STATEMENT OF ENVIRONMENTAL EFFECTS

Section 4.56 Application to Modify DA183/93

Redbank Power Station

At

Lot 450 DP1119428

112 Long Point Road, West Warkworth

Prepared For

Hunter Energy Pty Ltd

October 2020

Ref: 20/033

Prepared By

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planning > design > development

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1.0 INTRODUCTION

This report has been prepared by HDB Town Planning and Design on behalf of Hunter Energy in support of the s4.56 application relating to DA183/93 for the property at 112 Long Point Road, Warkworth.

This application seeks to allow for the use of biomass as a fuel to generate electricity via the amendment consent pursuant to s4.56 of *Environmental Planning & Assessment Act 1979* (the Act).

The application is made pursuant to Section 4.56 as an operating consent was issued by the Land and Environment Council subject to the outcomes of Greenpeace Australia Ltd v Redbank Power Company Pty Ltd and Singleton Council (1994) 86 LGERA 143.

The following details are provided to the consent authority in accordance with the requirements of Clause 115 of EP&A Regulation 2000 to support an application to modify development consents.

2.0 BACKGROUND

2.1 APPROVED DEVELOPMENT

Redbank Power Station was approved in 1997 and constructed over a 14-month period in 2000/2001, with the plant starting operation in October 2001. The Plant was in continual service until October 2014 when the management company was placed into receivership. Hunter Energy took ownership of the site in 2018 and has been working on restarting the project since.

The major features of the design of the Redbank Power Project include a nominal rating at Maximum Continuous Rating (MCR) of 146 megawatts (MWe) (gross) with an overload capacity of 151 MWe gross.

The approval, as it stands, requires Redbank to source the majority of its fuel as coal tailings from Warkworth Mine located approximately 7km (via road) to the south of Redbank. The approval also allows for the use of road haulage based on certain upgrades to the road network being undertaken. These upgraded were completed prior to the 2001 start date.

It is noted that previously fuel had been delivered to the site primarily via conveyor direct from Warkworth.

2.2 APPLICATION PARTICULARS

2.2.1 SITE DESCRIPTION

Address:	112 Long Point Road, West Warkworth
Lot/DP:	Lot 450 DP1119428
Local Government:	Singleton LGA
Locality:	Warkworth
Area:	18.03 hectares
Zone:	RU1 – Primary Production

The current registered owner of the site is Hunter Energy Pty Ltd.

2.2.2 APPLICANT DETAILS

Hunter Energy
C/- HDB Town Planning & Design
PO Box 40
MAITLAND NSW 2320

2.2.4 OWNERSHIP DETAILS

Owners Consent is provided on the attached application form.

2.2.5 CONTACT DETAILS

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2.3 EXISTING SITE

The subject site is located on the northern side of Jerrys Plain Road in Warkworth. Access from Jerrys Plain Road is restricted; Long Point Road, therefore, provides the only entry/exit to the subject site.

The Redbank Power Plant is a coal powered plant containing a single steam driven turbo generator with a maximum capacity of 151 MW of electricity. Redbank differs from other Plants in that it utilises circulating fluidised bed technology which is capable of consuming a variety of fuels including Coal tailings and Biomass.

Figure 1 shows the aerial photo of the locality and ***Figure 2*** is an aerial photo of the site.

Figure 1: Aerial photo of the locality
Source: Google Earth

Figure 2: Aerial photo of the site
Source: Google Earth

2.3.1 OPERATIONAL DETAILS

When in operation, the site generally operates 24 hours a day, 7 days per week. There are typically two shifts over this period, starting at 6 am and 6 pm.

The staffing levels at present are detailed below:

- Day shift (6:00 am to 6.00 pm) – 25 Full Time Equivalent (FTE) staff.
- Overnight shift (6:00 pm to 6.00 am) – 15 FTE staff.

The primary fuel (coal tailings) is delivered to the site via the conveyor system. Supplementary fuel is delivered via road transport when the conveyor is not available.

2.3.2 DA COMPLIANCE ASSESSMENT

In reviewing the DA, an assessment was undertaken to assess the level of compliance with the prescribed conditions. It is noted that the approval provides for conditions relating to the construction and management, as well as the operation of the Plant. As the Plant is presently not operational, a number of conditions need to be considered within this context.

The review determined that, based on approximately 15 years of operation, Redbank Power Station had been constructed, operated and managed in accordance with the prescribed conditions.

It is understood that Singleton Council is in the process of undertaking its own assessment of the operational compliance of the station.

2.3.3 Environment Protection Licence (EPL) Compliance

The operation of the Plant, including all the measures put in place to minimise the environmental impacts, are governed by the EPL issued by the NSW Environment Protection Authority (EPA). Redbank Power Station has operated since 2000 under EPL 11262. Since this time only a single incident (September 2013), resulting in the issuing of a caution Penalty Notice, occurred.

It is understood that this related to a rupture of the pipework connecting Warkworth Mine and Redbank. The ruptured ash pipe was upgraded/replaced and encased in another pipe that drains back into a dedicated area within the Redbank site, to ensure that there would be no further spillages. During the approximately 15 years of operation, this was the only caution penalty notice that is recorded as having been issued.

3.0 PROPOSED MODIFICATIONS

The proposal involves modification of the existing consent to allow for the plant to utilise biomass fuel as an additional fuel source. This provides the opportunity for the proponents to generate electricity with Net Zero CO^2 emissions in a cost-effective manner. This ultimately ensures that reliable green baseload energy is generated that supports the electrical grid requirements reducing the risk of blackouts and provides downward pressure on the cost of power, for both the residential and commercial/industrial markets.

The proposal will necessitate the modification of the current Environmental Planning license (EPL 11262).

The modification will therefore be for the inclusion of biomass to be used as fuel for use at Redbank under the EPL.

3.1 CONDITION 1

Condition 1 references the various documents and plans that are central to the approval of the Plant. This will require amending to include the reference to this application by adding to the end of the condition the words:

"and the section s4.56 applications dated ***October 2020.****"*

Existing Condition 1 – Scope of Development

The development being carried out generally in accordance with the Amended Environmental Impact Statement prepared by the National Power Company and ESI Energy Inc. dated November 1993 and the additional clarification contained in the responses to comments prepared by the National Power Company and ESI Energy Inc. dated 21 February 1994 and the information regarding improvements to the development contained in the prepared statements of Roy Alper and Thor Hibbler of February 1997.

Proposed Condition 1 – Scope of Development

The development being carried out generally in accordance with the Amended Environmental Impact Statement prepared by the National Power Company and ESI Energy Inc. dated November 1993 and the additional clarification contained in the responses to comments prepared by the National Power Company and ESI Energy Inc. dated 21 February 1994 and the information regarding improvements to the development contained in the prepared statements of Roy Alper and Thor Hibbler of February 1997 *and the section s4.56 applications dated* ***October 2020.***

3.2 CONDITION 16

Condition 16 presently limits the fuel type and source. With a proposal to allow for the Plant to be able to use biomass, this requires amending to remove the limit on fuel type. In addition, the conditions need to allow for the use of biomass. In so doing the intent and extent of the proposal is made clear. The amendment is set out below.

Existing Condition 16 – Fuel Source

At least the majority of the fuel burn at the power plant in any one year after commercial operation, on a dry tonnes basis, is to be derived from coal washery tailings obtained ~~either~~ directly from the Warkworth mine washery ~~and/or Lemington mine washeries~~ or indirectly from tailings storage dams on the Warkworth ~~and/or Lemington~~ mine leases. Coal washery tailings are not to be obtained from mines other than the Warkworth ~~and/or Lemington~~ without the further approval of Council.

Proposed Condition 16 – Fuel Source

At least the majority of the fuel burnt at the power plant shall be coal tailings and/or biomass, up to and including the potential use of 100% biomass in any one year, on a dry tonne basis. Coal Tailings derived from coal washery tailings shall be obtained directly from the Warkworth mine washery or indirectly from existing tailings storage dams on the Warkworth mine leases. Coal washery tailings are not to be obtained from mines other than Warkworth without the further approval of Council.

Biomass fuel must be considered an Eligible Waste Fuel as defined by the EPA's Eligible Waste Fuel Guidelines and/or biomass fuel as otherwise approved or exempted for use by the EPA and/or such that it meets the EPA emissions requirements for the power plant as established or varied from time to time.

4.0 ASSESSMENT

The *Environmental Planning and Assessment Act 1979* provides for the modification of consents through Section 4.55 and s4.56 of the Act. Section 4.56 operates to allow the modification of a consent where the Court had issued the notice of determination. Specifically, Section 4.56 states:

> *(1) A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the Court and subject to and in accordance with the regulations, modify the development consent if—*
>
> *(a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified (if at all), and*
>
> *(b) it has notified the application in accordance with—*
>
> *(i) the regulations, if the regulations so require, and*
>
> *(ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and*
>
> *(c) it has notified, or made reasonable attempts to notify, each person who made a submission in respect of the relevant development application of the proposed modification by sending written notice to the last address known to the consent authority of the objector or other person, and*
>
> *(d) it has considered any submissions made concerning the proposed modification within any period prescribed by the regulations or provided by the development control plan, as the case may be.*
>
> *(1A) In determining an application for modification of a consent under this section, the consent authority must take into consideration such of the matters referred to in section 4.15(1) as are of relevance to the development the subject of the application. The consent authority must also take into consideration the reasons given by the consent authority for the grant of the consent that is sought to be modified.*
>
> *(1B) (Repealed)*
>
> *(1C) The modification of a development consent in accordance with this section is taken not to be the granting of development consent under this Part, but a reference in this or any other Act to a development consent includes a reference to a development consent as so modified.*
>
> *(2) After determining an application for modification of a consent under this section, the consent authority must send a notice of its determination to each person who made a submission in respect of the application for modification.*
>
> *(3) The regulations may make provision for or with respect to the following—*

(a) the period after which a consent authority, that has not determined an application under this section, is taken to have determined the application by refusing consent,

(b) the effect of any such deemed determination on the power of a consent authority to determine any such application,

(c) the effect of a subsequent determination on the power of a consent authority on any appeal sought under this Act.

(4) (Repealed)

This application has been prepared with regard to the requirements set out in Section 4.56 above.

Section 4.56 of the Act states that an assessment under Section 4.15(1) must be undertaken. The following provides an assessment of the proposed modification against the provisions of Section 4.15(1).

4.1 SUBSTANTIALLY THE SAME DEVELOPMENT

The key element of s4.55/56 is the requirement that the development must be substantially the same as that approved. The meaning of substantially the same has been considered by the Land and Environment Court on multiple occasions. The meaning is generally considered to have been articulated by Justice Bignold in *Moto Projects v North Sydney Council (1999) 106 LGERA 298).* Justice Bignold, summarised the test as follows:

The requisite factual finding obviously requires a comparison between the development, as currently approved (NB Note that section 4.55/4.56 now requires the modified development to be "substantially the same" as the development that was originally approved, as opposed to the currently approved development), and the development as proposed to be modified. The result of the comparison must be a finding that the modified development is "essentially or materially" the same as the (currently) approved development.

The comparative task does not merely involve a comparison of the physical features or components of the development as currently approved and modified where that comparative exercise is undertaken in some type of sterile vacuum. Rather, the comparison involves an appreciation, qualitative as well as quantitative, of the developments being compared in their proper contexts (including the circumstances in which the development consent was granted).

As such, to assess whether the proposed development is substantially the same development a review of the key elements of the proposal has been undertaken against the current approved operation. The outcomes of this assessment are provided in ***Table 1.***

Element	Existing	Proposal	Assessment	Complies
Power Generation methodology	Presently coal tailings are used as fuel to fire a boiler, generating steam to drive a turbine.	Biomass would be used as a substitute fuel to fire a boiler, generating steam to drive a turbine.	The fuel type is modified. All other elements in regard to the method of generation remain the same.	Yes
Power Generated Capacity	The existing plant generates approximately 151MW.	The plant will continue to generate approximately 151MW.	The generation capacity/limit will remain the same.	Yes
Site Area	The existing plant is defined by the current approval.	The proposed modification will not require any additional groundworks.	As the proposal will not result in physical changes to the site it would be considered the same.	Yes
Fuel Requirements	The existing plant requires in the order of 700,000t of tailings annually.	The plant will require in the order of 850,000t of biomass annually.	The fuel requirement is substantially the same.	Yes
Operation Requirements	The site generally operates 24 hours a day, 7 days per week. There are typically two shifts over this period, starting at 6 am and 6 pm. The current staffing levels are as below: Day shift (6:00 am to 6.00 pm) – 25 FTE staff. Overnight shift (6:00 pm to 6.00 am) – 15 FTE staff.	The site generally operates 24 hours a day, 7 days per week. There are typically two shifts over this period, starting at 6 am and 6 pm. The current staffing levels are as below: Day shift (6:00 am to 6.00 pm) – 25 FTE staff. Overnight shift (6:00 pm to 6.00 am) – 15 FTE staff.	The operation of the plant will stay the same in both instances	Yes
Fuel Source	At least the majority of the fuel burn at the power plant in any one year after commercial operation on a dry tonnes basis, is to be derived from coal washery tailings.	The Plant will be allowed to use biomass as a substitute fuel.	The fuel source does change. The impact of this will be an improved environmental outcome. (see Section 6.2).	Yes
Environmental Impacts (general)	The existing operation is approved and	There is no proposal to change the manner in which the Plant	The impact of the development on the environment in regard	Yes

Element	Existing	Proposal	Assessment	Complies
	licensed in accordance with the EIS and EPL that apply to the site.	operates but it is expected to substantially improve environmental emissions to Net Zero CO^2.	to noise, ecology, hydrology and stormwater would not change, and emissions will improve.	
Transport /Access	The fuel source is predominantly delivered to site using the conveyor system. Nevertheless, at times the site does require deliveries which can generate up to 100 additional vehicle trips per day.	The delivery of fuel would require on average 70 trips, which is well within the existing consent which provided for up to 100 trips.	This level of service was considered as part of the EIS, albeit over a shorter period of time. No additional impacts have been identified as part of the assessment and the TIA (Section 6.3) shows the network continues to function well without the need for additional upgrades.	Yes

Table 1: Comparative Assessment of proposed modification
Source – HDB Town Planning and Design

5.0 LEGISLATIVE REQUIREMENTS

The legislative requirements for Electricity Generating Works aim to ensure that the environmental risk and community's safety are taken into consideration. Given that this is a s4.56 application, assessment should only target the variation and probable impact, therefore reducing the scope of legislative considerations.

The following legislative review is provided to give context to the application. It should be noted that owing to the nature and scale of the requested modification there is no requirement to review and/or consider the following legislation beyond what is provided herein.

5.1 *ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979*

5.1.1 MODIFICATION OF CONSENTS

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides for the modification of a development consent via s4.55/56 Application. Under this section there are several different pathways depending on the extent of modification, as described below:

- S4.55(1) – Correction of a minor error, misdescription or miscalculation.
- S4.55(1A) – Substantially the same development with the modification being of minimal environmental impact.
- S4.55(2) – All other applications provided the development remains substantially the same development.
- S4.56 – For applications approved by the Land and Environment Court.

As previously stated, this application was approved by the Court. As such this development is to be lodged under s4.56 it is considered that the requirement that the *"the proposed modification is of minimal environmental impact"* is not of relevance in this assessment.

An assessment of the proposal against these requirements is provided in Section 4.

5.1.2 DESIGNATED DEVELOPMENT

Schedule 3 of the Environmental Planning and Assessment Regulations 2000 (Regulations) sets out a list of activities that are considered to be "*Designated Development*". The carrying out of these activities requires specific procedures, including a longer advertising period, referral to government agencies, and the preparation of an Environmental Impact Statement (EIS).

Clarification on modifications that are not considered as designated developments are provided in Schedule 3 cl35 of the Regulations as stated below:

> *"Development involving alterations or additions to development (whether existing or approved) is not designated development if, in the opinion of the consent authority, the alterations or additions do not significantly increase the environmental impacts of the total development (that is the development together with the additions or alterations) compared with the existing approved development."*

The proposed variation to the fuel source does not change the nature of the development. The coal specifications are identical to that which was previously used. The fuel specifications for Biomass will be based on utilising "Eligible Waste Fuels" as defined by the EPA, which is regarded as carbon neutral and provides significant environmental benefits over coal.

As such there will be no increase in the environmental impacts associated with the proposed modification. The proposed amendment is therefore ***not a 'Designated Development'*** and hence can be addressed through a modification application.

5.1.3 INTEGRATED DEVELOPMENT

For the purposes of s4.46 of the Act, the proposed modification will not trigger/require the approval under any of the nominated Acts; therefore, the proposal is not an Integrated Development.

5.2 *PROTECTION OF ENVIRONMENTAL OPERATIONS ACT 1997* (POEO ACT)

The POEO Act is environmental protection legislation administered by the EPA. The current site operations fall within the category of 'electricity generation. which is listed as a scheduled activity requiring a license from the EPA.

The site's current license (EPL 11262) allows for crushing, grinding, or separating as well as the generation of electrical power from coal. The addition of biomass (from various sources) will require the EPL to be updated.

5.3 STATE ENVIRONMENTAL PLANNING POLICY (INFRASTRUCTURE) 2007

Electricity Generating Works is a permissible form of development, within the RU1 zone as outlined in Division 4 Electricity generating works or solar energy systems of the SEPP.

The SEPP (Infrastructure) also prescribes the specific types and intensity of development which are considered Traffic Generating under Schedule 3. Development nominated by the SEPP under Schedule 3 must be referred to the RMS. Electricity Generating Works are not nominated under Schedule 3.

5.4 STATE ENVIRONMENTAL PLANNING POLICY (STATE AND REGIONAL DEVELOPMENT) 2011 - SEPP 2011

Electricity Generating works fall under the category of State Significant Developments (SSDs) as listed under Schedule 1 Clause 20 of the SEPP 20 (Electricity generating works and heat or co-generation).

The original approval, however, predates the operation of the SEPP. It is also noted that the proposal seeks only to modify the fuel source. The Capital Investment Value (CIV) of the proposal will not exceed $30M and, as such, is well below the thresholds that would trigger an SSD application.

As stated above, the extent of the modification relates only to the modification of the application so to allow for the use of biomass as a fuel. No associated works are proposed.

Schedule 7 of the SEPP sets out all forms of development that are considered to be Regional Development. Where a proposal exceeds the nominated thresholds the Hunter and Central Coast Planning Panel becomes the determining authority rather than the Local Authority. In regard to this proposal Clause 5 of the Schedule sets out the following:

> *5 Private infrastructure and community facilities over $5 million*
>
> *Development that has a capital investment value of more than $5 million for any of the following purposes—*
>
> *(a) air transport facilities, **electricity generating works**, port facilities, rail infrastructure facilities, road infrastructure facilities, sewerage systems, telecommunications facilities, waste or resource management facilities, water supply systems, or wharf or boating facilities,*

As such, the proposal would not be considered Regionally Significant Development.

5.5 SINGLETON LOCAL ENVIRONMENTAL PLAN 2013

Existing Zoning & Permissibility

The Electricity Generating Works site is zoned RU1 – Primary Production under the provisions of the Singleton Local Environmental Plan (SLEP) 2013.

1 Objectives of Zone

- *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.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*

2 Permitted without consent

Extensive agriculture; Forestry; Home occupations; Intensive plant agriculture.

3 Permitted with consent

Agriculture; Airstrips; Animal boarding or training establishments; Aquaculture; Bed and breakfast accommodation; Boat launching ramps; Boat sheds; Building identification signs; Business identification signs; Camping grounds; Caravan parks; Cellar door premises; Cemeteries; Community facilities; Crematoria; Dual occupancies; Dwelling houses; Environmental facilities; Environmental protection works; Extractive industries; Farm buildings; Farm stay accommodation; Flood mitigation works; Hazardous industries; Heavy industrial storage establishments; Helipads; Highway service centres;

Home-based child care; Home businesses; Home industries; Information and education facilities; Intensive livestock agriculture; Jetties; Moorings; Offensive industries; Open cut mining; Places of public worship; Plant nurseries; Recreation areas; Recreation facilities (outdoor); Roads; Roadside stalls; Rural industries; Rural workers' dwellings; Service stations; Sewerage systems; Truck depots; Turf farming; Veterinary hospitals; Water supply systems.

The permissibility of the proposal is established via State Environmental Planning Policy (Infrastructure) 2007. It is however considered that the proposal is consistent with the objectives of the zone.

The proposal does not trigger any other Clauses within the Singleton Local Environmental Plan.

5.6 Draft Environmental Planning Instruments

No draft Local Environmental Plans were identified that would impact on this application.

5.7 Singleton Development Control Plan 2014

The existing Redbank Power Generation Plan has been designed and constructed to meet the various legislative and operational requirements which have been approved by Singleton Council.

The proposed changes involve:

- Modifying the proposed fuel source; and
- Increase the vehicle movements to/from the site.

With regard to the principal development standards and other provisions in the Singleton Development Control Plan (DCP), there will be no variation or additional requirement as a result of this proposal. The stockpiling of Biomass has been assessed to determine if there will be any impacts and if so the identification of management actions have been included. The proposal is thus considered to be consistent with the guidelines of Singleton DCP.

5.8 Planning Agreement (including Draft Planning Agreements)

No Planning Agreements or draft Planning Agreements were identified that would impact on this application.

5.9 The Suitability of the Site for the Development

The site presently houses the Redbank Power Station. The current consent allows for the continued operation of the plan beyond 2030. The level of investment on the site, along with its location, makes it well suited to continue providing power for the residential and commercial customers in NSW.

5.10 ANY SUBMISSIONS MADE

Any submission made will need to be considered in the context of the proposal. It should be noted that as part of the preparation of this application, consultation has been undertaken with the appointed Community Consultative Committee, as soon as Council advises Hunter Energy of the acceptance of the nominated Community Consultative Committee members and the appointed Council Chair person.

5.11 THE PUBLIC INTEREST

The purpose of the modification is to allow Redbank Power Plant to re-open, provide additional green baseload power to the network and increase the level of competition within the energy market.

Biomass is an approved fuel source pursuant to the Australian Renewable Energy Act and operating on 100% biomass, the plant will deliver Net Zero carbon dioxide emissions in line with the NSW aspirational aim for net zero emissions by 2050.

In addition, the plant will be baseload and will help assist to resolve the intermittency issues with solar and wind and complement these other technologies. It will assist with grid stability and the replacement of ageing coal baseload generators.

Redbank will provide a large job and economic stimulus to the region over its operating life. It is estimated over 250 jobs will be created in the restart operation, 50-60 full time at the plant once operating and well over 500 direct and indirect jobs in the fuel supply chain.

Redbank will be a leading renewable biomass project delivering green baseload electricity, assisting with climate change abatement, supporting our sustainable forestry industry, whilst at all times providing economic stimulus, regional development and jobs.

The availability of electricity to consumers at a fair and reasonable price continues to be an issue for Government. With the planned closures of existing ageing plants imminent, additional capacity is needed.

Public interest is therefore served by providing for additional capacity and competition in the clean energy market.

6.0 ASSESSMENT UNDER S4.15(1)

In determining a s4.56 application, the Consent Authority must assess the proposed modification against the relevant matters for consideration as referred to in s4.15(1) of the *Environmental Planning and Assessment Act 1979.*

The proposed changes are not affected by the provision of any environmental planning instrument, development control plan or any other planning agreements. Hence an assessment of the likely impact of the modification on both the natural and built environments as required under s4.15(1) is provided in the following table (***Table 2***).

Matters for consideration	**Assessment of likely impact from the proposed modification**
Geology and soil	The proposed modification does not involve any changes to the current site activities that affect the soil conditions or stability.
Hydrology and water quality	There are no changes, or works, that affect the water quality or hydrology or stormwater regime on the site. An assessment has been undertaken to confirm this (see Section 6.1).
Contamination	The proposed modification does not involve any changes to the current site operations and there are no additional concerns arising from the proposed modification.
Access and traffic	The inclusion of an additional fuel source location will require the use of road transport to move the material. An assessment of the volume of traffic and potential impacts which this would generate have been assessed. This is discussed in more detail below (see Section 6.2).
Noise	The facility is located in an area dominated by coal mines and related businesses/infrastructure. Given the same operating conditions, no adverse impacts are anticipated.
Air quality	The introduction of biomass will have a net benefit on air quality. An assessment of the air quality impact has been undertaken (see Section 6.3).
Flora and fauna	The proposed modification relates to the sourcing/movement of fuel and will not have any impact on local flora and fauna.
Visual environment	The proposal does not involve any external changes which are directly visible from the public domain; hence the visual amenity of the area will remain unaffected by the proposal.
Risk Management	Risks associated with the stockpiling of the biomass have been considered Matters such as bushfire risk, dust management and stormwater have all be included (see Section 6.4).
Waste storage and collection	The existing waste management measures will continue to be used onsite.

Socio-economic impacts	The project supports the Singleton Economic Development Strategy which identifies a vision fostering and supporting business and job creation. The proposed modification will enable a presently unutilised electricity generating equipment and infrastructure to be used. In doing so the plant will provide for additional electricity to the network, provide increased local employment as well as secondary economic benefits through the broader Singleton and regional community.

Table 2: Assessment of likely impact from proposed modification
Source – HDB Town Planning and Design

6.1 STORMWATER IMPACT ASSESSMENT

The proposed biomass fuel conversion will not alter the current hydraulic characteristics of the site. Therefore, it was deemed that no augmentation of the current site drainage network is required as part of the conversion. Similarly, the existing on-site detention system will function as normal and was also deemed satisfactory for the development modification.

However, the stockpiling of biomass, as oppose to coal may impact on the suitability and effectiveness of the existing stormwater management system. As such an assessment was undertaken to confirm there would be no additional impacts.

Modelling conducted using MUSIC software evaluated the performance of the existing 'treatment train' with respect to achieving the required targets. The model involved the inclusion of a sediment basin and detention basin as the water quality improvement devices to treat stormwater runoff. Other devices such as oil skimmers are already utilised on the site to achieve council's pollutant reduction targets. The outcomes of the Stormwater Impact Assessment (**Appendix A**) are summarised below.

Stormwater Management

The proposed biomass fuel substitution of the power station will not result in the creation of any additional impervious areas or alter the current hydraulic characteristics of the site. Therefore, it was deemed that no augmentation of the current site drainage network is required as part of the conversion.

Similarly, as there is no increase in impervious areas or alterations to current site drainage, existing on-site detention system will not require augmentation.

