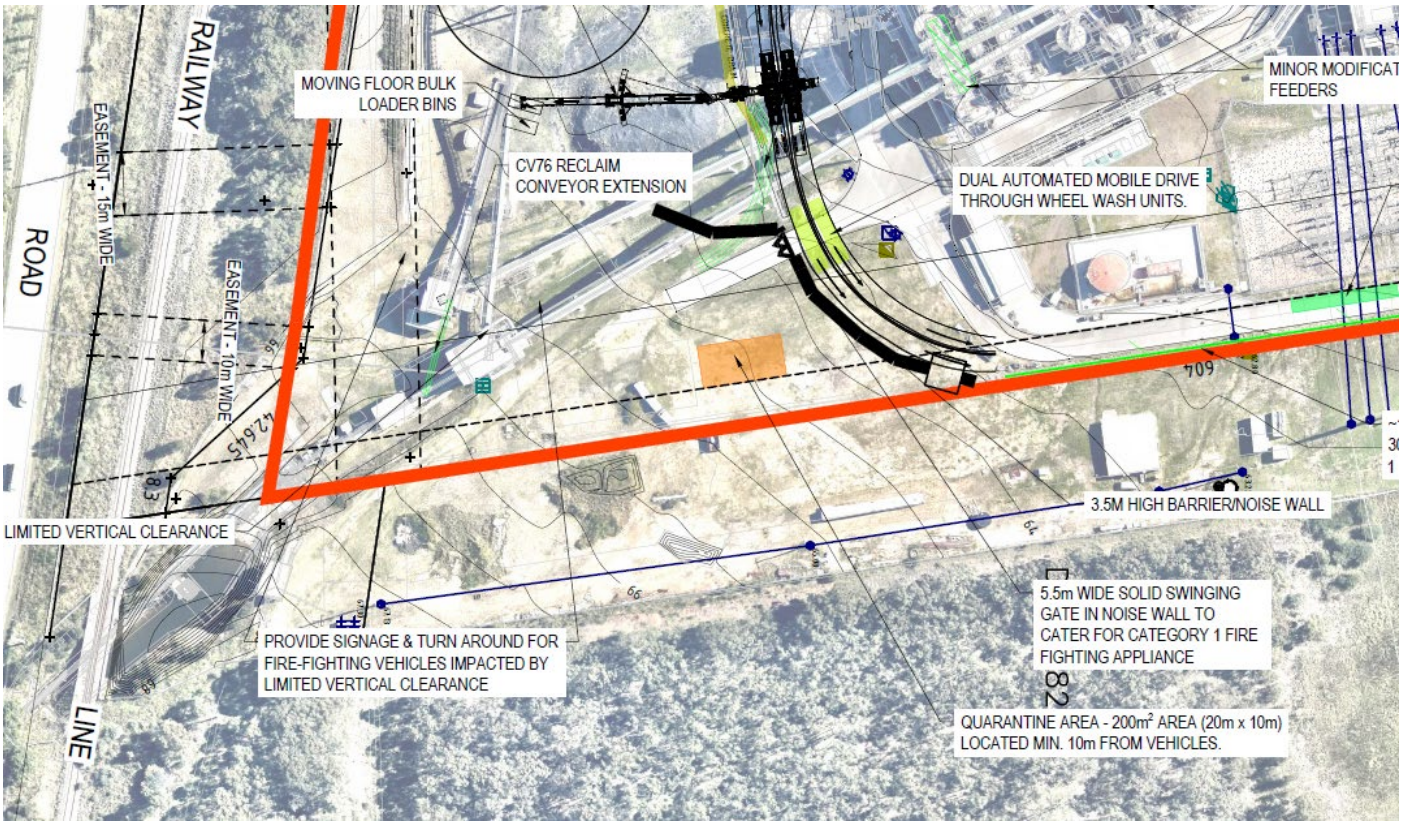
**Figure 13.2. Proposed noise barrier location and type.**




As indicated in Table 13.6, with the addition of a noise barrier as proposed, noise emissions to all receivers will comply with the criteria at all times during deliveries (including evening and night-time) under weather enhancing conditions.

**Table 13.6. Predicted Noise Levels (dB(A) Leq) – Combined All Sources with evening and night trucks and barrier.**

| Receiver | Day | | Evening | | Night | |
|---|---|---|---|---|---|---|
| | Predicted | Criterion | Predicted | Criterion | Predicted | Criterion |
| R1 | 38 | 40 | 36 | 37 | 36 | 36 |
| R2 | 38 | 40 | 36 | 37 | 36 | 36 |
| R4 | 34 | 40 | 30 | 36 | 30 | 35 |

## 13.2.2. Post Commencement Validation and Contingencies

A validation assessment will be undertaken shortly after commencement of operation to verify compliance at the receivers based on measurements of actual noise emissions (either by direct measurement if possible, or by a calibrated acoustic model based on actual noise emissions similar to that undertaken by Heggie). The main focus would be at receiver locations 1 and 2 where noise emissions are predicted to be just compliant.

The noise contribution from the "new" plant is well below the daytime criteria and below the evening and night criteria. The dominant noise contributor is the historical plant.

Whilst noise emissions from the historical plant may have increased over time due to normal wear and tear (e.g. fan bearings may need replacement), available data indicate that additional penalties do not need to be applied to account for modifying factors. However monitoring will confirm this.

Should monitoring indicate that additional sound attenuation is needed (following any maintenance that needs to be carried out), additional assessment would be undertaken.

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### 13.2.3. Maximum noise events

The plant will operate at night and an assessment of maximum noise levels has been prepared. Operations that may produce maximum noise events at night are truck deliveries and loading of the conveyors using a wheeled loader between 10pm and 7am.

The $L_{max}$ trigger level is 52 dB(A) at all locations. For the most affected location Soundplan modelling indicates a distance reduction of 83 dB(A) at night under enhancing weather conditions. Therefore, the night activities indicated above would need to generate a sound power level exceeding 135 dB(A) $L_{max}$ to produce an exceedance.

The loudest activities would be dropping biomass into loading hoppers, and the application of truck air brakes. Truck air brakes typically generate less than 115 dB(A).

There is no specific data in respect of noise dropping onto the proposed loading hoppers. However, it is considered unlikely that a sound power level of 135 dB(A) would be exceeded, particularly as the fuel consists of small wood chips and/or pellets.

### 13.2.4. Traffic Noise

The noise impact from the increase in traffic noise along the Golden Highway from the estimated 112 fuel vehicle trips has been assessed. There are two scenarios:

- Scenario 1 – all movements occur primarily during the period 7am to 10pm - the EPA “day”” period; and
- Scenario 2 – The maximum anticipated night movements occurs (considered 20% of total movements spread across evening and night). This means that the number of daytime movements will be lower than Scenario 1.

The calculated increase in noise due to the truck movements generated was less than 1dB(A) for both the $L_{eq,15hr}$ and $L_{eq,\ 9hr}$ descriptors. The day and night noise increases, even when conservatively assessed, are well below the 2 dB increase permitted by the EPA Road Noise Policy for traffic generating developments.

The small increase in traffic noise is not unexpected as the number of movements generated by the development is insignificant when compared to the existing traffic movements on the Golden Highway.

The calculated increase in noise due to the truck movements generated was 0.5 dB(A) for $L_{eq,15hr}$ and 0.3 dB(A) for $L_{eq,\ 9hr}$.

The day and night noise increases, even when conservatively assessed, are well below the 2 dB increase permitted by the EPA Road Noise Policy for traffic generating developments.

Regarding movements on Long Point Road, the nearest residence is approximately 1.75 Km from the road any noise generated by vehicles on this section of road would be well below the RNP absolute noise level criteria.

Even if the most conservative of assumptions is made (i.e. all trucks approach and leave via in the same direction), the increase in noise (day and night) would still be less than 1 dB(A) for both day and night – still well under the 2 dB increase permitted.

It is concluded that noise from the road traffic movements generated by the proposed fuel deliveries would not result in any adverse noise impacts. The small increase in traffic noise is not unexpected as the number of movements generated by the development is insignificant when compared to the existing traffic movements on the Golden Highway.

Regarding movements on Long Point Road, the nearest residence is approximately 1.75 Km from the road any noise generated by vehicles on this section of road would be well below the RNP absolute noise level criteria.

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It is further noted that the power station had approval to use road transport to carry coal to the Site when the conveyor was not operational. Therefore, the application of greenfield site RNP criteria in the above assessment is conservative, as the RNP increase is assessed against the "no build" option.

It is concluded that noise from the road traffic movements generated by the proposed fuel deliveries would not result in any adverse noise impacts.

### 13.2.5. Construction Noise and Vibration

Major construction works are not required. Construction will be primarily limited to minor modification of the fuel handling equipment to accommodate the biomass fuel and the installation of truck loaders.

The operational noise assessment indicates there is a greater than 80 dB(A) distance correction between the Site and the nearest receiver. Therefore, construction activity generating a noise level of 125 dB(A) (sound power level) would result in a noise level of less than 45 dB(A) at the closest residence.

The DECC Interim Construction Noise Guideline nominates a "noise management level" for construction related noise of background + 10 dB(A). The guideline requires that additional management of noise emissions be considered when noise levels exceed the management level.

As the day RBL is 35 dB(A), the construction noise management level applicable to this project is 45 dB(A).

None of the activities proposed would be expected to generate the >125 dB(A) Leq,15min sound power level needed to exceed the noise management level at the residences. Hence, additional management of construction noise is not likely to be needed.

Similarly, vibration from construction activities would not impact any surrounding receivers due to the low intensity of activity and the distance separation. Ground vibration generated by the proposal is not expected to be perceptible at any of the surrounding receivers during construction and operation given there is no blasting, no adverse vibration impacts have been previously reported from the operation of the facility, proposed activities will not produce significant ground vibration and there is significant distance separation between the Site and other sensitive receivers.

## 13.3. Mitigation Measures

With the implementation of the noise mitigation and management measures provided in Table 13.7, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential noise impacts and is therefore suitable for construction and operation.

**Table 13.7. Noise and vibration mitigation measures.**

| Measure | Description |
|---|---|
| NV1 | Installation of a noise barrier as provided in Figure 13.2, constructed of a solid material with minimal gaps having a surface density not less than 8 kg/m2 with a gate leading to the access road (it may be left open between 7am and 10pm). |
| NV2 | Undertake post commencement validation/verification measurements to confirm compliance. Should the post commencement validation indicate noise levels exceed the assessment criteria imposed in the approval, implement additional acoustic treatment (e.g. plant maintenance, additional treatment to the steam line or other alternatives). |

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## 13.4. Conclusion

With the implementation of the mitigation measures provided in Table 13.7, the NIA model predicts that noise emissions will comply with the project trigger levels at all times whether under neutral and noise enhancing weather conditions.

It is expected that operational noise emissions will not adversely impact any surrounding receiver, at any time of the day, evening or night. Post commencement validation/verification measurements to confirm compliance.

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# 14. Traffic and Transport

A Traffic Impact Assessment (TIA) (Appendix S) has been prepared for the Proposal. The TIA provides an assessment of the relevant traffic implications of the Proposal.

As part of the traffic assessment, AM and PM peak intersection counts were undertaken at identified key intersections including:

- Golden Highway & Long Point Road West; and
- Golden Highway & Watt Street.

An Automatic Tube Counter (ATC) was installed in the Golden Highway west of Long Point Road West.

The TIA also considered a specific matter to address community safety concerns regarding the right-hand turn lane from Golden Highway into Gouldsville Road.

This TIA has been prepared in consideration of the following access, traffic and parking guidelines, including:

- Roads and Maritime Services (RMS) Guide to Traffic Generating Developments (RMS Guide);
- Austroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections (Austroads 4A); and
- Austroads Guide to Traffic Management Part 8 – Local Traffic Management (Austroads Part 8).

## 14.1. Existing Environment

After the Power Station operations were suspended in 2014, the existing site experiences minimal operational traffic. Presently, the site generates approximately 12 additional vehicles other than staff, covering tasks such as site care maintenance, water delivery, mail services and garbage removal.

The key roads providing access for the Site and for the haulage routes heading north and south are detailed below:

- Golden Highway (Jerry Plains Road): A State Highway (SH 27), the Golden Highway generally runs in a north-west to south-east to direction between the Castlereagh Highway at Craboon and Putty Road at Singleton, respectively. It generally provides two traffic lanes for two-way traffic, and at-grade and grade- separated intersections appropriate to through and turning traffic demands along different parts of the route. In the vicinity of the Site, the Golden Highway has a posted speed limit of 100km/h; and
- Long Point Road West: A collector road, Long Point Road West generally run in an east-west direction between Gouldsville Road and the Golden Highway, respectively. It provides two sealed traffic lanes for two-way traffic, and has a posted speed limit of 100km/h.

The key intersection providing access for the Site is detailed below:

- Golden Highway and Long Point Road West: A Give Way intersection with priority to Golden Highway, this intersection provides auxiliary lane infrastructure including a channelised right turn lane (Golden Highway to Long Point Road West) and a short auxiliary left turn lane (Golden Highway to Long Point Road West). Sight distances on all approaches meet the requirements of Austroads.

An aerial of this intersection is provided in Figure 14.1 below.

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**Figure 14.1. Site location and intersection layout.**


Available RMS Average Annual Daily Traffic (AADT) volumes from existing and removed RMS count stations are summarised in Table 14.1 .

**Table 14.1. RMS historical AADT volumes.**

| RMS Count Station | AADT | | | | | |
|---|---|---|---|---|---|---|
| | 1992 | 1995 | 1998 | 2001 | 2004 | 2007 |
| Jerry Plains Road North of Mt Thorley (Count Station 05481) | 4508 | 7997 | 6256 | 7059 | 5572 | |
| Golden Highway East of Broke Road (Removed) | - | 6447 | 7164 | 7966 | 8143 | 9401 |

The results of Automatic Tube Counter (ATC) surveys installed in the Golden Highway west of Long Point Road West are provided in Table 14.2.

**Table 14.2. 2019 survey count data.**

| Survey Location | Volumes | | |
|---|---|---|---|
| | Daily | AM Peak (10:00-11:00) | PM Peak (4:00-5:00) |
| Golden Highway Near Long Point Road West | 4,772 | 647 | 561 |

The SIDRA analysis indicates that the key intersection currently operates at a good level of service, with low delays and queues, while retaining significant spare capacity. The full SIDRA results are provided in Appendix A of the TIA.

Crash data for Jerry Plains Road – 1.2km west of the intersection of Jerry Plains Rd and Long Point Road West showed one crash due to a struck animal. Whilst inappropriate speed or inattention can lead to incidents on roads such as

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these, the crash data indicates a generally good intersection, road geometry, turning infrastructure and sight distances and relatively moderate flows through the road network.

A review of the intersection of Golden Highway and Gouldsville Road indicates that there have been no crashes in the last 5-year period at this intersection. This indicates that the intersection is generally good here as well.

## 14.2. Impact Assessment

### 14.2.1. Trip Generation Assumptions

Transport of biomass fuel will be via B-double vehicles operating 24/7, with deliveries prioritised over a 16-hour period between 6am and 10pm, 7 days per week (Monday to Sunday). Deliveries of biomass are expected to be 56 trucks per day (112 trips).

The Proposal would include employment of up to 30 operational and maintenance staff per day shift (6:00am – 6:00pm) and 5 staff per night shift.

All Site access is provided via Long Point Road via two formal driveways at the eastern and western boundaries of the Site, as shown in Figure 14.2.

The internal weighbridge locations and fuel unloading facilities have been designed to ensure that any queuing resulting from these activities shall be accommodated on-site and not adversely impact on the adjacent road network.

The fuel unloading process includes:

- A truck arrives at the fuel unloading area and tips its load into the drive over hopper;
- The hopper floor is swept by a feeder conveyor or chain conveyor; and
- Once empty, the truck continues to the exit.

The capacity of the hopper and feeder conveyors will be designed to accommodate up to two B-double truck loads.

The truck generation rates have been calculated from the following assumptions;

- The facility has capacity for 700,000 tonnes (T) of dry equivalent biomass, or 850,000 tonnes (T) of biomass at 25% moisture per annum. To incorporate the worst-case scenario, the expected operation of 850,000 T per annum has been adopted for this assessment;
- Deliveries of biomass residues shall be undertaken by B-doubles with a capacity between 42-44T. Based on 850,000T this yields between 19,318 and 20,238 trips per year, respectively (or 56 trucks / 112 movements per day). To remain conservative in our assumptions it is expected the B-doubles will carry approximately 42T and as such, will make 20,238 trips per year;
- To meet operational needs feedstock deliveries will occur 24/7; however, deliveries will be prioritised to 16-hour shifts on Monday through Sunday between 6am and 10pm;
- Based on 16-hour delivery window, the resulting maximum trip generation is 11 truck movements per hour; and
- Verdant have allowed a nominal 20% of traffic worst case scenario during the evening / night. However, for traffic assessment purpose the worst-case scenario was assumed in SIDRA analysis.

A conservative maximum trip generation of 15 truck trips per hour has been allowed for during each of the peak hours in the assessment.

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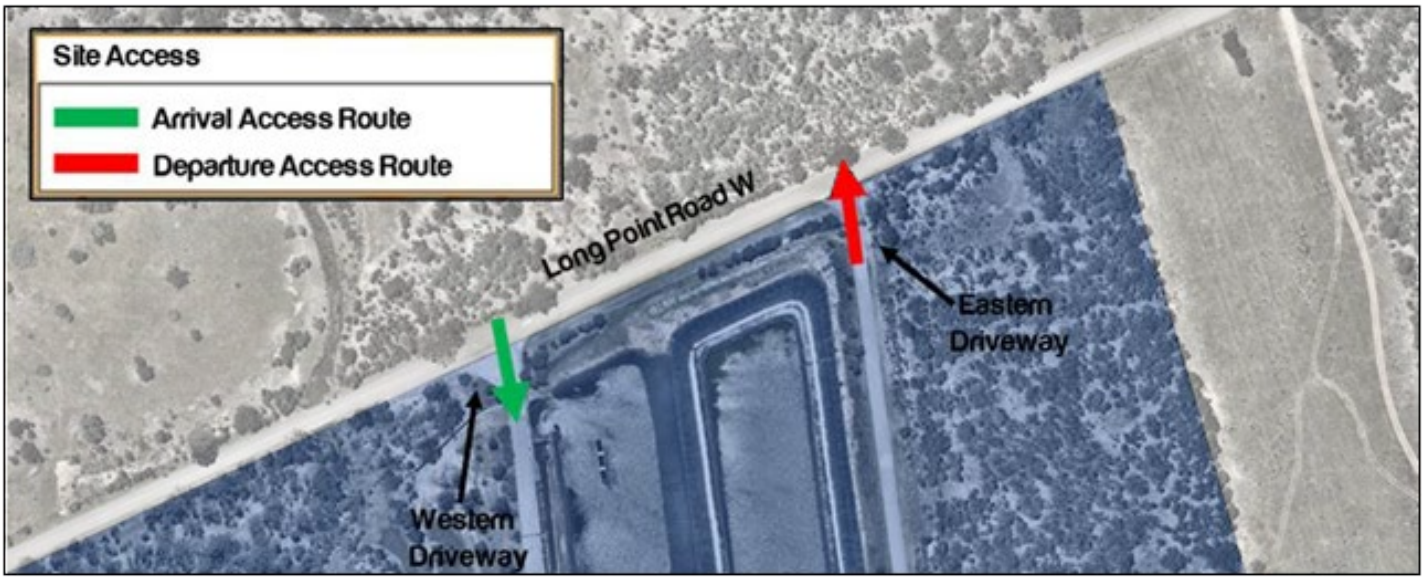
**Figure 14.2. Proposed (and existing) site access.**




In addition, the remains of biomass (residual ash) will comprise of roughly 3-5% of the delivered mass. Using a worst-case scenario 5% estimate there will be a requirement to remove 42,500 tonnes of ash from the site per year. Average daily ash generation will therefore be 116.4 tonnes per day. The same B-doubles used for delivery of biomass would be backfilled for removal of residual ash from the Site, and equate to 4 trucks per day, ash removal does not result in additional truck movements. Therefore, the 4 trucks are not technically classified as additional trips.

## 14.2.2. Modelling Results

The 2023 and 2033 background traffic volumes were derived using 3% growth rate applied on 2019 survey data. The scenarios modelled in the TIA are as follows:

- 2023 (Existing) Base case – Background only;
- 2023 (Existing) Project case – Background + Development trips;
- 2033 Base case – Background only; and
- 2033 Project case – Background + Development trips.

The level of service (LOS) criteria detailed in the RMS Guide is summarised in Table 14.3.

**Table 14.3. Level of Service criteria (RMS Guide).**

| Level of Service (LOS) | Average Delay per Vehicle (s) | Traffic Signal & Roundabout | Give Way & Stop Signs |
|---|---|---|---|
| A | < 14 | Good operation | Good operation |
| B | 15 to 28 | Good with acceptable delays & spare capacity | Acceptable delays & spare capacity |
| C | 29 to 42 | Satisfactory | Satisfactory, but accident study required |
| D | 43 to 56 | Operating near capacity | Near capacity & accident study required |
| E | 57 to 70 | At capacity; at signals, incidents will cause excessive delays. Roundabouts require other control mode | At capacity, requires other control mode |
| F | 70 < | Unsatisfactory and requires additional capacity. | Unsatisfactory and requires other control mode or major treatment. |

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SIDRA modelling analysis indicates that the additional traffic generated by the Proposal will have no significant impact on the operation of the Golden Highway and Long Point Road West intersection as shown in Table 14.4. The intersection is predicted to continue to operate at good levels and with spare capacity for all scenarios.

Refer to the TIA (Appendix S) for the detailed SIDRA results.

**Table 14.4. Golden Highway and Long Point Road West intersection performance SIDRA modelling results.**

| Scenario | Control Type | Period | Intersection Delay (Seconds) | Level of Service |
|---|---|---|---|---|
| 2023 Base Case | Sign Control | AM | 11.5 | A |
| | | PM | 17.6 | B |
| 2023 Project Case | | AM | 18.5 | B |
| | | PM | 19.7 | B |
| 2033 Base Case | | AM | 13.4 | A |
| | | PM | 23.0 | B |
| 2033 Project Case | | AM | 23.9 | B |
| | | PM | 26.9 | B |

## 14.2.3. Road Capacities

In accordance with RMS guidelines, consideration has also been given to the rural road network in the vicinity of the Site:

- As intersections are less frequent in rural areas, they are less of a determinant of rural road capacity;
- The need for overtaking opportunities on two-lane roads is greater, as the level of service is determined by average travel speeds and the percentage of time spent delayed; and
- A determination in regard to whether the acceptable volume threshold from one lane to two lanes per direction may be reached.

RMS Guide performance standards reflect the fact that recreational peak hour periods (weekend peaks, or peaks associated with particular tourist or recreational activity) occur less frequently than weekday commuter peak hour periods.

The survey count (Table 14.2) indicates a maximum of 647 and 561 vehicles in the AM and PM peak hours, respectively, travel along Jetty Plains Road in the vicinity of the Site. Further analysis indicates a range of heavy vehicle trips between 8.8% - 12.4% of the future total flows in the future AM and PM peak hours, respectively.

The RMS Guide indicates that Golden Highway / Jerry Plains Road intersection has a LOS C and LOS B in the AM and PM peak hours respectively and would therefore operate in compliance with the RMS capacity guidelines.

## 14.2.4. Intersection Upgrades

Although the SIDRA analysis indicates that the intersections of Jerry Plains Road and Long Point Road West operate at a good level of service during the peak periods, it is important to review the intersection design for the safety of all motorists.

As shown in Figure 14.3, the intersection of Golden Highway and Long Point Road West is currently designed and built as a "Channelised Right Turn (CHR)". With reference to the future traffic flows at the intersection, current vehicle speeds and existing geometry, no changes to the existing channelised right turn from the Golden Highway into Long Point is required.

