9. CONTEXT AND SETTING

9.1. OVERVIEW

In addition to the key areas identified in the DGRs, consideration has been given to the compatibility of the development within its immediate and broader context. In particular, the following matters have been considered:

- Built form compatibility;
- Landscaping; and
- Crime Prevention Through Environmental Design.

Overall site planning, with respect to setbacks, has taken into consideration the relevant local planning controls, contained within the Eastern Creek Precinct Plan and the Blacktown DCP 2015.

9.2. SITE LAYOUT AND BUILDING FORM

The development has been considered against the relevant local planning controls for development in the Eastern Creek Precinct and considered to be generally consistent.

The design of the facility with respect to building form and heights has largely evolved in response to operational nature of the technology. In particular, the following is noted:

- The generally liner extent of the building is a consequence of the moving grate technology layout;
- The building design has a graduated form and scale with the heights of various elements stepping up in height as they move into the site. This design approach overcomes the potential for adverse impacts associated with bulk and scale at the street and provides a site responsive design;
- The height of the emissions stacks was informed by detailed consideration of emissions and dispersion combined with the relevant design standard;
- The proposed subdivision is generally consistent with the minimum size requirements and dimensions of section 11.2 of the ECPP, except with regards to the proposed Lot 2, that will accommodate the substation;
- The proposed building setback from the proposed Estate Road are generally consistent with setbacks set out in the ECPP for standard collector roads, with the main façade of the building setback over 10 metres with a landscape edge along the road frontage; and
- Buildings have been sited, as far as is practicable to minimise impact on key biophysical features, in particular the Ropes Creek Tributary to the south. Where impact is unavoidable suitable management and mitigation measures are included, such as the revegetation using RFEF community species to offset the loss of existing vegetation removed to accommodate the building footprint.

The visual and aesthetic qualities of the development have been considered in detail in the Visual Impact Assessment report and **section 20** of the amended EIS. In general at a local level the building design and setbacks are considered to be consistent with the built form of the surrounding industrial buildings and those likely to be built as the precinct develops.

Materials and colours of muted and natural tones with low reflectivity will be used to ensure the development harmonises with the surrounding landscape.

9.3. LANDSCAPING

Landscaping proposed on site is consistent with the landscape theme across the Eastern Creek Industrial Precinct as detailed within the Eastern Creek Precinct Plan. The design objectives are to:

- Provide visual amenity generally against the built form;
- Provide screen amenity for the proposed industrial development;
- Create/ maintain passive surveillance of the Site; avoiding anti-social behaviour;
- Soften the ground plane;
- Provide vertical articulation via feature trees;
- Provide low-water-demanding plant species;
- Observe and maintain necessary safety and aesthetic sightlines; and
- Avenue tree planting to entries / formalised planting typologies.

Landscape treatment of the Site will be provided along the Precinct Road frontage as well as to the west of the tipping hall building. Batters are proposed around the perimeter of the subject Site which will be treated with mass planting and groundcovers to soften the appearance of the Site from surrounding locations.

The species of trees and shrubs have been carefully selected to compliment and provide a visual extension to existing streetscape.

The landscape plan prepared by Site Image (submitted at **Appendix D**) is considered suitable for the proposed development for the following reasons:

- Incorporates intensified landscaping along the Site's principle focal point closest to the public domain;
- Use locally indigenous species;
- Incorporates all planting species specified to meet Blacktown City Council species requirements;
- Incorporates drought tolerant and low-water demand planting, responding to the natural climate;
- Incorporates a range of low-maintenance native plants which will assist in maintaining an orderly site presentation for the development in perpetuity; and
- Includes landscaping and planting which will provide relief to the hardstand area.

The ground plane and landscape treatments are in proportion to the buildings and site, thus reducing the apparent scale of the built forms. The office area is provided with a simple outdoor terrace area.

The landscaping will be in accordance with the landscape plan prepared by Site Image and is provided at **Appendix D**. The plans prepared are concept and will be developed further as part of the detailed design process, at this stage consideration will be given to species selection to ensure all plantings are suitable for the saline soil conditions identified in the Soil and Water assessment by Edison Environmental.

9.4. CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED)

The NSW Guidelines for *Crime Prevention and the assessment of development applications: Guidelines Under section 79C of the Environmental Planning and Assessment Act 1979* has been used to inform the assessment of the application in relation to the primary principles of CPTED.

An assessment of the proposal against the CPTED principles is provided in Table 40.

9.4.1. CPTED Key Principles

Table 40 – Consideration of proposal against CPTED Principles

Principle	Design Response
Surveillance	
(a) Casual Surveillance	Casual surveillance is promoted through the predominantly open layout at the site. However, the use of the site for a traditional industrial operation provides limited opportunities for active uses at ground level. Active spaces, amenities blocks are located to the street frontage of the site and the 24-hour operation of the facility will ensure it is staffed at all times. Furthermore, CCTV will be used to monitor the site and 24-hour security will be present on site to responds to any safety concerns.
(b) Sightlines	The site has a generally open layout that promotes clear sight lines that will be enhanced during the evening through the use of suitable lighting and landscape works to achieve: • Building entries will have appropriate levels of lighting to avoid poorly-lit dark spaces to create a sense of safety and security. • Lighting will be 'vandal resistant' to limit breakage and maintenance issues. • Lighting will take into account all vegetation and landscaping in the car park, pedestrian pathways and street frontages that may act as an entrapment areas. • Lighting will be designed in accordance with standards that consider the control of obtrusive effects of outdoor lighting. • Lighting will be maintained and cleaned regularly. • Paths from the car parking areas to building entrances will be well lit and not obscured by vegetation. • External lighting will be activated 24/7. External lighting will be compliant with AS4282 'Control of the obtrusive effects of outdoor lighting to provide adequate safety for people on site, while minimising impact on surrounding land uses, roads and aircrafts. • The landscaping of the Site has been specifically designed to minimise opportunities for both the entrapment or concealment of intruders in the public domain, with all plantings being either low in height or having clear trunks to facilitate clear view lines across the Site. • Landscaping will not conceal the entry and exit points to the car park. • Planting of medium height or dense foliage will be avoided, which would obscure a person hiding behind them.

Principle	Design Response
	• Regular gardening and maintenance of the landscape areas will be undertaken to ensure that foliage does not obscure sight lines and complies with CPTED requirements.
(1) Access Control	Fencing is proposed around the perimeter of the facility to ensure the plant is secure. Fence heights will not obstruct views to and from the Site from a public place. The existing post and rail fencing will be maintained as part of the proposed works. New fencing and Armco barriers will be installed as required As well as fencing access control, will be achieved through: • Clear signage will be erected which indicates traffic direction and pedestrian access in all car parking areas. Signage will be strategically positioned within car parking areas, to facilitate ease of viewing for drivers in all parking bays. • The design has incorporated a clear vehicle entry/exit points for the Site. • Access into the Site will be controlled and restricted to those vehicles permitted to enter. • Pedestrian access to the building will have a clearly-defined direct pathway from the car park or hardstand areas.
(2) Territorial reinforcement	• Clear delineation of space is achieved through landscape treatments, signage and fencing will create a clear sense of ownership and territorial reinforcement between public and private space. • This will work in concert with access control measures combined with signage will be erected on the site to assist with way finding of visitors and guests. • Regular maintenance of the buildings will promote an image of a well-cared-for development which in itself discourages vandalism. • Appropriate materials will be utilised, where appropriate in the building, to minimise opportunities for vandalism.

9.5. CUMULATIVE IMPACTS & MITIGATION MEASURES

No cumulative impacts are anticipated to be associated with the design and layout of the site. In this regard while it is not considered necessary to implement formal mitigation measures to ameliorate potential impacts, to ensure that the development occurs in line with the matters set out above, a summary of mitigation measures integrate into the site design and function are set out in Table 41 that will ensure the preservation of amenity in the context of siting and building design.

Table 41 – Context & Setting: Mitigation Measures

Matter	Mitigation Measure	Timing
Visual Amenity	Materials and colours in accordance with those shown on Drawing No AR-KTA-1911 Rev 2.	Construction
	Implementation of landscaping in accordance with the concept land design package by Site Image. Final landscape detail and plant selection to consider the use of plants resistant to saline soils.	Prior to issue of Occupation Certificate
Lighting	All lighting used on site shall be implemented in accordance with AS4282 'Control of the obtrusive effects of outdoor lighting.	Construction and Operation.
Signage	No more than three (3) signs to be erected on the site. Signage to be in accordance with Krikis Taylor Signage Plan Drawing No. AR-KTA-1901 Rev 2.	Construction
CPTED	• Site layout in accordance with Krikis Tayler Architectural Plans; • Implementation of site boundary fencing; • CCTV will be used to monitor the site and 24 hour security personnel; • Use of appropriately placed lighting to ensure sightlines and promote recognition; and • Ongoing maintenance of landscaping and site.	Construction and operation.
Water Demand (Landscaping)	• A water demand strategy will be developed to identify measures aimed maximising the potential for water reuse on amenity landscaping.	Prior to construction certificate.

10. WASTE AVAILABILITY & MANAGEMENT

10.1. OVERVIEW

The DGRs for the Energy from Waste application include the following requirement for environmental assessment of waste management for the proposed Development:

Waste Management – including:

- *a description of the classes and quantities of waste that would be thermally treated at the facility;*
- *demonstrate that waste used as a feedstock in the waste to energy plant would be the residual from a resource recovery process that maximises the recovery of material in accordance with Environment Protection Authority Guidelines;*
- *procedures that would be implemented to control the inputs to the waste to energy plant, including contingency measures that would be implemented if inappropriate materials are identified;*
- *details on the location and size of stockpiles of unprocessed and processed recycled waste at the site;*
- *demonstrate any waste material (e.g. biochar) produced from the waste to energy facility for land application is fit-for-purpose and poses minimal risk of harm to the environment in order to meet the requirements for consideration of a resource recovery exemption by the EPA under Clause 51A of the Protection of the Environment Operations (Waste) Regulation 2005;*
- *procedures for the management of other solid, liquid and gaseous waste streams;*
- *describe how waste would be treated, stored, used, disposed and handled on site, and transported to and from the site, and the potential impacts associated with these issues, including current and future offsite waste disposal methods; and*
- *identify the measures that would be implemented to ensure that the development is consistent with the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Strategy 2007.*

Ramboll (formerly Environ) Consultants were engaged to prepare a *Waste Management Assessment* (attached as **Appendix J**) to address the above requirements. The following sections of the amended EIS demonstrate the way in which each of the matters identified in the DGRs has been responded to within the detailed documentation that forms part of the application.

Since the lodgement of the application, the EPA and their consultant ARUP have continued to raise matters relating to the current and future availability of the waste materials in light of ever improving recycling and reuse strategies. Along with matters of consistency between the stated processing volumes and capacities.

The proposal has been amended and clarified in several key ways to address this:

- The application has been formally amended reducing the maximum volume of residual waste fuels proposed to be treated in a year from 1.35 million tonnes to 1.105 million tonnes;
- The application has been amended to phase the implementation of the facility. With only phase 1 to be implemented in the immediate future. In order to support the delivery of phase 1 a maximum volume of 552,500 tonnes of residual waste fuels will be processed in a year.

  As outlined 4.2, consent is sought for the whole development, with implementation of phase 2 contingent on the proponent being able to satisfy the EPA on the availability of the additional 552,500 tonnes. As all the environmental assessment has been developed on the technological capacity of 1.35 million tonnes (above the proposed volume proposed to be processed) there should be sufficient certainty that key environmental targets such as emissions can be satisfied.

Since exhibition of the original EIS, the proponent has undertaken to provide the DPE and EPA with commercial in confidence information relating to waste sources and volumes currently available to TNG for processing at the Facility.

This information, combined with trends occurring in the broader waste industry has been reviewed by Ramboll in the revised Waste Report that concludes there is sufficient available residual waste being produced within the Sydney Metropolitan Area to support the operation and that these waste streams will continue to be available in the future owing to increasing population growth and urban expansion.

10.2. LEGISLATIVE REQUIREMENTS

- *Waste Avoidance and Resource Recovery Strategy 2007 (Department of Environment and Climate Change (DECC)).*
- *Waste Classification Guidelines (DECC).*
- *Environmental Guidelines: Assessment Classification and Management of Non-Liquid and Liquid Waste (NSW EPA).*
- *Environmental guidelines: Composting and Related Organics Processing Facilities (DEC).*
- *Environmental guidelines: Use and Disposal of Biosolid Products (NSW EPA).*
- *Composts, soil conditioners and mulches (Standards Australia, AS 4454).*

10.3. ASSESSMENT METHODOLOGY

The assessment methodology has involved the following:

- Compositional surveys of waste received and processed at Genesis MPC;
- Literature review of waste industry trends in recycling, reuse and landfill of waste streams proposed to be utilised at TNG; and
- Development of specific and appropriate measures to manage incoming waste streams to ensure use of only appropriate materials.

This Waste Assessment provides a comprehensive assessment of the potential waste management impacts of the proposed Facility and responds to the Director General's Requirements (DGRs) and NSW Environment Protection Authority (EPA) requirements in relation to waste management for the proposed Development, and State and Commonwealth legislative and policy requirements that would apply to the Facility, including the NSW Energy from Waste Policy Statement released in January 2015.

In addition, the report demonstrates how the proposed Development is consistent with the waste management hierarchy and State and national waste policies and legislation, and prioritises resource recovery.

10.4. ASSESSMENT OF KEY ISSUES

10.4.1. Residual Wastes

The NSW EPA, policy statement for Energy from Waste requires that *"only the residual of bona-fide resource recovery are eligible for use as feedstock".*

Approximately 23 per cent of the phase 1 fuel stock will be sourced from the adjacent Genesis Facility. The Genesis Facility is green star accredited and independently audited on annual basis as a means of verifying resource recovery targets to align with industry best practice. Furthermore, the EPA will have access to information relating to waste received and proposed as a means of "fact checking" their operations.

The MPC satisfies the criteria set out in the EfW Policy Guidelines, in that it achieves a diversion rate equal to or greater than 75% (the more conservative resource recovery criteria of mixed C&I and C&D).

Residual Waste Fuel from other resource recovery facilities are required require to participate in additional reporting under new POEO regulations. This data can be used by the EPA and/or TNG to ensure third party facilities achieve the diversion rates in the EfW Policy.

TNG will only accept waste for treatment from an authorised facility, as a pre-condition of getting “through the gate” so to speak. In the event that a delivery trucks presents at the site without authorisation it will either be turned away or diverted to Genesis MPC (depending on the nature of the materials). Furthermore, TNG will also request receipt of reports from third party facilities to verify the reported resource recovery rates of each facility. Proposed auditing and management processes are detailed in **Appendix J**. An overview of the process is provided in Figure 37.

10.4.2. Management of Incoming Fuels

10.4.2.1. Fuel originating from Genesis MPC

The best practice process at Genesis MPC from which input fuel is derived is described below.

Materials Receivable Delivery, Inspection and Classification

Waste materials are currently delivered to the Genesis Xero Waste Facility by a combination of light, medium and heavy vehicles, with loads typically varying from approximately one to 40 tonnes in weight. The waste received is co-mingled.

Classification of incoming waste is based on advice from the carrier, inspection of the carrier’s documentation prepared in accordance with the EPA (2008) *Waste Classification Guidelines* and verification of this information by visual inspection using the weighbridge camera (‘Check Point 1’).

Small mixed loads that can be unloaded by hand are directed to the hand unload area at the western end of the Genesis Xero Waste Facility. Larger mixed loads are directed to be tipped at the Genesis Xero Waste Facility work floor. Co-mingled wastes, either C&D or C&I, are tipped onto the floor within the Genesis Xero Waste Facility, where a second visual inspection takes place of the contents. Unacceptable wastes which may have eluded identification at the weighbridge are identified at this point and rejected either for disposal by landfilling on site or elsewhere.

Sorting

Where practicable, mixed loads delivered to the Genesis MPC are first segregated by material type and placed in adequate, appropriately labelled bays and bins for transport to appropriate stockpiles for recycling, or to landfill or off-site (as required).

The larger loads tipped at the work floor after inspection and verification are mechanically pre-sorted and inspected by working from the western to the eastern end of the building.

This process ensures the early removal of items that are:

- Easy to remove; and/or
- Unnecessary or undesirable to shred and process through the plant.

Following this pre-sorting process, these metals and other recovered items or materials (gas cylinders, air conditioners, fire extinguishers, colorbond steel sheets, steel beams or girders, copper pipes or wiring etc.) are stored temporarily in large bins within the Genesis Xero Waste Facility from where they are later transported for processing by others.

The remaining co-mingled waste is then fed into the Genesis MPC plant for automatic separation.

Efficient Separation and Processing

Separation machinery used at the Genesis Xero Waste Facility is state-of-the-art and is very efficient at segregating wastes for further processing and recycling, ensuring that recycling is maximised, while residual waste is minimised.

Of the waste loads received at the Genesis Xero Waste Facility that are classified as containing material capable of being recovered or recycled, it is estimated that, on average, 80% of materials will be recovered by sorting, separating and processing, and made available for resale or reuse by other processors. This represents the better and higher re-use of the material indicated by the *Waste Avoidance and Resource Recovery Act 2001.* Table 42 provides a summary of the waste streams recovered:

Table 42 – Recovered waste streams

Waste Streams	Waste Streams
• Road base; • Aggregates; • Bitumen road base; • Landscaping soil; • Bedding sand; • Dry shredded wood product (mulch and wood chip) • Green waste compost;	• Paper; • Cardboard; • Fabrics; • Carpet; • Gyprock; and • Polystyrene.

In accordance with the Resource Recovery Criteria of the Energy from Waste Policy, 25% of the total C&D waste processed by the Genesis MPC (the residual) will be used as fuel for the proposed Facility and 50% of the total C&I waste processed can be used as fuel for the proposed Facility. This allowable residual rate is higher than Genesis MPC's recovery rate of between 75% and 80%.

10.4.2.1. Fuel originating from other sources

As well as utilising residual waste streams from Genesis MPC waste fuels from external facilities will also be accepted and processed. To ensure that fuels delivered to the site are residuals TNG will implement a verification process to ensure that materials are bona fide residual wastes as well as being appropriate for treatment (i.e. not hazardous).

Procedures for Waste Receipt and Screening

It is envisaged that waste receipt and screening will occur in a manner similar to that adopted at the adjacent Genesis MPC. A copy of these detailed screening procedures is provided with the Waste Management Report (WMR) prepared by Ramboll at **Appendix J.** This process is summarised in Figure 37**.**

The Genesis facility is accredited by Green Star an independent, voluntary and internationally recognised sustainability rating system. The facility is audited annually by independent green star environmental specialists, who review the systems and processes in place at a waste service facility to ensure that meet compliance with the green star framework. A copy of the green star reporting and compliance framework is provided with the Ramboll WMR. The same process of verification will be applied to TNG.

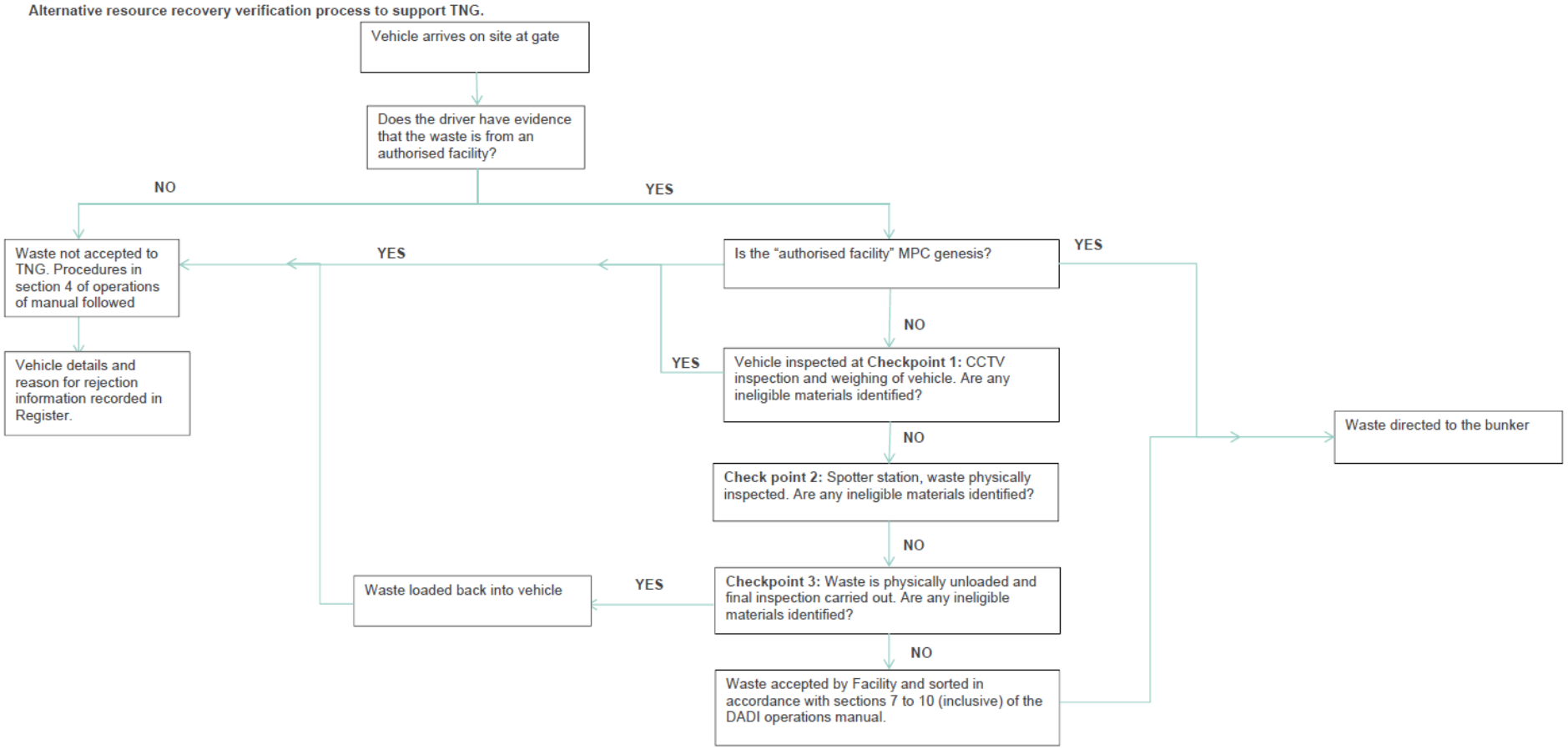
10.4.2.2. Waste storage

Waste delivered to TNG from the adjacent Genesis facility and external licensed contractors is stored in a waste bunker, located within and enclosed building referred to as the tipping hall.

The bunker has the capacity to store around 5 – 7 days worth of fuel. There is no open stockpiling of waste fuel materials and the tipping hall is kept under negative pressure to ensure the control of fugitive emissions. Waste stored within the bunker is mixed a minimum of three (3) times by the overhead crane prior to being loaded onto the grate.

The location and the size of the waste bunker is detailed in the architectural plan package provided at **Appendix C.**

Figure 37 – Flowchart for verification of waste materials received at TNG



10.4.3. Availability of Waste

A waste management report has been prepared by Ramboll Environ to support the proposal (**Appendix J**). This report includes the outcome of research to determine the current and potential future availability of residual waste fuels in NSW, using:

- confidential information supplied by DADI in relation to the volumes and sources of waste received, processed and landfilled at the Genesis Facility (provided under separate cover to the DPE/EPA); and
- publicly available data on resource recovery and recycling trends in the Sydney Metropolitan area and NSW.

Research and analysis has focused on the five (5) main waste streams including proposed to the form of the design fuel mix at TNG including, chute residual waste (residuals from the Genesis MPC), C&D, C&I, floc waste and AWT. These estimates are set out in Figure 38.

Figure 38 – Estimated availability of waste (Source: Ramboll: WMR; 216)

	% Fuel Mix[1]	Phase 1[2] '000'	Phase 2[3] '000'	Estimated Available Waste SMA[4] '000'
CRW	23.27%	128	257	361
C&D	28.69%	158	317	1,112
C&I	16.18%	89	178	1,430
Floc residual	14.43%	79	159	170
AWT residual	6.87%	37	75	200
Paper Pulp residual	4.81%	27	53	25
GO residual	2.06%	11	22	21
Glass residual	1.76%	9.5	19	486
MRF residual	1.20	6.60	13	17
TOTAL	**100%**	**552,5**	**1,150**	**3,822**

Note: Figures in this table are rounded up and down for simplicity. Refer to Table 7 for exact quantities.

[1] Percentages derived from the Project Definition Brief.
[2] Figures based on percentage data from Phase 1 processing capacity of 552,500 tpa
[3] Figures based on percentage data from Phase 2 processing capacity of 1,105,000 tpa
[4] Data base on estimated derived in Sections 7.1, 7.2 and 7.3

10.4.3.1. CRW – Genesis Facility

As outlined in the Ramboll Waste report, DADI has provided a confidential waste report outlining details of currently available waste tonnes received and processed across DADI's extensive waste asset portfolio for the year ending 30 June 2015. Based on this report DADI currently processes the following waste volumes:

- 879,249 tonnes received at Genesis (for materials processing – involving the sorting and separating of waste for the purpose of recycling and reuse); and
- 530,118 is landfilled (residual wastes – a portion of which may be described as CRW); and

Of the 530,118 tonnes of waste sent to landfill in the year ending 2015. 361,806 was a potential fuel for the EfW fuel facility having been identified as non-contaminated soils or non-asbestos containing soils.

Accordingly based on the most recent reported statistics of waste processed and landfilled at the Genesis site a total of 68. 2 percent of material could have feasibly been diverted from the landfill to TNG.

As this waste fraction represents materials that have already gone through DADI's three (3) phase screening process to remove all materials for higher and better purposes that is reviewed and accredited by Greenstar on annual basis, it is considered that this is verifiable waste residuals.

The data supporting the above, has been submitted direct to the DPE and EPA for verification. Given its commercial content the information is confidential in nature. However, as the incoming waste materials are accounted for by reference to an EPA mandated descriptive category. Returns are forwarded monthly to the NSW EPA identifying the quantity by weight of each material in each specified category. All stockpiles of these materials are subject to a biannual aerial photograph and independent survey the results of which are reported to the NSW EPA.

Furthermore, under the current NSW waste levy it is more profitable for DADI to recycle waste as oppose to using the waste for a fuel source in the TNG Facility. Therefore, it will be the preference and aim of DADI's Genesis MPC to recycle as far as reasonable practicable and not divert any recycling opportunities in favour of use at the Facility.

10.4.3.2. C&D and C&I Waste NSW

Information on the current and likely availability of construction and demolition (C&D) and commercial and industrial (C&I) waste steams was obtained from the National Waste Report, 2013 which was collated by the Commonwealth Department of the Environment (now the Department of the Environment and Energy) (National Waste Report 2013). This report is the most recent publicly available collection of waste data for these streams.

The following is a summary of Ramboll's findings in relation to the availability of C&D and C&I waste streams as a potential fuel source in NSW:

- C&I waste generation was approximately 5,500,000 tonnes per annum with a resource recovery rate of 60 per cent, which is 1 per cent above the Australian average. NSW was targeting a C&I recovery rate of 63 per cent by 2014. Therefore **2,200,000 tonnes per annum** is potentially available for EfW fuel source in NSW; and
- C&D waste generation was approximately 6,900,000 tonnes per annum with a resource recovery rate of 75 per cent which is nine percentage points above the Australian average. NSW is targeting a C&D recovery rate of 76 per cent by 2014. Therefore 1**,725,000 tonnes per annum** is potentially available for EfW fuel source in NSW.

Taking into account the current targets and trends for resource recovery in NSW Ramboll Environ estimate that the following amounts of waste available in SMA are potentially available as a fuel source for EfW:

- 1,112,150 tonnes of C&D; and
- 1,430,000 tonnes of C&I.

The above estimate assumes taking a representative 65 per cent (represented NSW population in the SMA) from the figures of the National Waste Report, 2013. Ramboll considers this to be a conservative assumption as the percentage of construction and industry in the Sydney area would represent a higher ratio to rural and township areas of NSW when compared against the population percentages (greater construction activities, greater density of commercial and industrial waste generators etc.).

While NSW continues to improve in waste recovery rates, the future availability of waste to support the operation of TNG. In particular, the availability of waste derived from C&I and C&D waste streams is not considered to be compromised as despite improving recovery long term trends indicating that waste generation continues to increase. In particular, Ramboll's report points to a 12 per cent increase in waste generation between 2006/07 to 2010/2011.

10.4.3.3. Source Separated Waste NSW

Publicly available information relating to these waste streams is not always readily available. Estimates of waste availability across this stream were established using a mix of public information and the information contained in the DADI confidential report. Based on the information contained in the latter, Ramboll was satisfied that there is currently sufficient waste within this category to support the implementation of TNG Phase 1.

Availability is summarised in Figure 39**.**

Figure 39 – Estimate of available source separated waste (source: WMR, Ramboll; 2016)

Source Separated Waste	Estimated waste to landfill	Source	Scope of Source
Floc residual	169,152 tpa	Confidential, *Source of Waste Report, November 2015,*	Source Waste Report stated that 112,768 tpa of floc residual is received at the Genesis landfill. At the time of this report Genesis was receiving floc residual from two of the three main producers. Based DADI verified calculation on known availability an estimated 169,152 tpa is available from the three main producers.
Paper Pulp residual	25,101 tpa	Confidential, *Source of Waste Report, November 2015,*	Source Waste Report stated that 25,101 tpa of pulp residual is received from one customer alone.
MRF residual	Not available	*National Waste Report 2013*	There are 34 MRF and mechanical sorting facilities in NSW. Residue quantities were not available but based on DADI experience the amount of available waste which would otherwise go to landfill is sufficient.
	17,633.98 tpa from the MPC alone.	Confidential, *Source of Waste Report, November 2015,*	The Confidential Report prepared by TNG indicated the following volumes of incoming MRF residual (both baled and loose MRF) to the Genesis landfill alone. The waste volumes are reported as per the EPL.
AWT residual	200,929 tpa (SMA)	*NSW EPA, NSW Local Government Waste and Resource Recovery Data Report – as reported by council 2012-13*	In 2012–13, four councils from the SMA started sending part of their residual waste to an AWT facility. A total of 21 councils (15 from the SMA), sent all or part of their kerbside residual waste to an AWT facility
Glass residual	468,000 tpa	*Sustainability Victoria, Market Fact Sheet – recycled glass*	While this is not NSW report, Victoria is recovering 76% of glass waste and has a smaller population then NSW. The Facility anticipates requiring a fraction (26,575t for Phase 2) of the Victorian estimated waste to landfill volumes (see **Table 7**).
	7,376 tpa	Confidential, *Source of Waste Report, November 2015,*	The Confidential Report prepared by TNG indicated that 7,376 tpa from one supplier alone is sent to the Genesis landfill..
GO residual	21,210 tpa (SMA)	*NSW EPA, NSW Local Government Waste and Resource Recovery Data Report – as reported by council 2012-13*	- Of the 466,984 tpa of 'kerbside organics bin' collected 15,837 tpa is disposed of; - Of the 168,875 tpa of 'drop off organics' collected 14,050 is disposed of. - Of the 31,557 tpa of 'clean up organics' collected 4,883 is disposed of. The report estimates 61% of the data is from SMA
	Not available	*National Waste Report, 2013*	The report does not include GO residual from GO processing facilities. There are 55 GO processing facilities in NSW. Data on residue to landfill was not publically reported.

10.4.3.4. Consideration of Availability

Figure 39 provides a summary of the findings of Ramboll's research that concludes based on estimates made using publicly available data there is potentially 3,822,000 million tonnes of waste available within the Sydney Metropolitan Area currently going to landfill that may be utilised for higher and better purposes, such as energy recovery.

TNG acknowledges that due to technological advances and regulatory changes, recycling percentages have increased over time and will continue to increase. However, despite these continual improvements trend data indicates that waste generation continues to rise in line with population and economic growth, as seen in the three (3) years between 2006/07 to 2010 where waste generation increased 12 percent.

Recent trends for landfill in NSW (i.e. 2012 – 2014) have been influenced by policy changes in Queensland that abolished landfill levies that saw significant volumes of waste transported interstate for disposal, artificially skewing local data on landfill trends and rates over this period. However, policy reform in NSW to introduce a "Proximity Principle" now makes it an offence to transport any waste by road more than 150 km from where it was generated in NSW. It is anticipated that this amendment in policy will divert waste back to NSW landfills and may contribute to further increases in the volume of residual waste available to be treated by TNG. As this trend is yet to be captured and reported the quantities of this has not been quantified.

Given the nature of waste, it is acknowledged that information regarding availability of certain waste streams varies and that waste recycling percentage have increased. However, the availability of waste as a fuel sources has commercial consequences to TNG, therefore TNG have undertaken to ensure an adequate supply of waste is available for both phases 1 and 2 of the project.

10.4.3.5. Existing Agreement or Arrangement

A source of waste report (submitted confidentially, due to the commercial in confidence nature of the information) demonstrates that the adjacent and associated Genesis MPC currently diverts to landfill waste types and volumes capable of providing 23 per cent of required volume for the operation of Phase 1 of the development.

The WMR report as discussed in this section of the amended EIS has addressed the availability of waste in a broader context and demonstrates that trends in waste management. The need to provide signed agreements and arrangement as part of the assessment of an application is unreasonable and unnecessary as these are commercial matters beyond the consideration of the EP&A Act 1979.

10.4.4. Waste Outputs

10.4.4.1. Output Waste Types and Quantities

The facility will generate the following wastes:

- Ash residue (bottom ash, boiler ash, and APC ash);
- Ferrous material residue;
- Liquid effluent (although not during normal operation);
- Gaseous emissions (pyrolysis gas);
- Staff waste; and
- Other waste.

Bottom ash

Bottom ash is the burnt-out residue from the combustion process. The specific contaminant concentration of lead and nickel in bottom ash it typically at hazardous levels. However, when applicable leachability is taken into account, the ash can be classified as general solid waste.

Boiler ash

The characterisation of boiler ash is dependent upon in which boiler pass it is accumulated in. Boiler ash of the horizontal pass will be conservatively disposed of with the APC residues. The composition of the ash from the first vertical passes is similar as the bottom ash and can be disposed of with the latter

Air pollution control (APC) Ash

Flue Gas Treatment (FGT) residue, also known as APC residues, comprise fine particles of ash and residues from the FGT process. APC residue is collected in bag filters and will contain fly ash and reaction products from the hydrated lime scrubber and spent activated carbon. Due to the heavy metals involved in FGT, there is the potential for this waste to be classified as hazardous waste.

Based on a maximum fuel input of approximately 1,350,000 tpa (8,000 hours operation at NCV of 10 MJ/kg and ash content 20%), it is estimated the proposed Facility will generate approximately 51,700 tpa of APC residue.

Based on a fuel input of 1,105,000tpa at design waste composition with NCV of 12.30 MJ/kg the amount of ash (three types) generated at the nominal load (8,000 hours) would be 336,966tpa. Of this, 293,166 tpa will be bottom ash (with 20% moisture content due to water absorbed from the quench bath) and 543,800tpa will be APC ash.

Ferrous Material Residue

Ferrous metals will be removed from the bottom ash by means of magnetic separators (or if adequate pre-treatment, magnet may not be required) and discharged to into bins which are then transported offsite to metal recycler.

Mass Balance

The residue production from the Facility has been estimated and presented in Figure 40.

Figure 40 – Waste Outputs Generated by EfW

Parameter	Units	Design fuel	Worst case fuel
Fuel NCV	MJ/kg	12.30	10
Ash content	%	21.49	20
Fuel Flow	tpa	1,105,000	1,350,000
Bottom ash (dry)	tpa	237,465	324,000
Bottom ash (wet)	tpa	293,166	400,000
FGT/APC residue	tpa	43,800	51,700
Combined ash and residue	tpa	336,966	451,700

10.4.4.2. Output Waste Storage, Management Disposal

Table 43 provides a summary of all waste outputs generated through the EfW process. In general waste materials arising as a result of the operation, where required, can be managed adequately through the implementation of the waste management plan and specifically those matters outlined in Section 6 of the Ramboll Waste Management Report (refer to **Appendix J**).

Table 43 –Overview of waste outputs generated as a result of EfW Process

Waste Output Stream	Storage	Disposal	Alternative reuse
Bottom Ash	On site storage collection bays capable of 5 days storage capacity.	Landfill (non-putrescible; non-hazardous).	Requires an EPA exemption. No alternative reuse sought.
APC residue/Boiler Ash	Residue and reagent materials will be stored in silos and tanks before being taken off site.	Landfill (Hazardous) or treated, verified and disposed of as general solid waste.	N/A
General Waste (staff waste)	On site storage in $3m^3$ bins.	Putrescible Landfill: Genesis currently serviced by SITA.	N/A
Ferrous Material	On site storage. Stored with bottom ash.	N/A	Transported off site to a recycler.
Packaging/drums/containers used to store chemicals (used in FGT)	In separated waste storage bins; in bunded area.	Collected by supplier or disposed of in accordance with their waste classification.	N/A
Liquid Effluent	N/A	N/A	Water reuse within the treatment process to achieve a water balance.
Gaseous Emissions (pyrolysis gas)	N/A	Released through stack emissions following treatment in FGT.	N/A
Miscellaneous (chemical packaging, waste oils etc)	Stored in accordance with WHS policy.	Classified prior to disposal at appropriate facilities.	N/A

10.5. CUMULATIVE IMPACTS AND MITIGATIONS MEASURES

Objective 3 of the NSW Waste Avoidance and Resource Recovery Strategy 2007 is to *'Divert Waste from Landfill - By 2021/22 increase waste diverted from landfill from 63% to 75%'.* The proposed Facility will itself contribute approximately 20 precent additional diversion from landfill in accordance with the Energy from Waste Policy Statement.

Table 44 provides details of the mitigation measures that will implemented in the operation of the facility to ensure only residual fuels from the identified waste streams are utilised.

Table 44– Mitigation Measures: Waste Management (Inputs and Outputs)

Matter	Mitigation	Timing
Waste Streams	TNG may only receive and process the following residual waste materials: • Genesis MPC Chute Residual Waste; • Construction and Demolition; • Commercial and Industrial; • Floc Waste; • AWT; • GO Waste; • Paper Pulp; and MRF TNG shall not receive or process hazardous waste materials. Details of all waste processed by TNG shall be reported to the EPA.	Operation: ongoing
Waste Management: Receipt of waste materials	Prior to commencement of operations, the operator shall develop an appropriate waste screening methodology. At a minimum the plan will include the following details; • Details of the residual waste streams that may be accepted from third party authorised facilities; • Detailed procedures for all employees on the process of accepting residual waste materials, including • Preliminary inspection of waste, source verification and CCTV footage; • Visual inspection post tipping; • Contractual tools such as penalties or right of refusal for delivery of waste with high lead or nickel concentrations; • Pre-screening, sorting and separation processes to remove hazardous materials at MPC, PSC and/or other authorised facilities.	Operation: ongoing

Matter	Mitigation	Timing
	• Reporting tool for the tracking of waste volumes and types received and processed. • Procedures for the exclusion and/or rejection of waste loads that have - not undergone resource recovery; and - loads that fail inspection at any point in the screening procedures.	
Waste Management: Audit Framework	Develop and implement auditing framework for external residual waste fuel suppliers. That should include details of: • The identification of an independent auditor(s). • The frequency with which audits may be undertaken; • Standards that external residual waste fuel providers are required to meet to process waste at TNG; • Contractual penalties for authorised facilities who fail the independent audit	Operation: Ongoing
Ash Handling and Management	• APC residues will be collected into sealed storage silos and transported via sealed tanker off-site for further treatment or disposal at landfill. In the event APC residue exceeds the criteria for Restricted Solid Waste, the residue will be taken off site to a Hazardous Waste Treatment facility, in line with relevant hazardous waste legislation.	Operation: Ongoing
Waste Management: General	Develop and implement an operational waste management plan in accordance with the section 6 of the Ramboll, WMR. The plan shall detail, as a minimum: • Storage methods and location of all wastes arising; • Where disposal is required, the location of disposal; • Maintain waste register of all outgoing wastes, in particular • Procedures for storing and transporting hazardous waste. • Options to immobilise waste will be examined in the event that sorting does not reduce lead and nickel	Prior to commencement of Operations.

Matter	Mitigation	Timing
	concentrations to be able to achieve a 'restricted solid waste' classification; and Periodic testing of bottom ash.	
Waste Management Output (Disposal)	• Bottom ash from the grate will be removed by quenching with water and moving it by conveyor to the enclosed ash storage bunker where it is stored prior to being transported off-site. The conveyor passes under a magnetic separator to remove ferrous materials.	Operation: Ongoing
	• Boiler ash will be disposed of with the APC residues, unless it can be proven to be reusable following rigorous testing procedures in compliance with EPA regulations.	
	• Any ferrous material removed, post combustion, shall be directed to an appropriate reuse and/or recycling facility.	

10.6. SUMMARY AND CONCLUSION

The facility, operating at its technological capacity, is capable of exporting approximately 137.3 MW of electricity to the grid.

Details on the source and composition of residual Waste Fuel to be received at the Facility has been provided, and it has been demonstrated the facility can operate with this fuel profile given the alignment between the Proposed and existing EfW facilities in the UK and Europe which operate successfully with similar fuel and the same, or similar technology to that proposed.

The significant anticipated population growth in the Sydney Metropolitan Area, coupled with an increasing per capita consumption rate, is expected to contribute to the quantity of waste generated across all waste streams. It is expected by the time the Facility has been commissioned; sufficient allowable tonnes will exist in the regulated area and in NSW as a whole for the proposed Facility.

11. AIR QUALITY

11.1. OVERVIEW

The project DGRs identify the following “key matters” for the purposes of undertaking environmental assessment to determine the suitability of the development with respect to air quality:

Air Quality and Human Health - including:

- *a quantitative assessment of the potential air quality and odour impacts for the development on surrounding landowners and sensitive receptors under the relevant Environment Protection Authority guidelines;*
- *a description of construction and operational impacts, including air emissions from the transport of materials;*
- *details of any pollution control equipment and other impact mitigation measures for fugitive and point source emissions;*
- *a demonstration of how the waste to energy facility would be operated in accordance with best practice measures to manage toxic air emissions with consideration of the European Union’s Waste Incineration Directive 2000 and the Environment Protection Authority’s draft policy statement NSW Energy from Waste;*
- *an examination of best practice management measures for the mitigation of toxic air emissions; and*
- *details of the proposed technology and a demonstration that it is technically fit for purpose.*

Hazard

- *Detail contingency plans for any potential incidents or equipment failure during the operation of the project.*

In Mach of 2014 following the issue of the project DGRs in December 2013 the NSW Environmental Protection Authority (EPA) published a formal policy statement for the management and assessment of Energy from Waste facilities.

The EPA EfW Policy, with respect to air quality, requires demonstration of the implementation of Best Available Technology (BAT) in the thermal treatment of waste materials and that as a minimum the emissions targets of the *Protection of the Environment (Clean Air) Regulation 2010* are attained to ensure the protection of amenity and human health.

The initial air quality assessment report, submitted and considered as part of the original environmental impact statement adopted the IED emissions profile and limits for the purpose of assessing the potential impact on existing air quality. Since this time, further research has been undertaken into operating reference plants and sourcing of actual plant emissions data. In this regard, the amended air quality report has utilised air emissions data from operating EfW plants in Europe.

In combination with the above, detailed design review of the technology has been undertaken to ensure the integration and delivery of BAT in line with European Standards set by the European Industrial Emissions Directive (EU, IED), noted to be a more stringent control than the NSW PoEO Regulation Standard. A detailed BAT assessment is provided in **Appendix KK.** The management of air quality is primarily related to the management of emissions and the type of flue gas treatment utilised. In this regard, the project will implement following flue gas treatment system, aimed at reducing primary emissions of concern:

- Optimised Selective Non-Catalytic Reduction (SNCR) to further reduce emissions of oxides of nitrogen (i.e. NO_x)

- Dry lime scrubbing for reducing emissions of acid gases, including HCl and SO_2.
- Activated carbon injection for reducing emissions of dioxins and Hg.
- Fabric filters for reducing emissions of particles and metals.
- Following flue gas treatment, emissions will be dispersed via a 100m stack.

A detailed assessment of the proposal has been undertaken by Pacific Environment (**Appendix K**). This assessment has identified the typical emissions profile based on operating EfW plants, modelled in the context of the local meteorological conditions and concluded that the project is capable of operating within project specific emission limits that will ensure the preservation of amenity and human health.

11.2. LEGISLATIVE REQUIREMENTS

Legislative and policy instruments used in the assessment, management and regulation of air quality in NSW, include;

- *Protection of the Environment Operations Act 1997*
- *Protection of the Environment Operations (Clean Air) Regulation 2010;*
- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC); and*
- *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC).*

The environmental assessment considered the following requirements with regards to air quality:

- The NSW OEH prescribe ambient impact assessment criteria which as outlined in their 'Approved Methods for Modelling and Assessment of Air Pollutants in NSW' (NSW DEC, 2005); and
- NSW Environment Protection Authority's Energy from Waste Policy Statement sets out the policy framework and overarching criteria that applies to facilities in NSW proposing to thermally treat waste or waste-derived materials for the recovery of energy. The policy also requires that emissions from EfW facilities must satisfy, as a minimum, current emission limits prescribed by the *POEO (Clean Air) Regulations*.

11.2.1. NSW EPA Energy from Waste Policy Statement

TNG proposes to thermally treat waste fuels that are not listed under section 3 of the EPA Energy from Waste Policy Statement. Accordingly the proposal is classed as an *"energy recovery facility"* under section 4 of the policy and is required to demonstrate the implementation of internal best practice in relation to the following matters (as they relate to air quality):

- Emission control equipment; and
- Emission monitoring with real time feed back to the controls of the process.

The proposed technology for the Facility is based on existing facilities in Europe and will incorporate best available technology (BAT) for flue gas treatment (refer to Project Definition Brief, **Appendix CC** and the BAT assessment at **Appendix KK**). The flue gas treatment is designed to meet the in-stack concentrations limits for waste incineration set by the EU, IED. The IED emissions limits are generally more stringent that the *POEO (Clean Air) Regulations*.

A summary of the technologies used to control emissions from the thermal treatment of waste at existing EfW facilities is provided and at **Appendix CC.** This summary presents what constitutes current international best practice and demonstrates that existing technology can satisfy the emission limit requirements of the EU IED, and therefore is appropriate for the EfW facility.

11.3. ASSESSMENT METHODOLOGY

The air quality impact assessment was undertaken having regard to the Site context, potential impacts of the proposed Development, consideration of statutory requirements and identification of appropriate mitigation measures. Air quality impacts were assessed at the closest sensitive receptors, including

locations such as schools and hospitals, located within the closest residential suburbs of Minchinbury and Erskine Park.

The AERMOD atmospheric dispersion model was selected as a suitable dispersion model due to the source type, location of nearest receiver and nature of local topography. Preliminary iterative modelling was completed and determined that a stack height of 100m was required to demonstrate compliance with the NSW impact assessment criteria.

Modelling predictions for air toxics were assessed against the 99.9^{th} percentile prediction, at and beyond the Site boundary. The ambient concentration of H_2S was assessed against the 99^{th} percentile prediction.

An emissions profile was established using publically available information compiled and reviewed for suitability by Ramboll. A total of seven (7) reference facilities were identified based on the technology in use and the fuel profile (i.e. waste streams being treated).

While no exact replica of the TNG plant was identified, it is considered that the number of plants review for the purposes of establishing the emission profile based on comparative fuel stock is representative of the future emissions at TNG.

11.4. ASSESSMENT OF KEY ISSUES

The primary emissions from the EfW facility, as defined by emission limits for waste incineration set by the European Union (EU) Industrial Emissions Directive (IED; Directive 2010/75/EU), are anticipated to be as follows:

- Particulate matter (PM), assumed to be emitted as PM_{10} and $PM_{2.5a}$.
- Hydrogen Chloride (HCl).
- Hydrogen Fluoride (HF).
- Carbon Monoxide (CO).
- Sulfur Dioxide (SO_2).
- Oxides of nitrogen (NO_x) (expressed as Nitrogen Dioxide (NO_2)).
- Heavy metals (including Mercury (Hg), Cadmium (Cd), Arsenic (As) and Chromium (Cr).
- Gaseous and vaporous organic substances (expressed as total organic carbon (TOC)).
- Dioxins and furans.

In addition to the atmospheric emissions identified in the EU IED, other potential emissions that have been addressed include:

- Hydrogen sulfide (H_2S).
- Chlorine (Cl_2).
- Ammonia (NH_3).
- Polycyclic -aromatic hydrocarbons (PAHs).

11.4.1. Existing Air Quality

Existing air quality was established using available data collected by the Office of Environment and Heritage (OEH), at monitoring stations in St Marys and Prospect and a Genesis Facility monitoring station in the suburb of Minchinbury. Data collected spanned a five (5) year period, from 2009 to 2013.

Generally, air quality for the local area can be described as good, with the exception of isolated high pollution days or extreme events such as dust storms and bushfires.

- Annual Average and maximum 24-hour average Pm_{10} concentrations for St Marys, Prospect and Minchinbury showed several exceedances. However at least one event, in 2009, was associated with significant recorded dust storm events. Exceedances in 2013 accounted for 2 days. Under the Air-NEPM up to five (5) days of exceedance falls within an acceptable range;
- NO_2 (Nitrogen Dioxide) concentrations for St Marys and Prospect are below EPA guideline levels based on annual average and maximum 1 hour averages;
- SO_2 (Sulfur Dioxide) concentrations for Prospect are below EPA guideline levels based on annual average and maximum 1 hour averages; and
- CO (carbon monoxide) concentrations for Prospect are below EPA guideline levels based on annual average and maximum 1 hour averages.

11.4.2. Best Available Technology

The proposed technology for the Facility is based on existing facilities in Europe and will incorporate best available technology (BAT) for flue gas treatment (refer to BAT Assessment Matrix provided at **Appendix KK**).

Emissions from EfW are primarily controlled by the flue gas treatment process. The flue gas treatment proposed for TNG is designed to meet the in-stack concentrations limits for waste incineration set by the EU IED. The IED emissions limits are more stringent that the NSW *POEO (Clean Air) Regulation* limits and therefore achieve a better outcome, capable of reducing emissions concentration below NSW guidelines.

An overview of the FGT system is provided in **section 4.5.8** of this amended EIS with a more detail set out in **section 7.1.2** of the AQ Assessment (refer to **Appendix K**).

A review of existing EfW facilities (mostly in the UK and Europe) indicates that BAT measures are routinely implemented at EfW facilities. Research undertaken by Ramboll, set out in the reference facility technical memo (refer to **Appendix DD**) demonstrates the application of the selected technology in operating EfW plants processing waste fuels similar to those proposed by TNG.

BAT measures integrated into the design and operation of the facility, in particular the FGT, are outlined in Figure 41

Figure 41 – BAT for EfW Flue Gas Treatment

Substance	BAT	Comments
Particles	Fabric filters / bag filters Cyclones Electrostatic precipitators	Fabric filters are generally sufficient to meet the emissions limits than prescribed by the EU Waste Incineration Directive and typically employed at existing EfW facilities.
Hydrogen chloride (HCl) Hydrogen Fluoride (HF) Sulfur Dioxide (SO2)	Waste control Wet scrubbers Dry and semi dry scrubbers	Wet FGT results in lowest emissions; however Dry FGT has the co-benefit of removing PCDD/F and mercury (with addition of activated carbon injection). Dry/semi dry most commonly employed at existing EfW facilities.
Oxides of Nitrogen (NOx)	Reduction of thermal NOx through combustion control and Flue Gas Recirculation Selective Catalytic Reduction (SCR) Selective Non Catalytic Reduction (SNCR)	Waste and combustion control with SNCR/SCR can generally result in emissions within limits prescribed by the EU Waste Incineration Directive. SNCR typically employed at existing EfW facilities.
Carbon Monoxide Gaseous and various organic substance (TOC)	Combustion control	Activated carbon injection may provide additional benefit of VOC control.
Mercury	Wet scrubbing with injection Activated carbon injection Condensing scrubbers Resin filters	Adsorption using carbon based reagents generally needed to meet limits prescribed by the EU Waste Incineration Directive. Activated carbon injection typically employed at existing EfW facilities.
Metals	Activated carbon injection Fabric filters	Techniques that control dust will also control metal emissions and fabric filters commonly used. Activated carbon injection additionally controls volatile metals (Hg).
Dioxins and Furans (PCDD/F)	Primary (combustion control) techniques, flue gas recirculation Selective Catalytic Reduction (SCR) Catalytic filter bags Adsorption by activated carbon injection / static beds Wet scrubbing with carbon injection / carbon slurries	Secondary abatement generally needed in combination with primary (combustion control) to meet limits prescribed by the EU Waste Incineration Directive.

11.4.3. Emissions during Normal Operations

Emission rates for modelling are estimated based on the EfW facility meeting the more stringent limits prescribed in the EU IED. The emission limits prescribed by the IED are expressed as both daily averages and half hourly maximums. Although the limits are based on the IED, the facility will be licenced under the NSW POEO Clean Air Regulation, which uses standards of concentration expressed as a 1-hour block (or the minimum sampling period in the relevant test methods).

Dispersion modelling is therefore based on the higher short term limits (where available), regardless of the averaging period for assessment of impact on ground level concentration (GLCs). In other words, even though the ambient assessment criteria for PM_{10} are expressed as 24-hour and annual averages,

the half hourly IED limit is used for all modelling, not the daily average so as to provide worst case emissions scenario.

In the main, the emission rates (g/s) adopted for modelling of each stack presented in Figure 42, are derived from the concentration limits (mg/Nm^3) and flue gas flow rate per stack (Nm^3/s) described in **Appendix K.**

Figure 42 – Instack emissions during normal conditions (source; PE; AQA; 2016)

Emission Parameter	In-stack concentration during normal operations (mg/m^3)[a]	Mass emission rate used to model normal operations (g/s)
Oxides of Nitrogen (NO_x expressed as NO_2)	188	24
SO_2	27	3.4
CO	23	2.9
PM	1.0	0.1
HCl	9.0	1.1
HF	4.0	0.5
Cd	0.009	0.001
Hg	0.004	0.001
Dioxins and furans	0.000000010	0.000000001
TOC (as benzene)	0.015	0.002
NH_3	2.0	0.3
H_2S	5.0	0.6
PAH (as benzo(a)pyrene)	0.0005	0.00006
Cl_2	9.0	1.1

Notes: (a) Reference conditions defined as dry, 273.15 K, 101.3 kPa and 7% O_2 for all air impurities when burning a solid fuel.

Where emission limits are not available as part of the EU IED the emission limits from the Clean Air Regulation have been adopted, as in the case for H_2S.

In the case of Cl_2, the Clean Air Regulation limit (200 mg/m^3) is considered inapplicable (overly high) to be used to estimate the mass emission rate of this compound. Rather, the EU IED limit for HCl (60 mg/m^3) is considered a more appropriate in-stack concentration upper limit for Cl_2.

A summary of the predicted ground level concentration (GLC) for each pollutant is presented in the Figure 43 below. GLCs are presented at and beyond the Site boundary, as well as the maximum prediction at sensitive receptors.

Figure 43 – Type figure caption here.Summary of predicted ground level concentrations during normal operations (PE: AQA; 2016)

Pollutant	Averaging period	Units	Criteria	Highest prediction at and beyond site boundary	Highest prediction at sensitive receptor
NO_2 (a)	1 hour	µg/m³	246	77.1	51.5
	Annual	µg/ m³	62	3.4	3.1
SO_2	10-minute	µg/ m³	712	15.9	10.6
	1 hour	µg/ m³	570	11.1	7.4
	24 hours	µg/ m³	228	1.9	1.7
	Annual	µg/ m³	60	0.49	0.45
CO	15-minute	mg/ m³	100	0.01	0.008
	1 hour	mg/ m³	30	0.009	0.006
	8 hours	mg/ m³	10	0.007	0.006
PM_{10}	24 hours	µg/ m³	50	0.07	0.06
	Annual	µg/ m³	30	0.018	0.017
$PM_{2.5}$	24 hours	µg/ m³	25	0.07	0.06
	Annual	µg/ m³	8	0.018	0.017
HCl	1 hour	mg/ m³	0.14	0.004	0.003
HF	24 hours	µg/ m³	2.9	0.28	0.26
	7 days	µg/ m³	1.7	0.21	0.17
	30 days	µg/ m³	0.84	0.15	0.11
	90 days	µg/ m³	0.5	0.1	0.09
Cd (b)	1 hour	mg/ m³	0.000018	0.0000037	0.000002
Hg (b)	1 hour	mg/ m³	0.00018	0.0000015	0.00000087
Dioxins and furans (b)	1 hour	mg/ m³	2.00E-09	3.7E-12	2.2E-12
TOC (as benzene) (b)	1 hour	mg/ m³	N/A	5.6E-06	3.3E-06
NH_3 (b)	1 hour	mg/ m³	0.33	0.0007	0.0004
H_2S (c)	1 hour	µg/ m³	1.38	1.2	0.96
PAH (as benzo(a)pyrene) (b)	1 hour	mg/ m³	0.0004	0.0000020	0.0000014

Note: (a) based on the assumption of 100% conversion from NO_x to NO_2 a
(b) expressed as the 99.9th percentile of the dispersion modelling prediction
(c) expressed as the 99th percentile of the dispersion modelling prediction

In summary, it was found that:

- The maximum predicted 1-hour NO_2 is 21% of the impact assessment criterion, even assuming 100% conversion from NOx to NO_2.
- The maximum predicted annual NO_2 is 5% of the impact assessment criterion.
- The maximum predicted 10-minute SO_2 is 1.5% of the impact assessment criterion, for 1-hour 1.3%, for 24-hour SO_2, 0.7% and for annual, 0.8%.
- The maximum predicted 24-hour PM is 0.1% of the impact assessment criterion for PM_{10} and 0.2% of the advisory reporting standard for $PM_{2.5}$.
- The maximum predicted annual PM is less than 0.1% of the impact assessment criterion for PM_{10} and 0.2% of the advisory reporting standard for $PM_{2.5}$.

- The maximum predicted CO 15-minute; 1-hour and 8-hour averaging periods are 0.1% or less than the relevant impact assessment criterion.
- The maximum predicted 24-hour HF is 9% of the impact assessment criterion, for 7-day 10%, for 30-day HF, 13% and for 90-day, 18%.

Modelling predictions for air toxics and individual odour compound H2S were assessed against the 99.9th percentile prediction, at and beyond the Site boundary. In summary, the modelling results showed:

- The 99.9th percentile predicted HCl is 2% of the impact assessment criterion.
- The 99.9th percentile predicted cadmium is 11% of the impact assessment criterion.
- The 99.9th percentile predicted mercury is 0.5% of the impact assessment criterion.
- The 99.9th percentile predicted dioxins and furans are 0.1% of the impact assessment criterion.
- The 99.9th percentile predicted TOC (as benzene) is 0.01% of the impact assessment criterion.
- The 99.9th percentile predicted NH_3 is 0.1% of the impact assessment criterion.
- The 99.9th percentile predicted PAH (as benzo (a) pyrene) is 0.4% of the impact assessment criterion.
- The 99th percentile predicted H_2S is 70% of the impact assessment criterion.

11.4.4. Emissions during Start-Up / Shut-Down Conditions

A clean auxiliary support fuel will be used in the incinerator to regulate the temperature. It is understood that the fuel would comprise diesel, with all emissions released from the 100m stack. The emissions from the combustion of diesel fuel would burn significantly cleaner than the residual waste fuel. Additionally, start-up and shut down occurrences will be infrequent. As such, impacts of emissions from start-up shut-down occurrences were not considered necessary for further assessment.

11.4.5. Emissions during Upset Conditions

In the absence of monitoring data for upset conditions from existing facilities, worst-case assumptions have been made following consultation with the UK Environment Agency based on their knowledge of plausible upset emissions for key pollutants.

The plausible emissions during upset conditions developed in association with the UK Environment Agency are shown in **Figure 44 –** Figure 45 below; along with the applicable Clean Air Regulation limit and the percentage such upset conditions would contribute to this limit. Also provided are the mass emission rates adopted in the dispersion modelling.

Figure 44 – Emissions during upset conditions (worst case scenario) (source: PE: AQA; 2016)

Emission parameter	In-stack concentration during upset conditions (mg/m³) (a)	Mass emission rate used to model upset conditions (g/s)
Oxides of Nitrogen (NO_x expressed as NO_2)	1880	238.8
SO_2	270	34.3
CO	230	29.2
PM	150	19.1
HCl	90	11.4
HF	40	5.1
Cd	0.09	0.011
Hg	0.013	0.002
TOC (as benzene)	0.15	0.019
NH_3	20	2.5

Notes: (a) Reference conditions defined as dry, 273.15 K, 101.3 kPa and 7% O_2 for all air impurities when burning a solid fuel.

Very high emission rates due to upset conditions are unlikely, would occur rarely and only for a short time because plant shutdown would likely be an imminent consequence.

A summary of the predicted maximum ground level concentrations (GLCs) for each pollutant during upset conditions is presented in Figure 45. GLCs are presented at and beyond the Site boundary, as well as the maximum prediction at sensitive receptors. Predictions above the relevant NSW impact assessment criterion are shown in bold.