Stormwater quality was assessed in accordance with Council's Water Sensitive Urban Design (WSUD) requirements for all developments. It was deemed appropriate to incorporate all the existing water quality improvement devices present on the site into the water quality model. Utilising MUSIC modelling software, the existing system, was shown to meet all relevant standards with the inclusion of biomass to the site (see ***Table 1***).

MUSIC modelling results in regard to council's targets are summarised below in ***Table 3***.

Pollutant	Target	Reduction
Total Suspended Solids (TSS)	80%	94.5%
Total Phosphorus (TP)	45%	88.2%
Total Nitrogen (TN)	45%	84.6%
Gross Pollutants (GP)	NA1	98.2%

Table 3: Outcomes of MUSIC Modelling
Source – RGH Consulting – Stormwater Management Report

The report concluded that the existing stormwater measures would adequately treat the stormwater from the stockpile area both in terms of quantity and quality to the satisfaction Council's requirements for the development modification.

6.2 Traffic Impact Assessment (TIA)

The sourcing of biomass fuel from sites other than Warkworth mine, will require road haulage to Redbank Power Station. As part of the scope of this report, it was forecasted that 140 movements (70 trips) per day (1 truck trip equals 1 entry movement plus 1 exit movement, equalling 2 movements), would be needed to haul the required biomass.

It is proposed that biomass would be transported via road (primarily using B-Double trucks). It has been assumed to be a consistent 50/50 split travelling to/from the site from the northern and southern directions.

The Ason Group undertook a traffic assessment of the proposal to determine the likely impacts of the traffic movements on both the intersection and the broader road network. The outcomes of the Traffic Impact Assessment (**Appendix B**) are summarised below.

Intersection Operations

The TIA focused on the Golden Highway (Jerrys Plain Road)/Long Point Road intersection. This intersection had been upgraded as part of the construction of the Redbank Power Station. SIDRA software package was used to assess the delay and level of service of the intersection.

Table 4 below provides the outcomes of this assessment.

		Existing		Proposed	
Intersection	**Period**	**Intersection Delay (sec)**	**Level of Service**	**Intersection Delay (sec)**	**Level of Service**
Golden Highway / Long Point Road	AM	10.9	A	16.2 (5.3)	A
	PM	15.5	B	16.9 (1.4)	B

Table 4: Network performance
Source: The Ason Group (Traffic Impact Assessment)

Based on the results, the Ason Group conclude that the intersection is predicted to continue to operate at a good level of service and with spare capacity.

Road Network Capacity

The original TIA assesses the likely impact of the additional heavy vehicle movements on the road network. The RMS guidelines state that for a Major Road the Weekday Level of Service should be C while the weekend a Level of Service D is acceptable. The Level of Service (LoS) is determined, having regard to the terrain of the road traverses, the overall number of vehicles using the road and the percentage of heavy vehicles.

Factoring in the traffic counts and the outcomes of the SIDRA modelling, the Ason Group concluded that the Golden Highway (Jerrys Plain Road) would have a LoS of C during the AM peak and a LoS of B during the PM peak.

Based on the results, the Ason Group conclude the existing road network has the capacity to cater for the proposed increase in traffic volumes associated with the proposed modification while maintaining the required levels of service.

Conclusion and recommendation

In conclusion, the Traffic Impact Assessment report has determined that allowing for a significant rise in the proposed heavy vehicle movements on the existing road network, the proposal is supportable from an access and traffic perspective. As such the existing network has sufficient capacity to support the proposed 140 movements per day.

6.3 AIR QUALITY ASSESSMENT

The use of biomass as a fuel will result in a change to the air quality impacts associated with Redbank Power Station. As such an assessment has been undertaken to provide a comparative assessment of the air quality impacts from the two fuel sources. This includes a comparison of both the stack emissions and the greenhouse gases. The air quality impacts in relation to the biomass were then also assessed to ensure that the proposal met the current air quality requirements. The outcomes of the Air Quality Assessment (**Appendix C**) are summarised below.

Comparative Assessment – Stack Emissions

The most significant source of operational air emissions for Redbank is combustion products exiting the main stack. To determine the potential stack emissions an estimation has been calculated based on the National Pollutant Inventory (NPI) Emission estimation technique manual for Combustion in Boilers.

Approximately 112 tonnes of biomass would be burned per hour, assuming a nominal fuel moisture content of 25%. Based on the above the estimated stack emissions are then combined with the stack emission rates to determine the in-stack concentrations.

Table 5 below presents the outcomes of this assessment. The modelled concentrations for the nominated pollutants are presented along with the current levels and the EPL limits presently in force.

Pollutant	In-Stack concentration (mg/m3)		
	Proposal	Current Performance	EPL Limit
Solid particles [a]	14	10	82
Nitrogen oxides	243	155	799
Fluoride	-	1.4	50
Sulphur dioxide	28	455	649
Type 1 substance [b]	0.046	0.016	2.5

a. Assessed using PM_{10}
b. Elements or compounds containing antimony, arsenic, cadmium, lead or mercury

Table 5: Stack Emission Assessment
Source: Wilkinson Murray (Air Quality Impact Assessment

For the majority of the nominated pollutants there will be a positive impact in regard to reduced concentrations by using biomass. For nitrogen oxides, solid particles and Type 1 substances, there is a slight increase, but all are well below EPL limits.

Air Quality Impact Assessment

An assessment of the proposed impacts was also undertaken to ensure that these were within the current required guidelines. The previously nominated pollutants were modelled to ascertain the incremental and total (i.e. incremental plus background) ground level concentrations of criteria pollutants associated with the operation of Redbank using biomass.

The results indicate compliance with the impact assessment criteria at all receptors for SO2, NO2, lead, CO, PM10 and 24-hour average PM2.5.

They also indicate exceedance of the impact assessment criteria for annual average PM2.5 only. However, the Report noted that the annual average ambient concentrations of PM2.5, as measured at the Singleton AQMS, were also above the impact assessment criteria, primarily due to recent extreme bushfire events. As such it would be considered that in 'normal circumstances' this exceedance would not occur.

The predicted 99.9th percentile 1-hour ground level concentrations of individual toxic pollutants were also determined. The results indicate compliance with the impact assessment criteria for all pollutants.

Greenhouse Gas Emissions

A greenhouse gas assessment has been conducted for the proposal **(Appendix C)**. As noted previously the use of biomass is considered a net zero impact due to the cyclical use of carbon within the system. The Assessment focuses on Scope 1 and 2 emissions as these allow for a direct comparative assessment of the proposal against the existing operation.

The estimated annual operational greenhouse gas emissions for Redbank, for both the approved and proposed fuels, are presented in ***Table 6***. The data indicate that the proposed use of biomass would result in a reduction in greenhouse gas emissions of approximately 98% compared to the approved fuel (coal tailings).

Parameter	Approved Fuel (coal)	Proposed fuel (biomass)
Energy content (GJ/t)	16.01	15.21
Consumption rate (t/h)	81.6	112.2
Annual consumption (t/y) [a]	652,800	897,600
GHG emissions (tCO_2-e/y)	**943,023**	**17,748**

a. 8000 operating hours per year

Table 6: Green House Gas Emission Assessment
Source: Wilkinson Murray (Air Quality Impact Assessment

The estimated annual greenhouse gas emissions using biomass as a fuel are approximately 98% lower than those for the approved fuel. At full operational capacity this would see a reduction of in excess of 900,000t of carbon being put into the atmosphere.

6.4 BUSHFIRE IMPACT ASSESSMENT

EMC Pty Ltd was engaged to complete a Bush Fire Assessment Report (BFAR) on the proposed use of biomass at the Redbank power station located at 112 Long Point Road, West Warkworth NSW **(Appendix D).**

To determine the planning and construction requirements a site assessment was undertaken in accordance with Appendix 1 of PBP 2019 to determine the appropriate bush fire threat level, design, planning and construction standards required to comply with PBP 2019.

The Assessment noted that the APZ is presently located wholly within the site boundaries and is not located on land >18 degrees slope, and there are no proposed building structures within the APZ.

With the existing APZ in place, a separation of 60m to +100m exists between the forested vegetation to the west and facilities-built infrastructure. Radiant heat calculations on flat ground with Coastal Valley Grassy Woodlands as the vegetation illustrated 40m separation to achieve 10kW/m2.

The provided APZ to the north and west provide ample separation for BAL-LOW construction and emergency service mobility within the facility within excessive radiant heat exposure.

Given the above the Assessment provide for a range of recommendations to ensure ongoing compliance with PBP 2019. This included:

- Retention and ongoing maintenance of the existing APZ.
- Upgrade of 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 (presently being addressed).
- A Bush Fire Emergency Management and Operations Plan is required to be developed **(Appendix D).**

7.0 REQUIREMENT OF CL115

Considerations under Clause 115(1) of the Environmental Planning & Assessment Regulation 2000 (EPA Regulations)

The following details are provided to the consent authority in accordance with the requirements of Clause 115 of EP&A Regulation 2000 for an application to modify development consents.

a) Name and address of the applicant

HDB Town Planning & Design
PO Box 40
Maitland NSW 2320

b) Description of the development to be carried out under the consent

The current consent, DA183/93 allows for the operation of a Power Station on the site.

c) Address and formal particulars of titles of the land on which development is to be carried out

Lot 450 DP1119428, 112 Long Point Road, West Warkworth.

d) A description of the proposed modification to the development consent

A detail description of the proposed Modification has been provided in Section 3.

e) A statement that indicates either:

(i) that the modification is merely intended to correct a minor error, misdescription, or calculation; or

(ii) that the modification is intended to have some other effect, as specified in the statement.

The proposed modification is intended to allow for the use of an alternative/additional fuel. This is considered to provide significant improvements to the environmental impacts of the proposal.

f) A description of the expected impacts of modification

Section 6 provides an assessment of the modification against all relevant matters for consideration stipulated in s4.15(1).

In summary, the proposed modification does not inflict additional risks or intensify the approved operations on the subject site. The potential alternative fuel source location will not result in any additional impacts. As a result, the proposed modification as a whole will not result in any significant, additional impacts.

g) An undertaking to the effect that the development (as to be modified) will remain substantially the same as the development that was originally approved

A detailed assessment of the proposal has been undertaken to assess the proposed changes in both a quantitative and qualitative manner. This is consistent with the requirements of the legislation as outlined by the NSW Land and Environment Court.

It is considered that the development as proposed is substantially the same as the currently approved.

h) If the applicant is not the owner of the land, a statement signed by the owner of the land to the effect that the owner consents to making of the application:

(i) a statement as to whether the application is being made to the Court or to the consent authority; and

(ii) if the consent authority so requires, must be in the form approved by that authority.

Owners consent is provided in the attached application form. This application is submitted to Singleton Council under provisions of s 4.56 of the Act.

8.0 CONCLUSION

The modification to the consent as outlined above clearly indicates the development is essentially the same development as previously approved and no additional significant impacts are anticipated from the proposed amendment.

The assessment of the proposed amendment has been undertaken in accordance with s4.15(1) anddemonstrates that the modification meets the relevant planning requirements.

Singleton Council as the Consent Authority is therefore requested to grant consent to this s4.56 amendment to DA183/93, as proposed.

APPENDIX A

STORMWATER IMPACT ASSESSMENT

RGH CONSULTING GROUP

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STORMWATER MANAGEMENT PLAN REPORT

Associated with the Proposed Biomass Fuel Conversion of Redbank Power Station

112 Long Point Road, West Warkworth NSW

For Hunter Energy Pty Ltd
Ref. 20200403_R01 Rev. A
September 2020

Singleton Council
Local Government Area

CONTENTS

	Revision Title	Prepared	Reviewed	Date
A	Issued for Information	B.K	B.W	04/09/20

Prepared: Date: 04/09/20

.....

Benjamin Koopman
GradIEAust., B.Eng. (Civil) (Hons)
Civil Engineer

Reviewed: Date: 04/09/20

.....

Ben Williams
MIE Aust., BE (Civil)
Director – Civil Engineering

EXECUTIVE SUMMARY

RGH has been engaged by the Client to complete a Stormwater Management Report for the proposed Biomass fuel conversion of Redbank power station. RGH has prepared a water cycle management plan sketch which should be referenced during review of this report and are referred to as the WCMP.

The Client proposes to convert the power station from coal fuel source to Biomass and as such, is seeking a development modification. Council has requested that the stockpile management in regards to stormwater be investigated as part of the development modification. RGH has investigated the implications of such a modification on the stormwater system in regards to Council's policies.

The proposed biomass fuel conversion will not alter the current hydraulic characteristics of the site. Therefore, it was deemed that no augmentation of the current site drainage network is required as part of the conversion. Similarly, the existing on-site detention system will function as normal and was also deemed satisfactory for the development modification.

Council specifies within their DCP2014 that pollutant reductions targets must be satisfied prior to approval of the development. Modelling conducted using MUSIC software evaluated the performance of the 'treatment train' with respect to achieving these targets. The model involved the inclusion of the sediment basin and detention basin as the water quality improvement devices to treat stormwater runoff. These devices are shown on the WCMP and detailed within the report. Other devices such as oil skimmers are also utilised on the site to achieve council's pollutant reduction targets.

No earthworks are proposed as part of the fuel type conversion and therefore no exposed soils subject to sediment runoff are expected. Sediment runoff from thee stockpile itself is expected to be reduced due to the material properties of the Biomass in comparison to coal. The existing sediment basin servicing the stockpile area was deemed adequate for sedimentation control.

This report summarises the modelling techniques employed, the results of the modelling, and an evaluation of the results in accordance with Councils design requirements. Appendix A to this report contains the original soil and water management plan for the development, Appendix B contains a basic data presentation for the power station, Appendix C contains the MUSIC Summary Report and Appendix D contains the WCMP sketch.

1. INTRODUCTION

RGH Consulting Group Pty Ltd (RGH) has been engaged by Hunter Energy Pty Limited (the Client) to complete a Stormwater Management Report for the proposed Biomass fuel conversion of Redbank power station, 112 Long Point Road, West Warkworth NSW (the Subject Site). RGH has prepared a water cycle management plan (WCMP) which is attached at appendix D and should be referenced during review of this report. The Subject Site is located within the Singleton Council (Council) Local Government Area (LGA).

The Client proposes to convert the power station from coal fuel source to Biomass and as such, is seeking a development modification to store Biomass in the area that was previously reserved for coal stockpiling. The client has advised that approximately 40,000T of woodchip will be stored in the area with the intention of installing a roof over the top to reduce the amount of moisture in the stored fuel.

Council has requested that the stockpile management in regards to stormwater be investigated as part of the development modification. RGH has investigated the implications of such a modification on the stormwater system in regards to Council's water sensitive urban design (WSUD) policies outlined in the development control plan (DCP2014) and technical manuals.

For developments of this type, Council requires stormwater to be managed both quantitatively and qualitatively prior to discharging into receiving water or receiving drainage infrastructure. This is to be undertaken both during and after construction and design involves a number of modelling techniques to determine the measures required to achieve Council's targets outlined in their DCP2014.

Council specifies that pollutant reductions targets must be satisfied prior to approval of the development. The qualitative models prepared involved the inclusion of water quality improvement devices to treat stormwater runoff. These devices are detailed within the WCMP accompanying this SMP Report. An evaluation of the existing On-Site Detention (OSD) system was also considered as part of the report.

This report summarises the modelling techniques employed, the results of the modelling, and evaluates the results in accordance with Councils design requirements. It will also provide a guideline to allow designers to provide detailed designs in the future.

2. SITE AND CATCHMENT DESCRIPTION

The Subject Site is located along the southern alignment of the Long Point Road carriageway and the rear of the site is bounded by a railway easement. The site is relatively flat with a north- easterly aspect. Average gradients of the site are in the order of 1-2%.

The total site area is approximately 11.192 Ha, as shown on the Water Cycle Management Plan accompanying this report.

The site currently contains power station infrastructure:

- 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
- Power generation infrastructure (Boiler, cooling towers, compressor etc.)

Figure 1 below shows the location of the Subject Site in regards to the Golden Highway and Warkworth Mine.

Figure 1 - Locality Map for Redbank Power Station, West Warkworth NSW

(Source: https://maps.six.nsw.gov.au/)

The site previously contained a watercourse however the channel was diverted around the site as part of the original construction works. An external catchment also affects the southern end of the site. A large diversion bund is situated adjacent to the stockpile area, which conveys flows from this external catchment to the aforementioned watercourse. Council's online mapping was consulted in regards to flooding information and the site exists outside any flood affected areas.

3. STORMWATER MANAGEMENT

3.1. Hydraulic Design

The proposed biomass fuel conversion of the power station will not result in the creation of any additional impervious areas or alter the current hydraulic characteristics of the site. Therefore, it was deemed that no augmentation of the current site drainage network is required as part of the conversion.

The external catchment will also remain unaffected due to the works and therefore the existing catchment diversion bund was deemed satisfactory.

It should be noted future improvement works involve the construction of a roofed area above the biomass stockpile. Future design will need to consider the hydraulic capacity of the concrete channel servicing the stockpile area as the rate of runoff will be increased due to the proposed roof.

3.2. On-site Detention

The objectives of council's onsite detention target are to ensure future development does not increase the impact of rainfall events and that the stormwater management design demonstrates a consideration for the existing capacity of the public drainage system.

As stated in section 3.2, the proposed fuel conversion of the power plant will not result in an increase in impervious areas or alter the time of concentration and the current site drainage. Therefore the existing on-site detention system will not require any augmentation. It should be noted that the existing detention basin is 6 megalitres (Ml) in volume with a permanent pool volume of approximately 3 Ml resulting in a remaining 3 Ml of OSD volume. Combined with a daily reuse of 0.330 Ml, the OSD would be considered oversized for the site and overflow from the OSD basin only occurs in extreme weather events.

3.3. Stormwater Quality

Stormwater quality was assessed in accordance with Council's Water Sensitive Urban Design (WSUD) requirements for all developments. It was deemed appropriate to incorporate the existing water quality improvement devices present on the site into the water quality model.

The stockpile area is captured by concrete channel and conveyed to the sediment basin at the western side of the site. The sediment basin also captures runoff from the boiler area which is collected via pit and pipe network. The sediment basin treats the water from these catchments areas that are expected to generate the majority of the pollutants.

Figure 2 below shows the sediment basin which is bisected by a sheet pile wall, separating the inlet and outlet which forces the stormwater to flow around the full perimeter of the basin before overflowing to the detention basin, thus increasing detention time and treatment effectiveness. The vegetation present in the sediment basin also contributes to the removal of phosphates and nitrates.

Figure 2 - Sediment Basin

Overflow from the sediment basin is conveyed to the large detention basin along with the remaining runoff from the majority of the site via open concrete channel.

The 6 megalitre detention basin at the northern end of the site was adopted as the final treatment node for the MUSIC model. The detention basin is the source of water for the operation of the power plant which draws from the basin at a rate of 315m^3/hr as can be seen in the basic data presentation at appendix B. The water is recirculated into the basin with a net loss of 330kL per day which is lost via steam through the exhaust stacks. As discussed in section 3.2, the permanent water level of the basin is approx. 3 Ml and is supplemented with water from the hunter river which is pumped into the basin.

Reuse from the basin contributes to water quality improvement by removing the contaminates from the system altogether and was incorporated into the MUSIC model. The recirculated water in the basin is monitored for salinity and is pumped into the 60 Ml waste water storage basin adjacent to the detention basin. From this basin, water is lost through evaporation and is treated/ monitored until the salinity is to an acceptable at which point it is released back into the Hunter River in accordance with the Hunter River Salinity Trading Scheme.

The portion of the external catchment that lies within the site boundary was also included in the MUSIC model as a bypass load directly to the receiving node along with a small area of driveway at the site entrance that is not captured by the stormwater system. Figure 3 below shows the MUSIC model schematic adopted for the site.

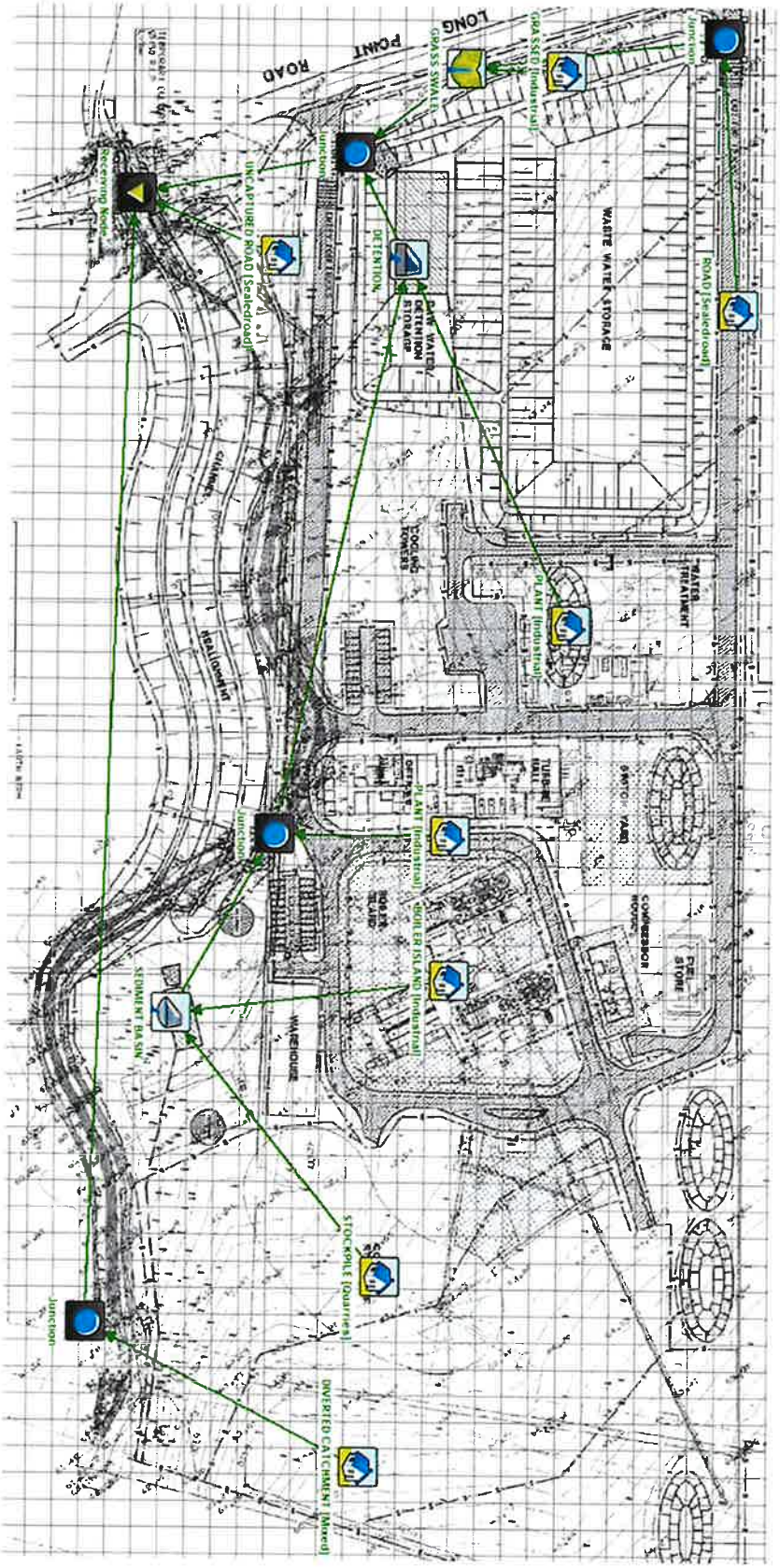


Figure 3 - MUSIC Model Schematic

MUSIC modelling results in regards to council's targets are summarised below in table 1.

Table 1 - MUSIC Model Results

Pollutant	Target	Reduction
Total Suspended Solids (TSS)	80%	94.5%
Total Phosphorus (TP)	45%	88.2%
Total Nitrogen (TN)	45%	84.6%
Gross Pollutants (GP)	NA[1]	98.2%

[1] DCP2014 section 2.4(3)(e) states that litter and coarse sediments must be retained for up to 50% of the 1 year ARI peak flow. The MUSIC software program combines litter and coarse sediment and outputs these pollutants as gross pollutants. As can be seen from table 1, the MUSIC model shows a 98.2% reduction in these pollutants for an average years' worth of storm data, therefore it can be concluded that these requirements are satisfied.

The DCP2014 also requires that the stormwater management system treat oil and grease so that there are no visible oils for flows up to 50% of the 1-year ARI. Multiple stormwater traps and oil skimmers as shown in figure 4 below are utilised to remove hydrocarbons from stormwater runoff flowing from the stockpile area and boiler area prior to the sediment basin.

Figure 4 - Pollutant Trap and Oil Skimmer

A detailed MUSIC summary report can be found at Appendix C, the WCMP outlines the catchments and the land use types adopted for the MUSIC model.

3.4. Sediment and Erosion Control

No earthworks are proposed as part of the fuel type conversion and therefore no exposed soils subject to sediment runoff are expected.

Sediment runoff from stockpiles is expected to be reduced as a result of the biomass conversion. This can be attributed to the material qualities of the biomass in comparison to coal. The granular material characteristics of coal make it subject to particle runoff during rain events, while the biomass is comprised of mostly fibrous materials and is less prone to sedimentation. An existing sediment basin services the stockpile area and will adequately capture siltation and control sedimentation carried by stormwater to acceptable standards.

3.5. Stormwater System Maintenance

The stormwater drainage system will need to be inspected and maintained at regular intervals. It is recommended that monitoring and recording of the performance of the stormwater system be undertaken regularly over a period of one year until such time as typical maintenance periods can be established. Initially, it is recommended that inspections be conducted at quarterly intervals and after large rainfall events until a suitable baseline can be estimated. Suitable intervals for maintenance work to be undertaken can then be programmed.

The sediment basin should be de-silted and the outlet should be cleared of debris whenever the site is visited by maintenance staff to ensure it functions as required. Table 2 below provides a schedule of maintenance procedures for the stormwater system.

Table 2 - Operation and Maintenance Intervals and Procedures

Item	Inspection Interval	Maintenance Interval	Task/Procedure
Pits and Pipes Network	Yearly	As required / Yearly	Remove and Dispose of Debris from Item
Sediment Basin	Yearly	As required / Yearly	De-silt and Disposal of sediment
Rainwater Re-Use Tank	Yearly	5 Years Maximum	5 Years Maximum

4. CONCLUSIONS AND RECOMMENDATIONS

RGH has been engaged by the Client to complete a Stormwater Management Report for the proposed Biomass fuel conversion of Redbank power station. RGH has prepared a water cycle management plan drawing which should be referenced during review of this report and are referred to as the WCMP.