A turn treatment is warranted for vehicles turning left into Long Point Road from Golden Highway. A widened shoulder exists in this spot, which assists turning vehicles to move further off the through carriageway making it easier for

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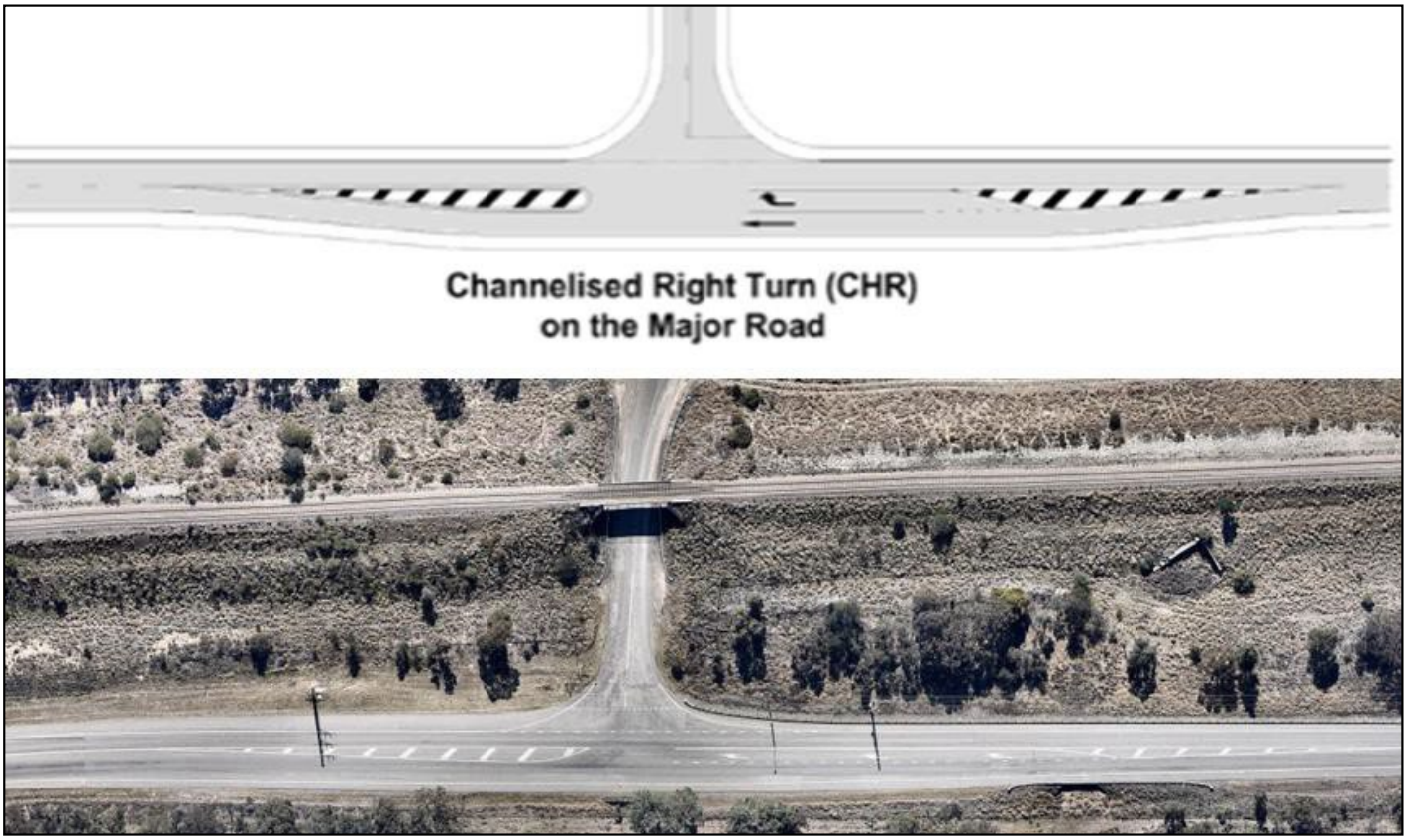
through vehicles to pass. The existing shoulder width is in excess of 4m, therefore would be acceptable for a left turn treatment to be constructed.

**Figure 14.3. Golden Highway & Long Point Road West Intersection Layout.**




In response to comments made by the community, and upon review of crash data, the following can be concluded regarding the Golden Highway and Gouldsville Road intersection. Although turning volumes are currently unknown, a turning volume of approximately 25 vehicles would be required before any intersection upgrade would be required (this represents the lowest turning volume required in the AM and PM peak periods).

All staff and haulage trucks will be instructed to use Long Point Road / Golden Highway so no further consideration of Gouldsville Road is warranted as this will not be relied upon by the proposal.

### 14.2.5. Construction Traffic

The construction traffic volumes are expected to be lower than the volumes anticipated for the Site once it becomes operational. Therefore, recognising that the key intersections are anticipated to perform satisfactorily once the Site is in operation, it can be assumed that the intersections would satisfactorily accommodate the lower volumes of construction traffic.

## 14.3. Mitigation Measures

With the implementation of the traffic mitigation and management measures provided in Table 14.5 the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential traffic impacts and is therefore suitable for construction and operation.

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**Table 14.5. Traffic mitigation measures.**

| Measure | Description |
|---|---|
| TA1 | A schedule of all biomass deliveries, and ash removals will be established prior to each day and be site-specific, and that radio contact is maintained with haulage vehicles at all times. |
| TA2 | A BAL turn treatment for the left turn into Long Point Road from Golden Highway. |
| TA3 | All staff and haulage trucks will be instructed to use Long Point Road / Golden Highway |
| TA4 | Update internal pedestrian crossing near the office to be parallel with the centre of the carriageway a new crossing and footpath to ensure safety for all pedestrians per Figure 4 in the TIA. |
| TA5 | Drivers will adhere to the Drivers Code of Conduct (DCC) for the Redbank Power Station. |
| TA6 | The Construction Traffic Management Plan prepared for the Proposal will be reviewed and updated prior to commencement of construction. |
| TA7 | The Operational Traffic Management Plan prepared for the Proposal will be reviewed and updated prior to commencement of operation. |

## 14.4. Conclusion

The Proposal will generate up to 56 trucks deliveries (or 112 movements) per day, as well as staff vehicle movements up to 70 vehicle trips per day.

Traffic modelling of a conservative development scenario of up to 15 heavy vehicle trips per hour during the peak periods, as well as staff trips occurring in those same peak hours, demonstrates that the Proposal would have no significant impact on the operation of the Golden Highway/ Long Point Road West intersection, nor on road capacity limits or existing geometry requirements.

The TIA concluded that the Proposal is supportable from an access and traffic perspective.

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# 15. Soil and Water

A Water Cycle Impact Assessment (Appendix T) has been prepared for the Proposal by Sustainability Workshop to assess the existing water cycle management including the stormwater management system and any further mitigation required at the Facility. A site inspection was undertaken by Sustainability Workshop on 6 October 2021 to assess the existing conditions on the Site. A MUSIC model was developed to simulate rainfall, runoff and the flow of storm water through the Site, and a water balance model was developed.

A Preliminary Site Investigation (PSI) was prepared by Consulting Earth Scientists (Appendix W) to assess potential contamination arising from past activities.

## 15.1. Existing Environment

### 15.1.1. Soils and Geology

Reference to the Newcastle 1:100,000 Series Geology Map indicates that the Site is underlain by the Jerrys Plains Subgroup, the upper section of the Wittingham Coal Measures of the Singleton Supergroup of late Permian age.

The soils belong to the Jerrys Plains Soil Landscape Unit. The Jerrys Plains Soil Landscape is comprised of Soloths on the crests to mid-slopes with Solodic soils on the lower slopes and in drainage depressions. The Site is dominated by Yellow Soloths. These soils are characterised by hard-setting brownish black loam to fine sands in the upper strata and bleached yellow light sandy clay below with an underlaying reddish brown or dull brown clay which becomes yellow at depth.

Most of the original soil has been disturbed by the original development of the power station.

### 15.1.2. Hydrology

The Site is located adjacent to a tributary of the Hunter River called Dights Creek. It is located on a stretch of the river between the Wollombi Hunter confluence and Singleton. This section of river is defined as a Major Regulated River described as follows:

> "*These rivers have large dams supplying irrigation, town and industrial water for substantial distances downstream. Flows are typically supplemented from dams, resulting in fairly stable and persistent flows when water is released for extractive use. River flow, such as small natural rises, can be reduced at other times, particularly during periods of high demand for water by industrial users. Flows in these regulated sections can also be substantially affected by use of water in the unregulated river sections upstream.*"

The Hunter River is located approximately 2km to the north-east of the Site.

Warkworth Mine has disrupted much of the original catchment upstream. Any remnant aquatic ecosystems within this catchment would be highly disturbed and severely modified by past development (see Figure 15.1).

Redbank Power Station discharges into Dights Creek. The creek appears to be in a stable and well vegetated state downstream of the point of discharge. The previously approved diversion works have successfully created a modified but otherwise naturalised and stable riparian environment.

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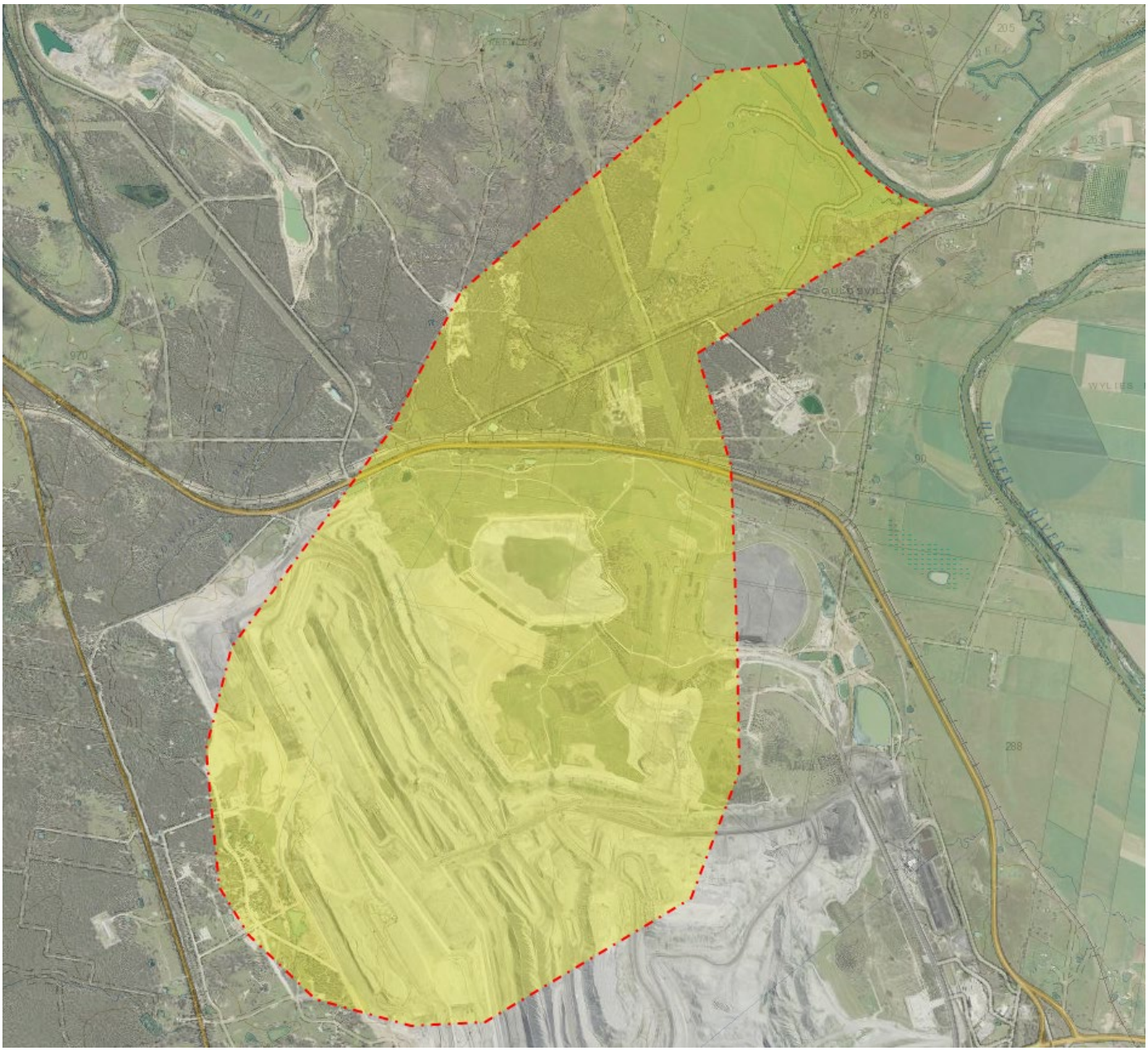
**Figure 15.1. Dights Creek mapped catchment area.**



## 15.1.3. Stormwater

The proposed (historic coal) stockpile area includes existing subsoil drainage beneath it. Subsoil drains are located at regular intervals underneath the stockpile area and drain directly into a concrete lined channel. Subsoil drains are embedded in free draining gravel. An existing concrete lined channel intercepts runoff from the stockpile area and subsoil drains under the stockpile, directing it to a sediment and oil trap which then discharges into an existing water quality pond.

The water quality pond in the existing pond was observed to be in healthy condition, with an internal baffle to ensure no short circuiting of flows. The pond had both emergent and submerged vegetation and appears to be well maintained and a healthy constructed wetland.

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Additional drainage features of the Site include surface drainage and a piped network that diverts runoff from the boiler island to the water quality pond after first being treated in a sediment and oil trap.

Numerous bunded areas on the Site store chemicals for wastewater treatment. Existing bunds are used to manage acute toxicity risks emanating from an accidental spill of a chemical. All bunded areas are clean, visibly free of pollution and well maintained with structural and liquid retention integrity intact. Stormwater from the north section of the Facility, including the administration building, wastewater treatment infrastructure, and water-cooling structure, is conveyed along with water quality pond runoff via a concrete channel to a welded plastic (HDPE) lined, raw water storage pond.

There was an additional screen and oil baffle and water quality monitoring point upstream of the entry into the raw water storage. Raw water storage overflows or spills via a weir near the site entry gate. The raw water storage overflows into a swale that travels west and joins Dights Creek.

The raw water storage pond has a volume of 6,000 cubic metres which equates to 6ML. The raw water storage is filled with water extracted from the Hunter River and is operated so that there is always a nominal level of 4ML of raw water available in the storage.

A much larger wastewater storage (60ML) is also lined with a welded waterproof plastic liner.

Dights Creek has been diverted around the operational area of the Site and this was approved under the previous development application. Where the creek was diverted it remains in a stable well vegetated state, free from visible erosion and without obvious weed infestation. Dights Creek downstream of the site after it flows under Long Point Road is in a well vegetated, stable state with numerous riparian trees and grasses.

Figure 15.2 shows the general direction of surface runoff flows at the Facility, including subsurface drains below the stockpiling area, concrete channel conveyance, wastewater and raw water storage and discharge points.

### 15.1.4. Acid Sulphate Soil Potential

The Site is in the upper Hunter River, nominally 90km upstream from the coast at nominally RL 60m which is well out of the tidal range and very unlikely to have acid sulphate soils. There is no evidence of acid sulphate soils present.

Based on a review of the Singleton LEP (2013), the site is located in a Class C risk area which carries an extremely low (1-5%) probability of occurrence and as such are not considered further.

### 15.1.5. Existing Groundwater Quality

Existing groundwater quality at the Site is unknown. Extensive drilling of the Site indicates the Site is underlain by an extensive clay deposit. No groundwater was detected or sampled as part of this work. There are no existing groundwater bores on the Site and groundwater sampling was not part of any previous environmental protection licence.

### 15.1.6. Flooding

According to Singleton Council's online flood mapping system, the Site is located outside the Flood Planning Area, and it can therefore be assumed that the Site is not prone to flooding. When the Site was originally developed a tributary of Dights Creek was relocated adjacent to the Site and designed to convey the probable maximum flood (PMF). This is now an established riparian corridor and has proven to be very successful in preventing any localised flooding on the Site.

Furthermore, none of the proposed changes to the Site would have any impact on floodwater storage as all changes are minor and outside of the floodplain.

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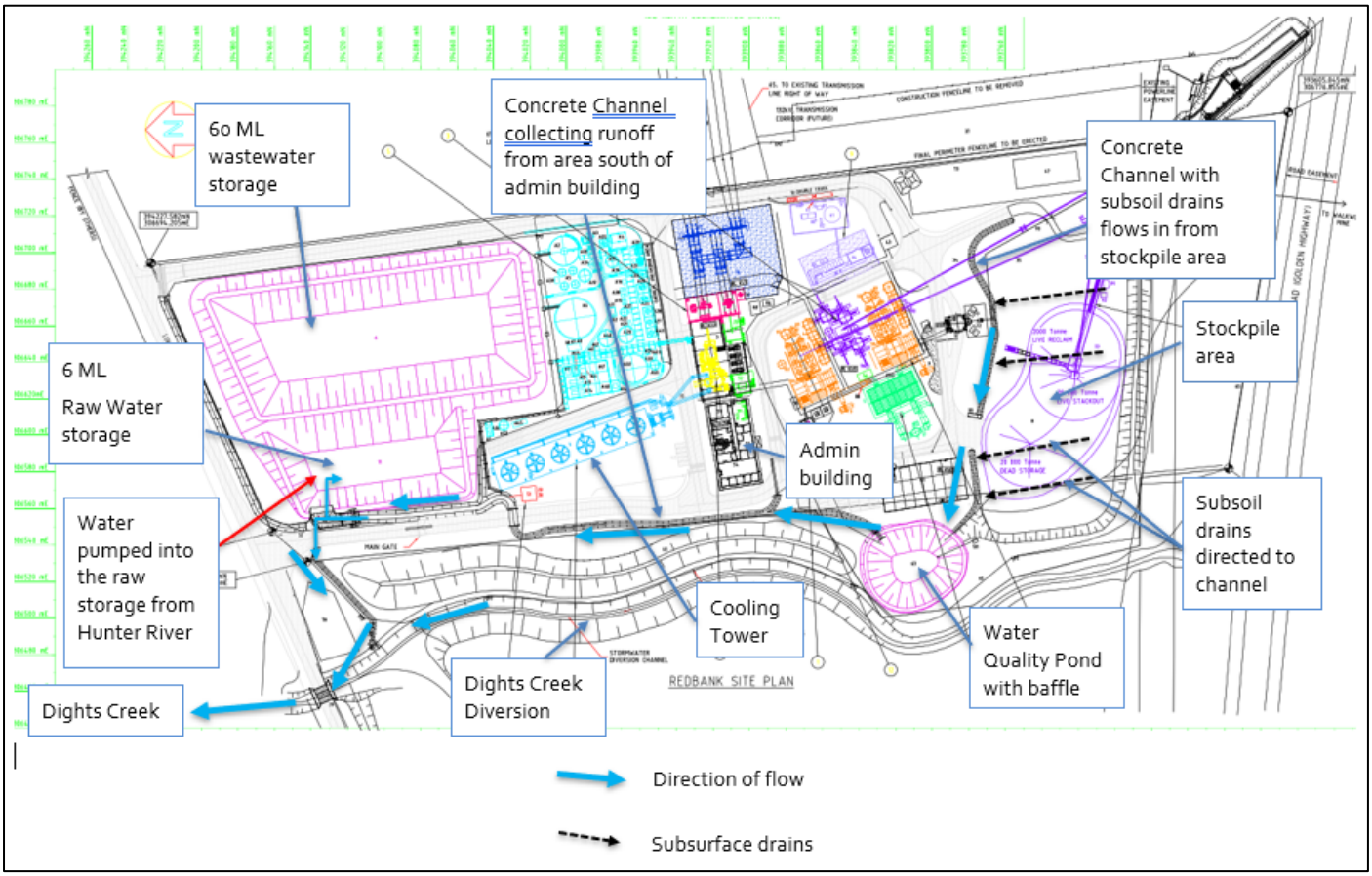
**Figure 15.2. Stormwater capture, conveyance and retention at the Facility.'**




## 15.1.7. Contamination Investigation

The PSI prepared by Consulting Earth Scientists (Appendix W) concluded that the Site is considered suitable for the Proposal and showed no indication of contamination arising from past activities.

The PSI included a desktop review, site walkover, interview with the Site operations manager and a review of the results of a previous pre-purchase due-diligence contamination assessment in 2015 prepared for the Redbank Power Station. The due-diligence involved an extensive soil sampling program across the Site, sampling from 68 bores and surface waters included the workshop area, diesel storage facility, diesel supply lines, generators, chemical storage, coal storage, stockpiling areas, and a series of dams.

The Site was undeveloped bushland prior to the construction of the Redbank Power Station. As such, no other potential source of contamination, other than the use of the site as a power station, has been identified.

A search was conducted of all records pertaining to Section 58 of the *Contaminated Land Management Act* 1997 and revealed that the Site is not encumbered by any notices from the NSW EPA with regard to contaminated land.

As part of the due-diligence, one hundred and fifty-nine (159) discrete soil samples were collected in accordance with the *NSW EPA Samples Guidelines 1994, NEPM 2013 and AS4482.1-2005*. The sampling and analysis undertaken by DLA (2015) did not identify contaminant concentrations in excess of the adopted commercial industrial screening criteria in the stockpiled materials.

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## 15.2. Impact Assessment

### 15.2.1. Water Balance

Raw water is defined as either water extracted from the Hunter River or stormwater runoff from the power station site which drains into the raw water storage pond shown in Figure 15.2.

As the power station combusts fuel to generate heat, the heat is used to boil water and generate steam which drives turbines to create electricity. A significant volume of raw water is used to cool the steam to condense it. The steam is ultra-high-quality demineralised water, and this form of water is simply recycled as it is expensive to make demineralised water.

Raw water is used to cool the steam once it has passed through the turbine without coming into direct contact with the steam via a heat exchanger. As a result, a significant volume of raw water is lost through evaporation.

The Facility will typically require 366.3 kL of raw water per hour to cool the steam. The 90th percentile demand increases to 368.1 kL/hour, and the maximum demand is 380.2 kL/hour. Approximately 39.7 kL/hour is returned to the raw pond giving a mean hourly withdrawal rate of 401.7 kL/hour from the pond.

Daily demand for raw water is therefore 8,407.2 kl/day (8.4 ML/day), and annual demand is 3,069 ML/year.

Verdant Earth will need to purchase a water access licence to extract up to 3,300 ML/year of raw water from the Hunter River. The original WAL was sold with the power station and not acquired by Verdant Earth at the time.

### 15.2.2. Stormwater Management

The primary difference in predicted pollution from the Proposal arises from the stockpiling of biomass instead of coal. In most other respects the proposal remains as existing, although there is a small increase in road surface on the Site and a negligible increase in traffic.

Biomass residues are likely to produce:

- Elevated levels of nutrients, especially nitrogen and dissolved organic nitrogen (measured as total Kjeldahl nitrogen (TKN));
- Elevated levels of BOD and COD;
- Elevated Levels of Nitrogen and Phosphorus (to a lesser extent);
- Elevated levels of tannins which would leach from immature wood chips;
- Formaldehyde which may be present in domestic biomass fuels arising from MDF or particle board. Formaldehyde is a natural chemical; it biodegrades in water and forms urea. However, due to the low proportion of domestic biomass fuels which would contain formaldehyde, together with the likelihood of being well cured, it is likely only low levels of formaldehyde would occasionally be present in runoff.

Drive in sediment and floating oil traps, cleaned periodically by bob cat, are present in two locations upstream of the water quality pond including a baffle wall to stop short circuiting of the incoming stormwater pipe close to the outlet.

The water quality pond accepts runoff from the stockpile storage area and the boiler island. This would be the dirtiest parts of the existing and proposed operation with all other elements being bunded and separated from stormwater to facilitate only controlled discharges.

The Site is operated so that 4 ML metres of raw water is available to provide nominally 12 hours water supply to cover the risk of a power outage or failure at the river side pumps.

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The raw water storage is then operated with 2 ML headroom. Headroom is defined as air space above the operating water level to temporarily store stormwater runoff from the Site to prevent an off-site discharge.

A safe work Procedure (SWP-10-0004) has been adopted by Verdant Earth which describes this operational procedure. It is broadly summarised as follows:

- The Facility operators continually review Bureau of Meteorology Forecasts, and if rain is predicted they prepare to turn off the pumps which they can do remotely from the power station site;
- Once rain commences and stormwater runoff from the Site starts entering the pond the pumps are turned off. Flow entering the pond is monitored both visually and remotely from a water level and conductivity gauge installed at the entry point to the pond;
- Site operators then monitor the event and pumping recommences once the storm event is over and flow and water level in the raw water pond are returned to the 4ML typical operating level; and
- In the event of a spill from the pond, Site operators are required to collect water quality samples hourly and get them tested to comply with the licence conditions on the site.

### 15.2.3. MUSIC Modelling Results

The model predicted three (3) runoff events in 40.5 years. On average, this is less than 1 runoff event every 10 years. The model predicts 99.7% of all runoff will be retained and reused on the site. The 0.3% of runoff that is discharged occurs during the most extreme rainfall events.

The model predicts that the Site effectively has no “chronic” discharges. In other words, the Site is predicted to discharge only during extreme rainfall events.

The existing and proposed operations at Redbank Power Station would remain, in water quality terms, effectively (99.7%) disconnected from Dights Creek. This outcome ensures that both the existing operation and the Proposal will have no adverse impacts on the adjacent creek or downstream water quality.

A minor modification to the water quality pond was included in the model which is to choke flows using a 300mm high plate placed across the outlet with a 150mm orifice hole at its base to allow flows to trickle out. This still allows extreme event flows to overtop the orifice plate and flow into the culvert.

Provided that the raw water storage is operated with 2 ML headroom, and a condition of consent is invited to ensure this outcome, the development proposal is extremely unlikely to result in any off-site adverse water quality impacts.

MUSIC water quality modelling indicates that the Site is likely to be able to comply with an EPL condition that stipulates the 90th percentile TSS at 30 mg/L and 100th percentile at 50 mg/L.

### 15.2.4. Pre and Post Development

As noted previously, the Site remains essentially the same aside from some minor differences. As the Site is expected to discharge stormwater less often than once every ten years, no adverse impacts off the Site are expected.

The change in the reduction of ash is considered immaterial to effluent quality, although the amount of ash produced by the plant will decrease.

As the Facility has a very high demand for raw water and stormwater, the Site consumes 99.7% of all stormwater runoff. The Site will discharge to stormwater less than once in ten years on average.

The remaining 0.3% of annual runoff is diluted 250-fold and only discharged when ambient water quality in receiving waters would, regardless of the Proposal, be extremely poor due to extreme rainfall events.

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## 15.2.5. Hunter River Salinity Trading Scheme

The Facility has a licence condition requiring it to report activities arising from its participation in the Hunter River Salinity Trading Scheme. The source of salt produced in this industrial process originates from salty water extracted from the river.

Wastewater is generated at a rate of 6.6 kL/hour and comes from reject water from the reverse osmosis plant on the site. Influent to the reverse osmosis plant has been first clarified and filtered to remove solids and chemicals that can be precipitated.

