Chapter 2

Strategic context

2 Strategic context

This chapter assesses how the proposal supports the objectives of relevant Government policies, strategies and plans, demonstrating the need for the proposal. It gives a strategic justification for EfW by describing its role in achieving Government objectives for waste and energy when considered as part of an integrated waste management strategy. It also describes the alternative sites considered for the proposed development, reviews the suitability of the preferred site and outlines the alternative layouts and designs considered within the site.

This chapter includes:

- An introduction to EfW
- A discussion on how the proposal supports relevant government policies, strategies and plans for waste, energy and land use
- An analysis of alternatives to EfW, alternative EfW technologies, alternative sites and alternative layouts and designs considered for the proposal, and that supported the selection of the preferred option
- Analysis of the site's suitability for the proposed use.

Chapter 4 Statutory context describes the legislation that this proposal must comply with to demonstrate the assessment pathway, permissibility and merits of the proposal.

2.1 Introduction to Energy from Waste

EfW refers to the process of converting waste materials into energy.

The Waste Management and Resource Recovery Association Australia (WMRR)[1] explains EfW as follows:

'Energy from Waste (EfW), also known as Waste to Energy (WtE), refers to a process of converting residual wastes into energy such as heat, electricity, or liquid transport fuels. The term EfW is broad, encompassing a range of thermal and biological processes. These include mature technologies, including combustion for heat and power, anaerobic digestion to generate biogas, and emerging technologies that allow waste to be converted to other energy products, such as gas or liquid fuels. EfW can form a vital part of a sustainable waste management chain, is fully complementary to recycling, and is already part of the global move towards implementing circular economy principles in waste management.'

[1] July 2019

For the purpose of this proposal, EfW refers to the recovery of energy through the thermal treatment of residual waste streams collected from a fully source-separated collection system or leftover after recycling and resource recovery. Source separation involves separating waste into common material streams or categories for separate collection. The EfW process significantly reduces the volume of waste being sent to landfill while generating baseload energy, part of which is categorised as renewable. Both the NSW Energy from Waste Policy Statement (NSW EfW policy) and the *Protection of the Environment Operations Act 1997* give a definition of thermal treatment as 'the processing of waste by burning, incineration, thermal oxidation, gasification, pyrolysis, plasma or other thermal treatment processes.'

In 2015, the NSW EPA published the NSW EfW policy which recognises that energy recovery is a valid pathway for managing residual waste in circumstances where higher-order material recovery is not possible. It reflects the environmental and human health protection objectives of the *Protection of the Environment Operations Act 1997* and the resource management objectives of the *Waste Avoidance and Resource Recovery Act 2001.* Note that the NSW EfW policy describes facilities that thermally treat non-eligible waste fuels as 'energy recovery facilities.' This term is interchangeable with 'energy from waste facilities' in the context of the WSERRC proposal.

While some residual materials are produced as a result of the EfW process, including incinerator bottom ash (IBA), boiler fly ash and flue gas treatment residues (FGTr) (which are further defined in **Chapter 3 Proposal description**), the EfW process typically leads to about 90% reduction in the volume (or 80% reduction in mass (tonnes)) of waste that would otherwise go to landfill. If IBA is reused for construction products, this number increases further to about 95% reduction in volume and mass of waste that would otherwise go to landfill. However, diversion from landfill will be dependent on the classification and fate of the wastes generated by the EfW facility.

2.2 EfW in the waste hierarchy

Figure 2.1 shows the waste hierarchy, a recognized waste management principle that guides the decision-making in Australia and internationally for the efficient use of resources. In New South Wales, the waste hierarchy underpins and is included in the objectives of the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act).

The waste hierarchy sets up an order of preference for how waste should be managed to help achieve the best possible environmental outcomes.
Waste avoidance is the best option, followed by resource recovery (including reuse, recycling and energy recovery) followed by treatment and disposal.

Waste should be managed at the highest practical level of the waste hierarchy to achieve the best outcome for the environment and for future generations. Economic, social and technological factors all play a role in determining the best practical outcome for specific waste streams.

On the waste hierarchy, energy recovery of residual waste is preferable to landfill because it recovers some value from the waste, reduces net GHG emissions, requires less land and diminishes the legacy impacts of landfills such as soil and water contamination from leachate as well as odour impacts. While operation of the facility will generate GHG emissions, consideration of factors including export of electricity back to the grid and the diversion of the equivalent waste which would otherwise be sent to landfill, results in the overall net reduction of GHG emissions by around 390,000t CO_2-e per year.

The NSW Government has a target of achieving 75% diversion from landfill by 2021 (WARR Strategy). The current diversion from landfill is 65%[2]. EfW as part of an integrated waste management strategy will help increase diversion from landfill.

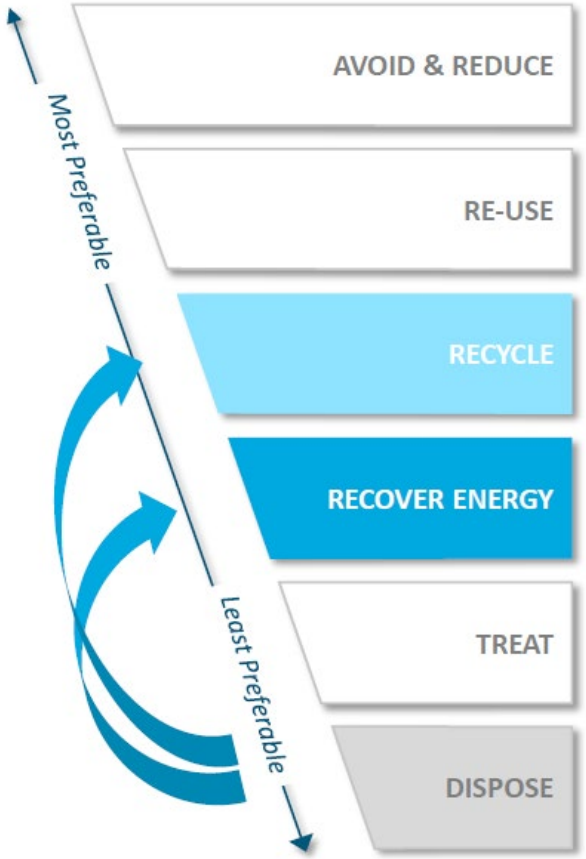


Figure 2.1: Waste hierarchy

[2] NSW EPA, *Waste Avoidance and Resource Recovery Strategy Progress Report 2017–18* (Sydney, 2019).

2.3 Global EfW context

Although EfW using thermal treatment is an emerging concept in Australia, it is a proven and widely used approach to treat residual waste globally with many operational examples located in highly populated urban areas.

In 2016, there were 488 EfW plants operating in Europe, thermally treating 93.3Mt of waste[3]. In the United States of America, 80 EfW facilities were operating in 2014 and processing 30Mt of waste annually.[4]

Internationally, the main drivers for developing EfW facilities include:

- The environmental benefits of EfW compared to landfill, such as:
  - Requiring a smaller land footprint, thus making better use of valuable land resources
  - Avoiding risks of soil, groundwater and surface water contamination through leachate migration
  - Avoiding landfill gas emissions which continue long after the landfill has closed
  - Decreasing general amenity impacts such as odour, vermin and pest issues
  - Promoting the proximity principle by treating waste close to the source of waste generation, reducing transport impacts
- Declining landfill space and availability due to a lack of suitable sites and social and environmental concerns limiting new landfills
- Legislative instruments such as landfill bans, mandatory waste diversion targets and the prohibition of waste transport for disposal
- Increasing price of waste disposal through increasing landfill tax levies associated with policy changes
- Synergies that EfW can offer with heat-demanding industrial facilities and urban heating systems, which offer attractive co-location opportunities
- Increasing price of fossil fuels and alternative production sources allowing EfW to be commercially competitive, coupled with increasing energy demand due to population growth as well as increasing waste generation
- EfW performing a useful urban function by reducing the volume of waste to be disposed and/or provision of affordable heating
- Incentive mechanisms designed to encourage low carbon and renewable energy generation which includes EfW
- Community expectations that valuable resources are used efficiently, and the environmental impacts of waste management are minimised.

[3] Confederation of European Waste-to-Energy Plants, 2019.
[4] USA Energy Recovery Council, 2014.

Moving grate is a common form of EfW combustion technology and is a recognised and proven EfW technology that has been used globally for over 50 years. In that time, the technology has been subject to continual improvement responding to regulatory, industry and public demands. Over 95% of facilities that thermally treat MSW and C&I waste to produce electricity worldwide use moving grate technology.

2.4 Australian EfW context

2.4.1 Approved EfW facilities

Although EfW is an emerging technology in Australia, there are other similar EfW facilities approved or already under construction in Australia. These include:

- Australia's first large-scale EfW facility located in Kwinana, Western Australia. Macquarie Capital is its co-developer, owner and asset manager. This facility is currently under construction and is expected to be completed in late 2021. This facility will process 400,000tpa of residual waste from MSW and C&I sources using moving grate technology to generate 36MW of baseload energy, part of which is renewable.
- The East Rockingham Resource Recovery Facility, which has recently started construction. This facility is expected to process around 300,000tpa of residual waste from MSW and C&I sources and up to 30,000tpa of biosolids from the Perth metropolitan area. The facility will use moving grate technology to generate 29MW of baseload energy, part of which is renewable.
- The Australian Paper EfW facility in Victoria, which achieved its key approvals in 2019. If the facility is developed, it will be capable of producing steam for the operation of the paper mill, and electricity for the mill or for export to the grid. It will thermally treat about 650,000tpa of residual MSW and C&I waste using moving grate technology to produce 225MW of thermal energy (steam and electricity).
- There are several other facilities that use residual waste as a feedstock including cement kilns.

2.4.2 NSW context

In New South Wales, demand for EfW is determined by the following:

- Resource recovery targets such as the WARR Strategy target to increase the amount of waste diverted from landfill to 75% by 2021, are unlikely to be achieved without EfW.

To achieve this target, more than 1.2Mt[5] of materials will need to be recycled when continued correcting for waste generation and population growth rates. The EPA recognises in the EfW Policy Statement that EfW can be a valid pathway for residual waste where further material recovery through reuse, reprocessing or recycling is not financially or technically feasible. In addition, overall waste generation is expected to increase as Sydney's population grows to around 10 million by 2036[6].

Despite waste generation per capita being expected to decrease (see **Technical report E Waste Flow Analysis for Greater Sydney**), population growth will result in more waste, which will need to be managed.

- Declining landfill space at existing landfills and social and environmental concerns limiting the development of new landfills
- Landfill levies and gate fees support the development of waste infrastructure including EfW facilities.
- Community expectations for a higher-order use for waste management than landfill.

Landfill airspace in the Sydney region is diminishing, with limited land suitable for expansion or new landfill developments. Sydney currently relies on two putrescible landfills to meet its waste disposal needs for MSW – Lucas Heights and Woodlawn. From 2033, it is expected to reduce to one facility – Veolia's Woodlawn Facility which is 220km from the proposal site – following the expected closure of the SUEZ facility at Lucas Heights (see **Technical report E Waste Flow Analysis for Greater Sydney**). EfW, as part of an integrated waste management strategy, will offer a solution to manage Sydney's residual waste stream that cannot otherwise be recycled in the current market, while generating energy in the process.

EfW can be used to recover useful energy and resources from Sydney's residual waste while reducing the volume of waste disposed to landfill, consistent with the waste hierarchy (**Figure 2.1**) and easing pressure on scarce landfill capacity.

2.5 Strategic policy

This section describes how the proposal supports the strategic outcomes identified in relevant Government waste, energy and land use policies, strategies and plans.

[5] WARR Strategy, 2014.
[6] http://www.planning.nsw.gov.au/Research-and-Demography/Demography/Population-Projections

The policies, strategies and plans relevant to setting the strategic context and justification of the WSERRC proposal include:

Waste:

- National Waste Policy – Less Waste, More Resources 2018
- NSW Waste Avoidance and Resource Recovery (WARR) Act 2001 (WARR Act)
- NSW Waste Avoidance and Resource Recovery Strategy 2014–2021 (WARR Strategy)
- Western Sydney Regional Waste Avoidance and Resource Recovery Strategy 2017–2021
- NSW EPA Energy from Waste Policy Statement (NSW EfW policy). The EfW policy describes detailed technical requirements for an EfW facility. These are discussed in **Chapter 5 EfW policy.**
- NSW Circular Economy Policy Statement 2019.

Energy:

- Commonwealth Renewable Energy Target Scheme
- NSW Renewable Energy Action Plan
- NSW Climate Change Policy Framework
- NSW Electricity Strategy.

Land use:

- Greater Sydney Region Plan – A Metropolis of Three Cities
- Central City District Plan (Greater Sydney Commission, 2018), part of the Greater Sydney Region Plan
- State Environmental Planning Policy (Western Sydney Parklands) 2009 (WSP SEPP, NSW Government, 2009)
- Western Sydney Parklands (WSP) Plan of Management 2030 (Western Sydney Parklands Trust, 2018).

Further discussion of SEPPs as they relate to the proposal is contained in **Chapter 4 Statutory context**.

It is noted that the Blacktown Local Environmental Plan 2015 (LEP) does not apply to land within the WSP. However, relevant requirements of the LEP are considered in various technical assessment reports throughout the EIS. **Table 2.1**, **Table 2.2** and **Table 2.3** analyse how the WSERRC supports the relevant objectives of waste, energy and land use policies, strategies and plans listed above.