Long term averaging periods (annual, 90 day, 30 day, 7 day and 1 day) have not been included. This is because the any upset emission scenario is anticipated to last a maximum of a matter of hours (likely less). Therefore, prediction over longer averaging periods is not relevant for this scenario.

Figure 45 – Summary of predicted ground level concentrations during upset conditions (source: PE: AQA; 2016)

Pollutant	Averaging period	Units	Criterion	Highest prediction at and beyond site boundary	Highest prediction at sensitive receptor
NO_2 (a)	1 hour	µg/m³	246	**771**	**515**
SO_2	10-minute	µg/ m³	712	159	106
	1 hour	µg/ m³	570	111	74
CO	15-minute	mg/ m³	100	0.1	0.1
	1 hour	mg/ m³	30	0.09	0.06
HCl	1 hour	mg/ m³	0.14	0.04	0.03
Cd (b)	1 hour	mg/ m³	0.000018	**0.000034**	**0.00002**
Hg (b)	1 hour	mg/ m³	0.00018	0.000005	0.000003
Dioxins and furans (b)	1 hour	mg/ m³	2.00E-09	1.9E-10	1.1E-10
TOC (as benzene) (b)	1 hour	mg/ m³	N/A	0.00006	0.00003
NH_3 (b)	1 hour	mg/ m³	0.33	0.008	0.004

Note: (a) based on the assumption of 100% conversion from NO_x to NO_2 h
(b) expressed as the 99.9th percentile of the dispersion modelling prediction

Modelling results for criteria pollutants are assessed against the maximum prediction at sensitive receptors. In summary, the modelling results show that during upset conditions:

- The maximum predicted 1-hour NO_2 is 209% of the impact assessment criterion, even assuming 100% conversion from NOx to NO_2.
- The maximum predicted 10-minute SO_2 is 15% of the impact assessment criterion, and for 1-hour 19%.
- The maximum predicted CO 15-minute, and 1-hour averaging periods are 0.3% or less than the relevant impact assessment criterion.

Modelling predictions for air toxics are assessed against the 99.9_{th} percentile prediction, at and beyond the Site boundary and indicate under upset conditions:

- The 99.9th percentile predicted HCl is 21% of the impact assessment criterion.
- The 99.9th percentile predicted cadmium is 111% the impact assessment criterion.
- The 99.9th percentile predicted mercury is 2% of the impact assessment criterion.
- The 99.9th percentile predicted dioxins and furans are 6% of the impact assessment criterion.
- The 99.9th percentile predicted TOC (as benzene) is 0.1% of the impact assessment criterion.
- The 99.9th percentile predicted NH_3 is 1.3% of the impact assessment criterion.

The pollutants predicted to exceed the NSW impact assessment criteria include NO_2 and Cd.

To assess the potential for exceedance, Pacific Environment have taken a probabilistic approach. Taking into account that facility adopted the design requirements of the EU IED, which require upset event, under no circumstance, to occur for more than four (4) hours uninterrupted where the emission values exceed the limits and no more than 60 hours per year.

The probability that upset conditions will actually result in adverse air quality impacts at ground level is a function of the maximum allowable hours of upset per year (60/8,760) multiplied by the predicted frequency of exceedance per annum for each pollutant. The resultant probabilities are therefore:

- NO_2 – 0.007% probability; and
- Cd – 0.002% probability.

Based on the above it can be inferred that in reality, the probability of the above pollutants resulting in adverse air quality impacts at ground level due to upset conditions would be extremely low.

11.4.6. Use of Diesel Generators during Emergency Conditions

The primary emissions during emergency conditions will be released from the operation of the emergency diesel generators. During such times emissions would typically comprise NO_2, CO and PM (PM_{10} and $PM_{2.5}$) and benzene.

The predicted maximum concentration of the generators and stacks in aggregate results in a concentration that is less than the respective criteria for the assessed pollutants. Notably this was a highly conservative assessment as it is not anticipated that the maximum concentrations from the two distinct sources would occur at either the same time or location, given the substantial difference in exit parameters between the sources.

11.4.7. Dust: Fugitive Emissions and Construction

Residual waste fuel would be transported onsite via sealed roads. The use of sealed roads is considered an effective management strategy in the reduction of fugitive dust emissions, specifically those related to wheel generated dust emissions.

The tipping hall building will also operate under negative pressure whereby air within the building will be used as excess air for the boilers, limiting the release fugitive dust emissions generated within the shed to the ambient environment (as this will subsequently pass through the FGT's bag house).

The EfW facility is considered to have minimal potential for the generation of fugitive dust emissions provided good dust management practices are adhered to. Therefore, this aspect has not been addressed further.

The main air pollution and amenity issues at construction sites are:

- Annoyance due to dust deposition (soiling of surfaces) and visible dust plumes.
- Elevated PM_{10} concentrations due to dust-generating activities.
- Exhaust emissions from diesel-powered construction equipment.

Exhaust emissions from on-site plant and site traffic are unlikely to have a significant impact on local air quality. Very high levels of soiling can also damage plants and affect the health and diversity of ecosystems.

The risk of dust impacts from a demolition/construction site causing loss of amenity and/or health or ecological impacts is related to the nature and duration of the activities being undertaken, the size of the site, current meteorological conditions, proximity and sensitivity of receptors, and adequacy of the mitigation measures applied to reduce or eliminate dust.

Any effects of construction on airborne particle concentrations would also generally be temporary and relatively short-lived.

11.5. CUMULATIVE IMPACTS AND MITIGATIONS MEASURES

11.5.1. Cumulative Impacts

Under normal operating conditions, there are no exceedances of the EPA criteria when the EfW facility contribution is added to maximum background.

Figure 46 –Predicted in-stack concentrations against applicable regulation limit

Pollutant	Averaging period	Units	Criteria	Maximum GLC at sensitive receptor	Maximum background	Cumulative concentration
NO_2 (a)	1 hour	µg/m³	246	51.5	100	151.5
	Annual	µg/ m³	62	3.1	23	26.1
SO_2	10-minute	µg/ m³	712	11	107	118
	1 hour	µg/ m³	570	7.4	57	64.4
	24 hours	µg/ m³	228	1.7	0.7	2.4
	Annual	µg/ m³	60	0.45	3	3.45
CO	15-minute	mg/ m³	100	0.01	14	14.01
	1 hour	mg/ m³	30	0.006	7	7.006
	8 hours	mg/ m³	10	0.006	2	2.006
PM_{10}	24 hours	µg/ m³	50	0.06	49	49.06
	Annual	µg/ m³	30	0.017	19	19.017
$PM_{2.5}$	24 hours	µg/ m³	25	0.06	17	17.06
	Annual	µg/ m³	8	0.017	7	7.02

Note: (a) based on the assumption of 100% conversion from NO_x to NO_2

When the plant emissions are modelled at the POEO limit, there are no exceedances of the EPA criteria except in relation to PM, which results in a cumulative concentration marginally above the 24-hour PM_{10} criterion of 50µg/m³. Notably this exceedance is based on a worst case scenario when the background concentrations are already high (49.2µg/m³) and the probability of the EfW resulting in additional exceedances of the impact assessment criterion is considered low.

Pacific Environment have undertaken to time-series plot of the background 24-hour PM_{10} concentration recorded at Prospect with the EfW facility increment (from the most impacted sensitive receptor) stacked on top. The EfW facility clearly adds a very small increment to the existing background, however is

predicted to result in one additional exceedances of the air quality goal. These exceedances are a result of the high background PM_{10} concentrations, rather than the incremental increase from the EfW facility. It is also noted that this assumes the facility operates at the POEO emission limit for PM continuously, which would not be an operational reality.

Under upset conditions, when the maximum predicted GLCs for products of combustion from the EfW facility are combined with maximum background levels, the cumulative concentrations of these GLCs is above the criteria for NO_2 and Cd. This provides a very conservative estimate of cumulative impact as the probability of a maximum observed value occurring at the time of a maximum predicted value is extremely small (i.e. less than 1%).

11.5.2. Mitigation Measures

The implementation and role of BAT as outlined in the Air Quality Assessment report will serve to manage emissions concentrations at levels appropriate for ensuring air quality, as well as human health and wellbeing.

Impacts on air quality are not anticipated based on the modelled performance of the technology. Notwithstanding this, measures (or conditions) of operation are anticipated to be imposed on the operation of the facility that would serve as mitigating factors in the potential for adverse events or impacts.

Table 45 – Mitigation Measures: Air Quality Management and Regulation

Matter	Mitigation	Timing
Maintain Target Air Emissions	• Implement BAT, as set out in Table 7-2 of the Pacific Environment; Air Quality and GHG Assessment. • Implement an appropriate maintenance schedule to ensure that FGT systems operate appropriately. • The plant shall be managed by a duly qualified specialist and trained personnel.	Construction and operation
Emission Concentrations (Normal Operations)	• Proposed energy from waste facility operating using emission rates set by the POEO Act, with the exception of Cd which will be set at the limit prescribed by the Industrial Emissions Directive (IED; Directive 2010/75/EU).	Operational Condition: Ongoing
Monitor Emission Concentrations	• Implement continuous monitoring system to ensure facility operates within acceptable parameters; • Set CEMs to commence safe shutdown procedures if emission limits are exceeded.	Operational Condition: Ongoing.
Fugitive Dust Emissions	• Construction of new Estate Road to provide a sealed surface and reduce dust emissions from vehicles; • Tipping hall building to be kept under negative pressure whereby air within the building will be used as excess air for the boilers, limiting the release fugitive dust emissions generated within the shed to the ambient environment (as this will	Site preparation and Construction

Matter	Mitigation	Timing
	subsequently pass through the FGT's bag house	
Waste Fuel	• Management of incoming waste fuels received from external sources (i.e. other than Genesis MPC); • Mixing of waste fuel to ensure homogenising and to manage waste fractions (including chlorine and wood waste).	Operation: ongoing
Emergency Conditions: Use/Operation of Diesel Generators	Imposition of operating conditions that: • Limits the use of diesel generators restricted to "black start" associated with plant upset; • Limit the Use of diesel generators is not to exceed 200 hours in any calendar year (a calendar year would commence on the day the EfW plant becomes operational); and • Imposes emissions restrictions on the diesel generators.	Operation: ongoing
Plant Upset Conditions	Impose conditions limiting concentration emissions during upset conditions. In the event of upset conditions leading to mass emissions, the Plant CEMS will trigger a shutdown. Require the preparation and implementation of a response plan outline protocols to be followed in the event of an upset, including: • Staff evacuation measures; • A notice systems to alert the EPA and local Councils, including Penrith and Blacktown; • Any other measures deemed necessary to ensure that all possible measures are taken to limit the potential impact; and • Maintain records of any regarding any incident, including details of cause (if known); action taken and any changes in the management of the facility implemented in response.	Operation: ongoing
EfW Plant Maintenance	• Plant may operator more than 8,000 hours in a year to allow for regular maintenance; and • The operator shall develop a maintenance schedule and keep a record of all major maintenance work carried out.	Operation: ongoing

Matter	Mitigation	Timing
Plant Operation and Staff Training	The proponent shall appoint a qualified plant operator to manage the EfW facility and oversee implementation; The operator shall ensure that all employees are suitable trained.	Implementation and Operation.

11.6. SUMMARY AND CONCLUSION

The proposed technology for the EfW facility is based on existing facilities in the UK and rest of Europe and will incorporate best available technology (BAT) for flue gas treatment, designed to meet the stringent in-stack concentrations limits for waste incineration set by the Industrial Emissions Directive (IED).

Dispersion modelling predictions are made based on the proposed Facility meeting the stringent limits prescribed in the IED and the results show:

Results for dispersion modelling predictions for normal operations show:

- The maximum predicted 1-hour NO_2 is 21% of the impact assessment criterion, even assuming 100% conversion from NO_x to NO_2.
- The maximum predicted annual NO_2 is 5% of the impact assessment criterion.
- The maximum predicted 10-minute SO_2 is 1.5% of the impact assessment criterion, for 1-hour 1.3%, for 24-hour SO_2, 0.7% and for annual, 0.8%.
- The maximum predicted 24-hour PM is 0.1% of the impact assessment criterion for PM_{10} and 0.2% of the advisory reporting standard for $PM_{2.5}$.
- The maximum predicted annual PM is less than 0.1% of the impact assessment criterion for PM_{10} and 3.8% of the advisory reporting standard for $PM_{2.5}$.
- The maximum predicted CO 15-minute, 1-hour and 8-hour averaging periods are 0.1% or less than the relevant impact assessment criterion.
- The maximum predicted 24-hour HF is 9% of the impact assessment criterion, for 7-day 10%, for 30-day SO_2, 13% and for 90-day, 18%.

Modelling predictions for air toxics are assessed against the 99.9^{th} percentile prediction, at and beyond the Site boundary. The individual odour compound H_2S is assessed against the 99^{th} percentile prediction.

In summary, the modelling results show:

- The 99.9^{th} percentile predicted HCl is 2% of the impact assessment criterion.
- The 99.9^{th} percentile predicted cadmium is 11% of the impact assessment criterion.
- The 99.9^{th} percentile predicted mercury is 0.5% of the impact assessment criterion.
- The 99.9^{th} percentile predicted dioxins and furans are 0.1% of the impact assessment criterion.
- The 99.9^{th} percentile predicted TOC (as benzene) is 0.01% of the impact assessment criterion.
- The 99.9^{th} percentile predicted NH_3 is 0.1% of the impact assessment criterion.
- The 99.9^{th} percentile predicted PAH (as benzo(a)pyrene) is 0.4% of the impact assessment criterion.

- The 99th percentile predicted H_2S is 70% of the impact assessment criterion.

Cumulative predictions for normal operations show there will be no exceedances of the EPA criteria when the Facility contribution is added to maximum background.

The results of the modelling during upset conditions indicate that, under worst-case dispersion conditions, NO_2 and Cadmium are predicted to exceed the NSW impact assessment criteria. A probabilistic approach has then been adopted, with results indicating that probability of the above pollutants resulting in adverse impacts (i.e. the potential for upset conditions to coincide with worst-case dispersion conditions) would be less than 0.01%.

Additional modelling of a Regulatory Scenario indicates that application of the POEO emission limits within the Environmental Protection Licence for the facility would be sufficiently protective of health and environmental impacts while providing the facility with some operational flexibility.

The exception to this is cadmium, where an alternative in-stack concentration limit, in line with the more stringent IED limit would be utilised.

Consistent with the NSW EPA Energy from Waste Policy Statement, the facility will utilise Continuous Emissions Monitoring System (CEMS) to provide the EPA with real time feedback and emissions monitoring.

12. GREENHOUSE GASES

12.1. OVERVIEW

The DGRs for the Energy from Waste application include the following requirement for environmental assessment of Greenhouse Gas for the proposed Development:

- *A full greenhouse gas assessment (including an assessment of the potential scope 1, 2 and 3 greenhouse gas emissions of the project, and an assessment of the potential impacts of these emissions on the environment; and*

- *A detailed description of the measure that would be implemented on site to ensure that the project is energy efficient.*

Assessment of Greenhouse Gas impacts of the development conclude the use of energy from waste technology will have a net positive contribution on reducing atmospheric CO_2, thereby having a positive effect on greenhouse gases.

12.2. LEGISLATIVE REQUIREMENTS

The legislative framework for the assessment of Greenhouse Gas Emissions is:

- National Greenhouse and Energy Reporting Act 2007;
- National Greenhouse and Energy Reporting Regulations 2008 (NGER);
- Sustainable Development Greenhouse Gas Protocol (the GHG Protocol);
- National Greenhouse and Energy Reporting (Measurement) Determination 2008 (the "NGER Measurement Determination"); and
- National Greenhouse and Energy Reporting (Measurement) Amendment Determination 2012 (No. 1).

The *Greenhouse Gas Assessment* uses the following Criteria and Standards for assessing the existing conditions, and modelling the impacts of the proposed Development:

- AGO Factors and Methods Workbook (AGO); and
- Guidelines for Energy Savings Action Plans (DEUS, 2005).

The environmental assessment considered the following requirements with regards to air quality and greenhouse gas emissions:

- The Australian Government has committed to reduce its emissions by between 5 and 25 per cent below 2000 levels by 2020. It has also committed to a long-term emissions reduction target of at least 60 per cent below 2000 levels by 2050;
- The *National Greenhouse and Energy Reporting (NGER) Act* requires corporations to register and report emissions, energy consumption or production that meets certain thresholds every year. For GHG emissions, thresholds are currently set at 25,000 tonnes carbon dioxide equivalent (tCO_2e) for a facility under a corporation and 50,000 tCO_2e for a corporation as a whole for 2010-2011 (DCC 2008);
- The *NSW Department of Infrastructure, Planning and Natural Resources - Department of Energy, Utilities and Sustainability Guidelines for Energy and Greenhouse in EIA* provides guidance on the consideration of energy and greenhouse issues when developing projects and when undertaking environmental impact assessment; and

- The Greenhouse Gas (GHG) emissions requirements have been considered in the context of the *'State and Territory Greenhouse Gas Inventories for 2008'* which outlines targets for GHG emissions in based on the Kyoto accounting. The assessment of GHG emissions considers emissions generated from key components of developments including transport, waste and manufacturing and construction.

12.3. ASSESSMENT FRAMEWORK AND METHODOLOGY

12.4. FRAMEWORK: GHG PROTOCOL

As required by the DGRs an assessment of the proposal using the GHG Protocol has been undertaken by Pacific Environment. The GHG Protocol defines three (3) scopes for developing inventories leading to reporting of emissions. These scopes help to delineate direct and indirect emission sources, improve transparency, and provide a degree of flexibility for individual organisations to report based on their organisational structure, business activities and business goals.

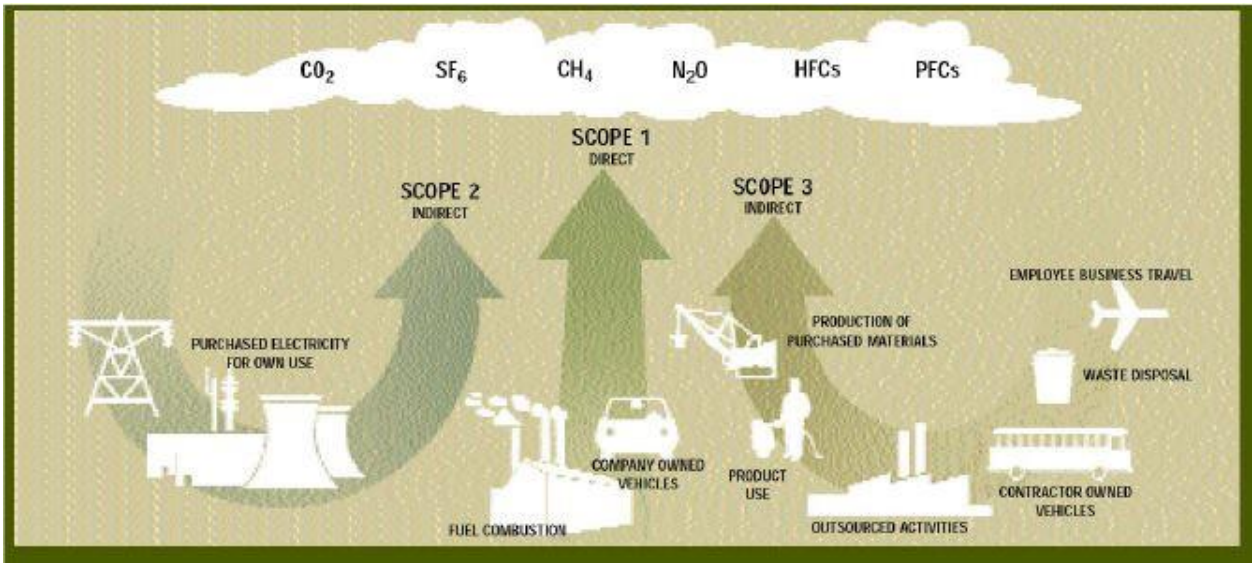
Three (3) scopes of emissions (also shown in Figure 47) are defined in the GHG Protocol:

'Scope 1' emissions: direct GHG emissions occurring from sources owned or controlled by the company – for example vehicle fleet and direct fuel combustion. Any negative emissions (sequestration), for example from a plantation owned by the entity, would also be included in Scope 1.

'**Scope 2' emissions:** indirect GHG emissions from purchasing electricity or heat from other parties.

'**Scope 3' emissions:** indirect emissions which occur due to the company's business activities, but from sources not owned or controlled by the company - for example emissions from employee business-related air travel.

Figure 47 – Overview of Scopes and Emissions across a Value Chain (Source: PE; AQA/GHG; 2016)



12.5. GHG EMISSION ESTIMATE METHODOLOGY

As the proposal involves the construction and operation of an electricity generating facility, there is likely to be negligible scope 2 emissions (indirect emissions arising from the purchase of electricity) as the site is capable of being a net exporter. Accordingly, the focus of assessment and reporting has been Scope 1 and 2 emissions. The methodology outlined in Table 46 was applied to the assessment of GHG.

Table 46 – Summary of Methods

Emissions Scope	Input information
Scope 1	Emissions are calculated using information of the maximum volume of waste to be combusted in a year using the compositional and chemical profile of the design fuel (refer to Ramboll, PDB; 2016). Combusted ash produces no GHG Emissions (there is an absence of carbon limiting methane production) and therefore not included as input in the equation. TNG does not include a vehicle fleet with materials delivered to and removed from the site by external operators. As such these factors were also not been included.
Scope 2	EfW will export electricity to the grid; consequently CO_2 diverted from the grid (substitution of grid electricity)
Scope 3	• Employees commuting to work; • Employee business travel; • Extraction, production and transport of purchased diesel fuel consumed; • Fuel consumption transporting waste to the site.

12.6. ASSESSMENT OF KEY ISSUES

GHG policy seeks to minimise the emissions of particular gases, such as Carbon Dioxide, methane, Nitrous Oxide and Fluorinated gases. Reduction in GHG emissions will slow the greenhouse effect which is contributing to global warming. To this end the key issues considered in this assessment have included:

- The potential GHG emissions associated with the operation of the facility;
- The potential benefits of the operation on reducing the production of GHG emissions, based on 1.35M tonnes/pa of waste being diverted from landfill (thereby reducing methane production);
- The cumulative effect GHG emissions produced and avoided, to determine the net GHG emissions likely to be associated with the operation; and
- The potential long term benefits of an alternative waste management and energy production alternative in reducing GHG emissions associated with landfill and traditional fuel/energy sources.

A detailed assessment in line with the GHG Protocols has been undertaken by Pacific Environment and is provided as part of **Appendix K**, section 10.

Having assessed scope 1, 2, and 3 emissions likely to arise in connection to the operation of the proposed EfW Facility, Pacific Environment have concluded the operation would have a net positive effect on GHG, with the potential to offset an approximate 3 million tonnes of GHG/per year.

12.6.1. Estimated GHG Emissions & Intensity

Table 47 contains the calculation of GHG emissions associated with the combustion of up to 1.35M tonnes of waste, per annum.

Table 47 – Estimated GHG Emissions from Waste Incineration

Waste (TPA)	Carbon Content (%)	% Carbon That is Fossil Origin	Oxidation Factor*	Co²-e (TPA)
1,350,000^	31.44%	31.44%	0.98*	505,069

^worst case scenario: technological capacity

Note: It is assumed that biomass based carbon is renewable or climate neutral.* Not known, default of 1 applied.

However, the EfW plant has the potential to export energy to the grid (as opposed to taking energy) achieving a net positive effect to the operation of the facility, diverting 944,624 tonnes of CO_2 from the electricity grid.

Table 48 – Summary of CO_2 diverted

Net Output (MW)	Operational Hours (pa)	Electricity diverted from grid	Emission factor for grid electricity in NSW (kg $CO_{2\text{-}e}$/kWh	Co²-e diverted from main electricity grid (TPA)
137.3	8,000	1,098,4000,000	0.86	944,624

The emission intensity for electricity generated from waste incineration is lower than that derived from the NSW electricity grid and therefore a net reduction in GHG emission is achieved when electricity is diverted from the NSW grid. Similarly, by removing biomass waste from the landfill, significant emissions of methane from the decomposition of that waste are also eliminated.

12.7. CUMULATIVE IMPACTS AND MITIGATION MEASURES

A summary of the estimated net GHG emissions resulting from the proposed Facility are shown in Table 49.

Table 49 – Estimation of Net GHG Emissions

CO²-e tonnes per annum from waste incineration	CO²-e Diverted from Grid (TPA)	CO²-e tonnes diverted from landfill	net GHG emissions (CO²-e tonnes per annum)
+ 505,069	- 944,624	- 2,560,239	- 2,999,794

The operation of the proposed Facility would have a net positive GHG effect, potentially eliminating 3 million tonnes of CO2-e per annum. The emission intensity for electricity generated from waste incineration is lower than that derived from the NSW electricity grid.

Additionally, by removing biomass waste from the landfill, significant emissions of methane from the decomposition of that waste are also eliminated.

Overall, the proposed development will result in a net benefit in terms of the reduction of Greenhouse Gas emissions and derived benefits of providing an alternative energy source. No mitigation measures are required.

12.8. SUMMARY AND CONCLUSION

The proposed development will have a positive impact on the production of GHG.

13. OZONE

13.1. OVERVIEW

The NSW Environment Protection Authority (NSW EPA) has provided 'Agency Requirements' for the Environmental Assessment of the proposed The Next Generation (TNG) Energy from Waste facility (EfW) at Eastern Creek, including a photochemical smog assessment, as follows

> *Include a quantitative photochemical smog assessment in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005)*

Ozone (O_3) is a secondary pollutant formed in a chemical reaction when emissions of NO_2 and Volatile Organic Compounds (VOCs) react in the presence of sunlight.

Ozone in the upper atmosphere is good for human health preventing ultraviolent radiation from reaching the earth's surface. However, ozone in lower atmosphere can have negative health effects and it is this atmospheric level ozone that is the focus of this assessment.

Ozone is the principal component of photochemical smog, which is typically formed several hours after the precursors (NO_x and VOCs) are emitted. The highest concentrations of ozone normally occur on summer afternoons in areas downwind of major sources of the precursors. The dominant ozone precursor released from the facility is NO_x.

Under the NSW Ozone assessment framework Sydney is categorised as being an ozone "non-attainment area" as it currently exceeds the ozone concentration "acceptance limit" established under the National Environment Protection Measures (NEPM).

As stated in section 11 of this amended EIS, the EfW plant will emit NO_2 during normal conditions in line with the relevant emissions limits and BAT measures have been implemented. The facility design has been refined since the initial EIS was exhibited to include optimised SNCR flue gas technology, to further reduces this emission fraction.

Accordingly, the Ozone Assessment was amended to consider the refined technology design. Pacific Environment has assessed the emissions associated with the operation of the amended facility design, having regard for the potential impact of the development on ozone concentrations within Sydney, both typical and upset, taking into account the background air quality/ozone environment. The quantitative assessment of potential impacts concludes that during typical operations the facility will be well within ozone limit values. A copy of this report is provided at **Appendix M**.

13.2. LEGISLATIVE REQUIREMENTS

Ozone Impacts are measured using:

- *Protection of the Environment Operations Act 1997*

The proposed EfW facility requires consideration of ozone impacts as it satisfies all the following:

- It is an activity listed under Schedule 1 of the *Protection of the Environment Operations Act 1997*
- It will release ozone precursors as part of the project's proposed operations.
- It is located within the NSW Greater Metropolitan Region (GMR) as defined within the Protection of the Environment Operations (Clean Air) Regulation 2010.
- It is a requirement of the DGRs.

At present, there are no regulatory documents or policies in the public domain that prescribe the preferred methodology for ozone impact assessment in NSW. At present the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (The Approved Methods; (NSW EPA, 2005)) state that advice should be sought from the EPA prior to undertaking a quantitative photochemical smog assessment.

Pacific Environment has consulted with the EPA and NSW Office of Environment and Heritage (OEH). An overview of process and outcome is provided in Figure 48.

Figure 48 – Assessment Framework for Ozone Assessment established with EPA (Source: PE: OIA; 216)

Agency	Date	Discussion Point / Outcome
NSW EPA (Air Policy)	28/02/2014	The EPA Level 1 screening tool for ozone assessment was not publicly available. The project was likely to need a Level 2 detailed assessment (based on Western Sydney being an ozone non-attainment area and the emissions threshold being exceeded).
NSW EPA (Air Policy)	6/03/2014	The Level 2 assessment requirements were discussed and formal consultation (teleconference between EPA, OEH and Pacific Environment) was arranged to discuss the approach to the assessment
OEH (Climate and Atmospheric Science Branch)	20/03/2014	Detailed discussion of approach to the assessment. Agreement on the use of TAPM-CTM with CB05 chemical mechanism, 2008 emissions data from EPA GMR air emissions inventory, and methodology to select scenario days. It was suggested by OEH that a method paper is prepared for review by CSIRO
NSW EPA (Air Policy),	17/2/2015	Preliminary discussion of the reported results. EPA indicated that OEH should also be given opportunity to provide additional comment.
NSW EPA (Air Policy), OEH (Climate and Atmospheric Science Branch) and CSIRO	10/03/2015	Discussion around additional analysis of NO_2 and NO_x predictions prepared by Pacific Environment, in consultation with CSIRO, in advance of this meeting. Discussion identified that an updated version of TAPM-CTM and OEH emission inventory inputs files had become available since the original modelling and should be incorporated into the modelling.
NSW EPA (Air Policy), OEH (Climate and Atmospheric Science Branch) and CSIRO	1/04/2015	Teleconference to discuss outcomes of revised modelling incorporating the above updated model inputs.
CSIRO	10/04/2015	Completion of CSIRO peer review role, as summarised within letter report provided as **Appendix F**.

Pacific Environment has discussed the broad assessment approach with the EPA and the following sections are based on our understanding of a proposed ozone assessment framework. As is stands, this project is the first project in NSW to be assessed under the ozone assessment framework.

13.3. ASSESSMENT FRAMEWORK AND METHODOLOGY

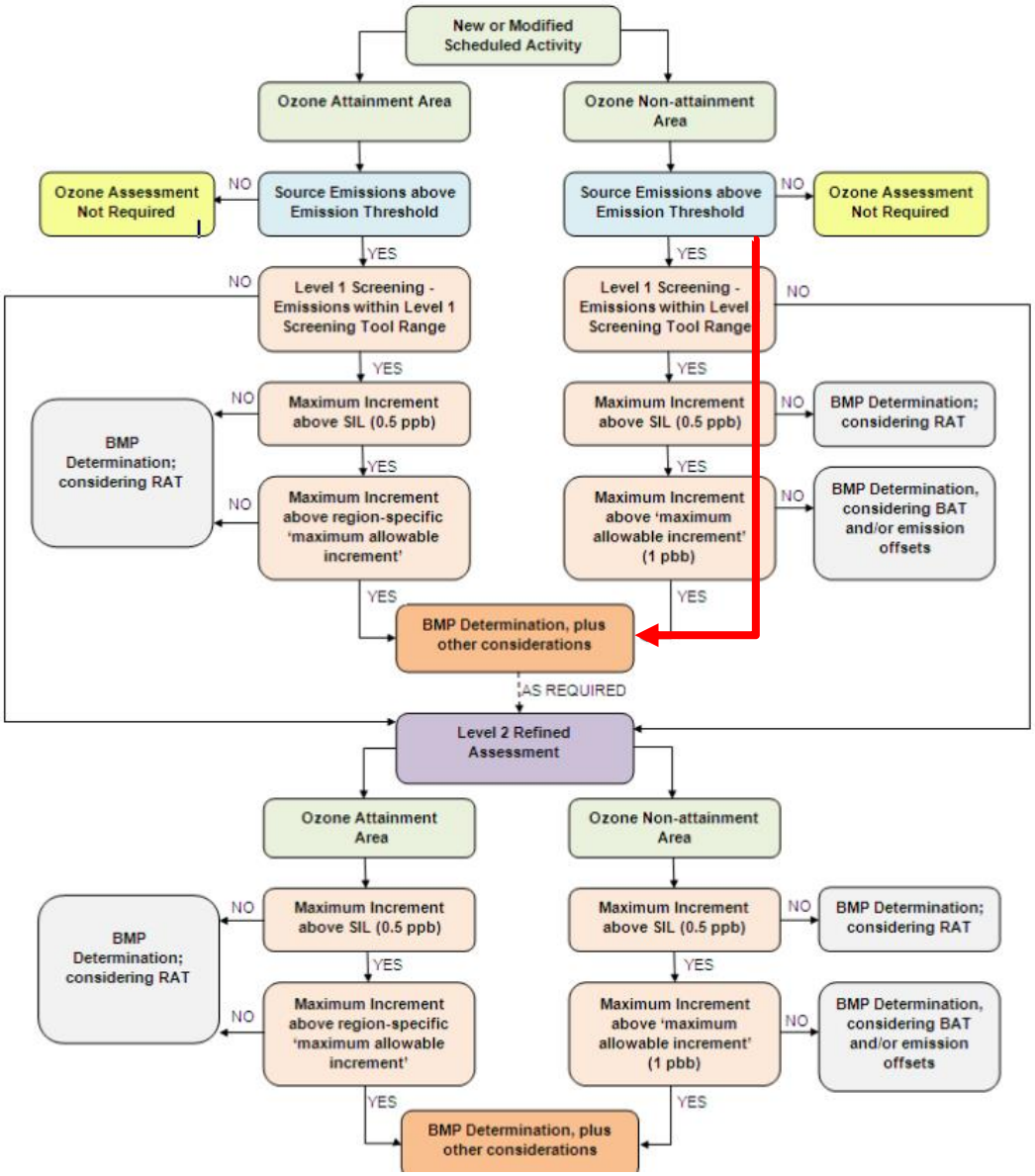
The framework is concerned with assessing stationary sources of ozone precursors (i.e. sources that generate gases known to contribute to the formation of ozone) and categorises development based on location across two (2) broad areas:

- **"attainment areas":** development areas that satisfy national ambient air quality standards for ozone are defined as being within an "attainment areas".
- **"non-attainment areas"** areas that do not satisfy national ambient air quality standards for ozone.

Ozone attainment and non-attainment areas, in NSW, are defined based on comparison with the ambient air quality (NEPMb) goals. The average of five years of monitoring data for the region is compared against an "acceptance limit" which is expressed as 82% of the NEPM goal.

An overview of the framework is shown in Figure 49. Consultation with the NSW EPA has determined that in the absence of "Level 1 screening emission", having established the project (i.e. source) emissions the assessment has moved direct to a "level 2 assessment (as shown by the superimposed red arrow).

Figure 49 – Ground level ozone impact assessment framework (source: EPA)



The Approved Methods for the Modelling and Assessment of Air Pollutants in NSW according to the NSW EPA 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' 2005 state that advice should be sought from the EPA prior to undertaking a quantitative photochemical smog assessment. In accordance with the Approved Methods, Pacific Environment consulted with the EPA and NSW Office of Environment and Heritage (OEH).

At present there are no regulatory documents or policies in the public domain that prescribe the preferred methodology for ozone impact assessment in NSW. The assessment approach adopted by Pacific Environment has been discussed with the EPA. The framework is based on Pacific Environments' understanding of a proposed ozone assessment framework. This application is the first in NSW to be assessed under the ozone assessment framework.

1. **Classification of region as ozone attainment or ozone non-attainment area**. Ozone attainment and non-attainment areas are defined based on comparison with the ambient air quality (NEPMb) goals.

2. **Emissions Threshold**. Evaluate the annual NO_x and VOC emissions from the Facility and compare them with the emission thresholds. Scheduled activities that trigger the relevant emissions threshold are required to assess the significance of the incremental ozone contributions.

The annual NO_x emissions for the TNG EfW facility have been estimated based on the facility meeting an in-stack concentration limit of 200 mg/Nm3, expressed as a daily average. Assuming the EfW facility emits NO_x at this limit for 333 days a year (or 8,000 hours of the year), the annual NO_x load to the Sydney airshed would be in the region of 800 tonnes/year. At this level, ozone assessment is triggered and the next step in the framework is a Level 1 screening assessment.

As agreed with the EPA and OEH, the photochemical grid model (PGM) used in the assessment is the CSIRO's The Air Pollution Model (TAPM), with chemical transport module (TAPM-CTM). A level 2 refined assessment methodology was used.

Two scenarios were examined, a Base Case and Test Case emissions scenario. The Base Case assesses model performance without the facility while the Test Case is used to assess the change in O_3 concentration with the addition of emissions from the facility.

13.3.1. Step 1: Region of Classification (ozone attainment vs. non-ozone attainment)

Pacific Environment reviewed maximum 1-hour and 4-hour ozone concentrations within the region, with aggregated average for the Sydney monitoring stations and determined that the Sydney region is classified as an ozone non-attainment area. This classification was adopted as current ozone concentrations exceed the "acceptance limit" established using the ambient air quality guidelines established under the National Environment Protection Measures (NEPM).

Figure 50 – Annual Maximum 1 -4 and 4-hour ozone concentrations in Sydney (source: PE: OIA; 2016)

Year	Annual 1-hour maximum ozone concentration (ppm)	82% of the NEPM (ppm)	Annual 4-hour maximum ozone concentration (ppm)	82% of the NEPM (ppm)
2009	0.154		0.112	
2010	0.119		0.103	
2011	0.136		0.122	
2012	0.095		0.084	
2013	0.117		0.110	
Average	**0.124**	**0.082**	**0.106**	**0.056**

Notes: NSW EPA monitoring Station include: Chullora, Earlwood, Lindfield, Randwick, Rozelle, Prospect, Richmond, St Marys, Vineyard, Bargo, Bringelly, Campbelltown West, Liverpool, Macarthur and Oakdale.

13.3.2. Step 2: Emissions Threshold

The second step evaluates the annual NO_x and VOC emissions from the project and compares them with the emission thresholds set by the *Protection of Environment Operations Act 1997* for scheduled activities. Where the emissions rates for a particular use exceed the POEO Act limit, an assessment of the significance of the incremental ozone contributions is triggered.

Figure 51 – POEO Limits (Source: PE: OIA; 2016)

Regulatory requirement	Source type	NOx / VOC Emission rates (tonnes/year)
Any scheduled activity listed in Schedule 1 of the *POEO Act* (2007)	New	>90
	Modified	>35

The annual NOx emissions for the TNG have been estimated based on the facility meeting an in-stack concentration limit of 200 mg/Nm3, expressed as a daily average. Assuming the TNG emits NO_2 at this limit for 333 days a year (or 8,000 hours of the year), the annual NO_x load to the Sydney airshed would be in the region of 800 tonnes/year.

At this level, ozone assessment is triggered and the next step in the framework is a Level 1 screening assessment. The Level 1 screening tool is currently not available. Given that projected emissions from the facility exceed the threshold by >8 times, the approach for this assessment is to proceed directly to a Level 2 refined assessment.

13.4. ASSESSMENT OF IMPACT

13.4.1. Ozone Emission Guideline Limits

Having identified the likely emissions rates of NO_x and VOCs require an assessment of significance, it was necessary to identify the likely ground level concentrations of ozone associated with TNG and measure these against the relevant regulatory standards that are an indicator of potential for human health impacts.

These standards are set by NEPM that contains standards for both ambient air quality measured as parts per billion (ppb) emitted over 1 and 4 hour periods combined with screening levels and maximum allowable increments of 0.5 ppb and 1 ppb.

13.4.2. Modelled Ozone Emission

To quantify the potential impact of the proposal on the existing environment Pacific Environment modelled two (2) scenarios:

- A base case scenario to establish the existing environments condition (i.e. the likely levels of ozone presently in the area); and
- A test case based on typical emissions, to quantify the likely addition of TNG above the base case. The test case was based on TNG operations at the "worst case scenario" of both stacks operating.

Figure 52 provides the maximum predicted 1-hour and 4-hour O_3 concentration (ppb) for selected days across the model domain.

Figure 52 – Maximum predicted 1-hour and 4-hour O3 concentration (ppb) for selected days across the model domain (PE: OI; 2016)

Date	Maximum O_3 prediction across grid for each day		Results paired in space and time			
	Base case (ppb)	Test Case (ppb)	Maximum difference (ppb)	Hour of maximum difference	Base case (ppb)	Test Case (ppb)
1-hour						
28/01/2009	61.9	61.6 [a]	2.2	16:00	51.2	53.5
30/01/2009	66.8	66.1 [b]	2.2	14:00	45.4	47.6
31/01/2009	77.2	77.2 [c]	2.5	15:00	50.7	53.2
06/02/2009	88.0	88.0 [d]	1.7	14:00	67.3	69.1
07/02/2009	78.9	78.9 [e]	4.7	12:00	43.0	47.8
08/02/2009	86.6	86.6 [f]	5.7	13:00	60.8	66.5
4-hour						
28/01/2009	57.2	56.8 [g]	1.1	17:00	49.0	50.1
30/01/2009	64.8	64.8 [h]	1.1	17:00	48.4	49.5
31/01/2009	69.3	69.5 [i]	1.7	17:00	52.7	54.5
06/02/2009	84.3	84.4 [j]	1.0	17:00	74.9	75.9
07/02/2009	86.6	87.1 [k]	3.2	16:00	40.1	43.3
08/02/2009	82.9	83.0 [l]	2.8	16:00	60.9	63.7

Note grid maximum occurs at UTM coordinates:

a)	262,160	6,190,200	g)	262,160	6,190,200
b)	271,160	6,190,200	h)	259,160	6,190,200
c)	286,160	6,193,200	i)	271,160	6,190,200
d)	319,160	6,283,200	j)	250,160	6,193,200
e)	334,160	6,274,200	k)	301,160	6,190,200
f)	307,160	6,214,200	l)	298,160	6,199,200

The results indicate that the maximum change between predicted O3 concentrations during Base Case and Test Case scenarios may be in excess of 1 ppb at any given grid cell under worst-case ozone formation conditions, for both the 1-hour and 4-hour averaging periods.

13.5. CUMULATIVE IMPACTS & MITIGATION MEASURES

13.5.1. Consideration of Effects

Ozone is the principal component of photochemical smog, which is typically formed several hours after the precursors (NO_x and VOCs) are emitted. This means that the highest concentrations of ozone normally occur on summer afternoons in areas downwind of major sources of the precursors. The dominant ozone precursor released from the facility is NOx. Ground-level ozone continues to be a problem in Sydney during summer months. Unlike many other pollutants, ozone levels in Sydney are not decreasing and may actually be on a slight upward trend (NSW DECCW, 2009).

At ground level, elevated ozone concentrations can cause health and environmental problems. As well as affecting vegetation growth and damaging materials such as rubber, fabric, masonry, and paint, it can also reduce visibility. Ozone (O_3) is a strongly oxidising gas. Human exposure to ground-level ozone damages lung tissue and reduces lung function. High concentrations of ozone affect not only people with respiratory problems such as asthma, but also healthy adults and children (NSW DECCW, 2010a).

In recognition of the potential health effects associated with ozone formation and the contribution of the EfW facility to ozone within the Sydney Region, TNG has integrated Best Available Technology (BAT in the form of Selective Non-Catalytic Reduction (SNCR) in the treatment of flue gas to limit NOx emissions) the dominant ozone precursor).

Adoption of SNCR technology reduces the in stack concentration of NOx to 120mg/m3 (based on a whole year operation) and was demonstrated to meet the NSW EPAs Level 1 screening tool to comply with the NSW EP's 0.5 ppb screening investigation level (SIL).

AECOM have considered the formation of photochemical oxidants (i.e. ozone) in the assessment of Human Health Impacts, the assessment focused on short term acute exposure, as the Pacific Environment modelling indicated that ozone exceedance was only likely to occur at particular hours at particular locations and these exceedances did not relate to periods of time or locations where the maximum concentrations were occurring, nor at concentrations that are predicted to exceed the NEPM ambient O_3 criteria. In other words, while the value of 1 ppb is predicted to occur on occasion under the Test Case scenario, this ozone formation is predicted to occur during periods when ambient ozone is low (and thus of lesser concern).

AECOM have considered the potential for human health impact against the relevant criteria and resolved the human health arising from ozone is low and acceptable.

13.5.2. Mitigation Measures

A review of the technology implemented in relation to the treatment of flue gas has been undertaken as part of detailed design and response to submissions and advice received in relation to the earlier assessment and exhibition. The implementation of BAT in the delivery of the EfW is considered to suitably mitigate the release of ozone forming gases, with particular emphasis on the reduction of NO_x that will emit below the POEO limit.

Table 50 – Mitigation Measures: Ozone

Impact	Heading	Heading
Release of NO_x	Use of BAT in flue gas treatment, specifically use of a SNCR	Implementation/Operation
	Continuous emissions monitoring to ensure they are within acceptable limits	Operation Ongoing
	Reporting of emissions to NSW EPA.	Operation: Ongoing

13.6. SUMMARY AND CONCLUSION

In terms of ozone impacts, during normal operation of the plant, the emission levels are generally expected to be well within the limit value.

14. ODOUR

14.1. OVERVIEW

The DGRs identified the following key requirements for the assessment of odour:

> *a quantitative assessment of the potential impacts for the development on surrounding landowners and sensitive receptors under the relevant Environment Protection Authority guidelines.*

The EfW facility is involved in the receipt, storage and processing of waste materials that may give rise to the generation of nuisance odour. The nearest sensitive receivers are located approximately 1 kilometre to the north and east in the residential suburbs of Minchinbury and Erskine Park respectively.

An odour profile was established based on the adjacent Genesis Facility, given the similarity in the nature of the waste streams to be processed by TNG. This profile was then modelled having regard to local meteorological conditions.

Assessment of potential impact, undertaken by Pacific Environment, concluded that odour concentrations associated with the operation would be highest at receivers to the north in Minchinbury. At this point odour would be marginally above the detection limit of (1 odour unit) but below the impact assessment criteria of (2 odour units). The TNG operation will receive only non-putrescible materials and the design of the facility is such that all waste is stored within an enclosed tip hall, kept under negative pressure, measures that will effectively control odour.

Many of the objections received from community raised concern regarding odour emissions from the proposed facility but also the existing ambient odour that was attributed to landfill operating within the area. The Genesis Facility, used as a basis for the odour model, has received no substantiated odour complaints since commencing operation in 2012. As such, it is maintained that existing odours detected by residents and/or local workers within the area are not emanating from the Genesis site.

As outlined above, the odour impact report has been reviewed and confirms that potential odours arising from the existing and proposed use will not exceed the impact assessment criteria of 2 odour units. Accordingly, the proposal will operate within acceptable environmental limits.

The following section provides an overview of the assessment methodology and the outcomes of the assessment report. A full copy of the Pacific Environment report is provided at **Appendix L**.

14.2. LEGISLATIVE REQUIREMENTS

The *Odour Assessment* was undertaken using the following Criteria and Standards for assessing the existing conditions, and modelling the impacts of the proposed Development:

- *Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (DEC); and*
- *Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (DEC).*

14.3. ASSESSMENT METHODOLOGY

Odour impacts arise in connection with concentration of odours emanating from a source combined with dispersion influenced by meteorological conditions.

The EPA has developed odour criteria and the way in which they should be applied with dispersion models to assess the likelihood of nuisance impact arising from the emission of odour.

There are two (2) factors that need to be considered:

- What "level of exposure" to odour is considered acceptable to meet current community standards in NSW; and

- How can dispersion models be used to determine if a source of odour meets the criteria which are based on this acceptable level of exposure.

The term "level of exposure" has been used to reflect the fact that odour impacts are determined by several factors the most important of which are (the so-called FIDOL factors):

- **F**requency of the exposure.
- **I**ntensity of the odour.
- **D**uration of the odour episodes.
- **O**ffensiveness of the odour.
- **L**ocation of the source.

Offensiveness of an odour, is often informed by the context in which the odour is experienced. That is to say to a certain degree odour can be considered subjective. Some odours, for example the smell of sewage, hydrogen sulfide, butyric acid, landfill gas etc., are likely to be judged offensive regardless of the context in which they occur. Other odours such as the smell of jet fuel may be acceptable at an airport, but not in a house, and diesel exhaust may be acceptable near a busy road, but not in a restaurant.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDOL factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable. Odour criteria need to take account of these factors.

The *"Approved Methods for the Modelling and Assessment of Air Pollutants in NSW"* (EPA, 2005) (Approved Methods) include ground-level concentration (GLC) criterion for complex mixtures of odorous air pollutants. They have been refined by the EPA to take account of population density in the area. **Appendix L** lists the odour GLC criterion to be exceeded not more than 1% of the time for different population densities. As shown in Figure 53 the acceptable ground level concentration for odour (i.e. the odour unit) for the local area surrounding the site is 2 odour units based on an urban population density including schools and hospitals.

Figure 53 – Odour Performance Criteria (source; PE, OIA; 2016)

Population of affected community	Ground level concentration (ou)
≤ ~2	7
~10	6
~30	5
~125	4
~500	3
Urban (2000) and/or schools and hospitals	2

The difference between odour criteria is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For a given odour level there will be a wide range of responses in the population exposed to the odour.

In a densely populated area there will therefore be a greater risk that some individuals within the community will find the odour unacceptable than in a sparsely populated area.

An odour criterion of 2 ou would apply to the built up areas around the Development Site in any further detailed assessment of proposed operations.

AERMOD was chosen as a suitable dispersion model due to the source type, location of nearest receiver and nature of local topography. AERMOD is the US EPA's recommended steady-state plume dispersion model for regulatory purposes. AERMOD replaced the Industrial Source Complex (ISC) model for regulatory purposes in the US in December 2006. Ausplume, a steady state Gaussian plume dispersion

model developed by the Victorian EPA and frequently used in Australia for simple near-field applications is based on ISC, which has now been replaced by AERMOD.

14.3.1. Peak-to-mean Ratios

It is common practice to use dispersion models to determine compliance with odour criteria. This introduces a complication because Gaussian dispersion models are only able to directly predict concentrations over an averaging period of 3-minutes or greater. The human nose, however, responds to odours over periods of the order of a second or so. During a 3-minute period, odour levels can fluctuate significantly above and below the mean depending on the nature of the source.

Peak-to-mean ratio refers to the ratio between the one-second peak concentrations and three-minute and longer period average concentrations. The ratio is also dependent on atmospheric stability and the distance from the source. For this assessment a peak-to-mean ratio of 2.5 and 2.3 for all stability classes for area sources and volume sources, respectively was adopted.

14.4. ASSESSMENT OF KEY ISSUES

14.4.1. Existing and ambient odour

Odour monitoring undertaken in January 2014 by Pacific Environment of the current Genesis Facility and landfill that operate from within the broader site was used to establish an existing ambient and baseline odour environment.

This earlier odour monitoring and assessment identified potential odour sources as the active tipping face within the landfill void, the leachate sump and riser and the leachate treatment and SBR tanks. The character of the odour emissions associated with these sources, include:

- Active tip face – oily, dusty and garbage.
- Leachate tank – garbage.
- Leachate riser - oily, grease, onion, garbage and sulphide.

Monitoring identified the leachate sump (riser) as the most significant source (50 times higher than the others). Refer to Figure 54**.**

Figure 54 –Modelled Existing Odour Emissions rates (Source: Pacific Environment; 2016)

	Odour Concentration (OU)	Specific Odour Emission Rate (SOER) ($OU.m^3/m^2/s$)	Source area (m^2)	Peak to mean ratio	Modelled Specific Odour Emission Rate (SOER) ($OU.m^3/m^2/s$)
Active tip face	558	0.3	1,344	2.5	0.7
Leachate tank (x 4)	362	0.2	4 x 19.6		0.5
Leachate riser	19,500	10.3	177		25.8

Dispersion modelling undertaken by Pacific Environment of the leachate sump found that the most stringent odour criterion of 2 ou is not exceeded beyond the Site boundary and does not encroach within 500 metres of the nearest residences.

14.4.2. Potential: Odour Sources and Emissions

Potential odour sources associated with the operation of the EfW facility include:

- Odour from waste stored in the tipping hall, from opening and closing roller doors; and
- Odour associated with stack emissions.

The location of potential odour sources is shown in Figure 55**.**

Figure 55 – Location potential odour sources within the site (source: PE; OIA; 2016)

Waste streams proposed to be received at TNG are outlined in **Section 4.4.2**. These waste streams are in part supplied by the adjacent Genesis MPC with the remainder received from external sources delivered direct via vehicle. However, as waste material to be received is to be consistent with the existing profile of waste received at the Genesis Facility the odour emission of the active tip face has been used as baseline data for determining impact of the EfW source. Notably waste received and processed is non-putrescible.

The odour concentrations and emission rates for the proposed Facility are presented in Figure 56. The emission rate was modelled on the basis of the roller door being 25m^2 with small volumes of air escaping the tipping hall when the doors are open and with the building operating under negative pressure having an exit velocity of 0.1m/s.

Figure 56 –Anticipated New Odour Emission Rates (source: PE; OIA; 2016)

	Odour Concentration (OU)	Odour Emission Rate for volume source (OU.m³/s)	Peak to mean ratio	Modelled Odour Emission Rate for volume source (OU.m³/s)
Tipping hall	558	1,395	2.3	3,209

14.4.3. Results

The dispersion modelling results for the 1 second (nose response) average 99th percentile odour ground level concentrations (GLCs) for the Facility in isolation and in combination with odour emissions from the Genesis Xero Waste Facility are presented in Figure 57, Figure 58 and Table 51**.**

The results indicate that when the Facility is considered in isolation and combined with odour emissions from the Genesis Xero Waste Facility that the predicted 99th percentile odour concentrations would be below the 2 ou impact assessment criterion at all of the sensitive receptors.

Review of the contour plots shows that the spread of the odour plume is greatest to the north, and to a lesser extent the south, of the Facility. The odour concentrations are predicted to be highest in the residential suburb of Minchinbury, where they are anticipated to be just above the detection threshold (1 ou) but notably below the impact assessment criterion of 2 ou throughout the suburb.

Comparison of the odour contours between the Facility in isolation (**Table 51**) and combined with the Genesis Xero Waste Facility show that there is little difference between the predicted odour impacts and can be inferred that the Facility would be the greatest contributor to offsite odour concentrations. This is largely because the most significant existing odour sources that comprise the Genesis Xero Waste Facility are located within the pit with little potential for the plume to disperse outside of the pit.

Table 51 – Summary of Predicted 99th Percentile Ground Level Concentrations of Odour (OU) (source: PE; 2016)

Receptor	Project	Project + Genesis Facility
James Erskine Primary School	<1	<1
Erskine Park High School	<1	<1
Clairgate Public School	<1	<1
Minchinbury Public School	1	1
Pinegrove Memorial Park Lawn Cemetery	<1	<1
Sunny Patch Preparation School & Long Day Care Centre	<1	<1
Eastern Creek Public School	<1	<1
St Agnes Catholic High School	<1	<1
All Areas Family Day Care Pty	1	1
Maria Hawey Child Care Centre	1	1
Jiminey Cricket Long Day Care	1	1
White Bunny Child Care Centre	1	1
LITTLESMARTIES	<1	<1
Kidz Fun Factory	<1	<1

Figure 57 – Predicted 1-hour average 99th percentile ground level odour concentrations – project in isolation (source: PE; OIA, 2016)

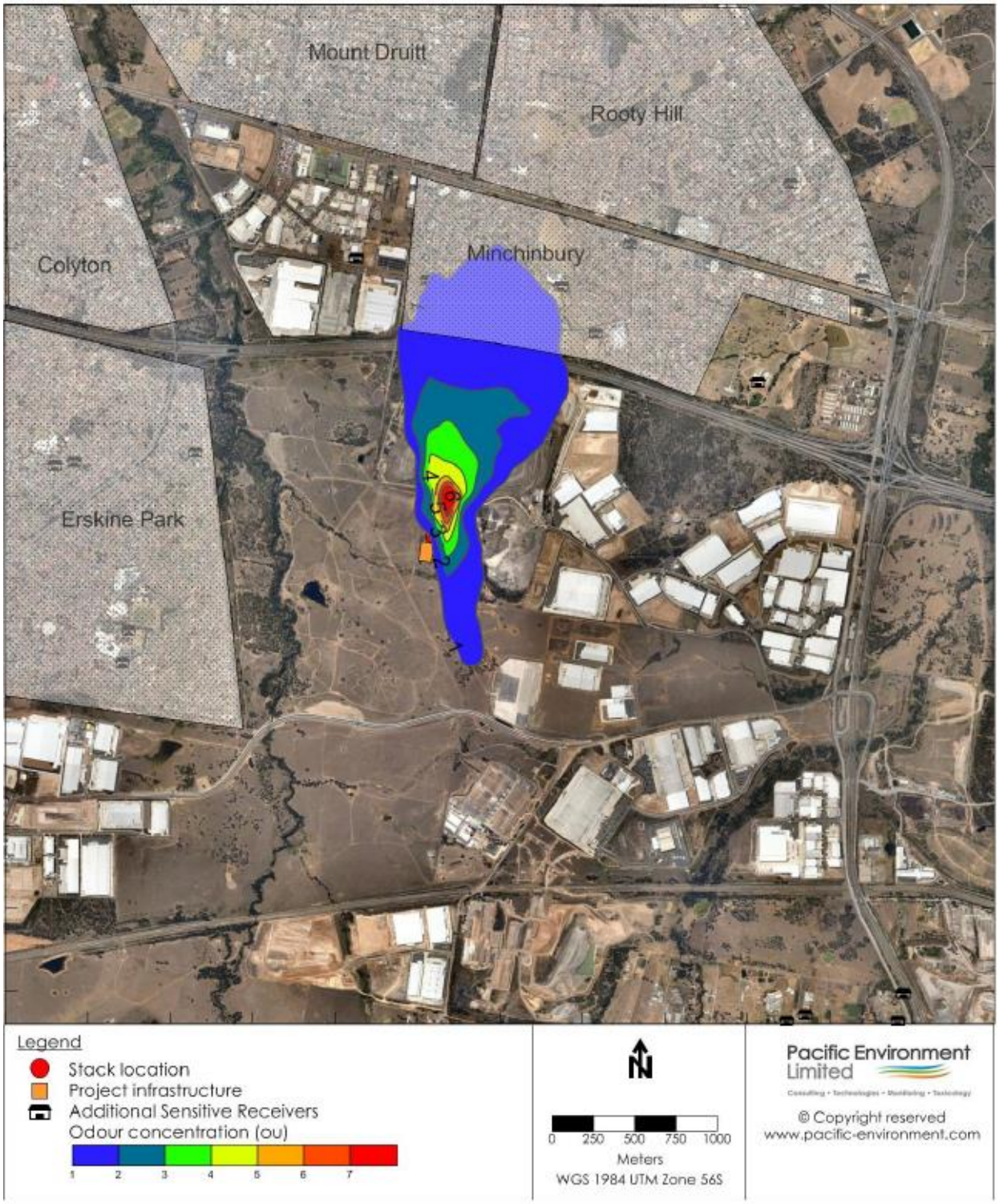
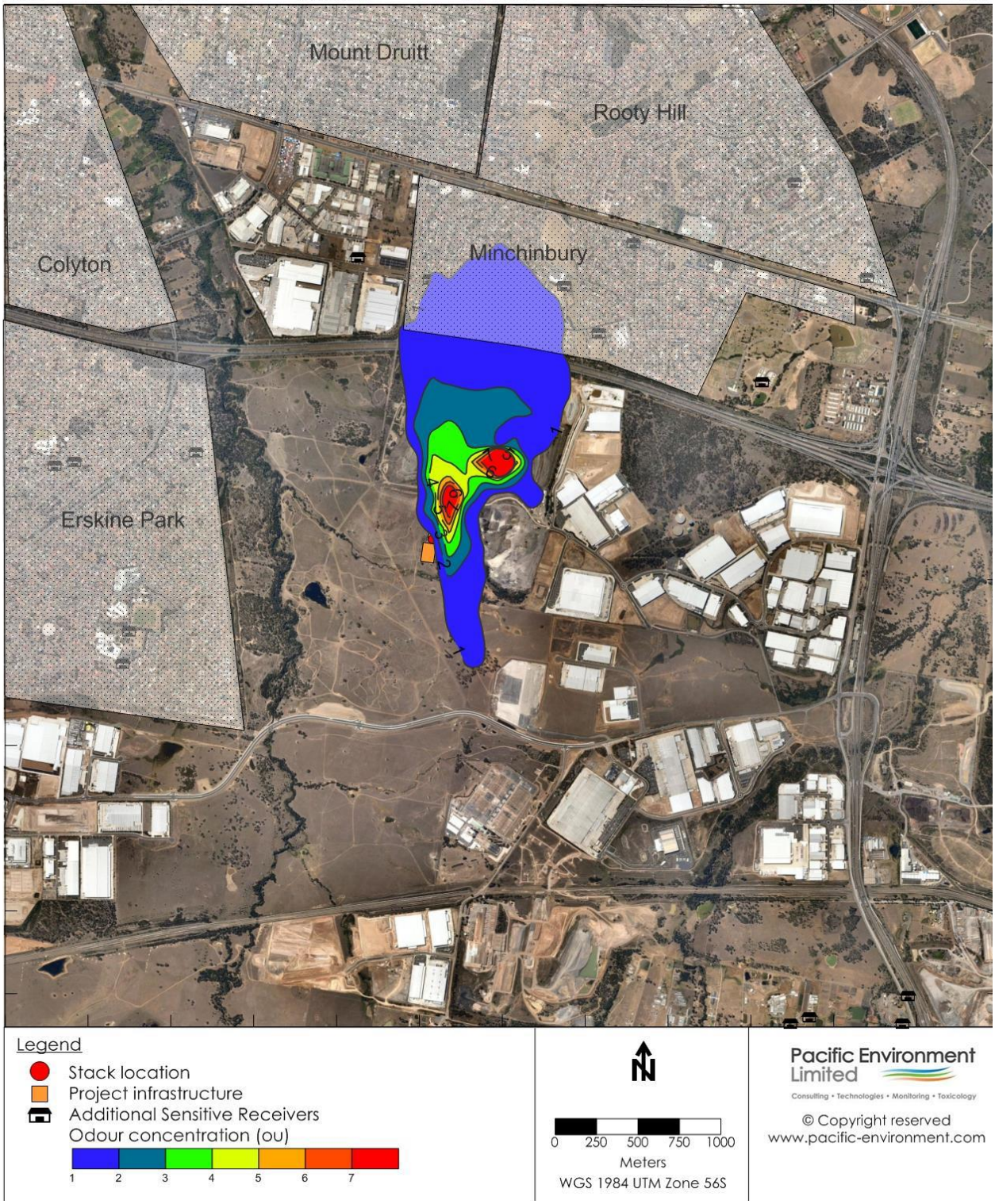


Figure 58 – Predicted 1-hour average 99th percentile ground level odour concentrations – cumulative assessment (source: PE; OIA, 2016)



14.5. CUMULATIVE IMPACTS AND MITIGATIONS MEASURES

14.5.1. Cumulative Impacts

A cumulative assessment odour sources (existing and proposed) on the site was completed by Pacific Environment. The assessment predicts that odour concentrations will be highest in the residential suburb of Minchinbury. However, despite being marginally above the detection threshold (1ou) and below the impact assessment criterion of 2 ou throughout the suburb

When measured at the 99th percentile all odour concentrations are anticipated to be below the 2ou impact assessment criterion for all sensitive receptors.