There are no anti-scaling agents used to clean the boiler which would then be present in wastewater. Because ultra-high quality deionised water is made on-site using an RO plant, magnetite is added to the demineralised water to ensure it doesn't leach metals from the boiler.

Therefore, the wastewater contains only brine from the treatment process. All solids, metals and other contaminants are removed from the waste stream by thickening and pressing and then disposed of lawfully. The source of salt in the water is largely from elevated salt levels present in raw water harvested from the Hunter River.

Occasionally water is discharged using salinity credits under the trading scheme when flow rates permit. The wastewater (brine) discharged from the Site is licensed. It is dosed to adjust its pH prior to any discharge.

All non-salt contaminants are removed from the process prior to treatment in the reverse osmosis (RO) plants and they are not found in the RO reject water, i.e., brine, which is discharged from the Site.

## 15.2.6. Contamination

The potential sources of contamination within the Site are chemicals and diesel stored in above ground storage tanks, sediment from the onsite dams, combustion of material within the boilers and the general operations of the Site.

The data provided in the due-diligence report was compared against the ASC NEPM (NEPC, 2013) criteria for Commercial / Industrial land use scenarios and is included in this report in the PSI (Appendix U) included in this EIS.

Chemical storage areas were observed to be bunded with bunding designed to exceed 110% of the volume of the largest tank. No staining or evidence of chemical release was noted, and no formal or anecdotal reports of spills were provided by the Client.

One area of hydrocarbon staining was observed, associated with the diesel and fuel oil AGT fill points. Sampling and analysis of soils collected from this area of the Site detected low level hydrocarbon impacts, which do not exceed the commercial/industrial screening criteria.

Three potential waste stockpiles were observed:

- A stockpile of residual coal material was observed in the coal storage area, in the south of the Site;
- A stockpile, understood to comprise sediments excavated periodically from the Water Quality Pond, was observed in the south western corner of the site;
- A small stockpile of ash and waste materials (brick fragments, timber fragments and concrete) was observed near the eastern site boundary.

If offsite disposal of the materials is required, the materials should be assessed in accordance with the NSW EPA (2014) *Waste Classification Guidelines: Part 1 Classifying Waste*.

Staff are trained to use spill kits at the Site. During operations, maintenance of the vehicle fleet occurs off site therefore no on-site impacts would occur as a result.

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The most common maintenance activity on-site is the use of grease and oil guns to lubricate pumps, valves and motors. Oil is stored in a bunded area, containers are filled in the bunded area and then taken to where they are needed.

Transformers, diesel storage, diesel fuel pump, any hazardous chemicals etc are all stored in bunded areas to contain at least 110% of the volume of the largest tank in accordance with relevant Australian Standards.

There are a large number of controls in place at the Site to prevent and monitor for an accidental spill including extensive use of spill bunds. The Site would operate under its numerous existing safe work procedures which include spill management procedures.

The Site currently operates in accordance with its Pollution Incident Response Management Plan[53]. This means that the development proposal, using all existing bunds and emergency spill controls such as water level, flow, salinity and oil on water real time monitoring, is unlikely to cause water pollution from an accidental spill.

## 15.2.7. Groundwater

Existing groundwater quality at the site is unknown. Extensive drilling of the Site indicate that it is underlain by an extensive clay deposit. No groundwater was detected or sampled as part of this work. There are no existing groundwater bores on the Site and groundwater sampling was not part of any previous environmental protection licence.

The existing stockpile area is well drained and underlain by subsoil drainage lines which discharge directly to the drainage channel. This will prevent any pooling of leachate at the base of the stockpile and protect groundwater.

The stockpile area is located on in-situ well compacted clays which form an impermeable liner.

It is recommended that two groundwater monitoring wells are established to enable groundwater to be monitored.

## 15.2.8. Construction Erosion and Sediment Control

During construction works there will be very little soil so this risk of erosion and sediment exportation due to construction work is very low. Works that may expose top soil during construction are limited to:

- Installation of two 28m weighbridges;
- Construction of a 160m of sealed road;
- Construction of the biomass fuel receival and storage area;
- Construction of a grass swale along the eastern boundary; and
- Minor landscaping

Erosion and sediment control measures will be implemented in accordance with ‘the blue book’, the industry standard for the management of site runoff during construction.

It is unlikely the works proposed will result in more than 2,500m$^2$ of soil being exposed, and therefore a temporary sediment basin is not expected to be required. Erosion and sediment control measures to be implemented during construction include sediment fencing or strawbale bunds downstream of works and temporary stockpiles, dust suppression (which is already part of the standard practice at the Site), and filter sausages around inlets to the Site’s stormwater network.

A detailed Erosion and Sediment Control Plan (ESCP) will be prepared as part of the construction documentation.

[53] https://verdantearthtechnologieslimited.com/verdant-new-site/wp-content/uploads/2021/08/001-PIRMP-V4.pdf

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## 15.2.9. Monitoring Recommendations

#### *15.2.9.1. Groundwater*

It is recommended that two groundwater spear points are to be established to enable groundwater to be monitored. The first spear point would be below the stockpile area and the second spear point, below the water quality pond.

If groundwater is not present, then suction of pore water should occur in the vadose zone using a lysimeter.

Sampling should be quarterly for the first 5 years and can be relaxed to annual after that.

#### *15.2.9.2. Proving Period Monitoring*

During the proving period – which should last for 6 months - the following water quality monitoring regime is recommended:

Monitoring locations:

1. Concrete channel upstream of the water quality pond;
2. Water quality pond close to the outlet;
3. Raw water pond – close to the outlet; and
4. Wastewater storage pond.

Frequency:

- Channel should be sampled when raining (this will measure biomass runoff quality) and elsewhere sample monthly.

Using water quality probe monitor the following analytes on site:

- pH, EC, DO, Temp, turbidity.

In a lab using EPA endorsed methods monitor the following analytes:

- BOD, TOC, TSS, TN, TKN, ammonia, nitrite/nitrate, TP, ortho P, Zinc, Chromium, Copper, Arsenic, Selenium, Iron, Lead, Formaldehyde and Tannins.

Following the proving period, monitoring can be relaxed to be quarterly.

The existing EPL on the Site monitoring will continue to ensure any discharge is monitored for water quality in accordance with the terms of the EPL.

# 15.3. Mitigation Measures

With the implementation of the soil and water mitigation and management measures provided in Table 15.1, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential soil and water impacts and is therefore suitable for construction and operation.

**Table 15.1. Soil and water mitigation measures.**

| Measure | Description |
|---|---|
| SW1 | A construction Erosion and Sediment Control Plan will be prepared and implemented prior to the minor areas of soil disturbance. |

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| Measure | Description |
|---|---|
| SW2 | Prior to issue of construction certificate, investigate the in situ compacted liners beneath the water quality pond and stockpile and (during construction) if required, carry out necessary upgrades to the liners to ensure compliance with the Environmental Guidelines – Composting and Related Organics Processing Facilities (DECC – 2004) to ensure the development complies with the applicable environmental guidelines. |
| SW3 | The raw water storage will be operated with 2 ML headroom to ensure stormwater runoff from the Redbank site occurs less often than once in 10 years. |
| SW4 | Construct a new grassed swale to reduce the area of catchment 5 (shown in Figure 5 of the Soil and Water Impact Assessment report) that contributes stormwater to the raw water pond. |
| SW5 | A stainless-steel orifice plate, 300mm high, with a 150mm diameter circular opening in its base, is to be placed over the outlet of the water quality pond. This will detain water in the pond for an extended period which will improve discharge water quality and help reduce the potential frequency of off-site discharge. |
| SW6 | The water quality pond will be aerated to ensure that it maintains high levels of dissolved oxygen. This is to address a risk that the water quality pond will receive elevated levels of BOD. This may result in the development of anoxic conditions on the water quality pond under low rainfall conditions. |
| SW7 | Construct a 2m vegetated buffer strip between the stockpile and the concrete channel to help reduce the export of woodchip from the stockpile. |
| SW8 | Carry out water quality monitoring as detailed in the Water Cycle Impact Assessment (and as detailed above) to manage the risk to water quality and operations from changing fuels. |
| SW9 | Install a Barramy Trap upstream of the water quality pond. This will enable the dry storage of woodchips which would see reduced leaching. |
| SW10 | An unexpected contamination finds procedure will be developed and implemented during construction and operation of the Facility. In the event contaminated soil is found in the areas planned for excavation, it will be sampled and classified in accordance with the NSW EPA's Waste Classification Guidelines (2014) and disposed of to a licenced facility approved to accept that waste type. |

## 15.4. Conclusion

The existing Facility has no significant contamination, all chemicals held onsite are bunded and contained, and there is an existing stormwater capture reuse/treatment system that will continue to be used and managed during operation of the Proposal.

The stormwater MUSIC model predicted three (3) runoff events in 40.5 years. On average, this is less than 1 runoff event every 10 years. The model predicts 99.7% of all runoff will be retained and reused on the site. The 0.3% of runoff that is discharged occurs during the most extreme rainfall events. Therefore the Site effectively has no "chronic" discharges.

The existing and proposed operations at Redbank Power Station would remain, in water quality terms, effectively (99.7%) disconnected from Dights Creek. This outcome ensures that both the existing operation and the Proposal will have no adverse impacts on the adjacent creek or downstream water quality.

An operational surface and groundwater monitoring program will be implemented to ensure water quality is protected.

The Site is therefore suitable for construction and operation of the Proposal.

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# 16. Bushfire Assessment

A Bushfire Assessment Report (BFAR) has been prepared (Appendix V) for the Proposal to assess the bushfire construction and planning requirements.

Section 4.14 of the EP&A Act requires developments to comply with the NSW Rural Fire Service's *Planning for Bushfire Protection* (PBP 2019) and to assess if any part of a development site is affected by bush fire hazard as indicated within the BPA Map.

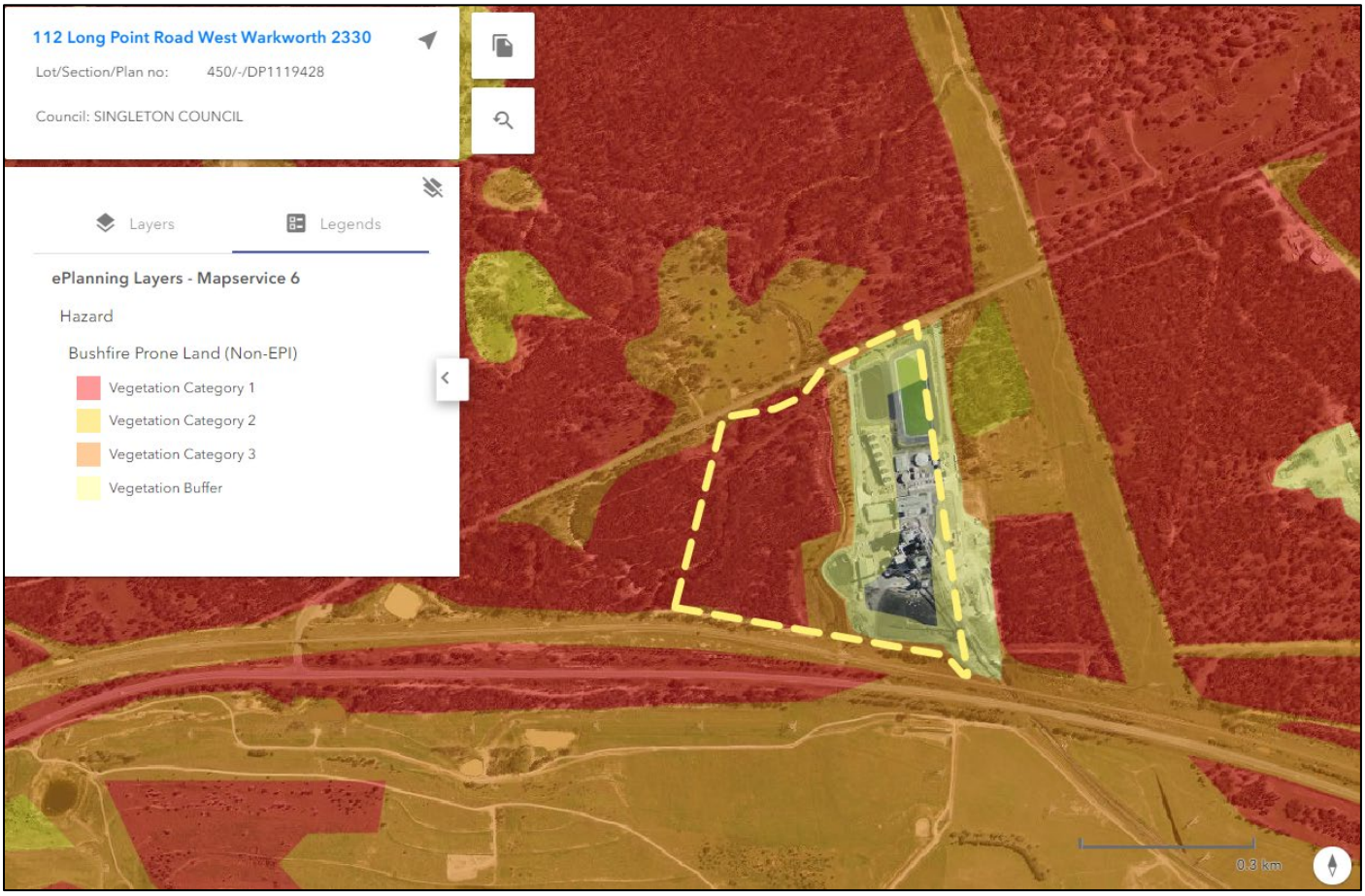
A site assessment was performed for the BFAR to assist in determining the appropriate bush fire threat level, design, planning and construction standards required to comply with relevant requirements of PBP 2019.

The BFAR takes into consideration access, water supply and services, and emergency and evacuation planning, and demonstrates how bushfire requirements can be met by ensuring suitable measures are put in place appropriate to the level of risk and to protect people using the site.

## 16.1. Existing Environment

The Proposal falls within the Bushfire Vegetation Buffer zone on the *Singleton Council Bushfire Prone Land Map* (see Figure 16.1).

**Figure 16.1. Bushfire prone area mapping.**




The Forest Fire Danger Index for the Singleton council area is 100.

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The requirement for these type of developments in PBP (2019) is based on providing suitable design, construction and sufficient space to ensure that radiant heat levels do not exceed critical limit for firefighters and other emergency service personnel undertaking operations, including supporting or evacuating occupants.

The implementation of the recommendations of this BFAR will reduce the risk of bushfire to an acceptable level to allow the development to proceed. The development of a Bushfire Emergency Management and Operations Plan will further analysis the operation requirements to manage wildfire event on the Facility.

## 16.2. Impact Assessment

The potential wildfire related risks associated with the operational phase of the Facility are due to wind, smoke and ember attack on the Facility and associated infrastructure such as transmission and distribution networks. Damage to powerlines and poles may result in the power station not able to provide services to the electricity network. Wildfire smoke can be sucked into the ventilation systems reducing the efficiencies of power generation. Ignition caused by the storage and stockpiling of the power station fuel (biomass) arcing from transmission lines and electrical shorts, hazards that could accelerate and intensify bushfires/ grassfires (fuels and oil) and human health risk associated with exposure to burning construction materials.

In the event of a serious bushfire threat to the Site, it will be essential to ensure that adequate ingress/ egress and the provision of defendable space are afforded in the design.

**Firefighting Access**

The site is relatively flat, with proposed perimeter trail, passing and turning provisions to accommodate emergency services vehicles within the south-eastern corner of the development. Infrastructure and materials to the south-east of the facility are located outside the perimeter of the facility and are owned by another landowner. Attempts should be made to encourage the landowner to relocated to allow a minimum 10m separation between the vegetation and material being stored.

Gates should be installed along boundary fencing association with gaps in the landscaping features to allow emergency services to access neighbouring properties.

A minimum 10m APZ is required to comply with PBP 2019. Road access to the Site (Long Point Road), power, other services and fencing are excluded from the APZ.

**Vegetation Management**

Vegetation management is required in the railway easement to the south as indicated in Figure 16.2. Verdant Earth has access to this land. The canopy vegetation has no continuity with other canopy vegetation, and canopy fire spreading from adjacent canopy vegetation is not possible. Ground based fire moving into the canopy is possible if the vegetation under the canopy is not maintained. The vegetation to the south within the railway easement shall be managed to the following prescriptions:

- Ground and shrub vegetation to <10cm;
- Removing branches below 2m;
- Canopy screening vegetation to remain; and
- No further vegetation to be established.

**Water Supply**

The Facility's primary water supply is drawn from the Hunter River, store within a 6ML raw water dam (north-east in the facility) prior to treatment and storage into a 1900m$^3$ above ground metal storage tank. This water supply is

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support by diesel pumps and provides the fire suppression water to the facilities hydrants and internal water suppression requirements.

A secondary water supply system existing to support the Stockpile water spray sprinkler system. Water is drawn from a 4ML raw water dam in the south-western portion of the Facility, which is gravity feed by the 6 ML raw water dam. This water supply is supported by a separate diesel pumping system to the Stockpile water spray sprinkler system.

Both systems principally work independently. There is the ability to change the Stockpile water spray sprinkler system from the 4MLt supply to the facilities primary water supply, if delivery of supply of raw water becomes an issue.

With adequate access to water from the Hunter River, both water supplies are considered reliable.

Bush Fire Emergency Management and Operations Plan has been developed (Appendix EE).

Table 16.1 provides a strategic assessment of assesses Bushfire Performance Measures (BPMs) for the Proposal in consideration of the aims and objectives and Chapter 8 of PBP 2019, the existing environment and whether the Proposal is appropriate in the context of bush fire hazard.

Figure 16.2 provides a visual summary of the bushfire assessment.

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**Table 16.1. Existing environment assessment summary.**

| No | Performance Criteria | Compliance for the Proposal |
|---|---|---|
| Aims and Objectives | Afford buildings and their occupants protection from exposure to a bush fire | • All buildings are exposed to BAL 12.5. No overnight accommodation is proposed.<br>• Office workers have the ability to evacuate the site to public road system through internal access not exposed to elevated radiant heat flux.<br>• Current landscaping suppresses the opportunity for ember ignition. |
| | Provide for a defendable space to be located around buildings | • All buildings are provided a defendable space with a perimeter road around the entire facility supported by internal road system liking various portions to facilitate emergency response. |
| | Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings | • Separations in excess of 36m are provided between the buildings and bushfire hazard.<br>• A 6m separation has been provided between the bush fire threat and woodchip stockpile that results in significant radiant heat flux to ignite the woodchip pile. In the event of a wildfire progressing to the site from the west, fire fighter access around the perimeter of the woodchip pile is not guaranteed.<br>• Vegetation management is required in the railway easement to the south as indicated in Figure 2, page 9. Redbank power station has access this this land, vegetation on this land was established for visual screening with ground and shrub vegetation to <10cm, removing branches below 2m and leaving the canopy screening vegetation. |
| | Ensure that appropriate operational access and egress for emergency service personnel and occupants is available | • The facility offers a perimeter road around the complex with internal road system liking various portions to facilitate emergency response and evacuation of staff.<br>• In the event of a wildfire progressing to the site from the west, fire fighter access around the perimeter of the woodchip pile is not guaranteed. |
| | Provide for ongoing management and maintenance of BPMs | • A bushfire emergency management and operations plan has been developed (although will require updating inconsideration of final design) to ensure ongoing application of bushfire protection measures. |

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| No | Performance Criteria | Compliance for the Proposal |
|---|---|---|
| | Ensure that utility services are adequate to meet the needs of firefighters | • No gas bottles are proposed, and electricity is underground from the transfer station to the east.<br>• A hydrant system is provided that provides hydrant points throughout the facility.<br>• The woodchip piles are exposed to radiant heat level that will result in pyrolysis with a 6m separation provided. A separate gun water spray system is provided to protect the woodchip stockpile in the event of a fire. Analysis has not been performed to establish if the gun water spray system or the volume of water emitted is sufficient to inhibit the ignition of the woodchip pile. |
| Class 5-8 buildings | To provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress for evacuation | • The facility offers a perimeter road around the complex with internal road system liking various portions to facilitate emergency response and evacuation of staff. |
| | To provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development | • The facility offers a perimeter road around the complex with internal road system liking various portions to facilitate emergency response and evacuation of staff. In the event of a wildfire progressing to the site from the west, fire fighter access around the perimeter of the woodchip pile is not guaranteed.<br>• A bushfire emergency management and operations plan has been developed (although will require updating inconsideration of final design) to provide staff triggers and decision point to inform emergency management and evacuation routes and locations. |
| | To provide adequate services of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building | • A hydrant system is provided that provides hydrant points throughout the facility.<br>• A separate gun water spray system is provided to protect the woodchip stockpile. |
| | Provide for the storage of hazardous materials away from the hazard wherever possible | • The woodchip stockpile could be considered hazardous material.<br>• A separate gun water spray system is provided to protect the woodchip stockpile. Analysis has not been performed within Acor Consultants (2022) Fire Safety Study, Redbank Power Station Doc # PE:210269-01 Revision E, and Arriscar Risk Engineering Solutions (2022), Waste Wood Residues Fuel Use at Redbank Power Station - Preliminary Hazard Analysis, Doc. No.: J-000510-PHA-001-Rev 0 to establish if the gun water spray system or the volume of water emitted is sufficient to inhibit the ignition of the woodchip pile. |

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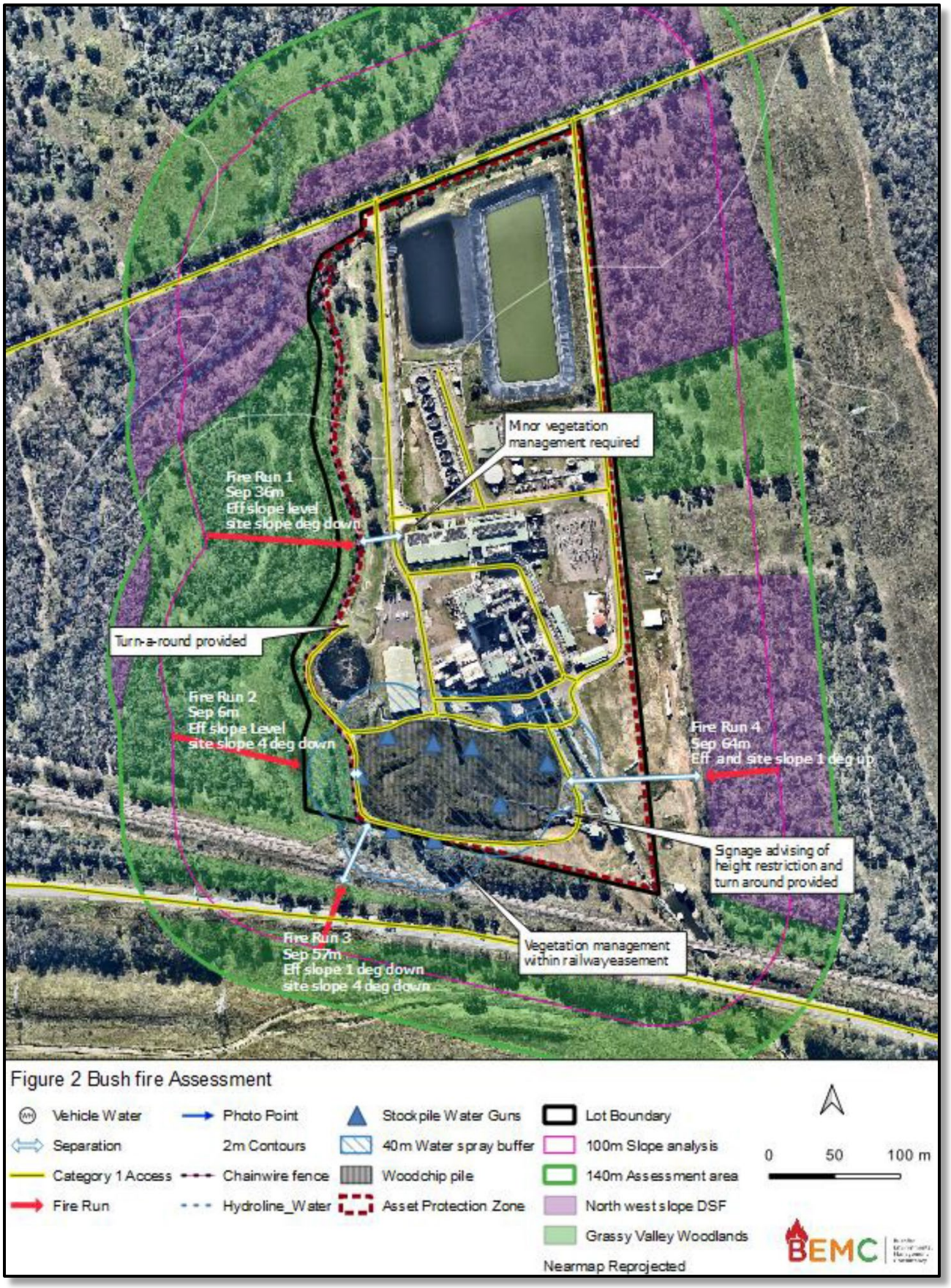
**Figure 16.2. Bushfire assessment of the Site.**

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## 16.3. Mitigation Measures

With the implementation of the bushfire hazard mitigation and management measures provided in Table 16.2, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential bushfire hazard impacts and is therefore suitable for construction and operation.