The Client proposes to convert the power station from coal fuel source to Biomass and as such, is seeking a development modification. Council has requested that the stockpile management in regards to stormwater be investigated as part of the development modification. RGH has investigated the implications of such a modification on the stormwater system in regards to Council's policies.

For developments of this type, Council requires stormwater to be managed both quantitatively and qualitatively prior to discharging into receiving water or receiving drainage infrastructure. Council specifies that pollutant reductions targets must be satisfied prior to approval of the development. The qualitative models prepared involved an assessment of the existing water quality improvement devices to treat stormwater runoff. These devices are shown within the WCMP accompanying this SMP Report. An evaluation of the existing On-Site Detention (OSD) system was also considered as part of the report.

This report has summarised the modelling techniques employed, the results of the modelling, and subsequently presented an evaluation in accordance with Councils design requirements. Therefore, it is the opinion of RGH Consulting Group that the existing stormwater measures for stockpile management described within this report and upon the WCMP satisfy Council's requirements for the development modification.

5. REFERENCES

NSW Department of Housing, ***"Soils and Construction"***, Vol.1, 4th Edition, 2004.

Pilgrim, D.H., ***"Australian Rainfall and Runoff"***, Engineers Australia, 2016.

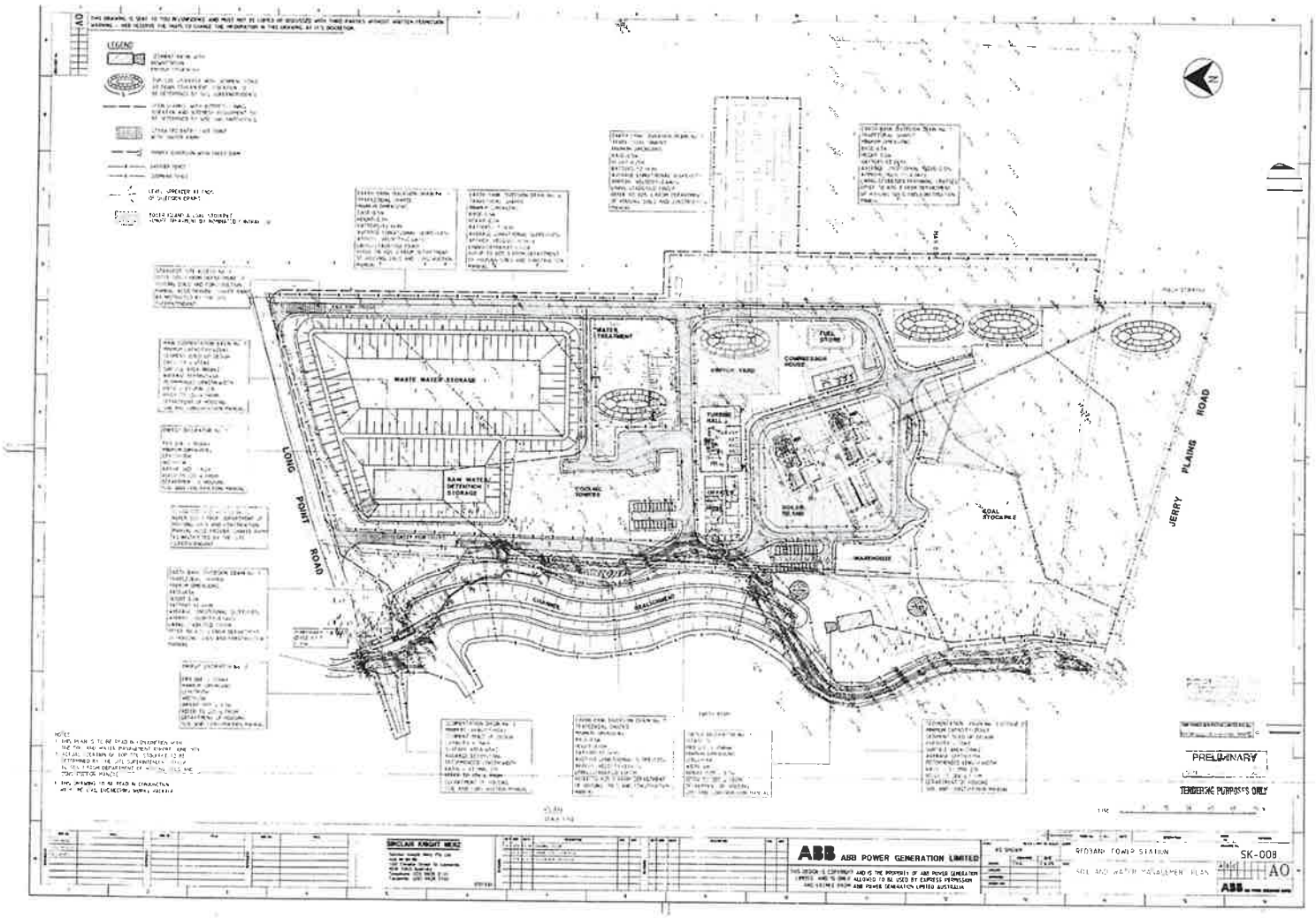
Standards Australia, ***"AS3500.1 – Plumbing and Drainage"***, 2018.

Singleton Council, ***"Development Control Plan"***, 2014.

BMT WBM, **"NSW MUSIC Modelling Guidelines"**, August 2015.

APPENDIX A

ORIGINAL SOIL AND WATER MANAGMENT PLAN


LEGEND
WASTE WATER STORAGE
RAW WATER DETENTION STORAGE
WATER TREATMENT
COMPRESSOR HOUSE
FUEL STORE
TURBINE HALL 2
TURBINE HALL 1
BOILER HOUSE
COOLING TOWERS
WAREHOUSE
COAL STOCKPILE
LONG POINT ROAD
JERRY PLAINS ROAD
CLEARWAY
RAILCORRIDOR
NOTES:
PRELIMINARY
TENDERING PURPOSES ONLY
SINCLAIR KNIGHT MERZ
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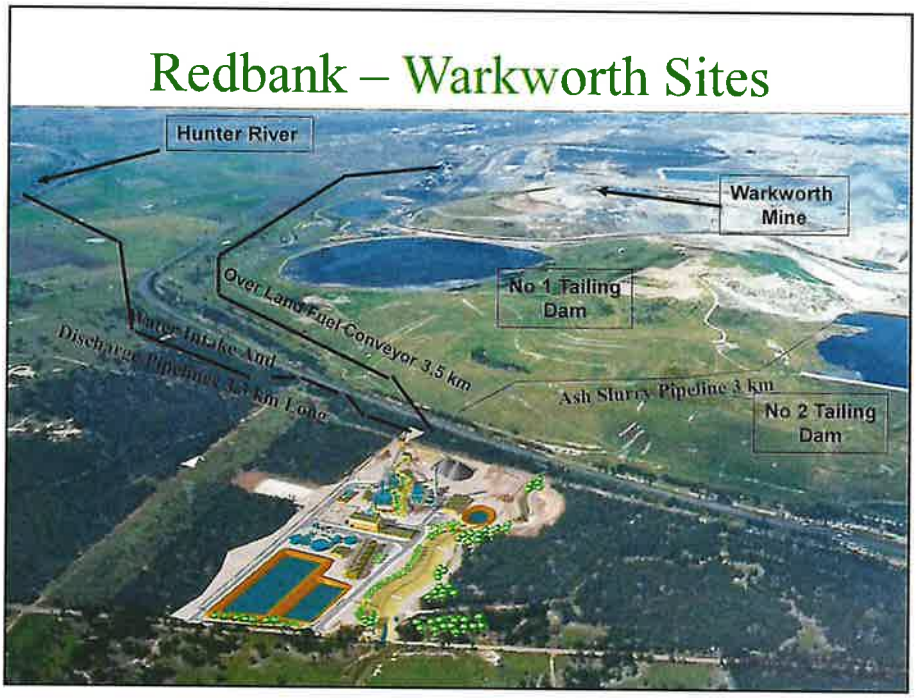
REDBANK POWER STATION
SOIL AND WATER MANAGEMENT PLAN
SK-008
A0

APPENDIX B

REDBANK BASIC DATA PRESENTATION


Welcome To Redbank


Redbank – Warkworth Sites
Hunter River
Warkworth Mine
No 1 Tailing Dam
Over Land Fuel Conveyor 3.5 km
Ash Slurry Pipeline 3 km
No 2 Tailing Dam

Principle Process Features

- Boilers
  - 2 x 75 MW FICIRC
  - Steam temperature 513°C
  - Steam pressure 10.7 MPa(g)
  - Steam flow total 520 t/hr
  - Coal usage total 70 - 80 t/hr
  - Height 43 meters
- Turbo generator
  - Operating speed 3000 rpm
  - Generator voltage 15.75 kV
  - Output 151 MW
- Cooling tower
  - Height 14 meters
  - 6 cells
  - CW flow ~ 17,500 m^3/hr
  - Evaporation ~ 300 m^3/hr
- Stack
  - Height 59 meters
  - Diameter 4.2 meters
  - Gas velocity > 10 m/s

3

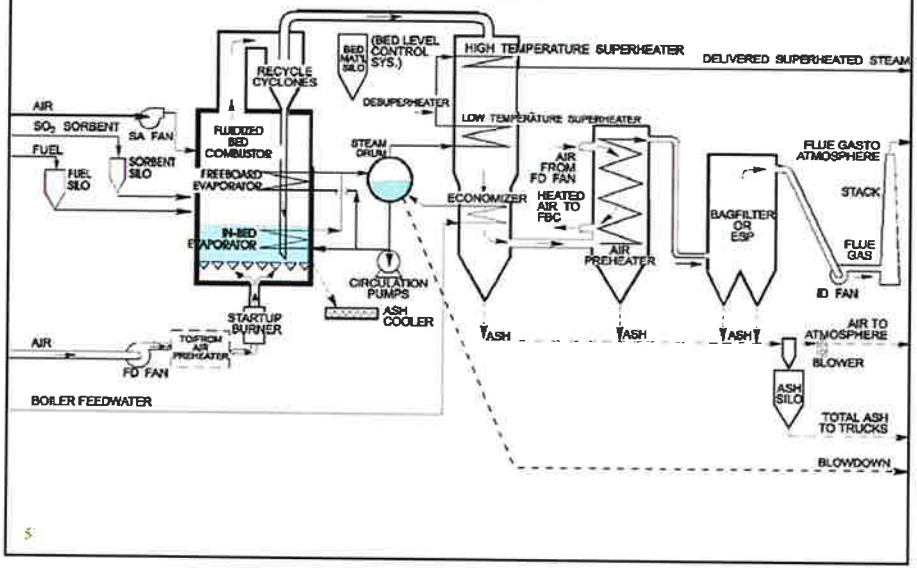
Why Use Fluidised Bed Combustion ?

- Able to utilise a wide variety of fuels
- Lower combustion temperatures result in lower oxides of nitrogen emissions
- In-situ removal of sulphur oxides
- High combustion efficiency
- BDT is a relatively low grade fuel suited to fluidised bed combustion technology

	BDT	BUF
TM	~ 28	~ 8
VM	~ 30	~ 25
FC	~ 34	~ 39
A	~ 8	~ 28
TS	~ 0.5	0.3 – 1.1

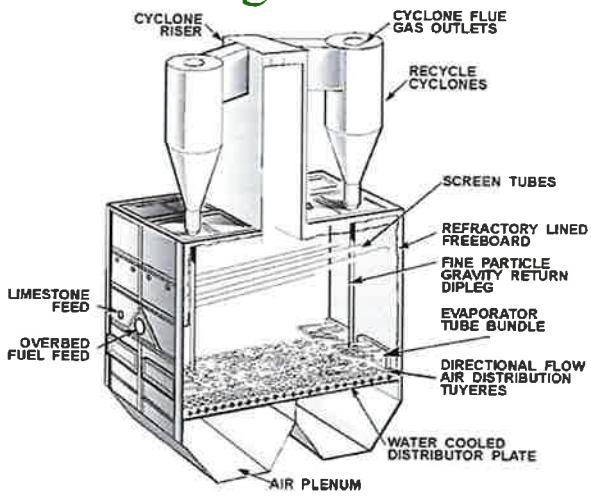
4

FI CIRC™ Fluidised Bed Process Overview



5

FI CIRC™ Fluidised Bed Furnace Segment



6

Redbank Resource Usage

- Fuel – BDT: 80 t/hr (wet)
  – BUF: 72 t/hr
- Water: 315 m^3/hr
- Limestone: 1.6 t/hr
- Inert Bed Material: 1.0 t/hr (BDT Only)

7

Institution Of Engineers Australia Award

State
Federal

THE INSTITUTION OF ENGINEERS, AUSTRALIA
SYDNEY DIVISION

ENGINEERING EXCELLENCE AWARDS

WINNER

Category
Environment

This commendation is presented to
Alstom Power
for
Redbank Power Station

PRESIDENT RJ Phillips DIRECTOR 2 November 2001 DATE

The Institution of Engineers, Australia

Proudly Sponsored by
Integral Energy

8

APPENDIX C

MUSIC SUMMARY REPORT

MUSIC SUMMARY REPORT

Source nodes

Location	STOCKPILE	ROAD	PLANT	PLANT	DIVERTED CATCHMENT	BOILER ISLAND	GRASSED	UNCAPTURED ROAD
ID	4	5	7	8	10	12	15	16
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode
Zoning Surface Type	Quarries	Sealedroad	Industrial	Industrial	Mixed	Industrial	Industrial	Sealedroad
Total Area (ha)	2.183	0.185	1.148	2.662	1.298	1.156	0.457	0.117
Area Impervious (ha)	0.222182355522188	0.308100559701493	0.914373432835821	2.662	0	1.156	0	0.0933136940298508
Area Pervious (ha)	1.960817160447761	0.0768994402985075	0.233626567164179	0	1.298	0	0.457	0.0233663059701492
Field Capacity (mm)	80	80	80	80	80	80	80	80
Pervious Area Infiltration Capacity coefficient - a	200	200	200	200	200	200	200	200
Pervious Area Infiltration Capacity exponent - b	1	1	1	1	1	1	1	1
Impervious Area Rainfall Threshold (mm/day)	1	1	1	1	1	1	1	1
Pervious Area Soil Storage Capacity (mm)	120	120	120	120	120	120	120	120
Pervious Area Soil Initial Storage (% of Capacity)	25	25	25	25	25	25	25	25
Groundwater Initial Depth (mm)	10	10	10	10	10	10	10	10
Groundwater Daily Recharge Rate (%)	25	25	25	25	25	25	25	25
Groundwater Daily Baseflow Rate (%)	5	5	5	5	5	5	5	5
Groundwater Daily Deep Seepage Rate (%)	0	0	0	0	0	0	0	0
Stormflow Total Suspended Solids Mean (log mg/L)	3	2.43	2.15	2.15	2.2	2.15	2.15	2.43
Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Stormflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Suspended Solids Serial Correlation	0	0	0	0	0	0	0	0
Stormflow Total Phosphorus Mean (log mg/L)	-0.3	-0.3	-0.6	-0.6	-0.45	-0.6	-0.6	-0.3
Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Stormflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Phosphorus Serial Correlation	0	0	0	0	0	0	0	0
Stormflow Total Nitrogen Mean (log mg/L)	0.34	0.34	0.3	0.3	0.42	0.3	0.3	0.34
Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Stormflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Nitrogen Serial Correlation	0	0	0	0	0	0	0	0
Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2	1.2	1.1	1.2	1.2	1.2
Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Baseflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Baseflow Total Suspended Solids Serial Correlation	0	0	0	0	0	0	0	0
Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85	-0.85	-0.82	-0.85	-0.85	-0.85
Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Baseflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Baseflow Total Phosphorus Serial Correlation	0	0	0	0	0	0	0	0
Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11	0.11	0.32	0.11	0.11	0.11
Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Baseflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Baseflow Total Nitrogen Serial Correlation	0	0	0	0	0	0	0	0
Flow based constituent generation - enabled	Off	Off	Off	Off	Off	Off	Off	Off
Flow based constituent generation - flow file								
Flow based constituent generation - base flow column								
Flow based constituent generation - pervious flow column								
Flow based constituent generation - impervious flow column								
Flow based constituent generation - unit								
OUT - Mean Annual Flow (ML/yr)	12.0	4.51	13.4	35.9	5.97	15.6	2.10	1.37
OUT - TSS Mean Annual Load (kg/yr)	9.98E3	1.50E3	2.31E3	6.61E3	676	2.87E3	318	488
OUT - TP Mean Annual Load (kg/yr)	4.80	2.52	3.84	10.7	1.62	4.64	0.446	0.800
OUT - TN Mean Annual Load (kg/yr)	23.9	10.8	29.1	80.3	15.4	34.9	3.76	3.18
OUT - Gross Pollutant Mean Annual Load (kg/yr)	116	113	337	869	0.00	377	0.00	34.4
Rain In (ML/yr)	32.5178	5.73494	17.1005	39.653	19.3349	17.2197	6.80745	1.74283
ET Loss (ML/yr)	20.5307	1.22751	3.66023	3.75933	13.3601	1.63253	4.70783	0.373036
Deep Seepage Loss (ML/yr)	0	0	0	0	0	0	0	0
Baseflow Out (ML/yr)	4.78356	0.187477	0.559021	0	3.16032	0	1.31269	0.056973
Imp. Stormflow Out (ML/yr)	2.9435	4.15299	12.3834	35.8937	0	15.5872	0	1.26208
Perv. Stormflow Out (ML/yr)	4.26019	0.160964	0.497857	0	2.81454	0	0.990943	0.05074
Total Stormflow Out (ML/yr)	7.20368	4.31995	12.8813	35.8937	2.81454	15.5872	0.990943	1.31282
Total Outflow (ML/yr)	11.9873	4.50743	13.4403	35.8937	5.97486	15.5872	2.10363	1.36979
Change in Soil Storage (ML/yr)	-5.8E-5	-2E-6	-7E-6	0	-3.8E-5	0	-1.3E-5	-1E-6
TSS Baseflow Out (kg/yr)	81.7016	1.21241	9.53847	0	42.9091	0	19.0191	0.974926
TSS Total Stormflow Out (kg/yr)	9898.76	1494.94	2298.76	6610.24	632.96	2870.56	198.618	486.57
TSS Total Outflow (kg/yr)	9980.46	1498.16	2308.29	6610.24	675.869	2870.56	217.637	487.545
TP Baseflow Out (kg/yr)	0.744684	0.029148	0.086731	0	0.525618	0	0.172708	0.00885
TP Total Stormflow Out (kg/yr)	4.05129	2.49423	3.75388	10.6957	1.09721	4.64471	0.273484	0.790952
TP Total Outflow (kg/yr)	4.79598	2.52338	3.84061	10.6957	1.69243	4.64471	0.446192	0.799802
TN Baseflow Out (kg/yr)	6.40371	0.250397	0.748592	0	6.8643	0	1.49018	0.076467
TN Total Stormflow Out (kg/yr)	17.531	10.5592	28.3204	80.3404	8.49058	34.8886	2.26767	3.10615
TN Total Outflow (kg/yr)	23.9347	10.8095	29.069	80.3404	15.3549	34.8886	3.75784	3.18262
GP Total Outflow (kg/yr)	142.467	113.345	337.973	868.551	0	377.177	0	34.445

No imported Data Source nodes

USTM treatment nodes

Location	SEDIMENT BASIN	DETENTION	GRASS SWALE
ID	1	3	13
Node Type	SedimentationBasinNode	DetentionBasinNode	SwaleNode
Lo flow bypass rate (cum/sec)	0	0	0
Hi flow bypass rate (cum/sec)	100	100	
Inlet pond volume	0	0	
Area (sqm)	1950	4490	
Initial Volume (m^3)	1500		
Extended detention depth (m)	1	1.34	0.5
Number of Rainwater tanks			
Permanent Pool Volume (cubic metres)	1500	3000	
Proportion vegetated	0	0	
Equivalent Pipe Diameter (mm)	5	5	
Overflow weir width (m)	7	5	40
Notional Detention Time (hrs)	9.30E3	24.8E3	
Orifice Discharge Coefficient	0.6	0.6	
Weir Coefficient	1.7	1.7	
Number of CSTR Cells	1	1	10
Total Suspended Solids - k (m/yr)	8000	8000	8000
Total Suspended Solids - C* (mg/L)	20	20	20
Total Suspended Solids - C** (mg/L)	20	20	14
Total Phosphorus - k (m/yr)	6000	6000	6000
Total Phosphorus - C* (mg/L)	0.13	0.13	0.13
Total Phosphorus - C** (mg/L)	0.13	0.13	0.13
Total Nitrogen - k (m/yr)	500	500	500
Total Nitrogen - C* (mg/L)	1.4	1.4	1.4
Total Nitrogen - C** (mg/L)	1.4	1.4	1.4
Threshold Hydraulic Loading for C** (m/yr)	3500	3500	3500
Horizontal Flow Coefficient			
Reuse Enabled	Off	On	Off
Max drawdown height (m)		0.668	
Annual Demand Enabled	Off	Off	Off
Annual Demand Value (ML/year)			
Annual Demand Distribution			
Annual Demand Monthly Distribution: Jan			
Annual Demand Monthly Distribution: Feb			
Annual Demand Monthly Distribution: Mar			
Annual Demand Monthly Distribution: Apr			
Annual Demand Monthly Distribution: May			
Annual Demand Monthly Distribution: Jun			
Annual Demand Monthly Distribution: Jul			
Annual Demand Monthly Distribution: Aug			
Annual Demand Monthly Distribution: Sep			
Annual Demand Monthly Distribution: Oct			
Annual Demand Monthly Distribution: Nov			
Annual Demand Monthly Distribution: Dec			
Daily Demand Enabled	Off	On	Off
Daily Demand Value (ML/day)		0.33	
Custom Demand Enabled	Off	Off	Off
Custom Demand Time Series File			
Custom Demand Time Series Units			
Filter area (sqm)			
Filter perimeter (m)			

Filter depth (m)			
Filter Median Particle Diameter (mm)			
Saturated Hydraulic Conductivity (mm/hr)			
Infiltration Media Porosity			
Length (m)			160
Bed slope			0 02
Base Width (m)			0 1
Top width (m)			4
Vegetation height (m)			0.1
Vegetation Type			
Total Nitrogen Content in Filter (mg/kg)			
Orthophosphate Content in Filter (mg/kg)			
Is Base Lined?			
Is Underdrain Present?			
Is Submerged Zone Present?			
Submerged Zone Depth (m)			
B for Media Soil Texture	-9999	-9999	-9999
Proportion of upstream impervious area treated			
Exfiltration Rate (mm/hr)	0	0	0
Evaporative Loss as % of PET	7%	100	
Depth in metres below the drain pipe			
TSS A Coefficient			
TSS B Coefficient			
TP A Coefficient			
TP B Coefficient			
TN A Coefficient			
TN B Coefficient			
Sfc			
S*			
Sw			
Sh			
Emax (m/day)			
Ew (m/day)			
IN - Mean Annual Flow (ML/yr)	27.6	73.2	6.61
IN - TSS Mean Annual Load (kg/yr)	12.9E3	10.5E3	1 72E3
IN - TP Mean Annual Load (kg/yr)	9.44	18.1	2.97
IN - TN Mean Annual Load (kg/yr)	58.8	146	14.6
IN - Gross Pollutant Mean Annual Load (kg/yr)	514	1.21E3	113
OUT - Mean Annual Flow (Ml/yr)	23.9	0.241	6.62
OUT - TSS Mean Annual Load (kg/yr)	1.54E3	4.94	178
OUT - TP Mean Annual Load (kg/yr)	3.58	31.4E-3	1 00
OUT - TN Mean Annual Load (kg/yr)	37.0	0.349	12.2
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0.00	0.00	0.00
Flow In (ML/yr)	27.5773	73.2042	6.61072
ET Loss (ML/yr)	1.84331	4.40627	0
Infiltration Loss (ML/yr)	0	0	0
Low Flow Bypass Out (ML/yr)	0	0	0
High Flow Bypass Out (ML/yr)	0	0	0
Orifice / Filter Out (ML/yr)	1.57899	0 240659	6 61656
Weir Out (ML/yr)	22.2855	0	0
Transfer Function Out (ML/yr)	0	0	0
Reuse Supplied (ML/yr)	0	71.2653	0
Reuse Requested (ML/yr)	0	120.344	0
% Reuse Demand Met	0	59.218	0
% Load Reduction	13.4633	99.6712	0 0883414
TSS Flow In (kg/yr)	12851	10454.5	1715.79
TSS ET Loss (kg/yr)	0	0	0
TSS Infiltration Loss (kg/yr)	0	0	0
TSS Low Flow Bypass Out (kg/yr)	0	0	0
TSS High Flow Bypass Out (kg/yr)	0	0	0
TSS Orifice / Filter Out (kg/yr)	32 7143	4 94032	177.701
TSS Weir Out (kg/yr)	1503.27	0	0
TSS Transfer Function Out (kg/yr)	0	0	0
TSS Reuse Supplied (kg/yr)	0	1449.35	0
TSS Reuse Requested (kg/yr)	0	0	0
TSS % Reuse Demand Met	0	0	0
TSS % Load Reduction	88.0477	99 9527	89 6432
TP Flow In (kg/yr)	9.44069	18.1119	2.96957
TP ET Loss (kg/yr)	0	0	0
TP Infiltration Loss (kg/yr)	0	0	0
TP Low Flow Bypass Out (kg/yr)	0	0	0
TP High Flow Bypass Out (kg/yr)	0	0	0
TP Orifice / Filter Out (kg/yr)	0.205931	0.0314346	1 00058
TP Weir Out (kg/yr)	3.36966	0	0
TP Transfer Function Out (kg/yr)	0	0	0
TP Reuse Supplied (kg/yr)	0	9.30421	0
TP Reuse Requested (kg/yr)	0	0	0
TP % Reuse Demand Met	0	0	0
TP % Load Reduction	62.1257	99.8264	66.2921
TN Flow In (kg/yr)	58.8233	146.415	14.5674
TN ET Loss (kg/yr)	0	0	0
TN Infiltration Loss (kg/yr)	0	0	0
TN Low Flow Bypass Out (kg/yr)	0	0	0
TN High Flow Bypass Out (kg/yr)	0	0	0
TN Orifice / Filter Out (kg/yr)	2.24069	0.34947	12.1553
TN Weir Out (kg/yr)	34.7651	0	0
TN Transfer Function Out (kg/yr)	0	0	0
TN Reuse Supplied (kg/yr)	0	102.213	0
TN Reuse Requested (kg/yr)	0	0	0
TN % Reuse Demand Met	0	0	0
TN % Load Reduction	37.0899	99.7613	16.5582
GP Flow In (kg/yr)	513.62	1205.67	113.057
GP ET Loss (kg/yr)	0	0	0
GP Infiltration Loss (kg/yr)	0	0	0
GP Low Flow Bypass Out (kg/yr)	0	0	0
GP High Flow Bypass Out (kg/yr)	0	0	0
GP Orifice / Filter Out (kg/yr)	0	0	0
GP Weir Out (kg/yr)	0	0	0
GP Transfer Function Out (kg/yr)	0	0	0
GP Reuse Supplied (kg/yr)	0	0	0
GP Reuse Requested (kg/yr)	0	0	0
GP % Reuse Demand Met	0	0	0
GP % Load Reduction	100	100	100
PET Scaling Factor			