14.5.2. Mitigation Measures: Facility Design and Operation

Despite the above results the facility has been designed to restrict the potential for odorous emissions. In particular, the following design and operational characteristics have been adopted:

Table 52 – Odour: Mitigation Measures

Potential Impact	Management Response	Timing
Nuisance odour (offsite) waste storage and receipt.	TNG will not accept or process putrescible waste streams.	Operational: ongoing
	The tipping hall will utilise high speed at the entrance and exit to limit the period with which fugitive emissions can escape.	
	All waste storage and unloading, associated with TNG will take place within the tipping hall building, which is kept under negative pressure.	
Nuisance odour (emissions) No mitigation required, removed through thermal treatment.	Excess air extracted from the building will be reused in the boiler (i.e. eliminating potentially odorous air through thermal oxidation).	Operational (ongoing)
	odorous compounds undergo chemical decomposition through thermal treatment.	

14.6. SUMMARY AND CONCLUSION

This odour assessment provides a quantitative assessment of potential odour impacts as a result of the proposed Facility.

A cumulative assessment odour sources (existing and proposed) on the site indicate that the predicted odour concentrations, at the 99th percentile, would be below the 2 ou impact assessment criterion for all of the sensitive receptors including the most affected residents in Minchinbury.

Taking into account the project specific design and operation measures outlined in Table 52 and the outcome of the assessment the operation of the Facility is considered unlikely to result in an unreasonable adverse off site odour impacts.

15. NOISE & VIBRATION

15.1. OVERVIEW

Pacific Environment has considered the directions of the DGRs requiring assessment of the following key issues:

- Description of all potential noise sources such as construction, operational, on and off-site traffic noise;
- Quantitative noise impact assessment including a cumulative noise impact assessment in accordance with relevant Environment Protection Authority guidelines; and
- Details of noise mitigation, management and monitoring measures.

The construction and operation of the facility has the potential to generate noise that may affect nearby receivers, including workers associated with the established industrial premises immediately surrounding the site as well sensitive noise receivers such as residents and school in Minchinbury and Erskine Park located 1 kilometre to the north and west, respectively.

Pacific Environment has undertaken detailed noise assessment to characterise the baseline (existing) noise environment; combined with a detailed assessment of all plant materials and activities associated with construction and operations, including road traffic noise and vibration effects.

The outcome of this assessment indicates that short term impacts may arise through construction works, owing to the unique requirements project requiring works to be undertaken during sensitive night time hours to ensure that ongoing environmental health is achieved. These works are limited to less than 5 per cent of the total construction program and for residential receivers are not expected to breach “sleep disturbance criteria” with exceedances of 1dBA above the criteria expected to be suitably mitigated through site management practices.

Once operational, Pacific Environment predict the facility will have no adverse impact on the receiving noise environment and will comply with the noise criteria of the INP. The Noise Impact Assessment (NIA) in support of the proposed Development at **Appendix O.**

15.2. LEGISLATIVE REQUIREMENTS

The potential for noise impact is managed and regulated across several frameworks are broadly separated into three (3) categories:

- Construction Noise;
- Operational Noise; and
- Road Traffic Noise.

Table 53 – Summary of regulatory guidelines based on noise source

Noise Source/Activity	Policies and Frameworks
Construction	NSW Interim Construction Noise Guideline (DECCW, 2009)
Operation	• Eastern Creek Precinct Plan • The EPA Industrial Noise Policy • The EPA Road Noise Policy
Road Traffic Noise	NSW Road Traffic Noise Policy (EPA, 2011)

Noise Source/Activity	Policies and Frameworks
Vibration	Assessing Vibration: A Technical Guideline (EPA)

15.3. ASSESSMENT METHODOLOGY

15.3.1. Identification and Characterisation of Receivers

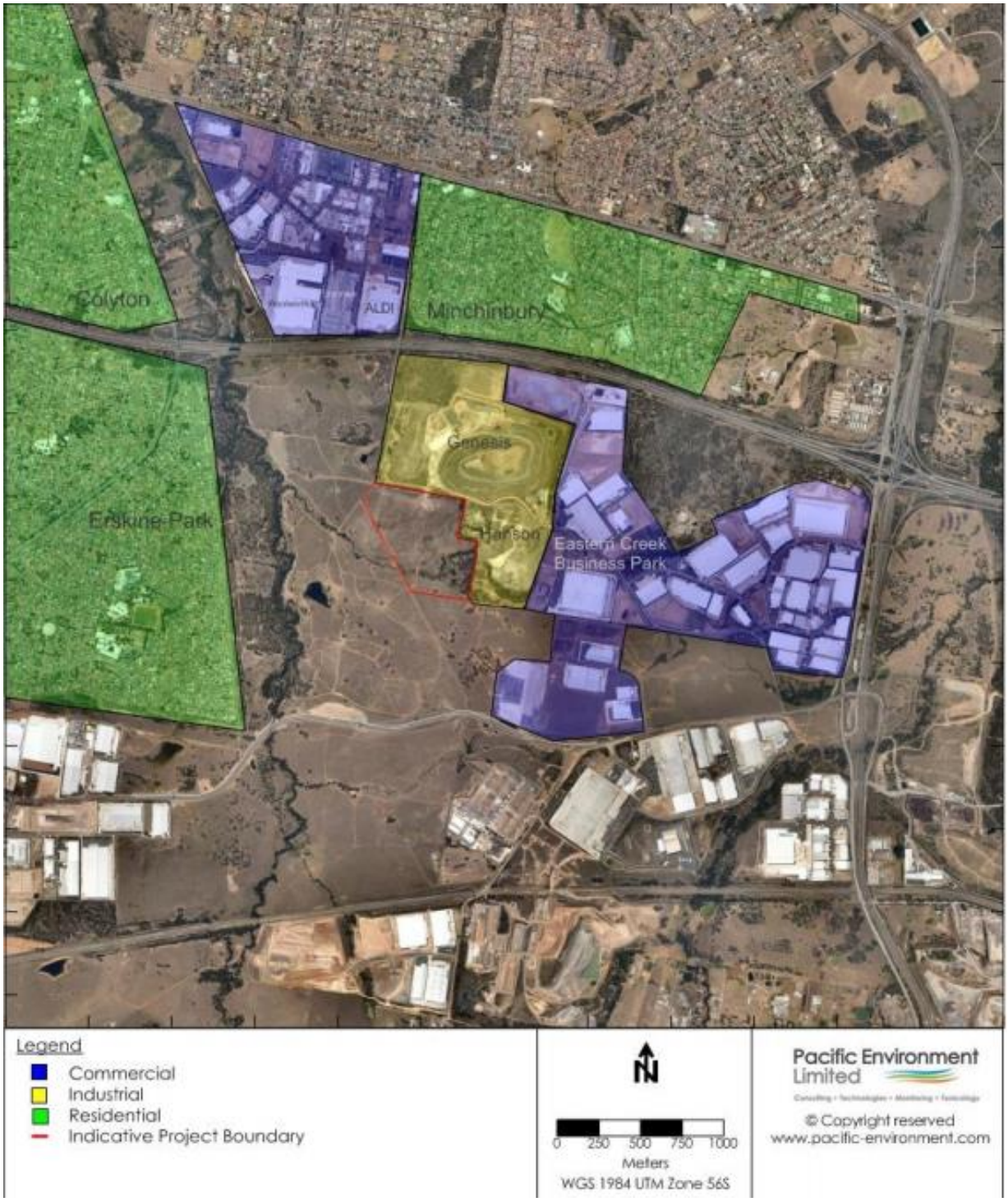
The development site forms part of a larger industrial land holding located within an existing industrial area that is undergoing development growth. This growth is anticipated to continue in the future in line with the draft WSEA expansion.

The site does not immediately adjoin residential zoned land or residential receivers, with the nearest "sensitive receivers" located in Erskine Park and Minchinbury approximately 1km to the west and north of the development site, respectively. In addition to residential receivers, other adjacent land uses identified as being relevant to the assessment include:

- Three (3) schools including Minchinbury Public, James Erskine Primary school and Erskine Park High School; and
- Commercial and Industrial premises to the north and east within Erskine Park.

Road and vehicle access to the site is via an established classified and industrial road network. Access to the site therefore does not require trucks or cars associated with the operation to use residential street networks. Refer to Figure 59.

Figure 59 – Location of the site relative to sensitive receivers (source: Pacific Environment; 2016)



15.3.2. Existing Noise Environment (Background Noise Levels)

Unattended noise monitoring was undertaken at the location of the most sensitive receivers, residential, to establish a baseline noise environment (i.e. the ambient or background noise environment). Baseline noise information was collected by noise monitoring undertaken at two (2) locations, identified as the most sensitive (i.e. the nearest) receivers, these included:

- **BG1:** No. 24 Cobbler Crescent, Minchinbury, to the north of the site; and
- **BG2:** 4 Blackbird Glen, Erskine Park, to the west of the site.

Each of the locations relative to the site are identified in Figure 60, these locations were identified as they represent the existing ambient and background noise environments in the two closest and potentially

most affected sensitive receiver areas to the project, without being unduly affected by road traffic noise from the M4.

Figure 60 – Noise Monitoring Locations Relative to the Development Site (source: PE; 2016)

Pacific Environment undertook unattended noise monitoring between 18 March and 27 March 2014 at both locations. Due to a fault at BG1, the monitoring was repeated between 8 April 2014 and 16 April 2014. Noise monitoring was carried out using two NTi Audio XL2 Type 1 Sound Level Meters. The meters have been calibrated in the last two years and calibration was checked before and after the measurement period and no significant drift (±0.5 dB) was noted.

The ambient noise levels established as a result are provided in Figure 61.

Figure 61 – Background Noise Levels (source: PE; 2016)

Location	Measured RBL dB(A)			Measured Ambient Noise Level $L_{eq,15min}$ dB(A)		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
BG1	43	48	41	55	54	51
BG2	37	44	35	53	57	46

Notes: 1.Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays & Public Holidays.
2. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays.
3. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.

Using the acoustic character statements set out in the INP, each of the identified sensitive receivers were classified, refer to Table 54.

Table 54 – Existing acoustic character of identified receivers

Receiver	Location	INP Defined Receiver	Comment
Minchinbury	North	"Urban"	Noise measurements and on site observations indicated the presence of 'urban hum' which includes continuous traffic noise from the M4 motorway and Great Western Highway. A suburban receiver is defined in the INP as an area that has local traffic flows or some limited commerce or industry. This area often has the decreasing noise levels in the evening period or evening ambient noise levels defined by the natural environment and infrequent human activity.
Erskine Park	West	"Suburban"	Traffic in Erskine Park is local traffic and influence from the M4 decreases towards the south of the suburb. The area generally experiences low ambient and background noise levels and no significant industrial noise was observed. As a result, Erskine Park has been classified as a suburban receiver area

Notably the measured background (baseline) noise levels at BG1 and BG2 are higher during the evening than during the day. The Industrial Noise Policy (INP) Application Notes (EPA, 2006) state that where this occurs:

- there is an expectation by the community that noise controls are greater during more sensitive evening and night periods; and
- that where the measured evening level is higher than the day, the background levels should be set no higher than the day level.

Therefore in determining project specific noise levels from the measured background levels, this approach has been applied.

Attended noise measurements were also carried out over 15 minutes during each period to characterise the existing noise environment and identify existing industrial and other types of noise sources. Refer to Figure 62.

Figure 62 – Attended Noise Measures identifying noise types (Source: PE; 2016)

Location	Date and Time	Measured Noise Level dB(A)		Notes
		L_{eq}	L_{90}	
BG1	18/3/14 11.57am	50	47	Noise environment was dominated by road traffic from M4 motorway (48-52 dB(A)). Other noise sources included some community noise (hammering and dog barking) and occasional bird calls (L_{max} 60 dB(A). Industrial noise was not noted.
BG1	18/3/14 8.20pm	47	45	Noise environment dominated by road traffic noise from M4 motorway, distant traffic from the Great Western Highway and insect noise (noted in the 4, 6.3 and 8kHz third octave bands). Industrial noise was not noted.
BG1	19/3/14 12.37am	51	48	Noise environment generally dominated by road traffic noise from M4 motorway. Some distant industrial noise from directly west of monitoring location estimated at <41 dB(A). Insect noise was also audible at this location.
BG2	18/3/14 1.03pm	47	40	Noise environment consisted of constant distant road traffic noise from M4, occasional community noise and birds, frogs and insects and cicadas (noted in 3.15, 4 and 5kHz one third octave bands). Industrial noise was not noted.
BG2	18/3/14 7.34pm	55	53	Noise environment dominated by frogs and insects (2-16kHz third octave bands) road traffic noise (L_{max} 51 dB(A). Other sources noted included community noise and one occurrence of a just audible tonal reversing alarm estimated <47 dB(A).
BG2	19/3/14 12.05am	50	49	Noise environment dominated by frogs and insects (2-4kHz third octave bands) road traffic noise (46-47 dB(A). Other sources noted included community noise. Industrial noise was not noted.

15.3.3. Construction Noise Criteria

Construction Noise assessments of potential impact were informed and measured against the standards set out in the *NSW Interim Construction Noise Guideline (DECCW 2009).* The noise management levels for residential receivers during construction are outlined in Table 55

Table 55 – Construction Noise Management Levels at Residences using Quantitative Assessment

Time of Day	Management Level ($L_{Aeq\ 15\ min}$)
Recommended Standard Hours: Monday to Friday: 7am to 6pm Saturday: 8am to 1pm No work on Sundays or Public Holidays	Noise affected: RBL + 10 d (A) Highly Noise affected: 75dB(A)
Outside recommended standard hours	Noise affected: RBL +5dBA

The standard can be used for both typical hours of construction works (Monday to Friday 7am to 6pm & Saturday 8am to 1pm) as well as out of hours works (all other times). Figure 63 provides the project specific noise managements levels identified for the project.

The project specific construction noise limits reflect the RBL (refer to Figure 61) + 10 dBA for construction during standard hours and RBL + 5dBA for out of standard hours.

Figure 63 – Project Specific Construction Noise Limits (Source: PE; 2016)

Land Use	Construction Noise Management Level, $L_{Aeq,15min}$ dB(A)			
	Standard Hours	Outside of Standard Hours		
	Monday to Friday 7am to 6pm Saturday 8am to 1pm	Day Saturday 7am-8am, 1pm to 6pm, Sunday 8am-4pm	Evening Monday to Sunday 6pm to 10pm	Night time Monday to Saturday 10pm to 7am Sunday & Public Holidays 10pm to 8am
Minchinbury (BG1)[1]	53	48	48	46
Erskine Park (BG2)[1]	47	42	42	40
Commercial	65	65	65	65
Industrial	70	70	70	70
School[2]	55	-	-	-

Notes: 1. The measured evening RBL was higher than the day. In this case, the evening RBL has been set equal to the day, in accordance with the INP Application Notes.
2. External noise level based on an outside to inside correction of 10 dB(A), in accordance with the INP.

15.3.4. Operational Noise Criteria

The site is subject to two (2) operational noise criteria management frameworks, including:

- The Eastern Creek Precinct Plan introduced under SEPP 59; and
- The Industrial Noise Policy (INP), NSW EPA framework for noise assessment.

15.3.4.1. Eastern Creek Precinct Plan

The site is located within Zone 4 of the Eastern Creek Precinct Noise Emissions Zone. Noise Management levels for zone 4 are shown in Figure 64**.**

Figure 64 – Precinct Noise Emission Zone Goals (zone 4 highlighted)

Period	Noise Emission Goal at Nearest Residential Areas, $L_{eq,period}$ dB(A)					
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Day	57	54	56	54	49	52
Evening	47	44	46	44	39	42
Night	42	40	40	39	34	37

15.3.4.2. EPA Industrial Noise Policy

The Industrial Noise Policy (INP) recommends that noise management criteria, these include:

- **Intrusiveness Criteria:** assess and control the potential for noise to be intrusive, such as tonal or impulsive noises. The intrusiveness criteria permit noise generation to be no more than 5dB(A) above existing background noise levels; and
- **Amenity Criteria:** Continuous, average background levels that seek to maintain amenity appropriate to land use. The INP using an “acceptable noise level”. The EPA INP states the intent of the amenity criteria is ‘to limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified’.

The INP includes provisions for certain characteristics of the noise emitted from an industrial premises. The characteristics include tonality, impulsiveness, intermittency or dominant low frequency content. Removing these existing characteristics is referred to as a modified ANL.

The INP Recommended noise levels are provided in Figure 65.

Figure 65 – INP Recommended Noise Levels (Source: PE, NIA; 2016)

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residential	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
School Classroom	All	Noisiest 1 hour period (when in use)	45 (external)	50 (external)
Commercial	All	When in use	65	70
Industrial	All	When in use	70	75

Note: 1. This table taken from Table 2.1 of the INP. It should be read in conjunction with the notes from Section 2.2.1 of the INP. Time periods are defined as: Day (7.00am-6.00pm Monday to Saturday and 8.00am-6.00pm Sundays and Public Holidays), Evening (6.00pm-10.00pm), Night (10.00pm-7.00am, unless preceding a Sunday or Public Holiday).
2. External noise criteria based on internal criteria + 10 dB, as recommended in the INP.

15.3.4.3. Project Specific Operational Noise Levels

Using the background noise levels outlined above, a project specific noise level was identified using the *NSW Interim Construction Noise Guideline* (DECCW 2009).

The operational noise criteria for the project are presented in Figure 66, the noise criteria have been established using the receiver types (outlined in **section 7.3.1**). The intrusive noise criteria are based on the RBLs (refer to Figure 61). The amenity criteria have been derived using the unattended and attended noise measurements. The existing level of industrial noise was determined from the attended monitoring and used to inform the modification of the ANLs.

The controlling criteria for the residential receivers is the intrusive criteria during the day, evening and night, except during the night at Minchinbury where the amenity criterion is 3 dB lower than the intrusive criterion.

The project specific noise levels will be assessed over 15 minutes. The operation of the facility is then assessed as a worst case 15 minutes. The amenity criterion is assessed over a period of eleven, four or nine hours and one hour for schools. For the criterion at Minchinbury during the night, the amenity criterion is the most stringent. However, it is conservatively considered that if compliance is achieved over a worst-case 15 minutes, it would also be achieved over the nine-hour period, in the unlikely event that the modelled level of noise was continuous for that period.

15.3.4.4. Cumulative Noise

Cumulative noise impacts affecting receivers from all industrial noise sources are assessed according to the INP's amenity criteria. The combined impact of all industrial noise sources at a receiver point should be considered, where industrial facilities are either operating or have been approved for development.

The cumulative noise criteria that apply for the residential receivers within the project area are the acceptable noise levels shown in Figure 66.

In addition, the Eastern Creek Precinct Plan provided noise levels at the nearest residential receivers to the specified zones. As a result, where predicted noise levels are compliant with these zone emission goals, adverse cumulative noise impacts would not be expected.

Figure 66 – Project Specific Noise Criteria (source: PE; NIA; 2016)

Receiver Area	Type	Period[1]	Amenity ANL	Amenity Existing Industrial Noise[2] $L_{eq,industrial}$	Amenity Adjusted ANL $L_{Aeq,period}$	Intrusive RBL	Intrusive Intrusiveness Criteria RBL+5 $L_{Aeq15min}$	Intrusive Project Specific Criteria
Minchinbury	Residential	Day	60	<41	60	43	48	$L_{Aeq,15min}$ 48
		Evening	50	<41	50	43	48	$L_{Aeq,15min}$ 48
		Night	45	<41	43	41	46	$L_{Aeq,period}$ 43
Erskine Park	Residential	Day	55	-	55	37	42	$L_{Aeq,15min}$ 42
		Evening	45	-	45	37	42	$L_{Aeq,15min}$ 42
		Night	40	-	40	35	40	$L_{Aeq,15min}$ 40
Minchinbury Primary School	School	When in use	45	-	-	-	-	$L_{Aeq,1hr}$ 45
Erskine Park Primary School	School	When in use	45	-	-	-	-	$L_{Aeq,1hr}$ 45
Industrial	Industrial	When in use	70	-	-	-	-	$L_{Aeq,period}$ 70
Commercial	Commercial	When in use	65	-	-	-	-	$L_{Aeq,period}$ 65

Notes: 1. Day (7.00am-6.00pm Monday to Saturday and 8.00am-6.00pm Sundays and Public Holidays), Evening (6.00pm-10.00pm), Night (10.00pm-7.00am, unless preceding a Sunday or Public Holiday).

15.3.4.5. Sleep Disturbance Criteria

The EPA does not currently have an explicit policy regarding sleep disturbance caused by noise from construction or industrial operation activities. However, there is some guidance mentioned in the INP application notes, which states *"The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development".*

Notwithstanding this screening criterion of RBL + 15 dB LA1,1min dB(A) is adopted as suggested in the INP Application Notes. This screening criterion indicates that if the criterion is met, sleep disturbance is unlikely. Where the criterion is exceeded, further analysis is required. The relevant sleep disturbance criteria set for the project are provided in Figure 67.

Figure 67 – Sleep Disturbance Screening Criteria dB(A)

Residential Receiver Area	Sleep Disturbance Screening Criteria $L_{1,1min}$ dB(A)
Minchinbury	56
Erskine Park	50

15.3.5. Road Traffic Noise

The *NSW Road Noise Policy (EPA, 2011)* provides guidance, criteria and procedures for assessing noise impacts from existing, new and redeveloped roads and traffic generating developments. The RNP provides several assessment criteria for traffic generating developments. The criteria are expressed as absolute levels and relative increase criteria for different land uses.

The road noise traffic assessment criteria established for the project are provided in Figure 68.

Figure 68 – Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of Project/Land use	Assessment Criteria – dB(A)[1]	
		Day (7.00am to 10.00pm)	Night (10.00pm to 7.00am)
Freeway/arterial/sub-arterial	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15hr}$ 60 (external)	$L_{Aeq,9hr}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1hr}$ 55 (external)	$L_{Aeq,1hr}$ 50 (external)

Note: 1. Noise level criteria are façade-corrected noise levels.

15.4. ASSESSMENT OF KEY ISSUES

The following key matters have been taken into consideration when assessing the impact of noise:

- The construction of the facility is expected to last 36 months and be completed over stages;
- Typical construction hours will be 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm Saturdays. Across all phases of the construction works;
- Some construction activities would be required to work outside of standard hours (7:00am to 8:00am and 1:00pm to 6:00pm Saturdays in conjunction with specific periods of 24 hour operation); and
- All noise sources, plant and machinery, anticipated to be used in the site preparation construction and implementation of the facility are the associated noise levels have been identified (refer to **Appendix O**).

15.4.1. Construction Noise

Noise generation and the potential noise impact will vary of the 36 month program of construction works as a consequence of the variation in construction and activity and the nature of the plant and machinery in use.

Due to the nature of the build, in particular the construction of the waste bunker requiring a 16 hour continuous concrete pour to ensure structural integrity (that will deliver the best environmental outcomes) and the bespoke technology involved there is a requirement for work to be undertaken outside standard hours and in some , very limited instances 24 hours a day.

Figure 69 sets out the proposed construction schedule, including the stages where it is expected non-standard work hours will be undertaken. Figure 70 provides details of the expected hours of operation within each stage.

For the most part, non-standard work hours will cease by 10pm weekdays (Monday to Friday) and 6pm on weekends. The critical periods for construction occur in stages 2 and 3, with the construction of the waste bunker and the plant implementation. As set out in Figure 69, during this period extended construction works may need to be undertaken up 24 hours day for a maximum of 61 days (over the 2 stages). This equates to approximately 6 per cent of the total construction period.

Section 5.2 of the Pacific Environment noise report Noise report provides a detailed breakdown of all construction stages, including construction activities and plant material type and number to be used along with an indication of the associated dBA. This detail was used to model seven (7) construction activity scenarios for the purpose of determining likely impact on the surrounding land use and in particular the sensitive receivers to the north and west in Minchinbury and Erskine Park, respectively.

Figure 69 – Construction Schedule

Stage	Description	Duration of Works	Expected Hours of Operation[1]
Site establishment and clearance	Excavation machinery will be used to clear the site envelope and clear any unwanted vegetation. Setting up of site fences and erosion control measures.	2 weeks	SH
Bulk Excavation/Detailed Excavation/Services Lead In works	Machinery will be used to commence the cut/fill requirement for the future building structure, as well as completing the bulk excavation of the waste bunker. Removal of top soil will be required using trucks. Utilities required to be brought into the site will be undertaken by excavators. This period should be around 10months.	6-10 months	SH
Structure and Concrete Works	The structure will require two methods of construction. The slip form method, requires concrete to be poured continuously over a period of 16 days. The second method is standard concrete placing methods, which will occur regularly throughout the structure period during standard hours.	5 months	SH, (Slip form OSH 1, 2, 3,4 & 5)
EFW Technology Provider plant installation and façade/roofing installation	During this period, the main plant and equipment used to install all the required elements to the EFW plant are cranes, EWP, mobile cranes, manitous, forklifts and the like. This occurrence will be daily for a period of 16-18 months. Out of hours construction may occur on up to 45 days during the stage.	16-18 months	SH, OSH 1, 2, 3,4 & 5
Landscaping	Nearing completion of the project the final fit out and landscaping stages will acquire minimal plant such as bob cats, backhoes, and smaller excavators. Trucks importing soil may also be required.	5 months	SH, (SH, OSH 4 for concrete pour days)

Figure 70 – Non-standard work hours (reference periods)

Construction Period		Time
Standard Hours (SH)		7.00am to 6.00pm Monday to Friday 8.00am to 1.00pm Saturdays
Outside of Standard Hours (OSH)		
OSH 1	Evenings	6.00pm to 10.00pm Monday to Sunday
OSH 2	Weekday Nights	10.00pm to 7.00am Monday to Friday
OSH 3	Saturday Night[1]	10.00pm (Saturday) to 8.00am (Sunday/Public Holiday)
OSH 4	Saturdays	7.00am to 8.00am and 1.00pm to 6.00pm Saturdays
OSH 5	Sundays/Public Holidays	8.00am to 6.00pm Sundays

Note: 1. Saturday Night may be replaced by the day preceding a Public Holiday

15.4.2. Predicted Construction Noise Levels

Noise modelling was undertaken by Pacific Environment using the ISO9613 algorithm, as implemented within the CadnaA acoustic modelling package and took into consideration the sound power level of the proposed site operations, activities and equipment, and applies adjustments for attenuation from geometric spreading, acoustic shielding from intervening ground topography and barriers, ground effect and atmospheric absorption.

The ICNG states that recommended construction hours are Monday to Friday 7.00am to 6.00pm and Saturdays 8.00am to 1.00pm. All work outside of these times is considered outside of standard hours.

Figure 71 indicates the seven (7) construction noise scenarios modelled in the assessment of potential impacts.

Figure 71 – Construction Noise Modelling Scenarios (source: PE; NIA; 2016)

Scenario	Description	Hours of Operation[1]					
		SH	OSH 1	OSH 2	OSH 3	OSH 4	OSH 5
1	Site Clearing and Preparation	x					
2	Excavation/Services Lead In	x					
3	Structure – non concrete pour days	x				x	
4	Structure – concrete pour days	x	x	x	x	x	x
5	Technology Provider Plant Installation /Structural Steel	x	x	x	x	x	x
6	Landscaping – non concrete pour days	x					
7	Landscaping – concrete pour days	x				x	

Note: 1. Refer to **Table 5-1** for definition of time periods.

Figure 72 and Figure 73 provide the outcome of the noise modellings, with the predicated construction noise level of each scenario at the identified receivers.

Figure 72 –Standard Construction Hours Predicted Noise Level (source: PE; NIA; 2016)

Receiver	Criteria	Scenario Predicted Noise Level $L_{eq,15min}$ dB(A)						
		1	2	3	4	5	6	7
Erskine Park Residential	47	41-47	41-47	31-33	35-37	38-41	31-37	30-39
Erskine Park School	55	38-45	38-45	28-33	31-36	28-41	28-36	29-38
Woolworths Distribution Centre	65	20-48	20-48	29-31	32-34	34-38	<20-38	<20-40
Startrack Centre	65	21-49	21-49	28-31	31-34	33-38	<20-39	<20-41
Aldi	65	22-46	22-46	28-31	31-34	33-39	<20-36	<20-38
Minchinbury Residential	53	22-44	22-44	30-31	33-34	37-39	<20-34	<20-36
Minchinbury School	55	<20-35	<20-35	25-27	27-29	28-33	<20-25	<20-27
Genesis	70	38-56	38-56	44-46	46-48	46-51	28-46	30-48
Hanson	70	44-83	44-83	45-50	49-53	48-58	31-73	33-75

Figure 73 – Non-Standard Hours: Predicted Noise Levels (source: PE; NIA; 2016)

Receiver	Criteria[1]				Scenario Predicted Noise Level $L_{eq,15min}$ dB(A)					
	OSH 1/2	OSH 3	OSH 4	OSH 5			3	4	5	6	7
Erskine Park Residential	42/40	40	42	42			31-33	35-37	38-41		30-39
Erskine Park School	55	55	55	55			28-33	31-36	28-41		29-38
Woolworths Distribution Centre	65	65	65	65			29-31	32-34	34-38		<20-40
Startrack Centre	65	65	65	65			28-31	31-34	33-38		<20-41
Aldi	65	65	65	65			28-31	31-34	33-39		<20-38
Minchinbury Residential	48/46	46	48	48			30-31	33-34	37-39		<20-36
Minchinbury School	55	55	55	55			25-27	27-29	28-33		<20-27
Genesis	70	70	70	70			44-46	46-48	46-51		30-48
Hanson	70	70	70	70			45-50	49-53	48-58		33-75

Notes: 1. Refer to **Table 5-1** for definition of time periods.

As out of hours works are proposed to be undertaken during the INP defined "night" period from 10.00pm to 7.00am Pacific Environment have undertaken assessment of the potential for sleep disturbance. The results of this assessment are provided Figure 74.

The potential for sleep disturbance is considered from short-duration, high level noise events. In this case, significant maximum noise level events that could occur from the following activities that occur during the night are considered as follows:

- Truck brakes;
- Dropping or striking tools or materials;
- Loading material into trucks;
- Engine starts; and
- Reversing alarms.

A conservative maximum noise sound power level of L_{max}125 dB(A) is considered the level of the maximum short duration noise event.

Figure 74 – Predicated Maximum Noise Levels: Sleep disturbance potential (source: PE; NIA; 2016)

Receiver	Sleep Disturbance Criteria $L_{1,1min}$ dB(A)	Predicted Maximum Noise Level L_{max} dB(A)
Minchinbury	56	46
Erskine Park	50	49

15.4.2.1. Assessment of Impact

The predicted construction noise levels indicate compliance would be achieved at all sensitive receiver locations during Standard Hours and for all construction scenarios.

Notwithstanding the above, two (2) identified receivers will be exposed to construction noise above the identified noise criteria, Erskine Park Residential Area to the west and Hanson Industrial premises to the east.

Erskine Park: Residential Receivers

The exceedance at Erskine occurs in relation to modelled Scenario 5, which may include works during the following hours (outside the standard construction hours):

- Saturday between 7.00am and 8.00am;

- Saturday between 1.00pm and 6.00pm;
- Saturday 10.00pm to 8.00am the next day;
- Sunday between: 8.00am and 6.00pm; and
- Weekdays between 6.00pm and 7.00am the following day.

A comparison matrix of the modelled exceedance and the construction noise criteria and sleep disturbance is provided in Table 56. Notably the exceedance occurs over the night time period, by a magnitude of 1dBA and is significantly below the sleep disturbance criteria.

Table 56 – Predicted Noise level matrix

Receiver Area	Period	CNL (Out of Hours)	Sleep Disturbance	S5 Predicted Noise Level	Compliance
Erskine Park	Day	42	N/A	38 -41	✓
Residential (suburban)	Evening	42	N/A	38-41	✓
	Night	40	50	**38-41**	✓/×

Scenario 5 has modelled the likely construction noise associated with stage 4 of the construction works, involving the implementation and construction of the EfW plant. While the program for construction over this stage will last between 16 to 18 months, the intended out of hours works is much less at a maximum of 45 days, or 6 per cent of the construction over this stage of the works.

Furthermore, the noise predictions have taken into account all plant working simultaneously at their closest point to the receiver. This is unlikely to be the scenario on site through construction where measures would be implemented to minimise the potential for disturbance and impact on residential receivers, through ensuring that plant does not work simultaneously and are located as far from the eastern boundary as is feasible. These measures would lower noise levels at the receivers.

In relation to this stage of the works, the out of hours construction are necessary at the following times owing to:

- Out of hours work on Saturday from 7.00am to 8.00am and 1.00pm to 6.00pm for structure and concrete works as advice from the construction contractor indicates that working hours between 8.00am and 1.00pm may not allow enough time for sections to be completed to a sufficient standard.
- The installation of EfW plant and equipment is anticipated to take longer to set up and complete than standard hours allows, due to its complexity, size and the need for plant and equipment used in its installation that will be required to be outside of standard hours for road safety reasons, in some instances equipment would be required to be manoeuvred into place immediately where it cannot be set down and installed at a later date.

Taking into account the relatively minor exceedance, 1dBA exceedance of the night time criteria for out of hours works combined with the limited duration of the expected works and compliance with the sleep disturbance criteria the request to extend the construction hours to support the installation of the plant equipment is considered reasonable. The development of an appropriate and site specific construction noise management plan could feasibly reduce the affect to acceptable limits by managing the number and types of plant operating through these hours and ensuring plant is as far away from the western boundary as possible.

Pacific Environment have provided detailed recommendations for the development of the construction noise management plant, these have been included in section 7.5 of this amended EIS. It is also proposed to provide notice to all residents within Erskine Park at least 48 hours prior to the commencement of out of hours works and that in giving notice all likely affected residents are provided with a 24 hour complaint line and the name and contact details of an authorised site representative.

Hanson Wallgrove: Industrial Noise Receivers

The Hanson Wallgrove Quarry site is located immediately to the east and shares a common boundary with the EfW site. The acoustic assessment has identified that occupants of the Hanson site would be exposed to construction noise exceeding the acceptable criteria during standard construction and out of hours construction hours.

The noise exceedances occurring during early (stage 1 and 2) and late phase (stage 4) works involving the intensive use large plant materials, such as dozers, excavators, compactors and the like. The works and the use of specified plant material are essential to construction and any development of the site is likely to encounter the same issue.

Out of hours works in stage 7 area limited to (OSH4) involving early morning (7.00am to 8.00am) and afternoon (1.00pm to 6.00pm) “out of hours operations and is required to undertake concrete pours that cannot be achieved in the shortened Saturday hours.

At present the Hanson site vacant and as such despite the predicted impact there is no receiver. Noise predictions have been established on the assumption that all plant required will operate simultaneously, which is unlikely and can be managed by the contractor allowing for the achievement of noise some noise reduction.

Notwithstanding this, construction management procedures would be adopted to minimise and manage noise.

15.4.3. Construction Vibration

Vibration as a result of construction works, often associated with earth moving equipment has the potential to impact on adjacent properties, in particular the structural integrity.

Pacific Environment have identified dozers as the most significant source of vibration associated with the proposed scope of construction works. Accordingly, a vibration source level was identified using the Environmental Noise Management Manual (RMS 2001), outlined in the table below.

Table 57 – Vibration Source Level

Equipment	Peak Particle Velocity (PPV) at 10m (mm/-s)
Dozer	4

Pacific Environment, in assessing the potential for vibration impacts have taken into account the distance between the sensitive receivers and the activities and applied distance attenuation according to the method in the USA’s Federal Transit Administration *Transit Noise and Vibration Impact Assessment Guideline* (FTA 2006). It is noted that the attenuation of ground vibration can vary from site to site depending on the specific geological and operating conditions.

The closest receiver is the Hanson Facility, sharing a common boundary to the east of the EFW site. It was identified from site layouts (Hanson, 2012) that the closest human comfort receiver is an office, located approximately 75m from the nearest boundary with the EFW site.

The most stringent criterion for building damage is 15mm/s and for human comfort in an office is 0.56mm/s.

Table 58 – Predicated Vibration Level

Distance (m)	Predicated PPV (mm/s)
10	4.0
20	1.4
30	0.8

Distance (m)	Predicated PPV (mm/s)
40	0.5
50	0.4

As shown in Table 58 the effect of vibration relating to the operation of the dozer dissipates over distances. At a distance of 75 metres, vibration will be well below the building damage criterion and human comfort criteria. No adverse impact is anticipated as a result of construction vibration. Accordingly, no mitigation measures are proposed.

15.4.4. Operational Noise

Noise modelling was by undertaken Pacific Environment using the ISO9613 and CONCAWE algorithms, as implemented within the CadnaA acoustic modelling package. Modelling took into consideration the sound power level of the proposed site operations, activities and equipment, and applied adjustments for attenuation from geometric spreading, acoustic shielding from intervening ground topography and barriers, ground effect and atmospheric absorption.

Ground absorption conditions were modelled according to the land type as identified by observations made on site, project plans and aerial photography.

As outlined earlier in this section a number of sensitive receiver locations were selected to be indicative of the potentially worst affected receivers in Minchinbury (BG1) and Erskine Park (BG2). Single storey receivers (dwellings) were modelled at a receiver height of 1.5m and double storey receivers (dwellings) at 4m. The greatest predicted noise level in each sensitive receiver area is presented.

Industrial and commercial receivers were assessed at the potentially most affected location on the site boundary.

The default meteorological conditions as specified in the INP have been used in the modelling. Based on the meteorological parameters determined in Section 3.2, the meteorological parameters used in the modelling are as follows:

- Neutral – Stability Class D, no wind (day, evening, night);
- Adverse 1 – Stability Class D, 3 m/s source to receiver wind (day, evening, night); and
- Adverse 2 – Stability Class F, no wind (night).

Modelling Scenario

A modelling scenario was established to provide a conservative assessment for operations at the facility over a 15 minute period and incorporated the following:

- The modelling considered significant noise sources based on information provided by the facility designers (Ramboll) and assessment of similar facilities (Ferrybridge, UK).
- The peak number of fuel trucks entering the facility of 17 per hour. In order to be conservative, it has been assumed that 75% of the trucks enter the facility within 15 minutes.
- The peak number of ash collection trucks is 5 per 15 minutes, APC trucks 1 per 15 minutes and consumable trucks is 1 per 15 minutes.
- Trucks travel around the site at 30km/h.
- Access doors to the tipping hall are left open.
- Within the tipping hall, the activities that are assumed are trucks entering hall, dumping material, idling and then exiting the tipping hall.
- Building break out noise was calculated based on façade details provided in the concept drawings and transmission loss data was taken from manufacturer's data or products of equivalent performance. It is assumed that building facades are continuous and contain no gaps between panels and sections.

- Air cooled condensers are housed in an open top enclosure.
- Building walls and roofs are clad according to the specification supplied by the project architect. They include the following materials:

– HiKlip 630 profiled steel sheeting;

– Alucobond 3mm panelling;

– Danapalon 16mm panelling; and

– Low level concrete walling.

– Steel sheeting roofing with one layer of insulation with an acoustic performance of Rw 25.

- All equipment is operating simultaneously.

Combined with the above operational information and characteristics the sound power level s of the site equipment was established from information provided by the client from the facilities designer and are based on noise levels measured at a similar plant in Ferrybridge, UK (refer to section 6.4 and Appendix E of PE; NIA at **Appendix O**).

15.4.4.1. Predicted Operational Noise Levels

The predicted noise, set out in Table 59, levels represent the greatest predicted noise level within the receiving area.

Table 59 — Predicated Operational Noise Levels (Source: PE; NIA; 2016)

Receiver	Criteria $L_{eq,15min}$ dB(A)			Predicted Noise Level, $L_{eq,15min}$ dB(A)		
	Day	Evening	Night	Neutral	Adverse 1	Adverse 2
Minchinbury Residential	48	48	43	33	38	38
Minchinbury School	45	-	-	28	33	33
Erskine Park Residential	42	42	40	35	40	40
Erskine Park Schools	45	-	-	34	38	39
Woolworths	65			32	37	37
Startrack	65			33	37	38
ALDI	65			33	38	38
GENESIS	70			55	56	56
HANSON	70			54	54	56

Operational noise contours provided in Figure 75**,** Figure 76 and Figure 77 demonstrate that worst case predicted noise levels (under night time inversion conditions) would be between 50 - 55 dB(A) at the southern boundary of the facility, well below the criteria for commercial or industrial land uses. Therefore, Pacific Environment predicts that noise levels at the nearby Eastern Creek Business Park will comply with relevant INP criteria

Figure 75 – Operational Noise Contours: Neutral Stability Class D, no wind (Source: PE: NIA; 2016)

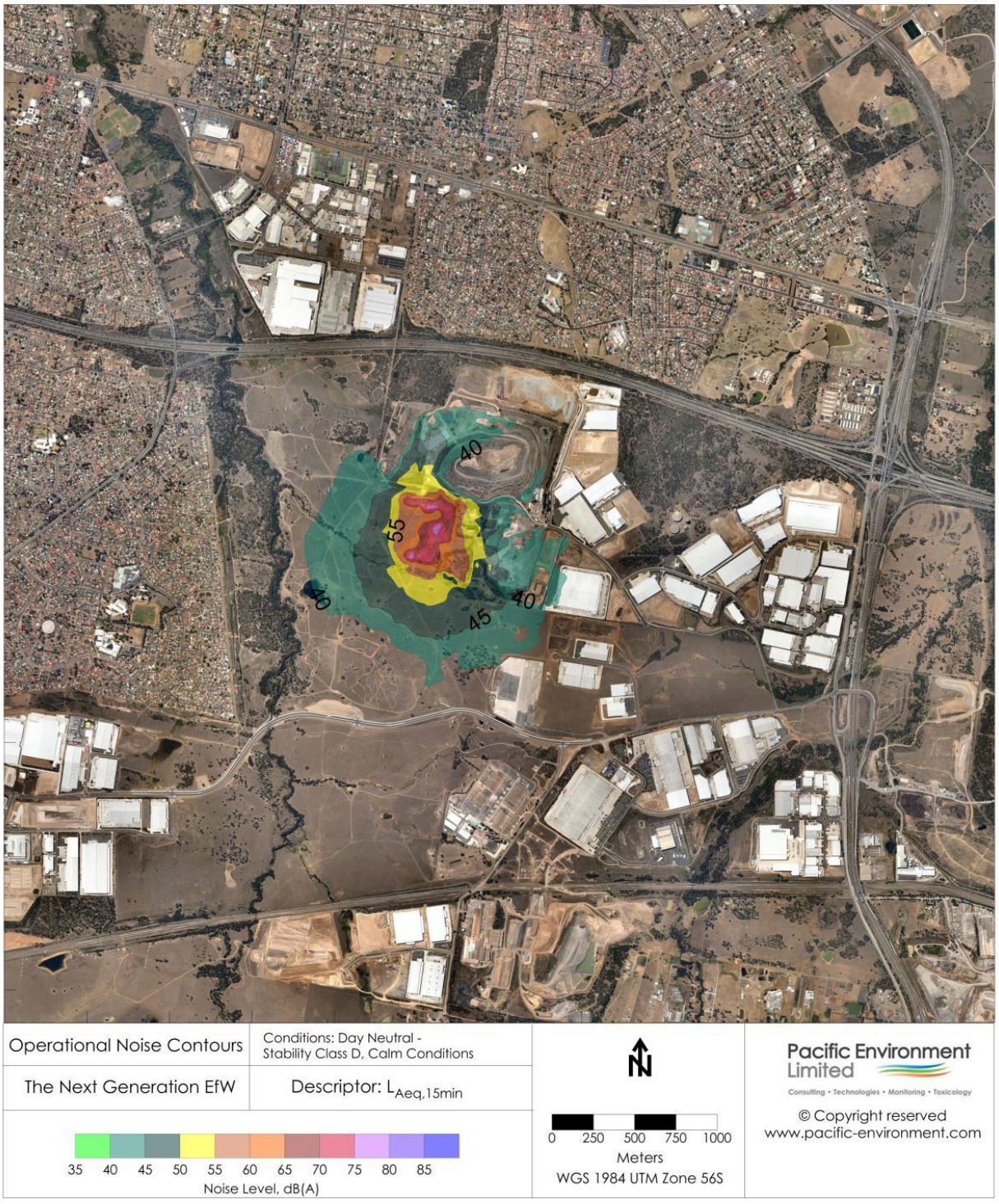


Figure 76 – Operational Noise Contours: Adverse 1 – Stability Class D, 3 m/s source to receiver wind (Source: PE: NIA; 2016)

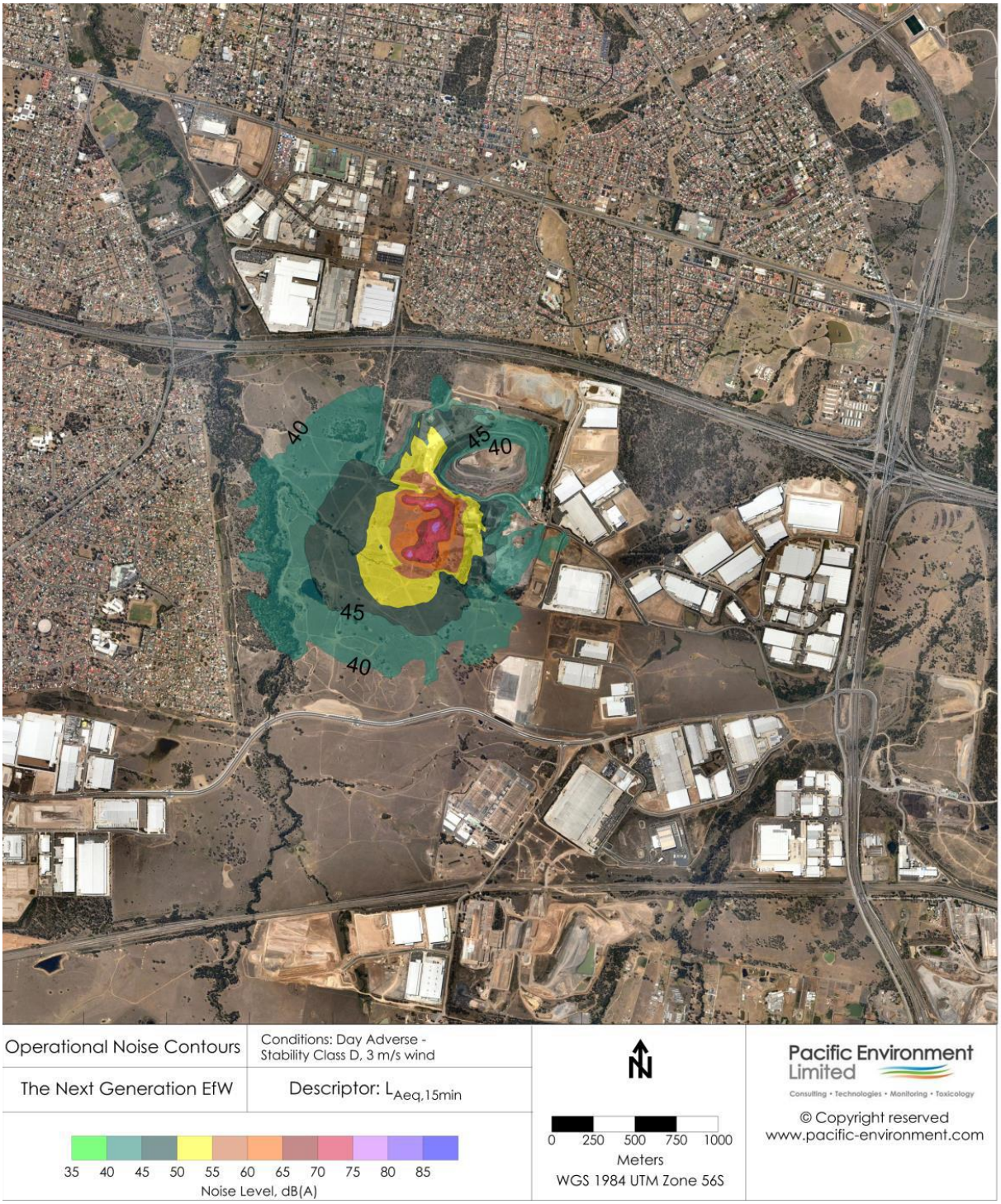
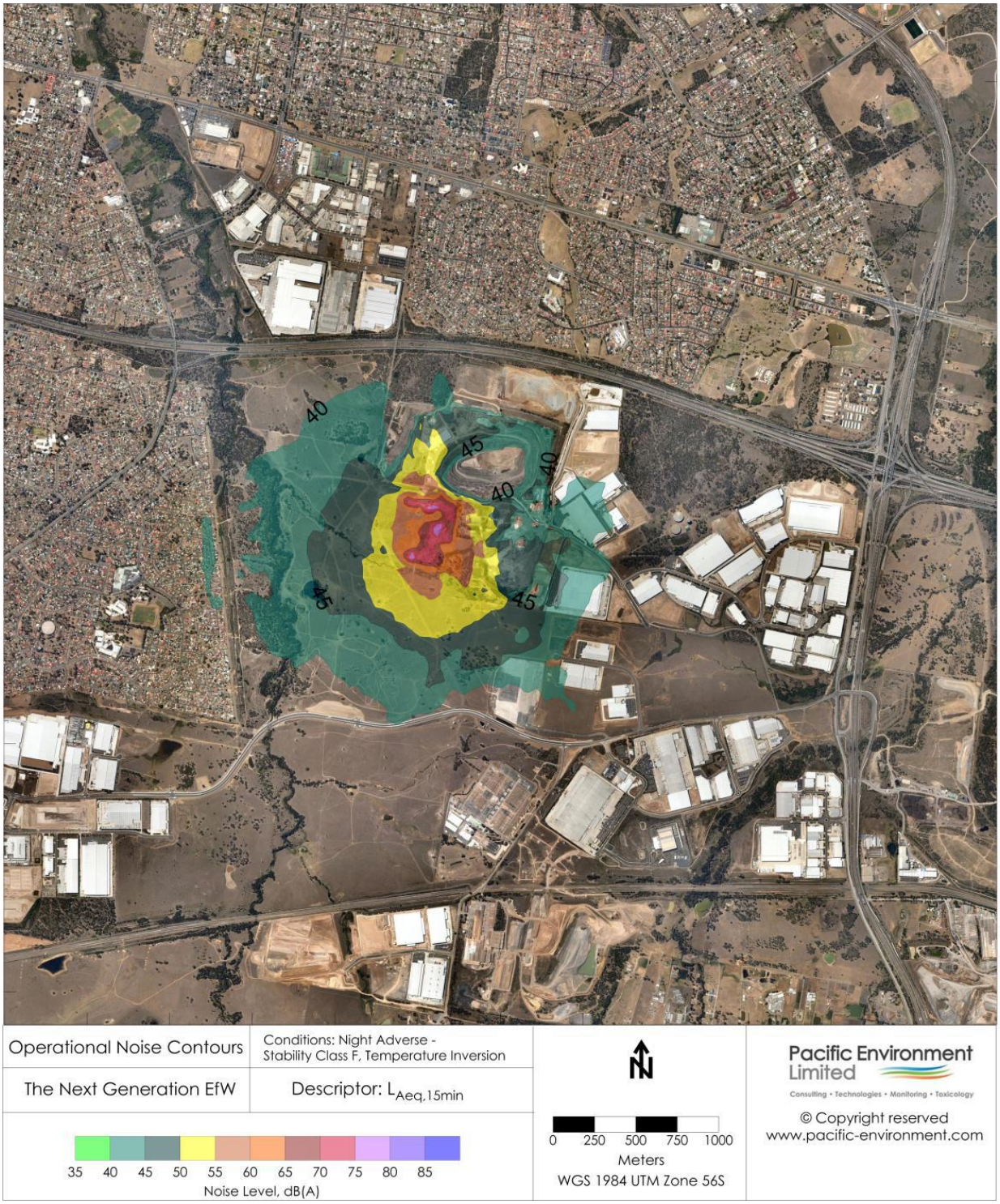


Figure 77 – Operational Noise Contours: Adverse 2 – Stability Class F, no wind (Source: PE: NIA; 2016)



Combined with the typical predicated A-weighting noise assessment, due to the nature of the use C-weighted noise levels were also assessed to consider the impact of very loud or low frequency tones.

The predicated C-weighted noise levels for adverse night time conditions, when the highest predicted noise levels are expected to occur, and a comparison against INP low frequency noise criteria is provided in Table 60.

Table 60 –Predicated C-Weighted Noise Levels (source: PE;NIA; 2016)

Receiver	Predicted Noise Level, $L_{eq,15min}$ dB(C) Adverse 2	Difference C-A dB	INP Criteria $L_{eq,15min}$ dB(C) C-A, dB
Minchinbury Residential	50	12	15
Minchinbury School	46	13	15
Erskine Park Residential	54	14	15
Erskine Park Schools	53	14	15

Noise levels are predicted to be below the commercial and industrial criteria outlined in the NSW EPA INP under all prevailing meteorological wind conditions.

Sleep Disturbance

As the EfW plant is proposed to operate 24 hours a day, seven (7) das week sleep disturbance assessment was undertaken.

Based on the operational profile the following noise sources have been identified as having potential to cause a high level of instantaneous noise event:

- Loading Ash into trucks;
- Operation of a truck park brake; and
- Pressure release valve.

The maximum sound power level of each was identified and is summarised on Table 61.

Table 61 — Maximum Sound Power Level (Source: PE: NIA; 2016)

Item	Sound Power Level, L_{max} dB(A)
Loading trucks	120
Truck park brake	112
Safety Valve	126

Noise Level predictions were made to the surrounding residential receivers and a summary of the greatest predicted result for each nearest residential area is presented in Table 62. As indicated in the predicted noise levels in Table 6-5, sleep disturbance impacts are not expected.

Table 62 – Predicted Maximum Noise Levels (Source: PE: NIA; 2016)

Receiver	Criteria $L_{1,1min}$ dB(A)	Predicted Maximum Noise Level L_{max} dB(A)	
		Neutral	Adverse 2
Minchinbury	56	42	46
Erskine Park	50	45	50

15.4.4.2. Assessment of Impact

Predicated operational noise generation achieves compliance with the project specific noise level criteria during both neutral and adverse meteorological conditions and is unlikely to cause sleep disturbance during night time operations.

The assessment indicated that adjustments for modifying factors are not required as the project is not expected to include tonal, intermittent, impulsive or low frequency noise characteristics as defined in the INP.

15.4.5. Road Traffic Noise

Pacific Environment has modelled the potential impact the new truck movements (associated with the operation of the EfW plant) will have on the noise environment of public roads.

Project traffic volumes (refer to section 10 of the amended EIS) were modelled with existing road traffic volumes obtained from RMS and Transurban, expressed as annual average daily, along identified transport routes. These included;

- Wallgrove Road (AADT, 25,754);
- M4 (AADT 93,000); and
- M7 (AADT, 154,157).

The majority of heavy vehicle traffic into the Site is expected to come from the Genesis facility, approximately 63 per cent via the connecting road between the sites. These traffic movements are incorporated into the existing Genesis generated traffic volumes. However approximately 37 per cent of fuel deliveries are expected to come from sources other than Genesis and result in an additional 57 heavy vehicle movements a day.

Other traffic movements in and out of the Site is expected to include up to 4 movements a day for heavy vehicle traffic associated with consumable deliveries and removal of combustion by products and light vehicle traffic from staff movements.

There are expected to be 55 staff working on a three-shift pattern. It is assumed that staff will use one car each to arrive and depart from the Site.

Existing roads related to the proposed Development already carry large volumes of traffic, including a large percentage of heavy vehicles on Wallgrove Road, M4 and M7 generated by existing industrial and commercial land uses. As a result of the Facility, the traffic volumes would be expected to increase on these roads by less than 2 per cent of the ADDT and therefore no significant noise increase is expected on these roads.

Typically, an increase in traffic noise level above the 2 dB increase criteria is expected where traffic volumes increase by 20 per cent or more. Since the Facility is expected to increase traffic by a much lower amount than this, it is considered to comply with the RNP relative increase criteria.

15.5. CUMULATIVE IMPACTS & MITIGATIONS MEASURES

15.5.1. Cumulative Impacts

An assessment of cumulative impact was undertaken by Pacific Environment to consider the operational contribution of the EfW plant to the local noise environment in the context of existing approved development for the adjacent Hanson's site and the potential for further future development within the broader Eastern Creek Precinct.

When the adjacent Hanson development is operational, the presence of the existing industrial noise at $L_{Aeq,9hr}$ 34 dB(A) would require the night time amenity criteria at Erskine Park to be decreased by 1 dB to $L_{Aeq,9hr}$ 39 dB(A). This would mean the cumulative noise of the EFW facility and the Hanson development would exceed the amenity criteria by 1 dB and the Precinct Plan goal by 2dB.

A 1-2 dB exceedance of the night time goals is considered marginal as typically a 3-5 dB increase in noise level represents a change in noise level noticeable by most people. Furthermore, the exceedance is only predicted to apply during the night under temperature inversion conditions. As these conditions are not present all the time, it is expected to reduce the chance of adverse noise impacts occurring.

Therefore, in consideration of conservative modelling, the marginal degree of exceedance and the conditions under which the exceedance is predicted to occur, additional mitigation is not considered necessary.

The increased cumulative noise, above the Eastern Creek Precinct Criteria for zone 4, is relatively minor nature. Research undertaken by Pacific Environment into the medical impacts of acoustic exposure, has found that the World Health Organisation (WHO) says the following with regard to noise-induced hearing impairment as a result of continuous, intermittent, impulse noise:

> "At L_{Aeq},8h levels of 75 dBA and lower, even prolonged occupational noise exposure will not result in noise-induced hearing impairment (ISO 1990). This value is equal to that specified in 1980 by the World Health Organization (WHO 1980a)."

The WHO guidelines also state that, in terms of annoyance related to noise exposure, "noise above 80 dBA is associated with increased aggressive behaviour" and has noted that annoyance is generally linked to noise exposure characteristics, with "stronger reactions have been observed when noise is accompanied by vibrations and contains low frequency components".

Accordingly, noise exposure from the project predicted to comply with regulatory guideline values for the majority of conditions, with minor (<1 dB(A)) exceedances predicted when assessed cumulatively with other noise sources will be significantly below the guideline values for medical health impacts as defined by WHO.

15.5.2. Noise Management Measures

In light of the predicted exceedances at the Hanson Facility and residential receivers in Erskine Park for selected scenarios, noise mitigation and management measures will be considered for implementation where reasonable and feasible.

Table 63 – Noise and Vibration: Mitigation Measures

Matter	Management	Timing
Construction Phase		
Construction Noise impacts on residents	Prior to the commencement of any work the proponent will prepare a detailed construction noise management plan • Communication with the potentially affected receiver locations to inform of the proposed works, durations and potential for noise. • Identification of key noise impacts. • Noise management measures. • Noise monitoring on site and at sensitive receivers. • Training and awareness of on-site personnel. • Incident and emergency response. • Non-conformance, preventative and corrective action.	Prepared prior to CC; implemented through construction.
Construction Noise Management	Construction Site Management Plan that includes measures to ensure noise is kept to a minimum. The plan shall include: • A Site induction that makes workers aware of the location of sensitive receivers and protocols to implemented to ensure management of noise beyond site. • Ensuring work occurs within approved hours.	Site preparation and construction.