**Table 16.2. Bushfire mitigation measures.**

| Measure | Description |
|---|---|
| BF1 | At the commencement of building works and in perpetuity, a 10m APZ around the entire development footprint shall be managed as an Inner Protection Area (IPA) and supported by a perimeter trail as outlines within PBP 2019. |
| BF2 | Materials within the south-eastern corner of the facility shall be relocated to allow a minimum 10m separation between the vegetation and material to be established. |
| BF3 | Ensure the provided APZ to the north and west are maintained to provide ample separation for BAL-LOW construction and emergency service mobility within the facility within excessive radiant heat exposure. |
| BF4 | Vegetation management is required in the railway easement to the south with ground and shrub vegetation to <10cm, removing branches below 2m and leaving the canopy screening vegetation. |
| BF5 | Gates should be installed along boundary fencing association with gaps in the landscaping features to allow emergency services to access neighbouring properties. Access shall be provided in accordance with Appendix 3 of PBP 2019. |
| BF6 | Upgrade the perimeter access to the south of the stockpile location, signage and turn around facilities to the south-east are required to comply with PBP 2019. |
| BF7 | A Bush Fire Emergency Management and Operations Plan (Appendix EE) will updated upon final design of the Facility and include:<br>• Igniting management and prevention.<br>• Strategies to reduce ignition.<br>• Strategies to suppress unplanned fires.<br>• Strategies to minimise potential spread of bushfires.<br>• Bushfire Mitigation treatments.<br>• Appropriate woks programming on fire danger days.<br>• Bushfire Emergency Management procedures.<br>The plan will also identify the operations that may be carried out on days of Total Fire Ban and any prohibited activities or exemptions that are notified by the Commissioner of the NSW RFS under the Rural Fires Act s.99. and requirements to notification of the local NSW RFS Fire Control. |
| BF8 | Fire engineering analysis will establish final design volume, capacity, and distribution of the proposed gun water spray system so that it is sufficient to inhibit the ignition of the woodchip pile during a modelled wildfire event. |

## 16.4. Conclusion

The BFAR assessment identified that the Proposal is able meet the broad aims and objectives in PBP 2019 if the appropriate and recommended Bushfire Protection Measures are established and maintained.

The Proposal includes provisions for staff to readily evacuate in the event of a bush fire event, provides separation between bush fire threats and the power station infrastructure and will not significantly limit the ability of emergency services to access the property and fight fires.

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# 17. Hazard and Risk

A Preliminary Hazard Analysis (PHA) has been prepared to identify key potential impacts of the Proposal, as well as potentially offensive or hazardous issues that need to be considered as part of the Development Application process. This section summarises the findings of the full PHA (Appendix W).

The assessment has been performed according to AS/NZS ISO 31000: 2009 Risk Management – Principles and Guidelines and the Preliminary Hazardous Analysis has been informed by the *Hazardous and Offensive Development Application Guidelines - Applying SEPP 33*[54] and in consideration of the following guidelines published by the NSW Department of Planning in 2011:

- *Hazardous Industry Planning Advisory Paper No 2 - Fire Safety Study Guidelines*55
- *Hazardous Industry Planning Advisory Paper No 3 - Risk Assessment*56
- *Hazardous Industry Planning Advisory Paper No 4 - Risk Criteria for Land Use Safety Planning*57
- *Hazardous Industry Planning Advisory Paper No 6 - Hazard Analysis*[58] .

## 17.1. Existing Environment

The main features nearby are:

- Railway line to Wambo Coal approximately 35 m from the edge of the proposed biomass stockpile to the south;
- Golden Highway approximately 75 m from the edge of the proposed biomass stockpile to the south;
- Dyno Nobel Warkworth emulsion manufacturing facility 1.1 km to the east;
- Nearest residential location is 1.5 km to the east; and
- The Hunter Valley Gliding Club is located 5.4km to the NW of the site.

Because of the location and the materials in use, the potential for impacts outside the boundaries of the Site by the Proposal is negligible.

Detailed upgrades to the fire protection system are yet to be designed. Areas to be reviewed during detailed design are:

- Firefighting for biomass delivery area;
- Stockpile hydrant locations;
- Potential foam suppression system for stockpile;
- Firefighting sprays along new conveyors;

[54] NSW Department of Planning (2011). Hazardous and Offensive Development Application Guidelines - Applying SEPP 33. Published by the NSW Department of Planning. Internet publication: http://www.planning.nsw.gov.au/en/Policy-and-Legislation/~/media/3609822D91344221BA542D764921CFC6.ashx

[55] NSW Department of Planning (2011). Hazardous Industry Planning Advisory Paper No 2 - Fire Safety Study Guidelines. Published by the NSW Department of Planning. Internet publication: http://www.planning.nsw.gov.au/Policy-and-Legislation/~/media/CCC734E980C4427DB95D319DF073C41A.ashx

[56] NSW Department of Planning (2011). Hazardous and Offensive Development Application Guidelines- Risk Criteria for Land Use Safety Planning. Published by NSW Department of Planning. Internet publication: http://www.planning.nsw.gov.au/Policy-and-Legislation/~/media/0D39F08E7889409BBA1FA88D5FB859FD.ashx

[57] NSW Department of Planning (2011). Hazardous Industry Planning Advisory Paper No 4 - Risk Criteria for Land Use Safety Planning. Published by the NSW Department of Planning. Internet publication: http://www.planning.nsw.gov.au/Policy-and-Legislation/~/media/0D39F08E7889409BBA1FA88D5FB859FD.ashx

[58] NSW Department of Planning (2011). Hazardous Industry Planning Advisory Paper No 6 - Hazard Analysis. Published by NSW Department of Planning. Internet publication: http://www.planning.nsw.gov.au/Policy-and-Legislation/~/media/3ACC37BE3EFE4BAAB3EBA5872AFBA8BD.ashx

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- Boiler silo water sprinkler system or nitrogen inerting system;
- Boiler silo area sprinklers; and
- Review of fire water supply capability to meet the new demand/s.

The proposed receival of biomass is a new combustible material to be introduced to the Facility (Table 17.1).

The principal hazards biomass dust presents in storage are:

- Fires of biomass in process and handling areas (materials handling);
- Biomass dust explosions in silos and hoppers; and
- Exposure to biological materials that may be present in the biomass.

Fire in biomass outside storage is a hazard but may not result in explosion as it is in the open and not confined.

Biomass is included in determining whether a potentially hazardous industry exists on the Site as the *Hazardous and Offensive Development Application Guidelines - Applying SEPP 33* state the following:

> *"Dust Explosions: Some combustible dusts that are not Dangerous Goods can cause explosions if there is a combination of a dust concentration within the explosive range and the presence of an ignition source. Static electricity is the most common source of ignition, due to the dry conditions typically prevailing within a dusty atmosphere. Coal dust and grain/flour dust are two examples of such materials.*
>
> *Proposals for the storage and handling of dusts and other finely divided materials should be carefully scrutinised to consider whether they should be considered potentially hazardous industry due to dust explosion factors."*

**Table 17.1. Combustible biomass materials to be received and stored at the Facility.**

| No. | Material | DG Class | UN No. | Quantity, $m^3$ | Type of storage |
|---|---|---|---|---|---|
| 1 | Biomass | Not classified as DG | - | 24,000 $m^3$ | Stockpile |
| | | | | 1,800 $m^3$ | Boiler Silos |
| | | | | 90 $m^3$ | Feedstock hopper |
| | | | | 25,890 $m^3$ | Total |

The Facility includes existing fuel oil and diesel oil tanks will continue to be used for boiler startup and operation of the backup emergency generator, respectively. The tank storage facilities are designed and maintained to prevent spills from migrating beyond the immediate storage area.

The above ground fuel oil storage tank has a maximum capacity of 380,000L. The above ground diesel oil tank has a maximum capacity of 40,000L. Both tanks are designed in accordance with the applicable Australian Standards and are enclosed by berms and impermeable aprons (i.e. concrete floors). The bermed areas are designed to contain the maximum contents of the tank (in the unlikely event of a spill), while providing sufficient additional volume (25-0.5m free board) to account for rainfall.

Other chemicals include acid and caustic storage tanks (for the boiler water treatment system), and various treatment chemicals and maintenance supplies. As with the fuel oil tanks the bermed areas would be capable of containing the tank contents plus rainfall.

A list of chemicals that are already part of the original approved development is provided in Table 17.2 for completeness.

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**Table 17.2 Risk screening analysis of potentially hazardous materials held on site as part of the Proposal.**

| No. | Material | DG Class | UN No. | Quantity, kL | Type of storage |
|---|---|---|---|---|---|
| 2 | Limestone | Not classified as DG | - | | Bulk silo. |
| 3 | Fuel oil (distillate) | Combustible liquid C1 | 1201 | 380 | tank |
| 4 | Diesel | Combustible liquid C1 | 1202 | 40 | tank |
| 5 | Phosphoric Acid >99% | 8 PG III | 2834 | 2.5 | Packaged store |
| 6 | Sodium Metabisulphite | 8 PG III | 2693 | 2.5 | Packaged store |
| 7 | Caustic Soda 46-50% | 8 PG II | 1824 | 10 | tank |
| 8 | Sulphuric Acid | 8 PG II | 1830 | 10 | tank |
| 9 | Sodium hypochlorite | 8 PG III | 1791 | 10 | tank |
| 10 | Ferric chloride | 8 PG III | 2582 | 10 | tank |
| 11 | Aqueous Ammonia 10-35% | 8 PG III | 2672 | 25 | tank |
| 12 | Magnesium Oxide | Not classified as DG | - | | |
| 13 | Hydrochloric Acid 20% | 8 PG II | 1789 | 3 | tank |
| 14 | Hydrochloric Acid <10% | 8 PG II | 1789 | 5 | tank |
| 15 | Trisodium Phosphate | Not classified as DG | - | | |
| 16 | SAS 602 Sodium & Potassium Hydroxide | 8 PG II | 3266 | 0.3 | Packaged store (solid) |

On the basis of the data in Table 17.3, the PHA has assessed the Proposal as a 'potentially hazardous industry'. As the Hazards SEPP applies, a multi-level risk assessment has been prepared.

**Table 17.3. The Hazards SEPP Screening.**

| No. | Hazardous Material | Dangerous Goods (DG) Class | Maximum capacity | Threshold in Guideline | SEPP 33 Applies? |
|---|---|---|---|---|---|
| 1 | Combustible liquids | C1 (not classified a DG) | 420 kL | - | No |
| 2 | Corrosive substances | 8 PG II | 28.3 kL | 25 tonnes | Yes |
| 3 | Biomass | Not formally classed as DG. Considered dangerous due to presence of combustible dust. | 1890m3 of confined storage in equipment | 1 tonne (DG Class 4.2) | Yes |

# 17.2. Impact Assessment

## 17.2.1. Hazardous materials storage and contamination

The most common maintenance activity on-site is the use of grease and oil guns to lubricate pumps, valves and motors. Oil is stored in a bunded area, containers are filled in the bunded area and then taken to where they are needed. Staff are trained to use spill kits.

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Transformers, diesel storage, diesel fuel pump, any hazardous chemicals etc are all stored in bunded areas to contain at least 110% of the volume of the largest tank in accordance with relevant Australian Standards. Containment of spills and leaks will be in accordance with EPA's guidelines *Storing and Handling of Liquids*[59].

A pre-purchase due diligence site contamination assessment revealed a strong history of operational environmental diligence and low risk acquisition for Verdant. A more recent report prepared by Consulting Earth Scientists in September 2023 concluded that the site is considered suitable for the proposed restart of the Redbank Power Station and showed no indication of contamination arising from past activities.

In the event contaminated soil is found in the areas planned for excavation, it will be sampled and classified in accordance with the NSW EPA's *Waste Classification Guidelines* (2014) and disposed of to a licenced facility approved to accept that waste type.

### 17.2.2. Multi-Level Risk Assessment

The scenario-based hazard identification method was used to identify operational hazards associated with the Plant. Scenarios were selected from a literature review.

The hazards that may have an offsite impact include:

- A biomass stockpile fire; and
- Carbon monoxide release from biomass confined storage (silos and hoppers).

Other hazards that are not expected to cause offsite impact include:

- Dust explosion in biomass storage silos and hoppers;
- Fire in biomass storage silos and hoppers; and
- Fire on biomass conveyors.

The facility was divided into various operational areas for hazard identification (HAZID). The areas are:

- Biomass receival and storage;
- Biomass material handling and feed to boilers;
- Fire side of the boiler;
- Water side of the boiler;
- Ash handling;
- Flue gas system; and
- Chemicals storage and handling.

Hazards on the power generation side were not addressed as there are no changes to the existing plant and equipment in these operations.

A total of 31 hazards were identified in the Proposal which are detailed in the PHA. A qualitative risk ranking of identified scenarios using "severity" versus "likelihood" rules is provided in the Risk Matrix. Risk rankings took into consideration the safeguards already provided at the Facility and those mitigation measures identified in the Proposal and this EIS. The result is a ranking of all identified hazards into a risk level of "Low", "Medium", "Moderate", "High" or "Extreme" in ascending order of risk.

There were no extreme risk incidents identified after the safeguards are taken into account. A single high-risk incident was identified – release of carbon monoxide (CO) in the boiler house and toxic exposure (see Table 17.4).

[59] https://www.epa.nsw.gov.au/~/media/EPA/Corporate%20Site/resources/licensing/2007210liquidsManual.ashx.

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**Table 17.4. Summary of risk rankings.**

| Risk Category | Risk Level | Number of events |
|---|---|---|
| Safety | High | 1 |
| | Moderate | 4 |
| | Medium | 13 |
| | Low | 6 |
| Environment | Moderate | 2 |
| | Medium | 3 |
| | Low | 2 |

## 17.2.3. Hazards Considered for further Assessment

Risk events ranked as Moderate or High were carried forward for further assessment. Quantification of consequences has been made where possible.

The list of events carried forward are summarised as follows:

- CO release from biomass silo and hoppers;
- Dust explosion in biomass silo/ hopper;
- Explosion in boiler combustion chamber/ flue gas duct;
- Explosion in boiler flue gas duct;
- CO release from flue gas duct;
- Fire in bulk biomass storage; and
- Exposure to biological materials present in biomass and injury.

These events have been assessed in detail in the PHA using both qualitative and quantitative analysis where appropriate.

## 17.2.4. Risk Evaluation

Since there were no events that had an offsite consequence, based on the multi-level risk assessment, it was decided that quantification of likelihood was not required in the PHA. A qualitative assessment was carried out.

To summarise, the risk assessment using the Risk Matrix has indicated the following conclusions:

- There are no hazardous events falling in the 'Extreme' risk category;
- Only a single incident falls in the 'High' risk category. It is CO release from flue gas duct and exposure. The risk can be reduced by the installation of CO gas detectors and alarm in the boiler house. On alarm personnel will evacuate and return to investigate only with respiratory protection;
- None of the hazardous incidents identified have offsite impacts. This means any risk to people would be contained entirely within the Site boundary;
- Since there are no off-site risks, the multi-level assessment did not require a quantitative risk assessment; and
- The numerical risk criteria specified in *HIPAP No.4 Risk Criteria for Land Use Planning* are implicitly satisfied.

Societal risk is calculated when there are incidents that have offsite effects, resulting in multiple fatalities. Since no incidents from the Proposal had offsite risk impacts, no societal risk would result.

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There are no new dangerous goods in the proposed inventory. Existing dangerous goods will remain with no changes in inventory.

The Proposal is based on proven technology and like plants operating overseas on biomass.

There is an existing fire detection and protection system at the Facility. Modifications to the fire protection system will be designed in the detailed design phase and informed by the Fire Safety Study and the Bushfire Assessment. The PHA recommends that the design consist of fire detection (sensors and thermal imaging), fire protection (sprinklers and water sprays within equipment where fire may occur) and hydrants and hoses in accordance with the requirements of AS 2419.1-2017.

Emissions control systems consist of dust emissions control with bag filters, and limestone injection for coal firing only into the bed of the fluidised boiler. These will be subject to performance standards and a separate environment protection licence from NSW EPA. Limestone injection is not required for biomass fuel.

Other incidents involving injury to personnel related to the occupational injury type and were ranked as low risk incidents.

### 17.2.5. Plume Rise Assessment

The nearest aerodromes from the power station are:

- Warkworth Airstrip (5.4 km);
- Singleton Military Area (10.8 km); and
- Elderslie Airport (25.5 km).

The Hunter Valley Gliding Club uses the Warkworth Airstrip.

Warkworth airstrip and Singleton Military Area are within 15 km of the Redbank power station site. As Elderslie Airport is more than 15 km from the Redbank power station site, there is no requirement to supply a copy of Form 1247 to this facility.

The stack velocity exceeds 4.3m/s. Therefore, Form 1247 of the CASA advisory circular – Plume rise assessments needs to be submitted to CASA. A copy of the form 1247 must also be submitted to the Operators of:

- Singleton Army camp; and
- Hunter Valley Gliding Club (for Warkworth airstrip).

Casa will conduct the plume rise assessment using their software and advise Verdant Earth. This will be completed in tandem with submittal and assessment of the EIS and Proposal application.

## 17.3. Mitigation Measures

With the implementation of the PHA recommendations provided in Table 17.5, the Proposal is expected to be suitable for construction and operation.

**Table 17.5. Hazard analysis mitigation measures.**

| Measure | Description |
|---|---|
| HA1 | A Hazard and Operability (HAZOP) study be conducted of the biomass feed and combustion system at the time of detailed design. |
| HA2 | The Considerations for Final Design identified in appendix A of the PHA will be reviewed for inclusion in post-consent detailed design phase and assessed in the FSS as applicable, including the following: |

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| Measure | Description |
|---|---|
| | • Develop safe work method for removing any biomass hung up in the trailer during tipping;<br>• Fire suppression equipment should be upgraded for potential biomass truck fire on sit, as part of the FSS;<br>• Fire protection equipment should be installed or upgraded for a fire in biomass stockpile, as part of the FSS;<br>• Provide fire protection requirements for a truck fire on site;<br>• Provide speed limit signposting on the truck routes on site;<br>• Develop truck driver induction procedure for site access;<br>• Consider installing fire sprays on new conveyors;<br>• Provide fire suppression for fire in biomass receiving hopper;<br>• Provide static earthing for hopper to minimise static electricity generation;<br>• Consider hazardous area classification for biomass receiving hopper/ boiler feed silo in accordance with AS/NZS 60059.10.2- 2012;<br>• Review dust collection/ ventilation requirements for biomass hopper;<br>• Confirm if nitrogen lances will be installed in boiler storage silos;<br>• Consider dust explosion venting for enclosed storages of biomass;<br>• Consider providing CO detectors and alarm in biomass silos and hoppers vapour space;<br>• Conduct a hazard and operability study (HAZOP) of the final design of biomass feed and combustion system;<br>• Consider installing CO detectors at relevant places in the boiler house and alarm for evacuation of the area. Respiratory protection required for return;<br>• Explosion venting in flue gas duct to be considered;<br>• Ensure that fire water system has adequate capacity; and<br>• Maintain spill cleanup kit at the chemicals storage area. |
| **HA3** | Form 1247 of the CASA advisory circular – Plume rise assessments will be submitted to CASA. A copy of the form 1247 will also be submitted to the Operators of:<br>• Singleton Army camp<br>• Hunter Valley Gliding Club (for Warkworth airstrip) |

## 17.4. Conclusion

The Proposal is based on proven technology and like plants operating overseas on biomass.

There is an existing fire detection and protection system at the Facility. Modifications to the fire protection system will be designed in the detailed design phase and informed by the Fire Safety Study and the Bushfire Assessment. The PHA recommends that the design consist of fire detection (sensors and thermal imaging), fire protection (sprinklers and water sprays within equipment where fire may occur) and hydrants and hoses in accordance with the requirements of AS 2419.1-2017.

Emissions control systems consist of dust emissions control with bag filters, and limestone injection for coal firing only into the bed of the fluidised boiler. These will be subject to performance standards and a separate environment protection licence from NSW EPA. Limestone injection is not required for biomass fuel.

The stack velocity exceeds 4.3m/s. Therefore, Form 1247 of the CASA advisory circular – Plume rise assessments needs to be submitted to CASA. A copy of the form 1247 must also be submitted to the Operators of:

- Singleton Army camp; and
- Hunter Valley Gliding Club (for Warkworth airstrip).

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CASA will conduct the plume rise assessment using their software and advise Verdant Earth. This will be completed in tandem with submittal and assessment of the EIS and Proposal application.

The Considerations for Final Design identified in the PHA will be reviewed for inclusion in post-consent detailed design phase and assessed in the FSS as applicable.

The PHA found that adequate safeguards are provided, commensurate with the consequence level of the incidents. No incidents from the Proposal would have offsite consequences, therefore no societal risk results. Therefore the Proposal is expected to be suitable for construction and operation.

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# 18. Fire Safety and Incident Management

A Fire Safety Study (FSS) (Appendix X) has been prepared for the Proposal in consideration of the *NSW Hazardous Industry Planning Advisory Paper No 2 Fire Safety Study Guidelines* (2011) and includes the following:

- Identification of fire hazards and the consequences of possible fire incidents;
- Fire prevention strategies and measures;
- Analysis of the requirements for fire detection and protection;
- Identification of the specific measures to be implemented;
- Calculation of firefighting water supply and demand;
- Containment of contaminated firefighting water; and
- First aid fire protection requirements.

## 18.1. Existing Environment

The existing Redbank Power Station abuts the Yancoal Mine mining leases. The Dyno Nobel ammonium nitrate emulsion plant is located approximately 1100 metres to the east. The nearest residential (rural) property is located approximately 1500 metres to the northeast.

**Stockpile and Boiler Fire Protection Infrastructure**

The facility is currently serviced by the following fire protection infrastructure:

- The primary fire booster station water is supplied from a 1700m$^3$ (500m$^3$ reserve)above ground tank, itself fed by the 6,000kL raw water dam (water drawn from the Hunter River). A secondary water supply is available to support the stockpile water spray sprinkler system, with water drawn from a 4,000kL raw water dam, adjacent to the filter system. Water is pumped to the stockpile water system using a dedicated diesel pump skid;
- DN150 Boiler House firewater ring-main:
    - Serviced by eight (8) hydrants (2 x dual, 1 x quad hydrants) with hose cabinet;
    - Serviced by 11 fire extinguishers (foam, DCP, $CO_2$);
- DN150 fuel storage ring-main:
    - Serviced by four (4) hydrants (2 x dual hydrants) with hose cabinet;
    - Serviced by two (2) fire extinguishers (foam, $CO_2$);
- DN150 stockpile ring-main:
    - Serviced by ten (10) hydrants (two located in underground reclaim pit) with hose cabinet.

One additional fire hydrant with hose cabinet will be required for the stockpile and boiler fire protection infrastructure, adjacent to fire hose reel No. 7 to provide coverage for the extended stockpile area. The FSS assessed that a minimum of 4 fire hydrants will be operational for a fire at any of the identified locations.

An automatic sprinkler system is installed at conveyors 35 and 36. Many of the existing system control valves are noted as being extensively corroded and in need of maintenance or replacement.

Figure 18.1 shows the approximate locations of existing fire hydrants on the Site.

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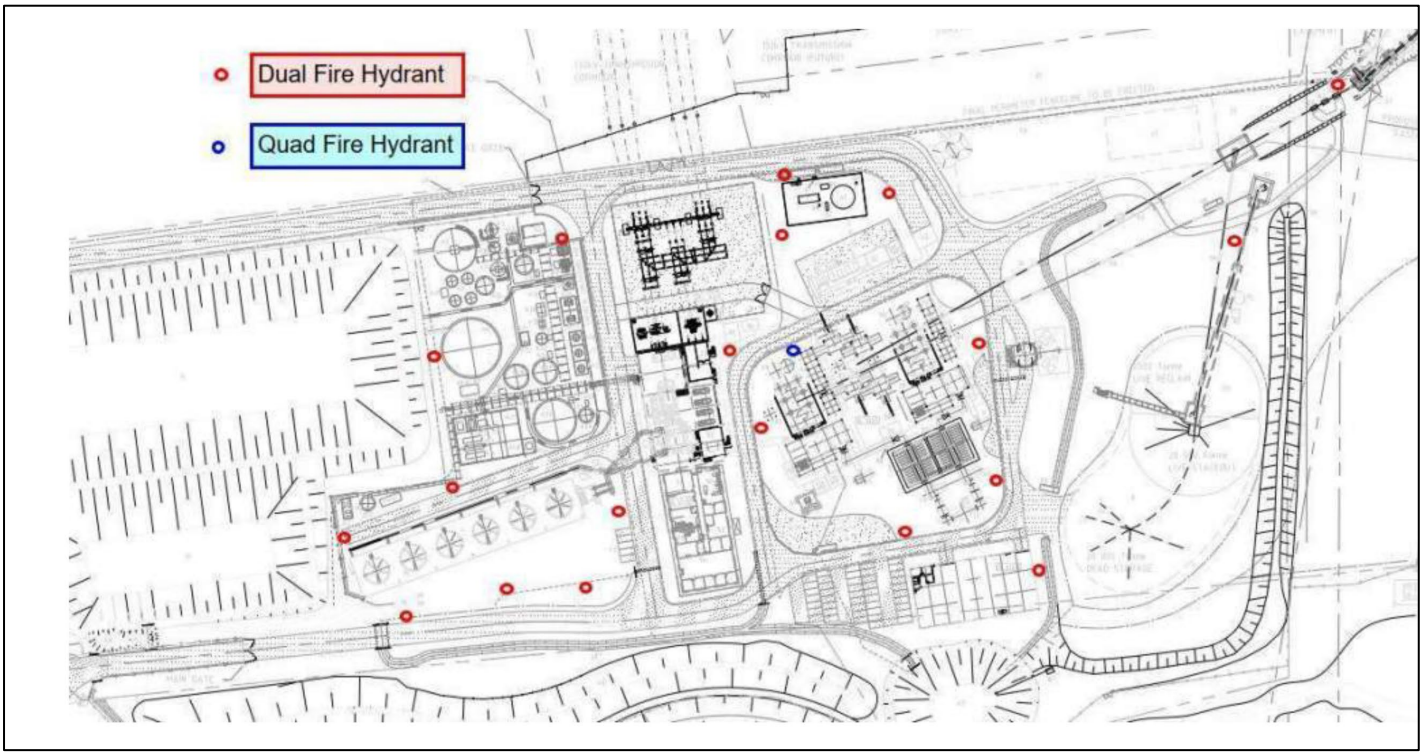
**Figure 18.1. Approximate fire hydrant locations at the Site.**




## 18.2. Impact Assessment

External stockpiling of biomass is assumed for the FSS to consist of storing up to 24,000m$^3$ (7,680 tonnes). The stockpiles are located within the former back-up fuel storage area and is equivalent to three (3) days of fuel storage for the power plant.