Table 2.1: Evaluation of strategic waste policies, strategies and plans relevant to this proposal

Waste policies, strategies and plans	
Relevant provisions	**WSERRC proposal**
NSW Waste Avoidance and Resource Recovery (WARR) Act 2001 (WARR Act)	
The WARR Act promotes waste avoidance and resource recovery to achieve a continual reduction in waste generation and allows for the development of a state-wide Waste Strategy.	
The WARR Act's key objectives relevant to the proposal include: (a) to encourage the most efficient use of resources and to reduce environmental harm in line with the principles of ecologically sustainable development, (b) to ensure that resource management options are considered against a hierarchy of the following order— (i) avoidance of unnecessary resource consumption, (ii) resource recovery (including reuse, reprocessing, recycling and energy recovery), (iii) disposal, (c) to allow for the continual reduction in waste generation, (d) to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste, (e) to ensure that industry shares with the community the responsibility for reducing and dealing with waste, (f) to ensure the efficient funding of waste and resource management planning, programs and service delivery, (g) to achieve integrated waste and resource management planning, programs and service delivery on a State-wide basis, (h) to help in the achievement of the objectives of the *Protection of the Environment Operations Act 1997*.	The principles of ecologically sustainable development and how this proposal addresses each of the principles is described in **Chapter 25 Evaluation and conclusions**. The WSERRC proposal is not an alternative to recycling. Rather, it is part of an integrated waste management strategy for New South Wales, complementary to the other steps in the waste hierarchy and contributing to the WARR targets. Before arriving at the EfW facility, waste will be either pre-processed to recover valuable materials to be recycled and reused or collected from source segregated collections. On the waste hierarchy, energy recovery of residual waste is preferable to landfill because it recovers some value from the waste, needs less land, reduces net GHG emissions, lessens the legacy impacts of landfills such as soil and water contamination from leachate as well as reducing odour impacts. Materials will be recovered through the EfW process onsite including metals, which will be sold to metal recyclers, and IBA. IBA will be transferred off site to a separate facility (to be developed) where further metals recovery is currently intended to take place. Options for the reuse of IBA in construction products replacing virgin materials are being investigated, which would allow these materials to be returned to productive use. In addition, the renewable component of the energy generated by the proposal will displace carbon emissions from fossil fuel sources. The proposal will involve building a visitor and education centre to help educate and inform the community on the principles of waste management, waste avoidance, the circular economy, recycling, resource recovery and EfW.
NSW Waste Avoidance and Resource Recovery Strategy 2014–2021 (WARR Strategy)	
The Waste Avoidance and Resource Recovery Strategy 2014–2021 is the state-wide Waste Strategy for the purposes of the Act, which also includes a requirement for biennial progress reporting by the EPA. The NSW WARR Strategy sets clear directions for a range of priority areas over the seven-year Strategy period with the primary goal of enabling the NSW community to improve environment and community well-being by reducing the environmental impact of waste and using resources more efficiently. The key areas covered in the strategy will support investment in much-needed infrastructure, encourage innovation and improve recycling behaviour. They will also help develop new markets for recycled materials and reduce litter and illegal dumping. The Strategy notes that reuse and recycling will remain the main avenues for diverting waste from landfill as supplemented by energy recovery in the future. The WARR Strategy also points to the EfW policy (2015), as a vital policy step to maximise resource efficiency noting that the inclusion of resource recovery criteria in the EfW policy ensures that the availability of energy recovery in New South Wales will not undermine current or future material resource recovery. The NSW EPA is currently in the process of preparing a new 20 Year Waste Strategy, to set the future direction of the State's waste and resource recovery system, which will replace the current Strategy document. The new strategy may introduce different targets or priority actions for the state. However, the core principle of the waste hierarchy is enshrined in the overarching legislation and will continue to guide NSW EPA in its approach to resource management and landfill diversion. The new 20 Year Waste Strategy will replace the WARR Strategy 2014–2021. An Issues Paper, Cleaning Up Our Act: The Future for Waste and Resource Recovery in N SW was released for consultation in March 2020 and seeks feedback on various options for reform which are relevant and largely complementary to the WSERRC proposal. Three main points outlined in the Issues Paper that may be of relevance to the proposal include: 1. New South Wales can't absorb the waste it is currently exporting and with the closure of export markets, there is a need for increased onshore waste and recycling infrastructure and markets. 2. Mandatory source separation of organics 3. Review and improve the EfW policy to uphold the waste hierarchy. Possibly introduce restrictions on waste acceptance to landfill which are at least as restrictive as acceptance criteria on EfW. The 20 Year Waste Strategy is still under development, noting that this policy is not legislated and so not currently relevant to this proposal.	

Waste policies, strategies and plans

Relevant provisions	WSERRC proposal
The NSW WARR Strategy's key result areas relevant to this proposal include: • Theme 2: Increase recycling, with a target to increase recycling of municipal solid waste, and commercial and industrial waste, to 70%. • Theme 3: Divert more waste from landfill, with a target to increase the amount of waste diverted from landfill to 75%.	The WSERRC proposal is not an alternative to recycling. Rather, it is part of an integrated waste management strategy for New South Wales, complementary to the other steps in the waste hierarchy and contributing to the WARR targets. The WARR targets being to increase recycling of MSW, and C&I waste, to 70% and to increase the amount of waste diverted from landfill to 75%. Although New South Wales has set itself these landfill diversion and recycling targets by 2021–2022, actual recycling rates in the Metropolitan Levy Area (MLA) for MSW are currently short of this target. MSW recycling rates declined in the MLA from 52% in 2010–2011 to 42% in 2017–2018[7], highlighting the need for investment in responsible waste infrastructure that is proven and effective. The decline in recycling rates should also be understood in the context of an overall increase in waste generation associated with population growth, placing further pressure on declining landfill capacity. Further, to achieve the NSW recycling target, NSW needs greater source separation of recycling streams including food and garden organics (FOGO), plastic, paper and glass to allow clean streams of material with reduced contamination. Without source separation, the contamination makes it ineffective and costly to separate out waste streams for recycling. Dirty Mixed Recycling facilities (MRFs) and the revocation of Mixed Waste Organic Outputs (MWOO) cases are examples of this. The general and specific Resource Recovery Orders and Resource Recovery Exemptions for the application of MWOO to land was revoked by the EPA in October 2018 due to the contamination of the output product. It is expected that this change will have an adverse effect on the MSW recycling rate[8]. Government initiatives in New South Wales to encourage recycling include Waste Less Recycle More (WLRM) grants to help with investment in infrastructure for C&I recycling and increase more effective kerbside recycling such as targeting FOGO as well as developing markets to encourage innovation. However, despite government efforts to increase recycling, the rate of recycling is still low. Experience from European countries with the highest rates of recycling indicates that they are achieving recycling rates up to 66% of their waste, with the remaining recovery being from EfW[9]. Achieving higher landfill diversion rates involves thermal treatment of the residual waste that cannot otherwise be recycled within existing technical and financial constraints. This may change in the future as circular economy principles influence the design of materials and products, allowing these materials to be reused and recycled, reducing the amount of waste generated. However, options to manage residual waste will continue to be needed, including EfW. Currently, the Metropolitan Levy Area (MLA) which comprises of the Sydney metropolitan area, the Illawarra region and Hunter region, sends about 3.27Mt of MSW and C&I waste to landfill each year, as shown in the table below. This represents roughly 55% of the total MSW and C&I waste generated in the MLA and offers an opportunity for this waste to be used for higher-order energy and resource recovery. Table 2.1-1: Volumes of MSW and C&I waste in the Metropolitan Levy Area[10] **Waste** | **Generated tonnes** | **Recovered tonnes** | **Disposed tonnes** MSW | 2,959,000 | 1,218,000 (41.1%) | 1,741,000 (58.9%) C&I | 3,007,000 | 1,469,000 (48.9%) | 1,538,000 (51.1%) **Total** | **5,966,000** | **2,687,000 (45%)** | **3,279,000 (55%)** This proposal will mainly target residual MSW and C&I waste in the Western Sydney market, although the proposal may also accept waste from other regions in Sydney. The proposal will process 500,000t of residual MSW and C&I waste each year, which is about 15% of the MSW and C&I waste from the MLA that is currently disposed of to landfill[11]. Cleanaway has many existing contracts with Councils and businesses in Sydney for the collection and disposal of MSW and C&I waste and will continue to compete for new contracts as Councils and businesses renew their waste service providers. MSW collected by Cleanaway is taken to a disposal location as prescribed by Council – collection and disposal contracts are generally separated. Cleanaway will continue to compete for Council waste disposal contracts, offering the option to thermally treat residual waste at the WSERRC after pre-treatment at a processing facility as detailed under the NSW EfW policy resource recovery criteria. The WSERRC can also directly accept residual waste from Councils that transition to a collection system that includes a FOGO bin as well as C&I waste that meets source separation criteria as defined within the EfW policy. Cleanaway currently serves a significant proportion of the C&I waste market in Sydney. C&I waste is sent to Cleanaway's network of post-collection recycling and resource recovery facilities which recycle and recover materials for resale, with residual waste leftover currently sent to landfill. In addition to energy recovery, the WSERRC proposal will include a ferrous metal separator to recover large ferrous metals from the IBA for recycling and sale to market. The remaining IBA will be transported to a dedicated ash storage, treatment, metal recovery and maturation facility where non-ferrous metals (or secondary metals) recovery will be carried out. The ash storage and secondary metals recovery facility does not form part of this proposal and will be subject to a separate development application process which is discussed further in **Chapter 22 Related development**. Building on knowledge and practice elsewhere, the applicant will work collaboratively with industry partners to investigate the feasibility of developing a market for reuse of IBA in construction products.

[7] NSW EPA, *Waste Avoidance and Resource Recovery Strategy Progress Report 2017–18* (Sydney, 2019).
[8] WARR, *Strategy Progress Report 2017–18*
[9] OECD, *Australian National Waste Report* (2018).
[10] NSW EPA, *Waste Progress Report 2017–18*.
[11] EPA, *Waste Progress Report 2017–18*

Waste policies, strategies and plans	
Relevant provisions	**WSERRC proposal**
	Cleanaway also work to educate the community and businesses through its in-house sustainability team including the EPA Bin Trim program and the kNOw waste school's education program which are complimentary educational initiatives not part of this proposal. Cleanaway will encourage uptake of source separation for high-quality resource recovery and expects the prevalence of source separation, particularly FOGO collection services for households, to increase over time. WSERRC and Cleanaway will actively support the transition to FOGO with Councils including through the education of the community which is critical to a successful transition and achieving low contamination rates. Cleanaway has also recently invested in a 100,000tpa FOGO processing facility in Melbourne, demonstrating the company's ability to treat this waste stream, a capability it could bring to Sydney to support the FOGO transition.
Western Sydney Regional Waste Avoidance and Resource Recovery Strategy 2017–2021	
The Western Sydney Regional Waste and Resource Recovery Strategy 2017–2021 (Regional Waste Strategy) gives a clear direction for improving sustainable waste avoidance and resource recovery practices across the region and demonstrates the region's commitment to adopting a strategic approach to waste management. The regional strategy is a subset of the overall WARR strategy and describes how the region will contribute to and align with the State objectives and targets developed through the WARR Strategy. For Western Sydney, the aim has been to analyse future waste generation in the region and combine alternative treatment and energy recovery facilities to treat residual waste to meet the WARR Strategy targets. The Western Sydney region brings together the members of WSROC, including Blacktown City Council (BCC). This proposal sits within the LGA of Blacktown.	
The Regional Waste Strategy's key outcomes relevant to this proposal include: • Contribute to the achievement of the NSW 2021 WARR targets through regional collaboration • Support councils where services can be improved • Identify and promote best practice community engagement to raise awareness of waste avoidance and resource recovery • Work collaboratively to develop innovative waste management and resource recovery initiatives that maximise regional benefits.	As described above, the proposal will contribute to the State WARR Strategy targets for landfill diversion and recycling which will also support the achievements of regional waste strategy objectives. The WSERRC will offer an alternative waste management option which is a higher-order use for waste management than landfill. This can be specified in its waste disposal contracts. Community and stakeholder engagement for the proposal started early and continued regularly. Engagement activities aimed to raise awareness about EfW and its widespread use in reputable waste management systems overseas, as well as discuss the beneficial impacts of EfW diverting waste from landfill and recovering valuable resources including metals and ash. Future community engagement will occur through a community reference group (CRG) through the detailed design and construction phases and during operation through an onsite visitor and education centre, where visitors can learn about waste avoidance, best practice recycling and the circular economy. Building on knowledge and practice elsewhere, the applicant will work collaboratively with industry partners to investigate the feasibility of developing a market for reuse of IBA in construction products. Developing an EfW facility is innovative given that it is introducing a technology which is recognized overseas but new to New South Wales.
NSW Energy from Waste Policy Statement 2015	
The NSW EfW Policy Statement sets up a framework and overarching criteria to guide proposals for thermal energy from waste infrastructure in New South Wales. It covers all technologies undertaking thermal treatment of waste to recover energy and 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 bring beneficial outcomes for the community and environment. The Policy sets requirements that EfW projects must meet, including best available techniques for emissions control and waste management as well as technical, thermal efficiency and resource recovery criteria. **Chapter 5 EfW policy** describes how the proposal meets the relevant objectives and criteria of the EfW Policy Statement.	
National Waste Policy – Less Waste, More Resources 2018	
The 2018 National Waste Policy sets a framework for collective action by businesses, governments, communities and individuals until 2030 and sets a framework for businesses to embrace innovation and develop technologies that create new opportunities. The policy identifies five overarching principles underpinning waste management in a circular economy: 1. Avoid waste 2. Improve resource recovery 3. Increase use of recycled material and build demand and markets for recycled products 4. Better manage material flows to benefit human health, the environment and the economy 5. Improve information to support innovation, guide investment and enable informed consumer decisions. The Policy does not remove the need for governments, businesses and industries to apply tailored solutions in response to local and regional circumstances. The Policy presents a common vision on priorities for responding to changing international waste markets that will help Australia move closer to a more circular economy that eliminates waste and improves economic, social and environmental outcomes.	
The Policy aims to better support the economy, protect community health and reduce environmental impacts by harnessing the value of materials that would otherwise be disposed of by returning them to productive use.	The proposal will support the Policy by generating up to 55MW of energy to be exported to the grid, equivalent to, 440GWh of baseload energy per year, part of which is categorised as renewable, by using residual waste that would otherwise be disposed to landfill. This is enough electricity to power up to 79,000 homes for one year. The proposal will also recover metals from the combustion process onsite for sale to metal recyclers. Options for the offsite recovery and reuse of ash from the combustion process are also being investigated, building on experience in other jurisdictions where ash is used in construction materials. This proposal will reduce net GHG emissions by around 390,000t of CO_2-e per year by reducing landfill emissions such as methane (which continue well after the landfill has closed) and contributing to a partly renewable energy source which displaces fossil fuel energy and its associated emissions.