No Generic treatment nodes

Other nodes

location	Receiving Node	Junction	Junction	Junction	Junction
ID	3	6	9	11	14
Node Type	ReceivingNode	JunctionNode	JunctionNode	JunctionNode	JunctionNode
IN - Mean Annual Flow (ML/yr)	14.2	4.51	59.8	5.97	6.86
IN - TSS Mean Annual Load (kg/yr)	1.35E3	1.50E3	8.15E3	676	183
IN - TP Mean Annual Load (kg/yr)	3.46	2.52	14.3	1.62	1.03
IN - TN Mean Annual Load (kg/yr)	31.0	10.8	117	15.4	12.5
IN - Gross Pollutant Mean Annual Load (kg/yr)	34.4	113	869	0.00	0.00
OUT - Mean Annual Flow (ML/yr)	14.2	4.51	59.8	5.97	6.86
OUT - TSS Mean Annual Load (kg/yr)	1.35E3	1.50E3	8.15E3	676	183
OUT - TP Mean Annual Load (kg/yr)	3.46	2.52	14.3	1.62	1.03
OUT - TN Mean Annual Load (kg/yr)	31.0	10.8	117	15.4	12.5
OUT - Gross Pollutant Mean Annual Load (kg/yr)	34.4	113	869	0.00	0.00
% Load Reduction	44.4	0.00	5.85	0.00	91.8
TSS % Load Reduction	94.5	0.00	58.1	0.00	99.2
TN % Load Reduction	84.6	0.00	15.7	0.00	93.2
TP % Load Reduction	88.2	0.00	29 1	0.00	9% 2
GP % Load Reduction	88.2	0.00	37.2	0.00	100

Links

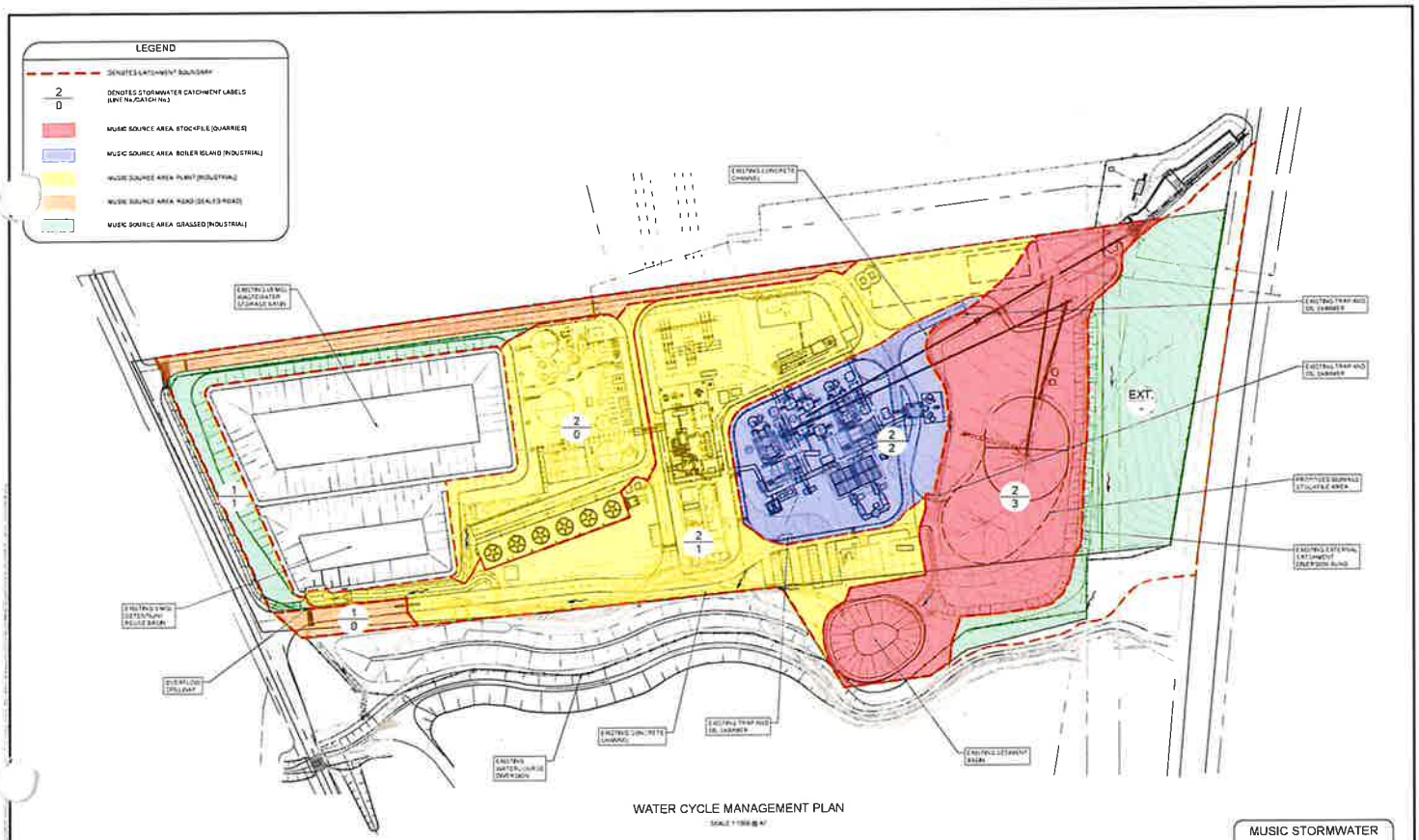
location	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
Source node ID	5	7	8	1	9	10	11	12

Target node ID	6	2	9	9	2	11	3	1
Muskingum-Cunge Routing	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed
Muskingum K								
Muskingum theta								
IN - Mean Annual Flow (ML/yr)	4.51	13.4	35.9	23.9	59.8	5.97	5.97	15.6
IN - TSS Mean Annual Load (kg/yr)	1.50E3	2.31E3	6.61E3	1.54E3	8.15E3	676	676	2.87E3
IN - TP Mean Annual Load (kg/yr)	2.52	3.84	10.7	3.58	14.3	1.62	1.62	4.64
IN - TN Mean Annual Load (kg/yr)	10.8	29.1	80.3	37.0	117	15.4	15.4	34.9
IN - Gross Pollutant Mean Annual Load (kg/yr)	113	337	869	0.00	869	0.00	0.00	377
OUT - Mean Annual Flow (ML/yr)	4.51	13.4	35.9	23.9	59.8	5.97	5.97	15.6
OUT - TSS Mean Annual Load (kg/yr)	1.50E3	2.31E3	6.61E3	1.54E3	8.15E3	676	676	2.87E3
OUT - TP Mean Annual Load (kg/yr)	2.52	3.84	10.7	3.58	14.3	1.62	1.62	4.64
OUT - TN Mean Annual Load (kg/yr)	10.8	29.1	80.3	37.0	117	15.4	15.4	34.9
OUT - Gross Pollutant Mean Annual Load (kg/yr)	113	337	869	0.00	869	0.00	0.00	377

Catchment Details	
Catchment Name	20200403_MUSIC MODEL_20200901
Timestep	6 Minutes
Start Date	1/01/1959
End Date	31/12/1959 11:54:00 PM
Rainfall Station	66062 SYDNEY
ET Station	Monthly User Defined
Mean Annual Rainfall (mm)	1490
Mean Annual ET (mm)	1260

APPENDIX D

WCMP SKETCH



WATER CYCLE MANAGEMENT PLAN

SCALE 1:1000 @ A1

MUSIC STORMWATER QUALITY RESULTS

POLLUTANT	TARGET	% REDUCTION
TSS	80	84.3
TP	45	88.2
TN	45	88.9
GP	NA	86.2

A1

DO NOT SCALE DRAWINGS VERIFY ALL DIMENSIONS ON SITE

NO.	DESCRIPTION	DATE	VERSION
A	ISSUE FOR INFORMATION	14.2.20	

INFORMATION

SCALE 30 10 0 20 40 60 80 100

SCALE OF METRES (1:1000 AT A1 SHEET BEFORE REDUCTION)

RCH CONSULTING GROUP

CLIENT: HUNTER ENERGY PTY LTD

ADDRESS: 113 LONG POINT ROAD WEST WARKWORTH

PROJECT: BIOMASS FUEL CONVERSION REDBANK POWER STATION

DRAWING TITLE: WATER CYCLE MANAGEMENT PLAN

SCALE: 1:1000 @ A1

DRAWING NO.: SK01

REV: A

DATE: 20200403

APPENDIX B

TRAFFIC IMPACT ASSESSMENT

Ref: P1025tn02

24 July 2020

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Sydney, NSW 2000
www.asongroup.com.au

Hunter Energy
112 Long Point Road West
Warkworth, NSW 2330

Attn: Costa Tsiolkas; General Manager

RE: Redbank Power Station – Review and Update SIDRA Modelling

Dear Costa,

I refer to the recent discussions regarding the design and operation of intersections and access arrangements along the intersection of Long Point Road West / Golden Highway (the Intersection)as outlined within the previously prepared Transport Assessment for the Redbank Power Station (the Site).

The purpose of this review is to revisit the previous traffic modelling to confirm that the changes to proposed routes can support the operational traffic demands of the Intersection. In this regard, the focus of this assessment is a 50/50 split of heavy vehicles in the north and southern direction of Golden Highway during both morning and afternoon peak periods.

Reference Documents

This TN is prepared with reference to the following reports, drawings, and guidelines.

- Transport Assessment (TA):

  Report name: *1025r01v4 TA Redbank Power Station, Warkworth, Issue IV*, Author: Ason group, Date: 15 July 2019.

- Email Correspondence :

  Email from Costa Tsiolkas: *Redbank Power station Sidra electronic file and traffic study project No 1025r01*, Dated 16 June 2020.

Background

A TA report was prepared by Ason Group to review the to assess the potential traffic impacts associated with the proposed haulage of coal between the Wambo Coal Mine and the Redbank Power Station (the Proposal) 112 Long Point Road West, Warkworth (the Site). This report sought approval for generating up to 100 truck trips per day.

It is now proposed that biomass shall be the primary fuel source for the Site. Previously the study had concentrated deliveries from the north of the Site, however, with the change in fuel source to biomass, it is expected that deliveries shall arrive and depart from both the northern and southern directions. Deliveries of biomass deliveries which could be up to 70 trucks per day

The key objective of this study is to review the capacity of the Intersection to satisfactorily cater for existing and operational traffic.

Assumptions and Design Considerations

The following assumptions and design considerations have been adopted for the purpose of this Technical Note (TN):

- As part of the scope of this report, the forecast operation heavy vehicle traffic generation is 140 movements per day (1 truck equals 1 in movement plus 1 exit movement, equalling 2 movements).
- Traffic surveys were undertaken in 2019 to obtain existing traffic generation and to identify the AM and PM peak periods. The findings of this traffic survey are utilised within this report.
- Peak hour periods will remain unchanged from those identified within the, being 6:00 – 7:00am and 3:30 – 4:30pm during a typical weekday.
- The Origin-Destination of traffic during both the AM and PM peak periods is assumed to be similar to that outlined within the TA. Therefore, the temporal distribution profile of both light and heavy vehicles outlined within this TA has been utilised for the purpose of this TN.
- Heavy vehicle traffic generation has been provided by the client, while the routes of vehicles to and from the Site has been assumed to be a consistent 50/50 split travelling to/from the northern and southern directions.
- It is assumed the existing intersection design shall remain unchanged as part of this assessment.

Modelling Scenarios

- Scenario 1: Existing Traffic; with existing Golden Highway and Long Point Road West traffic (surveyed).
- Scenario 2: Updated Future; consisting of 'Existing Traffic' plus operational traffic.

Geometric Arrangements

As outlined within the assumptions, the Intersection would remain unchanged for the existing and future scenarios. The Intersection caters for light and heavy vehicles and can be seen below.

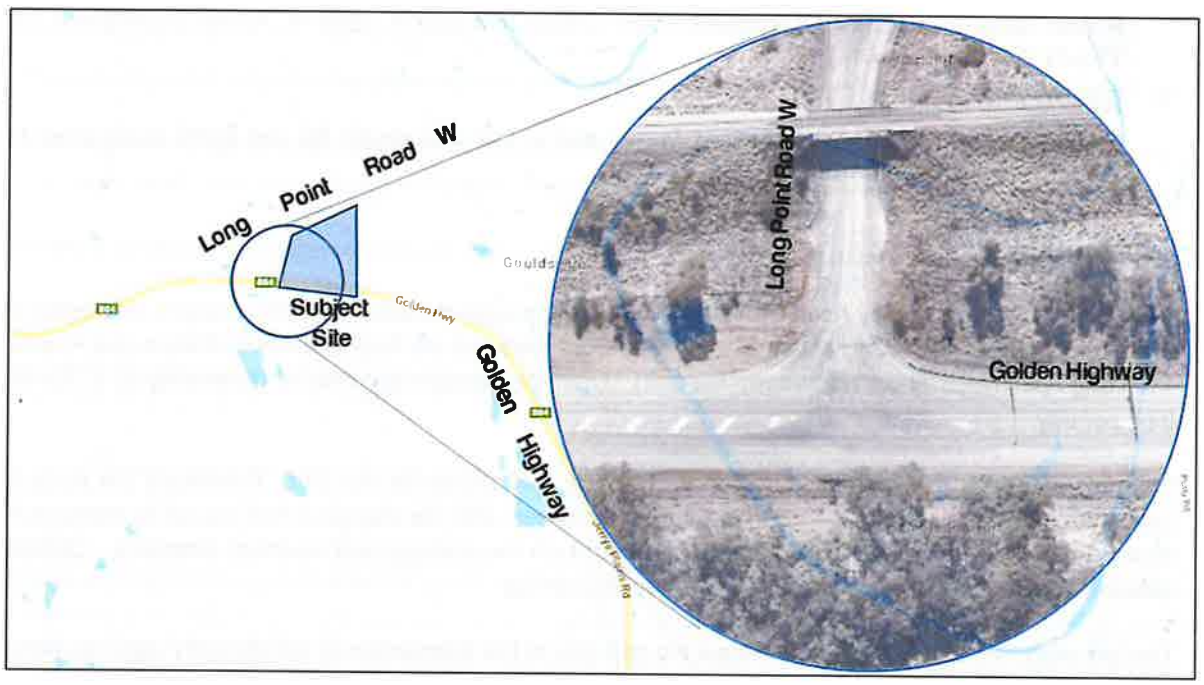


Figure 1: Site Location and Intersection Layout

Existing Traffic (Survey)

As part of this traffic assessment, Ason Group commissioned Northern Transport Planning and Engineering to undertake AM and PM peak intersection counts at the previously identified key intersections, being:

- Golden Highway & Long Point Road W; and
- Golden Highway & Watt Street

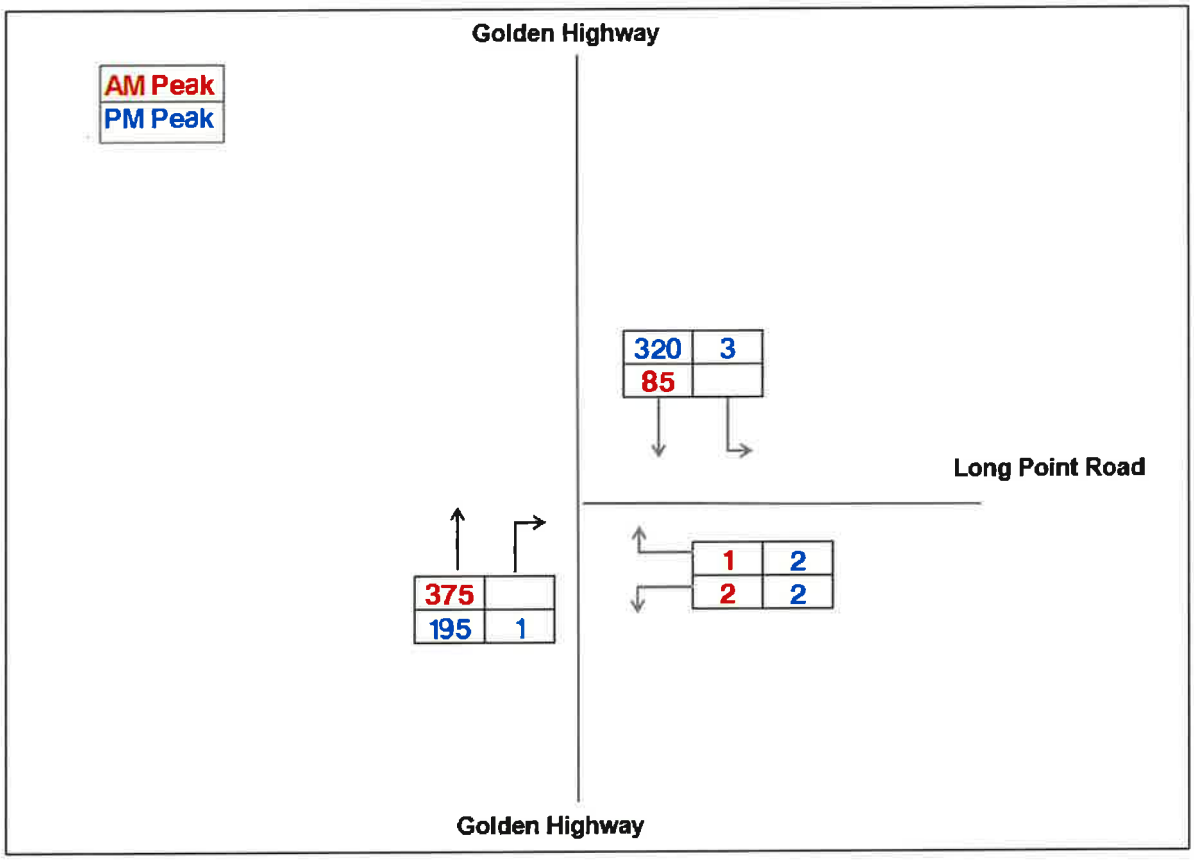


Figure 2: 2019 Survey Data

Future Traffic

The future road network in and around the Site and the Intersection shall comprise of the following components:

- Existing Traffic: Existing (2019) surveyed traffic.
- Future Traffic: Existing (2019) surveyed traffic PLUS 100 peak hour staff (light vehicles) movements PLUS 14 peak hour truck movements

The projected traffic volumes are summarised within **Appendix A**.

Methodology

Capacity of the Intersection has been assessed using SIDRA Intersection modelling software. This technical note (TN) summarises the assumptions, inputs, and results of the SIDRA assessment.

Sidra Assessment Parameters

The performance of the key intersections has been analysed using the SIDRA Intersection computer program. SIDRA modelling outputs a range of performance measures, in particular:

- Average Vehicle Delay (AVD) – The AVD (or average delay per vehicle in seconds) for intersections also provides a measure of the operational performance of an intersection and is used to determine an intersection's Level of Service (see below). For signalised intersections, the AVD reported relates to the average of all vehicle movements through the intersection. For priority (Give Way, Stop & Roundabout controlled) intersections, the AVD reported is that for the movement with the highest AVD.
- Level of Service (LOS) – This is a comparative measure that provides an indication of the operating performance, based on AVD.

The following table provides a recommended baseline for assessment as per the RMS Guide:

Table 1: Average Peak Hour Traffic Growth Rates

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	less than 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	More than 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode or major treatment

Sidra Results

Sidra model for 2019 Existing and Future Scenarios are presented in **Table 2**

Table 2: Sidra Results – Existing (2019) and Future Scenarios

Intersection	Peak Period	Existing Traffic		Future Traffic	
		Delay (sec)	LoS	Delay (sec)	LoS
Golden Highway / Long Point Road West	AM	10.9	A	16.2 (5.3)	B
	PM	15.5	B	16.9 (1.4)	B

As shown above, the Intersection of Golden Highway / Long Point Road West operates at LoS B or better in both peaks. The SIDRA analysis indicates that the additional traffic generated by the Proposal will have no significant impact on the operation of the Intersection with it predicted to continue to operate at good levels and with spare capacity.

Detailed Sidra modelling results for all scenarios are presented in Attachment B.

Summary and Conclusion

Ason Group has been engaged by Hunter Energy to assess the potential traffic impacts associated with the updated haulage routes of biomass to and from the Redbank Power Station.

Following our updated assessment of the intersection of Golden Highway / Long Point Road West, which is associated with the Proposal, Ason Group has concluded that the Proposal is supportable from an access and traffic perspective.

We trust the above is of assistance. Please contact the undersigned or Tim Lewis should you have any queries or require further information in relation to the above.

Yours sincerely,

James Laidler
Traffic Engineer – Ason Group
Email: james.laidler@asongroup.com.au

asongroup

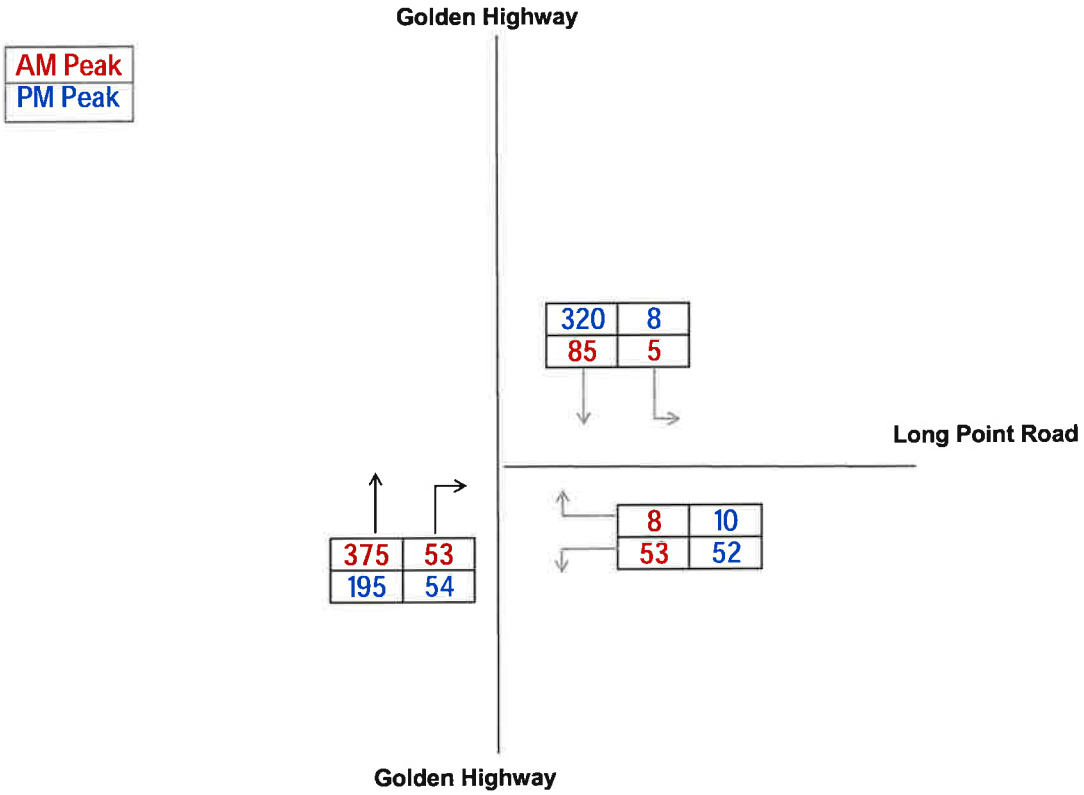
Attachment A

Traffic Generation

Redbank Power Station

Future (2019) Traffic

All Vehicles



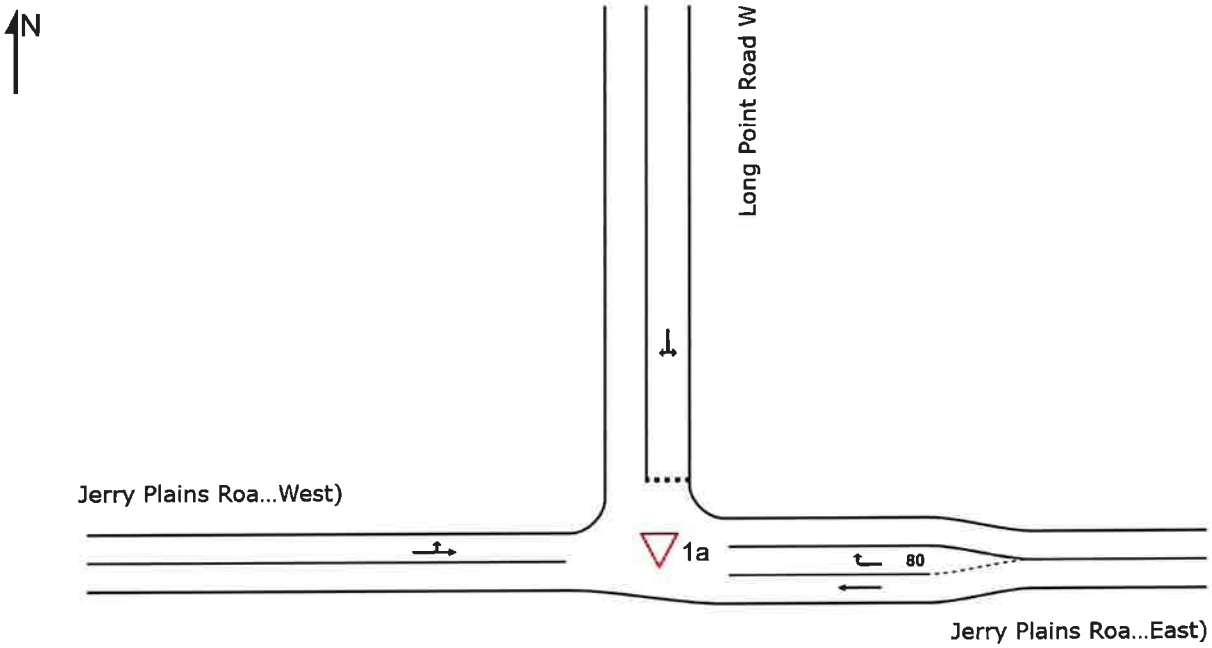
Attachment B

Sidra Modelling Summaries

SITE LAYOUT

Site: 1a [JPR x LPRW Existing AM]