The fuel silos would hold biomass fuel for introduction into each boiler. Each boiler requires three silos that have the following specifications:

- 6 metre diameter with attached flat bottom bin of 4.676 metre diameter; and
- Storage capacity of 250m$^3$ (80 tonnes) each.

The feedstock hoppers (formerly Transfer House and Crusher House) are 45m$^3$ (14.4 tonnes) each.

**Dust**

The storage of biomass in the fuel silos and feedstock hoppers are considered dangerous due to the presence of combustible dust generated by attrition of the chipped wood in handling and storage. This equates to approximately 1,890m$^3$ (508.8 tonnes) of Dangerous Goods Class 4.2 storage, assumed Packing Group (PG) III.

The wood chip dust is anticipated to have a lower explosive limit (LEL) concentration of 30g/m$^3$ air. The distance of the 3kW/m$^2$ contour from the fire source is the safe firefighting distance for short exposure.

The NSW Fire and Rescue is available from Singleton (16 minutes, 18km), Branxton (23 minutes, 31km) and the NSW Rural Fire Service is available from Bulga (11 minutes, 16km).

Within 30 metres of the silos and hoppers, the risk of fatality for an operator at an industrial site, either inside or outside a building are acceptable for thermal radiation hazard but are not acceptable for over pressure hazard from a dust explosion. Consequently, additional control measures will be required to achieve an acceptable risk outcome.

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**Supplementary Fuel Storage**

The supplementary fuel storage has a total capacity of 420,000 litres (348.6 tonnes) of combustible liquids.

The facility will store additional fuels at the former mobile equipment fuel station, including:

- 380kL of fuel oil (distillate fuel) for start-up of the boilers; and
- 40kL of diesel fuel for on-site mobile equipment.

**Firewater Containment**

Four fire hydrants operating will generate 2400 litres of firefighting water per minute for a minimum of 4 hours. This will typically generate up to 576kL of contaminated water. The Facility has an existing 60,000kL wastewater holding pond. The pond allows drainage via the wastewater drainage channel that drains from the eastern side of the property. The wastewater holding pond has sufficient surplus storage capacity to detain firewater.

**Portable Fire Extinguishers**

Portable fire extinguishers should be installed around the facility adjacent to fire loads and at entry/ exit points to the site, processing areas and sheds. Fire extinguishers are to be installed and maintained in conformance with appropriate Australian standards.

At least 1 x 2A 60B(E), dry chemical powder, 4.5kg fire extinguisher to be installed on each piece of mobile equipment.

Fire protection systems and equipment should be inspected, pressure tested, serviced and recharged as necessary at regular intervals to ensure that it is always fully operational.

**Emergency Vehicle Access**

Emergency service vehicle access is via two (2) gates opening onto Long Point Road. Both access routes allow access to the stockpile, fuel silos and boilers.

The minimum safe separation distance should be 13 metres. The 3kW/m$^2$ thermal radiation contour falls within this safe separation distance.

Unobstructed access is available within 18 metres of each potential fire event location.

## 18.3. Mitigation Measures

Fire safety mitigation and management measures are provided in Table 18.1.

**Table 18.1. Fire safety management and mitigation measures.**

| Measure | Description |
|---|---|
| F1 | Provide an external quarantine area, at the location indicated on ACOR dwg: PE210269-D3-100, at least 10 metres from parked vehicles and within a 70 metre radius of a hydrant. Quarantine area to be at least 200m$^2$. |
| F2 | Hose out fuel silos and hoppers with water prior to undertaking any internal or external hot works. |
| F3 | Ensure Ex-rated electrical equipment is installed with designated hazardous area zones. |
| F4 | Ensure underground tunnel section for CV76 is fitted with automatic sprinklers. |
| F5 | The fuel silos to be fitted with dust extraction filters and blast louvre vents. |
| F6 | The hopper buildings to be fitted with blast louvre vents. |

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| Measure | Description |
|---|---|
| F7 | Additional fire hydrants to be installed on the southwestern boundary for coverage of the stockpile. |
| F8 | Use portable infrared detectors to check for thermal hotspots. |
| F9 | Install foam kits at hydrants servicing the supplementary fuel storage bund. |
| F10 | Install fixed infrared cameras with audible alarm at three (3) identified high fire load locations. |
| F11 | Ensure 36m (DN19) fire hose reels are serviced or replaced. |
| F12 | Ensure 9 kg powder fire extinguishers are serviced or replaced. |
| F13 | Test hydrant system to ensure sufficient residual pressure when hydrants are in use. |
| F14 | Install foam kits at the hydrants adjacent to the supplementary fuel farm. |
| F15 | Use portable infrared detectors to check for thermal hotspots. |
| F16 | All fire protection system to be regularly maintained. |
| F17 | 2A 60B(E) 4.5 kg powder fire extinguishers will be installed on all the vehicles working in the vicinity of the fire compartments. |
| F18 | Maintain the maximum height of the stockpile at 4.6 metres. |
| F19 | Maintain the length of the stockpile such that NSWFR have clear access to reach all parts of the stockpiles. |
| F20 | Ensure that all ignition sources are kept away from the stockpiles:<br>• Ensure that all the equipment being used in this area are regularly inspected and maintained according to the OEM recommendations;<br>• Ensure that any hot works being carried out near fire load areas have work permits to do so and conduct all of the hot works as far as possible from the combustible materials; and<br>• Train all the staff members, contractors and visitors about the designated smoking area and all the non-smoking areas. |
| F21 | Ensure that all the staff, contractors, visitors are well-trained and informed on the operational, housekeeping and safety procedures practiced on site, including:<br>• Implement robust induction methods;<br>• Develop documentation for operational and safety procedures that are concise and provide correct instructions to the reader on their respective responsibilities, without any ambiguity;<br>• Develop and implement a robust change management system that allows personnel to identify and implement any changes to the type of materials being stored, quantities, and procedures being adapted to carry out tasks;<br>• Update relevant documentation capturing any changes, such that any discrepancies identified to the content of documentation provided can be communicated in an effective manner;<br>• Establish an effective communication or reporting system to raise any safety or operational related issues;<br>• Ensure the security system is activated at all times during non-working hours;<br>• Ensure fire prevention and detection strategies are maintained;<br>• Install the alarm system with multiple layers of protection depending on its readings of the parameter;<br>• Have firefighting trained staff on site during all working hours and having the right equipment available to stop/prevent escalation of small fires;<br>• Audit the licenses and skills of the staff and/ or contractors carrying out tasks; and<br>• Audit the operational, safety procedures, maintenance and inspection documents, any relevant checklists to make sure all changes are being captured. |

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## 18.4. Conclusion

The modelled outputs generated for the FSS indicate that all fire and explosion event scenarios are contained within the property boundary and buffer zones.

Although significant damage could result from a wood dust explosion, this damage would not escalate off Site.

With the implementation of the fire safety mitigation and management measures provided above, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential fire safety impacts and is therefore suitable for construction and operation.

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# 19. Biosecurity

A Biosecurity Management Plan (BMP) has been prepared (Appendix Z) to:

- Identify and assess the biosecurity risks as a result of the operation of the Redbank Power Station;
- Outline biosecurity practices currently implemented; and
- Identify biosecurity practices to be undertaken in the short and long-term to reduce biosecurity risks.

It may be an offence under the *Biosecurity Act* 2015 for a person to fail to comply with the measures set out in the BMP.

The scope of the document involves complying with Australia's biosecurity requirements by developing and implementing processes and procedures to mitigate biosecurity risks throughout the supply and use of biomass as a new fuel source for the Redbank Power Station.

## 19.1. Existing Environment

Verdant Earth is proposing to use biomass as a new fuel source for the Redbank Power Station (the Proposal). The biomass sources to be used at the Redbank Power Station are described in detail in Section 3.3 and in Appendix M.

At maximum capacity, the Redbank Power Station will require up to 850,000 tonnes per annum (at 25% moisture content) of biomass as fuel.

The National Priority Plant Pests, endorsed by Plant Health Committee in 2019, are plant pests that are either:

- Exotic to Australia;
- Under eradication; or
- Have limited distribution.

The list of National Priority Plant Pests is provided in Table A.1 in Appendix A. The list does not contain all the plant pests of biosecurity concern; however, the National Priority Plant Pest are used to focus national preparedness capability through the development of national action plans. These are the focus of government investment and action, including funding through the Priority Pest and Disease Planning and Response.

Many of the the National Priority Plant Pests listed in Table A.1 in Appendix A remain exotic plant pests that are not yet present in Australia. However, the following National Priority Plant Pests have established in Australia (National Priority Plant Pests Priority Number is shown in brackets):

- Exotic invasive ants (7);
- Internal and external mites of bees (10);
- Zebra chip (13);
- Citrus canker (16);
- Exotic bees (17);
- Potato cyst nematod (19);
- Exotic leaf miner species (20);
- Panama disease Tropical Race 4 (22);
- Exotic drywood termites (25); and
- Grape phylloxera (35).

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These are summarised in the BMP (Appendix Z) and provides an assessment of the fuel types that might be affected by the plant pests and the risk of occurrence of each pest in the fuel types to be sourced and used in the Redbank Power Station.

The *National Priority List of Exotic Environmental Pests, Weeds and Diseases* (abbreviated to the Exotic Environmental Pest List (EEPL)) was released in November 2020. The development of the EEPL delivers on a key recommendation of the 2017 'Priorities for Australia's biosecurity system' report, to strengthen environmental biosecurity and develop a national approach to address biosecurity risks to Australia's environment.

The EEPL contains 168 exotic species of significant environmental and social amenity risk to Australia. Species listed on the EEPL must:

- Be a pest, weed or disease that has potential for, or demonstrated, negative impacts on the environment, or social amenity; and
- Be exotic to Australia i.e., the pest, weed or disease is not currently known to be present in Australia, or, if present, is subject to nationally agreed eradication; and
- Have at least one known or potential pathway of entry to Australia; and
- Have the potential to establish and spread in Australia.

## 19.2. Impact Assessment

The two National Priority Plant Pests that have established in Australia and that have a moderate risk of occurrence in the biomass fuel types include the serpentine leaf miner and grape phylloxera. All other National Priority Plant Pests are considered low risk as the pests are not found in the areas where fuel is likely to be sourced from, or considered nil risk as the pests are currently not present in Australia.

Although the Varroa destructor mite has been detected in bee hives in NSW within proximity to the Redbank Power Station and areas where fuel is likely to be sourced from, the risk of Varroa destructor occurring in the biomass types is low. This is due to the mite affecting bee hives (mainly commercial) and any wild hives are likely to be vacated during the processing of the biomass.

### 19.2.1. Serpentine leaf miner

Leaf miners are tiny greyish black flies about 2 mm long, whose larvae (grubs) feed under the surface of leaves. Leaf miners poses a significant threat to Australia's agriculture and nursery industry as it is a highly polyphagous species (feeds on many types of plants) affecting a wide range of common horticultural crops and ornamental plant species including potato, melon, cotton, onion and grain crops as well as production nurseries.

The greatest risk of pest spread is by people moving infested plant material or soil. Adult flies may also hitchhike in vehicles, machinery or aircraft.

Damage caused by vegetable leaf miners reduces the growth and development of seedlings and young plants and can lead to plant death. Damage reduces crop yield and marketability, resulting in economic losses to growers.

### 19.2.2. Grape phylloxera

The grape phylloxera (*Daktulsphaira vitifoliae*) is a small yellow insect only just big enough to see by the naked eye that destroys grapevines by eating the roots. Many of the grapevines grown in Australia are susceptible to the pest, which can kill a vine within six years. There is no cure for it, so if vines are infested, they must be destroyed and replaced.

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The insects can crawl along the soil surface, in the canopy or below ground from root to root. This means that they're easily spread—on boots, clothing, equipment, and vehicles or can be moved with soil and vine material.

In NSW, there are two Phylloxera Infested Zones (PIZ), the Sydney region (counties of Cumberland and Camden) and the Albury–Corowa PIZ.

To prevent the spread of phylloxera from infested areas, each state and territory has legislation and associated regulations which restrict or prohibit the movement of 'phylloxera risk vectors' – i.e. things that could carry phylloxera. This includes grapevine material, grape products and vineyard or winery equipment and machinery.

## 19.3. Mitigation Measures

With the implementation of the mitigation and management measures provided in Table 19.1, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential Biosecurity impacts and is therefore suitable for construction and operation.

**Table 19.1. Biosecurity mitigation measures.**

| Measure | Description |
|---|---|
| BS1 | Avoiding high risk areas such as Phylloxera Infested Zones (PIZ); |
| BS2 | Restricting access to stockpiles If pests are detected; |
| BS3 | Reviewing the Department of Agriculture, Fisheries and Forestry's Biosecurity website[60] to ensure that particular pest species could be recognised should they enter Australia. |
| BS4 | Consulting the National Pests and Disease Outbreak website[61] regularly for information on pests, diseases and weeds that are under national eradication programs. |
| BS5 | Size reduction to a nominal <45mm and >8mm for up to 75% of the material. This physical process will help to destroy most insects, larvae and prepupae; |
| BS6 | Storage in stockpiles for 2-3 weeks within the forest compartment resulting in self-heating and pasteurisation of the core of the pile. Though it is noted that some insects / pathogens could survive in the outer area of the pile. |
| BS7 | Biomass will be transported in clean trucks, covered and will not be unloaded where there is a risk of pests or pathogens escaping the material. |
| BS8 | Trucks will be cleaned before returning to the forest compartment. |
| BS9 | Biomass will be stockpiled on a gravel hardstand surface at the power station, away from soils and vegetation for up to 3 days, and will be continually turned over, reducing the risk of pathogen or insect colonisation of the pile. |
| BS10 | A pest monitoring and weed control program, including staff training on site, will ensure the adequacy of these biosecurity measures. |

## 19.4. Conclusion

The Biosecurity Management Plan assessment concluded the biosecurity risk of transporting and handling the biomass is considered low with the implementation of the mitigation measures provided.

[60] https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/plant#stop-pests-diseases
[61] https://www.outbreak.gov.au/

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# 20. Visual Impact

A Visual Impact Assessment (VIA) (Appendix CC) has been prepared for the Proposal to assess landscape character and visual setting including any potential visual impacts associated with the Proposal.

The landscape character of a Site refers to the distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects how particular combinations of geology, landform, soils, vegetation, land use and human settlement create a particular sense of place for different areas within the landscape.

The potential visual impact of the proposal is assessed based on the relationship between the visual sensitivity and visual effect.

Visual sensitivity refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed nature of change. The sensitivity also refers to the landscape character zone or view and its capacity to absorb change of the nature of the proposal. In the case of visual impact this also relates to the type of viewer and number of viewers.

The magnitude (or visual effect) refers to the form (scale, size and character) of the project and its proximity to the viewer and the contrast it presents to the existing condition.

An initial desktop study was undertaken to determine the probable areas from where views may be affected by the development. Survey work was undertaken during December 2021 using key viewpoints and potential views to the Site. The VIA also provides an overview of proposed measures which may be considered to assist in mitigating potential visual impacts. Information is provided to aid understanding of likely impacts as well as how they may be managed to ensure the character of the immediate area is not negatively impacted.

## 20.1. Existing Environment

The Site is situated on 112 Long Point Road West, Warkworth on land zoned as RU1 Primary Production under the *Singleton Local Environmental Plan* 2013. The lot itself is approximately 18 hectares, and the existing Redbank Power Station comprises approximately 10 hectares on the east side of the lot.

The Site is located within a rural environment. The town of Singleton is located approximately 9km to the northeast and the village of Warkworth lies approximately 4 km to the west, and Gouldsville 2.5 km to the northeast.

The immediate surrounding area is covered with moderately dense regrowth woodland interspersed with patches of open grassland. Current land uses surrounding the Site are dominated by a mixture of coal mining and agriculture.

Operating collieries near to the Site include:

- Warkworth Mine immediately to the south;
- Wambo Colliery to the west; and
- Lemington Mine to the northwest.

Existing canopy vegetation surrounding site, provides a substantial barrier for a majority of views into the site. Even viewers travelling along road corridors within the immediate proximity, north and south of site, are filtered, due to established roadside and on site vegetation providing a visual buffer. Clear views are only afforded in breaks in vegetation immediately adjacent to the site boundary but are predominantly filtered, due to surrounding vegetation enclosing panoramic views.

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Figure 20.1 shows the larger surrounding environment and Figure 20.2 shows the Site using aerial imagery and the local surrounding lands.

The most dominant visible element of the power station is the 59m high stack. Figure 20.3 shows the front entrance to the Site and dominant Site features.

Five landscape character units are identifiable within a 1000m radius of site. These are the following:

1. Arterial Road (Golden Highway) - High-use, single lane, major vehicular corridor, linking Dubbo to Newcastle;
2. Rail corridor - Private use, railline for export of coal to the Port of Newcastle;
3. Rural Landscape/Primary Production - Open paddocks with limited development, other than scattered houses and sheds;
4. Large stands of existing vegetation; and
5. Powerline corridor.

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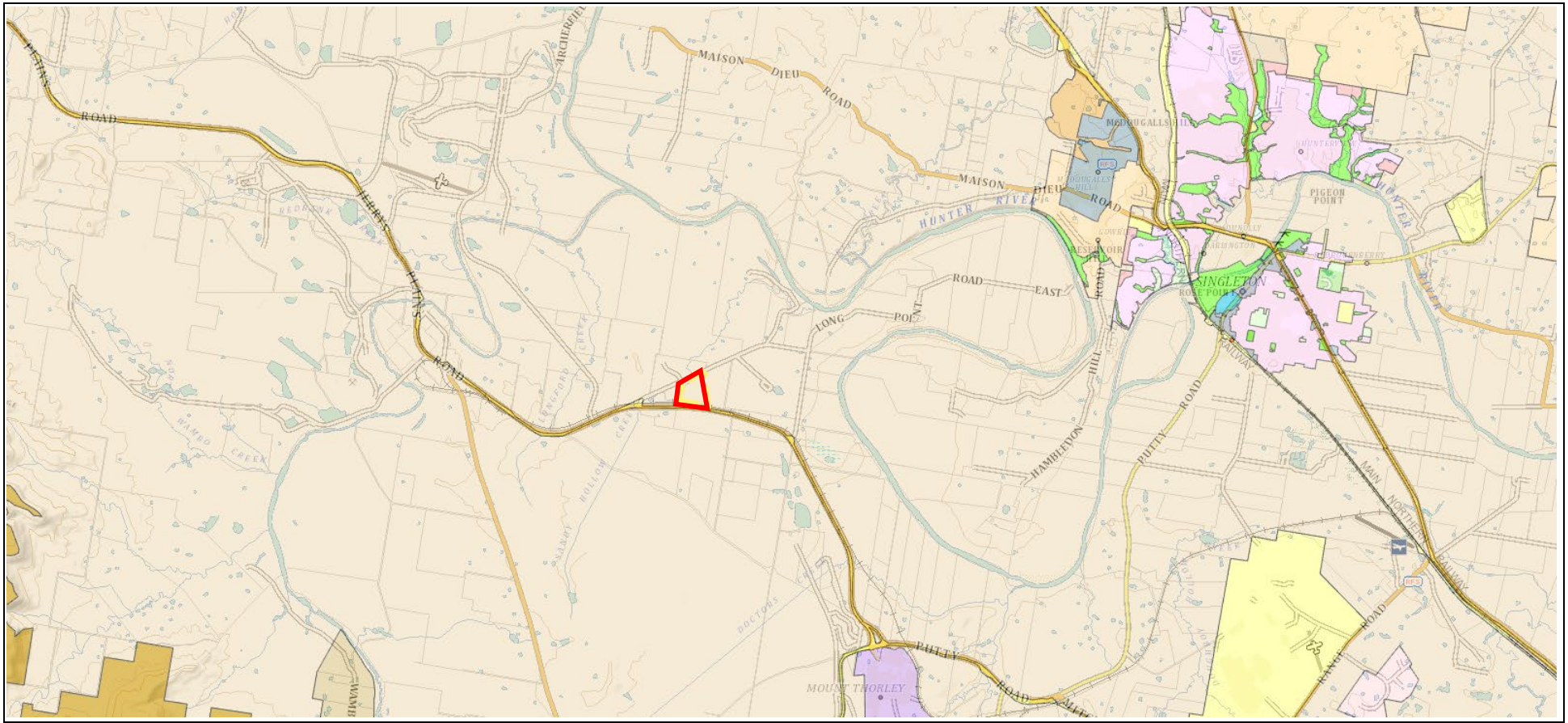
**Figure 20.1. Site location showing rural zoning (brown) and residential zoning (pink).**




| Date | Revision | Drawn By | Site description | Jackson Environment and Planning Pty Ltd | | Client | Verdant Earth Technologies Limited |
|---|---|---|---|---|---|---|---|
| 07/12/21 | Revision A | R. Loemker | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) | **Strategy \| Infrastructure \| Compliance \| Procurement**<br>**A:** Suite 102, Level 1, 25-29 Berry St, North Sydney NSW 2060<br>**E:** admin@jacksonenvironment.com.au<br>**T:** 02 8056 1849<br>**W:** http://www.jacksonenvironment.com.au | JACKSON ENVIRONMENT AND PLANNING STRATEGY \| INFRASTRUCTURE \| COMPLIANCE \| PROCUREMENT | Project | Redbank Power Station |
| | | | | | | Title | Site location and nearby residential areas |
| | | | | | | Scale | Per image |
| | | | | | | Source | NSW Planning Portal |

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**Figure 20.2. Site location and surrounding environment.**

| Date | Revision | Drawn By | Site description | Jackson Environment and Planning Pty Ltd | | Client | Verdant Earth Technologies Limited |
|---|---|---|---|---|---|---|---|
| 07/12/21 | Revision A | R. Loemker | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) | **Strategy \| Infrastructure \| Compliance \| Procurement**<br>**A:** Suite 102, Level 1, 25-29 Berry St, North Sydney NSW 2060<br>**E:** admin@jacksonenvironment.com.au<br>**T:** 02 8056 1849<br>**W:** http://www.jacksonenvironment.com.au | | Project | Redbank Power Station |
| | | | | | | Title | Site location and surround environment |
| | | | | | | Scale | Per image |
| | | | | | | Source | Nearmap |

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**Figure 20.3. View of the front of the Site showing dominant Site features.**


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## 20.2. Impact Assessment

As discussed in Section 3 of this EIS, the project is described primarily as modifications to the existing plant and equipment. The most significant change with the potential to impact on the visual amenity is the inclusion of the Biomass stockpiles in the southeast corner of the Site. The maximum height of the stockpile is approximately 4m. The fuel discovery system will incorporate two radial telescopic conveyors to unload the biomass to the existing fuel storage area. The height of the radial telescopic conveyors will be only slightly taller than the fuel stockpile.

Figure 3.7 through Figure 3.12 in Section 3 of this EIS provide illustrations of the proposed changes to the plant and equipment.

**Visual Assessment**

The scope of the VIA includes 3 km from the Site, but the focus of the assessment is within approximately 60 metres from the Site boundary. Topographic relief and existing vegetation limit and filter views beyond this zone. Any impacts are expected to be localised and decrease with distance from the Site.

The greatest visual access afforded into the site will be from users travelling along the Golden Highway and Long Point Road West. Despite viewer numbers travelling along the Golden Highway, short exposure time and filtered, established roadside vegetation, reduces overall visual impact.

For all the other viewpoints, the Proposal will be viewed through a filtered landscape of large stands of established vegetation. Where the Site extends vertically beyond the vegetated skyline, the views are “established” due to the original construction of the power station. These “established” views are afforded to residences and users along high points of Dights Crossing Road (north-east of site) and Gouldsville Road (east of site).

Figure 20.4 provides an overview of the viewpoints assessed. Table 20.1 provides a summary of the assessed visual impacts from each of the viewpoints.

Viewpoint 1 is considered from the perspective of viewers travelling along Long Point Road West next to the Site. The visual impact has been assessed as low because the road is a minor low-use road with a speed limit of 100km/hr.

Proposed additions blend with the existing infrastructure that already dominates this viewpoint. The proposed landscaped screening vegetation is expected to reduce visual effect further and provide a higher level of integration with the surrounding landscape.