Matter	Management	Timing
	• Ensuring plant and equipment is well maintained and not making excessive noise. • Not operating equipment simultaneously, where possible. This has the potential to substantially reduce noise emissions. • Turning off machinery when not in use. • Mitigation of specific noise sources may be possible by using portable temporary screens or site structures. • Maximising the offset distance between noisy plant items and receivers where possible, especially during more sensitive periods (evening and night). • Orientating directional noise emitting equipment away from receivers. • Operating excavators and other mobile plant in a manner that would reduce the likelihood of maximum noise level events occurring such as: - Sudden changes in vehicle direction/engine load. - Shaking excavator buckets. - Excavator buckets or similar contacting the ground or other solid structures. • Carrying out loading and unloading away from sensitive receivers. • Selecting plant and equipment based on noise emission levels. • Use of residential class mufflers to reduce noise emission from mobile plant such as dozers, cranes, graders and excavators. • Using alternative construction methods. ▪ Using spotters, closed circuit television monitors, “smart” reversing alarms, or “squawker” type reversing alarms in place of traditional reversing alarms.	
Construction Noise: Nuisance and Disturbance	Noise monitoring will be conducted as part of the construction noise management plan. It will follow the principles for noise monitoring outlined in **Appendix C** and be made up of a combination of continuous long term unattended and short term attended noise monitoring.	Prior to commencement to inform development of CEPM and during

Matter	Management	Timing
	Attended monitoring will also be conducted at appropriate intervals during each major construction stage, and in response to complaints, where appropriate.	construction work as required.
Out of Hours construction noise.	Prior to undertaking or commencing any out of hours works including phases of 24 hours construction works and those planned to occur over the IN “night time” hours the proponent must give a minimum of 48 hours notice to those residents most likely to be affected. Notice must be in writing and provide residents with a 24 hours complaints line and the details of the authorised personnel who will be onsite throughout the works and their contact details.	Construction: As need in response to OSH
Road Traffic Noise: Movement of trucks	No management required: all roads accessing the site are through established industrial areas with sufficient separation from residential areas.	N/A
Impact of vibration of buildings and people	Predicated vibration associated with construction works significantly below assessment criteria. No mitigation required.	N/A
Operational Phase		
Road Traffic Noise: Trucks	No mitigation measures required. Vehicle access only through industrial areas.	N/A
Noise from plant operation	Implementation of the Noise Management Plan, prepared by Pacific Environment (refer to Appendix D, NIA)	Operation: Ongoing
	The environmental noise goals of the project will be considered when selecting plant and equipment. All building envelope materials will have the same or better performance than those used in the Pacific Environment Assessment Building facades will be constructed so they are continuous and contain no gaps between panels and sections. Buildings will have openings orientated away from receivers, where possible. The opening will be designed so as to not compromise the acoustic performance of the building and remain closed where possible.	Construction and Operation.
Noise from Trucks and plant	Where possible, broadband or smart reversing alarms will be fitted to all vehicles on site, in order to reduce the potential impacts caused by tonal style reversing alarms.	Operation.

Matter	Management	Timing
Monitoring Operational Noise	Noise monitoring will be carried out to establish the noise emission level of the facility at sensitive receptors and determine compliance. In the event of a noise complaint received from the community and during the initial stage of the development's operation, compliance noise monitoring will be conducted. Noise will be monitored at the most critical time of day near the complainant and near the identified source of the impact.	Operation
Noise from site operations	Develop and implement an operational noise management plan aimed at minimising disturbance of sensitive receivers.	Operations.

15.6. SUMMARY AND CONCLUSION

The assessment was conducted for operations, construction and road traffic in accordance with the relevant guidelines, standards and policies. Assessment was made using a number of conservative assumptions as outlined in the report.

The construction noise assessment indicated the following:

- Predicted noise levels indicate that compliance would be achieved during standard hours at residential receiver locations.
- Exceedance of the noise management levels is expected at the closest industrial receiver for certain construction scenarios.
- Where work occurs outside of standard hours, exceedances of the construction noise management goals were predicted for residential receivers in Erskine Park during night works.
- Noise management measures are recommended to assist in the prevention of impacts.

The construction vibration assessment indicated that the most significant vibration generating activities would comply with the most stringent criteria at the closest receivers.

The operational noise assessment indicated that noise emissions from the operating proposed Facility would comply with the most stringent criteria under both neutral and adverse meteorological conditions.

The cumulative noise assessment for operational noise indicated that adverse cumulative noise impacts would not be expected.

Operational noise management principles are recommended to assist in the prevention of adverse impacts.

The road traffic noise assessment indicated that the predicted increase in road traffic noise from both construction and operational traffic would not be above the limiting criteria.

16. SOILS AND WATER

16.1. OVERVIEW

The DGRs for the Energy from Waste application include the following requirement for environmental assessment of Soils and Water for the proposed Development:

- *Description of the water demands and a breakdown of water supplies;*
- *Description of the measures to minimise water use;*
- *A detailed water balance;*
- *Description of the construction erosion and sediment controls;*
- *A description of the surface and stormwater management system, including on site detention, and measures to treat or reuse water;*
- *An assessment of potential surface and groundwater impacts associated with the development including the details of impact mitigation, management and monitoring measures; and*
- *An assessment of any potential existing soil contamination.*

The project involves early stage construction works including the clearing and removal of vegetation combined with bulk earthworks to establish a level construction pad for the EfW plant; construct a waste storage bunker and on site stormwater detention.

The described construction works will require disturbance of soils and the interference with the existing hydrology of the site.

The local hydrology of the site reflects a highly modified system that has arisen from successive land improvement works the most notable of which being the former quarrying operations that altered and continues to influence the groundwater regime. Modification of the landform associated with former land clearing practices to establish agricultural pursuits resulted in significant degradation of the riparian corridor to the Ropes Creek Tributary, leading to fragmented vegetation patches with limited structural complexity and the altered water regimes that includes the construction of onsite water storage (dam).

Soil health, influenced by past land use has been determined as suitable for continued commercial and industrial by A.D. Envirotech. Soil character is identified as friable contributing to the potential to be erosive and dispersive and moderately saline.

A range of technical reports were undertaken to consider the impacts of past use and future suitability of the development in the context of likely soil and water impacts. The primary report, into soil and water impacts is Edison Environmental supported by AT&L Engineering, Civil Design and Infrastructure; A.D. Envirotech, in relation to Contamination. As well historical contamination reports prepared by ADI.

Following exhibition of the original EIS several submissions raised matters relating to soil and water including the extent of contamination investigation undertaken by ADE and the need for ground water testing. The amended EIS has included a discussion on the limitations of site investigations noted by some submitted.

A cumulative assessment of the proposal and the relevant technical reports has been undertaken and where necessary impacts identified. Overall impacts associated with construction works are considered to be reasonable and unlikely to cause significant impacts, where necessary mitigation measures are included.

16.2. LEGISLATIVE REQUIREMENTS

The *Water Management Act 2000* (WM ACT) sets the framework for the management of watercourses and their associated riparian lands as well as the management of ground water systems (aquifers).

The breadth of the WM Act and the inter-related nature of water management and water quality is reflected in a serious of technical policy documents and strategies that provide guidance on interpretation. These include:

- National Water Quality Management Strategy;
- ANZECC Guideline and Water Quality Objectives in NSW (DEC);
- State Water Management Outcomes Plan;
- NSW Government Water Quality and River Flow Environmental Objectives (DECC);
- National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC);
- NSW State Groundwater Policy Framework Document (DLWC);
- NSW State Groundwater Quality Protection Policy (DLWC);
- NSW State Groundwater Quantity Management Policy (DLWC) Draft;
- Guidelines for the Assessment and Management of Groundwater Contamination (DECC);
- NSW Water Extraction Monitoring Policy; and
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DECC).

Stormwater Management

The management of overland likely overland flow and runoff from the site has been developed in response to the relevant requirements of the following instruments and policies.

- Eastern Creek Precinct Plan (Stage 3); former State Environmental Planning Policy No.59;
- Managing Urban Stormwater: Treatment Techniques & Source Control (DECC); and
- Technical Guidelines: Bunding & Spill Management (DECC).

Soil Management

The assessment of suitability and impact has considered the following instruments:

- State Environmental Planning Policy No. 55: Land Contamination;
- National Environmental Protection Measures (NEPM); and
- Managing Urban Stormwater: Soils & Construction (Landcom).

16.3. ASSESSMENT METHODOLOGY

The identification and assessment of potential impacts on soils and water has drawn on the following technical studies prepared in support of the application:

- Soil and Water Impacts Report prepared by Edison Environmental;
- Flora and Fauna Report (primary and addendum) prepared by Abel Ecology;
- Preliminary and Detailed Site Investigations (Contamination) by A.D. Envirotech; and
- Civil Infrastructure Report and Plan Package prepared by AT&L.

Detailed in each report is the methodology relevant to their specified discipline. The basis of the assessment of impact in this section has predominantly drawn on information contained within the Edison Environmental report. In this regard the methodology was:

- Extensive literature review to characterise the local conditions including; rainfall and climate; topography and geomorphology; soil types and properties including dispersive and erosive qualities combined with consideration of actual or potential presence of acid sulphate soils; geology and hydrogeology; potential for existing contamination of soil and/or groundwater;

salinity; and surface water system including existing catchment conditions for the Site and the local catchment area including existing surface water run-off yields.

- A walkover site inspection was undertaken, and groundwater levels were measured in the existing shallow monitoring bores to provide updated information on shallow groundwater and salinity conditions.
- Investigation into rainfall, climate, topography, soil, geological, hydrological and hydrogeological conditions at the site.
- Assess any potential for changes to groundwater recharge conditions and identify implications for the local groundwater system.
- Assessment of potential impacts associated with changes to geomorphology; including changes to erosion and sedimentation patterns and implications due to acid sulphate soils and/or existing contamination.

16.4. ASSESSMENT OF KEY ISSUES

16.4.1. Soil

16.4.1.1. Soil Health: Contamination

A Phase 1 Environmental Site Assessment was prepared for the site by AD Envirotech Australia P/L (ADE) and is submitted with this application at Error! Reference source not found..

As outlined in section 8.3.4 the proposed development involves a change of use of the land to permit the establishment and operation of an “electricity generating facility”. As the site had a known site history of use for agricultural purposes a preliminary site investigation (PSI) was undertaken in Clause (7) (4) and table 1 of the contaminated land planning guidelines.

The PSI recommended a Targeted Phase 2 Detailed Site Contamination Investigation to consider the potential for impacts arising from adjacent operations, in particular the potential for contaminants to have migrated soil, and or surface water and river sediment within the boundaries from the easterly adjoining Hanson operations.

A.D. Envirotech undertook a Targeted Phase 2 Detailed Site Contamination Investigation, involving the drilling and extraction of soil samples around the boundary of the asphalt plant (being the potentially worst affected area) to determine whether contamination is present within the soil, and/or surface water and river sediment within the boundaries of the Site.

A sampling density of 50 per cent of the NSW EPA Sampling Design Guidelines (1995) was considered appropriate considering the site’s history and low likelihood of contamination within the site. If any indicators of contamination were identified during the investigation the sampling density would have been increased to 100 per cent.

The depth of sampling was selected based on the opinion of ADE that contamination deeper than 0.5 m below ground level (bgl) was deemed unlikely and therefore sampling beneath this depth was not warranted.

This investigation and assessment of extracted soil samples concluded that concentrations of the potential contaminants within the soil, sediment and surface water samples were below the NEPM Schedule B (1) Health Based Investigation Levels (HIL) D, Ecological Screening Levels (commercial/industrial) and ANZECC Guidelines for Fresh and Marine Water Quality assessment criteria’s.

As all the samples collected returned acceptable results from the 50 per cent density collected from the top 0.5 m bgl of the soil profile, the most likely depth of contamination no further collection or testing of samples was deemed necessary.

Based on the findings of the detailed site investigation, the Site is deemed suitable for commercial/industrial land use and the proposed development.

Mitigation Measures

No mitigation measures are required as the site is suitable in its current state.

16.4.1.2. Construction – Bulk Earthworks and Fill Importation

The proposed development involves bulk earthworks across approximately one third of the development site to support the delivery of the new road infrastructure and level construction pad, combined with the implementation of the subsurface waste bunker.

The extent of cut and fill is defined as follows:

- Cut to maximum depths of up to 15 metres, typically 5 to 6 metres to the north portion of the site; and
- Fill to the remainder of the site to the south, maximum thickness is 7 metres, typically 3 to 4 metres.

AT & L have estimate that approximately a total of 294,500m^3 of spoil material (including rock) will be excavated from the site. Comparatively a total of 429,600m^3 of fill is required. The proposed development will seek to reuse excavated spoil on site, with the net balance of 147,000m^3 of additional fill material imported.

A.D Envirotech has undertaken preliminary and detailed site investigations to determine the presence and extent of contamination on the site (refer to **Appendix V**). These investigations have resolved that the soil in its current state is below the NEPM guidelines and that the site is suitable for commercial and industrial use. In this context the re-use of excavated material on site is considered appropriate (when compared to the option of removing and sending off site for disposal) and limits the need to import excessive amounts of fill material.

The site is not mapped as being within and known or potential acid sulphate soil region and despite the moderately saline character of soils, the potential impact of can be moderated through mixing soils prior to use and adoption of building standards to respond to the soil conditions.

The balance of fill materials required to undertake the necessary land forming works will be imported clean fill material, such as Virgin Excavated Natural Material.

Mitigation Measure

Imported fill material must be clean fill material, such as VENM. All fill material brought to site must be validated as clean prior to use. All spoil will be mixed prior to reuse and salinity levels tested prior to ensure the adoption of appropriate building and construction methods and materials.

16.4.1.3. Construction – Dust, Erosion and Sediment

Edison Environmental has identified soils on the site as having characteristics of highly erodible and dispersive. The potential for dispersion as dust arising from site clearing activities (tree and grass removal) combined with erosion and sedimentation resulting from stormwater runoff.

Pacific Environment, have assessed the potential for dust impacts as part of the Air Quality Impact Assessment (**Appendix K**). The assessment took a risk based approach to the potential for dust impacts arising as a result of construction work.

The assessment procedure applied considers the proximity of potential receivers, human and ecological. The framework applies the following standards when determining the need for mitigation:

- There are human receptors within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).
- There are ecological receptors within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

In the context of the site, the nearest human receptors are works at the Genesis MPC/landfill and the adjacent Hanson site. In the case of MPC, the site is probably already exposed to dust arising from proximity to the former quarry and the operation of waste processing facility. In the case of the Hanson's, it is noted that the site is currently vacant. Residential receptors are located at some distance, 1 km to the west and north.

As the proposal involves the removal of existing vegetation from the site (and vegetation on the adjacent Hanson site has been approved for removal) there is limited potential to affect ecological receptors. The

Ropes Creek Tributary to the south despite its degraded state would be considered an ecological receptor.

The context of the area is not considered to be sensitive to dust associated with construction works, owing to the nature of the existing land uses and it is anticipated that dust management could be satisfactorily achieved through the implementation of dust mitigation measures such as suppressing water spray, stockpile management and the stabilising works to the lay down pads to include planting of native cooch grass as soon as practicable following completion of works.

Brookfield Multiplex and AT&L have considered the potential soil migration from the site as a consequence of the proposed construction works and each has identified a range of management and mitigation options that may be implemented to avoid and mitigate impacts on the receiving environment.

Mitigation Measure

A detailed erosion and sediment control plan will be implemented on site throughout to construction to control soil dispersion and sediment loss in accordance with measures outlined in the Construction Environmental Management Plan (CEMP), prepared by Brookfield Multiplex and Erosion and Sediment Control plans and measures set out in the Civil Infrastructure report and plan package prepared by AT&L.

In particular the following measures will be implemented:

- Management of spoil stockpiles;
- Management of cleared land, including where necessary water spray/chemical soil stabiliser to suppress dust;
- Laydown pads will be stabilised as soon as practicable following completion. Stabilisation methods may include the planting of suitable native grasses i.e. cooch grass (or as recommended by the project ecologist) to form a suitable ground cover; and
- Sediment control devices will be implemented prior to any commencement of site clearing works and will be regularly inspected and maintained.

16.4.2. Surface Water Flows and Quality

16.4.2.1. Surface Water: Ropes Creek Tributary

Riparian lands play an important role in aquatic health and biodiversity. Accordingly, the protection, maintenance and where suitable revegetation of riparian lands is desirable.

The site is currently undeveloped and classified as a “Greenfield” site. The site generally falls from the north-east corner at RL78.99 down to the south west corner at RL 54.2. Two (2) surface water features are evident on the site the Ropes Creek tributary to the south of the development draining westward and connecting to Ropes Creek and smaller ephemeral drainage line running north-south connecting to the Tributary and bisecting the eastern edge of the development site (refer to Figure 79).

The Ropes Creek Tributary and smaller feeder stream are not identified as being of environmental consequence in the planning maps adopted by State Environmental Planning Policy (Western Sydney Employment Area) 2009. However, it is mapped under the Eastern Creek Precinct Plan (Figure 12, p. 5-6) and is subject to Section 8.3.5 (b) that establishes a 40 metre “riparian corridor” around the Ropes Creek Tributary.

A summary of the existing regulatory management controls applying to the Ropes Creek Tributary is provided in Table 64.

As the “corridor” and “buffer” area identified in the ECPP (a deemed DCP), are taken to guidelines and may be applied flexible in circumstances where to do so would not cause unreasonable impact and would contribute to an improved post development outcome. It is also noted that Figure 12 from ECPP (extract provided below in Figure 79), clearly allowed for detention basins within the defined corridor.

Table 64 – Relevant Planning Instruments

Instrument/Plan	Protection/status	Dimension	Extent of Works
Eastern Creek Precinct Plan (ECPP)/SEPP 59	**Ropes Creek** Riparian Corridor; and Riparian Habitat (Figure 17, p 8-8)	**Ropes Creek** 40 metres (20m either side) + 10 metre buffer zone for landscaping.	Minor works to include, batter of detention basin and swales.
	North-South Ephemeral Stream/Drainage (unnamed) Not mapped	N/A	Removed as part of works to construct laydown pad.
SEPP (Western Sydney Employment Area) 2009	Neither watercourse mapped. Whole site land zoned IN1 General Industrial; land immediately to the east (adjoining the site boundary) zoned E2 Environmental Conservation	N/A	N/A
Water Management Act 2000, controlled activities	**Ropes Creek Tributary** Riparian Zones	Variable based on Strahler classification. Not applicable as SSD.	Minor works to include, batter of detention basin and swales. No works impacting on east-west tributary
	North-South Ephemeral Stream/Drainage (unnamed) Riparian Zone	• West: 20 metres; • East: 10 metres	Removal of part of the north south stream. .

Figure 78 – Location of existing surface water features (source: Abel Ecology; 2015)

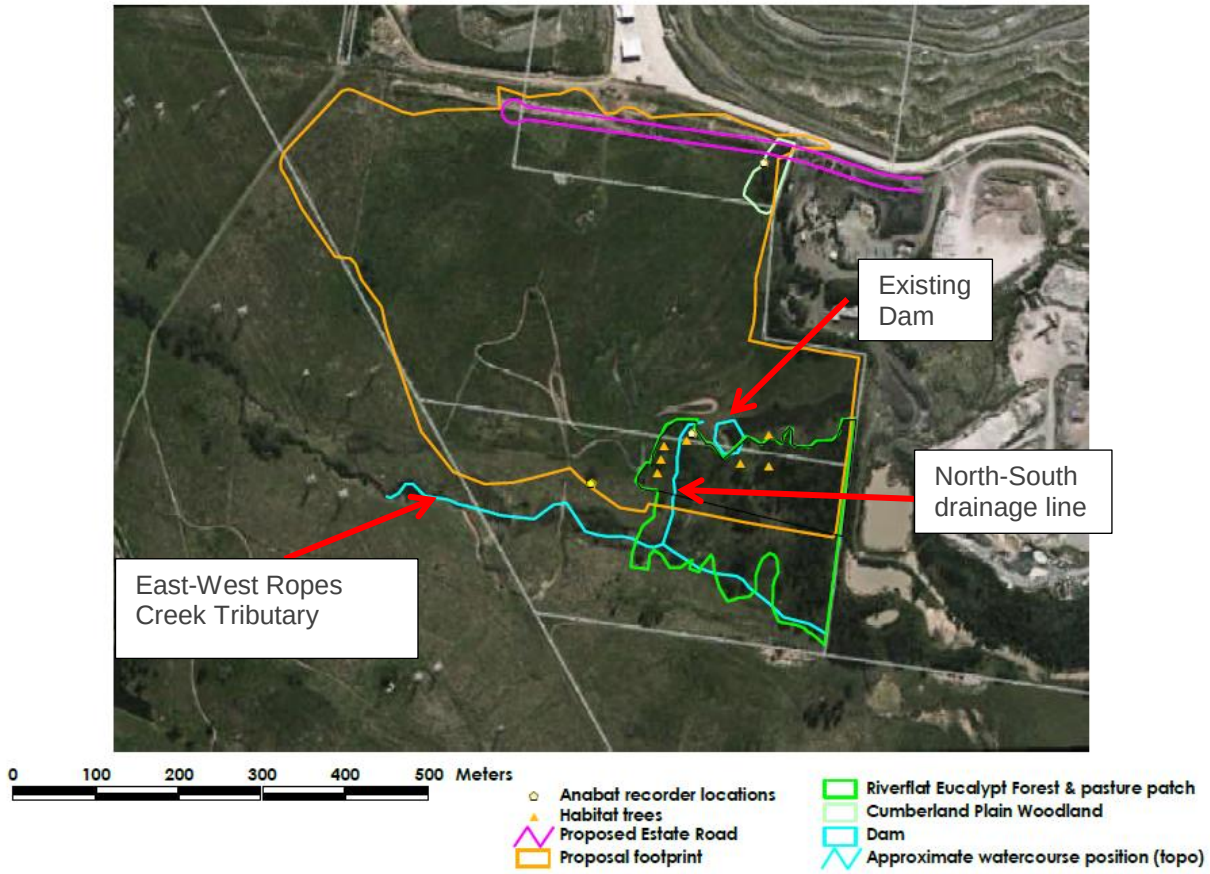
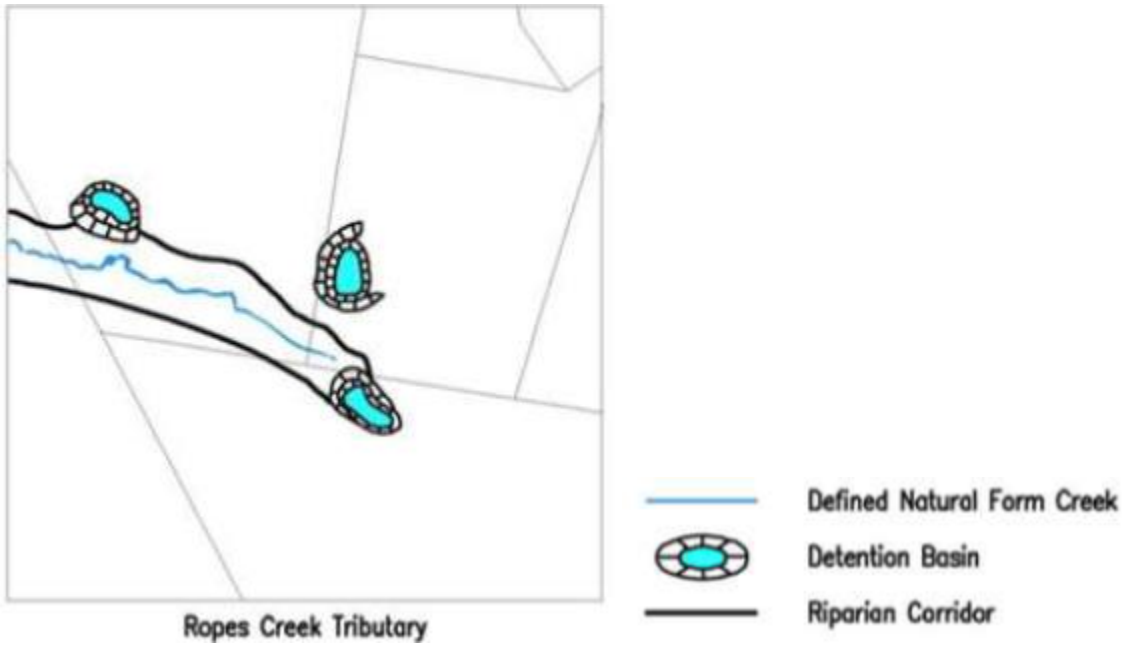


Figure 79 – ECPP Riparian Corridor (www.blacktown .nsw.gov.au)



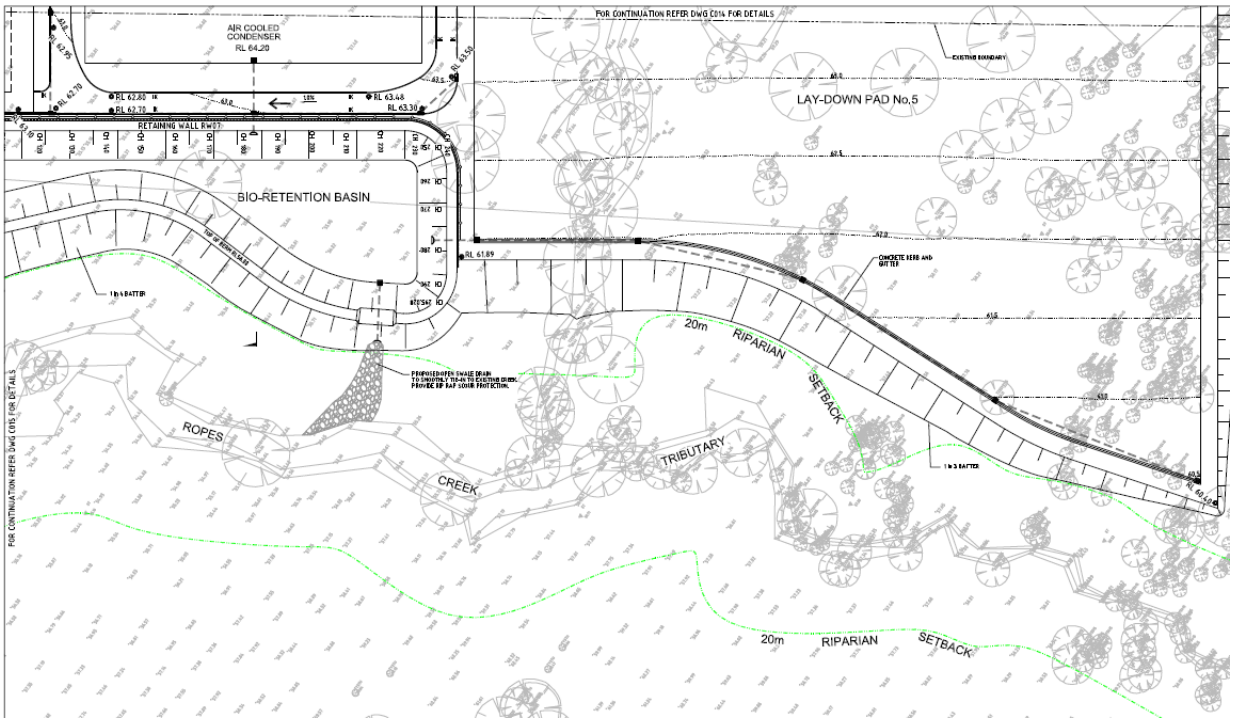
The corridor is measured from the top of the embankment on either side of the creek line. The location and extent of this 40 metre riparian corridor (measured 20m either side from the top of bank) has been established around the tributary, shown edged green in Figure 80**.**

The project will involve the following works:

- Removal of the north south drainage line (first order Strahler stream); and
- Minor works within the riparian corridor of the Ropes Creek Tributary to include, two (2) swale drains to convey water from the bio-retention basin to the creek, batter works (associated with detention basin) overlapping the edge of the riparian corridor at the eastern edge into the adjacent 10 metre buffer and 40 metre corridor measured from the top of bank of Ropes Creek Tributary.

All other construction and operation works are clear of the corridor.

Figure 80 – Location of development relative to riparian corridor (source: AT&L)



The proposal is, despite the minor intrusions, considered to be consistent with the requirements of requirements of the ECPP.

Impacts on Ropes Creek Tributary

The size of the Ropes Creek Tributary riparian corridor (excluding the basin) as defined by the riparian corridor polygon shown in in Figure 12 of the ECPP/SEPP 59 is approximately 48,000 m2. The batter overlaps approximately 1,600m² (approx. 3.3%) of the riparian corridor. Parts of the works are proposed on the eastern side over the 10 metre buffer and also occur within 40 metre of the top of bank of the Ropes Creek Tributary.

The works are relatively minor in nature and the condition of the riparian corridor has been assessed by both Edison Environmental and Abel Ecology as low condition. A Vegetation Management Plan (VMP) will be prepared for revegetation works along the Rope's Creek Tributary south of the proposed development. This document will provide additional details on the establishment and management of the area within the riparian setback. Planting material will include local indigenous species suitable for bio-retention ponds, such as *Baumea articulata, Carex appressa, Eleocharis sphacelata, Juncus usitatus, Lomandra longifolia, Phragmites australis* and possibly *Typha orientalis.*

The point of impact is relatively minor and will not diminish the existing quality or ecological value of the Ropes Creek Tributary riparian land given its significantly degraded state. Importantly, the proposal includes revegetation works within the riparian zone that will seek to re-establish RFEF vegetative community that will make a positive contribution to the stabilisation of the creek embankment, directly contribute to an improved habitat and flora complexity.

North-South Drainage Line

The removal of the north-south drainage line (first order Strahler stream) is not considered to have any adverse impacts. Site investigation by Abel Ecology describes the watercourse as “dry” indicating that the stream is only likely to flow when the upstream Dam over flows.

The proposed removal was discussed with the NSW Office of Water, the responsible authority, who has approved the works by email dated 4 March 2015 (Abel Ecology; addendum report; 2015) **(Appendix G).**

Given the low flow to dry conditions of this stream/drainage line, its removal is unlikely to have adverse consequences on the water flow regime of the southern Tributary. Furthermore, as trees within its proximity are also proposed for removal there is no consequential impact on dependant ecosystems.

Mitigation Measure

Mitigation measures will be implemented to ensure that impacts associated with works in proximity to the tributary are managed. Specifically, this will include the implementation of measures to protect existing vegetation combined with erosion and sediment measures to limit the potential for sediment carried by run off to enter the creek line and adversely affect water quality.

Revegetation of the riparian corridor following the completion of construction works will have a positive impact on biodiversity and river system process and function. The post development water flows within the creek will not be affected by the development. In this respect, no mitigation is required.

16.4.3. Groundwater

Edison Environmental has assessed the site as having low sensitivity with respect to potential groundwater impacts. The underlying Bringelly Shale has a low resource potential, with water bores generally having low yields of high salinity groundwater. Groundwater usage in the area of the site is very low. The low permeability of the shale and the overlying residual clays greatly limits the potential for near-surface pollution to reach groundwater.

16.4.3.1. Flow and Recharge

Development will result in a reduction in groundwater recharge. Under existing conditions, the lost recharge to the fractured rock aquifer would be contributing to inflow to the former quarry, and the lost recharge to the shallow groundwater system would most likely be lost to evapotranspiration, or emerge in areas subject to waterlogging or discharge.

Edison Environmental concludes that these changes will not affect the resource value of the local groundwater systems, and has potential benefits in terms of salinity.

16.4.3.2. Dewatering

The construction of the waste bunker will require up to 15 meters excavation. The depth of excavation has the potential to intercept or possibly obstruct shallow ground water flow.

In terms of groundwater seepage into excavations, inflow rates are expected to be low and will, in all likelihood, reduce further within a few days of the water-bearing strata being exposed. The volume of water generated by groundwater inflow is expect to be considerably less than that due to rainfall and it is considered unlikely that a formal groundwater dewatering system will be required.

In the event groundwater is encountered, a licence for temporary construction dewatering issued by the NSW Office of Water (NOW) is unlikely to be required as the total groundwater inflow is expected to be less than 3 ML/yr.

It is expected that seepage water will be suitable for transfer to the construction-phase stormwater management systems. Poor quality groundwater may be encountered in some areas, such as elevated salinity associated with saline soils or highly alkaline water perhaps with elevated ammonia levels associated with the volcanic breccia present beneath the hill in the northern part of the site. On-site treatment, blending with stormwater or transfer off-site to a suitable, licensed disposal site may be necessary as a last resort.

16.4.3.3. Potential for Contamination

The proposed development does not include any activities that pose a particular risk to groundwater quality. The development will be sewered, and stormwater drainage will be directed to the local surface water system.

Furthermore the design and construction of the waste bunker, involves a continuous pour of concrete to ensure that there is no requirement of joins. This will further limit the potential for impact arising from the storage of waste and prevent any leaching of contaminants into soil and groundwater.

The development therefore does not pose an unacceptable risk to groundwater quality, subject to standard pollution prevention measures for fuel storage etc.

16.4.4. Salinity

The potential impacts that may arise as a result of salinity in the context of the site and the proposed scope of works is as follows:

- The effect of reusing of saline soils on site (i.e. balance of cut and fill);
- The construction of the detention basin near to the Tributary and the potential to release additional soil through disturbance;
- The potential impacts of saline soils on building materials; and
- Impacts on quality of groundwater.

Edison Environmental reports that previous investigation of the site was completed as part of the Eastern Creek Precinct Salinity Assessment (PSM, 2005). This published information includes details of site inspection, drilling of boreholes (nine in total, three of which are on the current site), soil sampling, piezometer installation (four in total, one of which was on the current site) and measurement of groundwater levels.

This report identified no significant salinity impacts on the site and analysis of soil samples collected from the boreholes located on the site showed the following:

- Sulphate levels were all well below those considered potentially aggressive to concrete piles;
- Chloride levels were all below those considered potentially aggressive to steel piles; and
- Soil electrical conductivity (EC) levels generally indicated non-saline topsoil, moderately saline residual soils, and very saline shale bedrock.

The report concluded that soils on site are moderately saline, but that with appropriate site drainage, redevelopment would probably improve the salinity situation.

Later investigations by undertaken by Ian Grey (IGGC, May, 2014) included the use of piezometers (results included in Table 3.3. of **Appendix P**) and a site walk over that concluded there was no evidence of serious salinity impacts.

Edison Environmental, based on their review of all available literature and inspections of the site conclude that the potential to cause or exacerbate impacts of salinity is very limited and there are no constraints to development other than standard mitigation measures.

In relation to the potential for salinity impacts on the local groundwater system. Edison Environmental indicates that re-pressurisation of the deep shale aquifer is unlikely to occur in the timeframe relevant to the EfW plant and therefore impact on quality groundwater is unlikely.

Edison Environmental are of the view that the risk associated with salinity is low and the development may reduce to existing salinity impacts as a result of reduced recharge and improved drainage. Notwithstanding this, mitigation measures to address landscaping, construction standards and soil reuse have been included as precautionary measures.

16.4.5. Surface and Stormwater Management

The proposed onsite stormwater management system has been design to comply with the now repealed SEPP 59 (under direction from BCC) and the requirements of the Eastern Creek Precinct Plan (Stage 3).

The onsite detention basin, that includes bio-retention providing water sensitive urban design aimed at reducing the concentration of sediments and nutrients, has been the focus of consultation with Blacktown City Council engineers.

The basin is located at the southern edge of the development, north of the Ropes Creek Tributary and has been designed to accommodate all runoff a total catchment area of 21.4 ha.

The detention basin will be designed to attenuate peak flows to maximum flows over a range of storms from the critical 2 year ARI event up to and including the critical 100 year ARI event. This On Site Detention will be achieved by the construction of an open basin to the south of the site. All stormwater generated from site will discharge into this basin. The proposed stormwater management system is:

- Designed to capture and management of all overland flow generated from within the site;
- In line with the SEPP 59, precinct plan an on-site bio-retention basin is proposed to detain and treat all stormwater generated from the site;
- Supported by an overall catchment plan that has been prepared to demonstrate the proposed precinct road, north of the development and residue land will drain into the proposed EfW bio retention basin;
- Designed to ensure peak post developed flows for all storm events are less than peak pre developed rates and meets the requirements of the ECPP (SEPP 59). A DRAINS file has been provided to Blacktown City Council for verification;
- Design to treat all stormwater runoff through the inclusion of a bio-retention basin. A MUSIC file has been provided to Blacktown City Council to verify this;
- Consistent with the relevant design requirements of the Precinct Plan and the draft Section 94 Contributions Plan (CP18) for the area, it is planned to provide a precinct stormwater control basin at this location (Basin RC1.1) to manage the peak flows off the catchment and to treat the flows of the roads only. This basin has a capacity of 14,500m^3 and a PSD of 1.10 m_3/s in the 100 year ARI and 0.32m_3/s in the 2 year ARI; and
- Is consistent with the detention basin and outlet flow rates of Eastern Creek Precinct Plan (SEPP59).

As well as capturing and detaining water from the catchment, the basin will serve a stormwater quality treatment by incorporating WSUD into the design. A total surface area of 2,400m^2 of the basin will be dedicated to bio-retention. The design performance of the bio-retention basin will reduce annual loads of sediments and nutrients making their way into the adjacent Ropes Creek tributary. The reduction loads are outlined in Table 65**.**

Table 65 – Combined pollutant loads – WSUD reduction targets (source: AT&L; 2051)

Pollutant	Sources (Kg/yr)	Residual Load (Kg/yr)	Reduction (%)	Target Reduction (%)
Total Suspended Solids	146,000	141,000	87.4	85
Total Phosphorus	62.2	17.3	72.2	65
Total Nitrogen	39	166	51.1	45
Gross Pollutants	3800	0	100	90

Bio-retention ponds typically function to reduce pollution through the biological activities of the plants, micro-organisms and other life-forms. The bio-retention pond/s rather than being a source of pollution are likely to improve water quality. The use of bio-retention ponds is generally promoted by various government agencies as part of Water Sensitive Urban Design (WSUD). Accordingly the discharge of water from the basin to the Tributary is not expected to cause adverse water quality impacts.

Stormwater management, sedimentation and erosion control, flooding and Water Sensitive Urban Design are dealt with in further detail in the Civil Infrastructure Report at **Appendix E**.

16.4.6. Flooding

Based on previous flood modelling carried out and provided in the Brown Consulting Report appended at **Appendix Z**, the proposed flood levels of the creek do not adversely affect the Site. Flood levels associated with the creek are at least 2m below the proposed finished levels of the Site. Moreover, the site is not identified as being flood affected on any adopted flood planning maps.

The implementation of an appropriate on site stormwater management basin will capture and detain all surface water runoff. Outflow from the basin will be controlled through a pit and pipe system to ensure post developed flows do not exceed pre developed flow for all storms up to the 100 year ARI events. The outlet will discharge into the existing Ropes Creek tributary to the south of the site via a headwall and energy dissipater (refer to Civil drawings for all outlet details, **Appendix E**).

The development is not expected to contribute to any potential off site flood affectation related to the development or discharge of water from the basin to the tributary.

16.4.7. Water Demands

16.4.7.1. EfW Plant Demands

Based on the water balance from a typical EfW facility, the average process water requirement is likely to be 23.25 m^3 per hour for the overall plant. Based on 8,000 operating hours a year this equates to approximately 186,000 m^3 per year for the overall plant. The primary requirement for water is to provide make-up for the boiler and steam cycle (to replace that which is blown down) and the FGT plant.

The EfW process includes three (3) main stages of water use as follows:

- Water/Steam Cycle;
- Flue Gas Treatment and Boiler Cleaning; and
- Bottom Ash Handling.

Water/Steam Cycle

- A closed-loop boiler system is proposed. The combustion grate will use an air-cooled and partly water-cooled design.
- The cycle loss for the water/steam cycle is calculated to be 11.6 ML/yr.
- Air-cooled condenser. Steam from the turbines will be condensed using an air-cooled condenser which eliminates water consumption from this stage of the process. The condensed water is returned to the boilers.

HZI have advised only high-quality water is to be used in the Water/Steam Cycle. As such there is no potential for the use of stormwater runoff without treatment. No such treatment is contemplated in the current design.

Flue Gas Treatment and Boiler Cleaning

- A semi-dry scrubbing flue gas treatment system is proposed. The average water consumption requirement with boiler cleaning and flue gas treatment is estimated to be 3.4 m3/hr for each of the four lines.
- A total of 117.2 ML/yr is expected to be lost from this stage with the flue gas.

Bottom Ash Handling

- Wet handling of combustion residue (bottom ash) will be employed with a total average gross water requirement of approximately 40.6 ML/yr which will be met by re-use of demineralisation plant effluent with the remainder of the water demand being met from re-use of process water effluent from the other stages.
- Under average conditions 32.08 ML/yr is expected to be lost with the bottom ash.

16.4.7.2. Staff Facility Demands

Based on an average water use of 1.125 kL/m^2/yr, and an office space allocation per person of 23m^2, water use is estimated to be 1.43 ML/yr.

There is limited data available to divide the staff use between potable and non-potable sources. For the purpose of this report, a split of 70/30 respectively has been adopted. On this basis the potable versus non-potable water use for staff facilities is estimated to be 1.00 ML/yr and 0.43 ML/yr respectively.

Potable water supply will be made available to the site via extensions to the existing water main that runs across the northern boundary of the site.

A detailed review of the water requirements of the proposed Facility is provided within the Soils and Water Report submitted at **Appendix P**. TNG has consulted with the NSW Office of Water in relation to the water requirements to operate the proposed Facility who indicated that there is sufficient capacity to meet the water demands to run to proposed Facility.

16.4.7.3. Fire Management

The Hazard Risk Assessment completed by RawRisk has identified the need to have available no less than 546,000 Litres of water for the purposes of ensuring the adequate protection of the facility in the event of fire (refer to section 6.4 of **Appendix Y**).

While there is a significant volume of water stored across the broader site in the form of stormwater detention basins combined with the rainwater collection stored in tanks, it is anticipated that purpose built permanent storage devices will be required with water tanked in for the purposes of ensuring the availability of the water required.

Given the significant size of the site, it is feasible for these relatively minor elements to be resolved through the imposition of conditions of consent.

16.4.7.4. Water Capture and Re-Use

The proposed EfW process is designed to allow the maximum practicable level of re-use of water within the systems of the Facility. This includes use of demineralisation plant effluent for bottom ash handling; return of boiler blow-down water for re-use in the Water/Steam Cycle and use for flue gas treatment; and re-use of water from the sampling stations.

Re-use from roof run-off (non-potable) is proposed. The total available main roof area for rainwater collection is 17,570m^2. An optimal storage tank size of 1,000kL has been determined, allowing 95% re-use of total inflow into the tank. Further, rain water holding tanks will be installed adjacent to the turbine halls and that water will be used on site as required.

Re-use of stormwater run-off collected in the bio-retention is not proposed as the quality of this water is unsuitable. This water will be stored prior to discharge into the Ropes Creek Tributary.

16.5. CUMULATIVE IMPACTS & MITIGATIONS MEASURES

The proposed works are not anticipated to result in any significant or long term adverse impacts relating to the management of soil and water. Existing soil and water health can be maintained, and potentially improved through the implementation of WSUD elements and revegetation to the Ropes Creek Tributary.

Prior to commencement and throughout construction works a range of mitigation and management measures will be required to ensure the protection of the Ropes Creek Tributary and riparian corridor.

The proposed Development, as demonstrated within the Civil Infrastructure Report and supporting plans, is found to meet the relevant standards and requirements in relation to stormwater management, on site detention, piped and overland flows and water sensitive urban design.

While the risk of salinity and groundwater impacts, has been assessed as low and posing no constraint on the development of the site, mitigation requirements have been included ensure the best possible environmental outcomes.

Table 66 –Mitigation Measures: Soil and Water

Matter	Mitigation	Timing
Groundwater and Groundwater Dependant Ecosystems	No mitigation	N/A
Groundwater: Contamination Prevention	Implementation of groundwater drainage system around the entirety of the proposed waste bunkers to assist groundwater re-entering the strata.	Construction
	Monitoring of groundwater surrounding the waste bunkers, by incorporation of inspection manhole to enable periodic inspection of groundwater levels surrounding the waste bunkers. Monitoring of groundwater quality will include a monitoring for hardness.	Operation: ongoing
Erosion and Sedimentation	A detailed Erosion and Sediment Control Plan (ESCP) will be developed for the construction phase of the project. This will include a detailed description of the proposed overall approach and specific erosion and sediment control measures including the following: • Proposed phasing of works (it is suggested that this be based upon the final stormwater catchments for the completed development; with excavation, filling and surfacing carried out area by area from north to south). • Requirements for, and design sizing of sediment basins and associated catch drains; • Detailed erosion control measures; • Proposed systems for management of inflows and pumping of accumulated rainfall (and any minor groundwater seepage from excavations; • Proposed monitoring of volumes of run-off, pumped water from excavations and discharge from the site during construction; and, • Details of the approach and methods to be employed in post-construction revegetation of the site.	Prior to works commencing. Maintained throughout construction works.

Matter	Mitigation	Timing
	Erosion and Sedimentation controls will be installed and maintained in accordance with Department of Housing (1998), *Managing Urban Stormwater*, Soils and Construction, Fourth Edition. The following levels of control will be constructed: • Silt fences will be installed along the base of excavated slopes and stockpiles to prevent runoff. • Kerb inlet sediment traps will be installed at the completion of the drainage works. Whilst works are underway, geotextile filter fabric fences will be installed around open pits To demonstrate the effectiveness of erosion and sediment control, a surface-water monitoring programme is proposed. This will include background, routine, and event-based (wet weather) monitoring.	
Surface Water Quality	A surface water quality monitoring program as outlined in Section 5.2 and Table 5.1 of Edison Environmental report dated 12 April 2015 shall be undertaken.	Implement prior to commencement of site works and maintain throughout Construction
Dust	Implementation of CEMP prepared by Brookfield Mulitplex, that as a minimum will include the following: • Management of spoil stockpiles; • Management of cleared land, including where necessary water spray/chemical soil stabiliser to suppress dust; • Laydown pads will be stabilised as soon as practicable following completion. Stabilisation methods may include the planting of suitable native grasses i.e. cooch grass (or as recommended by the project ecologist) to form a suitable ground cover; and • Sediment control devices will be implemented prior to any commencement of site clearing works	Construction

Matter	Mitigation	Timing
	and will be regularly inspected and maintained.	
Cut and Fill: Soil Health	Reuse of spoil excavated from site; and any imported fill material to be VENM. Where reuse of excavated soil occurs, visual observation will be maintained during excavation of the subsoil profile and soils showing clear evidence of high salinity (visible salt crystals etc.) should be removed and stored in covered stockpiles. Reuse of site as backfill material is considered acceptable although blending with less saline soils is recommended.	Construction.
Soil Health: Contamination	Detailed Site Investigation confirmed that concentrations detected in the soil are within NEPM guidelines for continued commercial and industrial use. There is no need for mitigation measures.	N/A
Salinity: Environmental Health	The risk associated with salinity is also low, and the development is expected to reduce existing salinity impacts as a result of reduced recharge and improved drainage. Preparation of a detailed Salinity Management Plan, to include (but not be limited to): ▪ Avoidance/minimisation of exposure of saline subsoils, minimise cut and fill; ▪ Avoid disturbance in riparian zones and poorly drained areas; ▪ Establish vegetation is areas subject to erosion and disturbance; ▪ Consider salt-resistant construction materials in areas of shallow saline water tables; ▪ Monitor perched water tables. Landscaped areas will be planned with salt-tolerant vegetation.	Prior to CC and implanted through construction.
Salinity: Building Impacts	Undertake soil testing to confirm soil salinity content prior to commencement of construction (i.e. at the completion of bulk earthworks). Where necessary ensure construction materials to be resistant to the effects of salinity.	Prior to the commencement of construction.
Flood: Protection of Buildings	Implementation of Finished Ground Levels in accordance with the AT&L Civil works plans to	Construction.

Matter	Mitigation	Timing
	ensure plant is a minimum of 2 metres above flood level.	
Flood: Ropes Creek Tributary and downstream properties	Construction of onsite detention basin. Outlet flow shall ensure that discharge rate of water from detention is in accordance with BCC requirements.	Construction and Operation: ongoing.
Salinity: Soil and Water Quality	Implement stormwater management plan prepared by AT&L, including WSUD elements within the bio-retention basin. Ongoing maintenance of the basin by TNG to ensure appropriate ongoing operation to suitable standards.	Construction. Operation: ongoing.
Water Availability	• Connect to local potable water supply for use by Staff; • Construct water storage tanks to provide secure source of water for firefighting purposes (water to be tanked in for initial supply); • Implement rain water tanks to harvest water for resuse on landscaping.	Construction
Stormwater: Management	Implement AT&L Stormwater Management Plans as detailed in the Civil Works Package.	Construction and Operation
Stormwater: Quality	Implement bio-retention in accordance with Civil Works package prepared by AT&L.	Construction and Operation
Riparian Management	Limit works permitted within riparian corridor to the batter and swales associated with the construction of OSD/bio-retention. Prohibit the removal of trees within the riparian corridor. Revegetation of the riparian corridor in line with the plan contained in the Abel Ecology report.	Construction.
Water Demand	Connect site to potable water supply; Installation of water tank capable of retaining a minimum of 546,000 litres of water for firefighting purposes.	Construction.

16.6. SUMMARY AND CONCLUSION

The above assessment has considered the potential impacts associated with soils and water during construction and operation of the proposed Facility.

This report presents the results of assessment of conditions on the site and of potential impacts from the development and operation of the proposed Facility relating to soils, groundwater, surface water and salinity, including suitability of the site and mitigation measures required, and found:

- No Groundwater Dependent Ecosystems are considered to be present on the site.
- Soils on site are moderately saline, but with appropriate site drainage, redevelopment would probably improve the salinity situation. No evidence of serious salinity impacts was observed during detailed site inspection although minor areas of waterlogging are present.
- The stormwater generated from site will drain to the south into a bio retention basin to be detained and treated. A pit and pipe system will control the outflow to ensure post developed flows do not exceed pre-development flow for all storms up to the 100 year ARI events. An outlet from the basin will discharge into the existing Ropes Creek tributary to the south of the site
- Potential soil and water impacts can be adequately managed during the construction and operational phase. It is critical that soil and water management infrastructure is carefully designed and operated.

17. HUMAN HEALTH

17.1. OVERVIEW

The DGRs issued for the Energy from Waste project include a requirement to investigate the potential human health risks associated with the facility. In particular, the DGRs required the following:

> *a human health risk assessment covering the inhalation of criteria pollutants and exposure (from all pathways i.e. inhalation, ingestion and dermal) to specific air toxics.*

An initial Human Health Risk Assessment prepared by Fichtner was submitted in support the application. Submissions received from key agencies, such as the EPA, raised concern regarding the following areas of the assessment:

- Lack of Australian guidance in relation to risk assessment;
- Lacked transparency in the assessment as it used a proprietary model to assess risk and potential impacts;
- Used default assumption in the model based on US and UK experiences;
- Lacked a conceptual site model for the purpose of identifying source of potential contaminants, their pathways to clearly articulate the reasoning behind receptor identification;
- Miscalculated risk estimates in terms of Australian Guidance.

As outlined in the preamble of this amended EIS, the application has been amended to withdraw the Fichtner reports from further consideration. This includes the core engineering design detailed in the original concept definition brief as well as the human health risk assessment.

AECOM were subsequently engaged to prepare a further human health risk assessment, submitted in November 2015 as part of the response to submissions package. The amended HHRA is based on Australian guidelines using a risk based assessment model. The framework used was first discussed with the EPA and is outlined in section 17.2. Furthermore, a conceptual site model has been developed and is set out in section 17.4.1.4.

The submitted HHRA prepared by AECOM is an amended version of an initial assessment report submitted in November 2015 that has also been the subject of assessment advice from the EPA and EnRisk. EnRisk's August 2016 assessment concludes that the while the HHRA is now in line with Australian guidance, the issues requiring further review included the following:

- The use of updated air quality modelling based on "more realistic" stack concentration rather than the values proposed as licence limits;
- Lack of assessment of grid maximums;
- Lack of supporting information about the speciation of the volatile organic compounds (both chemicals included and the contribution they make);
- Some persistent and bio accumulative chemicals were considered to be missing from the multi-pathway assessment;
- Incorrect toxicity reference values for some chemicals;
- Insufficient justification of modelling approach and use of incorrect screening guidelines to assess upset conditions.

AECOM have revised and produced an amended HHRA in light of the comments received from EnRisk. Combined with amendment to the HHRA, it is noted that further amendment was also made to the Air Quality Assessment report that has been used in the preparation of the HHRA. In particular, the following is noted;

- Three scenarios have been assessed to consider the potential human health risks these include including emissions at the IED limit; emissions at the project specific limits and emissions at upset;

- Grid maximums have been assessed;
- Toxicity values have been revised;
- CoPC list was reviewed in the context of further research and where relevant included in the updated multi pathway assessment; and
- Detailed toxicological profiles have been provided of CoPCs that include details of dose values adopted.

The Facility has been designed to meet the emission limits contained within the Chapter IV and Annex VI of the Industrial Emissions Directive (IED) (Directive 2010/75/EU) for waste incineration and co-incineration plants.

Detailed investigation into the likely toxics associated with the process of combusting waste materials has been undertaken:

- research into identifying and reviewing comparable European reference facilities;
- compositional and chemical analysis of special fraction waste streams (i.e. floc waste; wood waste; chlorine etc); and
- literature reviews and research into CoPCs associated with the EfW process.

Importantly the technology, in particular the Flue Gas Treatment process including optimised SNCR, has been designed meet IED emissions targets, which are below the POEO Emissions limits.

The outcome of the above, investigations is detailed in a series of technical memos prepared by Ramboll (refer to **Appendix DD**) as well as the Pacific Environment reports into Air Quality Assessment/GHG, Ozone, Odour and Noise Reports (refer to **Appendices K, L, M.** and **O**).

This information has been utilised by AECOM in the assessment of potential risk to human health (submitted at **Appendix N**) to meet the DGRs.

The outcome of AECOMs assessment has concluded that the potential for risk to human health from odour, noise, ozone, hazards, soil and water were considered to be **low and acceptable** and did not warrant quantitative assessment within the risk assessment framework. AECOM has provided suitable management provisions for inclusion in the mitigation measures for the project.

17.2. LEGISLATIVE REQUIREMENTS

AECOM in preparing the *Human Health Risk Assessment* have utilised the following framework, which includes the relevant nationally adopted guidelines:

- Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards. Department of Health and Ageing and enHealth Council, Commonwealth of Australia (enHealth, 2012a update).
- Australian Exposure Factor Guide, Department of Health and Ageing and enHealth Council, Commonwealth of Australia (enHealth, 2012b).
- National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) 1999, National Environment Protection Council (NEPC), as amended and in force on 16 May 2013 (ASC NEPM, 2013).
- Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Office of Solid Waste, US Environmental Protection Agency (US EPA, 2005).

Additionally, the HHRA was consistent with the NSW Environment Protection Authority (EPA) Guidelines for the NSW Site Auditor Scheme (2nd Edition) (NSW EPA, 2006).

17.3. ASSESSMENT METHODOLOGY

The assessment methodology is set out in section 1.4 of the AECOM report, and follows the enHealth (2012a) and ASC NEPM (2013) guidance notes. The methodology/scope of works included the following 5 (5) stages of investigation and assessment;

1. Issue identification (including the development of a conceptual site model);
2. Hazard identification;
3. Dose-response assessment;
4. Exposure assessment for the relevant population; and
5. Risk characterisation.

The enHealth guidelines note that for planning purposes the amount of detail required when identifying the hazard will be limited to the identification of the relevant national or international guideline values for each substance identified as requiring assessment.

For full detail of the methodology for each of the five (5) stages of assessment refer to the AECOM report.

17.4. ASSESSMENT OF KEY ISSUES

The key issue of assessment is the risk of the proposed EfW to human health. AECOM having reviewed all relevant and technical data have identified the potential contamination sources as the release of emissions from the proposed stacks connected with the operation of combustion lines (2 per phase of the development). Accordingly, the key issues in the assessment of human health include:

- Investigate and identify all likely chemicals to be emitted in the operation of the emissions stacks (i.e. the full range of Chemicals of Potential Concern);
- Based on the identified CoPC and the receiving environment determine exposure pathways including consideration of the potential for CoPC to speciate;
- Identify potential receptors; and
- Assess the hazard potential using the accepted risk assessment framework as a means of quantifying the potential impact on human health.

17.4.1. Identification of Chemicals of Potential Concern

The CoPC were selected based on a range of development specific investigations and research was undertaken by Ramboll to identify all potential and likely CoPC associated with operating EfW plants in Europe as well as the following:

- the primary emissions from any Energy from Waste facility, as defined by emission limits from waste incineration set by the European Union (EU) Industrial Emissions Directive (IED; Directive 2010/75/EU);
- consideration of 'lead substances' i.e. those substances representative of an entire group of comparable compounds and either relevant in their toxicity or present in high concentrations;
- emission data from plants exclusively fired by C&I and C&D waste with semi dry APC system and plants with mixed waste (MSW plus C&I and C&D);
- total organic carbon (TOC) constituents based on emissions from an EfW plant;
- compounds listed in Schedule 1 of NEPM (Ambient Air) guideline (NEPC, 2003) and DEC (2005), and
- comments provided in the submissions from Public Exhibition and those contaminants of public concern.

Based on the above, the following CoPCs were identified:

- carbon monoxide (CO);
- sulphur dioxide (SO_2);
- nitrogen dioxide (NO_2);
- lead;
- photochemical oxidants (ozone);

- particulate matter (PM), assumed to be emitted as PM_{10} and $PM_{2.5;}$
- hydrogen chloride (HCl);
- hydrogen fluoride (HF);
- hydrogen sulphide (H_2S);
- chlorine (Cl_2);
- ammonia (NH_3);
- heavy metals (i.e. antimony, arsenic, beryllium, cadmium, cobalt, copper, chromium, molybdenum, manganese, mercury, nickel, selenium, silver, tin, titanium, vanadium and zinc);
- dioxins and furans as polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF);
- polycyclic aromatic hydrocarbons (PAHs) as benzo(a)pyrene;
- polychlorinated biphenyls (PCBs);
- hexachlorobenzene; and
- total organic carbon (TOC) (i.e. toluene, phthalates, dichloromethane (methylene chloride)), acetone (propanone), benzene, acetonitrile, xylene, trichlorophenol, methylhexane, trichloroethylene, heptane, benzoic acid, hexadecanoic acid, ethyl benzoic acid and tetradecanoic acid).

Although many wastes contain chlorinated organic compounds or chlorides, during the incineration process, the organic component of these compounds are destroyed and the chlorine is converted to HCl (PE, 2016b). Accordingly AECOM have not assessed chlorine as part of the HHRA.

17.4.1.1. Transport Pathways

Based on the environmental characteristics of the site and the identified CoPCs, AECOM have mapped the potential contaminant transport pathways (i.e. the means by which contaminants migrate from the source to potential human receptors).

The primary transport pathways include:

- Release of vapours into ambient air from the EfW facility; and
- Release of particulates into ambient air from the EfW facility.

Both are associated with the emissions release following flue gas treatment via the 100 metre stacks.

Other transport mechanisms, such as leaching through soil to groundwater or surface water, transport of leaved contamination within groundwater, volatilisation and vapour migration from subsurface media have been determined by AECOM to not be significant for the purposes of this project and the assessment of HHR.

17.4.1.2. Likely sensitive receptors

Two (2) groups have been identified as potential receptors:

- Off-site workers (existing and likely future based on surrounding land use zones); and
- Off-site residents including schools, childcare centres and hospitals.

Potential human health risks to onsite construction, ongoing workers and visitors to the site will be addressed in accordance with NSW Occupational Health and Safety (OHS) Regulations and are not addressed as part of the HHRA.

The distribution of receptors relative to the location of the EfW facility is shown in Figure 81.