Waste policies, strategies and plans	
Relevant provisions	**WSERRC proposal**
Strategy 7: Increasing industry capacity Identify and address opportunities across municipal solid waste, commercial and industrial waste, and construction and demolition waste streams for improved collection, recycling and energy recovery, to achieve ongoing improvements in diversion from landfill, improved quality of recycled content and use of the waste hierarchy.	The proposal will be designed to thermally treat up to 500,000tpa of residual Municipal Solid Waste (MSW) and residual Commercial and Industrial (C&I) waste streams that would otherwise be sent to landfill. This process would generate up to 58MW of base load electricity some of which would be used to power the facility itself with up to 55MW exported to the grid. A proportion of the electricity generated would be categorised as renewable. The WSERRC is being developed by industry to address opportunities for waste in New South Wales to be managed in line with the waste hierarchy. On the waste hierarchy, energy recovery of residual waste is preferable to landfill because it recovers some value from Sydney's residual waste while reducing the volume of waste disposed to landfill and easing pressure on scarce landfill capacity.
NSW Circular Economy Policy Statement 2019	
The NSW Circular Economy Policy Statement 2019 sets the ambition and approach for the NSW Government to transition to a circular economy that will generate jobs, increase the robustness of the economy, increase the accessibility of goods, maximise the value of resources, and reduce waste. The policy covers common language and definitions, and decision-making principles to support Government. The aim of this policy is for New South Wales to transition towards a circular economy by focusing on seven key principles as outlined below.	
Principle 1: Sustainable management of all resources	The proposal will significantly reduce the volume of waste going to landfill by recovering energy from residual waste, reducing pressure on the limited landfill air-space resource in Sydney and the need to identify new disposal sites. Diversion of waste from landfill will also reduce the amount of landfill gas generated, including methane, which is a significant contributor to climate change. Metals will be recovered from the IBA through an onsite process, with the recovered metals sold to metal recyclers. IBA will be transported off site where further metals recovery will be carried out. Options for recycling of IBA will be investigated including recycling in construction products, returning these materials to productive use. The renewable component of the energy generated by the proposal will displace carbon emissions from fossil fuel sources. Options are also being investigated for the use of heat and steam by nearby industrial facilities. This will significantly increase the energy efficiency of the proposal.
Principle 2: Valuing resource productivity	The energy contained in residual waste is a valuable resource which can be put to a productive use, and metals and ash can be recovered from the residual waste for recycling. The proposal enables these resources to be captured rather than going to landfill, for sale to end-users. EfW also has a smaller footprint than landfills and so is a better use of valuable land resources.
Principle 3: Design out waste and pollution	The proposal will significantly reduce the volume of waste going to landfill by recovering energy from residual waste. Diversion of waste from landfill will also reduce the amount of landfill gas generated, including methane, which is a significant contributor to climate change. The EfW facility has been designed to remove harmful gases and heavy metals from the exhaust gas before the cleaned air is released through the stack. The proposal's intention over the long term is to develop markets in New South Wales to beneficially reuse IBA within construction products, subject to IBA being granted a resource recovery exemption by the EPA under the *Protection of the Environment Operations (Waste) Regulation 2014*. The EPA would be consulted with regarding any such IBA exemption. The Dublin (Ireland) reference facility included in this EIS uses IBA (post removal of other recoverable materials such as metals) as a construction material. There are many examples across Europe of similar ash reuse schemes.
Principle 4: Maintain the value of products and materials	EfW recovers energy for homes and businesses as well as powering the facility itself. The proposal will also recover materials such as metals which can be recycled and ash that has the potential to be used in construction products. As circular economy principles influence the design of materials and products in the future, these materials can be reused and recycled, reducing the amount of waste generated. The proposal will process 500,000t of residual MSW and C&I waste each year, which is about 15% of the MSW and C&I waste from the MLA that is currently disposed of to landfill[12]. Since the proposal is only aiming to process 15% of current residual waste generation rates, it means that if residual rates decrease due to increased recycling then the facility is not undermining the advancement of higher-order waste principles. The proposal has the flexibility to accommodate improvements in resource recovery and changes in feedstock over time.
Principle 5: Innovate new solutions for resource efficiency	IBA, which is a residual waste from the EfW process is composed of inert, non-combustible materials which makes it viable to be used in construction products. Although not yet well-known practice in Australia, IBA is currently used in Europe in a variety of construction products including aggregates, roads and landfill capping material. The Dublin (Ireland) reference facility included in this EIS uses IBA (post removal of other recoverable materials such as metals) as a construction material. There are many examples across Europe of similar ash reuse schemes. Building on knowledge and practice elsewhere, the applicant will work with industry partners to investigate the feasibility of developing a market for reuse of IBA in construction products.
Principle 6: Create new circular economy jobs	The proposal will support this principle as it represents a major investment in Western Sydney of about $645m. It is estimated that the proposal will create 900 direct construction jobs over the 3-year construction period and in addition between 700-1200 indirect construction jobs. Further, 50 highly skilled jobs will be created locally during operation. In particular, the proposal will need and create new skill sets and employment opportunities in Western Sydney not otherwise currently available in the region.
Principle 7: Foster behaviour change through education and engagement	The proposal will include building a visitor and education centre to help educate and inform the community on the principles of the circular economy, recycling, resource recovery and EfW. WSERRC and Cleanaway will actively support additional source separation and promote the transition to FOGO with Western Sydney Council's and Cleanaway's C&I customer base including through the education of the community, which is critical to a successful transition and achieving low contamination rates. Cleanaway has also recently invested in a 100,000tpa FOGO processing facility in Melbourne, demonstrating the company's ability to treat this waste stream, a capability it could bring to Sydney to support the FOGO transition.

[12] EPA, *Waste Progress Report 2017–18*

Table 2.2: Evaluation of strategic energy policies, strategies and plans relevant to this proposal

Energy policies, strategies and plans	
Relevant provisions	**WSERRC proposal**
Commonwealth Renewable Energy Target Scheme	
The Commonwealth Renewable Energy Target Scheme forms part of the *Commonwealth Renewable Energy (Electricity) Act 2000*. The Scheme is designed to reduce emissions of greenhouse gases in the electricity sector and encourage the additional generation of electricity from sustainable and renewable sources. The scheme has two parts, small-scale energy generation and large-scale power stations. Under the *Commonwealth Renewable Energy (Electricity) Regulations 2001*, eligible renewable energy sources include biomass-based components of municipal solid waste. On this basis, the proposal is eligible for participation in the large-scale power station scheme. The Large-scale Renewable Energy Target (LRET) incentivises the development of renewable energy power stations in Australia through a market for the creation and sale of certificates called large-scale generation certificates (LGCs). Based on quarterly waste audits done at Cleanaway's Erskine Park Waste Transfer Station (to understand expected feedstock composition, energy and carbon content), it is expected that the proposal will be eligible for LGCs equivalent to roughly 50% of the electricity produced.	
(a) to encourage the additional generation of electricity from renewable sources; and (b) to reduce emissions of greenhouse gases in the electricity sector; and (c) to ensure that renewable energy sources are ecologically sustainable.	The proposal would form an eligible generation category under this Scheme. The large-scale renewable energy target of 33,000GWh means that about 23.5% of Australia's electricity generation in 2020 needs to be from renewable sources. While it is close to the end date of the scheme, it is likely that renewable energy generation targets will extend beyond 2020. The proposal would generate up to 58MW of base load electricity some of which would be used to power the facility itself with up to 55MW exported to the grid, equivalent to 440GWh of baseload energy per year, part of which is categorised as renewable. This is enough electricity to power 79,000 homes for one year.
NSW Renewable Energy Action Plan	
The NSW Renewable Energy Action Plan responds to the national renewable energy target set in 2013. The plan identifies opportunities for renewable energy in New South Wales and identifies actions that aim to attract renewable energy, build community support for renewable energy and grow expertise in renewable energy technology.	
Support the National target of 20% renewable energy generation by 2020.	The proposal will support the generation of up to 55MW of energy on a net basis to be exported to the grid, equivalent to 440GWh of baseload energy per year. This would be equivalent to the production of enough electricity to power 79,000 homes for one year. The renewable portion of energy generated by the proposal is assumed to be 50% (about 220GWh), which is equivalent to around 0.66% of Australia's current Renewable Energy Target of 33,000GWh.
NSW Climate Change Policy Framework	
The NSW Climate Change Policy Framework commits NSW to supporting the achievement of Commonwealth interim greenhouse gas emissions reduction targets of 5% below 2000 levels by 2020 and 26% to 28% below 2005 levels by 2030.	
The Framework sets an aspirational emission reduction objective for New South Wales of net zero emissions by 2050.	Regarding GHG emission reductions, the proposal would contribute to the production of a partly renewable energy source in a safe, reliable and affordable manner. The proposal will produce the equivalent amount of energy to power 79,000 homes in Western Sydney, reducing net GHG emissions by around 390,000t CO_2-e per year, also equivalent to taking about 85,000 cars off the road each year.
NSW Electricity Strategy	
The NSW Electricity Strategy is the NSW Government's plan for a reliable, affordable and sustainable electricity future. The plan responds to current challenges and opportunities in New South Wales, including energy efficiency, reliability, electricity emergencies and renewable energy.	
Promote private sector investment in energy generation Promoting utility scale renewable energy sources	The proposal will support the generation of up to 55MW of energy on a net basis to be exported to the grid, equivalent to 440GWh of baseload energy per year, part of which is categorised as renewable. This would be equivalent to the production of enough electricity to power 79,000 homes in Western Sydney for one year. The renewable portion of energy generated by the proposal would be equivalent to 0.5% of Australia's current Renewable Energy Target of 33,000GWh. The proposal represents a significant private sector investment in baseload energy generation in New South Wales, part of which is categorised as renewable, creating jobs during construction and operation. This is consistent with the Strategy, which notes the NSW Government's preference is for the market to generate the investment necessary to ensure reliable and affordable electricity. The Strategy also references the Australian Energy Market Operators (AEMO) Integrated Systems Plan (ISP) which demonstrates that retiring coal plants can be most economically replaced with a portfolio of utility-scale renewable generation, storage, distributed energy resources, flexible thermal capacity, and transmission (AEMO, ISP, 2018). As a utility-scale baseload energy project, part of which is categorised as renewable, brought by the private sector, WSERRC contributes to the objectives of the NSW Electricity Strategy.

Table 2.3: Evaluation of strategic land use policies, strategies and plans relevant to this proposal