Jerry Plains Road x Long Point Road W
Existing
AM Peak
Site Category: (None)
Giveway / Yield (Two-Way)



Organisation: ASON GROUP PTY LTD | Created: Friday, 24 July 2020 9:56:44 AM
Project: C:\Users\JamesLaidler\Desktop\1025m02 Redbank Modelling.sip8

MOVEMENT SUMMARY

▽ Site: 1a [JPR x LPRW Existing AM]

Jerry Plains Road x Long Point Road W
Existing
AM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Jerry Plains Road (East)												
5	T1	395	7.7	0.213	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	1	0.0	0.001	7.9	LOS A	0.0	0.0	0.19	0.58	0.19	74.2
Approach		396	7.7	0.213	0.0	NA	0.0	0.0	0.00	0.00	0.00	99.8
North: Long Point Road W												
7	L2	2	50.0	0.003	9.5	LOS A	0.0	0.1	0.22	0.62	0.22	58.2
9	R2	1	0.0	0.003	10.9	LOS A	0.0	0.1	0.22	0.62	0.22	72.5
Approach		3	33.3	0.003	10.0	LOS A	0.0	0.1	0.22	0.62	0.22	62.3
West: Jerry Plains Road (West)												
10	L2	1	0.0	0.049	7.8	LOS A	0.0	0.0	0.00	0.28	0.00	84.5
11	T1	89	7.1	0.049	2.0	LOS A	0.0	0.0	0.00	0.28	0.00	91.8
Approach		91	7.0	0.049	2.0	NA	0.0	0.0	0.00	0.28	0.00	91.8
All Vehicles		489	7.7	0.213	0.5	NA	0.0	0.1	0.00	0.06	0.00	97.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1p [JPR x LPRW Existing PM]

Jerry Plains Road x Long Point Road W
Existing
PM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Jerry Plains Road (East)												
5	T1	205	4.6	0.108	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	1	100.0	0.001	11.7	LOS A	0.0	0.1	0.50	0.60	0.50	56.5
Approach		206	5.1	0.108	0.1	NA	0.0	0.1	0.00	0.00	0.00	99.6
North: Long Point Road W												
7	L2	2	50.0	0.008	11.0	LOS A	0.0	0.3	0.52	0.68	0.52	55.6
9	R2	2	50.0	0.008	15.5	LOS B	0.0	0.3	0.52	0.68	0.52	55.2
Approach		4	50.0	0.008	13.2	LOS A	0.0	0.3	0.52	0.68	0.52	55.4
West: Jerry Plains Road (West)												
10	L2	3	0.0	0.185	7.9	LOS A	0.0	0.0	0.00	0.01	0.00	88.4
11	T1	337	9.1	0.185	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
Approach		340	9.0	0.185	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.6
All Vehicles		551	7.8	0.185	0.2	NA	0.0	0.3	0.00	0.01	0.00	99.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3a [JPR x LPRW Future AM]

Jerry Plains Road x Long Point Road W
Future
AM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Jerry Plains Road (East)												
5	T1	395	7.7	0.214	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	56	7.5	0.035	8.2	LOS A	0.2	1.2	0.21	0.61	0.21	70.6
Approach		451	7.7	0.214	1.0	NA	0.2	1.2	0.03	0.08	0.03	95.0
North: Long Point Road W												
7	L2	56	9.4	0.060	8.4	LOS A	0.2	1.8	0.20	0.62	0.20	69.5
9	R2	8	50.0	0.060	16.2	LOS B	0.2	1.8	0.20	0.62	0.20	57.8
Approach		64	14.8	0.060	9.4	LOS A	0.2	1.8	0.20	0.62	0.20	67.7
West: Jerry Plains Road (West)												
10	L2	8	50.0	0.054	9.1	LOS A	0.0	0.0	0.00	0.06	0.00	67.5
11	T1	89	7.1	0.054	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	98.9
Approach		98	10.8	0.054	0.8	NA	0.0	0.0	0.00	0.06	0.00	95.1
All Vehicles		613	8.9	0.214	1.9	NA	0.2	1.8	0.04	0.13	0.04	91.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 3p [JPR x LPRW Future PM]

Jerry Plains Road x Long Point Road W
Future
PM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Jerry Plains Road (East)												
5	T1	205	4.6	0.109	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	57	9.3	0.048	9.3	LOS A	0.2	1.5	0.43	0.66	0.43	68.9
Approach		262	5.6	0.109	2.0	NA	0.2	1.5	0.09	0.14	0.09	91.0
North: Long Point Road W												
7	L2	55	9.6	0.075	9.3	LOS A	0.3	2.3	0.44	0.68	0.44	68.1
9	R2	11	50.0	0.075	16.9	LOS B	0.3	2.3	0.44	0.68	0.44	56.8
Approach		65	16.1	0.075	10.5	LOS A	0.3	2.3	0.44	0.68	0.44	66.0
West: Jerry Plains Road (West)												
10	L2	35	87.9	0.191	10.1	LOS A	0.0	0.0	0.00	0.07	0.00	57.6
11	T1	311	1.4	0.191	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	99.6
Approach		345	10.1	0.191	1.0	NA	0.0	0.0	0.00	0.07	0.00	92.8
All Vehicles		673	8.9	0.191	2.3	NA	0.3	2.3	0.08	0.16	0.08	88.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX C

AIR QUALITY ASSESSMENT

ACOUSTICS AND AIR

REDBANK POWER STATION

AIR QUALITY AND GREENHOUSE GAS IMPACT ASSESSMENT

REPORT NO. 20224
VERSION A

SEPTEMBER 2020

PREPARED FOR

HUNTER ENERGY
112 LONG POINT ROAD WEST
WARKWORTH NSW 2330

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Draft	22 September 2020	Nic Hall	Phillip Henschke
A	Final	30 September 2020	Nic Hall	

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CASANZ
This firm is a member firm of the Clean Air Society of Australia and New Zealand and the work here reported has been carried out in accordance with the terms of that membership.

Celebrating 50 Years in 2012
Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. Today, with offices in Sydney, Newcastle, Wollongong, Orange, Queensland and Hong Kong, Wilkinson Murray services the entire Asia-Pacific region.

TABLE OF CONTENTS

GLOSSARY OF AIR QUALITY TERMS

Air Pollution – The presence of contaminants or pollutant substances in the air that interfere with human health or welfare, or produce other harmful environmental effects.

Air Quality Standards – The level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area.

Air Toxics – Any air pollutant for which a national ambient air quality standard (NAAQS) does not exist (i.e. excluding ozone, carbon monoxide, PM-10, sulphur dioxide, nitrogen oxide) that may reasonably be anticipated to cause cancer; respiratory, cardiovascular, or developmental effects; reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans.

Airborne Particulates – Total suspended particulate matter found in the atmosphere as solid particles or liquid droplets. Chemical composition of particulates varies widely, depending on location and time of year. Sources of airborne particulates include dust, emissions from industrial processes, combustion products from the burning of wood and coal, combustion products associated with motor vehicle or non-road engine exhausts, and reactions to gases in the atmosphere.

Area Source – Any source of air pollution that is released over a relatively small area, but which cannot be classified as a point source. Such sources may include vehicles and other small engines, small businesses and household activities, or biogenic sources, such as a forest that releases hydrocarbons, may be referred to as nonpoint source.

Concentration – The relative amount of a substance mixed with another substance. Examples are 5 ppm of carbon monoxide in air and 1 mg/l of iron in water.

Emission – Release of pollutants into the air from a source. We say sources emit pollutants.

Emission Factor – The relationship between the amount of pollution produced and the amount of raw material processed. For example, an emission factor for a blast furnace making iron would be the number of pounds of particulates per ton of raw materials.

Emission Inventory – A listing, by source, of the amount of air pollutants discharged into the atmosphere of a community; used to establish emission standards.

Flow Rate – The rate, expressed in gallons -or litres-per-hour, at which a fluid escapes from a hole or fissure in a tank. Such measurements are also made of liquid waste, effluent, and surface water movement.

Fugitive Emissions – Emissions not caught by a capture system.

Hydrocarbons (HC) – Chemical compounds that consist entirely of carbon and hydrogen.

Hydrogen Sulphide (H_2S) – Gas emitted during organic decomposition. Also, a by-product of oil refining and burning. Smells like rotten eggs and, in heavy concentration, can kill or cause illness.

Inhalable Particles – All dust capable of entering the human respiratory tract.

Nitric Oxide (NO) – A gas formed by combustion under high temperature and high pressure in an internal combustion engine. NO is converted by sunlight and photochemical processes in ambient air to nitrogen oxide. NO is a precursor of ground-level ozone pollution, or smog.

Nitrogen Dioxide (NO_2) – The result of nitric oxide combining with oxygen in the atmosphere; major component of photochemical smog.

Nitrogen Oxides (NO_x) – A criteria air polluant. Nitrogen oxides are produced from burning fuels, including gasoline and coal. Nitrogen oxides are smog formers, which react with volatile organic compounds to form smog. Nitrogen oxides are also major components of acid rain.

Mobile Sources – Moving objects that release pollution; mobile sources include cars, trucks, buses, planes, trains, motorcycles and gasoline-powered lawn mowers.

Particulates; Particulate Matter (PM-10) – A criteria air pollutant. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural burning (field and slash burning), and operation of fireplaces and woodstoves. Particulate pollution can cause eye, nose and throat irritation and other health problems.

Parts Per Billion (ppb)/Parts Per Million (ppm) – Units commonly used to express contamination ratios, as in establishing the maximum permissible amount of a contaminant in water, land, or air.

PM10/PM2.5 – PM10 is measure of particles in the atmosphere with a diameter of less than 10 or equal to a nominal 10 micrometers. PM2.5 is a measure of smaller particles in the air.

Point Source – A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack.

Scrubber – An air pollution device that uses a spray of water or reactant or a dry process to trap pollutants in emissions.

Source – Any place or object from which pollutants are released.

Stack – A chimney, smokestack, or vertical pipe that discharges used air.

Stationary Source – A place or object from which pollutants are released and which does not move around. Stationary sources include power plants, gas stations, incinerators, houses etc.

Temperature Inversion – One of the weather conditions that are often associated with serious smog episodes in some portions of the country. In a temperature inversion, air does not rise because it is trapped near the ground by a layer of warmer air above it. Pollutants, especially smog and smog-forming chemicals, including volatile organic compounds, are trapped close to the ground. As people continue driving and sources other than motor vehicles continue to release smog-forming pollutants into the air, the smog level keeps getting worse.

1 INTRODUCTION

Wilkinson Murray Pty Limited has been engaged by Hunter Energy Pty Ltd (Hunter Energy) to prepare an Air Quality and Greenhouse Gas Impact Assessment for the operation of the Redbank Power Station (Redbank) using biomass for fuel.

Hunter Energy is proposing to operate Redbank on 100% biomass fuel to create a net zero emissions green baseload generator and lead Australia's efforts to reduce greenhouse gas (GHG) emissions.

The ability to operate on coal, in accordance with the current approval, would be retained.

Redbank was approved in 1997 and constructed over a 14-month period in 2000/2001, with the plant starting operation in October 2001. The plant was in continual service until October 2014 when the management company was placed into receivership. Hunter Energy took ownership of Redbank in 2018 and has been working on the restart since.

The approval, as it stands, required all fuel to be sourced from Warkworth Mine located approximately 7 km (via road) to the south of Redbank. The approval also allows for the use of road haulage on the basis of certain upgrades of the road network. These upgrades were completed prior to the 2001 start date. It is noted that fuel has previously been delivered to the site primarily by conveyor directly from Warkworth.

This assessment presents the potential operational air quality and greenhouse gas impacts associated with the proposed development. The assessment has been conducted in general accordance with:

- *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016).
- *Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia* (DoE, 2017); and,
- *National Greenhouse Accounts Factors* (DoE, 2019)

2 PROJECT DESCRIPTION

2.1 Site Location

The site is located on the northern side of Jerrys Plan Road, Warkworth. Access from Jerrys Plan Road is restricted. Therefore, access to the site is from Long Point Road. The site location is shown in Figure 2-1.

Figure 2-1 Site location

2.2 Surrounding Land Use and Sensitive Receptors

The land use immediately surrounding the site to the north, east and west is predominantly rural. To the south of the site is the Warkworth mine. The nearest sensitive receptors are isolated rural residents to the north, east and west. Discrete receptors have been identified for assessment purposes, as shown in Figure 2-2 and identified in Table 2-1.

Nearby industrial land uses are not identified as sensitive receptors for the purposes of this assessment, however the predicted air quality impacts at these locations have been presented by way of the contour plots in Appendix A.

Table 2-1 Discrete Receptors

Receptor	MGA56 Coordinates	
	Easting (m)	Northing (m)
R1	320,765	6,393,695
R2	320,811	6,393,797
R3	321,519	6,391,910
R4	323,216	6,391,960
R5	323,454	6,392,457
R6	323,332	6,393,271
R7	322,834	6,393,868
R8	323,209	6,395,456
R9	322,442	6,395,419
R10	322,103	6,395,293
R11	321,817	6,395,230
R12	321,619	6,395,136
R13	321,494	6,395,050
R14	321,639	6,394,699
R15	321,269	6,394,969
R16	321,192	6,394,795
R16	320,915	6,394,511
R17	320,147	6,394,725
R18	318,450	6,396,163
R19	318,052	6,395,997
R20	315,017	6,395,118
R21	314,570	6,394,588
R22	314,804	6,394,345
R23	314,871	6,394,225
R24	315,592	6,393,875

Figure 2-2 Sensitive Receptors

2.3 Project Description

2.3.1 Existing/Approved Operations

The Redbank Power Station is a coal powered plant containing a single steam driven turbo generator with a maximum electrical capacity of 151 Megawatts (MW).

Redbank utilises FiCirc® fluidised bed steam generators to provide steam to the generator. FiCirc® technology was initially developed by CPC (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 a deep fluidised bed, configured to provide a high degree of bed fines recirculation to enhance the gas to solids contact and results in highly efficient combustion system producing low NO_x, SO_x and CO emissions due to the ability to control the combustion chamber temperatures and the addition of sorbent material if required. This style of unit has demonstrated excellent performance and emissions profiles with a wide range of fuels including coal, petroleum coke, and biomass.

2.3.2 Proposal Overview

The proposal involves modification of the existing consent to allow for the plant to utilise biomass fuel as an additional fuel. This provides the opportunity for the proponents to generate electricity with Net Zero emissions in a cost-effective manner. This ultimately ensures that reliable green energy is generated that supports the electrical grid requirements and provides downward pressure on the cost of power, for both the residential and commercial/industrial markets.

The proposal will necessitate the modification of the current Environmental Planning license (EPL 11262). The modification will be to include biomass to be used as fuel for use at Redbank under the EPL.

2.3.3 Hours of Operation

When in operation, the site generally operates 24 hours a day, 7 days per week. There are typically two shifts over this period, starting at 6 am and 6 pm.

3 AIR QUALITY CRITERIA

3.1 Introduction

The NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the Approved Methods) sets out applicable impact assessment criteria for a number of air pollutants.

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the pollutants of interest in this study and the application air quality criteria for each pollutant.

3.2 Pollutants of Interest

Potential air pollutants associated with the operation of Redbank are:

- Sulfur dioxide (SO_2)
- Nitrogen dioxide (NO_2)
- Particulate Matter ($PM_{2.5}$ and PM_{10})
- Carbon monoxide (CO)
- Metals/metallic compounds, such as:
  - Arsenic and compounds
  - Beryllium and compounds
  - Cadmium and compounds
  - Chromium (III) compounds
  - Chromium (VI) compounds
  - Copper and compounds
  - Lead and compounds
  - Mercury and compounds
  - Nickel and compounds
- Volatile organic compounds (VOC)
- Polycyclic aromatic hydrocarbons (PAH)
- Dioxins and furans.

3.3 Impact Assessment Criteria

3.3.1 Criteria Pollutants

Sulfur dioxide, nitrogen dioxide, lead, particulate matter and carbon monoxide are among a group of air pollutants referred to as "criteria pollutants" in the Approved Methods. The impact assessment criteria for criteria pollutants relevant to the Proposal are presented in Table 3-2.

The criteria in Table 3-2 are applied to the 100th percentile (i.e. maximum) dispersion modelling results and relate to the total concentrations of pollutants in the air and not just that from the Proposal. Therefore, some consideration of background levels needs to be made when assessing the air quality impacts from the Proposal.

Table 3-1 Impact assessment criteria – criteria pollutants

Pollutant	Averaging period	Criteria
Sulfur dioxide (SO_2)	10 minutes	712 µg/m³
	1 hour	570 µg/m³
	24 hours	228 µg/m³
	Annual	60 µg/m³
Nitrogen dioxide (NO_2)	1 hour	246 µg/m³
	Annual	62 µg/m³
Lead	Annual	0.5 µg/m³
Particulate matter ≤2.5 µm ($PM_{2.5}$)	24 hours	25 µg/m³
	Annual	8 µg/m³
Particulate matter ≤10 µm (PM_{10})	24 hours	50 µg/m³
	Annual	25 µg/m³
Carbon monoxide (CO)	15 minutes	100 mg/m³
	1 hour	30 mg/m³
	8 hours	10 mg/m³

3.3.2 Toxic Pollutants

The impact assessment criteria for individual toxic pollutants relevant to the Proposal are presented in Table 3-2. These pollutants are assessed as the incremental impact at and beyond the boundary of the facility using the 99.9th percentile dispersion modelling results.

Table 3-2 Impact assessment criteria – individual toxic pollutants

Pollutant	Averaging period	Criteria
Arsenic and compounds	1-hour	0.00009 mg/m³
Benzene	1-hour	0.029 mg/m³
Beryllium and compounds	1-hour	0.000004 mg/m³
Cadmium and compounds	1-hour	0.000018 mg/m³
Chromium VI compounds	1-hour	0.00009 mg/m³
Dioxins and furans	1-hour	2.0E-9 mg/m³
Nickel and compounds	1-hour	0.00018 mg/m³
Polycyclic aromatic hydrocarbons (as benzo[a]pyrene)	1-hour	0.0004 mg/m³
Chromium (III) compounds	1-hour	0.009 mg/m³
Copper dusts and mists	1-hour	0.018 mg/m³
Mercury	1-hour	0.00018 mg/m³

3.4 EPL Stack Limits

Redbank operates under EPL #11262, which includes stack emissions limits as presented in Table 3-3.

Table 3-3 Stack limits

Pollutant	Units of measure	100th percentile concentration limit
Solid particles	mg/m^3	82
Nitrogen oxides	mg/m^3	799
Fluoride	mg/m^3	50
Sulfur dioxide	mg/m^3	649
Type 1 substance [a]	mg/m^3	2.5

a. Elements or compounds containing antimony, arsenic, cadmium, lead or mercury.

4 EXISTING ENVIRONMENT

4.1 Local Meteorology

Meteorological conditions strongly influence air quality. Most significantly, wind speed, wind direction, temperature, relative humidity, and rainfall affect the dispersion of air pollutants, and are key inputs into dispersion models. The following sub-sections discuss the local meteorology near the Proposal site and identify a representative set of meteorological data for use in the dispersion modelling to be undertaken for this assessment.

4.1.1 Long Term Climate

Long term meteorological data for the area surrounding the site is available from the Cessnock Airport AWS operated by the Bureau of Meteorology (BoM). The Cessnock Airport AWS is located approximately 34 km south east of the Site and records observations of a number of meteorological parameters include wind speed, wind direction, temperature, humidity and rainfall.

Long-term climate statistics are presented in Table 4-1. Temperature data recorded at the Cessnock Airport AWS indicates that January is the hottest month of the year, with a mean daily maximum temperature of 30.5°C. July is the coolest month with a mean daily minimum temperature of 4.1°C. February is the wettest month with an average rainfall of 99 mm falling over 8 days. There are, on average, 72 rain days per year, delivering 721 mm of rain.

Table 4-1 Climate Averages for Cessnock Airport AWS

Obs.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9am Mean Observations													
Temp (°C)	23.2	22.2	20.2	17.8	14.1	11.0	10.1	12.2	16.2	19.1	20.2	22.2	17.4
Hum (%)	68	76	80	76	79	80	76	69	63	60	65	65	71
3pm Mean Observations													
Temp (°C)	28.7	27.3	25.7	23.0	19.6	16.8	16.4	18.6	21.2	23.4	25.0	27.3	22.8
Hum (%)	46	53	53	52	54	55	49	42	42	44	47	46	49
Daily Minimum and Maximum Temperatures													
Min (°C)	17.1	16.9	14.8	10.7	7.5	5.8	4.1	4.5	7.0	9.8	13.0	15.1	10.5
Max (°C)	30.5	29.3	27.4	24.3	20.8	17.9	17.6	19.5	22.6	25.4	27.1	29.2	24.3
Rainfall													
Rain (mm)	76.3	99.3	76.9	54.2	38.6	56.6	29.1	33.6	44.3	52.2	72.4	77.4	720.5
Rain (days)	6.4	7.9	7.5	5.6	5.0	5.6	4.0	4.3	5.6	6.3	7.1	7.0	72.3

4.1.2 Wind

Wind data from Warkworth air quality monitoring station (AQMS) has been incorporated into the dispersion modelling for this assessment.

Figure 4-1 to Figure 4-6 present annual and seasonal "wind rose" plots for the Warkworth AQMS for the period 2015 to 2019, inclusive. The plots show similar patterns of wind speed and wind direction over the five-year period, with north-westerly winds being prevalent throughout autumn, winter and spring and south-easterly winds being prevalent in summer. Wind speed and wind direction during 2019 are generally representative of the five-year period and have therefore been adopted for modelling purposes.

Figure 4-1 Warkworth AQMS Wind Roses, 2015

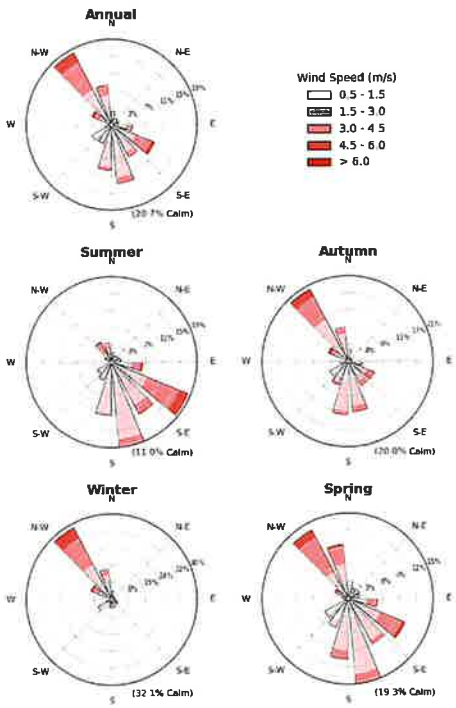


Figure 4-2 Warkworth AQMS Wind Roses, 2016

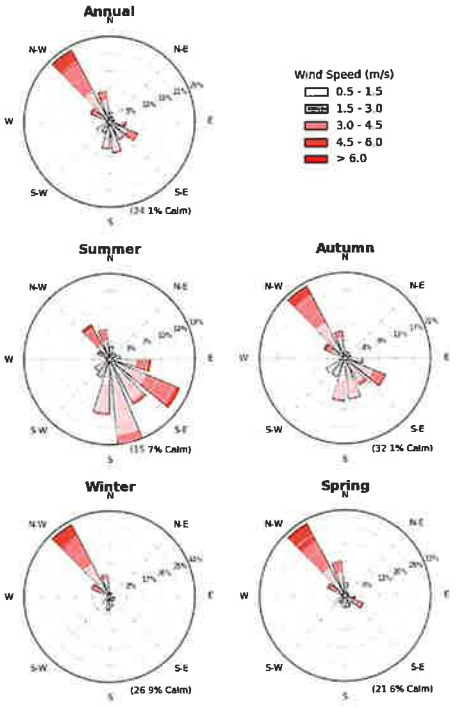


Figure 4-3 Warkworth AQMS Wind Roses, 2017

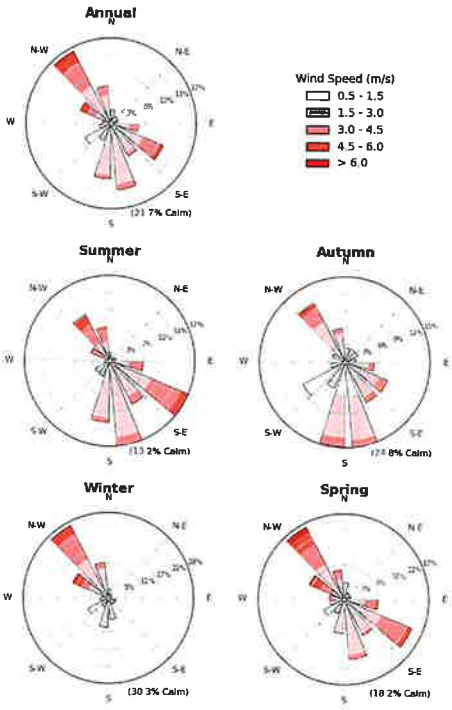


Figure 4-4 Warkworth AQMS Wind Roses, 2018

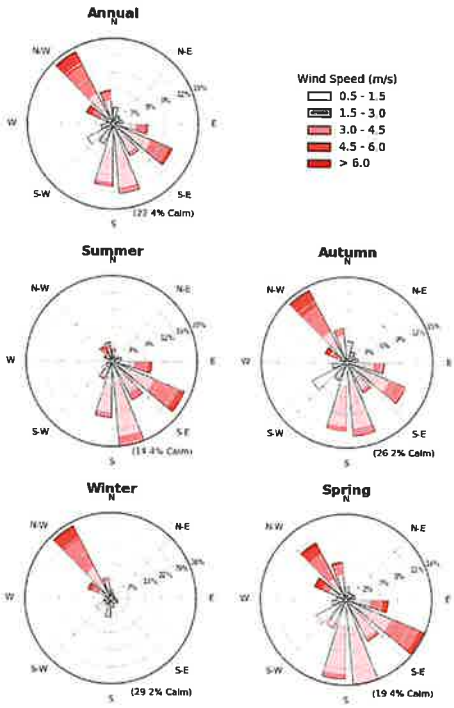


Figure 4-5 Warkworth AQMS Wind Roses, 2019

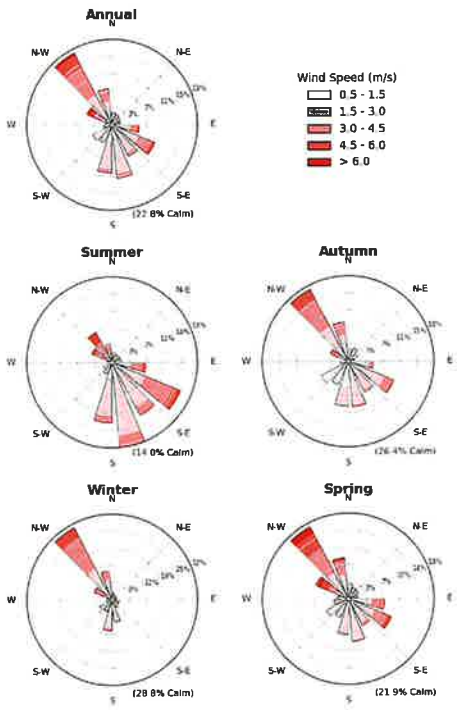
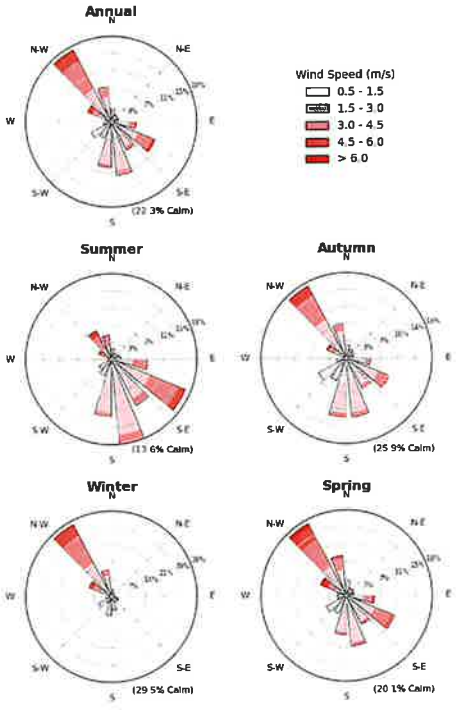


Figure 4-6 Warkworth AQMS Wind Roses, 2015-2019



4.2 Local Ambient Air Quality

No site-specific data are available to determine the existing concentrations of air pollutants at sensitive receptors near the Proposal. The NSW Department of Planning Industry and Environment (DPIE) operates a network of air quality monitoring stations (AQMS) across NSW.