Figure 81 – Modelled receptors (source: AECOM; 2016)

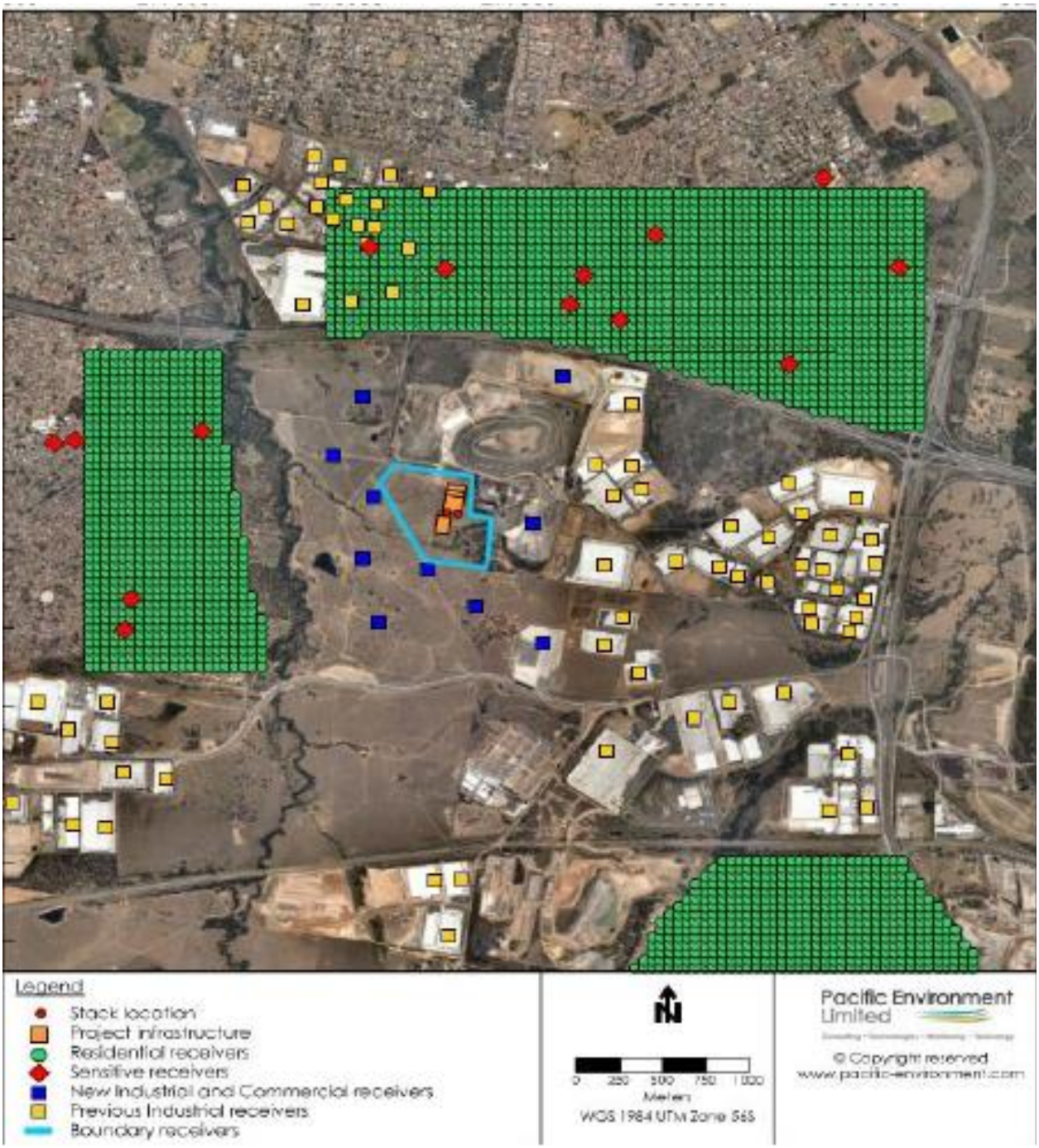


Table 67 includes details regarding the assumptions made and environmental factors considered in relation to the identified receptors.

Table 67 – Factors considered in assessment exposure of receptors

Receptor Group	Factors considered
Residents	• Nearest residential receivers are located 1 km from the site boundary and may be exposed to vapours and particulates; • Residential areas, Michinbury and Eastern Creek are low density and the potential for

Receptor Group	Factors considered
	yards used to grow produce has been assumed (in line with the NEPM); • Conservative assumption has been made that residents may keep poultry (egg consumption only); • Adjacent cattle farms assumed to be used for consumption (no dairy, due to lack of infrastructure), ingestion beef pathway assumed
Workers	Assumed only to be exposed to vapours and particulates emitted from stacks.

17.4.1.3. Exposure Pathways

In order for a human receptor to be exposed to a chemical contaminant derived from a site, a complete exposure pathway must exist. An exposure pathway describes the course a chemical or physical agent takes from the source to the exposed individual and generally includes the following elements (US EPA, 1989):

- a source and mechanism of chemical release;
- a retention or transport medium (or media where chemicals are transferred between media);
- a point of potential human contact with the contaminated media; and
- an exposure route (e.g. inhalation or direct contact) at the point of exposure.

Where one or more of the above elements is missing, the exposure pathway is considered to be incomplete and no further assessment is required. Pathways that have been considered to be complete for the Site and therefore were assessed in the HHRA include:

- Inhalation of vapours and dust in indoor and outdoor air (inhalation pathway assessment).
- Ingestion of home-grown fruit and vegetables (multiple exposure pathway assessment).
- Ingestion of eggs from home-grown chickens (multiple exposure pathway assessment).
- Ingestion of home-grown beef (multiple exposure pathway assessment).
- Ingestion of breast milk (multiple exposure pathway assessment).

Given the distance of Prospect Reservoir from the Site (approximately 4.5 km) and the covered tanks

The following pathways were not included in the assessment:

- Ingestion of any meat product other than beef, due to the absence of any other livestock in the areas;
- Ingestion of drinking water from either the Prospect and Minchinbury Reservoir due to distance separation (4.5km) and the use of covered tanks respectively.

Having established how receptors may be exposed to contaminants, AECOM assessed the overall body burden through a multiple pathway assessment that looks at chemicals characterised as being persistent and bio accumulative. This assessment focused on the following to CoPCs:

- Antimony;
- Arsenic;

- Cadmium;
- Chromium;
- Cobalt;
- Copper;
- Lead;
- Mercury;
- Nickel;
- Selenium;
- Vanadium;
- Zinc;
- Dioxins and furans as PCDD and PCDF;
- PAHs as benzo(a)pyrene;
- Polychlorinated biphenyls (PCBs); and
- Hexachlorobenzene.

Once present within the soil, the chemicals have been considered for the following pathways:

- Uptake by edible plants within roots and stems.
- Uptake by backyard chickens who lay eggs which are consumed by residents.
- Direct contact by residents of surficial soils during gardening. An assessment of incidental ingestion and dermal contact has been undertaken.
- It is considered that it is unlikely that residents surrounding the site will consume large amounts of locally grown beef as it is anticipated that the cows will be sent to slaughter for distribution to the wider NSW and Australian population. It is also considered that the population of cows is low, therefore volume produced which would be commercially available is unlikely to be consumed by local residents. Therefore very low contribution of 1% has been assumed within the cumulative assessment for consumption of locally grown beef.
- Uptake via all pathways detailed above by breast feeding mothers and exposures to infants.

17.4.1.4. Conceptual Site Model

A Conceptual Site Model (CSM) is a site-specific qualitative description of the source(s) of contamination, the pathway(s) by which contaminants may migrate through the environmental media, and the populations (human or ecological) that may potentially be exposed. This relationship is commonly known as a Source-Pathway-Receptor (SPR) linkage.

Where one or more elements of the SPR linkage are missing, the exposure pathway is considered to be incomplete and no further assessment is required. The CSM for the Site has been prepared in accordance with Schedule B2, ASC NEPM (2013) and is provided in Figure 82 and Figure 83.

Figure 82 – Conceptual Site Model.

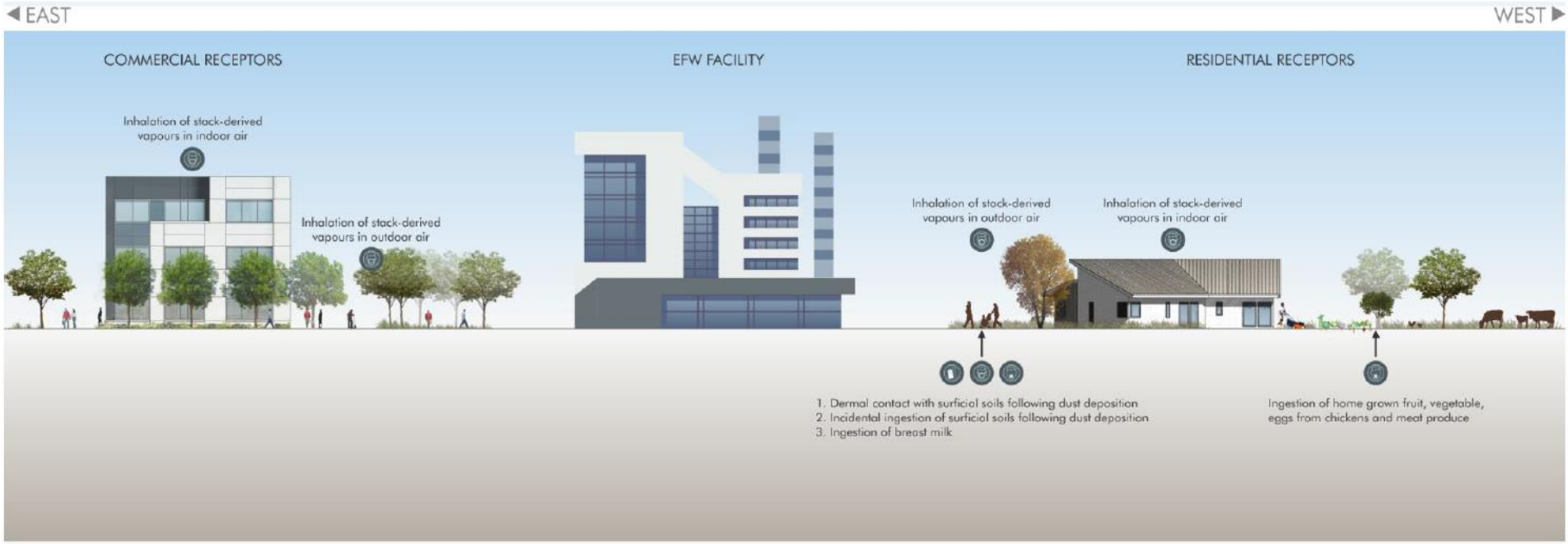
Exposure Pathway	Off-site Residents	Off-site Commercial Workers
Vapour		
Inhalation of stack-derived vapour in indoor air	✓	✓
Inhalation of stack-derived vapour in outdoor air	✓	✓
Soil / Deposited Dust		
Incidental Ingestion of surficial soils following dust deposition	✓	× (a)
Dermal Contact with surficial soils following dust deposition	✓	× (a)
Ingestion of home-grown fruit and vegetables	✓	× (a)
Ingestion of eggs from home-grown chickens	✓	× (a)
Ingestion of home-grown beef	✓	× (a)
Ingestion of breast milk	✓	× (b)

Notes: × – incomplete pathway
✓ – complete pathway

(a) Based on the surrounding land use inspection undertaken by AECOM, commercial properties were typically capped with hardstand and therefore soil is not exposure for direct contact. Additionally, these commercial properties were not used to grow home-grown produce.

(b) The assessment of ingestion of breast milk by a resident mother is considered to be protective of a commercial worker mother as the resident is exposed by more pathways and for longer periods of time.

Figure 83 – Pictorial of the Conceptual Site Model (prepared by AECOM)



17.4.2. Hazard Identification and Exposure Assessment Framework

AECOM Risk Assessment has considered and documented the following:

17.4.2.1. Hazard Identification

Hazard Identification compiles toxicological information and profiles combined with the associated hazards of CoPC (refer to Table 16, in HHRA, **Appendix N**) reproduced below in Figure 84

Figure 84 – Adopted Toxicity Values (source: HHRA; AECOM, 2016)

CoPC	Inhalation Unit Risk (IUR) $(\mu g/m^3)^{-1}$	Background Adjusted Reference Concentration (RfC) $(\mu g/m^3)$	Oral Cancer Slope Factor (CSF) $(mg/kg/day)^{-1}$	Background Adjusted Oral Reference Dose (RfD) mg/kg/day
antimony	-	21	NA	NA
arsenic	-	1	-	1.00E-03
beryllium	2.40E-03	0.02	NA	NA
cadmium	-	0.004	-	3.20E-04
cobalt	-	0.1	NA	
copper	-	147	NA	
chromium III (a)	-	0.1	-	9.00E-04
chromium VI (a)	-	0.1	-	
lead	NA	NA	-	3.50E-03
molybdenum	-	12	NA	NA
manganese	-	0.12	NA	NA
mercury	-	0.18	-	3.60E-04
nickel	-	0.016	NA	NA
selenium	-	8.4	-	2.40E-03
silver	-	17.5	NA	NA
tin	-	700	NA	NA
titanium	-	10500	NA	NA
vanadium	-	1	NA	NA
zinc	-	1750	-	5.00E-02
dioxins and furans as PCDD and PCDF	-	4.5885E-06	-	9.89E-10
PAHs as benzo(a)pyrene	8.70E-02	-	0.5	-
PCBs	-	0.5	NA	NA
hexachlorobenzene	-	0.16	NA	NA

CoPC	Inhalation Unit Risk (IUR) $(\mu g/m^3)^{-1}$	Background Adjusted Reference Concentration (RfC) $(\mu g/m^3)$	Oral Cancer Slope Factor (CSF) $(mg/kg/day)^{-1}$	Background Adjusted Oral Reference Dose (RfD) mg/kg/day
toluene	-	5000	NA	NA
Phthalates (value for phthalic anhydride)	-	20	NA	NA
dichloromethane (methylene chloride)	-	2700	NA	NA
acetone (propanone)	-	27810	NA	NA
benzene	6.00E-06	24	NA	NA
acetonitrile	-	54	NA	NA
xylene	-	870	NA	NA
trichlorophenol	-	9.45	NA	NA
methylhexane	-	630	NA	NA
trichloroethylene	4.00E-06	1.8	NA	NA
heptane	-	630	NA	NA
benzoic acid	-	12600	NA	NA
hexadecanoic acid	-	900	NA	NA
ethyl benzoic acid	-	12600	NA	NA
tetradecanoic acid	-	900	NA	NA

NA = Not Applicable

\- = No published toxicity value (not assessed as a threshold or non-threshold compound)

(a) As discussed in **Section 4.12**, total chromium has been assessed as 99% CrIII and 1% CrVI.

Following the identification of the CoPCs and their toxicity potential health effects are assessed on the basis of a dose response using threshold and non-threshold dose response (toxicity values).

Non-threshold Dose Response Values

The assessment of potential health effects associated with genotoxic carcinogens requires the use of non-threshold toxicity values. The values available are essentially the slope of the cancer dose response curve for the chemical (based on relevant studies and approaches to extrapolate effects from high doses to low doses) and are termed an inhalation unit risk (IUR). The IUR (expressed as $(\mu g/m_3)_{-1}$) is used to estimate the probability of an individual developing cancer at some point in a lifetime as a result of a specific exposure.

CoPCs assessed for non-threshold does response values are provided in Column 2 “Inhalation Unit Risk” provided in Figure 84**.**

Threshold Dose Response values

Potential health effects are assessed utilising a threshold value is typically termed an acceptable or tolerable daily intake (ADI or TDI). AECOM have adopted the term TDI for the purpose of this assessment.

A TDI is a chemical intake below which it is considered that no adverse effects would occur in human populations, including sensitive sub-groups (e.g. the very young or elderly). Hence, the TDI relates to intakes from all sources, the Site related impacts as well as background intakes (where relevant).

Where relevant to inhalation exposures the threshold value is typically termed a Tolerable Concentration in air (TC) or reference concentration (RfC), which is an estimate of a continuous inhalation exposure

concentration to people (including sensitive subgroups) that is likely to be without risk of harmful effects during a lifetime.

When evaluating potential health effects or deriving health-based investigation levels for chemicals assessed on the basis of a threshold dose-response criteria, total exposure to a given chemical (i.e. the sum of the background exposure and the substance exposure from contaminated media) should not exceed the TDI (enHealth, 2012a; ASC NEPM, 2013).

Background Intakes

Background levels of contamination comprise chemical concentrations present in the environment as a result of everyday activities or natural sources. These chemicals may be present in food, air, water and consumer products and represent the non-Site sources of contamination exposure. This is commonly referred to as background exposure. enHealth (2012a) and ASC NEPM (2013) require that 'background exposure' be taken into account during the assessment of potential human health risk.

Background exposure is only applied to threshold contaminants (i.e. non-carcinogens) because intakes of non-threshold contaminants (i.e. carcinogens) are considered on the basis of an increase in risk, irrespective of background exposure.

In cases where background exposure is considered to be essentially negligible (contributing to less than 5% of the threshold TRV), no background exposure has been applied. Should background exposure be considered to comprise greater than 50% of the threshold TRV, the background exposure is generally considered to be 50% of the TRV.

AECOM found that no CoPCs in this study exceeded the 50% figure and this approach was not adopted. It should be also noted that enHealth (2012a) does not recommend a specific background exposure value for an inhalation pathway.

The background exposure allocated for each of the CoPC assessed in the HHRA is summarised in Figure 85**.**

17.4.2.2. Exposures Assessment

Assess the impact of exposure of receptors to toxics based on magnitude, frequency, extent and duration.

In absence of direct measurement data, environmental sampling and predictive models are commonly used to estimate intakes of CoPC by the exposed populations. The key elements of exposure assessment in the context of contaminated land risk assessment are to:

- identify input values for contaminant concentrations and pathways;
- identify input values for exposed populations;
- estimate exposure concentrations; and
- estimate chemical intake.

The Air Quality Assessment provides details of the air dispersion modelling methodology and results of the air quality assessment (refer to **Appendix K**).

Figure 85 – Background Exposure allocations (Source: AECOM. HHRA, 2016)

CoPC	Background Allocation	Reference
antimony	0%	Negligible.
arsenic	0%	ASC NEPM (2013).
beryllium	0%	ASC NEPM (2013).
cadmium	20%	ASC NEPM (2013).
cobalt	0%	ASC NEPM (2013).
copper	70%	ASC NEPM (2013).
chromium III	0%	ASC NEPM (2013). Consistent with CrVI.
chromium VI	0%	ASC NEPM (2013).
lead	0%	Negligible.
molybdenum	0%	Negligible.
manganese	20%	ASC NEPM (2013).
mercury	10%	ASC NEPM (2013).
nickel	20%	ASC NEPM (2013).
selenium	60%	ASC NEPM (2013).
silver	0%	Negligible.
tin	0%	Negligible.
titanium	0%	Negligible.
vanadium	0%	Negligible.
zinc	90%	ASC NEPM (2013).

CoPC	Background Allocation	Reference
dioxins and furans as PCDD and PCDF	57% (b)	DEH (2004)
PAHs as benzo(a)pyrene	-	-
PCBs	0%	ASC NEPM (2013).
hexachlorobenzene	0%	ASC NEPM (2013).
toluene	0%	Friebel & Nadebaum (2011).
phthalates	10%	Friebel & Nadebaum (2011) (a)
dichloromethane (methylene chloride)	10%	Friebel & Nadebaum (2011) (a)
acetone (propanone)	10%	Friebel & Nadebaum (2011) (a)
benzene	20%	Friebel & Nadebaum (2011).
acetonitrile	10%	Friebel & Nadebaum (2011) (a)
xylene	0%	Friebel & Nadebaum (2011).
trichlorophenol	10%	Friebel & Nadebaum (2011) (a)
methylhexane	10%	Friebel & Nadebaum (2011) (a)
trichloroethylene	10%	ASC NEPM (2013).
heptane	10%	Friebel & Nadebaum (2011) (a)
benzoic acid	10%	Friebel & Nadebaum (2011) (a)
hexadecanoic acid	10%	Friebel & Nadebaum (2011) (a)
ethyl benzoic acid	10%	Friebel & Nadebaum (2011) (a)
tetradecanoic acid	10%	Friebel & Nadebaum (2011) (a)

(a) In absence of compound-specific background exposure data, the background exposure for semi or volatile CoPC has been set at 10% in accordance with the total petroleum hydrocarbon (TPH) background exposure allocation adopted by CRC CARE (2011) during derivation of the Health Screening Levels (HSLs).
(b) A background intake of dioxins and furans was calculated based on a blood serum study presented in DEH (2004). The mean average lifetime daily exposure (ALDE) was estimated as 1.3 TEQ pg/kg bw/day. The mean ALDE was converted to months (i.e. 40.15 TEQ pg/kg bw/day), which is 57% of the published tolerable monthly intake (TMI) of 70 pg TEQ/kg body weight/month. Therefore, a background percentage of 57% has been adopted.

Representative Exposure Point Concentrations

A key element of the risk assessment process is estimation of the concentration of site-derived CoPC in environmental media. This concentration is commonly termed the exposure point concentration (EPC) and should be selected as a conservative estimate of the average chemical concentration in an environmental medium at the point of exposure.

EPCs are determined for each site-impacted exposure unit', which is defined as the area throughout which a receptor moves and encounters an environmental medium for the duration of exposure. Typically, an individual receptor is assumed to be equally exposed to media within all portions of the exposure unit over the time frame of the risk assessment.

Consideration of exposure point concentrations has been done based on two (2) potential operating scenarios based on the following emissions limits/conditions:

- Scenario 1: Normal Operations based on IED Emissions limits (Typical scenario); and
- Scenario 2: Normal Operations based on the POEO Emission limits for all CoPC except cadmium which would be set to the IED limit (worst case scenario).

Estimation of Chemical intake:

Chemical intakes were calculated for each of the CoPC via the following exposure pathways:

- Indoor and outdoor inhalation of vapour;
- Incidental ingestion of surficial soils following dust deposition;
- Dermal contact with surficial soils following dust deposition;
- Ingestion of home-grown fruit and vegetables;
- Ingestion of eggs from home-grown chickens;
- Ingestion of home-grown beef; and
- Ingestion of breast milk by infants (<1yr).

Chemical intake calculations for human receptors vary for children and adult receptors as outlined **Table 18** of the HHRA (**Appendix N**). Exposure assessment based on chemical intake is then measured against acceptable exposure limits to determine the risk of impact on human health.

Human Behavioural Exposure Parameters

Human behavioural exposure parameters adopted in this risk assessment were developed by AECOM using the following recognised Australian and international sources:

- enHealth (2012a) Environmental Health Risk Assessment, Guidelines for Assessing Human Health Risks from Environmental Hazards. Department of Health and Ageing and enHealth Council, Commonwealth of Australia;
- enHealth (2012b) Australian Exposure Factor Guide, Department of Health and Ageing and enHealth Council, Commonwealth of Australia;
- ASC NEPM (2013) National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) 1999, National Environment Protection Council (NEPC), as amended and in force on 16 May 2013, specifically, Schedule B4, Guideline on Site-Specific Health Risk Assessment Methodology; and
- USEPA (1989) Risk Assessment Guidance for Superfund Volume I – Human Health Evaluation Manual Part A. United States Environmental Protection Agency Office of Emergency and Remedial Response. Washington DC, Revised December 1989; and associated updates. Where specific guidance was not available from the above or other literature sources, conservative estimates for exposure parameters were adopted

Where AECOM was unable to source specific guidance from the above or other literature sources, conservative estimates for exposure parameters were adopted. The human exposure parameters adopted by AECOM in their assessment, including source and justification are presented in Figure 86 and Figure 87 **.**

Figure 86 – Human Behavioural Exposure Parameters – off site residents (source: AECOM, HHRA, 2016)

Exposure Parameter (units)	Value Adopted		Reference
	Adult	Child	
Exposure Duration (years)	29	6	ASC NEPM (2013) - low to medium density residential.
Averaging Time (carcinogens) (years)	70	70	ASC NEPM (2013) - low to medium density residential.
Averaging Time (non-carcinogens) (years)	29	6	ASC NEPM (2013) - low to medium density residential.
Exposure Frequency (days/day)	365	365	ASC NEPM (2013) - low to medium density residential.
Exposure Time – Indoors and Outdoors (hours/day)	24	24	ASC NEPM (2013) - low to medium density residential.
Body Weight	70	15	ASC NEPM (2013) - low to medium density residential.
Daily Soil Ingestion Rate (mg/day)	50	100	ASC NEPM (2013) - low to medium density residential.
Exposed Skin Surface Area for Soil Contact (cm^2)	6300	2700	ASC NEPM (2013) - low to medium density residential.
Soil to Skin Adherence Factor (mg/cm^2)	0.5	0.5	ASC NEPM (2013) - low to medium density residential. Assumes 31.5% of total body surface area (20,000 cm^2) for an adult and 44.3% (6100 cm^2) for a child.
Inhalation Rate (mother) (m^3/hour)	1.34	-	Inhalation rate assuming 20 hours indoors at 1.17 m^3/hour and 4 hours outdoors at 2.2 m^3/hour. Only applicable to breast feeding mother.

Figure 87 – Human Behavioural Exposure Parameters -off site commercial workers (source: AECOM, HHRA, 2016)

Exposure Parameter (units)	Value Adopted	Reference
Exposure Duration (years)	30	ASC NEPM (2013) - commercial/industrial.
Averaging Time – Carcinogens (years)	70	ASC NEPM (2013) - commercial/industrial.
Averaging Time – Non-Carcinogens (years)	30	ASC NEPM (2013) - commercial/industrial.
Exposure Time – Indoors and Outdoors (hours/day)	9	ASC NEPM (2013) - commercial/industrial.
Exposure Frequency (days/year)	240	ASC NEPM (2013) - commercial/industrial.

17.4.3. Risk Assessment Outcomes

Exposures to air and deposition of particulates (which could deposit onto soil) was identified as a potential exposure pathway to identified receptors, including off site resident and worker populations, which warranted higher tiers of assessment. Pathways that have been considered to be complete for the Site and therefore were assessed in the HHRA include:

- Inhalation of vapours and dust in indoor and outdoor air (inhalation pathway assessment).
- Ingestion of home-grown fruit and vegetables (multiple exposure pathway assessment).
- Ingestion of eggs from home-grown chickens (multiple exposure pathway assessment).
- Ingestions of home-grown chickens (multiple exposure pathway assessment).
- Ingestion of home-grown beef (multiple exposure pathway assessment).
- Ingestion of breast milk (multiple exposure pathway assessment).

For the chronic health assessments, maximum annual average ground level concentrations (100^{th} percentile) at each receptor and grid maximum concentrations were adopted as these were considered to be representative of a typical exposure scenario. Additionally, annual dust deposition rates for bio accumulative contaminants were used to estimate contaminant concentrations in soil for consideration in the multiple pathway assessments.

For the acute health assessment, 1-hour maximum ground level concentrations (100_{th} percentile) at each receptor and grid maximum concentrations were adopted as these were considered to be representative of a worst-case exposure scenario.

17.4.3.1. Scenario 1 - IED Emission Limits

Using the maximum annual average GLCs and grid maximum GLCs, estimated conservative screening (upper-bound) ILCR estimates for off-site receptors considered in the inhalation and multiple pathway assessments were found to be below the adopted acceptable risk level of 1×10^{-5}, and hazard indices were below the adopted acceptable hazard index of 1.0.

17.4.3.2. Scenario 2 – POEO Emission Limits (except Cd, set at IED Limit) – Project specific limits

Using the maximum annual average GLCs and grid maximum GLCs, estimated conservative screening (upper-bound) ILCR estimates for off-site receptors considered in the inhalation and multiple pathway assessments were found to be below the adopted acceptable risk level of 1×10^{-5}, and hazard indices were below the adopted acceptable hazard index of these risk estimates for Scenario 1 and 2 were based on a number of conservative assumptions and were considered to overestimate actual risk to receptors, it is generally not considered necessary to further refine the assumptions given that the risk estimates were below adopted acceptable levels.

Overall the estimated health risks to off-site residents and commercial workers from inhalation and direct contact pathways under Scenario 1 and 2 operating conditions were considered low and acceptable.

17.4.3.3. Scenario 3 (Upset Conditions)

An acute exposure assessment during upset operating conditions was also undertaken as part of the HHRA. The acute assessment comprised the comparison of 1-hour maximum annual average ground level concentrations during upset operating conditions at each receptor to a hierarchy of published acute criteria.

The assessment of acute exposures indicated that there are no exceedances of the adopted criteria and therefore, no CoPC required further assessment with regard to acute inhalation exposures.

The following points summarise the results of the IRAP modelling against the relevant levels.

17.5. CUMULATIVE IMPACTS AND MITIGATIONS MEASURES

Worst-case scenarios have been assessed at the point of maximum impact. These scenarios have been considered to provide an upper maximum of the predicted impact of the proposed Facility. Even at the

upper maximum, the impact of the Facility will not lead to adverse health impacts and as such, mitigation measures are not proposed.

AECOM have considered in detail all potential CoPCs associated with emissions from the proposed EfW facility and resolved that under normal conditions there is an acceptable and low risk of impact on human health. The facility has been modelled under series of potential operating conditions, including upset conditions during which typical emissions may be exceeded. However, assessment by AECOM under such conditions has resolved that the impact is within acceptable limits so as to pose to no low and acceptable risk to human health.

17.5.1. Mitigation Measures

To minimise and avoid impact associated with the operation of the plant it is proposed that the emissions limits would be set to align with the IED (as opposed to the POEO limits). By doing this, even in the worst case scenarios (as modelled by AECOM) the potential for impacts is either avoided or minimised.

Table 68 – Summary of mitigation measures

Potential Impact	Mitigation Measure	Timing
Emission Concentrations (Normal Operations)	• Proposed energy from waste facility operating using emission rates set by the POEO Act, with the exception of Cd which will be set at the limit prescribed by the Industrial Emissions Directive (IED; Directive 2010/75/EU).	Operational Condition: Ongoing
Monitor Emission Concentrations	• Implement continuous monitoring system to ensure facility operates within acceptable parameters; • Set CEMs to commence safe shutdown procedures if emission limits are exceeded	Operational Condition: Ongoing.
Emission Concentrations (Facility upset)	• In line with the EfW policy a series of trials and tests would be undertaken to ensure proper functioning of technology prior to full operation.	Operational Condition: time restricted
	Following completion of PoP trials and within the first 12 months of commencing operations the proponent will undertake a minimum of two (2) measurements (at least 3 months apart) of the following toxics: • Heavy metals; • Polycyclic aromatic hydrocarbons; and • Chlorinated dioxins and furans.	Operational Condition: time restricted (first 12 months)

17.6. SUMMARY AND CONCLUSION

The outcome of AECOMs assessment has concluded that the potential for risk to human health from odour, noise, ozone, hazards, soil and water were considered to be **low and acceptable** and did not warrant quantitative assessment within the risk assessment framework. AECOM has provided suitable management provisions for inclusion in the mitigation measures for the project.

18. TRAFFIC, TRANSPORT & PARKING

18.1. OVERVIEW

The DGRs for the Energy from Waste application pertaining to environmental assessment of Transport and Traffic for the proposed Development are:

> *Details of traffic types and volumes likely to be generated during construction and operation;*
>
> *An assessment of the predicted impacts of this traffic on the safety and capacity of the surrounding road network and a description of the measures that would be implemented to upgrade and/or maintain this network over time;*
>
> *Details of key transport routes, site access, internal roadways, infrastructure works and parking; and*
>
> *Detailed plans of the proposed layout of the internal road network and parking on site in accordance with the relevant Australian standards.*

Combined with initial direction provided in the DGRs, matters were raised by members of the community and organisations in response to exhibition. These generally included:

- Out bound vehicle movements associated with the removal of ash and residue from the site;
- Potential effects of construction vehicle movements on the network capacity and the operation of key intersections.

A amended assessment of the proposed development in relation to the potential traffic and accessibility impacts has been prepared by Traffix for the proposed SSD, DA and is provided at **Appendix Q**. The matters raised by the community, organisations and agencies as part of consultation have incorporated into the revised report and the amended EIS as set out in the following sections. The amended traffic and parking impact statement has considered the following:

- Traffic movements associated within the removal of waste arising (ash and residues);
- Updated parking layout, including consistency with demand and compliance with the relevant Australian Standard;
- Includes a cumulative assessment of all traffic movements; and
- Construction traffic movements and the potential effects on the capacity of the existing road nnetwork and key intersections.

Where relevant mitigation and management measures have been updated to clearly align with potential impacts. Notably the recommendations of Roads and Maritime Services are included in the mitigation measures provided in section 18.8 as well as the consolidated set of measures provided **section 27.3.**

18.2. LEGISLATIVE REQUIREMENTS

There are no legislative requirements that relate to the assessment of this key issue. However, the *Traffic Assessment* has utilised industry accepted guidelines and assessment frameworks to assess the proposal and quantify the anticipated impacts. These include:

- State Environmental Planning Policy (Infrastructure) 2007;
- Guide to Traffic Generating Development (RTA); and
- Road Design Guide (RTA).

18.3. ASSESSMENT METHODOLOGY

The traffic report has applied the following assessment methodology:

- Establish existing traffic environment through literature review of previous traffic statement and confirm via traffic count survey;
- Estimate potential traffic volumes using information such as typical vehicle size/load capacity, facility design capacity, hours and day of operation; and
- Modell traffic (existing and likely) volumes using SIDRA software to determine potential impact on road network and intersection operation.

The traffic report provides an assessment of the existing conditions within the Precinct as well as an assessment of the potential traffic impact specifically related to the construction and operation of the proposed Facility.

The regional and local road network and the proposed capacity of the Precinct have been considered as part of this application. The Site is presently accessed via Honeycomb Drive (which runs in an east bound direction from Wonderland Drive. Positioned within the Eastern Creek Employment Precinct, the Site is well serviced by both the M4 and M7 motorways.

18.4. EXISTING SITE CONDITIONS

18.4.1. Road Access

The site forms part of the Western Sydney Employment Area (WSEA) located approximately 35 kilometres west of the Sydney CBD and 14 kilometres west of the Parramatta CBD. More specifically, the site is located within the Eastern Creek Precinct and lies to the south of the M4 Motorway, west of the Wallgrove Road/Westlink M7 Motorway.

The site is well service by established road infrastructure. The principal entry to the site is via Honeycomb Drive, with the principle vehicles route to the site likely to be M4/M7 to Wallgrove Road, Wallgrove Road to Wonderland Drive connecting to Honeycomb Drive and the site entry of Dial-a-Dump and the Genesis Facility. All streets connecting to the site are within an emerging industrial area.

The location of the site in the context of existing road infrastructure, including dedication of road hierarchy is shown in Figure 88.

18.4.2. Existing Traffic Generation: Genesis MPC

The TNG development site is part of a broader landholding that comprises Genesis MPC and Landfill. The development site is presently vacant and currently generates no traffic volumes of significance.

A previous traffic report had been prepared by Transport and Traffic Planning Associates (TTPA) in connection with the operation of the Genesis Facility, these traffic volumes are summarised in the table below.

Table 69 – TTPA Existing Traffic Generation (source: Traffix; 2016)

Site	AM Traffic Volume	PM Traffic Volume
Genesis Xero Waste	96	96
Hason	156	125
Total	**252**	**211**

Traffic assessed volumes were then verified by traffic counts, undertaken by Traffic on 18 March 2014, on the private internal road known as Dadi Drive (road entry serving both TNG/Genesis and Hanson). These results are provided in Table 70.

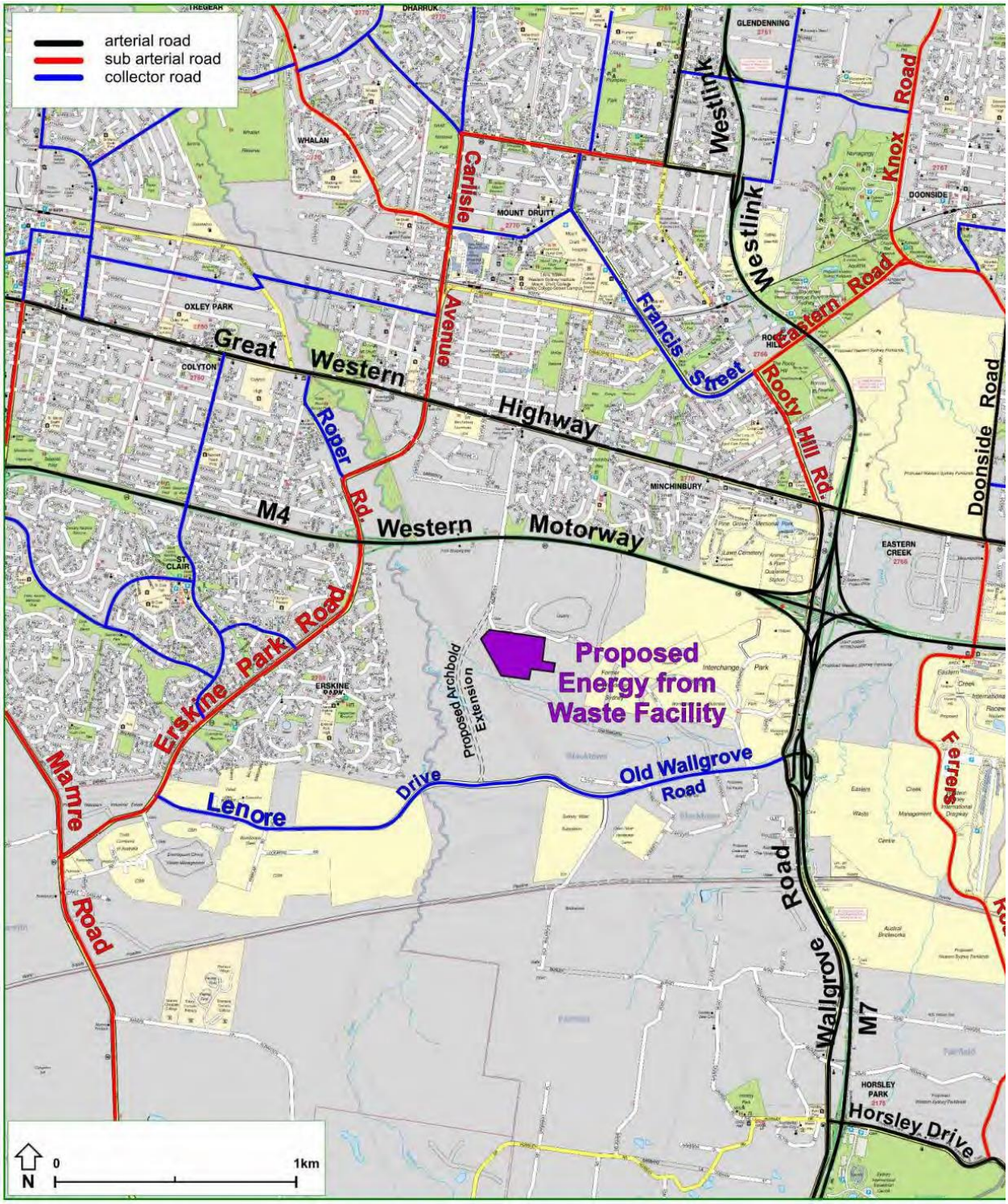
Table 70 – Surveyed traffic movements (source: Traffix; 2016)

Time	IN	Out	Peak Total
AM Peak	102	107	**209**

Time	IN	Out	Peak Total
(8.00am – 9.00an)			
PM Peak (3.00pm – 4.00pm)	80	117	**197**

As shown in the above Tables, the previously assessed traffic potential was higher than the current surveyed traffic volume along Dadi Drive.

Figure 88 – Existing road hierarchy and access (source: Traffix; 2016)



18.4.3. Existing Intersection Performance

The most critical intersection, being Wallgrove Road and Wonderland Drive, was surveyed for performance and determined to currently operate at Level of Service B, good with acceptable delays and spare capacity (refer to Table 71).

Table 71 –Existing Intersection Performance Summary (Source: Traffix; 2016)

Intersection Description	Control Type	Period	Degree Of Saturation	Intersection Delay	Level of Service
Wallgrove Road/Wonderland Drive	Signals	AM	0.581	19.7	B
		PM	0.595	19.5	B

18.5. ASSESSMENT OF KEY ISSUES

18.5.1. Transport and Accessibility

A detailed assessment of the proposed development in relation to the potential traffic and accessibility impacts has been prepared by Traffix and is provided at **Appendix Q**.

18.5.2. Public Transport

The site is moderately accessible via public transport options including daily bus service connecting the site to Mount Druitt Railway Station or Blacktown Interchange.

A bus stop is located to the southeast of the broader site on Honeycomb Drive, south of the Greville Street intersection. The service operates approximately once every 30 mins Monday to Friday. Services from Blacktown operate between 5.06am and 8.48pm; Mt Druitt Services operate between 5.26am and 7.30pm. The service does not operate on weekends.

A pedestrian path connects the site to the bus stops, located either side of Honeycomb Drive. Access to bus services along Honeycomb Drive will not be affected by construction.

The site is moderately serviced by public transport with a frequent weekday bus service available within walking distance of the site. Based on the 24 hour, seven (7) day a week operation access on weekends would be restricted to car only based on the current servicing timetable. However, services are frequently augmented in response to demand. In this regard as development within the broader WSEA and the locality generally increase services may be augmented to meet the increased demand generated by an increasing workforce population. The issue is not considered to be of sufficient significance to be prohibitive to the progression of the proposal.

18.5.3. Car Parking

The development proposes a total of 42 car parking spaces (including 3 visitor spaces and one disabled space) in accordance with the requirements of the RMS Guide to Traffic Generating Developments (RMS Guide) and The Disability (Access to Premises – Buildings) 2010 for generic industrial land uses and the Blacktown DCP 2006.

The proposed 42 car parking spaces will appropriately service the demands of the 55 staff who will be employed by the proposed Facility. Staff rosters will include 3 shifts per day and that staff numbers will be relatively evenly distributed across each shift.

Having regard for the above, there is potential for up to 37 persons to be on-site at shift changeover periods. Assuming each staff member drives to the Site separately, as a worst case scenario, then this results in a staff parking demand of 37 spaces. This demand would reduce to say 18 spaces outside of peak shift changeover periods.

The proposed development is nominally required under to provide one accessible parking space for the proposed development. This space shall be designed in accordance with AS2890.6.

The parking supply will enable the operational requirements to be accommodated on-site at all times with no reliance on on-street parking at any time including during critical periods such as shift change over where peak parking for staff may be required (including office staff, facility staff and truck drivers).

18.5.4. Traffic Impacts: External Road Network (Construction)

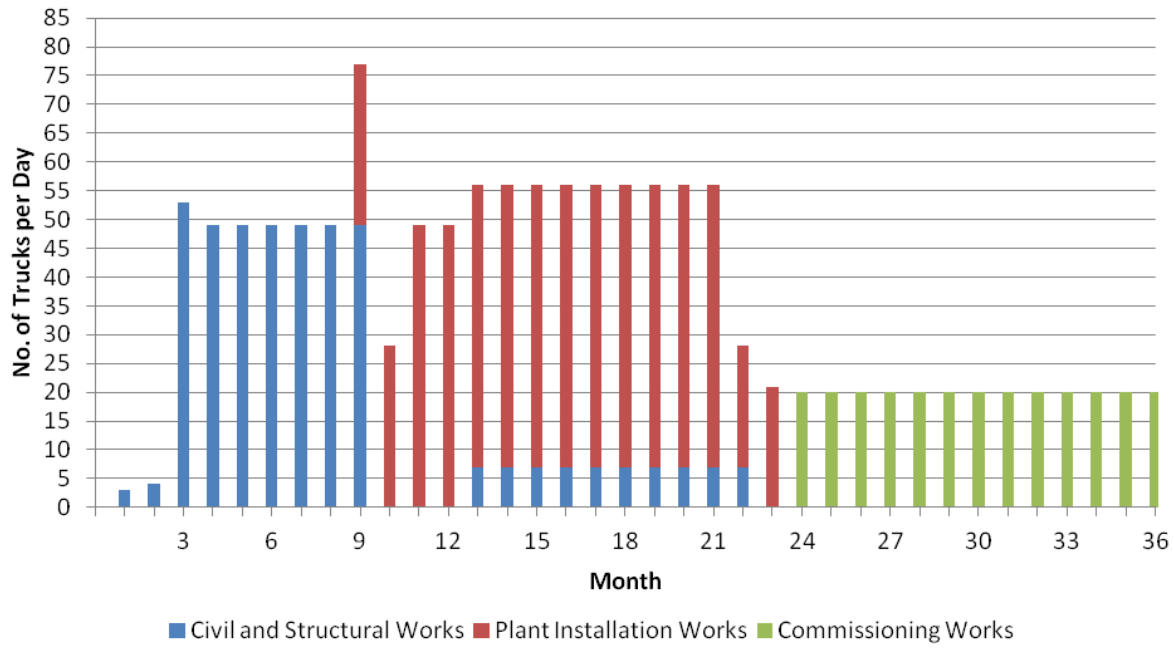
A preliminary estimate is that construction and implementation will take up to 3 years. As shown in Figure 89, peak construction works are anticipated to occur between month three and 21 and contribute an approximate average of 56 trucks per day during this time with the notable exception of month nine (9) where a spike of up to 77 trucks per day will attend the site. The latter reflects the absolute maximum

vehicle movements and is the result of overlapping construction phases, being the completion of the civil works and the commencement of plant installation.

This general maximum of up to 56 trucks per day equates to 112 movements per day. Notably, this is substantially less than the truck movements associated with the Facility once operational. Given that the operational traffic volume will not diminish the Level of Service at key intersections the lower construction traffic volumes are considered acceptable with capacity in the existing road network to accept the anticipated volumes.

The appointed construction project managers Brookfield Multiplex will, prior to the commencement of construction, will prepare a Construction Traffic Management Plan.

Figure 89 – Construction vehicles (source: Traffix; 2016)



18.5.5. Traffic Impacts: External Road Network (Operational)

To determine the potential impact of the facility, once operational, on the existing traffic network in particular the operation of key intersections

- Identification of the maximum capacity of the facility and staff numbers;
- Utilise information of accessibility of site by alternative modes of transport to determine staff transport modal split (if any);
- Identification of the typical delivery load size (i.e. tonnage per vehicle);
- Using average truck tonnage and maximum yearly throughput, determine the average daily trips (based on the hours and days of operation for certain operations);
- Using existing road traffic data for Dadi Drive, add proposed traffic volumes to determine likely daily trip volumes; and
- Model intersection operation using volume data to identify operational level.

18.5.5.1. Staff Movements

The development will employ a total of up to 55 staff per day across 3 shifts. Given the moderate level of accessibility to the site by alternate modes of transport, s bus or bicycle, it has been assumed that all staff will access the site using a private motor vehicle.

As such, the development will generate up to 110 staff trips per day (55 in, 55 out). A peak staff traffic generation of 37 vehicles per hour is expected to occur during shift changeover periods.

18.5.5.2. Waste/fuel deliveries

Waste fuels will typically be delivered to the site in 22 tonne trucks (articulated or B-Double). The facility operating at its technological capacity limit of 1.35 million/tonnes would generate up to 168 truck movements per day. However, as the facility will operate below this, processing a total of at 1,105,000 tonnes/per annum at completion of phase 2 vehicle movements will be a maximum of 138 trucks a day.

As outlined in **section 3** of this amended EIS, TNG will form part of an integrated waste management facility located immediately adjacent to the Genesis Facility that includes resource recovery and landfill operations. A large proportion of TNG waste will be residual wastes (i.e. left over after recovery processing) sourced direct from Genesis MPC, as set out in Table 72, allowing for efficient synergies to be achieved between the two (2) operations that will go some way to reducing the anticipated 138 vehicle trips per day (VTPD) even further as the operation at full capacity (completion of phase 2) will only require an additional 500,000 tonnes per annum of input waste material from external sources (via vehicle).

Table 72 – Input Material Source Summary

Source	Annual Input Material
via Conveyor from Genesis MPC	136,000 tonnes
Vehicles Re-routed (i.e. Reduced) From Genesis Xero Direct to EFW	469,000 tonnes
New Material from External Sources	500,000 tonnes
Combined Total	**1,105,000 tonnes**

Notwithstanding the above, an additional traffic generation of 168 truck deliveries (336 movements) has been adopted for the purposes of this assessment to provide a worst case analysis and to acknowledge the potential variability in the location source for input material. As such, this assessment adopts the full technological input capacity of 1.35 million tonnes per annum as additional to that of the existing Genesis Xero Waste Facility, as shown in the Table 73.

Table 73 – Input Material Source Summary - Modelled

Location	Annual (Max.) Input Material
Genesis Xero Only	2,000,000 tonnes
TNG: EfW Facility	1,350,000 tonnes
Combined Total	3,350,000 tonnes

18.5.5.3. Ash Residue Removal

The facility operating at its maximum technological capacity of 1.35M/tonnes will generate an estimate 451,700 tonnes/per annum of ash residue. While it is anticipated that a significant proportion of this waste material could be deposited on the adjacent Genesis site a worst case scenario approach has been adopted in relation to traffic modelling.

Ash residue removal, if required, would typically occur for using 18 tonne trucks, 12 hours a day, six (6) days a week each with an anticipate. This results in an additional 160 truck movements a day (80 in and 80 out) with an average hourly rate of 14 trucks per hour.

18.5.5.4. Miscellaneous Vehicle Movements

Combined with the incoming waste fuels and outgoing ash and residue material, miscellaneous deliveries such as hydrated lime, activated carbon and other materials required for the various processes involved in the power generation will be delivered to the site.

Miscellaneous deliveries will typically occur within the standard 5 day week result in a demand for up to 4 additional trucks per day and up to an additional 20 truck movements per week. Accordingly

miscellaneous truck movements account for 8 vehicle trips per day (4 in and 4 out), with an average of hourly rate of 0.3 trucks per hour.

18.5.5.5. Cumulative Traffic Movements (External)

Adopting the technological capacity of the Facility, 1.35 million tonne capacity of the facility (including staff movements) and not taking into account the synergies between the proposed Facility and Genesis Xero Waste the total volume of traffic associated with the operation of the facility is 614 vehicle trips in a day or 65 vehicle trips in an hour. Table 74 provides a summary of how these vehicles are apportioned.

Table 74 – Operational Traffic Generation: External Road Network (source: Traffix; 2016)

Type	Movements (two way)			
	Car Movements		Truck Movements	
	Daily (veh/day)	Hourly (veh/hr)	Daily (veh/day)	Hourly (veh/hr)
Staff (Cars)	110	37	-	-
Input Waste/Fuel deliveries	-	-	336	14
Miscellaneous Deliveries	-	-	8	0.3
Ash Removal	-	-	160	13.3
Total	**110**	**37**	**504**	**28**

Consideration has also been given to the potential for infrequent visitor attendance, such as the potential for community groups to tour the site. Given these would likely occur outside peak traffic hours they are anticipated to have a nominal effect on the assessed traffic volumes and have not been made a specific contributor or line item due to the level of infrequency it is anticipated to occur. As such, the traffic generated in connection to the development can be readily accommodated by the surrounding road network.

The anticipated increase in vehicle movements associated with the operational phase of the development does not require the development or implementation of any mitigation measure to prevent or minimise adverse impact on the local road network.

The Traffic Impact Assessment (**Appendix Q)** details the peak hour intersection analysis carried out. The analysis found that that the critical intersection of Wallgrove Road and Wonderland Drive will continue to operate with at its existing Level of Service (i.e. level of service “B”), and moderate delays during both peak periods. As such, the traffic impacts of the development can be readily accommodated by the surrounding road network.

18.5.5.6. Traffic Impacts: Internal Road Network (Operation)

The site has been designed to allow trucks to move through the site in an almost constant forward motion, with the only exception being when they reverse to unload at the tipping bunker.

Waste fuel will be received at the facility 24 hours a day, seven (7) days a week. As outlined above, trucks delivering waste are anticipated to have a 22 tonne, which Ramboll have estimated to take up to 12 minutes to unload (including reversing and leaving time).

Based on the maximum technological limit of the facility (1.35M/tonnes/pa or NCV (10 MJ/kg) and accounting for variability and peak flows, there would be a short term maximum of 17 deliveries per hour, requiring a minimum of 4 delivery bays.

TNG has made provision for 16 tipping bays to provide flexibility in operations (i.e. bunker management).

Based on the above, a more than adequate allowance has been made for the delivery of waste fuels to the site and it is considered unlikely that the volume or frequency of deliveries would contribute to a potential for vehicles to queue at the site or on the surrounding street network.

Once vehicles pass through the initial checkpoint and weighbridge, having satisfied TNG operatives that the waste is from a registered source, internal traffic management procedures will be implemented to ensure safe and fluid movement of trucks.

18.6. ROAD AND PARKING DESIGN

The proposed road and carpark design layout has been assessed by Traffix and the following provided:

- The general layout of the site lends itself to a one-way clockwise circulation throughout the site and this arrangement is encouraged;
- Separate car and truck accesses are not considered necessary having regard for the relatively moderate truck movements of approximately 28 trucks per hour (in and out combined), when including internal movements to/from the Genesis Xero Facility;
- All car parking manoeuvres themselves are separated from the general truck circulations areas. Similarly, no cars will be permitted within the Tipping Hall area where truck reverse movements will occur;
- A swept path analysis, included in Appendix D, has been undertaken for all critical manoeuvres through the site in accordance with relevant standards. This includes 26 metre B-Double access to the Tipping Hall and articulated tucks (AV) accessing all other areas within the site;
- Parking spaces are generally 2.4 metres in width and therefore satisfy the requirements of AS2890.1 for a Class 1 user; and
- Internal roads are a minimum of 6.0 metres in width and therefore satisfy the requirements for emergency vehicle access and can accommodate two-way traffic where required.

18.7. CUMULATIVE IMPACTS & MITIGATION MEASURES

The net traffic generation is a moderate increase above existing conditions and is unlikely to significantly impact the traffic capacity available to the wider area.

The traffic generated by the proposed development represents only a small proportion of traffic generated by the wider WSEA, and as such will not have a significant impact on the ability of the surrounding road network to operate at an acceptable level into the future. It is also emphasised that the critical intersection of Wallgrove Road and Wonderland Drive will operate with a Level of Service B (i.e. good to satisfactory for traffic signals and roundabouts, and acceptable to satisfactory for give way and stop signs) post development.

Given that this increase in based on the worst case, technological capacity of 1.35M/tonnes/per annum, once operational the traffic generation may in fact be lower due to efficiencies between TNG and Genesis and the Phase 2 capacity of 1,105,000M/tonnes/per annum.

The site layout and design accommodate all necessary onsite parking, capable of supporting the future full time workforce as well as the operational servicing requirements inside the tipping hall to avoid any impacts associated with queuing to enter the site.

As such, it is considered that there is additional spare capacity provided by the existing intersection to cater for further development within the area.

Table 75 – Traffic: Mitigation Measures

Potential Impact	Mitigation Measure	Timing
Design and delivery of parking (RMS)	Deliver parking in line with proposal. Car parking and associated access to be designed and constructed in accordance with:AS2890.1 – 2004; AS2890.2-2002 & AS2890.6 -2006 Off-Street Car Parking	Construction and Operation: ongoing.

Potential Impact	Mitigation Measure	Timing
Adverse impact on key intersection	No impact. Operation will maintain LoS B at key intersection of Wallgrove Road and Wonderland Drive. No measures required.	N/A
Road entry design vehicle: swept path	The access and internal layout of the proposed Facility is generally acceptable, subject to identification of suitable on-site car parking area(s) and minor improvements to the future access from the Estate Road to accommodate B-Double access. Notwithstanding, it is noted that there is ample space available such that any minor changes to the plans, including a car park capable of accommodating all parking demands on-site can be readily provided.	
Queuing of waste delivery trucks along adjoining street network to enter the site	No mitigation measures are considered necessary the tipping hall has been designed to accommodate a total of 42 parking spaces, considered adequate to meet the demand.	N/A
Management of access to the site during extended hours.	A Construction Traffic Management Plan is to be prepared prior to construction.	
Limited alternative transport opportunities.	No mitigation measure is considered necessary. The stie benefits from a moderate level of access (i.e. good for 5 days of the week and poor on weekends) It is anticipated that as the area develops bus services will be augmented to meet increasing demand. Given the location of the site and the use the level of access by public transport is considered acceptable.	N/A
Construction Traffic Management (RMS)	Development and implementation of a Construction Traffic Management Plan, detailing vehicle routes, number of trucks, hours of works, access arrangements and traffic controls.	Prior to the issue of a CC and implemented throughout construction works.

18.8. SUMMARY AND CONCLUSION

The net traffic generation is a moderate increase above existing conditions and is unlikely to significantly impact the traffic capacity available to the wider area. As such, no mitigation measures are proposed. The traffic impact has been also conservatively calculated not taking into account synergies between EFW and Genesis Xero. The increase can be readily accommodated by the surrounding road network with no change to existing Level of Service and only minimal impact on average delays.

19. FLORA AND FAUNA

19.1. OVERVIEW

The DGRs for the Energy from Waste application include the following requirement for environmental assessment of Flora and Fauna for the proposed Development:

> *Including an assessment of the potential impacts to threatened species, populations and communities, and their habitat(s), and if required describe how the principles of "avoid, mitigate, offset" have been used to minimise the impacts of the proposal on biodiversity*

The site has been extensively modified with significant areas cleared for the purposes of agricultural grazing. Despite this detailed ecological survey of the site by Abel Ecology recorded several species of fauna and fauna habitat and confirmed the presence of three (3) fragmented patches of vegetation remain identified as being part of vegetative communities listed under the *Environmental Protection and Biodiversity Conservation Act 1999* and *Threatened Species Act 1995* as Endangered Ecological Communities (EEC).

The detailed design of the project that has occurred over the past 12 months considered all possible alternatives in the location and siting of the plant to avoid direct impact on existing native flora and fauna. This consideration has resolved that the location as proposed is the most appropriate. The impacts likely to arise as a consequence of the development include the removal of 0.27 ha of Cumberland Plain Woodland and 1.29 ha of River Flat Eucalypt Forest vegetation types, including eight (8) habitat trees.

Notwithstanding the identified impacts, the condition of vegetation to be removed is poor, showing low structural complexity and limited habitat value. Faunal species recorded on the site or identified as possibly using the site for foraging and roosting have wide ranges and are unlikely to be significantly affected by the works.

Compensatory works to include revegetation works within the Ropes Creek Tributary riparian corridor will offset the loss of vegetation from the site; fauna clearing prior to construction and the implementation of 20 nesting boxes in the riparian corridor prior to the commencement of works will manage impacts on local fauna.

Accordingly, the proposal is unlikely to have long term significant adverse impacts on flora or fauna communities and suitable methods for the mitigation and management of identified impacts are provided. The Flora and Fauna Assessment Report is provided at **Appendix G**.

19.2. LEGISLATIVE REQUIREMENTS

The *Flora and Fauna Assessment* uses the following Criteria and Standards for assessing the existing conditions, and modelling the impacts of the proposed Development:

- *Environment Protection and Biodiversity Conservation Regulations 2000 (Schedule 4);*
- *Threatened Species Act 1995.*
- *Environmental Planning and Assessment Act 1979 (Section 5A).*
- *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 - Guide to implementation in NSW.*
- *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects.*

19.3. ASSESSMENT METHODOLOGY

The site was identified by high level mapping and literature review to contain flora communities and fauna species listed under the:

- *Environment Protection and Biodiversity Conservation Regulations 2000 (Schedule 4).*
- *Threatened Species Act 1995.*

To confirm the presence, condition and assess the potential impacts of the development, Abel Ecology undertook a site inspection. At the same time as undertaking flora assessment the site was inspected for fauna species.

Following determination of presence and condition, the seven part test established under Section 5A of the EP&A Act 1979 was used to determine whether the development was likely to have a significant impact on the identified species, communities or their habitats listed under the:

- the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) (Commonwealth legislation); and/or
- *Threatened Species Conservation Act 1995* (TSC Act 1995) (state legislation).

The assessment was based on the seven part test contained in Section 5A of the *Environmental Planning and Assessment Act 1979* (EPA Act), which is detailed in **Appendix G.** The assessment addresses both 'endangered' and 'vulnerable', as required by the Threatened Species Conservation Act, 1995 (TSC Act 1995).

The flora survey involved random meanders through the survey area to compile vegetation descriptions and vascular flora species lists for the Site. Targeted surveys were made for threatened flora species on the basis of local species records and suitable habitat within the survey area.

Targeted surveys were undertaken using quadrat analysis to determined distribution and abundance, with the development site divided into six (6) survey quadrats.

The fauna survey involved an aquatic biota survey, call playbacks, diurnal fauna searches, nocturnal fauna searches, stag watching, and microbat ultrasonic call recording.

19.4. EXISTING ENVIRONEMENT: PRESENCE & CONDITION

19.4.1. Flora

The proposal footprint and survey areas is approximately 24.4 hectares (ha) in size, the following vegetation was identified

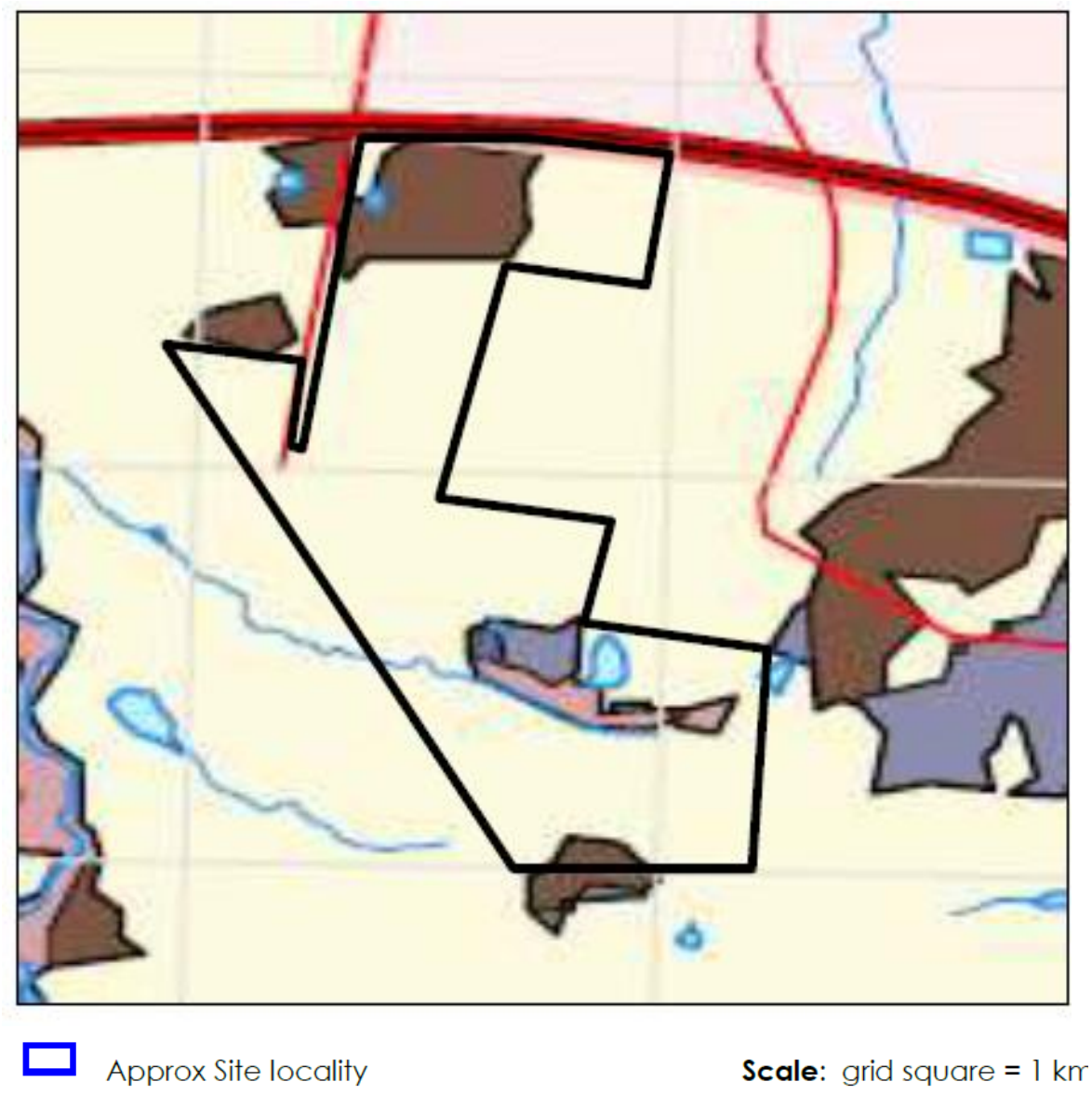
- 22.5 hectares of couch grass previously used as grazing pasture;
- An approximate 2,700m^2 patch of Cumberland Plain Woodland, containing Grey Box (*Eucalyptus Moluccana*) and Forest Red Gum (*Eucalyptus Tereticornis*), as well as scattered indigenous groundcovers;
- River-flat Eucalypt Forest located within the southern portion of the site; and
- 270m^2 of cumbungi (a tall Australian marsh plant from the Typha genus) located within the former farm dam.