Land use policies, strategies and plans	
Relevant provisions	**WSERRC proposal**
Greater Sydney Region Plan – A Metropolis of Three Cities	
The Greater Sydney Region Plan sets a 40-year vision (to 2056) and forms a 20-year plan underpinning each of three City District Plans. The proposal is in the Central City District. The plan brings new thinking to land use and transport patterns to boost Greater Sydney's liveability, productivity and sustainability by spreading the benefits of growth. As the district plans are the means to apply the Region Plan, the relevant objectives of the Greater Sydney Region Plan are covered in the discussion on the Central City District Plan below.	
Central City District Plan (Greater Sydney Commission, 2018), part of the Greater Sydney Region Plan.	
The Central City District Plan is a 20-year plan to manage growth in the context of economic, social and environmental matters for the local government areas of Blacktown, Cumberland, Parramatta and The Hills. The site is in the Central City, one of three City Districts that make up the Greater Sydney Region. The District Plan sets out a vision for the Central City, which will be applied through several objectives. The key objectives of the Plan relevant to this proposal include the following:	
Planning Priority C1: Planning for a city supported by infrastructure	The proposal will create infrastructure that is significant to the effective working of a city – infrastructure to manage the waste of a growing population and generate a source of baseload energy. In a context of limited space for waste management infrastructure, the proposal is using a site that is located in an area with other reputable waste management infrastructure. This proposal's location within Western Sydney also means that waste management infrastructure is close to the point of waste generation sources, reducing the economic and environmental costs of waste transportation in line with the proximity principle.
Planning Priority C2: Working through collaboration	The development of the WSERRC proposal has been informed by a comprehensive approach to community and stakeholder engagement. The community was engaged before and during the EIS process and will continue to be engaged during EIS exhibition. If the Proposal is approved, the community will continue to be engaged throughout construction, operations and for the life of the project with the visitor and education centre playing a crucial role in offering information on the role of EfW in managing waste as part of an integrated waste management strategy. Community research has been conducted to understand their issues, ideas, and sentiment and to recognise their preferences for how they wanted to be engaged on the proposal. The findings from this research have been applied throughout the community engagement strategy. Further information on community collaboration can be found in **Chapter 6 Engagement**. A collaborative approach has also underpinned efforts by Cleanaway and Macquarie Capital to identify a solution for the reuse of IBA. While not part of this proposal, Cleanaway and Macquarie Capital are working with industry partners to investigate the feasibility of developing a market for reuse of IBA in construction products. IBA is composed of inert, non-combustible materials which makes it viable to be used in construction products. Although not yet common practice in Australia, IBA is currently used in Europe in a variety of construction products including aggregates, roads and landfill capping material. The Dublin (Ireland) reference facility included in this EIS uses IBA (after removal of other recoverable materials such as metals) as a construction material. There are many examples across Europe of similar ash reuse schemes.
Planning Priority C11: Maximising opportunities to attract advanced manufacturing and innovation in industrial and urban services land	While not a manufacturing facility, the proposal to develop an EfW facility is innovative given that it is introducing a technology which is recognized overseas but new to New South Wales. Cleanaway and Macquarie Capital are also investigating options to reuse IBA in construction products, as described above.
Planning Priority C13: Protecting and improving the health and enjoyment of the District's waterways	The site design includes realignment of the overland flow path along the eastern boundary of the site and clearing and revegetation with native species. This will contribute to better biodiversity and water quality outcomes in the overland flow path which connects to Reedy Creek to the north.
Planning Priority C15: Protecting and enhancing bushland, biodiversity and scenic and cultural landscapes	Species within the threatened Cumberland Shale Plains Woodland vegetation class are native to the proposal site. However, the existing site is degraded and dominated by exotic grass and weeds, with small patches of regrowth in poor to very poor condition. The planting design for the proposal aims to restore this native vegetation by use of tree, shrub, grass and riparian species. A vegetation management plan (VMP) for the proposal has been prepared to guide the revegetation works and restoration of the overland flow path on site. Existing mature native trees will be retained where possible and safe to do so, particularly along the overland flow path.
Planning Priority C16: Increasing urban tree canopy cover and delivering Green Grid connections Objective 30 Urban tree canopy cover is increased. Objective 32 The Green Grid links parks, open spaces, bushland, and walking and cycling paths. Action 68. Expand urban tree canopy in the public realm Action 69. Progressively refine the detailed design and delivery of: (a) Greater Sydney Green Grid priority corridors and projects vital to the District (b) opportunities for connections that form the long-term vision of the network.	The District Plan recognises the significant role of the WSP in contributing to another objective – linking parks, bushland, playground and waterways through the Greater Sydney Green Grid. The location of the proposal on the western perimeter of the WSP, adjacent to the M7 and existing industrial facilities and on land of low environmental or recreational value, will avoid the areas of the WSP that are used for recreation, supporting the aims of the District Plan to integrate the Green Grid with the WSP. However, the overall landscaping plans for the proposal site will see the replacement of poor-quality vegetation with new native planting, expanding the urban tree canopy and restoration of Cumberland Plains Woodland species. The detailed design of the proposal will include a landscaping plan which may contribute to the further integration of the Green Grid with the WSP, subject to consultation with the WSPT. Native planting within the site offers biodiversity links to surrounding vegetation corridors. The landscape design responds to operational and aesthetic amenity through: • Water capture and treatment, ephemeral planting and embankment stabilisation within the bioretention basin, onsite detention basin and an overland flow path. • Green walls to the north and south end of the main facility, and green roof to the visitor and education centre to help with grounding the built form into the landscape • Revegetation of Cumberland Shale Plains Woodland species and overland flow path • Use of native hardy species to maintain an attractive and low maintenance landscape.

Land use policies, strategies and plans	
Relevant provisions	**WSERRC proposal**
(c) walking and cycling links for transport as well as leisure and recreational trips. Action 70 Create Greater Sydney Green Grid connections to the Western Sydney Parklands	Direct bike and walking path linkages to other areas of the WSP have not been included, due to the industrial nature of operational activities that will occur on the site. The main walking and cycling routes through the WSP are located east of the site with the M7 cycle track located adjacent to the western perimeter of the site. However, the design includes a visitor and education centre as an educational resource which will attract groups to the facility which may increase overall visitation to the WSP. The landscape design offers an attractive site for visitor experience, from the entrance and along the eastern area to the visitor and education centre. Adequate cycle parking and end of trip facilities will be arranged within the office component of the site. This will support employees wishing to travel to the site via bicycle, who can use the M7 shared path to access the site safely. Information will also be issued as part of the Green Travel Plan to improve awareness of the surrounding cycling routes. The site layout will have a paved path connecting from the entrance to the visitor and education centre, so pedestrians and cyclists can access the proposal site safely. A community reference group (CRG) will be formed for the proposal, responsible for administering a community funding package. The funding package would be designed to invest in infrastructure for Western Sydney and give back to those residents closest to the facility. The areas for investment would include environmental projects to offer solutions for urban heating (tree planting), improving sporting infrastructure (for example, upgrades to lighting at sport facilities) and community recreation.
Planning Priority C19: Reducing carbon emissions and managing energy, water and waste efficiently	The Australian energy landscape is transitioning away from fossil fuel based large scale power stations towards a diverse portfolio including utility-scale renewable generation, storage, distributed energy resources and flexible thermal capacity. EfW has a role to play in this shift by contributing to the energy mix, offering base-load generation and supporting renewable energy targets while diverting residual waste from landfill and reducing greenhouse gas emissions compared to the same baseload energy from coal-fired power plants. The diversion of waste from landfill will also contribute to reducing landfill related GHG emissions. The main source of water demand is for the EfW process and measures have been incorporated into the design to reuse process water as much as possible. Water consumption has been optimised such that water is wholly consumed by the EfW process with water lost to a combination of steam or quenching of the IBA. So, no remaining process water is discharged to sewer. Rainwater harvesting will also occur from main building roof runoff for reuse in the EfW plant process to reduce reliance on potable water.
Objective 33 A low-carbon city contributes to net-zero emissions by 2050 and mitigates climate change. Potential pathways towards net-zero emissions in the District include: • Precinct-scale renewable energy generation • Waste diversion from landfill.	Climate change is a significant risk and a major challenge for industry across the globe. The IPCC's review of the waste sector[13] determined that fugitive emissions from landfill waste make landfills the fourth largest contributor to climate change after electricity generation, transport and manufacturing. Methane gas is a greenhouse gas which is considered more potent than carbon dioxide at absorbing the sun heat, having 25 times the effect of carbon dioxide[14]. It is then critical to reduce not only waste disposal to landfills and associated fugitive methane generation, but to reduce reliance on non-renewable energy sources to move towards a net zero carbon future. There are opportunities for addressing methane emissions by reducing the amount of waste that ends up in landfill, an opportunity which the WSERRC facility will allow. The renewability of waste to energy and its climate change mitigation potential presents an opportunity to support the transition to a low carbon economy. The proposal will contribute to these objectives by creating a utility scale energy source leading to reduced net GHG emissions of up to 390,000t CO_2-e each year compared to coal-fired power, equivalent to taking about 85,000 cars off the road each year. The proposal will capture energy from residual waste materials to support the generation of up to 55MW of energy on a net basis to be exported to the grid, equivalent to 440GWh of baseload energy per year, part of which is categorised as renewable. This would be equivalent to the production of enough electricity to power 79,000 homes in Western Sydney for one year. The diversion of waste from landfill will result in the reduction of methane gases produced during the decomposition process of landfilled waste. Based on the alternate disposal of the equivalent amount (500,000tpa) of waste to landfill, resultant reduction of GHG emissions from landfill diversion are around 401,000t CO_2-e per year.
Objective 34 Energy and water flows are captured, used and reused.	The WSERRC will capture energy from residual waste materials equivalent of up 58MW of base load electricity some of which would be used to power the facility itself with up to 55MW exported to the grid. Energy flows are captured through the recovery of energy from waste. The main objective regarding water use is to reuse as much water as possible during operation of the facility. No process wastewater will be treated outside of the facility during normal operation. The site stormwater strategy covers the retention of water onsite and its controlled release to overland flow paths. Rainwater is captured in rainwater storage tanks for reuse within the site.
Objective 35 More waste is reused and recycled to support the development of a circular economy.	Transitioning to a circular economy for waste aims to make sure that products are designed to eliminate waste and pollution, and that products and materials keep circulating in the economy at their highest value for as long as possible. This is done through reuse, repair, re-manufacturing, recycling, and similar activities. When products and materials can no longer be circulated and become waste, the energy embodied in the waste can be harnessed, metals recovered and recycled, and the ash produced recycled, before finally disposing of the residues in landfill. As circular economy principles influence the design of materials and products in the future, these materials can be reused and recycled, reducing the amount of waste generated. However, options to manage residual waste will continue to be necessary in New South Wales, including EfW. The European Commission published guidance on the role of EfW in the circular economy (26.1.2017 COM (2017) 34). The main aim of this guidance document was to ensure that recovery of energy from waste in the EU supported the objectives of the circular economy action plan and was guided by the waste hierarchy.

[13] IPCC, *Protocol for predicting national methane emission inventories from landfills* (2018).
[14] https://theglobalclimate.net/methane-gas/

Land use policies, strategies and plans	
Relevant provisions	**WSERRC proposal**
	For member states with low or non-existent EfW capacity and ongoing reliance on landfill, it indicates that new EfW infrastructure could be an appropriate element of the long-term resource management system in line with the waste hierarchy and circular economy objectives. The WSERRC proposal is consistent with this guidance because the facility sizing and proposed feedstock strategy accommodates increased source separation, particularly of organics, over the long term. Similarly, the NSW EfW Policy recognises that energy recovery is a valid pathway for managing residual waste in circumstances where higher-order material recovery through reuse, reprocessing or recycling is not financially sustainable or technically achievable and community acceptance can be secured. The proposal will also recover metals from the combustion process onsite. Options for the offsite recovery and reuse of IBA from the combustion process are also being investigated, building on knowledge and practice elsewhere, and working collaboratively with industry partners to investigate the feasibility of developing a market for reuse of IBA in construction products. Recycling pathways, including organic recovery from mixed waste and export of recyclable materials, have become unavailable or unacceptable. The ambition to significantly increase domestic recycling and use of waste materials reflects a growing sense of responsibility for ensuring an environmentally sound fate for Australia's waste. EfW can offer an onshore pathway to manage residual waste and result in a higher-order outcome for waste which would otherwise have been landfilled. The WSERRC facility has flexibility to accommodate changes in feedstock as domestic recycling capacity and markets for recycled material are developed. WSERRC and Cleanaway will actively support and promote the transition to FOGO with Councils including through the education of the community which is critical to a successful transition and achieving low contamination rates. Cleanaway has also recently invested in a 100,000tpa FOGO processing facility in Melbourne, demonstrating the company's ability to treat this waste stream, a capability it could bring to Sydney to support the FOGO transition.
Action 75. Support initiatives that contribute to the aspirational objective of achieving NetZero emissions by 2050, especially through the establishment of low-carbon precincts in Growth Areas, Planned Precincts, Collaboration Areas, State Significant Precincts and Urban Transformation projects.	The proposal will contribute to these objectives by creating a baseload energy source, part of which is categorised as renewable leading to: • Reduced net GHG emissions of up to 390,000t CO_2-e each year • Capturing energy from residual waste materials equivalent to up to 55MW of baseload energy on a net basis • Emphasising the importance of only receiving residual material from higher-order reuse and recycling facilities. The proposal would divert up to 500,000t of residual waste. The Australian energy landscape is transitioning away from fossil fuel based large scale power stations towards a diverse portfolio including utility-scale renewable generation, storage, distributed energy resources and flexible thermal capacity. EfW has a vital role to play in this shift by contributing to the energy mix, offering base-load generation, supporting renewable energy targets, diverting residual waste from landfill and reducing greenhouse gas emissions. As noted earlier, the IPCC reviewed the waste sector[15] and determined that fugitive emissions from landfill waste make landfills the fourth largest contributor to climate change after electricity generation, transport and manufacturing. Methane gas is a greenhouse gas which is considered more potent than carbon dioxide at absorbing the sun's heat, having 25 times the effect of carbon dioxide[16]. It is then critical to reduce not only waste disposal to landfills and associated fugitive methane generation, but to reduce reliance on non-renewable energy sources to move towards a net zero carbon future. There are opportunities for addressing methane emissions by reducing the amount of waste that ends up in landfill, an opportunity which the WSERRC facility will allow. The renewability of waste to energy and its climate change mitigation potential presents an opportunity to support the transition to a low carbon economy.
Action 76. Support precinct-based initiatives to increase renewable energy generation and energy and water efficiency, especially in Growth Areas, Planned Precincts, Collaboration Areas, State Significant Precincts and Urban Transformation projects.	This proposal will be a source of baseload energy generation, part of which is categorised as renewable, located in the Wallgrove Precinct of the WSP. It has also included initiatives to enable the efficient use of water including reuse of process water on site, capturing rainwater for reuse on site, detention to manage the controlled release of stormwater and investigation of the feasibility of supply part of the site water demand through the Sydney Water recycled water network. Options to supply heat/steam to nearby industrial facilities are being investigated.
Action 77. Protect existing and recognize new locations for waste recycling and management	The proposal is located in the WSP Wallgrove Precinct at a site previously used for industrial purposes in a recognized area for waste and recycling infrastructure. Nearby waste facilities include the now-closed Eastern Creek landfill site and the operational Global Renewables (GRL) waste management facility. The site is also located adjacent to a well-known road network such as the M7 motorway which is central for waste facilities in ensuring waste can be easily transported to the waste facility. The site is also preferable due to it being well separated from residential and other receptor locations. The closest residential areas are around 1km to the south of the site with Erskine Park residential area located around 3.5km to the west and Minchinbury located around 3km to the north. As landfill capacity in the Sydney region declines and with new landfill sites difficult to find, the proposal offers an alternative option to landfill disposal, located in an area historically associated with waste management. The proposal creates a vital waste management service in the Sydney region on a site with low environmental or recreational value.