Viewpoint 2 and 3 are considered from users travelling along the Golden Highway. The overall viewpoint has been reassessed as low as users of the Golden Highway are travelling at speeds of 100km/hr in single lane traffic. Views when afforded are predominantly of existing infrastructure related to the existing power station and filtered through existing vegetation. This provides minimal overall visual impacts.

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**Figure 20.4. Assessed viewpoint locations.**

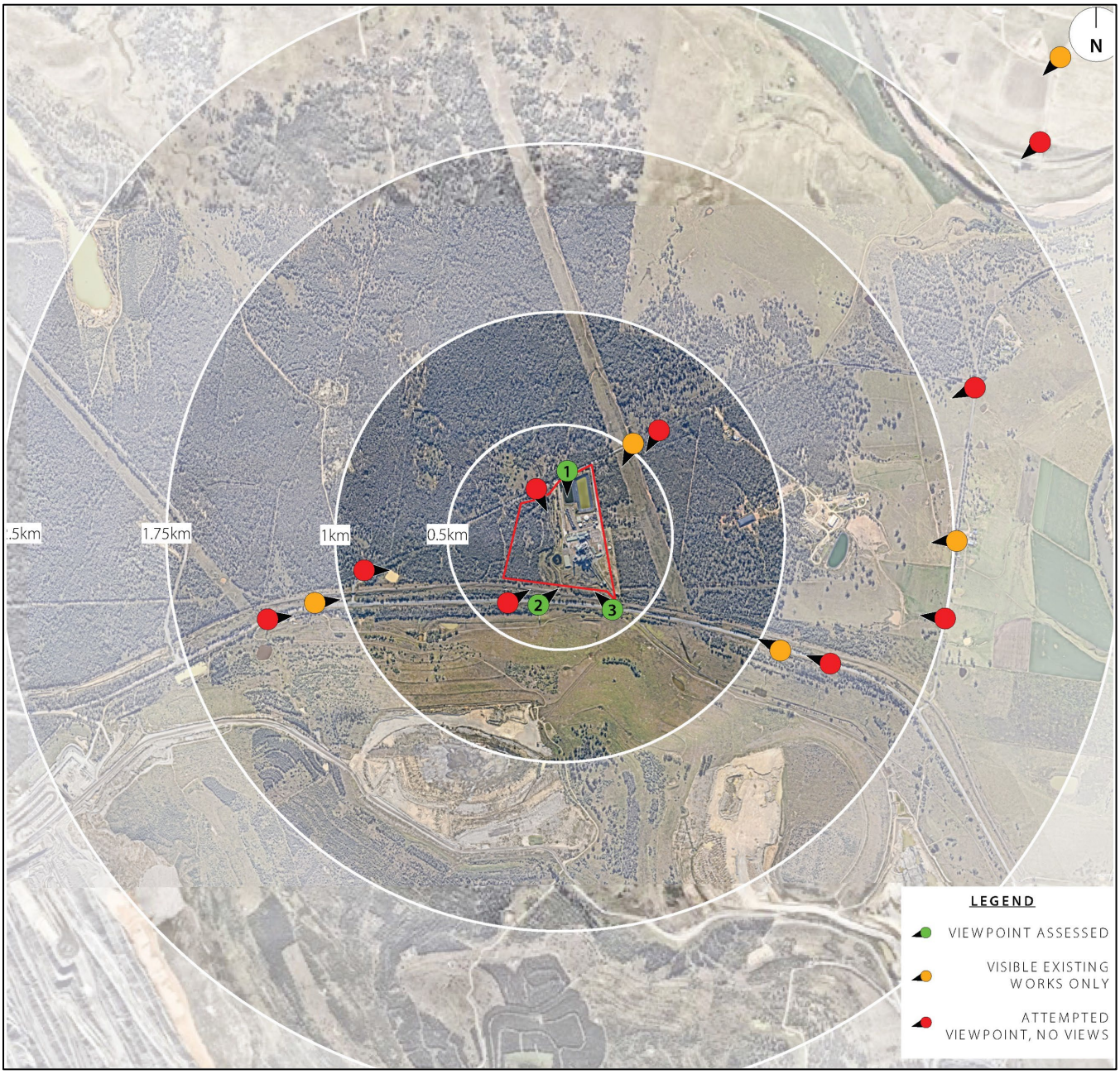


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**Table 20.1. Summary of visual impacts from viewpoints.**

| Viewpoints | | Access | Effect | Sensitivity | Impact |
|---|---|---|---|---|---|
| 1 | Long Point Road (10m) | Low | Low | Moderate | Low |
| 2 | Golden Highway East (60m) | High | Low | High | Moderate |
| 3 | Golden Highway West (55m) | Hight | Low | High | Moderate |

The Proposal additions to the existing power plant, whilst contrasting to the immediate rural character of the area, will largely blend with existing infrastructure and surrounding mined landscape. Cumulative visual impacts on the surrounding area is low, with the exception of immediate proximity views from Long Point Road West and the Golden Highway.

The Landscape Plan (Appendix E) provides screening vegetation to the northern boundary along Long Point Road West to reduce visual impact. The Landscape Plan also uses a native planting palette to reflect the character of the location.

The Proposal centres upgrades the existing power station only. Therefore the overall visual impact rating has been assessed to be LOW.

**Lighting**

Additional lighting is also proposed for the Site, as follows:

- Northwest “entry” roadway - one (1) additional streetlight (Light 116);
- Eastern “exit” roadway - Three (3) additional streetlights (Lights 113,114 and 115);
- Rear southeast roadway - Two (2) additional streetlights (Lights 127, and 128);
- Rear unloading - Three (3) flood lights on plant item 10 (emergency ash silo storage) to improve lighting for fuel unloading (Lights 119, 120 and 121)
- Stockpile - Three (3) flood lights on plant item 76 (back up fuel reclaim conveyor) to improve lighting for fuel unloading (Lights 119, 120 and 121) and one (1) flood light on plant item 35 (back up fuel/coal conveyor) (Light 101); and
- Western carpark - one (1) flood light on back of streetlight (Light 131).

The proposed lighting layout is provided in Figure 20.5.

The lighting installations and fixtures are generally very small scale constructed elements and will present low profile and largely indistinct features from relatively short distances from the Site.

Potential visual impacts will be mitigated through the largely ubiquitous nature of lighting elements with the surrounding landscape, including those within industrial areas, road corridors and urban areas.

The lighting design has adopted measures to mitigate the potential obtrusive effects of nighttime lighting which include shielding vertical light spill.

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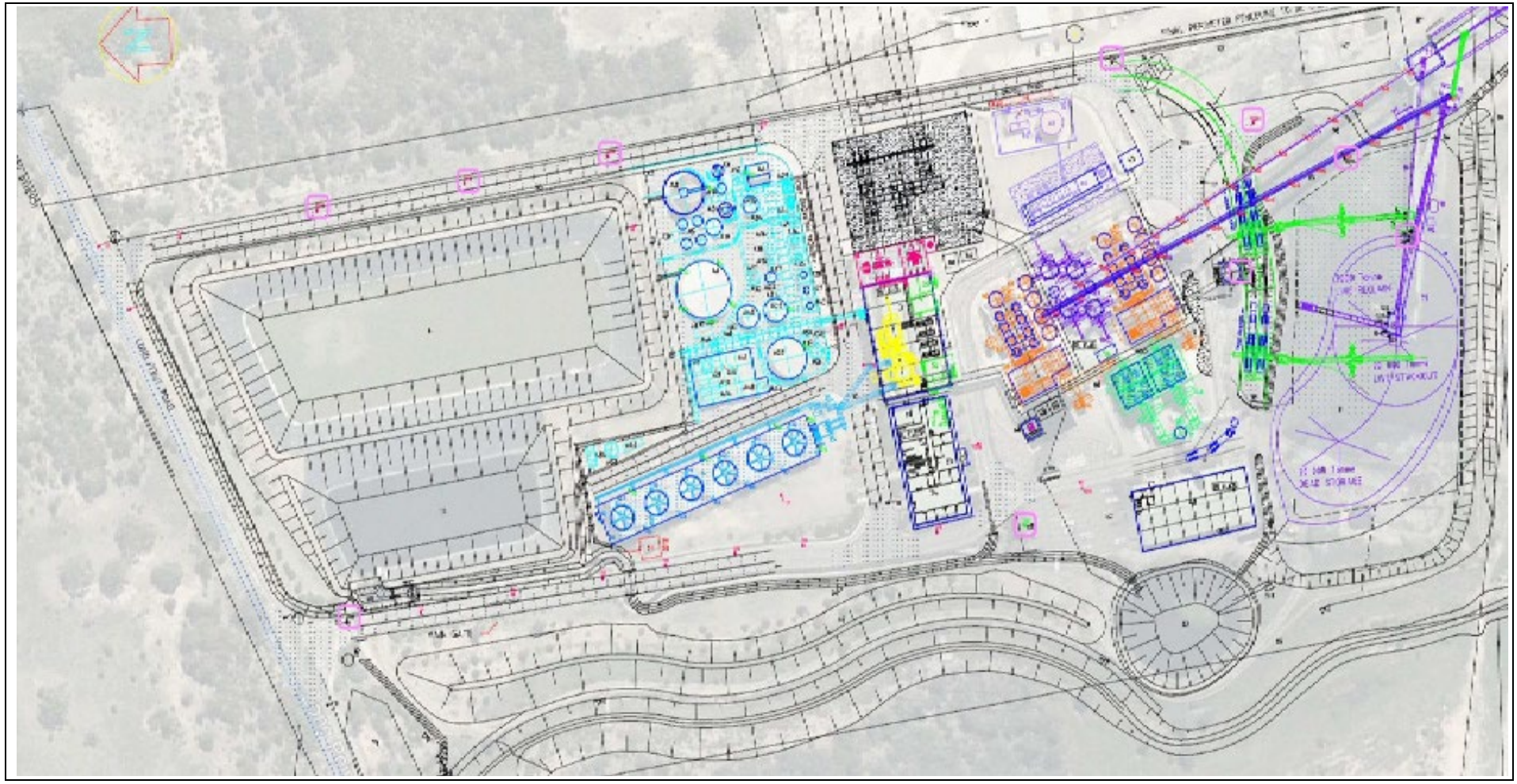
**Figure 20.5. Proposed lighting layout. The location of the additional lighting are highlighted with pink squares.**



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## 20.3. Mitigation Measures

The Proposal will largely blend with the existing site infrastructure of the power plant and surrounding mined landscape. The immediate proximity views from Long Point Road West and the Golden Highway are expected to be the most visually impacted.

A Landscape Plan has been prepared that will provide additional screening vegetation to the northern boundary along Long Point Road West to reduce visual impact from the immediate surrounding landscape. The landscape design has shown further consideration of site integration by introducing a native planting palette that reflect the character of the area.

## 20.4. Conclusion

The existing vegetation and topography screen all other public areas and private residences from the Site.

The VIA concluded the Proposal will have an overall low visual impact on the assessed viewpoints and is therefore recommended for approval on this basis.

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# 21. Biodiversity

A BDAR waiver was submitted with the application in December 2023 and was rejected by the Biodiversity Conservation and Science Group (BCS) of NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) on the grounds that there was insufficient evidence that the proposed development would not have a significant impact on biodiversity values. As a result, a full BDAR has been prepared by an accredited BAM assessor and included with the updated EIS and application.

Note that clause 6.8A of the *Biodiversity Conservation Regulation* 2017 (BC Regulation) provides that a "*biodiversity development assessment report is not required to include content relating to continued development"* if the following is true:

- The report is prepared in relation to State significant development that includes continued development; and
- The existing development consent for the continued development is proposed to be surrendered under the *Environmental Planning and Assessment Act* 1979, section 4.63.

Given that the existing consent (DA183/93) covers construction and operation of the power plant, as well as facilities on adjacent land – and given that the development proposed (e.g., changing conveyor belts to adapt to a different fuel source) is clearly within the contemplation of that existing consent –this SSD can be classed as a 'continued development' for the purposes of the BC Regulation.

A Biodiversity Development Assessment Report (BDAR) (Appendix Y) has nevertheless been prepared for the Proposal to assess potential biodiversity impacts associated with the Proposal in accordance with the *Biodiversity Conservation Act 2016* (BC Act) and the Biodiversity Assessment Method (BAM) 2020.

## 21.1. Existing Environment

Field assessments of the vegetation were carried out within the Site on the 6 February 2024. The field surveys were carried out in accordance with Biodiversity Assessment Methodology (BAM 2020) with additional assessment methods to assist in gaining an overview of potential biodiversity values. This included a habitat survey, hollow bearing tree survey and secondary indications and incidental observations.

The existing Site is cleared and highly disturbed due to the construction and operation of the existing approved Redbank Power Station. The Site is mapped as containing non-native vegetation on the Greater Hunter Native Vegetation Mapping (v4.0) layer available on the SEED mapping portal for NSW.

The surrounding environment consists of other RU1 Primary Production lots with remnant and regenerating vegetation. South of Jerry's Plains Road is a Glencore Hunter Valley mine site. Vegetation immediately abutting the Site to the north, east and west is a mosaic of remnant and regenerating vegetation that provides connectivity in the broader landscape, particularly in the west and south-west.

The Site was initially cleared for the construction of the power station and contains minimal native vegetation. The native canopy that exists today, consists of remnant canopy trees and planted native species that line the western boundary of the Site. The power station is encompassed by a large security mesh fence topped with barbed wire in order to protect the facility, which is a large physical barrier which would prevent all but highly mobile species from utilising the area.

There are no Areas of Outstanding Biodiversity Values within the 1,500 m buffer of the Site or in the general locality.

One PCT was identified within the Site, PCT 3438 Hunter Escarpment Grey Box Forest. PCT 3438 was the determined as the PCT of best fit due to the heavily modified nature of the Site. The area of vegetation is limited to a fragmented

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canopy on the western border of the Site that has regenerated along a man-made storm water wall. The understorey has been routinely managed and part of the operations of the power station.

The PCT was only present in a single condition class as the entire area had been managed with little variation in the structure of the vegetation. The site management regime will continue as it forms a part of the existing approval operating over the land.

The vegetation including PCT 3438 within the Site is not considered to be commensurate with any Federally listed TEC as it did not meet the minimum condition diagnostic requirements or thresholds as assessed.

No hollow-bearing trees were observed within Site during the field surveys.

The groundcover within the Site has been maintained as part of the operations of the power station, this has involved regular mowing and slashing of the area. Therefore the composition of exotic species is high in all areas.

Planted vegetation was present within the Site, particularly in close proximity to the existing office buildings. The vegetation consisted of horticultural plantings.

A search of the *Environment Protection and Biodiversity Conservation Act* 1999 Protected Matters database shows a total of 52 threatened species and seven threatened ecological communities listed under the EPBC Act have been recorded within 10km of the Site. No EPBC matters are located on the Site.

The nearest land mapped in an environmental planning instrument as containing potential biodiversity value is “Sandy Hollow Creek” as depicted on Singleton Council’s Riparian Lands and Watercourses Map, shown in Figure 21.1. The Sandy Hollow Creek riparian corridor is located to the west of the Proposal footprint and the waterway is outside of the area of construction and operation of the Proposal.

The waterway is also noted to be mapped on the Biodiversity Values Map (Non-EPI). The mapping is accessible through the NSW Planning Portal spatial viewer and is shown in Figure 21.2. The mapped BVM area generally follows the same area as the Singleton Council Riparian Lands and Watercourses Map. The BVM area is outside of the footprint of the Proposal.

It is noted that Singleton Council provides an online mapping system. The mapping includes Hunter Central Coast Regional Environmental Management Strategy (HCCREMS) Vegetation – Endangered Ecological Community (EEC) mapping. The digital map (hosted by the Hunter Joint Organisation) shows Central Hunter Grey Box-Ironbark Woodland mapped over the Proposal Site (see Figure 21.3. This vegetation community is listed as an EEC under Schedule 2 of the *Biodiversity Conservation Act* 2016.

This mapping is incorrect over the Site as determined by the BDAR. The Site is historically cleared and developed under the existing consent. There is no EEC located in the footprint of the Proposal.

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**Figure 21.1. Singleton Council's Riparian Lands and Watercourses Map showing mapped riparian land located to the west of the Proposal.**


| Date | Revision | Drawn By | Site description |
|---|---|---|---|
| 15/09/23 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) |
| | | | |
| | | | |
| | | | |

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| Client | Verdant Earth Technologies Limited |
|---|---|
| Project | Redbank Power Station |
| Title | Riparian Lands and Watercourses Map |
| Scale | Per image |
| Source | NSW Planning Portal espatial viewer |

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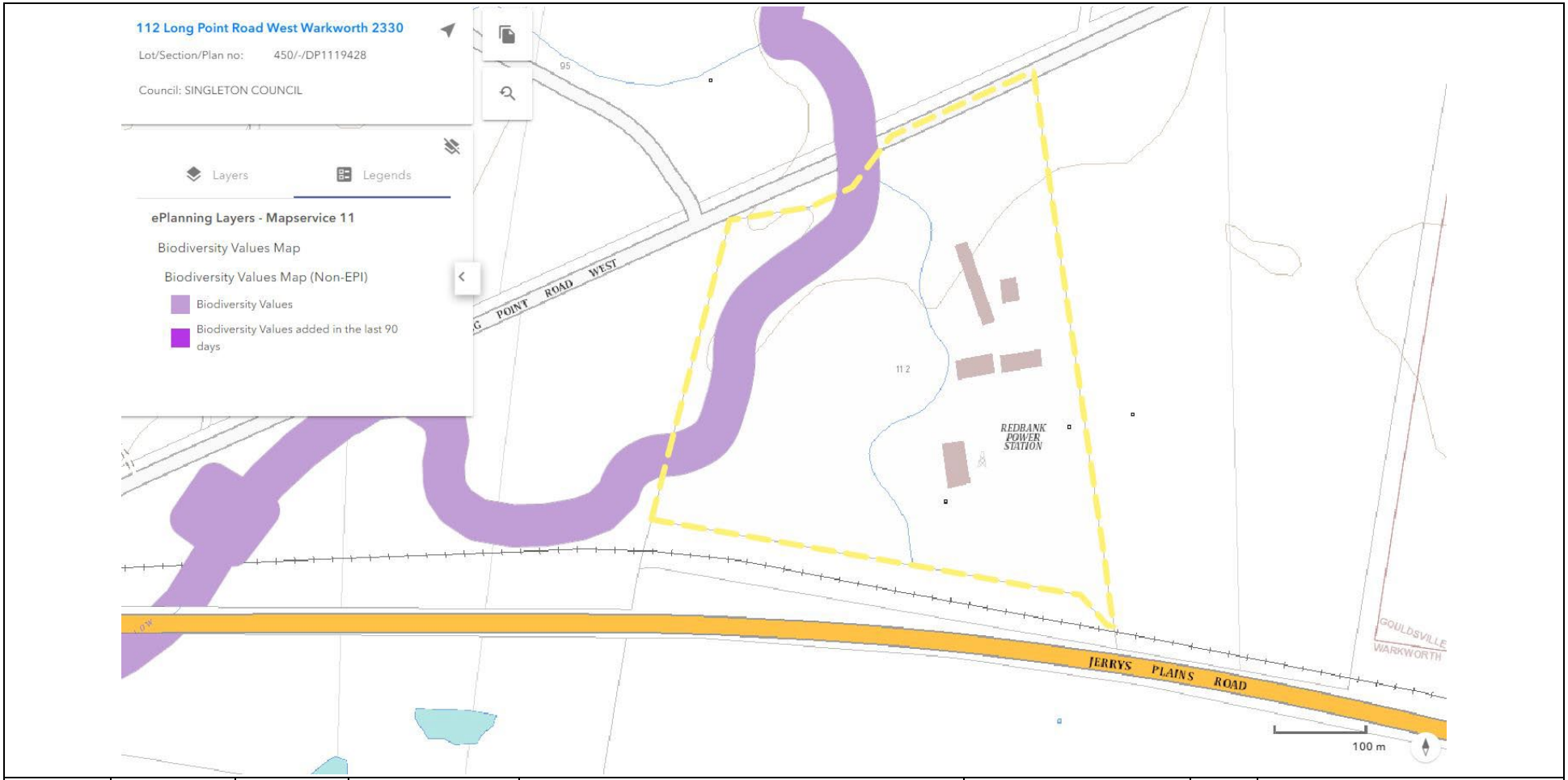
**Figure 21.2. Biodiversity Values Map (Non-EPI).**




| Date | Revision | Drawn By | Site description | Jackson Environment and Planning Pty Ltd | | Client | Verdant Earth Technologies Limited |
|---|---|---|---|---|---|---|---|
| 15/09/23 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) | **Strategy \| Infrastructure \| Compliance \| Procurement**<br>**A: Suite 102, Level 1, 25-29 Berry St, North Sydney NSW 2060**<br>**E:** admin@jacksonenvironment.com.au<br>**T: 02 8056 1849**<br>**W:** http://www.jacksonenvironment.com.au | | Project | Redbank Power Station |
| | | | | | | Title | Biodiversity Values Map |
| | | | | | | Scale | Per image |
| | | | | | | Source | NSW Planning Portal espatial viewer |

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**Figure 21.3. HCCREMS Vegetation – EEC mapping showing Central Hunter Grey Box-Ironbark Woodland (incorrectly) mapped over the Proposal site.**


| Date | Revision | Drawn By | Site description |
|---|---|---|---|
| 15/09/23 | Revision A | E. Larson | 112 Long Point Road West, Warkworth (Lot 450 DP1119428) |
| | | | |
| | | | |
| | | | |

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**W:** http://www.jacksonenvironment.com.au

| Client | Verdant Earth Technologies Limited |
|---|---|
| Project | Redbank Power Station |
| Title | HCCREMS Vegetation – EEC mapping |
| Scale | Per image |
| Source | Singleton Council online mapping viewer |

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## 21.2. Impact Assessment

The Site is historically cleared and developed under the existing consent. There is no EEC, mapped sensitive riparian waterways, or lands mapped as high value biodiversity located in the construction and operational footprint of the Proposal.

Though the Site contains native vegetation along the Site perimeter, this vegetation is discontinuous from the surrounding landscape, and will not be impacted by the Proposal.

The Proposal will be limited to the existing disturbed footprint of the Redbank Power Station facility.

No hollow bearing trees, fallen logs, trees or native vegetation will be cleared or disturbed during construction and operation of the Proposal. Areas of native vegetation are located outside the footprint of the Proposal and will not be disturbed.

Construction disturbance will include excavation, stockpiling, dismantling plant/equipment and construction of the upgraded access. These will be short term and limited to the existing disturbed industrial site.

Operations will include the continued use of the Site for power generation and will be limited to the existing disturbed Site.

Given that the Redbank Power Station is pre-existing and that it is primarily cleared, the Site provides limited connectivity to the broader region. The land to the north and west of the Site may provide a corridor to the southwest however, Long Point Road represents a potential barrier to the north for less mobile species.

Vegetation within the Site holds low biodiversity value for the most part, with native vegetation accounting for 0.31 ha within the site.

The Proposal is unlikely to have an impact to MNES assessed in the BDAR report based on the assessment criteria set out in relevant Commonwealth policies and advices as at the time of this assessment.

Trees belonging to the koala use trees species listed in Schedule 2 for the relevant koala management area (Central Coast) occur within the Subject Land, however, this vegetation is not proposed to be removed. During an assessment of the Site, no primary or secondary evidence of Koala utilisation was observed on the site.

### 21.2.1. Potential Impacts to Threatened Species and EEC

There are no records of any threatened species within the site boundary. A total of 22 records of threatened species are recorded as occurring within 1500m of the site boundary, the most recent record is of the BC Act listed Vulnerable Varied sittella (*Daphoenositta chrysoptera*) (date: 2015), the majority of the other records are from 2011 or before.

Under its current use, inclusive of multiple buildings and associated infrastructure such as stockpiles, power generation infrastructure, basins, and sealed roads, it provides little to no habitat as either foraging or breeding to threatened entities known to occur within the area, and the proposed works will not further deteriorate potential habitat existing on site.

No areas of connecting vegetation occur within the Site. Connected vegetation nearby to the Site will not be disturbed.

No construction of new buildings is proposed. Impediments will not be increased to potential bird flight paths, nor will the Proposal result in impacts to species flight path integrity.

The Proposal will not impact vegetation communities nor constitute a reduction of available habitat for threatened entities. Impacts to threatened species or ecological communities or their habitat are unlikely to occur.

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Impacts to habitat connectivity within the Site and surrounding area are not proposed. Expansion beyond the existing Site boundary, which contains multiple in-use buildings and associated infrastructure, is not proposed.

Due to the historical clearing and active use of the Site, the planted native vegetation within the APZ only provides marginal foraging habitat for highly mobile species. Security within the Site is high with barriers in place such as fencing and infrastructure that would deter many species from using the Site.

The high level of disturbance and fragmented landscape of the Site means it is unlikely to be used by threatened species.

The Site does contain infrastructure in the form of an existing power station which may provide suitable roosting and/or breeding habitat for threatened microbat species, which are known to use disused anthropogenic structures as roosts. As such, areas of the station that would typically be unsuitable due to noise, heat and light may constitute potential habitat when not in use.

An open underground concrete conveyor tunnel is also located on the southern end of the Site and may provide suitable breeding habitat in some areas for Microbat species. Habitat within the tunnel includes occasional crevices and small areas which could be utilised as well as several disused bottle shaped mud nests which may provide potential roosting habitat.