The distribution of vegetation remaining on the site is show in Figure 90.

The Cumberland Plain Woodland and River-flat Eucalypt Forest identified are listed ecological communities under either or both the *Environmental Conservation and Biodiversity Act 1999* and the *Threatened Species Act 1995.*

The threatened ecological communities present on the site were assessed by Abel Ecology as degraded remnants in Class 2/3 condition, with an understorey dominated by weeds (Class 2/3 condition indicated remnant or regenerating areas with weed invasion). Despite the presence of the two (2) protected flora communities on the site, no individual flora species listed under the relevant Acts were surveyed.

Figure 90 – Vegetation map for the EEC (source: Abel Ecology; 2015)



19.4.2. Fauna

A total of 47 species were surveyed on site including mammals, birds, frogs, fish, macroinvertebrates and reptiles (refer to Table 6, Abel Ecology, **Appendix G**). A summary is provided in Table 76**.**

Table 76 – Summary of fauna survey outcomes

Species Type	Number recorded	Protection status of recorded species
Mammals	10	No statutory protection
Reptiles	1*	No statutory protection
Frogs	5	No statutory protection – all species common in the western suburbs of Sydney
Birds	25	No statutory protection – species observed either common or reasonably common within western Sydney. Species likely to occur but not recorded include Sulphur Crested Cockatoo and Little Corella.
Fish	1	No statutory protection (included a long finned eel)
Macro-invertebrates	5 orders	No statutory protection
Micro-bats	5	2 species are listed as threatened under the NSW TSC Act 1995.

As outlined in Table 76 of the 5 bat species recorded two (2) are threatened insectivorous bat species including:

- the Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris;* and
- Eastern Freetail-bat *Mormopterus norfolkensis.*

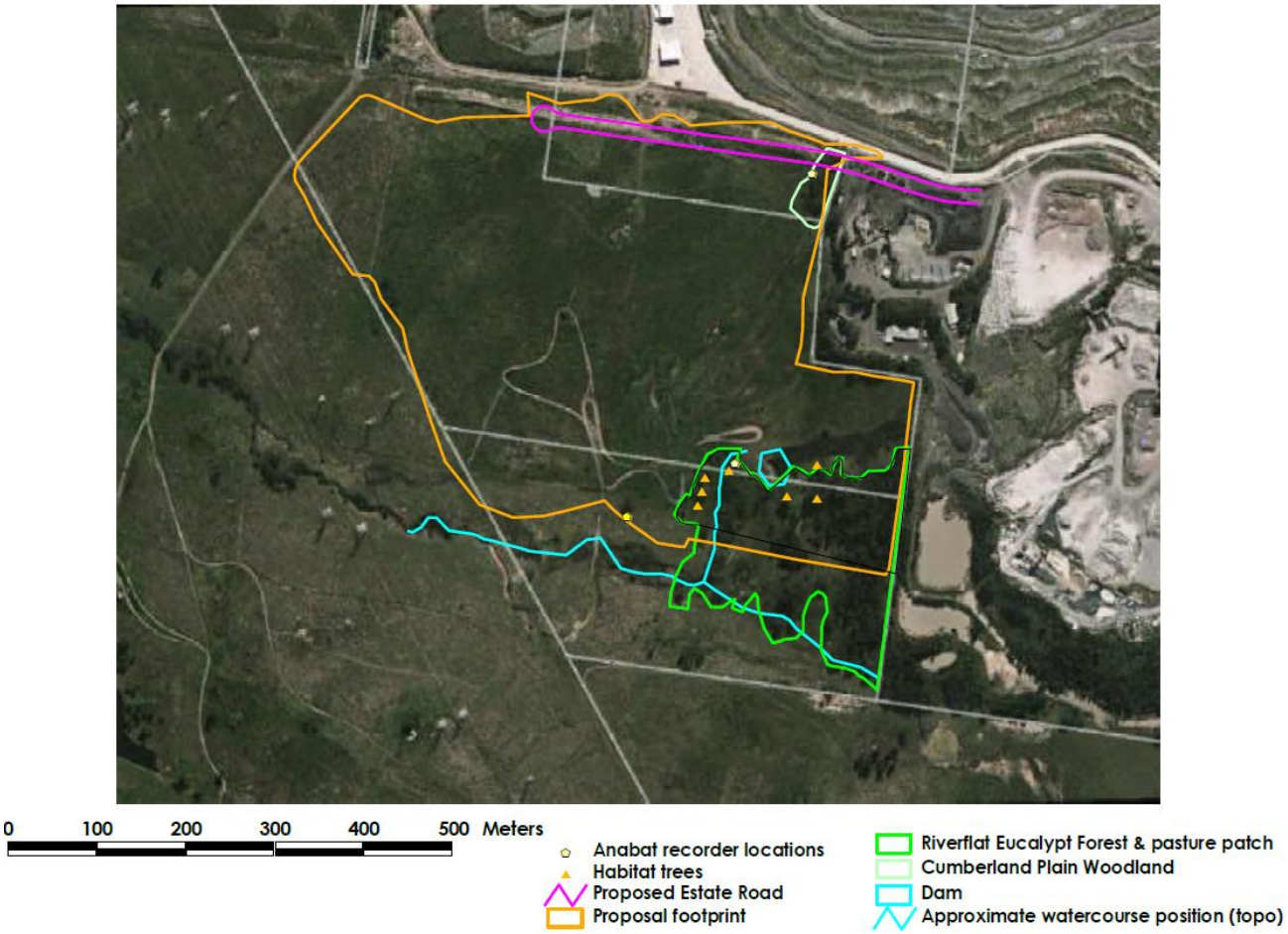
The presence of the Cumberland Plain Woodland Ecological Community is typically associated with the presence of the Cumberland Plain Snail. While the species was not recorded during the survey undertaken by Abel Ecology they have been previously surveyed elsewhere on the site.

19.4.3. Fauna Habitat

The survey area contains suitable habitat for a range of common indigenous species, feral species and some threatened indigenous species. Surveyed habitat types are shown on Figure 91 and summarised as follows:

- **Forest and Woodland:** constrained to the northeast and southeast corner of the site. Dominant species within these fragmented patches include *Eucalyptus* and *Casuarina.*
- **Open Paddocks:** The dominant habitat type accounting for 22.5 ha of the site area. Approximately 90 – 99%of the areas consists of open grassland used for pastures with few scattered exotic trees were surveyed within the grassland areas.
- **Farm Dam, Watercourse and drainage line:** a 970m² dam is located on a drainage line in the southern portion of the site. The Dam supports Cumbungi (*Typha Orientalis)*.

Figure 91 – Existing Fauna Habitat (Source: Abel Ecolgy, FFAR, 2015)



19.4.3.1. Habitat Features

Based on the potential and recorded fauna species and habitat features of the site, the following habitat features were identified as being present by Abel Ecology.

Table 77 – Specific Habitat Features (Source: Abel Ecology)

Habitat Purpose	Features of Habitat
Shelter/nesting/roosting sites and diversity	Scattered Logs, occasional rock, canopy vegetation and long grass, tree hollows. The emergent vegetation present on the dam provides suitable habitat for frog species. The water bodies, emergent vegetation and aquatic detritus also provides habitat for macroinvertebrates and tadpoles identified during the second field visit. The survey area contains hollow bearing trees (HBTs) that that provide suitable roosting habitat for *Falsistrellus tasmaniensis, Mormopterus norfolkensis, Scoteanax rueppellii, Myotis macropus, Miniopterus australis* and *Saccolaimus flaviventris*. The survey area does not have any caves, culverts, bridges, buildings and other suitable (often human-made) structures that provide potentially suitable roosting habitat for *Chalinolobus dwyeri*, *Miniopterus schreibersii oceanensis, Myotis macropus*. *Kerivoula papuensis* normally roosts in hanging bird nests or trees in rainforest gullies so is very unlikely to roost in the surveyed site.

Habitat Purpose	Features of Habitat
Food resources	Small patches of tree leaf litter. 90-99% grass and herb layer, canopy layer approximately 10% and the shrub layer is less than 5%. This survey area provides potentially suitable foraging habitat for six of the eight possible threatened species that may occur on the site (despite not been recorded during surveys).
Clearing	Large areas of grazing paddocks, some dirt roads.
Riparian Corridor (Ropes Creek Tributary): Potential Wildlife Corridor	Riparian corridor currently degraded and fragmented due to the presence of an existing power easement. Considered to provide limited opportunity for movement of wildlife.
Dam	Constructed dam with ephemeral drainage line. Long finned eel recorded observed at dusk in the shallows.

19.4.4. Assessment of Key Issues

The following key issues have been identified:

- Potential for adverse impact on vegetation condition;
- Impacts of vegetation removal, including the loss of critically endangered ecological communities; and
- Impact on fauna arising from habitat removal (considering both recorded and likely fauna).

Detailed consideration has been given to potential alternatives in relation to the siting of the EfW plant as a means of avoiding the potential for impact, particularly those associated with the need to remove a small patch of identified CPW, required to accommodate the development.

19.4.5. Test of Significance

As shown in Table 78 which includes the summary outcome of Abel Ecology's Assessment. The proposed development, including the removal of vegetation from the site, will not have a significant impact on the listed ecological communities or species, owing the degraded quality and small fragmented parcels.

Table 78 – Endangered Ecological Communities and Threatened Fauna Species Recorded within the Survey Area

Species/communities	Commonwealth Listing EPBC 1999	TSC Act 1995	Result
Fauna Species			
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*		Schedule 2, Vulnerable	No Significant Effect
Eastern Freetail-bat *Mormopterus norfolkensis*		Schedule 2, Vulnerable	No Significant Effect
Flora Communities			
Cumberland Plain Woodland	Critically Endangered	Critically Endangered	No Significant Effect
River-flat Eucalypt Forest		Endangered	No Significant Effect

Species/communities	Commonwealth Listing EPBC 1999	TSC Act 1995	Result

19.4.6. Vegetation Removal

The survey area is characterised by a high disturbance regime, evidenced in the extensive areas of pasture and presence of weed species combined with modified vegetation structure and composition of the surveyed ecological communities remaining.

This is not unexpected as the site has been used for grazing for many years. While there are patches of native vegetation, these patches display signs of disturbance as ground cover weeds are abundant with the recorded presence of feral indicator species, Red Fox, indicating that native terrestrial fauna abundance is likely to be low.

Ecological services for the site e.g. bioturbators, pollinators, seed dispersers may be present but do not appear to be functioning normally. There is generally a lack of recruitment of the indigenous Eucalypts within the survey areas. This may be caused by rabbits or perhaps cattle grazing on saplings.

The development will require the removal of the following existing Vegetation:

- All established grazing pasture equivalent to 22.5 ha;
- Approximately 0.27 hectares of the critically endangered ecological community Cumberland Plain Woodland;
- Approximately 2.89 hectares of River-Flat Eucalypt Forest;
- Removing vegetation including grass cover may contribute to soil disturbance and soil loss through erosion, requiring management to protect aquatic health of Ropes Creek Tributary; and
- Approximately 970m^2 of Cumbungi within a farm dam.

19.4.6.1. Vegetation Removal: Cumberland Plain Woodland (CPW).

In accordance with the Principles of Biodiversity of “avoid, mitigate, offset” (OEH) the proponent has review the site layout for ways to avoid the need to remove the fragmented patch of CPW. Given the location of the CPW the only option for avoiding impact is to relocate the approved precinct road or the EfW plant.

All options explored are neither practical nor feasible from a road design point of view.

- Relocation to the north would conflict with DADI drive or require its replacement. Upgrade of the existing DADI Drive cannot be undertaken due to its proximity to the edge of the quarry.
- Relocation south by 90 metres or eastward to avoid the CPW would require the adoption of a road design incorporating sharp right hand turns that are not considered practical or safe given the intended use of the road by heavy vehicles and relation onto land owned by Hanson.
- Relocation of the facility south is not possible due to constraining natural land features including the Ropes Creek Tributary. Relocation westward by 40 – 50 metres would compromise the connection between the site and the adjacent Genesis Facility, in particular internal road and conveyer connections that have positive effects on local road networks (i.e. reduce vehicle trips).

There is no feasible alternative to the location of the road that would support avoidance or mitigation. Accordingly, the proponent has proposed to “offset” the loss.

19.4.6.2. Vegetation Removal: River Eucalypt Flat Forest

In accordance with the Principles of Biodiversity of “avoid, mitigate, offset” (OEH) the proponent has review the site layout for ways to avoid the need to remove the fragmented patch of RFEF. In particular

consideration has been given to the relocation of the facility to the north of the existing quarry, to the south of the M7 and west of the 5 ha E2 Environmental Conservation lands.

This option is not considered suitable owing to the following:

- Inadequate site area to accommodate the facility; and
- Proximity to sensitive residential receivers would generate unreasonable adverse amenity impacts that are considered to be unreasonable.

On balance, given the assessed significance and condition of the RFEF patch, the protection of residential amenity would be considered to prevail.

19.5. FAUNA IMPACTS: HABITAT LOSS

The removal of vegetation and construction of the proposed facility will directly affect fauna through the removal of foraging and roosting habitat, for recorded and potential species, in particular the following:

- Ropes Creek Tributary has been identified as ephemeral with no signs of aquatic fauna accordingly partial removal is unlikely to contribute to aquatic habitat loss;
- removal and infill of dam;
- removal of eight (8) habitat trees which provide roosting habitat for surveyed microbats and may provide habitat for the Cumberland Plain Snail, although none were recorded at the time of the survey; and
- removal of 24.4 hectares of potential foraging habitat for large forest owls, eagles, kites, birds and bats to be removed.

Many of the species assessed for potential impacts arising from the removal of foraging habitat were not recorded as being present on the site and are known to have wide foraging ranges, such they are unlikely to be dependent on the site as a food source. Accordingly, the removal of foraging from the site is of no significance in the context of the seven (7) part test and faunal impacts.

Nesting and roosting boxes are proposed to be implemented at a rate of 2.5:1 (i.e. 2.5 boxes for every on HBT removed). These will be installed on trees retained within the riparian corridor along the southern extent of the site.

A single longfinned eel was observed in the dam and Abel Ecology is of the view this species is likely to have migrated there from a nearby habitat. The occurrence of this species is expected as it is commonly found in farm dams. However, there was noted absence of Plague Minnow, which is unexpected as the dam within the survey area offers apparently suitable conditions and their prevalence in farm dams in surrounding regions. However, this dam may be ephemeral in nature liming the potential for species to establish and persist.

As outlined above, the site is recorded as supporting the Cumberland Plain Woodland EEC which forms habitat for the Cumberland Plain Land Snail. Fauna surveys completed by Abel Ecology did not record the presence of the Snail on site however it is acknowledged that snails have previously been recorded elsewhere on the site. Typically, the snail will occur under logs and other debris, amongst leaf and bark accumulations around bases of trees and sometimes under grass clumps. The absence of the snail is likely related to the poor condition of the surveyed EECs and the absence of key habitat features. Notwithstanding this, to ensure consistency with OEH principles of biodiversity, further surveys will be undertaken prior to the commencement of work to verify presence or absence of the species. In the event the targeted survey records the snails' presence; pre-clearing surveys will relocate the snail to the north-western CPW patch zoned E2 Environmental Conservation that will ensure its long-term protection.

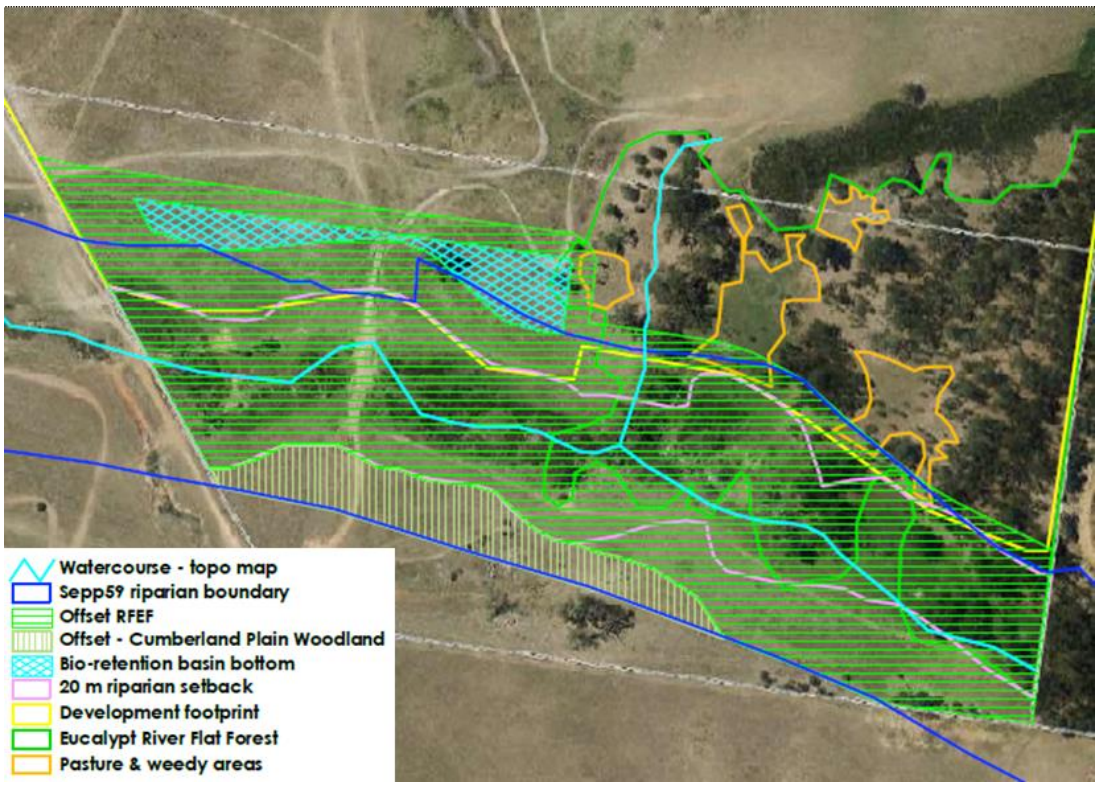
19.5.1.1. Offsets

As the impact of removing vegetation cannot be avoided, it is proposed to "offset" the loss through compensatory planting. Offsetting will be achieved within the SEPP59 area along the Ropes Creek Tributary and also on the batters surrounding the Bio-retention basin and to the south of the development footprint.

Approximately 0.54 ha of Cumberland Plain Woodland will be regenerated or replanted for the 0.27 ha that will be removed and approximately 4.98 ha of River Flat Eucalypt Forest will be regenerated or

replanted for the 2.89 ha that will be removed. The River Flat Eucalypt Forest will be regenerated and replanted within the SEPP59 Ropes Creek Tributary riparian corridor. Figure 92 shows the location of revegetation/regeneration areas including the bio-retention basin bottom, River-flat Eucalypt Forest on the batters and along the Ropes Creek Tributary, and the area of offset revegetation Cumberland Plain Woodland to the south-west of the tributary.

Figure 92 – Location of revegetation/regeneration areas



19.6. CUMULATIVE IMPACTS & MITIGATIONS MEASURES

The impacts associated with the development could be classified as short term pulse and press impacts related to the removal of all vegetation and habitat to accommodate the proposed development footprint. Long-term impacts are likely to be similar to short-term impacts.

Despite the identified impacts, the cumulative effect is considered acceptable in the context of the broader site that is used as an active industrial premises that is appropriately zoned for the intended development.

- Areas of remnant indigenous vegetation will be retained as a result of avoidance of clearing including an area of approximately 1.29 ha of River-flat Eucalypt Forest will be retained south of the proposal footprint.
- The proposal does not significantly affect species that may potentially use vegetation for the purposes of foraging as these areas have been assessed as “marginal at best” by Abel Ecology (p. 115; 2015 report) and faunal species identified as likely to use the site have wide foraging ranges.
- Roosting/nesting boxes will replace HBTs removed as part of the works. The rate of replacement is 2.5:1 (i.e. 20 boxes) that is considered more than adequate to offset the loss. Boxes will implemented a minimum of 2 weeks prior to construction to allow relocation of fauna and pre-clearing surveys will be undertaken prior to the commencement of tree removal and construction works ensure no fauna is harmed.
- Removal of approx. 0.27 ha of Cumberland Plain Woodland and 2.89 ha of River Flat Eucalypt Forest proposed to be cleared for the proposal will be offset. Notwithstanding this the condition of these communities has been found to be degraded lacking structural complexity as well as modified vegetative structure.

- Off set planting proposed of indigenous vegetation including areas of both Cumberland Plain Woodland and River Fla t Eucalypt Forest around the bio-retention basin, along the southern boundary of the development footprint and other parts of the SEPP59 area will provide habitat for indigenous flora and fauna.
- Weeds will be removed from the site including noxious and environmental weeds within the proposal footprint that may have a positive influence on the surrounding locality.
- Emissions from the EfW plant are unlikely to significantly affect indigenous flora and fauna as they have been designed to meet more stringent requirements to ensure that the operation is suitable for human.
- Stormwater falling within the development footprint will be directed towards suitably designed onsite detention dams proposed for construction along the southern boundary of the development footprint.

The landscape will be altered as a consequence of the project. However, the flora communities and fauna species affected as a result of the change will not be significantly affected as a consequence. Therefore any cumulative effect of the works is considered to be acceptable.

19.6.1. Mitigation Measures

In accordance with the DGRs the principles of "avoid, mitigate, offset" have been applied to design development and assessment of the proposal. In this circumstance, it is not possible to avoid the impact accordingly measures have been developed to mitigate and offset.

Table 79 – Summary of Mitigation Measures

Potential Impact	Management Response	Timing
Habitat Removal: Fauna Disturbance	Appointment of a project ecologist to undertake and oversee all flora and fauna pre-clearing, management and revegetation works.	Prior to the commencement of any works.
	Additional targeted fauna survey to determine the presence of the Cumberland Land Snail. In the event that targeted survey identifies the presence of the Snail, they will be relocated to the 1.29 hectares of RFEF.	Prior to vegetation clearing
	A pre-clearing survey will be undertaken and any vertebrate fauna and Cumberland Plain Land Snails captured will be moved to the retained area of River Flat Eucalypt Forest to the south of the development footprint;	Prior to commencement of any works on site.
	Prior to draining and filling of dam, any native fauna must be moved to wet areas within the Ropes Creek Tributary.	Prior to commencement of any works on site
	Implementation of roosting/nesting boxes within the riparian zone at a rate of 2.5:1 (i.e. 20 habitat boxes).	2 weeks prior to clearing surveys and any commencement of construction works, including the removal of any trees or vegetation from the site

Potential Impact	Management Response	Timing
Impact on vegetation by Construction	Erection of fencing to protect vegetation within the Ropes Creek Tributary.	Prior to commencement of any onsite works
Habitat and Flora Restoration:	Preparation of a vegetation management plan to align with the recommendation of the Department of Primary Industry *Guidelines for Vegetation Management Plans on Waterfront Land* and as a minimum to include: • Compensatory planting and replanting of a minimum 0.54ha of land within the Ropes Creek tributary riparian corridor using replacement CPW. Replacement canopy trees shall be planted at a ratio of 5:1; • Compensatory planting of a minimum area of 4.98ha within the Ropes Creek tributary riparian corridor or as otherwise shown on Figure 92 of this amended EIS using species from RFEF community. • All other trees species permitted to be removed will be replaced at a ratio of 2:1; • Landscaping implemented following construction will use locally indigenous flora; • All replanted tree species will utilise tube stock (and not seed); • Weed management will be undertaken within the development proposal footprint. This will mitigate against further weed spread; • Measures to prevent tree impacts during construction and prevent clearing within the riparian corridor. Ongoing (post construction) measures to ensure the establishment and maintenance of the Ropes Creek tributary. • The VMP will have a minimum post construction management and implementation phase of 2 years from completion.	Prior to CC and implanted as works commence, where relevant: Ongoing
Aquatic & soil health: sedimentation from site disturbance works (tree	Potential erosion will be mitigated through the use of sediment fencing adjacent to the downslope edge of the development footprint combined with maintaining and improving riparian planting.	Prior to the commencement of any works on site.

Potential Impact	Management Response	Timing
and ground cover removal)	Stormwater quality discharged from the site will meet or exceed the requirements of SEPP59 and thus this will mitigate against potential impact of poor water quality. The bio-retention basin will be planted with local indigenous wetland species to create wetland habitat	Construction and ongoing
Groundwater Dependant Ecosystems: reduced recharge and potential contamination	• No mitigation required: groundwater not anticipated to be encountered. • Impermeable surfaces (fully enclosed waste storage bunker),will prevent the movement of contaminants into groundwater system.	N/A N/A

19.7. SUMMARY AND CONCLUSION

The flora and fauna survey did not reveal any impediments to the proposed development. There is not likely to be a significant effect on any endangered ecological community, threatened species or their habitats, therefore a Species Impact Statement is not required.

Threatened ecological communities recorded as being present on the site are degraded remnants in Class 2/3 condition, with an understorey dominated by weeds and assessment undertaken in accordance with the seven-part test concludes that no significant impact on these communities is likely to occur as a result of their removal from the site. Accordingly, no referral to the Department of Environment (cwlth) is required.

Furthermore, due to the foraging range of all recorded and likely species using habitat present on the site, Abel Ecology has concluded that the project is not likely to have a significant effect adverse on the Yellow-bellied heathtail bat, Eastern Freetail-bat. Impacts associated with the loss of roosting habitat can be mitigated through the installation of nesting boxes.

Impacts can be suitable managed or mitigated by construction management protocols, including pre-clearing surveys and unexpected finds protocols; or post construction implementation of landscaping.

20. VISUAL AMENITY

20.1. OVERVIEW

A Visual Impact Assessment has been prepared by Urbis in support of the proposed Development and is submitted at **Appendix H**. The Visual Assessment has been prepared to address the key considerations contained within the DGRs.

- *An assessment of the proposed building height, scale, signage and lighting, particularly from nearby public receivers and significant vantage points of the broader public domain;*
- *Details of design measures to ensure the project has a high design quality and is well presented, particularly in the context of the broader Western Sydney Employment Area;*
- *A detailed photo-montage based analysis of the visual impacts of development and emissions stacks.*

The surrounding landscape has a high degree of visual absorptive capability that is tolerant to the anticipated change in outlook that will arise in response to the project.

Most views to the industrial landscape from Colyton, Minchinbury and Erskine Park are screened by existing vegetation and residential built form. Where views of the development are possible, these will generally be of the upper parts of the buildings and the slender twin vent stacks protruding above the tree canopy or building line. The resulting visual impact will be negligible for most locations and generally low to moderate where views are possible from sensitive viewpoints.

Most sensitive viewpoints are located within this sub-regional setting and the potential for impact is dissipated by the function of distance. The proposed development will influence the skyline from certain vantage points however those elements most likely to be visible, such as the emissions stacks, are considered to be characteristic of urbanisation and urban development with evidence of similar development forms punctuating the Sydney skyline elsewhere in the metropolitan region. Materials and colours have been selected to ameliorate the potential for adverse visual impact, the stacks and the buildings will be constructed of muted tones with low reflectivity.

The detailed visual assessment is provided at **Appendix H** and includes photomontages from key vantage points.

20.2. LEGISLATIVE REQUIREMENTS

There is no specific legislative framework to guide the assessment of visual impact beyond the requirement of Section 79C of the EP&A Act 1979 to consider the likely impacts of the development.

The assessment of likely impacts has been guided by qualitative and quantitative methods, drawn from international guideline documents and principles, including:

- **Qualitative Assessment Framework**:

– *Landscape Aesthetics Handbook* (United States Department of Agriculture [USDA] Forest Service, 1995) (Brush, & Shafer; 1975) *Visual Management System*; and

– Predicting Scenic Resource Values (studies in landscape perceptions) (Zube, et.al; 1976)

– The guidelines establish a suitable methodology and ranking framework to evaluate the degree of visual modification/fit of the development combined with determining the visual sensitivity of the expected change in the landscape.

- **Quantitative Assessment Framework:**

Assessment framework established in *Appendix A*; of the Urbis Visual Assessment Report, that quantifies the degree to which the development will be visible within a catchment using quantifiable measures such as:

– Vertical lines of sight; and

– Distance of the site from the visual receiver.

A key area of assessment has been the effect of ambient light and light overspill. In considering the potential for impact the following criteria and standards for assessing the existing conditions, and modelling the impacts of the proposed Development:

- Guidance Notes for the Reduction of Obtrusive Light (United Kingdom; Appendix B of the Urbis Visual Impact Assessment); and
- Control of Obtrusive Effects of Outdoor Lighting (Standards Australia, AS 4282).

20.3. ASSESSMENT METHODOLOGY

A visual impact assessment using both qualitative and quantitative measures of potential impacts was undertaken. This process generally involves the following steps:

- Establish the urban viewshed of the site (i.e. land where highest impacts are likely to occur, typically within 2.5 km of the Site area boundary) and identify sensitive view points;
- Characterise and analyse the existing visual context and setting of the site to determine the potential for impact;
- Undertake qualitative and quantitative assessment by considering and answering questions summarised in Table 80; and
- Categorisation of impacts allowing for decreasing visual modification as the distance from the development to various viewpoint locations increases refer to scale of impacts provided in Table 81).

Table 80 – Visual Impact Assessment Criteria

Qualitative Assessment Criteria	Quantitative Assessment Criteria
Visual modification/compatibility – How does the proposed development contrast with the landscape character of the surrounding setting?	How much of the proposed development is visible from particular viewpoints?
Quality - What is the quality of the landscape setting?	**Visual prominence** what is the quantum of viewshed subjected to change?
Sensitivity – How sensitive will viewers be to the proposed development?	
Lighting - Impacts of Night Lighting	

Table 81 – Categories of Visual Impact

Impact Level	Description of Impact
Negligible (or very low)	The development is distant and/or relates to a small proportion of the overall viewscape.
Low	Minimal visual contrast and a high level of integration of form, line, shape, pattern, colour or texture values between the development and the landscape. In this situation the development may be noticeable, but does not markedly contrast with the existing modified landscape.

Impact Level	Description of Impact
Moderate	A component of the development is visible and contrasts with the landscape, while at the same time achieving a level of integration. This occurs where surrounding topography, vegetation or existing modified landscape provide some measure of visual integration or screening.
High	Major components of the development contrast strongly with the existing landscape.

A detailed account of the methodology applied is provided in *Section 1.3* of the Urbis Visual Impact Assessment report provided at **Appendix H**.

20.4. EXISTING VISUAL ENVIRONMENT & VIEWSHED

The site is located at Eastern Creek, approximately 36 km west of the Sydney CBD within the Western Sydney Employment Area (WSEA), a developing industrial area located within proximity to low density residential development. The site is comprised of an existing land fill operation of previously quarried voids.

Urbis has assessed the visual sensitivity of land uses to assist in determining the visual impact of the development.

Viewpoints located within the local and near sub-regional settings of the Facility were chosen for detailed assessment based on their higher levels of viewer sensitivity:

- Residences and the local road network;
- Transport and Tourist Routes, e.g., motorway; and
- Open Space and recreation areas.

20.4.1. Subregional setting (1 to 5 km)

The sub-regional setting to the east and south is primarily comprised of large form industrial buildings

The residential suburbs of Minchinbury, Colyton and Erskine Park are located to the north, north-west and west respectively. The suburban residential character is primarily comprised of single storey residences with construction typically of brick veneer with tiled roofs with scattered canopy tree planting throughout.

The infrastructure associated with the setting includes the M4 Motorway and high voltage powerlines which traverse the setting.

20.4.2. Local setting (<1 km)

The eastern part of the local setting is comprised of industrial uses with large form industrial buildings constructed typically of tilt concrete slabs with metal deck roofs. The undeveloped areas are comprised of open paddocks. High voltage power lines diagonally traverse the setting to the east of the Project in a north-west to southeast direction.

The western part of the setting comprises an area of undeveloped open space along Ropes Creek Tributary, comprised of remnant and regrowth riparian vegetation up to 15 m in height.

20.4.3. Landscape Absorptive Capacity

Landscape absorptive capacity refers the capability of a receiving landscape to accommodate to change or a development, influenced by the nature of existing development, topography and vegetation.

The study are has been determined by Urbis to have a high level of absorptive capability in an area of high visual sensitivity (a subjective measure of critical change dependant on user) due to the relatively flat topography, which reduces the potential for overlooking and the screening provided by vegetation and surrounding development.

20.5. ASSESSMENT OF KEY ISSUES

The key issues of assessment and potential impact include:

- Height of proposed emission stacks and buildings and their potential to cause visual amenity impact when viewed from nearby sensitive locations;
- Visual impact of plume rise; and
- Excessive ambient artificial light at night, contributing to light overspill.

20.5.1. Visual Amenity

The critical issues to consider in the assessment of visual impact are:

- Degree to which the proposed works are visible from representative sensitive viewing locations; and
- The degree to which the Facility integrates within the character of the existing setting.

The assessment of impact in this regard has focused on “high sensitivity” areas where individuals may be sensitive to a change in the landscape appearance. Low sensitivity visual settings, such as existing landfill areas or industrial land uses have not been considered. A total of nine (9) sensitive viewpoints were identified (refer Figure 93).

A summary of the outcomes of the quantitative and qualitative visual impact assessment is provided in Table 82**.**

Table 82 – Summary of visual impact assessment: using quantitative and qualitative measures

Viewpoint (VP)	Viewshed	Quantitative (Visual Modification)	Qualitative (Potential View Impact)
Viewpoint 1 Roper Road Overpass	Sub-Regional	Low to Moderate	Moderate
Viewpoint 2 Peppertree Drive (Near Phoenix Crescent)	Sub-Regional	No Modification	No-apparent
Viewpoint 3 Peppertree Park	Sub-Regional	Moderate to High	High
Viewpoint 4 Minchin Drive	Sub-Regional	No Modification	Non-apparent
Viewpoint 5 McFarlane Drive	Sub-Regional	No Modification	Non-apparent
Viewpoint 6 Indus Street	Sub-Regional	Low to Moderate	Moderate
Viewpoint 7 Old Wallgrove Road	Sub-Regional	Moderate to High	Low

Viewpoint (VP)	Viewshed	Quantitative (Visual Modification)	Qualitative (Potential View Impact)
Viewpoint 8 Blackbird Lane Path	Sub-Regional	Moderate	Moderate
Viewpoint 9 Sennar Lane Path	Sub-Regional	Moderate	Moderate

From most locations, the lower parts of the Project will be totally obscured from view. Where views are possible, these will generally be of the upper parts of the buildings and the slender twin vent stack protruding above the tree canopy or building line. The resulting visual impact will be negligible for most locations and generally low to moderate where views are possible from sensitive viewpoints.

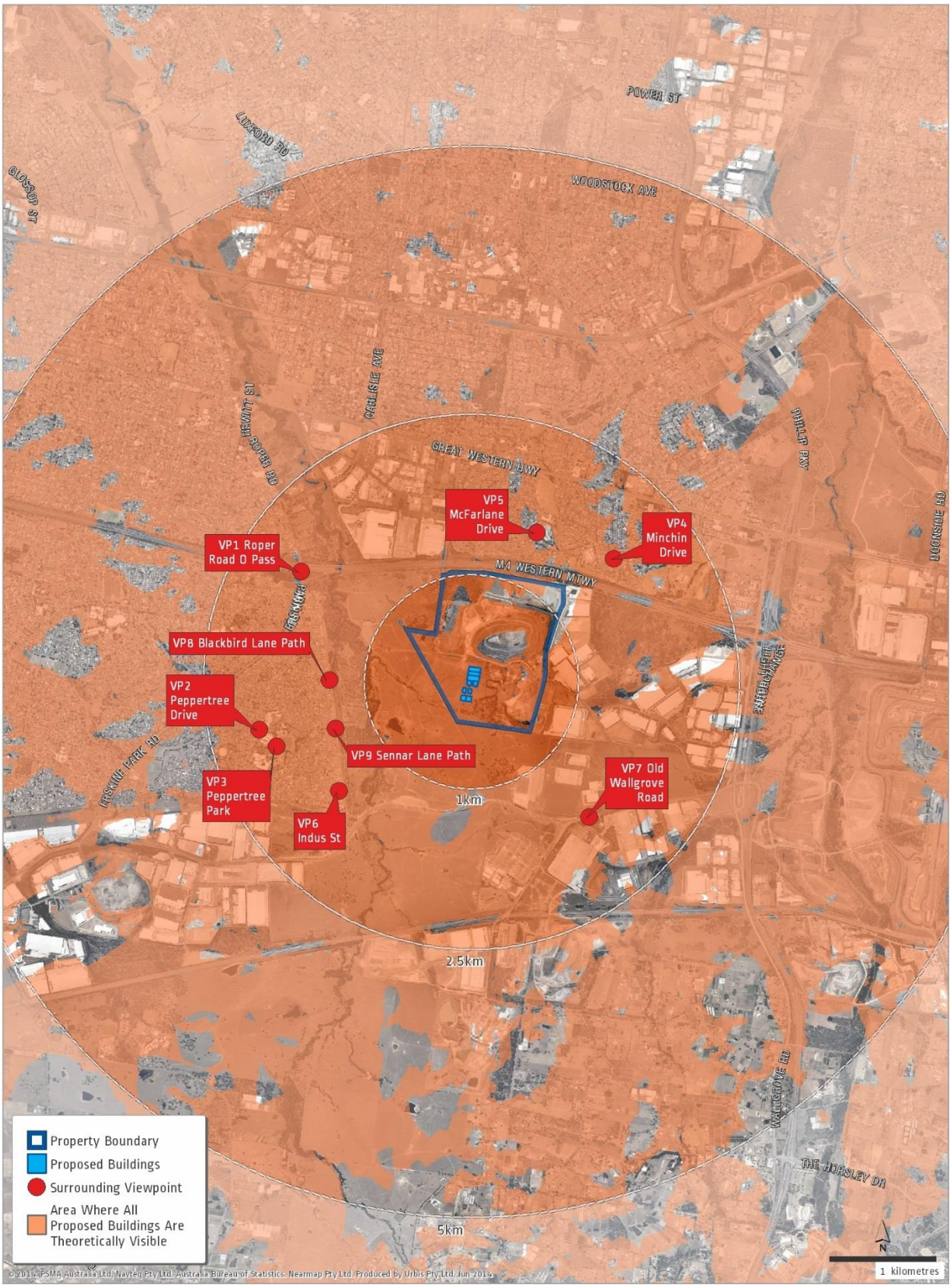
The highest sensitivity viewpoints with higher visual impacts are generally located within the near sub regional setting. The highest impact locations are:

- M4 Western Motorway – for a short section within close proximity to the Project (local setting). However, given the modification to the landscape setting created by the M4 itself, and the heavily modified landscapes that it traverses, impacts to views from the M4 are not considered to be significant;
- Shared Path / Recreation Areas- Peppertree Park and Ropes Creek path; and
- Residences – Erskine Park, Colyton and Minchinbury (sub regional setting).

Of the nine (9) sites assessed only one (1) is likely to experience a high impact, being Peppertree Park. In this instance the impact arises as a consequence of the following:

- A large proportion of the vent stacks and building are visually prominent and contrast with existing open and vegetated vista. Consequently the project contributes to a significant modification (i.e. change) is the outlook from the viewpoint;
- The change in the visual setting as a consequence of the development could be viewed critically by users of the park, resulting in a high sensitivity impacts; and
- The land use of the viewpoint, as a park, means the view is experienced stationary (as opposed to transient like when travelling along a road).

Figure 93 – Sensitive Viewpoints relative to the site (Source: Urbis)



Photomontages of the identified locations are provided in Appendix C, of the Urbis Visual Impact Assessment report with the “worst case scenario” shown in Figure 94 below.

In this instance, while the proposal will be visible, it won’t be dominant. The impact is mitigated the by distance and the effective use of materials and finishes to reduce the appearance of those elements likely to be visible.

Figure 94 – Peppertree Park Existing and Proposed Landscape View (VP1 in Figure 93)

Picture 7 – Existing Landscape View (Source: Orbit)

Picture 8 – Modified Source: Orbit

The landscape character of the broader area heavily modified and is defined by a cleared landscape and large form industrial buildings. Additionally, four high voltage transmission lines and the six lane M4 Western Motorway traverse the setting. The presence of such elements creates an already modified landscape character which is consistent with the form of proposed development.

20.5.2. Plume

TNG has selected technology and refined the design parameters of the operation to minimise plume visibility. In particular the following measures have been implemented:

- Use of a semi-dry flue gas treatment;
- a stack exit temperature of around 120 °C; and
- moisture of the flue gas of 15-18% is expected.

Calculations undertaken by Ramboll show that that plume formation will not occur at ambient temperatures above 12 °C and a relative humidity of 75%. Local meteorological data shows:

- mean relative humidity (9.00am of between 65 and 75% all year; and
- mean minimum temperatures between May and October (autumn/winter) are 7-11 °C, although mean temperature maximums for this period are 17-23 °C, which is well above the 12 °C threshold.

Accordingly, there will be a limited number of hours where plume visibility is possible, most only at night and in early morning hours in the coldest 6 months of the year and have very limited height.

Consequently, it can be concluded that the plume will not be visible the vast majority of the time, and even under adverse conditions, the plume will be light (not dense) and it will disappear quickly.

20.5.3. Night Lighting

The exact impact or acceptability of night-lighting is difficult to define as it is dependent on individual perceptions and sensitivities as well as the presence of existing light. From most locations in the sub–regional and regional setting, direct views to the lighting sources would be obscured from view by built form and vegetation within the landscape and around residences.

The local, sub regional and regional settings all contain lighting sources of a similar intensity emitted from both residences and other industrial uses and the nature of the night-lighting for the Facility would be similar to that of the existing night-time setting. Therefore, any change in potential night lighting impacts would be relatively minor for most viewpoints.

20.6. MITIGATION MEASURES

In accordance with the DGRs Table 83 and **Section 20** describes how the implementation of the project will align with the principles of “avoid, mitigate, offset” to minimise the impacts of the proposal on Visual Amenity.

Table 83 – Visual Amenity: Mitigation Measures

Factor	Mitigation Measure	Timing
Visual Impact Management	Implementation of the landscape and architecture plans as submitted, that include the following mitigation measures: • canopy tree planting along the north interface with the future Estate Road to act as screen planting that will softening the visual appearance of the built elements combined. Furthermore, large tree canopy plantings provide scale to the built form when viewed from the adjacent street. • Effective use of materials, including the use cladding of the buildings with non-reflective materials and subdued colours that mimic those found in the surrounding WSEA and landscape setting, including greys, browns and olive greens. The effective use of tonal shade achieves a dappled effect to building improving visual integration with the surrounding landscape. • Use of light grey finish on emission stack to aids visual integration in range of atmospheric conditions. Bright, un-natural colours have been avoided.	Post construction: ongoing
Plume visibility reduction	Implementation and management of technology design parameters including exit temperature of emission from stack at around 120°C and moisture of the flue gas of 15-18% is expected to reduce plume formation (noting the potential to occur in early morning and night in autumn/winter months).	Operational: ongoing

Factor	Mitigation Measure	Timing
Avoidance of Obtrusive Lighting	All external lighting associated with the Facility will comply with Australian Standard AS 4282: 1997 – *Control of the Obtrusive Effects of Outdoor Lighting*. Night-lighting will be kept to the minimum required for operations and safety requirements.	Construction: ongoing

3.1 SUMMARY AND CONCLUSION

A high degree of visual absorptive capability is afforded by the proposed Site landscaping and topography in the sub-regional and regional setting of the Facility which is generally flat to slightly undulating. Most sensitive viewpoints are located within this sub-regional setting.

Most views to the industrial landscape from Colyton, Minchinbury and Erskine Park are screened by existing vegetation and residential built form.

From most locations, the lower parts of the Facility will be totally obscured from view. Where views are possible, these will generally be of the upper parts of the buildings and the slender twin vent stacks protruding above the tree canopy or building line. The resulting visual impact will be negligible for most locations and generally low to moderate where views are possible from sensitive viewpoints.

The highest sensitivity viewpoints with higher visual impacts are generally located within the near sub regional setting. The highest impact locations are:

- M4 Western Motorway – for a short section within close proximity to the Facility (local setting). However, given the modification to the landscape setting created by the M4 itself, and the heavily modified landscapes that it traverses, impacts to views from the M4 are not considered to be significant;
- Shared Path / Recreation Areas- Peppertree Park and Ropes Creek path; and
- Residences – Erskine Park, Colyton and Minchinbury (sub regional setting).

Where open views are afforded to the Facility, they are from low sensitivity industrial areas in the vicinity of Wallgrove Road to the south east.

21. AIRSPACE OPERATIONS

21.1. OVERVIEW

The key issues for consideration set out in the DGRs issued for the EfW Facility in relation to “visual” impacts include

> *consideration of any impact on flight paths.*

As outlined the DGRs issued in relation to the project have requested consideration of the potential impact of the development on the operation of airspace of Sydney Metropolitan region. Furthermore, in response to the original EIS being exhibited in 2015 two (2) submissions were received from relevant stakeholders, Sydney Airport and the Commonwealth Department of Infrastructure and Regional Development. These submissions raised the following matters:

- The potential for the project to affect the airspace protection surfaces at the Western Sydney Airport (WSA) at Badgerys Creek and therefore raising concern regarding operational safety and efficiency of the same;
- The need for the facility to consider the potential impacts on the operation of the proposed WSA, including obstacles to aircraft flying overhead, including the impact of the emissions stacks and plume rise;
- Assessment to have regard to the National Airports Safeguarding Framework (NASF);
- That in the absence of final OLS information for the WSA an assessment of impact in relation to airspace operations cannot be completed;
- Potential for plume rise (from stack emissions) to pose a hazard to aircraft;
- The potential for the operation to attract wildlife, particularly bird that may contribute to bird strike;
- Given the economic implications of the WSA it is important to be clear and certain as to the potential impacts; and
- Cumulative impacts of the development and the airport in close proximity.

In light of the issues raised, the following action was taken:

- Aviation and Airspace Design Solutions have undertaken an airspace operations assessment to determine the future Obstacle Limitation Surface and any potential impact likely to arise in connection with the development.
- A plume rise assessment was undertaken by Ramboll to determine the potential impact of emissions (temperature and exit speed) may have on the operation of air space, in particular the potential to create turbulence.

The reports were provided direct to the DIRD. On 3 March 2016, the DIRD provided the outcome of assessment from Sydney Metro Airport, responding to potential impacts on the operation of Bankstown Airport; Air Services Australia considering the potential impacts of plume rise on the operation of at Sydney, Bankstown, Camden and Richmond Airports; and the Civil Aviation Safety Authority (CASA).

All assessment concludes that the facility, in particular plume associated with stack emissions, will not adversely affect the operation of airports or present as a hazard to airspace users based information available at the time. If the Obstacle Limitation Surface is less than 197.4 metres when Badgerys Creek becomes operational, penetration of the plume can be managed by inserting a symbol on the relevant aviation chart. A copy of these emails is provided at **Appendix GG.**

21.2. LEGISLATIVE REQUIREMENTS

The Assessment of impact on airspace operation has referred to the following legislation and frameworks:

- *Airports Act 1996.*
- *Airports (Protection of Airspace) Regulations 1996.*
- Procedures for Air Navigation Services – Aircraft Operations (Doc. 8168 PANS-OPS).
- Manual of Standards Part 173 of the Civil Aviation Regulations.
- Managing Bird Strike Risk at Australian Airports (2015) published by Australian Transport Safety Bureau (https://www.atsb.gov.au/media/5353201/managing_bird_strike_risk_species_information_sheets.pdf).

21.3. ASSESSMENT METHODOLOGY

The assessment of potential to affect safe airspace operations has been informed by two (2) key technical assessments, including:

- Identification of legislation framework;
- Identification of airports and protected airspace within proximity to the site;
- Identification of existing and likely OLS and PAN-OPS for relevant and proximate protected airspace (i.e. airports);
- Determine potential for impact on operation of protected airspace; and
- Application of the Wildlife Attraction Risk Assessment Framework for land use planning near airports to determine appropriate management and/or mitigation measure to prevent potential bird strike.

21.4. ASSESSMENT OF KEY ISSUES

Taking into account the above, the key issues in the assessment of maintaining safe airspace operations are as follows:

- The safe and efficient operation of protected airspace, to include:
  - Determine the potential to impact on the operation of known protected airspace (i.e. Bankstown and Sydney Airports)
  - Determining the potential OLS and PAN OPS of the WSA;
  - Determine the potential for the emissions stacks or associated plum to breach the obstacle limitation surface and PAN-OPS of protected airspace, in particular the WSA;
  - The potential for turbulence to be created as a result of plume rise and the need to determine if this will pose an adverse safety impact; and
  - In the event that the OLS information is not available on resubmission and the potential for the plume to cause impact exist identify suitable management or mitigation measures to avoid/overcome safety implications.
- The potential attraction of wildlife, in particular birds to the site, increasing the potential for bird strike incidents.

21.4.1. Safe and Efficient Operation of Protected Airspace

Detailed assessment of the potential for the EfW facility to affect the safe and efficient operation of protected airspace within Sydney has been undertaken for the two (2) existing airports at Mascot and Bankstown as well as the planned WSA at Badgerys Creek has been undertaken, in respect to:

- The existing and future OLS and PAN-OPS for all airports; and
- The proposed stack height and likely plume rise extent and velocity.

A summary of the outcomes of these detailed assessments is provided in Table 84, the assessments conclude the proposal is unlikely to breach either the OLS or PAN-OPS thresholds.

Table 84 – Summary of potential for TNG to affect airspace operations

Protected Airspace	OLS	PAN OPS	Compliance with limit (✓/✗)
Sydney Kingsford Smith Airport	15,000 m radius – TNG beyond the lateral extent	PAN-OPS: 552m AHD; TNG: 162.5 m AHD	✓
Bankstown Airport	15,000 m radius – TNG beyond the lateral extent	PAN-OPS: 505m AHD; TNG: 162.5 m AHD	✓
Western Sydney Airport (WSA), Badgerys Creek*	OLS*: 223m AHD: TNG Stack Height: 162.5m AHD Plume^: + 30m = 192.5m	Undefined, but given the link between OLS and PAN-OPS a breach is not anticipated*.	✓

* Estimate OLS and PAN-OPS – refer to Airspace Operations for complete list of assumptions.

^ Based on modelled exit velocity of 4.3m/s.

The Airspace Operations and Plume Rise assessments have been provided to the DIRD including CASA, who have reviewed the outcomes of the assessment. All conclude that the facility, in particular plume associated with stack emissions, will not adversely affect the operation of airports or present as a hazard to airspace users based information available at the time. In the event that the Obstacle Limitation Surface is less than 197.4 metres when Badgerys Creek becomes operational, penetration of the plume can be managed by inserting a symbol on the relevant aviation chart.

As shown in the table above, the anticipated maximum height of the emissions stack and plum is 192.5metres AHD, which is below the nominated threshold provided by CASA. Notwithstanding this, a mitigation measure has been included to ensure that prior to commencement of Proof of Performance trials the proponent should contact the DIRD and CASA and confirm the OLS and PAN-OPS limits to advise of the commencement of operations to ensure that adequate measures have been implemented to avoid impacts.

21.4.2. National Airports Safeguarding Framework: Summary of Assessment

Initial consultation with the DIRD concluded that due to the early stage of the airport planning specific advice regarding the potential flight paths could not be provided.

The DIRD requested that the regard be given to the National Airports Safeguarding Framework. An assessment against this framework is provided in Table 85 below.

Subsequently the application was formally exhibited during which time the DIRD were further consulted. Advice received leading to the preparation of an Airspace Operations and Plume Rise Assessments (**Appendices EE and FF**) each of which were referred direct to the DIRD.

Table 85 – Key points of consideration under National Airports Safeguarding Framework

Key Point	Consideration	Response
Obstacles to aircraft overhead	The height of buildings, structures and objects in the proposed development must not penetrate any prescribed airspace (which would include at the very least the Obstacle Limitation Surfaces) expected to be declared around the proposed airport site. Once declared, any construction or activity that impacts on the prescribed airspace will require approval.	As outlined in section 21.4.1 above the emissions stacks, being the highest point on the site, are not anticipated to be penetrate the future OLS.
The attraction of certain wildlife, particularly birds	The proposed site activity may attract birds and other wildlife through the accumulation of waste. Mitigation strategies may be required as the development may result in increased hazards for aviation operations at a future airport development, especially in relation to bird strike during the take-off and landing phases of flights.	As the waste stored on site at the adjoining landfill is non-putrescible waste birds are not an existing issue for the site like they are for putrescible landfills. Further, as outlined previously waste will be stored within the tipping hall at negative pressure to reduce any potential for odour. The attraction of birds to the site is not considered likely. A detailed assessment of bird strike potential against the relevant framework is provided in **section 21.4.3**).
Other potential impacts	Any other potential impacts which may result in increased hazards for aircraft operations at a future airport such as particulate matter and hot air being released into the air, which may require a plume rise assessment.	With approximately 14km separation between the second airport location and the broader site, it is unlikely the Facility will interfere with aircraft operations. As outlined above, CASA have indicated that in the event the OLS is lower than anticipated a symbol can used to alter airspace users of the plume and avoid potential adverse effects.
Cumulative impacts	The cumulative impacts associated with the proposed Energy from Waste Facility being located in the Western Sydney region which is already subject to significant residential, commercial and infrastructure development.	Cumulative impacts of the total project scope have been addressed within the amended EIS. Furthermore, each of the technical reports has, where relevant, considered the cumulative effect of the development within the context of the existing environmental conditions.

21.4.3. Wildlife Management: Bird Strike

The potential for wildlife, in particular birds, to be attracted to the TNG site as a consequence of waste receipt has been raised as potentially impacting on the safe operation of protected airspace due to the potential for an increased incidence in bird strike.

While the impact of and potential for wildlife to affect the safe and efficient operation of airspace is recognised it is important to note the following characteristics of the operation and site that may mitigate the potential for the attraction of wildlife:

- TNG will receive non-putrescible waste streams; and
- The waste storage bunk is completely enclosed within a building intended to be kept under negative pressure with high speed roller doors only opened during vehicle entry and exit.

Notwithstanding the above, the Managing Bird Strike Risk at Australian Airports (2015) published by Australian Transport Safety Bureau. In particular the following fact sheets:

- *Land use Planning near airports;* and
- *Managing Birds At Waste Management Facilities,* has being consulted to identify potential mitigation measures.

An extract of the land use management and risk assessment matrix for the attraction of wildlife is provided in Figure 95

The risk assessment framework does not specifically align with the project, as the storage of waste for the purposes of operating an EfW facility is not identified. Given however the characteristics of the operation involving the delivery and storage of waste pending use it is considered to be akin to a “waste transfer station” as opposed to landfill operation that would store the waste in its current form in perpetuity. On the basis of the above, the “risk of wildlife attraction” is considered to be “moderate”.

The next step of the process is to determine the spatial relationship of the facility to the airport to determine the appropriate action. In this instance the WSA will be 14 km southwest of the site requiring “monitoring” for both “actions for existing developments” and “actions for proposed/developments/changes to existing developments”.

While the outcome of the “wildlife attraction risk assessment” has determined that there is no need to implement mitigation measures in relation to the operation. It is worthwhile noting that the recommendations for mitigation provided in the fact sheet for *Managing Birds at waste management facilities* includes the following:

- Converting operations to closed systems where waste is turned into energy or composted; and
- Covering operations to an enclosed transfer station.

In the context of the above, the proposal is considered to align with key directions given to the management and reduction of bird attraction to waste management operations.

Figure 95 – Wildlife Attraction Risk and Actions by Land Use (source: ATSB)

Land Use	Wildlife Attraction Risk	Actions for Existing Developments			Actions for Proposed Developments/ Changes to Existing Developments		
		3km radius (Area A)	8km radius (Area B)	13km radius (Area C)	3km radius (Area A)	8km radius (Area B)	13km radius (Area C)
Utilities							
Food / organic waste facility	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility – landfill	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility – transfer station	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Non-putrescible waste facility – landfill	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Non-putrescible waste facility – transfer station	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Sewerage / wastewater treatment facility	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Potable water treatment facility	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action

21.5. CUMULATIVE IMPACTS & MITIGATIONS MEASURES

The proposed development is consistent with the ATSB policy for the management of wildlife near airports, proposing an enclosed waste operation that involves converting waste in energy. There are considered to be no cumulative impacts associated with this key issue.

Table 86 – Airspace Operations: Mitigation Measures

Factor	Management Method	Timing
Safe and Efficient Operations of Protected Airspace: WSA only	A minimum of 2 weeks' notice should be given prior to commencement of PoP or testing of the emissions stacks to the DIRD and/or CAS regarding the commencement of operation to ensure that adequate measures have been implanted in the airport instrument management system. At a minimum TNG should advice the relevant authority of the final stack height + 30 metres.	Prior to OC and commencement of any PoP or equipment testing
	The plume exit velocity must not exceed 4.3m/s.	Operational: Ongoing
Wildlife Management to minimise the incidence of bird strike	Limit the processing and storage of putrescible waste.	Operational: Ongoing
	Storage of waste inside the tipping hall under negative pressure with high speed doors only opened during vehicle entry and exit.	Operational: ongoing

21.6. SUMMARY AND CONCLUSION

The operation of the plant is not anticipated to affect the safe or efficient operation of airspace at existing or future airports within the Sydney region.

22. ABORIGINAL AND NON-ABORIGINAL CULTURAL HERITAGE

22.1. OVERVIEW

Referral of the preliminary (pre-exhibition) EIS to Blacktown City Council led to the identification of the following matters which need to be addressed in this application:

- *Address Aboriginal Heritage in accordance with the Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation 2005 and Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.*
- *Any impacts to Aboriginal cultural heritage as a result of the proposal must be adequately mitigated.*
- *Address European Heritage through a European Heritage assessment with the primary purpose of recording and identifying any potential heritage issues on the site, archaeological protocols for ground works.*

GML Heritage prepared the following documents in 2014 in support of the application in response to the DGRs:

- Aboriginal Archaeological Technical Report (ATR) (**Appendix R**);
- Aboriginal Cultural Heritage Assessment Report (ACHAR) (**Appendix S**); and
- Heritage Impact Statement (**Appendix U**).

Following preparation of these reports, Artefact consultants conducted an archaeological test excavation over a period of four (4) days at the proposed Development Site. The appended Aboriginal Heritage Test Excavation Report (TER) (**Appendix T**) outlines the results of archaeological investigations. Artefact prepared an ACHAR addendum to incorporate the additional Aboriginal consultation and results of test excavation (**Appendix S**).

A total of three (3) submissions raised matters related to Heritage and Archaeology. All submissions were made in relation to matters of Aboriginal Heritage and Archaeology. In particular submissions raised matters relating to:

- the extent of consultation with local Indigenous stakeholder groups;
- clarification on the extent of conservation that may be undertaken in relation to the site identified as Archbold Road 2; and
- the potential for harm in relation to a landscape assessed by the Darug community as having high community values.

No matters were raised in relation to the non-aboriginal heritage and/or archaeology.

The amended application has refined the area of the existing site to which the application now relates, with no subdivision or works proposed over that portion of the site identified as being Archbold Road 2. Notwithstanding, this measures have been included to ensure that this site combined with Archbold Road 1 are not disturbed as a consequence of the project.

While the proposal will have noted impact on the landscape value of the site and its context, local indigenous groups were consulted in the process of project scheme development and no objections have been raised. The assessed impacts are a foreseeable and unavoidable of any development related to the land as a consequence of historical association and in the absence of objection are considered reasonable.