The nearest DPIE AQMS is located approximately 4 kilometres west of the Proposal site, at Warkworth. The Warkworth AQMS records hourly observations of PM_{10}, but does not record SO_2, NO_2 or $PM_{2.5}$. The Singleton AQMS, located approximately 10 kilometres east of the Proposal site records observations of SO_2, NO_2 or $PM_{2.5}$, which have been adopted for the purposes of this assessment. The nearest AQMS to the Proposal site that records CO is located at Newcastle, approximately 75 kilometres south-east of the site.

A summary of the ambient air quality monitoring data collected at the Warkworth, Singleton and Newcastle AQMS during the modelling year (2019) is presented in Table 4-2.

Table 4-2 Ambient air quality monitoring results –2019

Pollutant	AQMS	Concentration (µg/m³)			
		1-hour [a]	8-hour [a]	24-hour [a]	Annual ave.
SO_2	Singleton	248.1	n/a	31.4	4.29
NO_2	Singleton	67.6	n/a	n/a	13.0
$PM_{2.5}$	Singleton	n/a	n/a	69.3 (24.9)	10.9
PM_{10}	Warkworth	n/a	n/a	181.5 (49.8)	33.4
CO	Newcastle	2,226	1,770	n/a	n/a

a. maximum values

It is noted that ambient $PM_{2.5}$ and PM_{10} concentrations during 2019 were elevated. This was primarily due to extreme bushfire events. The values in brackets in Table 4-2 represent the highest observations that were below the relevant impact assessment criteria. These values have been adopted for this purposes of this assessment.

5 DISPERSION MODELLING

5.1 Meteorological Modelling

5.1.1 TAPM

Site-specific meteorological data for input into the dispersion model was generated using The Air Pollution Model (TAPM). TAPM is a prognostic model, developed and distributed by the Commonwealth Scientific and industrial Research Organisation (CSIRO).

TAPM is an incompressible, non-hydrostatic, primitive equations prognostic model with a terrain-following vertical coordinate for three-dimensional simulations. It predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of large scale meteorology provided by synoptic analyses. TAPM benefits from having access to databases of terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic scale meteorological analyses for various regions around the world.

The prognostic modelling domain was centred at 32.583° S, 151.075° E and involved four nesting grids of 30 km, 10 km, 3 km and 1km with 41 grids in the lateral dimensions and 25 vertical levels.

The TAPM model included assimilation of wind data collected at Warkworth AQMS during 2019.

5.1.2 AERMET

The TAPM results, including predictions of wind speed, wind direction, temperature, humidity, cloud cover, solar radiation, and rainfall, were used as inputs to AERMET – AERMOD's meteorological pre-processor. AERMET uses the TAPM data, along with land use data, to calculate mixing heights and velocity scaling parameters.

5.2 Dispersion Modelling

5.2.1 AERMOD

The dispersion model chosen for this assessment was AERMOD – the US EPA regulatory Gaussian plume air dispersion model.

AERMOD is a steady state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts. It includes treatment of both surface and elevated sources, and both simple and complex terrain.

AERMOD is accepted by NSW EPA for use in air quality impact assessments.

5.2.2 NO_X to NO_2 Transformation

In most combustion sources, high-temperature chemical processes cause the nitrogen in the fuel air mixture to oxidise, creating various 'oxides of nitrogen' or NO_X. Nitric oxide (NO) makes up the majority of NO_X emissions from engines, with NO_2 typically making up 5-10% of the NO_X percentage.

After emission from the stack, NO is transformed to NO_2 through oxidation with atmospheric ozone.

For the purposes of this assessment, it is assumed that 100% of the NO_X emitted from the stack is transformed to NO_2. This is very conservative assumption and is supported by the Approved Methods.

5.2.3 Sub 1-hour Concentrations

Dispersion models typically predict ground level concentrations at time intervals of one hour or more. To predict sub 1-hour average concentrations, the following power-law, recommended by EPA Victoria (EPA Victoria, 1986), has been used:

$$C_{\tau_2} = C_{\tau_1} \left(\frac{\tau_1}{\tau_2}\right)^{0.2}$$

Where:

C_{τ_2} = concentration for averaging period 2

C_{τ_1} = concentration for averaging period 1

τ_1 = averaging period 1 (minutes)

τ_2 = averaging period 2 (minutes)

6 EMISSIONS TO AIR

The following section presents the estimated emissions of air pollutants associated with the operation of the Proposal.

6.1 Operational Air Emissions

The most significant source of operational air emissions for Redbank is combustion products exiting the main stack. In addition to stack emissions, fugitive dust emissions would also be associated with the storage and handling of fuel and ash.

6.1.1 Emissions Controls

NO_X is predominantly released when temperatures in the furnace exceed 900 Deg C. The operating temperatures for the Redbank fluidised bed do not exceed 900 Deg C hence the production of NO_X is substantially lower when compared to other combustion technologies that typically operate above 1100 Deg C

SO_X is mainly controlled by the injection of Limestone into the furnace at a rate determined by the sulphur content in the fuel. The limestone reacts with the sulphur in the furnace bed to create Calcium Carbonate which supplements the bed material when the ash content is low.

Redbank utilises a baghouse and fabric filter technologies to clean the flue gases from the boilers. There are a total of 2 fabric filters – one for each boiler. Each fabric filter consists of 4 cells and has approximately 2,900 bags per filter. Each bag is in the order of 8 metres long with a nominal diameter of 130 mm. The bag material used at Redbank is "Procon PPS". This is one of the latest developments in filtration media and is developed and produced in Germany.

6.1.2 Stack Emissions

Stack emissions associated with the operation of Redbank using biomass as fuel have been estimated using emissions factors published in the National Pollutant Inventory (NPI) *Emission estimation technique manual for Combustion in Boilers*. The client advises that approximately 112 tonnes of biomass would be burned per hour, assuming a nominal fuel moisture content of 25%. Based on this fuel consumption rate, the estimated stack emissions are presented in Table 6-1.

The emission factors in Table 6-1 account for the pollutant control achieved through the use of fluidised bed boiler technology and a baghouse. The efficiency of the baghouse at removing $PM_{2.5}$ and PM_{10} is assumed to be at least 99%. This value is consistent with the US EPA *Air Pollution Control Cost Manual, 2002*. For other pollutants, the "controlled" emissions factors published in the NPI document were used.

Table 6-1 Stack Emissions

Pollutant	Emission Factor (kg/t)	Emission Rate (g/s)
CO	0.700	21.82
NO_X	1.490	46.44
PM_{10}	0.084	2.62
$PM_{2.5}$	0.050	1.56
SO_2	0.170	5.30
VOC	0.120	3.74
Arsenic	4.27E-05	1.33E-03
Beryllium	1.64E-07	5.11E-06
Cadmium	1.06E-05	3.30E-04
Chromium III	7.80E-05	2.43E-03
Chromium VI	2.30E-05	7.17E-04
Copper	1.87E-04	5.83E-03
Lead	2.23E-04	6.95E-03
Mercury	2.58E-06	8.04E-05
Nickel	3.45E-05	1.08E-03
PAH [a]	1.78E-03	5.55E-02
Dioxins + Furans [b]	5.29E-10	1.65E-08

a. Includes 99% control from baghouse
b. Benzo[a]pyrene equivalent
c. Toxic equivalent (TEQ)

Stack release parameters are presented in Table 6-2.

Table 6-2 Stack Parameters

Release Point	Location (MGA56)		Height (m)	Temperature (K)	Diameter (m)	Velocity (m/s)
	Easting (m)	Northing (m)				
Main Stack	318,983	6,393,584	50	422	4.2	21.3

Combining the stack emission rates presented in Table 6-1 with the stack parameters presented in Table 6-2, the in-stack concentrations of pollutants identified in the EPL are presented in Table 6-3. Also shown in Table 6-3 are the typical in-stack concentrations for the current performance of Redbank.

The data in Table 6-1 indicate compliance with the EPL limits. Table 6-3 also indicates the potential for emissions of NO_X, particulates and Type 1 substances to increase under the Proposal. However, this is considered to be a consequence of adopting conservative emissions factors for this assessment. Pollutant emissions associated with the use of biomass are likely to be similar or less than those for coal.

Table 6-3 In-stack Concentrations

Pollutant	In-Stack concentration (mg/m³)		
	Current Performance	Proposal	EPL Limit
Solid particles [a]	10	14	82
Nitrogen oxides	155	243	799
Fluoride	1.4	-	50
Sulfur dioxide	455	28	649
Type 1 substance b	0.016	0.046	2.5

a. Assessed using PM_{10}
b. Elements or compounds containing antimony, arsenic, cadmium, lead or mercury

6.1.3 Fugitive Emissions

Due to its larger size and higher moisture content, dust emissions associated with the storage and handling of biomass would be negligible compared to that of coal. Therefore, fugitive dust emissions associated with the storage and handling of biomass have been omitted from this assessment.

The ash content of the biomass proposed to be used at Redbank is approximately less than one per cent by mass, on a "bone dry" (bd) basis. Alternatively, the ash content of the fuel used under the current approval is approximately 29 %. Therefore, fugitive dust emissions associated with the storage and handling of ash when using biomass would be negligible compared to that for coal. Accordingly, fugitive dust emissions associated with the storage and handling of ash have been omitted from this assessment.

7 ASSESSMENT OF IMPACTS

This section presents the dispersion modelling results and discusses the likely off-site air quality impacts associated with the operation of the Proposal. Contour plots are presented in Appendix A.

7.1 Criteria Pollutants

The predicted incremental and total (i.e. incremental plus background) ground level concentrations of criteria pollutants associated with the operation of Redbank using biomass are presented in Table 7-1 and Table 7-2, respectively.

The results indicate compliance with the impact assessment criteria at all receptors for SO_2, NO_2, lead, CO, PM_{10} and 24-hour average $PM_{2.5}$.

The results indicate exceedance of the impact assessment criteria for annual average $PM_{2.5}$. However, as noted in Section 4.2, the annual average ambient concentrations of $PM_{2.5}$, as measured at the Singleton AQMS, was above the impact assessment criteria, primarily due to extreme bushfire events.

7.2 Individual Toxic Pollutants

The predicted 99.9th percentile 1-hour ground level concentrations of individual toxic pollutants are presented in Table 7-3.

The results indicate compliance with the impact assessment criteria for all pollutants.

Table 7-1 Predicted incremental ground-level concentrations – criteria pollutants

Receptor ID	SO_2				NO_2		Lead	$PM_{2.5}$		PM_{10}		CO		
	10-minute	1-hour	24-hour	Annual	1-hour	Annual	Annual	24-hour	Annual	24-hour	Annual	15-minute	1-hour	8-hour
Goal (µg/m³)	**712**	**570**	**228**	**60**	**228**	**60**	**0.5**	**25**	**8**	**50**	**25**	**100,000**	**30,000**	**10,000**
R1	2.688	1.879	0.301	0.044	16.466	0.383	<0.001	0.089	0.013	0.149	0.022	0.089	7.736	2.758
R2	2.769	1.935	0.298	0.041	16.961	0.357	<0.001	0.088	0.012	0.147	0.020	0.088	7.968	2.831
R3	2.456	1.716	0.322	0.072	15.042	0.627	<0.001	0.095	0.021	0.159	0.035	0.095	7.067	2.474
R4	1.786	1.248	0.169	0.033	10.938	0.292	<0.001	0.050	0.010	0.084	0.016	0.050	5.139	1.883
R5	1.997	1.395	0.154	0.027	12.230	0.233	<0.001	0.045	0.008	0.076	0.013	0.045	5.746	1.738
R6	2.013	1.406	0.105	0.022	12.328	0.191	<0.001	0.031	0.006	0.052	0.011	0.031	5.791	1.237
R7	1.893	1.323	0.114	0.021	11.594	0.188	<0.001	0.033	0.006	0.056	0.011	0.033	5.447	1.339
R8	1.585	1.108	0.096	0.016	9.708	0.144	<0.001	0.028	0.005	0.047	0.008	0.028	4.561	1.134
R9	1.799	1.257	0.111	0.018	11.018	0.162	<0.001	0.033	0.005	0.055	0.009	0.033	5.176	1.313
R10	1.924	1.344	0.121	0.020	11.783	0.175	<0.001	0.035	0.006	0.060	0.010	0.035	5.536	1.427
R11	2.044	1.428	0.130	0.022	12.519	0.189	<0.001	0.038	0.006	0.064	0.011	0.038	5.882	1.539
R12	2.148	1.501	0.137	0.023	13.156	0.199	<0.001	0.040	0.007	0.068	0.011	0.040	6.181	1.624
R13	2.214	1.547	0.143	0.024	13.558	0.210	<0.001	0.042	0.007	0.071	0.012	0.042	6.370	1.696
R14	2.235	1.562	0.154	0.025	13.688	0.215	<0.001	0.045	0.007	0.076	0.012	0.045	6.431	1.892
R15	2.342	1.636	0.152	0.025	14.343	0.222	<0.001	0.045	0.007	0.075	0.013	0.045	6.738	1.803
R16	2.471	1.727	0.170	0.027	15.132	0.234	<0.001	0.050	0.008	0.084	0.013	0.050	7.109	2.099
R16	2.704	1.889	0.225	0.031	16.559	0.271	<0.001	0.066	0.009	0.111	0.015	0.066	7.779	2.775
R17	2.551	1.782	0.264	0.038	15.622	0.333	<0.001	0.078	0.011	0.131	0.019	0.078	7.339	2.486
R18	2.670	1.866	0.320	0.046	16.354	0.401	<0.001	0.094	0.013	0.158	0.023	0.094	7.683	3.264
R19	2.966	2.072	0.244	0.047	18.165	0.412	<0.001	0.072	0.014	0.120	0.023	0.072	8.534	2.644
R20	2.524	1.764	0.214	0.031	15.462	0.274	<0.001	0.063	0.009	0.106	0.015	0.063	7.264	2.284
R21	1.686	1.178	0.185	0.027	10.325	0.237	<0.001	0.054	0.008	0.091	0.013	0.054	4.850	2.079
R22	1.461	1.021	0.182	0.028	8.949	0.243	<0.001	0.054	0.008	0.090	0.014	0.054	4.204	2.103
R23	1.573	1.099	0.183	0.028	9.636	0.242	<0.001	0.054	0.008	0.090	0.014	0.054	4.527	2.127
R24	2.178	1.522	0.204	0.031	13.340	0.273	<0.001	0.060	0.009	0.101	0.015	0.060	6.267	2.416

Table 7-2 Predicted total ground-level concentrations – criteria pollutants

Receptor ID	SO_2				NO_2		Lead	$PM_{2.5}$		PM_{10}		CO		
	10-minute	1-hour	24-hour	Annual	1-hour	Annual	Annual	24-hour	Annual	24-hour	Annual	15-minute	1-hour	8-hour
Goal (µg/m³)	**712**	**570**	**228**	**60**	**228**	**60**	**0.5**	**25**	**8**	**50**	**25**	**100,000**	**30,000**	**10,000**
R1	357.7	250.0	31.70	4.334	84.07	13.38	<0.001	24.99	**10.91**	49.95	33.42	2,947	2,234	1,773
R2	357.8	250.0	31.70	4.331	84.56	13.36	<0.001	24.99	**10.91**	49.95	33.42	2,948	2,234	1,773
R3	357.5	249.8	31.72	4.362	82.64	13.63	<0.001	24.99	**10.92**	49.96	33.44	2,947	2,233	1,772
R4	356.8	249.3	31.57	4.323	78.54	13.29	<0.001	24.95	**10.91**	49.88	33.42	2,944	2,231	1,772
R5	357.0	249.5	31.55	4.317	79.83	13.23	<0.001	24.95	**10.91**	49.88	33.41	2,945	2,232	1,772
R6	357.0	249.5	31.51	4.312	79.93	13.19	<0.001	24.93	**10.91**	49.85	33.41	2,945	2,232	1,771
R7	356.9	249.4	31.51	4.311	79.19	13.19	<0.001	24.93	**10.91**	49.86	33.41	2,944	2,231	1,771
R8	356.6	249.2	31.50	4.306	77.31	13.14	<0.001	24.93	**10.90**	49.85	33.41	2,943	2,231	1,771
R9	356.8	249.4	31.51	4.308	78.62	13.16	<0.001	24.93	**10.91**	49.85	33.41	2,944	2,231	1,771
R10	356.9	249.4	31.52	4.310	79.38	13.17	<0.001	24.94	**10.91**	49.86	33.41	2,945	2,232	1,771
R11	357.1	249.5	31.53	4.312	80.12	13.19	<0.001	24.94	**10.91**	49.86	33.41	2,945	2,232	1,772
R12	357.2	249.6	31.54	4.313	80.76	13.20	<0.001	24.94	**10.91**	49.87	33.41	2,945	2,232	1,772
R13	357.2	249.6	31.54	4.314	81.16	13.21	<0.001	24.94	**10.91**	49.87	33.41	2,946	2,232	1,772
R14	357.3	249.7	31.55	4.315	81.29	13.22	<0.001	24.95	**10.91**	49.88	33.41	2,946	2,232	1,772
R15	357.4	249.7	31.55	4.315	81.94	13.22	<0.001	24.94	**10.91**	49.88	33.41	2,946	2,233	1,772
R16	357.5	249.8	31.57	4.317	82.73	13.23	<0.001	24.95	**10.91**	49.88	33.41	2,947	2,233	1,772
R16	357.7	250.0	31.63	4.321	84.16	13.27	<0.001	24.97	**10.91**	49.91	33.42	2,947	2,234	1,773
R17	357.6	249.9	31.66	4.328	83.22	13.33	<0.001	24.98	**10.91**	49.93	33.42	2,947	2,233	1,772
R18	357.7	250.0	31.72	4.336	83.95	13.40	<0.001	24.99	**10.91**	49.96	33.42	2,947	2,234	1,773
R19	358.0	250.2	31.64	4.337	85.76	13.41	<0.001	24.97	**10.91**	49.92	33.42	2,948	2,235	1,773
R20	357.5	249.9	31.61	4.321	83.06	13.27	<0.001	24.96	**10.91**	49.91	33.42	2,947	2,233	1,772
R21	356.7	249.3	31.58	4.317	77.92	13.24	<0.001	24.95	**10.91**	49.89	33.41	2,944	2,231	1,772
R22	356.5	249.1	31.58	4.318	76.55	13.24	<0.001	24.95	**10.91**	49.89	33.41	2,943	2,230	1,772
R23	356.6	249.2	31.58	4.318	77.24	13.24	<0.001	24.95	**10.91**	49.89	33.41	2,943	2,231	1,772
R24	357.2	249.6	31.60	4.321	80.94	13.27	<0.001	24.96	**10.91**	49.90	33.42	2,945	2,232	1,772

Table 7-3 Predicted 99.9th percentile ground-level concentrations – individual toxic pollutants

Receptor ID	Arsenic	Beryllium	Cadmium	Chromium (III)	Chromium (VI)	Nickel	Copper	Mercury	VOC	PAH	Dioxins/Furans
	1-hour	1-hour	1-hour	1-hour	1-hour	1-hour	1-hour	1-hour	1-hour	1-hour	1-hour
Goal (mg/m³)	**9.00E-05**	**4.00E-06**	**1.80E-05**	**9.00E-03**	**9.00E-05**	**1.80E-04**	**1.80E-02**	**1.80E-04**	**2.90E-02**	**4.00E-04**	**2.0E-09**
Max offsite	8.27E-07	3.18E-09	2.05E-07	1.51E-06	4.46E-07	6.68E-07	3.62E-06	5.00E-08	2.32E-03	3.45E-05	1.02E-11
R1	3.34E-07	1.28E-09	8.28E-08	6.10E-07	1.80E-07	2.70E-07	1.46E-06	2.02E-08	9.38E-04	1.39E-05	4.13E-12
R2	3.29E-07	1.26E-09	8.17E-08	6.01E-07	1.77E-07	2.66E-07	1.44E-06	1.99E-08	9.25E-04	1.37E-05	4.08E-12
R3	2.92E-07	1.12E-09	7.26E-08	5.34E-07	1.57E-07	2.36E-07	1.28E-06	1.77E-08	8.22E-04	1.22E-05	3.62E-12
R4	2.33E-07	8.94E-10	5.78E-08	4.25E-07	1.25E-07	1.88E-07	1.02E-06	1.41E-08	6.54E-04	9.71E-06	2.88E-12
R5	2.11E-07	8.12E-10	5.25E-08	3.86E-07	1.14E-07	1.71E-07	9.25E-07	1.28E-08	5.94E-04	8.81E-06	2.62E-12
R6	1.89E-07	7.27E-10	4.70E-08	3.46E-07	1.02E-07	1.53E-07	8.29E-07	1.14E-08	5.32E-04	7.89E-06	2.35E-12
R7	2.02E-07	7.77E-10	5.02E-08	3.70E-07	1.09E-07	1.63E-07	8.86E-07	1.22E-08	5.69E-04	8.43E-06	2.51E-12
R8	1.33E-07	5.11E-10	3.30E-08	2.43E-07	7.17E-08	1.08E-07	5.83E-07	8.04E-09	3.74E-04	5.55E-06	1.65E-12
R9	1.46E-07	5.59E-10	3.61E-08	2.66E-07	7.84E-08	1.18E-07	6.38E-07	8.80E-09	4.09E-04	6.07E-06	1.80E-12
R10	1.55E-07	5.97E-10	3.86E-08	2.84E-07	8.37E-08	1.26E-07	6.80E-07	9.39E-09	4.37E-04	6.48E-06	1.93E-12
R11	1.64E-07	6.32E-10	4.08E-08	3.00E-07	8.86E-08	1.33E-07	7.20E-07	9.94E-09	4.62E-04	6.86E-06	2.04E-12
R12	1.75E-07	6.74E-10	4.35E-08	3.20E-07	9.45E-08	1.42E-07	7.68E-07	1.06E-08	4.93E-04	7.31E-06	2.17E-12
R13	1.82E-07	7.01E-10	4.53E-08	3.33E-07	9.83E-08	1.47E-07	7.99E-07	1.10E-08	5.13E-04	7.60E-06	2.26E-12
R14	1.96E-07	7.52E-10	4.86E-08	3.58E-07	1.05E-07	1.58E-07	8.58E-07	1.18E-08	5.50E-04	8.16E-06	2.43E-12
R15	1.93E-07	7.41E-10	4.79E-08	3.52E-07	1.04E-07	1.56E-07	8.45E-07	1.17E-08	5.42E-04	8.04E-06	2.39E-12
R16	2.04E-07	7.82E-10	5.05E-08	3.72E-07	1.10E-07	1.64E-07	8.92E-07	1.23E-08	5.72E-04	8.49E-06	2.52E-12
R16	2.34E-07	8.97E-10	5.80E-08	4.27E-07	1.26E-07	1.89E-07	1.02E-06	1.41E-08	6.56E-04	9.74E-06	2.89E-12
R17	3.00E-07	1.15E-09	7.44E-08	5.48E-07	1.62E-07	2.42E-07	1.31E-06	1.81E-08	8.43E-04	1.25E-05	3.71E-12
R18	3.53E-07	1.36E-09	8.76E-08	6.45E-07	1.90E-07	2.85E-07	1.55E-06	2.13E-08	9.92E-04	1.47E-05	4.37E-12
R19	3.83E-07	1.47E-09	9.51E-08	7.00E-07	2.06E-07	3.10E-07	1.68E-06	2.31E-08	1.08E-03	1.60E-05	4.75E-12
R20	2.02E-07	7.75E-10	5.01E-08	3.69E-07	1.09E-07	1.63E-07	8.84E-07	1.22E-08	5.67E-04	8.42E-06	2.50E-12
R21	1.78E-07	6.82E-10	4.41E-08	3.24E-07	9.57E-08	1.44E-07	7.78E-07	1.07E-08	4.99E-04	7.41E-06	2.20E-12
R22	1.78E-07	6.84E-10	4.42E-08	3.25E-07	9.59E-08	1.44E-07	7.80E-07	1.08E-08	5.00E-04	7.42E-06	2.21E-12
R23	1.64E-07	6.30E-10	4.07E-08	3.00E-07	8.84E-08	1.33E-07	7.19E-07	9.92E-09	4.61E-04	6.84E-06	2.03E-12
R24	1.68E-07	6.44E-10	4.16E-08	3.06E-07	9.02E-08	1.35E-07	7.34E-07	1.01E-08	4.71E-04	6.98E-06	2.08E-12

8 GREENHOUSE GAS ASSESSMENT

This section presents a greenhouse gas (GHG) assessment of the Proposal. This GHG Assessment has been conducted in general accordance with:

- *Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia* (DoE, 2017); and,
- *National Greenhouse Accounts Factors* (DoE, 2019)

To demonstrate the value of the Proposal to reducing GHG emissions associated with electricity generation. this assessment presents annual scope 1 GHG emissions based on both the approved coal fuel and the proposed biomass fuel.