[15] IPCC, *Protocol for predicting national methane emission inventories from landfills* (2018)
[16] https://theglobalclimate.net/methane-gas/

Land use policies, strategies and plans	
Relevant provisions	**WSERRC proposal**
Action 78. Support innovative solutions to reduce the volume of waste and reduce waste transport requirements.	The EfW process typically leads to about 90% reduction in the volume (or 80% reduction in mass (tonnes)) of waste that would otherwise go to landfill. In the case that IBA is reused into construction products, this number increases further to about 95% reduction in volume and mass of waste that would otherwise go to landfill. However, diversion from landfill will be dependent on the classification and fate of the wastes generated by the EfW facility. This proposal will divert up to 500,000t of residual waste. The sites location is favourable due to the industrial nature of the surrounding land uses creating the potential for synergies with surrounding industry. For instance, the site is located next to similar waste facilities such as the operational GRL waste management facility located immediately to the east with the Erskine Park Waste Transfer Station located further to the west. The sites location next to transport infrastructure such as the M7 Motorway and Wallgrove Road allows for convenient road transport access routes. Furthermore, the sites location in Western Sydney also means that it is close to waste generation sources reducing the economic and environmental costs of waste transportation to landfill sites further away from the source of waste generation.
Western Sydney Parkland Plan of Management 2030 – Precinct 6: Wallgrove	
The Western Sydney Parklands Trust (WSPT) developed the Plan of Management 2030 to create the strategic framework for the Parklands and assists the WSPT in determining its priorities and actions over the coming years. The NSW Minister for the Environment and Heritage adopted the Plan of Management in December 2018. The Plan of Management divides the WSP into sixteen precincts and includes a high-level Precinct Plan for each. The proposed site is in the Wallgrove Precinct (Precinct 6). The land use framework described in the Plan of Management identifies several land use opportunities for the WSP which include: • Services infrastructure, where the WSP has a long-term role in providing land with low environmental or recreational value, to meet the ongoing and expanding needs of the community for services infrastructure such as electricity, gas, telecommunications, water, and sewerage. • Business and employment, where a means of achieving financial sustainability for the WSP is to use land with low environmental or recreational values for long-term business leases. This generates income, additional local jobs and capital investment in the region.	
The desired future character of the Wallgrove Precinct (Precinct 6) is described as: ' *To be an evolving precinct that includes some of the current uses such as environmental monitoring, brickmaking, agriculture and recycling sites. The precinct has potential for the development of renewable energy and recycling opportunities, agriculture, unstructured recreation and sport uses, and a potential WSPT Business Hub development'.*	The proposal will be consistent with the Plan of Management by using land of low environmental or recreational value for services infrastructure and by creating employment. The site has an industrial and agricultural history having previously been used for poultry production. A detailed site contamination investigation (DSI) has been carried out and is documented in **Technical report G**. The investigation concluded that all soil, water and gas concentrations were within the adopted site assessment criteria, except for asbestos impacted soils, asbestos containing materials (ACM) found in near surface soil and lead beneath one of the workshops. A draft Remediation Action Plan (RAP) (**Technical report G2)** has been prepared for the site and will be carried out to make the site suitable, from a contamination risk perspective, for the proposed land use before construction and in line with SEPP 55. The site is located next to the M7 and Wallgrove Road as well as the Warragamba Pipeline and the Austral Bricks road, with other waste infrastructure located immediately to the east, limiting the recreational and amenity value of the site. The desired future character for the Wallgrove Precinct includes retention of some current uses such as recycling sites and future uses such as recycling and renewable energy. The WSERRC incorporates both recycling and renewable energy and would be consistent with the desired future character of the Precinct.
Objectives:	
Work with other State Government agencies to manage the transition from landfill, to other long-term land uses that will meet Western Sydney's needs	A DSI was carried out and is documented in **Technical report G**. The DSI concluded that all soil, water and gas concentrations were within the adopted site assessment criteria, except for asbestos impacted soils, asbestos containing materials (ACM) found in near surface soil and lead beneath one of the workshops. A draft Remediation Action Plan (RAP) (**Technical report G2**) has been prepared for the site and will be carried out to make the site suitable and safe for the intended use of the proposal. In addition, when first acquiring the site, it was found that the proposal site had an Individual Biosecurity Direction (IBD) due to the site having been detected previously for Salmonella Enteritidis (SE) due to past poultry activities. The applicant worked closely with DPI to render the site safe and suitable and has since received a letter from the Department of Industries (DPI) dated 26 May 2020 which stated *'The NSW DPI Chief Veterinary Officer has approved the status of your property to change from a SE Infected Premise to a Resolved Premise, as you have completed decontamination and 2 sets of SE negative clearance sampling'* and as such, the Individual Biosecurity Direction has been revoked on the proposal site. The WSERRC incorporates both recycling and renewable energy and would be consistent with the Precinct's desired future character. The proposal would divert up to 500,000t of residual red bin waste and reduce net GHG emissions of up to 390,000t CO_2-e each year, capturing energy from residual waste materials equivalent to up to 55MW of baseload energy on a net basis, part of which is categorised as renewable. In developing the proposal, Cleanaway and Macquarie have consulted with government agencies to integrate the proposal into the Wallgrove Precinct and to create a facility that contributes to the energy and waste management needs of Western Sydney as well as creating employment opportunities during construction and operation. Notably, the facility has been sized to receive waste volumes that are known to be available in the Western Sydney region.
Work with agencies to restore ecological and visual landscapes	The design has sought to protect existing vegetation and integrate it into the overall site layout and landscaping strategy with the aim of enhancing the visual appearance and biodiversity. The landscaping (restricted to within the site) is to include screening of the perimeter to mitigate views of ancillary infrastructure. Installation of canopy trees to the front and the east of the site will help with some screening of taller buildings from the east. Revegetation works will reconstruct native vegetation communities and restore the ecological functions of overland flow path, with further details discussed in the Vegetation Management Plan.
Investigate options to develop WSPT Business Hubs at sites designated by the Trust	WSPT has applied for development consent for the Light Horse Interchange Business Hub located to the north of the site. The WSERRC site is not identified as a potential Business Hub but would contribute to employment in the Precinct, employing 50 people full time, as well as generate demand for specialist services and products to support operation of the facility. This will open supply opportunities for local business.

Land use policies, strategies and plans Relevant provisions	WSERRC proposal
Land use opportunities:	
WSPT Business Hubs at sites designated by the Trust	WSPT has applied for development consent for the Light Horse Interchange Business Hub located to the north of the site. The proposal aligns with the direction of supporting Business Hubs by providing energy to support nearby future development in line with WSP businesses and other facilities. WSERRC is already exploring potential heat usage with industrial facilities near the site.
Urban farming and associated facilities	The proposal can support urban farming by providing energy to farming and associated facilities. It is noted that the Horsley precinct located further south is the main precinct in the WSP identified for urban farming. The proposal could support urban farming activities by creating a source of electricity and/or heat to this precinct. WSERRC is already exploring potential heat usage with industrial facilities near the site.
Extraction, recycling and associated uses	The proposal is an energy-from-waste facility. The WSERRC incorporates both recycling and renewable energy and would divert up to 500,000t of residual Municipal Solid Waste (MSW) and residual Commercial and Industrial (C&I) waste streams that would otherwise be sent to landfill. The proposed facility can generate up to 55MW of electricity, part of which is categorised as renewable, for export to the grid.
Walking and cycling tracks	Direct bike and walking path linkages to other areas of the WSP have not been included to this stage of the design, mostly due to safety reasons due to the industrial nature of operational activities to occur on the site. The location of the site on the western perimeter of the Parklands avoids impact on the main north-south circulation and access network that runs through the Parklands. The site is in the Wallgrove Precinct which comprises services land and industrial facilities not accessible to the public. The main walking and cycling routes through the WSP are located east of the site with the M7 cycle track located adjacent to the western perimeter of the site. However, although direct path linkages through the site have not been included to this stage of the design, the design has allowed for a visitor and education centre. The landscape design offers an attractive site for visitor experience, from the entrance and along the eastern area to the visitor and education centre. Further, adequate cycle parking and end-of-trip facilities will be arranged within the office component of the site. This will support employees wishing to travel to the site via bicycle, who can use the M7 shared path to access the site safely. Information will also be issued as part of the Green Travel Plan to improve awareness of the surrounding cycling routes. The site layout will have a paved path connecting from the entrance to the visitor and education centre, so pedestrians and cyclists can access the proposal site safely.
Environmental protection works	A Biodiversity Development Assessment Report (BDAR) (**Technical report Q**) has been prepared as part of this EIS and identifies management measures to protect biodiversity. These include the development of a Flora and Fauna Management Plan, incorporating design measures to avoid and mitigate biodiversity impacts (design footprint and configuration) and construction measures such as preparation of management plans that address potential impacts (Erosion and Sediment Control Plan). Landscaping and visual assessments developed as part of this EIS align with the ecological profile of the wider WSP, with suggested mitigation measures to reduce and manage the impacts of the proposal on the landscape, views and visual amenity. Key mitigation strategies include, reducing the bulk form of the facility, incorporating living walls into the architecture and screening around the perimeter of the site to block direct views. A Vegetation Management Plan has also been prepared for this EIS (Appendix G to **Technical report Q**) which supports the restoration of the overland flow path on site, through realignment, to achieve natural channel design principles, revegetation actions and weed management. Revegetation actions will include plantings of species representative of the threatened Cumberland Shale Plains Woodland community (in alignment with site landscaping). Onsite contamination will be remediated in line with the draft RAP prepared for the site, as detailed by the *Contaminated Land Management Act 1997* and SEPP 55 Remediation of land.
Potential Aboriginal and non-Aboriginal cultural and heritage interpretation	An Aboriginal Cultural Heritage Assessment Report (**Technical report O**) has been prepared as part of the EIS. There is potential for interpretation of these findings to be incorporated in detailed design, including, but not limited to plaques, murals, paving, visitor and education centre display.
Utilities infrastructure	The proposal is a form of utilities infrastructure, giving a source of electricity generating as well as waste processing infrastructure.
Key Management Priorities:	
Environmental Protection and Land Stewardship	
Work with State Government agencies to improve water quality in Eastern Creek	The proposal will improve the existing overland flow path and re-plant with native vegetation, with associated water quality benefits. The overland flow path drains to Reedy Creek to the north. The proposal will also include bio-retention and onsite detention to manage the flow and quality of stormwater to the overland flow path and on to Reedy Creek. As Reedy Creek joins with Eastern Creek further north, these measures will also improve the water quality in Eastern Creek (see **Chapter 12 Hydrology and flooding** for further information).
Further investigate the area's Aboriginal and non-Aboriginal cultural heritage	An Aboriginal Cultural Heritage Assessment Report has been prepared as part of the EIS (**Technical report O**). The assessment included a review of existing archaeological investigations, Aboriginal community consultation and assessing the cultural significance of Aboriginal heritage for the proposal. The assessment concludes that there are no Aboriginal archaeological sites within the proposal area due to high levels of previous disturbance, and the potential for areas of Aboriginal archaeological potential are very low. Similarly, there are no non-Aboriginal heritage features located at the site which could be potentially impacted by the proposal.

Land use policies, strategies and plans	
Relevant provisions	**WSERRC proposal**
Community Participation and Engagement	
In association with the development of recreation or sports facilities as they are developed, increase visitation, precinct activation and engagement and its recreation or environmental uses	Community engagement started during the early stages of proposal planning and has continued throughout the development of this EIS. Engagement will continue following lodgement of the EIS. Before the EIS start, community research was conducted to understand the issues, ideas, and sentiment relevant to the community. It also asked the community how they wanted to be engaged during the EIS with the findings from this research informing the approach to community engagement. Further information on community engagement can be found in **Chapter 6 Engagement**. A community reference group (CRG) will be formed for the proposal, responsible for administering a community funding package among other duties. The funding package would be designed to invest in infrastructure for Western Sydney and give back to those residents closest to the facility. The areas for investment would include environmental projects to offer solutions for urban heating, sporting infrastructure and community recreation.
Financial Sustainability and Economic Development	
Explore the potential for WSPT Business Hubs at sites designated by the Trust	The proposal aligns with the direction of supporting Business Hubs by providing energy to support nearby future development in line with WSP businesses and other facilities. The applicant will also create a community reference group (CRG) responsible for administering a community funding package. The funding package would be designed to invest in infrastructure for Western Sydney and give back to those residents closest to the facility. The areas for investment would include environmental projects, sporting infrastructure and community recreation.
Manage the impacts of future service infrastructure expansions in the Precinct	The location of the proposal on the western perimeter of the WSP, adjacent to the M7 and existing industrial facilities and on land of low environmental or recreational value, will avoid the areas of the WSP that are used for recreation and which support the aims of the District Plan to integrate the Green Grid with the WSP. The approach to the architectural and landscape design is motivated by the concept of integrating the proposed facility thoughtfully into the local and district wide context and offering education through a world-class visitor and education centre experience and facility tour. The site design includes clearing and revegetation with native species of the overland flow path. This will contribute to better water quality outcomes in the overland flow path and to the water quality of Reedy Creek to the north. The EfW facility is an enclosed design where all impacts relating to odour and noise are minimised by being contained within the EfW building. Covered waste trucks will enter the enclosed reception hall via fast moving roller shutter doors which will be kept under negative pressure to prevent odour escape, and unload waste directly into the waste bunker. A detailed site contamination investigation (DSI) was carried out and is documented in **Technical report G**. The investigation concluded that all soil, water and gas concentrations were within the adopted site assessment criteria, except for asbestos impacted soils, asbestos containing materials (ACM) found in near surface soil and lead exceeding the environmental investigation level (EIL) beneath one of the workshops. A draft Remediation Action Plan (RAP) (included as **Technical report G2**) was prepared for the site and will be carried out to make the site suitable, from a contamination risk perspective, for the proposed land use before construction. In addition, when first acquiring the site, it was found that the proposal site had an Individual Biosecurity Direction (IBD) due to the site having been detected previously for Salmonella Enteritidis (SE) due to past poultry activities. The applicant has since received a letter from the Department of Industries (DPI) dated 26 May 2020 which stated '*The NSW DPI Chief Veterinary Officer has approved the status of your property to change from a SE Infected Premise to a Resolved Premise, as you have completed decontamination and two sets of SE negative clearance sampling'* and as such, the Individual Biosecurity Direction has been revoked on the proposal site.