22.2. NON-ABORIGINAL CULTURAL HERITAGE

22.2.1. Legislative requirements

The Heritage Impact Assessment uses the following Criteria and Standards for assessing the existing *conditions, and modelling the impacts of the proposed Development:*

- *Heritage Act 1977 (NSW);*
- NSW Heritage Manual (NSW Heritage Office & DUAP);
- The Burra Charter (The Australia ICOMOS charter for places of cultural significance);
- NSW Heritage Manual documents *Assessing heritage significance;*
- *Statements of Heritage Impact*, issued by the NSW Heritage Office; and
- Assessing Significance for Historical Archaeological Sites and Relics. (OEH; 2009).

22.2.2. Methodology

The methodology and approach used by GML in the preparation of the Heritage Impact Statement is summarised as follows:

- Literature and aerial photography was review to establish past use and disturbance as a means of determining disturbances that are likely to have taken place as a means of identifying archaeological potential.
- Assessment of Significance using NSW Heritage Criteria and Brickford and Sullivan (1984) framework.
- Cross correlation of the potential for archaeological remains to be present on the site combined with an assessment of potential significance of likely remains across all phases of development and use was then used to determine the potential for adverse impact on heritage values.

22.2.3. Assessment of Key Issues

Taking into account the location of the proposed building footprint and the archaeological potential of these locations, the following matters are considered to be of relevant in the assessment of key concerns:

- The potential for archaeological relics to occur on the site and be disturbed as a consequence of excavation and land forming works;
- The potential for excavation and construction works to adversely affect the significance of the site and any relics; and
- The potential for unexpected finds in other areas of land forming works in areas categorised as disturbed.

22.2.3.1. Assessment of Archaeological Potential

The site is not an identified item of environmental heritage, nor located within proximity to an identified item or conservation area identified by a statutory planning or heritage instrument. The present state of the development site is vacant and free of improvements.

The site was the subject of early land grants and use for cultivation soon after colonisation was not substantially developed, beyond the use of a portion of the site as a Nurser, until quarrying commenced in the 1950s, that expanded several times between 1978 and 1986.GML determined from review of historical records that there were four (4) main phases of development and impacts that apply generally across the site, these are:

- Phase 1 – Early History (1819-1856);

- Phase 2 – The Shepherds (1856-1909);
- Phase 3 – Early Twentieth Century (1909-1954); and
- Phase 4 – Quarrying and Industrial Use (1955-Present).

Using these phases of land use and development a site disturbance map was developed, shown in Figure 96, categorises the potential for disturbance and thus archaeological potential.

The proposed location of the EfW facility is predominantly located over an area of the site, identified as being partially disturbed to disturbed as summarised in the Table below.

Table 87 – Summary of assessed disturbance potential with location of proposed works

Disturbance level/Archaeological Potential	GML Description	EfW Development
Little or No Potential (Not Disturbed)	Areas where there is no known historical activity and areas which are not likely to have been used in any phase of the study area's history retain a high degree of natural vegetation and exhibit minimal disturbance and therefore have little or no historical archaeological potential.	Riparian planting
Low Potential (Partially Disturbed)	Areas where historical activity has taken place and areas which have been partially disturbed in later phases have low historical archaeological potential.	EfW facility located over these areas requiring excavation.
No Potential (Disturbed)	Areas where historical activity has taken place and areas which have been subject to high levels of disturbance in Phase 4 have no historical archaeological potential.	Future laydown pads, works are limited to minor grading earthworks followed by stabilisation.

22.2.3.2. Assessment of Archaeological Significance

An assessment of archaeological significance was undertaken using both the OEH Assessing significance for historical archaeological sites and relics (OEH; 2009) and the framework of Brickford and Sullivan (1984).

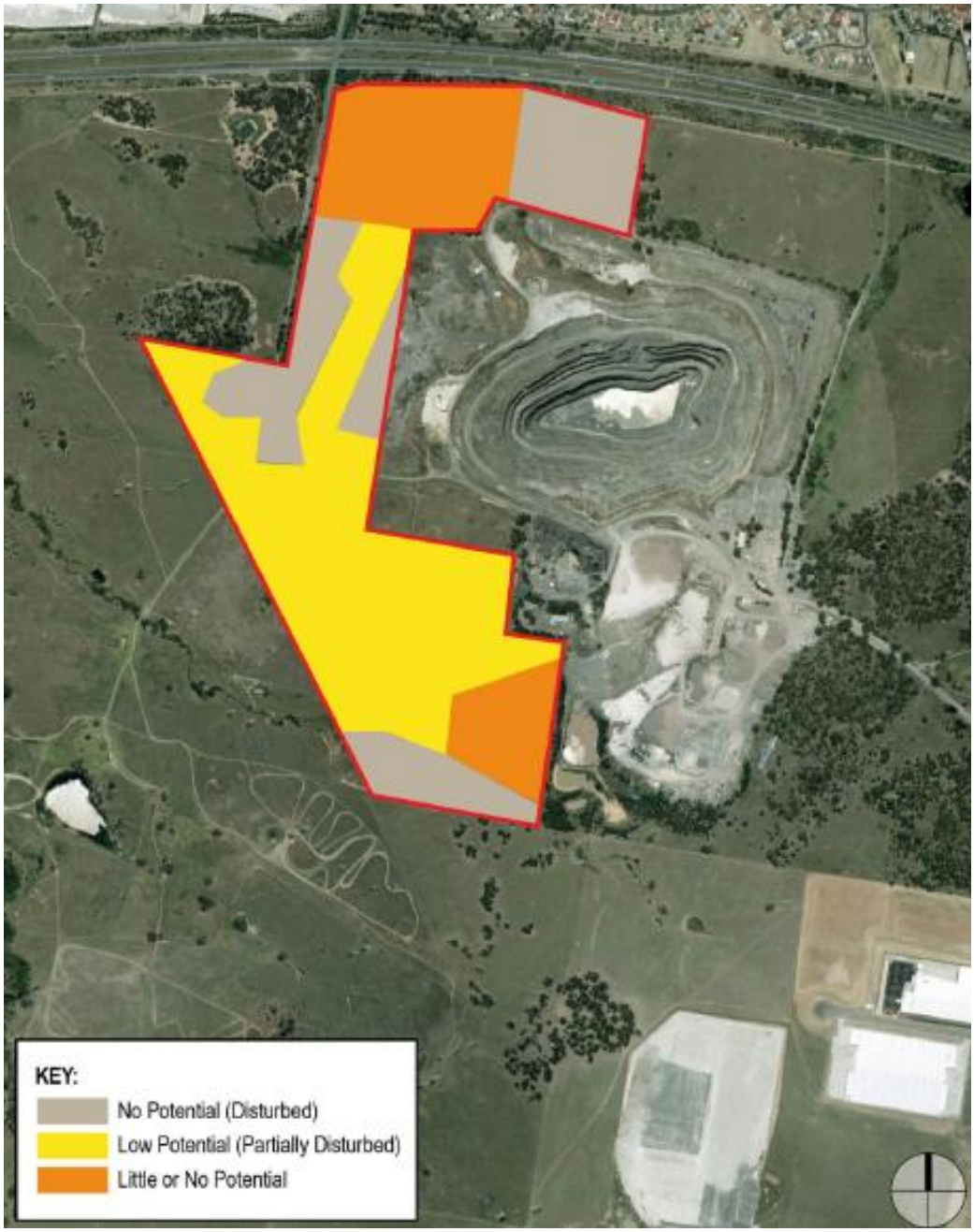
In general, the assessment concluded that any relics or remains of part use present on the site are likely to be of low significance.

Table 88 – Summary of Outcomes: Assessment of Significance

Research	Association	Aesthetic or Technical	Ability to demonstrate the past
Low	Limited: previously occupied by prominent residents and the Chatsworth Nursery.	Low	Low

GML have considered the potential for the above works to impact on the presence of archaeological remains and determined that due to the low level of potential and significance attributed to the site any remains would not meet the classification of "relics".

Figure 96 – Existing levels of site disturbance (source: GML)



22.2.4. Cumulative Impacts and Mitigation Measures

Cumulative impacts are not expected due to the low archaeological potential combined with the low significance of any potential artefacts present within the study area.

Notwithstanding the above, to ensure the potential for unexpected finds are appropriately managed site induction of all construction workers should include detail of and procedures for handling unexpected relics found as a consequence of construction.

Table 89 – Non-Aboriginal Cultural Heritage: Mitigation Measures

Potential Impact	Management Response	Timing
	In the event that unexpected archaeological remains not identified within the statement are discovered at the area, all works within the affected area should	Site preparation and construction

Potential Impact	Management Response	Timing
Heritage Value: Management of unexpected finds	cease and the OEH should be notified, in accordance with Section 146 of the Heritage Act.	
	All contractors involved in the development should receive a Heritage Induction outlining the protocol regarding the identification of unexpected archaeological remains, and their obligations under the Heritage Act and the National Parks and Wildlife Act (NSW).	Site preparation and construction

22.2.5. Summary and Conclusion

The assessed significance of the site, as low, can be maintained and any unexpected artefacts or remains adequately managed through the imposition of the recommended management conditions.

22.3. ABORIGINAL CULTURAL HERITAGE

The Eastern Creek area forms part of the Darug landscape, in which the development site is located.

22.3.1. Legislative Requirements

The following Criteria and Standards for assessing the existing conditions, and modelling the impacts of the proposed Development have been used:

- *Environmental Planning and Assessment Act (1979).*
- *National Parks and Wildlife Act (1974).*
- Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment.
- Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (Department of Environment Climate Change and Water (now OEH)).

22.3.2. Methodology

The methodology and approach used by Artefact in the preparation of the Aboriginal Cultural Heritage Report was based on the procedure and practice as relevant and provided for in the frameworks outlined in section 14.2.1. In brief the following methodology was followed:

- Literature review of previous archaeology studies completed for the site and surrounds;
- Consultation with 12 local Aboriginal stakeholder groups was undertaken to determine social values, community views and opinions with respect to Aboriginal heritage and artefacts;
- Targeted test excavations based on the recommendations of earlier technical reports and consultation outcomes; and
- Interpretation of results from literature review, consultation and test excavation to determine significance.

22.3.3. Assessment of Key Issues

The proposed development involves the excavation and modification of the landscape aesthetic through the construction of the EfW facility that may:

- Directly impact and disturb potential Aboriginal archaeological remains within the EfW South Aboriginal partly located within the footprint of the facility; and
- Directly and indirectly diminish the intangible Aboriginal cultural values associated with the site and the Eastern Creek area generally through landscape modification.

To determine the quantum of likely impacts detailed Aboriginal Archaeology and Cultural Heritage Assessment of the broader site and development site has been undertaken by GML and Artefact Heritage Consultants. This assessment has included Consultation with Local Aboriginal Groups and Stakeholders as well as test pit excavation within the EfW South site to gain a better understanding of the potential historical use of the site by Aboriginal groups.

22.3.3.1. Assessment of Archaeological Significance

Three (3) Aboriginal sites are present within the broader site, as shown in Figure 97. These sites, their key archaeological features and potential are summarised in Table 90**.**

Table 90 – Summary of Aboriginal archaeological site within and adjacent to development site

Site reference	Location	Features Recorded	Archaeological potential
Archbold Road 1	North west corner	Three previously recorded sites (not registered in AIMS) GML survey recorded two surface artefacts (one silcrete and one quartz) and a large PAD	High
Archbold Road 2	West edge	GML identified three surface artefacts and a large PAD	Moderate
EfW South	South east (north of Ropes Creek Tributary)	Previously identified in earlier site studies as an area of high archaeological potential; GML survey recorded two artefacts and area was assessed as a large PAD with a high archaeological potential; and Test excavation of the site encountered 14 silcrete flaked pieces.	High

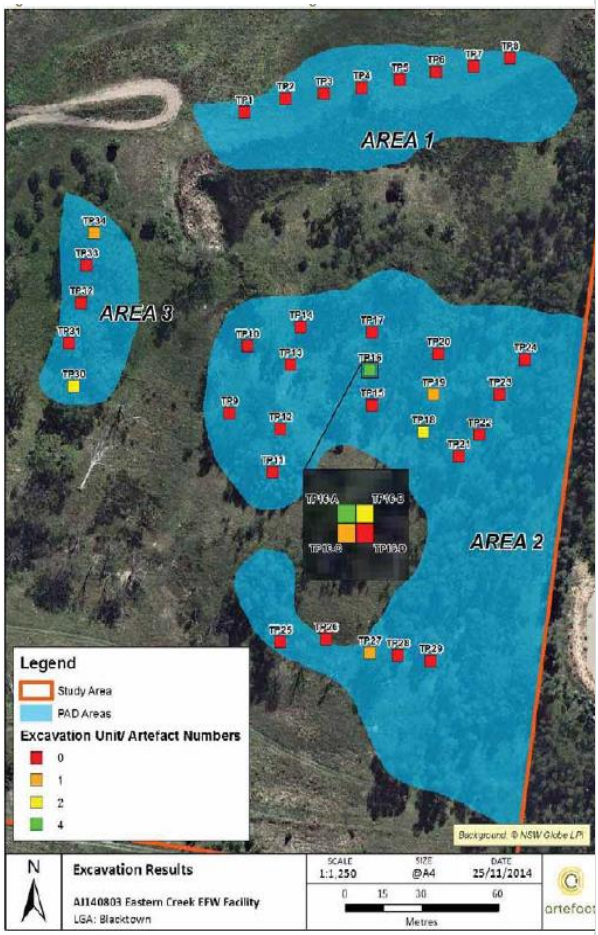
It is evident when comparing the location of the identified sites and the proposed EfW footprint (shown red in Picture 9 of Figure 97) that Archbold 1 and 2 are located outside the proposed area of works and therefore considered unlikely to be directly impacted by the proposed construction or operation of the facility. Consequently Artefact assessed (p.11) *that no further exploration, in the form of test excavation, of Archbold Road 1 and 2 was required for the purpose of this project.*

GML indicate have not established a definitive past use of the site. However, indicate it artefacts are the result of knapping that could be related to the use of the land as campsite, or occurred during movement across the landscape, as tools were prepared or repaired during hunting and gathering activities.

Archaeological data gathered by Artefact in the locality suggests that artefacts are found across the landscape in varying densities. High density artefact scatters are adjacent major waterlines in the area (Ropes Creek and Eastern Creek); with a drop in artefact density in the transitional land between them.

Figure 97 – Aboriginal Archaeology Sites within and adjacent to EfW development site (source: artefact)

Picture 9 – Three (3) Aboriginal Sites on EfW Broader Site



Picture 10 – EfW South: Test Excavation sites

As the proposed works are located immediately atop the EfW South Site, test excavations were undertaken to determine the extent of impact based on the following assessment:

- Stone artefact distribution and density;
- Raw material and Artefact characteristics;
- Artefact depth;
- Artefact Assemblage; and
- Aboriginal Settlement History.

A total of 37 test excavations were undertaken with the EfW South Site (refer to Figure 97**,** Picture 10), resulting in the collection of a total of 14 assemblages from nine (9) of the pits.

Table 91 – Summary of Assessment of Artefacts (Source: Artefact)

Factors Investigated	Outcome
Density	Sparse scatter at an average density of 0.76 artefacts/m²
Raw material and Artefact characteristics	Raw assemblage composed entirely of silcrete; Four (4) technological categories were identified as follows:

Factors Investigated	Outcome
	• Angular fragment: 7 (50%); • Distal flakes: 4 (29%); • Complete flakes: 2 (14%); and • Proximal Flake 1 (7%).
Artefact depth	All retrieved from within 0 – 100 mm (i.e. the A Horizon of the soil profile). None were retried from the underlying B Horizon.
Artefact Assemblage	Low density and diffuse with no meaningful pattern discernible between location and landform. No meaningful statistical correlation can be made between location and density. The material encountered is ubiquitous with the area.
Aboriginal Settlement History.	No evidence of use was identified on the site. Raw material is common and there is no evidence of intensive use of the site or tool manufacture. Artefacts are associated with general stone reduction and discard. Reflective of background scatter or a transient campsite. The site is common in the Eastern Creek area and wider Cumberland Plan region.

While the proposed development will have a direct impact on the location of the identified artefacts, as outlined in Table 91, the assemblage is indicative of general stone reduction and casual discard. The artefacts identified during test excavation offer low research or educational value (refer to Figure 98). All material recovered the same quality, silcrete raw material waste flakes, with very little technical diversity.

The relatively low significance of the artefacts in the context of earlier investigations completed by GML (2014) that identified a relative abundance of (63 recorded on the OEH Aboriginal Heritage Information Management Sydney) of artefact concentrations (open camp sites), Potential Archaeological Deposits (PADs) and Artefact sites with PADs in the Eastern Creek area. At this time GML also noted that artefact concentrations constitute the predominant remnants in this area and generally patterning indicates that these sites can be found in any location and on any landform.

Figure 98 – Outcome of Archaeological Significance Assessment (Source: Artefact)

AHIMS #	Site name	Research potential	Scientific/ archaeological potential	Representative value	Rarity value	Overall significance
45-5-4491	EFW South	Low	Low	Low	Low	Low

Taking into account the relative abundance of similar archaeological sites within the both Eastern Creek area and wider Cumberland Plan region and the assessed low significance the impacts are considered acceptable.

The likely impacts were discussed as part of consultation with local Aboriginal groups, in particular representatives of the Darug people who supported the proposal subject to retrieved artefacts being reburied close by.

Based on the detailed assessment of the sites significance and the outcome of consultation with local Aboriginal groups the proposed impact is considered acceptable subject to management measures to rebury retrieved artefacts within the adjacent riparian zone (in line with recommendations made by Artefact).

22.3.4. Assessment of Cultural Heritage Values

Aboriginal cultural heritage is closely linked to the intangible aspect of the Australian landscape. The significance of a place and/or objects has been assessed in accordance with the OEH Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage, NSW 2011.

The guideline involves two (2) main steps in determining cultural heritage significance, these include:

1) ***Social/cultural heritage values and significance:*** As determined by Aboriginal people, who have a connection or interest in the area, through consultation. In this instance, the site was considered by local and interested Aboriginal groups as being of part of a complex of sites within the region and represented a component of the wider Darug landscape.

2) ***Historic values and significance***: referring to association of place with aspects of Aboriginal history. No comments were provided from registered Aboriginal groups into the historic value of the study area and there are no known historic values associated with the site or evidence (determined by test excavations) of historic interactions at EfW South. The study area was determined to demonstrate low historic significance.

Combined with the above. The aesthetic values of the site were assessed as demonstrating moderate significance despite the notable disturbances due to the presence of natural land features, including vistas of the surrounding area and gentle slope towards Ropes Creek Tributary. The site also derived aesthetic value from examples of woodland still present within the extant of the EfW South and Archbold Road 1.

Consequently Artefact concluded that the proposed construction works of the EfW plant would contribute to a partial loss of value of intangible heritage values, cultural and aesthetic.

22.4. CUMULATIVE IMPACTS AND MITIGATION MEASURES

A summary of the cumulative assessment of significance is provided below in Figure 99**.**

With the exception of Archbold Road 1 and a small portion of EfW South the majority of the site is zoned IN1 General Industrial. It is reasonable to assume that in rezoning the site (and broader areas surrounding including the extended WSEA) that a level of visual modification of the landscape was anticipated.

Direct impacts are constrained to that area of the site that has been assessed to have a low significance with respect to archaeological artefacts and the proposed development has been discussed with local, relevant Aboriginal groups, in particular the Darug people who have confirmed they have no objection to the proposal.

Figure 99 – Cumulative Assessment of Significance (Source: Artefact)

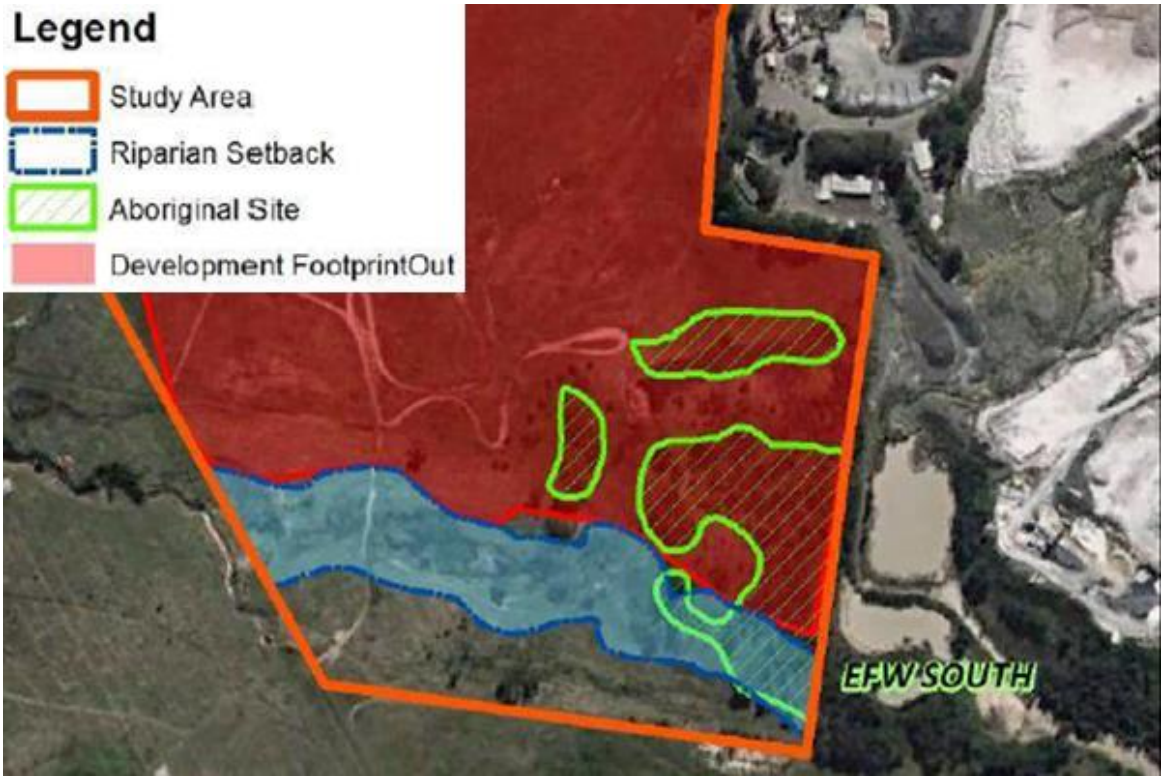
Site Name	Site type	Significance	Type of harm	Degree of harm	Mitigation measures	Management measures
EFW South (45-5-4491)	Artefact Scatter	Low	Direct	Partial	Test excavation	None
Archbold Road 1 (45-5-4492)	Artefact Scatter, PAD	Moderate	Indirect (no physical impacts)	Partial	None	Conservation
Archbold Road 2 (45-5-4493)	Artefact Scatter, PAD	Moderate	Indirect (no physical impacts)	Partial	None	Conservation

Based on the defined extent of the proposed works and low significance value of the site as assessed by GML, no cumulative impacts are anticipated.

Table 92 – Aboriginal Culture: Mitigation Measures

Potential Impact	Management Response	Timing
Protection of Aboriginal Cultural Values	Incorporate Aboriginal Values management measures into CEMP identifying the location of known Aboriginal Sites, including Archbold 1 and 2 as well as the extent of EfW South.	Prior to CC and implemented till completion of works
	Erect fencing around Archbold Road 1 and 2 to prevent unintentional access or damage during construction	Prior to CC and implemented till completion of works
	Rebury retrieved artefacts in riparian corridor adjacent to Ropes Creek Tributary within EfW South Site, as identified in the Artefact Report and shown in Figure 100. Once reburied OEH is to be advised of their location and depth using the “update card” to permit update of records.	On completion of construction and prior to OC
	Develop an appropriate unexpected finds protocol	Develop prior to commencement of works. Maintain throughout “stage 1” construction.

Figure 100 – Location of reburial site, shown blue, within EFW South (Source: artefact)



22.5. SUMMARY AND CONCLUSION

In consideration of the previous archaeological work within the study area and surrounding region and current consultation with the project Registered Aboriginal Party, the following points can be summarised:

- Of the three (3) aboriginal site identified within the broader site only one will be directly and physically impacted by the project works, EfW South;
- The study area (EfW South) and surrounds has been identified by the local Aboriginal community to be of high social significance;
- Artefacts collected from within the study area were assessed as being of low significance by Artefact; and
- Previous archaeological excavations at sites directly surrounding the study area have confirmed the present of subsurface intact archaeological deposits. The majority of these sites that have been located on similar landforms as the study area have been consistent with low density background artefact scatters of moderate to low scientific significance.

As this project is to be assessed in accordance with the EP&A Act, it is not subject to the requirements for an Aboriginal Heritage Impact Permit (AHIP) in accordance with Section 90 of the NSW Park and Wildlife Act 1974 (NPW Act).

23. HAZARDS AND RISKS

23.1. OVERVIEW

The DGRs have sought detailed information into the potential Hazards and Risks associated with the operation of an EfW facility, in particular the storage of combustible materials and goods on the site so as to determine the incident potential and the need for suitable management and mitigation measures aimed at avoiding serious incident.

In particular, the following key issues and information were requested to support the application and be considered within the Environmental Impact Assessment (EIA) framework:

- *A Preliminary Hazard Analysis (PHA) in accordance with Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis and Multi-Level Risk Assessment and details of fire/emergency measures and procedures; and*

- *Detail contingency plans for any potential incidents or equipment failure during the operation of the project.*

The operation of an EfW plant requires the storage and use of materials that are typically classified as hazardous. These potentially hazardous materials are listed in Table 93.

A preliminary hazard and fire risk assessment was undertaken by RawRisk to determine the potential for incidents to occur and they risk they presented to offsite properties.

The Preliminary Hazard Analysis was developed according to the Hazardous Industry Planning and Advisory Paper (HIPAP) No. 6 "*Hazard Analysis*" (Ref. 1) which requires hazard identification, consequence analysis, frequency analysis and risk assessment of potential incidents which could impact offsite. If offsite impacts are identified, the cumulative fatality risk is estimated and compared to acceptable risk criteria published in HIPAP No. 4 "*Risk Criteria for Land Use Planning*" (Ref. 2). If the cumulative risk is below the acceptable criteria for the surrounding land zoning, then the facility is considered to be potentially hazardous and is permitted for development.

The PHA prepared for the project identified several scenarios which had potential for offsite impacts (i.e. waste fire, powdered activated carbon dust explosion, etc.) which were then assessed for consequence to estimate the potential impact distances of the scenarios. This analysis indicated that the impact distances from these incidents would not extend over the site boundary; hence, the risk of a fatality at the site boundary would be 0. The surrounding land use is industrial; hence, the acceptable fatality risk is 50 chances per million per year (pmpy, Ref. 2); therefore, the facility is below the criteria and would be considered potentially hazardous and would be permitted for development.

The acceptable fatality risk for residential uses (closest residence is 1 km away) is 1 chance pmpy (Ref. 2). The estimated fatality risk is 0 pmpy at the site boundary; hence, the facility is below the criteria at the closest resident.

In addition to the preliminary hazard analysis (PHA) a fire risk assessment (FRA) was conducted to ensure adequate fire services would be available. This assessment concludes that radiant heat from fire all identified fire scenarios would be contained within the Site and hence, fire propagation across the Site boundary would be unlikely to occur.

Notwithstanding the above, a range of site management procedures are recommended to be implemented to ensure the appropriate management and storage of materials aimed at avoiding and where necessary mitigating the effect of hazards. To ensure the proposed management of fire incidents water storage capacity of 546,000 Litres is recommended for the site. A full copy of the Hazard Risk Assessment is provided at **Appendix Y.**

Combined with an assessment of Hazard and Risk associated with the operation of the EfW, storage and management an assessment of the potential risk of bushfire was undertaken. The site is not identified on any statutory planning map as being within a bushfire planning area. However, land to the immediate south is identified as categorised bushfire "buffer 1". In this regard to mitigate the risk of potential impact the principles of bushfire protection have been applied to the site. Refer to **Appendix AA.**

23.1.1. Legislative Requirements

The *Hazards and Risks Assessment* uses the following Criteria and Standards for assessing the existing conditions, and modelling the impacts of the proposed Development:

- State Environmental Planning Policy No. 33 Hazardous and Offensive Development.
- AS/NZS 4360:2004 Risk Management (Standards Australia).
- HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia).
- Hazard Industry Planning Advisory Paper No. 6, "Guidelines for Hazard Analyses", NSW Department of Planning (2011).

Assessment of Bushfire has been undertaken in accordance with *Rural Fires Act 1995* and the associated Planning for Bushfire Guidelines.

23.2. STORAGE AND HANDLING OF HAZARDOUS MATERIALS

RawRisk Engineering has completed the Preliminary Hazard Assessment (PHA) and Fire Risk Assessment (FRA) for the development, submitted at **Appendix AA**.

23.2.1. Assessment Methodology

RawRisk Engineering adopted a two (2) pronged approach to the assessment of Hazard and Risk incorporating the following:

- Preliminary Hazard Assessment (PHA); and
- Fire Risk Assessment (FRA).

23.2.1.1. Preliminary Hazard & Fire Risk Assessment

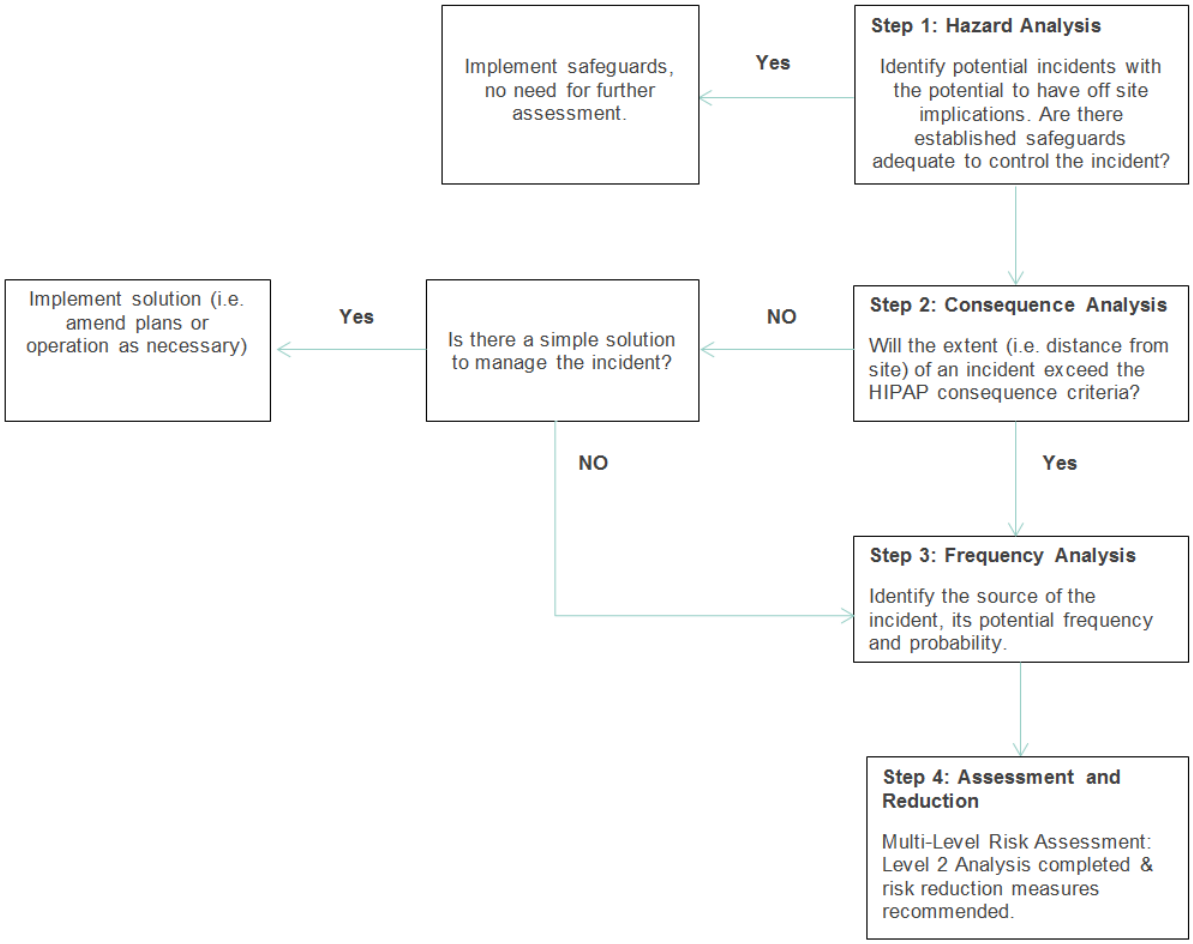
The PHA study utilised a four (4) step approach, summarised in Figure 101 below. For a detailed explanation of the process refer to Section 2.1.1 of **Appendix Y**.

As part of the PHA study, it was necessary to assess fire risks, including fire scenarios, incident frequency, probability of failure of the safety systems at the site and risk of fire (as a result of the combination of the fire impacts and frequency).

The fire risks identified at the Site were used to determine the fire protection required at the Site. This was reported in a separate chapter within the PHA study.

The conclusions and recommendations for both the general and fire hazards and risks were reported within the same section of the document.

Figure 101 – Overview of PHA Methodology



23.2.1.2. Hazard Analysis

Source of Potential Hazard

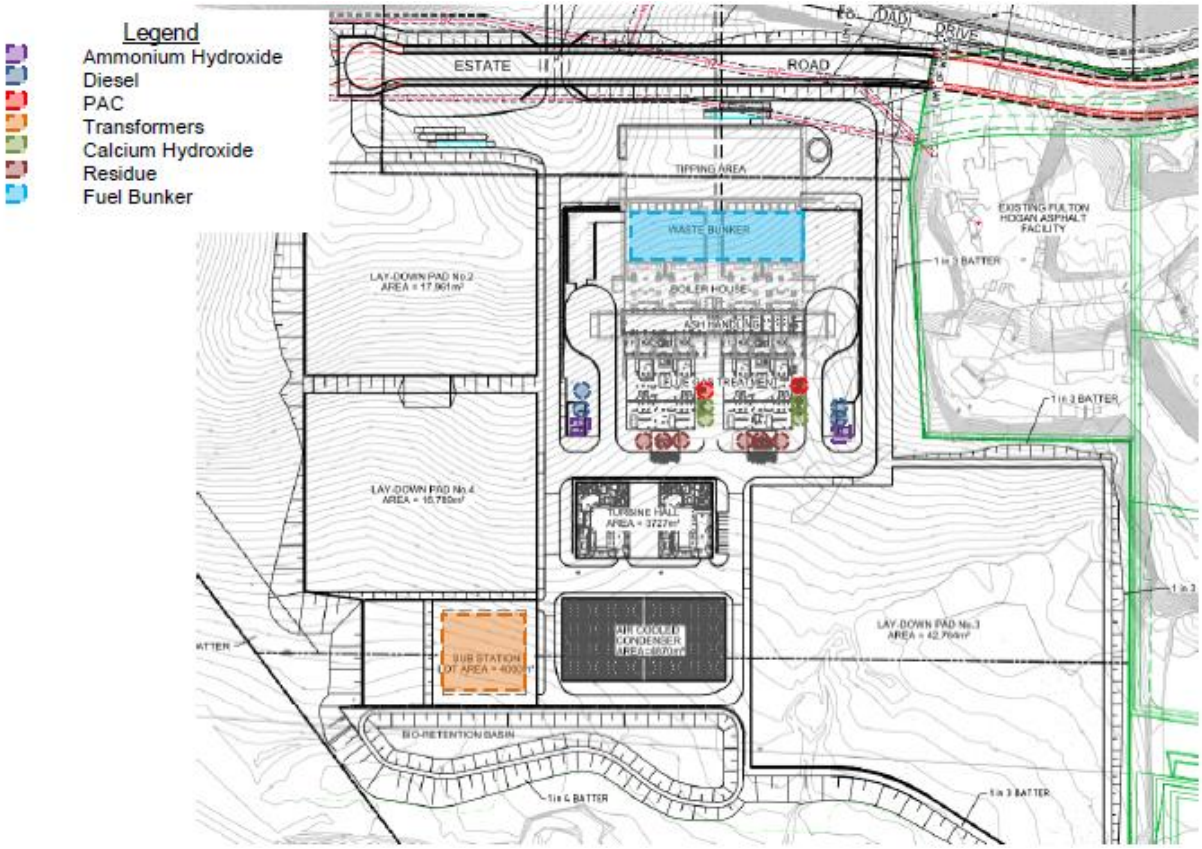
The Hazard identification process has focused on the storage of goods and materials on the site combined with equipment and technology used in the process of combusting waste materials. In this regard the elements of the proposal identified in “step 1: hazard identification” are summarised in Table 91. The location of the identified hazard are shown in Figure 102.

Table 93 – Identified sources of potential hazard

Material/Plant	Quantity
Ammonium Hydroxide (DG)	80
Diesel (NDG)	320
Powdered Activated Carbon (PAC) (DG)	208
Transformer Oil (NDG)	85
Calcium Hydroxide (NDG)	1052
Residue (NDG)	1518
Waste Storage Bunker	N/A
Stack Emissions	2 Stacks

Material/Plant	Quantity
Transformer	N/A
Residue Silo	N/A
Turbines	N/A
Trucks	N/A

Figure 102 – Location of identified potential hazard sources (source: RawRisk)



Hazard Identification

A hazard identification table was developed for operations and storages at the Site. A detailed assessment matrix of the hazard identification process and outcomes is provided at Appendix A of the PHA report (refer to **Appendix Y**). Using the matrix RawRisk identified a possible 13 incidents arising from the storage of material and/or the operation of the plant/technology, these include:

- Ammonium hydroxide tank leak, spill and release to environment;
- Diesel tank leak, spill and release to environment;
- Diesel tank leak, spill, immediate ignition and pool fire;
- Diesel tank leak, spill, unconfined, delayed ignition and flash fire;
- Diesel tank leak, spill, confined, delayed ignition and vapour cloud explosion;
- PAC dust cloud, ignition and dust cloud explosion;
- Ignition of waste in bunker and full bunker fire;
- Emission of combustion by-products;

- Transformer oil spill, ignition and pool fire;
- PAC dust cloud explosion within residue silo;
- Turbine fire;
- Release of calcium hydroxide; and
- Ignition of waste in truck and truck fire.

Using the assessment framework RawRisk determined that of the 13 scenarios/incidents identified only four (4) could not be resolved by way of simple and known safeguard. The four (4) incidents carried forward into Step 3, involving the hazard consequence analysis, included;

- Diesel tank leak, spill, immediate ignition and pool fire;
- PAC dust cloud, ignition and dust cloud explosion;
- Ignition of waste in bunker and full bunker fire; and
- Transformer Oil Spill, Ignition and Pool Fire.

The impacts estimated for each of the scenarios were overlaid on the site layout diagram to assess offsite impacts. No scenarios were identified to impact over the Site boundary and so no further analysis was conducted.

23.2.1.3. Fire Risk Analysis

The fire scenarios identified in the PHA (listed above) were used to assess the requirements for fire protection for each scenario location at the Site.

23.2.2. Assessment of Key Issues

A hazard identification table was developed for the proposed Facility to identify potential hazards that may be present at the Site as a result of operations or storage of materials.

23.2.2.1. Hazard Assessment

A detailed qualitative review of each hazard scenario was performed to assess the potential for offsite impacts. Following the qualitative review, scenarios that still had potential to impact offsite were carried forwards for consequence analysis. These scenarios are listed below together with the summarised outcomes of estimated impacts:

Diesel tank leak, spill, immediate ignition and bund fire

There is potential for the diesel tanks to leak resulting in a flammable liquid spill within the bund. If the spill is ignited, a pool fire with the dimensions of the bund will occur.

The radiant heat impacts at 4.7 kW/m^2 do not extend over the Site boundary and, hence, it is unlikely that a fatality would occur at the Site boundary.

PAC dust cloud, ignition and dust cloud explosion within storage silo

A PAC dust explosion may occur within the storage silo provided the following are present: fuel, oxygen, confinement, dispersion, and ignition. It is noted that the analysis conducted for the silo explosion has been performed without the confinement of the silo enclosure. As a result, the results present a conservative outcome.

The pressure impacts do not extend over the Site boundary and therefore it is unlikely that a fatality would occur at the Site boundary.

Ignition of waste in bunker and full bunker fire;

There is potential for a fire to develop within the waste bunker. All the materials within the bunker are combustible so there is potential for the fire to grow and consume the entire waste storage.

The radiant heat impacts at do not extend over the Site boundary; therefore it is unlikely that a fatality would occur at the Site boundary.

Transformer internal arcing, oil spill, ignition and bund fire

There is potential for arcing to occur within the transformers which may lead to generation of gases and pressure above the structural integrity of the oil reservoir which may rupture leaking oil into the bund. As a result of the arcing and rupture, the oil may ignite leading to a fire within the bund.

The radiant heat impacts do not extend over the Site boundary; therefore it is unlikely that a fatality would occur at the Site boundary.

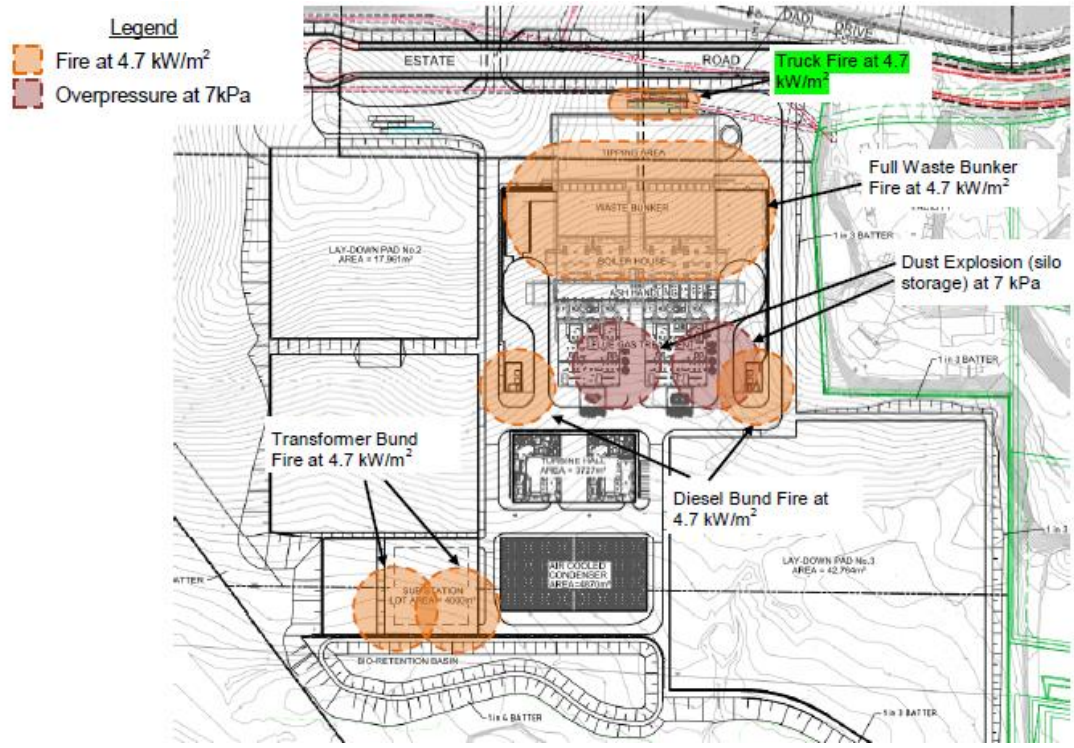
Ignition of waste in truck and truck fire

Products inside the truck trailers may catch on fire due to damaged packages which are exposed to an ignition source, and the stock loaded within the truck may be shielded from sprinkler discharge.

The radiant heat impacts at do not extend over the Site boundary; therefore it is unlikely that a fatality would occur at the Site boundary. As no “offsite” impact area anticipated and therefore mitigation measures are not required.

As shown in Figure 103 the impacts estimated for each of the scenarios when overlain on the Site layout diagram to assess offsite impacts. As none of the identified hazard incident scenarios were assessed to impact over the Site boundary no further analysis of the proposal was required.

Figure 103 – Assessed extent of incidents (source: RawRisk)



23.2.2.2. Fire Risk Assessment

The following fire scenarios may occur at the EfW Facility, and have the potential to impact over the Site boundary:

- Diesel bund fire;
- Waste bunker fire;
- PAC silo fire; and
- Transformer bund fire.

A follow-up consequence analysis on the above incidents showed that radiant heat at the Site boundary would be below 4.7 kW/m$_2$ and therefore it is unlikely a fatality would occur at the boundary. In addition, radiant heat from these scenarios would be contained within the Site and hence, fire propagation across the Site boundary would be unlikely to occur.

23.3. BUSHFIRE

23.3.1. Assessment Methodology

The site is not mapped as bushfire prone land on any planning or statutory management act. As such assessment of hazard has taken a first principle approach of identifying potential hazards.

In reference to the potential for bushfire, the most significant influence is vegetation type. Abel Ecology undertook vegetation surveys of the site to determine vegetation hazard and identified that the most significant potential hazard source on site was the “forest” to the south east and grasslands to the west and south.

Assessment of hazard in relation to the identified vegetation types was undertaken in accordance with Appendices 2 and 3 of Planning for Bushfire Protection 2006 guideline and Table 2.4.2 of Australian Standard 3959: Construction of Buildings in Bushfire Prone Areas.

23.3.1.1. Identification of potential bushfire risk

A detailed assessment of five (5) vegetation classes/development scenarios was undertaken, including:

- Grassland on level ground;
- Grassland level ground, development on slope;
- Grassland on a slope with development above;
- Forest on level ground on the same level as the development; and
- Forest on level ground below the development.

Based on the assessment framework outlined in section 23.3.1, all were assessed to have a potential Bushfire Attack Level (BAL) of 12.5. This BAL is noted to be second lowest rating that can be achieved under the bushfire assessment framework, described as follows in the Planning for Bushfire Protection guidelines published by the Rural Fire Service:

> *Attack by burning debris is significant with radiant heat (not greater than 12.5 kW/m2). Radiant heat is unlikely to threaten building elements (eg unscreened glass). Specific construction requirements for ember protection and accumulation of debris are warranted.*

Based on the identified risk and need for protection, Abel Ecology south to establish the capability of the site to deliver a suitable asset protection zone so as to protect staff and the facility.

23.3.2. Assessment of Key Issues

Threat

The facility may be threatened by bushfire in the form of either a grass fire or a forest fire.

Radiant heat and flame are likely to impinge on built structures. Flame and smoke provide atmospheric conditions that create a path for electrical discharge. That is the reason that electrical transmission lines and substation switch yards have clearances from vegetation. Even so, dense smoke provides a path for earthing from high voltage electrical structures.

As the proposal includes the delivery of compensatory plantings within the riparian corridor to the Ropes Creek Tributary, the likely fire hazard would likely be at most 10m from the top of bank of the watercourse.

A fire poses a heat exposure that increases over about 15 minutes to a peak which lasts for about three (3) minutes. The heat impact then declines by about half each 15 minutes. A smoke plume may be of longer duration depending on wind direction but is not predictable.

Protection Needs

The performance criterion is to protect any staff from undue exposure to radiant heat of 10kW/m_2. Any part of the facility will need to withstand a radiant heat of 10kW/m_2 for three minutes and 5kW/m_2 for 15 minutes.

Analysis

The location of threats is west, south and east of the area proposed for development, the level of exposure is shown in Figure 104, which indicates that any part of the facility within 27m of unmown grass and 55m of forest will need to withstand a radiant heat of 10kW/m2 for three (3) minutes.

Mitigation Measures

The potential impacts can be managed and mitigated through the following:

- Grass fire may be controlled by mowing a strip 27m wide around any part of the facility.
- Clearance of 55m from forest, being that 10m edge creek corridor (65m from top of bank) will be an adequate buffer distance.
- Fire Resistance Level construction of FRL 30/30/30 minimum for any wall facing forest and windows will be screened with stainless steel mesh with a maximum aperture 2mm.
- A flame and radiant heat door will be provided to ensure a safe retreat for staff and fire fighters.

Figure 104 – Summary of radiant heat exposure (source: Abel Ecology; 2015)

Location of a development on the site	Separation (metres)	Radiant heat kW/m²	Flame length (metres)
Grassland on level ground on the same level as the development	23	9.9	7.5
Grassland level ground, development on a slope above	23	9.7	7.5
Grassland on a slope with development above	27	9.7	9
Forest on level ground on the same level as the development	55	10.1	23.7
Forest on level ground with development on a slope above	55	9.8	23.7

23.4. CUMULATIVE IMPACTS AND MITIGATIONS MEASURES

The cumulative potential for an offsite incident to occur in relation to the storage of hazardous materials and goods or the operation of the plant is considered low subject to the implementation of management measures recommended by RawRisk.

The following recommendations from the PHA have been made, and will be adopted at the proposed Facility;

- Ignition sources within the hazardous area should be controlled according to AS60079.14; and
- Investigate the feasibility of installing explosion venting in the PAC silos.

Given the various consequence analyses showed that none of the scenarios would impact over the Site boundary and therefore a fatality would not occur at the Site boundary, the cumulative risk at the Site boundary would be less than 50 per million per year, which is considered an acceptable risk level.

The potential for bushfire on the site is considered low, given its location beyond the buffer identified in the statutory planning maps applied by Blacktown Council. Notwithstanding this, the management of risk is in the public interest to further limit the potential of an incident and thereby further reducing risk. In this regard the implementation of appropriate construction methods combined with land management practices controlling vegetation will contribute to further reducing risk of bushfire impacts.

Table 94 – Hazard and Risk: Mitigation Measures

Potential Impact	Mitigation Measure	Timing
General Mitigation/Management Measure		
Hazard and Fire Response	Develop and implement hazard and fire response protocol detailing location of evacuation muster points and procedures to be implemented in case of emergency.	Operation: ongoing
Mitigation of Potential incidents arising from operations:		
On site incidents arising from the storage of hazardous materials and goods.	Implement the following site practices and tools • Development of a work permit system, including hot work permits; • Development of hazardous area diagrams in accordance with AS60079.10.2 be conducted; • Installation of monitor(s) in the waste bunker (further monitor recommendations below); • Implementation of all recommendations contained in Appendix A of the HRA by RawRisk	Operation: Ongoing
Storage and Management of chemicals	Storage of all liquid chemicals shall be in a bunded control area and or double skinned tank with 110% of the stored capacity as per the *Work Health and Safety Regulation 2011*	Constriction (delivery of bund) and operation: ongoing.
Spill Management	Prior to commencement of operations a spill management procedure shall be developed and implemented. Spills of chemical substances within bunded areas required to be taken off site shall be classified and transported in accordance with the *Environmental Guideline: Assessment, classification and Management of Liquid and Non-liquid Wastes.*	Operation: ongoing Operation: ongoing
Mitigation of Potential Fire Incidents		
Diesel tank leak, spill, immediate ignition and bund fire	Implement the following measures a diesel bund: • 1 powder type fire extinguisher per bunded area; • 1 hose reel with foam making capabilities per bunded area; and • 1 hydrant with foam making capabilities per bunded area.	At time of construction and maintained throughout operations.

Potential Impact	Mitigation Measure	Timing
PAC dust cloud, ignition and dust cloud explosion within storage silo.	PAC Silo • Potential of nitrogen blanketing for the purpose of fire protection (via oxygen exclusion) will be investigated.	Prior to OC and, where relevant maintained throughout operations.
Ignition of waste in bunker and full bunker fire;	*Waste Bunker* • Two 1900 L/min monitors shall be installed to provide complete coverage within the fuel bunker; • Monitors shall be installed such that access is provided externally from the fuel bunker; and • Monitors shall be installed on raised platforms to prevent trucks from colliding with the monitors.	Implemented at the time of construction and maintained throughout operation.
Transformer internal arcing, oil spill, ignition and bund fire	Transformers: • 1 powder-type fire extinguisher per transformer. • Pumping and Water Availability • A pump set shall be installed to provide adequate water pressure for the monitors; and • At least 504,000 L of firewater shall be stored at the Site.	Implemented at the time of construction and maintained throughout operation.
Management of fire incidents: Volume requirements	Ensure that the site has access to no less than 546,000L (a 4 hour supply + 0.5 hours for firefighters to arrive) of water for the purposes of managing onsite fires.	Operation: Ongoing
Bushfire Management		
Protect the site and plant from bushfire	Application and demonstration of the following • Building construction for all aspects of the buildings excluding windows will need to be minimum FRL 30/30/30 where separation of 27m from grassland and 55m from forest is not achieved; • Openable portions of windows are to be screened with metal mesh maximum 2mm aperture; and • Water requirements. Fire hose reels must be provided, which is capable of reaching	Construction

Potential Impact	Mitigation Measure	Timing
	all extremities of the proposed development.	
	• Maintenance of grass land between the facility and unmanaged grassland of adjoining sites to be mown as lawn.	Operational: Ongoing

3.2 SUMMARY AND CONCLUSION

The implementation of appropriate building construction methods combined with ongoing site and land management practices are adequate to mitigate any potential impact associated with hazards related to the potential for bushfire and the storage of hazardous materials.

24. SERVICES & UTILITIES

A review of the various municipal services and the need for extensions or upgrades to and within the site to suit the Project has been carried out. These are discussed in the following sections.

24.1. ASSESSMENT OF KEY ISSUES

Despites being located within an urban environment the site is not presently serviced by all necessary utilise and where existing connections existing there is the potential for the project to require upgrade or potentially impose unreasonable pressure of existing services.

24.1.1. Sewer

There are no existing sewer mains within the area of the proposed development. Sewer is however available at the entrance to the Genesis Xero Waste Facility on Honeycomb Drive (as provided with the recently approved Australand latest development).

Sydney Water is proposing to construct the Ophir sewer carrier main which will be installed east of Ropes Creek to the west of the Site. Discussions have been entered into with Sydney Water to construct the lead in sewer main from the Site to this carrier sewer.

24.1.2. Water Supply

There is an existing 375mm Ductile Iron Cement Lined (DICL) water main within the access road off Honeycomb Drive. This water main runs across the northern boundary of the Site. Water for the Site can be accessed from this main.

A detailed review of the water requirements of the proposed Facility is provided within the Soils and Water Report submitted at **Appendix P**. TNG has consulted with the NSW Office of Water in relation to the water requirements to operate the proposed Facility who indicated that there is sufficient capacity to meet the water demands to run to proposed Facility.

24.1.3. Communications

From Dial Before You Dig records there does not appear to be any telecommunications cables adjacent the Site. The closest telecommunications cables are within Honeycomb Drive to the east of the Site. In order to service the Site, extensions from this existing network will be required. Fibre optic supply can also be made available to the Site within the same system as the electrical cable supply from TransGrid.

24.1.4. Power Supply

Existing electricity cables and additional conduits are located within Honeycomb Drive to the north and continue down the Genesis Xero Waste Facility private road adjoining the Site. The offtake power from the EFW will be transferred via underground cable from the proposed electrical substation to the existing TransGrid easement that runs on the western boundary of the Site. The 132kV underground cable will be housed in a 4m wide trench.

24.1.5. Power

Power is not required once the facility is operational. However, power is intended to be exported from the site. Accordingly, power generated from the EfW is proposed to be transmitted via underground 132 kV cables within a 4m wide trench from the proposed substation, westward into the existing TransGrid 132kV transmission line easement.

The underground cable continues within the existing TransGrid easement heading south east into the Sydney West 330kV substation, which is located approximately 2km to the south-east of the site. The works will also include re-configuration of the equipment within Sydney West Substation to accommodate the connection.

24.2. CUMULATIVE IMPACTS AND MITIGATION MEASURES

There are no cumulative impacts or mitigation measures required. However to ensure services are delivered at the appropriate time the following measures are included.

Table 95 – Services: Mitigation Measures

Potential Impact	Management Response	Timing
Development of un-serviced land	Require services and infrastructure to be delivered prior to the commencement of operation	Prior to OC.
Servicing capacity	No response required – there is sufficient capacity within the relevant networks to support the development.	N/As

25. ECOLOGICALLY SUSTAINABLE DEVELOPMENT (ESD)

The primary objective of the construction and operation of the proposed Facility is the provision of sustainable infrastructure within Metropolitan Sydney for the processing of waste and the generation of clean energy.

The *Environmental Planning and Assessment Regulation 2000* requires than an Environmental Impact Statement include:

> *'The reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development.'*

The principles of Ecologically Sustainable Development, as listed in the Regulations, are as follows:

- *The **precautionary principle**, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*

– *Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*

– *An assessment of the risk-weighted consequences of various options,*

- ***Inter-generational equity**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,*

- ***Conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*

- ***Improved valuation, pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services, such as:*

– *Polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*

– *The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*

– *Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

25.1. PRINCIPLE 1: THE PRECAUTIONARY PRINCIPLE

The proponent's precautionary approach is demonstrated by the design and management controls to be implemented as part of the proposed development. The controls proposed specifically address the threat of serious or irreversible damage from:

- Greenhouse gas emissions;
- Air emissions;
- Noise emissions;
- Surface water discharges;

- Soil and groundwater contamination;
- Impacts of biodiversity;
- Visual impacts;
- Damage to cultural artefacts;
- Wastewater disposal;
- Potential hazards; and
- Land use change.

Monitoring of these aspects would be carried out in accordance with regulatory and licence requirements. Where deviations for expected conditions are recorded, the matter would be investigated immediately and appropriate action taken as necessary, to prevent any adverse environmental impact as required by the Environmental Management Plans (construction and operations) for the proposed Facility. The proposed Development does not contemplate works that would result in serious or irreversible environmental damage.

25.2. PRINCIPLE 2: INTER-GENERATIONAL EQUITY

The proposed Facility will ensure a safe, clean and reliable form of energy generation for Metropolitan Sydney now and in the future, while providing a means of waste management through the operation of the proposed Facility in concurrence with the Genesis MPC to reduce or even eradicate the need for landfill in the future. As demonstrated within the Greenhouse Gas Assessment prepared by Pacific Environment (**Appendix K**), the operation of the proposed Facility would have a net positive GHG effect, potentially eliminating approximately 3 million tonnes of CO_2-e per annum. The emission intensity for electricity generated from waste incineration is lower than that derived from the NSW electricity grid.

The Proposed Development ensures that the environment will be protected for its enjoyment by future generations. The Site is located within an established industrial precinct and has been designed to complement the interface with the adjoining land uses. All environmental management measures have been assessed as appropriate for the Site and include best practice management.

25.3. PRINCIPLE 3: CONSERVATION OF BIOLOGICAL DIVERSITY & ECOLOGICAL INTEGRITY

The Site is currently largely cleared of vegetation; however the Proposed Development has been designed to protect habitats and biological diversity where possible. This is further detailed within Flora and Fauna Report prepared by Abel Ecology submitted with the amended EIS at **Appendix G.**

Measures to avoid impacts on biodiversity have been developed, mainly through locating the proposed Facility and associated infrastructure as far away as possible from endangered ecological communities or threatened species habitats, siting the proposed Facility within cleared grazing lands, allowing for a suitable setback from the Ropes Creek tributary. Mitigation measures to reduce or minimise biodiversity impact are included within the Construction Environmental Management Plan (**Appendix BB**).

25.4. PRINCIPLE 4: IMPROVED VALUATION, PRICING & INCENTIVE MECHANISMS

Given the proposed development is positioned for the clean treatment of identified waste fuels (that cannot be recovered or reused by Genesis) and will result in a net benefit for the locality in terms of Greenhouse Gas reduction and reduced landfill, the proposed Facility is a unique development in terms of the generation pollution or waste. However, the proposed Development is subject to the regulatory requirements of the NSW and Australian Governments, and the open market, when it comes to the valuation, pricing and incentive mechanisms influencing the costs associated with the operation of the project including those relating to waste management and operational systems.

The primary objective of the construction and operation of the proposed Facility is the provision of sustainable infrastructure within Metropolitan Sydney for the processing of waste and the generation of clean energy.

The will in addition to the above, incorporate the following ecologically sustainable design features:

- Installation of energy efficient fixtures and fittings;
- Installation of bio-retention basins which will treat stormwater run-off from the site;
- Balancing cut and fill requirements so as to minimise truck movements during construction and also the amount of materials to be transported to and from the site;
- Use of recycled or sustainable materials where possible;
- Encouragement of design which maximises natural light and ventilation; and
- Planting of vegetation that has low water requirements.

In addition, the above it is noted that the proposed development will result in the improvement of the bio-diversity values of the site through:

- Protection of the land zoned E2 Environmental Conservation zoned;
- Planting of new native trees and shrubs on the site; and
- Creation of new potential habitat through the construction of bio-retention basins within the precinct.

The Proposed Development accords within the principles of Ecologically Sustainable Development outlined within Schedule 2 of the *Environmental Planning & Assessment Regulation 2000.*

26. ENVIRONMENTAL RISK ASSESSMENT

26.1. RISK ASSESSMENT AND MITIGATION MEASURES

The DGRs require an environmental risk analysis to identify potential environmental impacts associated with the construction and operation of an energy from waste facility.

This analysis comprises a qualitative assessment consistent with AS/NZS ISO 31000:2009 *Risk Management–Principles and Guidelines* (Standards Australia 2009). The level of risk was assessed by considering the potential impacts of the proposed development prior to application of any mitigation or management measures.