8.1 Reportable Greenhouse Gases

The following greenhouse gases have been identified as significant contributors to global warming:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Synthetic gases; and
- Hydro fluorocarbons HFCs, SF_6, CF_4, C_2F_6.

GHG emissions are categorized as Scope 1, Scope 2 and Scope 3 emissions; which are defined as follows:

- **Scope 1 – Direct (or point-source) emissions** – emissions from sources owned or operated by the facility.
- **Scope 2 – Indirect emissions** – emissions released as a result of the generation of electricity, or the production of heat, cooling or steam purchased by the reporting company.
- **Scope 3 – Various emissions** – all other GHG emissions that are not covered under Scope1 or Scope 2. Scope 3 emissions. These can include activities such as employees commuting to work; extraction, production and transport of fuels, materials and other goods; and use of products manufactured and sold.

This GHG assessment considers scope 1 emissions only. Since Redbank is a producer of electricity, it does not purchase electricity from the grid during normal operations and has negligible scope 2 emissions.

Reporting of Scope 3 emissions is optional since these emissions are reported as either Scope 1 or Scope 2 emissions from other activities. Accordingly, Scope 3 emissions are not discussed further in this assessment.

8.2 Emission Factors

Based on the identified sources of GHG emissions from the Project, relevant emission factors have been adopted from the *National Greenhouse Accounts Factors, August 2019*, with some modifications to account for the properties of the approved and proposed fuels. Specifically, the

calorific value of the approved coal fuel and the proposed biomass fuel have been used to supplement the default values.

Table 8-1 presents the Scope 1 emissions factors used in this assessment.

Table 8-1 Scope 1 Emission Factors (Solid Fuels)

Fuel Type	Energy Content (GJ/t)	Emission Factor (kg CO_{2-e}/GJ) [a]		
		CO_2	CH_4	N_2O
Green and air dried wood	15.21	0	0.1	1.2
Coal	16.01	90	0.03	0.2

a. relevant oxidation factors incorporated.

8.3 Operational Greenhouse Gas Emissions

Greenhouse gas emissions have been estimated based on information from the client, and published emissions factors.

The estimated annual operational greenhouse gas emissions for Redbank, for both the approved and proposed fuels, are presented in Table 8-2. The data indicate that the proposed use of biomass would result in a reduction in greenhouse gas emissions of approximately 98% compared to the approved fuel.

Table 8-2 Estimated Annual Greenhouse Gas Emissions

Parameter	Approved Fuel (coal)	Proposed fuel (biomass)
Energy content (GJ/t)	16.01	15.21
Consumption rate (t/h)	81.6	112.2
Annual consumption (t/y) [a]	652,800	897,600
GHG emissions (tCO_2-e/y)	943,023	17,748

a. 8000 operating hours per year

9 CONCLUSION

Hunter Energy is proposing to operate Redbank on 100% biomass fuel to create a net zero emissions green baseload generator and lead Australia's efforts to reduce greenhouse gas (GHG) emissions.

The ability to operate on Coal, in accordance with the current approval, would be retained.

Wilkinson Murray Pty Limited has been engaged by Hunter Energy Pty Ltd (Hunter Energy) to prepare an Air Quality and Greenhouse Gas Impact Assessment for the operation of the Redbank Power Station (Redbank) using biomass for fuel.

Potential air quality impacts associated with the operation of the Proposal have been assessed in general accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016).

Quantitative assessments of potential air qualty impacts from the operation of the Proposal have been conducted, based on TAPM meteorological simulations and the AERMOD dispersion modelling system.

The results of the dispersion modelling indicate that pollutant concentrations due to the operation of the Proposal would comply with the established criteria at all sensitive receptors.

A greenhouse gas assessment has been conducted for the Proposal. The estimated annual greenhouse gas emissions using biomass as a fuel are approximately 98% lower than those for the approved fuel.

APPENDIX A

CONTOUR PLOTS

Figure A-1 Predicted incremental ground level concentration – 1-hour NO_2

Figure A-2 Predicted incremental ground level concentration – 24-hour $PM_{2.5}$

Figure A-3 Predicted incremental ground level concentration – 24-hour PM_{10}

APPENDIX D

BUSHFIRE IMPACT ASSESSMENT

BEMC

Bushfire
Environmental
Management
Consultancy

BPAD
Bushfire
Planning & Design
Accredited Practitioner
Level 2

Bushfire Assessment Report

Redbank Power Station

112 Long Point Road, West Warkworth NSW

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Title	Bush Fire Assessment Report			
Description	112 Long Point Road, West Warkworth NSW			
Created By	Duncan Scott-Lawson			
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Version Number	**Modified By**	**Modifications Made**	**Date Modified**	**Status**
1	DSL	Draft for Review	04/07/2020	Completed

Summary

BEMC Pty Ltd was engaged by Costa Tsiolkas to complete a Bush Fire Assessment Report (BFAR) utilising Method 2 assessment pathway from AS3959:2018 on the proposed restart of Redbank power station burning Biomass instead of coal at 112 Long Point Road, West Warkworth NSW.

This report considers and assess the bushfire construction and planning requirements to determine compliance with the performance criteria in Planning for Bushfire Protection 2019.

The identification of Bushfire Prone Areas in NSW is required under section 10.3 of the *Environment Planning and Assessment Act* 1979 (EP&A Act). Section 4.14 of the EP&A Act requires developments to comply with NSW Rural Fire Service, Planning for Bushfire Protection (PBP 2019) if any part of a development site is affected by bush fire hazard as indicated within the BPA Map. This development falls within the Bushfire Vegetation Buffer zone on the Singleton Council Bushfire Prone Land Map.

To determine the planning and construction requirements a site assessment in accordance with Appendix 1 of PBP 2019 has be performed in June 2020 to determine the appropriate bush fire threat level, design, planning and construction standards required to comply with the Section 1 aims and objective and Section 8.3.1, 8.3.6 and 8.3.9 of the PBP 2019.

In summary, based upon this assessment of the plans it is recommendations that development consent be granted subject to the following conditions to comply with PBP 2019:

APZ and Construction Standards

- At the commencement of building works and in perpetuity, a 10m APZ around the entire development footprint (establishment required to the south of the stockpile) shall be managed as an Inner Protection Area (IPA) and supported by a perimeter trail as outlines within PBP 2019.
- 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.
- The provided APZ to the north and west provide ample separation for BAL-LOW construction and emergency service mobility within the facility within excessive radiant heat exposure.

Access

- Upgrade of 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.

Water, Electricity, Gas and Hazardous Materials

- The facility meets the electricity services acceptable solution is accordance with PBP 2019.

Emergency Management Arrangements

- A Bush Fire Emergency Management and Operations Plan is required to be developed.

Finally, the implementation of the adopted measures and recommendations forwarded within this report comply with PBP (2019) and will contribute to the amelioration of the potential impact of any bushfire upon the development, but they do not and cannot guarantee that the area will not be affected by bushfire at some time.

1 TABLE OF CONTENTS

TABLES

FIGURES

PLATES

Table 1 Planning for Bushfire Protection compliance (PBP 2019)
Aims and Objectives of section 1.1 and specific objectives of Solar Farm developments in section 8.3.5 of PBP 2019

	PERFORMANCE CRITERIA	ACCEPTABLE SOLUTION	COMPLIANCE
Aims and Objectives of section 1.1	Afford buildings and their occupants protection from exposure to a bushfire	• Setbacks and ample and internal network of vehicle access enables evacuation of the site which ingress of emergency services.	**YES**
	Provide for a defendable space to be located around buildings	• An adequate defendable space is provided around the buildings.	**YES**
	Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings	▪ A 10m APZ is to be established to the south of the stockpile. ▪ A perimeter trail associated with the APZ is to be established to the south of the stockpile.	**Made condition of consent**
	Ensure appropriate operation access and egress for emergency services personnel and residents is available	▪ Setbacks and ample and internal network of vehicle access enables evacuation of the site which ingress of emergency services. ▪ Two access routes from Long Point Road to Jerrys Plain Road	**YES**
	Provide for ongoing management and maintenance of Bush fire Protection Measures (BPMs);	▪ The APZ will be maintained as an Inner Protection Zone (IPA) as outlines within Appendix 4 of Planning for Bushfire Protection 2019, and NSW Rural Fire Service 'Standards for Asset Protection Zones'. ▪ Maintenance of the APZ to IPA standards is also supported by the Bushfire Emergency Management and Operations Plan	**YES**
	Ensure the utility services are adequate to meet the needs of firefighters	▪ Signage and turn-around provision provided in the south-eastern corn associated with the perimeter trail and APZ where the restricted vertical clearance is encountered.	**Made condition of consent**

Section 8 requirements	A Minimum 10m Asset Protection Zone (APZ) for the structure and associated buildings and infrastructure	▪ A 10m APZ is to be established to the south of the stockpile.	**Made condition of consent**
	Propose an appropriate combination of Bushfire Protection Measures	▪ Implementation of the recommendations within this report will ensure the appropriate level of Bushfire Protection Measures are implemented.	**YES**
	Consideration of Department of Primary Industries - Hazardous Industry Planning and Assessment Papers (HIPAPs)	▪ . Development of a Bushfire Emergency Management and Operations Plan is required.	**YES**
	Development of a Bushfire Emergency Management and Operations Plan	▪ Completed	**YES – Refer to accompanying Bushfire Emergency Management and Operations Plan**

BUSHFIRE CERTIFICATION

The report has been prepared by Duncan Scott-Lawson, BPAD level 2 certifier BPAD 47789. I certify that the proposed development design conforms to the relevant specifications and requirements of PBP 2019 and AS 3959-2018 detailed in Section 4.14 (1) (b) of the *Environmental Planning and Assessment Act* (1979).

2 INTRODUCTION

EMC Pty Ltd was engaged by Costa Tsiolkas to complete a Bush Fire Assessment Report (BFAR) on the proposed restart of Redbank power station burning Biomass instead of coal at 112 Long Point Road, West Warkworth NSW, hereafter referred to as the 'site' (Figure 1).

To determine the planning and construction requirements a site assessment in accordance with Appendix 1 of PBP 2019 has be performed in June 2020 to determine the appropriate bush fire threat level, design, planning and construction standards required to comply with PBP 2019.

2.1 DESCRIPTION OF THE PROPOSED DEVELOPMENT

Table 2 Site Particulars

Boundaries	Long Point Road to the north, forested vegetation to the west and east and and Jerrys Plains Road to the south.
Topography	Flat to undulating lower hills associated with the Hunter River.
Type of development	Existing Power Station facility restarting, with change in combustible elements
Roof construction	Metal
External wall construction	Metal
Landscaping	Yes
Bush fire Prone Land	Yes

The location of the Redbank power station is provided in Figure 1.

2.2 OBJECTIVES OF ASSESSMENT

This assessment has been undertaken to enable council to make determination of the proposed development in consideration of the requirements of s4.14 of the Environmental Planning and Assessment Act 1979, PBP 2019 and AS 3959-2018.

The report assesses to requirements of the development to meet the six objectives listed in section 1.1 of PBP 2019, which provide for the protection of human life and minimize impacts on property.

- Afford buildings and their occupants protection from exposure to a bushfire.
- Provide for a defendable space to be located around buildings.
- Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings.
- Ensure appropriate operation access and egress for emergency services personnel and residents is available.
- Provide for ongoing management and maintenance of Bush fire Protection Measures (BPMs); and
- Ensure the utility services are adequate to meet the needs of firefighters.

Figure 1 Site Location of 112 Long Point Road, West Warkworth, NSW (Sixmaps, 2020)

2.3 Specific Objectives of S8.3.5 of PBP 2019

The aims and objectives listed in section 1.1 of PBP 2019 remain applicable, although the bushfire performance provisions of section 8.3.1, 8.3.6 and 8.3.9 of PBP 2019 guide requirements for Power station developments.

The specific objectives of section 8.3.1, 8.3.6 and 8.3.9 of PBP 2019 solar farm developments are:

- A Minimum 10m Asset Protection Zone (APZ) for the structure and associated buildings and infrastructure.
- Propose an appropriate combination of Bushfire Protection Measures.
- Consideration of Department of Primary Industries - *Hazardous Industry Planning and Assessment Papers* (HIPAPs)).
- Development of a Bushfire Emergency Management and Operations Plan.

3 BUSH FIRE STRATEGIC STUDY

A Bush Fire Strategic Study (BFSS) has been prepared to inform the context of the assessment of the Bush Fire Assessment Report (BFAR). The level of information gathered and analysis within the BFSS depends upon the nature of development, scale of the proposal, the bush fire risk, and potential impact on the wider community and emergency management arrangements. This process provides an opportunity to assess if a proposed development is appropriate in the bush fire hazard context.

Table 3 Bush fire strategic study

Adjoining land	The development will not have significant impact on the adjoining rural landowners' ability to undertake bushfire management activities.
Surrounding infrastructure	The facility will provide increased ignition source for bushfire events. Bushfire Protection Measures should establish protections to maintain fires within the boundary of the development.
Access and egress	Access along Long Point Road is sealed and all weather, with adequate passing. There are several rural lots and residential dwellings that utilise this access. There will be an increase in truck volume during normal operations although this will not increase the number of vehicles using the road network at the time of an emergency. The existing road network is appropriate for this development type.
Emergency services	The increased ignition potential may increase the reliance on emergency services. Bushfire Protection Measures should establish protections to keep fire within the boundary of the development, minimising the impact on emergency services.
Land use assessment	The Power Station infrastructure is appropriately located.
Bush fire landscape assessment	The highest potential is a wildfire approaching the proposal is from the west and north-west. Small roadside ignitions along Long Point and Jerrys Plains Road can have short-term impact on the facility. A wildfire leaving the proposal to the east can burn through the neighbouring forest and into the grasslands impacting on neighbouring rural residential properties prior to containment along to Hunter River. Bushfire Protection Measures should establish protection measures around the entirety of the proposal.

This Bush Fire Strategic Study identifies that the proposed development can meet the broad aims and objectives and section 8. of PBP 2019 if appropriate Bushfire Protection Measures (BPMs) are established for the development. The proposed development provides staff the ability to readily evacuate from a bush fire event, provides separation between the bush fire threat and power station infrastructure, will not significantly limit the ability of emergency services ingress to undertake grassfire suppression operations.

4 BUSHFIRE HAZARD ASSESSMENT

This section details the site assessment methodology in Appendix 1 of PBP2019. It provides detailed analysis of the vegetation, slope, exclusions, vegetation downgrades and shielding elements to provide the required Bush fire Protection Measures.

4.1 FIRE DANGER INDEX

In accordance with PBP2019 and method 1 assessment pathway of AS3959:2018 the FFDI for the Singleton council area is 100.

4.2 ASSESSMENT METHODOLOGY

Vegetation classification over the site has been carried out as follows:

- Aerial Photograph Interpretation to map the vegetation classification and extent.
- Kogan 6*25 Laser distance finder.
- Photo Theodolite application supported by contour and terrain profiles.
- Vegetation assessment in June 2020, and
- Reference to regional vegetation community mapping.

Plates 1 – 6 depict the elements in and around the site that are considered within the bushfire hazard assessment.

4.3 VEGETATION ASSESSMENT

In accordance with PBP 2019, an assessment of the vegetation over 140m in all directions from the building was undertaken. Vegetation that may be considered a bushfire hazard was identified and classification based on PBP 2019.

4.3.1 Vegetation classification, exclusions and downgrades

The size and shape of small areas of vegetation influences the behaviour of bush fires and the associated risk to the built environment. Small or narrow parcels of vegetation have less opportunity to support fully developed bush fires because of their limited size. Modified landscapes, coastal wetlands and riparian areas vary significantly in structure and composition, but are generally considered as bush fire hazards, with the exception of saline wetlands. Non-hazard and non-vegetated area are not required to be considered for the purposes of PBP 2019.

Anecdotal evidence obtained from previous fire events indicates that exotic vegetation species (weed species) support intense surface fires. Under adverse fire weather conditions these plants can contribute to the intensity of bush fires due to additional fuel loads. Exotic vegetation species display similar fire behaviour characteristics to some native vegetation classifications with lower fuel loads. Table A1.9 of PBP 2018 can be used to convert the Exotic vegetation to native vegetation formations and fuel loads. Where a mixture of exotic and native vegetation exists, the native vegetation fuel loads will apply.

There are no exclusions or downgrades within this assessment.

4.3.2 Predominant Vegetation Classification

Vegetation in and around the site consists of 'Coastal Valley Grassy Woodlands' designated as '*Forests*' and '*grasslands*' in accordance with PBP 2019. For bushfire assessment Forests are considered the greatest bushfire threat.

4.4 Separation Assessment

Measuring the distance between the proposed building envelop and bushfire threat (vegetation) provides one of the Bushfire Protection Measures (BPMs) to reduce the risk from bushfire attack. The land within the separation must conform to the standards of an Asset Protection Zones to be accepted within the separation areas.

4.5 Slope Assessment

This section details the site assessment methodology in Appendix 1 of PBP2019 to assess the effective slope (under classified vegetation) within the 100m of the proposed building envelop.

4.6 Effective Slope Assessment

The slope of the land under the classified vegetation has a direct influence on the rate of fire spread, the intensity of the fire and the ultimate level of radiant heat flux.

The effective slope is the slope of the ground under the hazard (vegetation). When identifying the effective slopes, it may be found that there are a variety of slopes covering different distances. The effective slope is the slope under the vegetation which will most significantly influence the bush fire behaviour for each aspect.

The topography of the site and surrounds has been assessed to identify the maximum slope present under the classified vegetation (hazard). These values help determine the vegetation that possess bushfire threat and significantly influence fire behaviour.

Plate 1 Asset Protection Zone along the Western Boundary

Plate 2 Vegetation That forms the bushfire threat

Plate 3 Limited clearance around perimeter road

Plate 4 Location of the stockpile

Plate 5 Fire protection equipment and hydrants appropriately locate throughout facility

Plate 6 Treated fire fighting water supply

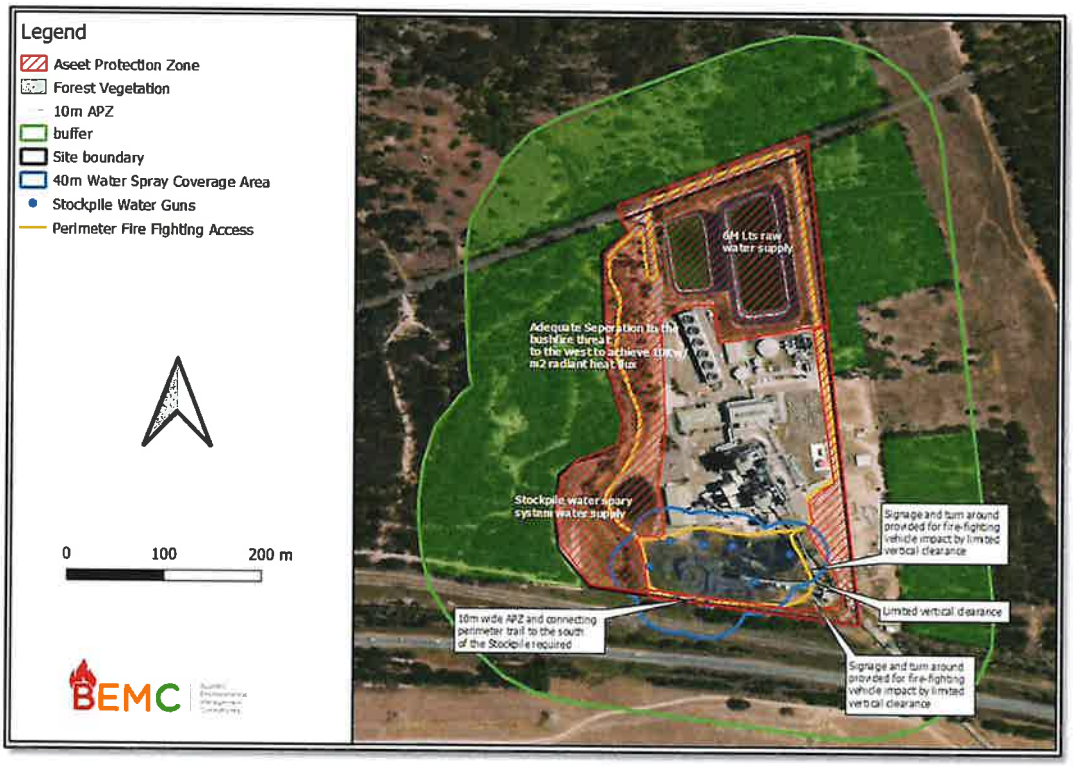

Figure 2 Bushfire Assessment

5 BUSHFIRE ASSESSMENT

This section assesses the Bushfire Protection Measures (BPMs) for the proposed development in consideration of the acceptable solutions required for each performance criteria within PBP 2019.

The Redbank Power Station will not lead to significant increase population or residential infrastructure on or around the site. The principle aims of the special provisions in Chapter 8 of PBP is for types of developments to ensure the provision of safe egress to and from public road system, adequate services of water and consideration of the location of gas and electricity, suitable emergency and evacuation arrangements and location of hazardous materials.

5.1 SETBACKS AND ASSET PROTECTION ZONES

The APZ on this site is wholly within the site boundaries and is not located on land >18 degrees slope, and there are no proposed building structures within the APZ. The ongoing maintenance of APZs are recognised under 100C of the *Rural Fires Act* 1997 and is supported in 2.8(1)(d) of the *Biodiversity Conservation Act* 2016.Any clearing of vegetation within the site to allow the development to occur may require assessment under the *Biodiversity Conservation Act* 2016.

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.

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. The setbacks to the west result in a 10kw/m^2 radiant heat flux towards the facility, which is ample to allow fire-fighting operations to continue in the event of a bushfire attack from the west.

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.

5.2 CONSTRUCTION STANDARDS

This section indicates the Bush fire Attack Level (BAL) construction requirements of the proposal which are to meet the performance criteria in PBP2019. The performance criteria within PBP 2019 are:

- The proposed structures can withstand bush fire attack in the form of embers, radiant heat and flame contact.
- APZ are maintained to the standard of an IPA.
- Access is adequate for emergency egress and firefighting ingress.

5.2.1 Building Construction Standards

Australian Standard 3959 "Construction of buildings in bushfire-prone areas" provides for six (6) levels of building construction these being BAL - Low, BAL - 12.5, BAL - 19, BAL - 29, BAL - 40 and BAL - FZ. The Australian Standard 3959 specifies construction standards for buildings within various Bushfire Attack Levels as determined by PBP 2019 document.

5.2.2 Ongoing Operations

It is proposed that the grounds within the Power Station be fuel reduced to both prevent direct flame contact to flammable vegetation and reduce the likelihood of sparking from the modules causing ignition.

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.

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.

A separation between 60m to +100m exists between the forested vegetation to the west and facilities-built infrastructure. Radiant heat calculations on flat ground with Coastal Valley Grassy Woodlands as the vegetation illustrated 40m separation to achieve 10kW/m^2.

The provided APZ to the north and west provide ample separation for BAL-LOW construction and emergency service mobility within the facility within excessive radiant heat exposure.

5.3 Access

The performance criteria within PBP 2019 are:

- Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation.
- The capacity of access roads is adequate for firefighting vehicles.
- There is appropriate access to water supply.

In the event of a serious bushfire threat to the proposed development, it will be essential to ensure that adequate ingress/ egress and the provision of defendable space are afforded in the design. Access requirements are provided in Appendix 3 of PBP 2019.

Jerrys Plain Road exists to the south of the site and is a major arterial road for the Upper Hunter Valley. provides access to Long Point Road to access the site.

The site is relatively flat, with an established 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. Access shall be provided in accordance with Appendix 3 of PBP 2019.

Upgrade of 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.

5.4 WATER SUPPLY

Reticulated water supply is not provided to the site.

The facility primary water supply is drawn from the Hunter River, store within a 6 M Lt raw water dam (north-east in the facility) prior to treatment and storage into a 1900m^3 above ground metal storage tank (Plate 6). This water supply is 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 4M Lt raw water dam in the south-western portion of the facility, which is gravity feed by the 6 Mega Lt 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.

Due to the provision to access water from the Hunter River, both water supplies can be considered reliable.

The requirement of water provisions in accordance with 8.3.5 is to ensure the availability of fire-suppression equipment (including water).

The facility meets the water supply acceptable solution is accordance with PBP 2019.

5.5 ELECTRICITY SERVICES

The performance criteria within PBP 2019 are:

- Location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.

Electricity services have been found to contribute to bush fire ignition and spread, as well as impeding access during bush fire events. Were possible electricity should be placed underground. If above ground, maintenance of the vegetation around the transmission lines should be in accordance with the ISSC 3 Guideline for Managing Vegetation Near Power Lines. This guideline was established by the five NSW Network Operators under the Electricity Supply (General) Regulation 2001 and the Electricity Supply (Safety and Network Management) Regulation 2002. Landscaping and vegetation should be maintained to comply with Energy Australia 'Vegetation Safety Clearances' (NS179, April 2002).

The facility meets the electricity services acceptable solution is accordance with PBP 2019.

5.6 GAS SERVICES

There are no gas supplies proposed for this development.

5.7 HAZARDOUS INDUSTRY

A hazard assessment has been completed in accordance with DPE Hazardous Industry Planning and Assessment Paper (HIPAP) NO. 3, 2011 to identify bushfire hazards, analyses the effects on people and the environment and their probability of occurrence.

The environmental risk impact assessment identified in the HIPAPs include:

- A preliminary hazard analysis study to be undertaken at an early stage of a project and as part of the development application (and environmental impact statement (EIS) processes, if required). The study should:
    - identify all potential hazards.
    - analyse both their effects on people and the environment and their probability of occurrence.
    - following the principles of multi-level risk assessment, quantify resultant risk levels to surrounding land uses and environment where hazard identification has indicated potential for significant off-site risk. An assessment of resultant risk levels on a cumulative basis should be undertaken at the development application stage to establish the suitability of the proposed location as well as the relevancy and adequacy of proposed safeguards.