2.6 Consideration of alternatives

The avoidance and minimisation of environmental impacts has been a key driver in the selection of the site, the choice of EfW technology and the layout and design of the facility.

The main issues of concern to the community and stakeholders, based on experience of other EfW projects and confirmed through the engagement process, are the potential impacts of the proposal on air quality and health, visual impacts, as well as understanding how EfW supports recycling and resource recovery.

Air quality and health issues are addressed by adopting combustion and flue gas treatment technologies that are consistent with best available techniques as defined by the EU BREF, coupled with a site selection strategy that sought to maximise the separation distances to residential areas. Regarding visual impacts, the design of the facility has employed a few design strategies to reduce the mass and bulk of the facility and its visual impact from surrounding areas.

The alternative technologies, designs and site selection process which supports these outcomes and responds to key community concerns are described in detail below. The role of EfW in supporting recycling and resource recovery is described earlier in this chapter.

Further information on how the proposal considers specific issues raised by the community and stakeholders during engagement is available in **Section 6.3** of **Chapter 6 Engagement**.

2.6.1 Do-nothing

The ‘do nothing’ scenario was considered as an alternative to the proposal. Adoption of this scenario would result in the continued disposal of residual waste to landfill, reducing the life of Sydney’s landfills and continuing the burden of landfills on the environment and communities. The do-nothing scenario is not in line with the WARR targets of the NSW Government because if the proposal was not to proceed, 500,000t of residual MSW and C&I waste proposed to be processed at the WSERRC would otherwise be disposed of to landfill every year. The NSW waste hierarchy and WARR Act identifies the treatment of waste for the purposes of energy as a more suitable option compared to landfill. Accordingly, the ‘do nothing’ scenario was discounted.

2.6.2 EfW as part of an integrated waste management strategy

EfW does not displace or preclude higher-order steps in the waste hierarchy and is complementary to the other steps when considered as part of an integrated waste management strategy. Transitioning to a circular economy for waste aims to make sure that products are designed to eliminate waste and pollution, and that products and materials keep circulating in the economy at their highest value for as long as possible. This is done through reuse, repair, remanufacturing, recycling, and similar activities.

When products and materials can no longer be circulated and become residual waste, the energy embodied in the waste can be harnessed, metals recovered and recycled, and ash recycled before finally disposing of the residues in landfill. As circular economy principles influence the design of materials and products in the future, these materials can be reused and recycled, reducing the amount of waste generated. However, options to manage residual waste will continue to be necessary, including EfW.

Experience from European countries with high levels of recycling confirms the complementary role of EfW as part of an integrated waste management solution. It is not possible to fully recycle and compost municipal waste. Leading countries such as Germany, Netherlands and Denmark achieve recycling rates of up 66% of their waste[17], with the remaining recovery being from EfW. In the Australian context, the WARR Strategy has set a target of increasing the waste diverted from landfill from 63% in 2010–11 to 75% by 2021–22. However, current data shows actual performance of 55% diversion rates in the Metropolitan Levy Area (refer to **Table 2.1-1**). Achieving landfill diversion rates beyond this will need investment in waste infrastructure such as EfW, while pursuing long-term strategies to embed circular economy principles in product design that will enable higher rates of reuse and recycling in the future.

As noted earlier, the European Commission published guidance on the role of EfW in the circular economy (26.1.2017 COM (2017) 34). The main aim of this guidance document was to ensure that recovery of EfW in the EU supported the objectives of the Circular Economy Action Plan and was guided by the waste hierarchy. This document recommends that member states should prioritise investment in separate collection and processing infrastructure to enable high-value recycling within Europe, with a focus on separate collection of organic waste. In addition, in some specific and justified cases, for example with materials that contain certain substances of very high concern, disposal or energy recovery may be preferable to recycling.

[17] OECD, *Australian National Waste Report 2018*

For member states with low or non-existent EfW capacity and ongoing reliance on landfill, it indicates that new EfW infrastructure could be an appropriate element of the long-term resource management system in line with waste hierarchy and circular economy objectives. The WSERRC proposal is consistent with this guidance as it offers solution to achieving higher rates of landfill diversion, while having the flexibility to accommodate increased source separation, particularly of organics, over the long term.

Several councils and businesses within the Sydney region send their mixed general red-bin waste to be processed at an alternative waste treatment facility (AWT) or mechanical-biological treatment facility (MBT). MBTs process red bin waste to recover the organic content which is called mixed waste organic outputs or MWOO. However, in 2018 the NSW EPA revoked the resource recovery exemption order for use of MWOO on agricultural land and suspended its use for forestry or mine site rehabilitation purposes.

As the organic material originated from a mixed waste stream, it was considered that the risks of using organic material from residual waste on agricultural land outweigh the benefits. This development indicates that the feasibility of the recycling of mixed waste for application to land is questionable and the optimal waste management system is a combination of source separation of recyclable materials (including FOGO) with EfW processing options for residual materials only. Landfills will always have a place within the waste hierarchy but should be designated solely for disposal of EfW outputs and materials that cannot be recycled.

Development of EfW capacity in New South Wales would support the achievement of landfill diversion targets, preserve the limited landfill capacity available for the disposal of materials with no other available management option and delay the need to start new landfill sites, which has proven highly challenging for the Sydney region.

2.6.3 Flexibility of waste feedstock

As recycling rates increase over time through market development and in line with NSW WARR strategy targets, circular economy principles, EfW operations will need flexibility to accommodate changes in waste feedstock to continue to offer landfill diversion of residual waste. Modelling completed for the proposal indicates that even with the introduction of additional source separation and maximised resource recovery within the Sydney region, there would still be enough residual waste feedstock for the proposal. Cleanaway supports increased source separation for high-quality recovery and recycling. The WSERRC feedstock strategy and process design accommodates increased source separation over time, particularly of organics. In this way, the WSERRC proposal expects to accommodate improvements in both recycling and landfill diversion.

The design of the facility is also modular in that it incorporates two lines, so if one line goes offline, the facility can continue to operate.

Feedstock modelling has been completed for this proposal and is included in **Technical report E Waste Flow Analysis for Greater Sydney,** with a summary available in **Technical report C Waste and Resource Management Assessment.** The modelling results demonstrate that there is significantly more waste feedstock available in the Sydney Basin than the 500,000tpa design capacity of the WSERRC proposal. There are several other EfW facilities proposed to service the Sydney Basin. They include the proposed Dial a Dump Industries (DADI) Next Generation facility in Eastern Creek and the proposed SUEZ Botany Cogeneration facility in Matraville. The Next Generation facility EIS states that it will process and thermally treat up to 552,000t of non-putrescible residual waste sourced from construction and demolition (C&D), C&I sources as well as shredder floc. The Botany Cogeneration facility scoping report states that it will process and thermally treat up to 165,000t of feedstock made up of processed engineering fuel (PEF) and residuals from the Orora recycled paper mill. The PEF will be sourced and prepared from non-putrescible C&I waste.

The proposed feedstock for the WSERRC facility differs from both other proposals in that it will thermally treat residual putrescible and non-putrescible waste from MSW and C&I sources. These modelling results indicate that the Sydney Basin, even with increased source separation, reduction in waste generation per capita and meeting recycling targets, will still generate significant quantities of residual waste that will need to be managed. The WSERRC proposal along with the other proposed EfW facilities will give the opportunity to manage a portion of the residual waste generated and support diversion of waste from landfill. The WSERRC also has significant flexibility to secure waste from both putrescible and non-putrescible MSW and C&I sources in comparison to the other proposals which rely on non-putrescible waste only. The proposal has been sized to offer a viable residual waste management infrastructure solution, while not needing to attract or cannibalise waste that can be effectively and economically reused, repaired or recycled.

Refer to **Chapter 5 EfW policy** which discusses the proposals short-term and long-term waste feedstock strategy.

2.6.4 Alternative EfW technologies

2.6.4.1 Consideration of thermal treatment technologies

Cleanaway and Macquarie Capital reviewed operational EfW facilities around the world to identify a technology that was reliable and with a proven track record in terms of operational, technical, human health and environmental performance. This EfW technology review was focused on the following criteria:

- Technologies commonly used in the European Union (EU) given the similarities with the NSW waste market and the close alignment between the two jurisdictions in their approach to regulating EfW
- Reputable technology with available reference facilities
- Ability to achieve strict environmental performance standards and be compliant with BAT recommendations and the NSW EfW policy
- Reliability and proven technology at scale
- Ability to be flexible and manage a variable waste feedstock
- Costs.

The review identified five main technologies for the thermal treatment of waste to generate energy, these are:

1. Moving grate combustion
2. Fluidised bed combustion
3. Gasification (thermal and plasma)
4. Pyrolysis
5. Two-stage combustion.

Table 2.4 below summarises each technology and gives high-level commentary against a range of criteria on which judgement was based.

Table 2.4: Summary of thermal treatment technologies considered for WSERRC

Parameter	Moving Grate Combustion	Fluidised Bed Combustion	Gasification (Thermal and Plasma)	Pyrolysis	Two-stage Combustion
Short description	Combustion of waste on a moving grate furnace.	Combustion of waste on a fluidised bed (usually fluidised using sand).	Gasification of waste to generate a synthetic gas which can be combusted either in a boiler or a gas engine.	Pyrolysis of waste to generate a synthetic gas, char and synthetic oil.	Gasification process immediately followed by combustion above the fuel bed or in an adjacent chamber.
Operation – At least 12 months fully operational at design loads	Yes – well proven with over 2,000 lines in Europe, US, Japan and China combined.	Yes – well proven but less than 100 facilities (at scale) and mostly based in Europe and US.	Yes, mostly in Japan with a few operational facilities in Europe. Relatively high operational cost and low energy recovery.	Yes, mostly in Japan. Relatively high operational cost and low energy recovery.	Some facilities under construction in Europe and some operational in Japan. Some European facilities currently being commissioned.
Historical Track Record	Good – Operating data available over many years showing successful operation.	Good – Operating data available over many years showing successful operation.	Mixed – good record with homogeneous feedstock in Asia. Poor track record in Europe, however some new facilities emerging in the UK.	Emerging technology, several failed projects in Europe. Poor track record.	Emerging technology, insufficient data for long term track record with some technical issues noted.
Waste Streams – suitable for mixed MSW and C&I from the Sydney area	Yes	Yes	No, without significant pre-treatment.	No, without significant pre-treatment.	No, without significant pre-treatment.
Emissions – Compliant with EU BAT	Yes	Yes	Yes	Yes	Yes
IBA slag/ash has Total Organic Carbon ≤3% and Loss on Ignition ≤5% (dry basis)	Yes	Yes	Yes	Yes	Yes

Parameter	Moving Grate Combustion	Fluidised Bed Combustion	Gasification (Thermal and Plasma)	Pyrolysis	Two-stage Combustion
Flue gas retention time (Minimum 850°C for 2 seconds)	Yes	Yes	Not applicable, generates syngas and oil	Not applicable, generates syngas and oil	Yes
Energy Efficiency (greater than 25% achievable on a gross basis)	Yes	Yes	Yes	Yes	Yes
Summary	Taken forward for further analysis below due to proven technology status and good track record.	Taken forward for further analysis below due to proven technology status and good track record.	Not considered further due to mixed track record, poor performance in numerous European facilities and requirement for extensive pre-treatment to make the waste feedstock more homogenous.	Not considered further due to emerging technology status, lack of available reference facilities and requirement for extensive pre-treatment to make the waste feedstock more homogenous.	Not considered further due to emerging technology status, lack of available reference facilities and requirement for extensive pre-treatment to make the waste feedstock more homogenous.

Based on this assessment, it was concluded that gasification, pyrolysis and two-stage combustion were not suitable at this time due to the relative immaturity of the processes, lack of available reference facilities and requirement for extensive pre-treatment to make the waste feedstock more homogenous.

Two technologies were shortlisted for this proposal:

1. Moving grate combustion
2. Fluidised bed combustion.

These technologies were shortlisted because they can comply with emissions regulations and have a proven track record of safe, reliable and environmental performance.

A more in-depth analysis of moving grate combustion and fluidised bed combustion was carried out with the following key findings:

- There are significantly more operating plants globally for moving grate combustion technology (for mixed MSW and C&I waste) (see **Table 2.4**). Over 95% of facilities thermally treating MSW and C&I waste to produce electricity worldwide use moving grate technology.
- Although fluidised bed combustion can process a wider array of different fuels from an energy content (calorific value) perspective, the fluidised bed combustion process requires a more homogenous fuel stream. When waste is used as the fuel, pre-treatment in the form of shredding is necessary to produce a smaller, more homogenous particle size than would be needed with moving grate technology.
- Fluidised bed technology uses hot sand as a fluidising medium. This is broken down and must be replaced over time generating a solid waste stream.
- Operational availability of a fluidised bed facility is slightly lower than a moving grate facility (7,500 hours vs 8,000 hours).

After careful consideration, moving grate technology was selected as the preferred technology. It the most recognised and proven technology used globally for over 50 years, and in that time it has continually improved responding to regulatory, industry and public demands with operational advantages, compared to fluidised bed technology.