The existing cooling towers may provide potential roosting habitat. No species were detected during the Site inspection, however there were areas within the structure that constituted potential roosting habitat. Water within the cooling towers is cycled once per week as part of the maintenance of the facility. No direct works will be taking place within the cooling towers. These structures are a part of the existing approved plant. Upon commencement of operations, the microclimate will change due to an increase in heat from cooling water and a more regular cycle of the water within the structure.

The Proposal will not remove the concrete conveyor tunnel, however, the reclaim conveyor belt (CV 76) located within the tunnel become active generating movement, creating noise and an increase of human activity, potentially altering the microclimate. Crevices within the steel structure may provide suitable roosting habitat which will also be impacted via an increase in noise, heat, vibrations and human activity.

Active use of the existing buildings and infrastructure (i.e. care and maintenance) deter potential habitat for threatened species such as Microchiropteran Bats which are known to use built structures. There are 176 records of various endangered bats species within 10km of the site, with the closest, a Large-Bent winged bat (Miniopterus orianae oceansis) located about 300m to the north, 2011. With the infrastructure in care and maintenance mode, the Site is still in use, producing noise and disturbance through maintenance. Whilst the Site is unlikely to be used by these species, a set of mitigation measures is proposed to ensure potential impacts from the Proposal are minimised.

### 21.2.2. Potential Impacts to Riparian Waterway mapped under the Singleton LEP

No existing water courses or aquatic habitats occur within the Site. The biodiversity Site assessment confirmed that the mapped 1st order watercourse occurs is incorrectly mapped and actually located to the west of the Proposal.

The waterway near the Proposal is named “Sandy Hollow Creek” under NSW naming conventions. In the SWIA (Appendix T) the creek is referred to as Dights Creek, however the creek is the same.

The Proposal is not located on land mapped as Riparian Lands and Watercourses under the Singleton LEP. The Proposal does not seek consent over the land forming part of the watercourse.

The SWIA makes the following observations about Dights Creek (Sandy Hollow Creek):

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- The creek has historically been diverted to allow development of the Redbank Power Station;
- The upstream catchment is severely modified by mining;
- Two thirds of the creek's catchment is disconnected due to historic mining activities;
- Much of the rest of the watershed is cleared for farming; and
- Any remnant aquatic ecosystems within this catchment would be highly disturbed and severely modified by past development.

The SWQIA estimates three (3) runoff events in 40.5 years. On average, this is less than one (1) runoff event every 10 years. The Proposal Site effectively has no "chronic" discharges and would discharge only during extreme rainfall events. In water quality terms, the SWQIA Proposal would remain effectively (99.7%) disconnected from Dights Creek. This ensures that the Proposal will have no adverse impacts on the creek.

Note that the SWQIA proposes several additional mitigation measures (as summarised in Section 15.3 of this EIS) for implementation to optimise the existing stormwater treatment system. The existing infrastructure and proposed measures will mitigate any potential for runoff entering and impacting the nearby waterway.

The two (2) water holding ponds are located to the north on the Site. Both of these ponds have been assessed as not containing habitat for threatened entities due to the lack of vegetation and that they are lined with an artificial material.

The containment storage dam located at the south west of the Site is the only waterbody on Site that offers potential habitat for *Litoria aurea* (Green and Golden Bell Frog), should the species be present. The habitat was characterised as being an unshaded waterbody with fringing vegetation and an island of vegetation both of which are maintained.

As no potential GDE's are mapped as occurring within the Site or associated with watercourses, or tributaries thereof, the Proposal will not impact any mapped GDE's and therefore no avoidance and minimisation is required.

The Proposal is highly unlikely to result in impacts to the water quality, water bodies, or hydrological processes off the Site.

### 21.2.1. Direct Impacts

There is no proposal to remove or augment extant native vegetation or water bodies on the Site that may provide habitat in some form for local threatened species as part of a larger home range. Site management activities (mowing) and processes that are already approved on the land (eg stockpiling of fuel) shall remain unchanged. Other than recommissioning the plant, the only physical modifications to the plant relate to a change in fuel (from coal to biomass). Given that no native vegetation or water bodies will be removed or modified as a result of the Proposal, it is considered there are no direct impacts.

### 21.2.2. Indirect Impacts

The proposed conversion of the power station to fire biomass fuels may result in the following indirect impacts:

- Noise and movement within the Site as part of the upgrade of the facility;
- Reduced viability of habitat within the Site due to noise, dust, light or anthropogenic movement; and
- Transport of weeds and pathogens.

### 21.2.3. Offset Requirements

There is no proposal to remove or augment extant native vegetation or water bodies on the Site that may provide habitat in some form for local threatened species as part of a larger home range. Site management activities (mowing) and processes that are already approved on the land (eg stockpiling of fuel) shall remain unchanged. Given that no

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native vegetation, water bodies will be removed or modified as a result of the Proposal, it is considered there are prescribed impacts from augmentation to man-made structures.

On this basis there is no biodiversity credit liability generated for the Proposal.

## 21.3. Mitigation Measures

With the implementation of the mitigation and management measures provided in Table 21.1, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential Biodiversity impacts and is therefore suitable for construction and operation.

**Table 21.1. Biodiversity mitigation measures.**

| Measure | Description |
|---|---|
| BD1 | Construction including stockpiling and materials, plant and equipment storage and materials stockpiling will be confined to the existing disturbed footprint of the Site. |
| BD2 | An Unexpected Fauna procedure will be developed and followed in the event a native animal is discovered during the course of construction or operation. Work will only re-commence once the requirements of that Procedure have been satisfied. |
| BD3 | Develop a microbat management plan to be implemented in the event microbat individuals are located during the preclearance survey. |
| BD4 | Prior to commencement of construction, undertake microbat surveys to determine if any microbat species are present. |
| BD5 | Prior to commencement of works, during construction and during the operation of the powerstation, deploy Anabat ultrasonic recording units to determine if there have been impacts on microbat species. |
| BD6 | If microbats are found during the pre-construction survey, implement daily inspections of structures prior to the commencement of works each day. |
| BD7 | Staff Site Induction - Prior to commencement of construction, all staff that will be working on in areas of potential habitat should be conducted prior to the commencement of works. This induction would involve how to identify microbats, what to do if microbats are encountered (cease works and consult with the Project Ecologist) and safety procedure for working in proximity to microbats. |
| BD8 | Plant upgrade works and associated infrastructure should be completed between March and September, outside of microbat breeding periods wherever possible. |
| BD9 | All plant and machinery is to be maintained and operated appropriately during operations of the power plant, to avoid excessive noise of machinery due to poor maintenance or faulty parts. |

## 21.4. Conclusion

The Site is historically cleared and disturbed. No clearing of native vegetation would occur during construction and operation of the Proposal. Based on the nature of the proposed works and the limited works to recommission the existing plant and equipment any negative impact on threatened flora and fauna within the proposal Site is considered unlikely.

The existing infrastructure and proposed water quality improvement measures specified in Section 15.3 will mitigate any potential for runoff entering and impacting the nearby waterway.

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The Proposal is unlikely to significantly impact threatened species, populations, ecological communities or migratory species within the meaning of the *Environment Protection and Biodiversity Conservation Act* 1999.

With implementation of the proposed mitigation measures, the Proposal is recommended for approval.

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# 22. Aboriginal Cultural Heritage

An Aboriginal Cultural Heritage Assessment (ACHA) (Appendix BB) has been prepared for Proposal.

## 22.1. Existing Environment

The Hunter Valley region was historically an important location for Aboriginal life prior to European settlement as it provided food and a way of life for the local Aboriginal people.

The Amended EIS dated 1993 states that archaeological investigations were carried out by a suitably qualified archaeologist and representatives of the Wanaruah Local Aboriginal Land Council (LALC).

Archaeological work in the form of a program of subsurface investigation (test pitting) was performed at the Proposal Site for the original and Amended EIS to ensure that the original Redbank Power Station development did not negatively impact on cultural resources.

As a consequence of these archaeological investigations, several Aboriginal sites were identified and subsequently after extensive consultation with the Wanaruah LALC, a plan developed for the collection and care of the artefacts. During collection of the artefacts, representatives of the Waharuah LALC and the Wonnarua Tribal Council Inc. attended for assistance. Collection occurred in 1997 and all material collected were handed over to the Wanaruah LALC and Wonnarua Tribal Council Inc.

A search of the AHIMS register was limited to a one-kilometre radius due to the number of sites in the area (AHIMS will not provide a search result with more than 120 sites). The AHIMS results has shown that 42 known Aboriginal sites are currently recorded within one kilometre of the project area and all are artefact sites (AFT). There are no AHIMS site or Aboriginal Places in the project area.

One Aboriginal Heritage site is noted on the Redbank Power Station site plan (Site 78). This area has been permanently cordoned off for protection.

As per the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (April 2010), the four stages of consultation were undertaken. Nine (9) Aboriginal parties registered their interest and were invited to attend a site inspection and walkover. All Registered Aboriginal Parties (RAPs) were invited to participate in the survey on 16th February 2023. No RAPs attended and the survey proceeded.

## 22.2. Impact Assessment

The Proposal area consists of a highly disturbed landscape with none of the original land forms remaining and consisting predominantly of buildings and roads. The area of the Proposal has been previously excavated and subject to construction works for the existing power station with buildings throughout, access roads, two large dams in the north and a smaller one in the southwest. Small areas of vegetation were present throughout.

No sites or PADs were identified during the survey and as such there are no impacts on the archaeological record.

As the Redbank Power Station is an existing development that does not require expansion into undisturbed areas and does not require extensive excavation for the Proposal, it is unlikely unexpected or unidentified Aboriginal heritage items would be uncovered during construction and operation of the Proposal.

The extensive previous ground disturbance and establishment of the existing Facility suggests that the Proposal is unlikely to harm any known Aboriginal object or items of cultural heritage value. No further archaeological survey or testing is proposed but the minor excavation associated with the weighbridges, access and fencing should be undertaken with caution.

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The following recommendations are provided:

1. The persons responsible for the management of onsite works will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974; and
2. Should any Aboriginal objects be uncovered during works, all work will cease in that location immediately and the Environmental Line contacted.

There would be no long-term impacts on Aboriginal heritage sites or items resulting from this proposal.

## 22.3. Mitigation Measures

With the implementation of the mitigation and management measures provided in Table 14.2, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential Aboriginal Cultural Heritage impacts and is therefore suitable for construction and operation.

**Table 22.1. Aboriginal Cultural Heritage mitigation measures.**

| Measure | Description |
|---|---|
| AH1 | An Unexpected Aboriginal Cultural Heritage Items procedure will be developed and followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. Work will only re-commence once the requirements of that Procedure have been satisfied. |
| AH2 | The persons responsible for the management of onsite works will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974; |

## 22.4. Conclusion

The extensive previous ground disturbance and establishment of the existing Facility suggests that the Proposal is unlikely to harm any known Aboriginal object or items of cultural heritage value.

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# 23. Historic Heritage

A review of the original and amended EIS for Redbank Power Station was completed. A desktop search of the following data was also carried out:

- Singleton LEP 2013;
- Australian Heritage Places Inventory; and
- NSW State Heritage Register

## 23.1. Existing Environment

There are no recorded sites of historic European heritage on or in proximity to the Proposal.

The nearest heritage item to the Proposal Site are the “Stafford”, homestead and “Clifford”, homestead (ruins), listed as I142 in the Singleton LEP 2013, located about 642 metres to the north-east of the Site entrance.

## 23.2. Impact Assessment

The Proposal is unlikely to harm any known or unknown historic heritage items of non-Aboriginal origin during construction and operation. No further archaeological surveys or testing is proposed. There would be no long term impacts on non-Aboriginal heritage sites or items resulting from this proposal.

Unexpected or unidentified non-Aboriginal heritage items may be uncovered during the construction or operation of the proposal. In the event of an unexpected find of a non-Aboriginal heritage item (or suspected item). Tthe safeguards specified below would be implemented to avoid or minimise any potential impact on non-Aboriginal heritage items uncovered during the proposed works.

## 23.3. Mitigation Measures

With the implementation of the mitigation and management measures provided in Table 23.1, the Proposal is expected to comply with all applicable legislation and guidelines with respect to potential historic heritage of non-Aboriginal origin and is therefore suitable for construction and operation.

**Table 23.1. Non-Aboriginal Cultural Heritage mitigation measures.**

| Measure | Description |
|---|---|
| HH1 | An Unexpected Heritage Items will be prepared and followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered during construction or operation of the Proposal. Work will only re-commence once the requirements of that Procedure have been satisfied. |

## 23.4. Conclusion

The Proposal is unlikely to harm any known or unknown historic heritage items of non-Aboriginal origin during construction and operation.

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# 24. Capital investment value

A Capital Investment Value (CIV) estimate was prepared by Muller Partnership. The total estimated project costs (excluding GST) is estimated to be $$70,718,379. A summary is provided in Table 24.1 below. A copy of the full CIV assessment report is provided at Appendix G.

**Table 24.1. Capital Investment Value summary.**

| Ref | Description | $/ Excl. GST |
|---|---|---|
| 1.0 | **Refurbishment / Recommissioning** | |
| 2.0 | Refurbishment / recommissioning costs (excl. conversion) | $15,790,434 |
| 3.0 | On Costs | $6,104,207 |
| 4.0 | Escalation to November 2023 | $5,115,178 |
| 5.0 | **Biomass Conversion** | |
| 6.0 | Weighbridges | $583,898 |
| 7.0 | Infrastructure to New Fuel Delivery Area | $2,975,318 |
| 8.0 | Modification to 2 Reversing Conveyors | $928,753 |
| 9.0 | Silo Bottom incl. Augers | $4,934,882 |
| 10.0 | Additional Lighting | $676,500 |
| 11.0 | Electrical, Instrumentation & Control (EI&C) Equipment | $180,250 |
| 12.0 | Truck Unloaders | $2,476,967 |
| 13.0 | Radial Stackers | $1,253,305 |
| 14.0 | Civil Works | $463,470 |
| 150 | Materials Handling (2 Loaders) | $1,183,553 |
| 16.0 | Storage and Feeding Bins | $1,033,052 |
| 17.0 | Fire Services & Bushfire | $392,753 |
| 18.0 | Freight | $200,000 |
| 19.0 | Permits & Studies | Incl. |
| 20.0 | Existing Basin | Excl. |
| 21.0 | As-builts, Training and Manuals, Maintenance | Excl. |
| 22.0 | Power Supply from Power Plant | Excl. |
| 23.0 | New Items | $257,350 |
| 24.0 | Preliminaries, Overheads & Margin (12%) | $2,104,806 |
| 25.0 | **Indirect Costs** | |
| 26.0 | Professional fees (Lump Sum provided by client circa 5%) | $3,547,331 |
| 27.0 | Contingency (5%) | $3,018,923 |
| 28.0 | Authority Fees | Excl. |
| 29.0 | Client Costs (Restart Costs) | $13,723,795 |
| 30.0 | Escalation (5% p.a from November 2023 to assumed midpoint of construction April 2025) | $3,773,654 |
| 31.0 | GST | Excl. |
| 32.0 | **Total Project Budget** | **$70,718,379** |

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# 25. Cumulative Impacts Assessment

A cumulative impact on the environment results from the incremental impact of human activities has been prepared with consideration to the historic, current and foreseeable planned activities for a particular area.

The Department of Planning and Environment's *Cumulative Impact Assessment Guidelines for State Significant Projects* (2022) has guided the preparation of this assessment[62].

## 25.1. Approach

This assessment considers what potential material impacts on community and environment the Proposal would have when combined with other relevant future projects. The assessment also considers how the Facility will be managed in response to this assessment, and the capacity of the local environment and community to accommodate the Proposal. There are also numerous long-term cumulative benefits related to construction and operation of the Proposal and these are considered as well.

The locations, numbers and types of future facilities in the vicinity has been derived from several sources including the NSW Major Projects website, the NSW spatial viewer and Verdant Earth's knowledge of the development location.

## 25.2. Incremental assessment

Incremental assessment of potential impacts from the Proposal to the existing baseline condition has been prepared for each environmental and community aspect and reviewed in detail in this EIS for each matter. There are no impacts that cannot avoided through management and mitigation measures as provided in Appendix C of this EIS.

## 25.3. Combined incremental assessment

The combined incremental assessment approach involves considering the combined effect of the different impacts of the Proposal to an area or sensitive receiver. For example, the combined effect of dust, noise, visual and social impacts of the project on people or communities living close to the Site.

No impacts to the community or environment are left unmanaged or unmitigated based on the results of each specialist report and the summary assessment in the EIS.

There are no impacts that cannot avoided through management and mitigation measures as provided in Appendix C of this EIS. Therefore, there are no cumulative effects predicted from the combined effect of these different aspects.

A set of monitoring and review measures as provided in Section 26 will be implemented to assess each aspect over the construction and operation of the Proposal to verify and ensure compliance with the criteria and standards of the Proposal, as set forth in this EIS.

## 25.4. Issue specific cumulative assessment

Cumulative impacts on the environment result from the incremental impact of human activities with consideration to the historic, current and foreseeable planned activities for a particular area. Cumulative impacts from a cluster of

[62] NSW Department of Planning, Industry and Environment (2022). *Cumulative Impact Assessment Guidelines for State Significant Projects.* Internet publication: https://www.planning.nsw.gov.au/sites/default/files/2023-03/cumulative-impact-assessment-guidelines-for-ssp.pdf

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activities will vary between locations but are usually a product of the location, number and type of facilities present in the area, the way they are managed, and the capacity of the local environment to accommodate them.

This section provides an overview of the existing environmental stress levels and any key potential long-term environmental impacts from the Proposal.

The following sections summarise the incremental assessment for each environmental, community and social/economic aspect in light of upcoming significant projects listed in Table 25.1. and development of the Singleton and Hunter region generally over time.

Traffic, air quality and potentially construction accommodation are considered to be most impacted from a cumulative impacts point of view, primarily in the short-term during construction. Long term benefits to the electricity market are also expected.

**Table 25.1. Nearby major projects in the nearby region.**

| Future Projects | Location of the Proposal | Project status | Type of Project | Relevant assessment matters |
|---|---|---|---|---|
| **Bowmans Creek Wind Farm** | Bowmans Creek, 10 kilometres (km) east of Muswellbrook | Under assessment | 70 - 80 wind turbines | Long term benefits to the electricity market, with no negative cumulative impacts to the Proposal, which supports long term electricity reliability. |
| **Singleton Bypass - New England Highway** | Singleton | Under construction (early works started) | Eight-kilometre project bypassing five sets of traffic lights in the Singleton CBD. Shortlisted tenderers for design/build with a contract expected to be announced in late 2023. Early works continuing in preparation for major works. The Bypass is expected to be open to traffic by the end of 2026. | Local and regional construction and operational traffic expected to be affected in the short term as it will be in construction through 2026. The bypass is likely to improve overall network performance, reduce freight traffic through the town centre and potentially improve access to Singleton in the long term. |
| **The Hunter Gas Pipeline (HGP)** | Route travels to the north-east of Singleton | Commence construction by October 2024 | Delivering gas from Northern Australia from Queensland to Newcastle. An extension to project approval lapse date was approved on 17 October 2019, with the new lapse date now being 15 October 2024. The project must commence physical construction before that date for the project approval to remain valid. | The HGP received a five-year extension in 2019 and is slated to begin construction by 2024. However the pipeline route travels from Newcastle east of Singleton and then to the north. Additional construction traffic could cumulatively impact traffic during the construction of the Proposal, but the schedule is still uncertain. Designated camp accommodation is proposed, which will relieve construction accommodation congestion in the region in the short term. |
| **Glencore HVO** | Lemington | Under assessment | Continuation of mining until 2050 | Air quality will continue to be a cumulative impact issue in the Hunter Region, along with traffic from this large employment sector. However, contribution from the Proposal is insignificant. |
| **Huntlee New Town** | South of the town of Branxton | Prepare EIS | The Huntlee New Town site is 1,722 hectares master planned residential | The Huntlee New Town project has potential long-term benefits to provision of additional housing and |

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| Future Projects | Location of the Proposal | Project status | Type of Project | Relevant assessment matters |
|---|---|---|---|---|
| | | | development. Includes subdivision for the Town Centre and about 5,000 lots for dwellings. Works associated with parks, recreation facilities and riparian areas and associated buffer, site preparation, remediation, earthworks, infrastructure, road works and open space. | amenities to the growing Hunter region. Short and medium term pressure on construction workforce and regional traffic in the lower Hunter may occur, however the Proposal is not expected to contribute significantly to cumulative negative effects on traffic in this area. |
| **Bridgman Solar Farm** | Rix's Creek | Prepare EIS | 50MW Solar Farm | Long term benefits to the electricity market, with no negative cumulative impacts to the Proposal, which supports long term electricity reliability. |
| **Maison Dieu Solar Farm** | Maison Dieu | Prepare EIS | 151MW solar farm with associated battery storage and substation. | Long term benefits to the electricity market, with no negative cumulative impacts to the Proposal, which supports long term electricity reliability. |
| **Rix's Creek North Continuation Project** | Rix's Creek | Prepare EIS | Continuation of mining | Air quality will continue to be a cumulative impact issue in the Hunter Region, along with traffic from this large employment sector. However, contribution from the Proposal is insignificant. |
| **Quarry** | 30kms north-west of Singleton | Prepare EIS | Extraction and processing of the hard rock resource (ignimbrite) of the Hebden area | Wider regional construction traffic, although not in immediate vicinity of the Proposal, so no cumulative effects likely. |
| **Liddell Battery and Bayswater Ancillary Works** | Liddell Power Station | Determined 2022 | 500MW battery storage and decoupling works | Long term benefits to the electricity market, with no negative cumulative impacts to the Proposal, which supports long term electricity reliability. |
| **Liddell Future Land Use and Enabling Works** | Liddell Power Station | Response to Submissions | Demolition of the LPS and associated infrastructure and the recontouring of the site, if required, would enable the continued industrial use of the LPS site. | Long term benefits to the electricity market, with no negative cumulative impacts to the Proposal, which supports long term electricity reliability.<br>Electricity market<br>Construction traffic<br>Social Impacts |
| **Muswellbrook Solar Farm** | 5km east of Muswellbrook | Response to Submissions | Development of a 135 MW solar farm and associated infrastructure, including battery storage facility. | Long term benefits to the electricity market, with no negative cumulative impacts to the Proposal, which supports long term electricity reliability. |
| **Hunter River Solar Farm** | 7km north-east of Denman | Prepare EIS | 84MW solar installation with battery storage | Long term benefits to the electricity market, with no negative cumulative impacts to the Proposal, which supports long term electricity reliability. |
| **Muswellbrook Bypass project** | Muswellbrook | Under construction (early works started) | Nine kilometres of new highway including new connections and bridges. Bypass is expected to open to traffic by the end of 2027. | Local and regional construction and operational traffic expected to be affected in the short/medium term as it will be in construction through 2027. The bypass is likely to improve overall |

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| Future Projects | Location of the Proposal | Project status | Type of Project | Relevant assessment matters |
|---|---|---|---|---|
| | | | | network performance, reduce freight traffic through the town centre and potentially improve access to Muswellbrook in the long term. |

The Hunter Region has a long history of coal mining. There are a host of coal mining extension modifications proposals in the area. These extensions will provide for maintenance and occasional increase in workforce. Continuation of mining activities has positive long-term benefits to employment, and some negative impacts to environmental quality (e.g. air quality) and traffic congestion. Predictions of coal mining and exports by the NSW government are that coal in the short and medium term will remain generally steady due to export of coal. Although the transition to renewables is picking up speed in Australia, air quality will continue to be a cumulative impact issue in the Hunter Region, as will traffic from this large employment sector.

There are several solar and/or battery installation proposals in the area and at least one additional wind farm planned in the Hunter vicinity. These are considered cumulatively positive in assisting NSW in reaching net zero goals by 2050. The Proposal is not considered to make a significant contribution to any cumulative negative impacts. On the contrary the Proposal will assist NSW transition from coal energy to renewable energy as more coal-fired power plants close, and help ensure a more stable and reliable electricity supply for the future.

### 25.4.1. Social, economic and community

The Singleton LGA and Hunter Region will continue to be an important area for growth and industry, and that with the inevitable transition away from coal to renewables, this Proposal would assist in providing a diversity of opportunities for growth and employment, particularly in the areas of industrial trades.

The assessment of broader social impacts suggests that the Proposal is unlikely to have significant negative impacts, such as those related to odour or traffic, on the surrounding community. The development is surrounded by open pit mines, agricultural land and rural dwellings, and remnant bushlands. The nearest dwellings are approximately 1.6km away.

The Proposal has provided detailed assessments and integrated a set of mitigation measures detailed in this EIS to ensure the project has minimal impact on the local environment and the surrounding community in the long term.

### 25.4.2. Waste and sustainability

The Proposal would provide a resource recovery option for the eligible waste fuel with no higher order uses from manufacturing industries biomass whereas some of this manufacturing and processing waste is landfilled.

Ash from the burning of biomass would be disposed on in line with NSW policies and legislation. The waste material would be tested in accordance with *The Ash From Burning Biomass Order* 2014, or a Specific RROE, and sent back to energy crop land or other agricultural land for spreading, thereby replenishing any depleted nutrients and supporting soil health.

The Proposal sits within the Hunter-Central Coast Renewable Energy Zone. By providing an alternative (to coal) dispatchable electricity source, the Proposal is well-placed to support the transition to a cleaner energy sector whilst maintaining a reliable and secure energy supply. This would reduce potential negative cumulative impacts from fossil fuel based energy generation resulting in additional GHG emissions.