Risk comprises the likelihood of an event occurring and the consequences of that event. For the proposal, the following descriptors were adopted for 'likelihood' and 'consequence'.

Table 96 – Risk Descriptors

Likelihood		**Consequence**	
A	Almost certain	1	Widespread and/or irreversible impact
B	Likely	2	Extensive but reversible (within 2 years) impact or irreversible local impact
C	Possible	3	Local, acceptable or reversible impact
D	Unlikely	4	Local, reversible, short term (<3 months) impact
E	Rare	5	Local, reversible, short term (<1 month) impact

The risk levels for likely and potential impacts were derived using the following risk matrix.

Table 97 – Risk Matrix

		LIKELIHOOD				
		A	B	C	D	E
CONSEQUENCE	1	High	High	Medium	Low	Very Low
	2	High	High	Medium	Low	Very Low
	3	Medium	Medium	Medium	Low	Very Low
	4	Low	Low	Low	Low	Very Low
	5	Very Low	Very Low	Very Low	Very Low	Very Low

The results of the environmental risk assessment for the proposed development are presented in **Table 98** and are based upon the range of technical and specialist consultant reports appended to the amended EIS. The table has directly related mitigation measures responding to each impact also based upon the range of technical and specialist consultant reports appended to the amended EIS.

Table 98 – Risk Assessment

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
Waste Management	Impacts associated with construction waste	C	5	Very Low	A Demolition and Construction Waste Management Plan can be prepared prior to CC.
	Impacts associated with operation waste	C	5	Very Low	Details of waste streams arising, management and disposal have been provided. Refer to **Appendix J**.
	Processing of ineligible waste fuels	C	5	Very Low	Rigorous and auditing procedures will be implemented to ensure only eligible waste fuels are accepted.
	Management of waste fractions (i.e. chlorine content)	C	3	Medium	Mitigation measures are set out in the Project Definition Brief (refer to **Appendix CC**). Through mixing and homogenisation of waste materials in waste storage bunker.
	Impacts associated with waste outputs	C	5	Very Low	Details of waste streams arising, management and disposal have been provided. Refer to **Appendix J**.
Air Quality	Impact from typical emissions	A	1	High	Emissions are controlled through the following: • Proposed energy from waste facility operating using emission rates set by the POEO Act, with the exception

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					of Cd which will be set at the limit prescribed by the Industrial Emissions Directive (IED; Directive 2010/75/EU) • Implement continuous monitoring system to ensure facility operates within acceptable parameters; • Set CEMs to commence safe shutdown procedures if emission limits are exceeded • In line with the EfW policy a series of trials and tests would be undertaken to ensure proper functioning of technology prior to full operation. • Following completion of PoP trials and within the first 12 months of commencing operations the proponent will undertake a minimum of two (2) measurements (at least 3 months apart) of the following toxics: - Heavy metals;

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					- Polycyclic aromatic hydrocarbons; and - Chlorinated dioxins and furans
	Impact from Emissions above the accepted PoEO level	C	3	Medium	Mitigation designed into the facility. The facility has been designed to align with the stringent emissions limits set by the IED and adopts BAT in particular the use flue gas treatment system to include SNCR works to reduce emissions that may be considered harmful. The facility is managed by a Continuous Emissions Monitoring System (CEMS) that will ensure emissions are maintained at the prescribed level. If an exceedance is detected the facility, will initiative a safe shut down procedure.
	Impact from Emissions during Upset	E	4	Very Low	Implement response plan: • Plant shutdown triggered; • CEMS would record emission breach and alert operator and EPA; and

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					• Where necessary alert emergency services.
	Impact from operation of diesel generators	E	4	Very Low.	Only used in emergency. Can be restricted by way of condition limiting use to no more than 200 hours per year.
	Dust and particulates resulting from clearing and excavation	B	5	Very Low	• Modify working practices by limiting excavation during periods of high winds (greater than 20 km/hour). • Limiting the extent of clearing of vegetation and topsoil to the designated footprint required for construction and appropriate staging of any clearing. • Use of suppressing water to limit wind borne dust • Implement stabilisation methods, such as grass groundcover as soon as practicable following

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					construction of laydown pads
	Dust and emission impacts from earth moving equipment	B	5	Very Low	• Use of water sprays during internal haul road construction. • Where conditions are excessively dusty and windy, and fugitive dust can be seen leaving the site, work practices should be modified by limiting the use of machinery.
	Impact of dust/dirt from truck movements	B	5	Very Low	• All vehicles on-site should be confined to a designated route with speed limits enforced (20 km/hour). • Trips and trip distances should be controlled and reduced where possible, for example by coordinating delivery and removal of materials to avoid unnecessary trips.

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					• When conditions are excessively dusty and windy, and dust can be seen leaving the works site the use of a water truck (for water spraying of travel routes) should be used.
	Impact from wind erosion	B	5	Very Low	• Wind erosion from exposed ground should be limited by avoiding unnecessary vegetation clearing and ensure revegetation occurs as quickly as possible. • Wind erosion from temporary soil stockpiles can be limited by minimizing the number of stockpiles on-site and minimizing the number of work faces on stockpiles.
Greenhouse Gases	Impacts associated with direction and indirect emissions	D	5	Very Low	The EfW plant has a net positive effect on GHG by reducing the volume of waste directed to landfill and not grid demands. No mitigation is required.

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
Ozone	Emissions exceed NEPM guideline limit	C	4	Low	Use of SNCR Flue Gas treatment to reduce the NOx emissions; Use of emissions limits monitoring equipment and automated shutdown to protect Human Health.
Odour	Emissions from waste storage bunker	D	3	Low	The tipping hall in which the bunker is kept will be under negative pressure and utilise high speed roller doors to prevent the escape of fugitive emissions. Only process/receive non-putrescible waste. Maintaining an odour complaint logbook and in the event of a complaint immediately investigate any unusual odour sources (including spill or leakage in the traffic areas) within the site boundary and take appropriate action to eliminate these.
	Emissions from Stack associated with combustion of waste fuels	D	3	Low	Use of flue gas treatment.

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
Noise & Vibration	Impact from construction noise	A	2	High	Implementation of a Construction Management Plan to minimise acoustic impact.
	Impact from construction vibration	D	3	Low	Implementation of a Construction Management Plan to minimise vibration impact.
	Impact from operational noise generated on site	C	3	Moderate	Noise impact associated with the operation is not predicted to cause impact on sensitive receivers. However, to ensure that all possible measures are taken to reduce the potential for impact mitigation measures to ensure ongoing management of noise potential.
	Impact of road traffic noise from traffic generation on public roads and 24/7 operation	B	4	Low	Not required. No use of residential streets. The proposed use of the site is capable of meeting EPA Road Noise Policy guidelines.
	Impact on sleep disturbance: construction	C	5	Very Low	Not required. The use of the site during the night time period between 10pm and 7am (to allow for vehicles to enter/leave the site) is compliant with EPA sleep disturbance guidelines.

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
	Impact from mechanical plant equipment	C	5	Very Low	Acoustic testing when upon plant commission to determine if acoustic treatment is required
Soil & Water	Impact from salinity	D	4	Low	The location of the works is identified as being moderately saline. Salinity may affect the building if not accounted for. Measures to manage salinity include: • Undertake soil salinity testing prior to the commencement of works to determine the extent of high salinity around the Ropes Creek Tributary. • Where necessary, limit the extent of ground disturbance works around Ropes Creek Tributary. • Mixing of spoil excavated and reused on site to manage saline soils. • Following completion of bulk earth works test soil salinity to determine appropriate construction materials and methods.

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
	Impact on groundwater	D	3	Low	Not required. No groundwater was encountered during the course of the investigation and as such groundwater is unlikely to be disturbed during the course of the development.
	Impact from flooding	C	5	Very Low	No mitigation required. The site is not identified in BCC on line mapping as being flood affected land. Notwithstanding this, site planning has set the finished ground level of the plant 2 metres above the modelled flood level.
	Impact of stormwater resulting from increase of impervious area	B	5	Very Low	Stormwater drainage infrastructure will be constructed to manage stormwater. Refer to Civil Drawings and Report.
	Impact from erosion and sediment occurrences, including water pollutants.	C	4	Low	Refer to the Erosion and Sediment Control Plan for full detail of the control measures.
Land Contamination	Impact on land use due to historical land contamination	D	3	Low	Not needed. PSI and DSI completed and determined site is suitable for proposed use. A Remediation Action Plan (RAP) is not required.
	Potential for leachate from bunker	C	3	Medium	Construction of waste bunker in a single poor will ensure waste

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					storage area is sealed to prevent any leachate from waste.
Human Health	Impact from Emissions	D	1	Low	The potential impact for Human Health Impacts have been assessed as low and acceptable based on the inherent mitigation measures implemented into the design and operation of the technology. These include: • Proposed energy from waste facility operating using emission rates set by the POEO Act, with the exception of Cd which will be set at the limit prescribed by the Industrial Emissions Directive (IED; Directive 2010/75/EU); • Implement continuous monitoring system to ensure facility operates within acceptable parameters; and • Set CEMs to commence safe shutdown procedures if emission limits are exceeded.
Traffic & Parking	Impacts of road network from demolition / construction phase.	D	4	Low	No mitigation required. Modelled intersections will continue to operate satisfactory.

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
	Adverse impact on key intersections as a result of increased operational traffic generation on the site.	D	4	Low	No mitigation required. Modelled intersections will continue to operate satisfactory.
	Additional demand for on street car parking spaces.	D	5	Very Low	Not mitigation required. Onsite car parking provision is adequate for the proposed use.
	Impact of internal road designed for truck use.	D	5	Very Low	Not mitigation required. Adequate internal circulation is provided.
	Queuing of trucks waiting to enter site	C	5	Very Low	No mitigation required. Only 4 bays required and 16 provided.
	Vehicle conflict accessing parking bays in: Tipping hall	C	5	Very Low	No mitigation required.
	Adverse impact on pedestrian movements around and into site.	D	5	Very Low	No mitigation Required. Pedestrian movements in the area are expected to be minimal, site forms part of a broader privately held landholding.
Flora and Fauna (Biodiversity)	Impact on sites ecological values	A	3	Medium	Detailed mitigation measures aligned with potential impacts are outlined in Section 19 Flora and Fauna and consolidated mitigation measures in Section 27.3.
	Impact of fauna habitat loss	C	3	Medium	The revegetated habitat will have artificial naturalised habitat structures, reused hollows and

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					artificial hollows suited to the fauna of the locality.
	Impact of tree hollow loss	A	3	Medium	All hollows will be inspected by removal using a camera probe under the inspection of a fauna ecologist. Artificial hollows are proposed for re installation on artificial poles and structures within proposed revegetation areas. Replacement of HBT with nesting boxes at a ratio of 2:1 to be undertaken 2 weeks prior to site clearing surveys of fauna to ensure to allow fauna “adjustment period”.
	Impact of Endangered Ecological Community loss	B	2	High	Compensatory revegetation measures as set out in section 19.6.1 and consolidated measures in Section 27.3. Based on the assessed quality and significant impact is reversible with suitable revegetation strategy implemented and managed.
	Impact of threatened fauna species loss	B	3	Moderate	Habitat of two (2) microbats will be removed as part of the works. Implementation of roosting boxes will mitigate immediate impacts. Species surveyed or likely to use the

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					site for foraging have wide foraging range and unlikely to be effected in the long term. Further surveys of Cumberland Plain Snail to be undertaken prior to commencement of site works. If recorded appropriate measures to relocate to the E2 Conservation lands ibn the northeast of the site will be implemented.
	Impact of degradation of aquatic habitats	B	4	Low	Works involve removing part of the stream, this will likely impact on any aquatic habitat present in the tributary. However limited aquatic fauna was recorded during inspection the consequence of the action is low. Pre-clearing of all fauna prior to works will ensure suitable protection and management. Revegetation of the riparian corridor has the potential to make a positive contribution to aquatic health and habitat.
Visual Impact	Impact on key views of the site from key public places	A	1	High	A “high” impact has been attributed to visual amenity in recognition of the quantum of change anticipated

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					to occur to the existing landscape vistas as a consequence of construction. The impact itself is considered to be acceptable given the urban context, moderating effects of distance to visual receivers and effective use of colour, materials and landscaping. Mitigation measures include strategic landscaping and effective use of colour and materials. The orientation and design of the buildings positions all operational functions away from sensitive receivers.
Air Space Operations	Impact on future obstacle limitation surface (OLS) and PAN-OPS for Badgerys Creek Airport	C	1	Medium	The proposal has been referred to relevant authorities who have provided comments of no objection. To ensure the safe and efficient operation of airspace, a requirement for the proponent to confirm with CASA potential implications for the OLS and PAN-OPS should be confirmed prior to commencement of operations (including any trials). Where necessary a symbol should e placed on airspace operations maps

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					to ensure operators are aware of the stack and plume heights.
	Increase the incidence of bird strike due to the nature of the land use (storage of putrescible wastes)	E	2	Very low	The proposal has been assessed against the relevant land use guidelines and has been assessed to include appropriate management methods to control the incidence of wild.
Aboriginal Cultural Heritage	Impact on the Aboriginal cultural heritage values on site	A	1	High	The location of works will directly impact a known Aboriginal site. Consultation with local Aboriginal groups, in particular the Darug People, has been undertaken and the mitigation strategy endorsed. Mitigation will include the reburying of artefacts in the Ropes Creek Tributary Riparian zone. An expected finds protocol will also be implemented throughout construction to manage any further artefacts. All artefacts retrieved from the site will be reburied in the Ropes Creek Tributary riparian corridor and their location recorded and reported to NPWS.
European Heritage	Impact of the European heritage values on site	D	1	Low	There is no known European heritage. Notwithstanding this, an unexpected finds protocol will be

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
					implemented throughout site workto ensure that any items encountered are appropriately managed. Refer to Section 22.3.5.
Hazards & Risks	Impact from the storage of dangerous goods	C	5	Very Low	Implementation of appropriate storage areas and site management practices as set out in Section 23.4.
	Impact of fire associated with the storage of hazardous materials and goods.	C	5	Very Low	Implementation of appropriate storage areas and site management practices as set out in Section 23.4.
Bushfire	Impact for potential bushfire threat	E	1	Very Low	The site is not identified in regulatory planning maps as being bushfire affected. Notwithstanding this, to further minimise the potential for impact on the operation of the plant measures to minimise risk will be implemented including: • Adoption of suitable building construction standards; and • Management of grassland surrounding the buildings.
Energy Efficiency	Impacts associated with excessive energy use.	E	5	Very Low	The plant will produce its own energy; no mitigation.

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
Ecologically Sustainable Development	Impacts associated with ecologically unsustainable development	D	1	Low	The proposed development will make a positive contribution to ESD, providing viable alternative green energy that will have net positive effect on the emission of greenhouse gases. Mitigation measures have been identified where there is a direct and unavoidable impact, implementation of these measures will prevent the development from being unsustainable.

27. CUMULATIVE IMPACTS: MITIGATION MEASURES

The DGRs require the Environmental Assessment to address a number of key issues of perceived high environmental, social, and economic value, sensitivity or impact.

> *Detailed assessment of the key issues specified below, and any other significant issues identified in this risk assessment, which includes:*
>
> - *An assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes; and*
> - *A description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the development, including proposals for adaptive management and/or contingency plans to manage significant risks to the environment; and*
> - *Consolidated summary of all the proposed environmental management, mitigation and monitoring measures, highlighting all commitments included in the EIS.*

27.1. OVERVIEW

Cumulative impacts may arise as a result of the development of the proposed Energy from Waste facility either concurrently or sequentially as other sites within the immediate and broader regional context develop. In particular, the effects of the following areas have been considered in this section:

- Development of the adjacent Hanson's site;
- Development and ongoing use of sites within the Eastern Creek Precinct; and
- The anticipated increasing urbanisation likely to occur in response to the Broader Western Sydney Employment Area.

Cumulative operational noise impacts are predicted to be within acceptable range, likely to be imperceptible at the nearest residential receivers during operations.

Existing background air quality monitoring data in conjunction with the modelled emissions used in the local air quality assessment conclude that during normal operations air quality as a result of emissions will comply with the relevant regulatory requirements. In the event of upset, exceedances are expected, however the probability of such an event has been calculated as less than 1 per cent. Mitigation measures have been integrated into the design of the facility to include BAT flue gas treatment measures and emissions targets that align with the more stringent targets of the IED.

A quantitative assessment of potential ozone impacts concludes that during typical operations the facility will be well within ozone limit values and the operation of the proposed facility would have a net positive Greenhouse gas effect, potentially eliminating 3 million tonnes of CO2-e per annum.

The traffic assessment concludes that despite the contribution of additional truck and car movements as a result of construction and operation there is will be no change in the performance of key intersections that will continue to operate at a Level of Service "B", having acceptable delays and spare network capacity. The majority of the roads on the anticipated construction traffic routes carry relatively high volumes of existing traffic and the increase in noise from construction traffic is unlikely to be perceptible.

Increasing urbanisation of the precinct and the broader area encompassing the WSEA will contribute to a change in the visual aesthetic as well as placing increased pressure on biodiversity and Aboriginal heritage values within the immediate context and the broader region. The development has sought to mitigate the site specific effects through consultation with local Aboriginal groups to identify acceptable management of excavated artefacts that will be reburied within the adjacent riparian lands that will be maintained and enhanced by the proponent as part of the biodiversity management measures.

27.2. CUMULATIVE IMPACT ASSESSSMENT

The broader site and the land adjoining have been identified under SEPP (WSEA) for redevelopment for higher end industrial and employment uses over the next decade.

To determine the potential cumulative impacts of the development within the context of existing and likely future development a review of publicly available information sources was undertaken. Sources included the major project register and online application system of the Department of Planning and Environment and Blacktown City Council respectively. The proponent also corresponded with the Department of Planning and Environment's Employment Land Release division.

The outcome of this review and liaison is summarised in Table 99 and includes details of existing and approved developments within the immediate context of the site combined with identified likely impacts that may arise as a consequence of construction and operation.

The majority of land uses existing and proposed are light industrial in nature and likely to generate impacts of traffic and noise. However, land to the immediate east is owned by Hanson and is the subject of a Part 3A concept and project approval issued in 2010 that has been the subject of a series of modification applications. This approval allows for the creation of up to 14 new industrial lots, which will be progressively developed. Unless otherwise stated, reference to "Hanson's" is a reference to development on the land immediately east of the site.

Table 99 – Cumulative impact identification matrix

Land Owner	Status of Land	Operation	Likely Impacts
Sargents (west)	Vacant	Proposing a pie making facility. Application currently being assessed by Blacktown Council. VPA and works in kind proposed.	• Noise; and • Traffic (volume and emissions)
The Department of Planning and Environment (south west)	None.	Currently preparing a DCP for the site. Possible future market sale after finalisation of DCP. Timing unknown.	Unknown
Hanson (east)	Undergoing transition	Part 3A concept & project approval for operation of asphalt plant and 14 lot subdivision	• Air Quality (dust and emissions); • Traffic (volume and emissions); • Noise; and • Biodiversity.
	Fulton Hogan asphalt/emulsion plant (operation until June 2015)	Concrete plant, logistics centre, fuel depot, workshop, concrete recycling, office and lab, road infrastructure, continued asphalt/emulsion plant	• Air Quality (dust and emissions); • Hazard Risk: Explosion; • Traffic (volume and emissions); and • Noise.
	Vacant: Modification to approved Part 3A lodged July 2016; undergoing assessment	Project Approval modification is facilitative, seeking amendment to biodiversity offsets area, subdivision layout, road alignments and	• Air Quality (dust and emissions); • Traffic (volume and emissions);

Land Owner	Status of Land	Operation	Likely Impacts
		inclusion of warehouse areas. For the purpose of supporting Frasers: Warehouse, Logistics and Industrial purposes. This application **is not** submitted	• Noise; and • Biodiversity.
Australand (north east)	Current distribution and warehouse tenants on land include • Kmart (distribution) • OfficeMax • Kuehne & Nagel (logistics) • Kmart (warehouse)	Remaining land to be developed for same general industrial purposes.	• Noise; and • Traffic (volume and emissions).
Jacfin (south)	None. Land subdivided. Jacfin seeking pre-commitments for development.	Likely to continue pursuing industrial/warehouse/logistics development in line with their approvals.	• Noise; and • Traffic (volume and emissions).

27.2.1. Noise

As outlined in **Section 15** noise during construction may exceed the acceptable criteria level at both residential and industrial receivers during construction. At present, there are no other active construction sites in the immediate vicinity of the site and based on the existing conditions there is considered to be limited potential for cumulative effects related to construction noise.

Notwithstanding the above, since lodgement of this application in April 2015, a part 3A modification has been lodged for part of the adjoining Hanson site, referred to as “Lot 6”. This part of the site is currently the subject of a facilitative modification application to permit the submission of the local development application to construct and operate a warehouse. As the modification application is still being considered by the DPE there is no certainty in the outcome of either the facilitative modification or the future DA to Council for construction and use. In this regard, it is reasonable that the onus to consider cumulative noise construction impacts be on the future applicant, Frasers.

The operation of the facility has been assessed by Pacific Environment in the context of the existing background noise levels, including the future Hanson’s development, to identify cumulative impacts (i.e. background + TNG). This assessment has concluded that

> *Where the Hanson development is operational prior to the EfW facility, the presence of the existing industrial noise at $L_{Aeq,9hr}$ 34 dB(A) would require the night time amenity criteria at Erskine Park to be decreased by 1 dB to $L_{Aeq,9hr}$ 39 dB(A). This would mean that the cumulative noise of the EfW facility and the Hanson development would exceed the amenity criteria by 1 dB and the Precinct Plan goal by 2 dB.*
>
> *A 1-2 dB exceedance of the night time goals is considered marginal as typically a 3-5 dB increase in noise level represents a change in noise level noticeable by most people. Furthermore the exceedance is only predicted to apply during the night under temperature inversion conditions. As these conditions are not present all of the time, it is expected to reduce the chance of adverse noise impacts occurring.*

Therefore in consideration of conservative modelling, the marginal degree of exceedance and the conditions under which the exceedance is predicted to occur, additional mitigation is not considered reasonable.

As outlined above, the cumulative effects of ongoing development on the local noise environment are anticipated to be within an acceptable range. The predicted effects are contingent on the timing of the Hanson's redevelopment. However, once operational noise levels will be below perceptible levels.

27.2.2. Traffic

Detailed traffic assessment has been undertaken for both the construction and operational phases of the development. The assessment demonstrates that the cumulative traffic impacts (i.e. existing + proposed based on a worst case scenario) would not alter the current level of service at the key intersection of Wallgrove Road and Wonderland Drive.

Maintaining the intersection operation at a Level of Service B ensures that there is still capacity in the network for future development to occur.

27.2.3. Air Quality

Assessment of air quality has considered the following:

- Emission concentrations from the facility;
- The potential formation of ozone;
- Greenhouse gas contribution; and
- Odour emissions.

The outcome of assessment across the spectrum of potential air quality impacts concludes that the facility when operational is capable of maintaining suitable air quality standards in line with the various regulatory frameworks.

The design and operation of the facility has been developed specifically to align with delivering suitable air quality outcomes. This is achieved through the integration and implementation of Best Available Technology in relation to flue gas treatment process and the use of a continuous emissions monitoring system that will provide a real time 24 hour data feed on emission and if necessary trigger a safe shutdown of the plant in instances of exceedance.

Detailed modelling of the air quality conditions, existing and predicted, have been undertaken on a worst case scenario basis and the probability of these events and conditions is low.

Future developments in the vicinity of the Facility will have the potential to impact local air quality, and therefore influence the cumulative impact of the area on air quality. There is a finite threshold of acceptable pollutant concentrations. This threshold is defined by the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA, 2005). Generally speaking the development of an asphalt plant in the local area will release gaseous pollutants, particulate matter, air toxics and odour. Gaseous pollutants, particulate matter, and air toxics are limited by the capacity of the air shed to diffuse these pollutants, and for concentrations to be at a safe level and below the NSW EPA limits.

As odour from the asphalt plant will be of different character than odours generated by the Facility or MPC, cumulative effects of odour should not be considered additive.

In terms of other future developments, the onus is on the proponent to demonstrate their proposed development can operate without adversely impacting upon an air shed which may already be constrained by local land uses.

At construction phase, particulate matter emissions are generated by onsite activities, such as earthworks and wheel generated dust on unpaved roads. The proponent has included mitigation measures to ensure the appropriate management of these matters from the site. However, there is shared obligation for all developers and landowners to apply the same management approach to ensure the maintenance of the local air quality parameters.

27.2.4. Flora and Fauna

The proposed development will remove vegetation from the site that has been identified as Cumberland Plain Woodland and River Eucalypt Flat Forest. In general the two (2) vegetation communities to be removed, despite being listed a EECs, have been assessed as having low significance due to their degraded state.

A seven part test ("test of significance) was undertaken by Abel Ecology for all identified EECs and threatened or endangered fauna species recorded on site or considered likely to use the site for foraging or roosting. These assessments found:

- That the proposed works would not adversely affect life cycle of any identified threatened or endangered species.
- In the case of endangered ecological communities the proposed action was not considered to adversely affect the composition of the composition of the ecological community such that its local occurrence would be at risk of extinction.
- The proposed action did not contribute to the fragmentation of habitat as this the vegetation to be removed is already isolated and fragmented.
- The site contains no critical habitat for any fauna species.

The removal of native vegetation (and consequently habitat) will have a cumulative effect in respect vegetation loss, in relation to previous and future development in the area. However, the quality of the current vegetation and habitat is low and in this regard does make a significant contribution to biodiversity values. The proponent will offset the loss through replanting the equivalent of a combined 5.52 ha of CPW and RFEF vegetative communities, including canopy trees within the Ropes Creek Tributary riparian corridor and land adjacent to the north of the Tributary and south of the onsite detention basin.

27.2.5. Cultural and Heritage (Aboriginal)

Increasing urbanisation within the WSEA has and will continue to place pressure on the retention of Aboriginal cultural heritage.

Consultation with local Aboriginal groups and stakeholders has been undertaken to inform the assessment of significance and management. All artefacts recovered from the site as part of test excavations will be reburied within the Ropes Creek Tributary riparian corridor. Consultation has confirmed that this approach is acceptable to the Darug people.

27.2.6. Soil and Water

The construction of the EfW plant will cause disturbance to soil and water on the site. However these impacts are anticipated to be localised with all identified impacts capable of being managed through effective site management practices including sediment and erosion control devices, stabilisation works and stormwater management.

The development is unlikely to affect post development run off/overland flows to the extent of impact on adjacent land and the potential for exacerbated flooding as a consequence is considered low. A detention basin will be constructed to the south of the development that has been designed in accordance with the provisions of SEPP 59. The design and location has been the subject of consultation with BCC who have indicated that subject to the basin being retained in private ownership, it is acceptable.

The proposed development is not considered to contribute to the risk of adverse cumulative impacts on soil and water.

27.2.7. Visual Amenity

Continuing development and increasing urbanisation within the Eastern Creek Precinct and across the broader WSEA will alter the visual character of the area.

The proposed development, with respect to form and finishes, is considered to be consistent with modern industrial design. While it is acknowledge that the site, in particular the stacks will be seen at some distance from the site, being visually prominent does not in all instances result in an adverse impact.

At a site and precinct level the development is visually consistent with the existing and the likely future character of development within the area. Visibility of the stacks is most pronounced at the sub-regional

scale (i.e. >1-5km away from the site) at this distance, separation has a diminishing effect on their scale and height. That when combined with the muted tones and colours combined with low reflectivity materials have been selected to promote a subdued appearance that will blend with the surroundings of the site.

The development will not contribute to a negative cumulative effect on visual amenity.

27.3. MITIGATION MEASURES

The following measures have been compiled based on the Environmental Impact Assessment undertaken in the preparation of the amended EIS and following review and consideration of the issues raised in consultation with government agencies.

They provide a commitment by The Next Generation NSW and indicate the responsibilities required to implement measures to prevent potential environmental impacts that have been identified through the assessment.

This will ensure that the proposed Development is environmentally, socially and economically sustainable.

Schedule 2 of the Environmental Planning and Assessment Regulation 2000 requires a full description of the measures proposed to mitigate any adverse effects of the development on the environment.

The collective measures required to mitigate the impacts associated with the proposed works are detailed within Table 100. These measures have been derived from the assessments in previous Sections and those detailed within the appended consultant reports.

In many cases, the operational and environmental management controls inherent to operation of the Facility adequately manage the potential impacts. In these cases no additional mitigation measures are required to address the potential impacts.

For this reason, the below summarises both mitigation (where relevant) and environmental control measures.

Table 100 – Mitigation and environmental control Measures

Matter	Mitigation Measure	Timing
Key Area: Site Layout and Design		
Visual Amenity	Materials and colours in accordance with those shown on Drawing No AR-KTA-1911 Rev 2	Construction
	Implementation of landscaping in accordance with the concept land design package by Site Image. Final landscape detail and plant selection to consider the use of plants resistant to saline soils.	Prior to issue of Occupation Certificate
Lighting	All lighting used on site shall be implemented in accordance with AS4282 ‘Control of the obtrusive effects of outdoor lighting	Construction and Operation.
Signage	No more than three (3) signs to be erected on the site. Signage to be in accordance with Krikis Taylor Signage Plan Drawing No. AR-KTA-1901 Rev 2.	Construction
CPTED	• Site layout in accordance with Krikis Tayler Architectural Plans; • Implementation of site boundary fencing;	Construction and operation.

	• CCTV will be used to monitor the site and 24 hour security personnel; • Use of appropriately placed lighting to ensure sightlines and promote recognition; • Ongoing maintenance of landscaping and site.	
Water Demand (Landscaping)	• A water demand strategy will be developed to identify measures aimed maximising the potential for water reuse on amenity landscaping.	Prior to construction certificate.
Key Area: Waste Management		
Waste Streams	TNG may only receive and process the following residual waste materials: • Genesis MPC Chute Residual Waste; • Construction and Demolition; • Commercial and Industrial; • Floc Waste; • AWT; • GO Waste; • Paper Pulp; and MRF TNG shall not receive or process hazardous waste materials.	Operation: Ongoing
Waste Management: Receipt of waste materials	Prior to commencement of operations, the operator shall develop an appropriate waste screening methodology. At a minimum the plan will include the following details; • Details of the residual waste streams that may be accepted from third party authorised facilities; • Detailed procedures for all employees on the process of accepting residual waste materials, including - Preliminary inspection of waste, source verification and CCTV footage; - Visual inspection post tipping; • Contractual tools such as penalties or right of refusal for delivery of waste with high lead or nickel concentrations;	Develop prior to operations, implementation of plan at operation and ongoing.

	• Pre-screening, sorting and separation processes to remove hazardous materials at MPC, PSC and/or other authorised facilities. • Reporting tool for the tracking of waste volumes and types received and processed.	
Waste Management: Audit Framework	Develop and implement auditing framework for external residual waste fuel suppliers. That should include details of: • The identification of an independent auditor(s). • The frequency with which audits may be undertaken; • Standards that external residual waste fuel providers are required to meet to process waste at TNG; and • Contractual penalties for authorised facilities who fail the independent audit.	Prior to the commencement of operations.
Ash Handling and Management	• APC residues will be collected into sealed storage silos and transported via sealed tanker off-site for further treatment or disposal at landfill. In the event APC residue exceeds the criteria for Restricted Solid Waste, the residue will be taken off site to a Hazardous Waste Treatment facility, in line with relevant hazardous waste legislation.	Operation: ongoing
	• Bottom ash from the grate will be removed by quenching with water and moving it by conveyor to the enclosed ash storage bunker where it is stored prior to being transported off-site. The conveyor passes under a magnetic separator to remove ferrous materials.	Operation: ongoing
	• Boiler ash will be disposed of with the APC residues, unless it can be proven to be reusable following rigorous testing procedures in compliance with EPA regulations.	Operation: ongoing
	• Any ferrous material removed, post combustion, shall be directed to an appropriate reuse and/or recycling facility.	Operation: ongoing
Waste Management Output (Disposal)	Develop and implement an operational waste management plan in accordance with the section 6 of the Ramboll, WMR. The plan shall detail, as a	Operation: ongoing

	minimum: • Storage methods and location of all wastes arising; • Where disposal is required, the location of disposal; • Maintain waste register of all outgoing wastes, in particular; • Procedures for storing and transporting hazardous waste; • Options to immobilise waste will be examined in the event that sorting does not reduce lead and nickel concentrations to be able to achieve a 'restricted solid waste' classification; and • Periodic testing of bottom ash.	
Key Area: Air Quality, Human Health & Odour		
Maintain Target Air Emissions	• Implement BAT, as set out in Table 7-2 of the Pacific Environment; Air Quality and GHG Assessment. • Implement an appropriate maintenance schedule to ensure that FGT systems operate appropriately. • The plant shall be managed by a duly qualified specialist and trained personnel.	Construction and operation
Emission Concentrations (Normal Operations)	• Proposed energy from waste facility operating using emission rates set by the POEO Act, with the exception of Cd which will be set at the limit prescribed by the Industrial Emissions Directive (IED; Directive 2010/75/EU).	Operational Condition: Ongoing
Monitor Emission Concentrations	• Implement continuous monitoring system to ensure facility operates within acceptable parameters; • Set CEMs to commence safe shutdown procedures if emission limits are exceeded	Operational Condition: Ongoing.
Fugitive Dust Emissions	• Construction of new Estate Road to provide a sealed surface and reduce dust emissions from vehicles; • Tipping hall building to be kept under negative pressure whereby air within the building will be used as excess air for the boilers, limiting the	Site preparation and Construction

	release fugitive dust emissions generated within the shed to the ambient environment (as this will subsequently pass through the FGT's bag house	
Waste Fuel	• Management of incoming waste fuels received from external sources (i.e. other than Genesis MPC); • Mixing of waste fuel to ensure homogenising and to manage waste fractions (including chlorine and wood waste)	Operation: ongoing
Emergency Conditions: Use/Operation of Diesel Generators	Imposition of operating conditions that: • Limits the use of diesel generators restricted to "black start" associated with plant upset; a • Limit the Use of diesel generators is not to exceed 200 hours in any calendar year (a calendar year would commence on the day the EfW plant becomes operational). • Imposes emissions restrictions on the diesel generators.	Operation: ongoing
Plant Upset Conditions	Impose conditions limiting concentration emissions during upset conditions. In the event of upset conditions leading to mass emissions, the Plant CEMS will trigger a shutdown. Require the preparation and implementation of a response plan outline protocols to be followed in the event of an upset, including: • Staff evacuation measures; • A notice systems to alert the EPA and local Councils, including Penrith and Blacktown; • Any other measures deemed necessary to ensure that all possible measures are taken to limit the potential impact. • Maintain records of any regarding any incident, including details of cause (if known); action taken and any changes in the management of the facility implemented in response.	Operation: ongoing
EfW Plant Maintenance	• Plant may operator more than 8,000 hours in a year to allow for regular maintenance;	Operation: ongoing

	• The operator shall develop a maintenance schedule and keep a record of all major maintenance work carried out.	
Plant Operation and Staff Training	The proponent shall appoint a qualified plant operator to manage the EfW facility and oversee implementation; The operator shall ensure that all employees are suitable trained.	Implementation and Operation.
Key Area: Ozone		
Release of NO_2	Use of BAT in flue gas treatment, specifically use of a SNCR.	Implementation/Operation
	Continuous emissions monitoring to ensure they are within acceptable limits	Operation Ongoing
	Reporting of emissions to NSW EPA.	Operation: Ongoing
Key Issue: Odour		
Nuisance odour (offsite) waste storage and receipt	TNG will not accept or process putrescible waste streams.	Operational: ongoing
	The tipping hall will utilise high speed at the entrance and exit to limit the period with which fugitive emissions can escape.	
	All waste storage and unloading, associated with TNG will take place within the tipping hall building, which is kept under negative pressure.	
Nuisance odour (emissions) No mitigation required, removed through thermal treatment.	Excess air extracted from the building will be reused in the boiler (i.e. eliminating potentially odorous air through thermal oxidation).	Operational (ongoing)
	odorous compounds undergo chemical decomposition through thermal treatment.	
Key Area: Noise and Vibration		
Construction Phase: Noise Mitigation		
Construction Noise impacts on residents	Prior to the commencement of any work the proponent will prepare a detailed construction noise management plan • Communication with the potentially affected receiver locations to inform of the proposed works, durations and potential for noise. • Identification of key noise impacts.	Prepared prior to CC; implemented through construction.

	• Noise management measures. • Noise monitoring on site and at sensitive receivers. • Training and awareness of on-site personnel. • Incident and emergency response. • Non-conformance, preventative and corrective action.	
Construction Noise Management	Construction Site Management Plan that includes measures to ensure noise is kept to a minimum. The plan shall include: • A Site induction that makes workers aware of the location of sensitive receivers and protocols to implemented to ensure management of noise beyond site. • Ensuring work occurs within approved hours. • Ensuring plant and equipment is well maintained and not making excessive noise. • Not operating equipment simultaneously, where possible. This has the potential to substantially reduce noise emissions. • Turning off machinery when not in use. • Mitigation of specific noise sources may be possible by using portable temporary screens or site structures. • Maximising the offset distance between noisy plant items and receivers where possible, especially during more sensitive periods (evening and night). • Orientating directional noise emitting equipment away from receivers. • Operating excavators and other mobile plant in a manner that would reduce the likelihood of maximum noise level events occurring such as: - Sudden changes in vehicle direction/engine load. - Shaking excavator buckets. - Excavator buckets or similar contacting the ground or other solid structures. • Carrying out loading and unloading away from sensitive receivers.	Site preparation and construction.

	• Selecting plant and equipment based on noise emission levels. • Use of residential class mufflers to reduce noise emission from mobile plant such as dozers, cranes, graders and excavators. • Using alternative construction methods. • Using spotters, closed circuit television monitors, “smart” reversing alarms, or “squawker” type reversing alarms in place of traditional reversing alarms.	
Construction Noise: Nuisance and Disturbance	Noise monitoring will be conducted as part of the construction noise management plan. It will follow the principles for noise monitoring outlined in Appendix C and be made up of a combination of continuous long term unattended and short term attended noise monitoring. Attended monitoring will also be conducted at appropriate intervals during each major construction stage, and in response to complaints, where appropriate.	Prior to commencement to inform development of CEPM and during construction work as required.
Out of Hours construction noise.	Prior to undertaking or commencing any out of hours works including phases of 24 hours construction works and those planned to occur over the IN “night time” hours the proponent must give a minimum of 48 hours notice to those residents most likely to be affected. Notice must be in writing and provide residents with a 24 hours complaints line and the details of the authorised personnel who will be onsite throughout the works and their contact details.	Construction: As need in response to OSH
Operational Phase: Noise Mitigation		
Noise from plant operation	Implementation of the Noise Management Plan, in accordance with Appendix D of the Noise Impact Assessment prepared by Pacific Environment.	Operation: Ongoing
	• Conditions of consent requiring performance of the facility to be consistent with the environmental noise goals of the project will be considered when selecting plant and equipment.	Construction and Operation.
Noise Management: plant selection and building materials	• The selection of plant and equipment will ensure the environmental noise goals of the project will be considered • All building envelope materials will have the same or better performance than those used in the Pacific Environment Assessment • Building facades will be constructed so they are continuous and contain no gaps between panels and sections.	Detailed design and prior to the issue of a Construction certificate

	• Buildings will have openings orientated away from receivers, where possible. The opening will be designed so as to not compromise the acoustic performance of the building and remain closed where possible.	
Noise from Trucks and plant	Where possible, broadband or smart reversing alarms will be fitted to all vehicles on site, in order to reduce the potential impacts caused by tonal style reversing alarms.	Operation: ongoing
Monitoring Operational Noise	Noise monitoring will be carried out to establish the noise emission level of the facility at sensitive receptors and determine compliance. In the event of a noise complaint received from the community and during the initial stage of the development's operation, compliance noise monitoring will be conducted. Noise will be monitored at the most critical time of day near the complainant and near the identified source of the impact.	Operation: During Proof of Performance trial period.
Noise from site operations	Develop and implement an operational noise management plan aimed at minimising disturbance of sensitive receivers.	Operations.
Key Area: Soil and Water		
Groundwater and Groundwater Dependant Ecosystems	No mitigation	N/A
Groundwater: Contamination Prevention	Implementation of groundwater drainage system around the entirety of the proposed waste bunkers to assist groundwater re-entering the strata.	Construction
	Monitoring of groundwater surrounding the waste bunkers, by incorporation of inspection manhole to enable periodic inspection of groundwater levels surrounding the waste bunkers. Monitoring of groundwater quality will include a monitoring for hardness.	Operation: ongoing
Erosion and Sedimentation	A detailed Erosion and Sediment Control Plan (ESCP) will be developed for the construction phase of the project. This will include a detailed description of the proposed overall approach and specific erosion and sediment control measures including the following: • Proposed phasing of works (it is suggested that this be based upon the final stormwater catchments for the completed development; with excavation, filling and surfacing carried out area by area from north to south).	Prior to works commencing. Maintained throughout construction works.

	• Requirements for, and design sizing of sediment basins and associated catch drains; • Detailed erosion control measures; • Proposed systems for management of inflows and pumping of accumulated rainfall (and any minor groundwater seepage from excavations; • Proposed monitoring of volumes of run-off, pumped water from excavations and discharge from the site during construction; and, • Details of the approach and methods to be employed in post-construction revegetation of the site. Erosion and Sedimentation controls will be installed and maintained in accordance with Department of Housing (1998), *Managing Urban Stormwater*, Soils and Construction, Fourth Edition. The following levels of control will be constructed: • Silt fences will be installed along the base of excavated slopes and stockpiles to prevent runoff. • Kerb inlet sediment traps will be installed at the completion of the drainage works. Whilst works are underway, geotextile filter fabric fences will be installed around open pits. To demonstrate the effectiveness of erosion and sediment control, a surface-water monitoring programme is proposed. This will include background, routine, and event-based (wet weather) monitoring.	
Water Quality	Undertake surface water quality monitoring program outlined in Section5.2 and Table 5.1 of Edison Environmental report dated 12 April 2015.	Implement prior to commencement of site works and maintain throughout Construction
Dust	Implementation of CEMP prepared by Brookfield Mulitplex, that as a minimum should include the following: • Management of spoil stockpiles; • Management of cleared land, including where necessary water spray/chemical soil stabiliser to suppress dust; • Laydown pads will be stabilised as soon as practicable following completion. Stabilisation methods may include the planting of suitable native grasses i.e.	Construction

	cooch grass (or as recommended by the project ecologist) to form a suitable ground cover; and • Sediment control devices will be implemented prior to any commencement of site clearing works and will be regularly inspected and maintained.	
Cut and Fill: Soil Health	• Reuse of spoil excavated from site; and any imported fill material to be VENM. • Where reuse of excavated soil occurs, visual observation will be maintained during excavation of the subsoil profile and soils showing clear evidence of high salinity (visible salt crystals etc.) should be removed and stored in covered stockpiles. Reuse of site as backfill material is considered acceptable although blending with less saline soils is recommended.	Construction.
Salinity: Environmental Health	The risk associated with salinity is also low, and the development is expected to reduce existing salinity impacts as a result of reduced recharge and improved drainage. Preparation of a detailed Salinity Management Plan, to include (but not be limited to): • Avoidance/minimisation of exposure of saline subsoils, minimise cut and fill; • Avoid disturbance in riparian zones and poorly drained areas; • Establish vegetation is areas subject to erosion and disturbance; • Consider salt-resistant construction materials in areas of shallow saline water tables; and • Monitor perched water tables. Landscaped areas will be planned with salt-tolerant vegetation.	Prior to CC and implanted through construction.
Salinity: Building Impacts	Undertake soil testing to confirm soil salinity content prior to commencement of construction (i.e. at the completion of bulk earthworks). Where necessary ensure construction materials to be resistant to the effects of salinity.	Prior to the commencement of construction.
Flood: Protection of Buildings	Implementation of Finished Ground Levels in accordance with the AT&L Civil works plans to ensure plant is a minimum of 2 metres above flood level.	Construction.
Flood: Ropes Creek Tributary and downstream properties	Construction of onsite detention basin. Outlet flow shall ensure that discharge rate of water from detention is in accordance with SEPP 59 or BCC requirements.	Construction and Operation: ongoing.

Salinity: Soil and Water Quality	Implement stormwater management plan prepared by AT&L, including WSUD elements within the bio-retention basin. Ongoing maintenance of the basin by TNG to ensure appropriate ongoing operation to suitable standards.	Construction. Operation: ongoing.
Water Availability	Connect to local potable water supply for use by Staff; Construct water storage tanks to provide secure source of water for firefighting purposes (water to be tanked in for initial supply); Implement rain water tanks to harvest water for re-use on landscaping.	Construction
Stormwater: Management	Implement AT&L Stormwater Management Plans as detailed in the Civil Works Package.	Construction and Operation
Stormwater: Quality	Implement bio-retention in accordance with Civil Works package prepared by AT&L.	Construction and Operation
Riparian Management	Limit works permitted within riparian corridor to the batter and swales associated with the construction of OSD/bioretention. Prohibit the removal of trees within the riparian corridor. Revegetation of the riparian corridor in line with the plan contained in the Abel Ecology report	Construction.
Water Demand	Connect site to potable water supply. Installation of water tank capable of retaining a minimum of 546,000 litres of water for firefighting purposes.	Construction.
Key Area: Human Health		
Emission Concentrations (Normal Operations)	• Proposed energy from waste facility operating using emission rates set by the POEO Act, with the exception of Cd which will be set at the limit prescribed by the Industrial Emissions Directive (IED; Directive 2010/75/EU).	Operational Condition: Ongoing
Monitor Emission Concentrations	• Implement continuous monitoring system to ensure facility operates within acceptable parameters. • Set CEMs to commence safe shutdown procedures if emission limits are exceeded	Operational Condition: Ongoing.
Emission Concentrations (Facility upset)	• In line with the EfW policy a series of trials and tests would be undertaken to ensure proper functioning of technology prior to full operation.	Operational Condition: time restricted
	• Following completion of PoP trials and within the first 12 months of commencing operations the proponent	Operational Condition: time

	will undertake a minimum of two (2) measurements (at least 3 months apart) of the following toxics: – Heavy metals; – Polycyclic aromatic hydrocarbons; and – Chlorinated dioxins and furans.	restricted (first 12 months)
Key Area: Traffic, Transport and Parking		
Design and delivery of parking (RMS)	• Deliver parking in line with proposal. • Car parking and associated access to be designed and constructed in accordance with:AS2890.1 – 2004; AS2890.2-2002 & AS2890.6 -2006 Off-Street Car Parking.	Construction and Operation: ongoing.
Management of access to the site during extended hours.	A Construction Traffic Management Plan is to be prepared prior to construction.	Prior to issue of Construction Certificate
Construction Traffic Management (RMS)	Development and implementation of a Construction Traffic Management Plan, detailing vehicle routes, number of trucks, hours of works, access arrangements and traffic controls.	Prior to the issue of a CC and implemented throughout construction works.
Key Area: Flora and Fauna		
Habitat Removal: Fauna Disturbance	Appointment of a project ecologist to undertake and oversee all flora and fauna pre-clearing, management and revegetation works.	Prior to the commencement of any works.
	Additional targeted fauna survey to determine the presence of the Cumberland Land Snail. In the event that targeted survey identifies the presence of the Snail, they will be relocated to the 1.29 hectares of RFEF.	Prior to vegetation clearing
	A pre-clearing survey will be undertaken and any vertebrate fauna and Cumberland Plain Land Snails captured will be moved to the retained area of River Flat Eucalypt Forest to the south of the development footprint;	Prior to commencement of any works on site.
	Prior to draining and filling of dam, any native fauna must be moved to wet areas within the Ropes Creek Tributary.	Prior to commencement of any works on site
	Implementation of roosting/nesting boxes within the riparian zone at a rate of 2.5:1 (i.e. 20 habitat boxes).	2 weeks prior to clearing surveys and any commencement of construction works, including the

		removal of any trees or vegetation from the site
Impact on vegetation by Construction	Erection of fencing to protect vegetation within the Ropes Creek Tributary.	Prior to commencement of any onsite works
Habitat and Flora Restoration:	Preparation of a vegetation management plan as a minimum to include: • Compensatory planting and replanting of a minimum 0.54ha of land within the Ropes Creek tributary riparian corridor using replacement CPW. Replacement canopy trees shall be planted at a ratio of 5:1; • Compensatory planting of a minimum area of 4.98ha within the Ropes Creek tributary riparian corridor or as otherwise shown on Figure 92 of the amended EIS using species from RFEF community. • All other trees species permitted to be removed will be replaced at a ratio of 2:1; • Landscaping implemented following construction will use locally indigenous flora ; • All replanted tree species will utilise tube stock (and not seed); • Weed management will be undertaken within the development proposal footprint. This will mitigate against further weed spread; a • Measures to prevent tree impacts during construction and prevent clearing within the riparian corridor. Ongoing (post construction) measures to ensure the establishment and maintenance of the Ropes Creek tributary. • The VMP will have a minimum post construction management and implementation phase of 2 years from completion.	Prior to CC and implanted as works commence, where relevant: Ongoing
Aquatic & soil health: sedimentation from site disturbance works (tree and ground cover removal)	Potential erosion will be mitigated through the use of sediment fencing adjacent to the downslope edge of the development footprint combined with maintaining and improving riparian planting.	Prior to the commencement of any works on site.

	Stormwater quality discharged from the site will meet or exceed the requirements of SEPP59 and thus this will mitigate against potential impact of poor water quality. The bio-retention basin will be planted with local indigenous wetland species to create wetland habitat	Construction and ongoing
Key Area: Visual Amenity		
Visual Impact Management	Implementation of the landscape and architecture plans as submitted, that include the following mitigation measures: • canopy tree planting along the north interface with the future Estate Road to act as screen planting that will softening the visual appearance of the built elements combined. Furthermore, large tree canopy plantings provide scale to the built form when viewed from the adjacent street. • Effective use of materials, including the use cladding of the buildings with non-reflective materials and subdued colours that mimic those found in the surrounding WSEA and landscape setting, including greys, browns and olive greens. The effective use of tonal shade achieves a dappled effect to building improving visual integration with the surrounding landscape. • Use of light grey finish on emission stack to aids visual integration in range of atmospheric conditions. Bright, un-natural colours have been avoided.	Post construction: ongoing
Plume visibility reduction	Implementation and management of technology design parameters including exit temperature of emission from stack at around 120°C and moisture of the flue gas of 15-18% is expected to reduce plume formation (noting the potential to occur in early morning and night in autumn/winter months).	Operational: ongoing
Avoidance of Obtrusive Lighting	all external lighting associated with the Facility will comply with Australian Standard AS 4282: 1997 – *Control of the Obtrusive Effects of Outdoor Lighting*. Night-lighting will be kept to the minimum required for operations and safety requirements.	Construction: ongoing
Key Issue: Airspace Operations		
Visual Impact Management	Implementation of the landscape and architecture plans as submitted, that include the following mitigation measures: • Canopy tree planting along the north interface with the future Estate Road to act as screen planting that will softening the visual appearance of the built elements combined. Furthermore, large tree canopy plantings provide scale to the built form when viewed from the adjacent street.	Post construction: ongoing

	• Effective use of materials, including the use cladding of the buildings with non-reflective materials and subdued colours that mimic those found in the surrounding WSEA and landscape setting, including greys, browns and olive greens. The effective use of tonal shade achieves a dappled effect to building improving visual integration with the surrounding landscape. • Use of light grey finish on emission stack to aids visual integration in range of atmospheric conditions. Bright, un-natural colours have been avoided.	
Plume visibility reduction	Implementation and management of technology design parameters including exit temperature of emission from stack at around 120°C and moisture of the flue gas of 15-18% is expected to reduce plume formation (noting the potential to occur in early morning and night in autumn/winter months)	Operational: ongoing
Avoidance of Obtrusive Lighting	all external lighting associated with the Facility will comply with Australian Standard AS 4282: 1997 – *Control of the Obtrusive Effects of Outdoor Lighting*. Night-lighting will be kept to the minimum required for operations and safety requirements.	Construction: ongoing
Key Area: Aboriginal and non-Aboriginal Cultural Heritage		
General Site Management: Aboriginal and Non-Aboriginal Cultural Heritage		
Heritage Value: Management of unexpected finds	In the event that unexpected archaeological remains not identified within the statement are discovered at the area, all works within the affected area should cease and dependant on the nature of the find the OEH or NPWS should be notified.	Site preparation and construction
	All contractors involved in the development should receive a Heritage Induction outlining the protocol regarding the identification of unexpected archaeological remains, and their obligations under the Heritage Act and the National Parks and Wildlife Act (NSW).	Site preparation and construction
Aboriginal Cultural Heritage Management		
Protection of Aboriginal Cultural Values	Incorporate Aboriginal Values management measures into CEMP identifying the location of known Aboriginal Sites, including Archbold 1 and 2 as well as the extent of EfW South.	Prior to CC and implemented till completion of works
	Erect fencing around Archbold Road 1 and 2 to prevent unintentional access or damage during construction	Prior to CC and implemented till completion of works

	Rebury retrieved artefacts in riparian corridor adjacent to Ropes Creek Tributary within EfW South Site, as identified in the Artefact Report and shown in Figure 100. Once reburied OEH is to be advised of their location and depth using the "update card" to permit update of records.	On completion of construction and prior to OC
Heritage Value: Management of unexpected finds	Develop an appropriate unexpected finds protocol	Develop prior to commencement of works. Maintain throughout "stage 1" construction.
Key Area: Hazard and Risk		
General Mitigation/Management Measure		
Hazard and Fire Response	Develop and implement hazard and fire response protocol detailing location of evacuation muster points and procedures to be implemented in case of emergency.	Operation: ongoing
Mitigation of Potential incidents arising from operations:		
On site incidents arising from the storage of hazardous materials and goods.	Implement the following site practices and tools • Development of a work permit system, including hot work permits; • Development of hazardous area diagrams in accordance with AS60079.10.2 be conducted; • Installation of monitor(s) in the waste bunker (further monitor recommendations below); • Implementation of all recommendations contained in Appendix A of the HRA by RawRisk.	Operation: Ongoing
Storage and Management of chemicals	Storage of all liquid chemicals shall be in a bunded control area and or double skinned tank with 110% of the stored capacity as per the *Work Health and Safety Regulation 2011*	Operation: Ongoing
Spill Management	Prior to commencement of operations a spill management procedure shall be developed and implemented. Spills of chemical substances within bunded areas required to be taken off site shall be classified and transported in accordance with the *Environmental Guideline: Assessment, classification and Management of Liquid and Non-liquid Wastes.*	Operation: Ongoing
Mitigation of Potential Fire Incidents		

Diesel tank leak, spill, immediate ignition and bund fire	Implement the following measures a diesel bund: • 1 powder type fire extinguisher per bunded area; • 1 hose reel with foam making capabilities per bunded area; and • 1 hydrant with foam making capabilities per bunded area.	Operation: Ongoing Construction (delivery of bund) and operation: ongoing.
PAC dust cloud, ignition and dust cloud explosion within storage silo	PAC Silo • Potential of nitrogen blanketing for the purpose of fire protection (via oxygen exclusion) will be investigated.	Operation: ongoing
Ignition of waste in bunker and full bunker fire;	*Waste Bunker* • Two 1900 L/min monitors shall be installed to provide complete coverage within the fuel bunker; • Monitors shall be installed such that access is provided externally from the fuel bunker; and • Monitors shall be installed on raised platforms to prevent trucks from colliding with the monitors.	Operation: ongoing Operation: ongoing
Transformer internal arcing, oil spill, ignition and bund fire	Transformers • 1 powder-type fire extinguisher per transformer. • A pump set shall be installed to provide adequate water pressure for the monitors; and • At least 504,000 L of firewater shall be stored at the Site.	Operation: ongoing
Management of fire incidents: Volume requirements	Ensure that the site has access to no less than 546,000L (a the environmental noise goals of the project will be considered 4 hour supply + 0.5 hours for firefighters to arrive) of water for the purposes of managing onsite fires.	Operation: Ongoing.
Bushfire Management		
Protect the site and plant from bushfire	Application and demonstration of the following: • Building construction for all aspects of the buildings excluding windows will need to be minimum FRL 30/30/30 where separation of 27m from grassland and 55m from forest is not achieved; • Openable portions of windows are to be screened with metal mesh maximum 2mm aperture; and	Construction

	• Water requirements. Fire hose reels must be provided, which is capable of reaching all extremities of the proposed development.	
Vegetation Management: Bushfire Management	• Maintenance of grass land between the facility and unmanaged grassland of adjoining sites to be mown as lawn.	Operation: Ongoing
Key Area: Services and Utilities		
Development of un-serviced land	Require services and infrastructure to be delivered prior to the commencement of operation.	Construction, prior to issue of occupation certificate

28. CONCLUSION

This amended EIS provides a consolidated assessment of potential environmental impacts that may arise as a result of the proposed construction and operation of an Energy from Waste Facility and the associated works.

In making this assessment, the amended EIS addresses the issues listed in the Director General's Requirements (**Appendix B**) and accords with Part 4.1 of the *Environmental Planning and Assessment Act 1979,* Schedule 2 of the *Environmental Planning and Assessment Regulations 2000* and *SEPP (State and Regional Development) 2011.*

The key issues for all components of the project identified in the DGRs have been assessed in detail, with specialist reports underpinning the key findings and recommendations outlined in the Environmental Assessment. It has been demonstrated that for each of the likely impacts identified in the assessment of the key issues will either be positive or can be appropriately mitigated. In many cases, the operational and environmental management controls inherent to operation of the Facility adequately manage the potential impacts, and mitigation measures are not required. However for the purposes of clarity the inherent technological qualities have been included.

The importance of the recovery of energy from waste as part of effective waste management is reflected in *NSW Energy from Waste Policy Statement 2014.*

> *The Environmental Protection Authority (EPA) recognises that the recovery of energy and resources from the thermal processing of waste has the potential, as part of an integrated waste management strategy, to deliver positive outcomes for the community and the environment. Energy from waste can be a valid pathway for residual waste where:*
>
> - *Further material recovery through reuse, reprocessing or recycling is not financially sustainable or technically achievable;*
> - *Community acceptance to operate such a process has been obtained.*

The diversion of waste from landfill, reducing the potential for methane emissions, while also providing a form of low carbon, renewable energy, is now recognised by Government as making an important positive contribution to the targets for dealing with waste.

It is therefore considered that the 'Do Nothing' scenario is not appropriate given the established need for new energy generation, including a need for low carbon generation. The alternative to the Facility proceeding would be continued operation of traditional landfill waste management operations which have been found to be inefficient and undesirable as a long term sustainable solutions to Sydney's expanding population and waste generation.

There are several alternative technologies available for the type of proposed Facility (including external kilns, fluidised beds, gasification and pyrolysis, plasma gasification and moving grate technology).

Given the combined objective of the proposed Development primarily as an electricity generating station but also as a waste solution, moving grate technology was the only technology considered due to its reliability and performance in relation to energy generation.

The selection of the Site for the proposed Development is directly related to its location within a large industrial area, its proximity to the M4 and M7 motorways, local electricity grid, and the direct synergies between the proposed Development and the adjoining MPC currently in operation which will provide a percentage of the waste fuels.

Whilst there are various methods of generating of energy from waste, the only one that is tried and tested in thousands of applications worldwide is moving grate technology. Alternative combustion techniques are available but do not have the same number of reference facilities and in some cases technology has been withdrawn from the commercial application market. The only other technologies that have achieved a degree of commercial development are gasification technologies, but these tend to rely on a modular form and so are not suited to large scale commercial facilities. They tend to be less efficient in converting the waste feedstock into electricity than moving grate technology over a range of different fuel types. This is an important consideration for achieving compliance with the waste hierarchy, and also commercially given the proposed Development is a commercial facility.

For the reasons set out above, the selected technology is a reciprocating grate system (a type of moving grate system).

The proposed Development represents a positive development outcome for the Site and surrounding area for the following reasons:

- The proposed Facility will ensure a safe, clean and reliable form of energy generation for Metropolitan Sydney now and in the future, while providing a means of waste management resulting in improved management or reduction for the need for landfill in the Metropolitan Sydney.

- The proposed Facility provides a sustainable solution to Sydney's growing waste generation.

- The proposed Facility will result in a net positive Greenhouse Gas effect, eliminating the emission of approximately 3 million tonnes of CO^2 per annum from landfill.

- No adverse impacts will be experienced by residential properties as the development is well separated from residential uses.

- The proposed Facility has been designed to respond to the Sites natural topography minimising the visual impact of the facility from the public domain and nearby sensitive land uses.

- The proposed Development is accompanied by a full suite of expert reports and drawings which address all the issues contemplated by the DGRs i.e. strategic planning, waste management, air quality and human health, noise, soils and water, traffic and transport, hazards and risks, flora and fauna, visual, greenhouse gas, and Aboriginal and non-Aboriginal Cultural heritage.

- The proposed Development is in the public interest in that it will generate in the order of 500 direct construction jobs and 55 new jobs during Facility operation, it contributes to energy security and diversity by providing additional low carbon, renewable electricity generating capacity, and supports the use of waste materials destined for landfill, thus saving landfill space and reducing greenhouse gas emissions from decomposing landfill matter.

Given the benefits of the proposed Development, its importance for the management of waste and clean energy production to the local community and wider Metropolitan Sydney and the effective management and mitigation of identified impacts, we are of the view that the development is worthy of the support.

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