2.6.4.2 Consideration of flue gas treatment system techniques

As well as the overall combustion technology selection, other technologies embedded within the EfW facility itself were also reviewed such as the flue gas treatment (FGT) technology (cleaning system) and NOx abatement technologies.

FGT refers to the treatment of dust, acid gases, heavy metals, dioxins and furans before release from the stack. The two main FGT concepts available on the market are referred to as a dry system or a wet system. However, numerous variations for these two systems exist. For this proposal, the three most common FGT system variants were reviewed. These were:

- Base semi-dry system
- Semi-dry system with additional wet scrubbing stage
- Wet system.

A base semi-dry system includes the following main equipment:

- Water spray for conditioning of flue gases
- Reactor for injection of either hydrated lime or sodium bicarbonate and activated carbon for reduction of acid gases and capture of heavy metals, dioxins and furans
- Filter bag house to remove dust (boiler fly ash that is entrained within the flue gases) and FGTr.

A semi-dry system with an additional wet scrubbing stage includes the same equipment as the base semi-dry solution with the addition of a wet scrubbing stage using a sodium hydroxide and water solution to further reduce acid gases and heavy metal concentrations within the flue gas. The wastewater from this process can be recycled back into the semi-dry part of the process, so there is no additional water use as part of this wet scrubbing process over a semi-dry solution.

A wet system is substantially different. A wet system uses a variety of wet scrubbing stages (usually two or three) to treat the flue gases. The main components of a typical wet system are:

- Dust removal, either using an Electrostatic Precipitator or bag filters
- Quench water stage to cool the flue gases for further treatment and remove mercury
- Wet scrubbing stages with activated carbon injection to remove pollutants including dust, acid gases, heavy metals, dioxins and furans
- Secondary dust removal.

These systems represent different forms of Best Available Techniques (BAT) under the European Union Industrial Emissions Directive within the Waste Incineration (WI) BAT Reference Document (WI BREF). They are able to meet the upper emissions limit values set out in the WI BREF. Each was analysed against a variety of criteria, as summarised in **Table 2.5** below, to determine the preferred solution for the WSERRC facility.

Table 2.5: FGT comparison

Parameter	Base Semi-dry	Semi-dry with wet scrubber	Wet System
Suitable for proposed waste types	Yes	Yes	Yes
Proven technology	Yes	Yes	Yes
Operational performance and availability	Good	Good	Good
Flexibility to handle short-term variation in waste characteristics	Possible difficulties with maintaining consistently low Sulphur Dioxide	Good – scrubber acts as an additional polishing stage	Good
Emissions performance	Compliant with EU WI BREF upper limits	Better than base semi-dry, particularly regarding acid gases and heavy metals.	Similar performance to semi-dry system with wet scrubber.
Future proofed against tighter emissions limits	No	Yes	Yes
Wastewater stream generated	No	No – recycled into process.	Yes – wastewater treatment needed.

After consideration of the different FGT technologies for WSERRC, a semi-dry system with additional wet scrubber was chosen because:

- The base semi-dry system was discounted as there was concern that WI BREF emission limit values, particularly for sulphur dioxide, could be temporarily exceeded if there was a change in waste characteristic over a short period of time, causing a change in the characteristics of the raw flue gases. In addition, the use of either a semi-dry system with a wet scrubber or a wet system offers an element of future proofing against potential tightening of emission limit values as they result in lower emissions than a semi dry system.
- The fully wet system was discounted as it had similar characteristics to a semi-dry system, but with a wet scrubber it creates a wastewater stream and uses additional water. In addition, there was no viable point of discharge for the industrial wastewater near the WSERRC site.

2.6.4.3 Consideration of oxides of nitrogen (NO_x) reduction techniques

The proposal also needed to consider which technology would be applied to reduce oxides of nitrogen (NO_x).

There are two applicable technologies that can be applied for the reduction of oxides of nitrogen within the flue gases. Both technologies operate under the principle of breaking down oxides of nitrogen into nitrogen and water (both harmless elements) to reduce the volume of oxides of nitrogen (NO_x) within the cleaned flue gases, using ammonia or urea. The two technologies are:

- Selective Catalytic Reduction of NO_x (SCR), which uses a special catalyst to break down NO_x
- Selective Non-Catalytic Reduction of NO_x (SNCR), which uses injection of ammonia to break down NO_x without the need for a catalyst.

Both technologies are described as 'Best Available Techniques' (BAT) within the WI BREF for Waste Incineration and both are commonly used in Europe.

The WSERRC facility has chosen to use SNCR for the following reasons:

- SNCR achieves the upper WI BREF NO_x limit of 120mg/Nm^3.
- SNCR is described as BAT in the WI BREF.
- SNCR achieves significantly lower emission levels than the requirements for NO_x emission under New South Wales POEO legislation (500mg/Nm^3).
- SNCR is a simpler technology than SCR. SCR systems are complex to operate, need more intensive maintenance than SNCR systems and are more complex to maintain.
- SNCR achieves a higher energy efficiency overall. A tail end SCR system requires reheating of the flue gases for proper operation of the catalyst, not necessary in SNCR technology, which uses energy that would otherwise be used for electricity generation. A front-end SCR system requires dust removal using an electrostatic precipitator. The electrostatic precipitator uses electricity that would not be necessary in a SNCR system and is then less energy efficient.

The reference facilities for this proposal, Dublin Waste to Energy and Filborna Waste to Energy, which are fully described in **Chapter 5 EfW policy,** both use the SNCR technology.

2.6.5 Alternative sites

The proposal site located at 339 Wallgrove Road, Eastern Creek was selected as the preferred site following a detailed and systematic site screening analysis completed between July 2018 and October 2019. The site screening analysis was based on a set of selection criteria aimed at identifying potential sites in the wider Sydney region that would be suited to the development of an EfW facility. After shortlisting numerous potential sites throughout the wider Sydney region, further environmental constraints investigations and due diligence assessments were completed to identify any risks to acquisition of these sites based on technical, social and environmental considerations.

2.6.5.1 Multi-criteria analysis

To screen for potential sites, a multi-criteria analysis was used which involved mapping sites against standard criteria for making infrastructure investment decisions in New South Wales. The criteria used to map initial sites for discussion was based on the following principles:

- Land use zoning that allows for an EfW facility
- Proximity to sensitive receivers (>1km buffer)
- Sites with a minimum area of 5ha
- Proximity and access to main roads and rail corridors (within a 1km buffer).
- Proximity to power lines.
- Proximity to the source of waste generation
- Planned future development in the vicinity of the site.

Sites that had larger separation distances from sensitive receivers were favoured to minimise the possible risk to health from exposure to emissions from electricity infrastructure associated with the proposal, such as electric and magnetic fields (EMF), noise, and air emissions from the EfW process.

Sites that complied with the above selection criteria were mapped for further consideration and those sites that did not satisfy the criteria were excluded from further assessment. Over 140 sites were originally identified and mapped for consideration. Various internal workshops have been conducted to discuss and prioritise the mapped sites against the selection criteria.

As a result, 25 locations were identified, which were subsequently narrowed to 9 preferred areas. Further workshops and desktop research were conducted to prioritise sites within these preferred areas that better addressed environmental risks, stakeholder concerns, approvals risk, utilities access considerations, geotechnical aspects, ease of construction, and feedback during early community consultation.

It was also imperative to select a site that is located in an area that is expected to accommodate the majority of the population growth forecast for Sydney, motivated in part by the development opportunities created by the Western Sydney Airport and Western Sydney Aerotropolis. The location of a site in this growth region and close to established waste management infrastructure will minimise the transport distances (and related GHG emissions) between the sources of waste, waste processing facilities and the proposal.

The areas were further narrowed to three main areas including:

- Aerotropolis area
- Mulgoa area
- Eastern Creek area.

Table 2.6 summarises the key features of the short-listed areas considered during the site selection process and explains why Eastern Creek was ultimately selected.

Table 2.6: Pros and cons for the areas considered

Area	Pros	Cons	Outcome
Aerotropolis area	• Sites close to the Western Sydney Aerotropolis Agribusiness Precinct were prioritised for the proposal given the potential to offer a source of energy and heat to the commercial activities planned for the precinct. • Ability for the proposal to contribute to the management of waste for the wider Aerotropolis • Away from residential suburbs • Large lots of land.	• The planning framework for airspace protection (Obstacle Limitation Surface) restricted the location of tall structures such as a stack, near the Airport. • There was a 3km wildlife buffer to manage the risk of wildlife strikes to planes which limited available sites in the area. • Lack of suitable major roads • Large scale residential developments • Future transport corridors which had potential to cut through preferable sites • Rural residents near preferred sites.	Discounted as an option and no investment made
Mulgoa area	• Large lots of land.	• The north-west region of the Aerotropolis comprises an area with residents owning large, rural properties • Although the Aerotropolis industrial zone is immediately adjacent, the number of sensitive receivers in the vicinity creates challenges from a community relationship perspective.	Discounted as an option and no investment made
Eastern Creek area	• This area was suited to building a stack that would not affect aircraft operations for the Western Sydney Airport. • Industrial and commercial nature of the area creating the potential for synergies with surrounding industry • Other waste facilities in the area.	• Public perception and heightened community awareness and sensitivity existing and planned waste management assets in the Western Sydney region.	Site identified at 339 Wallgrove Road, Eastern and noted as the most suitable site to develop an EfW facility.

2.6.5.2 Environmental constraints analysis and due diligence

Before deciding on the purchase of any shortlisted site, a due diligence analysis was completed. This process was significant because it highlighted any potential critical constraints and helped with:

- De-risking acquisition and supporting investment outcomes
- Understanding the receiving environment that may be impacted by the development
- Understanding likely community responses to the development
- Informing regulatory and agency discussions
- Identifying any issues to be addressed during the environmental assessment process.

A desktop environmental constraints analysis was completed on the prioritised sites within the three main areas, using publicly available databases and information to assess the following:

- Road access and transport infrastructure, and potential traffic routes into the property
- The size/area of property
- Existing or future land use conflicts
- Zoning and permissibility to support the development
- Proximity to utilities
- Considerations of noise and air pollution risks to nearby residents/properties
- The presence of Aboriginal and non-Aboriginal heritage listed sites
- The presence of threatened species
- The extent of vegetation removal and/or earthworks that would be necessitated
- Soils, geology and contamination
- Surface and ground water features
- Bushfire risk.

2.6.6 Preferred site

The proposal site chosen via the extensive site screening analysis is located at 339 Wallgrove Road in Eastern Creek, NSW (Lot 1 DP 1059698) within the Blacktown local government area (LGA) (see **Figure 1.2** in **Chapter 1 Introduction**). The site was recognised as the most suitable site to develop an EfW facility for various reasons as discussed below in **Section 2.6.6.2**.

2.6.6.1 Site history

Before 1960, the site was vacant of buildings and was similar in use to the surrounding land use, being predominantly rural. In the early 1960s, the site was cleared of vegetation with warehouses and ancillary sheds built on the southern end of the site. The present-day farm dam located near the eastern boundary was built during this time.

In the 1970s, the site was first used for chicken farming. Large chicken coups were built, and the existing warehouses were expanded during this time. The site continued to be used predominantly for agricultural purposes.

In the early 2000s, the surrounding area continued to be developed for industrial activities. Similarly, the site has been used for various industrial and agricultural activities including truck/vehicle storage, miscellaneous debris storage and chicken farming.

Currently, two hectares of the northern part of the site are paved. Disused poultry sheds and ancillary buildings occupy the southern portion of the site, with mature vegetation along the eastern boundary and a man-made farm dam occupying the eastern part of the site (see **Figure 1.4** in **Chapter 1 Introduction**).

A previous development approval (DA-12-316) was granted allowing a shed associated with agricultural use to be constructed on the proposal site. The shed was never constructed, and the development approval is no longer valid.

A search of the BCC development register and the POEO public register found no existing development consents or EPLs for the proposal site.

2.6.6.2 Site suitability

The site's location in the Wallgrove Precinct of the Western Sydney Parklands was favourable due to the site being previously used for industrial purposes and the industrial and commercial nature of the surrounding land uses, mitigating aesthetic and amenity impacts and creating the potential for synergies with surrounding industry. For instance, the site is located next to waste facilities such as the now-closed Eastern Creek landfill site to the north and north-east and the GRL waste management facility immediately to the east. To the west of the site is the Eastern Creek industrial area and to the south is the Austral Bricks facility.

This site is located near to existing industries, including waste management industries, which benefit from their distance to residential areas and the low environmental or recreational value of the area surrounding the site.

The site is of an optimal size and configuration to design an EfW facility, being a rectangular-shaped lot. Compared to other sites investigated, this site was suitable for building a sufficiently well dispersing stack that would not affect aircraft operations for the Western Sydney Airport.

The site would avoid existing and planned residential areas, rural land uses and future airspace restrictions. The site was preferable from an air quality perspective as its distance from sensitive residential and other receptor locations would enable better management of emissions within air quality criteria. The closest residential areas are about 1km to the south of the site, with Erskine Park residential area located about 3.5km to the west and Minchinbury – about 3km to the north. Horsley Park Public School is over 2km south of the site and a childcare centre is within the Eastern Creek industrial area, about 1km to the west of the site. Refer to **Figure 7.1** for a map showing the sensitive receptors.

There is also no significant elevated terrain in the medium distance (3–6km). It is noted that emissions from stacks tend to have their greatest impact on nearby elevated locations which was taken into consideration when choosing a preferred site. This site meant that a generally shorter and less visible stack can be used in this location without compromising the local air quality. Of all the possible available locations that were assessed (via screening level air quality modelling), this location resulted in the least impact in terms of population exposure. Any other comparable locations were ruled out due to constraining factors, such as plume rise impacts on aircraft.