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## 25.4.3. Air Quality

The AQIA considered cumulative impacts by taking into account the combined effect of existing (background) air quality, other local sources of emissions, reasonably foreseeable future emissions, and any indirect or induced effects.

Overall, the results of the air quality modelling indicate that emissions from the Proposal can meet all relevant NSW legislation and EPL requirements.

All cumulative air pollutant concentrations were well below the stringent impact assessment criterion for the expected operations of the Proposal. This was also the case for the 'regulatory worst case' scenario modelled with the exception of the $PM_{10}$ and $PM_{2.5}$ which included only minor contribution by the Proposal, and is not the expected worst case.

Firing the plant on biomass also results in a significant reduction in ambient concentrations of $SO_2$ compared to coal, which reduces the potential for any detectable odours. The air quality risk for CO is minimal, with cumulative concentrations being 5% of the impact assessment criterion.

The more stringent Group 6 limits have been adopted for biomass combustion. Adopting Group 6 limits for biomass combustion would tighten the existing limits and would, as the most stringent limits in the POEO Clean Air regulation, reflect proper and efficient operation for the facility.

Monitoring requirements in EPL 11262 will continue to be implemented for the Proposal, thus ensuring the plant's emissions are within stringent and established guidelines.

In the unlikely event of complaints from the community, mitigation measures and procedures would be in place so that Verdant Earth staff can review weather conditions and operations of the plant and equipment and address complaints promptly and undertake timely community engagement.

## 25.4.4. Greenhouse Gas and Lifecycle Assessment

The Proposal would provide environmental savings to global warming, fossil fuel depletion, eutrophication, particulate matter, and water scarcity impacts equal to a savings of 882 $kgCO_2$-eq for every MWh generated. This is a reduction of 93% from a coal firing scenario. In the transition out of coal derived electricity, this is a substantial reduction.

The NSW electricity grid is undergoing rapid decarbonisation. In NSW/ACT, at Proposal commencement in 2025 the emission intensity of the grid (for Scope 2 plus Scope 3) will be 0.53 t $CO_2$-e/MWh (530 t $CO_2$-e/GWh). By 2035 the emission intensity reduces to 0.02 t $CO_2$-e/MWh (20 t CO2-e/GWh) due to the closure of remaining coal-fired power stations. The emission intensity for the Proposal (0.0182 t $CO_2$-e/MWh) is therefore well below the current grid average for the state, and around 90% of the projected grid average for the state in 2035.

The Proposal will be a small contributor to GHG emissions in NSW. Under a 'current policy' scenario for NSW, the project represents 0.03% of state-wide emissions in 2030, and 0.08% in 2050.

Under the Australian Government's policy for reducing GHG emissions, the Safeguard Mechanism, the national sectoral baseline for electricity generation is set at 198 million tonnes of $CO_2$-e per year. At around 21,241 t $CO_2$-e per year, emissions from the Proposal would represent a negligible contribution (0.011%) to the sectoral baseline. The Proposal would therefore not increase the risk of non-compliance with the sectoral baseline.

Overall, the Lifecycle study and the GHG Assessment have shown that the conversion of Redbank Power Station to a biomass facility will result in significant savings in climate change impacts. Savings are also seen in multiple other impact categories, with the exception of ozone layer depletion, which is considered irrelevant since the emission contributions are so small and come from deep in the transport supply chain. Additionally, the water consumption was modelled conservatively, without considering potential use of stormwater. The Proposal still results in significant

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environmental savings in the impact categories which hold the largest shares of global impacts (climate change, fossil fuel depletion, and photochemical oxidation).

When fully operational the Proposal will supply the grid with approximately 1 million megawatt hours of baseload electricity per year, equivalent to supplying around 200,000 homes. The Proposal will also drive progress towards the NSW Government's *Net Zero Plan Stage 1: 2020-2030*, the foundation for NSW's action on climate change and goal to reach net zero emissions by 2050.

## 25.4.5. Human Health and Risk

The cumulative impacts from the Proposal on human health were assessed by adding what the Proposal would contribute along to existing conditions. All risks to human health and chronic risks were assessed as negligible. Emissions from the Proposal would have a negligible impact on water quality in rainwater tanks used for drinking water and on crops and produce grown in the area.

The existing technology used at the Redbank Power Station has a high degree of bed fines recirculation to enhance the gas to solids contact resulting in highly efficient combustion. With the fluidised bed combustion technology's demonstrated excellent performance (internationally) and low emissions profiles with a wide range of fuels, including biomass, the potential cumulative impacts to human health are considered negligible.

## 25.4.6. Noise and Vibration

The Proposal only requires minor modifications to the power plant to allow the firing of biomass, therefore the noise generated by the plant itself is expected to be unchanged. Additional noise sources will result from the change in fuel use due to an increase in truck movements to transport fuel to the power station and greater use of plant on-site for the unloading and stockpiling of fuel and loading of fuel for firing. This equipment includes mobile front-end loaders, bulk unloaders, conveyors and silo augers.

The NIA model predicts that noise emissions will comply with the project trigger levels at all times whether under neutral and noise enhancing weather conditions. Operational noise emissions will not adversely impact any surrounding receiver, at any time of the day.

Cumulative noise and vibration impacts associated with the Proposal combined with other scheduled projects in the region are not expected.

## 25.4.7. Traffic

The key roads providing access for the Site and for the haulage routes heading north and south are the Golden Highway (Jerry Plains Road) and Long Point Road. The primary intersection providing access for the Site is the Golden Highway and Long Point Road West.

Biomass would be hauled by road (primarily using B-Doubles) 24/7, but primarily between 6am and 10pm Monday through Sunday. Up to 112 truck trips (5 6 return trips) would be required. B-doubles would be used in the removal of residual ash from the Site, therefore 42T per trip would equate to about 4 trucks per day. Up to 30 operational and maintenance staff would be employed per day shift (6:00am – 6:00pm) and 5 staff per night shift.

A Traffic Impact Assessment (TIA) prepared for the Proposal used SIDRA modelling to assess the relevant traffic implications and potential impacts on the local road to and from the Site. SIDRA modelling analysis indicates that the additional traffic generated by the Proposal would have no significant impact on the operation of the Golden Highway and Long Point Road West intersection. The intersection is predicted to continue to operate at good levels and with spare capacity in the 2033 case with the Proposal.

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Most of the traffic for the Proposal will be using the Golden Highway, with a fraction of the Proposal traffic expected to use the New England Highway across Singleton during construction of the Singleton Bypass. In any event, B-Doubles are more likely to use the Golden Highway via Denman and/or through Muswellbrook to and from regional areas to the west, and the Hunter Expressway to reach the M1. This relieves pressure from the Proposal on the New England Highway.

The TIA concluded that the Proposal is supportable from an access and traffic perspective and is expected to have minimal contribution to future cumulative traffic impacts.

### 25.4.8. Soil and Water

The Proposal requires water to operate, and re-uses as much water from the Site as possible. Existing stormwater capture, drainage and treatment systems existing on the Site provide some of the water needed to generate and cool steam for the turbine. Additional water necessary will be drawn from the Hunter River under a water access licence with water allocations purchased or leased post approval. A water treatment plant located on the Site is also used to ensure adequate quality of the water used in the plant.

The existing Facility has no significant contamination, all chemicals held onsite are bunded and contained, and there is an existing stormwater capture reuse/treatment system that will continue to be used and managed during operation of the Proposal. Maintenance of this infrastructure will ensure no long-term or cumulative impacts to surface runoff or groundwater contributions by the Proposal.

### 25.4.9. Visual and Landscape Character

The Proposal is being developed at the approved Redbank Power Station containing existing infrastructure on previously cleared and disturbed land. The Proposal will not result in any infrastructure changes and limited stockpile heights (~4m) will be below the existing vegetation. The existing vegetation and topography screen all other public areas and private residences from the Site. No significant visual impacts are expected once the Facility is in operation.

### 25.4.10. Bushfire, Hazards and Risk

Hazards and risks have been assessed in the preliminary hazard assessment and bushfire risk assessments prepared for the Proposal. Wildfire related risks associated with the operational phase of the facility are due to wind, smoke and ember attack on the facility and potential damage to electricity services.

Whilst bushfire will continue to be a risk to the Proposal and all surrounding areas into the future, the Proposal provides for mitigation measures to reduce risks. These measures include procedures for monitoring and maintenance of the facility, and emergency plan measures. Essential ingress/ egress and the provision of defendable space are provided in the design of the Proposal per the bushfire risk assessment.

The Facility will include stockpile monitoring and hot spot detection, and fire safety equipment and hydrants. Full access around the facility will be provided for fire trucks, and APZs will be maintained.

### 25.4.11. Biodiversity

The Proposal will not require any clearing of bushland or undisturbed areas. The Site is already disturbed, and the existing approved power station will be recommissioned with minor plant and equipment changes to enable the use of biomass. No habitat will be impacted by the Proposal, and therefore does not add to potential cumulative impacts.

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### 25.4.12. Aboriginal Cultural Heritage and European Heritage

The Proposal is unlikely to harm any known Aboriginal object or items of cultural heritage value. No further archaeological survey or testing is proposed but the minor excavation associated with the weighbridges, access and fencing should be undertaken with caution.

There are no significant heritage sites within the Site and surrounds that would be impacted by the project. The development will have no long-term impacts on heritage values in the area.

## 25.5. Combined cumulative impact assessment

In the long term, development in the Hunter region will be ongoing. State, regional and local plans to guide and manage growth and development, such as the *Hunter Regional Plan* 2041, are meant to provide a framework for organised development to minimise cumulative impacts and benefit the local and regional communities. The Hunter Region is positioned to act as one of several Renewable Energy Zones, with a host of future hydrogen and renewable projects in the feasibility stages. The Proposal is in a position to provide an underpin of support to assist in the transition to renewables by providing reliable and firm electricity generation to the grid.

The combined effect of various potential cumulative impacts stemming from the Proposal and other projects revolve primarily around traffic, air quality and electricity market conditions.

Overall, the Proposal's contribution to combined cumulative impacts is expected to be limited. The Proposal strives to meet the objectives of local, regional, state and federal planning objectives, and in so doing provides beneficial support and services to the economy.

## 25.6. Infrastructure requirements flowing from the proposal

The Facility is an existing power station, with most of the needed infrastructure for the Proposal already in place.

Minimal infrastructure augmentation is required to connect the Proposal to existing infrastructure. Connection to the electricity grid is also existing and few modifications are required.

Key plant and equipment upgrade and modifications have been described in detail in this EIS. These are considered minor.

Potential impacts during construction are likely to be short-term and localised in the immediate vicinity of the work area. Standard and proven management measures such as those contained in the environmental management measures for the EIS would be implemented to avoid and minimise these impacts.

No infrastructure that is proposed will be constructed prior to the development and approval of a Construction Environmental Management Plan (CEMP). The CEMP will document the specific control measures that will be implemented during construction works, to avoid impacts to the area and the local community.

## 25.7. Conclusion

The cumulative impact of the Proposal is expected to be minimal. The potential for adverse impacts will be mitigated by a range of measures, as listed in Appendix C.

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# 26. Environmental Monitoring and Reporting

The monitoring requirements for Redbank Power Station as outlined in condition P1 and M2 of EPL 11262 are proposed to continue for the Proposal in addition to the monitoring recommendations for water quality as outlined in Section 15.2.9. These requirements may be updated in consultation with the NSW EPA.

Monitoring requirements per a Specific RROE for the relevant fuel types would be needed first on a trial basis and then continue throughout operations of the Proposal.

## 26.1. Continual Improvement

Environmental monitoring and inspections will be conducted in accordance with a schedule nominated in an Operational Environmental Management Plan (EMP). Quantified and unquantified information contained in the EIS will be assessed to ensure that the construction and operational phases of the Project meet acceptable environmental standards. Inspections and monitoring will be in line with the OEMP, development approval conditions and applicable licenses. Monitoring and inspection results will be followed up with corrective actions where required. Where needed appropriate action will be taken to avoid recurrence of non-conformances.

Any corrective and preventive action will require a change environmental management documentation in a continual process for document control. This process has the ultimate goal of driving continual improvement.

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# 27. Ecological Sustainable Development

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all State and Territory governments endorsed the National Strategy for Ecologically Sustainable Development.

An important objective of the EP&A Act is "*to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment*."

Clause 7(1)(f) in Part 3 of Schedule 2 of the EP&A Regulation requires an EIS to provide justification for a development with specific reference to the principles of ESD. Clause 7(4) sets forth the principles of ecologically sustainable development.

The Proposal is considered ecologically sustainable, due to the social, economic and environmental benefits described in this EIS, and the mitigation measures put in place to protect from adverse impacts on the environment. Switching from the use of coal tailings to biomass offers benefits in all four pillars of ESD.

## 27.1. The Precautionary Principle

The precautionary principle applies where 'if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'. Implementing the precautionary principle includes:

- Careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and
- An assessment of the risk-weighted consequences of various options.

Climate change is a major threat to human systems and the environment. The most important climate change mitigation measure is the transformation of energy, industry, and transport systems so that fossil carbon is not emitted to the atmosphere. Energy production from the Proposal will be based on standard fuel and eligible waste fuel biomass with no higher value application.

Use of sustainably sourced biomass contributes to climate change mitigation and supports decarbonisation of the economy. Strategic use of bioenergy can play a key role in decarbonisation of the NSW grid, which remains dominated by coal-fired electricity[63].

Biomass is a storable, dispatchable energy source that can support the rapid expansion of intermittent renewables (e.g. solar and wind), providing grid stability. Strategic use of biomass can allow faster, deeper penetration of wind and solar, thus supporting the rapid transition away from fossil fuels, at lower cost[64]. Society needs a portfolio of measures to address climate change. Taking known beneficial action to address climate change, including strategic deployment of bioenergy, is consistent with the precautionary principle.

The electricity generated from biomass under this proposal would reduce NSW GHG emissions directly, by displacing coal emissions, and provide grid stability to complement other balancing options, enabling accelerated expansion of wind and solar power, further reducing NSW GHG emissions and contributing to the global goal of net zero, required to reach the Paris Agreement.

[63] NSW EPA (2018). State of the environment report. Web: https://www.soe.epa.nsw.gov.au/all-themes/human-settlement/energy-consumption

[64] Li, M., Lenzen, M., Yousefzadeh, M. and Ximenes, F.A. (2020). The roles of biomass and CSP in a 100% renewable electricity supply in Australia. Biomass and Bioenergy, 143, p.105802.

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## 27.2. Intergenerational Equity

The intergenerational equity principle recognises that 'the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations'.

Emissions of $CO_2$ from combustion of fossil fuel cause permanent warming of the planet. Taking action now to support rapid decarbonisation reduces the absolute quantity of $CO_2$ in the atmosphere and therefore reduces future warming. Delaying action, which leads to additional fossil fuel emissions, will impose additional burden on future generations to achieve deep emissions reductions and deploy large-scale carbon dioxide removal strategies, which will be costly and have adverse effects on natural ecosystems and food security. The Proposal will reduce fossil fuel emissions, reducing the burden on future generations to undertake carbon dioxide removal and adapt to extreme climate change.

Additionally, the Proposal would not result in any other impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations. The Proposal is therefore consistent with the principles of intergenerational equity.

## 27.3. Conservation of Biological Diversity and Ecological Integrity

Ecologically Sustainable Development mandates that the conservation of biological diversity and ecological integrity should be a fundamental consideration in environmental planning and decision-making processes. Biodiversity refers to the variety of all life.

Biodiversity and ecological integrity are threatened by climate change. This proposal would reduce fossil fuel emissions, thus contributing to reducing global warming and its impacts on biodiversity and ecological integrity.

In addition, the Proposal aims to use plant and equipment on land that has already been developed. No clearing of native vegetation is proposed.

## 27.4. Improved valuation, pricing and incentive mechanisms

This principle requires that environmental factors should be included in the valuation of assets and services in terms of the overall costs to the Proposal.

The Proposal is consistent with the principle of pursuit of goals "in the most cost-effective way". The Proposal will enable the beneficial utilisation of a facility that is currently idle. It thus supports efficiency in use of natural resources that have been utilised in construction of the existing facility.

Development of the Proposal imposes an economic cost on the proponent and provides for increased economic activity for a relatively low capital cost. Effects on environmental resources have been given appropriate valuation and assessed in this EIS.

The Proposal has been designed with an objective of minimising potential impacts on the surrounding environment.

## 27.5. Cleaner Production Principles

Cleaner production is a practical method for protecting human and environmental health. This is achieved through the continuous application of an integrated, preventive environmental strategy towards processes, products and services. Cleaner production increases the overall efficiency of products and services and reduces damage and risks to humans

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and the environment. A proactive approach to reduce initial risks and consequences of impacts will assist in lowering reliance on reactive environmental mitigation measures.

The cleaner production techniques that are applicable to the ongoing operations of the project include:

- Selecting and using the most appropriate technology and materials to reduce the quantity of resources used and to minimise the amount of waste generated;
- Improved operation and maintenance practices to reduce the quantity of resources used and to minimise the amount of waste generated;
- Employing processes that are efficient in their consumption of energy, materials and natural resources and reduce greenhouse gas emissions;
- Selecting energy efficient plant and equipment for use in the facility;
- Reuse of captured stormwater as the primary source of water for the site;
- Safely disposing of any residual wastes and process (ash) residues; and
- Promoting the safe use, handling, recycling and disposal of waste products through an understanding of their life cycle.

When cleaner production principles cannot further remove environmental risk or consequence, mitigation strategies must be considered to ensure the remaining potential environmental harm is reduced to the lowest risk level possible.

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# 28. Project Justification

Verdant Earth are seeking approval to restart the Redbank Power Station using biomass (excluding native forestry residues from logging) as a sustainable fuel to produce near net zero $CO_2$ emissions and enable the power station to continue to produce "green" electricity on an ongoing basis (the Proposal).

To address concerns expressed by the community in relation the use of native forestry residues as fuel, the Applicant has developed an alternative biomass fuel strategy which specifically excludes this fuel source. Verdant will also relinquish the current approval to use coal tailings as a fuel at Redbank.

The power station was designed to burn low value fuels such as coal tailings and is a preferred technology for energy generation from biomass. The technology has demonstrated excellent performance and a low emissions profile.

The Proposal is forecast to generate 1 million megawatt hours of baseload electricity 24/7 to support the electricity grid and replace the use of coal whilst complementing other renewable energy sources such as solar and wind power. The Proposal aims to maintain sustainability policies to ensure the biomass fuel is responsibly sourced feedstock with no higher order uses.

The Proposal is considered a State Significant Development (SSD) under Clause 20(a) of Schedule 1 of *State Environmental Planning Policy (Planning Systems)* 2021 as it involves a development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that has a capital investment value of more than $30 million. The Secretary's Environmental Assessment Requirements (SSD-56284960) for the Proposal were issued by the Department of Planning and Environment on 30th August 2023.

While variable renewable energy (VRE) such as utility scale wind and solar, and rooftop solar, continue to be installed at record rates in NSW their lower capacity factor, reliance on new transmission and inability to respond to demand signals mean that firm or "dispatchable" sources of generation are in critical need.

If the Proposal were to go ahead, an additional 151 MW of firm (at generator) capacity would be available in NSW that is not presently accounted for in official market projections.

The supply gap identified in the 2023 ESOO to meet the reliability standard in NSW in 2025-26 is forecast at 191 MW. Were the Proposal to be in place by then, the gap would reduce to 40 MW.

This means that over the next seven to ten years, and beyond, the Proposal could have a direct role in delivering better electricity supply reliability and security in NSW and provide support to addressing unforeseen changes in outlook.

The NSW Government supports thermal energy recovery as a residual waste management option where it can deliver positive outcomes for the community while protecting human health and the environment.

Multiple key NSW and Australian government strategies, policies and plans provide strategic support for the Proposal, including the following:

- *Energy from Waste Infrastructure Plan 2021;*
- *NSW Waste and Sustainable Materials Strategy 2041;*
- *NSW Government's Net Zero Plan Stage 1: 2020 – 2030;*
- *The National Waste Policy 2018 Strategy;*
- *NSW Electricity Infrastructure Roadmap;*
- *Energy Security Safeguard (NSW Government 2021);*
- *NSW Electricity Strategy (DPIE 2019);*
- *Australia's Long Term Emissions Reduction Plan; and*

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- *Hunter Regional Plan 2041 (HRP).*

Bioenergy is supported as critical to achieving Net Zero by 2050 by the world leading authorities on Climate change, the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA).

Modern Bioenergy is a critical part of the solution to the intermittency of solar and wind and cornerstone to replacing retiring coal and fossil fuel fired generation.

The Proposal is predicted to generate 1,009 direct and indirect jobs. The 25-Year Net Present Value (NPV) of the Proposal is $901.1 million, and the majority of economic activity would occur in the Hunter Region, with an estimated annual value add during operation of $34.41 million, and in the Singleton LGA alone of $20.64 million.

Table 28.1 summarises how the Proposal is justified as a whole, having regard to the economic, environmental and social impacts of the Proposal and the principles of ecologically sustainable development.

With the implementation of the proposed mitigation and management measures, the Proposal will comply with all applicable legislation and guidelines and is therefore suitable for construction and operation and is recommended for approval.

**Table 28.1. Justification of the Proposal.**

| Aspect | Justification | Where addressed in the EIS |
|---|---|---|
| **Design of the project** | The Proposal has been developed in line with international best practice to avoid and minimise potential impacts through consideration of alternatives, site selection, physical layout and design, proposed uses and activities, timing, and proposed mitigation measures. The Proposal is consistent with and supportive of the principles of Ecological Sustainable Development. | Section 3 (Project summary)<br>Section 1.5.4 (Analysis of feasible alternatives)<br>Appendix C (Summary of Mitigation Measures)<br>0 (Site plans)<br>Section 2.2 (International Significance)<br>Section 27 Ecologically Sustainable Development |
| **Strategic context** | The Proposal is consistent with and supported by strategic NSW and Australian government plans and policies. The Proposal is designed to avoid impacts on air quality, water quality and human health, and will provide economic benefits to the regional community. The Site is suitably located to serve a key developing area the Hunter Region. | Section 2(Strategic Context)<br>Section 6 (Social Impact Assessment)<br>Section 7 (Economic Impact Assessment)<br>Sections 8 to 23 (Assessment and Mitigation of Impacts) |
| **Statutory requirements** | The Proposal is compliant with all relevant statutory requirements. | Section 4 (Statutory Context) and Appendix B (Statutory Compliance Tables) |
| **Community** | Consultation undertaken shows that concerns over potential impacts from the Proposal have been addressed through design of the Facility and mitigation measures proposed for construction and operation of the Facility. | Section 5 (Consultation summary)<br>Section 6 (Social Impact summary)<br>Appendix H (Consultation Report)<br>Appendix I (Social Impact Assessment Report) |
| **Economic and social scale** | The scale and nature of the Proposal is economically viable and would provide social, economic and environmental benefits to the local and regional community. Cumulative impacts have been assessed to be generally positive and in support of the transition to a low carbon energy future. | Section 2.1 (Addressing Electricity Shortfalls)<br>Section 25 (Cumulative Impact Assessment)<br>Appendix I (Social Impact Assessment Report)<br>Appendix K (Economic Impact Assessment) |
| **Compliance** | The approved project will be monitored and communicated over time via a suite of construction and operational mitigation measures, and via mandatory monitoring tracking under an Environment Protection Licence. | Section 26 (Environmental Monitoring)<br>Appendix C (Mitigation Measures Summary Table) |

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| Aspect | Justification | Where addressed in the EIS |
|---|---|---|
| **Risk** | key risks associated with this Proposal have been assessed in this EIS and a suite of mitigation and monitoring measures proposed to address them. | This EIS<br>Appendix C (Mitigation Measures Summary Table) |

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# Appendix A Secretary's Environmental Assessment Requirements

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# Appendix B Statutory Tables

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# Appendix C Mitigation Measures Summary Table

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# Appendix D Site Engineering Plans

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# Appendix E Landscape Concept Plans

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# Appendix F Plant Conversion Report

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# Appendix G Capital Investment Valuation

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# Appendix H Community Consultation Report

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# Appendix I Social Impact Assessment

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# Appendix J NSW Electricity Supply Gap: Expert opinion prepared for Verdant Earth Technologies on NSW electricity market

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# Appendix K Economic Impact Assessment

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# Appendix L Waste Management Plan (WMP)

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# Appendix M Fuel Supply and Characterisation Study

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# Appendix N Lifecycle Assessment

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# Appendix O Air Quality Impact Assessment

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# Appendix P Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan

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# Appendix Q Human Health Risk Assessment

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# Appendix R Noise and Vibration Impact Assessment

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# Appendix S Traffic Impact Assessment

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# Appendix T Soil and Water Impact Assessment

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# Appendix U Preliminary Site Investigation

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# Appendix V Bushfire Assessment

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# Appendix W  Preliminary Hazard Assessment

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# Appendix X Fire Safety Study

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# Appendix Y Biodiversity Development Assessment Report

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# Appendix Z Biosecurity Assessment and Management Plan

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# Appendix AA Land Use Conflict Assessment

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# Appendix BB Aboriginal Cultural Heritage Assessment Report (ACHAR)

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# Appendix CC Visual Impact Assessment

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# Appendix DDDust Management Plan

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# Appendix EE Bush Fire Emergency Management and Operations Plan

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# Appendix FF Site Constraints Map

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# Appendix GG Section 10.7 Certificates

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