This Bush fire Assessment Report (BFAR) completes the required preliminary hazard assessment, identifying bushfire risks, there impact and level of threat to comply with this HIPAP requirement.

- A hazard and operability study, fire safety study, emergency plan and an updated hazard analysis which are appropriate assessment studies and safety procedures to be undertaken as part of the detailed design of the proposed development. These studies should specifically relate to the development at the proposed location. The requirements for these studies may be adopted in part or on whole through conditions of consent.
- A construction safety study prepared to ensure safety during construction.
- Implementation of a comprehensive safety management system which incorporates independent hazard auditing at regular intervals during the operation of the development. This is appropriate to ensure continued safety of the development and of the development and of surrounding land uses.

The development of a Bushfire Emergency Management and Operations Plan that is consistent with existing facility emergency response planning complies with this HIPAP requirement, although does not comply with the requirement to complete hazard auditing at regular intervals during the operation of the development. The development of a Bush Fire Management Plan for the site is not a statutory requirement, although would bring together the Bush fire Assessment Report and Bushfire Emergency Management and Operations Plan and provide treatment schedules for the management of Bushfire Protection Measures to ensure hazard auditing at regular intervals (every 5 years) during the operation of the development is completed.

5.8 Landscaping and Vegetation Management

It is essential that any landscaping be included in any bushfire assessment to ensure appropriate BPM are incorporated into the design elements of the development. All Landscaping shall comply with Appendix 4 of PBP 2019.

A landscaping maintenance should be included into the Bushfire Emergency Management and Operations Plan to illustrate the maintenance of APZ and landscaping features.

5.9 Emergency Management and Bushfire Survival Plans

Bush Fire Emergency Management and Operations Plan is required to be developed. This document will include detailed measures to prevent or mitigate bushfires, including:

- Igniting management and prevention.
- Strategies to reduce ignition.
- Strategies to suppress unplanned fires.
- Strategies to minimise potential spread of bushfires.
- Bushfire Mitigation treatments.
- Appropriate woks programming on fire danger days.
- Bushfire Emergency Management procedures.

The document 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

A Bush Fire Emergency Management and Operations Plan is required to be developed.

6 CONCLUSION AND RECOMMENDATIONS

It is clear from this investigation and assessment that the site constitutes Bushfire risk. In accordance with the provisions of PBP 2019, the recommendations outlined within this assessment will substitute as appropriate actions to reduce the risk of damage and/or harm in the event of a bushfire event.

This Bush Fire Assessment Report found the land surrounding the proposed development supports vegetation consistent with a forests and grasslands. The vegetation that forms the greatest bush fire threat is the forest from the west.

In summary, the following key recommendations have been generated to guide development and design requirements to meet the requirements of PBP 2019.

APZ and Construction Standards

- 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.
- 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.
- The provided APZ to the north and west provide ample separation for BAL-LOW construction and emergency service mobility within the facility within excessive radiant heat exposure.

Access

- Upgrade of 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.

Water, Electricity, Gas and Hazardous Materials

- The facility meets the electricity services acceptable solution is accordance with PBP 2019.

Emergency Management Arrangements

- A Bush Fire Emergency Management and Operations Plan is required to be developed.

Finally, the implementation of the adopted measures and recommendations forwarded within this report are based on a thorough assessment under the Planning for Bushfire Protection 2019 to manage the risk caused by bushfire to people, property, and public safety. The recommended bushfire protection measures will contribute to the amelioration of the potential impact of any bushfire upon the development estate, but they do not and cannot guarantee that the area will not be affected by bushfire at some time.

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Bushfire
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Management
Consultancy

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Planning & Design
Accredited Practitioner
Level 2

Bush Fire Emergency Management and Operations Plan

Redbank Power Station

112 Long Point Road, West Warkworth NSW

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1	DSL	Draft for Review	05/07/2020	Completed

Summary

BEMC Pty Ltd was engaged by Costa Tsiolkas to complete a Bush Fire Emergency Management and Operations Plan on the proposed restart of Redbank power station burning Biomass instead of coal at 112 Long Point Road, West Warkworth NSW.

The risk of bush fire impacting on the site was assessed within the Bush fire Assessment Report. It considers bush fire threat from all direction surrounding the site is possible. The highest level of risk from a forest fire from the north or north-west of the site.

At risk developments, such as this facility that have sensitive infrastructure required to assist community in resilience and recovery following bushfire events. This require a greater degree of planning and coordination to ensure staff and community safety.

The *'Emergency Response Plan for Redbank Power, 112 Long Point Road West Warkworth via Singleton NSW 2330 (2014)'* identifies emergency response procedures for the facility. This *'Bush Fire Emergency Management and Operations Plan'* forms a sub-plan to the *'Emergency Response Plan for Redbank Power, 112 Long Point Road West Warkworth via Singleton NSW 2330 (2014)'* providing further detail on the preparation, planning and response to bushfire scenarios. Specifically, 'SP 11- *Description of equipment and scenario - Bushfire'* of the *'Emergency Response Plan for Redbank Power, 112 Long Point Road West Warkworth via Singleton NSW 2330 (2014)'* should be updated to refer to this document as a sub-plan.

This Bush Fire Emergency Management and Operations Plan outlines the management of hazard reduction and ignition management and prevention strategies to enable adequate preparation and emergency management response before and during a bush fire event.

The document has been prepared in accordance with AS3745:2010 Planning for emergencies in facilities and NSW RFS Development Planning – A guide to developing a Bush fire Emergency Management and Evacuation Plan. The structure is concise and succinct to allow the reader to absorb the salient elements and focus on the operational practicality of the emergency arrangements.

The significant Bush Fire Emergency Management and Operations Plan actions are:

- On *'Total Fire Ban'* days no vegetation management or hot works will be undertake unless notification and approved through s99 by NSW RFS is obtained. Only general maintenance works that do not require mechanical machinery that can create an ignition source will be permitted during *'Total Fire Ban'* days.
- Stockpile sprinkler system will be activated during Extreme and Catastrophic fire weather and when an active running bushfire towards the facility has been identified with 2km of the facility.
- Ignition management and prevention procedures within this report undertaken.
- Shelter-on-site is the primary bushfire emergency management arrangements.

A copy of this plan should be available for staff and contractors and a copy provided to the Emergency Service to assist in their pre-incident planning. Individuals identified in this plan have the responsibility to annually review and maintain the plans relevance to the site characteristics as change occurs.

This plan should be reviewed by a qualified Bushfire consultant every 5 years.

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2 INTRODUCTION

EMC Pty Ltd was engaged by Costa Tsiolkas to complete a Bush Fire Emergency Management and Operations Plan on the proposed restart of Redbank power station burning biomass instead of coal at 112 Long Point Road, West Warkworth NSW.

The risk of bush fire impacting on the site was assessed within the Bush fire Assessment Report. It considers bush fire threat from all directions with the highest level of risk from a bush fire is from the north and west.

At risk developments, such as this power stations require a greater degree of planning and coordination to ensure the facility is protected from a bushfire event and does not contribute to bush fire ignition and spread.

This Bush Fire Emergency Management and Operations Plan has been prepared in accordance with:

- AS3745:2010 Planning for emergencies in facilities.
- NSW RFS Development Planning – A guide to developing a Bush fire Emergency Management and Evacuation Plan.
- NSW Rural Fire Service, Planning for Bushfire Protection 2019 (PBP 2019).

The structure of this report is concise and succinct to allow the reader to absorb the salient elements and focus on the operational practicality of the emergency arrangements.

2.1 OBJECTIVES OF BUSH FIRE EMERGENCY MANAGEMENT AND OPERATIONS PLAN

This Bush Fire Emergency Management and Operations Plan is developed to meet the bushfire planning requirements NSW Rural Fire Service, Planning for Bushfire Protection 2019 and has two principle elements.

1. In detailing the measures to prevent and mitigate, a series of strategies will be established to protect the facility and neighbouring landowners from a bushfire ignition off and on the site. This includes:
   - Igniting management and prevention.
   - Strategies to reduce ignition.
   - Strategies to suppress unplanned fires.
   - Strategies to minimise potential spread of bushfires.
   - Bushfire Mitigation treatments.
   - Appropriate woks programming on fire danger days.

The document 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 s.99 of the *Rural Fires Act* requirements to notification of the local NSW RFS Fire Control.

2. To establish Bush fire Emergency Management procedures in the event of a bush fire, the following objectives are determined:
   - Notification procedures and Key Stakeholders.
   - Decision triggers for shelter-in-place and evacuation.

A copy of this plan should always be available for staff and visitors. A copy shall be provided to the Emergency Service to assist in their pre-incident planning. Individuals identified in this plan have the responsibility to annually review and maintain the plans relevance to the site characteristics as change occurs.

3 STATUTORY REQUIREMENTS

Fire management activities within the study area are constrained by numerous legislations, plans and guidelines.

3.1 COMMONWEALTH

There is no commonwealth legislation specific to fire management, although commonwealth conservation legislation is relevant to bushfire management principles.

3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection & Biodiversity Conservation Act* 1999 (EPBC Act) stipulates that approval from the Commonwealth Environment Minister is required if a development is likely to have a significant impact on matters considered to be of national environmental significance.

The Commonwealth Heritage List, established under the EPBC Act, comprises natural, Indigenous and historic heritage places on Commonwealth lands and waters or under Australian Government control. The nine matters of national environmental significance (MNES) are; World heritage properties, National heritage places, Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed), Nationally threatened species and ecological communities, Migratory species, Commonwealth marine areas, The Great Barrier Reef Marine Park, Nuclear actions (including uranium mining), A water resource, in relation to coal seam gas development and large coal mining development.

3.2 NEW SOUTH WALES

The site is in NSW and several pieces of NSW legislations that are relevant to this facility.

3.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals in NSW.

3.2.2 Rural Fires Act 1997

The objectives of the Rural Fires Act 1997 (RF Act) are to provide for:

- The prevention, mitigation, and suppression of fires.
- Coordination of bush firefighting and prevention.
- Protection of people and property from fires, and
- Protection of the environment.

The RF Act outlines the responsibilities of landowners to manage their land for bush fire protection and provides a mechanism for the approval of hazard reduction works, through the issue of a bush fire hazard reduction certificate. Section 63 specifies that it is the duty of the owner or occupier of land to take the notified steps (such as any listed in a bush fire management plan) and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of bush fires on or from, that land.

The RF Act also provides for the formation of fire management committees and the preparation of fire management plans which includes

(a) a plan of operations, and

(b) a bush fire risk management plan.

The RF Act also provides provisions for bush fire suppression and hazard reduction works including interaction with the *Environmental Planning and Assessment Act* 1979, *National Parks and Wildlife Act* 1974, *Biodiversity Conservation Act* 2016 and the *Local Government Act* 1993. The ongoing maintenance of Asset Protection Zones are recognised under 100C of the RF Act and is supported in 2.8(1)(d) of the BC Act. Any clearing of vegetation within the site to allow the development to occur may require assessment under the BC Act.

Section 44 of the RF Act provides for the appointment of bush fire suppression control to the Commissioner of the RFS particularly in declared emergency situations. In these situations, environmental provisions of the above Acts are covered by the RF Act. Further to this, Section 100C of the RF Act specifies that the carrying out of emergency or managed bush fire hazard reduction work cannot be prohibited by the above Acts when carried out in accordance with a bush fire hazard reduction certificate. The Bush fire Environmental Assessment Code (BEAC) (RFS 2006b) provides an approach for the provision of bush fire hazard reduction certificates by the RFS under the RF Act.

The document 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 RF Act. Section 99 of the RF Act requirements notification to the local NSW RFS Fire Control when operations are carried out on days of Total Fire Ban. The Commissioner, through the local NSW RFS Fire Control can provide exemptions to any prohibited activities on Total Fire Ban days.

3.2.3 National Parks and Wildlife Act 1974

Aboriginal and cultural heritage sites are protected under the *National Parks and Wildlife Act* 1974 (NPW Act), as well as protected flora and fauna species.

3.2.4 Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act* 2016 (BC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The BC Act is integrated with the EP&A Act and requires consideration of whether a development or an activity (such as mechanical hazard reduction) is likely to significantly affect threatened species, populations and ecological communities or their habitat.

4 BUSH FIRE OPERATIONAL PLAN

The Bushfire Operations Plan (BOP) sets out the work and activities that will be undertaken within the site to prevent and mitigate bush fire events. Implementing the bushfire management works and activities listed in this plan is dependent upon the financial, human and equipment resources being available.

If the implementation of bushfire management activities identified in this BOP are implemented with fewer resources than estimated, the balance of the resources will be allocated to implementing other high priority bushfire management activities not listed in this BOP after discussion with the Emergency Services Agency.

Fire management attempts to coerce fire into a desired regime using three primary strategies:

1. Hazard Reduction through mechanical (slashing) fuel reduction.
2. Fire suppression, and
3. Ignition management and prevention.

Hazard reduction and ignition management and prevention of fire outbreaks are the primary focus of fire control strategies within this document.

4.1 STRATEGIES TO REDUCE IGNITION

The key personnel responsible for reporting and monitoring fire hazards and for the prevention of fire are:

- All Employees of Hunter Energy and Contractors have a general duty of care to observe and report fire hazards within the site.
- Hunter Energy Facility Manager is responsible for overall monitoring of fire hazard within site.

The key to minimising fire ignition is to increase the awareness of the risks of ignition. The Singleton Bush Fire Risk Management Plan (2011) reports the region has on average 203 bush fire calls per year, of which about 30 on average can be major fires. The Singleton area has experienced bush fires on a variety of occasions which have been documented since 1939. Major fire activity occurred in September 1939, October 1968 and 1974, November 1980 and 1983, January 1994, December 1997 and 2001, January 2002 and October 2002, November 2006 and February 2009. These wildfires burnt large areas of public and private lands.

Fires generally travel in an easterly direction under the influence of west to north-westerly winds. Southerly and/or easterly winds also have the potential to intensify wildfire burning during the passage of cooler changes during the spring and summer. The main sources of ignition in the Singleton Bush Fire Risk Management Plan area are:

- Lightning.
- Electrical power lines
- Escape from legal and illegal burning operations.
- Car dumping and Arson.

Table 1 documents the actions required concerning the identified ignition causes to help prevent fire ignition. These strategies are especially important during the fire season when weather patterns are conducive to the spread of fire.

Table 1 Ignition Risk and Actions

Ignition Risk	Actions
Deliberate / Arson	Promoting cooperative surveillance programs with fire agencies and community. Promoting staff, community education and awareness programs. Limiting public access during severe and catastrophic fire weather conditions. Cooperatively assist NSW Police and the Rural Fire Service to investigate all fires believed to have been deliberately lit.
Combustion within stockpile	Pre-activation of water spray system during elevation risk levels. Activation when active running bushfire towards the facility has been identified with 2km of the facility.
Camp fires	Promoting staff, community education and awareness programs.
Debris Burning	Ensure neighbours obtain appropriate permits to implement Debris burns.
Machinery use	Maintain high level of employee awareness (e.g. toolbox talks). Ensure adequate buffer zone between activities and fuel source. All hot work activities to have a spotter and a fire extinguisher within work zone when required. Hot works to be avoided during total fire bans or on FDR days of Very High or greater. Do not undertake mechanical clearing works on Extreme and Catastrophic fire danger days Removal of some visual rocks before slashing. Avoid driving on/through long grass (vehicle exhaust systems are known to igniting grass fires)
Lightning	Aerial surveillance by fire authorities for early detection Implementation of fire agencies rapid response aerial fire teams
Electrical	Liaise with electricity providers to ensure maintenance of powerlines.

4.2 STRATEGIES TO SUPPRESS UNPLANNED FIRES

Fire suppression actions start from the time the fire is detected until it is extinguished. The Power Station facilities priorities in bush fire suppression operations are:

- The safety of all staff and visitors.
- The effective protection of human life, facility and community assets.
- Reduces ignition potential on site to acceptable levels.

Table 2 Activities and Fire Danger ratings

Element	Low/Moderate	High	Very High	Severe	Extreme	Catastrophic
Preparedness for ignition	Assessing the required level of day to day preparedness by monitoring Fire Danger Indexes and synoptic conditions on a continuous basis throughout the fire season. Identifying pre-emptive incident management and ensure staff are aware of response procedures.					
Response to ignition	Identify triggers and implement appropriate actions within the Bush fire emergency management and evacuation procedures					
Minimise hot works through appropriate work scheduling	No requirements	If deemed appropriate. Hot works should be accompanied by a spotter and a fire extinguisher.	If deemed appropriate. Hot works should be accompanied by a spotter and a fire extinguisher.	If deemed appropriate. Hot works should be accompanied by a spotter and a fire extinguisher.	No hot works	No hot works
Stockpile ignition	No requirements	No requirements	Monitor stockpile for combustion and implement sprinkler system as required	Monitor stockpile for combustion and implement sprinkler system as required	Implement sprinkler system to pre-dampen and suppress	Implement sprinkler system to pre-dampen and suppress
Minimise vegetation maintenance activities through appropriate work scheduling	No requirements	No requirements	No requirements	If deemed appropriate. Vegetation management should be accompanied by a spotter and a fire extinguisher.	If deemed appropriate. Vegetation management should be accompanied by a spotter and a fire extinguisher.	No vegetation maintenance activities
Bush fire PPE and Firefighting equipment.	No requirements	No requirements	Ensure equipment is functional and readily available	Ensure equipment is functional and readily available	Ensure equipment is functional and readily available	Ensure equipment is functional and readily available

On *'Total Fire Ban'* days no vegetation management or hot works will be undertake unless notification and approved through s99 by NSW RFS is obtained. Only general maintenance works that do not require mechanical machinery that can create an ignition source will be permitted during *'Total Fire Ban'* days.

4.3 STRATEGIES TO MINIMISE POTENTIAL SPREAD OF BUSHFIRES

A range of permanent, natural and point fire control advantages exist to minimise the potential for the spread of bush fires in and around the site. The following sections define the different advantages, their characteristics, and considerations.

Table 3 summarises the control advantages in and around the site. Hunter Energy will ensure the Power Station facility effectiveness of fire control advantage infrastructure on site is maintained to minimise the potential for the spread of fires from or into and from the property. In general,

- Priorities the maintenance of Asset Protection Zones and the perimeter fire trail;
- Maintain Assets Protection Zone to standards in accordance with NSW RFS, specifically management of the ground and shrub growth, and lower tree branches under the tree line for a minimum of 2m height.
- Point advantages such as water availability and access locations are maintained.
- pre-emptive management of stockpile, activating sprinkler system when fire are detected within 5km of the site and on extreme and catastrophic fire danger days.

Table 3 Summary of Permanent Advantages

Control Advantage	Type of Zone	Characteristics and Considerations
Asset Protection Zones	Permanent	Cleared areas immediately adjacent to assets that provided an area of low flammable materials. Undertaken within the first month of fire season. Completed in accordance with NSW Rural Fire Service, Standards for Asset Protection Zones. NSW Rural Fire Service, Sydney.
Roads, Track and Trails	Permanent	Roads, tracks and trails may be used as control lines for containing a low intensity fires. Fire crew safety and probability of success will be assessed against track characteristics such as width, overhanging limbs, passing bays, bridges, turn-around areas.
Other Areas cleared of flammable materials	Permanent	Other cleared areas that act as advantages include roads that will impede the progress of a fire.
Drainage lines and rivers	Natural	The effectiveness of drainage lines depends upon whether it is saturated or has a bed of sand or stones that will impede fire crossing rather than vegetation litter. Drainage lines are unlikely to contain high intensity fires under severe conditions due to the likelihood of ridge top spotting.
Recent (<3yr) fire history	Natural	Recently burnt areas can be used for containment. Their effectiveness is limited by their depth, the level of fuel reduction, the vegetation type, the recovery time for fuel loads, and the spotting distance of approaching fire
Vehicle water points	Point	Vehicle based firefighting can draw water from numerous hydrants or dams within rural and semi urban areas.
Fire detection lookouts	Point	Detection can also be gained from vantage points on the top of the facility.

Figure 1 Bushfire Management of Stockpile

4.4 BUSHFIRE MITIGATION TREATMENTS

The bush fire mitigation treatments are strategic in nature as they prioritise protection of life and property. The principle elements of the Bushfire mitigation treatments are:

- Establishing and maintain landscape maintenance schedules.
- Making representations to the District BFMC.
- Implementation of the Bush fire Operations and Evacuation Plan; and
- Establishing a staff and visitors education program.

Table 4 Bush fire Action statement

Period	Trigger	Issue	Action	Responsibility
Preparation	Planning requirement	Risk assessment	Review Maintenance schedules for landscaping and ground maintenance Review site 'fire hygiene' and treat as required.	Facility Manager
Preparation	Planning requirement	Response capacity	Contact local rural fire brigades and NSW Fire and Rescue and undertake familiarisation of the facility.	Facility Manager
Preparation	Planning requirement	Response capacity	Maintain inspection of APZ and gardens within facility.	Facility Manager
Preparation	Planning requirements	Risk assessment	Undertake annual review of Operations plan and hold fire scenario training and simulation as required for new staff.	Facility Manager
Preparation	Planning requirements	Evacuation	NSW RFS and Local Emergency Management Officer to recognise the shelter-on-site areas within this emergency response documentation	Facility Manager
Response	Severe – Extreme – Catastrophic Fire Danger Index	Evacuation response triggered	Unlock all gate to allow access to emergency service Activation of Stockpile Water Spray sprinkler system	Facility Manager
Response	Confirmed bushfire event	Hazardous materials	Ensure all hazardous materials are portected an secured.	Facility Manager
Recovery	Following passage of fire	Site Safety	Contact utility providers to re-establish services.	Facility Manager

5 BUSHFIRE EMERGENCY MANAGEMENT PROCEDURES

Procedures for both sheltering and evacuation should be developed, with one identified as the Primary Action to be followed during a bush fire. In this case, due to the critical nature of the facility to support community recovery, shutdown and evacuation is not desired, although must be accepted as a last option. Shelter-on-site is the preferred bushfire emergency.

Emergency services may decide to evacuate areas for public safety. For this reason, procedures to evacuate are required to ensure the necessary planning and coordination arrangements are in place.

An important factor when planning for emergency procedures is that under intense conditions it is common for people to behave irrationally and this may increase the time taken to move people.

The '*Emergency Response Plan for Redbank Power, 112 Long Point Road West Warkworth via Singleton NSW 2330 (2014)*' identifies emergency response procedures for the facility. This '*Bush Fire Emergency Management and Operations Plan'* forms a sub-plan to the '*Emergency Response Plan for Redbank Power, 112 Long Point Road West Warkworth via Singleton NSW 2330 (2014)*' providing further detail on the preparation, planning and response to bushfire scenarios. Specifically, 'SP 11- *Description of equipment and scenario - Bushfire'* of the '*Emergency Response Plan for Redbank Power, 112 Long Point Road West Warkworth via Singleton NSW 2330 (2014)*' should be updated to refer to this document as a sub-plan.

Specific to the management of the stockpile during bushfire conditions or in the event of a bushfire attack on the facility, reference to this plan should also be included '*SP 01- Description of equipment and scenario - Bushfire*' of the '*Emergency Response Plan for Redbank Power, 112 Long Point Road West Warkworth via Singleton NSW 2330 (2014)*'.

5.1 PRE-EMPTIVE CLOSURE

The lead time for a planned closure varies depending on weather patterns, but every attempt is made to give the facility and attending staff as much notice as possible to prepare and respond.

Once the decision that the facility is to undertake pre-emptive closure, information needs to be disseminated quickly and clearly identifying the expectations of staff.

Potentially, between declaration of the closure and the day of closure, weather conditions improve sufficiently to remove the need to close and the facility can therefore stand down its pre-emptive closure plans. Triggers for these decisions need to be clear and concise.

Due to the function of the facility providing critical infrastructure to supply of energy to the network which facilitates community recovery and resilience, pre-emptive closure for the facility are highly unlikely.

5.2 SHELTER

Facilities with sheltering as their Primary Action will have evacuation procedures in case they can no longer shelter, or emergency services call for a pre-emptive evacuation due to catastrophic or extreme bush fire conditions.

Shelter-on-site is the preferred response for this facility with the Eastern Muster Area the preferred location of site mustering, as the western muster area is more likely to be impacted by an approach bushfire.

The objective to provide the facility strong Bushfire Protection Measure to allow operations to continue through a bushfire attack scenario. The critical infrastructure will be required for community recovery efforts following a landscape fire.

5.3 EVACUATION

Facilities with evacuation as their Primary Action that have no shelter-on-site mechanisms will have clear and concise decision triggers for staff to follow. Pre-emptive site closures become more critical in these situations ensuring staff are not placed in any danger when they are required to consider shelter as an emergency response option.

Safe access arrangements for people to evacuate an area whilst emergency service personnel are accessing the same area to suppress a bush fire are essential. Alternative access/way out routes will also assist if part of the road system is cut by bush fire or bush fire related activities, such as fallen tree of firefighting appliances.

If site evacuation is determined, procedures will be undertaken in accordance with the '*Emergency Response Plan for Redbank Power, 112 Long Point Road West Warkworth via Singleton NSW 2330 (2014)*'.

5.4 DECISION TRIGGERS

Developing a clear set of triggers will increase the ability to react quickly and make decisions when a bush fire event occurs. The following table provides the Triggers to be implemented prior and during a bush fire event.

Awareness of trigger events are initially determined by knowledge of Daily Fire Danger Categories and the predominant weather (specifically wind) conditions. It is essential that staff maintain daily awareness of these categories to ensure they are informed and aware of trigger requirements.

Category	FDI	Wind Direction	Confirmed Ignition	Action	Bush fire specific arrangements	Responsibility
Extreme and Catastrophic	>74	All directions	No	Monitor Fire Near Me, undertake preliminary preparations	Activate Stockpile sprinkler systems	Hunter Energy
			Yes (<5km)	Implement emergency management arrangements	Continue Stockpile sprinkler systems Undertake notifications and pre-emptive emergency planning Unlock access gates for emergency services Only critical staff to remain and ensure they are aware of evacuation procedures	Hunter Energy
Low to Severe	<74	All directions	No	Monitor Fire Near Me	Normal Operations	Hunter Energy
			Yes (<2km)	Implement emergency management arrangements	Activate Stockpile sprinkler systems Undertake notifications and pre-emptive emergency planning Unlock access gates for emergency services	Hunter Energy