The site's location next to transport infrastructure such as the M7 Motorway and Wallgrove Road is also favourable as it allows for convenient road transport access routes and minimises the possible effects on nearby receivers from site truck traffic.

Furthermore, its location in Western Sydney also means that the site is in an area that is expected to accommodate most of the population growth forecast for Sydney, motivated in part by the development opportunities created by the Western Sydney Airport and Western Sydney Aerotropolis.

The location of the site in this growth area and close to established waste management infrastructure such as the Erskine Park Waste Transfer Station, minimises the transport distances (and related GHG emissions) between the sources of waste, waste processing facilities and the proposal.

2.6.7 Alternative site layout

Alternatives to the site layout were prepared during the development of the concept design. This was due to various site constraints, to allow for safety in design for operational activities and the aspiration to offer both an excellent visitor experience and working environment. The following points outline the site constraints that were considered and shaped the final preliminary site layout as shown in **Figure 3.3** in **Chapter 3 Proposal description**.

- The eastern portion of the site along the boundary is low-lying and modelling shows that it sits within the 1% AEP (100yr) flood event. Buildings and infrastructure located in this area would therefore be flood prone.
- A small strip of land not part of the proposal site divides the site into a 2.04ha northern section and a 6.19ha southern section. This dividing strip is part of the adjacent lot and includes a right of carriageway benefitting the proposal site, allowing vehicles to move between the two parts of the site. However, because this strip of land has a different owner, physical structures cannot be built on, over or under this land, which limited the layout and design to being contained within the 6.19ha southern section.

Options to locate the tipping hall closest to the southern boundary of the site with the stack located in the north-east corner of the site were also considered. However, this option wasn't chosen due to the need to maximise the space between the site entry and the tipping hall in order to maximise this space for internal truck queuing, reducing the impact on public roads and intersections.

Architecturally, there was always a vision to have the visitor and education centre in the eastern portion of the site overlooking the basins and areas of vegetation. The alternative to this was locating the visitor and education centre in the shaded western part of the site adjacent the M7 which was dismissed due to noise impacts on visitors and was inconsistent with the visitor experience aspirations of the design.

Alternative site access options

Alternative site access arrangements were also considered as part of the site layout.

During the initial design period, four alternative site access options were investigated. These included two different access points off the Austral Bricks Road along the southern boundary and two different access points off the Eastern Creek Waste Management Facility road along the northern boundary. Any accesses from the eastern and western boundaries of the site were dismissed due to these areas being bounded by the operational GRL facility to the east, and the Westlink M7 motorway to the west.

Road design guidelines applicable to the M7 stipulate that for a dual carriageway, the desirable minimum distance between an on-ramp and off-ramp is 900m. An existing on-ramp is located adjacent to the northern part of the site, and the nearest location for a compliant on-ramp would be several hundred metres south of the Warragamba Pipelines.

Two alternative site access options were investigated from the north of the proposal site. The first option included the creation of a new junction from the main access serving Eastern Creek Waste Management Facility. The access road would run through undeveloped land, cross the right of carriageway in the proposal site, and enter the EfW facility at the north-west corner of the southern 6ha section of the proposal site. The second option considered access from the north-east of the site via the GRL site access road. The site access road would branch off the GRL access road, entering the northeast of the proposal site, crossing the right of carriageway and entering the site at the north-east corner of the southern 6ha section.

Both access options from the north were discarded for the following reasons:

- The need to carry out works to make it safe for heavy vehicles to cross the right of carriageway. The proposal does not own this strip of land and so would need the approval of the landowner, SUEZ.
- The northern access would be on land currently being used for a composting operation.
- The existence of a utilities easement on land that would be used for the northern access places restrictions on how that land can be developed
- Long-term plans to rehabilitate the land to the north and return this land to the WSPT
- The construction and operation from this access would disrupt and complicate traffic management of the existing waste management facilities.

Two alternative site access options were investigated from the south of the proposal site.

The first option comprised retaining the existing access road located in the southwest corner of the site, upgraded as needed.

The second option involved a new access road crossing the Warragamba Pipeline corridor, about 90m east of the existing access road, either via a new bridge crossing of the Pipeline or encasing the Pipeline in concrete. The eastern option was discarded due to construction risk associated with piling work creating new restrictions on future upgrade works for the pipelines.

The first option comprised retaining the existing access road located in the southwest corner of the site and upgrading this via carriageway widening within the footprint of the existing, load-rated concrete encasement. This was ultimately selected as the preferred option.

This option aligns with the overarching principles of the Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines and avoids placing new restrictions on future upgrade works for the pipelines.

The preferred access solution has been agreed in principle with WaterNSW. Ongoing consultation will continue with WaterNSW to agree on the detailed design and construction methodology.

2.6.8 Alternative design

An Architecture and Landscape Design Strategy Report has been prepared for the proposal and is included as **Appendix B**.

The architectural design work to date only represents the beginning of the design process and sets the direction for further refinement.

The architectural team has worked closely with the wider technical specialists to understand the technical parameters of the facility to make sure that these operational requirements of the facility are fully integrated into the overall design.

The design responds to the SEARs and has been influenced through engagement with stakeholders such as architectural staff from BCC. Following direction from the Western Sydney Parklands Trust, the design also provides for the continuation of green areas through the site.

As part of Arup's iterative design process, 2D and 3D software has been used to test design options and refine the concept. Regular design reviews have been conducted to provide robust and diverse critique. Regular progress updates have been given to stakeholders including BCC and the community through a video which gives an overview of the design.

The key areas covered in the early stage design work were the integration of the built form into the existing local context, ensuring steps were taken to mitigate the visual bulk of the building, and focus on the human experience for passers-by, employees and visitors.

Initially, four key design aspirations were identified and described. These align with the wider proposal aspiration and set the priorities for the design outcome. All subsequent design moves were determined by and critiqued against these aspirations to make sure they were in alignment.

The design aspirations are as follows:

1. Embrace innovation:

- Lead the way in the use of world class sustainable technologies
- Become a catalyst for high-quality design and innovation in Western Sydney
- Promote a circular economy
- Create an exemplar facility.

2. Integrate with the context:

- Positively contribute to and integrate with existing and the emerging local character of the area
- Ground the building into the unique local context
- Shape the built form to mitigate visual impact
- Select materials which complement and align with the local environment.

3. Invigorate the wider ecosystem:

- Benefit the local ecosystem and microclimate
- Responsibly manage the site through the handling of stormwater and the reuse of collected rainwater
- Focus the landscape planting strategy around the use of native trees and shrubs to reinvigorate native biodiversity.

4. Include a generous human interface:

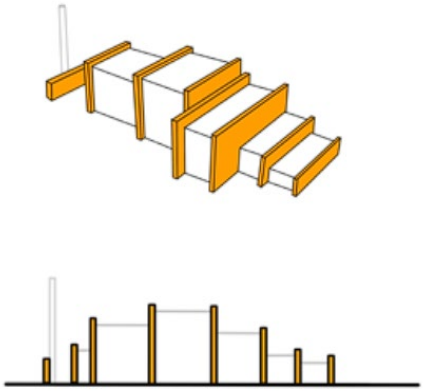
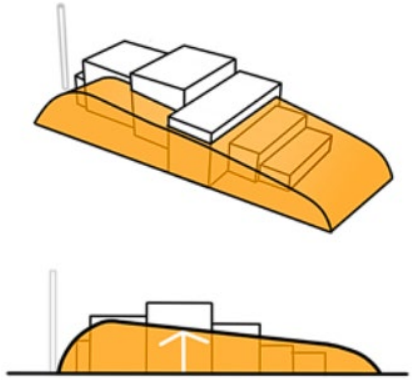
- Be honest and transparent about the purpose of the facility
- Carefully consider the buildings appearance from key public viewing points
- Offer an excellent visitor experience to educate and inspire.

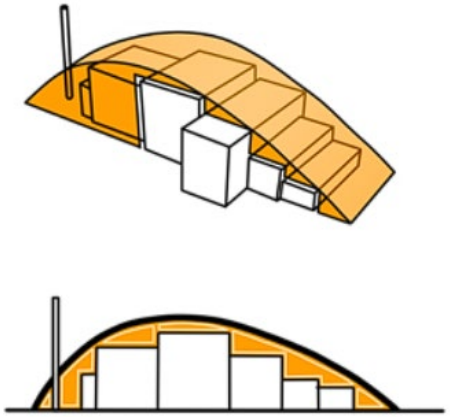
Early in the design process, alternative approaches to the envelope and massing of the building were considered. These options were modelled and tested to assess their visual impact from viewpoints in the local area. The team also worked closely with the Visual Impact Assessment team to locate and refine the built form to further minimise the buildings visual impact.

The early massing options which were explored are presented below in **Table 2.7**.

Initial materials guidelines have been developed in the EIS to set the expectation for the visual characteristics and sustainable properties of materials. Final materials will be selected in the upcoming detailed design stage, and these must consider sustainable procurement practices, as well as demonstrate exemplar sustainability credentials, including the consideration of the materials source, manufacturing processes, embodied carbon, lifecycle and end of life strategy. This is particularly significant for the large areas of cladding to the main building. The visitor and education centre is proposed to be of timber construction which has relatively low embodied carbon. A green roof is also proposed along with green walls on the northern and southern sections of the EfW building. The use of rammed earth is suggested for the main wall dividing the visitor and education centre from the vehicular route. If possible, the rammed earth would be made from earth excavated from the site, or at the very least from the local area.

Table 2.7: Design options for building façade

Design Option	Pros	Cons	Schematic
Layered 'blades' SELECTED MASSING APPROACH	• Building façade maintains functional form of the building. • Vertical subdivision breaks up building bulk. • The blades capture functional volume neatly. • Opens opportunity for further design options in between blades. • Perceived mass of the building is reduced from main viewing angles. • Building integrates with the landscape.	• The building mass is not unified.	
Landscape manipulation	• Minimises visual building form by lifting the landscape.	• Building bulk increases at lower levels. • Disruptive to the landscape • Significant impact to local ecosystem and watershed • Non-cost-effective use of resources • Reduced transparency of the activities that occur within the building and thus lost educational opportunities.	

Design Option	Pros	Cons	Schematic
Curved 'shell'	• Unifies overall building mass.	• Perceived building size is larger because the overall scale of the form increases as the cladding does not wrap tightly to the massing of the facility. • The curved canopy captures a large amount of airspace. • The eye is drawn up and along the curved from and is attracted to the tallest part of the building. This has the potential to increase the apparent mass of the building. • Sun reflectivity from the curved form may present a safety issue. • There is no opportunity to conceal roof mounted plant and equipment as the roof scape is highly exposed from the adjacent road.	

Of the design options shown in **Table 2.1**, the first design option (layered 'blades') was chosen to further develop the building design. This was due to the advantages outlined in the table and due to the design aligning with the design aspirations noted previously. The layered blades approach uses a series of vertical blade walls which incrementally rise from the landscape. The tallest section is in the centre of the building. The use of the 'blades' interrupts the large façades, so they are more visually interesting and less bulky, as well as breaking up the mass from key viewing corridors on the M7 in the north and south directions.
To further soften the building's appearance from the road and connect it to the landscape, the northern and southern ends of the building will be covered in living green walls. The design tightly wraps the building, eliminating any wasted space. Once the building is subdivided in this manner, the facades in between the blades will be clad in materials to break up mass.

The areas in between the blades are to be clad in materials which become increasingly transparent as you move along the building. This expression follows the internal process, supporting the WSERRC's function as an educational resource.

2.6.9 Alternative stack height and location

Assessing alternative heights and locations for the stack on the proposal site was based on several considerations, including site layout, process operations, architecture, visual amenity, structural considerations and air emission dispersion conditions.

Two principal site layout options were tested regarding the location of the stack:

1. A site layout that situated the waste receiving tipping hall to the north of the site and the stack to the south of the site.
2. A site layout that situated the waste receiving tipping hall to the south of the site and the stack to the north of the site (opposite configuration to option 1).

The first option was selected as the preferred option because the south of the site is at a slightly higher elevation, facilitating the stack on a higher part of the site and thus improving overall emissions dispersion. This layout was also beneficial to other operational parameters of the facility such as maximising space for vehicles to queue within the proposal site rather than on public roads, and process operational flow.

Once the site layout was determined, the next consideration was whether to integrate or separate the stack from the southern area of the built form and where to place it in the context of the building form.

Factors considered were:

- An integrated stack requires significant transfer structures to allow for access underneath.
- A stack off the central axis would have resulted in longer and unsymmetrical ducting/pipework that would impact the performance of the stack, including the stack exit temperature.
- A standalone stack requires ducting and piping to connect to main process but minimal transfer architectural and structural treatment to tie it to main building form.

Based on the above considerations, the decision was to proceed with a stand-alone stack centred to the southern end of the main building axis with a low-level architectural treatment. This was preferred architecturally and simplified the structural design. In addition, the central location of the stack is preferable as it is in line with the built form and when viewed from the primary viewing corridor along the M7, the stack is largely obscured to south bound motorists and cyclists. For northbound traffic, the lower portion of the stack is set against the silhouette of the main building, noting that the sun path is to the north, so the southern face of the stack is typically in shadow. The addition of a large green wall at the southern end of the building also conceals the lower portion of the stack and associated tanks at ground level.

It is noted that previous air quality modelling reviewed emission dispersion from various stack heights, ranging from 30m to 90m tall. The stack height was mainly dictated by the receiving air quality conditions and dispersion needed to meet best practice emission limit values. For this site, a 75m stack height was chosen, which achieved permissible air quality emissions and adequate dispersion to have no unacceptable impact on air quality and human health.